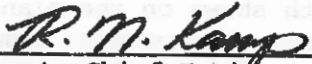


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| TO: MAIN OFFICE REGIONAL OFFICES SUPERSEDED BY EI 86-041 EFFECTIVE 12/16/1986 | <h2 style="text-align: center;">ENGINEERING INSTRUCTION</h2> <p style="text-align: center;">NEW YORK STATE DEPARTMENT OF TRANSPORTATION</p> SUBJECT: PILE DRIVING CRITERIA Subject Code: 7.27-1-629 |
| Distribution: <input checked="" type="checkbox"/> Main Office <input checked="" type="checkbox"/> Regions <input type="checkbox"/> Special APPROVED: <div style="text-align: center;">  <hr/> Deputy Chief Engineer (Structures) </div> | Code: EI 74-108 Date: 12/4/74 Supersedes: |

The ENR pile driving formula, or variations thereof, shall no longer be used to relate driving resistance to pile length or capacity. All future pile driving criteria shall be established by the Deputy Chief Engineer (Structures).

The Deputy Chief Engineer (Structures) may establish pile driving criteria by publishing either the required driving resistance or the ordered and minimum pile lengths on the plans. In most cases, however, a computer solution to the pile driving problem (known as the Pile Wave Equation Analysis) will be used. The computer program for this analysis requires, as input, certain foundation soil parameters, and data on pile materials, pile driving equipment, and associated appurtenances. To insure the prompt availability of this vital information, a Special Note shall be included in all future Proposals. This note reads as follows: "Piles shall be acceptable only when driven to pile driving criteria established by the Deputy Chief Engineer (Structures). Prerequisite to establishing these criteria, the Contractor shall submit to the Deputy Chief Engineer (Structures) and others, as required, Form BD 138, 'Pile and Driving Equipment Data.' All information listed on Form BD 138 shall be provided within fourteen (14) days after the award of the contract. Each separate combination of pile and pile driving equipment proposed by the Contractor shall require the submission of a corresponding Form BD 138."

An initial supply of Form BD 138 is available in the Region's stock rooms. Resupply may be arranged by submitting Stock Requisition Form AD 86. Sample filled-out copies of Form BD 138 are attached to this instruction.

Form BD 138 is to be submitted on all projects which include piles, whether a Pile Wave Equation Analysis is indicated or not. Submission of Form BD 138 will satisfy the specification requirements of individual pile items pertaining to the approval of materials, details, and equipment by the Deputy Chief Engineer (Structures).

Some projects for which plans are already completed include a Special Note requiring the Contractor to submit certain pile data. These projects should submit this required data on Form BD 138, although no time limit is stated. No pile driving should be permitted on such projects until the

Subject: FILE DRIVING CRITERIA

required data is made available and approved by the Deputy Chief Engineer (Structures).

On projects already in progress, or for which no Special Note is included, the use of Form BD 138 is encouraged, but not mandatory.

The Deputy Chief Engineer (Structures) shall retain the right to modify pile driving criteria at the time of driving. If the original drive criteria supplied by the Deputy Chief Engineer (Structures) are not realized within a few feet of the estimated length shown on the plans, the Engineer shall notify the Deputy Chief Engineer (Structures) immediately. A re-evaluation of pile capacity, based on pile driving logs, may then be performed.

COMMENTS ON THE USE OF THE PILE WAVE EQUATION

The advantages anticipated through use of Pile Wave Equation Analysis are several. Pile driving criteria will be customized to the conditions unique to each structure site. Pile and driving equipment data submitted by the Contractor will be matched with soil property data obtained by the Soil Mechanics Bureau to provide a more accurate evaluation of pile capacity and characteristics than heretofore available. Computer Program Output will be in terms of stresses in the pile and a graph of drive resistance versus pile capacity for the estimated length of pile shown on the plans. This will enable the Deputy Chief Engineer (Structures) to re-evaluate pile capacities, on the basis of driving log results very quickly. Thus, when field conditions prove that some modification of pile driving criteria is in order, the Deputy Chief Engineer (Structures) can estimate what changed assumptions would produce output equal to the actual driving results. Using these new assumptions, it will be possible to pinpoint the driving resistance and pile length combination which will yield the required pile capacity. This improved accuracy and reliability should result in better control of overruns.

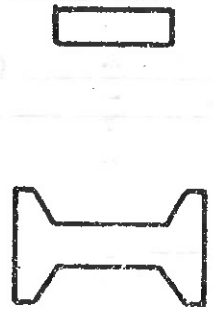
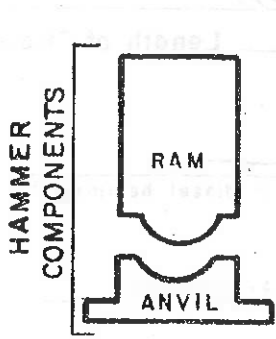
It is anticipated that most pile length estimates will not lead into a situation where pile driving criteria must be revised. When this procedure does become necessary, however, the computer performed re-analysis can be accomplished in a matter of hours. This efficiency should minimize delays.

