8-4.10 GEOTECHNICAL CONSIDERATIONS

8-4.10.1 Setting

8-4.10.1.1 Topography

The San Fernando Valley is a broad, flat, elliptically shaped alluvial valley between mountain ranges of the Transverse Ranges geomorphic province. The bounding mountain ranges include the Santa Monica Mountains on the south, the Santa Susana and San Gabriel Mountains on the north, the Simi Hills on the west, and the Verdugo Mountains on the east. A topographic map of the San Fernando Valley is shown in Figure 4-51 of the Final EIR. The San Fernando Valley slopes gently to the east with an average gradient of less than 1 percent. Existing ground surface elevations range from about 1,000 feet above mean sea level near the northern end of San Fernando Road to about 600 feet above mean sea level near Warner Center.

8-4.10.1.2 Geologic Setting

The San Fernando Valley lies within the Transverse Ranges geomorphic province, a region of east-west trending mountain ranges that formed as a result of compressive stress at a restraining bend in the San Andreas Fault. These mountain ranges continue to rise through folding and faulting of rocks being compressed between the North American and Pacific tectonic plates. As the mountains rise, landslides and erosion break down the rocks and transport the resulting sediment, or alluvium, to the San Fernando Valley. Over time, hundreds of meters of alluvium have been deposited in the San Fernando Valley. The continuing processes of folding and faulting result in frequent earthquakes in the region.

Bedrock exposed in the mountain ranges is composed of Precambrian (greater than 570 million years old) to Tertiary (66 to 1.6 million years old) crystalline basement rocks and Tertiary and Quaternary (1.6 million to 11,000 years old) sedimentary and volcanic rocks. The wide range in composition of bordering bedrock materials results in a similarly wide range in composition and grain size of the alluvial sediments in the San Fernando Valley. A geologic map of the San Fernando Valley is shown in Figure 4-52 of the Final EIR.

Based on information provided in the Safety Element of the City of Los Angeles General Plan,[1] the Pacoima Oil Field is located south of the Interstate 5 and State Route 118 intersection. Additional oil fields are located west of the Los Angeles Reservoir, west of Interstate 5 and north of State Route 118.

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[1] / *Safety Element of the Los Angeles City General Plan*, Exhibit E, “Oil Field and Oil Drilling Areas,” Department of City Planning, Los Angeles, California, adopted November 26, 1996.

8-4.10.1.3 Soils

Alluvial fan deposits ranging from Holocene (less than 11,000 years old) to upper Pleistocene (between 11,000 and 125-130,000 years old) ages cover the San Fernando Valley. A study prepared by Tinsley et al. (1985)[2] describes the general surficial geology of the San Fernando Valley, and the following discussion is derived from this report. Alluvial deposits in the eastern half of the San Fernando Valley consist primarily of relatively coarse sediments such as cobbles, gravel, and sand. These deposits are highly permeable and can contain groundwater at depths shallower than 50 feet subsurface; as a result, these deposits are subject to liquefaction. Alluvial deposits in the western half of the San Fernando Valley are composed of a large proportion of relatively fine-grained sediments such as silt and clay, and these fine-grained sediments are less permeable and correspondingly less liquefiable. However, distributed irregularly within these fine-grained deposits are coarse-grained buried stream channels, which are highly permeable and subject to liquefaction. Perched water frequently occurs within these stream channel deposits. In general, the alluvial deposits in the San Fernando Valley are laterally and vertically non-uniform in terms of grain size, sorting, and composition.

