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|  | Florida ITS Architecture Support and Maintenance ProjectDistrict 5 RITSA Conversion Report (ARC-IT 9.0) Version 1.0 |

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# Introduction

This Architecture Conversion Report records the District 5 Regional Intelligent Transportation System (ITS) Architecture (RITSA) conversion from its reference in the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) Version 8.3 to ARC-IT Version 9.0. This report addresses the results of the conversion process.

# Conversion Process

The architecture conversion process uses the Regional Architecture Development for Intelligent Transportation (RAD-IT) software Version 9.0 to convert the architecture to be compatible with ARC-IT Version 9.0. The process includes the following steps to accomplish the conversion.

* Architecture conversion: Conversion features in RAD-IT Version 9.0 convert the architecture database schema to be compatible with RAD-IT Version 9.0 and aligned to reference ARC-IT Version 9.0 content.
* Conversion analysis: Conversion information is produced by RAD-IT for the architecture conversion noting the changes made. The conversion information notes the schema and content changes, such as service splits or consolidations, element divisions, and information flow adjustments. Analysis is required for each converted item to assess the appropriateness of each change for the architecture. For example, the roadway equipment coordination information flow was split into 14 separate information flows which need to be analyzed to determine which apply for each architecture. Another example includes the addition of the new CVO05 Commercial Vehicle Parking service which also involves the division of the Parking Management System element into two new elements, namely the Parking Area Equipment and Parking Management Center elements. These new elements along with the new CVO05 service are applicable to all eight Florida ITS Architectures requiring analysis and update of the architectures to accommodate the new ARC-IT content.

A substantial change that ARC-IT Version 9.0 imposes on the Florida ITS Architectures during conversion is the reorganization of the standards associated with each information flow in each of the architectures and their associated projects. The reorganization introduces solutions which associate sets of standards that are required to address an interface or information flow implementation. The conversion process does not provide the solutions information automatically. The standards solutions were populated with default selections and the selections were analyzed for their applicability for the architecture and each project. In the RAD-IT software, the Standards tab in the user interface is now the Communications tab.

* Architecture content update: The intent of the conversion process was to maintain the alignment of the converted Architecture content to the greatest extent possible with the pre-conversion Architecture content. As noted above, element physical object mapping changes, service package changes, information flow additions and adjustments, and the evolution of the standards mappings in ARC-IT Version 9.0 required changes to be made to the Architecture content. Unless it was necessary, no additional changes beyond those required to align the pre-conversion and converted architecture content were made. During the course of the Annual Architecture Maintenance Update, ARC-IT Version 9.0 features that could be considered as additional information to the Architecture will be assessed.
* Architecture website posting: The converted architecture will be posted to the Florida ITS Architecture website.

# Architecture Conversion Results

The District 5 RITSA was converted to be compatible with ARC-IT Version 9.0. The following sections highlight the changes made to the architecture as a result of the conversion process.

## Architecture Inventory Elements

Table 1 provides conversion results for architecture inventory elements impacted by the conversion process. The table information shows the element impacted, the results of the element conversion, the analysis disposition, and the notes of the conversion implementation.

