California High-Speed Train System

TECHNICAL MEMORANDUM

Interface Management Plan (IMP)
TM 1600.02

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0	21 May 13	Initial Release, R0

Note: Signatures apply for the latest technical memorandum revision as noted above.

Prepared by PARSONS BRINCKERHOFF

for the California High-Speed Rail Authority

System Level Technical and Integration Reviews

The purpose of the review is to ensure:

- Technical consistency and appropriateness
- Check for integration issues and conflicts

System level reviews are required for all technical memoranda. Technical Leads for each subsystem are responsible for completing the reviews in a timely manner and identifying appropriate senior staff to perform the review. Exemption to the system level technical and integration review by any subsystem must be approved by the Engineering Manager.

System Level Technical Reviews by Subsystem:

Systems:	*Signed document on file* Bradley Banks, PE	24 Apr 13 Date
Infrastructure:	*Signed document on file* Gene Lusherovich, PE	25 Apr 13 Date
Operations and Maintenance:	*Signed document on file* Joseph Metzler	6 Jun 13 Date
Rolling Stock:	*Signed document on file* Frank Banko	25 Apr 13 Date
Project Management Oversight:	*Signed document on file* Michael D. Lewis, PE	27 Sep 12 Date

Note: Signatures apply for the technical memorandum revision corresponding to revision number in header and as noted on cover.

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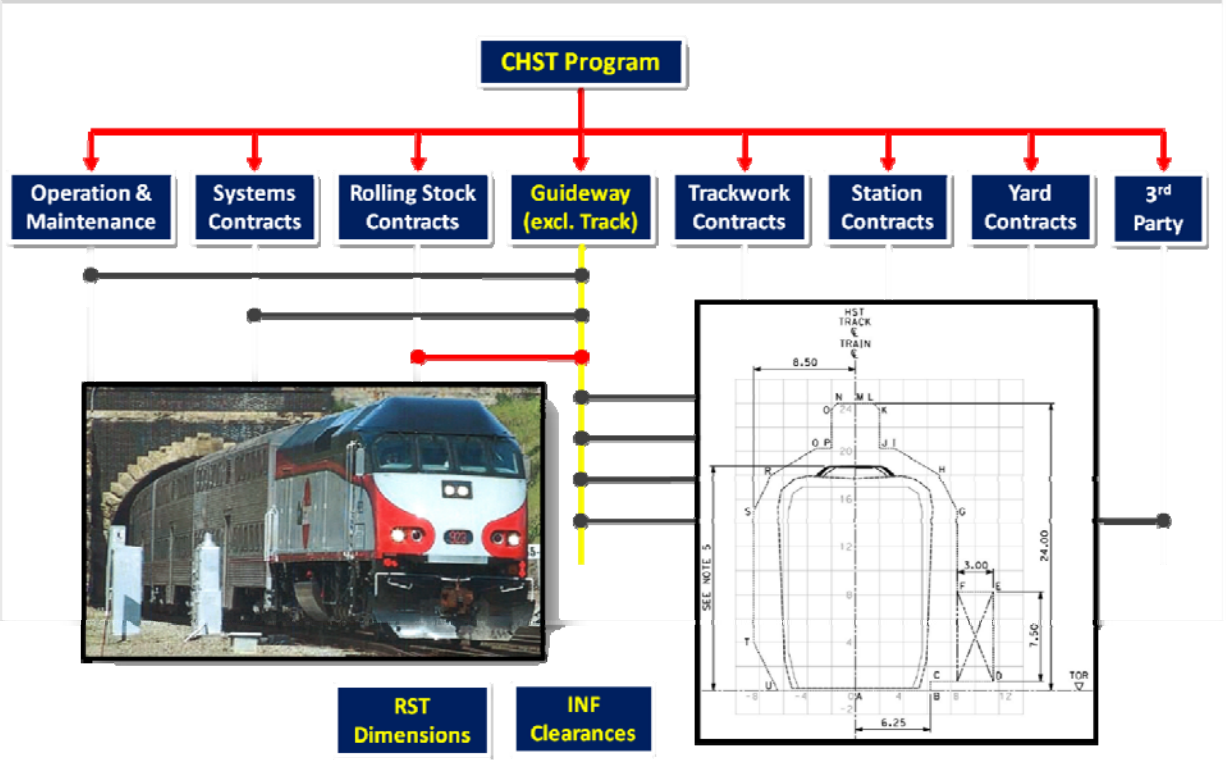
ABSTRACT

The objective of Interface Management is to ensure that all elements of the California High-Speed Train System (CHSTS) procured long-term in many different contracts can be integrated together effectively and provide a system that meets or exceeds the requirements set out in the Proposition 1A, the Business Plan, Basis of Design and other related requirements documents.

Ineffective interface management is often responsible for integration issues during testing and commissioning, causing delays, cost overruns and excessive re-work. Interface management is particularly important on large scale multi-contract and multi-discipline mega-projects.



This Interface Management Plan (IMP) describes the program approach to interface management, including but not limited to:

- CHST program stages and steps
- Inputs and outputs/deliverables for each stage/step
- Stakeholders, their roles and responsibilities
- Tools and methods

The IMP provides an overview of a typical interface life-cycle, including:

- Identification
- Specification
- Implementation
- Verification and validation
- Integration

The IMP identifies the critical interfaces that are to be managed and tracked from the program perspective, typically referring to interfaces between different procurement contracts affecting the overall project performance.

The IMP will provide an initial set of interface for the first procurement contract CP01. Interface are stored and managed in the requirements management tool. The detailed interface descriptions, including interface requirements and preliminary interface design is contained in separate Interface Control Documents (ICD).

The IMP is a living document and will be updated as required to reflect the identified interfaces.

The IMP serves as the Interface Control Manual (ICM).

INTRODUCTION

1.1 PURPOSE OF THE TECHNICAL MEMORANDUM

The purpose of the memorandum is to describe the programmatic approach to Interface Management (IM) for the California High-Speed Train System (CHSTS) throughout its program life-cycle and to determine the IM requirements needed to deliver a fully compliant and functional program.

The Interface Management Plan (IMP) establishes the overall inputs, outputs and deliverables, methods and tools, and roles and responsibilities for each stage in the CHSTS.

The IMP also identifies the critical interfaces between the procurement contracts to be tracked and managed from a program perspective.

1.2 STATEMENT OF THE TECHNICAL ISSUE

An interface is typically defined as a point of interaction or a common boundary between a number of systems, people, organizations, etc.

Interfaces in the context of the CHSTS involve typically at least one technical interface partner. To identify meaningful and manageable interfaces, the CHSTS has to be decomposed into smaller, manageable pieces until an interface can be clearly defined.

Decomposition is an accepted standard procedure in Project Management (PM) and Systems Engineering (SE) by which a complex project or system is repetitively subdivided into smaller, better manageable parts until an acceptable level of complexity is accomplished.

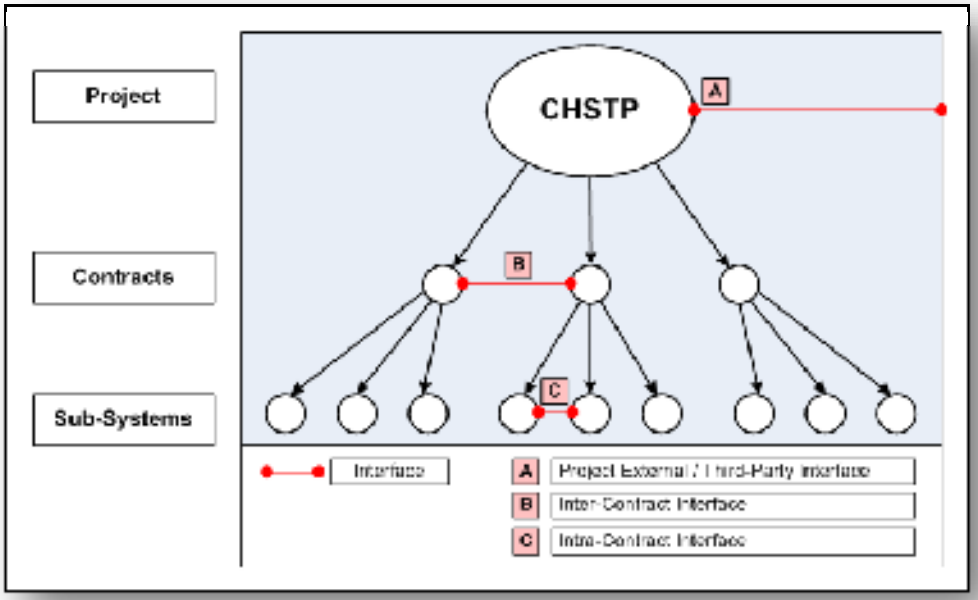
The Interface Management (IM) process is part of an overarching, existing and proven SE process, and follows the general provisions of the SE principles as defined in IEEE 1220 / IEC 26702 – “Systems engineering -- Application and management of the systems engineering process” and IEC 15288 “Life Cycle Management – System Life Cycle Processes”.

The IM process in the CHSTS is tailored for the purpose of a multi-contract infrastructure project. The “System” is comprised of the Guideway (GWY), Trackwork (TRK), Stations (STA), Yards (YRD), Systems (SYS), Rolling Stock (RST) and Operations and Maintenance (O&M).

1.2.1 Top-Down Approach

The first level of decomposition results in procurement contracts (section 1.2.2) which can be further sub-divided into sub-systems (section 1.2.4) as presented in Figure 1.

Figure 1: Top-Down Approach



Three different types of interfaces can be identified:

A. Project external / third party interfaces: are defined as interfaces that require the coordination between CHSTS and project external / third parties. Typical examples are utility relocations, or other projects that impact CHSTS.

B. Inter-contract interfaces: are defined as interfaces that require the coordination between two or more different CHSTS procurement contracts. Examples are spatial provisions by a civil /structural contract for future rolling stock or systems contracts.

C. Intra-contract interfaces: are defined as interfaces that require only coordination within one CHSTS procurement contract. Examples are interfaces between civil and drainage construction elements or between the procurement contract and utilities for the purpose of utility relocation.

In general, only the first two types of interfaces are managed from the program level. Intra-contract interfaces are managed by the Design/Build (D/B) or Design/Bid/Build (D/B/B) Contractor. Since most contracts are expected to be Design/Build, they will be further referred to as D/B-Contracts (D/B-C).

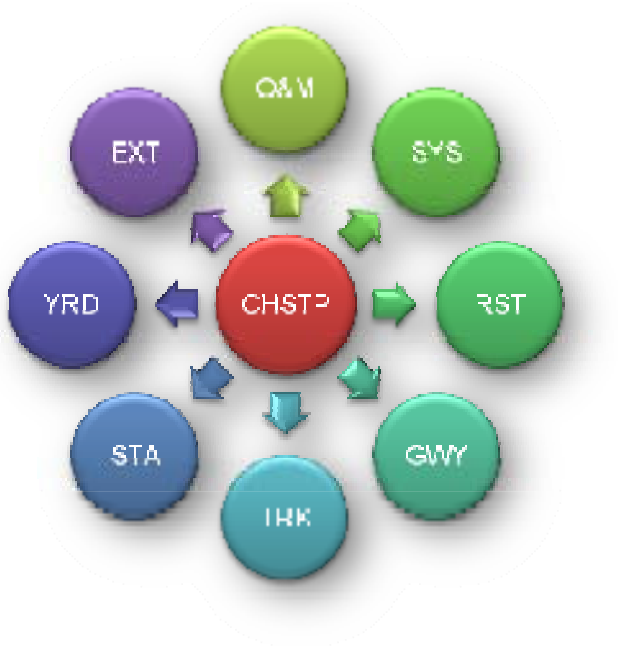
1.2.2 Procurement Contracts

The definition of the boundaries between procurement contracts is fundamental to the correct identification of inter-contract interfaces. The final procurement strategy will be determined by the Authority and is subject to change.

Since identification and specification of interfaces requires a certain amount of time and effort, a risk mitigation strategy is to assume a most granular level of procurement contracts. If contracts are later combined, e.g., between Rolling Stock (RST) and Systems (SYS), the interfaces do not

"disappear", they still exist but are re-classified as "intra-contract" rather than "inter-contract" interfaces.

Figure 2: Potential Procurement Contracts



For the purpose of interface identification, the following types of procurement contracts are assumed:

- O&M – Operations and Maintenance: Also referred to as the Concessionaire and often included in Design/Build/Operate/Maintain (DBOM) contracts. O&M also includes Safety and Security.
- SYS – Systems: Includes the Traction Power (TP), Overhead Contact system (OCS), Automatic Train Control (ATC), Communication (COM) Systems, and Grounding and Bonding.
- RST – Rolling Stock: Includes HST Trainsets.
- GWY – Guideway: Includes Track Geometry, Clearances, Civil/Structural elements (embankment, aerial structures, trenches), Tunnels, Drainage, Seismic, etc.
- TRK – Trackwork: Includes subballast, ballast, ties, rail, non-ballasted track, special trackwork, etc.
- STA – Stations: Includes station facilities including the actual station, parking, access roads, etc.
- YRD – Yards: Includes support facilities such as the Heavy Maintenance Facility (HMF), Rolling Stock Maintenance (RSM) Facilities, Maintenance of Infrastructure (MOI) Facilities and Sidings, etc.
- EXT – External / Third Party: Includes CHSTS external stakeholders or existing infrastructure such as Amtrak, freight railroads, existing bridges, etc.

