

# CALIFORNIA HIGH-SPEED TRAIN

## System Requirements Database Report

### Program

List of CHSTP System Requirements grouped by Subsystem

August 2010



California High-Speed Rail Authority



# California High-Speed Train Project




## SYSTEM REQUIREMENTS DATABASE REPORT

# List of CHSTP System Requirements grouped by Subsystem

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Prepared by  for the California High-Speed Rail Authority

## Subsystem: Infrastructure (INF)

3-01	Infrastructure General provisions
3-02	Nominal track gauge
3-03	Minimum infrastructure gauge
3-04	Distance between track centers
3-05	Maximum rising and falling gradients
3-06	Minimum radius of curvature
3-07	Actual Superelevation (Ea)
3-08 .1	Unbalanced Superelevation on plan track and on the through route of switches and crossings
3-08 .2	Abrupt change of unbalanced superelevation on diverging track of switches
3-09	Equivalent conicity
3-09 .1	Definition
3-09 .2	Design values
3-09 .3	In service values
3-10	Track Geometrical Quality and limits on isolated defects
3-11	Rail inclination
3-12	Switches and crossings
3-13	Track resistance (category I and II)
3-14 .1	Vertical loads
3-14 .2	Dynamic analysis
3-14 .3	Centrifugal forces
3-14 .4	Nosing forces
3-14 .5	Actions due to traction and braking (longitudinal loads)
3-14 .6	Longitudinal forces due to interaction between structures and track
3-14 .7	Aerodynamic actions from passing trains on line side structures
3-14 .8	Application of the requirements of EN1991-2:2003
3-15	Global track stiffness
3-16 .1	General requirements
3-16 .2	Piston effect in underground stations
3-17	Effect of crosswinds
3-18	Electrical characteristics
3-19	Noise and vibration
3-19 .1	Noise mitigation
3-19 .2	Vibration mitigation
3-20 .1	Access to the platform
3-20 .2	Usable length of the platform
3-20 .3	Usable width of the platform
3-20 .4	Platform height
3-20 .5	Distance from the centre of the track
3-20 .6	Track layout along the platforms
3-20 .7	Prevention of electric shock on platforms
3-20 .8	Characteristics linked to the access of people with reduced mobility
3-21	Fire safety and safety in railway tunnels
3-22	Access to or intrusion into line installations
3-23 .1	Lateral space alongside tracks
3-23 .2	Escape walkways in tunnels

3-24	Distance Markers
3-25	Storage, yard, and connecting tracks and other locations with very low speed
3-26 . 1	Toilet discharge
3-26 . 2	Train external cleaning facilities
3-26 . 3	Water restocking equipment
3-26 . 4	Sand restocking equipment
3-26 . 5	Refueling
3-27	Ballast pick-up
3-37	The rail
3-37 . 1	Railhead profile
3-37 . 2	Design linear mass
3-37 . 3	Steel grade
3-38	The rail fastening systems
3-39	Track sleepers and bearers
3-40	Switches and crossings
3-41	Water filling connector
3-42	ADA Accessibility Requirements for Infrastructure
3-43	Vegetation Control
3-44	Drainage
3-45	Derailment Containment
3-46	Utility Encroachment
3-47	Welding of Rail
3-48	Station Signage and Graphics
3-49	Geotechnical Monitoring – Instrumentation, Record Keeping, and Documentation
3-50 . 1	Traffic Load on Structures - Seismic Risk and Performance
3-50 . 2	Traffic Load on Structures - Derailment Effects
3-50 . 3	Traffic Load on Structures - Temperature Effects
3-50 . 4	Traffic Load on Structures - Gravity Loads on aerial structures and facilities
3-51	Rail Joints
3-52	Rail Mismatch
3-53	Torch Cut Rail
3-54	Derails
3-55	Track qualification by vehicle

