Research Project Highlight

A Comprehensive Database of RC Column Tests

TSRP Topic – PBE Tools – T1

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Start-End Dates:
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Abstract

The PEER Column Database was developed in the mid-2000s, and there have since been limited efforts to update the database. Although other databases have been developed, these efforts have not been comprehensive, i.e., test results limited to specific geographic regions (e.g., Japan) or to narrowly focused issues (e.g. high-strength rebar). Furthermore, existing databases (e.g., PEER, ACI Committee 369, and SERIES column Databases) lack detailed information about test geometry, materials, test setup, loading protocol, reinforcement details, experimental results, and analytical results to enable more systematic studies on how particular variables impact column behavior. Also, a significant number of column tests have been conducted over the last several years that are not typically included in these databases. Lastly, most databases do not include test results for retrofitted and repaired columns. Given these issues, this project will focus on updating, expanding, and replacing the PEER Column Database to enable development of new design provisions for bridge and building columns for stiffness, strength (primarily shear strength), and deformation capacity. The primary goals are to: 1) improve the database structure and interface to enable a more efficient use of the database, 2) add more metadata (more parameterized details about the specimens, test setup, loading protocols, and test results, e.g., backbone curves) for the existing tests in the database, 3) add more column data from recent tests, including retrofitted and repaired columns, and 4) include computed and analytical data (e.g., the degree to which the test columns satisfy code detailing provisions, computed strengths, demands relative to these strengths, neutral axis depths at nominal moment strength, moment-curvature analysis). The database will be used to evaluate Caltrans, ACI 318, and ASCE 41 provisions using traditional approaches (e.g., correlation) and machine learning approaches, given that the expanded database will allow more detailed assessments.

Deliverables

The deliverables will include a database, a PEER report, and a few conference and journal papers describing the data in the database and findings from studying the data and evaluations of Caltrans, ACI 318, and ASCE 41 provisions and recommendation.
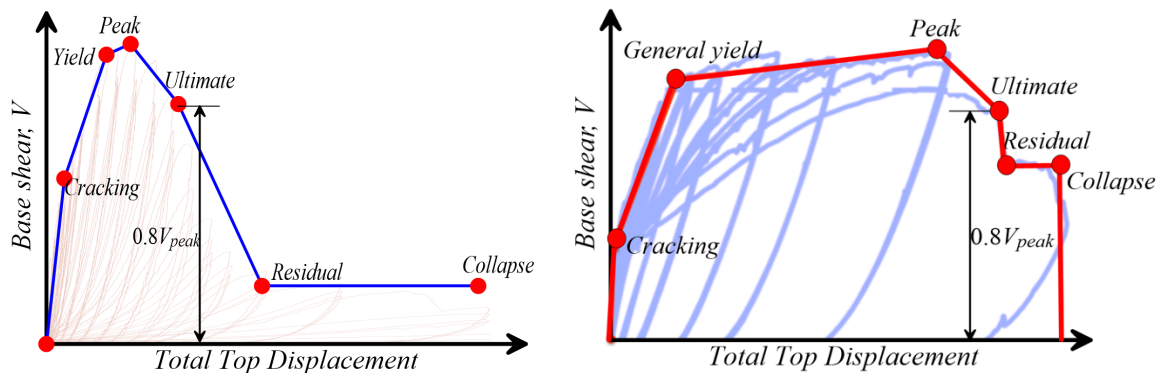
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Research Impact

1. Reevaluate Caltrans Seismic Design Criteria to improve design provisions (e.g., lateral stiffness and shear strength, as well as statistical information) of bridge columns for new and existing construction.
2. Provide experimental data on retrofitted and repaired columns that could be used to develop updated design provisions and modeling parameters.
3. Assess the newly introduced one-way and two-way column shear strength equations in ACI 318-19 and address potential issues associated with seismic design.
4. The expanded database should also provide data for extending and validating existing fiber-based modeling approaches implemented in OpenSees for coupled axial-bending (P-M) and shear (V) responses of RC columns
5. Provide the structural/earthquake engineering community with a comprehensive column database. It is expected that the new database would be widely used by both researchers and practitioners

Project Images

a) Example of backbones curves fitted through force-displacement plots

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b) An example of how filters can be used to screen data.

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