Wave Equation Analysis of Piles
Effective: November 14, 2008

**Description.** This work shall consist of conducting Wave Equation Analysis of Piles (WEAP) at each substructure or location specified on the contract plans, using the latest version of the WEAP software program. The analyses assumptions and driving recommendation shall be provided to the Engineer for review and approval, to establish the pile acceptance criteria and ensure the proposed driving system will not overstress the piles.

**Submittals.** No later than twenty five (25) days prior to driving the test or production piles at the specified location(s), the Contractor shall submit the wave equation analysis results and driving recommendations to the Engineer for review and approval.

The wave equation analysis shall be sealed by a Professional Engineer licensed in the state of Illinois having experience in the use of the WEAP program and selection of the geotechnical and hammer input parameters.

As a minimum, the Contractor shall submit the following analysis assumptions:

1. The pile type and size analyzed at each location.
2. The Nominal Required Bearing specified at each location.
3. The test pile bearing when test pile(s) are specified.
4. The batter angle(s) of any piles specified to be driven in a non-vertical alignment.
5. The proposed or anticipated total pile length and length above ground at end of driving.
6. Ground surface elevation during driving.
7. The assumed subsurface soil profile layer depths and thicknesses, location of water table, soil type and strength parameters.
8. Borings numbers used to develop the design soil profile.
9. Explanation of why any input values were selected that differ from the default values recommend by the program.
10. A completed “Hammer Data Form” documenting the proposed hammer, helmet and cushion information (see attached) or see http://www.dot.il.gov/bridges/bridgforms.html

The recommendations to be included in the submittal are to include:

1. An assessment of the proposed hammer driving system(s) ability of drive the test, production and batter piles to their required bearings at a penetration rate between 2 and 10 blows per inch.
2. The expected stress levels in the piles at the maximum expected hammer energy and any recommended limitations on hammer energy or fuel settings to ensure the pile stresses do not exceed 90% of the pile yield stress.
3. A pile inspector’s charts showing hammer stroke (ft) or Energy versus pile penetration rate (blows/inch) at the nominal required bearing, batter pile bearing and test pile bearing for each substructure specified.

A new analysis is required if the contractor makes driving system changes from what is proposed in the approved analysis.

**Basis of Payment.** This work will not be measured for payment and shall be included in the cost for the various pay items associated with pile foundation construction.
Pile Driving Equipment Data

Structure Number: __________
Pile Driving Contractor: ________________________________
Abutment /Pier Number(s): ___________________________ Route: __________
Pile Type & Size(s): _________________________________ Section: __________
Nominal Required: _________________________________ County: __________
Production Pile Length(s): __________ Closest Boring(s): __________ Contract: __________

Hammer Manufacturer: ______________________________ Model No: __________
Type (diesel, air/steam hydraulic, etc.): __________ Ram Stroke Type (fixed or Variable): __________
Maximum Operating Energy: __________________________ Minimum Operating Energy: __________________________

Maximum Recommended Stroke: __________________________
Minimum Measurable Stroke: __________________________
Ram Weight: __________________________
Anvil Weight: __________________________
Modifications to Hammer (if any): __________________________

Striker Plate
Diameter: __________________________
Thickness: __________________________
Weight: __________________________

Hammer Cushion Material 1
Material Type: __________________________ Material Type: __________________________
Diameter: __________________________ Diameter: __________________________
Thickness per Plate: __________________________ Thickness per Plate: __________________________
No. of Plates: __________________________ No. of Plates: __________________________
Total Hammer Cushion Thickness: __________________________

Hammer Cushion Material 2 (if composite)
Material Type: __________________________
Diameter: __________________________
Thickness per Plate: __________________________
No. of Plates: __________________________
Total Hammer Cushion Thickness: __________________________

Helmet (Drive Head, Pile Cap) Weight (including bonnet insert if any): __________________________
Pile Cushion (precast concrete piles only)
Material:
Thickness Per Sheet: __________________________
Area: __________________________
No. of Sheets: __________________________
Thickness Total: __________________________

Double Acting/Differential Acting Air or Steam
Hammers Net Weight: __________________________
Cylinder Net Weight: __________________________
Piston Area: __________________________

Attach Bounce Chamber Pressure vs. Equivalent Energy Graphs (Closed-End Diesel Hammers Only): __________

Hammer Data Completed by: __________________________ Contact Phone Number: __________________________
Date Completed: __________________________