

Response history analysis validation (RHAV): a cross-technology-platform initiative

Background and objectives

Over the past couple of decades, response history analysis of structural and geotechnical systems has become increasingly prevalent in earthquake engineering research and practice. This development could be attributed to the shift in emphasis from prescriptive to performance-based design and assessment principles. The results of response history analyses are currently used as the basis for a number of important design decisions, especially for important facilities like tall buildings, bridges, dams, and levee embankments. Proportionately little attention has, however, been paid to the verification and validation of commonly employed modelling techniques and numerical solution procedures. Hence, we are presently unable to provide quantitative estimates of the accuracy and precision of our simulation results. The objective of this cross-technology-platform initiative is to improve confidence in the predictive capabilities of response history analysis procedures through a systematic validation exercise.

Key thrust areas

Achieving this objective would require concerted efforts in the following four key thrust areas:

1. [Inputs from laboratory experiments](#): TP1 (laboratory facilities)
 - a. Guidelines for loading protocols and instrumentation schemes to be used in experimental tests that are consistent with the needs for validation of local and global system response
 - b. Best practices for the documentation of experimental test setups and boundary conditions in a format that enables use in future analysis validation efforts
 - c. Promote prospective (blind) prediction efforts prior to conducting experimental tests
2. [Inputs from field instrumentation and monitoring](#): TP2 (field testing and monitoring)
 - a. Widen the network of instrumented structural and geotechnical systems in the field, in collaboration with GeoNet, with ambient vibration and strong motion recording capabilities
 - b. Recommendations for optimal sensor distribution so as to adequately capture important response modes with minimal instrument density
 - c. Collation of structural and geotechnical system characterisation information (e.g., structural drawings, site characterisation data) in conjunction with GeoNet to facilitate model creation for analysis validation
 - d. Work with GeoNet to enable free dissemination of system characterisation information for research
3. [Collection and curation of recorded datasets](#): TP3 (community data and models)
 - a. Uniform standards for the presentation of experimental and field monitoring datasets
 - b. Collation of data from previous experimental tests and field monitoring efforts in New Zealand and overseas
 - c. Storage and dissemination of validation datasets via cyber-infrastructure like DesignSafe
 - d. Tools to streamline access to the compiled datasets for analysis validation studies
4. [Methodology for analysis validation](#) TP4 (computational simulation and data visualisation)
 - a. Examination of the scope and objectives of previous analysis validation efforts, and the tools and methods they adopted
 - b. Verification of nonlinear models and solution techniques using different analysis software
 - c. Multi-tiered hierarchical framework for validation of structural and geotechnical models, ranging from simple SDOF models to large, complex 3D models with advanced constitutive models
 - d. Evaluation of various modelling and analysis techniques using the collected datasets
 - e. Quantification of the accuracy and precision (uncertainty) of simulation results using various modelling approaches
5. [Collaboration with international efforts](#)
 - a. Coordination with international activities in the above thrust areas

Project oversight group

QuakeCoRE: Brendon Bradley (Lead; UC), Ken Elwood (TP1; UA), Liam Wotherspoon (TP2; UA), Nick Horspool (TP3; GNS), Chris McGann (TP4; UC)

International: [TBC](#)

Please get in contact with any of the above personnel to express your interest in contributing to this project, all contributions welcome!

RHAV Workshop

An international workshop to address the issue of *Response History Analysis Validation (RHAV)* will be held on 4 September 2017 at Wairakei, Taupo, in conjunction with the 2017 QuakeCoRE Annual Meeting. The objective of this workshop is to bring together researchers and practitioners in order to collate ideas, identify priorities, and foster collaborative efforts to move forward with the validation exercise. Additional information regarding the workshop can be found in [Workshop Information.pdf](#). The following template is to be used to submit an extended abstract to the workshop: [Extended Abstract Template.docx](#).