June 7th, 2006

Architecture Implementation Plan Usage Guide

Deliverable A3-a

Draft

Central Coast ITS Implementation Plan

Association of Monterey Bay Area Governments

TRANSCORE

CENTRAL COAST ITS IMPLEMENTATION PLAN

Architecture Implementation Plan (Usage Guide)

Deliverable A3-a

Draft

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1. INTRODUCTION

This document presents the CCITS Architecture Implementation Plan/Usage Guide. While this document does discuss Turbo Architecture and some of its functionality, it only provides an overview of each major function and is not meant as a tutorial on how to use Turbo (for that, please see the appropriate documentation discussed in Section 6).

This document should be used to show how CCITS members can update (via Turbo) and use their ITS Architectures to facilitate the documentation and implementation of ITS projects under their purview.

2. ITS ARCHITECTURE BASICS

This section presents an overview of the National ITS Architecture and presents a basic "How To" guide for Turbo Architecture (Turbo), the FHWA's software to implement the National ITS Architecture.

2.1 The National ITS Architecture

In its most basic form, an architecture is a set of rules that facilitates the building of systems and that allows these systems to communicate and inter-operate after being built. An ITS architect is to an ITS system, as a building architect is to a building. A building architect could not build a structure without a set of plans. Neither could an ITS architect build a complex ITS environment without a set of plans. These plans are the ITS system architecture. (It is important to distinguish between an architecture built for planning and implementation guidance and an architecture used to design and build actual working systems/projects.)

Since 1992, the U.S. DOT has been engaged in the development of the National ITS Architecture – a framework and common vocabulary for planning, defining, and integrating ITS systems among modes of travel and geographic areas. The toolset that comprise the National ITS Architecture provide a common information source in the following manner:

- **Framework** to identify system components and interconnections
- **Vocabulary** to better communicate with colleagues
- **Guidance** to help develop ITS architectures (e.g., Regional, County, etc.) and to help identify integration opportunities during project definition

The National ITS Architecture's main objectives are to describe what functions/processes are needed, decide where these functions should be located, and identify who needs to be involved and/or is responsible. Basically, the Architecture consists of a series of reports and diagrams/exhibits that show the relationships within/between components, subsystems, and agencies.

The major components of the Architecture will be described briefly in the appropriate Turbo Architecture "How To" sections that follow.

2.2 Turbo Architecture

Turbo Architecture is a Microsoft Access-based tool developed for the USDOT to assist Agencies with building and maintaining their ITS architectures. As of this writing, it is at version 3.1 and implements version 5.1 of the National ITS Architecture.

Turbo provides the data management tools (input, reporting, updating, etc.) needed to create and maintain your ITS architecture(s). In general, there is a data form (implemented via data tabs in Turbo) for each of the types of data discussed in the subsequent sections.

It is assumed that the reader/user has a basic knowledge of using Microsoft Windows applications and has already installed Turbo Architecture on their PC. The following sections step through the Turbo data screens and describe their usage in creating and/or maintaining their ITS architecture.

You will also get a better understanding of the tool and more comfortable with it as you continue to use Turbo to update your architecture(s).

2.2.1 Before you Start

A certain amount of legwork is required prior to building or updating an ITS architecture. If you are going to be updating the architecture, the first step is to ensure that the Architecture Maintenance Plan has been followed and that the requisite documentation has been prepared. If this is not the case, you would be wise to stop here and make sure those steps are followed.

If you are updating the architecture to a new version of the National ITS Architecture (as of this writing it is at V5.1 and is implemented by Turbo Architecture V3.1) you should familiarize yourself with the services, data flows, etc. in your architecture so you will be able to asses the impact of the changes being implemented.

Also, you should always ensure that you have a back-up copy of the original Turbo database file(s) in case something goes amiss and you need to revert back to it. If the changes to be made are substantive, you might also consider making backups of the database at key points along the updating process.

2.2.2 Common Interface/Usage

There are generally two (2) types of user input forms used throughout Turbo: general data input forms and Excel-like grids. General data forms, such as the form used on the Start tab (see Exhibit 1) is a data entry form with a combination of fields to input or edit data, make data selections, etc. These forms are usually laid out such that there is a list of items (usually to select from) on the left of the form and the data descriptions/details are to the right.

The forms with Excel-like grids can work in some ways like Excel in that you can resize columns and reorder data, but they do not perform any calculations nor are they used for actual text data entry. They are primarily used for tailoring the architecture by selecting items (data flows, standards, etc.) to include in the architecture. These forms are generally structured with a pick-list in the upper left of the tab, a series of buttons to the immediate right, and the grid occupying the majority of the form below (See Exhibit 11).

2.2.3 Menus

Along with the standard MS Windows File, Edit, Tools, and Help menus, Turbo Architecture has an additional menu for generating reports and diagrams: the Output menu. Some of the options of the Tools and Output menus are described below.

Tools

The Tools menu can be used to create or edit custom (user defined) Status and Architecture Flow values. For each, a context specific data screen will be presented to allow for data entry and manipulation applicable to that data type. Status is a global data element, so customizations made here will be available throughout Turbo. The customized architecture flow value(s) will only be used in when working with architecture flows.

Output

The Output menu is used to define report filters and/or to select specific inventory elements to be included in the Turbo reports and/or diagrams. This menu is also how you launch the Turbo reports and diagrams screens, which will be discussed in Section 2.2.14.

2.2.4 The "Status" Attribute

Before starting the overview of Turbo Architecture, a brief overview of the "Status" attribute that is used throughout Turbo is in order. The Status attribute is used to define the current implementation stage of the data being described. Turbo has pre-defined status values of Existing and Planned. In several places an additional status of "Not Planned" is also pre-defined. The meanings of these statuses are pretty much self-evident. For the CCITS architectures, we have added an additional status of Programmed for those projects that have already been added in the appropriate planning process(es) – on the way from Planned to Existing.

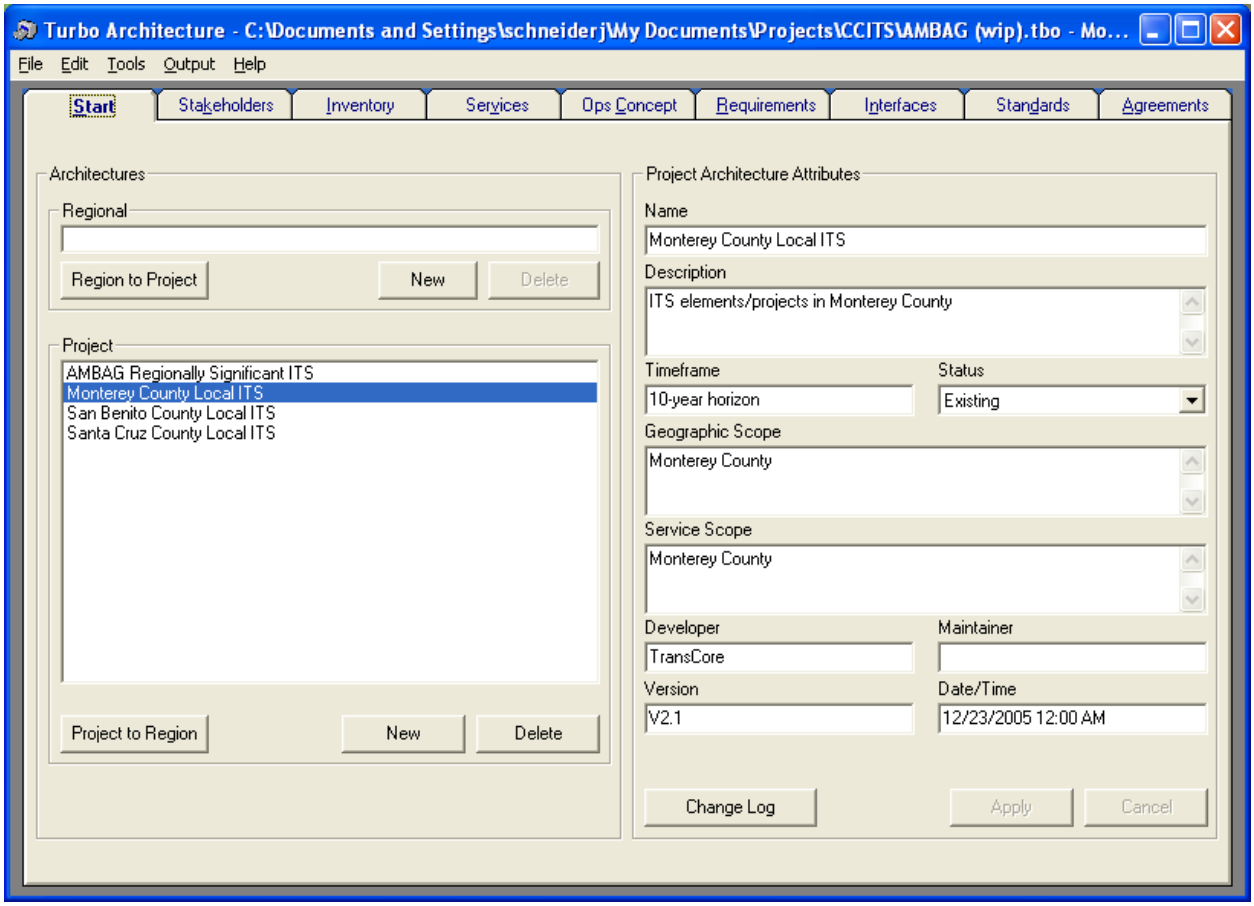
In some parts of Turbo, it is possible that multiple statuses may apply to the same item. For instance, a signal system may be "Existing", but there are plans to integrate it into a Regional traffic control system. In cases like this, the status of the signal system should still be set to "Existing" for Inventory and in the applicable Market Package, Operational Concepts, Interconnects, etc. assignments/definitions, however the additional integration features should be set to "Planned" or "Programmed".

2.2.5 The Start Tab

The Start tab (Exhibit 1) is used to create project and regional architectures, to select an existing architecture to be the active architecture (for maintenance or reporting), and also to maintain the architecture descriptions/definitions in the Turbo database. The left-hand side of the tab is generally used for selection and the right-hand side for data manipulation.

In addition to its data management aspects, this tab is also used to select which ITS architecture you want to use, report, build, or maintain. This is done by clicking your mouse on the desired ITS architecture (from the list on the left) and proceeding to your desired functions. Selecting the architecture is a vital step in the maintenance of the MPO architecture – failing to do so may cause your changes to be implemented in the wrong ITS architecture.

Exhibit 1 – The Start Tab



Major Data Fields:

Field	Description
Name (required)	Name of the ITS Project of Regional Architecture.
Description	Description of the architecture.
Timeframe	The time horizon for the architecture (e.g., 10 year).
Status (required)	The deployment status of the architecture (Not Planned is not a valid selection; only project architectures are defined for the CCITS).
Geographic Scope	Where the architecture will be deployed (e.g., the geographic area).
Service Scope	The scope of services to be covered.
Version & Date/Time	Fields to keep track of changes made to the architecture.

Major Operations:

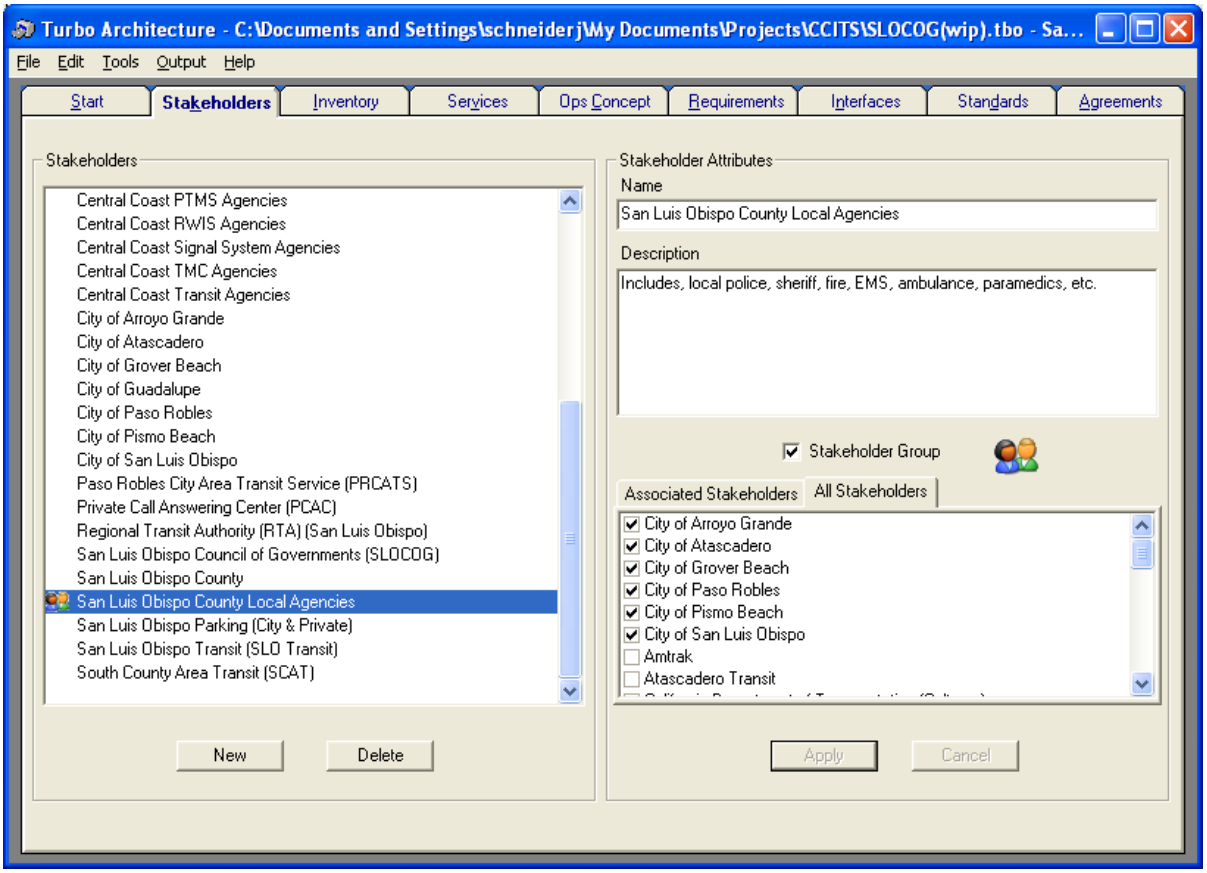
Button	Function
New	Used to create a new regional or project architecture in the open database. There can be multiple project architectures but only one regional architecture per Turbo database. Pressing the New button (either one) will create an empty form for data entry and you must enter the required fields before hitting the Apply button.
Project to Region	Used to merge/promote a project architecture into the regional architecture. Note that not all data is moved.
Region to Project	Used to demote a regional architecture into a project architecture. Note that not all data is moved.
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.
Delete	Used to delete the selected architecture and cannot be undone once deleted (you will be prompted to verify the delete).
Change Log	Allows you to keep a history of changes made to the architecture (log/history viewable by report only).

