California High-Speed Train Project

TECHNICAL MEMORANDUM

International Rail Standards Comparison

TM 7.3

Prepared by:	*Signed document on file*	27 Apr 09
	Matthew Petty	Date
Checked by:	*Signed document on file*	27 Apr 09
	Vladimir Kanevskiy	Date
Approved by:	*Signed document on file*	27 Apr 09
	Ken Jong, PE, Engineering Manager	Date
Released by:	*Signed document on file*	11 May 09
	Anthony Daniels, Program Director	Date

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Prepared by PB 100 YEARS

for the California High-Speed Rail Authority

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ABSTRACT

The intent of this Technical Memorandum is to review and compare the various international rail standards, and to provide a brief overview of them as a reference for the California High-Speed Train Project (CHSTP).

The CHSTP is proposed as a high-speed steel wheel on steel rail train operation that provides service throughout the state of California at speeds up to and exceeding 220 mph. While it is planned that CHSTP's trains will run on dedicated rail, with no public grade crossings, there are several locations where the proposed California High-Speed Rail (CHSR) line will operate adjacent to or within a shared right-of-way with conventional passenger railroad lines and freight railroad lines.

In accordance with 49 U.S.C 20102, the federal railroad statutes apply to all railroads, including the proposed CHSTP, and therefore, the CHSTP is subject to Federal Railroad Administration (FRA) jurisdiction, especially considering proposed connections to the general railroad system.

In addition, new federal regulations must be put in to place where federal railroad statures are not applicable or do not address high-speed rail safety standards required for high-speed rail operations at 200+ mph.

CHSTP will seek a system wide approach for regulating CHSTP operations by FRA through development of the project specific standards and rules following FRA's Rule of Particular Applicability (RPA) process. This will establish a regulation applicable to the CHSTP system as a whole rather than regulating its discrete components or subsystems set forth by the rules under current Code of Federal Regulations (CFR) 49.

In the State of California the California Public Utilities Commission (CPUC) has regulatory and safety oversight of railroad crossings to ensure compliance with railroad safety regulations. The current General Order 95 does not include provision for an electrified railroad operating at voltages in excess of 5kV. The CHSTP will therefore make an application to the CPUC for variances from the existing rules for the particular case of the CHSTP 25kV ac system.

1.0 INTRODUCTION

The CHSTP is proposed as a high-speed steel wheel on steel rail train operation that provides service throughout the state of California at speeds up to and exceeding 220 mph. While it is planned that CHSTP's trains will run on dedicated rail, with no public grade crossings, there are several locations where the proposed California High-Speed Rail (CHSR) line will operate adjacent to or within a shared right-of-way with conventional passenger railroad lines and freight railroad lines.

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In the State of California the California Public Utilities Commission (CPUC) has regulatory and safety oversight of railroads and grade crossings to ensure compliance with federal railroad safety regulations. The current General Order 95 does not include provision for an electrified railroad operating at voltages in excess of 5kV. The CHSTP will therefore make an application to the CPUC for such exemptions from or modifications of the existing rules for the particular case of the CHSTP 25kV ac system.

1.1 PURPOSE OF TECHNICAL MEMORANDUM

One purpose of this technical memorandum is to provide an overview of the various international standards bodies, their interrelationships and how they address high-speed rail. Another purpose is to identify if other standards can be used in developing the CHSTP system requirements and regulatory requirements. A recommendation is made to incorporate the Technical Specifications for Interoperability into CFR 49 where possible.

2.0 SUMMARY COMPARISON OF STANDARDS BODIES

2.1 UNITED STATES

2.1.1 Code of Federal Regulations (CFR)

- Mandatory.
- Freely available on World Wide Web.
- Describes what to do, but not how to do it.
- Supports speeds up to 150mph, or up to 200mph with a Rule of Particular Applicability.

2.1.2 California Public Utilities Commission (CPUC)

- Mandatory.
- Freely available on World Wide Web.

2.1.3 American Railway Engineering And Maintenance-Of-Way Association (AREMA)

- Not mandatory.
- Best practice recommendations.
- Available for a fee.