## Subsystem: Operations and Traffic Management (OPS)

3-33	Infrastructure - Operating rules
3-33.1	Infrastructure - Execution of works
3-33.2	Infrastructure - Notices given to railway undertakings
3-33.3	Infrastructure - Protection of workers against aerodynamic effects
3-35	Infrastructure - Professional competences
3-36	Infrastructure - Health and safety conditions
4-12	Tunnels - Operating rules
4-12.1	Tunnels - Checking the condition of trains and appropriate actions
4-12.2	Tunnels - Emergency rule
4-12.3	Tunnels - Tunnel emergency plan and exercises
4-12.4	Tunnels - Earthing procedures
4-12.5	Tunnels - Timetable Special Instructions (TTSI)
4-12.6	Tunnels - Co-ordination between tunnel control centers
4-13.2	Tunnels - Maintenance of rolling stock
4-14	Tunnels - Professional qualifications
4-14.1	Tunnels - Tunnel specific competence of the train crew and other staff
4-15	Tunnels - Health and safety conditions
5-14.40	Rolling Stock - Operating rules
5-14.41	Rolling Stock - Maintenance rules
5-14.42	Rolling Stock - Professional competencies
5-14.43	Rolling Stock - Health and safety conditions
6-31.1	Energy - Management of power supply in case of danger
6-31.2	Energy - Execution of works
6-31.3	Energy - Day-to-day management of power supply
6-33	Energy - Professional competences
6-34	Energy - Health and safety conditions
6-34.1	Energy - Protective provisions of substations and posts
6-34.2	Energy - Protective provisions of overhead contact line system
6-34.3	Energy - Protective provisions of current return circuit
6-34.4	Energy - Other general requirements
6-34.5	Energy - High Visibility Clothing
7-01.1	Operations - General requirements (staff)
7-01.2	Operations - Required Reference Material for Train and Engine Crews
7-01.3	Operations - Required Reference Material for Railroad Staff other than Train and Engine Employees
7-01.4	Operations - Documentation for Infrastructure Manager's staff authorizing train movements
7-01.5	Operations - Safety-related communications between train crew, other Railway Undertaking staff and staff authorizing train movements
7-02.1	Train visibility
7-02.2	Train audibility
7-02.3	Vehicle identification
7-02.4	Requirements for Passenger vehicles
7-02.5	Train composition
7-02.6	Train braking
7-02.7	Ensuring that the train is in running order
7-03.2	Identification of trains

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7-03.3	Train departure
7-03.4	Traffic management
7-03.5	Data recording
7-03.6	Degraded operation
7-03.7	Managing an emergency situation
7-03.8	Aid to train crew in the event of an incident or of a major rolling stock malfunction
7-09	Operations - Operating rules
7-11.1	Operations - Professional competence
7-11.2	Operations - Linguistic competence
7-11.3	Operations - Initial and ongoing assessment of staff
7-12	Operations - Health and Safety Conditions
7-12.1	Operations - Introduction
7-12.2	Operations - Recommended criteria for approval of occupational doctors and medical organizations
7-12.3	Operations - Criteria for approval of psychologists involved in psychological assessment and psychological assessment
7-12.4	Operations - Medical examinations and psychological assessments
7-12.5	Operations - Medical requirements
7-12.6	Operations - Specific requirements regarding the task of driving a train
7-13	Operations - Health and safety conditions
8-24	TCC - Health and safety conditions