2.2.6 The Stakeholders Tab

The Stakeholders tab is where you can maintain the slate of stakeholders for the overall ITS architecture. Stakeholders are available to all ITS architectures in the database. You can also define a stakeholder group, which is a way of simplifying the architecture by having a single pseudo-stakeholder represent many individual stakeholders. For example, all of the municipal emergency service providers (e.g., police, fire, ambulance, etc.) in each CCITS County have been grouped into a "Local County Agencies" stakeholder, rather than enumerating each one individually.

Stakeholder groups can greatly simplify the architecture by consolidating repetitive and/or redundant ITS inventory, interconnections, information flows, etc. Stakeholder groups can be identified in the list by a special icon to the left of the stakeholder name (see the example in Exhibit 2).

Exhibit 2 – The Stakeholders Tab



Major Data Fields:

Field	Description
Name (required)	Name of the stakeholder.
Description	Description of the stakeholder.
Stakeholder Group	Checkbox to indicate that the specified stakeholder is a Group Stakeholder.
Stakeholders (tabs)	Indicates which real stakeholders are members of the group (grayed out if the Stakeholder Group checkbox is not selected).

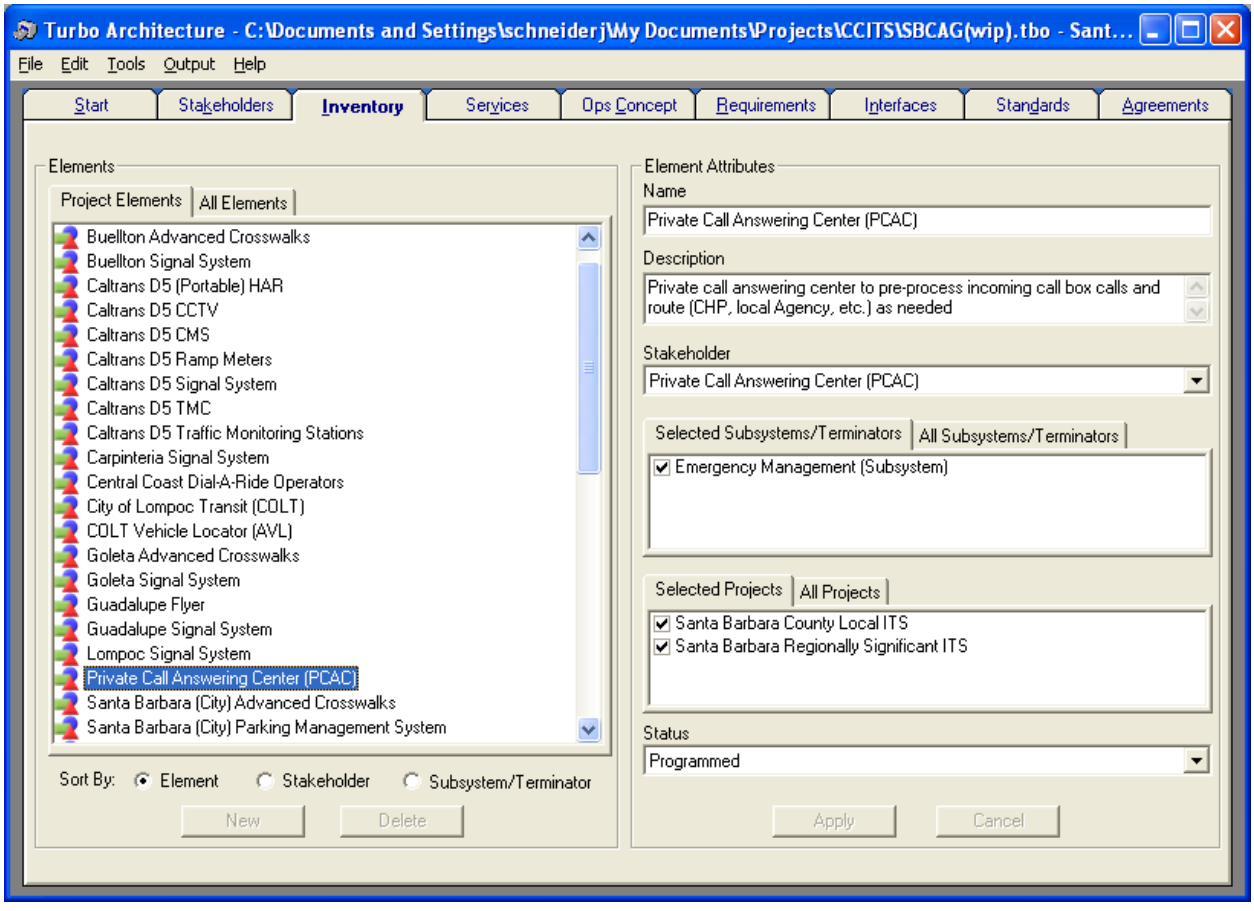
Major Operations:

Button	Function
New	Used to create a stakeholder.
Delete	Used to delete the selected stakeholder (note that this does not delete the stakeholder's associated ITS inventory, if any).
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.7 The Inventory Tab

The ITS inventory is a core step in building and maintaining an ITS architecture and this tab is where it is managed in Turbo (Exhibit 3). The left-hand side of the form is the list of ITS elements in the architecture (if any have been created for it). There is an additional tab on this form to select whether to view only the inventory in the active architecture (selected on the Start tab described above) or all items in the database, regardless of which particular architecture(s) the element is in. (An inventory element may be in multiple ITS architectures in the same Turbo database.) You may only add or delete ITS elements when the "All Elements" tab is active, but you can change its data properties in either mode.

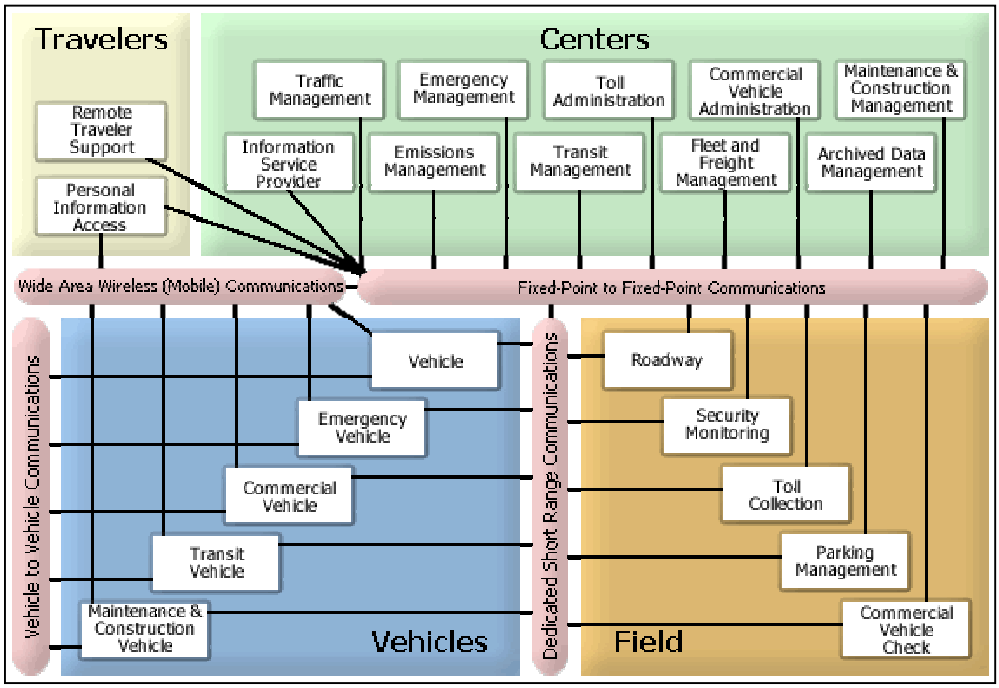
Exhibit 3 – The Inventory Tab



This screen is where you define the various items that are or will be part of your ITS system. In general, we advise you to use the following naming convention for ITS elements: start each element with the stakeholder/owner name or its abbreviation followed by a descriptive name. This will group related elements in subsequent tasks and reports. We also advise trying to avoid using "brick and mortar" items (e.g., buildings) unless there is an ITS system associated with it, such as a TMC.

Every ITS element must have at least one subsystem or terminator associated with it. Subsystems are defined by the National ITS Architecture and correspond to physical implementations of ITS functionality. They are grouped into four categories, based upon where they are (to be) deployed: Centers, Field, Vehicles, and Travelers (Exhibit 4). For example, depending upon its functionality, a TMC might be associated with the Traffic Management and Emergency Management subsystems (both from the Field group), or a smart card system to be used for transit and parking might be associated with the Transit Management, Transit Vehicle, and Parking Management subsystems.

Exhibit 4 – National ITS Architecture Subsystems



Selection of subsystems is an important step as these assignments will be the foundation for developing subsequent parts of the architecture. Associating too many subsystems will lead to additional filtering work later, while adding too few will limit your available choices and may require returning here to associate the "missing" subsystem(s).

At a minimum, you must provide the element name and assign at least one subsystem in order to be able to save data on this tab, but you should be as complete as possible when defining data here (or on any of the Turbo forms).

Major Data Fields:

Field	Description
Name (required)	Name of the ITS element.
Description	Description of the ITS element.
Stakeholder	Primary "owner" of the ITS element (pick-list from the Stakeholders tab).

Field	Description
Subsystems (required)	Checkbox list of applicable subsystems. Note that you can right-click in this area to expand the list and get descriptions of each of the subsystems (right-click again to collapse the section back to normal size).
Projects	Checkbox list of available ITS architectures in the database.
Status	Status of the ITS element (default values are Existing and Planned, but additional status values, such as Programmed, can be created).

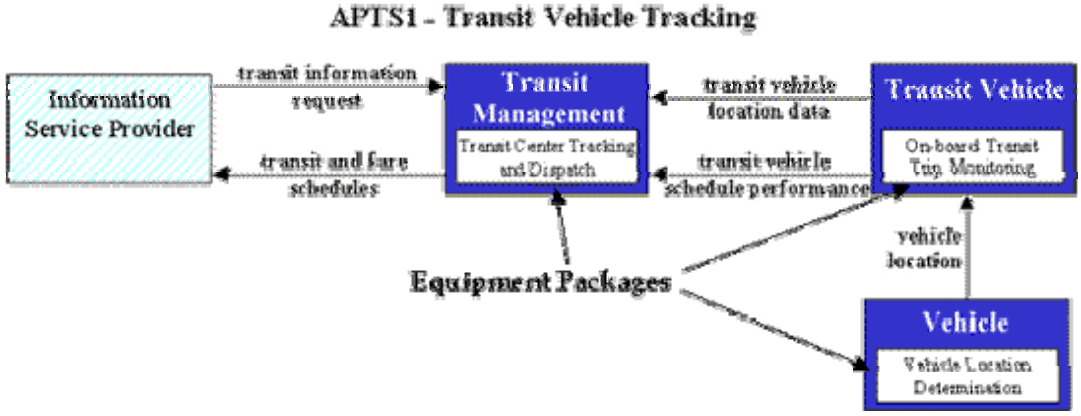
Major Operations:

Button/Control	Function
Elements tab	Selects whether to show all ITS elements in the database or only those for the selected ITS architecture.
Sort by	Sort the ITS inventory by various criteria.
New	Used to create a new ITS element in the database (only available from the "All Elements" tab).
Delete	Used to delete an ITS element from the database (only available from the "All Elements" tab).
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.8 The Services Tab

The Services tab is where you associate the ITS inventory elements to National ITS Architecture Market Packages. Market Packages (MPs) are pre-defined transportation service technology "bundles" that can be deployed (built or bought) to improve some aspect of traveling. Each MP consists of one or more "equipment packages" that work together to deliver a specific transportation service and the data flows between them. **Error! Reference source not found.** shows the APTS1 – Transit Vehicle Tracking MP. It is comprised of three (3) equipment packages from three (3) different subsystems (Information System Provider is external to this MP).

