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Behavior of an Elevated Liquid Storage Tank under Near-Fault Earthquakes

Authors : Koushik Roy, Sourav Gur, Sudib K. Mishra

Abstract : Evidence of pulse type features in near-fault ground motions has raised serious concern to the structural engineering community, in view of their possible implications on the behavior of structures located on the fault regions. Studies in the recent past explore the effects of pulse type ground motion on the special structures, such as transmission towers in view of their high flexibility. Identically, long period sloshing of liquid in the storage tanks under dynamic loading might increase their failure vulnerability under near-fault pulses. Therefore, the behavior of the elevated liquid storage tank is taken up in this study. Simple lumped mass model is considered, with the bilinear force-deformation hysteresis behavior. Set of near-fault seismic ground acceleration time histories are adopted for this purpose, along with the far-field records for comparison. It has been demonstrated that pulse type motions lead to significant increase of the responses; in particular, sloshing of the fluid mass could be as high as 5 times, then the far field counterpart. For identical storage capacity, slender tanks are found to be more vulnerable than the broad ones.

Keywords : far-field motion, hysteresis, liquid storage tank, near fault earthquake, sloshing
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