8-4.10.1.4 Seismicity

a. History

After the highly destructive San Fernando earthquake of 1971, California passed the Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) of 1972 to prevent the location of structures designed for human occupancy across the traces of active faults. For additional discussion of the Alquist-Priolo Act and San Fernando Valley area seismicity, reference Section 4-10.1.4(a) of the Final EIR, including Figure 4-54, which depicts the locations of faults, and Table 4-53, which lists details regarding the faults mapped in Figure 4-54.

b. Surface Rupture Hazard

As delineated on the Alquist-Priolo Earthquake Fault Zoning Map for the San Fernando Quadrangle,[3] the active San Fernando Fault crosses near the Sylmar/San Fernando Metrolink Station on San Fernando Road, a proposed stop for the RB-Network Alternative in the northernmost portion of the study area. During the 1971 San Fernando earthquake, surface faulting occurred on this delineated fault zone. No other identified Alquist-Priolo Earthquake Fault Zones cross the study area. However, in the southeast portion of the San Fernando Valley is an unnamed fault mapped by Weber et al. (1980), and a hypothetical extension of this fault extends across Chandler Boulevard between Laurel Canyon Boulevard and Lankershim Boulevard. This hypothetical extension crosses: the Metro ROW where the BRT alignment is located, the proposed Chandler Boulevard bus route of the RB-5 Alternative, and possibly the

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[2] / Tinsley, J.C., T.L. Youd, D.M. Perkins, and A.T.F. Chen. "Evaluating Liquefaction Potential," In Joseph I. Zioney, ed. *Evaluating Earthquake Hazards in the Los Angeles Region – An Earth Science Perspective*. U.S. Geological Survey, Professional Paper 1360, 263-315 (1985).

[3] / Official Map of Alquist-Priolo Earthquake Fault Zones, San Fernando Quadrangle (1979), California Division of Mines and Geology CD-ROM 2000-003 (2000).

easternmost portions of routes for the RB-3 and RB-Network alternatives. Figure 4-54 of the Final EIR illustrates the location of the unnamed fault relative to the BRT alignment and the southeastern portion of the Valley.

c. Ground Shaking Hazards

The Alquist-Priolo Earthquake Fault Zone Maps only address the hazard of surface fault rupture and are not directed toward hazards that may result from seismic ground shaking. Seismic activity on other faults in the Southern California area could generate substantial ground shaking. Reference Figure 4-55 of the Final EIR for an illustration of the peak accelerations that could occur as a result of earthquakes on nearby faults. Furthermore, landslides are not a significant hazard because the topography in the San Fernando Valley is generally level.

Ground shaking in areas underlain by unconsolidated alluvium may cause soil liquefaction. Areas containing very young (late Holocene) stream channel deposits where the water table lies close to (within 10 feet of) the surface may have very high susceptibility to liquefaction. Shallow groundwater tends to occur in areas along the Los Angeles River and near reservoirs, recharge facilities, and flood control basins. Thus, the greatest liquefaction susceptibility tends to be in the southern and southwestern portions of the San Fernando Valley (near the Los Angeles River) and in areas around water facilities, such as the Los Angeles Reservoir.[4] Inundation of the Sepulveda Flood Control Basin could also saturate the soil and increase the soil liquefaction hazard between Encino Avenue and Interstate 405.

d. Hazardous Materials

There is no potential to encounter hazardous waste in the soil along any of the RB routes in the study area because no major construction would occur. The RB stop areas would undergo minor construction activities to install the support poles, canopies, benches, and kiosks within the public sidewalk area. In addition, loop detectors would be installed in the streets before major intersections.

8-4.10.2 Impact Analysis Methodology and Criteria

Potential impacts associated with geotechnical considerations have been identified by reviewing the Safety Element of the General Plan for the City of Los Angeles, Alquist-Priolo Earthquake Fault Zone Maps, publications by the California Department of Conservation, the United States Geological Survey, and available geotechnical and environmental reports.

The criteria for determining the presence of significant geotechnical impacts as a consequence of the RB alternatives are as follows:

- Disruption of a unique geologic feature of unusual scientific value or landform alteration;

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[4] / Tinsley, J.C., T.L. Youd, D.M. Perkins, and A.T.F. Chen. "Evaluating Liquefaction Potential," In Joseph I. Zioney, ed. *Evaluating Earthquake Hazards in the Los Angeles Region – An Earth Science Perspective*. U.S. Geological Survey, Professional Paper 1360, 263-315 (1985).

