MEMORANDUM

San Joaquin River Crossing Design Refinement – Merced to Fresno Section

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DATE: December 9, 2011

The purpose of this memorandum is to present a design refinement for the San Joaquin River crossing in response to the technical assistance workshop held October 31, 2011, with staff from the National Marine Fisheries Service (NMFS). This information supplements and updates the Biological Assessment (BA) submitted to NMFS on November 30, 2011, in support of a Biological Opinion. The Biological Opinion is needed prior to the Federal Railroad Administration (FRA) issuing a Record of Decision in the spring of 2012 for the Merced to Fresno Section High-Speed Train (HST) Project.

The BA addresses potential project effects on two anadromous fish species: the Central Valley steelhead distinct population segment (DPS) and the Central Valley spring-run Chinook salmon evolutionarily significant unit (ESU). The design refinement described in this memorandum was developed to further avoid and minimize potential adverse effects of the proposed HST Project on Central Valley steelhead and Central Valley spring-run Chinook salmon. The design refinement is being applied to the San Joaquin River crossing, as it is the only waterway crossing within the Merced to Fresno Section that has the potential to provide habitat for listed fish species as well as the unique circumstances associated with the San Joaquin River Restoration Program's reintroduction of spring-run Chinook salmon by Fall 2012.

The design detail described below replaces the San Joaquin River crossing text found on pp. 2-16 thru 2-21, 2-25, 2-27 thru 2-30, and 2-32 thru 2-33 of the BA. Appendix A of this memorandum also provides the plan, elevation, and pier detail of the proposed San Joaquin River HST crossing, and Appendix B provides the 15% Design Set for the crossing.

Additional Design Detail of the San Joaquin River Crossing

Construction of Elevated Structures at the San Joaquin River

The HST guideway would be elevated from approximately 1,000 to 1,500 feet north of the north bank of the San Joaquin River to just north of Veterans Boulevard, a distance of between 9,000

and 12,000 feet. The soffit, or lowest portion of the structure, spanning the waterway would be a minimum of 10 to 15 feet above the top bank on both sides of the river, providing ample clearance for passage of flood flows and wildlife. The section of the elevated structure or guideway that crosses the San Joaquin River is anticipated to be supported on foundations consisting of cast-in-drilled-hole with cast-in-place concrete column extensions, as illustrated in Figures 2-13 and 2-14 in the BA.

Currently, the UPRR railway and the Caltrans SR 99 bridge structures downstream from the future crossing have piers in the San Joaquin River corridor that are spaced approximately 160 feet apart. The design refinement being proposed shows a configuration of the HST crossing that uses a combination of the typical precast segmental construction at each approach to the crossing and then spans the main low flow channel with a 160 to 320-foot steel truss superstructure to minimize the need to enter the wetted perimeter of the low-flow river channel.

Where required, the construction of foundations within the edge of the active waterway would use construction methods such as installation of sheet pile cofferdams to isolate the activity from the live stream in order to avoid or minimize the potential for adverse effects on anadromous fish within the Action Area (see Section 3.1 of the BA). In addition, both temporary and permanent steel casings for cast-in-drilled-hole pile construction and piling for falsework would use vibratory pile hammers for installation, which would minimize underwater sound pressures.

The number of foundation elements is directly related to the span arrangement necessary to meet the requirements for bridge hydraulics. Since the future crossing would be located upstream of the two existing bridge structures, the hydraulic effect of the placement of new piers within the river corridor on downstream structures and the geomorphology of the channel will be considered during the design of the final configuration of the structure.

Construction Work Window Restrictions

Due to the number of federally listed species that the Merced to Fresno Section would potentially affect and the conflicting potential construction work windows for each species or their habitat, construction work window restrictions would be determined through agency consultation. Because construction work window restrictions may not reduce effects on all federally listed wildlife species, additional measures may be required, as determined by the natural resource regulatory agencies. These measures may include provision of non-disturbance zones, additional site or species-specific biological monitoring, and approved passive or active species relocation.

