# NIST/NSF BLIND PREDICTION CONTEST ON THE IN-GROUND HINGE PERFORMANCE OF STEEL PIPE PILES

SUBMISSIONS DUE November 5th , 2024

## Contest Rules

- Contestants may consist of individuals and/or teams.
- An individual can only be involved in a single team.
- If an individual is part of a team the individual cannot enter the competition separately as an individual.
- Multiple teams from a company, a research institution or a university may submit predictions.
- Contestants will submit a single entry of only one of the following two (2) categories:
  - **Limited Analysis:** This category is recommended for practitioners and researchers intending to use simple computational models to capture the main response parameters.
  - **Comprehensive Analysis:** This category is recommended for practitioners and researchers intending to model the test specimens and test setup to capture the full cyclic response of the test specimens and to predict overall and dynamic response parameters.
- There will be one winner for each of the two categories. Each will be evaluated and rewarded separately.
- Results will be presented anonymously except for those of the "winning" entries.
- Questions about the blind prediction contest or details of the single in-ground pile test specimen can be submitted via peer_center@berkeley.edu. Questions should be submitted by October 7, 2024. Questions and answers will be posted on the blind prediction web site.

## Contest Schedule

| Event | Deadline |
|---|---|
| Blind Prediction Contest Opens | August 21, 2024 |
| Deadline for Questions | October 7, 2024 |
| Deadline for Submissions | November 5, 2024 |
| Category Winners Notified | November 14, 2024 |

## Provided Information, Assumptions and References

The blind prediction contest website contains the following information:
- Contest Rules
- General Test Information
    - Test Set-up (Pictures and Drawings)
    - Test Specimen Parameters and Material Properties
    - Site Geotechnical Parameters
    - Test Loading Conditions
    - A video of the test. This video demonstrates the cyclic test at a large amplitude displacement. Note: the rate of loading in the video was sped up for viewing convenience.
- Submission Spreadsheet (see below for a detailed description)

## Submittal Rules

The individual or team must use the contest submittal spreadsheets provided and input the required values.

**Category A. Limited Analysis:**

Submit results using the spreadsheet provided:

- Questionnaire Tab: Provide brief description of the method of analysis that clearly explains the structural system and modeling assumptions in no less than 450 words.
- Envelope Tab: Provide the following information
    - Positive Lateral Force (kip) vs. Lateral Displacement (inch) Response Curve at the elevation of applied lateral force at 7'-9" above ground surface. Positive being the loading condition when the pile is being pushed north, away from the reaction wall.
        - Provide the lateral force (kip) at the peak displacements which occur at semi-cycle peaks marked as 25, 29, 33, 37 and 41 in the displacement loading protocol, Figure 10 in the *Information_Assumptions_Reference* document. (5 Total)
    - Determine the in-ground depth z (ft) at the pile's maximum bending moment when the peak lateral force occurs. Note: The depth below ground surface, z, is a negative number. Also provide the peak lateral force and the pile maximum bending moment.
    - Identify the mode of failure which results in softening of the response.

**Category B. Comprehensive Analysis:**

Submit results using the spreadsheet provided:

- Questionnaire Tab: Provide brief description of the method of analysis that clearly explains the structural system and modeling assumptions in no less than 450 words.
- Free Vibration Tab: The pile was subjected to free vibration testing. For this test, the Axial Load Apparatus was fully fixed on the pile to provide mass. The tire test was performed with only the Axial Load Apparatus applied, no concrete weights applied. An initial maximum lateral displacement of 0.260-inches was measured at the top of the pile due to a single hit with a tire. Compute the fundamental period (sec) of free vibration and the effective viscous damping ratio. The effective viscous damping ratio shall be calculated assuming a free vibration harmonic response decay. Please refer to the *Information_Assumptions_References* document and *Comprehensive Analysis Results Spreadsheet* for details of the free vibration test including the geometry and properties of the loading apparatus.
- Envelope Tab: Provide the following information (graphically and in table)
  - Lateral Force (kip) vs. Lateral Displacement (inch) Response Envelope at the elevation of applied lateral force at 7'-9" above ground surface. Positive being the loading condition when the pile is being pushed north, away from the reaction wall.
    - Provide the lateral force (kip) at the peak displacements which occur at semi-cycle peaks marked as 25, 29, 33, 37 and 41 in the displacement loading protocol, Figure 9 in the *Information_Assumptions_Reference* document. (5 Total)
  - Determine the in-ground depth z (ft) at the pile's maximum bending moment when the peak lateral force occurs. Note: The depth below ground surface, z, is a negative number. Also provide the peak lateral force and the pile maximum bending moment.
  - Identify the mode of failure which results in softening of the response.
- Hysteretic Energy Tab: Calculate the hysteretic energy (kip-in) in cycles 25-26, 33-34 and 37-38. Refer to Figure 10 loading protocol in the *Information_Assumptions_Reference* document and the figure in the *Comprehensive Analysis Results Spreadsheet* for the definition of a cycle. The hysteretic energy shall be taken as the shaded area enclosed by the lateral force vs. lateral displacement loop. Please refer to the *Comprehensive Analysis Results Spreadsheet* for further details.

