

REVIEWED

By Todd Sumner at 2:00 pm, Nov 21, 2014

AGENCY OF TRANSPORTATION

OFFICE MEMORANDUM

To: Aaron Guyette, P.E., Structures, Project Manager

From: Callie Ewald, P.E., Geotechnical Engineer, via Christopher C. Benda, P.E. Soils and Foundations Engineer

Date: November 18th, 2014

Subject: Rockingham BRF 0126(12) Wave Equation Analysis Review

The following summarizes our review of the wave equation analysis conducted for the piles proposed for the Rockingham BRF 0126(12) project. We received a copy of the wave equation analysis provided to Chad Contaldi of Cold River Bridges, LLC that was conducted by Michael Deery of GZA GeoEnvironmental, Inc. and Pile Driving & Equipment form prepared by the contractor. Mr. Deery performed wave equation analyses for the pile and hammer proposed for use at both abutments. The APE D19-42 single-acting diesel hammer was requested for analysis with a maximum rated energy of 47,126 ft-lbs. This hammer was evaluated for the pile-soil system for the Rockingham BRF 0126(12) site only.

The characteristics of the proposed pile as well as the hammer and hammer cushion data were reviewed in the WEAP analysis to ensure the analysis was conducted per the contractors' submitted pile and driving equipment data form.

Mr. Deery performed both a variable and a constant capacity analysis. Analyses were run assuming either a 50% or 10% skin friction triangularly distributed along the lower 30 feet of pile. Both analyses were run because these piles are anticipated to gain the required resistance in soil prior to reaching bedrock. The analyses were performed assuming the hammer was operating on fuel setting 1 to produce a driving criterion that met VTrans requirements. Based on discrepancies between GZA's analysis and the pile and driving equipment form, VTrans requested that the contractor resubmit the form after verifying the inconsistencies. The resubmitted form dated November 14th, 2014 included hammer cushion and capblock parameters that agreed with GZA's analysis. We concur with the chosen analyses with respect to the subsurface information presented in the boring logs and geotechnical reports.

Based on a review of the material submitted, we agree with the recommendations put forth by GZA in their report dated November 3rd, 2014, which recommends a driving criterion of 4 blows per inch and a stroke of approximately 6.0 feet operating at fuel setting 1. At these blow counts, the stresses in the pile are expected to remain below 45 ksi per GZA's analysis. Mr. Deery recommends this driving criterion for a minimum of six (6) consecutive inches. In our experience, and based on these site conditions, **we recommend the driving criterion be developed for a minimum of three (3) consecutive inches. A saximeter is required to be on site to monitor the driving process at each substructure.** We recommend using a refusal criterion as 10 blows per half inch.

The 2011 VTrans Standard Specifications for Construction, Section 504.02(b), states the pile driving equipment must be capable of driving the pile to the required ultimate capacity at blow counts between 3 and 15 BPI. **Based upon this information and the WEAP analysis, the APE D19-42 hammer should be able to drive the steel HP 10x57 piles to the desired resistance and stay within the specifications.**

The serial number of the hammer should be recorded and kept in the pile driving records. Also, it is important to note that the thickness and condition of the prescribed Monocast MC 904 blue nylon cushion should be inspected prior to driving any piles. **If the thickness of the hammer cushion has decreased by 25%, then the cushion should be replaced, per Agency Specifications.** Generally, the best time to inspect the hammer cushion is when the hammer first arrives on the job, and is placed in the leads.

cc: Chad Greenwood, Resident Engineer