

## Closing address

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Fundamental concept of antiseismic design is to design and construct the structures which can have enough resistance against seismic forces, but recently the design concept is changing as to reduce the input seismic force shaking structures, as low as possible, for making structures less vulnerable and more economical.

The design concept of base isolation at the early stage was proposed just after 1891, Nobi earthquake and 1906 San Francisco earthquake. However, during more than 60 years, this concept has not been realized, and the first base-isolated building was completed in 1969 in Skopje this kind of building is designed by such design concepts as changing the fundamental period as long as possible by, use of laminated rubber bearing for decreasing its seismic acceleration response, but no driving energy needed for controlling the seismic response is consumed in this case. Figuratively speaking, base isolated buildings will be well compared with yachts which is sailing by canvas and wind.

Since the completion of the first base-isolated building, many research works have been carried out, for instance, ultimate strength of laminated rubber bearings (LRB) and dynamic behavior observation of the actual base-isolated buildings, and so on. The major object of research works in the field of seismic control is still centering on aseismic base isolation and this can be clearly understood by the number of papers presented in the category of base isolation topic of IOWCEE as shown in the following table.

Table 7.1 Number of papers related to the topic No. 7 IOWCEE

Base isolation	Passive and active control	Others*
33	18	2

\* analytical method, test of LRB and so on.

Now the number of base-isolated building in Japan is about 60, and weak points of base-isolated building have been pointed out by structural engineers, for instance, discomfort of building vibration induced by strong wind and difficulty in applying this system to high-rise buildings.

It is the modern trend that the type of seismic control is changing from base-isolation system to passive or active control system. As the case of ship-building industry, in

which sailboats without engine power were replaced by steamboats with enough power for their navigation, structures supported by high damping rubber bearing systems are giving way to passively or actively controlled ones in building industry.

Recently research works on passive or active control devices have been much more carried out. In Japan 11 storied building installed the active control devices has already completed and seismic response records are obtained, showing satisfactory results, and in the world, about 10 buildings have been designed, some of which are now under construction.

As for civil engineering constructions, the base isolation system is widely applied, and research works on seismic control in the field of civil engineering, are now limited within such fields as, dynamic behavior of bridge piers using laminated rubber bearing, special damping mechanism, seismic response of offshore structures and so on.

During IOWCEE, hybrid control system was proposed by several authors, that is, combination of active control system for wind excitation, and weak or moderate earthquakes, and passive control system for severe earthquakes. This means that many scientists and engineers are not quite sure of applying the active control system for reducing building vibration excited by severe earthquakes, before solving such items as reliability, energy problem, control algorithm, and cost-effectiveness and so on.

During this conference, establishment of International Association for Seismic Control has been discussed, as Prof. Masri talked in his presentation. The writer thinks that building are keeping the leadership, in the field of active control, and civil engineering structures will follow them for the time being. Finally, the writer hopes that technology of software as well as hardware of control devices will be well developed, and seismic response of all kind of structures will be controlled satisfactorily.