2.1.4 Association Of American Railroads (AAR)

- Not mandatory.
- Best practice recommendations.
- Available for a fee.

2.2 EUROPE

2.2.1 Technical Specifications for Interoperability (TSI)

- Obligatory EU Directive, applicable to conventional and high-speed rail systems.
- Applicable to systems requiring interoperability, such as those crossing European Union (EU) internal borders.
- Does not apply to self-contained, “closed” systems not requiring interoperability.
- Directive describes what to do, but not how to do it.
- Directive supported by decisions containing detailed technical requirements for each railway sub-system discipline.
- Combines two previous sets of standards, one for high-speed rail, one for conventional rail.
- Supports speeds up to 350km/h (217mph).
- Freely available from EU website.
- Offers a global approach to the system, linking all the aspects to achieve interoperability.

2.2.2 European Standards (EN for European Norms)

- Consist of standards from CEN, CENELEC and ETSI.
- CEN (European Committee for Standardization) contains railway engineering standards.
- CENELEC (European Committee for Electrotechnical Standardization) contains electrical engineering standards.

- ETSI (European Telecommunications Standard Institute) contains telecommunications engineering standards.
- Obligatory standards adopted by EU member states.
- Many standards applicable to many specific situations.
- Often created in conjunction with International Standardization Organization (ISO), thus it is often the international standard.
- Available for a fee from national members, e.g. British Standards Institute.

2.2.3 International Union of Railways / Union Internationale des Chemins de fer (UIC)

- Applicable to all heavy rail systems, conventional and high-speed.
- Each UIC leaflet is either obligatory or recommended to UIC members.
- Not laws, because they are not decreed by national legislative bodies.
- Can act as a reference for creating design standards and criteria.
- Applicable to any rail system.
- Contain measures that are often incorporated in obligatory standards.
- Contain measures supporting cross-border interfaces.
- Available for a fee from UIC website.
- Offers focused and detailed technical guidance for all engineering disciplines.

2.3 JAPAN

2.3.1 Ministry of Land, Infrastructure and Transport (MLIT) Ordinance

- 'Ordinance' is mandatory performance-based standard.
- 'Interpretive Criteria' is guidance based on Ordinance.
- Interpretive Criteria adapted by Shinkansen lines into Implementation Standards.
- Mandatory within Japan.

2.3.2 Japanese Railway Construction, Transport and Technology Agency (JRTT)

- Independent Administrative Agency
- Promotes the development of rail and marine transport networks.
- Promotes new transportation technologies.
- Domestic scope.

2.3.3 Japan Railway Technical Service (JARTS)

- Publishes journal of railway guidance.
- Consults with international rail community.

3.0 DESCRIPTION OF STANDARDS AND STANDARDS BODIES

3.1 UNITED STATES

3.1.1 Code of Federal Regulations (CFR)

The Code of Federal Regulations (CFR) is the codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government. It is divided into 50 titles that represent broad areas subject to Federal regulation. Each volume of the CFR is updated once each calendar year and is issued on a quarterly basis. Title 49, updated each October 1, deals with Transportation, within which 43 specific parts (numbered in the range 200-299, updated annually in October) that regulate safety, operations and maintenance of railroads in the U.S.

49 CFR describes classes of tracks which will support speeds up to 200mph, but speeds over 150mph are only supported with a Rule of Particular Applicability.

49 CFR incorporates by reference excerpts from published national standards such as ANSI, APTA, ASTM, AREMA, AAR and others. Specific standards incorporated by reference in to CFR 49 will be viewed as if it were included in full. A summary of material approved for incorporation by reference is in Section 3.1.1.1.

3.1.1.1 Material Approved for Incorporation by Reference

The following publications are approved for incorporation by reference in 49 CFR. The 49 CFR section reference is in parentheses. Not all of these are relevant to CHSTP.

