# APPENDIX 2-C: APPLICABLE DESIGN STANDARDS

## Table 1 Transportation

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Feature</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alteration of existing state and local roadways</td>
<td>Alignment (bridges and viaducts)</td>
<td><em>Merced to Fresno Section: Central Valley Wye Transportation Technical Report</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>California HSR Ridership and Revenue Business Plan Technical Report</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Federal Railroad Administration Standards and Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Federal Emergency Management Agency Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Federal Highway Administration Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>National Earthquake Hazards Reduction</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>U.S. Army Corps of Engineers Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>U.S. Bureau of Land Management Surveying Manual</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>United States Geological Survey Standards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>AASHTO Highway Drainage Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>AREMA Manual for Railway Engineering</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>California Disabled Accessibility Guidebook</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>California Seismic and Safety Commission Standards and Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>California Occupational Safety and Health Administration Standards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Bridge Design Manuals</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Seismic Design Criteria ver. 1.7</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Caltrans <em>Highway Design Manual</em>:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Chapter 80 – Application of Design Standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Chapter 200 – Geometric Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Chapter 300 – Geometric Cross Section</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Chapter 400 – Intersections At Grade</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Plans Preparation Manual</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Project Development Procedures Manual</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Standard Plans</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Surveys Manual</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Transportation Management Planning Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Caltrans <em>User’s Guide to Photogrammetric Products and Services</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Caltrans Right-of-Way Manual, and Forms and Exhibits</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Transportation Research Board Highway Capacity Manual</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>BNSF Railway Engineering Standards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Union Pacific Railroad Engineering Standards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Amtrak Standards and Guidelines</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Peninsula Corridor Joint Powers Board (Caltrain) Design Criteria and Engineering Standards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Southern California Regional Rail Authority Engineering Standards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Public Utilities Commission(s)</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Regional Water Quality Control Boards</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Air Quality Districts</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Flood Control Districts</em></td>
</tr>
</tbody>
</table>
**Table 2 Air Quality**

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Construction    | HSR civil work and track construction (alignment, bridges and viaducts) | *Merced to Fresno Section: Central Valley Wye Air Quality Technical Report*  
The Authority would comply with the California Air Resources Board, including the following California air basins:  
  • Sacramento Valley  
  • San Francisco Bay Area  
  • San Joaquin Valley  
  • Mojave Desert  
  • South Coast  
  • San Diego County  
Emissions would be tracked by the California Air Resources Board and include ozone, carbon monoxide, carbon dioxide, hydrogen sulfate, methane, NOx, PM$_{2.5}$, PM$_{10}$, sulfur dioxide, and lead. |
| Operations      | HSR Operations                                       | *Merced to Fresno Section: Central Valley Wye Air Quality Technical Report*  
The Authority would comply with the California Air Resources Board, including the following California air basins:  
  • Sacramento Valley  
  • San Francisco Bay Area  
  • San Joaquin Valley  
  • Mojave Desert  
  • South Coast  
  • San Diego County  
Emissions would be tracked by the California Air Resources Board and include ozone, carbon monoxide, carbon dioxide, hydrogen sulfate, methane, NOx, PM$_{2.5}$, PM$_{10}$, sulfur dioxide, and lead. |

HSR = high-speed rail  
AASHTO = American Association of State Highway and Transportation Officials  
AREMA = American Railway Engineers and Maintenance of Way Association  
Caltrans = California Department of Transportation  

NO$_x$ = nitrogen oxides  
PM$_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter  
PM$_{10}$ = particulate matter smaller than or equal to 10 microns in diameter
### Table 3 Noise and Vibration

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Construction    | HSR civil work and track construction (alignment, bridges and viaducts) | Merced to Fresno Section: Central Valley Wye Noise and Vibration Technical Report  
FRA High-Speed Ground Transportation Noise and Vibration Impact Assessment Guidelines  
Federal Transit Administration Transit Noise and Vibration Assessment |
| Operations      | Alignment (bridges and viaducts) | Merced to Fresno Section: Central Valley Wye Noise and Vibration Technical Report  
FRA High-Speed Ground Transportation Noise and Vibration Impact Assessment Guideline  
Federal Transit Administration Transit Noise and Vibration Assessment |