If necessary, any additional information will be provided at the blind prediction contest website and questions can be submitted by emailing peer_center@berkeley.edu.

# Evaluation

Teams and/or individuals are requested to predict the test specimen performance and fill in the tables and values as indicated in the Category A. Limited Analysis Submittal Spreadsheet or the Category B. Comprehensive Analysis Submittal Spreadsheet. The winning team will have the highest total points. In the case of a tie, the winning team will be the one that has the minimum error(s) in Table A-1/Table B-2 of the corresponding submittal sheets.

The following will be scored with a point system as described below, with maximum points for

1. Category A. Limited Analysis Results Spreadsheet          26 points Max.
2. Category B. Comprehensive Analysis Results Spreadsheet          42 points Max.

Note: Error is defined as the absolute value of the difference between the measured value from the test and the predicted values input by the contestant, normalized by the absolute value of the measured value from the test.

Questionnaire Tab: Up to 4 points will be assigned. Scoring is similar for both categories.

- 0 points – Incomplete
- 1 point – Less than 50 words and unclear description of methodology
- 2 points - Unclear assumptions and modeling description
- 3 points – Clear modeling description, however assumptions are not provided. OR clear detailed modeling description with assumptions listed, however, exceeds 450 words.
- 4 points – Less than 450 words and clearly describes program/software used, modeling description and outlines modeling assumptions.

Free Vibration Tab: Up to 10 total points for completion of this tab will be assigned. Only scored for Category B. Comprehensive Analysis participants.

- 0.5 pts total for each Table B-1 entry. Each entry will be deducted 0.1pt for every 10% calculated error, up to 50%. If the error is greater than 50%, 0 pts will be assigned for that entry.
- 3 pts total for calculated Fundamental Period. 0.5 pt will be deducted for every 20% calculated error. If the error is greater than 120%, 0 pts will be assigned for that entry.
- 2.5 pts total for calculated Effective Viscous Damping Ratio. 0.5 pt will be deducted for every 20% calculated error. If the error is greater than 180%, 0 pts will be assigned for that entry.

Envelope Tab: Up to 22 points will be assigned. Scoring is similar for both categories.

- 2 pts total for each Table A-1/Table B-2 entry. Each entry will be deducted 0.25pt for every 10% calculated error, up to 50%. If the error is greater than 50%, 0.5 pts will be assigned.
- 3 pts total for Peak Lateral Force value. 0.5 pt will be deducted for every 10% calculated error. If the error is greater than 60%, 0 pts will be assigned for that entry.

- 3 pts total for Pile Maximum Bending Moment value. 0.5 pt will be deducted for every 10% calculated error. If the error is greater than 60%, 0 pts will be assigned for that entry.
- 4 pts total for determined *Depth Below Ground* (ft) value. 0.5 pt will be deducted for every 6-in variation. If the variation is greater than 48-in, 0 pts will be assigned for that entry.
- 2 pts total for Identified mode of failure. 1 pt deduction for correct partial response. 0 pts for incorrect response.

Hysteretic Tab: Up to 6 total points will be assigned. Only scored for Category B. Comprehensive Analysis participants.

- 2 pts total for each Table B-3 entry. Each entry will be deducted 0.5pt for every 20% calculated error, up to 40%. If the error is greater than 40%, 0 pts will be assigned for that entry.

Scoring sheets will not be distributed. The scoring can be made available upon request after November 14, 2024.