1.2.3 Organizational Disciplines

The Program Management Team (PMT) comprises the following operations and engineering disciplines:

- Operations and Maintenance (O&M)
- Systems (SYS)
- Rolling Stock (RST)
- Infrastructure (INF)

Each discipline is further subdivided into discipline specific sub-systems. Each engineering discipline has typically input into each procurement contract, either directly (via requirements, scope of work) or indirectly (via interfaces, required future provisions). During the early stages of engineering provisions for future contracts have to be considered. These provisions are identified as interface requirements, with the corresponding engineering discipline information added to the interfaces.

1.2.4 Sub-Systems

Sub-systems are managed by the Engineering Disciplines and specified in the Procurement Contracts. Typically the organizational structure reflects the sub-systems. As a result, there is a clear relationship between sub-systems and the engineers responsible for the identification of interface requirements and the implementation of interface designs.

The following sub-systems are defined, as presented in Table 1. The three-letter codes are references used in the interface register (section 5.4).

Table 1: Sub-Systems

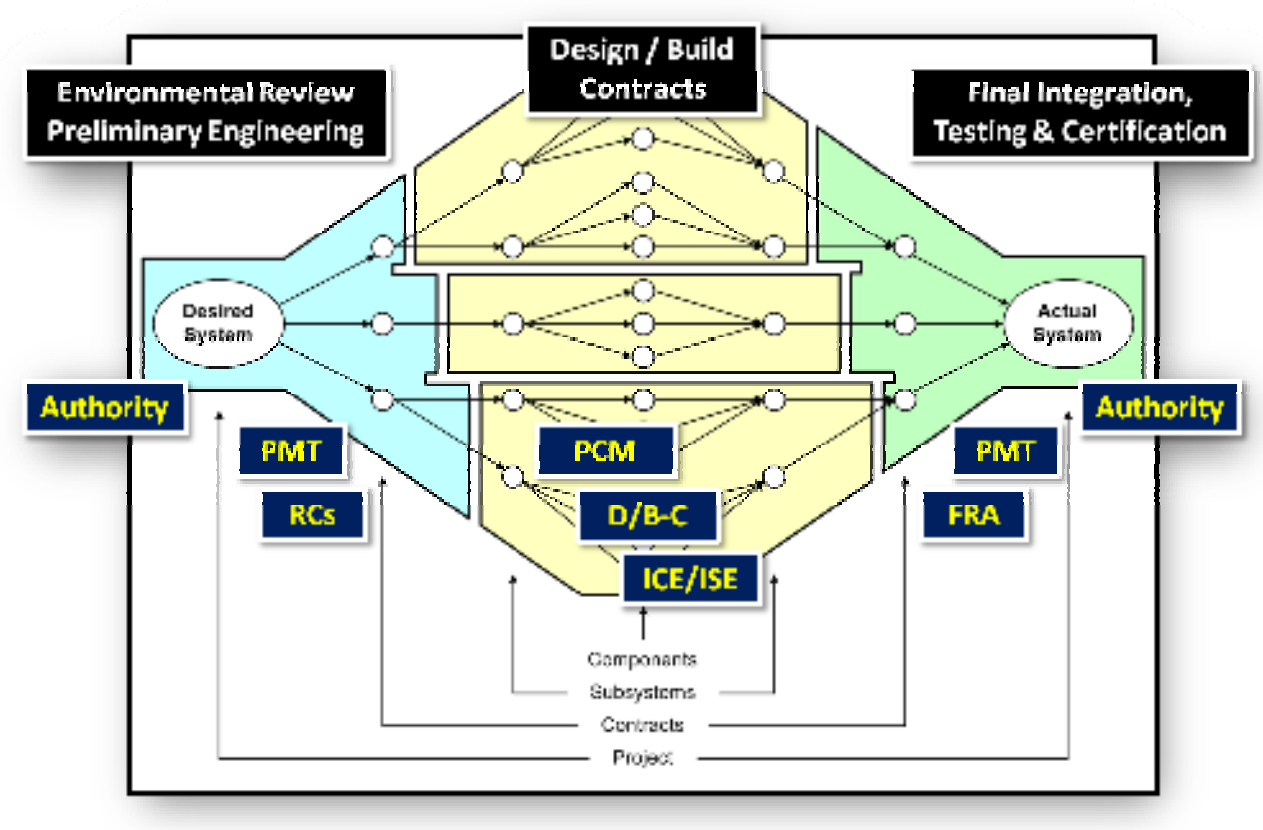
Sub-System		Organization/ Discipline	Procurement Contract
O&M			
OPS	Operations	O&M	O&M
MTC	Maintenance	O&M	O&M, Other
SAF	Safety	O&M	O&M, Other
SEC	Security	O&M	O&M, Other
SYS			
TP	Traction Power	SYS	SYS
OCS	Overhead Contact System	SYS	SYS
ATC	Automatic Train Control	SYS	SYS
COM	Communication Systems	SYS	SYS
G&B	Grounding and Bonding	SYS	SYS, Other
RAMS	Reliability, Availability, Maintainability, Safety	SYS	SYS, Other
YSG	Yard Signaling	SYS	SYS
SCA	SCADA Systems	SYS	SYS
CC	Corrosion Control	SYS	SYS, Other
RST			
RST	Rolling Stock Trainsets	RST	RST

Sub-System		Organization/ Discipline	Procurement Contract
INF			
GEN	General	INF	GWY, Other
DSM	Design Survey and Mapping	INF	GWY, Other
CLR	Trackway Clearances	INF	GWY, Other
ALG	Track Geometry / Alignment	INF	GWY, Other
TRK	Trackwork	INF	TRK
IPR	Intrusion Protection	INF	GWY, Other
CIV	Civil	INF	GWY, Other
DRN	Drainage	INF	GWY, Other
UTL	Utilities	INF	GWY, Other
GEO	Geotechnical	INF	GWY, Other
SEI	Seismic	INF	GWY, Other
STR	Structures	INF	GWY, Other
TUN	Tunnels	INF	GWY
STA	Stations	INF	STA
SFC	Supporting Facilities	INF	GWY, Other
MEC	Mechanical	INF	GWY, Other
ELE	Electrical	INF	GWY, Other
BMS	Building Management System	INF	GWY, Other
FPR	Fire Protection	INF	GWY, Other

1.2.5 Program Management Life-Cycle

The CHSTS is organized in several stages and steps with different roles and responsibilities and several handovers in between. Refer to section 2.0 for more details. The CHSTS Interface Management process reflects this level of complexity by providing several tools and methods, including traceability throughout the life-cycle of interfaces.

Figure 3: Program Management Life-Cycle



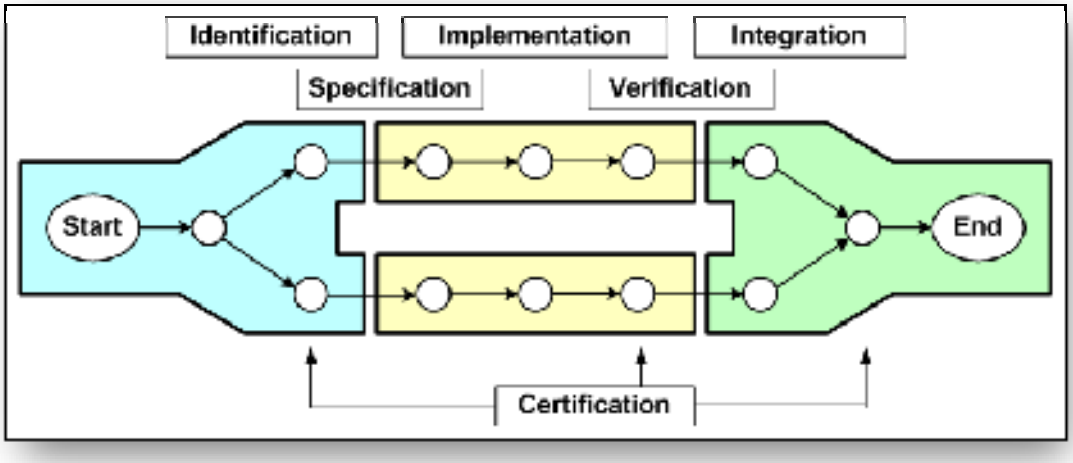
Legend:

- Authority: The California High-Speed Rail Authority
- PMT: Project Management Team, includes Engineering Management Team
- RC: Regional Consultant
- PCM: Project and Construction Management Team
- D/B-C: Design/Build Contractor
- ICE/ISE: Independent Checking Engineer / Independent Site Engineer
- FRA: Federal Railroad Administration

1.2.6 Interface Life-Cycle

Figure 4 depicts a typical interface life-cycle. The colors represent the different stages in the CHSTS as shown in Figure 3.

Figure 4: Interface Life-Cycle



Identification: The program management focus is generally on CHSTS external and inter-contract interfaces. Most of these interfaces will be identified prior to the release of the actual procurement contracts. However, the IM process does support the identification of additional interface at any stage of the CHSTS. Identified interfaces are stored in the Interface Register (section 5.4) located in the Requirements Management Tool (section 5.3).

Specification: Once an interface has been identified, interface requirements have to be defined (specified, section 5.5). The interface requirements have to be accepted by the interface partner and appropriate provisions have to be made in the corresponding design (section 5.6), which in turn are accepted by the originator of the interface requirements. An example is shown in Figure 5. The agreement between both interface parties is documented in a signed interface control document (section 5.7). During Preliminary Engineering (PE), the interface requirements and design will be specified to an appropriate level of detail, which will be brought to the final design level by the D/B contractors. Configuration Management processes (section 5.14) are used to ensure interface integrity.

Implementation: During the Design/Build Contract stage, the agreed upon interface design will be implemented by one or more interfacing contracts, depending on the actual type and content of the interface. The implementation is subject to Verification and Validation (V&V), as described below.

Verification (and Validation): Describes the inspection, testing and acceptance (section 5.12) of the interface design and implementation and whether they meet the specified interface requirements. V&V applies to all program stages and is closely related to the certification of interfaces.

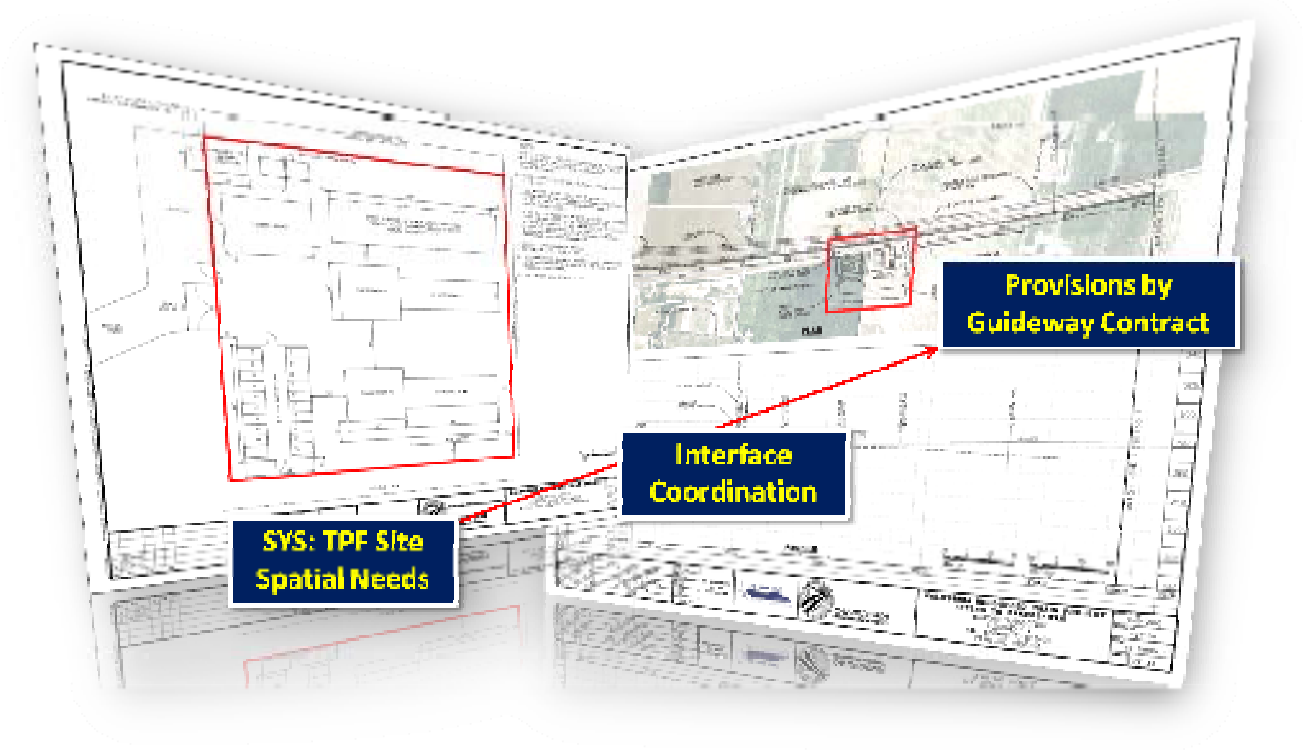
Integration: Once contributing interface implementations have been successfully inspected, tested and accepted individually, the interface can be tested across the interface boundaries. For inter-contract interfaces this will happen typically after the D/B contractors have completed their contracts.

