Bond-Based Earthquake-Proof of RC Bridge Columns Reinforced with Steel Rebars and SFCBs

Mohamed F.M. Fahmy1 and Zhishen Wu2

Abstract:

Bond between reinforcement and the adjoining concrete has been extensively studied, and it is confirmed that the use of deformed bars is essential for composite behavior of reinforced concrete (RC) structures. But since bond between the longitudinal bars and concrete results in concentration of damage at a specific localized interval of longitudinal bars where the local buckling occurs, Takiguchi et al. (1976) suggested mitigating this concentration of damage through unbonding of the longitudinal bars from concrete at plastic hinge zone. Kawashima et al. (2001) conducted an experimental study on RC columns reinforced with different lengths of unbonded bars at the plastic hinge zone. It was noticed that the failure of concrete was much less in the unbonded column than standard column, and strain on unbonded bar was less than that on the reinforcement of standard column. Recently, to improve the seismic performance of RC members, it is highlighted in the study of Pandey and Mutsuyoshi (2005) that reducing bond strength between the longitudinal bars and concrete has a favored effect on the failure mode, shear capacity and ductility of RC bridge piers: failure mode at ultimate state is changed from shear to flexural and shear strength and ductility are increased. In the performance-based design approach, the design is primarily focused on meeting a performance objective, which is in line with a desired level of service (Floren et al., 2001, Priestley et al., 2007). For instance, new seismic design philosophies for bridges recommend that important bridges subject to massive earthquakes should be able to sustain the expected maximum lateral force in the inelastic stage with limited damages. To achieve this aim, structure should realize the existence of post-yield stiffness, damage level should be limited, and its permanent deformations (residual deformations) should be smaller than a specified limit; and all these indices are essentially dependent on the composite behavior of RC structures. On the other hand, the studies of Kawashima et al. (2001) & Pandey and Mutsuyoshi (2005) revealed the importance of reducing concrete-to-steel bond to mitigate the concentrated damage in the plastic hinge zone. In the last two decades, civil engineers and designers have attempted to develop and adopt new forms of materials that would assist in the building of stronger, larger, more longer

Published In:

Intechopen , pp. 429 - 454