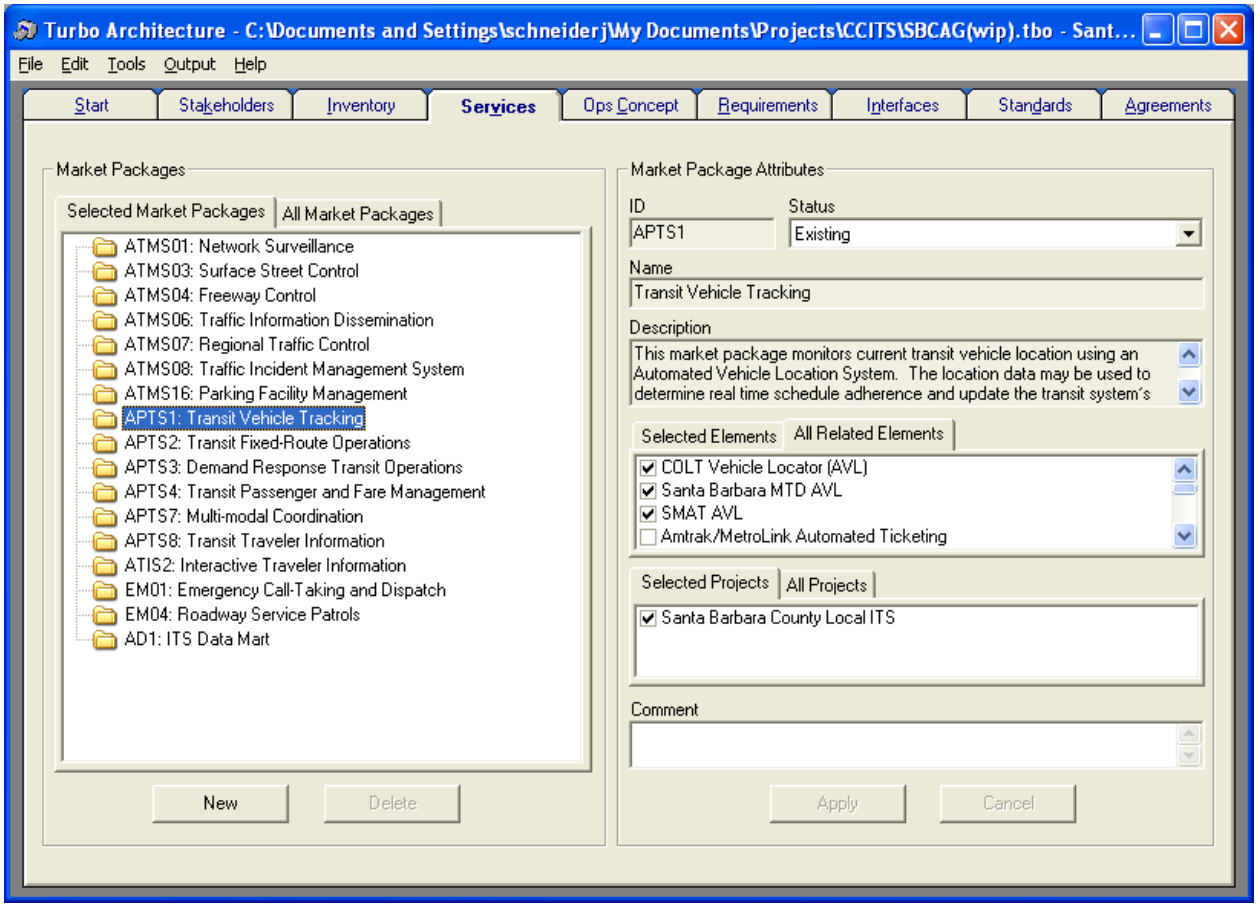
Exhibit 5 – The Transit Vehicle Tracking Market Package



To associate MPs with ITS elements, select the desired MP from the list on the left of the form (information about the selected MP will be shown in grayed-out fields on the right-hand side of the form) and check (select) the inventory elements that should be associated with it (i.e., which elements will provide those services). You need to also indicate the applicable architecture(s) that this MP is (or will be) in based upon which architectures the inventory elements are in (or will be).

Lastly, the MP's status should be assigned. The default selections are Existing, Planned, Not-Planned. In general, you do not need to define Not-Planned MPs. If any part of the MP is already implemented, then the MP should have a status of Existing. Exhibit 6 is an example of the Services tab.

Exhibit 6 – The Services Tab (Market Packages)



Major Data Fields:

Field	Description
Status	Status of the ITS element (default values are Existing and Planned, but additional status values, such as Programmed, can be used).
Selected Elements	Checkbox list of ITS inventory that can be associated with the MP.
Projects	Checkbox list of available ITS architectures in the database.
Comment	Additional information can be added here (e.g., timeframe, status, etc.).

Major Operations:

Button/Control	Function
Market Packages tab	Selects whether to show all MPs or only those selected in the active ITS architecture.
New	Used to create a new ITS element in the database (only available from the "All Elements" tab).
Delete	Used to delete an ITS element from the database (only available from the "All Elements" tab).
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

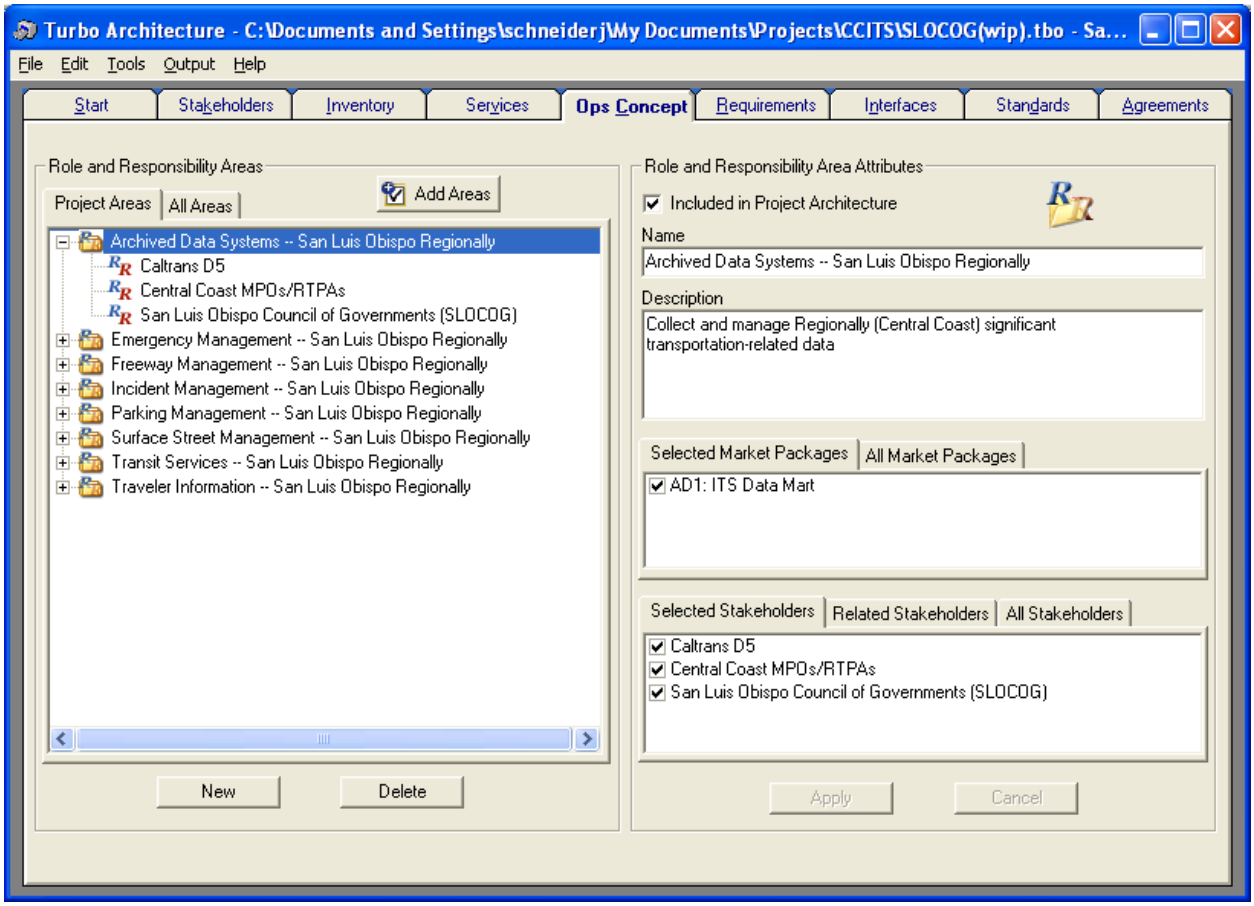
2.2.9 The Ops Concept Tab

The Operational Concepts tab is where the various stakeholder's ITS-related roles and responsibilities (R&Rs) are defined. In general, these are descriptions of the high-level tasks and activities that the stakeholder is or will be performing with respect to the implementation and operation of the transportation services described in the ITS architecture.

Turbo will build an initial set of R&R Areas for you based upon the MP selections for the active architecture. You may perform this function at any time by pressing the Add Areas button and Turbo will create the R&R Areas (or recreate them if any were deleted) and automatically pre-select potential MP associations. You will need to review these selections and deselect those MPs that are not applicable or select additional MPs (very unlikely). You can also create R&R Areas from scratch by hitting the New button then adding the appropriate MP associations. Whether you create the R&R Areas manually or automatically, you should also add descriptive text for the R&R area.

The final step of the R&R Area definition is associating the stakeholders who will be performing these tasks with the R&R Areas. The R&R Areas in the left-hand pane (see Exhibit 7) are shown in a tree structure. Areas with associated stakeholders are denoted with a plus sign (+) next to the Area's name. These items can be expanded (by clicking on the plus sign) to show the associated stakeholder(s). R&R Areas without any associated stakeholder(s) have no notation beside the name.

Exhibit 7 – The Ops Concept Tab – R&R Area Definition



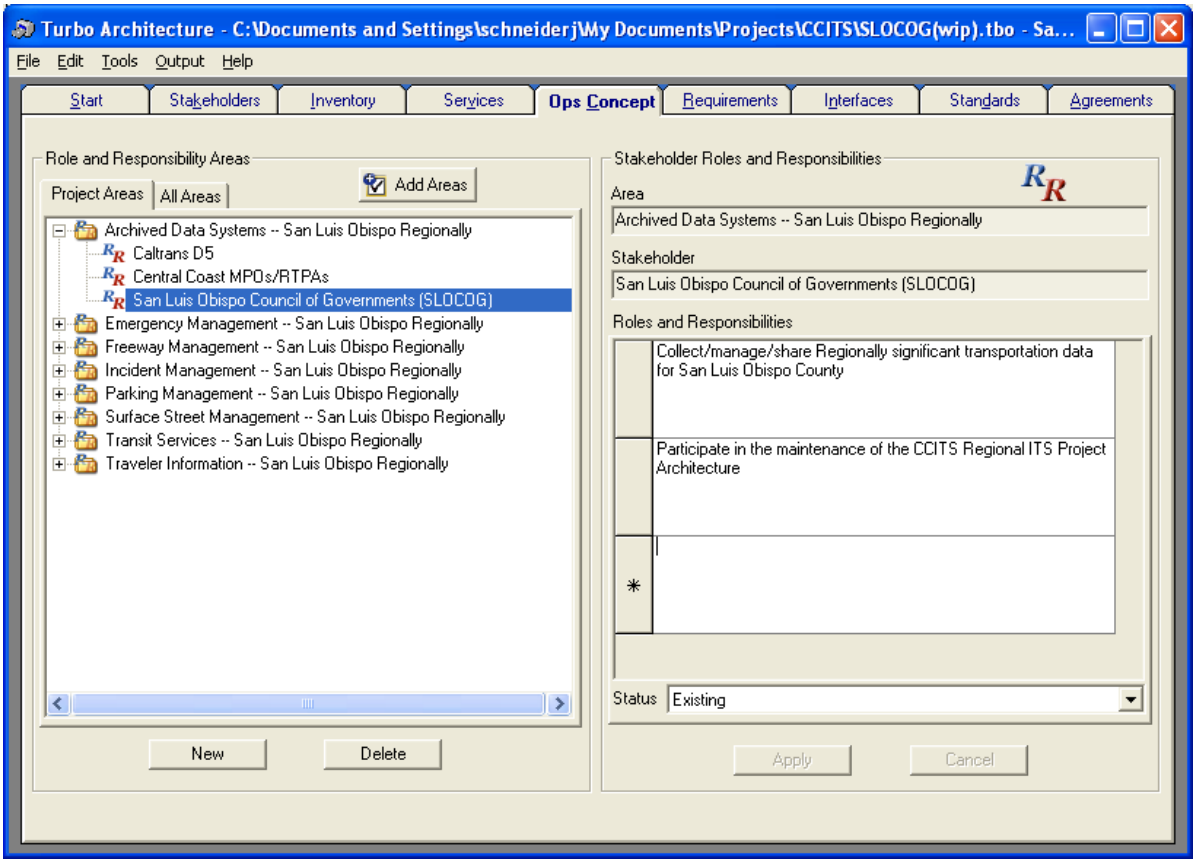
To define the actual activities for a stakeholder, expand the appropriate R&R Area and select the desired stakeholder (you must apply any existing changes before you can proceed with this step). This will change the data fields available on the tab (Exhibit 8) and you can now enter the high-level duties that the stakeholder is or will perform.

Enter one task description per row of the R&R table (on the right-hand side). You will want the task descriptions to be concise but still to get the point across – remember you are not the only person needing to understand the task activities.

The status for each activity also needs to be set (Existing, Planned or Programmed). Please note that a task may have a status that is different than either the inventory element or MP that is supporting the task. For example (continuing with the earlier signal system "status" example), there may be a responsibility related to signal synchronization that is "Planned" while a related signals operation and maintenance task in the same R&R Area has a status of "Existing".

Unfortunately, there is no way of easily copying activities between stakeholders or architectures. So, if you need to copy tasks, you will need to use Windows' copy and past functionality as you navigate between the stakeholders and/or R&R Areas.

Exhibit 8 – The Ops Concept Tab – Roles & Responsibilities



Major Data Fields:

Field	Description
Include in Architecture checkbox (Overview view)	Check box to include the selected R&R area in the active architecture.
Name (Overview view)	Name of the R&R area.
Description (Overview view)	Description of the R&R Area.
Market Packages tab (Overview view)	Select the applicable MPs for the R&R area (these will be pre-selected if the Add Areas button was used to create the R&R Areas); you can view only MPs selected for this R&R Area or all MPs selected in the active architecture.
Stakeholders tab (Overview view)	Select the Stakeholders that will be performing the tasks; you can view only stakeholders assigned to the R&R Area, stakeholders that could have a role in the R&R Area (based on MP/ITS element associations), or all stakeholders.
Role & Responsibility (R&R tab)	Actual description of the various R&Rs for the R&R Area.
Status (R&R tab)	Status of the active R&R (NOT for the R&R Area).