Certification: This defines the formal sign-off process and agreement of the interface requirements, design, implantation and acceptance, depending on the program stage. During PE, sign-off is typically provided between the engineering disciplines acting in lieu of the future D/B contractors, documenting agreement between interface requirements and interface design.

During construction, sign-off is provided to certify compliance to the specified interface requirements and design and is provided by the D/B contractor. During final integration and testing, sign-off is provided to certify that the interface was successfully integrated, works as specified, and meets the intended use requirements.

Figure 5 provides an example of a SYS to INF requirement. Interface requirements (spatial needs) have been specified by the SYS/TP team and have been provided for by the INF team along the ROW.

Figure 5: Example Interface – Spatial Provisions for a Traction Power Facility



1.3 GENERAL INFORMATION

1.3.1 Definition of Terms

The following technical terms and acronyms and abbreviations used in this document have specific connotations with regard to the California High-Speed Train system.

Terms

Authority	California High-Speed Rail Authority
Contract	Procurement Contract, Procurement Package
Validation	Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled
Verification	Confirmation by examination and provision of objective evidence that the specified requirements have been fulfilled

Acronyms

CCB	Change Control Board
CHSTS	California High-Speed Train System
CIL	Certifiable Items List
CIMP	Contractor Interface Management Plan
D/B	Design/Build
D/B/B	Design/Bid/Build
D/B-C	D/B Contractor
DBOM	Design/Build/Operate/Maintain
EMT	Engineering Management Team
FRA	Federal Railroad Administration
HMF	Heavy Maintenance Facility
HST	High-Speed Train
ICD	Interface Control Document
ICE	Independent Checking Engineer
ICT	Interface Coordination Team
ISE	Independent Site Engineer
IM	Interface Management
IMP	Interface Management Plan
INF	Infrastructure
O&M	Operations and Maintenance
MOI	Maintenance of Infrastructure
PE	Preliminary Engineering
PE4P	Preliminary Engineering for Procurement
PHA	Preliminary Hazard Analysis
PMT	Project Management Team

RFC	Ready for Construction
RFP	Request for Proposal
RM	Requirements Management
ROW	Right-of-Way
RST	Rolling Stock
RVTM	Requirements Verification Traceability Matrix
SI	Systems Integration
SONO	Statement of No Objection
SOW	Scope of Work
SSMP	Safety and Security Management Plan
SSPP	System Safety Program Plan
TCC	Train Control and Communications
TSI	Technical Specifications for Interoperability
TSMF	Terminal Storage and Maintenance Facility
TVA	Threat and Vulnerabilities Assessment
V&V	Verification and Validation
VSMF	Vehicle Storage and Maintenance Facility
VVMP	PMT Verification and Validation Management Plan
xHA	(Unspecified) Hazard Analysis, such as Interface, Seismic, etc.

1.3.2 Document References

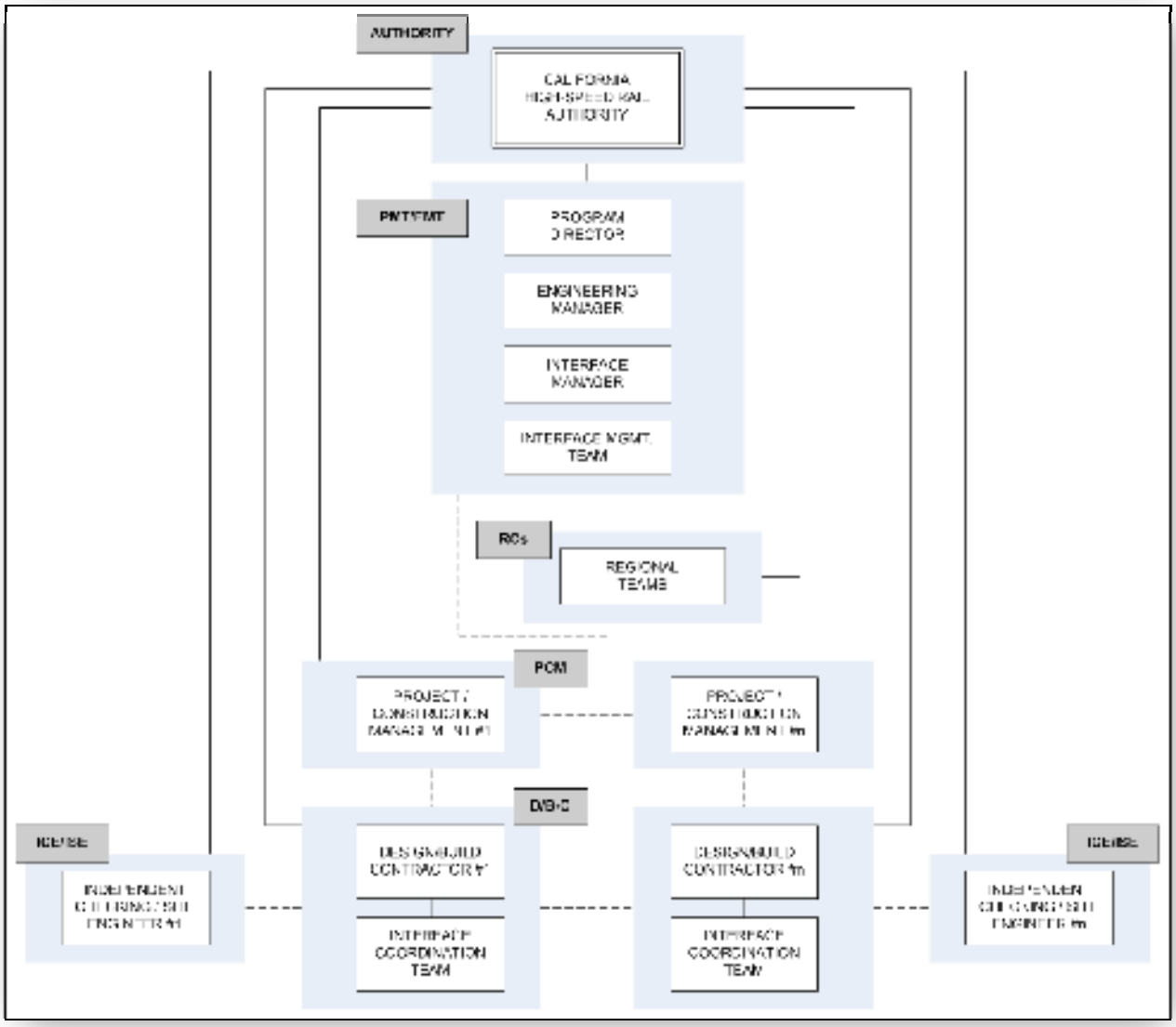
Table 2: Document References

Ref	Document
1.	CHSTS TM 1600.01 Verification and Validation Management Plan – R0
2.	PC.2.04 Program Change Control and Configuration Management Plan and Procedures
3.	IEC 15288 Life Cycle Management – System Life Cycle Processes
4.	IEEE 1220 / IEC 26702 Systems Engineering – Application and Management of the Systems Engineering Process

2.0 INTERFACE MANAGEMENT ORGANIZATION

The program IM organization is presented in Figure 6. Roles and responsibilities are defined in detail for each program stage in Table 3.

Figure 6: Interface Management Organization



Legend:

- Authority: California High-Speed Rail Authority
- PMT: Project Management Team
- EMT: Engineering Management Team
- RC: Regional Consultant
- PCM: Project and Construction Management Team
- D/B-C: Design/Build Contractor
- ICSE/ISE: Independent Checking Engineer / Independent Site Engineer

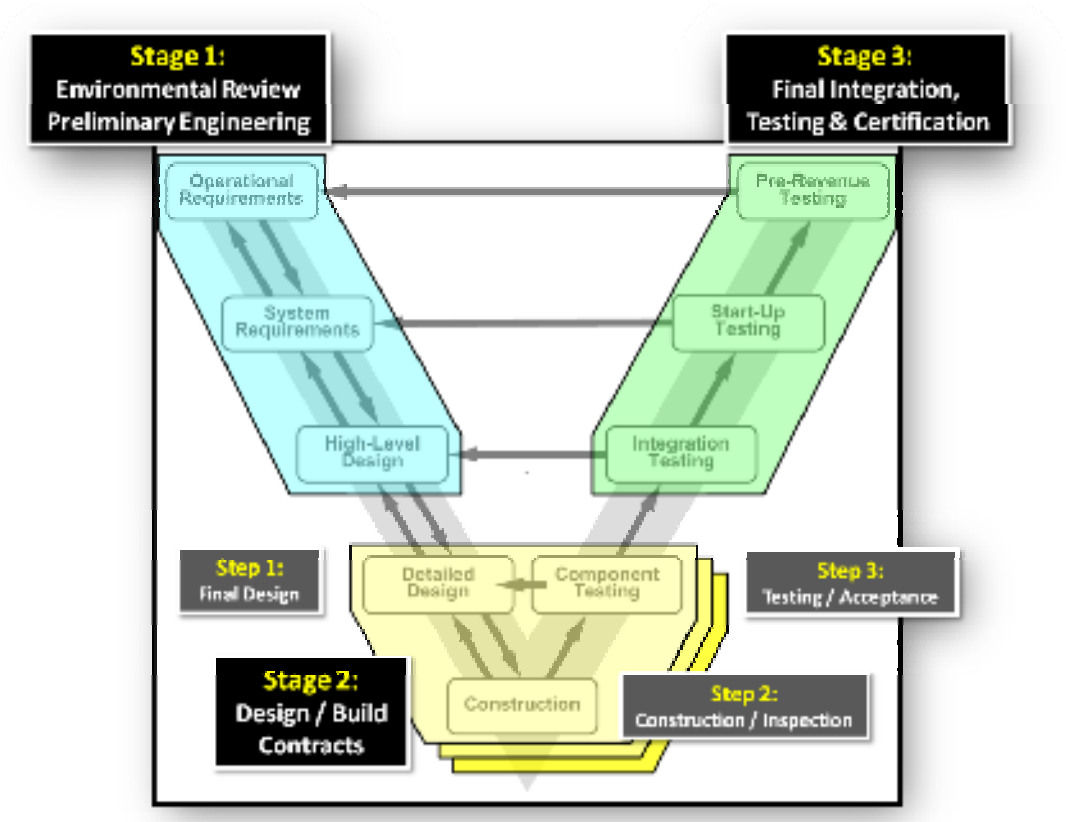
3.0 INTERFACE PROGRAM MANAGEMENT

3.1 OVERVIEW

As described in section 1.2, Interface Management is part of an overarching Systems Engineering (SE) Process. The life-cycle applied in the CHSTS is presented in Figure 7. The life-cycle can be described in three main stages of which the design/build stage can be subdivided further into three steps:

- Stage 1: Environmental Review/Preliminary Engineering
- Stage 2: Design / Build Contracts
  - Step 1: Final Design
  - Step 2: Construction
  - Step 3: Testing / Acceptance
- Stage 3: Final Integration, Testing, and Certification

Figure 7: Interface Management Life-Cycle in the CHSTS



For details on each stage, please refer to the corresponding sections of the Interface Management Plan.

3.2 ENVIRONMENTAL REVIEW AND PRELIMINARY ENGINEERING

3.2.1 Technical Criteria and Preliminary Engineering for Procurement

3.2.1.1 General

The main purpose of the IM process in this stage of the program is the following:

Planning

- Define the Interface Management process for the program
- Develop D/B contractor interface management requirements

Execution

- Identify critical project external/third party and inter-contract interfaces
- Develop preliminary interface requirements and designs and document them in interface control documents
- Apportion the applicable interfaces to the specific procurement contract packages
- Support the change process by providing change impact analysis capabilities

Monitoring and Control

- Verify and certify interface agreements between interface partners
- Review the Preliminary Engineering (PE) submittals prepared by the regional teams

3.2.1.2 Inputs

Stage 1 of the CHSTS IM process uses the following inputs to identify critical interfaces, including:

- Proposition 1A
- Technical Specifications for Interoperability (TSI)
- Regulatory system requirements
- Program Environmental Impact Report/Statements
- Basis of design
- Operational and maintenance documents
- Reliability, availability, maintainability targets and requirements
- Safety and security requirements

3.2.1.3 Outputs and Deliverables

Stage 1 of the CHSTS IM process will result in the following outputs and deliverables:

- Interface Management Plan (this document)
- Identified critical interfaces, populated interface register
- Preliminary interface requirements and designs
- Verified and certified interface agreements and interface control documents
- Apportioned interfaces as applicable to the procurement contracts
- Reviewed preliminary engineering
- D/B contractor interface management requirements

3.2.1.4 Tools and Methods

Stage 1 of the IM process uses the tools and methods as shown Table 4. Refer to section 5.0 for more detailed information on tools and methods.

3.2.1.5 Roles and Responsibilities

Stage 1 of the IM process allocates as a minimum the roles and responsibilities as presented in Table 3.

3.3 DESIGN / BUILD CONTRACTS

3.3.1 General

Each of the Design/Build contractors is required to develop and implement a contract specific Interface Management process to confirm to the Authority applying the V&V process that the specified interfaces have been completely and correctly implemented. The contract specific interfaces are included in the corresponding request for proposals (RFP).

