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Seismic Hazard Studies in Anchorage, Alaska

A. H. Martirosyan (1), N. N. Biswas (1), U. Dutta (2)

(1) Geophysical Institute, University of Alaska Fairbanks, Fairbanks, AK 99775, USA, (2) Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK 99501, USA (A.Martirosyan@giseis.alaska.edu)

Anchorage is the largest population center in Alaska, which is situated in a highly active seismic zone. In 1964, this region experienced the M9.2 Prince William Sound earthquake, the second largest earthquake ever recorded in the world. In addition, the area is underlain by a west dipping sedimentary basin, known to amplify seismic waves. A seismic zonation program for the metropolitan area of Anchorage was implemented in early 1990, during which various aspects of seismic hazard were studied, including the local site response, seismic site classification, and the attenuation characteristics of the media. The Anchorage strong motion network was initially set up in 1995 and currently consists of more than 42 free-field stations, along with downhole and building arrays. The network has generated an important set of strong motion records for more than 140 local earthquakes in the magnitude range from 2.6 to 7.9. Site response characteristics at more than 40 locations were determined from weak motion and strong motion records with amplitudes less than 0.1 g in the frequency range from 0.5 to 12 Hz. The results show a strong influence of subsurface geological conditions on the characteristics of ground motion. Particularly, the ground motion at the soil sites in the central and western parts of the city is amplified by a factor of 2-4 at low frequencies ($<$3 Hz) compared to the bedrock sites in the east. There is a prominent resonance peak around 1 Hz with amplification values up to about 4 in the central part of the city related to the soft soil layers. Shear wave velocity profiles at 36 sites were obtained from Rayleigh-wave measurements in the frequency range of about 1-100 Hz. The upper 30 m average shear wave velocities were used to obtain the seismic site class of the Anchorage basin. The eastern section of the basin is dominated by site class C, followed by the narrow transition zone C/D and class D in the western section. There is a good correlation between the spatial distribution of 30 m average velocity and site response at low frequencies.