Assessment of Pile Tip Capacity in Liquefiable Soil

By
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Progress Report
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Project Objective:

The objective of this study is to provide a new analysis procedure for assessing the tip response of caissons and short shafts embedded in saturated sands as liquefaction develops in response to dynamic loading such as earthquake shaking. Various departments of transportation (e.g. WashDOT) use short shafts surrounded by soft liquefiable soil to support highway bridges. Several studies have been conducted for a better assessment of the potential of the soil to liquefy. However, predicting the response of pile foundations in liquefied (or approaching liquefaction for that matter) soil is very complex and yet no realistic design procedure exists. The work conducted will provide a tool by which degradation in tip response and soil resistance due to the free-field excess porewater pressure generated by earthquake along with the near-field excess porewater pressure generated by superstructure can be assessed.

This study comes as a subsequent phase to a multi-phase research project. In phase one, an analysis procedure was developed, by the authors, to assess pile tip load and the associated tip displacement in sand over the entire strain range of the soil up to "true" failure

Progress to Date

The work was divided into two tasks.

Task One (completed)
Develop a method to integrate Seed's method, for assessing the value of free-field excess porewater pressure, along with a technique developed by Norris et al, for assessing the near-field excess porewater pressure, into a one-circle model. This one-circle model (Mohr circle) represents one stress zone.

Task Two (60 % compete)
Apply the method developed in task one to the four-circle model, representing the four zones of stress, which the current model for pile tip behavior assessment is based upon.

Budget

The total award for the project was $30,000 ($15,000 from NESC and $15,000 from Gary Norris salary). Below is the breakout for the expenditures so far.

- $8,077 Summer salary for Sherif Elfass for the month of July
- $3,846 Summer salary for Sherif Elfass in August
- $2,500 Student wages (for August and September)