Construction work window restrictions for special aquatic resources would be implemented to reduce potential direct and indirect effects of construction activities on federally listed species within those habitats. Construction activities in special aquatic resources (e.g., vernal pools, seasonal wetlands, seasonal riverine areas, riparian areas) would be restricted during the rainy season (i.e., October 15 to April 15) or would be conducted when the resource is dry, when it lacks flowing or standing water, or when sensitive fish species are least likely to be present. In the event that construction work window restrictions cannot be conducted, dewatering, water diversions, or additional best management practices (BMPs) would be employed as determined through consultation with the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), NMFS, California Department of Fish and Game (CDFG) and the Regional

Water Quality Control Board (RWQCB). Additional measures would be necessary to reduce or lessen the nature and magnitude of significant adverse effects when construction work window restrictions are not feasible (e.g., nesting bird surveys, non-disturbance exclusion zones, resource and species monitoring).

No structural features (e.g., piers, abutments, etc.) are proposed to be constructed directly within the low-flow channel (or below the ordinary high-water mark) of the San Joaquin River or any other waterways; however, depending on water surface levels and exact construction footprints, construction activities may require a small portion of the low-flow channel along the bankline to be isolated with sheetpile cofferdams and dewatered. In the event that in-water work is required, construction work window restrictions for the San Joaquin River and other waterway crossings would include the following:

- Work within the wetted perimeter of the river channel is assumed to occur between June 15 and October 15 to minimize impacts to aquatic species and other aquatic resources.
- Where the Central Valley Flood Protection Board (CVFPB) has defined the limits of a designated floodway, work within those limits will be typically limited to the restricted period, which occurs from April 15 to October 31 for flood protection issues, unless otherwise authorized by the CVFPB.
- Material and equipment storage in close proximity to the river channel areas will be limited to the restricted period from April 15 to October 31. Equipment may enter into the restricted river channel areas but will be removed daily and stored outside of the areas subject to flooding.

Dewatering and Water Diversion

If construction occurs where open or flowing water is present, a strategy approved by the resource agencies (e.g., USACE, RWQCB, CDFG, NMFS) would be used to dewater or divert water from the immediate work area. It is possible that pier support work could be required in a small portion of the San Joaquin River adjacent to the bankline. If temporary in-water work is required, the area would be isolated with a sheet pile cofferdam and dewatered. In order to avoid and/or minimize potential effects that could result from these activities, the following measures would be implemented:

- Develop and Implement a Storm Water Pollution Prevention Plan (SWPPP). Temporary construction BMPs will be implemented in accordance with the Merced to Fresno Section plans and specifications, as well as the approved SWPPP. BMPs may include, but would not be limited to, silt fences, fiber rolls, straw bales, sandbag barriers, check dams, and sediment basins.
- Pile Driving Underwater Sound Pressure Measures. The following measures will be implemented to avoid and minimize potential adverse effects that could otherwise result from in-water pile-driving activities:
  - The contractor will develop a plan for pile-driving activities in water to minimize impacts on fish and will allow sufficient time in the schedule for coordination with regulatory agencies. Measures will be implemented to minimize underwater sound

pressure to levels below thresholds for peak pressure and accumulated sound exposure levels. Threshold levels established by NMFS[1] that will not be exceeded are as follows:

Peak pressure	=	206 dB
Accumulated sound exposure levels	=	183 dB

- Underwater sound monitoring will be performed during pile-driving activities. A qualified biologist or natural resource specialist will be present during such work to monitor construction activities and compliance with terms and conditions of permits.
- Sheet piling will be driven by vibratory or nonimpact methods (i.e., hydraulic) that result in sound pressures below threshold levels to the extent feasible.
- Pile driving will be conducted only during daylight hours and initially will be used at low energy levels and reduced impact frequency. Applied energy and frequency will be gradually increased until necessary full force and frequency are achieved.

- Implement Fish Rescue Plan Inside Cofferdam. Installation of the cofferdam and dewatering of the site during construction could result in fish stranding. The contractor will develop and implement a Fish Rescue Plan acceptable to the CDFG, USFWS, and NMFS.
  - The contractor will ensure that a qualified fisheries biologist with a current CDFG collection permit conducts the fish rescue and relocation efforts behind the cofferdam. The fish rescue effort will be implemented during the dewatering of the areas behind the cofferdam(s) and involve capture and return of those fish to suitable habitat within adjacent waterways. A fisheries biologist will be present on-site during initial pumping (dewatering) to ensure compliance with the plan.
  - The contractor will monitor the progress of dewatering and allow for the fish rescue to occur prior to completely closing the cofferdam and again when water depths reach approximately 2 feet. USFWS, NMFS, and CDFG will be notified at least 48 hours prior to the start of fish rescue efforts. Information on the species, number, and sizes of fish collected would be recorded during the fish rescue and provided in a letter report to be submitted within 30 days after the fish rescue to USFWS, NMFS, and CDFG.
  - The Fish Rescue Plan will contain methods for minimizing the risk of stress and mortality due to capture and handling of fish removed from the construction site and returned to adjacent waterways.
  - Implementation of the Fish Rescue Plan would minimize potential adverse effects to listed fish species (if present) associated with fish stranding during dewatering activities related to the construction activities.

