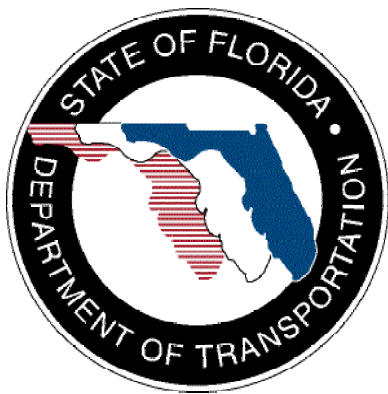# Statewide Transportation Management Center Software Library System:

Configuration Management Plan

STMCSLS-CMP-1.0.0-Draft

Prepared for:

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List of Acronyms

CCB............................Configuration Control Board

CM ....Configuration Management

CR ....Change Request

CSCI...........................Computer Software Configuration Item

DOT ....Department of Transportation

DPM............................Deputy Project Manager

ECR.............................Engineering Change Request

FDOT ....Florida Department of Transportation

ITS...............................Intelligent Transportation Systems

ITN..............................Invitation to Negotiate

MCMR ....Master Configuration Management Repository

PCM ....Project Configuration Manager

PM...............................Program Manager

SCCB ....Software Configuration Control Board

SCMP..........................Software Configuration Management Plan

SDP ....Software Development Plan

SE................................Software Engineering

SPM.............................Software Program Manager

SPR ....Software Problem Report

STMCSLS..................Statewide Transportation Management Center Software Library System

SwRI ....Southwest Research Institute

TxDOT.......................Texas Department of Transportation

VOB ....Versioned Object Base

VSS ....Visual Source Safe

REVISION HISTORY

Revision	Date	Changes
1.0.0-Draft	November 3, 2003	Initial Release

1. Software Configuration Management (SCM) Procedures

1.1   Project Identification

This document serves as the Software Configuration Management Plan (SCMP) for the Statewide Transportation Management Center Software Library System (STMCSLS). It is to be used by Southwest Research Institute® (SwRI®) to manage configuration baselines for the STMCSLS project.

1.2   Project Overview

The Florida Department of Transportation (FDOT) is conducting a program that is developing an STMCSLS. The STMCSLS 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. The goal of the STMCSLS is to have a common software base that can be deployed throughout the state of Florida. The STMCSLS development effort is based on ITS software available from both the states of Texas and Maryland; significant customization of the software is being performed as well as the development of new software modules.

1.3   Related Documents

The following documents were used to develop this document:

- Southwest Research Institute® (SwRI®) Qualification Response: *Response to the Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: November 18, 2002.

- SwRI Technical Proposal: *Technical Proposal for Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: January 31, 2003.

- SwRI Cost Proposal: *Cost Proposal for Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR, ,* SwRI Proposal No. 10-35924, dated: January 31, 2003.

- SwRI BAFO letter: *Southwest Research Institute Proposal No. 10-35924, "Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System", Reference: Negotiation Number: ITN-DOT-02/03-9025-RR*, dated: May 5, 2003.

- FDOT procurement document: *Invitation To Negotiate (ITN), Negotiation Number: ITN-DOT-02/03-9025-RR, Statewide Transportation Management Center Software Library System*, dated: October 21, 2002.

▪ FDOT Scope of Services: *Statewide Transportation Management Center Software Library System: Scope of Services,* September 19, 2003.

▪ FDOT Requirements Document: *Statewide Transportation Management Center Software Library System: Requirements Specification,* June 3, 2003.

1.4 Project SCM Staff Assignments

This section defines key project SCM staff assignments.

- Software Configuration Control Board (SCCB)

  - The SCCB will be composed of the Project Manager (PM), the Software Project Manger (SPM) and the Project Configuration Manager (PCM). The SCCB will approve all baselines and modifications to the baseline for the project.

- Project Configuration Manager (PCM)

  - The PCM 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 Configuration Management (CM) status accounting and audits.

- Software Engineering (SE) Secretarial Staff

  - The Intelligent Transportation Systems (ITS) Section secretary is primarily responsible for maintaining the SE Archive for the project. The ITS Section secretary has the following responsibilities:

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

1.5 Tools and Project Repository

1.5.1 Rational® Tool-Based Method

The STMCSLS project will use the Rational ClearCase LT tool in the configuration management process and ClearQuest for Engineering Change Request (ECR) and Software Problem Report (SPR) tracking. (While ClearCase and ClearCase LT are separate products, for the purposes of this document, the terms will be used interchangeably.) ClearCase is designed for storage and version control of artifacts for the project. All baselined code and document deliverables will be stored in ClearCase. ClearCase will be used to create project baselines, and may be used to capture snapshots of what all project artifacts look like at a certain point in time, if required. These products were selected based on SwRI's past experience with Rational tools and discussions with Rational representatives on the appropriate tools for this project. Additional information on these tools can be found on the following web site: http://www-3.ibm.com/software/rational/offerings/ppa.html.

