The 2010 JiaSian, Taiwan M_{L} 6.4 earthquake occurred on March 4, 2010 at 00:18:52 UTC. The epicenter was located in the southern Taiwan (22.969°N 120.707°E) at the depth of 22.6 km. This was the most powerful earthquake in the Kaohsiung area in the recent hundred years. The quake did not cause death, but injured 96 people. Several buildings were collapsed during the main shock and aftershock. Six trains of THSR (Taiwan High Speed Rail) were disrupted, and one was de-railed while in an emergency braking. This is the first de-railed accident of THSR caused by earthquake in Taiwan. The strong ground shaking also induced the soil liquefaction near the Xinhua town and close to the THSR bridge pier. Fortunately the soil liquefaction only occurred locally did not cause any building damage. In this study, the strong motion data from Jiasian, Taiwan earthquake are analyzed by using the Horizontal-to-Vertical (H/V) spectral ratio method to study the site effect in the Chianan plain. The 2D finite-difference method was used to simulate the wave propagation in the Chianan Plain of the JiaSian earthquake. The results of the simulation demonstrate that the long duration surface wave in the west Chianan plain resulting from the multi-path waves trapped in the top Pleistocene Formation. The simulation can be applied to understanding the strong ground motions expected for future earthquake.