San Joaquin River Crossing Plans and Final Design

The San Joaquin River Crossing Plans and Final Design will incorporate a series of checkpoints (please refer to the series of bullets below). The California High-Speed Rail Authority (Authority) and FRA will coordinate with NMFS, USFWS, CDFG, CVFPB, USACE, U.S. Bureau

[1] National Marine Fisheries Service (NMFS). 2009. *Pile driving analysis spreadsheet*. Available at: http://www.wsdot.wa.gov/NR/rdonlyres/1C4DD9F8-681F-49DC-ACAF-ABD307DAEAD2/0/BA_NMFSpileDrivCalcs.xls. Last accessed on November 7, 2011.

of Reclamation (Reclamation), and California Department of Water Resources (DWR) to provide additional cross-sectional and profile data of the proposed San Joaquin River crossing as further refinement of the planning and design process continues. The checkpoints will include specific product deliverables and data that could then be used to conduct hydraulic modeling to demonstrate how bridge design might influence in-river processes, such as scour. These analyses will address velocity, turbidity, and fluvial processes, such as sediment scour and deposition. These checkpoints will be developed in concert with the resource agencies to obligate the Design-Build Team to work with NMFS systematically on the design of the crossing. The anticipated design-build phases are itemized below. The first four action items are a part of the preliminary design process to be performed by the Design-Build Team, with the final design completion following NMFS concurrence.

The checkpoints are presented below:

- Establish Design Hydrology (peak design flow rate):
  - Collect, review and summarize available hydrology.
  - Consult with CVFPB and USACE.
  - Develop original hydrology, if required.
- Obtain Existing Conditions Field Data (can start concurrent with the first checkpoint):
  - Aerial and field reconnaissance – field plans.
  - Channel cross-section survey and processing.
  - Geotechnical sampling, testing, and data report.
- Establish Existing Conditions Hydraulics (HEC-RAS model):
  - Develop HEC-RAS model for each crossing.
  - Calibrate or validate the model.
  - Establish design water surface elevation and freeboard.
  - Consult with CVFPB and USACE.
- Demonstrate Minimal Hydraulic Impacts from Design:
  - Incremental flood rise.
  - Freeboard.
  - Setbacks and levee clearance.
  - Environmental Questionnaire.
  - Scour and channel Stability; considerations for changes in geomorphology.
- Final Design incorporating any potential design modifications consistent with findings during the preliminary design process.

The Authority will closely coordinate with the Design-Build Team, NMFS, USFWS, and other appropriate agencies during the final design process. Requirements of the design and placement will continue to include compatibility with the intent of the San Joaquin River Restoration Program and the habitat needs of Central Valley steelhead and Central Valley spring-run Chinook salmon. The HST crossing shall be designed with the planned increase in upstream flow releases to maintain or effectively minimize any appreciable changes in scour, sediment transport, and deposition, or changes in geomorphic processes that could alter habitat

conditions in a manner that would impede the reestablishment of these species. The Authority, in partnership with the Design-Build Team, will design and conduct a hydraulics/hydrology analysis with appropriate modeling tools and incorporate site-specific data, including the needed geotechnical investigations to develop design (including sizing and location of piers) and construction techniques that are compatible with habitat conditions that support salmonid utilization of the San Joaquin River within the area impacted by the proposed HST crossing.

The Authority will coordinate with NMFS, Reclamation, USACE, DWR, CVFPB, and CDFG on the study design methods, hydraulic and geomorphology criteria, and follow-up post construction monitoring to ensure crossing location biological integrity is maintained for habitat primary constituent elements and the compatibility with the goals of the San Joaquin River Restoration Program for the reintroduction of spring-run Chinook salmon and Central Valley steelhead.

