KUBRICKY CONSTRUCTION CORP.
269 BALLARD ROAD

WILTON, NY 12831
518 792-5864

KUBRICKY CONSTRUCTION CORP.
A PROUD MEMBER OF THE D A. COLLINS™ COMPANIES
An Equal Opportunity Employer

Rutland City BRF 3000 (2014036)
SUBMITTAL 66

Issued 07/23/15
Respond by 08/06/15

To

Timothy Pockette, PE

Topic	208.40 / 900.645 Ripley Cofferdam and Causeway Designs
Status	For Approval
Spec section	208.40 / 900.645
Responsibility	Ripley Road (19)
Received from submitter	7/23/15
Sent to approver	7/23/15
Required from approver	8/6/15

From

Volker H.D. Burkowski

Signed by _____ Date 7/23/15

Proceed as Indicated _____ Date _____
Owner Authorized Representative

GENERAL NOTES:

THESE PLANS AND ACCOMPANYING DESIGN SUBMITTAL ADDRESS THE TEMPORARY CAUSEWAY AND COFFERDAM TO BE USED TO FACILITATE CONSTRUCTION OF PIER NO. 1 OF THE PROPOSED RIPLEY ROAD BRIDGE.

1. CONFORM TO THE GENERAL NOTES AND CONSTRUCTION SEQUENCE AND ALL OTHER REQUIREMENTS OF THIS SUBMISSION UNLESS OTHERWISE APPROVED BY WILLIAM J. FRANK ENGINEERING, P.C.
2. REPORT LOCATIONS AND ELEVATIONS OF UTILITIES, STRUCTURES AND OBSTRUCTIONS WHICH CONFLICT WITH THE DESIGN LOCATIONS OF SHEETPILES AND BRACING SO THAT THE DESIGN CAN BE MODIFIED AS REQUIRED.
3. REPORT CHANGES IN CONTRACT DOCUMENTS AND SUBSURFACE CONDITIONS TO WILLIAM J. FRANK ENGINEERING, P.C. SO THAT THE DESIGN CAN BE MODIFIED ACCORDINGLY.
4. LAYOUT AND LIMITS OF THE EXCAVATION SUPPORT SYSTEM SHOWN HEREIN ARE APPROXIMATE. THE CONTRACTOR SHALL VERIFY ACTUAL LAYOUT AND LIMITS OF SHEETING, PRIOR TO DRIVING.
5. THE TEMPORARY COFFERDAM SHOWN HEREIN IS DESIGNED FOR A UNIFORM 250 PSF VERTICAL CONSTRUCTION SURCHARGE AND FOR AN ALTERNATE CONSTRUCTION SURCHARGE FROM A LINK–BELT 308 110–TON CAPACITY LATTICE CRAWLER CRANE WITH TRACKS PARALLEL TO THE COFFERDAM. IF THE CONTRACTOR FEELS THE DESIGN SURCHARGE MAY BE EXCEEDED BY THE CONSTRUCTION EQUIPMENT, WILLIAM J. FRANK ENGINEERING, P.C. SHALL BE NOTIFIED AND THE DESIGN MAY NEED TO BE MODIFIED.
6. FOR THE PURPOSES OF DESIGN, SURFACE WATER IS ASSUMED TO BE AT ELEVATION 511 FEET (CURRENT GRADE). IF THE WATER LEVEL EXCEEDS ELEVATION 511 FEET WORK SHALL TEMPORARILY CEASE AND THE COFFERDAM SHALL BE FLOODED.
7. CONTRACTOR SHALL NOT EXCAVATE MORE THAN 2 FEET BELOW THE PROPOSED BRACE LEVEL PRIOR TO BRACE INSTALLATION.
8. SHEETPILES SHALL CONFORM TO ASTM A328 GR 50. WALES AND STRUTS SHALL CONFORM TO ASTM A572 GR 50, SIZED AS SHOWN HEREIN. MISCELLANEOUS PLATES AND STEEL SHALL CONFORM TO ASTM A36 OR BETTER.
9. CONTRACTOR MAY DRIVE PIN PILES IF NECESSARY TO SUPPORT BRACING PRIOR TO DRIVING SHEET PILES. PIN PILES SHALL BE HP12x84 (OR LARGER) DRIVEN TO SHEET PILE TIP ELEVATION.
10. THE TEMPORARY CAUSEWAY SHOWN HEREIN TO ACCESS THE PIER COFFERDAM SHALL BE CONSTRUCTED TO THE LIMITS AS SHOWN HEREIN.
11. THE TEMPORARY CAUSEWAY BRIDGE HAS BEEN DESIGNED TO SUPPORT A LINK–BELT 308 HYLAB CRAWLER CRANE WEIGHING UP TO 206 KIPS DISTRIBUTED OVER A 111 S.F. TRACK CONTACT AREA.
12. INSPECTION OF THE INSTALLATION OF THE SUPPORT OF EXCAVATION SYSTEM IS BY OTHERS.

MATERIAL NOTES:

1. SHEET PILING SHALL CONFORM TO ASTM A572 GRADE 50.
2. HP SECTIONS SHALL CONFORM TO ASTM A572 GRADE 50.
3. PLATES SHALL BE ASTM A36.
4. WELDING ELECTRODES SHALL BE E70XX.
5. USED STEEL IS ACCEPTABLE PROVIDED IT IS IN GOOD CONDITION. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR DETERMINING THE ADEQUACY OF USED STEEL INCORPORATED INTO THE TEMPORARY SUPPORT OF EXCAVATION SYSTEM.
6. TREMIE CONCRETE SHALL BE VTRANS TYPE D CONCRETE WITH THE EXCEPTION THAT THE SLUMP MAY BE INCREASED TO UP TO 9 INCHES USING PLASTICIZERS TO AID IN WORKABILITY AND PLACEMENT.
7. STONE FILL FOR CONSTRUCTING THE TEMPORARY CAUSEWAY SHALL BE PER THE CONTRACT PLANS AND APPROVED PERMITS.

SUGGESTED CONSTRUCTION SEQUENCE:

THE FOLLOWING SEQUENCE IS A GENERAL SEQUENCE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTOR TO SUIT FIELD CONDITIONS AND THEIR SCHEDULE.

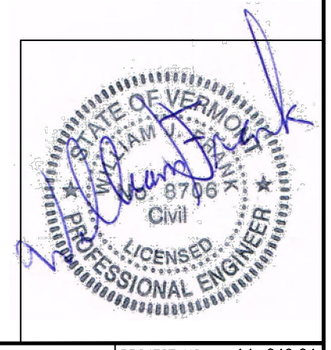
1. ESTABLISH STREAM PROTECTION AS REQUIRED BY CONTRACT DOCUMENTS AND APPROVED EROSION CONTROL PLANS (BY OTHERS).

   TEMPORARY CAUSEWAY

2. INSTALL TEMPORARY CONCRETE BARRIER IN STREAM ALONG LIMITS OF TEMPORARY CAUSEWAY ALONG WEST SHORELINE AS SHOWN HEREIN.
3. BACKFILL BEHIND TEMPORARY BARRIER WITH CRUSHED STONE AS APPROVED BY VAOT.
4. INSTALL TEMPORARY CONCRETE BARRIER IN STREAM ALONG LIMITS OF TEMPORARY CAUSEWAY ALONG CENTER PIER SHORELINE AS SHOWN HEREIN.
5. INSTALL HP14x117 BEAMS ACROSS TEMPORARY BARRIERS AS SHOWN.
6. PLACE STEEL ROAD PLATES ON BEAMS.
7. BACKFILL BEHIND TEMPORARY BARRIER WITH CRUSHED STONE AS APPROVED BY VAOT TO COMPLETE TEMPORARY CAUSEWAY.

   TEMPORARY COFFERDAM

8. LAY OUT THE PROPOSED PIER LOCATION AND COFFERDAM LIMITS.
9. DRIVE SHEETPILES TO THE REQUIRED TIP ELEVATIONS. PRE–EXCAVATE IF REQUIRED TO EASE SHEETPILE INSTALLATION.
10. EXCAVATE WITHIN THE COFFERDAM (AND DEWATER, IF NECESSARY) DOWN TO NO MORE THAN 2 FEET BELOW THE PROPOSED BRACING ELEVATION SHOWN HEREIN.
11. INSTALL BRACING AND CONNECT TO SHEETPILES.
12. DISCONTINUE DEWATERING AND CONTINUE EXCAVATION IN THE WET WITHIN COFFERDAM TO PROPOSED BOTTOM OF TREMIE SEAL ELEVATION SHOWN HEREIN.
13. DRIVE PROPOSED FOUNDATION PILES PER CONTRACT DOCUMENTS.
14. POUR TREMIE CONCRETE SEAL TO BOTTOM ELEVATION OF PROPOSED PIER FOOTING.
15. DEWATER COFFERDAM TO BOTTOM OF PROPOSED PIER FOOTING.
16. PREPARE SUBGRADE, CUTOFF PILES, PLACE REBAR AND POUR PIER PILE CAP PER CONTRACT DOCUMENTS.
17. BACKFILL TO WITHIN 2 FEET OF THE BRACING IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
18. REMOVE BRACING.
19. REMOVE OR CUT OFF SHEET PILES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
20. COMPLETE CONSTRUCTION OF PROPOSED PIER AND BRIDGE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
21. REMOVE EXISTING TEMPORARY BRIDGE AND EXISTING BRIDGE (BY OTHERS) PER CONTRACT PLANS.
22. HOE RAM AND REMOVE EXISTING PIER TO 2 FEET BELOW PROPOSED FINISHED GRADE PER CONTRACT PLANS.
23. REMOVE TEMPORARY CAUSEWAY AND RESTORE AREA PER CONTRACT PLANS.



DESIGNED BY	NO.	DATE	REVISIONS	DRWN.	CHKD.	APPVD.
EMC						
DRAWN BY						
PKG						
CHECKED BY						
WJF						
APPROVED BY						
WJF						

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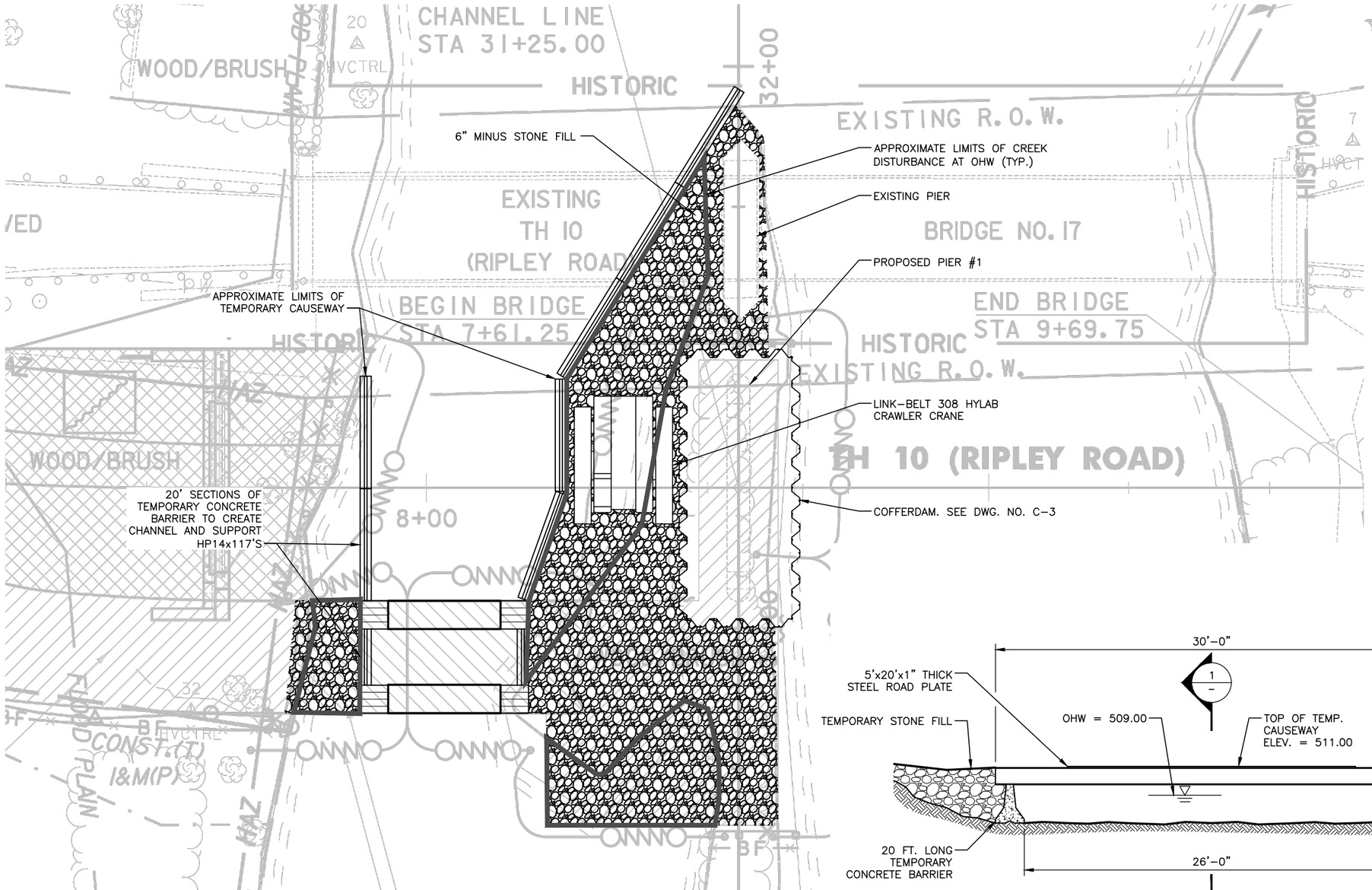
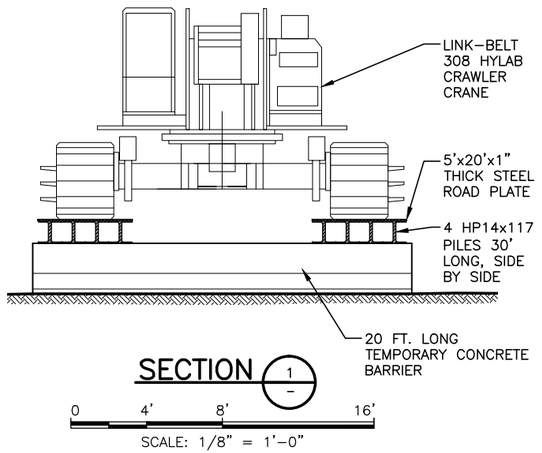
DWG. TITLE
PIER 1 TEMPORARY CAUSEWAY & COFFERDAM
NOTES and SEQUENCE

