March 9, 10:30 a.m.
Bowen Lab 2007

EARTHQUAKE EFFECTS ON ARTICULATED STRUCTURES LOCATED IN FAULT RUPTURE ZONES

ABSTRACT

Gur, Turel Ph.D. Purdue University, May, 2004. Earthquake Effects on Articulated Structures Located in Fault Rupture Zones. Major Professor: Mete A. Sozen

Long surface structures in fault regions are susceptible to serious damage by permanent ground deformations occurring during earthquakes as well as strong ground shaking. This thesis aims to develop a theoretical model to help understand and explain the behavior in earthquakes of long articulated surface structures located in earthquake-rupture zones. The earthquakes in Taiwan and Turkey in 1999 provided examples of damage to structures crossed by the surface ruptures of the earthquakes. Among these examples, the Bolu Viaduct, a 2.3-km articulated structure comprising prestressed concrete girders and reinforced concrete columns, was a unique case. The fault rupture of the 1999 Duzce, Turkey earthquake crossed the footstep of the viaduct. The right-lateral movement of the fault during the earthquake changed the relative positions of the piers with respect to each other. The distance between the abutments was shortened by 2.1 m. The change in the geometry of the structure was estimated quantitatively by the comparison of the structural survey data before and after earthquake. The investigation of the earthquake effects on the Bolu Viaduct is performed in three major steps. First, a simple inelastic model of the bridge is analyzed by using the records of the earthquakes in the vicinity of the viaduct. The calculated response is compared with the observed damage. The sensitivity of the structural response to the PGA and the PGV of the records is investigated. Second, the static inelastic response of the viaduct to ground distortion is calculated. Third, the response of the viaduct to ground distortion is evaluated by introducing pier movements assuming that they occurred in a few seconds.