HSR = high-speed rail  
FRA = Federal Railroad Administration

### Table 4 EMF/EMI

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Electromagnetic compatibility of HSR equipment and facilities with themselves, and with equipment and facilities of HSR neighbors | HSR Systems | 46 C.F.R. 15, Subpart B, Sections 15.107(a) and 15.109(b) for Class A digital devices  
European Committee for Electrotechnical Standardization Standard EN 50121-4, Railway Applications – Electromagnetic Compatibility, Part 4: Emissions and Immunity of Signaling and Telecommunications Apparatus |
| Electromagnetic compatibility of HSR equipment and facilities with passengers, workers, and neighbors of the HSR | HSR Systems | IEEE Standard C95.6-2002 – IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz  

HSR = high-speed rail  
C.F.R. = Code of Federal Regulations  
kHz = kilohertz  
GHz = gigahertz  
IEEE = Institute of Electrical and Electronic Engineers  
FCC = Federal Communications Commission  
OET = Office of Engineering and Technology
## Table 5 Public Utilities and Energy

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
National Fire Protection Association Standards  
Caltrans *Highway Design Manual*:  
  - Chapter 80 – Application of Design Standards  
  - Chapter 200 – Geometric Design  
  - Chapter 300 – Geometric Cross Section  
  - Chapter 400 – Intersections At Grade  
Caltrans Plans Preparation Manual  
Caltrans Project Development Procedures Manual  
AREMA Manual for Railway Engineering  
Conformance with the latest technical specifications and practices of the respective utility owner.  
American National Standards Institute Standards:  
  - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications  
  - Standard for Outside Plant Communications Cable  
  - Communications Wire and Cable for Wiring of Premises  
  - Standard for Fiber Optic Premises Distribution Cable  
  - Human Factors Engineering Requirements for Visual Display Terminal Work Stations  
  - Standard for Tolerance of Radiated Electromagnetic 1 Frequency Interference  
Electronic Industries Association/Telecommunications Industry Association Standards  
Underwriters' Laboratories Inc. Publications  
National Transportation Communications for Intelligent Transportation Systems Protocol Standards  
Telecommunication Standardization Sector Standards  

**Caltrans** = California Department of Transportation  
AREMA = American Railway Engineers and Maintenance of Way Association  
HSR = high-speed rail
## Table 6 Hydrology

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Alteration of stream flows and water surface elevations from the placement of structures (e.g., piers and abutments) within stream channels | Alignment (bridges and viaducts)      | *Merced to Fresno Section: Central Valley Wye Hydraulics and Floodplains Technical Report*  
Caltrans Highway Design Manual:  
- Chapter 810- Hydrology  
- Chapter 820- Cross Drainage  
FHWA Hydraulic Design Series:  
- HDS-1- Hydraulics of Bridge Waterways  
- HDS-5- Hydraulic Design of Highway Culverts  
AREMA Manual for Railway Engineering  
AASHTO Highway Drainage Guidelines |
| Alteration of drainage patterns from placement any type of project feature in any location, including changes from impervious surfaces and floodplain impacts | All project features                  | Stormwater Pollution Prevention Plan:  
- Hydromodification  
*Merced to Fresno Section: Central Valley Wye Hydraulics and Floodplains Technical Report*  
*Merced to Fresno Section: Central Valley Wye Stormwater Management Plan*  
Caltrans Highway Design Manual:  
- Chapter 820- Cross Drainage  
- Chapter 830- Roadway Drainage  
- Chapter 860- Open Channels  
FHWA Hydraulic Design Series No. 2 (Hydrology)  
FHWA Hydraulic Engineering Circular No. 22 (Urban Drainage Design Manual)  
AREMA Manual for Railway Engineering  
AASHTO Highway Drainage Guidelines |
| Generation of pollution from roadways                                           | State highway and local roadway modifications and crossings | Stormwater Pollution Prevention Plan:  
- Construction BMPs  
- Post-Construction Controls  
*Merced to Fresno Section: Central Valley Wye Stormwater Management Plan*  
Caltrans Storm Water Quality Handbook:  
- Project Planning and Design Guide  
- Stormwater Pollution Prevention Plan and Water Pollution Control Program Preparation Manual  
AASHTO Highway Drainage Guidelines |