PROJECT
TH 10 RIPLEY ROAD, BRIDGE NO. 17
RUTLAND CITY
VTRANS PROJECT NO. BRF 3000 (19)

PROJECT NO. 14–049.04
SCALE AS NOTED
DATE 7/22/15
DRAWING NO. C–1
SHEET 1 OF 3





SECTION 1

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

CRANE LAYOUT PLAN

20 0 10 20

SCALE: 1" = 20'

PARTIAL ELEVATION VIEW – TEMPORARY CAUSEWAY

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

STATE OF VERMONT
WILLIAM J. FRANK
No. 8706
Civil
LICENSED
PROFESSIONAL ENGINEER

DESIGNED BY	NO.	DATE	REVISIONS	DRWN.	CHKD.	APPVD.
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WJF						
APPROVED BY						
WJF						

WARNING

IT IS A VIOLATION OF SECTION 7209.2 OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER IN ANY WAY PLANS, SPECIFICATIONS, PLATS OR REPORTS TO WHICH THE SEAL OF A PROFESSIONAL ENGINEER HAS BEEN APPLIED. IF AN ITEM BEARING THE SEAL OF A PROFESSIONAL ENGINEER IS ALTERED THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE, THE DATE, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.'

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DWG. TITLE
PIER 1 TEMPORARY CAUSEWAY & COFFERDAM
TEMPORARY CAUSEWAY PLAN and SECTIONS

PROJECT
TH 10 RIPLEY ROAD, BRIDGE NO. 17
RUTLAND CITY
VTRANS PROJECT NO. BRF 3000 (19)

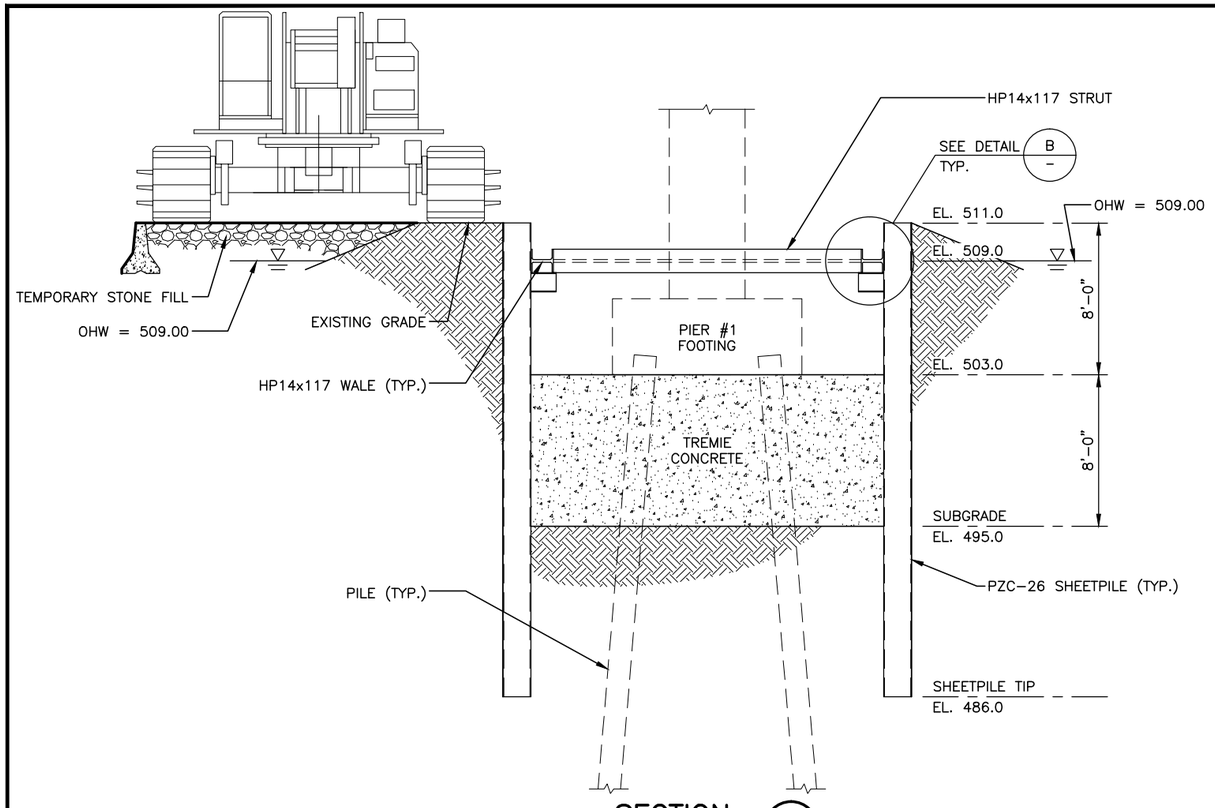
PROJECT NO. 14-049.04

SCALE AS NOTED

DATE 7/22/15

DRAWING NO. **C-2**

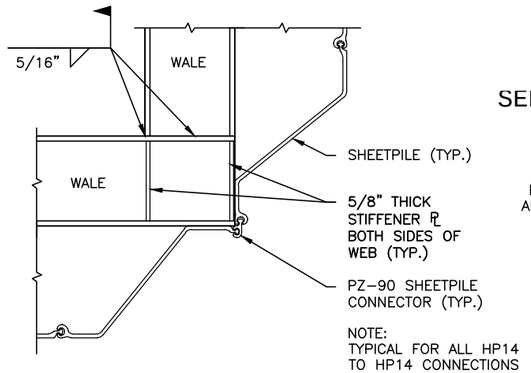
SHEET 2 OF 3



SECTION 2

0 4' 8' 16'

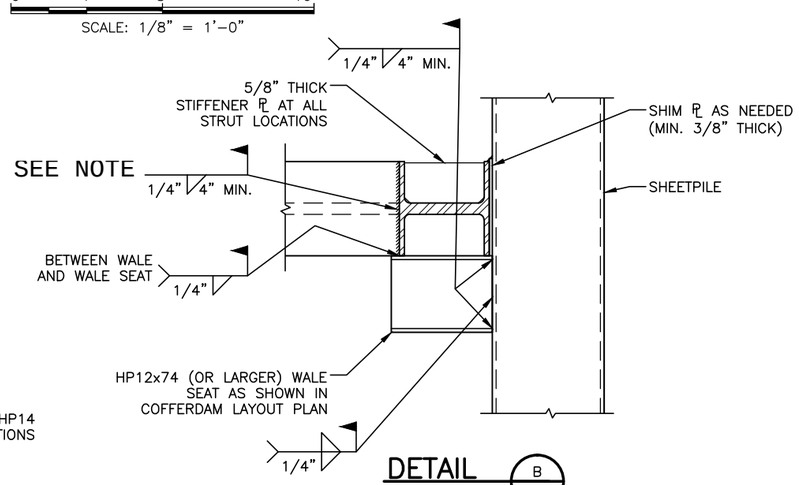
SCALE: 1/8" = 1'-0"



DETAIL A

0 1' 2' 4'

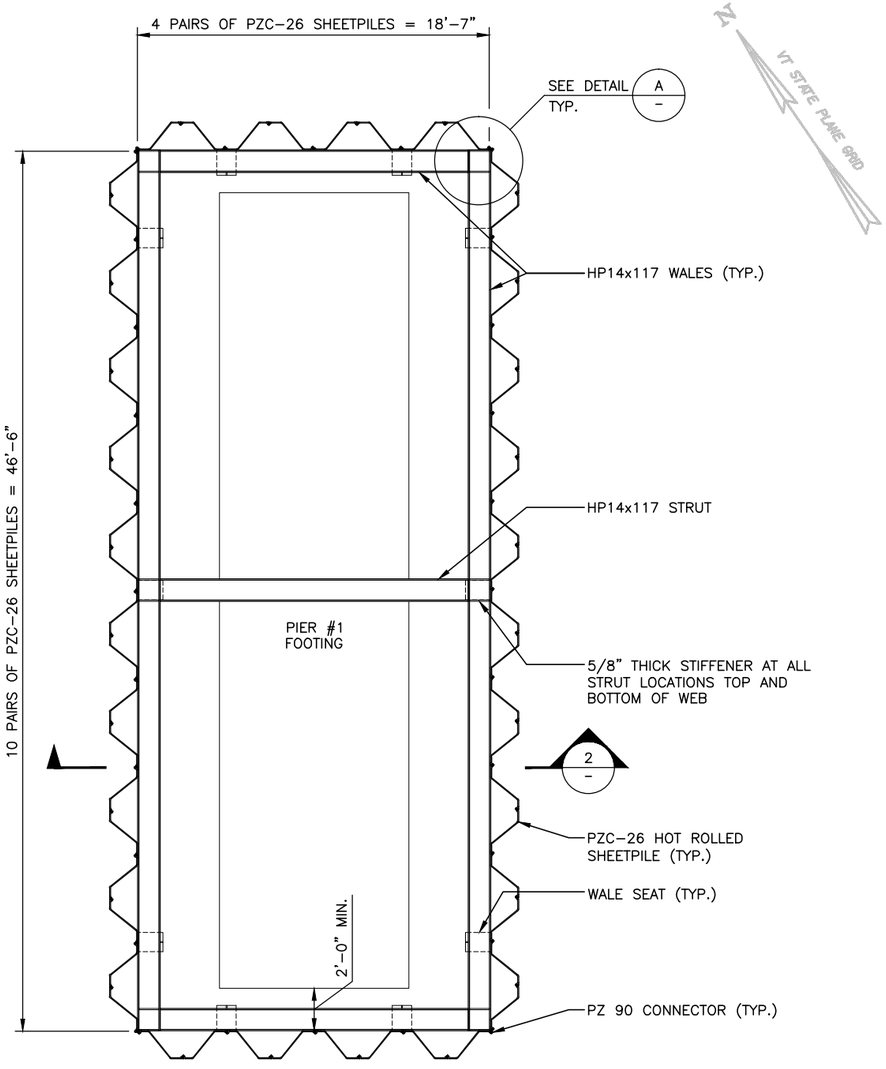
SCALE: 1/2" = 1'-0"



DETAIL B

0 1' 2' 4'

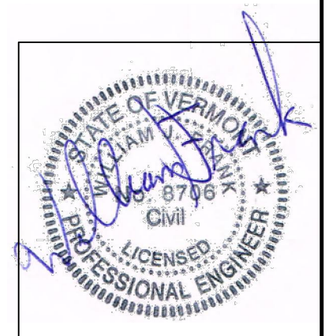
SCALE: 1/2" = 1'-0"



COFFERDAM LAYOUT PLAN

0 4' 8' 16'

SCALE: 1/8" = 1'-0"



DESIGNED BY	NO.	DATE	REVISIONS	DRWN.	CHKD.	APPVD.
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WJF						
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DWG. TITLE
PIER 1 TEMPORARY CAUSEWAY & COFFERDAM
COFFERDAM LAYOUT PLAN, SECTIONS and DETAILS

PROJECT
TH 10 RIPLEY ROAD, BRIDGE NO. 17
RUTLAND CITY
VTRANS PROJECT NO. BRF 3000 (19)

PROJECT NO. 14-049.04
SCALE AS NOTED
DATE 7/22/15
DRAWING NO. C-3
SHEET 3 OF 3

Design Submittal

Temporary Causeway and Cofferdam at Pier 1

Ripley Road over Otter Creek
Rutland, VT

State of Vermont Agency of Transportation

Project Name: Rutland City
Project No.: BRF 3000 (19)

Prepared for:

Kubricky Construction Corp.
295 Ballard Road
Wilton, NY 12831

Prepared by:

William J. Frank Engineering, P.C.
4 Old Route 6
Brewster, NY 10509
845-490-1393

July 22, 2015

Job No. 14-049.04

SUPPORTING DESIGN CALCULATIONS

William J. Frank Engineering, P.C.
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JOB 14-049.04
SHEET NO. 1 OF 53
CALCULATED BY EMC DATE 7/9/15
CHECKED BY WJF DATE 7/22/15
SCALE

References:

1. Contract Drawings from State of Vermont Agency of Transportation for 'Rutland City' Project No. BRF 3000 (19)
2. AISC Manual of Steel Construction 14th Edition.