Major Operations:

Button/Control	Function
Areas tab	Selects whether to show all R&R Areas or only those defined in the active ITS architecture.
Add Areas button	Button to automatically add R&R Areas for selection.
New	Used to create a new R&R Area in the database.
Delete	Used to delete an R&R Area from the database.
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.10 The (Functional) Requirements Tab

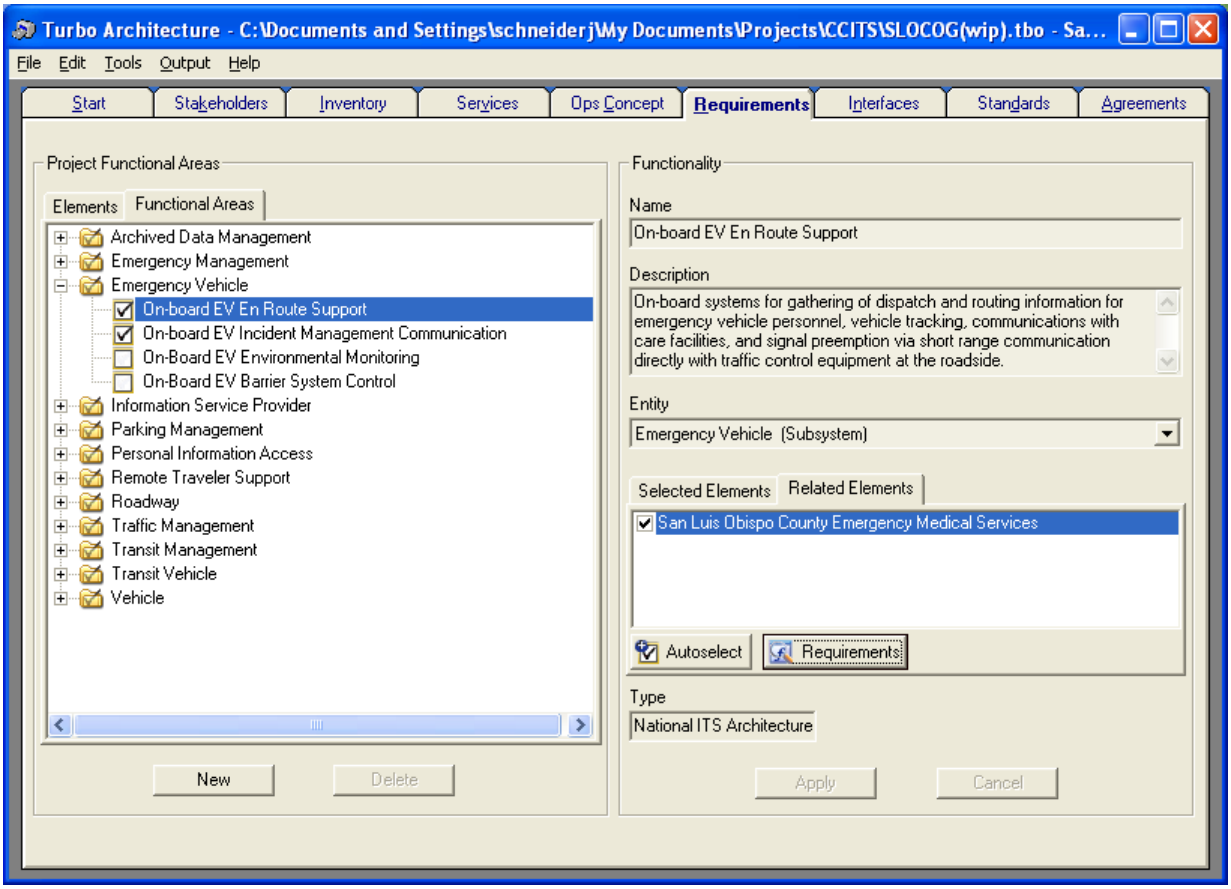
While the Operational Concepts describe how stakeholders will use the ITS elements, the functional requirements (FRs) describe what (functions) the individual ITS elements are to perform. The requirements should be described at a level to provide enough detail to understand what the system will do, and certainly not detailed enough to be used to build a system. The National ITS Architecture has defined a large set of functional requirements based upon MP Equipment Package functionality that you can select from or tailor, as needed.

The Functional Requirements tab operates similarly to the Ops Concept tab in that you must first define and select the desired functional areas and then provide/select the actual requirements in a second step. You cannot change the name, description, or Entity data for pre-defined functional areas since they are taken from the National ITS Architecture. If you create a new functional area, you will need to define these items.

There are two (2) ways to select the actual functional areas (using the Functional Area sub-tabs): by element or by functional area and each has its own merits. The Element sub-tab will present the list of ITS elements in the active architecture on the left-hand side and the applicable/related functional areas on the right-hand of the form. If you only need to add or modify one (or a few) individual element(s), then you should probably use the Elements view.

If you want to compare or modify the requirements for a related group of elements, then the Functional Area view will probably work best. In this view (see Exhibit 9), functional areas are presented in a tree on the left-hand side and applicable/related ITS elements are on the right-hand of the form. Either way, select the appropriate element and functional area and press the Requirements button to add or review the actual functional requirements.

Exhibit 9 – The Requirements Tab: Functional Areas



Major Data Fields:

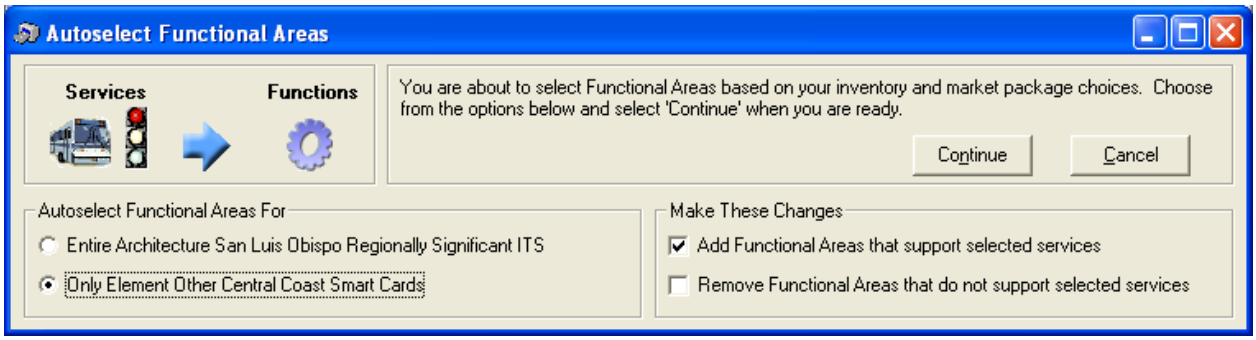
Field	Description
Name	Name of the Functional Area (only available via the Functional Areas view).
Description (Functional Areas view)	Description of the R&R Area.
Entity (Functional Areas view)	Picklist of National ITS Architecture subsystems.
Elements	List of inventory elements associated with the Functional Area.

Major Operations:

Button	Function
Autoselect button	Button to automatically add Functional Areas.
New (Functional Areas view)	Used to create a new Functional Area in the database.
Requirements button	Used to manage (create, delete, edit) FRs for selected Functional Area and Element (only active if an inventory element is selected).
Delete	Used to delete an R&R Area from the database (only active for user-created Functional Areas).
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

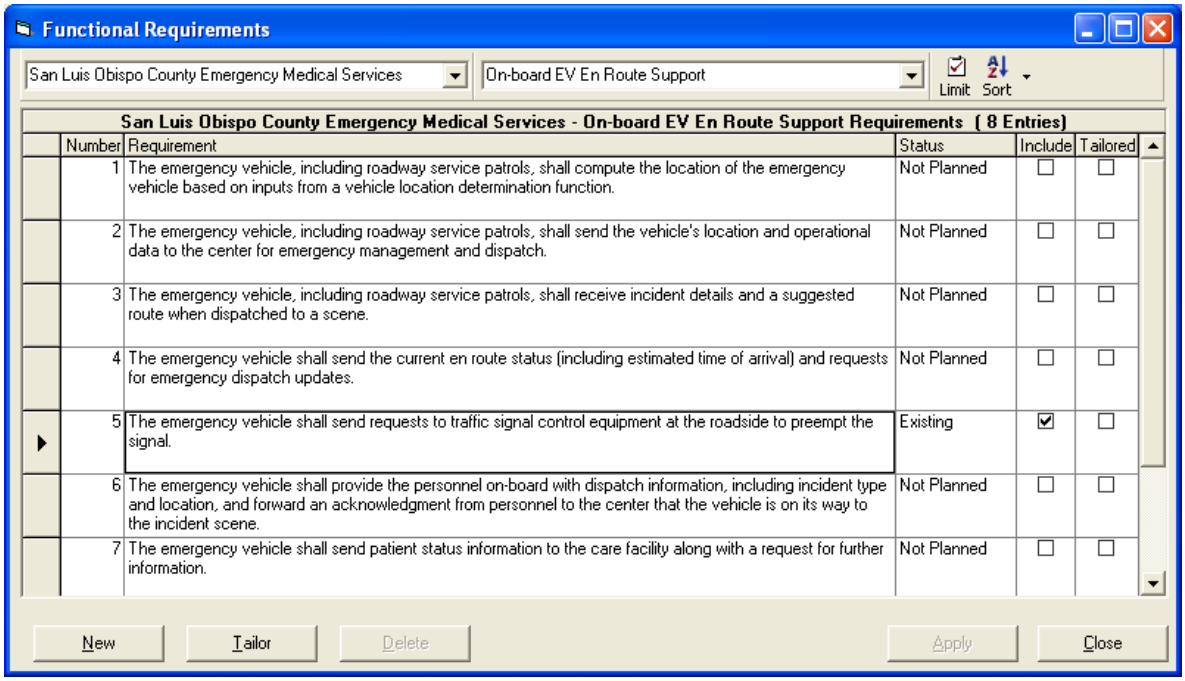
There is actually a third way to select functional areas. You can have Turbo select the functional areas automatically (but not the requirements, themselves). This can be done for a specific element or the entire active architecture (Exhibit 10). This tool can create the functional areas for the entire active project or a specific element. It will present the list of proposed changes and let you approve or reject them (en masse, not individually) prior to adding them to the architecture.

Exhibit 10 – Functional Requirements: Functional Areas Autoselection



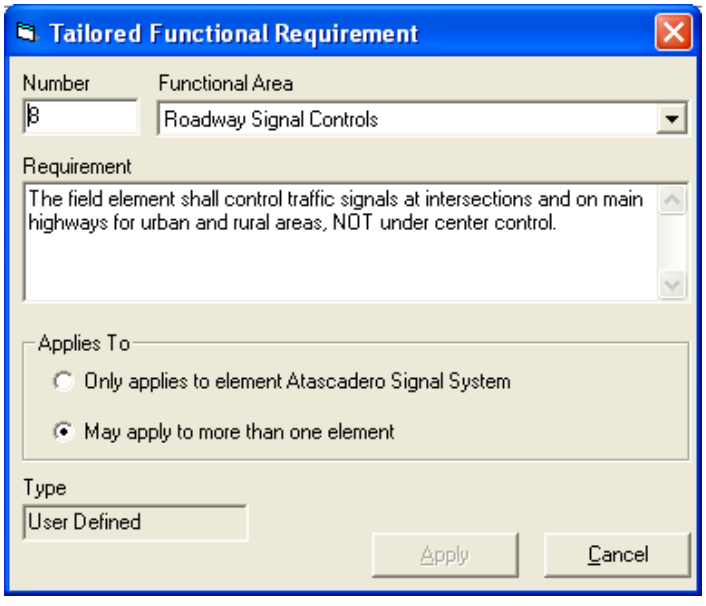
As stated earlier, the initial actual functional requirements are taken from the National ITS Architecture. You may select the applicable ones from them, tailor (customize) them as needed, or create new ones altogether. When the Requirements button is pressed, a new form (Exhibit 11) will be presented with a list of potentially applicable (and pre-defined) FRs for the selected element and functional area. (If no functional area is selected/active, all applicable functional requirements for the element will be presented.)

Exhibit 11 – Functional Requirements



This process is fairly straightforward. Review the list of functional requirements and include those that apply to the element. If a requirement is close to the desired functionality, but needs minor changes, you can tailor it by selecting the requirement and hitting the Tailor button. This will raise a new form (Exhibit 12) where you can make the needed changes. While there is an option to have this change apply only to the selected element, it is usually best to have the new requirement available to all elements. You may apply the changes or revert back to the original version.

Exhibit 12 – Functional Requirements: Tailored Requirements



If you find that you need a completely new requirement, hit the New button and the same form will appear, however there will not be any data for you to modify. Before you hit the New button, you must make sure that you are in the correct functional area or your new requirement may not be saved in the correct place.

Major Data Fields:

Field	Description
Requirement	Text of the Functional Requirement (only editable when creating or tailoring a FR).
Status	Status of the FR in the active architecture (changing the status of the FR from Not Planned automatically includes it).
Include	Checkbox to indicate if the FR is to be included in the active architecture.
Functional Area	Used to select the Functional Area for the FR.
Applies To (Tailoring Form)	Used to indicate the scope of the new/custom FR (generally let it apply to more than one element).

Major Operations:

Button	Function
New (Requirements Form)	Used to create a new Functional Requirement (starts the Tailoring Form).
Tailor (Requirements Form)	Used to modify an existing National ITS Architecture Functional Requirement (a new version of the requirement is created).
Delete	Used to delete an R&R Area from the database (only active for user-created Functional Areas).
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.11 The Interfaces Tab

The Interfaces tab presents a slightly different user interface than the previous tabs. This interface is more Excel-like in that a data grid is presented from which elements (or data flows) are selected for inclusion in the active architecture. In addition, there is a row of buttons that (mostly) affect what and how data is displayed. Since the interfaces and flows are so inter-related, they are presented on the same tab. In fact, when Turbo is used to generate the interfaces, the data flows are built at the same time.

Interfaces

Interfaces describe what ITS elements are or are going to be connected to which other ITS elements. Usually, these connections are in the same active architecture, but it does not need to be that way (i.e., just as in real implementations, the interconnections can cross architecture

boundaries). Interconnections are independent of what data is being shared or which direction the data is flowing – basically, they define who's talking to whom (or what's connected to what).

There is not an explicit implementation status for interconnections. Although the standard Turbo report does include one, the only way to manipulate the implementation status of interfaces is by setting the associated data flows (explained more in the Flows section).

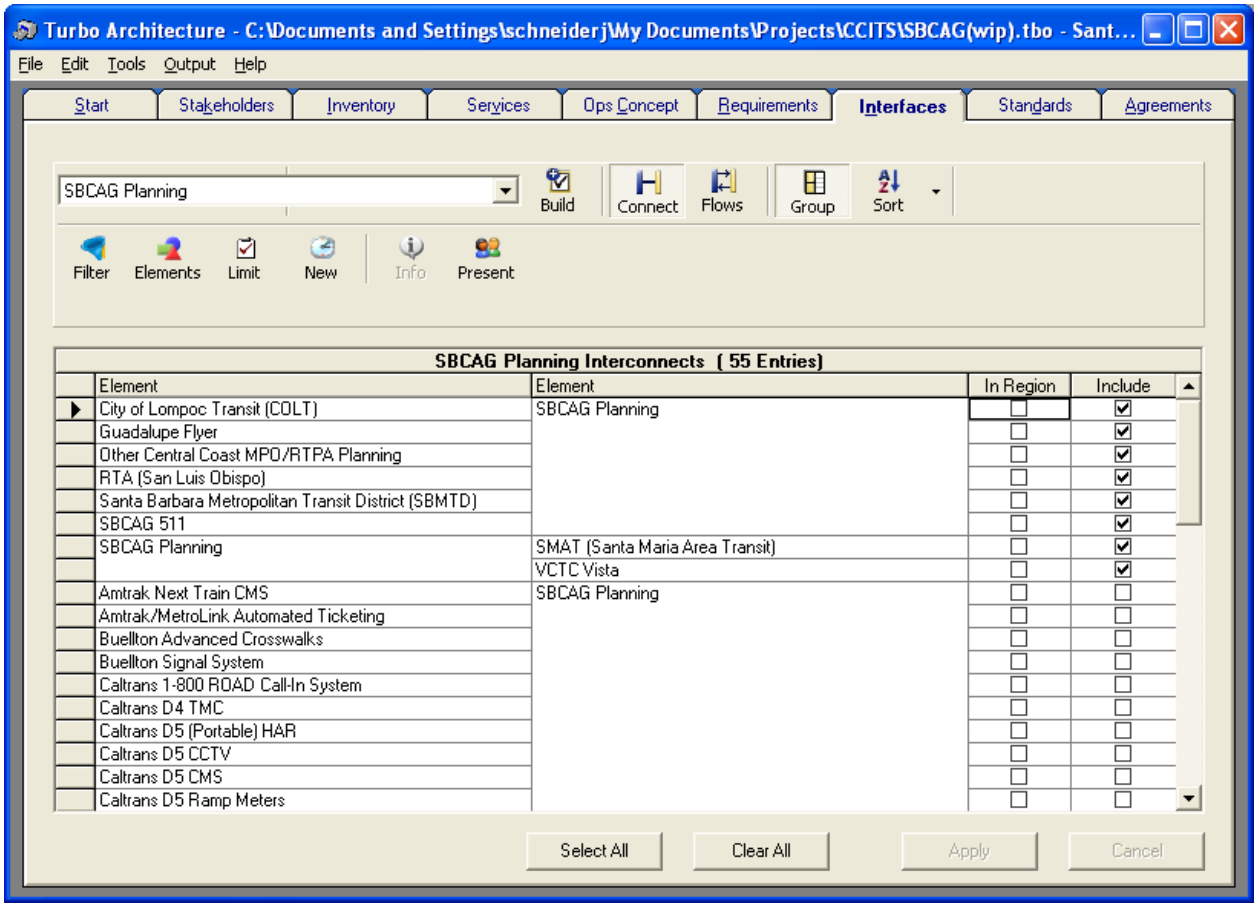
The Interconnects interface is pretty straightforward (Exhibit 13). It presents a source and destination ITS element with each row representing a potential interconnection and you can include (check the Include column) or exclude each potential interconnection (unchecked). Because interconnects are directionless, Turbo only displays the potential interconnection once (even though logically it could "go" either way), so you may need to check both Element columns to find the desired interconnection pairing.

In general, the potential interconnections are based upon subsystem assignments made to the inventory elements earlier in the development process. So, if a potential interconnection is missing, you may need to go back and ensure that the inventory is properly defined. (Note that if you change the definition of a particular ITS inventory, you may need to change other related aspects of the architecture, such as the functional requirements, etc.).

Turbo will build a set of interconnects (and data flows) for the active architecture by using the Build button (the interconnects and data flows for each architecture in the Turbo database need to be built individually). In fact, you must use Turbo's build function in order to work with an element in the Interfaces tab. In general, if you are adding new elements to the active architecture (or changing an element's subsystem associations), you will need to "rebuild" the architecture prior to proceeding. If you are merely updating data for existing elements (e.g., new flows, etc.) then you probably do not need to perform a rebuild unless the interconnects and/or flows you are looking for are not present. Please note that rebuilding an architecture may in fact remove some interconnections/flows that were excluded previously.

The "In Region" column indicates if the interconnection is defined in the regional Turbo database (not the MPO's regionally significant ITS project architecture). Since there are not regional Turbo architectures, this field does not apply to the CCITS as of this writing.

Exhibit 13 – The Interfaces Tab: Interconnects



Data Flows

The data flows are the real meat of the ITS architecture. The flows are taken from the National ITS Architecture (custom flows can be created, if needed) and show what data is actually being shared between ITS systems – the actual and planned integration of systems. If the interconnects describe who's talking to whom, the flows describe what's being said and by whom.

The major differences between the interconnection and flow screens are the addition of two columns: Flow Name and Status; otherwise, the operation of the Flows form (see Exhibit 14) is basically the same as the Connections. Each row represents a potential data flow between elements that are interconnected and each data flow is either included in the active architecture and given a status of Existing or Planned (or Programmed, if that status is being used) or not included (unchecked or a status of Not Planned).

As opposed to interconnections, data flows do have a direction associated with them, so you may need to have seemingly duplicated data flows between elements if the same data flows exist between both systems. For example, if two TMCs both (plan to) share CCTV images and control, then "traffic images" and "video surveillance control" data flows (amongst others, potentially) will need to be defined between the TMC in both directions. However, if only one

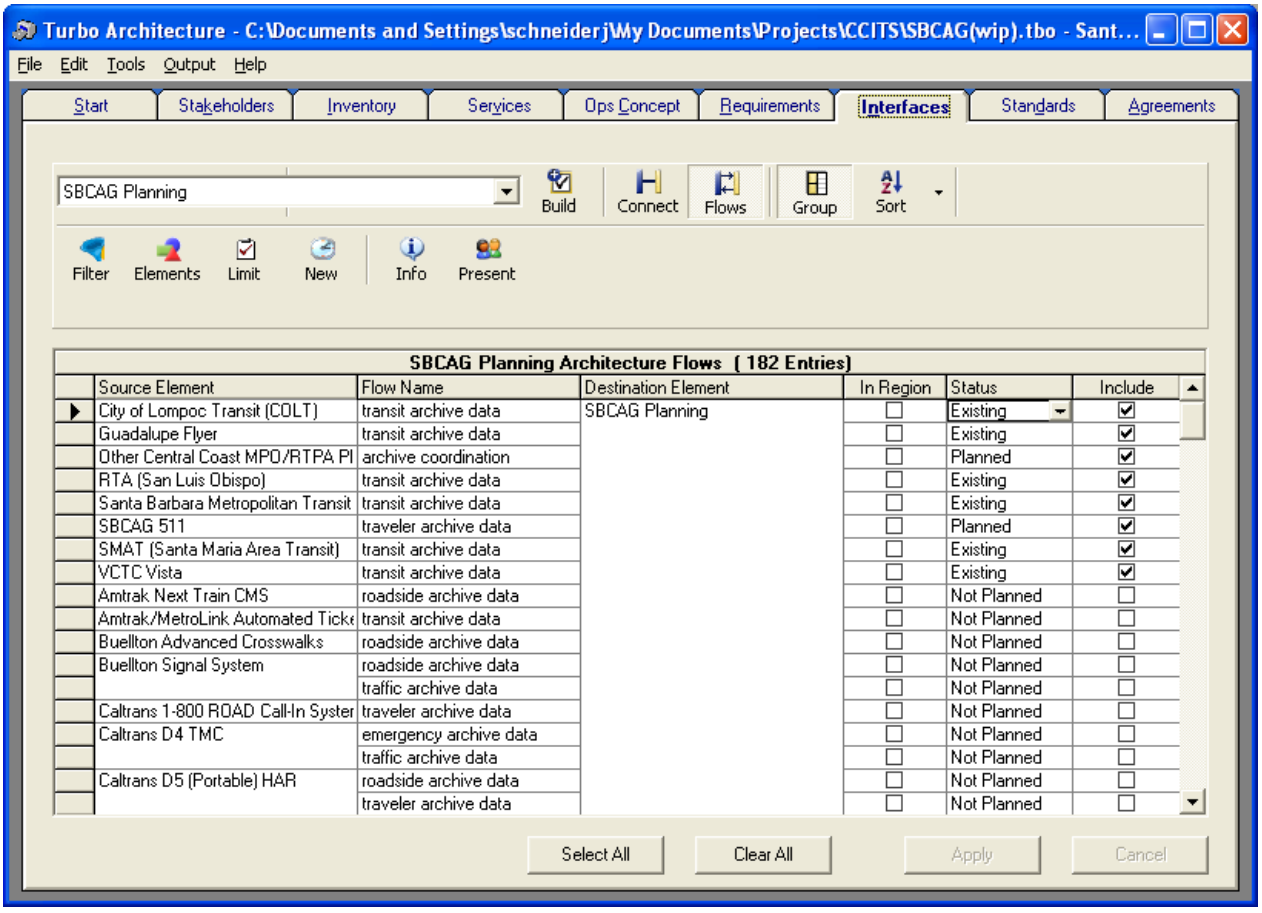
of the TMCs will allow shared CCTV control, then both directions will have the traffic images data flow and only one will have the "video surveillance control" data flow defined.

Note that you can indirectly define an interconnection between elements by including a data flow between them (even if they were not linked via the Connect view). Conversely, you can indirectly remove an interconnection by eliminating all defined data flows between the elements.

It is possible that different flows between the same elements may have different statuses. This can occur under several circumstances, but most commonly when existing systems have plans to expand functionality or to be integrated into a larger system. (As an aside, the status of an interconnection is based upon the status of its data flows. In most cases, if there is an Existing data flow between elements, then the interconnect status between the elements is normally assumed to be Existing.)

Please remember that you may need to perform a rebuild of the active architecture, depending upon what has been updated. This may become evident when required data flows are not found.

Exhibit 14 – The Interfaces Tab: Architecture (Data) Flows



Major Data Fields:

Field	Description
Include	Checkbox to indicate if the Connection or Data Flow is to be included in the active architecture.
Status (Flows view)	Status of the data flow: Existing, Planned, or for some databases, Programmed; setting a flow to Not Planned unchecks Include (i.e., excludes the Data Flow) and setting the status to any other status checks Include.

Major Operations:

There are basically two (2) types of buttons across the top of the Interfaces form (for both Interconnects and Flows): action and switches. Action buttons perform a task (sort data, start another form, etc.) and switches turn functions on or off.

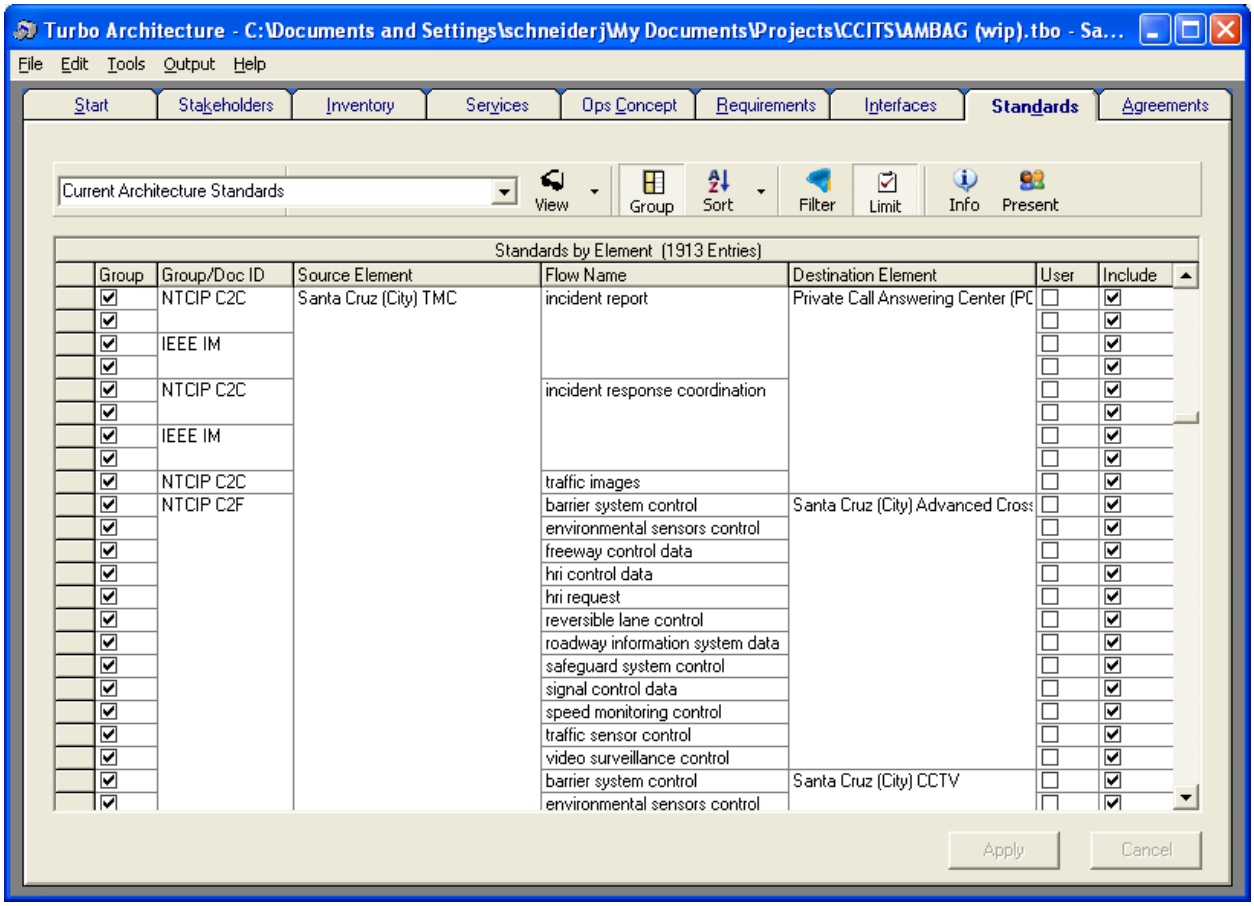
Control/Button	Function
Element List	Drop-down list of all elements in the active architecture that controls what interconnects/flows to present: All elements or only the selected element.
Build	Action button that starts the build process. A new screen is presented that will allow you to generate a cross-reference report and actually perform the build. When the build is complete you can review and accept or reject the just built flows (en masse, not individually). A rebuild may also delete interconnects/flows that were previously excluded.
Connect/Flows buttons	Toggle buttons to indicate whether to show interconnections or data flows in the data grid.
Group	Toggle button to change the data grid to only show the element name of consecutive rows once (improved readability).
Sort	Action button to reorder the data grid using pre-defined or user-defined sorts.
Elements	Toggle and action button that is used to select which elements in the Turbo database to include in the display. You can (and will probably want to) select only those elements in the active architecture, all architectures, or any subset. Pushing the button applies the selection. Right-clicking on the button starts the element selection form.
Limit	Toggle button to limit the data grid to only those items included in the active architecture.
New	Toggle button to limit the data grid to only those items added in the last build.
Info (Flows view)	Provides additional information regarding the specified data flow.
Select All	Switch to select (check) all of the rows in the displayed table.
Clear All	Switch to unselect (uncheck) all of the rows in the displayed table.
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.12 The Standards Tab

The Standards tab is used to indicate which ITS-related standards are (to be) implemented. There are numerous potential standards managed by several different standards development organizations (SDOs). More information on ITS standards can be obtained on the web at http://www.standards.its.dot.gov/default.asp.

The Standards tab (Exhibit 15) operates very much like the Interfaces tab with may of the same buttons and functions. The standards can be presented in several ways: by ITS standard, subsystem, or element. The element and subsystem presentations display the standards by data included flows between elements.

Exhibit 15 – The Standards Tab



Major Data Fields:

Field	Description
Include	Checkbox to indicate if the Connection or Data Flow is to be included in the active architecture.

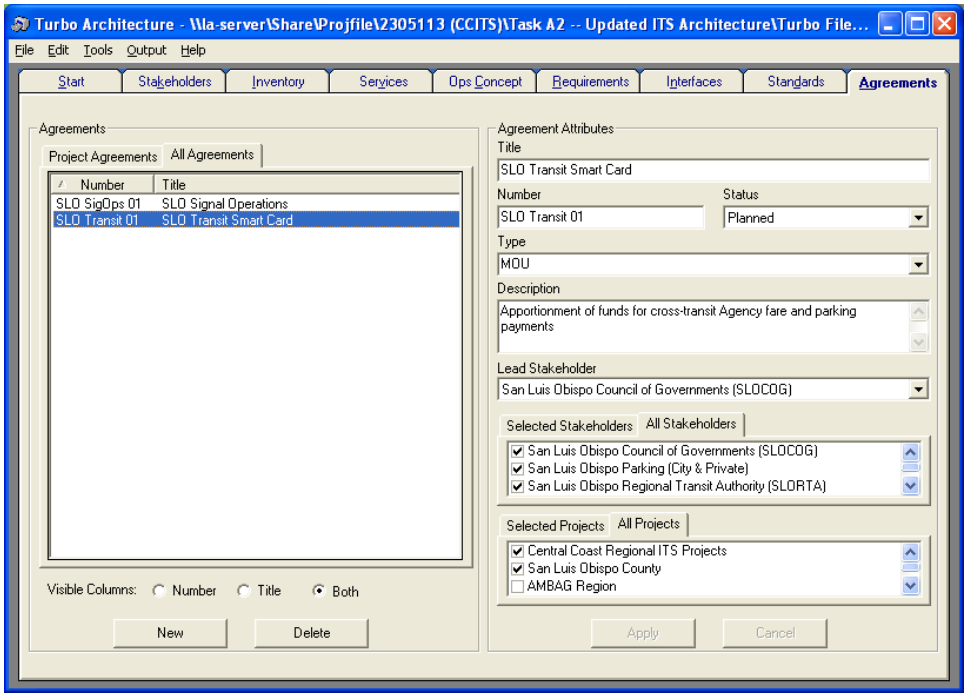
Major Operations:

Control/Button	Function
Standards List	Drop-down list of all ITS standards that controls what standards to present: all or only the selected standard.
View	Action button to indicate which standards view to display.
Group	Toggle button to change the data grid to only show the standard and element names of consecutive rows once (improved readability).
Sort	Action button to reorder the data grid using pre-defined or user-defined sorts.
Limit	Toggle button to limit the data grid to only those items included in the active architecture.
Info	Provides additional information regarding the specified standard.
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.13 The Agreements Tab

The Agreements tab (Exhibit 16) is used to document and mange various (existing and potential) Agency agreements. There should be a correlation between R&Rs (described earlier in the operational concepts) and Agency agreements. This tab functions very similarly to the Inventory tab: Agency agreements on the left-hand pane and the associated data are to the right. The display of the agreements can be restricted to the active architecture or the entire Turbo database.

Exhibit 16 – The Agreements Tab



Major Data Fields:

Field	Description
Title (required)	Title of the agreement.
Number	An agreement number (should be unique).
Status	Status of the agreement (default values are Existing and Planned, but additional status values, such as Programmed, can be created).
Type	User definable and selectable list of agreement types (e.g., MOU, Handshake, etc.) Either pick a type from the list or enter a new agreement type.
Description	Description of the agreement.
Lead Stakeholder	Primary "owner" of the agreement (pick-list from the Stakeholders tab).
Stakeholders	Checkbox list of applicable stakeholders/participants.
Projects	Checkbox list of applicable ITS architectures in the database.

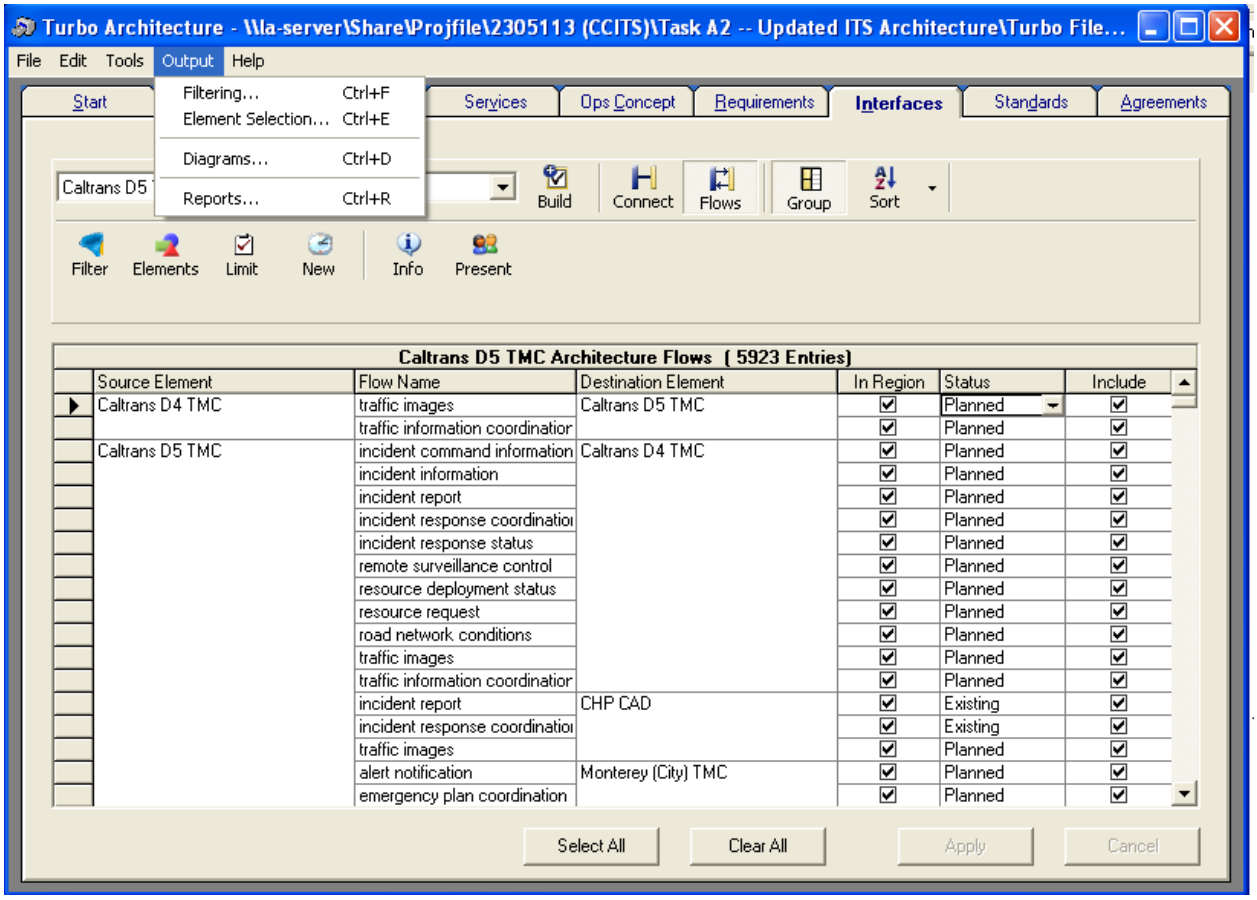
Major Operations:

Button	Function
Agreements sub-tab	Selects whether to show all agreements in the database or only those for the selected ITS architecture.
New	Used to create a new agreements in the database.
Delete	Used to delete an all agreements from the database.
Apply	Saves the changes to the Turbo database.
Cancel	Ignore the changes and revert to the original data.

2.2.14 Running Reports

Turbo Architecture comes with a variety of pre-built reports and diagrams. Generally there is at least one report or diagram for each Turbo tab. The reports can be accessed via the Turbo Menu via the Output menu item (Exhibit 17). In general, the data to be used in the reports and diagrams are for the active architecture only and not the entire Turbo database.

Exhibit 17 – The Reports Menu



The following is a summary of some of the more important or useful reports and diagrams:

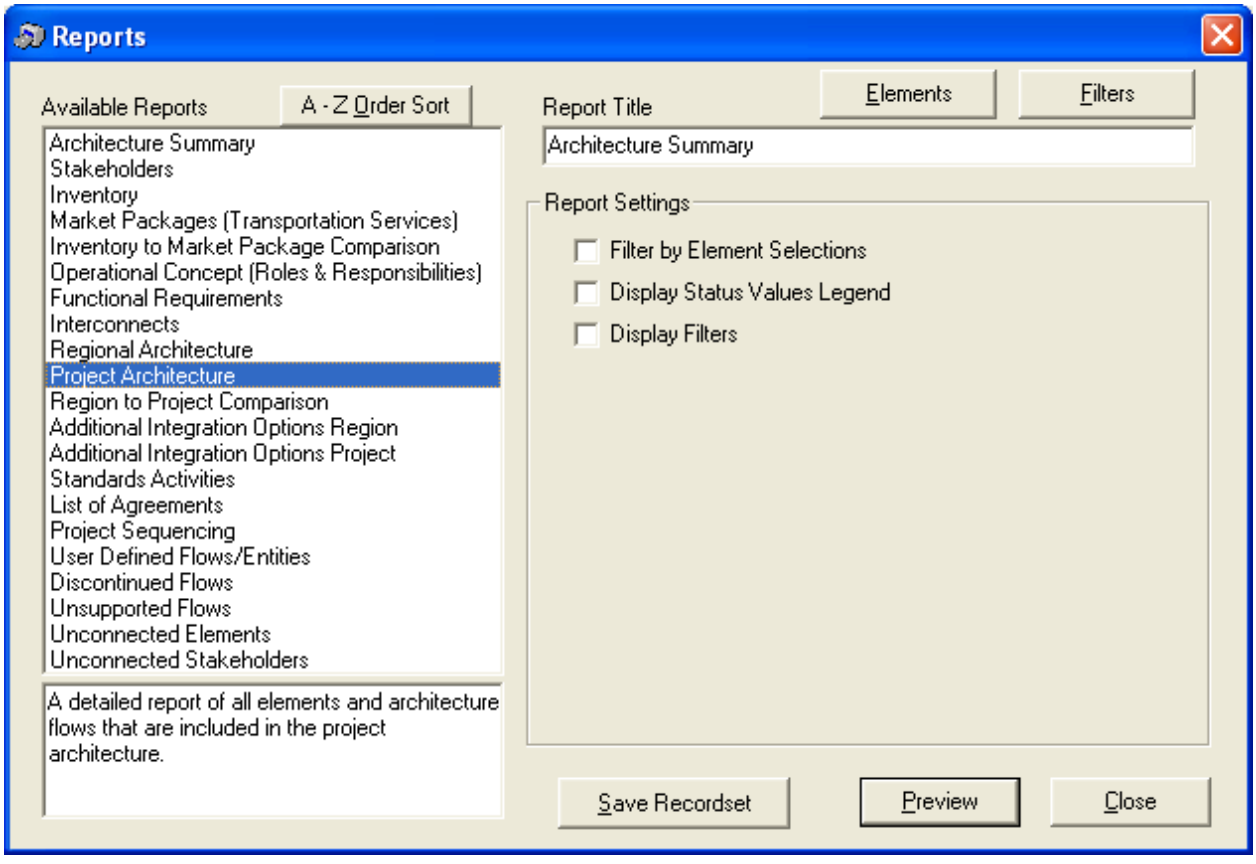
Report/Diagram	Description
Subsystem Diagram	Generates a Physical Diagram (a.k.a. Sausage Diagram) that shows the selected subsystems and communications for the active architecture.
Interconnect Diagram*	Diagram showing how the selected systems are interconnected.
Flow Diagram*	Diagram showing how the selected systems are interconnected and the related data flows.
Architecture Summary	Report showing all of the ITS inventory for all architectures in the Turbo database.
Stakeholders	Report showing all stakeholders in the Turbo database.
Inventory*	Report listing the ITS inventory in the active architecture.
Market Packages	Report showing the selected Market Packages and associated inventory elements for the active architecture.
Operational Concepts	Report showing the stakeholder roles and responsibilities defined in the active architecture.

Report/Diagram	Description
Functional Requirements	Report showing the functional requirements defined for the ITS (selected) elements in the active architecture.
Interconnects*	Report showing how the (selected) elements in the active architecture are interconnected (note that his report only lists each interconnection once, so, for example, the connection between TAMC Planning and AMBAG Planning will only appear under AMBAG Planning).
Project Architecture*	Report showing data flows between the (selected) elements in the active architecture.
Standards*	Report showing the applicable ITS-related standards for the active architecture.
Agency Agreements	Report showing the Agency agreements that have been entered into Turbo.

* You can limit these reports and diagrams to any or all of the elements in the active architecture by filtering or explicit element selection

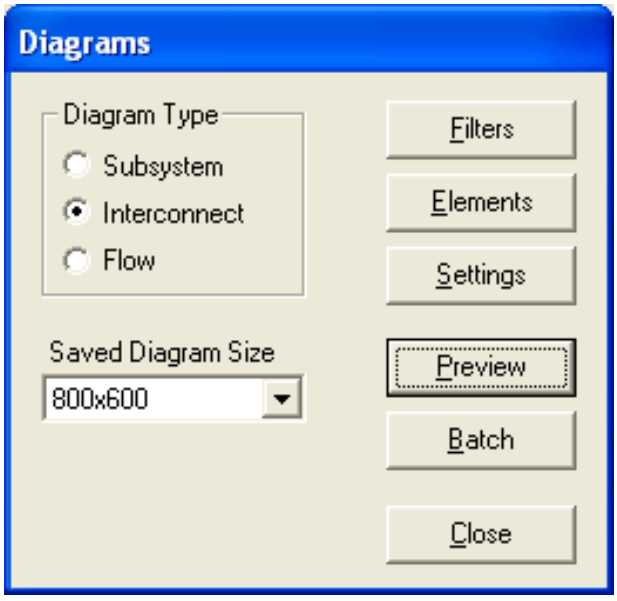
To run a report, select the desired report in the left-hand window (Exhibit 18), select the desired options and filters using the checkboxes and top buttons and then hit the Preview button. This will generate the report in a new window. From there, you can examine the output and print or save it, if desired.

Exhibit 18 – Report Selection



Similarly, to run a diagram (Exhibit 19), select the diagram from Diagram Type and set the desired filters and options (unfortunately, you cannot filter the Subsystem diagram). Press the preview button to generate the diagram. The Batch button allows you to submit a large number of the same type of diagram at one time, but this can take a long time and use a lot of system resources.

Exhibit 19 – Diagram Selection



Most of the architecture reports presented in the CCITS project were custom MS Access reports. If you are proficient with MS Access (or other data reporting tools), you can export the data used to generate the Turbo reports (in CSV format) using the Save Recordset button and then import the file into your tool of choice. This functionality may be of particular use when working with a complex interconnection or flow diagram that is difficult to read and a tabular presentation could make the information more accessible.

3. CCITS ARCHITECTURES

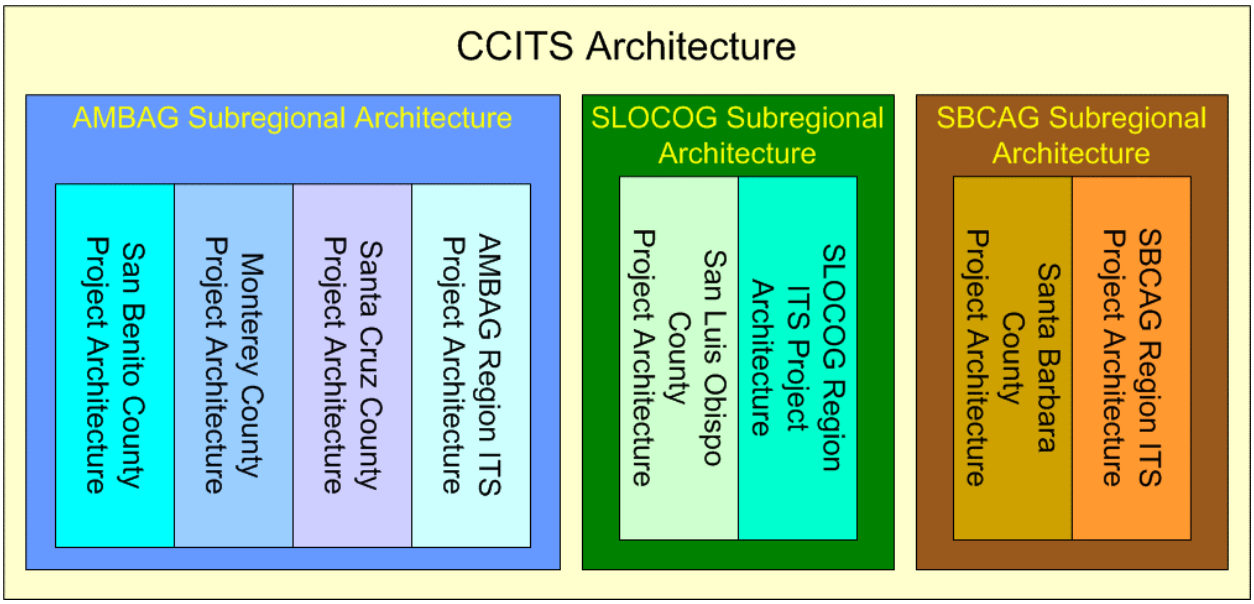
This section describes the structure of the CCITS Architecture database and how to obtain the correct database prior to performing updates.

3.1 CCITS Architecture Databases

Turbo allows two (2) types of architectures: regional and project. The CCITS Turbo databases have been segmented into separate Turbo databases for each CCITS MPO. (Originally, there was a single CCITS Turbo database with seven (7) project architectures, one for each County, AMBAG and Regionally significant projects.) Currently, in each MPO Turbo database there is a project database that is representative of local ITS for each constituent County of the MPO (i.e., ITS that is [to be] implemented in the County and is generally local to Agencies in the County) and a separate project architecture for ITS that is of significance to the entire MPO and/or beyond the MPO boundaries. The combination of the individual County architectures and the MPO-significant architecture form the regional architecture for the MPO. (Note that these

individual project architectures could be "merged" together to create an actual Turbo regional ITS architecture, but that would create additional complexities, especially when updating the architectures.) Exhibit 20 depicts the CCITS Turbo database structure graphically.

Exhibit 20 – CCITS Turbo Database Structure



3.2 ITS Architecture Maintenance Plans

An ITS Architecture Maintenance Plan has been developed for each CCITS County/MPO (with AMBAG covering its tri-County area). These plans are available from the project website (http://www.iteris.com/ccits-admin/html/deliverables.html) and describe the roles and responsibilities needed to keep each of the ITS architectures up-to-date. The plans also contain advice on what project-related data to collect prior to starting the update process and how to document that data.

3.3 How to get the appropriate ITS Architecture

Each MPO is responsible for managing its own ITS architecture and Turbo database. This includes version control procedures and distribution of the Turbo database and related files (paper and electronic). Refer to the Architecture Maintenance Plan for your MPO to obtain the needed reference information and contacts.

3.4 Relationship with other ITS Architectures

One of the goals of an ITS architecture is to document existing and potential interfaces between ITS systems (i.e., ITS integration). This is of particular importance when defining links with systems outside of the local project area and thus defined in another ITS architecture. In general, only projects that are of Regional significance should rise to this level. For example, a local Agency's signal system will probably not require this consideration. However, a transit Smart Card might, if there are plans to allow usage of the Smart Card with adjacent transit Agencies or with Agencies outside of the MPO area.

In general, most ITS elements in a County architecture will not interface with systems beyond the owning/operating Agency or, in some cases the Regionally significant ITS (i.e., not beyond the MPO architecture). ITS that has a scope involving multiple Agencies throughout the MPO or that (may) integrate with systems outside of the MPO will need to have those Agencies or systems represented in the ITS architecture. These items will also need to be coordinated with updates to the corresponding ITS architectures when they are updated.

The Architecture Maintenance Plan for each CCITS architecture contains a list of potentially impacted ITS architectures that need to be to be considered (for coordination) when updating the particular architecture(s). This information can be found in Chapter 7 of each project architecture maintenance plan.

In order to advance the integration of ITS in the Central Coast, it is recommended that AMBAG and Caltrans promote and facilitate the coordination and standardization of the various CCITS ITS architectures henceforth.

4. ITS PROJECT IMPLEMENTATION

If the data in the architecture is not used, then its development and maintenance is merely a bureaucratic exercise. The key to getting value from the ITS architecture is to integrate it into the (local and) Regional ITS planning and deployment processes.

4.1 Interrelationship of ITS Planning and the ITS Architecture

In the recent past, ITS projects were often funded through various R&D and/or demonstration projects without competing against "traditional" transportation projects that had gone through the planning process(es). With the relatively new FHWA and FTA rules, this is no longer possible for projects that receive federal funds. Therefore, planned projects identified in the ITS architecture (and in the forthcoming updated ITS Implementation Plan) will need to go through the defined transportation planning processes.

Now that your ITS architecture is built, you can make it part of your Region's various planning processes. Section 4 of the ITS Architecture Maintenance Plan discusses when the MPO's architecture should be updated so it can be better linked with planning events, such as the preparation of the Regional Transportation Plan or Regional Transportation Improvement Plan.

But why update the architecture at these points? Because the ITS architecture can be used as a resource in the preparation of these documents and also because the process of updating these documents involves identifying new ITS-related projects that need to be added to the ITS

architecture. Also, the ITS Architecture offers a way to help examine the linkages between projects/systems and provide insight into project sequencing.

4.2 Moving from Project Concept to Operating System

The Central Coast ITS Strategic Deployment Plan (2000) laid out a set of recommended ITS projects for the Region and for each of the Counties. The CCITS Implementation Plan will update this slate of projects.

The various Agencies throughout the Region will generate additional project concepts over time that will need to be added into the mix. These projects will need to be added to the Regional SDP and evaluated vs. the other projects already in the SDP. This can be accomplished by using a Project Description Form (the SDP project form) similar to the ones used by the SDP, thus allowing an evaluation with data similar in format. The SDP project form should be completed by the proposing Agency and in the same level of detail as those in the SDP. Several areas of the SDP project form relate to the National ITS Architecture, so adding the project to the appropriate ITS architecture(s) will assist with its completion.

The project concept needs to then get added into the transportation planning process. (Section 4.1 addressed the linkages between the ITS Architecture and the various planning processes.) This is where the project will get evaluated against other project competing for limited funding. Additional paperwork may be required, depending upon which planning process is being performed and what funding sources are being requested. The project sponsor will need to determine what is required by the particular funding program(s) being considered and to meet the funding requirements (e.g. timelines, data requirements, etc.).

For example, if Federal funds are being requested, a Systems Engineering Review Form (SERF) will probably be required. (Section 5.2 has an overview of how to use the ITS architecture when developing a Systems Engineering Analysis, which has some similarities to the SERF.)

Most, if not all, funding sources now require projects follow a Systems Engineering (SE) approach when developing ITS projects. SE entails a full life-cycle view of the project, so you will need to consider details like ongoing Operations and Maintenance (O&M) and project termination in your analyses. In addition, since all CCITS projects are in the State of California, the projects will also need to follow Caltrans' ITS project guidelines (e.g., Local Assistance Program Guidelines, etc.).

4.2.1 Funding Programs

There are several potential funding opportunities for ITS projects and each will have their own requirements, in terms of background/paperwork as well as types of projects available for funding. Caltrans' Division of Local Assistance has a variety of documents to help with the policies and programs. Here are some of the available funding opportunities:

- Federal Programs and Grants
    - Surface Transportation Program (STP) – funds transportation projects from capital improvements to planning (e.g., traffic signal systems, planning studies, etc.)

- Congestion Mitigation and Air Quality (CMAQ) – funds transpiration projects targeted at improving congestion and/or air quality (e.g., transit improvements, HOV lanes, etc.)
- Transportation Enhancement Activities (TEA) – funds projects that are over and above "normal" transportation projects; TEA has been incorporated into the STIP (see below), so this is now a two (2) step application process and is managed at the State level
- Urbanized Area Formula Program – funds mostly transit projects (planning, capitol investments, security, etc.) and applies to incorporated areas with populations of at least 50,000
- State Planning and Research Program – funds transit planning in small urban areas (under 50,000 population) and multi-regional transit planning projects
- Transportation, Community and System Preservation Program – funds for the planning, development, and implementation of strategies that improve the efficiency of the transportation system and reduce the impacts of transportation on the environment or reduce the need for costly future infrastructure (Congressional appropriation)

- State
  - State Transportation Improvement Program (STIP) – (mostly funded with Federal monies) funds transportation projects from capital improvements to planning and ridesharing
  - SHOPP – funds a variety of transportation projects on State highways (available to Caltrans only)
  - Hazard Elimination Safety – funds safety improvement projects on public roads
  - SB-821 Bicycle and Pedestrian Facilities Program – Calls for projects are usually made in June and allocations made in July
- Local (varies by locality)
  - Many Counties have funds set aside via local fees and taxes that are available for transpiration-related projects (e.g., ½ cent gas taxes [Santa Barbara County Measure D], bed taxes, developer fees, etc.)

4.2.2 Procurement Options

Once the project is approved and funded, there are several methods of procurement available. Sole sourcing might be used if only a single contractor can provide the technical solution or when compatibility with existing equipment or systems is needed. While it is probably the easiest method, due to the potential for abuse and overcharging, this technique is not usually looked upon favorably.

Competitive procurements (e.g., invitation to bid, request for proposal, etc.) allow Agencies to select the best from a variety or technical approaches and/or costs. The Agency can assign weighting to different parts of the proposal requirements based upon the type of project. For example, for a project that involves commodity-like items (e.g., signal controllers), price may be

the most important factor, but more complex projects (e.g., a Regional smart card system) the technical approach may be paramount.

While this approach is probably the best for most system procurements, it does require effort by the Agency. Up front, the requirements and legal matters (proposal language, contract, etc.) need to be developed along with the evaluation methodology. Then the Agency must perform the evaluation and select the winning offer.

Other procurement options include a two-step process for engineering/construction, design/build, and system manager. Exhibit 21 summarizes each of the aforementioned procurement approaches.

Exhibit 21 – Procurement Options

Procurement Method	Description/Usage
Sole Source	Purchase direct from vendor without competition. Use when singular source for technology or with compatibility issues.
Invitation for Bid (IFB)	Requesting pricing from multiple vendors for specific product(s). Generally award to lowest price or best value.
Request for Proposal (RFP)	Allow Agency to select the best solution (technical, cost, schedule) to the stated problem(s). Award to vendor that scores highest in evaluation.
Request for Qualifications (RFQ)	Used to select a vender that is best qualified to address a problem without considering cost. Negotiate cost following selecting the most qualified vendor.
Two-step/Turn-key	Typically used on civil engineering projects. First an engineer develops contract documents (PS&E) for a specific project phase, which is then advertised. Vendor with the lowest cost/best value response is awarded the contract and is responsible for providing an operations system.
Design/Build	A single vendor is contracted to be responsible for all work needed to deliver the project following an Agency review of the vendor-submitted conceptual plans. The vendor is then responsible for all design work and any and all procurement and subcontracting until the system is on-line and turned over to the contracting Agency. Not often used for transportation projects in the US.
System Manager	The system manager approach is similar to design/build, except the Agency's normal procurement processes are used and the Agency is more involved in the process.

As mentioned earlier, the SE process requires you to address O&M in your project. The O&M analysis involves addressing the proactive and reactive activities concerned with operating a system, such as system checks, equipment repair and replacement, upgrades, etc. and their associated direct and indirect costs (e.g., staffing, training, workarounds or rental of temporary equipment, etc.). Consider this scenario: you get funding to design and build a TMC, but since there was no plan for the O&M, it sits idle because there is no staff to operate it. The costs (hard and soft) for these activities need to be factored into the budget and planned for in the procurement process.

5. USAGE EXAMPLES

This section will present three (3) scenarios showing how the ITS Architecture can be used to help support Agency ITS Project-related activities.

5.1 Scenario 1: Add a new ITS project to the Architecture

The first step to adding a new ITS project into the appropriate ITS architecture is to gather and review the required information. The particular information needed is discussed in the Architecture Maintenance Plan for your MPO. (The architecture mark-up described in Section 2.3 of the Maintenance Plan should already have been completed.)

This scenario assumes that the correct Turbo database has already been obtained (and a back-up copy created) and that any needed coordination (between Caltrans, other local Agencies, MPOs, etc.) has been completed and incorporated into the preparatory documentation.

A summary of the information you will need to update the architecture is described below:

- The name of the system/project, its owner, and implementation status
- An understanding of what the system is to do and who will operate it
- What other Agencies and systems will it interact with

Once the information is gathered and understood, the following steps will update the ITS architecture with the new project/system:

- Select the appropriate project architecture on the Start tab (based upon the system's scope and location/ownership) and update the log information (version, maintainer, etc.)
- If needed, add the stakeholder using the Stakeholder tab
- Move to the Inventory tab
    - Click on the All Elements sub-tab and then hit the New button
    - Enter the project name and description
    - Select the appropriate stakeholder from the picklist
    - Check the appropriate subsystems from the list of Subsystem/Terminators (remember, you expand the list to see explanations of the subsystems) – generally 1 to 3 subsystems will fully cover a project
    - Select the appropriate project architectures for this system based upon its scope. For example, if it is a local project (e.g., a signal system, advanced crosswalk, etc.), then it belongs with the County project architecture; if it spans the MPO or will interface with systems outside the MPO (e.g., a smart card, etc.), then it should be part of the MPO's Regionally Significant architecture; if it has aspects of both (e.g., a TMC, etc.), then make it part of both.
    - Select the status of the project (if you are adding the element as part of your planning process, the status is probably Programmed, otherwise it is probably Planned)
    - Apply your changes once you are satisfied with your entries

- Move to the **Services tab**
    - Review the list of Market Packages already defined for the MPO. Select the new project from the All Related Elements sub-tab
    - Add the MP to additional architecture projects if the scope of this project necessitates that change (e.g., adding a Regional fare control system might extend APTS4 [Transit Passenger and Fare Management] to the regionally significant architecture, if it were not already in it)
    - If all of the needed MPs are not yet selected, click on the All Market Packages sub-tab and repeat the previous steps as required (as well as adding the correct MP status)
    - Apply your changes for each MP change/addition
- Move to the **Ops Concepts** tab
    - Review the R&R areas already defined for the selected architecture
    - If there are any R&R areas missing you will need to add them
        - Hit the New button
        - Enter the Name (chose a name similar in structure to the existing Areas) and Description
        - Select the applicable MPs (note that the list will be limited by MP selected on the Services tab)
        - Select the applicable stakeholders (who will be performing the tasks to be defined)
        - Accept entries when complete
    - If the needed R&R Area(s) are already included, add the applicable stakeholders (who will be performing the tasks to be defined) to each Area, as needed
    - Enter the actual Responsibilities for each affected R&R Area (note that you may need to add R&Rs for other stakeholders, depending upon the scope and functionality of the project being added)
        - Expand the R&R Area by double-clicking on it or clicking on the + symbol next to the Area name
            - Select the desired stakeholder and enter the responsibilities in the grid (one per row) and its status. You may want to use or copy existing R&Rs as examples.
            - Repeat as needed for each R&R Area & stakeholder
        - Apply your changes for each R&R Area
- Move to the **Requirements tab**
    - Generally, you will want to use the Elements view for adding or modifying a single project/system. The new element should be in the list, but with no FRs. Select the new project/system and click the Specify Functionality checkbox.
    - Check the checkbox of each of the applicable Functional Areas

- For each checked Functional Area, select it and hit the Requirements button. This will start the Requirements form where you can
- Select applicable pre-defined requirements as-is by clicking on the applicable Include box(es) and setting the Status field for each requirement. (Alternately, if you set the Status field, the Include field is automatically selected.)
- If an existing requirement is close, but minor changes are needed, double-click on Requirement field (or select the field and hit the Tailor button). This will start another form where you can modify an existing requirement as needed (be sure to allow the change to apply to more than one element). Apply the change and Close the forms.
- If a new requirement needs to be written, hit the New button, select the correct Functional Area on the new form and enter the requirement text (be sure to allow the change to apply to more than one element). Apply the change and Close the forms.

- Move to the **Interfaces tab** (Interconnects and Data Flows)
  - You will need to rebuild the active architecture in order to get the interconnections and flows defined. Hit the Build button and run and review the offered Inventory/MP report, if desired, or answer no and initiate the build process (you shouldn't need to change any of the Build the settings at this point). The build may take a while, depending upon your computer and the amount of changes made.
  - When the build process is complete, you will be shown a form with the proposed flows (added flows and possibly some flows to be removed from the architecture). Review the entries to make sure that the new element's flows look reasonable (you will revisit them in a while). If it appears to be good, then accept the changes. If not, reject the changes, change the subsystem and MP assignments for the new element(s), and perform another Build.
  - Once the Build is approved, put the Interfaces form into the Connect view and select the new element from the picklist (upper left corner).
  - Include the desired system interconnections (check the Include box for each applicable system interconnection row) and Apply the changes
  - Switch the form into the Flows view (the new element should still be selected)
  - Select the applicable data flows (and its Status) between the systems just interconnected (remember that the flows need to be defined to and from both systems)
  - Apply the changes when completed
- Move to the **Standards tab**
  - Put the form into the Standards by Element view (click on the arrow on View button)
  - Sort by Source Element by clicking on the column heading
  - Review the standards for each of the defined data flows (detailed information on each can be obtained by hitting the Info button) and include/exclude as applicable

- Sort by Destination Element and repeat the previous step

- Move to the **Agreements tab**, if this new project will require an Agency agreement
  - Select the All Agreements sub-tab
  - Select any existing agreements that need to be modified and amend as needed
  - If new agreements are needed, hit the New button and enter
    - Agreement name and description
    - Agreement number (must be unique)
    - Agreement status and type from the pulldown lists
    - Select the lead stakeholder and other stakeholders involved in the agreement
    - Select the applicable architecture(s) based upon the scope of the project/system
  - Accept the changes
- Go back through each of the tabs to review your changes and make sure that the new project is fully described. If you are not satisfied make additional changes until you are satisfied with it.
- If you want to print any diagrams or reports, open the **Output menu** and select and run the diagrams and reports desired (one at a time)
- Close Turbo (**File|Exit menu**) and save your work.

5.2 Scenario 2: Using the Architecture to Help Prepare a Systems Engineering Analysis

Systems Engineering Analysis (SEA) is a method of designing projects that considers all phases of the project's life cycle, including initial planning, design, acquisition/development, deployment, O&M, and eventually retirement. An SEA is an important part of developing and deploying ITS projects and is a key component needed to help satisfy Federal funding requirements.

An ITS architecture can support the development of an SEA document by providing some of the initial content. A typical SEA document consists of the following sections:

1. **ITS Project Description**

   ITS architecture support: The Description field for the ITS element can be used as a starting point.

2. **Identification of Regional ITS Architecture Being Implemented**

   ITS architecture support: The ITS element's subsystems, MP associations and interconnections can be used as the main content for this section. Alternately the Physical ("Sausage") Architecture diagram might also be useful, unfortunately, the Turbo diagram can not be filtered, so additional text would be required to explain which parts of the diagram apply.

3. **Participating Agencies and Their Roles and Responsibilities**

   ITS architecture support: The applicable stakeholders' Op Concepts can be used to satisfy this section.

4. **Requirements Definitions**

   ITS architecture support: The FRs and the data flows for the ITS element can be used for this section.

5. **Alternative Analysis of Configuration and Technology Options**

   ITS architecture support: None.

6. **Procurement Options**

   ITS architecture support: None.

7. **Applicable ITS Standards and Testing Procedures**

   ITS architecture support: The ITS Architecture's Standards report will directly feed the first part of this section.

8. **Resources Needed for System O&M**

   ITS architecture support: None directly, but the R&Rs relating to O&M can be used as a starting point for this section.

To extract ITS element-specific reports from Turbo, hit the Elements button on the Report Selection screen. You will then get a form where you will be able to limit your report to a single element or a specific subset of elements. Note that not all reports allow this feature. In those cases, you will need to either manually copy/transcribe the desired information or export the data into another tool, such as MS Access, and generate a custom report.

5.3 Scenario 3: Is My ITS Project Compliant with the National ITS Architecture?

In general, for a project to be in compliance with the National ITS Architecture, it needs to be included in the ITS architecture for the Region and it needs to have the appropriate associated ITS architecture data defined. More specifically, the project specifications should facilitate the (automated) sharing of information between other ITS elements as well as between Agencies and jurisdictions (depending upon the scope of the project). In addition, the project should also include the use of applicable ITS standards.

If there is enough project-related data in the ITS architecture to support the development of the SEA form (summarized above), then the project is probably compliant. Here is a summary of what to review in the ITS architecture:

- **Inventory:** Is the ITS project fully defined (including location, timeframe, primary stakeholder, subsystem associations, etc.)?
- **Services:** Have the appropriate Market Package associations been made?
- **Op Concept:** Is there an adequate description of how the system is to be operated and by whom
- **Requirements:** Is there a full (high-level) description of what the system is to do?
- **Interfaces (Connect):** Are all system interconnections identified?
- **Interfaces (Flows):** Have the proper data flows between systems been defined?
- **Standards:** Have the appropriate supporting ITS standards been identified?
- **Agreements:** Have the required Agency agreements been described?

If any of these areas are lacking, then you will need to go to the necessary tabs to add the required information.

6. ITS RESOURCES

If you have questions regarding ITS in general and/or your ITS architecture, your MPO representative (the person that gave you a copy of your ITS architecture) should probably be your first point of contact after you have tried the on-line resources (if you are from a local Agency). Another option might be to contact a peer at another nearby Agency.

If you still need additional assistance or just want to get more in-depth information, there are a variety of informational and assistance resources available to you, for both Turbo and ITS in general.

6.1 Websites

There are a number of websites dedicated to ITS and the National ITS Architecture. Many local Agencies also have good information about their ITS as well as additional ITS-related links. Some of the more noteworthy websites include:

- ITS America's website (http://www.itsa.org/) contains a plethora of ITS information and links
- The National ITS Architecture (http://itsarch.iteris.com/itsarch/)
- ITS Standards (http://www.standards.its.dot.gov/default.asp)
- FHWA Joint Programs Office website (http://www.its.dot.gov/index.htm) has ITS deployment-related information, including ITS costs and benefits database
- California Statewide ITS Architecture (http://www.kimley-horn.com/CAArchitecture/)
- USDOT's Lessons Learned database (http://www.itslessons.its.dot.gov/) is a searchable knowledge-base of Agency experiences with evaluating and deploying various ITS
- Caltrans' Statewide ITS architecture (http://www.kimley-horn.com/CAArchitecture/)
- Caltrans' Division of Local Assistance has a variety of resources to help with ITS project funding and documentation (http://www.dot.ca.gov/hq/LocalPrograms/index.htm)
- Caltrans transportation planning grant website (http://www.dot.ca.gov/hq/tpp/grants.htm)
- PATH (http://www.calccit.org/itsdecision/) can be used to find information about ITS Services and Technologies and their performance and is operated by a consortia that includes Caltrans
- ITS and architecture training/education is available through CITE (Consortium for ITS Training and Education) (http://www.citeconsortium.org/)
- The National Highway Institute also offers ITS and ITS architecture courses (http://www.nhi.fhwa.dot.gov/category.asp?category_id=8)

6.2 Turbo Help

Turbo Architecture help is available several ways. For quick-and-dirty help on Turbo in general or for a specific tab or function, you can hit the F1 key (or go through the Help menu item) and you will be shown a summary of the functions and options for each of the Turbo tabs. This is a

standard Windows help system, so there is a table of contents and limited keyword searching. This will probably be sufficient for most issues.

If you find you need more in-depth information, the Turbo Architecture User Manual (Turbo Architecture User's Manual V3.1.pdf) can be found on the Turbo installation CD. This document should have been copied to your local PC during the installation process and should be found in: C:\Program Files\National Architecture\Turbo Documents\, if you installed Turbo in the default directory. Please note that the file name will change with the version of Turbo Architecture installed.)

There is limited Turbo training available through several sources. Training information is available on-line at: http://itsarch.iteris.com/itsarch/html/training/training.htm and the NHI link, above. Additional Turbo assistance is also available via an email form at: http://itsarch.iteris.com/itsarch/html/menu/feedback.htm.

Lastly, other Central Coast Agencies might have also run into the same issue(s) and it might be useful to discuss them with other Central Coast Agencies or Caltrans. This will also help facilitate coordination between the various CCITS Agencies.

6.3 Caltrans

Caltrans has developed the Statewide ITS architecture for California (see link above). It can be used in a variety of ways, including as a resource for additional information and examples relating to usage and application of Turbo and the National ITS Architecture. The site also includes ITS glossaries, links to other sites, etc.

Caltrans District 5, in San Luis Obispo, may be able to provide information regarding ITS in the Region, funding opportunities, etc. More importantly, the District 5 office can assist with Regional project coordination and related questions.

6.4 FHWA

The USDOT/FHWA has a plethora of information and resources regarding ITS and the National ITS Architecture (some of the links are provided above). As of this writing, Frank Cechini is the FHWA representative for the Central Coast. He will be able to address questions about the National ITS Architecture, applicability of particular aspects of the ITS architecture related to local projects, documentation, funding, etc. (For specific Turbo questions please refer to section 6.2).

The FHWA also maintains an ITS Help line that can be accessed via telephone (866-367-7487) or email (itshelp@volpe.dot.gov). The help line was established to assist the general transportation community to seek resources, websites, and documents that relate to Operations and ITS