In the following sections, the use of ClearCase to manage project source code and documentation and other considerations related to SCM for the STMCSLS Project is discussed. Because of the iterative nature of this project, some CM-related material will change from iteration to iteration and will be documented in changes to this document or in supplemental documentation to be developed as required.

1.5.2 Version Control of Software Assets

Initial baseline project artifacts are being obtained under license agreement from the Texas Department of Transportation. These will be maintained in the SwRI Master Configuratioin Management Repository (MCMR). The initial baseline repository for the STMCSLS project will be populated from the MCMR and artifacts from the Maryland Department of Transportation and PB Farradyne MIST product. The SwRI STMCSLS repository will also contain future baselines identified as Release 1, Release 2a, and Release 2b. Additional snapshots of project artifacts may be stored in this repository, as required. The STMCSLS repository will be controlled using ClearCase.

1.5.3 Project Servers

1.5.3.1 ClearCase Project Server

The following table describes the ClearCase project file server.

Project File Server	Archimedes.datasys.swri.edu
Project File Server Type	Windows 2003
Project Root Directory Location	\\Archimedes\FDOT\Clearcase_Repository\
Project Root Directory Environment Variable	N/A for Windows
Project File Server Access Method	\\Archimedes\FDOT\Clearcase_Repository\

CAUTION: A Versioned Object Base (VOB) storage directory and all of its contents are created and managed by ClearCase commands and services. Use of non-ClearCase commands or utilities to alter either the contents or the protection of the VOB storage directory or any of its files or subdirectories will result in contaminated baselines and affect the ability of ClearCase to manage the VOBs.

1.5.3.1.1 Project Directory Structure

1.5.3.1.1.1 VOB Structure

In ClearCase, each project is typically composed of VOBs. A VOB is a collection of versioned items (known as elements). While a project in ClearCase can have multiple VOBs, it is less confusing to organize components so that they are part of a single VOB. The STMCSLS project will utilize a single VOB structure as outlined below:

```
PM                          Doc                      SubSys
    status_reports              COO                      Core
    customer_corresp            SRS                          Src
    internal_memos              SDD                          Del
    mgmt_reviews                SUM                      DBUS
    sqa_surv                    VDD                          Src
    schedules                   ATP                          Del
    cost_tracking               ICD                      UI
    proposal                            DMS                  Src
                                        CCTV                 Del
                                        TD               Map
                                        IM                   Src
                                        C2C                  Del
                                        COC              DMS
                                        RM                   Src
                                        RWIS                 Del
                                        AD               CCTV
                                        HAR                  Src
                                        WS                   Del
                                        EE               TD
                                        PT                   Src
                                DBDD                         Del
                                                         IM
                                                             Src
                                                             Del
                                                         C2C
                                                             Src
                                                             Del
                                                         COC
                                                             Src
                                                             Del
                                                         RM
                                                             Src
                                                             Del
                                                         RWIS
                                                             Src
                                                             Del
                                                         AD
                                                             Src
                                                             Del
                                                         HAR
                                                             Src
                                                             Del
                                                         WS
                                                             Src
                                                             Del
                                                         EE
                                                             Src
                                                             Del
```

The structure for the initial TxDOT licensed baseline, Release 1, 2a, and 2b will be similar. Only those portions of the directory structure relevant to a particular baseline of the project will be populated.

Note: ClearCase as a product has a rather colorful history, and as part of that history there are policies for the product to use that have to be supported through the use of ClearCase triggers, which are written in Perl. Because these triggers have to call certain ClearCase interfaces, and some of those interfaces can not accept a path name longer than 255 characters, ClearCase directories usually use as short a name as can be reasonably supported. For this reason, it is highly recommended that the directory structures listed below be used in a standardized fashion.

1.5.3.1.2 VOB Definitions

Item	Description
Cost_tracking	Documents that track adherence to planned expenditures for the project.
Customer_correspondence	Customer correspondence not covered under other specifically defined deliverable categories.
Del	Directories that will contain the folders with the compiled source code that has been prepared for delivery to and installation by FDOT.
Internal_memos	SwRI internal correspondence used to facilitate project progress.
Mgmt_reviews	Minutes of SwRI internal management reviews conducted to review project progress.
Proposal	Artifacts associated with the delivery of the proposal to the customer.
Schedules	Project schedules and recorded progress against those schedules.
Sqa_surv	Minutes of surveillances conduced by the Software Quality Assurance Group to ensure the Software Development Plan addresses contractual requirements and internal software development policies and that the plan is executed as planned.
Src	Directories that will contain the folders that contain the baselined source files.
Status_reports	Contractually required status reports to the customer.