Introduction:

This submittal addresses the design of the temporary cofferdam and the temporary causeway to be used for construction of Pier No. 1 at the Ripley Road Bridge over Otter Creek.

The cofferdam will be approximately 46.5 feet by 14 feet in plan, and will have a height from ground surface to bottom of tremie concrete seal of 16 feet. Design high water elevation will be 511 feet (existing grade).

Per Borings B-103 and B-104 which were taken at each end of the pier, the soil consists of loose to medium dense sand, fine sand, and silty sand. For design purposes the soil is considered granular with a friction angle of 30 degrees and a saturated unit weight of 120 pcf.

Two alternate surcharge loadings adjacent to the cofferdam were assumed: a uniform vertical surcharge of 250 psf, and a LinkBelt 308 crane for pile driving.

The PZC-26 sheetpiles from the River Street Bridge cofferdam at Abutment No. 1 will be re-used at the Ripley Road Bridge cofferdam at Pier No. 1. One level of bracing using HP14x117 wales and strut will be used.

A temporary causeway spanning 28 feet (26ft clear) between temporary concrete barriers was designed to support a LinkBelt 308 HYLAB crawler crane. Two pairs of 4 HP14x117 beams with a 1-inch thick road plate will be used. The steel road plate does not contribute to the load carrying capacity of the H piles but instead just helps distribute the crawler track loads to the 4 beams. The beams and steel road plates will be adjusted as required in the field to allow dump trucks and other construction vehicles to access the pier cofferdam as construction progresses.

The flow in Otter Creek is checked to confirm that the presence of the temporary causeway, as shown in the contract documents, will not adversely affect flow in the creek during the Q 2.33 yr design flow.

The following calculations are included in this submittal:

- Estimate of the required tremie concrete thickness
- CT-Shoring calculations to determine bracing loads, required sheetpile size and embedment.
- Calculations to check structural members to be used as cofferdam bracing and check of connections.
- Calculations for causeway beams

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JOB 14-049.04
SHEET NO. 2 OF 53
CALCULATED BY EMC DATE 7-2-2015
CHECKED BY WJF DATE 7-22-15
SCALE

Determine Req'd Thickness of Tremie Seal

Try 8 feet thick, with a plan area of $46.5' \times 14' = 651\ ft^2$

Assume ground water at existing grade (El. 511)

Bottom of tremie at El. 503 (Bottom of pier footing) − 8' = El. 495

Uplift force on tremie: $P = (511' - 495') \times 0.0624\ kcf \times 651\ ft^2 = 650^k$ (16')

Weight of tremie = $8' \times 0.145\ kcf \times 651\ ft^2 = 755^k$

Weight of sheetpiling:
52 PZC26 sheets, 30' long
$W = 52 \times 73.9\ lb/f \times 30' / 1000 = 115^k$

Req'd adhesion between tremie and sheetpiling to allow considering weight of sheetpiling:
Perimeter = $2(46.5') + 2(14') = 121'$
Req'd adhesion = $115^k / (121' \times 8') = 0.119\ ksf \times \frac{1000\ lb/k}{144\ in^2/ft^2}$

$= 0.8$ psi Low. ok

Total resistance = 755^k (Tremie) $+ 155^k$ (Sheetpiling) $= 910^k > P = 650^k$ uplift

$F.S. = \frac{910^k}{650^k} = 1.40 > 1.25 \therefore$ (OK)

Use 8-foot thick tremie seal

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JOB 14-049.04
SHEET NO. 3 OF 53
CALCULATED BY EMC DATE 7-6-2015
CHECKED BY WJF DATE 7-22-15
SCALE

Soil Properties for Cofferdam Design

Reference: Boring Logs B-103 and B-104

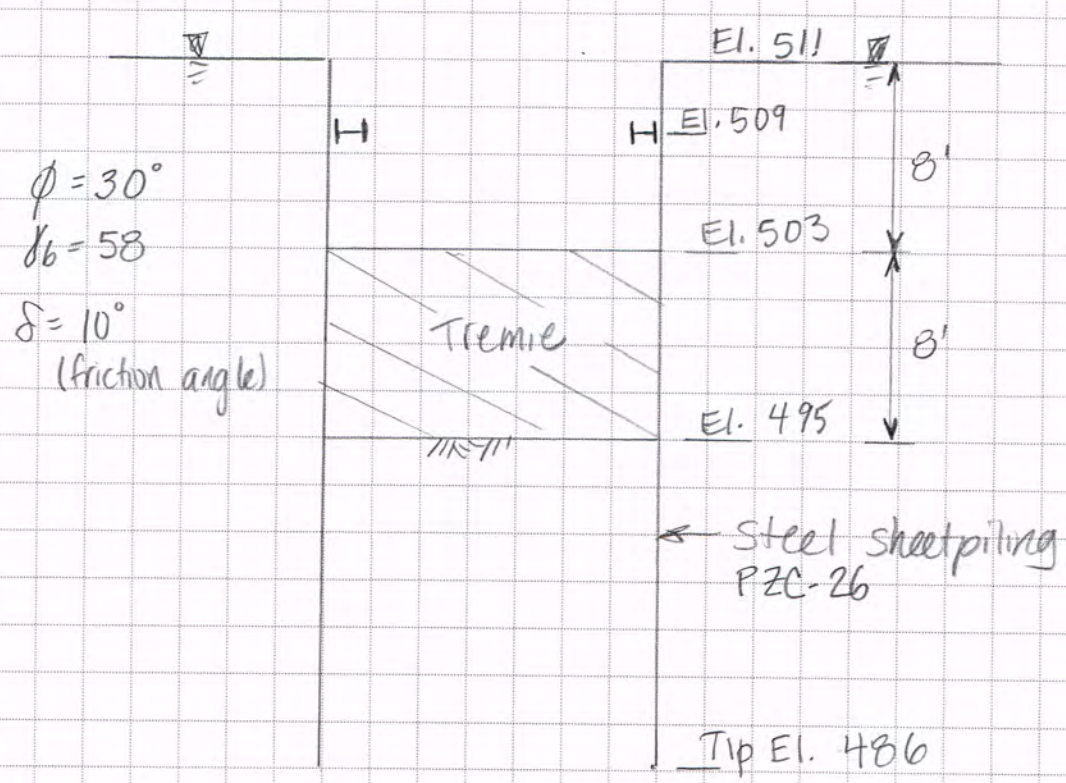
Consider depths up to 30 feet (length of sheet piles)

The soil consists generally of sand, fine sand, and silty sand with blow counts ranging from N=2 to N=17 (ignoring N=27 at one location noting "cobbles").

Avg. N ≈ 7.5

Use $\phi = 30°$, $\gamma = 120$ pcf, $\gamma_b = 58$ pcf

Assume water at grade (El. 511)



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JOB 14-049.04
SHEET NO. 4 OF 53
CALCULATED BY EMC DATE 7-6-2015
CHECKED BY WJF DATE 7-22-15
SCALE

Design Surcharge

Alt No. 1: 250 psf uniform surcharge

Alt No. 2: LinkBelt 308 crane with tracks parallel to and against the cofferdam.

See track pressures on next sheet (provided by Kubricky)

Worst case with boom over side.

Closest to cofferdam: $p_1 = 18.6 \text{ psi} \times 12^2 = 2678 \text{ psf} = 2.68 \text{ ksf}$ over $18.9' \times 3'$

Distance to other track = $17.5' - 3' = 14.5'$ (See sh. C2)

$p_2 = 8.3 \text{ psi} \times 12^2 = 1195 \text{ psf} = 1.20 \text{ ksf}$ over $18.9' \times 3'$

Alt No. 2 surcharge to be considered when excavation is complete and the crane is driving pier piles.

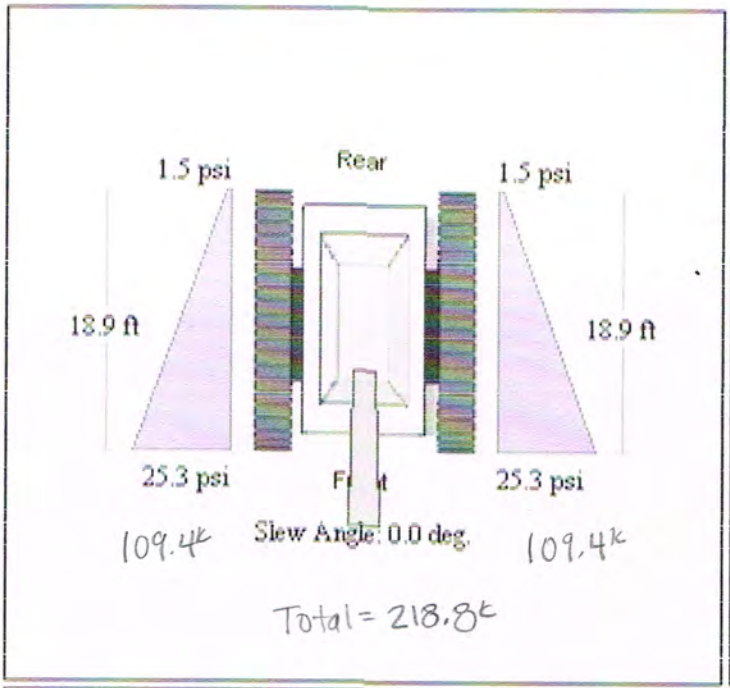
Link-Belt Constructon Equipment Co., Lexington, Kentucky - 308 HYLAB 5 Unit: English

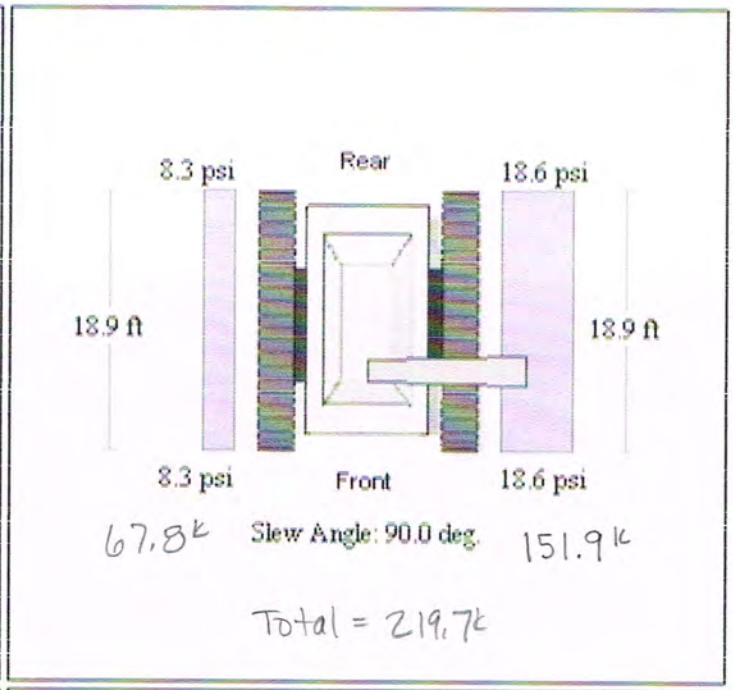
Model 308 HYLAB 5 Lattice Boom w/ AB CTWT w/ 54" X 60" Angle Boom w/ 36" shoes

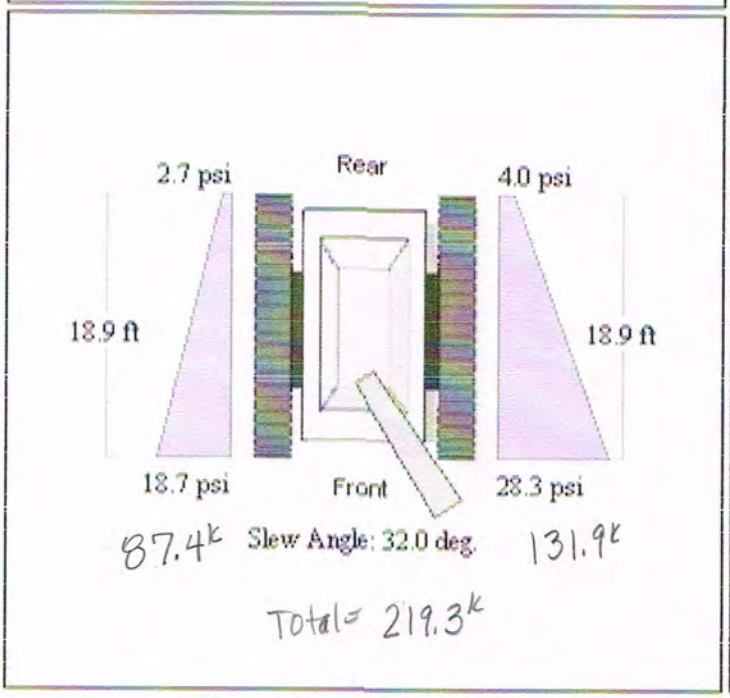
31000 lb load @ **36** ft radius, pick from **Boom** **140** ft main boom