- AREMA Communications and Signal Manual, Volume 4, Section 17: “Quality Principles”:2005 {236.909}
- AAR Standard S-486-01. Section 3.0: “Tests-Standard Freight Brake Equipment”, January 1, 2001. {232.305}
- AAR Standard S-486-01, Section 4.0: “Special Tests”, January 1, 2001 {232.305}
- AAR Standard S-469-47, “Performance Specification for Freight Brakes”. April 1, 1999. {232.103}
- AAR Standard S-580: “Locomotive Crashworthiness Requirements,” revised July 2005. {229.205; 229.206}
- AAR Standard S-5506: “Performance Requirements for Diesel Electric Locomotive Fuel Tanks.” revised 2001. {229.217}
- AAR Code of Rules for Cars in Interchange, 1979 {232.17(b)}
- AAR Code of Tests. Instruction Pamphlet No. 5039-4, Sup. 1, Single Car Testing Device, 1974. {232.17(a)}
- AAR Railway Signaling Principles and Practices. Ch. 2: Symbols, Aspects and Indications, 1956. {235.12(b)}

3.1.2 California Public Utilities Commission (CPUC) General Order 95

The California Public Utilities Commission (CPUC) is part of the state government and regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies.

The rules and regulations of CPUC General Order 95 embody the results of extensive investigations and mature study. Its predecessor, General Order 64 was first issued by the Railroad Commission in 1922. It is divided into 11 sections. Section VII deals with the Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors.

The General Order will require an application to the CPUC for exemptions or modifications to make provision for a 25kV ac electrified system. This application will be made as part of the

Caltrain electrification project, but will impact the CHSTP. The CHSTP will use the proposed language as described in the petition as the project standard for electrification.

3.1.3 Association of American Railroads (AAR)

The AAR (Association of American Railroads) is a Washington DC based association of railroad operators and manufacturers. AAR members include the major freight railroads in the United States, Canada and Mexico, as well as Amtrak, accounting for nearly 100% of both freight and commuter rail operators.

The Safety and Operations Department of the AAR oversees the industry's interchange rules and technical standards for many aspects of freight and passenger rail, and exercises authority for design in many areas. In addition, this department represents industry interests to the US Government.

The AAR sell a range of publications including a series of best practice recommendations for rail safety and operations covering rolling stock, freight loading, control systems and other areas.

3.1.4 American Railway Engineering and Maintenance-of-Way Association (AREMA)

The American Railway Engineering and Maintenance-of-Way Association (AREMA) was formed on October 1, 1997, as the result of a merger of three engineering support associations, namely the American Railway Bridge and Building Association, the American Railway Engineering Association and the Roadmasters and Maintenance of Way Association, along with functions of the Communications and Signal Division of the Association of American Railroads.

The mission of AREMA is the development and advancement of both technical and practical knowledge and recommended practices pertaining to the design, construction and maintenance of railway infrastructure.

AREMA publish the following manuals, which are recognized as best practice recommendations in the industry.

The **Manual for Railway Engineering** (MRE), published each April, consists of over 4000 pages of railway engineering reference material representing the recommended practices for the industry. It contains principles, data, specifications, plans and economics pertaining to the engineering, design and construction of the fixed plant of railways (except signals and communications), and allied services and facilities. The aim is to engineer and construct railway plant with inherent qualities of safe and economical operation as well as low maintenance cost.

The **Portfolio of Track Work Plans** consists of plans and specifications that relate to the design, details, materials and workmanship for switches, frogs, turnouts and crossovers, crossings, rails and other special track work. This is a companion volume to the Manual for Railway Engineering.

The **Communications and Signals Manual** is a manual of recommended practice written by AREMA technical committees in the interest of establishing uniformity, promoting safety, efficiency and economy.

3.2 EUROPE

3.2.1 Technical Specifications for Interoperability (TSI)

The Technical Specifications for Interoperability (TSI) refer to a series of European Commission directives and decisions regarding harmonization of railway standards within the European Union.

A **directive** is a legislative act of the EU which requires member states to achieve a particular result without dictating the means of achieving that result. It can be distinguished from EU regulations which are self-executing and do not require any implementing measures. Directives normally leave member states with a certain amount of flexibility as to the exact rules to be adopted.

A **decision** is one of the three binding instruments provided by secondary EU legislation. A decision is a law which is not of general application, but only applies to its particular addressee of the decision (be it Member States, companies or individuals).