The main purpose of the IM process in this stage of the program is the following:

Planning

- Develop a Contractor Interface Management Plan (CIMP)

Execution

- Identify intra-contract interfaces
- Develop final interface requirements and designs
- Implement interfaces
- Integrate interfaces as applicable (intra-contract)
- Assemble Interface Coordination Team (ICT)
- Perform interface workshops

Monitoring and Control

- Verify and validate interface implementations
- Certify interface compliance

3.3.2 Final Design

3.3.2.1 Inputs

Stage 2, step 1 of the IM process (final design) uses several inputs including the following:

- Scope of work
- General and special provisions
- Contractor Interface Management requirements
- Contractor applicable list of interfaces

3.3.2.2 Outputs and Deliverables

Stage 2, step 1 of the IM process will result in the following outputs and deliverables:

- Contractor Interface Management Plan
- Identified intra-contract interfaces
- Final interface requirements and designs
- Verified and certified interface agreements and interface control documents
- V&V deliverable as per contract requirements demonstrating final design is in compliance with critical interfaces as identified and specified in contract requirements

3.3.2.3 Tools and Methods

Stage 2, step 1 of the IM process uses the tools and methods as shown in Table 4. Refer to section 5.0 for more detailed information on tools and methods.

3.3.2.4 Roles and Responsibilities

Stage 2, step 1 of the IM process allocates as a minimum the roles and responsibilities as presented in Table 3.

3.3.3 Construction and Inspections

3.3.3.1 Inputs

Stage 2, step 2 of the IM process (construction and inspections) uses the following documents as source documents, including:

- Inputs into the final design (Contract, section 3.3.2.1)
- Outputs from final design (section 3.3.2.2)
- Ready for construction (RFC) documents

3.3.3.2 Outputs and Deliverables

Stage 2, step 2 of the IM process will result in the following outputs and deliverables:

- Implemented and inspected interfaces
- Updated, verified, and certified interface agreements and interface control documents
- V&V deliverable as per contract requirements demonstrating construction is in compliance with critical interfaces as identified and specified in contract requirements and final design

3.3.3.3 Tools and Methods

Stage 2, step 2 of the IM process uses the tools and methods as shown in Table 4. Refer to section 5.0 for more detailed information on tools and methods.

3.3.3.4 Roles and Responsibilities

Stage 2, step 2 of the IM process allocates as a minimum the roles and responsibilities as presented in Table 3.

3.3.4 Testing and Acceptance

3.3.4.1 General

Testing and acceptance is one of several stages within the design/build stage. The contractor is expected to achieve acceptance by demonstrating compliance through a comprehensive inspection and testing program.

For more information, refer to TM 1600.01 Verification and Validation Management Plan (VVMP).

3.3.4.2 Inputs

Stage 2, step 3 of the CHST IM process (testing and acceptance) uses the following documents as source documents, including:

- Inputs into the final design (Contract, section 3.3.2.1)
- Outputs and deliverables from final design (section 3.3.2.2)
- Outputs and deliverables from construction (section 3.3.3.2)

3.3.4.3 Outputs and Deliverables

Stage 2, step 3 of the IM process will result in the following outputs and deliverables:

- Tested and accepted interfaces
- Updated, verified and certified interface agreements and interface control documents
- V&V deliverable as per contract requirements demonstrating construction is in compliance with critical interfaces as identified and specified in contract requirements and final design
- Construction certificate of conformance in compliance with the Safety and Security Management Plan (SSMP), as applicable to the interfaces

3.3.4.4 Tools, Methods and Responsibilities

Stage 2, step 3 of the IM process uses the tools and methods as shown in Table 4. Refer to section 5.0 for more detailed information on tools and methods.

3.3.4.5 Roles and Responsibilities

Stage 3 of the CHST IM process allocates as a minimum the roles and responsibilities as presented in Table 3.

3.4 FINAL INTEGRATION, TESTING, AND CERTIFICATION

3.4.1 Integrated High-Speed Rail System

3.4.1.1 General

Stage 3 of the IM process includes the final integration, testing, and certification under supervision of the Authority as part of program management. Once all design/build contracts have been successfully completed, the high-speed rail (HSR) system will be integrated, tested, and certified.

For more information, refer to TM 1600.01 Verification and Validation Management Plan (VVMP).

3.4.1.2 Inputs

Stage 3 of the CHST IM process uses the following documents as source documents, including:

- Outputs and deliverables from completed contracts (3.3.4.3)
    - Final interface agreements and interface control documents
    - Interface test and acceptance reports
    - Contractor V&V submittals
    - Construction certificates of conformance
- Outputs and deliverables from Program planning

- List of critical interfaces

3.4.1.3 Deliverables

Stage 3 of the IM process will result in the following outputs and deliverables:

- Final testing and commissioning plan, procedures and test results
- Certification of Compliance with FRA approved SSPP, as applicable to the interfaces

3.4.1.4 Tools and Methods

Stage 3 of the IM process uses the tools and methods as shown in Table 4. Refer to section 5.0 for more detailed information on tools and methods.

3.4.1.5 Roles and Responsibilities

Stage 3 of the IM process allocates as a minimum the roles and responsibilities as presented in Table 3.

4.0 ROLES AND RESPONSIBILITIES

Table 3 provides an overview of CHSTS IM process roles and responsibilities.[1]

Table 3: CHSTS IM Roles and Responsibilities

Roles and Responsibilities	STAGE 1	STAGE 2			STAGE 3
	ER / PE	STEP 1 (Final Design)	STEP 2 (Construction)	STEP 3 (Testing and Acceptance)	Final Integration, Testing & Certification
Regional Teams	• Develop Preliminary Engineering for Procurement in compliance with Technical Memoranda (TM) and Environmental Requirements as applicable to interfaces	• N/A in this stage	• N/A in this stage	• N/A in this stage	• N/A in this stage
Design/Build Contractor	• N/A in this stage	• Prepares Contractor Interface Management Plan • Identifies intra-contract interfaces • Assembles Interface Coordination Team (ICT) • Perform interface workshops • Develops final interface requirements and designs • Verifies and certifies interface agreements and interface control documents • Provides V&V deliverable demonstrating interfaces are in compliance contract requirements	• Implement and inspect interfaces • Update, verify and certify interface agreements and interface control documents • Provides V&V deliverable demonstrating interfaces are in compliance contract requirements	• Test interfaces • Update, verify and certify interface agreements and interface control documents • Provides V&V deliverable demonstrating interfaces are in compliance contract requirements • issues construction certificate of conformance	• N/A in this stage
Independent Checking Engineer	• N/A in this stage	• Check interface submittals in compliance with V&V contract requirements	• N/A in this stage	• N/A in this stage	• N/A in this stage
Independent Site Engineer	• N/A in this stage	• N/A in this stage	• Witnesses interface inspections • Check interface submittals in compliance with V&V contract requirements	• Witnesses interface acceptance tests • Check interface submittals in compliance with V&V contract requirements • Check construction certificate of conformance	• N/A in this stage
Project Management/ Construction Management	• N/A in this stage	• Manages execution of procurement contract • Reviews and audits contractor's interface submittals • Provides SONO recommendation to Authority	• Manages execution of procurement contract • Reviews and audits contractor's interface submittals • Provides SONO recommendation to Authority	• Manages execution of procurement contract • Reviews and audits contractor's interface submittals • Provides SONO recommendation to Authority	• N/A in this stage
Project Management	• Prepare Interface Management Plan	• Reviews contractor's interface	• Reviews contractor's interface	• Reviews contractor's interface	See notes[2]:

[1] Actual Roles and Responsibilities require approval from the Authority and inclusion in the annual work plans (scope of work).

Roles and Responsibilities	STAGE 1	STAGE 2			STAGE 3
	ER / PE	STEP 1 (Final Design)	STEP 2 (Construction)	STEP 3 (Testing and Acceptance)	Final Integration, Testing & Certification
Team / Engineering Management Team	and D/B contractor interface management requirements • Identify critical interfaces and populate interface register • Develop preliminary (PE4P) interface requirements and designs • Verify and certify interface agreements and interface control documents • Apportion interfaces as applicable to the procurement contracts • Reviewed preliminary engineering for procurement	submittals from CHST program and system performance perspective • Provides SONO recommendation to Authority	submittals from CHST program and system performance perspective • Provide SONO recommendation to Authority	submittals from CHST program and system performance perspective • Provides SONO recommendation to Authority	• Provides final testing and commissioning plan, procedures and test results • Performs interface integration testing • Performs interface certification • Issues Certification of Compliance with FRA approved SSPP, as applicable to interfaces
California High-Speed Rail Authority	• Review and approval of CHST Program interface management plan	• Issues SONO, if given	• Issues SONO, if given	• Issue SONO, if given • Provides Certification of Compliance with SSPP to FRA, ass applicable to interfaces	• Provides self-certification of compliance with the requirements of the System Safety Program Plan to FRA, as applicable to interfaces
Federal Railroad Administration	• N/A in this stage	• N/A in this stage	• N/A in this stage	• N/A in this stage	• Reviews final testing and commissioning plan, procedures and test results • Reviews and approves Authority's System Safety Program Plan

[2] The items listed are the interface management activities that need to be performed at this stage on a program level. The Authority may chose to perform the work in-house or assign the work to a designee such as a Systems, Specialty or O&M Contractor. PMT will be able to support the Authority in defining the required scope and verification of interfaces.

5.0 SUPPORTING TOOLS AND METHODS

Table 4 provides an overview of CHSTS IM process tools and methods. Refer to the subsequent sections for more details.

Table 4: IM Tools and Methods

Activity	Tools and Methods	Section
Identify Interfaces	• System Decomposition	5.1
	• Requirements Management Tool	5.3
	• Interface Register	5.4
	• Interface Coordination Teams	5.8
	• Interface Coordination Workshops, Meetings and Reports	0
Specify Interface Requirements	• Interface Requirements Specification	5.5
	• Interface Control Document	5.7
	• Interface Coordination Teams	5.8
	• Interface Coordination Workshops, Meetings and Reports	0
Develop Interface Design	• Interface Design Description	5.6
	• Interface Control Document	5.7
	• Interface Coordination Teams	5.8
	• Interface Coordination Workshops, Meetings and Reports	0
Apportion Interfaces	• Requirements Apportioning/Scope of Work	5.2
Verify and Validate Interfaces	• Verification & Validation	5.12
	• Requirements Verification Traceability Matrix	5.10
	• Certifiable Items list	5.11
Integrate Interfaces	• System Integration	5.13
Certify Interfaces	• Certifiable Items list	5.11
Change Interfaces	• Configuration Management	5.14

5.1 SYSTEM DECOMPOSITION

Interfaces in the context of CHSTS involve typically at least one technical interface partner. To identify meaningful and manageable interfaces, the CHSTS has to be decomposed into smaller, manageable pieces until an interface can be clearly defined.

(System) decomposition is an accepted standard procedure in Project Management (PM) and Systems Engineering (SE) by which a complex project or system is repetitively subdivided into smaller, better manageable parts until an acceptable level of complexity is accomplished.

5.2 REQUIREMENTS APPORTIONING / SCOPE OF WORK

Requirements apportioning refers to the decomposition (section 5.1) and allocation of requirements. Requirements are usually subdivided until they reach a level of detail where they can be unambiguously allocated to one design element.

5.3 REQUIREMENTS MANAGEMENT TOOL

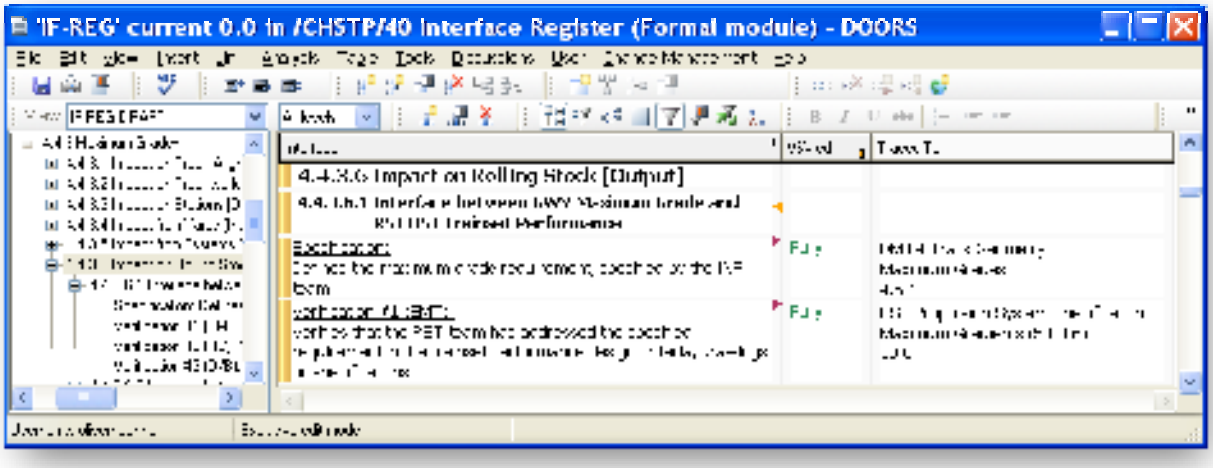
CHSTS uses IBM Rational DOORS (Dynamic Object Oriented Requirements System) as the requirement management tool. DOORS is used for the following IM purposes, including:

- Store and manage CHSTS program interfaces in the Interface-Register
- Maintain traces between:
  - Requirements and interfaces
  - Interface requirements and related interface designs
- Verification and validation of interfaces
- Support the change impact analysis

5.4 INTERFACE REGISTER

The interface register is used to document the identified interfaces as well as all references to the interface requirements specification (section 5.5) and interface design descriptions (section 5.6). The interface register is managed in the requirements management tool (section 5.3).