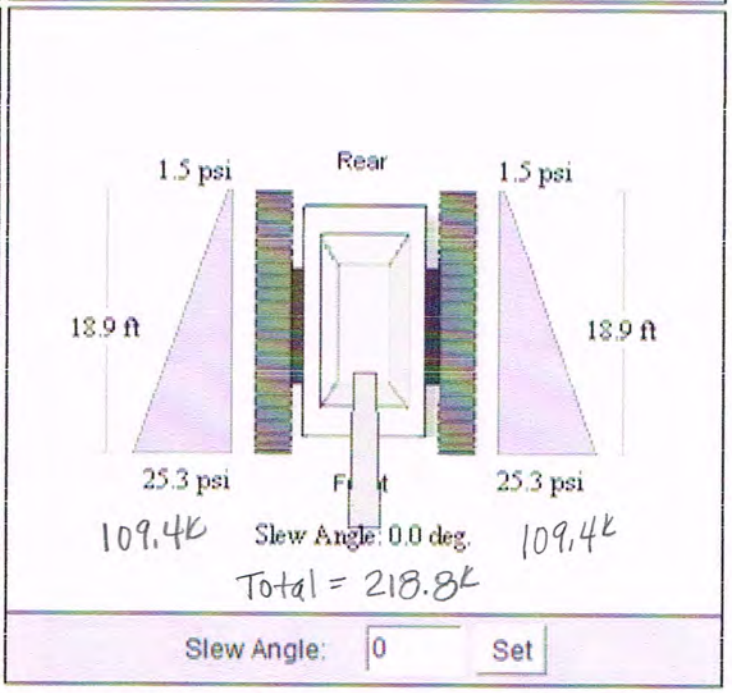
77.0° boom angle

218,575 lb gross vehicle weight (GVW) Date: **4/27/2015** - v 1.0



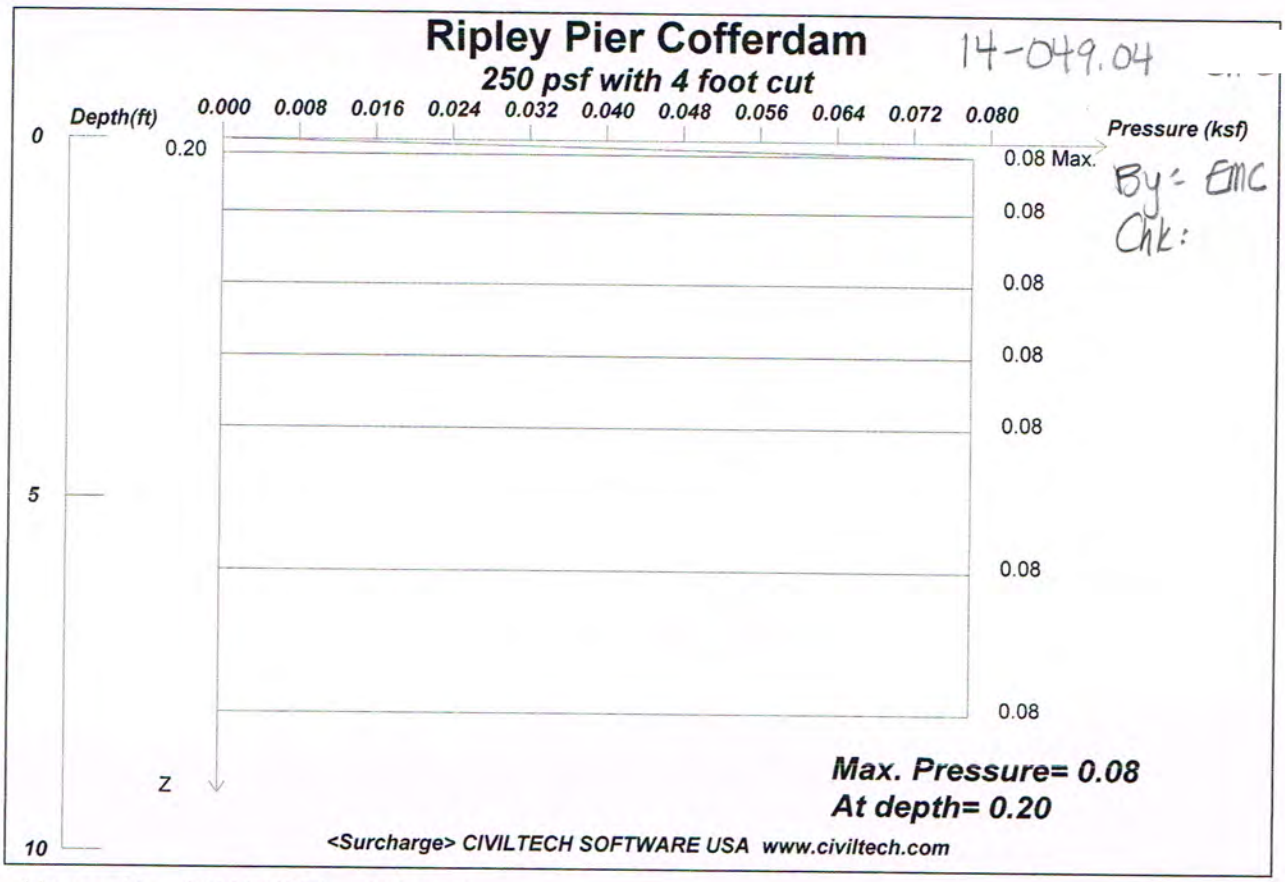






Slew Angle For Max Ground Bearing Pressure

Click & Drag the Boom or Input Slew Angle



By: EMC 7-7-15
Chk:

Licensed to 4324324234 3424343
Date: 7/7/2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Rutland Ripley St Bridge Pier Cofferdam 14-04

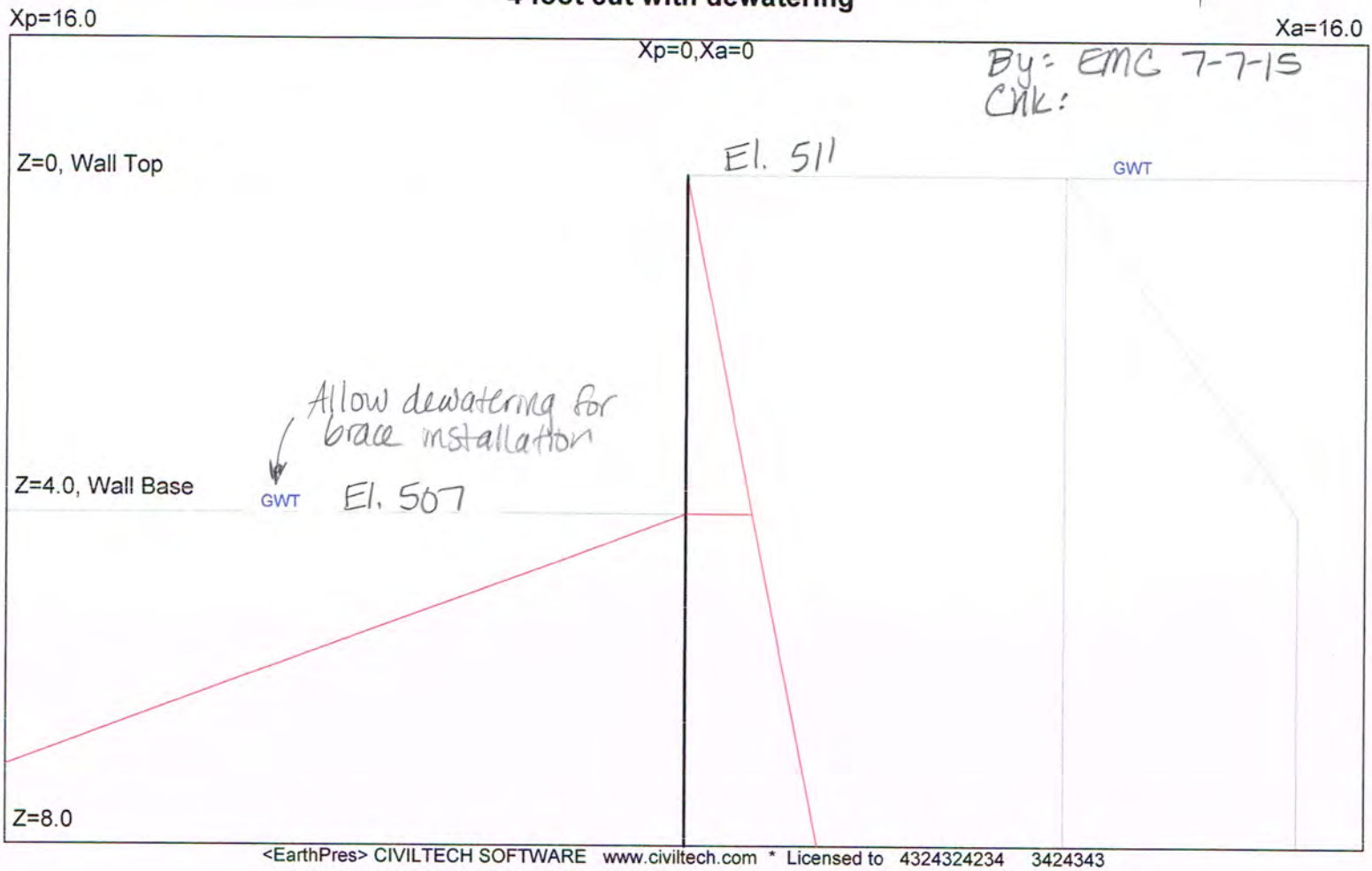
Wall Height, H= 4 Load Depth at Surface, D= 0
Load Factor of Surcharge Loading = 1
Semi-flexible Wall Condition -- Small movement or deflection are allowed.
Max. Pressure = 0.078 at depth = 0.20

Infinite Surcharge, Q=.250 Active Wedge Approach * (recommend)

UNITS: LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

Ripley Pier Cofferdam

4 foot cut with dewatering



UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

7/2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Rutland Ripley St Bridge Pier Cofferdam 14-049.04\Calculations\CT Shoring\4 foot cut with dewate

* INPUT DATA *

Wall Height=4.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	30.00	0.0	0	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	4.0	0.0	4.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	4.0	0.0
2	4.0	800.0

Wall Friction Options: 3. Both sides (for formulary solution)
Wall Friction = 10
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

14-049.01

By: EMC 7-7-15
Chk: WJF 7-22-15

* OUTPUT RESULTS *

Total Force above Base= 0.14 per one linear foot (or meter) width along wall height
Total Static Force above Base= 0.14

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	4.00	0.07	0.0178	0.3085

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
4.00	0.07	8.00	0.14	0.0178	0.3085

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
4.00	0.00	8.00	0.95	0.239	4.1433

Water Pressure - Output to Shoring - Multiplier of Pressure = 1

No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	4.00	0.25	0.06
1	4.00	0.25	8.00	0.25	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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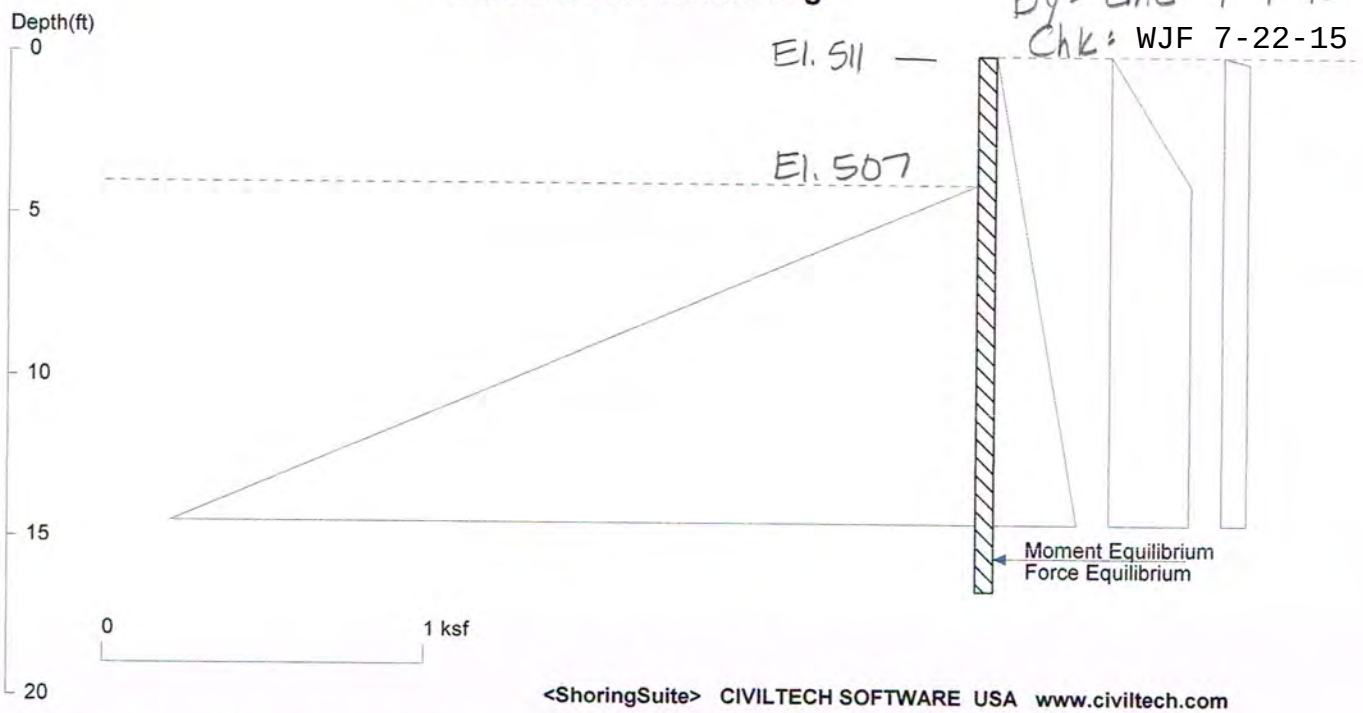
By: EMC 7-7-15
Chk: WJF 7-22-15

