Caltrans Responses to ECRB Questions Part 2 – August 29, 2025

1. Confirm that Caltrans is defining the bridge as Ordinary Non-Standard, which is why there is no Project Specific Seismic Design Criteria for this bridge, per response to comment i.

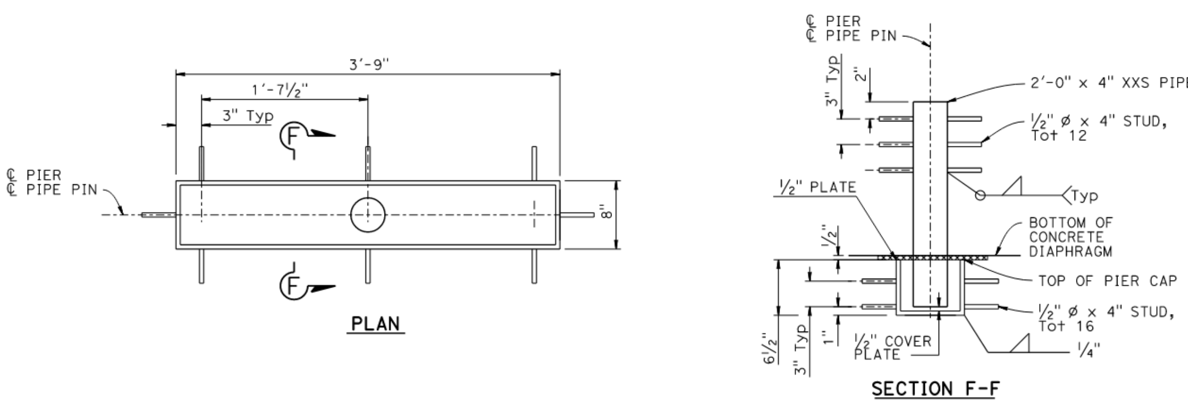
Yes, the bridge has been type selected as Ordinary Non-Standard.

2. Do we understand correctly that the positive attachment of the bridge deck to the abutments and pile caps consists entirely of the pin connections, which are sacrificial elements that will break under seismic loads that are less than the design level loads. After the pin connections break the bridge deck would be free to slide around on top of the pile caps for the duration of the earthquake and during aftershocks.

    a. If this is not correct, please describe what the positive attachment is that prevents the deck from sliding off the abutments and pile caps after the pin connections break.

    b. If this is correct, then the design would seem to rely on the pile caps being wide enough that there is plenty of room for the pier deck to slide around in all directions without losing bearing capacity from the supports below. This would be an unusual seismic design strategy for most structures and, if it is the intended approach here, there should be a well-established criteria for determining the sliding displacement that must be accommodated in all directions, and possibly other requirements as well. We have reviewed the Caltrans Seismic Design Criteria 2.0 document and we are unable to find any mention of this as an acceptable seismic design strategy or any established criteria for deploying it. Please point out where in the Caltrans Seismic Design Criteria 2.0 document this strategy is discussed and where the appropriate criteria is defined. In the sketch provided with the draft responses to ECRB comments it appears that there is a total bearing width of 66 inches at the abutment in the longitudinal direction prior to any earthquake loading. Per the draft responses to ECRB comments, "ongoing seismic analysis shows longitudinal displacement demands are up to 52 in." It remains unclear if the calculation of 52 inches recognizes that the fuses have broken at service level loads and the deck is sliding free for the duration of the earthquake, which could result in significantly larger displacements. It remains unclear if additional displacements due to torsional rotation of the deck, aftershocks, or other causes have been adequately considered and whether the remaining 14 inches of bearing support, beyond the 52 inch displacement is adequate. If this is the intended strategy, please provide an established criteria that supports the approach of allowing the deck to slide freely without positive attachment anywhere, defines the appropriate criteria for managing sliding displacements, and demonstrate how that criteria will be met.

There is a secondary system in place to handle longitudinal movement as well as any movements beyond the fault rupture displacement. The detail below shows the pipe pin assembly which allows for engagement of the pier caps in the longitudinal direction under all loading cases (service, seismic etc.), in this direction the assembly acts as a typical pipe pin which has been utilized on many Caltrans projects. In the Transverse direction the fault rupture design displacement will be allowed to occur, the gap inside of the assembly was designed based on this displacement, any unanticipated displacement beyond the fault rupture will be restrained by this pinned connection. Additional seat width in the transverse direction has also been provided at the Pier Caps and Abutment to prevent unseating.