Figure 8: Interface Register



5.5 INTERFACE REQUIREMENTS SPECIFICATION

Interface Requirements Specifications (IRS) are part of the former military standard MIL-STD-498, which describes a comprehensive system life-cycle approach. MIL-STD-498 has since been replaced with commercial standards.

Interface Requirements Specifications specify the requirements imposed on one or more systems, subsystems, manual operations, or other system components to achieve one or more interfaces among these entities. An IRS can cover any number of interfaces.[3]

The CHSTS follows the general stipulation of documenting interface requirements; however, they are embedded in the general technical criteria. No specific IRSs will be prepared. Interface requirements for a specific interface will be referred from Interface Control Documents (section 5.7).

[3] Source: MIL-STD-498, DID, Interface Requirements Specification.

5.6 INTERFACE DESIGN DESCRIPTION

Interface Design Descriptions (IDD), similar to IRSs, are also part of the former military standard MIL-STD-498.

The Interface Design Description (IDD) describes the interface characteristics of one or more systems, subsystems, manual operations, or other system components. An IDD may describe any number of interfaces.[3]

The CHSTS follows the general stipulation of documenting interface design descriptions; however, they are embedded in the general technical criteria and preliminary design documents. No specific IDDs will be prepared. Interface designs for a specific interface will be referred from Interface Control Documents (section 5.7).

5.7 INTERFACE CONTROL DOCUMENT

An Interface Control Document (ICD) serves as an "Envelope" and comprises the interface specific Certifiable Items Lists (CIL, section 5.11) and the supporting objective evidence available at each stage of CHSTS. As the CHSTS progresses, final design and construction related information will be added to the CIL, and consequently to the ICD.

In order to avoid duplication, the Interface Control Document will not repeat the interface related information in the ICD rather than point/refer to it and use document excerpts to control the specific interface during its life-cycle. There will be one ICD for each identified interface.

As shown in Figure 9, the Interface Control Document is contains the following information:

PMT/EMT: Prepared by PMT during stage 1 of the IM process

- Sign-Off Sheet: Demonstrating agreement between the interfacing partners
- Section References: List of section reference to applicable interface requirements, design descriptions and interface verifications.
- Interface Requirements: Excerpt of the referenced interface requirements, with applicable document sections highlighted.
- Interface Design Description: Excerpt of the referenced interface design descriptions, with applicable document sections highlighted.
- Interface Verification: Excerpt of the referenced preliminary designs, with applicable document sections highlighted.

D/B-C: Prepared by Design/Build Contractor during stage 2 of the IM process

- Final Design: List of section reference to applicable final design submittals, demonstrating compliance to IM stage 1 interface documents.
- Construction/Inspection: List of section reference to applicable construction and inspection submittals, demonstrating compliance to IM stage 1 interface documents final design submittals.
- Testing/Acceptance: List of section reference to applicable testing and acceptance submittals, demonstrating compliance to IM stage 1 interface documents final design submittals.

Authority/PMT: Prepared by Authority and/or PMT during stage 3 of the IM process

- Interface Integration: List of section reference to applicable integration, testing and certification documents, demonstrating successful integration of the interfaces and compliance to IM stage 1 and 2 interface documents.

Figure 9: Interface Control Document

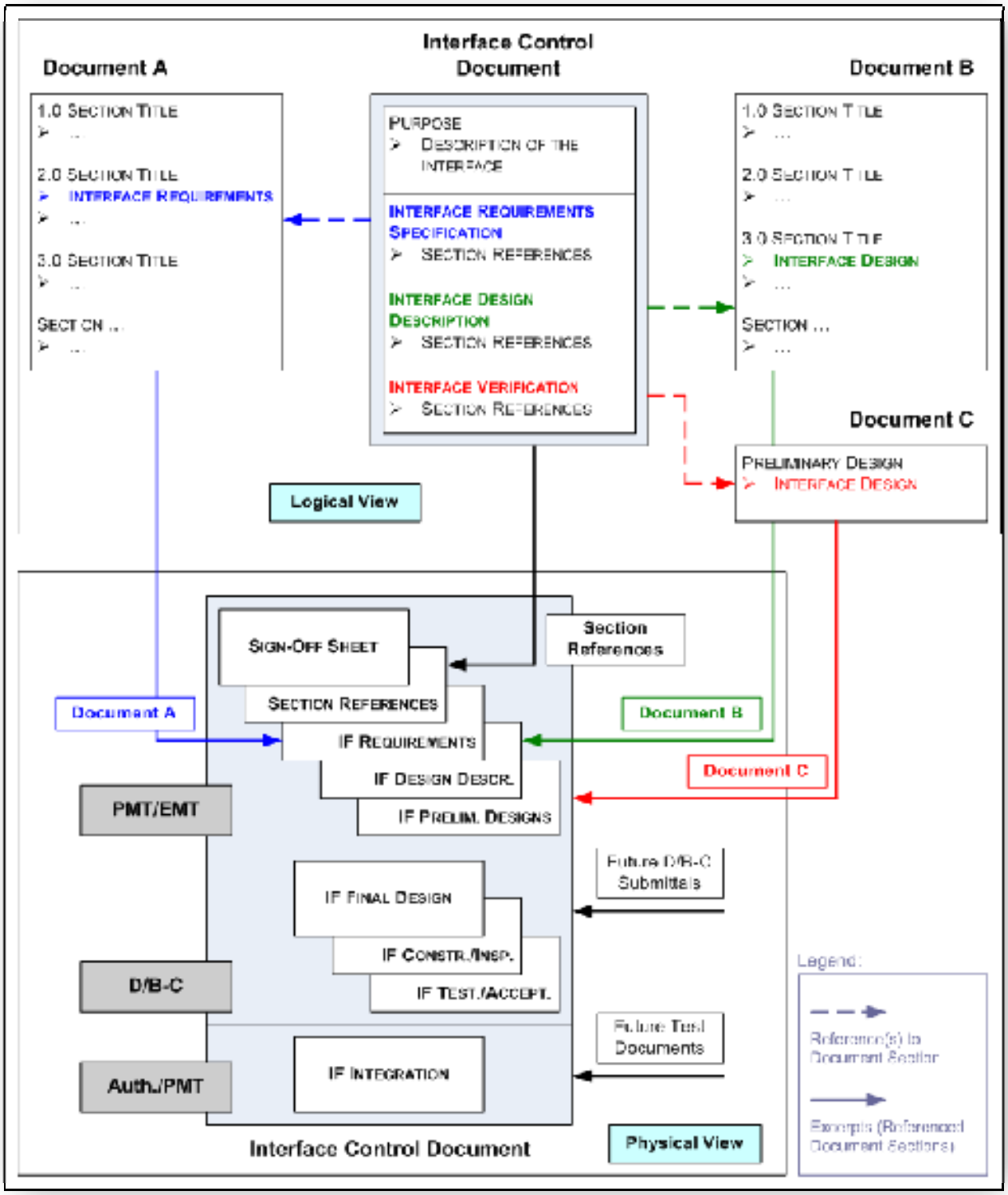
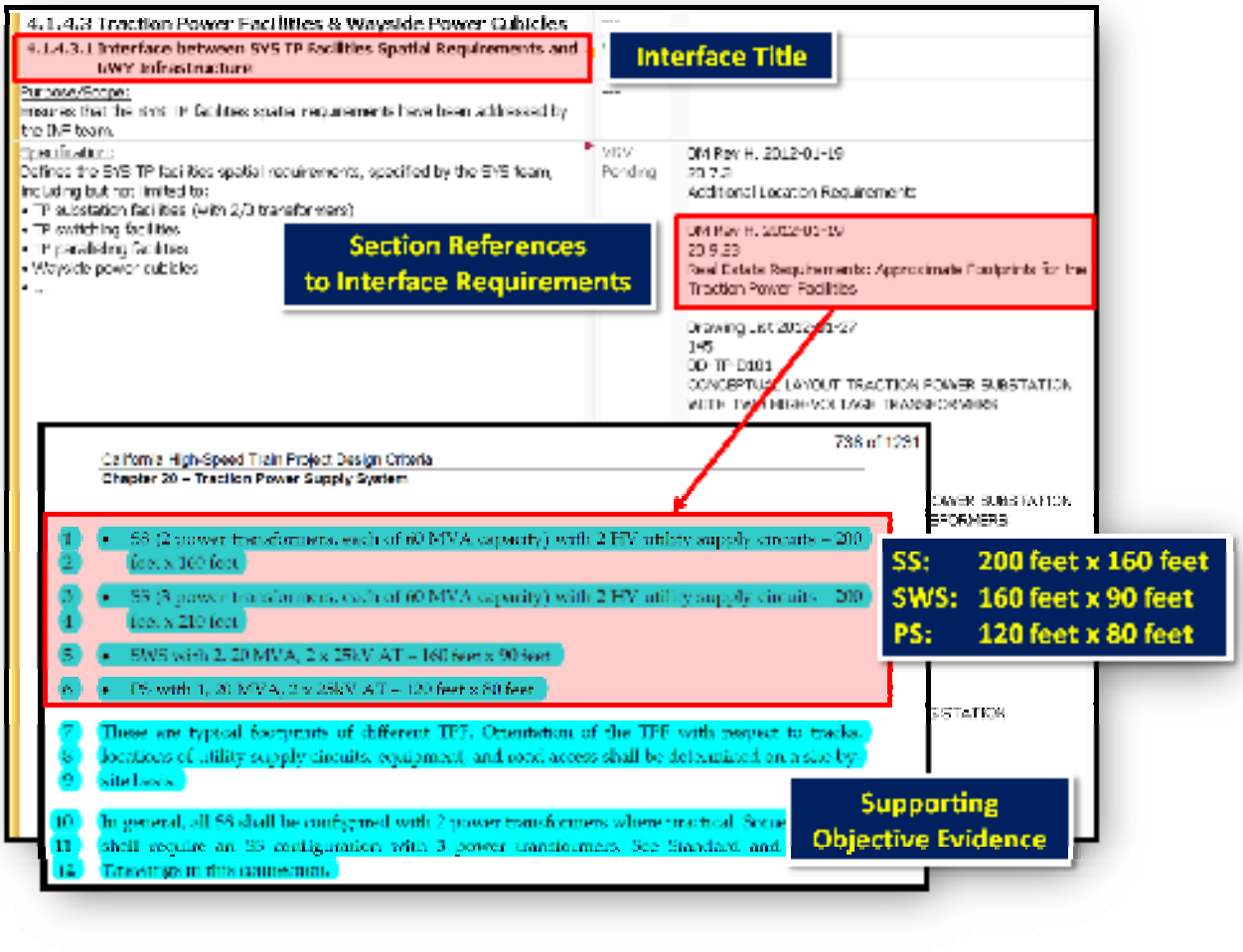


Figure 10 provides an example of section references to supporting objective evidence held in the Interface Register. The (Interface Requirements) Specification provides section references where the actual interface requirements are described, in this case the spatial needs for Traction Power Facilities. The applicable document sections are excerpted and highlighted, and attached to the CIL to form the Interface Control Document.

Figure 10: Section References and Supporting Objective Evidence – Example



5.8 INTERFACE COORDINATION TEAMS

The Design/Build Contractor will establish an Interface Coordination Team (ICT) to employ an interface and integration management approach to the scope of his contract.

The ICT will have identified members from the Contractor's and relevant sub-contractors' staff(s) with specific assigned project responsibility and accountability for interface coordination and control within the overall design and construction activities. The Interface Coordination Team will be staffed by professionals with at least the minimum experience as required by the procurement contracts.

The ICT will meet regularly using Interface Workshops as stipulated in section 0.

5.9 INTERFACE COORDINATION WORKSHOPS, MEETINGS AND REPORTS

The Interface Control Team (section 5.8) will conduct interface coordination workshops with the Authority, adjacent contractors, third parties, and other entities no less than monthly, or at other times as required.

