Seismic Ground Motion Analyses and Design Criteria for San Vicente Dam

in San Diego County, California

PROJECT DESCRIPTION

An existing dam in San Diego County is being raised to increase its water storage capacity. Earth Consultants International was retained as part of the engineering team to develop the recommended seismic design criteria for the project. We conducted the following tasks 1) prepared a report describing the tectonic setting of the site; 2) compiled a fault database that summarizes the current state-of-knowledge for all known faults within 100 km (62 miles) of the site that are thought to have moved at least once in the past 35,000 years (the California Division of Dam Safety's definition of active fault), 3) calculated peak ground accelerations using a deterministic analysis, and 4) developed the acceleration time histories.

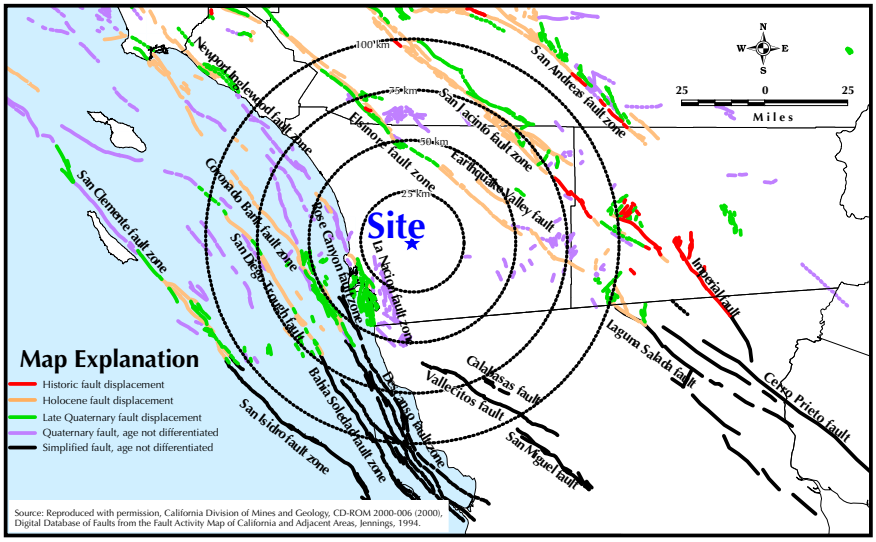

Figure 1 (above): Site Location Map showing the faults, both onshore and offshore, that have been mapped in the area. The circles illustrate the area within 25, 50, 75, and 100 km of the site, respectively. Our study also considered those faults south of the international border that could also pose a seismic hazard to the site.

SOLUTION

As part of our study, we compiled all known seismic sources within 100 km of the site (Figure 1) into a database. Each of the faults in the database was classified according to style of faulting, segment length, maximum magnitude earthquake, and closest distance to the dam site. Once these data were developed, we computed the peak ground accelerations that could be experienced at the site for each of the fault segments considered. Our analysis showed that the La Nación and Rose Canyon faults, as well as the Julian segment of the Elsinore fault, are the principal contributors to the seismic hazard at the site. Specifically, rupture of the La Nación fault during an earthquake of moment magnitude (Mw) 6.7 could produce horizontal ground accelerations at the site of about 0.16g (50th percentile) and 0.26g (84th percentile), whereas a Mw 7.1 earthquake on the Rose Canyon fault, or a Mw 7.5 earthquake on the Julian segment of the Elsinore fault, could produce horizontal peak ground accelerations at the site in excess of 0.13g (50th percentile) and 0.21g (84th percentile). We then selected two natural earthquake records as reasonable analogues to the design earthquakes on the La Nación and Elsinore faults: the Gilroy array from the 1989 Loma Prieta earthquake, and the Whitewater Trout Farm station from the 1992 Landers earthquake (Figure 2). These natural earthquakes were used to model the maximum ground motions expected at the site.

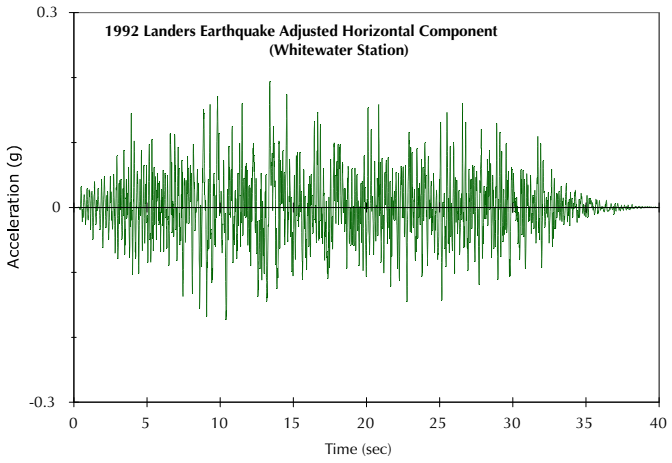

Figure 2 (above): Adjusted horizontal time history from the 1992 Landers earthquake used to model the ground motion expected at the site from the Julian segment of the Elsinore fault.

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