When the original pile driving criteria given by the Deputy Chief Engineer (Structures) are not realized within a few feet of the estimated lengths shown on the plans, the Engineer shall notify the Deputy Chief Engineer (Structures) immediately. If the discrepancy is serious, the Engineer will be told to stop work on pile driving. No new Form BD 138 information will be necessary (unless an unauthorized change has been made), but the pile driving logs shall be telephoned to the Deputy Chief Engineer (Structures) at once. As soon as the re-analysis is complete, revised pile driving criteria and/or procedures will be telephoned to the Engineer. A following memorandum will be sent to the Region.

PILE AND DRIVING EQUIPMENT DATA

P. I. N.: 6100-20 Contract No.: FERC 14-71 Structure Name and/or No.: FITCH BRIDGE OVER CHEMUNG RIVER
 Project: CATON - FITCH BRIDGE
 County: CHEMUNG Pile Driving Contractor or Subcontractor: C. D. MURRAY
 (Piles driven by)

Manufacturer: M. K. T. Model DE-30
 Type: SINGLE ACTING Serial No.: 7840
 Rated Energy: 16,800 @ 6' Length of Stroke
 Explosive Force: 98,000 LB's.
 (For diesel hammers)
 Ram Weight: 2800 Ram Length: 7.29'
 Ram Cross Sectional Area: 112.9 (For diesel hammers)
 Anvil (With diesel hammers) Anvil Weight: 775 lbs.
 Material: HARDWOOD Area: 112.9
 Thickness 2"
 Modulus of Elasticity - E 45,000 (P.S.I.)
 Coefficient of Restitution-e .5



HAMMER
 RAM
 ANVIL

CAPBLOCK

PILE CAP

CUSHION

PILE

- Helmet
- Bonnet
- Anvil Block
- Drivehead

Weight: 4,000 lbs

Cushion Material: N/A Area:
 Thickness:
 Modulus of Elasticity - E (P.S.I.)
 Coefficient of Restitution-e

Type: HP 12x53
 Pile Size: Length (In Leads)- 55 FT.
 Diameter-
 Wall Thickness: Taper:
 Material: STEEL Weight/Ft.: 53
 Design Pile Capacity: 10 (Tons)
 Description of Splice: FULL PENETRATION BUTT WELD
 Tip Treatment Description: MANUFACTURED POINT ASSOCIATED BP 15 150

- DISTRIBUTION
 ONE COPY EACH TO:
- DEPUTY CHIEF ENGINEER (Structures)
 - DIRECTOR, SOIL MECHANICS BUREAU
 - REGIONAL DIRECTOR
 - ENGINEER IN CHARGE

NOTE: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

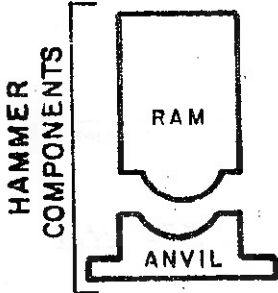
Submitted By: TOM SMITH Date: 10/11/74

PILE AND DRIVING EQUIPMENT DATA

P. I. N.: 9357.07 Contract No.: FISH 73-13 Structure Name and/or No.: 5
 Project: I-88 OTEGO-ONEONTA
 County: OTSEGO Pile Driving Contractor or Subcontractor: LANE CONSTRUCTION
 (Piles driven by)

Manufacturer: VULCAN Model NO. 1
 Type: SINGLE ACTING Serial No.: 48691
 Rated Energy: 15,000 @ 3' Length of Stroke
 Explosive Force: _____
 (For diesel hammers)

HAMMER



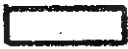
RAM

Ram Weight: 5,000 Ram Length: _____
 Ram Cross Sectional Area: 102.9 (For diesel hammers)

ANVIL

(With diesel hammers) Anvil Weight: _____

CAPBLOCK



Material: HARDWOOD Area: 102.9
 Thickness: 2"
 Modulus of Elasticity - E 45,000 (P.S.I.)
 Coefficient of Restitution-e 0.5

PILE CAP



Helmet
 Bonnet
 Anvil Block
 Drivehead
 Weight: 1,000 lbs

CUSHION



Cushion Material: N/A. Area: _____
 Thickness: _____
 Modulus of Elasticity - E _____ (P.S.I.)
 Coefficient of Restitution-e _____

PILE



Type: C.I.P.
 Pile Size: Length (In Leads)- 90'
 Diameter- 12 3/4" O.D.
 Wall Thickness: .219" Taper: NONE
 Material: STEEL Weight/Ft.: 27.56 lbs
 Design Pile Capacity: 35 (Tons)
 Description of Splice: FULL PENETRATION BUTT WELD
 Tip Treatment Description: 13 1/2" dia. x 3/4" thk BOOT PLATE

DISTRIBUTION
 ONE COPY EACH TO:

- DEPUTY CHIEF ENGINEER (Structures)
- DIRECTOR, SOIL MECHANICS BUREAU
- REGIONAL DIRECTOR
- ENGINEER IN CHARGE

NOTE: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

Submitted By: HARRY WADE Date: 10/11/74

PILE AND DRIVING EQUIPMENT DATA

P. I. N.: 512101-331 Contract No.: FASTE 73-3 Structure Name and/or No.: CHAUTAUQUA LAKE BRIDGE STRUCTURE No. 1
 Project: CHAUTAUQUA LAKE BRIDGE SECTION 5C, S.T.E.
 County: CHAUTAUQUA Pile Driving Contractor or Subcontractor: RAYMOND INTERNATIONAL
 (Piles driven by)

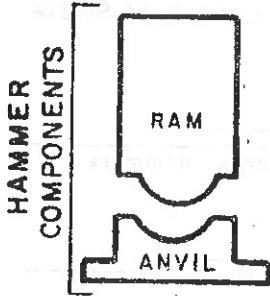
Manufacturer: LINK BELT Model 440

HAMMER

Type: CLOSED END DIESEL Serial No.: 10-1845

Rated Energy: 18,200 @ 4.55' EQUIV. Length of Stroke

Explosive Force: 98,000 FT.-LB.
(For diesel hammers)



RAM

Ram Weight: 9,500 #s Ram Length: 4.6'

Ram Cross Sectional Area: 254.5 IN.² (For diesel hammers)

ANVIL

(With diesel hammers)

Anvil Weight: 705



CAPBLOCK

Material: STEEL - SPAULDITE Area: 256 IN.²

Thickness: 1 IN. STEEL - 5 IN SPAULDITE

Modulus of Elasticity - E 450,000 SPAULDITE (P.S.I.)

Coefficient of Restitution-e 0.8



PILE CAP

Helmet
Bonnet
Anvil Block
Drivehead

Weight: 4,130 lbs



CUSHION

Cushion Material: LAMINATED FIR PLYWOOD Area: 400 in.²

Thickness: 6 IN.

Modulus of Elasticity - E 35,000 (PERPENDICULAR TO GRAIN) (P.S.I.)

Coefficient of Restitution-e 0.4



PILE

Type: PRE-CAST CONCRETE

Pile Size: Length (In Leads)- 80 FT.

Diameter- 14 INs

Wall Thickness: N/A. Taper: NONE

Material: CONCRETE (TYPE 3 CEM.) Weight/Ft.: 205 #/ft.

Design Pile Capacity: 60 (Tons)

Description of Splice: FLOOROCK

Tip Treatment Description: H-PILE BUILD UP CAST INTO TIP

DISTRIBUTION
ONE COPY EACH TO:

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- DIRECTOR, SOIL MECHANICS BUREAU
- REGIONAL DIRECTOR
- ENGINEER IN CHARGE

NOTE: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

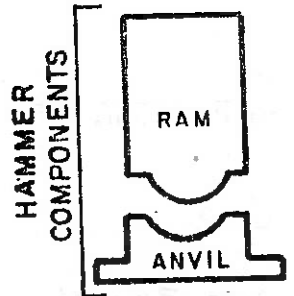
Submitted By: Harry Frank Date: 10/11/74

PILE AND DRIVING EQUIPMENT DATA

P. I. N.: 1119.01.322 Contract No.: FARC-72-1 Structure Name and/or No.: SOUTH BAY BRIDGE
 Project: SOUTH BAY BRIDGE
 County: WASHINGTON Pile Driving Contractor or Subcontractor: C.D. PERRY
 (Piles driven by)

Manufacturer: VULCAN Model 06
 Type: SINGLE ACTING AIR Serial No.: 12737
 Rated Energy: 19,500 @ 3 FT. Length of Stroke
 Explosive Force: _____
 (For diesel hammers)

HAMMER



RAM

Ram Weight: 6,500 Ram Length: _____
 Ram Cross Sectional Area: 147 (For diesel hammers)

ANVIL

(With diesel hammers) Anvil Weight: _____

CAPBLOCK



Material: ASBESTOS Area: 102 in²
 Thickness: 6 in.
 Modulus of Elasticity - E 45,000 (P.S.I.)
 Coefficient of Restitution-e 0.5

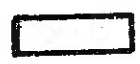
PILE CAP



Helmet
 Bonnet
 Anvil Block
 Drivehead

Weight: 1,000 lbs.

CUSHION



Cushion Material: N/A. Area: _____
 Thickness: _____
 Modulus of Elasticity - E _____ (P.S.I.)
 Coefficient of Restitution-e _____

PILE



Type: C.I.P.
 Pile Size: Length (In Leads)- 30'
 Diameter- 12 3/4" O.D.
 Wall Thickness: 0.25 in. Taper: NONE
 Material: A252, GRADE 2 STEEL Weight/Ft.: 31.37 #
 Design Pile Capacity: 35 (Tons)
 Description of Splice: FULL BUTT WELD

Tip Treatment Description: 13 1/2" dia. x 3/4" BOOT PLATE

- DISTRIBUTION**
 ONE COPY EACH TO:
- DEPUTY CHIEF ENGINEER (Structures)
 - DIRECTOR, SOIL MECHANICS BUREAU
 - REGIONAL DIRECTOR
 - ENGINEER IN CHARGE

NOTE: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

Submitted By: John Doe Date: 10/11/74