## Subsystem: Rolling Stock (RST)

5-01.1	Introduction
5-01.2	Design of trains
5-02	Structure and mechanical parts
5-02.1	General
5-02.2	End couplers and coupling arrangements to rescue trains
5-02.4	Access
5-02.5	Toilets
5-02.6	Driver's cab
5-02.8	Storage facilities for use by staff
5-02.9	External steps for use by shunting staff
5-03	Track interaction and gauging
5-03.1	Kinematic gauge
5-03.10	Sanding
5-03.11	Ballast pick up
5-03.2	Static axle load
5-03.3	Rolling stock parameters which influence ground based train monitoring systems
5-03.4	Rolling stock dynamic behavior
5-03.5	Maximum train length
5-03.6	Maximum gradients
5-03.7	Minimum curve radius
5-03.8	Flange lubrication
5-03.9	Suspension coefficient
5-04	Braking
5-04.1	Minimum braking performance
5-04.2	Brake wheel/rail adhesion demand limits
5-04.3	Brake system requirements
5-04.4	Service braking performance
5-04.5	Eddy current brakes
5-04.6	Protection of an immobilized train
5-04.7	Brake performance on steep gradients
5-04.8	Brake requirements for rescue purposes
5-05.1	Public address system
5-05.2	Passenger information signs
5-05.3	Passenger alarm
5-06	Environmental conditions
5-06.1	Environmental conditions
5-06.2	Train aerodynamic loads in open air
5-06.3	Aerodynamic loads on track workers at the line side
5-06.4	Aerodynamic loads on passengers on a platform
5-06.5	Pressure loads in open air
5-06.6	Crosswind
5-06.7	Maximum pressure variations in tunnels
5-06.8	Exterior noise
5-06.9	Exterior electromagnetic interference
5-07	System protection

5-07.1	Emergency exits
5-07.10	Monitoring and diagnostic concepts
5-07.11	Particular specification for tunnels
5-07.12	Emergency lighting system
5-07.13	Software
5-07.14	Driver-Machine-Interface (DMI)
5-07.15	Vehicle identification
5-07.2	Fire safety
5-07.3	Protection against electric shock
5-07.4	External lights and horn
5-07.5	Lifting/rescue procedures
5-07.6	Interior noise
5-07.7	Air conditioning
5-07.8	Driver's vigilance device
5-07.9	Control-command and signaling system
5-08	Traction and electrical equipment
5-08.1	Traction performance requirements
5-08.2	Traction wheel/rail adhesion requirements
5-08.3	Functional and technical specification related to the electric power supply
5-09	Servicing
5-09.1	General
5-09.2	Train external cleaning facilities
5-09.3	Toilet discharge system
5-09.4	Train interior cleaning
5-09.5	Water restocking equipment
5-09.6	Sand restocking equipment
5-09.7	Special requirements for stabling of trains
5-09.8	Refueling equipment
5-10	Maintenance
5-10.1	Responsibilities
5-10.2	The maintenance file
5-10.3	Management of the maintenance file.
5-10.4	Management of maintenance information.
5-10.5	Implementation of the maintenance
5-15	ADA Accessibility Requirements for Rolling Stock



## Subsystem: Train Control and Communications (TCC)

8-01	TCC safety characteristics relevant to interoperability
8-02	On-board ATC functionality
8-03	Wayside ATC functionality
8-04	ATC, Voice and Other Data Radio Subsystem Functions
8-05	ATC radio air gap interfaces
8-06	On-Board Interfaces Internal to TCC
8-06.2	ATC Data Radio
8-06.3	Odometry
8-07	Trackside Interfaces Internal to TCC
8-07.1	Functional interface between RBCs
8-07.2	Technical interface between RBCs
8-07.3	ATC Radio Block Controlling
8-07.4	Eurobalise/LEU
8-07.5	Euroloop/LEU
8-07.6	Requirements on pre-fitting of ATC wayside equipment
8-08	ATC Key Management
8-09	ATC-ID Management
8-10	HABD (Hot axle box detector)
8-11	Compatibility with Wayside Train Detection Systems
8-12.1	Internal TCC Electromagnetic compatibility
8-12.2	Electromagnetic Compatibility between Rolling Stock and Control-Command Track-side equipment
8-13	ATC DMI (Driver Machine Interface)
8-14	ATC and Voice Radio DMI (Driver Machine Interface)
8-15	Interface to Data Recording for Regulatory Purposes
8-16	Visibility of wayside TCC objects
8-16.1	Wayside Signals
8-16.2	Wayside Signs
8-18.12	Odometry
8-18.13	Interface to data recording for regulatory purposes
8-18.14	On-Board Pre-Fitting
8-18.15	Driver's External Field of View
8-18.16	Automatic Train Operation and Emergency Brake interfaces
8-18.3	Guaranteed train braking performance and characteristics
8-18.4	Position of TCC antennas
8-18.5	Physical environmental conditions for TCC equipment
8-18.6	Electromagnetic Compatibility between Rolling Stock and TCC On-Board equipment
8-18.7	Isolation of On-Board ATC functionality
8-18.8	Data Interfaces
8-19.1	Interfaces to Subsystem Infrastructure – Train Detection Systems
8-19.2	Wayside TCC Equipment
8-22	TCC - Maintenance rules
8-23	TCC - Professional competences
8-25	Yard Train Control (TC)
8-26	Automatic Train Control (ATC) Centralized Control (ATC-ATS)
8-27	ATC - Operating Modes - Main Line