The Technical Specifications for Interoperability (TSI) were published through Commission Decisions in accordance with Council Directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system. There is a companion, Council Directive 2001/16/EC of 19 March 2001 on the interoperability of the trans-European conventional rail system.

The Council Directive 96/48/EC defines interoperability as the ability of the high-speed rail system to allow the safe and uninterrupted movement of high-speed trains which accomplish the specified levels of performance. This ability rests on all the regulatory, technical and operational conditions which must be met in order to satisfy essential requirements.

There are a number of Technical Specifications for Interoperability published through Commission Decisions resulting from Directive 96/48/EC of 23 July 1996, which describe in detail the various specific ways of implementing the directive to ensure interoperability. They apply to the following railway sub-system disciplines:

- 2002/730/EC – Maintenance
- 2002/731/EC – Command, Control and Signaling
- 2002/732/EC – Infrastructure
- 2002/733/EC – Energy
- 2002/734/EC – Operation
- 2002/735/EC – Rolling Stock

Directive 2004/50/EC of 29 April 2004 substantially amended 96/48/EC and 2001/16/EC.

Directive 2008/57/EC of 17 June 2008 recasts all of the above, including the 2004 amendments into a new directive applicable to both conventional and high-speed trains. As a result, to implement the new directive for the different sub-systems, the following decisions have been published:

- 2008/386/EC and 2006/860/EC – Command, Control and Signaling
- 2008/217/EC and 2008/218/EC – Infrastructure
- 2008/284/EC – Energy
- 2008/231/EC – Operation (incorporating the Maintenance decision)
- 2008/232/EC – Rolling Stock
- 2008/163/EC – Safety in Railway Tunnels
- 2008/164/EC – Persons of Reduced Mobility

The Technical Specifications for Interoperability specify, for each sub-system, the essential requirements which are defined with particular attention to RAMS (Reliability, Availability, Maintenance and Safety), health and environmental protection, and technical compatibility. They also establish basic parameters and determine the interoperability constituents and interfaces which must be covered by specification and standards.

Implementation of TSI specifications, or incorporation of these standards into the CHSTP design, would provide many benefits including flexibility of procurement of rolling stock.

The TSIs and all other European Legislation can be freely obtained from the EUR-Lex website at *http://eur-lex.europa.eu*.

The TSIs are published and maintained by the European Railway Agency (ERA), established by EC Regulation 2004/881/EC, which specifies its work. The ERA's role also includes reviewing and monitoring EU Member States' implementation of and progress with achieving interoperability, and advising the Commission accordingly.

3.2.2 European Committee for Standardization (CEN)

European Standards (EN meaning European Norms) are documents that have been ratified by one of the three (3) European Standards Organizations, CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization) or ETSI (European Telecommunications Standard Institute) intended to be used throughout Europe and beyond. They are obligatory standards which must be followed in their specific context.

The CEN (Comité Européen de Normalisation or European Committee for Standardization) is the European Standards body, made up of the standards bodies from the EU member countries.

All European Standards (EN) and drafts (prEN), as well as any other approved document (Technical Specifications (CEN TS), Technical Reports (CEN TR) and CEN Workshop Agreements (CWA)), can be obtained for a fee from any of the CEN National Members in the official English, French or German version. CEN itself does not sell these publications.

CEN works in close technical cooperation with the International Standardization Organization (ISO). For example, CEN and ISO cooperate to mutually adopt existing standards of the other organization and to produce common new standards or publications.

Error! Reference source not found. is an overview of how some TSIs refer to EN standards. Many EN standards then refer to other EN standards themselves. The TSIs also refer to various other sets of standards, such as the UNISIG ERTMS standards.

