NGL Meeting – PEER Feb 5 2016

Participants: Donald Anderson, Richard Armstrong, Ariya Balakrishnan, Sjoerd van Ballegooy, Steven Bartlett, Christine Beyzaei, Yousef Bozorgnia, Scott Brandenberg, Jonathan Bray, Brian Carlton, K. Onder Cetin, Ahmed Elgamal, Kevin Franke, Russell Green, Mike Greenfield, Tadahiro Kishida, Steven Kramer, Dong Youp Kwak, Jorge Meneses, Shoichi Nakai, Thomas Shantz, Jonathan Stewart, T. Leslie Youd, Thomas Weaver, Zia Zafir, Paolo Zimmaro

1. J Stewart – Introduction: objective database vs subjective Flatfile (synthesis of parameters used for model development)
    - Z Zafir: Visit old datasets? Ans: Yes – specifics are given in the 6ICEGE NGL paper (accessible from web site)
    - R Moss: how to avoid between-developers issues? Ans: No magic bullet. But aside from the notable recent example, we have proven over time to be a community that can cooperate. Good leadership and a clear mandate from the outset should provide the basis for cooperation.
    - Y Bozorgnia: We don't exclude any specific team for modeler.
    - J Bray: key is that we are focusing on the data. The objective data cannot be disputed. Start there and move forward.
2. S Kramer - NRC Study:
    - NRC study examines state-of-the-art and practice in earthquake induced soil liquefaction
    - Y Bozorgnia: NRC study is complementary to NGL. These efforts are not in competition.
3. S Nakai (Chiba Univ., Japan) – Liquefaction effects in Mihama ward (Japan)
    - A Elgamal: expresses some concerns about higher order site effects (2D, 3D) that are not considered because the site response is assumed as 1D. Ans: the complexity of the layering is exaggerated in Nakai's slides because of vertical exaggeration in cross sections. The actual layering is quite flat and 1D likely ok.
    - S Nakai: Difference of PGA or PGV across the area was not large based on ground motion recordings.
    - L Youd: Were settlements measured in the study area? Ans: yes, but they are relative settlements (i.e., structure relative to surrounding ground). They do not have absolute settlements. In subsequent discussion it was discussed that there are remote sensing data sources that can likely be used to extract this information (information of this type is available in Urayasu, for example). We will pursue this.
4. D Kwak – case history development for the Tokyo-Chiba area
    - Few comments.
    - R Moss: They measured V_S (MASW and SASW) for the Urayasu lateral spread site
5. M Greenfield – Presented rationale and methodology for examining ground motion recordings at liquefaction sites to locate the CSR-PR value on the triggering curve. Finding the time of liquefaction from accelerogram can be done several ways (STFT: time is smeared, Wavelet: not effective, Stockwell: good compromise – drops of high frequency content for evaluating initiation of liquefaction). With that time, PR value, PGA, and rd, can identify point in CSR-PR space. Requires corrections for pore pressure, penetration resistance, and timing of softening

relative to the surficial evidence. A wide ranging discussion followed that got into issues of how ground motions are affected by liquefaction and how they should be estimated for NGL project.

- R Moss: We would ideally like to have vertical array data with downhole record below liquefiable layer and surface record. Would allow for more reliable estimate of CSR for hypothetical no-pore pressure condition.

There was discussion of how reliable are the SPT values at Knet and Kiknet sites. J Stewart reported on meeting with NIED staff where they indicated that Knet logs are by low bidders, Kiknet was one large national company managing whole network.

- S Nakai – Japanese experience is that KNet data are usually not reliable.
- A Elgamal: In site documentation, it is important to include maps and cross sections that show the site configuration, so that geologic heterogeneity and possible static shear stress effects can be evaluated.

6. C Beyzaei – New Zealand
    - They have focused on 53 sites from a series of projects. They have performed testing and compiled documentation so that they can be added to NGL database. Actually entering the data remains to be completed in most cases.
    - An especially valuable aspect of these data set is that most locations are 5 case histories, due to being shaken in multiple events.
    - J Stewart and group discussion: T&T have been working with various researchers on additional sites with excellent documentation – field performance, ground motions from Brendon Bradley, borings with samples and lab tests, CPT, Vs from multiple sources. There are 55 such sites. To what degree do these overlap with the UCB sites? These should be added in next phase of work – who will do this (Christine or Dong Youp)?
7. S Bartlett – NGL-lateral spreading:
    - He is leading a NGL-themed lateral spreading project with funding from various state DOTs.
    - Intent is that this data will be part of NGL case history database.
    - S Brandenberg: consider Lidar-based lateral displacements for recent case histories
    - K Franke: How to define lateral spread vs. slope displacement
8. L Youd: Presented lateral spread case history data that fit Bartlett and Youd model poorly, it was judged deficient because it may not have satisfied certain conditions that went into the development of that model.
    - J Stewart: We cannot decide on the suitability of a data set based on how it fits a model.
    - L Youd: Agree. We need to be careful about only using high quality data. Data screening is important, especially for lateral spreading prediction). Lateral continuity is necessary for using Youd et al. (2002) equation. This procedure is now abused also when you do not meet main assumptions of the method
9. D Kwak – NGL Database
    - J Stewart: Add source of the photographs
    - J Bray: Need to clearly state what is objective and what may be somewhat subjective data (there is some modest subjectivity in the ground motions).
    - Y Bozorgnia: Ground motion data might not even be objective because it's sensitive to how it's processed

- R Moss: geotech would want to do a ground response analysis rather than use a nonlinear site response regression equation. Can get ground response analysis results to interpret cyclic stress in critical layer rather than using rd.
- J Stewart: site-specific analysis can be incorporated into the proposed ground motion estimation procedure, but we need to provide suitable documentation.
- Y Bozorgnia: capture the epistemic by using more than 1 GMPE
- Y Bozorgnia and T Shantz: Interpretation of ground motion at a specific site could be supporting study.

