

3.10 GEOLOGY/SOIL/SEISMIC/TOPOGRAPHY

1. It was not demonstrated that the cited seismic/geology design, build and operational standards for the Tunnel Alternative are appropriate.

In Section 3.10.4, the Draft EIR/EIS claims that all Build Alternatives will be designed, constructed and operated in accordance with a list of standards; however, it is not clear that these standards are adequate for the Tunnel Alternative. The proposed SR-710 tunnels will be the longest, contiguous, passenger vehicle tunnels built in the United States and have unique challenges including very difficult geological and seismic conditions. It's unlikely that the standards cited were written with such tunnels in mind. While tunnels with similar features have been built elsewhere in the world, international tunnel standards were not cited and do not appear to have informed the Draft EIR/EIS.

The adequacy of the cited U.S. standards were not discussed and it appears that the Draft EIR/EIS approach for construction and safety is to meet very minimal requirements, rather than to maximize public safety.

2. For the LRT and Freeway Tunnel Alternatives, the Draft EIR/EIS fails to establish either environmental impacts or significance criteria for ground settlement cause by tunnel boring.

For the LRT Alternative, the Draft EIR/EIS Section 3.10.3.1 Temporary Impacts, states

“The proposed excavation would result in the potential for ground settlement and differential settlement immediately above and adjacent to the bored tunnel portion, and the portal and station excavations of the LRT Alternative; however, tunneling equipment and procedures as well as portal and station support methods are capable of controlling ground movements to limit surface settlements and in turn minimize damage to existing structures.” (p. 3.10-11)

An identical statement is made for the Freeway Tunnel Alternative on p. 3.10-12.

These statements are not reassuring. An analysis of ground settlement could not be found in the report. If performed, it was not released to the general public. Reference is given to future geotechnical reports that are not planned until after the final alternative is selected.

Ground settlement is a known issue related to tunnel boring and can cause damage to roads, buildings and structures above the tunneling activity, contiguous to it, and for some distance on either side Yet the Draft EIR/EIS mostly dismisses this environmental impact, suggesting that ground settlement can be ‘limited’ by using proper tunneling equipment, procedures and support methods. Furthermore, the report fails to address thresholds for significance for ground settlement; consequently, a meaningful environmental impact assessment was not performed. This is in violation of NEPA and CEQA. Failure to provide this important information to the public, stakeholders and decision-makers also threatens the integrity of the EIR/EIS process.

This technical issue is especially important given that the tunnel alignment passes directly under the following:

- The LRT Gold Line in South Pasadena,
- The Union Pacific Railroad tracks in El Sereno,
- The historic Arroyo Seco Parkway (originally part of the U.S. Route 66, it is designated a State Scenic Highway, National Civil Engineering Landmark, and National Scenic Byway. It was listed in the National Register of Historic Places in 2011),
- Historic districts, neighborhoods and buildings, and
- South Pasadena's business district.

3. For the LRT and Freeway Tunnel Alternatives, key geological/seismic designs, investigations and analyses have been inappropriately deferred until after the Final EIR/EIS.

As described in Section 3.10.4, the following geological/seismic designs, investigations and analyses have been deferred until after the final project is selected:

- “geologic and geotechnical investigations”,
- “design recommendations for geology-related constraints such as settlement, collapse potential, expansion, landslides, erosion, and naturally occurring gas”,
- identification of “construction methods required to overcome the geologic challenges”,
- development of a fault crossing design that “will be evaluated to be able to accommodate the expected fault offset, maintaining the structural integrity of the tunnel lining and preventing the intrusion of surrounding groundwater into the tunnel”,
- a “site-specific hazard assessment and fault characterization evaluation”, and
- “condition surveys for structures along the tunnel alignment.”

Deferral of these items is not acceptable because they are required to demonstrate tunnel feasibility and safety, to perform environmental impact assessments, and to convey risk to the public, stakeholders and decision makers. This is in violation of both NEPA and CEQA.

4. Seismic design criteria have not been established.

The Geotechnical Report Appendix E, p. 15, states “No Caltrans seismic design criteria for tunnels are currently available.” In the absence of such requirements, the report used the Caltrans seismic design criteria for ‘an Ordinary Nonstandard facility.’ No explanation was given as to why this criterion was adequate. Without firm design criteria, the tunnel designs are notional and cannot be claimed to be safe. Furthermore, claims of ‘no significant impact’ cannot be validated or mitigations identified.

5. Seismic modeling performed to date is inadequate to determine the feasibility and safety of the Freeway Tunnel Alternative, and meaningful modeling has been deferred until after the Final EIR/EIS.

As stated in the Geotechnical Report, Appendix F, p. 2, ground motion models

“were developed based on the subsurface conditions interpreted from the limited geotechnical field investigations conducted by CH2M HILL during the current study and the SR 710 Tunnel Technical Study.” (*underline added for emphasis*)

Of course, model accuracy is limited by the quality of data that goes into the models. In the Geotechnical Report, Appendix F, pp. 17-19, it is disclosed that there are significant uncertainties in the relevant fault data used. For example, fault locations, widths and activity are often unknown. Geological conditions are uncertain. Moreover, for the Raymond fault, which is claimed to be the “primary seismic hazard to the Freeway Tunnel Alternative”, it is stated “published data and opinions on the Raymond fault span almost a full order of magnitude on all of the important kinematic values.” While the discussion offers many solutions to achieve the minimum information required, there is no indication that these solutions have been pursued. In fact, it is stated that seismic models will only be

“updated in the future once a decision is made on the final Alternative for development”.

This is not acceptable. A meaningful seismic assessment is required to determine tunnel feasibility and safety. This assessment needs to be performed before a final decision is made to implement the tunnels.

Moreover, seismic modeling performed to date is limited in scope and does not appear to be conservative. First, models appear to have only considered single fault displacements. Cumulative fault displacements and cascading seismic event scenarios, which would result in larger displacements, have not been modeled (Geological Report, Appendix E, p. 11). This is important given that the Study Area lies within the LA basin, which has numerous faults and is seismically very active. Second, two methodologies (Wells and Coppersmith, and Wesnousky) were presented for estimating displacements as a function of fault length, but the less conservative values were chosen without adequate explanation (Geological Report, Appendix E, pp. 8-11). Third, the worst case spectral acceleration value criteria were not adequately explained (a 2013 Caltrans memo was cited, but was not made available). Spectral values may not be conservative given the possible large risk to human life (e.g. a probabilistic spectral value for a 5 percent chance of being exceeded in 50 years) (Geological Report, Appendix F, pp. 8).

6. There is no evidence that geological/seismic lessons learned from historic tunnel seismic events were adequately considered or incorporated into tunnel designs.

The proposed SR-710 tunnels will be the longest, contiguous, passenger vehicle tunnels built in the United States and have unique challenges including extremely difficult geological and seismic conditions. Consequently, it is incumbent on tunnel designers to research historic tunnel seismic events and incorporate lessons learned early in the design phase. While a few completed tunnel projects are mentioned in the Draft EIR/EIS, there is no evidence that lessons learned were considered for these or other tunnel projects that were built either in the United States or internationally. Design options for mitigating seismic event impacts that might have resulted from such a study, were not discussed.