Depending on the results of the hydraulic and hydrologic analyses, the Authority and the Design-Build Team may be required to implement design changes to further avoid and minimize adverse affects to aquatic habitat, where appropriate, and/or make other design changes. Design changes would be evaluated and considered in consultation with NMFS, Reclamation, USACE, DWR, CVFPB, and CDFG. Possible design changes that could be evaluated and considered include the following:

- Minor reconfiguration of piers and pier foundations to minimize hydraulic forces and associated potential for scour; and/or
- Providing additional armoring along the bed and banks to minimize scour.

The Authority, along with the Design-Build Team, will present a detailed San Joaquin River Crossing Plan to NMFS, Reclamation, USACE, DWR, CVFPB, and CDFG that considers the hydraulic and hydrology analyses and that addresses the issues presented above prior to any site preparation or mobilization of work at the San Joaquin River. If the design revisions or refinements are deemed to be substantial changes from the original project description, NMFS or USFWS may reinitiate Endangered Species Act (ESA) Section 7 consultation. Design changes or refinements will be further addressed with the appropriate permitting for USACE, DWR, CVFPB, and CDFG.

Project Design Features for Flood Protection

Design of the project will allow the HST to remain operational during flood events and will minimize increases in 100-year flood elevations. Design features include the following:

- In Special Flood Hazard Areas (SFHA), raise the guideway at least 4 feet above the 100-year flood elevation.
- Minimize development within the floodplain as appropriate. Avoid placement of facilities in the floodplain or raise the ground with fill above the base-flood elevation.

Design of the crossings limits the change in floodwater surface elevation to no greater than 0.1 foot above current levels (zero rise within designated floodways). The following design considerations would minimize the effects of pier placement in the floodways:

- Design crossings to be as nearly perpendicular to the channel as feasible to minimize bridge length.

- Orient piers to be parallel to the expected high water flow direction where feasible to minimize flow disturbance.
- Elevate bridge crossings at least 3 feet above the high water surface elevation to provide adequate clearance for floating debris or as required by local agencies. (The CVFPB requires that the bottom members [soffit] of a proposed bridge must be at least 3 feet above the calculated water surface elevation for the design flood. The required clearance may be reduced to 2 feet on minor streams at sites where significant amounts of stream debris are unlikely.)
- Conduct engineering analyses of channel scour depths at each crossing to evaluate the necessary embedment depth for bridge piers. Implement scour-control measures to reduce erosion potential.
- Use quarry stone, cobblestone, or their equivalent for erosion control along rivers and streams, complemented with native riparian plantings or other natural stabilization alternatives that would restore and maintain a natural riparian corridor, where feasible.

Place bedding materials under the stone protection at locations where the underlying soils require stabilization resulting from streamflow velocity.

Conclusion

The additional design detail for the San Joaquin River crossing provided in this memorandum refines and updates the bridge crossing data within the BA (November 2011) by further avoiding and minimizing potential adverse effects on listed anadromous fish species. By further avoiding potential adverse effects on anadromous fish species that may occupy the San Joaquin River, the additional design detail for the San Joaquin River crossing also represents a refinement to the design that allows the project to move forward in the ESA Section 7 consultation process without additional hydrologic or hydraulic analyses at this time.

As the design process continues, the Authority and FRA will continue to coordinate with NMFS and USFWS after the Biological Opinion is issued to provide additional cross-sectional and profile data of the proposed San Joaquin River crossing. Development of the final designs will incorporate a series of checkpoints that will include specific deliverables and data that can then be used to conduct hydraulic modeling to demonstrate how bridge design might influence in-river processes, such as scour.