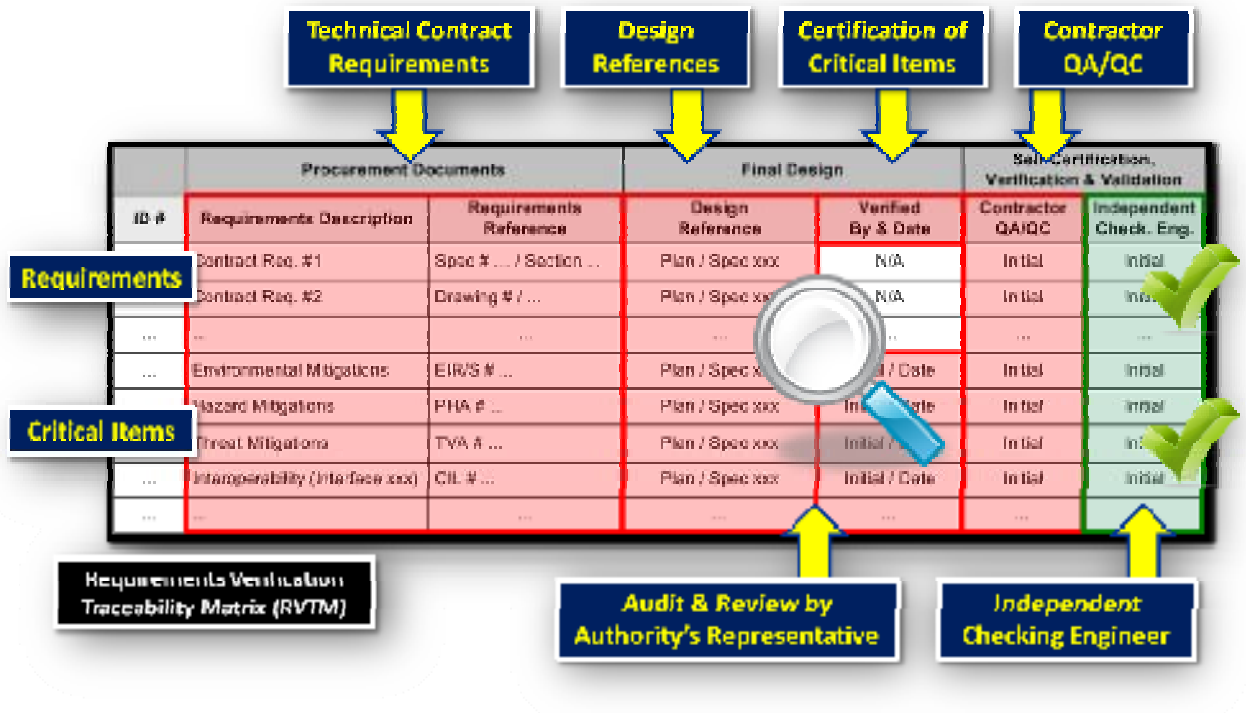
- The interface coordination workshops will be used to discuss the specifics of the interfaces, resolution of conflicts, and to monitor and track the incorporation of the interfaces contained in the Requirements Management Tool (section 5.3).
- The ICT will demonstrate that the CHSTS is being designed and executed such that facilities and subsystems identified in the design criteria and drawings are being accommodated without functional or spatial constraints.
- The workshops shall be used to identify new interfaces which may affect the design or construction, and to reach a common agreement on the management approach to addressing the interface and any possible constraint on this or future contract(s).
- New interfaces will be incorporated into the Interface Registry of the Requirements Management (RM) Tool.

The Design/Build-Contractor will produce and present a matrix or tracking sheet for the workshops which provides updates, activities and responsible parties of interface and integration activities. The D/B-C will also produce output reports from the RM Tool to demonstrate progress on interface and integration activities.

5.10 REQUIREMENTS VERIFICATION TRACEABILITY MATRIX

Requirements verification traceability matrices (RVTM) are used to demonstrate compliance to requirements (including interface requirements) by providing reference to objective evidence demonstrating that the stated requirements have been fulfilled.

Figure 11: Requirements Verification Traceability Matrix



5.11 CERTIFIABLE ITEMS LIST

Certifiable items lists (CILs) are used in addition to RVTMs to certify compliance with critical items by additional sign-off. Interoperability items (interfaces between procurement packages) are considered critical items.

Figure 12: Certifiable Items List – Excerpt from IF No. 0070 (RST/INF)

CHSTP Verification, Validation and Self-Certification
Certifiable Items List (CIL) - Certification Sheet

CIL Item No. IF0070
Certification Signoff Sheet Page 1 of 2

To all signatories: Please review the included information and sign and date in the appropriate spaces. By signing this form, you are certifying that the critical item described has been coordinated between the **Specifier** and all **Verifiers**, and that the documentation references accurately and completely describes the specification and verification of the critical item to your satisfaction.

To Specifier: After reviewing the contents, please sign the front page and initial the individual entries in the attached table. By signing this form, you hereby certify that:

1. the documentation referenced by you accurately specifies the requirements of the critical item, and
2. the documentation referenced by the **Verifier** fully satisfies the requirements of the critical item.

Specifier Signature

Systems: _____ Date: 3/12/12

To Verifiers: After reviewing the contents, please sign the front page and initial the individual entries in the table. By signing this form, you hereby certify that:

1. you understand the documentation referenced by the **Specifier**,
2. the documentation referenced by you accurately and completely verifies that the requirements of the critical item have been addressed, and
3. entries marked "Not applicable" accurately reflect that the requirement for that discipline does not apply.

Verifier Signature

Track: _____ Date: 3/22/2012

Track: _____ Date: 3/26/2012

5.12 VERIFICATION AND VALIDATION

Verification and validation (V&V) are defined as follows:

- Verification: Confirmation by examination and provision of objective evidence that the specified requirements have been fulfilled.
- Validation: Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled

V&V is used to ensure that the interface design and construction is in compliance with the original interface requirements. For more information on V&V, refer to TM 1600.01 Verification and Validation Management Plan.

5.13 SYSTEM INTEGRATION

Systems Integration (SI) is the opposite of System Decomposition (section 5.1) and includes the integration and assembly of components, subsystems, systems and procurement packages. Previously identified and tested interfaces will be integrated and interface testing will be performed. System Integration will be performed within procurement packages for intra-contract interfaces during IM stage 2 and between procurement contracts for inter-contract interfaces during IM stage 3.

5.14 CONFIGURATION MANAGEMENT

CHSTS Configuration Management (CM) is described in the *Program Change Control and Configuration Management Plan and Procedures* and defines CM as: "A project controls process that focuses on establishing and maintaining consistency between program requirements and the program products including its functional attributes. Configuration management defines the process necessary to coordinate, control, track and make changes to the physical characteristics of project facilities and systems."

Configuration Management is used to ensure interface integrity by applying:

- Configuration Identification: Identifying interfaces including their design, construction, and testing/acceptance baselines
- Configuration Control: Identifying potential changes to interface baselines, analyzing the potential impact analysis and approve/reject changes employing Change Control Boards (CCB)
- Configuration Status Accounting: Capability to report on status of each interface, its baseline and all proposed changes
- Configuration Audits: Performing V&V activities ensuring that an interface is in compliance with the interface configuration (requirements)

6.0 INTERFACES

This section provides an overview of the identified interfaces held in the Interface Register (section 5.4) at the time of the release of this Interface Management Plan, showing interfaces for the first procurement contract CP01. This section will be updated whenever IMP updates are released.

Interfaces will be identified as the CHSTS progresses. Currently, most of the interfaces are Infrastructure (INF) related interfaces. Interfaces between procurement contracts other than INF contracts will be added at a later time.

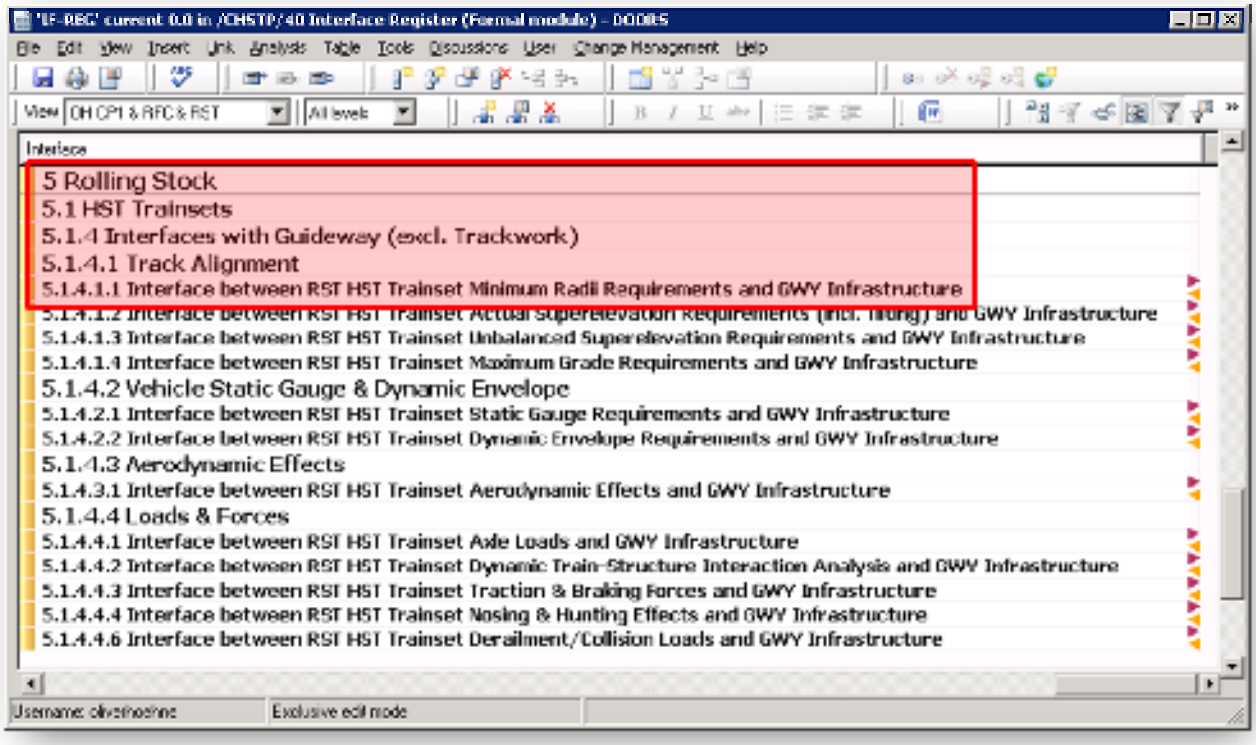
6.1 INTERFACE HIERARCHY

Interfaces have been organized in a hierarchical view for ease of management:

- Level 1: Procurement contract as defined in section 1.2.2
- Level 2: Subsystem as defined in section 1.2.4
- Level 3: Interfacing procurement contract
- Level 4: Interface Category
- Level 5: Interface

Figure 13 shows an example with the levels 1-5 highlighted for actual interfaces.

Figure 13: Interface Hierarchy – Example



6.2 INTERFACE MATRIX

Table 5 provides section references to the specific interfaces, e.g. RST to GWY interfaces can be found in section 6.6.4.

Table 5: Interface Matrix

From IF To	Section	O&M	SYS	RST	GWY	TRK	STA	YRD	EXT
O&M	6.4	6.4.1	6.4.2	6.4.3	6.4.4	6.4.5	6.4.6	6.4.7	6.4.8
SYS	6.5	6.5.1	6.5.2	6.5.3	6.5.4	6.5.5	6.5.6	6.5.7	6.5.8
RST	6.6	6.6.1	6.6.2	6.6.3	6.6.4	6.6.5	6.6.6	6.6.7	6.6.8
GWY	6.7	6.7.1	6.7.2	6.7.3	6.7.4	6.7.5	6.7.6	6.7.7	6.7.8
TRK	6.8	6.8.1	6.8.2	6.8.3	6.8.4	6.8.5	6.8.6	6.8.7	6.8.8
STA	6.9	6.9.1	6.9.2	6.9.3	6.9.4	6.9.5	6.9.6	6.9.7	6.9.8
YRD	6.10	6.10.1	6.10.2	6.10.3	6.10.4	6.10.5	6.10.6	6.10.7	6.10.8
EXT	6.11	6.11.1	6.11.2	6.11.3	6.11.4	6.11.5	6.11.6	6.11.7	6.11.8

6.3 GENERAL INTERFACES

General interfaces include CHSTS-wide interfaces that apply to more than one procurement contract, engineering discipline, or subsystem.

Table 6: CHSTS-Wide Interfaces

General	IF No.
Reliability, Availability, Maintainability and Safety	
Reliability and Availability	
Interfaces with Guideway (excluding Trackwork)	
Interface between GEN Reliability and Availability Targets and GWY Infrastructure	IF 1233

6.3.1 Environmental

Environment interfaces currently address the following topics:

- Seismic events
- Fault zones

For more information on a specific interface, refer to the Interface Register using the Interface Number listed in Table 6.

6.3.2 RAMS

RAMS interfaces currently address the following topics:

- Reliability
- Availability
- Maintainability
- Safety

Reliability and availability are addressed as one; interfaces, maintainability and safety are currently addressed by Operations and Maintenance (O&M) interfaces in section 6.4.

For more information on a specific interface, refer to the Interface Register using the Interface Number listed in Table 6.

6.4 OPERATIONS AND MAINTENANCE (O&M)

O&M will be performed by a future Concessionaire and is often included in Design/Build/Operate/Maintain (DBOM) contracts. Operations and Maintenance (O&M) includes the following subsystems:

- Operations
- Maintenance
- Safety
- Security

Table 7 provides an overview of the O&M interfaces currently identified for procurement contract CP01.

