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Seismic Fragility Curves for Shallow Circular Tunnels under Different Soil Conditions

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Abstract : This paper presents a methodology to develop fragility curves for shallow tunnels so as to describe a relationship between seismic hazard and tunnel vulnerability. Emphasis is given to the influence of surrounding soil material properties because the dynamic behaviour of the tunnel mostly depends on it. Four ground properties of soils ranging from stiff to soft soils are selected. A 3D nonlinear time history analysis is used to evaluate the seismic response of the tunnel when subjected to five real earthquake ground intensities. The derived curves show the future probabilistic performance of the tunnels based on the predicted level of damage states corresponding to the peak ground acceleration. A comparison of the obtained results with the previous literature is provided to validate the reliability of the proposed fragility curves. Results show the significant role of soil properties and input motions in evaluating the seismic performance and response of shallow tunnels.

Keywords : fragility analysis, seismic performance, tunnel lining, vulnerability
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