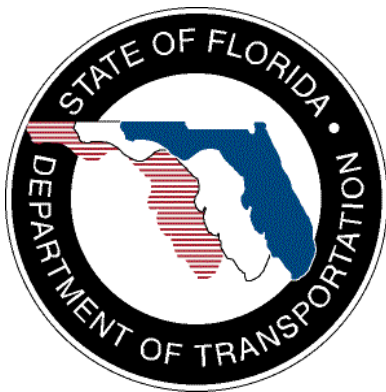


SunGuide[®]:

Configuration Management Plan

SunGuideSMD-CMP-1.0.0(WorkingFinal)



Prepared for:

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August 13, 2010

Document Control Panel			
File Name:	SunGuideSMD-CMP-1 0.0(WorkingFinal).docx		
File Location:	SunGuide CM Repository		
	Name	Initial	Date
Created By:	Robert Heller	RWH	07/15/2010
Reviewed By:	Ken Irvin	KDI	07/18/2010
	Tucker Brown	TJB	07/19/2010
	Ken Irvin	KDI	08/12/2010
	Tucker Brown	TJB	08/12/2010
Modified By:	Robert Heller	RWH	08/11/2010
Completed By:			

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List of Acronyms

ATP.....	Acceptance Test Plan
CDRL.....	Contract Data Requirements List
CM	Configuration Management
CMB.....	Configuration Management Board
CMP	Configuration Management Plan
ConOps	Concept of Operations
CSA.....	Configuration Status Accounting
DBDD	Database Design Document
DOT	Department of Transportation
ECR.....	Engineering Change Request
FAT.....	Factory Acceptance Test
FDOT	Florida Department of Transportation
FTE	Florida Turnpike Enterprise
ICD.....	Interface Control Document
ITN.....	Invitation to Negotiate
ITS.....	Intelligent Transportation Systems
IV&V	Independent Verification and Validation
MDX.....	Miami Dade Expressway Authority
PCM	Project Configuration Manager
PSP.....	Project Staffing Plan
QAP.....	Quality Assurance Plan
RMP	Risk Management Plan
SCCB	Software Configuration Control Board
SDD.....	Software Design Document
SICP	Software Integration Case Procedures
SIP.....	Software Integration Plan
SCM	Software Configuration Management
SCMP.....	Software Configuration Management Plan
SMD.....	Support, Maintenance and Development
SMP.....	Subcontractor Management Plan
SPR	Software Problem Report
SRR.....	Software Requirements Review
SRS	Software Requirements Specification
SSP.....	Software Security Plan
SUM.....	Software User Manual
SwRI	Southwest Research Institute
TxDOT.....	Texas Department of Transportation
VDD.....	Version Description Document

Revision History

Revision	Date	Changes
LOA001 Draft	July 22, 2010	Initial Release (DRAFT).
1.0.0 Working Final	August 13, 2010	Revised in response to FDOT comments.

1. Scope

1.1 Document Identification

This document serves as the Configuration Management Plan (CMP) for the SunGuide® Support, Maintenance and Development contract. The CMP describes how Southwest Research Institute® (SwRI®) will:

- Manage and identify the SunGuide source code
- Manage and identify the SunGuide documents
- Coordinate the development and maintenance activities for multiple SunGuide installation locations.

Revision of the Configuration Management Plan is event driven; specifically, it may become necessary to revise the CMP in response to external events. Common events that may cause revisions include SwRI changing the Software Configuration Management Tool used to manage the SunGuide software, or the event the methods and processes described herein do not produce the desired outcome.

1.2 Project Overview

The Florida Department of Transportation (FDOT) SunGuide Support, Maintenance and Development Contract, contract number BDQ69, addresses the necessity of supporting, maintaining and performing enhancement development efforts to the SunGuide software. The SunGuide software was developed by the FDOT in a contract from October 2003 through June 2010. The SunGuide software is a set of Intelligent Transportation System (ITS) software that allows the control of roadway devices as well as information exchange across a variety of transportation agencies and is deployed throughout the state of Florida. The SunGuide software is based on ITS software available from the state of Texas; with significant customization and development of new software modules to meet the needs of the FDOT. The following figure provides a graphical view of the SunGuide software architecture:

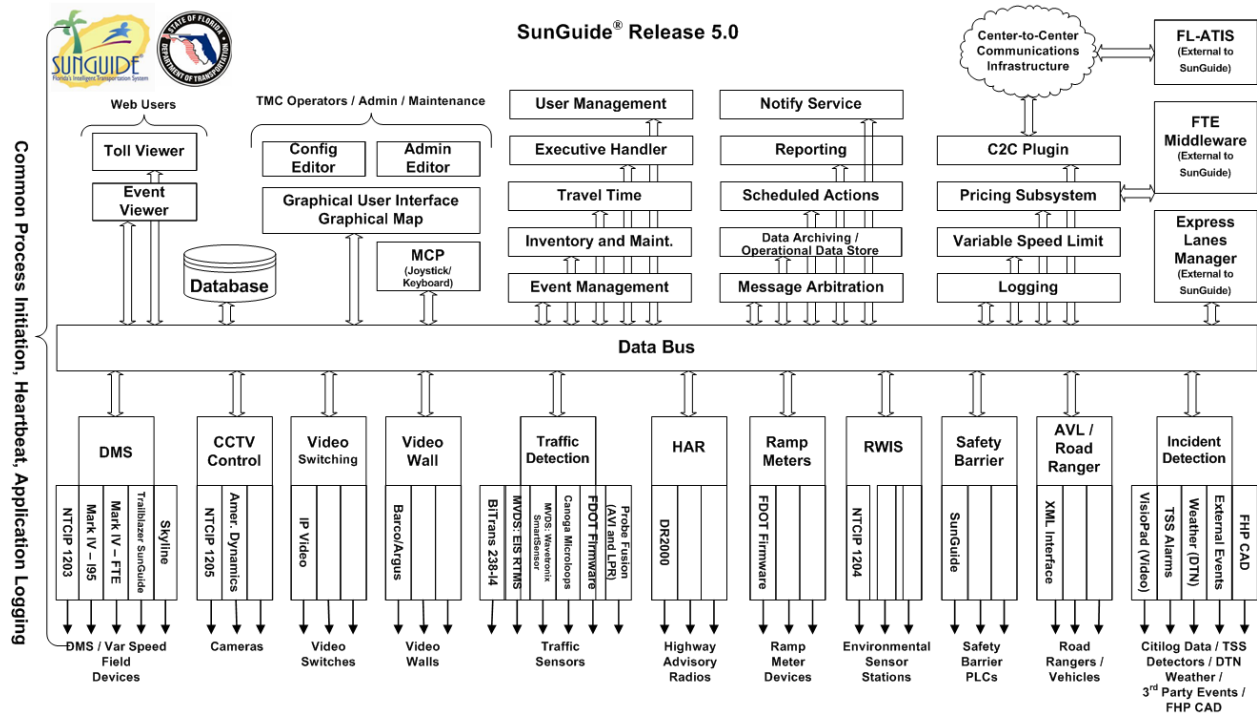


Figure 1.1 – High-Level Architectural Concept

1.3 Related Documents

Additional information regarding the SunGuide project can be found in the following documents and electronic publications:

- FDOT Scope of Services: *BDQ69, Standard Written Agreement for SunGuide Software Support, Maintenance, and Development, Exhibit A: Scope of Services*. July 1, 2010.
- Notice to Proceed: Letter to SwRI for BDQ69, July 1, 2010
- Letter of Authorization 001: Letter to SwRI for BDQ69, July 1, 2010.
- SunGuide Project website: <http://sunguide.datasys.swri.edu>.
- SunGuide SMD Software Development Plan, latest revision.

1.4 Contacts

The following are contact persons for the SunGuide software project:

- Elizabeth Birriel, ITS Section, Traffic Engineering and Operations Office, elizabeth.birriel@dot.state.fl.us, 850-410-5606
- Arun Krishnamurthy, FDOT SunGuide Project Manager, arun.krishnamurthy@dot.state.fl.us, 850-410-5615
- Khue Ngo, PBS&J Project Manager, khue.ngo@dot.state.fl.us, 850-410-5579
- David Chang, PBS&J Project Advisor, David.Chang@dot.state.fl.us, 850-410-5622
- Robert Heller, SwRI Project Manager, rheller@swri.org, 210-522-3824
- Tucker Brown, SwRI Software Project Manager, tbrown@swri.com, 210-522-3035