Table 7: Operations and Maintenance Interfaces

Operations and Maintenance	IF No.
Operations	
Train Operating/Service Plan	
Interfaces with Guideway (excluding Trackwork)	
Interface between O&M Operating/Service Plan and GWY Infrastructure	IF 230
Operating and Design Speeds	
Interfaces with Guideway (excluding Trackwork)	
Interface between O&M Maximum Design Speed @ HST Tracks and GWY Infrastructure	IF 355
Interface between O&M Maximum Design Speed @ Special Trackwork and GWY Infrastructure	IF 4355
Physical Requirements	
Interfaces with Guideway (excluding Trackwork)	
Interface between O&M Visibility of Wayside/Trackside Equipment Requirements and GWY Infrastructure	IF 597
Maintenance	
Interfaces with Guideway (excluding Trackwork)	
MOI Roadway Access	
Interface between O&M MOI Infrastructure Access Requirements and GWY Infrastructure	IF 911
MOI Walkway and Stairs	
Interface between O&M MOI Walkway Spatial Requirements and GWY Infrastructure	IF 843
Interface between O&M MOI Access Stairway Spatial Requirements and GWY Infrastructure	IF 912
MOI Live Loads	
Interface between O&M MOI Walkway Floor Live Load Requirements and GWY Infrastructure	IF 3481
Interface between O&M MOI Access Stairway Live Load Requirements and GWY Infrastructure	IF 3839
MOI Equipment	

Operations and Maintenance	IF No.
Interface between O&M MOI Equipment Dynamic Envelope Requirements and GWY Infrastructure	IF 512
Interface between O&M MOI Equipment Axle Loads Requirements and GWY Infrastructure	IF 3691
Interface between O&M MOI Equipment Dynamic Train-Structure Interaction Analysis and GWY Infrastructure	IF 3678
MOI Maintainability and Ease of Maintenance	
Interface between O&M MOI CIV Maintainability and Ease of Maintenance Requirements and GWY Infrastructure	IF 2586
Interface between O&M MOI STR Maintainability and Ease of Maintenance Requirements and GWY Infrastructure	IF 5892
Interface between O&M MOI DRN Maintainability and Ease of Maintenance Requirements and GWY Infrastructure	IF 1203
Safety	
Interfaces with Guideway (excluding Trackwork)	
General	
Interface between O&M SAF Non-Combustible Material Requirements and GWY Infrastructure	IF 5910
Interface between O&M SAF High-Wind Barrier Requirements and GWY Infrastructure	IF 5932
Reliability & Availability	
Interface between O&M SAF Reliability & Availability Requirements and GWY Infrastructure	IF 5918
Clearances	
Interface between O&M SAF Clearance Requirements and GWY Infrastructure	IF 5930
Emergency Egress & Access	
Interface between O&M SAF Emergency Walkway Requirements and GWY Infrastructure	IF 3872
Interface between O&M SAF Emergency Walkway Floor Live Load Requirements and GWY Infrastructure	IF 3470
Interface between O&M SAF Emergency Walkway Fall Protection Requirements and GWY Infrastructure	IF 3927
Interface between O&M SAF Egress/Access Stairway Spatial Requirements and GWY Infrastructure	IF 3932
Interface between O&M SAF Access/Egress Stairway Live Load Requirements and GWY Infrastructure	IF 3799
Interface between O&M SAF Egress & Access Point, Assembly Area & Emergency Facility Requirements and GWY Infrastructure	IF 5902
Interface between O&M SAF Access/Egress Roadway Requirements and GWY Infrastructure	IF 3937
Intrusion Protection	
Interface between O&M SAF Adjacent Railroad Intrusion Protection Requirements and GWY Infrastructure	IF 1069
Interface between O&M SAF Adjacent Roadway Intrusion Protection Requirements and GWY Infrastructure	IF 1070
Interface between O&M SAF Overpass Roadway Intrusion Protection Requirements and GWY Infrastructure	IF 5904
Interface between O&M SAF Overpass Thrown Objects Intrusion Protection Requirements and GWY Infrastructure	IF 5905
Access Control	
Interface between O&M SAF Pedestrian/Wildlife Access Control Requirements and GWY Infrastructure	IF 901
Grade Crossings	

Operations and Maintenance	IF No.
Interface between O&M SAF Grade Crossing Requirements and GWY Infrastructure	IF 5900
Drainage	
Interface between O&M SAF Hydrologic Analysis Requirements and GWY Infrastructure	IF 5909
Interface between O&M SAF Flood Prevention & Protection Requirements and GWY Infrastructure	IF 5908
Interface between O&M SAF Drainage System Requirements and GWY Infrastructure	IF 6165
Interface between O&M SAF Landfill Gas Requirements and GWY Infrastructure	IF 5931
Interface between O&M SAF Hazardous Gas Requirements and GWY Infrastructure	IF 5933
Utilities	
Interface between O&M SAF High-Risk Adjacent/Underground Utility Requirements and GWY Infrastructure	IF 5924
Interface between O&M SAF Low-Risk Adjacent/Underground Utility Requirements and GWY Infrastructure	IF 5925
Interface between O&M SAF Overhead Utility Requirements and GWY Infrastructure	IF 5926
Interface between O&M SAF Seismic Event Requirements and GWY Infrastructure	IF 1201
Interface between O&M SAF Fault Zone Requirements and GWY Infrastructure	IF 263
Loads	
Interface between O&M SAF Load & Pressure Requirements and GWY Infrastructure	IF 5922
Aerodynamic Effects	
Interface between O&M SAF Aerodynamic Effects and GWY Infrastructure	IF 5927
Derailment Containment Structures	
Interface between O&M SAF Derailment Containment Structure Requirements and GWY Infrastructure	IF 3355
Tunnel Ventilation	
Interface between O&M SAF Tunnel Ventilation Requirements and GWY Infrastructure	IF 5915
Power Supply & Lighting	
Interface between O&M SAF Power Supply Requirements and GWY Infrastructure	IF 6231
Interface between O&M SAF Lighting Requirements and GWY Infrastructure	IF 5917
Fire Protection	
Interface between O&M SAF Fire Protection Requirements and GWY Infrastructure	IF 5912
Interfaces with External	
Utilities	
Interface between O&M SAF Utility Access Requirements and GWY Infrastructure	IF 2737
Security	
Interfaces with Operations and Maintenance	
TVA Mitigations	
Interface between O&M SEC Fencing Requirements and GWY Infrastructure	IF 1237
Interface between O&M SEC Signage Requirements and GWY Infrastructure	IF 6265
Interface between O&M SEC Security Patrol Requirements and GWY Infrastructure	IF 6278

6.4.1 O&M Interfaces with Operations and Maintenance

Interface within O&M are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract interfaces are not tracked on the CHST program level.

6.4.2 O&M Interfaces with System Contracts

A detailed list of O&M to SYS interfaces will be added at a later stage.

6.4.3 O&M Interfaces with Rolling Stock Contracts

A detailed list of O&M to RST interfaces will be added at a later stage.

6.4.4 O&M Interfaces with Guideway Contracts

Interface between O&M and GWY for the first procurement contract CP01 have been identified in Table 7. O&M interfaces currently address the following topics, including:

- Operating and service plan requirements
- Operating and design speeds
- Visibility of trackside equipment
- Roadway access
- Walkway and stairway access
- Maintenance of infrastructure equipment
- Maintainability and ease of maintenance
- Emergency egress and access
- Safety and security mitigations

6.4.5 O&M Interfaces with Trackwork Contracts

A detailed list of O&M to TRK interfaces will be added at a later stage.

6.4.6 O&M Interfaces with Station Contracts

A detailed list of O&M to STA interfaces will be added at a later stage.

6.4.7 O&M Interfaces with Yard Contracts

A detailed list of O&M to YRD interfaces will be added at a later stage.

6.4.8 O&M Interfaces with External / Third Parties

A detailed list of O&M to EXT interfaces will be added at a later stage.

6.5 SYSTEMS (SYS)

Systems include the following subsystems:

- Traction Power
- Overhead Contact System
- Automatic Train Control

- Yard Signaling
- Communication Systems
- SCADA Systems
- Grounding and Bonding
- Corrosion Control

Table 8 provides an overview of the SYS interfaces currently identified for procurement contract CP01.

Table 8: System Interfaces

Systems	
Traction Power	
Interfaces with Operations and Maintenance	
Maintenance	
Interface between O&M MOI TP Facility Site Access Requirements and GWY Infrastructure	IF 878
Interfaces with Guideway (excluding Trackwork)	
Track Alignment	
Interface between SYS TP Maximum Grade @ Phase Break Requirements and GWY Infrastructure	IF 80
Traction Power Facilities and Wayside Power Cubicles (Sites)	
Interface between SYS TP Facility and WPC Site Location Requirements and GWY Infrastructure	IF 5597
Interface between SYS TP Facility and WPC Site Spatial Requirements and GWY Infrastructure	IF 4271
Interface between SYS TP Facility and WPC Site Foundation Requirements and GWY Infrastructure	IF 871
Wayside/Field Equipment	
Interface between SYS TP Wayside/Field Equipment Spatial Requirements and GWY Infrastructure	IF 1143
Interface between SYS TP Wayside/Field Equipment Foundation Requirements and GWY Infrastructure	IF 5671
Conduits and Cables	
Interface between SYS TP Conduit, Duct Bank, Cable Trough and Manhole Requirements and GWY Infrastructure	IF 885
Dead and Live Loads	
Interface between SYS TP System Dead Load Requirements and GWY Infrastructure	IF 3019
Utilities	
Interface between SYS TP Utility Spatial Requirements and GWY Infrastructure	IF 2606
Overhead Contact System	
Interfaces with Guideway (excluding Trackwork)	
Pantograph Clearances	
Interface between SYS OCS Pantograph Clearance Envelope Requirements and GWY Infrastructure	IF 656
Wayside/Field Equipment	
Interface between SYS OCS Structure and Wire Spatial Requirements and GWY Infrastructure	IF 3299
Interface between SYS OCS Wayside/Field Equipment Spatial Requirements and GWY Infrastructure	IF 5752

Systems	
Interface between SYS OCS Phase Break Spatial Requirements and GWY Infrastructure	IF 5766
Foundations and Support Structures	
Interface between SYS OCS Foundation and Supporting Structure Location Requirements and GWY Infrastructure	IF 898
Interface between SYS OCS Foundation and Supporting Structure Spatial Requirements and GWY Infrastructure	IF 5780
Conduits and Cables	
Interface between SYS OCS Conduit, Duct Bank and Manhole Requirements and GWY Infrastructure	IF 886
Dead and Live Loads	
Interface between SYS OCS Dead Load, Additional Load and Capacity Protection Requirements and GWY Infrastructure	IF 3018
Protective Screens	
Interface between SYS OCS Protective Screening and Barrier Requirements and GWY Infrastructure	IF 5641
Automatic Train Control	
Interfaces with Operations and Maintenance	
Maintenance	
Interface between O&M MOI ATC Interlocking and TCC House Site Access Requirements and GWY Infrastructure	IF 831
Interfaces with Guideway (excluding Trackwork)	
Interlockings / TCC Houses (Sites)	
Interface between SYS ATC Interlocking and TCC House Site Location Requirements and GWY Infrastructure	IF 5611
Interface between SYS ATC Interlocking and TCC House Site Spatial Requirements and GWY Infrastructure	IF 794
Interface between SYS ATC Interlocking and TCC House Site Foundation Requirements and GWY Infrastructure	IF 1049
Wayside/Field Equipment	
Interface between SYS ATC Wayside/Field Equipment Spatial Requirements and GWY Infrastructure	IF 3304
Interface between SYS ATC Wayside/Field Equipment Foundation Requirements and GWY Infrastructure	IF 5627
Conduits and Cables	
Interface between SYS ATC Conduit, Duct Bank, Cable Trough and Manhole Requirements and GWY Infrastructure	IF 876
Dead and Live Loads	
Interface between SYS ATC System Dead Load Requirements and GWY Infrastructure	IF 3017
Utilities	
Interface between SYS ATC System Utility Spatial Requirements and GWY Infrastructure	IF 2611
Communications	
Interfaces with Operations and Maintenance	
Maintenance	
Interface between O&M MOI COM Equipment Shelter and Radio Tower Site Access Requirements and GWY Infrastructure	IF 5871
Interfaces with Guideway (excluding Trackwork)	
Equipment Shelter (Sites)	
Interface between SYS COM Equipment Shelter and Radio Tower Site Location Requirements and GWY Infrastructure	IF 5653

Systems	
Interface between SYS COM Equipment Shelter and Radio Tower Site Spatial Requirements and GWY Infrastructure	IF 904
Interface between SYS COM Equipment Shelter and Radio Tower Site Foundation Requirements and GWY Infrastructure	IF 1048
Wayside/Field Equipment	
Interface between SYS COM Wayside/Field Equipment Spatial Requirements and GWY Infrastructure	IF 600
Interface between SYS COM Wayside/Field Equipment Foundation Requirements and GWY Infrastructure	IF 5725
Conduits and Cables	
Interface between SYS COM Conduit, Duct Bank, Cable Trough and Manhole Requirements and GWY Infrastructure	IF 877
Air Gaps	
Interface between SYS COM Air Gap Requirements and GWY Infrastructure	IF 657
Dead and Live Loads	
Interface between SYS COM System Dead Load Requirements and GWY Infrastructure	IF 3016
Grounding and Bonding	
Interfaces with Guideway (excluding Trackwork)	
System-wide	
Interface between SYS Conduit, Duct Bank, Cable Trough and Manhole Requirements G&B Requirements and GWY Infrastructure	IF 4252
At-Grade	
Interface between SYS At-Grade G&B Requirements and GWY Infrastructure	IF 1141
Aerial Structures	
Interface between SYS Aerial Structure G&B Requirements and GWY Infrastructure	IF 4071
Interface between SYS New Overpass Structure G&B Requirements and GWY Infrastructure	IF 4112
Trench Structures	
Interface between SYS Trench Structure G&B Requirements and GWY Infrastructure	IF 4122
Interface between SYS Cut and Cover Tunnel Structure G&B Requirements and GWY Infrastructure	IF 5796
Utilities	
Interface between SYS Utility G&B Requirements and GWY Infrastructure	IF 3999
External	
Interface between SYS Existing Overpass Structure G&B Requirements and GWY Infrastructure	IF 4107

6.5.1 SYS Interfaces with Operations and Maintenance

A detailed list of SYS to O&M interfaces will be added at a later stage.