How to contribute to the database?

- Group favors "Anyone can upload, and filter afterward", but may need to start with "Database manager(s) receive data, filter, and upload".
- J Bray: As soon as the database is ready you have to publish it right away before developing models
- Y Bozorgnia: avoid the publication of unreliable data (the model developers will be performing a double check on the data)
- R Moss: Need to get away from level ground and start studying sites with buildings and other sources of driving shear stress. Information about initial driving shear stress must be included in the database (site plan, google maps, cross sections, etc., these items will be useful for K_α and modeling)
- J Bray: Adapazari dataset (downloadable from PEER web site) should be incorporated into the NGL database
- J Stewart: Taiwan too, also on PEER web site.
- S Bartlett: Can you link lidar (or point clouds) to the database, if so, which software? Ans: not sure.

10. T Shantz (Caltrans) – Perspective of funding agency.
    - Caltrans has an important design guidelines document on the effects of lateral spreading on bridges, formal approval is pending. This follows a 2011 PEER report by Ashford, Boulanger, Brandenberg.
    - Caltrans screened about 6000 bridges down to 450 that need further analysis. Based largely on susceptibility and horizontal continuity of crucial layers.
    - Caltrans MTD (memo to designers) 20-15 is currently in progress. Makes lateral spread guidelines official.
        - Dropping inertial load (or displacement demand) contribution
        - Analysis through global bridge model instead of single bent
        - More lenient performance criteria. Column ductility demands <= 8, Footing settlement < 24 inches, Allow plastic hinging of piles with max drift <= 20%.
    - Caltrans has committed $210K to NGL + $60K to UDOT project + numerical modeling (Martin and Elgamal). Previously funded $100K for field work in Japan. NGL needs to deliver a practical research product ... soon. A research product means a deployable product, such as an update to a triggering relation, not a deliverable such as part of a database. Need to find low-hanging fruit to facilitate future funding. Stewart, Kramer, and Bozorgnia to follow up with Tom on this point (these deliverables will relate to triggering and lateral spreading).

11. T Weaver (US NRC) – Perspective of potential funding agency (NRC)
    - Performance-based target goal. Frequency of liq = 10^{-5} year, or also to target displacement values.
    - Principles of good regulation
        - Clarity
        - Reliability
    - RG 1.198 is the key document. Weaver is responsible for updating.
    - Code of Federal Regulations requires evaluation for liquefaction potential for spent fuel storage and reactor citing.
    - Target 10^{-5}/year probability of exceeding the onset of inelastic deformation.
    - NRC Interests
        - Reliable database and predictive models
        - Evaluation at high confining stress (structures embedded down to 40ft)
        - Evaluating settlement (free field and beneath structure)
    - NGL Contributions
        - Openness of process
        - Reliable database, models and methods
        - Increased clarity
        - Lead to improved regulatory guidance and geotechnical engineering practice
    - S Brandenberg: is NRC interested in the study of levees that protect structures?
    - T Weaver: it will be desirable to include details on these systems.
12. Kramer-led discussion starting 3:38 pm
    - R Armstrong: Gravel correction for SPT blow counts (important for dams)
    - Shantz spoke with Elgamal at PEER annual meeting about numerical modeling (permeability in numerical models is the most important parameter)
    - S Bartlett: Can measure horizontal permeability using CPT.
    - S Kramer: System permeability (i.e., permeability gradients or layering) might be more important than permeability at a point.
    - R Green: Fines content is a very important parameter. Correlation between fines content and Ic based on New Zealand specific model was actually worse than generic fines correction by Idriss and Boulanger.
    - R Moss: driving shear stress is fundamental (we need improvement on this issue)
    - S Kramer: cyclic simple shear tests are important for improving understanding on driving static shear stress
    - R Moss: cyclic simple shear test is important to better understand the effect of static shear stress.
    - S Kramer: When we are assessing effects, rather than triggering, we need to integrate the effect (strains, etc.), which avoids the need to identify a single critical layer.
    - R Moss: there are many studies on identifying the critical layer – end result is that the selection is extremely subjective. Geology and geomorphology should dictate the choice.

- Fines content and depth effect are most important. Seemed to be a group consensus on this. (Others are effects of initial shear stress, selection of critical layer, void redistribution, aging effects, and ground motion estimation).
- New IM's may be explored, and new alternatives to PR (i.e., vector including PR plus Vs).
- R Moss and S Kramer: only a few procedures have been developed for picking the critical layer (useful for developers)
- S Bartlett: pattern of observed deformations/damages is important. For probability analysis neural network could be a good solution (pattern is more important than 1D integration). There is a way to make the critical layer less subjective
- J Bray: Depth, fines, GM, void redistribution are the 4 most important issues
- S Brandenberg: Combination of penetration resistance with VS for resistance measure
- K Franke: How deep should we go?
- Z Zafir: Geologic age may be different from aging. Aging is a function of number of past earthquakes, which correlates with geologic age but in a region-specific manner depending on seismic hazard (focus on Holocene series)
- S Brandenberg: SSI effects on consequences and triggering (by means of shear stress)