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常時微動記録を用いた被災 9 階建 SRC 造建物におけるせん断波速度の測定
Shear-Wave Velocity Evaluation from Microtremor Records Measured in a Damaged Nine-Story SRC Building

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The building analyzed in this paper is a severely damaged nine-story steel reinforced concrete (SRC) building during the 2011 off the Pacific coast of Tohoku Earthquake, which was designed and constructed in 1990 according to the new anti-seismic design code of Japan. Hereafter it is called K9SRC for short. Obvious shear cracks happened in the external concrete walls in the longitudinal direction (EW), which can be defined as non-structural damage. However, the shear deformation of walls brought about distortion of entrance doors, which hindered escape during the earthquake. The building K9SRC suffered structural damage in the northwest corner column of the first story and multistory shear walls of lower stories, whose steel bars have yielded and been exposed to air. After the earthquake, the building K9SRC was classified to be dangerous. Residents have to move out until it is repaired.

According to the preliminary reconnaissance report of the 2011 Tohoku-Chiho Taiheiyo-Oki Earthquake published by the Architectural Institute of Japan, buildings constructed after 1981 generally showed a good performance during this earthquake, and few of them suffered severe damage. Furthermore, based on the on-site investigation performed by our study group, there are no buildings damaged as severely as the building K9SRC within 1000 km of it. Therefore, the building K9SRC should be paid more attention to scrutinize the damage of it.

In this paper, we made comparative observations of microtremors on each floor and the top of the building K9SRC to extract the shear-wave velocity (Vs) traveling within each story using the deconvolution method. Because the shear wave velocity relates only with the seismic property of the structure, it is a reliable way to evaluate the inter-story shear stiffness degradation.

Based on the analyses, Vs decreases more greatly in the longitudinal direction than in the transverse direction. The interfloor Vs in the longitudinal direction has decreased to less than 300 m/sec. In the transverse direction, the Vs decrease along the height of the building, and Vs traveling in the lower four stories are higher than 300 m/sec. Vs traveling within the first story decreased obviously because of the damage of the corner column. The Vs traveling within the 5th and 6th story decreased to less than 300 m/sec in both of the longitudinal and transvers direction.

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