1.5.3.2 Visual Source Safe (VSS) Workspaces

Day to day development activities will be conducted in VSS. The files required from the appropriate baseline maintained in ClearCase will be exported to the VSS environment. The developers will add to, modify or delete material as required to meet the STMCSLS specifications. Once activities to prepare the artifacts for baselining have been completed, the files will be imported into the appropriate ClearCase directories.

Project File Server	Archimedes.datasys.swri.edu
Project File Server Type	Windows 2000
Project Root Directory Location	C:\FDOT\VSS Repository\(on Archimedes file server)

Project Root Directory Environment Variable	N/A for Windows
Project File Server Access Method	\\Archimedes\FDOT\VSS Repository\

1.5.4 What is Source Controlled?

Baseline ready deliverable documents, source code, and installation files will be source controlled in the ClearCase repository. Certain other artifacts required for project management but not deliverable may also be maintained in the repository.

The contents of each ClearCase_Repository directory are summarized below.

Directory Name	Description/Contents
Del	Contains directories and the baselined code that is ready for delivery to the customer.
Doc	Contains folders or baselined files of the documents required for the system and the ICDs for the subsystems.
PM	Contains the deliverable and non-deliverable artifacts that are required for overall project management and communication with the customer.
Src	Contains directories and the baselined source code for each of the subsystems.
SubSys	Contains the directories and files for the initial baseline licensed from TxDOT and the modified files and directories for the applicable release (e.g. Release 1, Release 2a, Release 2b).

1.5.5 Abbreviation List

Due to ClearCase's path length limitations, it is beneficial to keep file and folder names as short as possible. Whenever possible, the abbreviations shown below should be used when naming folders and files.

Abbreviation	Meaning
AD	Archive Data
ATMS	Advanced Traffic Management System
ATP	Acceptance Test Plan
C2C	Center-to-Center
CCTV	Closed Circuit Television
COC	FDOT Central Office Configuration

Abbreviation	Meaning
COO	Concept of Operations
Core	Core software framework
DB	Database
DBDD	Database Design Document
DBUS	Data Bus
Del	Deliverable (Installable code)
DMS	Dynamic Message Sign
EE	Emergency Evacuation
ESS	Environmental Sensor System
HAR	Highway Advisory Radio
ICD	Interface Control Document
IM	Incident Management
IMDBMS	Integrated Maintenance Database Management System
Map	Map display and control
PM	Project Management
PT	Provider Template
PV	Process Viewer
RM	Ramp Metering
RWIS	Road Weather Information System
SD	Statewide Driver
SDD	Software Design Document
SL	Status Logger
Src	Source
SRS	Software Requirements Specification
SUM	Software Users Manual
Sys	System
TD	Traffic Detection, driver for Bitrans238I-95
TM	Traceability Matrix
TMC	Transportation Management Center
TSS	Traffic Sensor System
UI	User Interface
VDD	Version Description Document
WS	Web Server

1.5.6 ClearCase Directory Structure

The lower-level directory structures may change throughout the life of the project. Questions about where to place a document in ClearCase should be referred to the task lead or the designated PCM.

1.5.7 ClearCase Directory Structure Assignments

Task leads are assigned to each of the major tasks within the STMCSLS project. They have the responsibility of determining the lower-level structures and access permissions for their areas. They should consult with the designated PCM before making significant structural or naming changes to the directories or files in day-to-day development as this may impact the importation of the directories and files into the baseline controlled ClearCase repository.

1.6 Development Procedures for Version Control

The following sections describe CM procedures applicable to the software developers.

1.6.1 Rational ClearCase

The base item in ClearCase is a "Versioned Object." This is a single piece of code or other work that can be stored in multiple versions. The next step "up" is then an "Element". This refers to all the versions of a single "Versioned Object." This leads to the top level, which is a "Project" that consists of all the items that are related to a single development effort.

When you are working with ClearCase you will often be working with a VOB. This is a collection of elements that is created to help logically group the items for work as part of a development effort. Multiple VOBs can be created for a single ClearCase installation; however, for this project a single VOB will be used.

