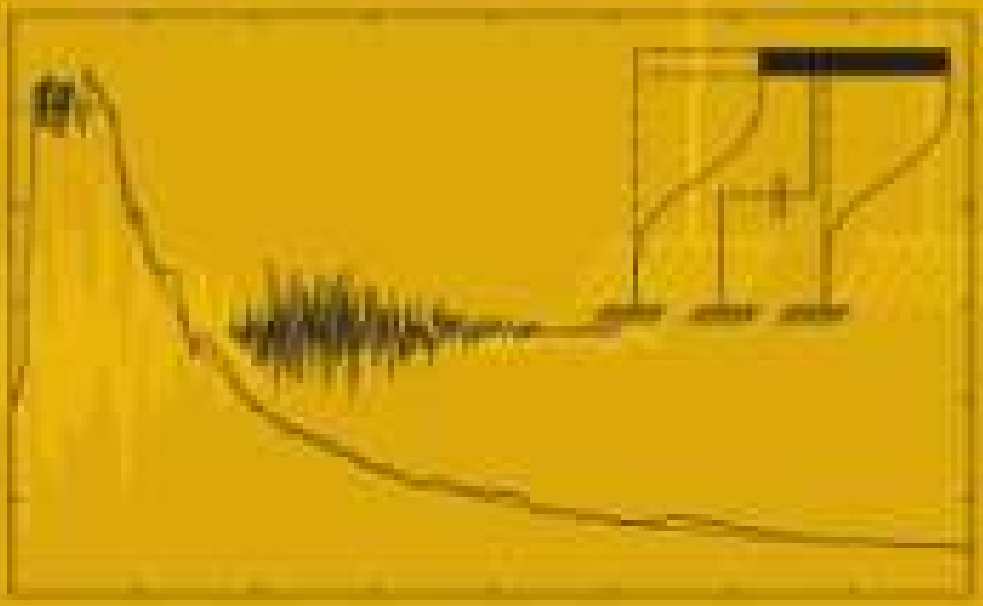
Earthquake Resistant Design of Structures



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or abetting structures. For the former, non-structural components must be designed and detailed in a similar way to the building structure, using an analysis of forces to determine bracing support requirements. For the latter, separation from backup or abetting structures is necessary. Mechanical, electrical, and plumbing distribution system must be secured to the building structure, with allowances for differential movement where applicable.

15.4.8 Foundation Soil/Liquefaction

Knowledge of the foundation soil is essential to correct earthquake-resistant design. In some cases a soil behaving well under static loads will pose serious problems under seismic loads. Problems related to foundation soil can be classified mainly in two groups: (i) influence of subsoil on the characteristics of seismic movement, landslides and loss of soil resistance (liquefaction), these problems are not significantly affected by the structures and their foundations and (ii) problems caused by the loads transmitted to the soil by foundations and the settling of the foundations under static and seismic loads. This problem generally arises in loose unsaturated granular soils, which may be compacted as a result of earthquake.

The liquefaction of the soil is most common feature in an earthquake. This phenomenon of loss of resistance is generally occurred in saturated granular soil. At Niigata, Japan, in 1964 subsoil of the loose saturated sand underwent a considerable loss of resistance during an earthquake, as a result, many buildings were damaged, severely undermined and in extreme cases, completely toppled.

15.4.9 Foundations

Foundation of the building is subjected to earthquake stresses; the following major recommendation on structural design must be borne in mind

(i) Foundation should preferably be designed as continuous (mat or raft) in order to avoid relative horizontal displacement
(ii) In case of isolated footing, they should be joined to each other by means of foundation beams or ties. These ties should be designed such that it will bear tension and compression forces.
(iii) It is recommended that parts of building foundations, which rest on soils of different types or are sunk to different depths, should be designed as separate units. In such cases there should also be structural independence in the superstructure.
(iv) It is recommended that if different parts of the building are to be structurally independent because of the shape of their ground plan; their foundations should also be independent.

15.5 QUALITY OF CONSTRUCTION AND MATERIALS

One of the main factors responsible for stepping of seismoresistant capacity of building is its quality of materials and workmanship of construction. The industrially produced materials used