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The effect of vibroreplacement and efficiency of the base-isolation sliding-bearing system

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ABSTRACT: The report deals with some research problems and practical realization of buildings with systems of base-isolations sliding supports. The design and proportionong details are discussed.

Nowadays the problems of earthquake resistance became the subject of mankind investing. Among others load-bearing systems the base isolation attrack thorough attention of engineers and designers as well as managers in earthquake engineering and engineering seismology. These systems allow to protect the structures from earthquake-induced hazard and to prevent a lot of socioeconomical undesirable consequences.

The report deals with one of the base-isolation systems which differs from other by special type of sliding supports, that composed of the pair of plates (roughless, steel and ftoroplast, native version of teflon). Due to creation of the sliding supports all other load-bearing stru ctures of the building became unloaded comparing the structure of traditional scheme and it appears the possibility to eleminate the seismic loads on structures during prominent vibrating of the ground. When the shear force in the base level of the building exceeds the forces of friction between the plates the upper part of structure slides on them begins to slide. In the process of sliding the deformations of structural elements became miserable, as well as the inner forces.

Such a system of sliding base-isolation supports (SBIS) was investigated thoroughly in TsNIISK named after Kucherenko and Bishkek Polytechnical Institute. About hundred buildings (with brick masonry walls and large-panel walls) were constructed and tested under static and vibrational forces in Bishkek (former Frunze), Feodosia (the Crimea), Petropavlovsk-Kamchatskiy, etc.

The later research was fulfilled due to the necessity of establishing the adequate design scheme of buildings with SBIS. The structure was modelled by multy-degree of freedom systems with concentrated masses under one- and three component seismic excitation. In cooperation with the Irkutsk Institute of Earth (A.Berzinskiy, A.Ordinskaya) and the Institute of Physics in Bishkek (Prof. V. Gurovich, G.Desyatkov) there were analysed 2-9 storeyed apartments and social buildings with SBIS systems under real seismic excitations presented by the accelerograms of various earthquakes.

It was discovered that the buildings with SBIS systems could not have intensive vibrations. The process of its movement devides into two components - rapid oscillations and slow sliding of the upper part as a rigid body (Fig.I).

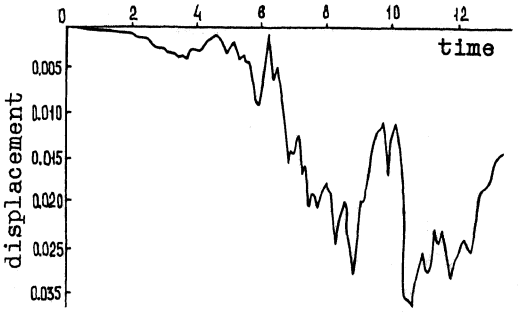

Figure I.

It was aslo investigated the phase portrets of the systems (Fig. 2). They show that even under severe seismic excitations (up to II intensity degree according to MSK or MKS scale) the base-isolated systems have closed cycles of vibrations. It was proved that the shock regime requirements for proportioning of the stoppers could be dropped.

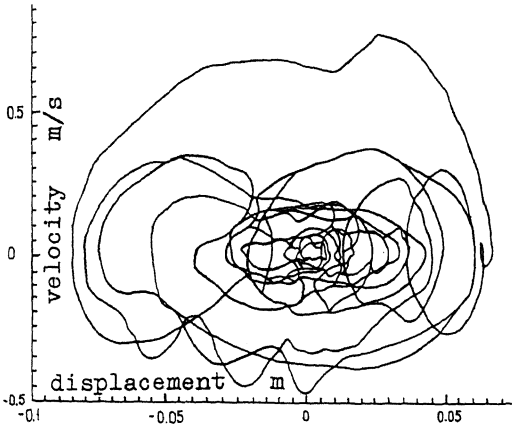

Figure 2.

Nowadays the new type of base-isolation supports is in the process of investigations and experimental desing. They compound the favourable features of SBIS and rubber isolators. These devices could be also supplied by gauges and other instrumental blocks as to follow their behaviour during earthquakes or natural vibrational tests. The rubber base-isolation sliding supports would be used in the projects of some experimental buildings in Bishkek and other towns as well as in earthquake protection systems of built-in technological and engineering equipment in earthquake-prone areas.