6.5.2 SYS Interfaces with System Contracts

Interface within SYS are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract interfaces are not tracked on the program level.

6.5.3 SYS Interfaces with Rolling Stock Contracts

A detailed list of SYS to RST interfaces will be added at a later stage.

6.5.4 SYS Interfaces with Guideway Contracts

Interfaces between SYS and GWY for the first procurement contract CP01 have been identified in Table 8. SYS interfaces currently address the following topics, including:

- Site location requirements
- Site spatial requirements
- Wayside/field equipment spatial requirements
- Wayside equipment
- Conduits, duct banks, cable trough, manholes
- Air gaps
- Dead loads
- Foundations
- Grounding and bonding

6.5.5 SYS Interfaces with Trackwork Contracts

A detailed list of SYS to TRK interfaces will be added at a later stage.

6.5.6 SYS Interfaces with Stations Contracts

A detailed list of SYS to STA interfaces will be added at a later stage.

6.5.7 SYS Interfaces with Yards Contracts

A detailed list of SYS to YRD interfaces will be added at a later stage.

6.5.8 SYS Interfaces with External / Third Parties

A detailed list of SYS to EXT interfaces will be added at a later stage.

6.6 ROLLING STOCK (RST)

Rolling Stock includes high-speed trainsets as subsystems

Table 9 provides an overview of the RST interfaces currently identified for procurement contract CP01.

Table 9: Rolling Stock Interfaces

Rolling Stock	
HST Trainsets	
Interfaces with Guideway (excluding Trackwork)	
Track Alignment	
Interface between RST HST Trainset Minimum Radii Requirements and GWY Infrastructure	IF 392
Interface between RST HST Trainset Actual Superelevation Requirements (including Tilting) and GWY Infrastructure	IF 489
Interface between RST HST Trainset Unbalanced Superelevation Requirements and GWY Infrastructure	IF 395
Interface between RST HST Trainset Maximum Grade Requirements and GWY Infrastructure	IF 70

Vehicle Static Gauge and Dynamic Envelope	
Interface between RST HST Trainset Static Gauge Requirements and GWY Infrastructure	IF 490
Interface between RST HST Trainset Dynamic Envelope Requirements and GWY Infrastructure	IF 481
Aerodynamic Effects	
Interface between RST HST Trainset Aerodynamic Effects and GWY Infrastructure	IF 604
Loads and Forces	
Interface between RST HST Trainset Axle Loads and GWY Infrastructure	IF 1073
Interface between RST HST Trainset Dynamic Train-Structure Interaction Analysis and GWY Infrastructure	IF 3457
Interface between RST HST Trainset Traction and Braking Forces and GWY Infrastructure	IF 3180
Interface between RST HST Trainset Nosing and Hunting Effects and GWY Infrastructure	IF 3185
Interface between RST HST Trainset Derailment/Collision Loads and GWY Infrastructure	IF 3227

6.6.1 RST Interfaces with Operations and Maintenance

A detailed list of RST to O&M interfaces will be added at a later stage.

6.6.2 RST Interfaces with System Contracts

A detailed list of RST to SYS interfaces will be added at a later stage.

6.6.3 RST Interfaces with Rolling Stock Contracts

Interfaces within RST are considered intra-contract interfaces. Except for critical interfaces required to achieve the CHSTS performance requirements, intra-contract interfaces are not tracked on the program level.

6.6.4 RST Interfaces with Guideway Contracts

Interface between RST and GWY for the first procurement contract CP01 have been identified in Table 9. RST interfaces currently address the following topics, including:

- Track alignment considerations
- Vehicle static and dynamic envelopes
- Aerodynamic effects
- Loads and forces

6.6.5 RST Interfaces with Trackwork Contracts

A detailed list of RST to TRK interfaces will be added at a later stage.

6.6.6 RST Interfaces with Stations Contracts

A detailed list of RST to STA interfaces will be added at a later stage.

6.6.7 RST Interfaces with Yard Contracts

A detailed list of RST to YRD interfaces will be added at a later stage.

6.6.8 RST Interfaces with External / Third Parties

A detailed list of RST to EXT interfaces will be added at a later stage.

6.7 GUIDEWAY (EXCLUDING TRACKWORK)

Guideway (GWY) includes the following subsystems:

- Design Survey and Mapping
- Trackway Clearances
- Track Geometry / Alignment
- Intrusion Protection
- Civil
- Drainage
- Utilities
- Geotechnical
- Seismic
- Structures
- Tunnels
- Stations
- Supporting Facilities

Table 10 provides an overview of the GWY interfaces currently identified for procurement contract CP01. Please note that the majority of the GWY interfaces have been "imposed" by O&M, SYS, and RST and are therefore listed in sections 6.4, 6.5, and 6.6.

Table 10: Guideway Interfaces

Guideway (excluding Trackwork)	
Drainage	
Interfaces with Operations and Maintenance	
Maintenance	
Interface between O&M MOI Pump Station Site Access Requirements and GWY Infrastructure	IF 1260

6.7.1 GWY Interfaces with Operations and Maintenance

The majority of the O&M related GWY interfaces have been "imposed" by O&M and are therefore listed as O&M to GWY interfaces in section 6.4.

6.7.2 GWY Interfaces with System Contracts

The majority of the SYS related GWY interfaces have been "imposed" by SYS and are therefore listed as SYS to GWY interfaces in section 6.5.

6.7.3 GWY Interfaces with Rolling Stock Contracts

The majority of the RST related GWY interfaces have been "imposed" by RST and are therefore listed as RST to GWY interfaces in section 6.6.

6.7.4 GWY Interfaces with Guideway Contracts

Interface within GWY are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract interfaces are not tracked on the program level.

6.7.5 GWY Interfaces with Trackwork Contracts

A detailed list of GWY to TRK interfaces will be added at a later stage.

6.7.6 GWY Interfaces with Stations Contracts

A detailed list of GWY to STA interfaces will be added at a later stage.

6.7.7 GWY Interfaces with Yard Contracts

A detailed list of GWY to YRD interfaces will be added at a later stage.

6.7.8 GWY Interfaces with External / Third Parties

A detailed list of GWY to EXT interfaces will be added at a later stage.

6.8 TRACKWORK (TRK)

6.8.1 TRK Interfaces with Operations and Maintenance

A detailed list of TRK to O&M interfaces will be added at a later stage.

6.8.2 TRK Interfaces with System Contracts

A detailed list of TRK to SYS interfaces will be added at a later stage.

6.8.3 TRK Interfaces with Rolling Stock Contracts

A detailed list of TRK to RST interfaces will be added at a later stage.

6.8.4 TRK Interfaces with Guideway Contracts

A detailed list of TRK to GWY interfaces will be added at a later stage.

6.8.5 TRK Interfaces with Trackwork Contracts

Interface within TRK are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract interfaces are not tracked on the program level.

6.8.6 TRK Interfaces with Stations Contracts

A detailed list of TRK to STA interfaces will be added at a later stage.

6.8.7 TRK Interfaces with Yard Contracts

A detailed list of TRK to YRD interfaces will be added at a later stage.

6.8.8 TRK Interfaces with External / Third Parties

A detailed list of TRK to EXT interfaces will be added at a later stage.

6.9 STATIONS (STA)

6.9.1 STA Interfaces with Operations and Maintenance

A detailed list of STA to O&M interfaces will be added at a later stage.

6.9.2 STA Interfaces with System Contracts

A detailed list of STA to SYS interfaces will be added at a later stage.

6.9.3 STA Interfaces with Rolling Stock Contracts

A detailed list of STA to RST interfaces will be added at a later stage.

6.9.4 STA Interfaces with Guideway Contracts

A detailed list of STA to GWY interfaces will be added at a later stage.

6.9.5 STA Interfaces with Trackwork Contracts

A detailed list of STA to TRK interfaces will be added at a later stage.

6.9.6 STA Interfaces with Stations Contracts

Interface between STA and STA are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract are not tracked on the program level.

6.9.7 STA Interfaces with Yard Contracts

A detailed list of STA to YRD interface will be added at a later stage.

6.9.8 STA Interfaces with External / Third Parties

A detailed list of STA to EXT interface will be added at a later stage.

6.10 YARDS (YRD)

6.10.1 YRD Interfaces with Operations and Maintenance

A detailed list of YRD to O&M interface will be added at a later stage.

6.10.2 YRD Interfaces with System Contracts

A detailed list of YRD to SYS interface will be added at a later stage.

6.10.3 YRD Interfaces with Rolling Stock Contracts

A detailed list of YRD to RST interface will be added at a later stage.

6.10.4 YRD Interfaces with Guideway Contracts

A detailed list of YRD to GWY interface will be added at a later stage.

6.10.5 YRD Interfaces with Trackwork Contracts

A detailed list of YRD to TRK interface will be added at a later stage.

6.10.6 YRD Interfaces with Stations Contracts

A detailed list of YRD to STS interface will be added at a later stage.

6.10.7 YRD Interfaces with Yard Contracts

Interface between YRD and YRD are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract are not tracked on the program level.

6.10.8 YRD Interfaces with External / Third Parties

A detailed list of YRD to EXT interface will be added at a later stage.

6.11 EXTERNAL / THIRD PARTIES (EXT)

External / third party interfaces refer to external factors influencing CHSTS beyond the control of the project. Table 11 provides an overview of the EXT interfaces currently identified for procurement contract CP01.

Table 11: External / Third Party Interfaces

External	
Amtrak	
Interfaces with Guideway (excluding Trackwork)	
Vehicle Static Gauge and Dynamic Envelope	
Interface between EXT Amtrak Trainset Dynamic Envelope Requirements and GWY Infrastructure	IF 3764
Loads and Forces	
Interface between EXT Amtrak Trainset Axle Loads and GWY Infrastructure	IF 3706
Interface between EXT Amtrak Trainset Dynamic Train-Structure Interaction Analysis and GWY Infrastructure	IF 3683
Interface between EXT Amtrak Trainset Derailment/Collision Loads and GWY Infrastructure	IF 3537
Construction Equipment	
Interfaces with Guideway (excluding Trackwork)	
Loads and Forces	
Interface between EXT Construction Equipment Axle Loads and GWY Infrastructure	IF 3701
Interface between EXT Construction Equipment Dynamic Train-Structure Interaction Analysis and GWY Infrastructure	IF 3673

6.11.1 EXT Interfaces with Operations and Maintenance

A detailed list of EXT to O&M interfaces will be added at a later stage.

6.11.2 EXT Interfaces with System Contracts

A detailed list of EXT to SYS interfaces will be added at a later stage.

6.11.3 EXT Interfaces with Rolling Stock Contracts

A detailed list of EXT to RST interfaces will be added at a later stage.

6.11.4 EXT Interfaces with Guideway Contracts

Interface between EXT and GWY for the first procurement contract CP01 have been identified in Table 11. EXT interfaces currently address the following topics, including:

- Shared rail corridor

- Shared use track
- Amtrak
- High/roadways
- Pedestrian/wildlife
- Construction equipment

6.11.5 EXT Interfaces with Trackwork Contracts

A detailed list of EXT to TRK interfaces will be added at a later stage.

6.11.6 EXT Interfaces with Stations Contracts

A detailed list of EXT to STA interfaces will be added at a later stage.

6.11.7 EXT Interfaces with Yard Contracts

A detailed list of EXT to YRD interfaces will be added at a later stage.

6.11.8 EXT Interfaces with External / Third Parties

Interface within EXT and EXT are considered intra-contract interfaces. Except for critical interfaces, required to achieve the CHSTS performance requirements, intra-contract interfaces are not tracked on the program level.

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June 12, 2013

PMT-CHSRA-03424

Frank Vacca
Chief Program Manager
California High-Speed Rail Authority
770 L Street, Suite 800
Sacramento, CA 95814

RE: Request for Authority review and concurrence of
TM 1600.02 Interface Management Plan, R0

Mr. Vacca,

The objective of TM 1600.02 Interface Management Plan, R0 is to ensure that all elements of the California High-Speed Train System (CHSTS) procured long-term in many different contracts can be integrated together effectively and provide a system that meets or exceeds the requirements set out in the Proposition 1A, the Business Plan, Basis of Design and other related requirements documents.

The IMP identifies the critical interfaces that are to be managed and tracked from the program perspective, typically referring to interfaces between different procurement contracts affecting the overall project performance.

The IMP will provide an initial set of interface for the first procurement contract CP01. Interface are stored and managed in the requirements management tool. The detailed interface descriptions, including interface requirements and preliminary interface design is contained in separate Interface Control Documents (ICD).

The IMP is a living document and will be updated as required to reflect the identified interfaces. The IMP serves as the Interface Control Manual (ICM).

It is understood that this is a living document and will be updated as required. If this meets with your requirements, please sign below acknowledging your concurrence for adoption and use on the program.

Regards,

Brent Felker, P.E.
Program Director

California High-Speed Rail Authority
Concurrence

Frank Vacca, Chief Program Manager

Date: 6-19-2013

Enclosure: TM 1600.02 Interface Management Plan, R0