1.6.2 Using ClearCase

The ClearCase PCM will be the focal point for supplying files or directories to the developers from the FDOT ClearCase baseline repository to the VSS day-to-day working repository. Normally the files and directories required by the STMCSLS project will be pushed by the PCM from the TxDOT license repository to the FDOT ClearCase baseline repository. From there the PCM will push them to the VSS working repository. Once the developers have completed development activities and are ready to enter the files and/or directories into the FDOT ClearCase baseline, they will work with the PCM to import those files into the appropriate directory within the FDOT VOB. The updated FDOT ClearCase repository will then be the baseline for subsequent pushes to the development environment.

1.7 Version Control of Documents

ClearCase will be used to control both documents and software artifacts, the procedure for version control of documents is described in the previous section.

1.8 Commenting

Not only does ClearCase have the capability to store multiple versions of a document or artifact as a single object, but it can also record information about the changes made to that object.

ClearCase will store the dates and times that objects were accessed and changed, but it is up to the developers and the PCM to store information about those changes through the use of the **Comment** field when checking files into ClearCase. A descriptive, meaningful comment should be made whenever changes are made to an object.

1.9   Engineering Change Request and Problem Report Tracking

Engineering Change Requests (ECRs) and Software Problem Reports (SPRs) will be tracked using Rational® ClearQuest.

1.9.1 Engineering Change Requests

Because ECRs can by submitted by the client, by users, and by SwRI, the ClearQuest tool will be used to track ECRs. The SCCB is responsible for the overall administration of the ECRs and will determine which ECRs will be contained in which baseline. The SCCB will determine the impact of ECRs and provide recommendations to the client and will determine if ECRs submitted by the users and client are actually ECRs or SPRs.

An ECR is divided into four major sections:

- ❑ Requests
- ❑ Evaluation Results
- ❑ Recommendations
- ❑ Disposition

At a minimum, the following information will be provided in the sections:

Requests:

- ❑ Change Request (CR) Identifier (unique number for each CR entered by the Development Agency)
- ❑ Date CR submitted
- ❑ Requesting organization
- ❑ Point of Contact - including name, phone number, e-mail address
- ❑ Type of change (addition, modification, or deletion)
- ❑ Requirement text
- ❑ Rationale
- ❑ Threshold
- ❑ Objective
- ❑ Priority (Urgent - mission critical change needs to be implemented during current build; Routine - should be implemented consistent with the current development schedule)

Evaluation Results:

❑ Type of evaluation performed: Functional, Developmental, Operational

❑ For each evaluation performed:

  ❑ Organization assigned to perform evaluation

  ❑ Point of Contact for evaluation - including name, phone number, e-mail address

  ❑ Date evaluation task assigned

  ❑ Suspense date

  ❑ Evaluation results

Recommendations:

❑ Date of meeting when CR reviewed

❑ Recommendation

❑ Rationale

❑ Clarification request

Disposition:

❑ Date Configuration Control Board (CCB) addressed CR

❑ CR Status: Possible statuses include: Request Received, Awaiting clarification, Undergoing Evaluation, Evaluation Complete, Recommendation Complete, Closed

❑ CR Disposition: Approved, Approved with modification, Disapproved

1.9.2 Software Problem Reports

For the SPRs generated during the Inception Phase, the task lead will be responsible for prioritization, assignment, and resolution of the SPRs. The task lead may defer to the SCCB those SPRs, which present complex problems that may impact design or implementation.

SPRs will contain the following:

- Uniquely assigned identifier
- Title
- Problem status (open or closed)
- Priority (high, medium, or low)
- Date reported
- Reporting individual
- Problem description
- Software component affected
- Version or baseline affected
- Person responsible to fix the problem
- Description of actions taken or resolution
- Date of resolution

1.10 Backups

1.10.1 ClearCase Backup

The following table describes key parameters of the ClearCase server backup strategy. The ClearCase server is hosted on the machine Archimedes and is used to store all project artifacts, including documents and source code.

Backup Responsibility	Primary: Division 10 Network Support Group Secondary: PCM
Backup Frequency	Daily
CM Baseline Frequency	As directed by the PM/SPM
Backup Type	See the detailed discussion below
Backup Process	See the detailed discussion below

Since a ClearCase server outage could significantly impact the project during critical phases, the backup strategy should be robust. The restore strategy should quickly and faithfully reconstruct the project repository. While the Redundant Array of Inexpensive Disks (RAID) 5 structure of the project server provides a first line of defense against data loss, additional backup procedures will be implemented to provide more robust protection of the data.

A standard functionality of the ClearCase software is to save past and deleted versions of stored files. The most recent day's backup should, in theory, hold all or nearly all previous file versions. However, since ClearCase software database corruption may occur and since this corruption could go undetected for several days, several days worth of backups will be kept.