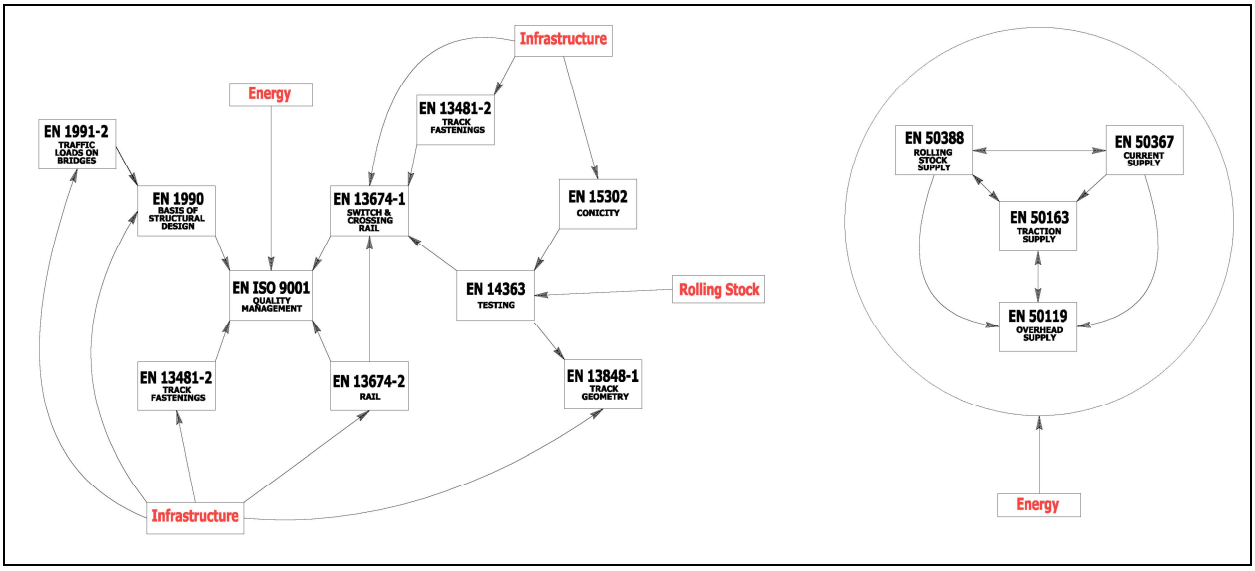

Figure 1. TSI references to EN standards

3.2.3 European Committee for Electrotechnical Standardization (CENELEC)

CENELEC is the European Committee for Electrotechnical Standardization responsible for electrical engineering and control systems.

The CEN and CENELEC standards do not conflict, they are both European Standards (EN) – they simply cover different engineering disciplines.

One of the roles of CENELEC is to support the International Electrotechnical Commission (IEC) in the same way CEN supports ISO. CENELEC and IEC work in close technical cooperation for the revision of existing standards or the production of new standards. For example, procedures have been put in place for the submission and adoption of new or revised IEC standards deemed necessary by CENELEC. This results in new or revised IEC standard with an equivalent EN standard.

3.2.4 European Telecommunications Standards Institute (ETSI)

The European Telecommunications Standards Institute (ETSI) produces globally-applicable standards for information and communications technologies, including fixed, mobile, radio, converged, broadcast and internet technologies.

ETSI is recognized by the European Commission as a European Standards Organization, with almost 700 ETSI member organizations drawn from 60 countries world-wide. Its purpose is to produce and perform the maintenance of the technical standards and other deliverables which are required by its members.

3.2.5 EU Member State Adoption of EN Standards

EU Member States have internal standards organizations which are National Members of CEN, and as such adopt and distribute European and international standards for use in internal projects. Many CEN, CENELEC and ETSI standards are adopted in this way. These organizations include:

- The British Standards Institution (BSI) in the United Kingdom
- The Association Française de Normalisation (AFNOR) in France
- Deutsches Institut für Normung (DIN) in Germany
- Österreichisches Normungsinstitut (ON) in Austria
- Asociación Española de Normalización y Certificación (AENOR) in Spain

For example, EN 61508 is a CENELEC standard regarding functional safety of electronic systems. The British Standard BS EN 61508 is the official English language version of EN 61508-1:2001. It is identical to IEC 61508-1:1998 including the corrigendum of May 1999.

Many CEN National Members are also members of ISO.

3.2.6 Union Industry of Signaling (UNISIG) and Union of European Rail Industries (UNIFE)

The Command and Control part of the TSI makes multiple references to UNISIG standards for ERTMS (European Rail Traffic Management System). UNISIG (Union Industry of Signaling) is a working group in UNIFE (Union des Industries Ferroviaires Europèennes = Union of European Rail Industries), founded in 1998 with the goal of creating specifications for ERTMS and ETCS (European Train Control System). The UNISIG standards are the basis of ERTMS, and use the CEN standards as a foundation.