APPENDIX A

San Joaquin River Crossing Plan, Elevation, and Pier Detail

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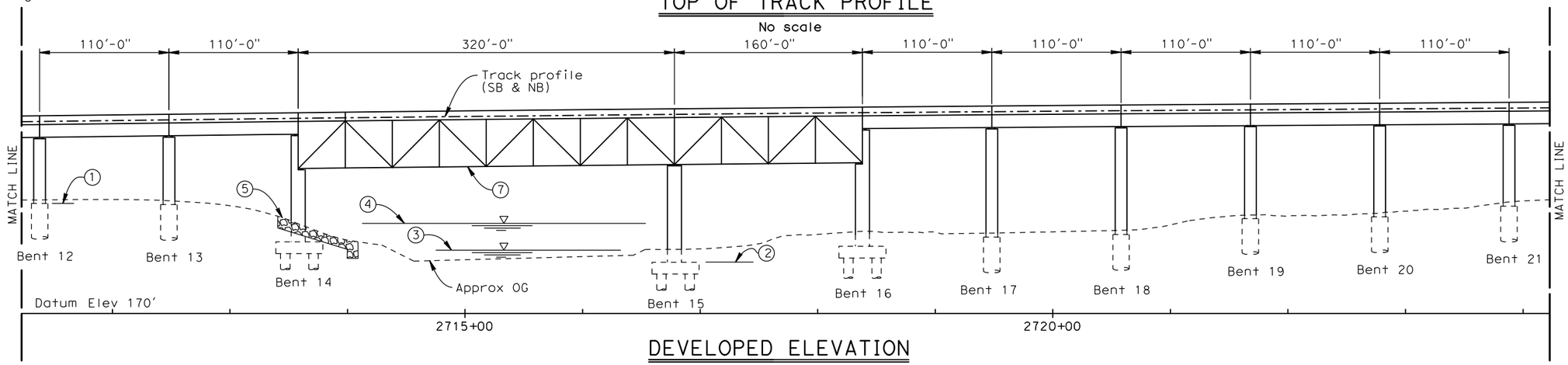

DEVELOPED ELEVATION

1" = 50'

PLAN

1" = 50'

NOTES:

1. CIDH Pile cut-off elevation.
2. Approx top of footing, min 1'-0" below calculated scour.
3. Approx water survace, Low Flow, Elev = 226.0'±.
4. Approx water surface - Base Flood = Q_{100}, Elev = 245.0'±.
5. Approx Limits of Rock Slope Protection for bank erosion and scour protection.
6. Approximate limit of CA State Floodway and FEMA-AE Zone.
7. Approximate elevation of low structure, Elev = 300.0'±.

NOT FOR CONSTRUCTION

50 0 50 100
1"=50'

REV	DATE	BY	CHK	APP	DESCRIPTION

DESIGNED BY T. Barnard
DRAWN BY C. Lee
CHECKED BY H. Lee
IN CHARGE A. Boone
DATE 11/30/2011

15% DESIGN

NOT FOR CONSTRUCTION

AECOM Technical Services, Inc.
2020 L Street, Suite 300
Sacramento, CA 95811
CH2MHILL

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

CALIFORNIA HIGH-SPEED TRAIN PROJECT
MERCED TO FRESNO

EXAMPLE PLAN AND ELEVATION
RIVER CROSSING

CONTRACT NO. HSR06-007
DRAWING NO.
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APPENDIX B