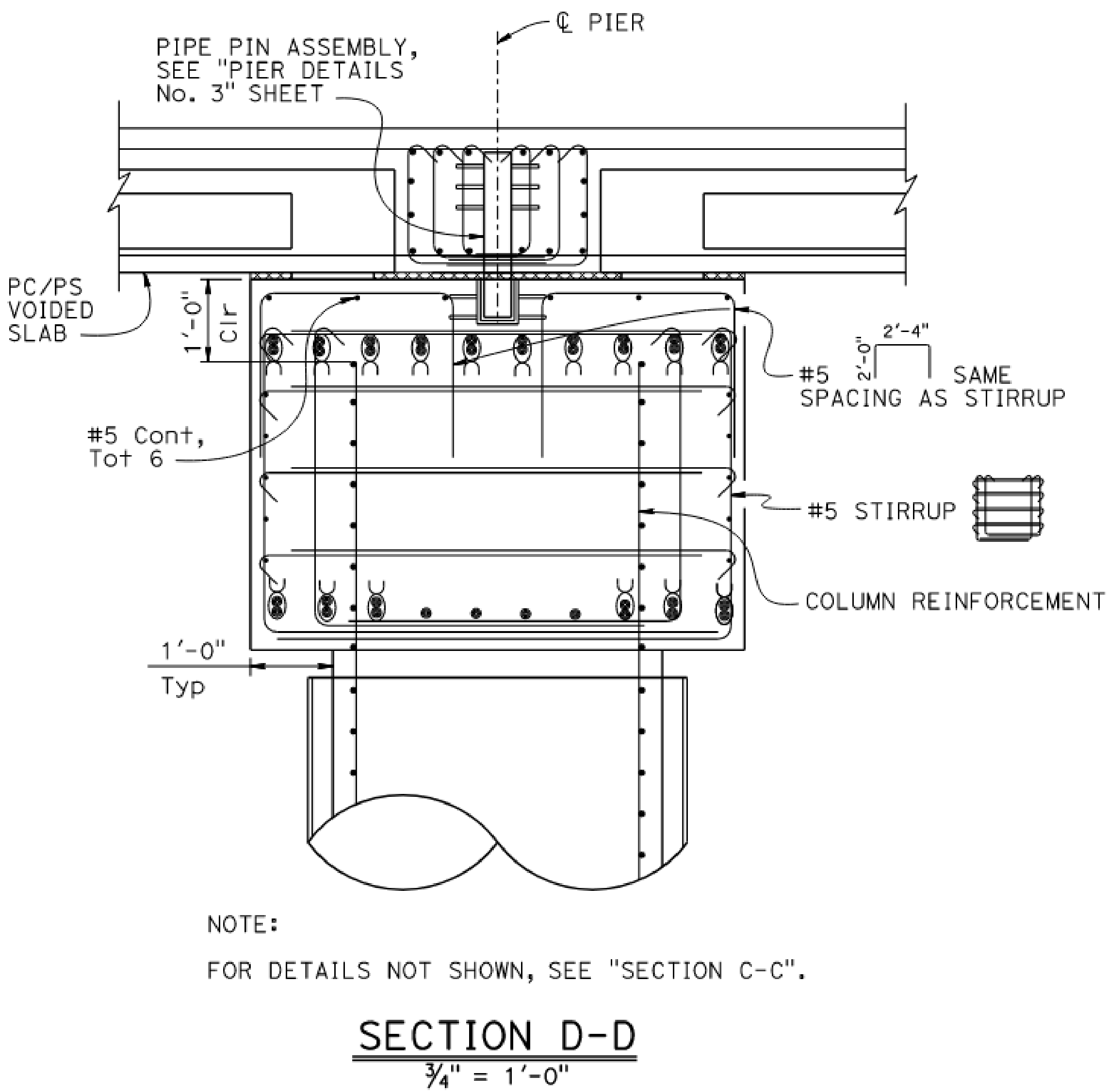


NOTES:

1. Use 10 Pipe Pin Assemblies per pier spaced along each pier cap as shown.
2. Use E70XX Weld.
3. Use 50 ksi Steel.
4. Allow partial penetration with welded connection.

PIPE PIN ASSEMBLY DETAILS

1½" = 1'-0"



3. Caltrans provides the saturated surface dry unit weight of lightweight aggregate, but the earth pressures this material exerts may be a function of the saturated unit weight.

    a. Please provide the saturated unit weight of the lightweight aggregate.

    The lightweight aggregate is highly permeable and free draining as shown in the stipulated particle size gradation. The lightweight aggregate backfill may be temporarily soaked by heavy rain. But lightweight aggregate is very difficult to be saturated except when it submerged. Besides, the water will drain within a few hours at most. The reason for using lightweight backfill for this project is to address long-term settlement caused by time-rated consolidation of underlying clay layers that sustain constant load over several decades. The transient weight of additional water in the lightweight aggregate backfill will not affect the performance of the backfill on this issue.

4. The document "EPS 96-1_02S_N11-18-22__2022.pdf" does not include the material unit weight. It will presumably between 1 and 2 pcf, but this should be stated somewhere.
   a. Please provide the unit weight of the proposed EPS. An updated revision of SSP (to be published in October 2025) including the unit weight of EPS is attached.