Table 1 Conversion Analysis of Inventory Elements

| **Element in Source Architecture** | **Element in Converted Architecture** | **Conversion Disposition** | **Conversion Notes** |
| --- | --- | --- | --- |
| FDOT CV Parking Management System. Mapped to: * Parking Management System
 | FDOT CV Parking Management System. Mapped to: * Parking Management Center
* Parking Area Equipment
 | Remove the mapping to the ‘Parking Area Equipment’ Physical Object. Add a ‘Parking Area Equipment’ element and an interface with appropriate flows to the ‘FDOT CV Parking Management System’ element using CVO05 SP which will replace the existing PM04: Regional Parking Management (FDOT Parking) SP.  | Added ‘FDOT CV Parking Area Equipment’ element. Deleted’ PM04: Regional Parking Management (FDOT Parking)’ and added ‘ CVO05: Commercial Vehicle Parking (FDOT Parking)” SP.  |
| OCCC Operations CenterMapped to: * Parking Management System
* Traffic Management Center
* Archived Data User System
 | OCCC Operations CenterMapped to: * Parking Management Center
* Parking Area Equipment
* Traffic Management Center
* Archived Data User System
 | Remove the mapping to the ‘Parking Area Equipment’ Physical Object. Add a ‘Parking Area Equipment’ element and interfaces with the ‘OCCC Operations Center’ in PM01: Parking Space Management (Orlando Convention Center) and PM03: Parking Electronic Payment (Orlando Convention Center (1 of 2)) SPs.  | Created ‘OCCC Parking Area Equipment’ element. Added interfaces with ‘Orlando Convention Center Parking Facility System’ in PM01 and PM03. Also, removed OCC Operations Center mapping to Parking Management System. |
| Orlando Convention Center Parking Facility System. Mapped to: * Parking Management System
 | Orlando Convention Center Parking Facility System. Mapped to: * Parking Management Center
* Parking Area Equipment
 | Remove the mapping to the ‘Parking Area Equipment’ Physical Object. Add a ‘Parking Area Equipment’ element and interfaces with the ‘Orlando Convention Center Parking Facility System’ in PM01: Parking Space Management (Orlando Convention Center) and PM03: Parking Electronic Payment (Orlando Convention Center (1 of 2)) SPs. | Created ‘OCCC Parking Area Equipment’ element. Added interfaces with ‘Orlando Convention Center Parking Facility System’ in PM01 and PM03. |
| Parking Facility Operators. Mapped to: * Parking Management System
 | Parking Facility Operators. Mapped to: * Parking Management Center
* Parking Area Equipment
 | Remove the mapping to the ‘Parking Area Equipment’ Physical Object. Add a ‘Parking Area Equipment’ element and interfaces with the ‘Parking Facility Operators’ in PM01: Parking Space Management (Parking Facility Operators) and PM03: Parking Electronic Payment (Parking Facility Operators) SPs. | Implemented as dispositioned. |
| UCF Parking.Mapped to: * Parking Management System
 | UCF Parking.Mapped to: * Parking Management Center
* Parking Area Equipment
 | Remove the mapping to the ‘Parking Area Equipment’ Physical Object. Add a ‘Parking Area Equipment’ element and an interface with the ‘UCF Parking’ in PM01: Parking Space Management (Parking Facility Operators) SP. | Added’ UCF Parking Equipment’ element and added it in the PM01: Parking Space Management (Parking Facility Operators) SP and has an interface with UCF Parking element.  |
| Volusia County TMCMapped to: * Parking Management System
* Traffic Management Center
* Archived Data User System
 | Volusia County TMCMapped to: * Parking Management Center
* Parking Area Equipment
* Traffic Management Center
* Archived Data User System
 | This element is in ‘Volusia County Park Parking Information’ project. Remove the mapping to the ‘Parking Area Equipment’ Physical Object. Since, it is only involved in PM04, no need to add any ‘Parking Area Equipment’ element. Parking Operator’ element’s mapping was lost during conversion. Also, it became disconnected in the converted architecture.  | Parking Operator element has been re-mapped to ‘Parking Operator(terminator)’. But, it does not have any interface in PM04. Parking Operator element has been removed from the SP. |

## Architecture Services

Table 2 provides conversion results for architecture services impacted by the conversion process. The table information shows the service impacted, the results of the service conversion, the analysis disposition, and the notes of the conversion implementation.

