

Annexure A

GLOSSARY

Active Fault: A fault known to have produced historical earthquakes or shown evidence of movements in Holocene time (i.e. in the last 11,000 years) or large faults which have moved in Latest Pleistocene time (i.e. between 11,000 and 35,000 years ago) or major faults which have moved repeatedly in Quaternary time (1.8 million years).

Attenuation: Decrease in amplitude and change in frequency content of the ground motion with increase in distance from the earthquake source because of geometric spreading, energy absorption and scattering of the seismic waves.

Critical Damping: The damping beyond which the free vibration motion will not be oscillatory.

Damping: The effect of internal friction, imperfect elasticity of material, slipping, sliding, etc. in reducing the amplitude of vibration of the structure, which is expressed as a percentage of critical damping.

Design Earthquake: The earthquake magnitude and distance to which the seismic ground motion used for the earthquake-resistant design of a structure at a site corresponds. Two commonly used design earthquakes are the DBE and MCE. These earthquakes in the PSHA method are estimated by de-aggregation of the seismic hazard described in Subsection 11.2.

Earthquake Event: The process of release of energy in the Earth's interior by sudden movements along a fault plane, which propagates outwards in all directions in the form of seismic waves and generates the ground vibration.

Epicenter: The geographical point on the surface of the earth vertically above the focus (hypocenter) of an earthquake.

Fault: A fracture or fracture zone in the earth's crust along which there has been displacement of the two sides relative to one another parallel to the fracture plane.

Floating earthquake: An earthquake with a specified maximum magnitude that cannot be correlated with a known fault, and is assumed to be equally likely to occur within a specified distance range.

Focal depth: The vertical distance between the epicenter and the hypocenter.

Free-field Ground Motion: The earthquake motion on the ground surface or at some depth within the earth in the absence of or far away from any man-made structures.

Ground Motion Model: Same as Ground Motion Prediction Equation.

Hypocenter/Focus: The point on the fault plane at which the displacement of the two sides of the fault initiates during an earthquake. It may in general be located anywhere on the fault rupture plane, but it is assumed to be at the centroid of a rectangular fault rupture for the hypothesized earthquake sources in seismic hazard analysis.

Macroseismic Intensity: A numerical index describing the effects of an earthquake on man-

made structures, or other features of the earth's surface. The assignment of intensity values is subjective and is influenced by the quality of construction, the ground surface condition and the individual perception of the observer. The Modified Mercalli Intensity (MMI) and European Macroseismic Scale (EMS) are currently the most commonly used types of intensity scales.

Comment: Intensity value represents the severity of ground shaking at site and it is not the same as earthquake magnitude, which represents the energy released at the source.

Liquefaction: A condition in which a saturated soil layer loses its shear strength due to buildup and maintenance of high pore-water pressures under cyclic stress applications during an earthquake. The chances of liquefaction depend on the void ratio or relative density and the confining pressure of a cohesionless soil.

Magnitude of Earthquake: A number representing the earthquake size related to the strain energy released by it. This is normally defined by the logarithm of the amplitude at a specific wave period of the earthquake record corrected for the attenuation for the distance between the source and the recording seismograph at a site. Based on the frequency response of the seismograph and the distance of recording, several different types of magnitude scales are defined to have accurate measure of the earthquake size. Most commonly used types of magnitude are the Richter's local magnitude (M_L), surface wave magnitude (M_S), short period or broad-band body wave magnitude (m_b or m_B), and the moment magnitude (M_W).

Natural Period (T): Natural Period of a structure or a single-degree-of-freedom system is its time period of un-damped free vibration.

Peak Ground Acceleration (PGA): The absolute maximum value of the ground acceleration during the total duration of an accelerogram. As the PGA represents just a single point on the complete time-history of ground motion, it is not sufficient to describe the overall effect of an earthquake on the structural response. The PGA is generally expressed in terms of g (acceleration due to gravity).

Predominant Periods: The range of system periods which are excited much more than others for a particular ground motion.

Recurrence Time/Period/Interval: This is the average time between earthquakes with magnitude above a specified threshold value in a given seismic source zone or on a given fault. In reality, earthquakes do not follow any periodicity and the inter event times for the largest possible magnitude in a region or on a fault may vary widely, but an average recurrence time consistent with the long-term strain rate is considered for the purpose of seismic hazard analysis.

Return Period: This is the reciprocal of the average occurrence rate for a specified level of ground motion (e.g., PGA of 0.1 g) at a selected site as computed by the probabilistic seismic hazard analysis method. The return period depends on the occurrence rates of earthquakes of different magnitudes in the region around the site and the probability of exceeding the specified level of ground motion due to different pairs of earthquake magnitude and source-to-site distance.

Comment: The ‘return period’ and ‘recurrence period’ should not be used interchangeably, because the former refers to the ground motion and the later to the earthquake events.

Seismic Hazard Analysis: The process of quantifying the natural effects caused at a site by the earthquakes in the region around the site. This may include ground vibration, landslides, liquefaction, and permanent ground displacement, but not the structural damage at a site. The present guidelines provide the recommendations for seismic hazard analysis in terms of ground motion at river valley project sites for earthquake resistant design of dams and appurtenant structures.

Seismic Risk Analysis: The process of estimating the economic losses, adverse effect on the society, and casualties as a result of the seismic hazard. Though, it is not possible to bring down the seismic risk to zero, realistic estimation of seismic hazard may help a great deal in mitigation of the seismic risk in a cost-effective manner. The practical approach should be to use a level of the seismic hazard that brings down the seismic risk to a level with which we are otherwise also living in our day-to-day life, for example the risk due to a road accident or a plane crash.

Seismotectonic Province: A large geographical area characterized by similarity of tectonic processes, geologic structure, and/or seismic history.

Seismotectonic Structure/Feature: An identifiable dislocation or distortion within the earth's crust resulting from recent tectonic activity or revealed by seismologic or geologic evidence.

Smooth Response Spectrum: A response spectrum with sharp peaks and valleys ironed out by running mean averaging for use in the analyses of the structural response.

Source Parameters: Variables describing the physical characteristics (e.g., seismic moment, stress drop, fault displacement) of the source of energy release causing an earthquake.

Tectonic: It refers to the processes, properties, or resulting features by the deformation (breaking and slow plastic deformation) of rocks over large sections of the upper mantle and crust (lithosphere) as a result of the plate motion or more localized geodynamic processes like upliftment due to erosion, subsidence due to deposition, or volcanic eruption.