15% Design Set for San Joaquin River Crossing

CALIFORNIA HIGH-SPEED TRAIN

HST Structure Plans

Record Set
15% Design Submittal
Merced to Fresno Section

Viaducts & Stream Crossings
Hybrid Alternative

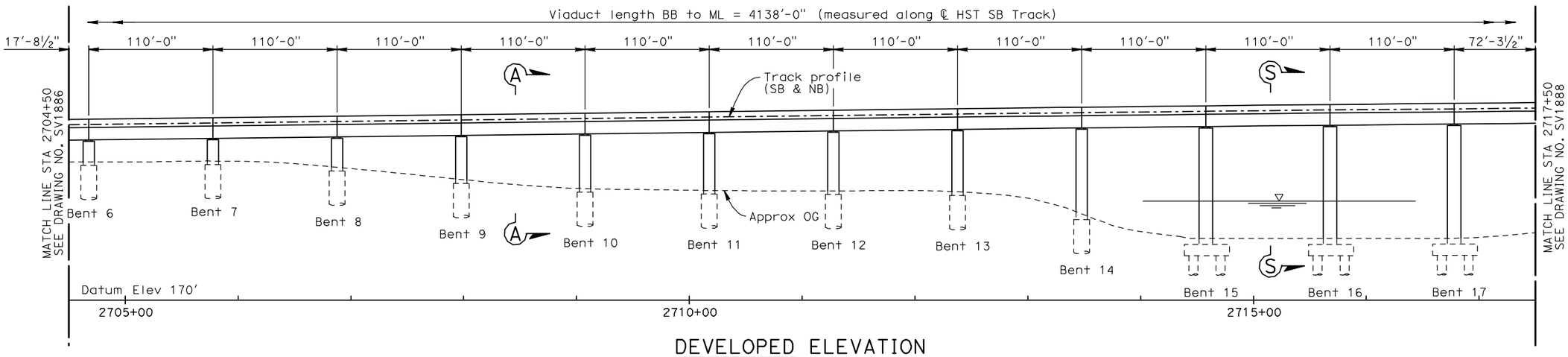
May 2011

CALIFORNIA
High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

TOP OF TRACK PROFILE

No scale



DEVELOPED ELEVATION

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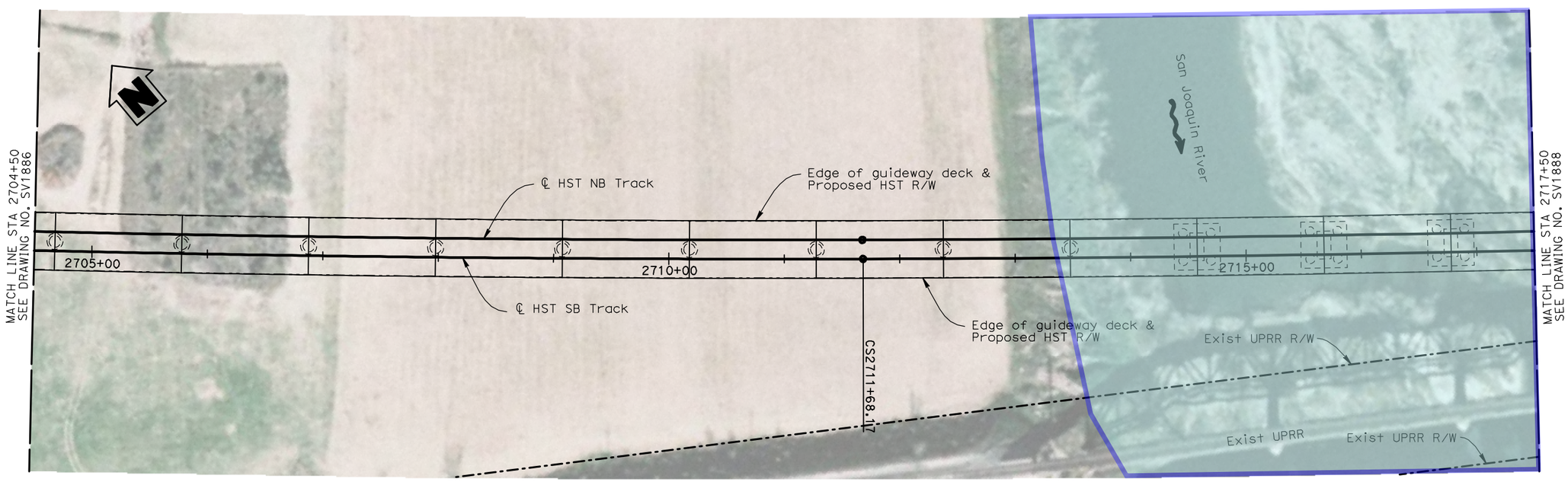

PLAN

1" = 50'

NOTES:

1. For General Notes, see Drawing No. SB0201.
2. For Section A-A, see Drawing No. SV3001.
3. For Section S-S, see Drawing No. SV3006.

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1"=50'

REV	DATE	BY	CHK	APP	DESCRIPTION

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IN CHARGE A. Boone
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RECORD SET
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CALIFORNIA HIGH-SPEED RAIL AUTHORITY

CALIFORNIA HIGH-SPEED TRAIN PROJECT
MERCED TO FRESNO
HYBRID MAIN LINE
AVENUE 24
VIADUCT NO. 203
STA 2704+50 TO STA 2717+50

CONTRACT NO. HSR06-007
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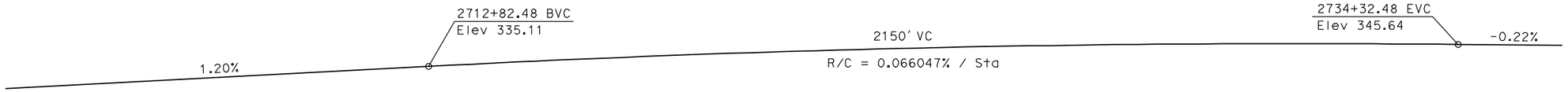