Table 2 Conversion Analysis of Services

|  |  |  |  |
| --- | --- | --- | --- |
| **Service in Source Architecture** | **Service in Converted Architecture** | **Conversion Disposition** | **Conversion Notes** |
| TM12: Dynamic Roadway Warning (FDOT Wrong-Way Driving) | TM12: Dynamic Roadway Warning (FDOT Wrong-Way Driving).  | Replaced this SP with TM25: Wrong Way Vehicle Detection and Warning SP. Contact FDOT to determine if Connected Vehicle based Wrong Way Vehicle Detection system has been deployed or could be deployed in future.  | Infrastructure based TM25: Wrong Way Vehicle Detection and Warning (FDOT Wrong-Way Driving) has been included. If FDOT planning to implement CV based Wrong way Vehicle detection service, then CV interfaces will be added. Deleted TM12: Dynamic Roadway Warning (FDOT Wrong-Way Driving). |
| PM04: Regional Parking Management (FDOT Parking) | PM04: Regional Parking Management (FDOT Parking) | Replace PM04: Regional Parking Management (FDOT Parking) with CVO05: Commercial Vehicle Parking (FDOT TPAS). Add a ‘Parking Area Equipment’ element and an interface with appropriate flows to the ‘FDOT CV Parking Management System in CVO05.  | Added ‘CVO05: Commercial Vehicle Parking (FDOT Parking)” SP. Removed the ‘PM04: Regional Parking Management (FDOT Parking)’ SP. |

## Architecture Functional Requirements

The functional requirements were reviewed in the converted architecture for any changes resulting from conversion. Minor changes resulted from the conversion process to 171 functional requirements. No issues were found with the conversion changes. An example of the changes to the requirements are provided in Table 3.

Table 3 Functional Requirements Conversion Examples

| **Element Name** | **Functional Object** | **Req Num** | **Old Requirement** | **New Requirement** |
| --- | --- | --- | --- | --- |
| FDOT District 5 RTMC | TMC Data Collection | 04 | The center shall be able to produce sample products of the data available. | The traffic management center shall be able to produce sample products of the data available. |
| FDOT District 5 RTMC | TMC Environmental Monitoring | 01 | The center shall remotely control environmental sensors that measure road surface conditions including temperature, moisture, icing, salinity, and other measures. | The traffic center shall remotely control environmental sensors that measure road surface conditions including temperature, moisture, icing, salinity, and other measures. |
| FDOT District 5 RTMC | TMC Environmental Monitoring | 02 | The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility. | The traffic center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility. |
| FDOT District 5 RTMC | TMC Signal Control | 15 | The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center. | The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements at or near signalized intersections. |
| FDOT District 5 RTMC | TMC Traffic Information Dissemination | 15 | The center shall coordinate information and controls with other traffic management centers. | The center shall coordinate information dissemination with other traffic management centers. |

## Architecture Information Flows

During the conversion process, 8123 new information flows were added to the interface tab in the RAD-IT software but were not added to the architecture. This makes these new flows available for future tailoring based on stakeholder needs or requests, but did not change the architecture content represented by the pre-conversion architecture.

During conversion process 234 additional information flows were added to the architecture database related to the FDOT District 5 Field Equipment interfaces, specifically the *roadway equipment coordination* information flow, with other agencies’ field equipment. The roadway equipment coordination information flow was replaced in ARC-IT Version 9.0 with 14 specific information flows, including:

|  |  |
| --- | --- |
| * advisory radio coordination
* barrier system coordination
* dynamic sign coordination
* environmental sensor coordination
* lane management coordination
* local priority request coordination
* passive vehicle monitoring coordination
 | * reversible lane coordination
* roadway warning coordination
* signal control coordination
* traffic detector coordination
* traffic metering coordination
* vehicle occupancy coordination
* video surveillance coordination
 |

Each instance of the roadway equipment coordination information flow replacement was reviewed based on the services it supported in the original RITSA and decisions on which new information flows to use as replacements were based on the service analysis. In some cases, no replacement information flow was evident and the interface between the related field equipment elements was removed. The results of the interface analysis are provided in Table 4 for each occurrence of the source destination pairs.