Ripley Pier Cofferdam
4 foot cut with dewatering



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Wall Height=4.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=12.59 Min. Pile Length=16.59 ← Does not control
MOMENT IN PILE: Max. Moment=8.11 per Pile Spacing=1.0 at Depth=10.34

PILE SELECTION: ← Does not control
Request Min. Section Modulus = 4.1 in3/ft=220.14 cm3/m, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66
-> Piles meet Min. Section Requirements: Top Deflection is shown in (in)
LZ5 (5.63) LZ3 (4.92) PMA22 (4.25) LZ250 (4.70) CS55 (3.12)
CS60 (2.85) NSZ10 (2.13) NSZ11 (1.96) CS69 (2.45) SZ12 (1.60)
CS76 (2.22) NSZ12 (1.67) SZ14 (1.60) SZ15 (1.60)

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	4.000	0.071	0.017768
*	Below	Base		
4.000	0.071	40.000	0.711	0.017768
*	Water	Pres.		
0.000	0.000	4.000	0.250	0.062400
4.000	0.250	40.000	0.250	0.000000
*	Sur-	charge		
0.000	0.000	0.200	0.078	0.390625
0.200	0.078	0.400	0.078	0.000000
0.400	0.078	0.600	0.078	0.000000
0.600	0.078	0.800	0.078	0.000000
0.800	0.078	1.000	0.078	0.000000
1.000	0.078	1.200	0.078	0.000000
1.200	0.078	1.400	0.078	0.000000
1.400	0.078	1.600	0.078	0.000000

14-049.04

By: EMC 7-7-15

Chk: WJF 7-22-15

1.600	0.078	1.800	0.078	0.000000
1.800	0.078	2.000	0.078	0.000000
2.000	0.078	2.200	0.078	0.000000
2.200	0.078	2.400	0.078	0.000000
2.400	0.078	2.600	0.078	0.000000
2.600	0.078	2.800	0.078	0.000000
2.800	0.078	3.000	0.078	0.000000
3.000	0.078	3.200	0.078	0.000000
3.200	0.078	3.400	0.078	0.000000
3.400	0.078	3.600	0.078	0.000000
3.600	0.078	3.800	0.078	0.000000
3.800	0.078	4.000	0.078	0.000000
4.000	0.078	4.400	0.078	0.000000
4.400	0.078	4.800	0.078	0.000000
4.800	0.078	5.200	0.078	0.000000
5.200	0.078	5.600	0.078	0.000000
5.600	0.078	6.000	0.078	0.000000
6.000	0.078	6.400	0.078	0.000000
6.400	0.078	6.800	0.078	0.000000
6.800	0.078	7.200	0.078	0.000000
7.200	0.078	7.600	0.078	0.000000
7.600	0.078	8.000	0.078	0.000000
8.000	0.078	8.800	0.078	0.000000
8.800	0.078	9.600	0.078	0.000000
9.600	0.078	10.400	0.078	0.000000
10.400	0.078	11.200	0.078	0.000000
11.200	0.078	12.000	0.078	0.000000
12.000	0.078	12.800	0.078	0.000000
12.800	0.078	13.600	0.078	0.000000
13.600	0.078	14.400	0.078	0.000000
14.400	0.078	15.200	0.078	0.000000
15.200	0.078	16.000	0.000	-0.097656

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.25

Z1	P1	Z2	P2	Slope
*	Below	Base		
4.000	0.000	40.000	8.592	0.238654

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	4.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

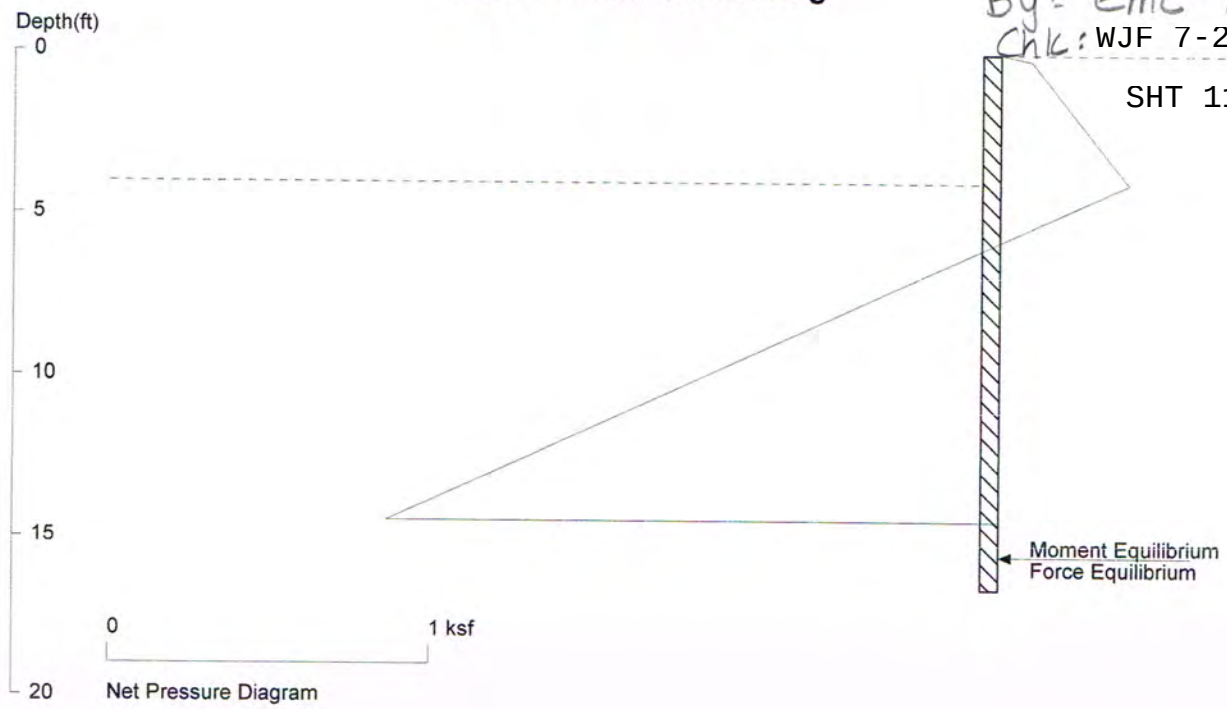
UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

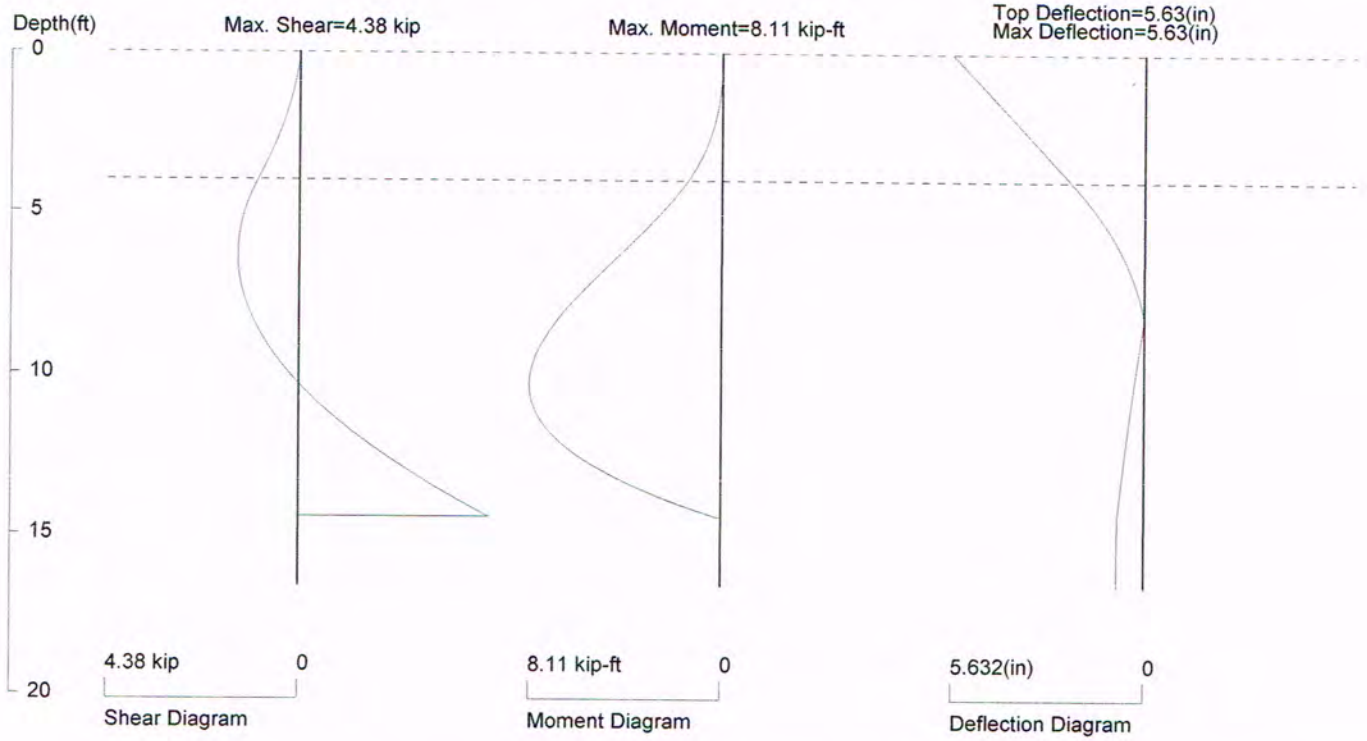
Ripley Pier Cofferdam
4 foot cut with dewatering

14-049.04

By: EMC 7-7-15
Chk: WJF 7-22-15

SHT 11 OF 53





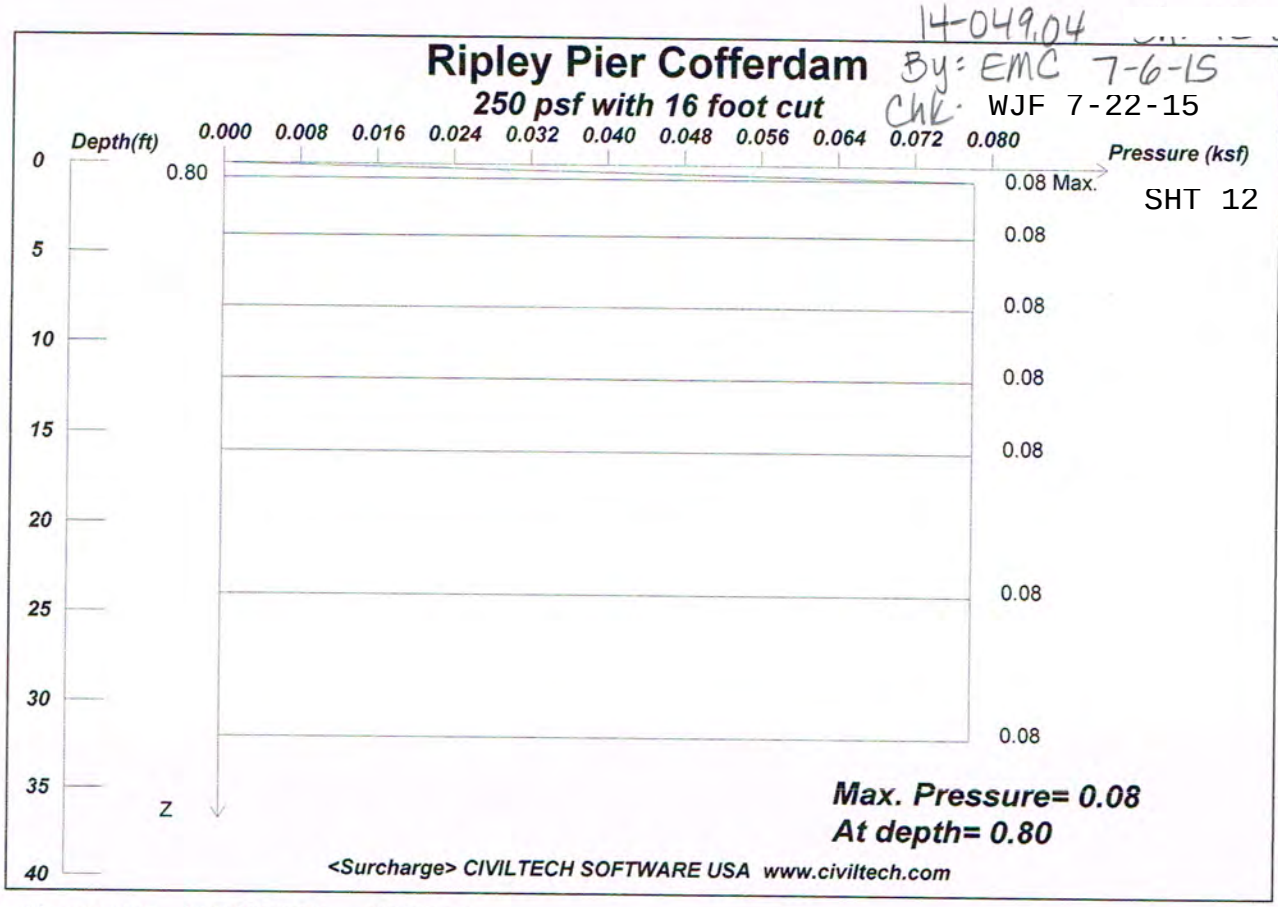
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

