Abstract

Earthquake waves cause horizontal shaking of structure at foundation level. The inertia force of structure is a predominant force to cause failure of structure. It introduces shear force in the lateral load resisting elements like columns and shear walls. General structures designed for vertical (gravity) loading are unable to carry this shear force and this leads to failure of structures during earthquake. To resist earthquake effects two approaches are available *viz.*, Conventional approach and Modern approach. The conventional approach relies on the ductility and inelastic behavior of structural members, which results in damage. This approach aims at saving human lives at the cost of extensive damage to structure without collapse. On the other hand modern approach attempts to control the response through different devices and techniques. The modern approaches can be classified in to three categories *viz.*, Passive control, Active control and Hybrid control.

Base isolation is one of the passive control systems. The main objective of base isolation is to filter or deflect the earthquake forces acting on the structure. The base isolations are of three types, (i) Elastomeric bearing (ii) Sliding system and (iii) Combined system. Elastomeric bearing have restricted capacity of horizontal displacement. Hence under large deformation they lead to failure. In combined system initiation of sliding of PF and deformation of elastomeric to stop should achieve at the same time. Practically it seems to be difficult to achieve both these two things at the same time. Sliding isolation system can undergo large horizontal displacements. Base isolation is typically effective under far-field earthquakes with relatively high predominant frequencies.

When lower value of coefficient of friction is used for siding isolation system the sliding and residual displacement are higher, but the storey accelerations are lower, vice a versa when higher value of coefficient of friction is used the sliding and residual displacement are lower, but the storey accelerations are higher. Hence to improve the performance of sliding isolation system variable coefficient of friction has been suggested in present research work. The coefficient of friction is varied at predefined point from centre of isolator, so that practically it will be possible to develop such an isolator. The two coefficients of friction are used, initial coefficient of friction (μ_1) and final coefficient of friction (μ_2). The coefficients of friction are varied at predefined point d_f = 0.1 m to 0.6 m at an incremental value of 0.1 m from centre of isolator.

Five sliding isolation systems are studied in present research work, *viz.*, PF, FPS ($T_b = 2$ s), CFPI ($T_i = 2$ s), VFPI ($T_i = 1$ s) and VFPI ($T_i = 2$ s). Performance of all these five sliding systems subjected to far field, near-field and low frequency ground motions are studied for lumped mass single storey shear structure having a period of 0.5 s and lumped mass five storied shear structure. Lot of literature available for far field ground motion. Hence analysis is carried out only for one far field record just to show that all sliding systems perform well under far field ground motion. Ten near-field and fifteen low frequency ground motions are used for analysis purpose for more extensive conclusion. The analysis has been carried out for two cases of constant coefficient of friction *viz.*, $\mu = 0.05$ and $\mu = 0.1$. Also analysis has been carried out for six cases of variable coefficient of friction *viz.*, $\mu_1 = 0.05$ and $\mu_2 = 0.1$ at $d_f = 0.1$ m to 0.6 m at an incremental value of 0.1 m from centre of isolator.

Finally the most suitable isolator for near-field and low frequency ground motions has been suggested.