- Loss of the availability of mineral resources that would be of future value;
- Exposure of people or property to geologic hazards (including surface fault rupture, landslides or mudflows, subsidence, or other types of ground failure);
- Exposure of people or property to seismic hazards (such as ground shaking, liquefaction, lateral spreading, and seismic settlement);
- Increases in wind or water erosion and changes in topography or ground surfaces;
- Exposure of people or property to existing soil or groundwater contamination; and
- Accumulation of hazardous gases.

8-4.10.3 Geotechnical Impacts

Implementing the Three East-West Rapid Bus Routes Alternative (RB-3), the Five East-West Rapid Bus Routes Alternative (RB-5), or the Rapid Bus Network Alternative (RB-Network) would only require minor construction to install RB stop shelters, seating, signal progression equipment, and signs. The buses for each RB alternative would run on existing urban streets in the Valley. Since hardly any soil would be disturbed by construction, none of the three alternatives would result in a landform alteration or in a loss of mineral resources. Furthermore, because the San Fernando Valley study area is nearly level, erosion and changes in topography would not occur.

8-4.10.3.1 Surface Fault Rupture

The RB-Network Alternative and possibly the RB-3 and RB-5 alternatives, as well, are thought to cross the trace of an active fault. However, under CEQA, if a proposed project (or alternative) does not propose “developments and structures for human occupancy across the trace of active faults,”[5] then the project would not result in a significant risk from surface fault rupture. The RB alternatives would construct RB stops, but these stops would not include structures that constitute what is normally defined as a “structure for human occupancy” (see Section 2621.6.of the Alquist-Priolo Earthquake Fault Zoning Act). Therefore, although the RB alternatives are thought to cross the traces of active faults, the RB alternatives would not expose people or structures to substantial risk from rupture of a known earthquake fault. Rather, the RB alternatives would present the same level of risk as do the existing land uses.

8-4.10.3.2 Subsidence, Settlement, and Liquefaction

Subsidence of the ground surface can typically result from several causes, including extraction of petroleum, gas, and groundwater, and from ongoing tectonic activity. According to a study by Weber et al. (1980), there is documented subsidence east of Tujunga Avenue, in the eastern portion of the San Fernando Valley. This subsidence is attributed to either groundwater withdrawal or to ongoing tectonic downwarping of the San Fernando Valley. However, the subsidence has occurred over a very broad area and there has been no reported damage to surface

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[5] Alquist-Priolo Earthquake Fault Zoning Act, Section 2621.5.

structures as a result. While subsidence due to groundwater extraction may have occurred in the past, it is no longer a threat because groundwater withdrawal in the San Fernando Valley is now regulated to prevent substantial changes in groundwater levels over time.

Seismic settlement may occur when poorly compacted granular soils are densified during ground shaking. Because the subsurface soil composition within the San Fernando Valley is laterally non-uniform, the degree of seismic settlement would also be laterally non-uniform and could cause structural damage. However, the RB-3, RB-5, and RB-Network alternatives would only install minor structures, as discussed above. Since only minor structures would be built, the RB alternatives would result in a less-than-significant risk from seismic settlement.

Liquefaction potential is greatest in unconsolidated alluvial deposits where the water table is close to the ground surface. In the San Fernando Valley, the greatest liquefaction susceptibility tends to be in the southern and southwestern areas (near the Los Angeles River) and in areas around water facilities, such as the Los Angeles Reservoir.[6] Inundation of the Sepulveda Flood Control Basin could also saturate the soil and increase the soil liquefaction hazard between Encino Avenue and Interstate 405. However, the RB-3, RB-5, and RB-Network alternatives would only install minor structures, as discussed above. Since only minor structures would be built, the RB alternatives would result in a less-than-significant risk from liquefaction.

8-4.10.3.3 Exposure to Contaminated Soils

Because the RB stop areas would undergo only very minor construction activities to install canopies, benches, and signage within the public sidewalk area, hardly any soil would be exposed or moved by construction of the RB alternatives. Thus, the RB alternatives would generate a less-than-significant risk to persons from exposure to contaminated soils.

8-4.10.4 Mitigation Measures

Since the geotechnical impacts of the RB alternatives are less than significant, no mitigation measures are proposed.

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[6]/ Ibid.