First Suitable Pile: LZ5: E (ksi)=29000.0, I (in4)/foot=10.4

rs\Ellen Connell\Desktop\Projects\Kubricky Rutland Ripley St Bridge Pier Cofferdam 14-049.04\Calculations\CT Shoring\4' Cantilever with 250 psf and dewat

14-049.04
By: EMC 7-6-15
Chk: WJF 7-22-15
SHT 12 OF 53



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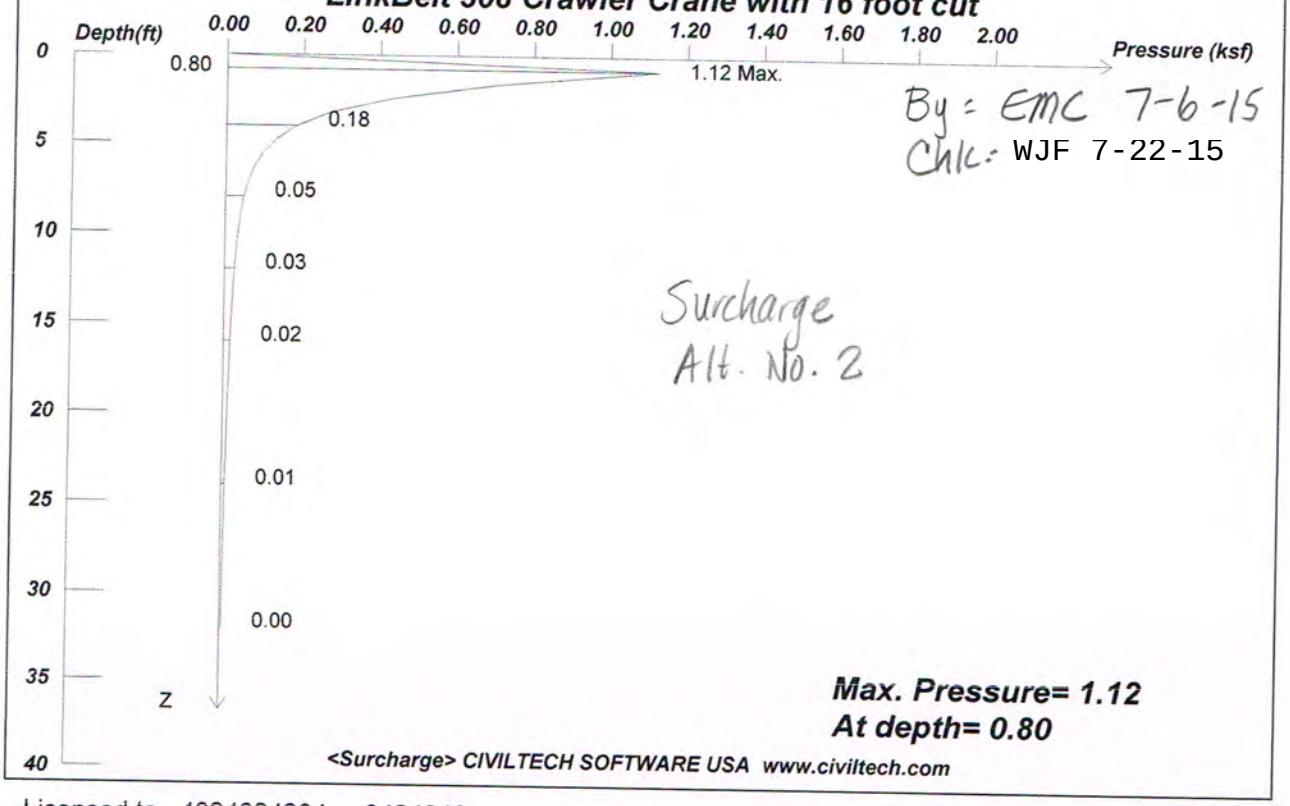
Wall Height, H= 16 Load Depth at Surface, D= 0
Load Factor of Surcharge Loading = 1
Semi-flexible Wall Condition -- Small movement or deflection are allowed.
Max. Pressure = 0.078 at depth = 0.80

Infinite Surcharge, Q=.250 Active Wedge Approach * (recommend)

UNITS: LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

Ripley Pier Cofferdam

LinkBelt 308 Crawler Crane with 16 foot cut



By: EMC 7-6-15
Chk: WJF 7-22-15

Surcharge
Alt. No. 2

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Wall Height, H= 16 Load Depth at Surface, D= 0
Load Factor of Surcharge Loading = 1
Semi-flexible Wall Condition -- Small movement or deflection are allowed.
Max. Pressure = 1.123 at depth = 0.80

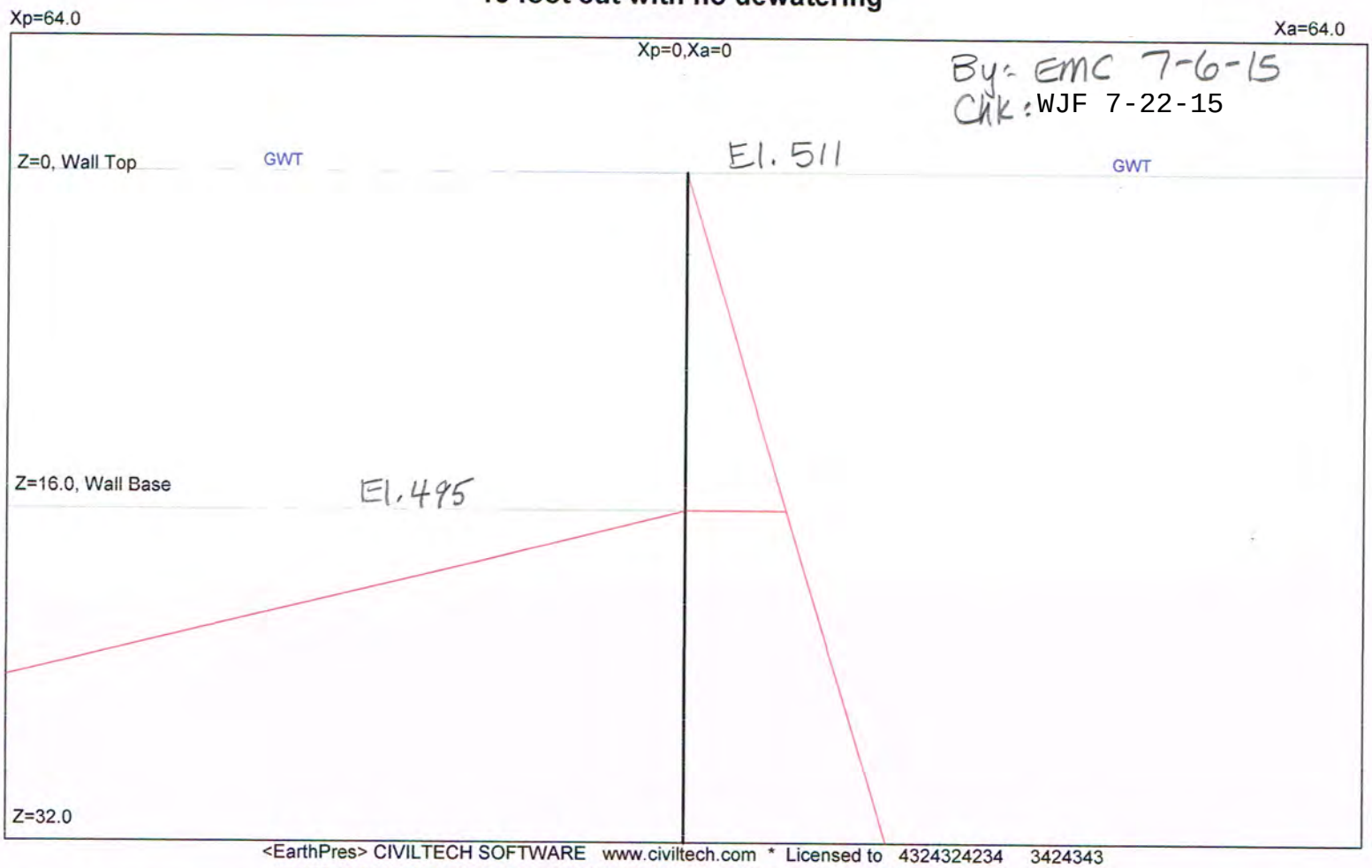
See Sh. 4 for pressure calculations.

X	Width	Length	Area Load
.0	3.0	18.9	2.68
14.5	3.0	18.9	1.20

UNITS: LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

Ripley Pier Cofferdam
16 foot cut with no dewatering

14-049.04



UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Rutland Ripley St Bridge Pier Cofferdam 14-049.04\Calculations\CT Shoring\16 foot cut with no dew

* INPUT DATA *

Wall Height=16.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	30.00	0.0	0	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	16.0	0.0	16.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Wall Friction Options: 3. Both sides (for formulary solution)
Wall Friction = 10
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

14-049.04

By: EMC 7-6-15

Chk: WJF 7-22-15

* OUTPUT RESULTS *

Total Force above Base= 2.27 per one linear foot (or meter) width along wall height

Total Static Force above Base= 2.27

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	16.00	0.28	0.0178	0.3085

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
16.00	0.28	32.00	0.57	0.0178	0.3085

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
16.00	0.00	32.00	3.82	0.239	4.1433

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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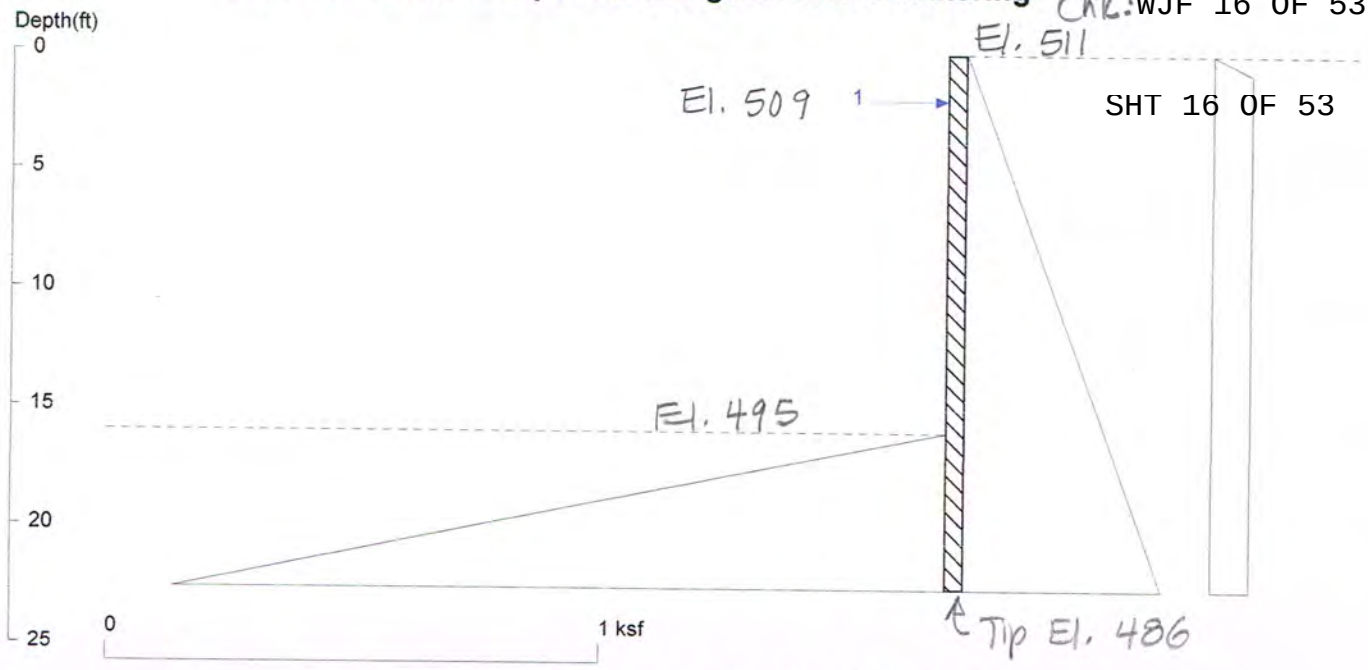
14-049.04

Ripley Pier Cofferdam

16 foot cut with 250 psf surcharge and no dewatering

By: EMC 7-7-15
Chk: WJF 16 OF 53

SHT 16 OF 53



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Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=6.55 Min. Pile Length=22.55 ← Controls. Say 9' embedment
MOMENT IN PILE: Max. Moment=11.12 per Pile Spacing=1.0 at Depth=11.87

Sheeting length = 25' min
Tip El 486.

