5.7 GEOLOGY AND SEISMICITY

This section assesses the geologic effects of the No Build, BEP, and SVRTP alternatives. Areas along the SVRTC where the proposed alternatives could be affected by potential geologic hazards are identified and evaluated.

5.7.1 INTRODUCTION

Several impact thresholds for geology and seismicity were considered based on the Alquist-Priolo Fault Zoning Act, the California Seismic Hazards Mapping Act, and the California Building Code. The project would have adverse effects if it would:

- Expose people or structures to potential substantial adverse effects; including the risk of loss, injury, or death involving: rupture of a known earthquake fault; strong seismic ground shaking; seismic-related ground failure (including liquefaction); landslide, lateral spreading, subsidence, and collapse as a result of underlying unstable geologic units; or expansive soil.

5.7.2 METHODOLOGY

The geology and seismicity analysis for the No Build, BEP, and SVRTP alternatives focuses on two primary factors: ground shaking and liquefaction. The alternatives are evaluated against geologic and seismic conditions for the entire length of the SVRTC.

5.7.3 IMPACT DISCUSSION

No Build Alternative

The No Build Alternative consists of the existing transit and roadway networks and planned and programmed improvements in the SVRTC (see Section 2.6, Related Projects, for a list of these projects). The No Build Alternative projects would likely result in geologic and seismic effects typically associated with transit vehicles and facilities and roadway projects. Structures associated with the projects would be designed in accordance with current seismic design standards as found in the California Uniform Building Code (CUBC). Additionally, it could be anticipated that engineering studies would be performed to identify the appropriate design measures needed for the geologic and seismic conditions of any project sites. Projects planned under the No Build Alternative would undergo separate environmental review to determine geologic effects.

BEP and SVRTP Alternatives

Surface Fault Rupture

There are no known active faults crossing the SVRTC and it is not located within an Earthquake Fault Zone as defined and mapped under the Alquist-Priolo Earthquake Fault Zoning Act. Therefore, the potential for ground rupture due to faulting is considered very low. The closest distance to a mapped active fault trace is the BEP and SVRTP alternatives south end of the Hayward Fault at approximately 1.3 kilometers (less than 1 mile) from the Warm Springs Station in Fremont. Therefore, the potential for ground rupture due to faulting is considered very low and no mitigation would be required.

Ground Shaking

The three active faults in the SVRTC with the greatest potential for ground shaking are the San Andreas, Hayward, and Calaveras faults. Other faults in the region may also produce significant ground shaking. Therefore, the potential for strong ground shaking is considered moderate to high. The proximity of these faults and other nearby active faults, which are capable of generating large magnitude earthquakes, means that strong ground shaking would expose any structures and proposed alignments to strong seismic ground shaking. Structures could be damaged or destroyed and people could be harmed during a major seismic event.

If the Bank of America building is selected as the station entrance option for the Downtown San Jose Station, the building would be required to be seismically retrofitted to current applicable building codes consistent with Secretary of Interior standards. Refer to the Section 5.4, Cultural and Historical Resources, for adverse effects to this historic resource related to seismic retrofitting.

All structures associated with the BEP and SVRTP alternatives would be designed in accordance with current seismic design standards as found in the CUBC, as well as the BART Facilities Standards, Release 1.2 (May 2004). The ground motion criteria to be used for seismic design of the BART trackway structures—including tunnels, underground and aboveground passenger stations, bridges, retaining walls, cut-and-cover, and U-wall subway structures—would be in accordance with SVRT Tunnel Segment Report on Seismic Ground Motions (HMM/Bechtel, 2005). These measures would minimize the potential exposure of people to harm from geologic or seismic hazards to a negligible level.

Liquefaction

The BEP Alternative falls partially or completely within liquefaction hazard areas on three Seismic Hazard Zone maps (Milpitas Seismic Hazard Quadrangle, October 2004; San Jose East Quadrangle, January 2001; and San Jose West Quadrangle, February 2002.). As these maps are based on a broad characterization of soil conditions, site-specific liquefaction studies were conducted along the alignment to account for local soil

variations. The results indicated that portions of the BEP Alternative are susceptible to liquefaction. In locations susceptible to liquefaction, the primary hazards are seismic induced settlement and temporary increase in lateral earth pressures on below-grade structures.

The BART Facilities Standards limit total settlements for trackway structure foundations to 1 inch or less; thus, there would be a need to reduce the liquefaction-related settlement hazard along some portions of the BART alignment. Methods used on recent BART projects include in-situ treatment/densification with vibro-replacement stone columns; load transfer to underlying bearing layers, which are non-liquefiable with soil/cement columns; and the overexcavation method via removal and replacement with compacted engineered fill. Methods considered to eliminate or minimize the effects of seismic liquefaction include, but are not limited to, in-situ densification with stone columns, dynamic compaction, vibro-compaction, surcharging, and/or compaction grouting. The exact methodology(ies) to be used will be determined during final engineering. These design requirements would reduce the potential exposure of people to hazard from seismic risk associated with liquefaction. Therefore, no mitigation is required.

Earthquake Induced Landslides

The SVRTC is located on nearly flat terrain, and is not identified on any California Geological Survey Seismic Hazard Zone maps as being potentially susceptible to earthquake-induced landslides. Therefore, this potential hazard is considered very low and no mitigation would be necessary.

5.7.4 CUMULATIVE IMPACTS

Cumulative impacts are defined as two or more individual effects which, when considered together, are considerable. They may result from individually minor but collectively significant projects taking place over a period of time. With implementation of design requirements such as the California Building Code and BART Facilities Standards, the BEP and SVRTP alternatives would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, due to geologic or seismic hazards. Furthermore, performance of BART facilities during previous earthquakes demonstrates that the design criteria that would be used for the proposed BEP and SVRTP alternatives are highly effective. Therefore cumulative geologic effects from the BEP and SVRTP alternatives would not be adverse.

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