3.2.7 International Union of Railways / Union Internationale des Chemins de fer (UIC)

The International Union of Railways (UIC) is the worldwide organization for international cooperation among railways and promotion of rail transport at a global level. The United States Department of Transport is a member of the UIC.

One of the key tasks of the UIC is to propose specifications and standards to standardization bodies. UIC sell leaflets describing the technical provisions of these standards, ranging from 20 to 500 euros.

The UIC website describes the leaflets as follows, emphasis added:

> "Within the context of its primary mission of "standardization and improvement of location and operating conditions of railways with a view to international traffic", the UIC has developed common measures, specifications and recommendations aimed at facilitating international rail traffic.
>
> **"The UIC Leaflets are professional documents, the application of which is either obligatory or recommended**. They are the result of international cooperation between experts of the member railway networks of the UIC, more often than not in collaboration

with other experts in the industry, standardization organisms, etc. Their content makes them of global value and they are **a reference for the entire railway community**. They aim at unifying or standardizing the construction measures as well as the railway operating procedures with a view to facilitating international traffic. They also allow members to rationalize their operations and to lower their costs.

"The UIC Leaflets are applied, according to their content, by railway undertakings, infrastructure managers, industry, public works undertakings, etc. **The measures they contain are often integrated in national norms, European norms**, global invitations to tender for railway equipment.

"They therefore contain the technical requirements which must be respected to facilitate the exchange of equipment between the networks, as well as cross-border transport.

"The UIC Leaflets are not norms, since the measures that the UIC decrees are only obligatory for its members.

"The UIC Leaflets are not law as they are decreed by those railway undertakings which are members of the UIC and not by national legislative bodies.

"The UIC Leaflets coexist with the national and international laws. In this context, it should be noted that they often act as a reference and technical basis for drafting the norms and regulations decreed by authorized organisms in Europe (CEN, AEIF, etc.)"

UIC design criteria and technical specifications, while not serving as a formal code or standard, have been coexisting with the EU national railroad regulations by providing a comprehensive guidance on the development and operation of high speed rail systems.

Implementation of UIC technical guidance on CHSTP would provide a benefit of successful international high-speed rail experience through a system-wide approach to the development of infrastructure, train controls, rolling stock, and operating and maintenance procedures.

3.2.8 Standardization for a European High Speed Rail System

The UIC Leaflets are a reference for the entire railway community, the application of which is either obligatory or recommended by reference, and have coexisted with the EU national railroad regulations by providing comprehensive guidance on the development and operation of high-speed rail systems.

In Europe, a mandate was agreed to in 1999 between the EU and the European standardization organizations to carry out the common standardization program, to ensure that the European Standards are available for high-speed rail. Experts working in the European standardization technical committees and experts developing the TSIs have met regularly in order to adjust standards to the TSI need; to provide harmonization of railway reference standards within the European Union. The standards take account of, and where necessary make reference to, other European standards in the field, either existing or in preparation.

The elaboration of the standards were undertaken in cooperation with a broadest possible range of interested groups, including international and European level associations, involving railway operators, infrastructure managers and railway regulatory bodies, as well as manufacturers and installers of railway equipment and rolling stock.

As part of the program, the cooperation with UIC, and between the European Standardization Organizations (CEN / CENELEC / ETSI and the IEC and ISO international organizations) was regarded as essential.

The implementation of such a program involving standardization organizations and other interested groups enabled the development of European Rail Traffic Management System (ERTMS). ERTMS resulted from one of the EU directives and is designed to ensure a common standard for the safety and reliability of the high-speed rail traffic management system, including the control command and signaling of Trans-European high-speed rail system

Also, some UIC Leaflets served as the reference documents for a number of interoperability elements of each TSI sub-system in the elaboration of the high-speed rail system TSIs.

3.3 JAPAN

3.3.1 Japanese Railway Regulatory Structure

In 1987, Japanese National Railways was privatized and then divided into six (6) regional companies and the Japan Freight Railway Company. Fares and regulations are standard for all companies and every region of Japan except Okinawa is covered by the railway network spanning approximately 12,400 miles.

