

To: Kristin Higgins, Structures Project Manager

From: ^{CEE} Callie Ewald, P.E., Geotechnical Engineer, via ^{CCB} Christopher C. Benda, P.E. Soils and Foundations Engineer

Date: February 19th, 2013

Subject: Jamaica ER BRF 013-1(16) Wave Equation Analysis Review

The following summarizes the results of our wave equation analysis review conducted by John Linscott IV of HB Fleming, Inc. for the Jamaica ER BRF 013-1(16) project. Three single acting diesel hammers were requested for analysis for the abutments and pier, the APE D19-42, the MKT DE 42, and the APE D36-42. These hammers were evaluated for the pile-soil system for the Jamaica ER BRF 013-1(16) site only.

The results of our analyses were very similar with the exception of small differences between blow counts that will be verified with PDA testing in the field. Some errors were noticed in the transmission of results onto the cover page of the submittal for the abutments. This includes the ultimate capacity and the blows per inch values. These have been noted in red on the original submittal and are attached to this memo.

For the pile-hammer system, H.B. Fleming modeled the resistance during driving encountered by the pile as 80% end bearing and 20% skin friction triangularly distributed along the pile. We conducted a sensitivity analysis of the percent skin friction for the APE D36-42 hammer as the resulting criteria was on the low end of our acceptable blow counts, between 3 and 15. Very dense silt was found in the subsurface investigation, and it is likely that more than 20% shaft resistance could develop during driving. It was found that higher percentages of shaft resistance modeled in the wave equation analysis result in unacceptable driving criteria. **For this reason, we recommend that the APE D36-42 hammer not be approved to drive the pier piles.**

In order to drive the specified piles to the nominal resistances listed for the abutment and the pier, the anticipated blows per inch and corresponding minimum ram stroke are provided below in Table 1.

Table 1. GRLWeap Analysis Output

Substructure	Hammer Type	Blows per inch (BPI)	Min. ram stroke
Abutments	APE D19-42	4	9.0'
	MKT DE 42	5	8.0'
Pier	APE D19-42	7	9.0'
	MKT DE 42	8	8.0'
	APE D36-42	Not Acceptable	Not Acceptable

Based upon this information and the WEAP analysis, both the MKT DE-42 and APE D19-42 hammers should be able to drive the steel HP 14x102 piles at the abutments and pier location to the desired resistance and stay within the specifications.

Attachments: H.B. Fleming’s Submittal Cover Sheets – M&R Review (2 pages)

cc: Chad Greenwood, Resident Engineer
CCB/Project File



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PILE DRIVING

BRIDGES

SUBMARINE PIPELINES

SUBMITTAL

Submitted To:

Client: T-Buck Construction
 Attention: Brian Emmons

Date: 01/21/2013
 Project: VT. Bridge No.78 Abutments
 Location: Jamaica, VT

Subject: Pile Driving Criteria

H.B. Fleming Proposes to use the following driving criteria for the piles to be installed at the above location.

Hammer(s)

- Either an APE D19-42 or an MKT DE 42 may be used for this project. The details for each hammer are listed below respectfully.
- The D19-42 has a ram weight of 4,190 lbs, a maximum stroke of 10'3", and a rated energy of 42,800 ft-lbs.
- The DE-42 has a ram weight of 4,200 lbs, a maximum stroke of 10'6", and a rated energy of 42,000 ft-lbs.

Pile

- HP 14X102, ASTM A572 Gr. 50 steel piles.
- The Ultimate Capacity which we based our analysis on is ~~238.5~~ tons.
- Piles will be fitted with cast steel driving points.

152.5 tons



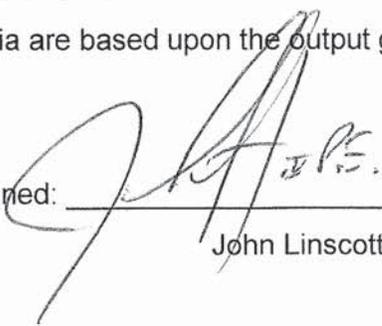
Results

- Piles will be driven until a blow count of ~~8 blows per inch~~ for three consecutive inches with the MKT DE 42.
- Piles will be driven until a blow count of ~~7 blows per inch~~ for three consecutive inches with the APE D19-42.
- These criteria are based upon the output generated from the WEAP analysis that follows.

5 blows per inch with 8' min. ram stroke

4 blows per inch with 9' min. ram stroke



Signed: 

John Linscott IV "Scotty"





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PILE DRIVING

BRIDGES

SUBMARINE PIPELINES

SUBMITTAL

Submitted To:

Client: T-Buck Construction
 Attention: Brian Emmons

Date: 01/21/2013
 Project: VT. Bridge No.78 Pier
 Location: Jamaica, VT

Subject: Pile Driving Criteria

H.B. Fleming Proposes to use the following driving criteria for the piles to be installed at the above location.

Hammer(s)

- An APE D19-42, MKT DE 42 or an APE D36-42 may be used for this project. The details for each hammer are listed below respectfully.
- The D19-42 has a ram weight of 4,190 lbs, a maximum stroke of 10'3", and a rated energy of 42,800 ft-lbs.
- The DE-42 has a ram weight of 4,200 lbs, a maximum stroke of 10'6", and a rated energy of 42,000 ft-lbs.
- The D36-42 has a ram weight of 7,938 lbs, a maximum stroke of 11'3", and a rated energy of 89,302 ft-lbs.
- The hammer cushioning material consists of 2 inches of Monocast MC901 material for the APE D19 and the MKT DE 42. The D36 cushioning material consists of 3.5" total, 2 EA 1" Micarta material and 3 EA 1/2" Aluminum material alternated and stacked.

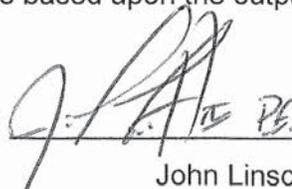
Pile

- HP 14X102, ASTM A572 Gr. 50 steel piles.
- The Ultimate Capacity which we based our analysis on is 238.5 tons.
- Piles will be fitted with cast steel driving points.

Results

- Piles will be driven until a blow count of 8 blows per inch for three consecutive inches with the MKT DE 42. 8' min. ram stroke
- Piles will be driven until a blow count of 7 blows per inch for three consecutive inches with the APE D19-42. 9' min. ram stroke
- Piles will be driven until a blow count of 3 blows per inch for three consecutive inches with the APE D36. 9' min. ram stroke

These criteria are based upon the output generated from the WEAP analysis that follows.

Signed: 

John Linscott IV "Scotty"



This criteria falls below Section 504.02(b) specs when the shaft resistance is increased, which is likely to happen in the field.

We find the APE D36-42 hammer unacceptable as evidenced from the WEAP analysis with an increased shaft resistance and blow counts out of the VTrans specification.