5. CLIQ output looks good. However, Caltrans summarily state there is no liquefaction, which is not quite true. A number of CPTs show liquefaction below about 50 feet: these should be discussed, but can probably be dismissed as being deep and so the deposits are old and likely don't present significant liquefaction hazard. The liquefied soils below about 50 feet are isolated lens and are overlain by more than 50 feet of non-liquefied soils, which prevents surface manifestation of liquefaction.
   a. However, CPT-23-003 has about 4 feet that CLIQ identifies as liquefiable in the upper 15 feet, with nearly 1.5 inches of liquefaction-induced settlement. The bottom elevation of the liquefaction soil encountered in CPT-23-003 (near Pier 2) is approximately 0 feet. The channel will be excavated down to elevation 0 feet during construction and to -8.3 feet in the future. Any soil resistance above elevation -8.3 feet is ignored in CIDH pile capacity calculation. The liquefaction in the upper 15 feet of soil does not affect the design of the bridge foundations.
   b. The significance of the CLIQ-identified liquefaction potential in the upper 15 feet of CPT-23-003 should be discussed in greater detail. Refer to response to 5.a.
   c. Please clarify whether CPT-<u>23</u>-003 in the CLIQ report is the same as CPT-<u>22</u>-003 in the presentation slides from the previous meeting. CPT-22-003 was numbered when we were planning the field investigation in 2022 and was advanced in 2023. There is only one CPT.

6. Soil parameters used in the LPILE analysis were provided in Appx IV. We did not see any presentation of soil parameters used for the axial capacity (using SHAFT).
    a. Please indicate what soil parameters were input in the SHAFT analyses. Same soil parameters were used for SHAFT input.
7. We requested "design criteria and results (if available) for a slope stability evaluation on slopes adjacent to the bridge and its landings." What was provided was just the generic Caltrans manual for embankments.
    a. Please provide some discussion of stability of slopes around the project. These are mainly underwater. If no analyses are considered necessary, please provide a discussion justifying this decision. Embankments include slopes in the Caltrans highway system. The submitted Caltrans Geotechnical Manual, Section 3.3, provides design criteria for embankment or slope stability assessment. The embankments by the Tolay Creek Bridge will be restrained by retaining walls 3, 4, 5 and 6 extending up to approximately 45 feet to the west and 870 feet to the east. The retaining walls will be supported on piles extending into stiff to hard soils below bay mud. Lightweight backfill materials will be placed behind the walls. The vertical and lateral loads will be incorporated into design of retaining walls and piles.
8. Item 2, a)
    Please elaborate on how vertical fault rupture is proposed to be accommodated. The vertical offset is understood to be approximately 11 inches. Over what span is this offset likely to occur? If the offset occurs between (say) adjacent pile bents, how will the continuous superstructure deck be designed and detailed to accommodate the forces imposed by this vertical movement at, presumably, one or more, pile bents?
    The fault offset can occur between any adjacent spans. The superstructure has been designed to handle the vertical offset between any adjacent spans. In the vertical offset scenario, the superstructure will form a plastic hinge. This means the superstructure will sustain damage, however there is significant reserve ductility capacity in the hinge before it reaches ultimate capacity (rotational capacity). This is similar to the design of the pier columns and other seismic critical elements for seismic demands.

    Also, there was no response provided regarding the design of barriers/guardrails to accommodate the fault movements.
    There are no design requirements for barriers to accommodate fault movements.

9. Item 2, j)
   Please confirm that the bridge is not required to support any utility lines or other critical infrastructure.
   There are no utilities on the bridge.

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96-1.02S Expanded Polystyrene Geofoam Block

EPS geofoam blocks must consist entirely of expanded polystyrene. EPS geofoam blocks must comply with ASTM D6817, D7180, and the requirements shown in the following table:

EPS Geofoam Block

Quality characteristic	Test Method	Requirement					
		EPS15	EPS19	EPS22	EPS29	EPS39	EPS46
Density (min, pcf)	ASTM D1622	0.90	1.15	1.35	1.80	2.40	2.85
Compressive resistance at 1 % strain (min, psi)	ASTM D1621	3.6	5.8	7.3	10.9	15.0	18.6
Flexural strength (min, psi)	ASTM C203	25	30	35	50	60	75
Oxygen index (min, volume %)	ASTM D2863	24					

After an EPS geofoam block is released from the mold, the EPS geofoam block must be seasoned for at least 72 hours at normal ambient room temperature and inside a building that protects the EPS geofoam block from moisture and ultraviolet (UV) radiation. EPS geofoam blocks must be separated during seasoning to allow positive air circulation and venting to foster outgassing of blowing agent and trapped condensate from within the EPS geofoam blocks.

EPS geofoam block must meet the following dimensional tolerances:

1. Deviation of dimensions of each EPS geofoam block from the theoretical dimensions must be less than 0.5 percent.
2. Deviation of any face of the block from a theoretical perpendicular plane must be less than 0.5 percent.
3. Corner or edge formed by any two faces of an EPS geofoam block must form an angle of 90 degrees.
4. Planarity deviation of any EPS geofoam block surface must be less than 0.2 inch over 10 feet.

EPS geofoam block must be labeled on three sides with the manufacturer’s name, product type, dimensions, weight, density as measured after seasoning and trimming, resin source, lot number, and date of manufacture.

EPS geofoam block must be marked to identify the location and direction of placement as shown in the shop drawings.

96-1.02T–96-1.02Y Reserved