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Best Research Paper

Design of prestressed, jointed columns for enhanced seismic performance

Travis Thonstad, Marc O. Eberhard, John F. Stanton
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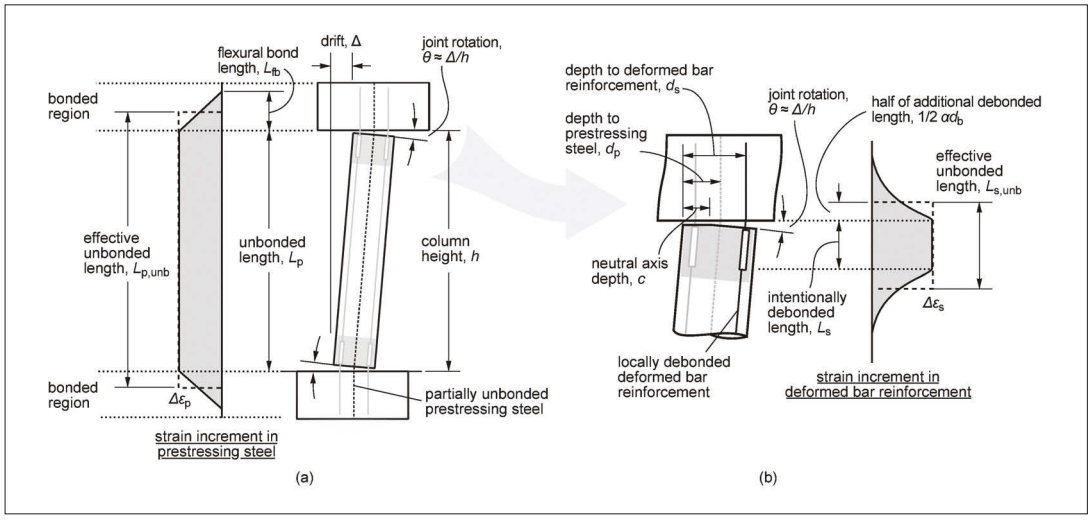
Jointed, prestressed columns have been shown to enable accelerated construction and to offer superior seismic performance, as compared with cast-in-place columns without prestressing. During an earthquake, such columns deform primarily through concentrated rotations at the joints, and special detailing at the ends of the columns prevents crushing and spalling. Unbonded prestressing steel, running vertically through the columns, provides a restoring moment that returns the columns to plumb after the ground motion stops. The use of prefabricated substructure elements speeds up the bridge assembly by eliminating building formwork, fixing steel, casting and curing concrete on-site. A variety of detailing strategies have been developed for jointed, prestressed columns, but their fundamental behavior is similar. More importantly, this behavior differs from that of conventional reinforced concrete columns for which current seismic code provisions were developed. This paper develops a displacement-based procedure for designing jointed, prestressed columns that is based on the framework provided by the AASHTO Guide Specifications for LRFD Seismic Bridge Design. To account for the unique characteristics of these systems, the design procedure introduces new performance criteria; it also provides recommendations for proportioning the prestressed and non-prestressed steel, calculating the effective column stiffness, and estimating the column displacement capacity.

The focus of the paper is on columns with pretensioned strands and internal energy dissipaters, although the procedure would work for post-tensioned systems and those with external dissipaters as well. This design approach is critically evaluated through comparison to the results of both cyclic tests of cantilever columns and shaking table tests of a two-span bridge system.

→| Read the full paper: **https://doi.org/10.1016/j.istruc.2021.01.105**



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Best Research into Practice Paper

Modelling of soil-structure interaction in OpenSees: A practical approach for performance-based seismic design

Smail Kechidi, Aires Colaço, Pedro Alves Costa, José Miguel Castro, Mário Marques
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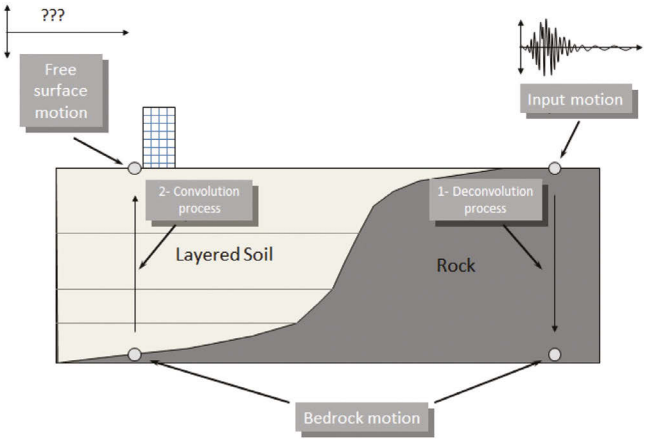

In this paper, a numerical tool based on the Monkey-tail fundamental lumped parameter model is proposed for the simulation of dynamic soil-structure interaction (SSI). The proposed model has been implemented in the OpenSees finite element environment where the input parameters are merely function of the soil properties. The ease of use, accuracy and versatility of the proposed model is demonstrated in order to encourage its use within, among others, the practicing engineers' community. Furthermore, the influence of the SSI and local soil conditions (*i.e.*, site effect) on the seismic response of two 5-storey steel moment-resisting frame buildings has been investigated. Preliminary results shed light on the influence of these two geotechnical aspects on the structural seismic response where peak floor displacements and inter-storey drifts considering the SSI are even larger in the lower stories than those of the fixed base case. Furthermore, the results revealed the dependence of the soil amplification factor on the fundamental period of vibration, seismic intensity level and soil stiffness which are not taken into account by the current European design codes.

→| Read the full paper: **https://doi.org/10.1016/j.istruc.2021.01.006**