Driven Piling – Acceptance Criteria

To verify that the proposed hammer can develop the required minimum energy as required by the specifications, use the manufacturer's maximum energy rating and the nominal driving resistance to calculate the maximum acceptable blow count in accordance with *Contract Specifications*, Section 49-2.01A(4)(c), *Piling – Driven Piling – General – Quality Assurance – Acceptance Criteria*, (Note that in the formula **N**, the number of hammer blows in the last foot, is not to exceed 96 blows per foot which is equivalent to a penetration rate of not less than 1/8 inch per blow). Hammer data is typically submitted by the Contractor and can be found on the hammer manufacturer's website or by contacting Foundation Testing and Instrumentation, within the Office of Geotechnical Support.

When calculating the number of blows for the required nominal driving resistance, the hammer energy rating ($\mathbf{E_r}$) can be calculated by multiplying the hammer ram weight by the observed stroke (or drop height).

Form SC-4809, *Pile Driving (US Customary) Blows Per Foot using Gates Formula,* is used to calculate number of blows in the last foot (**N**), based on the stroke height (**H**) and the hammer energy rating ($\mathbf{E_r}$).

Appendix E, *Driven Piles,* of the *Foundation Manual* provides example calculations for minimum hammer energy, establishing a blow count chart, battered pile blow count chart, and other related information.

It is important to note that:

- The Gates formula uses nominal values as indicated in the *Standard Specifications*. Nominal resistance and nominal driving resistance of a given pile are shown in the Pile Data Table on the contract plans.
- The nominal driving resistance is always equal to or greater than the nominal resistance. This is because the nominal driving resistance accounts for driving resistance through unsuitable penetrated soil layers (very soft, liquefiable, scourable, etc.) which do not contribute to the design nominal resistance.
- Even under ideal hammer operations, the energy dissipation from impact and losses within the hammer mechanism may greatly reduce the actual energy delivered to the pile during driving. Additional losses may occur due to improper or inadequate hammer use, changing fuel setting, using interchangeable ram, etc. Be aware of reductions in actual hammer energy. Using an inaccurate high hammer energy value in the Gates formula will yield false high nominal resistance results.