2. Baseline Identification

2.1 Software Identification

SwRI will develop, test and deliver under the SunGuideSMD contract as directed by the FDOT Project Manager (PM) through “Letters of Authorization.” BDQ69 Exhibit A ‘Scope of Services’ defines a rigorous Software Development Lifecycle (SDLC), but allows the FDOT PM, in agreement with the SwRI PM, to use alternate lifecycles. The following is recommended for identifying software releases by abbreviation of the lifecycles:

- Major Release (e.g. 6.0). A major release would bring significant functionality changes in the software. Major releases will utilize the full waterfall lifecycle as described in the Scope of Services. SwRI prepares installers for these releases.
- Moderate Release (e.g. 6.1). A moderate release will involve a noticeable change but may not necessarily a major change. Moderate releases will utilize an abbreviated waterfall lifecycle. SwRI prepares installers for these releases.
 - Requirements elicitation will combine Concept of Operations (ConOps) and System Requirements development
 - Design will have only a high level design review, no delivery of the Database Design Document (DBDD)
 - Development will omit FDOT in-process review of code
 - Integration testing will omit FDOT Software Integration Case Procedures (SICP) Dry Run¹
 - Normal Acceptance Test Cycle
- Minor Release (e.g. 6.0.1). Minor releases will utilize an abbreviated waterfall lifecycle as noted below. SwRI prepares installers for these releases.
 - Requirements Elicitation: ConOps, System Requirements and Software Requirements will be provided by SwRI in short description of release. An LOA will constitute acceptance of the ConOps and requirements. There will be no Requirements Review, no delivery of Software Requirements Specification (SRS) or Requisite Pro Database (however, SwRI will modify the Requisite Pro database to reflect requirements changes).
 - There will be no design reviews, Software Design Document (SDD) and DBDD will not be delivered. Interface Control Documents (ICDs) will be updated as necessary and delivered to FDOT.
 - Development will omit FDOT in-process review of code
 - Integration testing will omit Software Integration Plan (SIP), SICP, and FDOT SICP Dry Run
 - No Acceptance Test Cycle
- Software Pre-Release (e.g. 6.0.0.1). SwRI will prepare software pre-releases as the software goes through the formal testing stages of software development life cycle (FAT, IVV, etc). A Software Pre-Release is not intended for use in a live environment and will not be supported for such use. Following approval of a software pre-release (for release), SwRI will prepare a corresponding formal release (major, moderate or minor).
- Patch Release (e.g. 4.2.2 Patch 3, 5.0 Patch 1, 8.9 Patch 27). This level of release is made to resolve one or more latent defects observed by more than one district. Patches are

¹ Defined in BDQ69 Exhibit A “Scope of Services”

released by way of a zip file. A file, typically named “readme.txt”, is included that describes the issues the patch addresses and the specific version of the software against which the patch should be applied.

- Hotfix (e.g. Release5.0.3-Hotfix-RRNotifyingContact-SystemMessages) This level of release is made to resolve a latent defect observed at a single deployment. Hotfixes are released of a zip file. A file, typically named “readme.txt”, is included that describes the issue the hotfix addresses and the specific version of the software against which the hotfix should be applied.

Table 2.1 – Release Type with Recommended Reviews, Documents and Activities

Activity	Major	Moderate	Minor	Pre-Release	Patch / Hotfix
Requirements Elicitation					
ConOps	Y	Y	Y		
FDOT System Requirement	Y	Y	Y		
Software Requirements	Y	Y	Y		
Requirements Review	Y	Y			
SRS Delivery	Y	Y			
Requirement Database Delivery	Y	Y			
Design					
Preliminary Design Review	Y	Y			
Detail Design Review	Y				
SDD Delivery	Y	Y			
ICD Delivery	Y	Y	Y		
DBDD Delivery	Y				
Development Unit Test					
FDOT in process code review	Y				
Integration Testing	Y	Y			
SIP	Y	Y			
SICP	Y	Y			
FDOT Dry Run	Y				
VDD	Y	Y	Y	Y	
IN	Y	Y	Y	Y	
Acceptance Testing	Y	Y			
PCA	Y	Y			
SUM	Y	Y			
FAT	Y	Y			
IVV	Y	Y			

2.2 Document Identification

BDQ69 Exhibit A ‘Scope of Services’ identifies numerous baseline documents, the revision cycle of some of those document is driven by software releases, the release cycle of others is not driven by software release, but by other factors (e.g. LOAs, changes in Configuration Management (CM) system).

