FOREWORD

A very shallow quake with magnitude of 6.8-7.0 on Richter scale attacked the northern part of the Republic of Armenia, U.S.S.R., on December 7, 1988. Several hundred of tall residential buildings were collapsed and at least thirty thousand people were killed. The Japanese Government dispatched the expert teams twice to cooperate with the U.S.S.R. Government and the Armenian Government in restoring the cities near the epicenter. The first mission consisting of ten experts from the field of seismology and earthquake engineering visited the Republic of Armenia and the city of Moscow during the period of December 19-24, 1988 and the second mission of 17 experts from February 19 to March 15, 1989. The author had opportunities to join both missions and stayed for about two weeks at the Republic of Armenia.

As reported by mass media, the disaster caused by the earthquake was extremely miserable. Almost all buildings at the downtown of Spitak City with the population of about thirty thousand were collapsed. The housing complex consisting of more than a hundred precast concrete frame buildings of nine stories at the city of Leninakan was also destroyed and became a heap of rubble. Other type of collapsed buildings were reinforced stone masonry buildings of 4 or 5 stories. One of the major reasons caused such a severe damage to the buildings may be both the intensity of the ground motion and the response story shear force of the buildings were much higher than expected in the seismic design. The margin both in the ultimate strength and ductility might be also insufficient to resist such higher response.

In order to derive deep lessons from the earthquake disaster, further investigation and research be carried out. However, the author strongly feels that we, structural engineers, must not depend upon only the design seismic force given in the design code, but must realize the importance of "a margin" in seismic design of structures.

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