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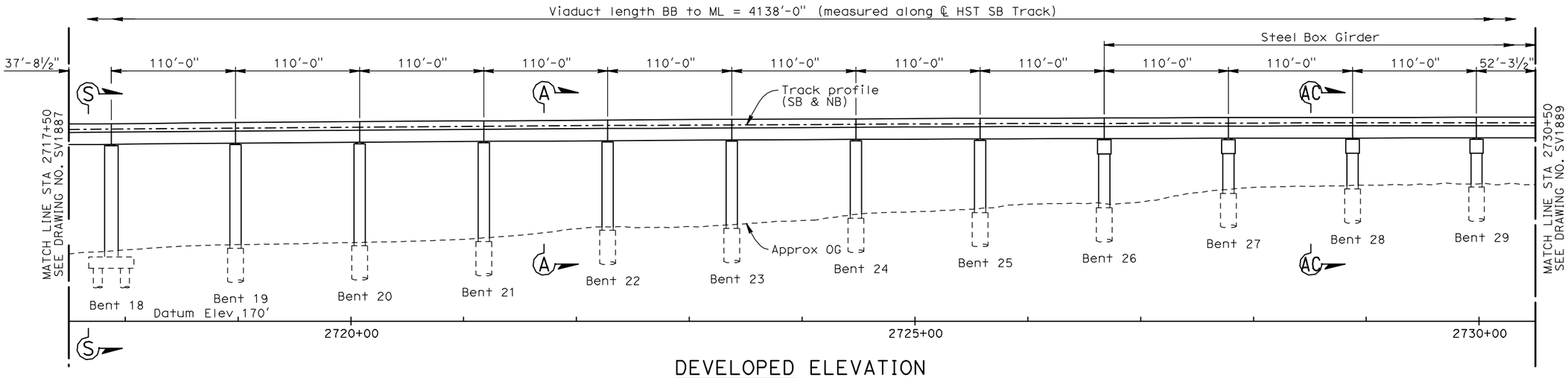
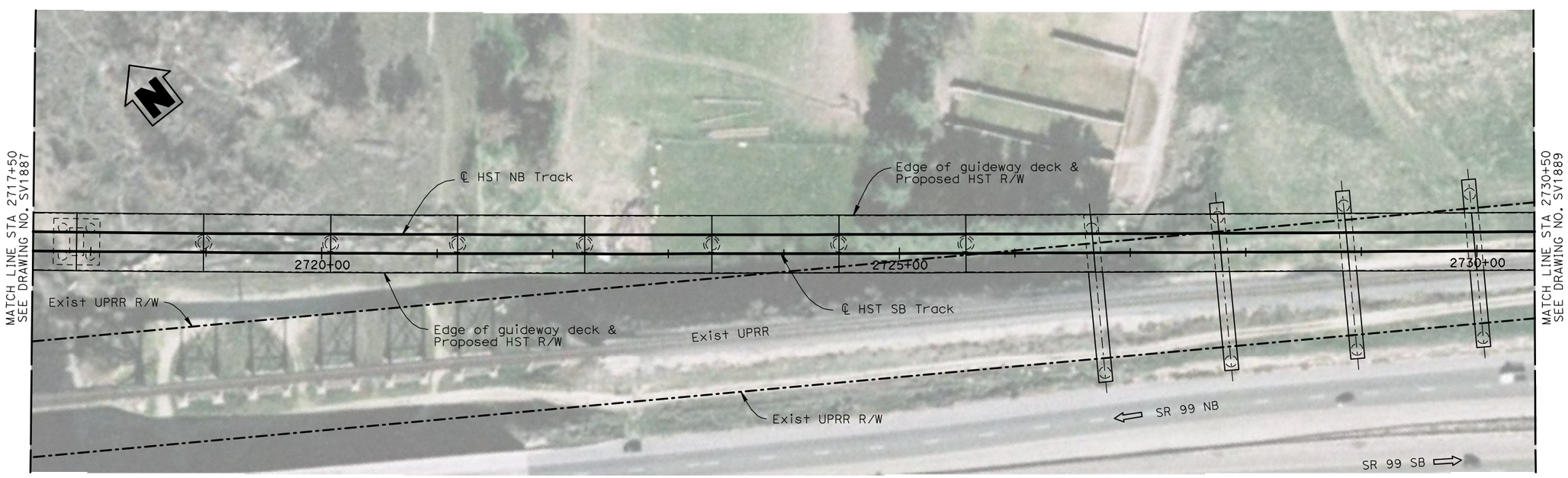


DEVELOPED ELEVATION

1" = 50'



PLAN

1" = 50'

NOTES:

1. For General Notes, see Drawing No. SB0201.
2. For Section A-A, see Drawing No. SV3001.
3. For Section S-S, see Drawing No. SV3006.
4. For Section AC-AC, see Drawing No. SV3102.