2.2.1 Release Document Identification

Table 2.2 contains a list of baseline documents identified by BDQ69 Exhibit A, ‘Scope of Services.’ Each of these documents has a document identifier consisting of three parts in the form *SunGuideSMD-TLA-x.y.z.w*. The parts of the document identifier are as follows.

SunGuideSMD	is a contract identifier to distinguish these documents from those produced under the FDOT contract BD829
TLA	acronym that indicates the document type
x.y.z.w	Refers to either the software release with which this document is associated, or a revision of the document where x refers to a LOA number and y.z.w refer to revisions which may be necessary or desirable between LOAs (revisions to staffing between LOAs).

Table 2.2 – SunGuide Release Documents

Document	Document Identifier
Concept of Operations	SunGuideSMD-COO-x.y.z.w
Software Requirements Specification	SunGuideSMD-SRS- x.y.z.w
Output from Requisite Pro	SunGuideSMD-ReqPro-x.y.z.zip containing: SunGuideSMD-x.y.z.ldb SunGuideSMD-x.y.z.mdb SunGuideSMD-x.y.z.rql SunGuideSMD-x.y.z.rqs
Software Design Document	SunGuideSMD-SDD-x.y.z.w
Database Design Document	SunGuideSMD-DBDD-x.y.z.w
Interface Control Document	SunGuideSMD-ICD-x.y.z.w
Software Integration Procedure	SunGuideSMD-SIP-x.y.z.w
Software Integration Case Procedure	SunGuideSMD-SICP-x.y.z.w
Training Plan and Training Materials	SunGuideSMD-TP-x.y.z.w
Training Materials	SunGuideSMD-TM-x.y.z.w
Version Description Document	SunGuideSMD-VDD-x.y.z.w
Software Users Manual	SunGuideSMD-SUM-x.y.z.w
Software Development Plan	SunGuideSMD-SDP-x.y.z.w
Project Staffing Plan	SunGuideSMD-PSP-x.y.z.w
Risk Management Plan	SunGuideSMD-RMP-x.y.z.w
Configuration Management Plan	SunGuideSMD-CMP-x.y.z.w
Quality Assurance Plan	SunGuideSMD-QAP-x.y.z.w
Subcontract Management Plan	SunGuideSMD-SMP-x.y.z.w
Software Security Plan	SunGuideSMD-SSP-x.y.z.w

3. Software and Document Management

All software and documentation will be managed using the AccuRev CM tool.

3.1 Software Management

The SwRI SunGuide project uses the AccuRev CM tool to support multiple concurrent support and development streams; a snapshot of the 5.0 Release is illustrated by Figure 3.1.

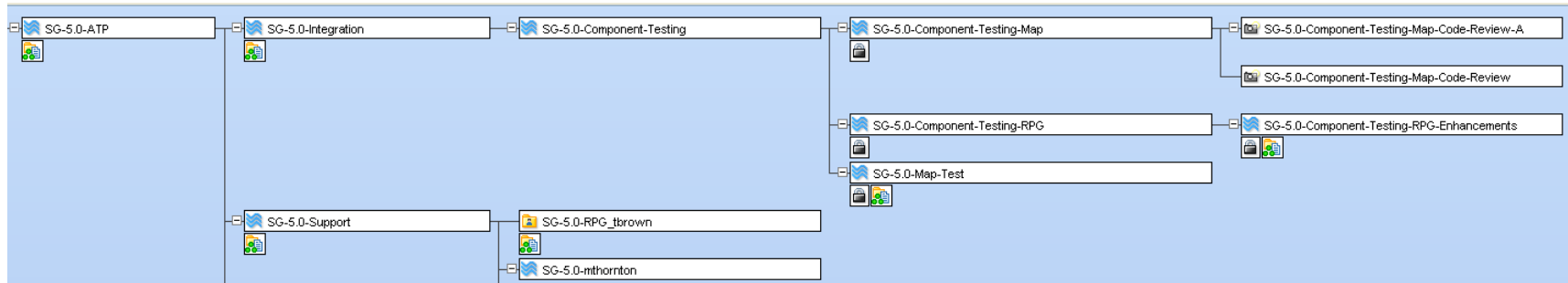


Figure 3.1 – AccuRev Multiple Development Streams

3.1.1 Support Stream

SwRI maintains a “support” stream that is separate from the normal development streams. The SwRI support staff uses this stream as a baseline against which reported issues are corrected.

