Seismic performance of pile-to-pile cap connections: An investigation of design issues

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ABSTRACT

Damage in recent earthquakes has resulted in the design of pile foundation systems becoming more conservative, particularly pile-to-pile cap connections. However, the application of current international design practice results in pile cap joint details having congested steel reinforcement in the pile cap and this is extremely difficult to construct in accordance with the designers recommendations. The formation of plastic hinges in the piles remains a serious risk. A review of critical design issues and former research investigations into the soil-structure interaction of pile systems and the findings of a three-dimensional, nonlinear finite ele-ment analysis of the system is reported. Significant gaps have been identified between current practice and the performance of piling systems when subjected to seismic events. Preliminary findings indicate potential for alternate connection details to improve performance under seismic action. The paper concludes with a concise summary of current state-of-the-art design approaches and details further research requirements.

KEYWORDS

Pile-to-pile cap connections, nonlinear finite element analysis, seismic performance, international design practice, state-of-the-art design approach