Overseas offices in New York and Paris were opened in the 1960s, whose operations consist mainly of information exchange with European and North American railways on high-speed rail technology development and operation reform, and partnership with international bodies such as International Union of Railways (UIC).

3.3.2 Japanese Railway Design and Operation Laws

The Japanese railway standards are produced by the Railway Bureau of the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

Table 1 on the following page describes the various laws which must be complied with for railway design and operation, and what government ministry is responsible for enforcement

Table 1. Japanese Railway Design and Operation Laws

Ministry	Law	Description
Ministry of Land, Infrastructure and Transport	Nationwide Shinkansen Railway Development Law	Construction of Shinkansen lines
	Railway Operation Law	Duties of railway operators, employees and users
	Railway Business Law	Procedures to manage railway businesses
	Building Standards Law	Structures other than railway facilities and procedures for their installation
Ministry of Economy, Trade and Industry	Electricity Utilities Industry Law	Management of electricity businesses including electrified railways, protection of users and maintenance
	Electrical Appliance and Material Safety Law	Regulation of the manufacture, selling and safety of electric appliances
Ministry of the Environment	Basic Environment Law	Basic idea of Environmental Preservation
	Vibration Regulation Law	Regulation of the vibration generated at factories, in business activities and at construction work sites
	Noise Regulation Law	Regulation of the noise emitted at factories, in business activities and at construction work sites
Ministry of Internal Affairs and Communications	Fire Service Law	Prevention, precaution against fire, fire extinction, protection of lives, bodies and properties against fire, and reduction of damage due to fire
	Telecommunications Business Law	Appropriate and rational management of telecommunications business, offer of labor and protection of users
	Cable Telecommunications Law	Installation and use of cable telecommunications equipment and establishment of order
	Radio Wave Law	Fair and efficient utilization of radio waves

To implement these laws, detailed standards are prescribed based on rules, regulations, ordinances and notifications established by each ministry.

The basic technical standards by which the government specifies the concrete railway structures are prescribed by a Ministerial Ordinance that specifies railway-related technical standards, which is based on the Railway Operation Law.

There was a concern that too-detailed specifications based on the Ordinance would stifle innovation and impede the introduction of new technologies. Therefore, in 2001, the Japanese government comprehensively reviewed the ordinances, and replaced detailed technical specifications with performance-based specifications, accompanied by option “criteria for interpretation” or design criteria.

3.3.3 Japanese Railway Construction, Transport and Technology Agency (JRTT)

The Japanese Railway Construction, Transport and Technology Agency (JRTT) was founded in 2003 as an Independent Administrative Agency by integrating the Japan Railway Construction Public Corporation (JRCC) and the Corporation for Advanced Transport and Technology (CATT). Promotes the development of rail and marine transport networks and new transportation technologies.

JRTT works in domestic markets, cooperating with JARTS to access international markets.

3.3.4 Japanese Railway Implementation Standards

The designers and contractors responsible for building and operating the various Shinkansen lines develop their own implementation standards based on the Ordinances. This has given rise to a range of different standards used across Japan by the different Shinkansen lines.

Table 2 on the following page summarizes the major implementation standards adopted by Japan Railway Construction, Transport and Technology Agency (JRTT) and the operation companies JR East, JR Central, JR West and JR Kyushu. In addition to

Table 2 below, the JRTT has an 'Implementation Standards for Shinkansen lines' which applies to all regions.

3.3.5 Japan Railway Technical Service (JARTS)

The Japan Railway Technical Service (JARTS) was established in September 1965 under the guidance of the Japanese Ministry of Transport (the present Ministry of Land, Infrastructure and Transport) and Japanese National Railways (the present JR Group) to provide technical assistance for railroad construction. JARTS works in unison with JR Group, JRTT, the Tokyo Metro Co., Ltd. and other railway-related entities to dispatch experts overseas and to receive foreign railroad personnel for training.

JARTS consults with many organizations worldwide to help in applying Japanese railway technical expertise, including high-speed rail systems in China, Taiwan, Korea and Australia. JARTS consulted with the California High-Speed Rail Authority CHSRA until September 2005 on the CHSTP.