When SwRI in coordination with the FDOT PM decides to release a Patch or Hotfix, the SwRI support staff creates a separate stream that will contain only the code to be released. That is a copy of the support stream is made and the source code within the copy is inspected to remove changes that may have been made that are not to be part of the Patch or Hotfix. The Patch or Hotfix stream is then used to generate the Patch or Hotfix (i.e. the isolated code is compiled and a zip file created for distribution).

3.1.2 Release Streams

At the beginning of development activities for a release, SwRI will establish a new stream for that release. This new stream will be the Acceptance Test Plan (ATP) stream and be the top level stream from which code will be released. Off of that stream, an Integration stream is created. This stream will contain the development code when developmental parts have been integrated together. Next, off of the Integration stream, a Component Testing stream is created to facilitate integration between multiple different development tasks. For every new development task within a release, a specific stream is created. For example, as illustrated in Figure 3.1, there are three development streams created off of Component Testing that were used to facilitate concurrent development. Off of these specific development streams, workspaces can be created where a developer can write new segments of code.

Progression from between stream levels is based on the success of testing that occurs at each level. Except for the Component level, the level names correspond to the testing that occurs at each level. At the component stream level, unit testing and preliminary integration testing occurs. The SwRI team (or subset thereof) meets periodically during the testing phases to review progress of the testing. During these reviews, the SwRI PM (or SPM) may decide to promote code to the next stream level. As code is tested, it is promoted to higher levels until it gets to the Component Testing stream where all of the development efforts can be tested together. Once the changes have been tested together, they are promoted to Integration and eventually to ATP. Code is only released from the ATP stream. One of the development streams that must be “tied” together is the support stream which must be merged into the Integration Stream.

Once code has been released it becomes necessary to be able to support that code. At this point a new stream is created off of the ATP stream for support. The Support stream is where the support staff will make small fixes to code and test them before promoting them up to the ATP stream where they can be released to the Districts in Hotfix or Patch Releases.

For each numbered release, a snapshot of the code is taken to ensure a known code base, should the need arise in which it would need to be used.

As new development tasks are needed, the ATP code base is used to start a new top level ATP stream. This ensures all development and support code is transferred to subsequent releases. While support is still done against active installations, AccuRev lets users know when there is code in older streams that needs to be promoted into newer streams.

3.2 Document Management

SwRI will use AccuRev to manage documents during the BDQ69 contract. AccuRev does not support change management for binary files (e.g. Microsoft Word or Adobe PDF), but it does support storage and backup of document revisions. Documents will be stored by revision in a depot² separate from the SunGuide project. Storing documents in AccuRev allows a user to “lock” a document while editing the document. This prevents a developer from overwriting the changes made by another developer while making their own. Also, similar to code, it gives a change history of all documents. So, for any change, you will know what changed and who changed it.

The following documents will be stored in AccuRev:

- Software Development Plan
- Project Staffing Plan
- Configuration Management Plan
- Subcontractor Management Plan
- Risk management Plan
- Quality Assurance Plan
- Software Security Plan
- Release Specific Documents
 - Concept of Operations
 - Software Requirements Specification
 - Requisite Pro Database will also be stored in AccuRev
 - Software Design Document
 - Interface Control Documents
 - Software Integration Procedures
 - Software Integration Case Procedures
 - Version Description Document
 - Software Users Manual
 - Database Design Document
- Meeting Minutes
- Deployment Plans
- Training Materials
- Testing Results

² Please refer to the AccuRevAccuRev documentation for discussion of “depots.”

4. Configuration Management Responsibilities

4.1 SunGuide Configuration Management Board

The SunGuide Change Management Board (CMB) reviews and approves all changes to the SunGuide software baseline including the addition or alteration of requirements. The SunGuide CMB is composed of the following persons:

- Representatives of all FDOT districts (District ITS Engineers)
- Representative of the Florida Turnpike Enterprise (FTE)
- Representative of Miami Dade Expressway Authority (MDX)
- Representative of the FDOT ITS Central Office

4.2 FDOT SunGuide Project Manager

The FDOT SunGuide PM and SPM are responsible for providing timely input to the FDOT CMB regarding proposed modifications to the SunGuide software. This may be in the form of enhancements already approved and contractually obligated or those that the CMB may prioritize for implementation in the future.

4.3 SwRI SunGuide Project Configuration Manager

The SwRI SunGuide Project Configuration Manager (typically the SPM) has the following responsibilities:

- Managing access and updates to the Project Repository.
- Creating software products from the Project Repository.
- Verifying that appropriate baselines are in the Project Repository.
- Performing CM status accounting and audits.