The ClearCase server is backed once each evening, after work hours: using a differential backup technique provided by the Veritas Backup Exec software. These tapes are stored on the tape backup server's robotic tape library for two weeks to facilitate rapid restoration of files should the need arise. This robotic tape library is located in a server room located in a different part of the building from the location of the project repository to add a level of protection from localized incidents in the project area.

- A daily differential backup is also run to provide tapes for offsite storage in the event a restoration from a catastrophic event within the project building is required. These are also kept for two weeks.
- A full backup is performed weekly on Friday nights after normal work hours and stored on the robotic tape library for up to six weeks. In the event additional room is required, the oldest weekly backups may be moved to storage near the robotic tape library to maintain the ability to restore files expeditiously.
- A second full backup is performed weekly on Saturday night for offsite storage to support recovery in the event of a major catastrophe in the project building. These backups are also kept for six weeks.
- Finally a full backup is performed monthly and kept offsite for two years as another restoral capability.

The offsite backup tapes are maintained in a fireproof safe in a SwRI building (Blg 128) removed from the project building to limit the likely-hood that a major catastrophe could affect both the project location and the backup site but still be close enough for timely restoral, if required, for less than catastrophic events.

The Division 10 Network Support Group practices restoral actions approximately twice every three weeks. These restoral actions verify that the backup system is working correctly and that files can be restored successfully.

1.10.2 ClearQuest Backup

The following table describes key parameters of the ClearQuestData Server backup strategy. The ClearQuestData Server is also hosted on the machine Archimedes and is used to store and track project issues and defects.

Backup Responsibility	Primary: Division 10 Network Support Group
	Secondary: System Administration Team
Backup Frequency	Daily
CM Baseline Frequency	As directed by the PM/SPM
Backup Type	See ClearCase backup description above
Backup Process	See ClearCase backup description above

Since the ClearQuest server is co-located with the ClearCase server on the machine Archimedes, backup procedures have been developed that are the same for both.

1.10.3 Local PC Files Backup

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

2. Configuration Status Accounting

The status of the project configuration management repository will be assessed whenever a new baseline is created or at the direction of the PM, SPM, or SCCB.

A checklist and procedure for performing Configuration Status Accounting is provided in Appendix A.

To conduct project configuration status accounting, perform the activities and inspections described in the following table. Rate each area as Green (fully compliant), Yellow (partially compliant), or Red (non-compliant). If an area is Red, record corrective action in the Comments column. If an item is not applicable, write "N/A" in the Comments column along with a brief explanation. Audit each area in the context of the project's Software Configuration Management Plan as outlined in the latest Software Development Plan (SDP) and the latest Management Review Meeting minutes.

Appendix A

Configuration Status Accounting

Audit Activity	Green	Yellow	Red	Comments
Project Repository Status				
Are all baselined documents and Computer Software Configuration Item (CSCIs) in the project CM repository?				
Are all historical project artifacts (paper and electronic) that have been delivered to the client in the departmental archive?				
Source Code Control				
Have the development directories been set up as described in the project CMP?				
Have source files under development been checked into ClearCase?				
Run a report listing the status of each source file. Are there any files currently checked out which should not be?				
Are there any files that have any indication of corruption or other bad status?				
Have critical project utilities (such as XML parsers or other libraries/binaries) been checked into source code control?				

Audit Activity	Green	Yellow	Red	Comments
Have baselined modules been captured using an appropriately named ClearCase Baseline?				
Checkout a copy of a baseline. Does each directory contain the source files, binaries, and output from the build process (if applicable)? Are there any files in those directories that should not be there? Are any files missing?				
Versioning				
Has each baseline item document been assigned a unique identifier, and is that identifier used consistently across the project?				
Has each baseline item CSCI been assigned a unique identifier, and is that identifier used consistently across the project?				
Are baseline items (documents and software) being assigned version numbers consistent with the SDP? Record the current version of all baseline items in the column to the right (or attach separate sheet).				
Engineering Change Requests/Problem Reports				
Has the project ECR/SPR system been implemented and is it being used?				
Is the status of each ECR and SPR current?				

Audit Activity	Green	Yellow	Red	Comments
Backups				
Are backups being performed regularly and as described in the project CMP?				
Are backup media stored in a separate facility as described in the CMP?				
Retrieve a backup. Select one or more files that have changed since that backup was performed. Attempt to restore the file(s) from the backup media and verify that the file(s) were successfully restored				

Audit Completed By:	Date: