Configuration Management Plan

Metropolitan Model Deployment Initiative Project

of the

Washington State Department of Transportation
Regional and Local Agencies
Commercial and Academic Partners

and the

U. S. Department of Transportation

Version 2.0

July 30, 1999

Configuration Management Plan -- Revision Control			
Revision	**Description**	**Revision Date**	**Entered by**
Internal Draft 0.5	Initial collection, review, organization and presentation of materials	June 10, 1997	taf
Version 1.0	Includes revisions and upgrades suggested by the first external review by Management and Team Members	September 15, 1997	taf
Version 2.0 (Draft)	Include final revisions and slight restructuring. Revisions based on informal comments from Smart Trek program management and are designed to capture "as built" conditions and broaden the scope of this CMP to include the regional baseline, and "after" Smart Trek.	July 30, 1999	dec
Version 2.0 Final	Removed Draft and printed. No changes to content.	December 21, 1999	dec

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Figures and Illustrations

1. Introduction

1.1. Background

There are 25 partners simultaneously contributing to the development or significant enhancement of Intelligent Transportation System (ITS) infrastructure components and subsystems for the Smart Trek Metropolitan Model Deployment Initiative (MMDI) system.

In systems engineering and integration terms, configuration management (CM) is absolutely essential for a program of this size and complexity. The benefits that accrue from appropriate CM will enable each partner to depend on the stability of the design and implementation of other components and subsystems with which their subsystem must interfaces to acquire input or provide output. In the event that changes are needed, CM will facilitate and ensure that appropriate communications occur among all who must communicate and all who are potentially affected by the change. This will assure participants that they will be informed of the requested change, that they will have a chance to participate in discussions of its scope and impact, and after the change is agreed upon and approved, that they can adjust their design as needed.

An appropriate CM process thus avoids or minimizes frivolous changes, helps identify alternative solutions to functional or technical challenges, and guides the technical and programmatic evaluation of changes toward solutions that are mutually acceptable for all affected partners.

1.2. Purpose

The purposes of this plan are to communicate the details of how the Smart Trek partners will use CM, who is responsible for using CM procedures, how CM functions will be performed, and what the partners need to do to conform to CM procedures.

Additionally, although the language of this document will tend to focus on the Smart Trek MMDI program, it is not intended to preclude the use of an identical or derived process for the implementation of a regional CM program. This regional program would include the pre-MMDI regional ITS baseline, Smart Trek MMDI enhancements and new functional/physical components and subsystems, and concurrent or future ITS improvement projects.

1.3. Configuration Management Defined

Configuration Management (CM) is a systems engineering management process that identifies the functional and physical characteristics of a system component or subsystem throughout its life cycle, identifies and controls changes to those characteristics, and records and reports change processing and implementation status.

CM is the means through which the integrity and continuity of the design are recorded, controlled and communicated by program management. The CM process includes three main functions:

- Configuration Identification
- Configuration Control
- Configuration Status Accounting and Reviews

Configuration Identification is the process of identifying the subject elements that require configuration management, control, and review. The component or subsystem elements that will be subjects of CM are called Configuration Items (CIs). This document describes how CIs are designated from among the components of the Smart Trek program.

The ***Configuration Control*** functions of the CM process manage how changes will occur by ensuring organized communication among the partners, such that the activities and functional responsibilities of one partner are not hindered by unannounced or unanticipated changes made by another partner. The implementation of configuration control typically requires a chartered governing panel and a well-defined process--for Smart Trek these are the Configuration Control Board and the Change Request process respectively. The suggested membership and roles of the Configuration Control Board (CCB), and CM Coordinator are described in Sections 3 and 4. The Change Request (CR) process is illustrated in Figure 2 and discussed in Section 4.

Configuration Status Accounting and Reviews ensure that the regional partners will know with appropriate confidence what is being built as it moves through the design process. Smart Trek CM will give all partners the confidence that specified designs will remain stable, and that they will be notified of and participate in changes, allowing them to proceed efficiently with their respective design elements. CM Reviews will be performed periodically to verify the status of all designs and changes and communicate results to all the Smart Trek partners. The partners can then ensure that the results of this verification process conform to their expectations and meet the needs of their particular ITS components or subsystem.

These three functions of CM are discussed in the sections that follow. Section 2 discusses Configuration Identification by defining the concept of CIs and presenting a preliminary list of these system components. Configuration Control is presented in Sections 3 and 4. Sections 3 and 4 also include a discussion of organizational responsibilities and the change process. Configuration Status Accounting and Reviews are addressed in Section 5. Section 6 and 7 discuss schedule and resources needed to implement and perform appropriate CM.

2. Configuration Identification

As the overall Smart Trek system design and its component subsystems evolve, CIs are being identified; initially by the system integrator and later by the CCB, as described in Section 4. CIs include selected subsystems of Smart Trek, and Smart Trek system-level documentation. The subsystems referred to include all hardware, software, firmware, and documentation that comprise the subsystems. A general characteristic of CIs is that they have (or, in the case of documentation, describe) interdependencies with other parts of the overall system. As each CI reaches a level of maturity in the design process, it will be entered into the CM process and thereby become subject to the requirements of CM as it relates to Smart Trek. This section discusses how system components are identified as CIs, and how they are subsequently tracked.

2.1. Identification and Selection of Configuration Items

The designation of a system component as a CI is both a technical and a management decision that is ultimately a matter of judgment. The general criteria for identifying a CI include evidence of the following:

- identifiable, observable inputs and outputs that link the candidate CI to other elements or subsystems in the Smart Trek program and create interdependencies;
- inputs and outputs that can be effectively monitored and managed;
- favorable -cost-benefit tradeoff for the investment of time and effort required to control the CI.

The Smart Trek system is described in depth in the sequence of Smart Trek documents as illustrated in Figure 1. These documents describe each of the component projects that, taken together,

comprise the Smart Trek MMDI program. A CI may constitute an entire component project, a subsystem of a project, or potentially both.

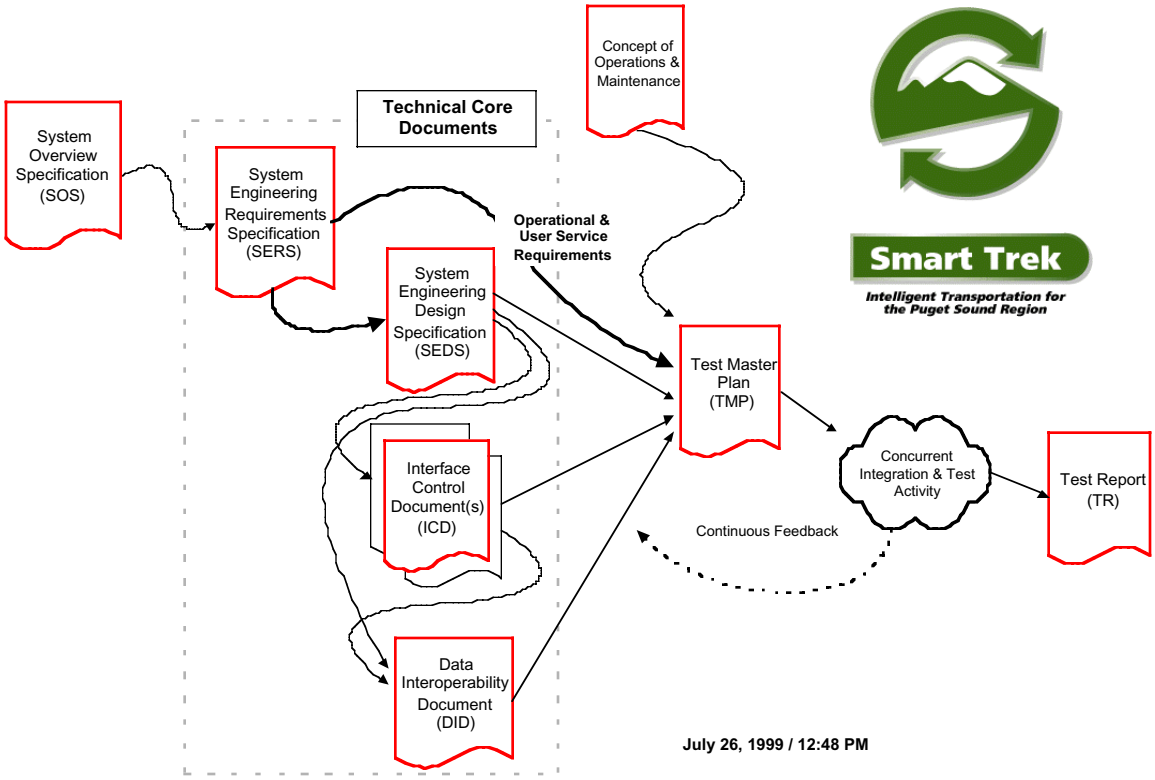

Figure 1 Smart Trek MMDI Documentation

CIs must be identified before it becomes necessary to apply CM oversight to them. The decision to apply CM to a CI generally will be made jointly by Smart Trek project management, bundle manager(s), and the cognizant subsystem (or project) manager, based on the recommendations of the CM Coordinator. Typically, the System Integration team is likely to initiate the process of designating a system element or component as a CI. This will usually occur after the inputs and outputs associated with the subsystem are sufficiently defined that they become significant factors to be considered by related or interacting CIs. In the case of system documentation, the document CI will usually come under CM after it has been placed on record as a fully reviewed version--a procedure called **baselining** as described below.

Currently, there are three types of CIs for the Smart Trek effort:

Subsystem CI. These refer to the subsystems developed, modified, or produced by the partners that:

- exist solely as a result of Smart Trek,
- existed prior to Smart Trek and are modified as a result of Smart Trek, or
- exist independently of Smart Trek but interface with one or more Smart Trek system CI.

Distributed CI. These refer to the hardware and software that provide for the distribution of a capability. It is created by one organization but used by others. The ITS Information Backbone (I^2B) Client Software is one such distributed CI. The software is developed by the University of Washington to interface with the ITS Information Backbone and is resident in subsystem software of

the various clients (partners).

Smart Trek System-level Documentation CI. These refer to documentation created to specify, design, integrate and test the Smart Trek system (as in Figure 1 for example).

The five major Smart Trek program components that are the subject of system integration are traffic management, traveler information, transit management, and emergency management and the ITS information backbone. These broad program components are identified in Appendix A with a list of their respective CI subsystem components. Also included are the system-level documents. The table also indicates the responsible subsystem manager for each CI. The CM Coordinator will review these CIs and update the table as needed.

2.2. Configuration Item Baseline

Baselining is an important event in configuration management. It refers to the first complete technical description of the system. The aggressive Smart Trek development schedule demands that design and development occur simultaneously on multiple subsystems, instead of following the normal linear development cycle. Under this method of operation, baseline design will occur as soon as design information is disclosed. In this sense, all CIs are considered to be under CM now. The initial issuance of design information generally will be the baseline for each aspect of a given subsystem. Once the design of a CI has been established by the initial release of design information, the CI may not change in any way that would impact the subsystems with which it is linked or the overall Smart Trek program unless the change is implemented by following the CM process. It is the responsibility of the cognizant subsystem manager, as listed in Appendix A, to ensure that the CM plan is followed after the decision is made to include the CI as an element subject to CM.

Designating a subsystem as a CI means that all subsystem hardware, software and documentation that interrelate to other Smart Trek components are subject to CM procedures and are part of that CI. For example, the ITS Information Backbone is a CI. The ITS Information Backbone CI includes all hardware, all software that runs on that hardware, and all associated documentation. Any change to the hardware, software or documentation that affects the inputs, outputs or the functions in a way that impacts other Smart Trek subsystems must be managed through the CM process.

An example of a distributed CI is the ITS Information Backbone Client Software. This CI refers to a set of software components associated with the ITS Information Backbone, but not run on the backbone equipment. This set of software components is provided to other partners by the University of Washington for use in their subsystems to facilitate data exchange with the backbone. It is incorporated into the software in their subsystems. This client software and associated documentation is therefore designated as a CI so that changes can be tracked, communicated and approved among all involved parties.

Many of the key design aspects that must be controlled are identified in Smart Trek system documents being written jointly by the partners. As system integrator, Battelle is doing much of the initial work, but close coordination with each of the partners on their subsystems is driving the specification, design and content of each document. Each partner is provided with critical documentation review opportunities that must be pursued with diligence for the system to function properly. Each of the Smart Trek system documents is designated as a CI, and is identified in Appendix A. Preliminary drafts of each of these CIs, including this CM document, will be provided to the partners for their review and comment prior to its entry into the CM process. Each updated draft will then be placed under formal CM control.

As the Smart Trek system design continues to develop, this list of CIs may be adjusted by submission and approval of a CR.

3. Configuration Control: Management, Organization, and Responsibilities

The entire Smart Trek team must contribute to CM for project efficiency and success. Each partner shall follow CM procedures and shall notify the CM Coordinator of any and all configuration changes that could affect Smart Trek in any way. When called upon, each partner shall review proposed changes and support the CM process. Each partner shall ensure that the CIs for which it is responsible are developed in accordance with the design as communicated to the team, baselined and then modified only through the CM process.

Configuration control is essentially a process for tracking and managing system and subsystem changes.
It is important to note that these changes include:

- any change to an input or output variable associated with a Smart Trek CI, whether in terms of form, value, or timing; and
- any significant changes to processing that might affect another subsystem.

A Configuration Control Board (CCB) is designated as the decision authority for CM. The CCB will be organized as illustrated in Table 1.

Table 1 Suggested Smart Trek CCB Membership

Position	Name	Organization
CM Coordinator/CCB Chairman[1]	Tom Ferryman	Battelle
Smart Trek MMDI Program Management		
Program Manager	Pete Briglia	WSDOT
DPM, System Integration	Don Creighton	Battelle
DPM, O&M and Evaluation	Bart Cima	IBI Group
Smart Trek Bundle Management		
Traffic Management		
Transit Management	Tom Friedman	Metro Transit
Emergency Services/Incident Management	Paul LaValle	IBI Group
Traveler Information Systems	Mark Whiting	Battelle
ITS Information Backbone	Dan Dailey	University of Washington

The CCB is chaired by the CM Coordinator. The Smart Trek Program Management Team are ex-officio members of the CCB.

It is envisioned that many of the day-to-day activities, including project-specific decisions, can be conducted with a subset of the CCB members, such as the CM Coordinator and the affected bundle manager, with input from specific affected project partners.

The CM Coordinator will be responsible for facilitating most of the activities of the CCB in support of the CM process as illustrated in Figure 2. CM information, including change requests (CRs), will flow first to the CM Coordinator, who will present them to the CCB via e-mail, organize discussions of the CRs at CCB conference calls or meetings, document the decisions, and inform Smart Trek partners of the results. The CM Coordinator will initiate conference calls or meetings as needed. It

[1] For Smart Trek, this position was filled by a member of the System Integration Team. For long-term general use of the CMP, it is suggested that this position be filled by a CM Technical Representative from WSDOT Traffic Operations and Management.

is envisioned that they will occur weekly during key integration phases of the project, then less frequently or on event in later stages of the Smart Trek MMDI program.

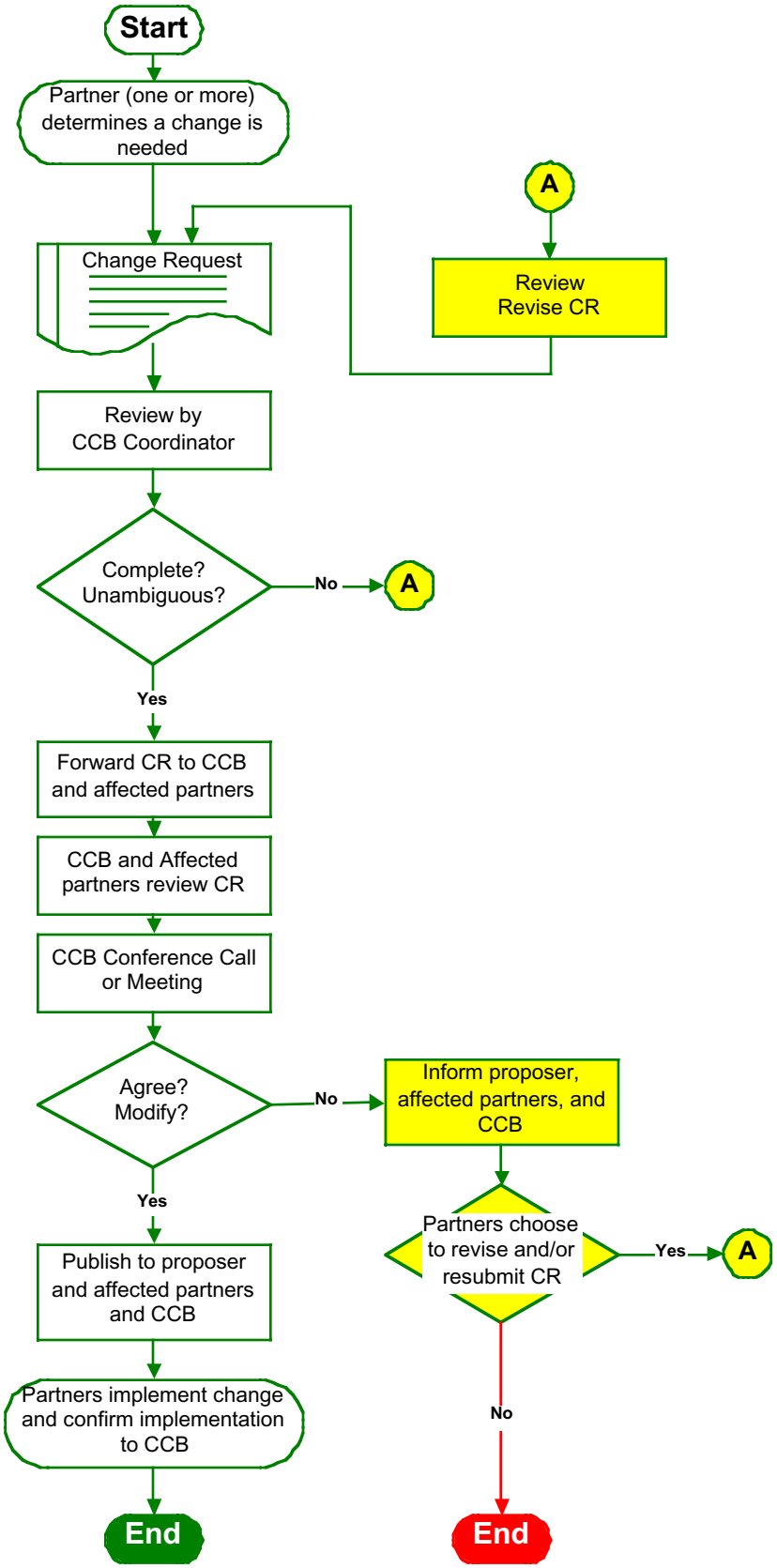

Figure 2 Change Request Review and Approval Process

4. Configuration Control: Change Requests

In a system of the size and complexity of Smart Trek, changes are inevitable. It is essential that changes be managed to minimize potential adverse impacts on the design and implementation progress of the project partners. When a change is considered necessary, a Change Request (CR) will be submitted, as illustrated in Figure 2 and described below (Section 4.1). The CM Coordinator will review, check, summarize, and research the CR content, and provide a recommendation to the CCB. The CCB will review the CR and issue an approval or ask for more clarifying information (Section 4.2). The project partner(s) originating the CR and the projects directly impacted by the CR are expected to participate in this review process.

4.1. Change Request Submittal

Change Requests will be submitted to the CCB for evaluation whenever any of the following events occurs:

- Addition or deletion of a CI;
- Changes to the contents of the CIs, including major or minor additions, deletions, corrections or design changes in hardware or software;
- Any change to any data exchange input or output variable passed between Smart Trek subsystems, whether in form, value, or timing; or
- Any significant changes to processing or functions that might affect another subsystem.

Change requests concerning any CI can be made by any of the partners. In cases where one partner requests a change to another partner s system, it is expected that these partners will have discussed and negotiated a consensus approach prior to submission of the CR and involving the CCB. The process is initiated by providing the information listed below and illustrated in the sample CR (Appendix B):

1. Title of proposed change
2. Affected CI(s)
3. Identification of the portions of the CI(s) to be changed, (functions, sections, paragraphs, individual words, tables, etc.)
4. Originator s name and organization
5. Date of request
6. Date of proposed implementation
7. Indication of urgency for change approval
8. Description of the proposed change
9. Justification for the proposed change
10. Estimated cost impact on other partners, WSDOT, USDOT
11. Estimated schedule impact on other partners and the Smart Trek project
12. Estimated performance impact on other components or aspects of Smart Trek
13. Comments

For changes to CI documents, marked-up versions of the document with marginal change bars, revision marks or other editing notation are requested, to help identify the exact changes proposed.

The information may be transmitted to the CM Coordinator by any of three methods:

1. Sending an e-mail message to:
   Smart.Trek.CM@pnl.gov

2. Sending surface mail to:

Tom Ferryman, CM Coordinator
Pacific Northwest National Laboratory — Mail Stop K5-12
Battelle Memorial Institute
P.O. Box 999
Richland, WA 99352

3. Sending a fax to:
   Tom Ferryman
   CM Coordinator
   (509) 375-2604

4.2. CR Processing and Disposition

The CM Coordinator will add the following information to the CR:

14. Request number
15. Status/disposition code

If the supplied background information and detail is judged unclear or insufficient for a complete review and evaluation of the CR request, the CM Coordinator may request further clarification from the originator. An initial analysis will be conducted by the CM Coordinator to approximate the impact of the change request and to determine which partners are most likely to be affected by the proposed change. The CM Coordinator will collect all change requests; forward them to the CCB for review along with appropriate summaries, background research and recommendations; prepare an agenda for the CCB meeting; and host the conference call or meeting. Each change request will be reviewed, and a disposition determined by the CCB parties involved in the conference call or meeting.

The results of the meeting will be summarized in written form by the CM Coordinator and distributed to all partners in a timely fashion. If a partner disagrees with the CCB s disposition of a change request, the partner is invited to appeal the ruling to the CCB at its next meeting (The CM Coordinator can call another CCB meeting immediately, if appropriate). If the originating partner wishes, discussions with the Smart Trek management team can be scheduled.

Once a change request is authorized by the CCB, it is expected that it will be made. A target implementation date will be established, based on the date of proposed implementation (item number 6 on the CR request). If for any reason the change is not made by that date, the partner who is responsible for making that change must inform the CM Coordinator of that fact and of the anticipated date that the change will be implemented. If, for any reason, the responsible partner does not want to make the change, a CR identifying the request to return to the original configuration must be submitted for CCB approval.

All actions by the CCB, including authorization or rejection of CRs, shall relate only to the CM aspects of Smart Trek. No action by the CCB shall be construed as authorizing any changes in scope, schedule or resources (cost) as indicated in contracts between WSDOT and any other Smart Trek organization.

5. Configuration Status Accounting and Review

The configuration status of all designs and changes will be communicated to all the partners. Notification will occur at least monthly, or following each CCB meeting that results in a decision to

authorize or not authorize a CR, and will reflect the status of the CIs and CRs as known to the CCB. Each partner will review the changes and assure themselves and the CCB that the changes are in accordance with their records, match their designs and support their input and output needs. This review and concurrence will serve as a Configuration Review. Additional configuration verification efforts are a natural result of the interface, integration and test efforts conducted as each partner s system is integrated into and operated as part of the Smart Trek system.

6. Schedule

The CM process shall commence with the issuance of the draft CM Plan. Specific design information may be released by a subsystem partner during the design of a subsystem CI or distributed CI, to enable other partners to proceed with their development. Any and all updates to that information shall be subject to the CM process and require CR submission and approval. Each Smart Trek System-level Documentation CI shall be considered baselined, and subject to CM, upon submission of the first draft version of the document to the CCB for review. The date of baselining shall be recorded by the CM Coordinator in an updated version of Appendix A. The CM process described herein shall continue until project completion[2]

7. Resources

Much of the CM process will be conducted manually, especially for CI documents. Documents are expected to be in Word format. In some cases, the Revision Control System (RCS) software package may be used to support the CM process. The CM Coordinator is knowledgeable about CM practices, the RCS package and will provide this support to the Smart Trek MMDI Program.

[2] As of this revision, that date is estimated to be 12/31/1999.

Appendix A

Configuration Items and Status

Configuration Items and Configuration Management Status

Traffic Management

CI	Responsible Subsystem Manager	Status
WSDOT TSMC	Michael Forbis (WSDOT NW)	
NSATMS	Tom Saul (PBFI)	
ESATMS	Tom Saul (PBFI)	
SSATMS	Tom Saul (PBFI)	
SeaTac ATMS	Glen Fromm (PBFI)	
Bellevue ATMS	Dirk Mitchell (Bellevue)	
Tacoma ATMS	Stan Ching (PBFI) and Toby Rickman (WSDOT Olympia Region)	
Additional Vehicle Detection	Michael Forbis (WSDOT NW)	
Ferry Location	Stan Ching (PBFI)	
Ferry Terminal Queue Detection	Stan Ching (PBFI)	
Seattle Center Parking Information	Paul LaVallee (IBI Group)	
Historical Data	Michael Forbis (WSDOT NW)	
Travel Aid	Glen Fromm (PBFI)	

Traveler Information

CI	Responsible Subsystem Manager	Status
Cable TV (UWTV 75)	Dan Dailey (UW)	
ETAK Traffic Workstation	Gary Latshaw (Etak)	
Traffic View (seattle.sidewalks)		
Embarc - Handheld Personal Computers	Steve Wollenberg (Fastline)	
DIS WIN	*Mike Marshall (DIS)*	
RRM	*Lee Balzer (Seiko)*	

Transit Management

CI	Responsible Subsystem Manager	Status
AVL Enhancements	Dan Overgaard (KC Metro Transit)	
Transit Watch	Tom Friedman (KC Metro Transit) and Dan Dailey (UW)	

BusView	Tom Friedman (KC Metro Transit) and Dan Dailey (UW)	
Riderlink/EZRider	Tom Friedman (KC Metro Transit)	
Dynamic Ridesharing	Dan Dailey (UW)	