PILE SELECTION: ← Does not control

Request Min. Section Modulus = 5.6 in3/ft=301.84 cm3/m, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66
-> Piles meet Min. Section Requirements: Top Deflection is shown in (in)
CS55 (-0.43) CS60 (-0.39) NSZ10 (-0.30) NSZ11 (-0.27) CS69 (-0.34)
SZ12 (-0.22) CS76 (-0.31) NSZ12 (-0.23) SZ14 (-0.22) SZ15 (-0.22)
NSZ14 (-0.20) CZ67 (-0.19) PDA27 (-0.20) NSZ15 (-0.19)

Does not control

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	N/A	N/A
1. Strut	2.0	0.0	1.0	2.1	2.1	0.0	0.0	0.0

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	16.00	0.284	0.017768
*	Below	Base		
16.00	0.284	144.0	2.559	0.017768
*	Sur-	charg		
0.000	0.000	0.800	0.078	0.097656
0.800	0.078	1.600	0.078	0.000000
1.600	0.078	2.400	0.078	0.000000
2.400	0.078	3.200	0.078	0.000000
3.200	0.078	4.000	0.078	0.000000
4.000	0.078	4.800	0.078	0.000000

14-049.04

By: EMC 7-7-15
Chk: WJF 7-22-15

4.800	0.078	5.600	0.078	0.000000
5.600	0.078	6.400	0.078	0.000000
6.400	0.078	7.200	0.078	0.000000
7.200	0.078	8.000	0.078	0.000000
8.000	0.078	8.800	0.078	0.000000
8.800	0.078	9.600	0.078	0.000000
9.600	0.078	10.40	0.078	0.000000
10.40	0.078	11.20	0.078	0.000000
11.20	0.078	12.00	0.078	0.000000
12.00	0.078	12.80	0.078	0.000000
12.80	0.078	13.60	0.078	0.000000
13.60	0.078	14.40	0.078	0.000000
14.40	0.078	15.20	0.078	0.000000
15.20	0.078	16.00	0.078	0.000000
16.00	0.078	17.60	0.078	0.000000
17.60	0.078	19.20	0.078	0.000000
19.20	0.078	20.80	0.078	0.000000
20.80	0.078	22.40	0.078	0.000000
22.40	0.078	24.00	0.078	0.000000

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.25

Z1	P1	Z2	P2	Slope
*	Below	Base		
16.00	0.000	144.0	30.54	0.238654

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

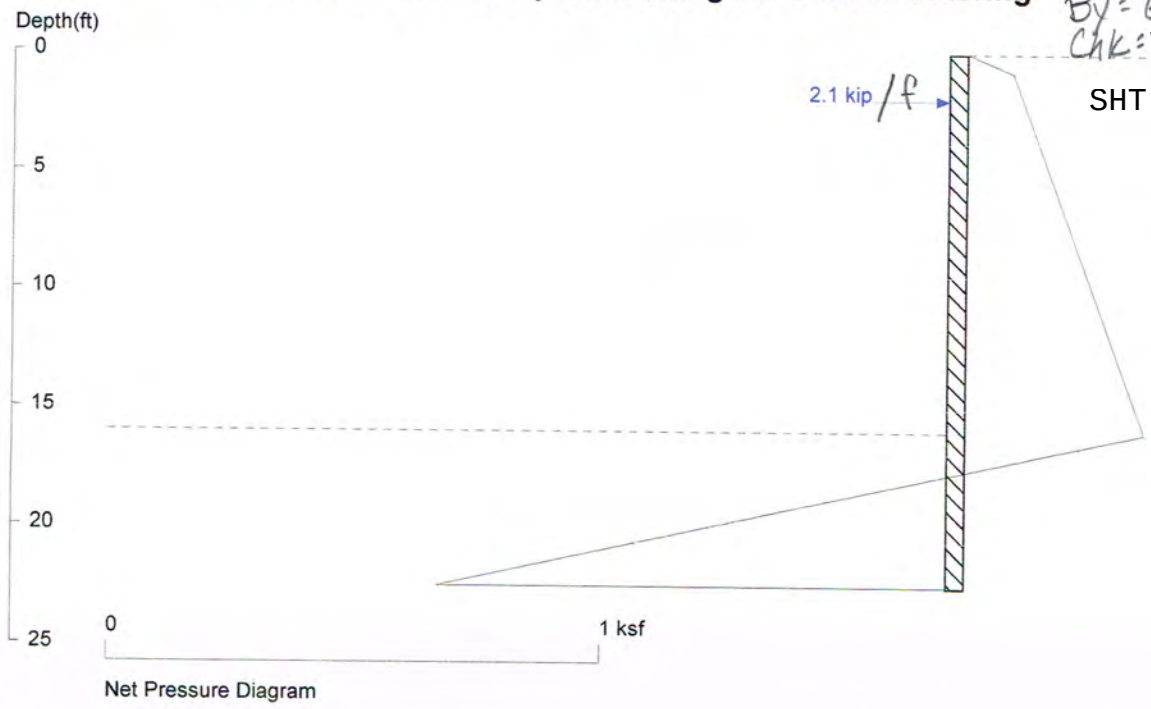
Ripley Pier Cofferdam

16 foot cut with 250 psf surcharge and no dewatering

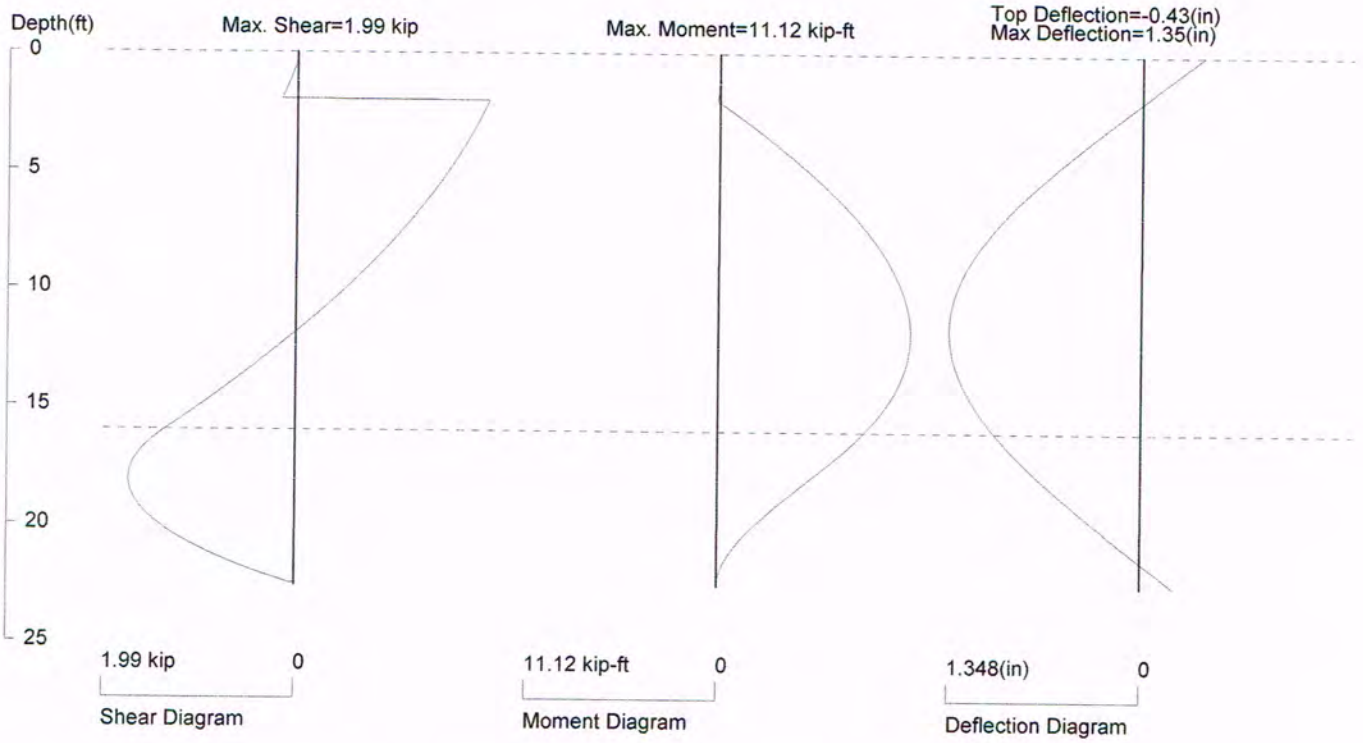
14-049.04

By: EMC 7-7-15

Chk: WJF 7-22-15



Net Pressure Diagram



Shear Diagram

Moment Diagram

Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

First Suitable Pile: CS55: E (ksi)=29000.0, I (in4)/foot=18.7

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14-049.04

Ripley Pier Cofferdam

16 foot cut with Crane Surcharge and no dewatering

By: EMC 7-7-15
Chk: WJF 7-22-15

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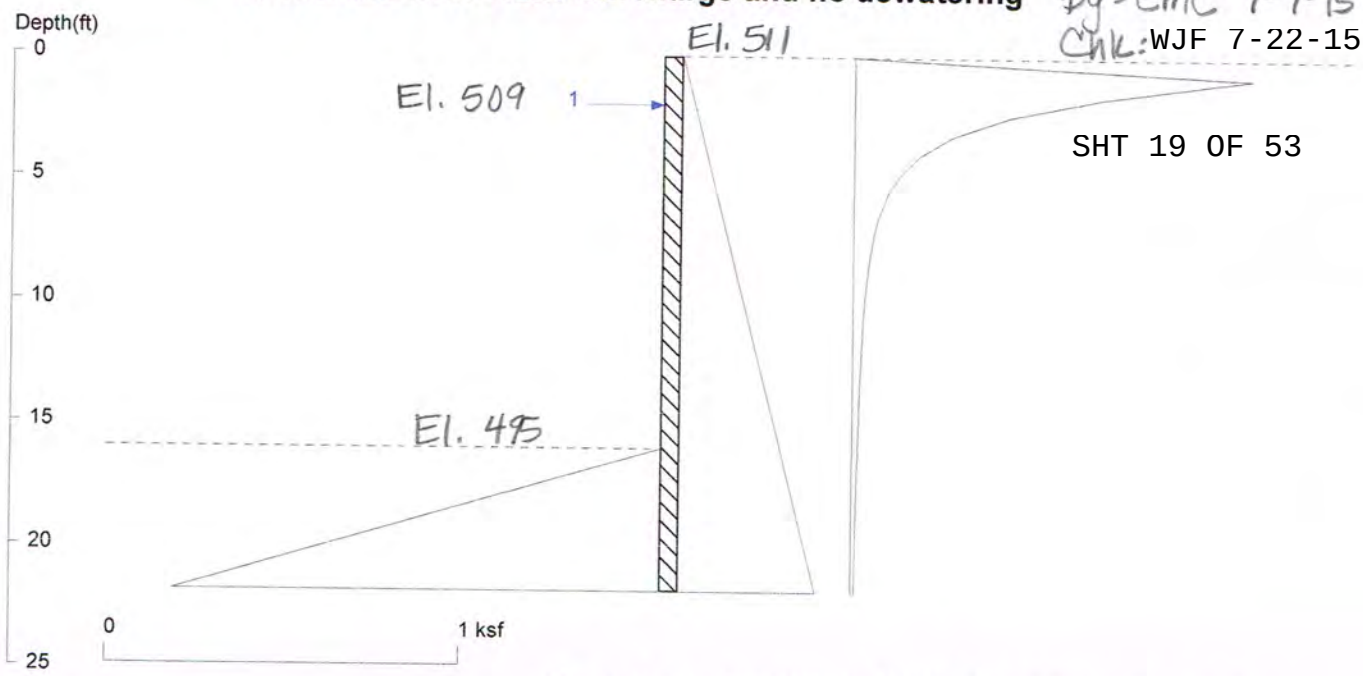

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Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=5.76 Min. Pile Length=21.76 ← Does not control.

MOMENT IN PILE: Max. Moment=8.52 per Pile Spacing=1.0 at Depth=11.67

PILE SELECTION: ← Does not control.