HSR = high-speed rail  
FHWA = Federal Highway Administration  
AREMA = American Railway Engineers and Maintenance of Way Association  
AASHTO = American Association of State Highway and Transportation Officials  
BMPs = best management practices  
Caltrans = California Department of Transportation
<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Construction    | Backfilling of borings, test pits, Cone Penetration Tests, rotosonic holes, wells, and probe holes. | AASHTO Guidance:  
  - AASHTO LRFD Bridge Design Specification with Caltrans Amendments  
  - AASHTO Guide Specifications for Design and Construction of Segmental Concrete Bridges  
  - AASHTO Guide Specifications for Thermal Effects in Concrete Bridge Superstructures  
  Caltrans:  
  - Caltrans Seismic Design Criteria  
  California Building Code  
  FHWA Guidelines:  
  - FHWA Drilled Shaft Construction Procedures and LRFD Design Methods, FHWA-NHI-22 10-016  
  - FHWA Drilled Shafts: Construction and Procedures and Design Methods, FHWA-IF-99-26 02  
  - FHWA Mechanically Stabilized Earth Walls and Reinforced Soil Slope Design and Construction Guidelines, FHWA-NHI-00-043  
  - FHWA Earth Retaining 1 Structures, FHWA-NHI-99-025  
  - FHWA Soil Slope and Embankment Designs, FHWA-NHI-01-026  
  - FHWA Rock Slopes Reference Manual, FHWA-HI-99-00  
  FHWA Geosynthetics Design and Construction Guidelines, FHWA HI-95-038  
  California Well Standards, Water Wells, Monitoring Wells, Cathodic Protection Wells:  
  - Bulletins 74-81 and 74-90 |
| Restoration of pavement | AASHTO Guidance:  
  - AASHTO LRFD Bridge Design Specification with Caltrans Amendments  
  - AASHTO Guide Specifications for Design and Construction of Segmental Concrete Bridges  
  - AASHTO Guide Specifications for Thermal Effects in Concrete Bridge Superstructures  
  Caltrans:  
  - Caltrans Seismic Design Criteria (CSDC) |
<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Construction    | HSR civil work and track construction (alignment, bridges and viaducts) | FHWA Guidelines:  
  - FHWA Drilled Shaft Construction Procedures and LRFD Design Methods, FHWA-NHI-22 10-016  
  - FHWA Drilled Shafts: Construction and Procedures and Design Methods, FHWA-IF-99-26 02  
  - FHWA Mechanically Stabilized Earth Walls and Reinforced Soil Slope Design and Construction Guidelines, FHWA-NHI-00-043  
  - FHWA Earth Retaining 1 Structures, FHWA-NHI-99-025  
  - FHWA Soil Slope and Embankment Designs, FHWA-NHI-01-026  
  - FHWA Rock Slopes Reference Manual, FHWA-HI-99-00  
  - FHWA Geosynthetics Design and Construction Guidelines, FHWA HI-95-038 |


AASHTO = American Association of State Highway and Transportation Officials  
LRFD = Load and Resistance Factor Design  
Caltrans = California Department of Transportation  
FHWA = Federal Highway Administration

Table 8 Hazardous Materials

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Construction    | HSR civil work and track construction (alignment, bridges and viaducts) | Title 49 C.F.R Part 192, “Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards”  
Title 49 Part 195, “Transportation of Hazardous Liquids by Pipeline” |

HSR = high-speed rail  
C.F.R. = Code of Federal Regulations
## Table 9 Safety and Security

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Project Features</th>
<th>Applicable Design Standards</th>
</tr>
</thead>
</table>
| Construction    | HSR civil work and track construction (alignment, bridges and viaducts). | 49 C.F.R., Part 213, Section 316 for protection of the right-of-way for Class 8 and 9 tracks  
49 C.F.R, Part 214, Railroad Workplace Safety  
California Public Utilities Commission General Order No. 26-D  
FRA guidelines regarding the separation and protection of adjacent transportation systems and conventional railroads  
High-Speed Passenger Rail Safety Strategy published by FRA (November 2009)  
AREMA Manual for Railway Engineering  
Caltrans Highway Design Manual  
Caltrans Plans Preparation Manual  
Caltrans Project Development Procedures Manual |
| Operations      | Alignment (bridges and viaducts). | Be fully grade separated at crossings and fully access-controlled  
Incorporate supervisory control and data acquisition system  
Incorporate climatic and seismic monitoring systems  
Crime Prevention Through Environmental Design principles would be employed in the design of the HSR System |

HSR = high-speed rail  
C.F.R. = Code of Federal Regulations  
FRA = Federal Railroad Administration  
AREMA = American Railway Engineers and Maintenance of Way Association  
Caltrans = California Department of Transportation