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AVENUE 24
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STA 2717+50 TO STA 2730+50

CONTRACT NO. HSR06-007
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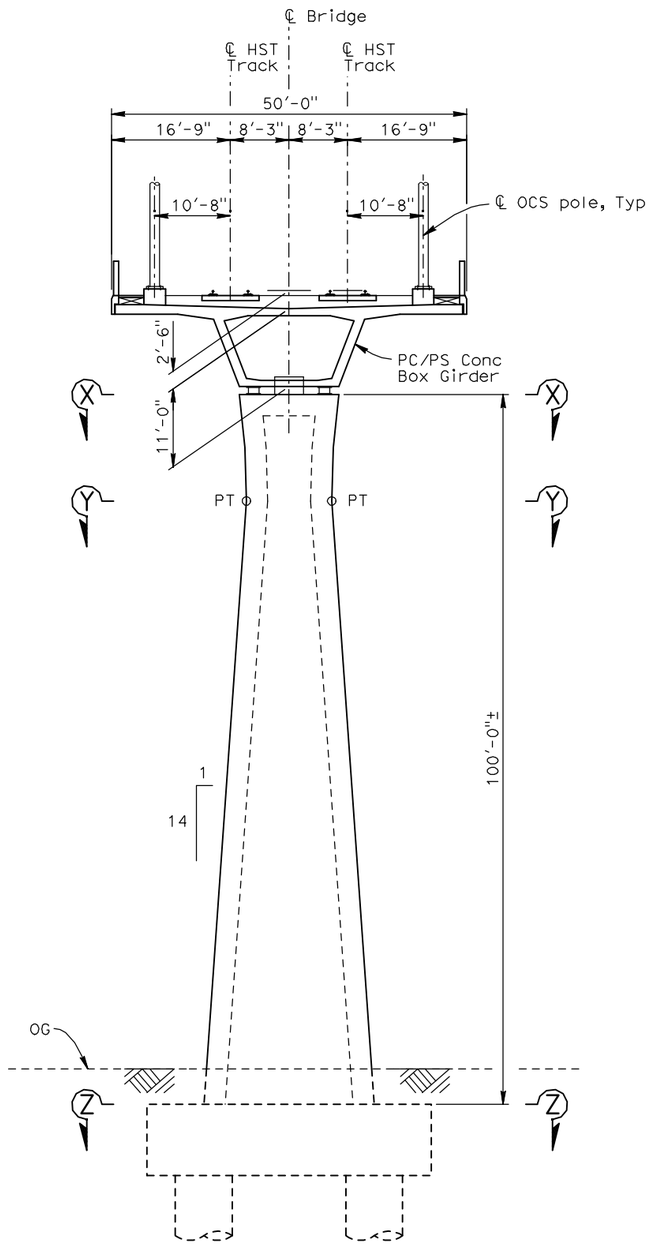
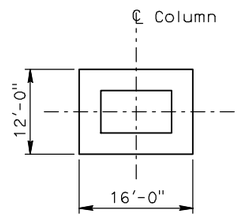


TYPICAL SECTION S

FOR DOUBLE TRACK PC/PS CONCRETE BOX GIRDER

3/32" = 1'-0"



SECTION X-X

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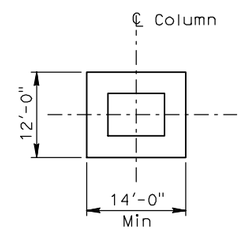
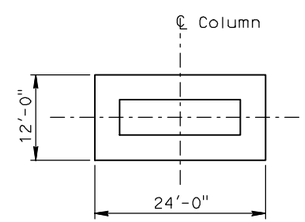


SECTION Y-Y

3/32" = 1'-0"



SECTION Z-Z

3/32" = 1'-0"

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CALIFORNIA HIGH-SPEED RAIL AUTHORITY

CALIFORNIA HIGH-SPEED TRAIN PROJECT
MERCED TO FRESNO
ALIGNMENTS
AVENUE 21 AND 24
TYPICAL SECTIONS
SHEET 6

CONTRACT NO. HSR06-007
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