4.4 Version Control of Documents

The Intelligent Systems Department (ISD) administrative assistant is primarily responsible for maintaining the archives for the project. The ISD administrative assistant has the following responsibilities:

- Placing an electronic copy of project deliverables in the ISD archive.
- Placing a "compressed" copy of the final Project Repository into the ISD archive (and/or the physical/paper archive) at the conclusion of a project.

4.5 Project Website

SwRI established a SunGuide Project Website³ under contract BD826. Though no longer a contractual requirement, SwRI continues to post project documents to the website for public dissemination. Those responsible for posting document include (in order, not limited to):

- SwRI SunGuideSMD PM
- SwRI SunGuideSMD SPM
- SwRI SunGuide PM (now a project advisor)

³ <http://sunguide.datasys.swri.edu>

5. Tools and Project Repository

5.1 AccuRev Repository

The SunGuide project uses the AccuRev software configuration management tool to manage development and version control. The AccuRev repository is maintained on an ISD software configuration management server (ISD-SCM).

5.2 Backups

5.2.1 AccuRev Backup

The AccuRev repository is backed up by the ISD backup system nightly.

5.2.2 Local PC Files Backup

Working files resident on local developers' machines are checked into the AccuRev working repository soon after creation so that they can be backed up to protect against their loss due to accidental deletion or corruption. Since that repository also resides on the ISD-SCM machine, it will be backed up by the same procedures noted for the AccuRev repository. Creating backup of working files on the machine of a specific developer is the responsibility of that developer. These files should be backed up at appropriate intervals to CD-ROM, or other media.

6. Configuration Management Audits

6.1 Functional Configuration Audit

SwRI performs internal Functional Configuration Audits as part of releases.⁴ The following steps are performed during a Functional Configuration Audit:

1. The product is tested using the SICP for the respective release verifying the requirements in the SRS are implemented.
2. A Functional Configuration Audit report is developed which includes the following information:
 - a) Name of software product
 - b) Auditor
 - c) Dates of audit
 - d) Results of testing that occurred in step 1 (a reference to project documentation is acceptable if the results are documented.)

6.2 Physical Configuration Audit

SwRI performs internal Physical Configuration Audits during its final integration and testing process. These audits are not the audits performed by the FDOT; those audits are beyond the scope of this document and change from one audit to the next. A Physical Configuration Audit is performed during the process of building⁵ the release media. The following steps are performed during a Physical Configuration Audit:

1. SwRI utilizes a build server; copies of the “source code files” are placed on the build server hard disk.
2. The SUM and VDD are utilized to determine what files are needed to build an installer for the software product.
3. The software delivery media is verified to ensure that all necessary files are available.
4. The software product is built; any build discrepancies are noted. The build may include any, all or none of:
 - a) Compilation of source code files into object code
 - b) Creating a single file consisting of compressed files and sufficient information to recreate the original files
 - c) Other transformations of the original files
 - d) Creation of an installer for the software product
5. A Physical Configuration Audit report is developed which includes the following information:
 - a) Name of software product
 - b) Auditor
 - c) Dates of audit
 - d) List of files utilized (a reference to project documentation is acceptable)
 - e) Results of build (excluding the installer)

⁴ Not all releases have FCAs performed.

⁵ Normally this is a compilation step followed by the construction of an installer.

6.3 Configuration Status Accounting

Configuration Status Accounting (CSA) evaluates the status of the project repository and the archive. SwRI SunGuide staff perform CSA Audits quarterly. SwRI staff perform the following checks:

1. Document Deliverables
 - a. Verify deliverable documents are in the project AccuRev repository
 - b. Verify deliverable documents are in the project archive
2. Check configuration item status
 - a. Verify software configuration items are properly stored in the AccuRev
 - b. Verify version numbers are applied correctly and all present
3. Check backups
 - a. Verify backups are performed
 - b. Verify backups can be retrieved

7. Engineering Change Request and Software Problem Report Tracking

Engineering Change Requests (ECRs) and Software Problem Reports (SPRs) will be tracked using Numara® Footprints®. SwRI has established a Footprints database for use on the SunGuide project and available to authorized users via the Internet.

7.1 Footprints Issues

Footprints issues can be submitted by any Footprints user granted the privileges to do so. This includes FDOT personnel, FDOT contractors, and SwRI personnel. Footprints issues are divided into two primary classes:

- *Enhancement Requests* are those issues that require approval from FDOT to implement because they are either changes to existing functionality or requests for new functionality.
- *Software Problem Reports* are those issues that do not require approval from FDOT to resolve and are prioritized by level of severity.

7.1.1 Footprints Enhancement Requests

FDOT on occasion will request SwRI implement an enhancement as part of a software release. At that time SwRI will follow the flow as shown in Figure 7.1.

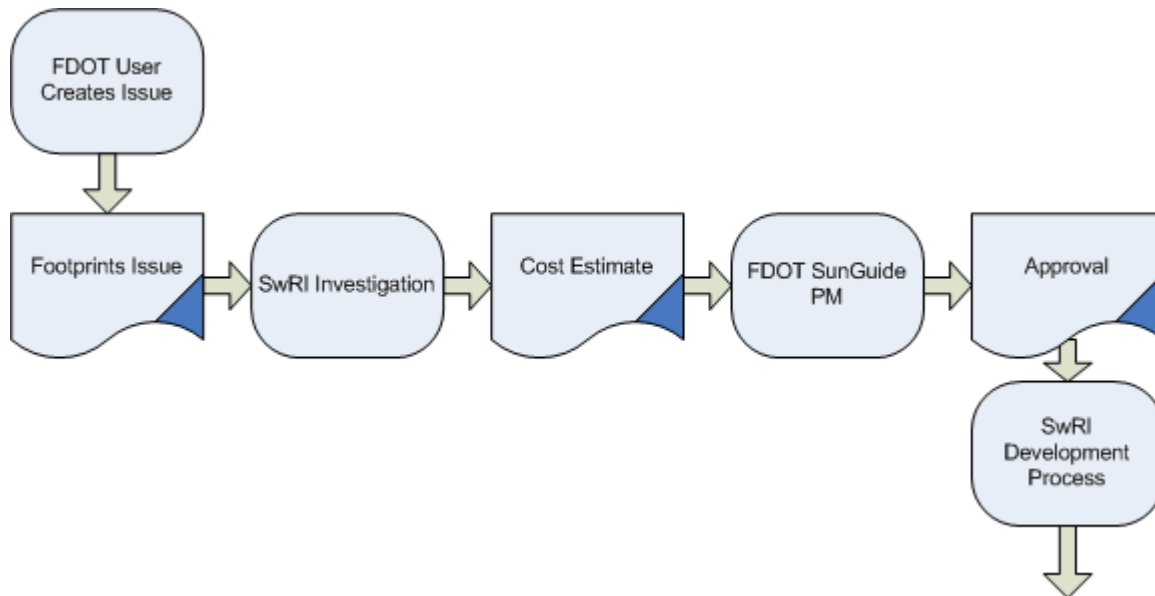


Figure 7.1 – Footprints Enhancement Request Flow

Once an enhancement has been approved by the FDOT SunGuide PM, it is forwarded to the FDOT SunGuide CMB for approval and inclusion with appropriate requirements and funding in the next FDOT issued LOA.

7.1.2 Software Problem Reports

SwRI resolves SPRs in an order determined dynamically by the SwRI PM⁶. Typically, SwRI resolves SPRs as they are entered into Footprints; prioritizing them based on level (Critical Failure, Failure, External Failure, Defect) and number of districts reporting the problem. Severity levels are defined as follows:

- Critical Failure – A failure of multiple SunGuide software subsystems or a single critical SunGuide subsystem that prevents operation of the SunGuide Software. Critical SunGuide subsystems are defined as the Databus and the Graphical User Interface (GUI).
- Failure – A single SunGuide application, subsystem or driver failure that prevents operation of a part of the SunGuide Software.
- External Failure – An interface between SunGuide and an external system has failed.
- Defect – A software issue that can be compensated for through manual operation or that does not impact operation of a Traffic Management Center.

SPRs are resolved and, depending on severity of the problem, a modification may be issued as a Hotfix, a Patch, or may be carried forward into the next scheduled release. The decision to issue one of these types of SPRs is made in conjunction with the SwRI PM and FDOT PM.

⁶ The SwRI PM consults with the FDOT PM to determine an order. The FDOT PM has polled the FDOT community to establish relative importance of legacy issues. With this information, the FDOT and SwRI will determine an order to address those legacy issues.