

NUMERICAL SIMULATION OF PALLET RACK SYSTEMS FAILURE UNDER SEISMIC ACTIONS

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Abstract. *Pallet rack steel structures are very slender, tall structures that are used all along the production process for storage. It was shown that, for a five bay typical pallet rack, the progressive collapse of the structure will often occur if the rack is loaded to its ultimate limit state and a single leg removed by impact **Error! Reference source not found.** The failure as a result of excessive external forces could have had two possible reasons: static failure due to local or global overloading with stored goods, or a dynamic failure due to an impact load (e.g., collision with forklift), vibrations or unstable loads **Error! Reference source not found.** The bracings of pallet rack systems, in most cases, is unsymmetrical and this configuration was found to influence the collapse behaviour of rack structures. Another structural key factor to be considered is the strength and rigidity of beam to upright connection and base plate connection. For load bearing uprights, analyses **Error! Reference source not found.** showed that the removal of a column at the bottom of the structure was more critical than at any other level. Moreover, according to analyses performed, **Error! Reference source not found.** different failure mechanisms were observed for ductile and brittle frames. For a brittle frame, the pushover force was only 50% of the corresponding force of a ductile frame with the same symmetry and loading. For present study, two gravitational load cases, uniform and non-uniform loading were considered. In terms of seismic loading, far field and near field seismic action was taken into consideration. The aim of present study is to observe the failure modes of pallet rack structures with different bracing systems and various beam to upright connection details under seismic action. Further, the dominant factors that leads to local failure of pallet rack uprights and further, to progressive collapse of pallet rack structures were identified and ranked.*

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