Emergency Management

CI	Responsible Subsystem Manager	Status
Video to/from Incident Scene	Michael Forbis (WSDOT NW)	
Enhanced Incident Information	Michael Forbis (WSDOT NW)	
Expand Links to Emergency Response Center	Paul LaVallee (IBI Group)	
Enhanced Video Information	Michael Forbis (WSDOT NW)	

ITS Information Backbone

CI	Responsible Subsystem Manager	Status
ITS Information Backbone	Dan Dailey (UW)	
ITS Information Backbone Client Software	Dan Dailey (UW)	

System Documentation

CI	Responsible Document Manager	Status
SOS (System Overview Specification)	Don Creighton (Battelle)	
SERS (System Engineering Requirements Specification)	Don Creighton (Battelle)	
SEDS (System Engineering Design Specification)	Dan Donohoo (Battelle)	
ICD (Interface Control Document)	Dan Donohoo (Battelle)	
DID (Data Interoperability Document)	Mark Whiting (Battelle)	
SIM (Standards Implementation Memos)	Tom Heimbigner (Battelle)	
CMP (Configuration Management Plan)	Don Creighton (Battelle)	
TMP (Test Master Plan)	Tom Ferryman (Battelle)	

TR (Test Report)	Tom Ferryman (Battelle)	
CofO&M (Concept of Operations and Maintenance)	Bart Cima (DEA)	

Appendix B

Change Request Form

Change Request Form

(This is intentionally a simple list of information requirements to facilitate e-mail submission.)

TO: Smart.Trek.CM@pnl.gov
FROM:

1. TITLE OF PROPOSED CHANGE:
2. AFFECTED CI(s):
3. SPECIFIC PORTIONS OF THE AFFECTED CI(s):
4. ORIGINATOR S NAME AND ORGANIZATION:
5. DATE OF REQUEST:
6. DATE OF PROPOSED IMPLEMENTATION:
7. INDICATION OF URGENCY FOR CHANGE APPROVAL:
8. JUSTIFICATION FOR THE PROPOSED CHANGE:
   (1) New Information
   (2) Clarification or expanded information
   (3) Change of information

9. DESCRIPTION OF THE PROPOSED CHANGE:

10. ESTIMATED COST IMPACT ON OTHER PARTNERS, WSDOT, USDOT:
    (1) None
    (2) Minor
    (3) Significant

11. SCHEDULE IMPACT ON OTHER PARTNERS, SMART TREK PROJECT:
    (1) None
    (2) Minor
    (3) Significant

12. PERFORMANCE IMPACT ON OTHER COMPONENTS OR ASPECTS OF SMART TREK:
    (1) None
    (2) Minor
    (3) Significant

13. COMMENTS:

For CCB use only:

14 Request #:

15 Status/Disposition:

Appendix C

Glossary of Acronyms

Glossary of Acronyms

Acronym	Meaning
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
CCB	Configuration Control Board
CI(s)	Configuration Item(s)
CM	Configuration Management
CMP	Configuration Management Plan
CofO&M	Concept of Operations and Maintenance
CR(s)	Change Request(s)
DEA	David Evans and Associates
DID	Data Interoperability Document
DIS	Department of Information Services
DIS WIN	Department of Information Services Washington Information Network
ESATMS	East Side Advanced Traffic Management System
ICD	Interface Control Document
ITS	Intelligent Transportation System(s)
NSATMS	North Seattle Advanced Traffic Management System
PBFI	PB Farradyne, Inc.
RCS	Revision Control System
SEDS	System Engineering Design Specifications
SERS	System Engineering Requirements Specification
SIMM	Standards Implementation Memos
SOS	System Overview Specification
SSATMS	Southside Advanced Traffic Management System
TMP	Test Master Plan
TSMC	Traffic System Management Center
TR	Test Report
USDOT	United States Department of Transportation
UW	University of Washington
WSDOT	Washington State Department of Transportation
WSDOT NW	Washington State Department of Transportation, Northwest Region