Table 4 Roadway Information Coordination Flow Disposition

| **Source Element** | **Destination Element** | **Flow Disposition** |
| --- | --- | --- |
| FDOT District 5 Field Equipment | FTE Data Dissemination Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FDOT District 5 Field Equipment | Lake County Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FDOT District 5 Field Equipment | Marion County Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FDOT District 5 Field Equipment | OCCC Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FDOT District 5 Field Equipment | Orange County Field Equipment | The services associated with this element interface were analyzed and the following information flow replacements for the *roadway equipment coordination* information flow were made to the RITSA.* + - *dynamic sign coordination*
		- *local priority request coordination*
		- *signal control coordination*
		- *traffic detector coordination*
		- *video surveillance coordination*
 |
| FDOT District 5 Field Equipment | Osceola County Field Equipment | The services associated with this element interface were analyzed and the following information flow replacements for the *roadway equipment coordination* information flow were made to the RITSA.* + - *dynamic sign coordination*
		- *signal control coordination*
		- *traffic detector coordination*
		- *video surveillance coordination*
 |
| FDOT District 5 Field Equipment | Seminole County Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FDOT District 5 Field Equipment | Sumter County Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FDOT District 5 Field Equipment | Volusia County Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| FTE Data Dissemination Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| Lake County Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| Marion County Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| OCCC County Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| Orange County Field Equipment | FDOT District 5 Field Equipment | The services associated with this element interface were analyzed and the following information flow replacements for the *roadway equipment coordination* information flow were made to the RITSA.* + - *dynamic sign coordination*
		- *local priority request coordination*
		- *signal control coordination*
		- *traffic detector coordination*
		- *video surveillance coordination*
 |
| Osceola County Field Equipment | FDOT District 5 Field Equipment | The services associated with this element interface were analyzed and the following information flow replacements for the *roadway equipment coordination* information flow were made to the RITSA.* + - *dynamic sign coordination*
		- *signal control coordination*
		- *traffic detector coordination*
		- *video surveillance coordination*
 |
| Seminole County Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| Sumter County Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |
| Volusia County Field Equipment | FDOT District 5 Field Equipment | There were no services specifically associated with this interface in the RITSA. No information flow replacements were defined for the *roadway equipment coordination* information flow. |

## Architecture User Defined Information Flows

The conversion process can generate information flow alternatives for user defined flows in the original architecture. Where these information flow alternatives were available, they were reviewed against the user defined flows in the architecture for potential replacement. This a manual process requiring comparison of the user defined information flows with alternatives. In many cases, the user defined flows exist between inventory elements that are not functionally supported by the physical object pairs and selected services. In those cases, the user defined flows were retained. Where information flow alternatives provided an exact replacement, the user defined flows were replaced with the ARC-IT information flows. Examples of user defined information flows that were revised during conversion are provided in Table 5.

Table 5 User Defined Information Flow Change Examples

| **Source Element** | **Destination Element** | **User Defined Flow** | **ARC-IT Flow** |
| --- | --- | --- | --- |
| FDOT District 5 RTMC | FL511 | parking information\_ud | parking information |
| County and Local Traffic Control Systems | County and City Roadway Maintenance and Construction | environmental conditions data\_ud | environmental conditions data |

## Standards

ARC-IT Version 9.0 reorganized the standards associated with each information flow. The reorganization introduces solutions which associate sets of standards for consideration to address an interface or information flow implementation. During the conversion process, standards solutions are not automatically converted. The auto-selection function was used to populate the standards solutions associated with the architecture interface content. The standards solutions selections were reviewed for consistency with the pre-conversion architecture. While additional standards information is now available in the converted architecture, the information was found to be appropriate for each interface to support system design considerations and decisions. The following is an example of the type of standards information now available in the architecture.

**Source Element:** FDOT District 5 Field Equipment

**Destination Element**: FDOT District 5 RTMC

**Information Flow**: traffic situation data

**Standards Solution**: NTCIP Transportation Sensors - SNMPv3/TLS

**Solution Description**: This solution is used within the U.S. It combines standards associated with US: NTCIP Transportation Sensors with those for I-F: SNMPv3/TLS. The US: NTCIP Transportation Sensors standards include upper-layer standards required to implement center-to-field transportation sensors (e.g., vehicle detectors) communications (e.g., real-time). The I-F: SNMPv3/TLS standards include lower-layer standards that support secure center-to-field and field-to-field communications using simple network management protocol (SNMPv3); implementations are strongly encouraged to use the TLS for SNMP security option for this solution to ensure adequate security.

**Solution Readiness**: High-Moderate

**Solution Issues**: Data not fully defined (medium)

* Some of the data elements for this information flow are not fully defined.
* The process for aggregating data collected from connected vehicles into the format defined by NTCIP 1209 has not been defined and NTCIP 1209 may not address all needs.
* Process for converting BSM/probe data into aggregated data and related data specifications (e.g., additional configuration parameters) are not defined.

Use case not considered in design (medium)

* While the indicated standards nominally address the information flow, the design may not meet practical constraints because this particular use case was not the focus of the design effort.
* NTCIP 1209 was designed for infrastructure-based detection and does not provide the robustness of data that is available from Connected Vehicles.

## Projects

Each project in the architecture was analyzed for impacts from the conversion process. Results of the project analysis and disposition are provided in Table 6.

Table 6 Project Conversion Disposition

| **Project** | **Conversion Disposition** |
| --- | --- |
| ATTAIN Central Florida | * + - Mapping to Parking Area Equipment of City of Orlando TMC element was removed.
		- *parking information\_ud* and *archive status* information flows were replaced with corresponding ARC-IT flows.
 |
| CFX CAV | The *roadway equipment coordination* information flow bidirectionally connecting the CFX CAV Field Equipment and CFX Field Equipment inventory elements was replaced in ARC-IT Version 9.0 with 14 specific equipment coordination flows. However, the scope of the project does not support the equipment coordination information flow concept as it is currently defined. For this project, the roadway equipment coordination information flow was removed and not replaced with any substitute information flows. |
| CFX Wrong Way Driver Deployment | Replaced the VS03: Situational Awareness (CFX WWD Deployment Project) service with the TM25: Wrong Way Vehicle Detection and Warning (CFX WWD Deployment Project) service.* + - The TM25 service package afforded the addition of the *vehicle location and motion* information flow between the Vehicle and the FDOT District CAV Field Equipment inventory elements, as well as the Commercial Vehicle and the FDOT District CAV Field Equipment inventory elements, which better describes the exchange of information in this project.
 |
| FDOT D5 Regional Integrated Corridor Management System | Replaced two 'archive status' discontinued flow with corresponding ARC-IT flows. |
| FDOT I-4 BtU Segments 1A/1B/2 | Replaced TM12: Dynamic Roadway Warning (FDOT Wrong-Way Driving) service with TM25: Wrong-Way Vehicle Detection and Warning (FDOT Wrong-Way Driving) service.* + - The TM25 service package afforded the addition of the *vehicle location and motion* information flow between the Vehicle and the FDOT District 5 Field Equipment inventory elements which better describes the exchange of information in this project.
 |
| FDOT I-4 BtU Segments 3/4 | Replaced TM12: Dynamic Roadway Warning (FDOT Wrong-Way Driving) service with TM25: Wrong-Way Vehicle Detection and Warning (FDOT Wrong-Way Driving) service.* + - The TM25 service package afforded the addition of the *vehicle location and motion* information flow between the Vehicle and the FDOT District 5 Field Equipment inventory elements which better describes the exchange of information in this project.
 |
| Volusia County Park Parking Information | Volusia County Parking Operators terminator was originally mapped to the parking operator terminator. ARC-IT change the parking operator terminator to a parking manager terminator. The mapping of the Volusia County Parking Operators terminator was changed to the parking manager terminator. The *parking operator input* information flow was changed to *parking manager input*. |