The structure of JARTS consists of a President, Chairman and Board of Directors, with headquarters for Corporate Planning, Business Administration and Engineering. The organization publishes a journal with articles covering various aspects of railroad planning, design and construction

Table 2. Implementation Standards for Shinkansen

Field	JR East	JR Central	JR West	JR Kyushu
Civil engineering	Implementation standard for Shinkansen track and facilities Implementation standard for Shinkansen civil facilities	Rules of the implementation standard for Shinkansen facilities	Rules of the implementation standard for Shinkansen track structure	Implementation standard for Shinkansen facilities and equipment
Electrical, Signaling and Command	Implementation standard for Shinkansen train operation and security equipment Implementation standard for Shinkansen electric facilities	Rules of the implementation standard for Shinkansen signal and telecommunications equipment Rules of the implementation standard for Shinkansen power supply facilities	Rules of the implementation standard for Shinkansen train operation and security equipment Rules of the implementation standard for Shinkansen electric facilities	Implementation standard for Shinkansen train operation and security equipment Implementation standard for Shinkansen electric facilities Attached table of the implementation standard for Shinkansen electric facilities
Rolling stock	Implementation standard for rolling stock structure Implementation standard for Shinkansen electric car maintenance and servicing	Rules of the implementation standard for Shinkansen rolling stock structure Rules of the implementation standard for Shinkansen electric car maintenance and servicing	Rules of the implementation standard for Shinkansen rolling stock structure Rules of the implementation standard for Shinkansen electric car maintenance and servicing	Implementation standard for Shinkansen rolling stock structure Implementation standard for rolling stock structure Implementation standard for Shinkansen electric car maintenance and servicing
Train operation	Implementation standard for Shinkansen train operation Detailed rules for the implementation standard for Shinkansen train operation Table of Shinkansen train operation speed	Rules of the implementation standard for Shinkansen train operation Detailed rules for the implementation standard for Shinkansen train operation Table of Shinkansen train operation speed	Rules of the implementation standard for Shinkansen train operation Detailed rules of the implementation standard for Shinkansen train operation Table of Shinkansen train operation speed	Implementation standard for Shinkansen train operation Detailed rules for the implementation standard for Shinkansen train operation Table of Shinkansen train operation speed

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4.0 RECOMMENDATION

This recommendation is based on how best to develop CHSTP System Requirements that meet Authority performance objectives and maintain an open and competitive technical platform that provides best value for the State of California and that meets or exceeds applicable US safety regulations.

Utilization of TSIs for the high-speed rail system of the CHSTP would provide a regulatory point of reference for a successful integrated high-speed rail system design approach to the development of the infrastructure, energy, control command and signaling, rolling stock, and operation and maintenance technical documentations. The TSI standards can be used in developing the proposed draft RPA for 49 CFR. This approach is outlined by Technical Memorandum 0.9 - Development of Draft RPA, which recommends that CHSTP System Requirements should be based on the applicable CFR, CPUC General Order, and EU TSI regulations and CHSTP Basis of Design Policy. With respect to the federal and state regulatory requirements, a Basis of Equivalency analysis is included that demonstrates how the CHSTP System Requirement meets or exceeds the applicable section of the CFR, the CPUC General Order, and the EU TSI regulations.

Implementation of UIC technical guidance could assist in substantiating the basis of equivalency under the safety case, and would provide support to the use of TSIs in the development of the RPA for 49 CFR, where the TSI does not provide sufficient guidance. Implementation of UIC technical guidance on the CHST would provide a benefit of successful international high-speed rail experience through a system-wide approach to the development of infrastructure, energy, train controls and signaling, rolling stock, and operating and maintenance procedures.

Caltrain is currently in the process of making an application to the CPUC for variances to General Order 95 to accommodate the 25kV ac Electrification Program between San Francisco and San Jose. It is expected to receive approval from the CPUC in early 2009. In the event this approval is limited to Caltrain's particular case and geographical limits, CHSTP would then make a follow-on application for extension of the limits for the CHSTP 25 kV ac system.