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- 8-28 Degraded Mode Wayside Signal Control
  - 8-29 Interlocking Functions

## Subsystem: Traction Electrification System (TES)

6-01	General provisions
6-02	Voltage and frequency
6-03	System performance and installed power
6-04	Regenerative braking
6-05	Harmonic emissions towards the power utility
6-06	External electromagnetic compatibility
6-07	Continuity of power supply in case of disturbances
6-08	Protection of the environment
6-09	Overhead contact line
6-09.1	OCS Overall design
6-09.2	Geometry of overhead contact line
6-10	Compliance of the overhead contact line system with infrastructure gauge
6-11	Contact wire material
6-12	Contact wire wave propagation speed
6-14	Static contact force
6-15	Mean contact force
6-16	Dynamic behavior and quality of current collection
6-16.1	Dynamic behavior and quality of current collection - Requirements
6-16.2	Dynamic behavior and quality of current collection - Conformity Assessment
6-17	Vertical movement of the contact point
6-18	Current capacity of the overhead contact line system: AC and DC systems, trains in motion
6-19	Pantograph spacing used for the design of the overhead contact line
6-20	Current capacity, DC systems, trains at standstill
6-21	Phase separation sections
6-22	System separation sections
6-22.1	General
6-22.2	Pantographs raised
6-22.3	Pantographs lowered
6-23	Electrical Protection Coordination Arrangements
6-24	Effects of DC operation on AC systems
6-25	Harmonics and Dynamic Effects

## Subsystem: Safety in railway tunnels (TUN)

4-02	Subsystem Infrastructure
4-02.1	Installation of switches and crossings
4-02.10	Emergency communication
4-02.11	Access for rescue services
4-02.12	Rescue areas outside tunnels
4-02.13	Water supply
4-02.2	Prevent unauthorized access to emergency exits and equipment rooms
4-02.3	Fire protection requirements for structures
4-02.4	Fire safety requirements for building material
4-02.5	Fire detection
4-02.6	Facilities for self-rescue, evacuation and rescue in the event of an incident
4-02.7	Escape walkways
4-02.8	Emergency lighting on escape routes
4-02.9	Escape signage
4-03.1	Segmentation of overhead line or conductor rails
4-03.2	Overhead line or conductor rail earthing
4-03.3	Electricity supply
4-03.4	Requirements for electrical cables in tunnels
4-03.5	Reliability of electrical installations
4-04	Subsystem control-command and signaling
4-04.1	Hot axle box detectors
4-05.1	Material properties for rolling stock
4-05.10	Switching off of air conditioning in the train
4-05.11	Escape design of passenger rolling stock
4-05.12	Rescue service's information and access
4-05.2	Fire extinguishers for passenger rolling stock
4-05.3	Fire protection for freight trains
4-05.4	Fire barriers for passenger rolling stock
4-05.5	Additional measures for running capability of passenger rolling stock with a fire on board:
4-05.6	On board fire detectors
4-05.7	Communication means on trains
4-05.8	Emergency brake override
4-05.9	Emergency lighting system in the train

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