Request Min. Section Modulus = 4.3 in3/ft=231.23 cm3/m, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66

-> Piles meet Min. Section Requirements: Top Deflection is shown in (in)

LZ5 (-0.55) LZ3 (-0.48) PMA22 (-0.42) LZ250 (-0.46) CS55 (-0.31)
CS60 (-0.28) NSZ10 (-0.21) NSZ11 (-0.19) CS69 (-0.24) SZ12 (-0.16)
CS76 (-0.22) NSZ12 (-0.16) SZ14 (-0.16) SZ15 (-0.16)

Controls for brace loading

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	N/A	N/A
1. Strut	2.0	0.0	1.0	3.8 k/f	3.8	0.0	0.0	0.0

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	16.00	0.284	0.017768
*	Below	Base		
16.00	0.284	144.0	2.559	0.017768
*	Sur-	charg		
0.000	0.000	0.800	1.123	1.404099
0.800	1.123	1.600	0.708	-0.51920
1.600	0.708	2.400	0.438	-0.33687
2.400	0.438	3.200	0.278	-0.20076
3.200	0.278	4.000	0.184	-0.11742
4.000	0.184	4.800	0.128	-0.06978

14-049.04

By: EMC 7-7-15

Chk: WJF 7-22-15

4.800	0.128	5.600	0.094	-0.04278
5.600	0.094	6.400	0.072	-0.02720
6.400	0.072	7.200	0.058	-0.01797
7.200	0.058	8.000	0.048	-0.01234
8.000	0.048	8.800	0.041	-0.00881
8.800	0.041	9.600	0.035	-0.00654
9.600	0.035	10.40	0.031	-0.00503
10.40	0.031	11.20	0.028	-0.00401
11.20	0.028	12.00	0.026	-0.00329
12.00	0.026	12.80	0.023	-0.00277
12.80	0.023	13.60	0.021	-0.00239
13.60	0.021	14.40	0.020	-0.00210
14.40	0.020	15.20	0.018	-0.00187
15.20	0.018	16.00	0.017	-0.00168
16.00	0.017	17.60	0.015	-0.00145
17.60	0.015	19.20	0.013	-0.00121
19.20	0.013	20.80	0.011	-0.00102
20.80	0.011	22.40	0.010	-0.00087

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.25

Z1	P1	Z2	P2	Slope
*	Below	Base		
16.00	0.000	144.0	30.54	0.238654

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Ripley Pier Cofferdam

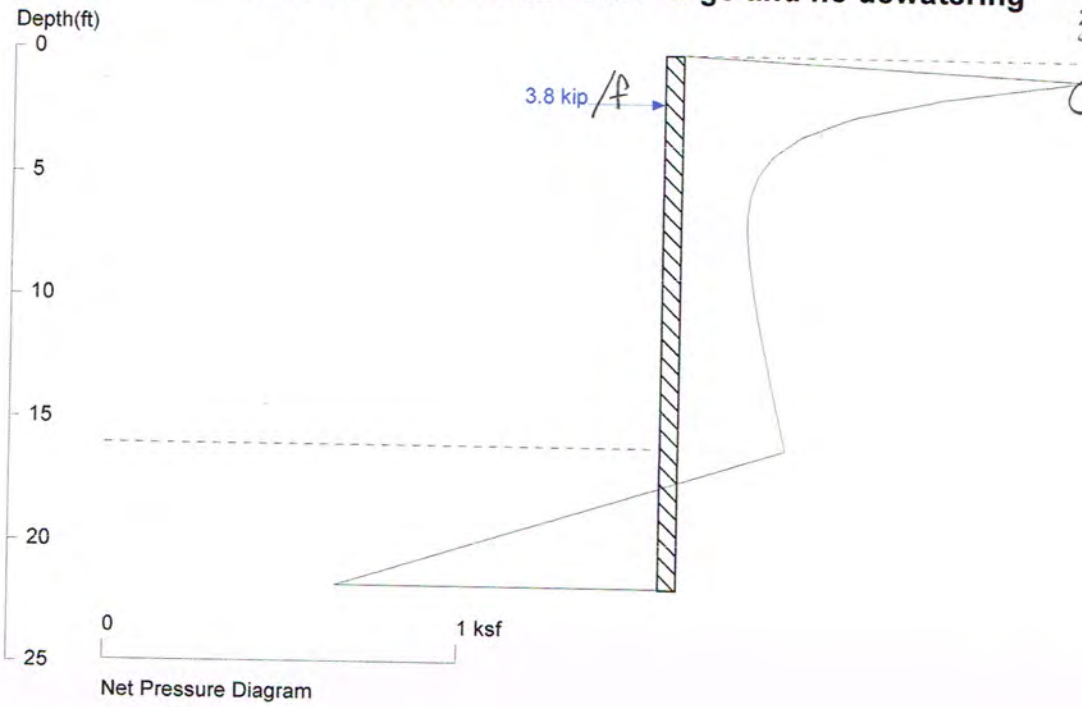
16 foot cut with Crane Surcharge and no dewatering

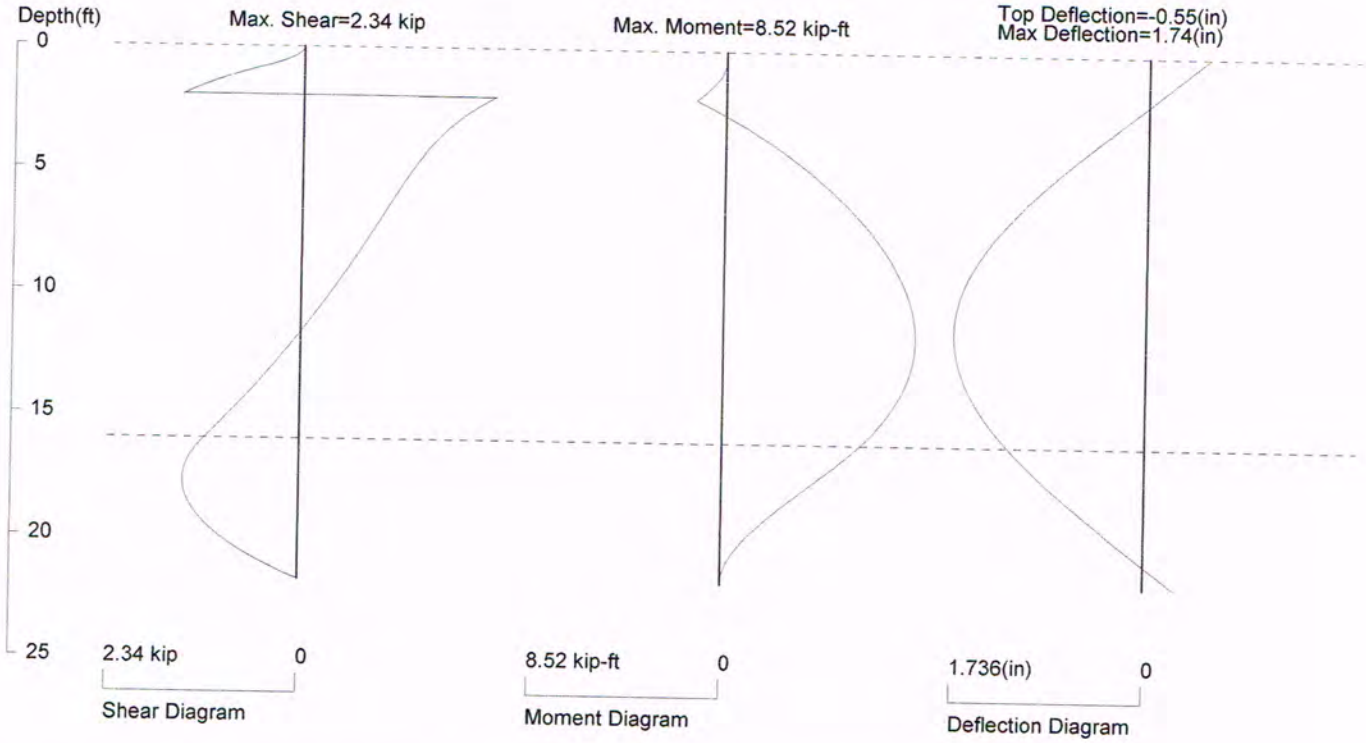
14-049.04

By: EMC 7-7-15

Chk: WJF 7-22-15

SHT 21 OF 53





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

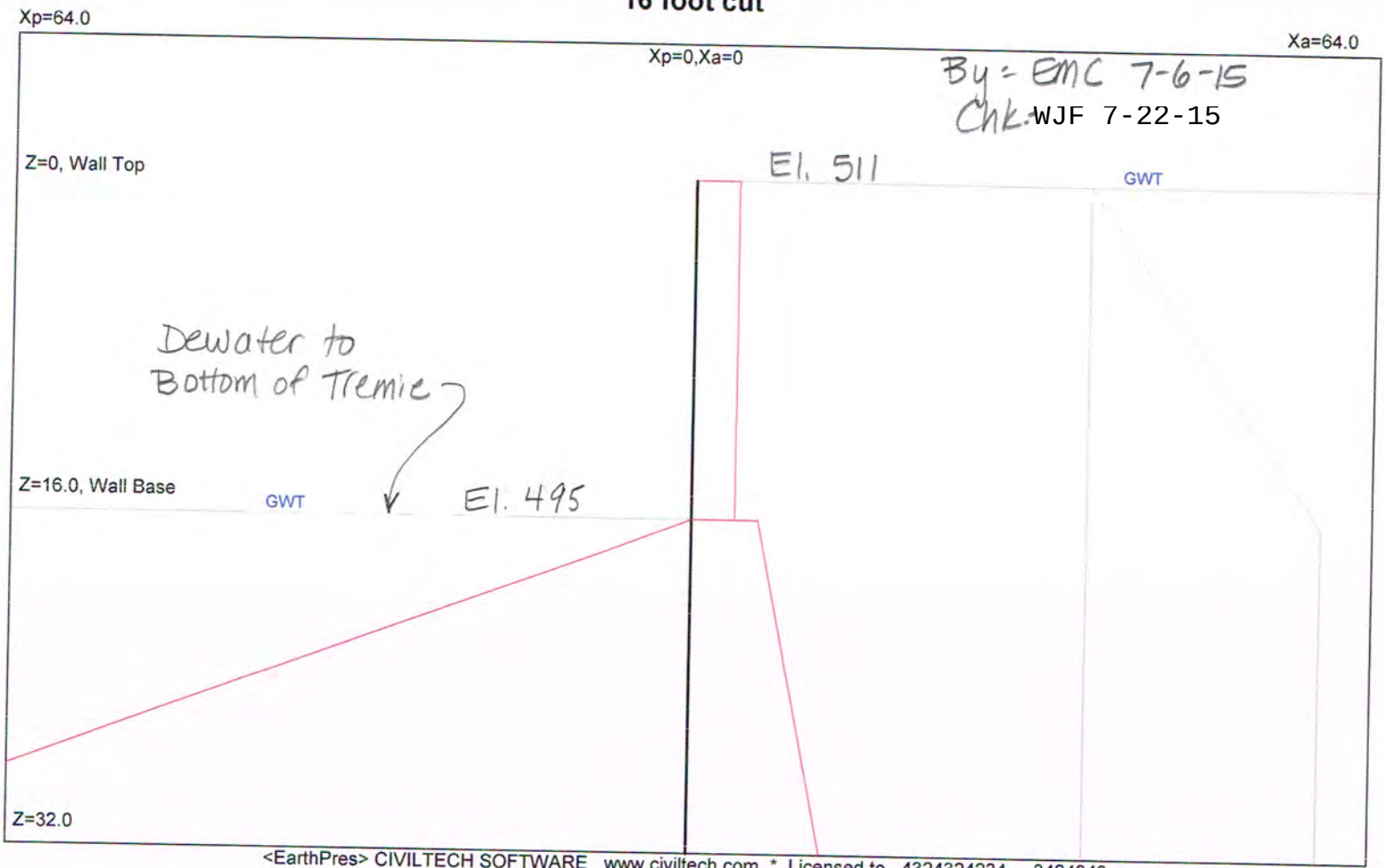
Based on pile spacing: 1.0 foot or meter

First Suitable Pile: LZ5: E (ksi)=29000.0, I (in4)/foot=10.4

Ripley Pier Cofferdam

16 foot cut

14-049.04



UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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* INPUT DATA *

Wall Height=16.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	30.00	0.0	0	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	16.0	0.0	16.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	16.0	0.0
2	16.0	800.0

Wall Friction Options: 3. Both sides (for formulary solution)
Wall Friction = 10
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

* OUTPUT RESULTS *

Total Force above Base= 2.27 per one linear foot (or meter) width along wall height

Total Static Force above Base= 2.27. Distributed in Apparent Envelope along wall height. Ignore soil layers and water line

By: EMC 7-6-15
Chk: WJF 7-22-15

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.18	16.00	0.18	0.0000	0.0000

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
16.00	0.28	32.00	0.57	0.0178	0.3085

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
16.00	0.00	32.00	3.82	0.239	4.1433

Water Pressure - Output to Shoring - Multiplier of Pressure = 1

No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	16.00	1.00	0.06
1	16.00	1.00	32.00	1.00	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

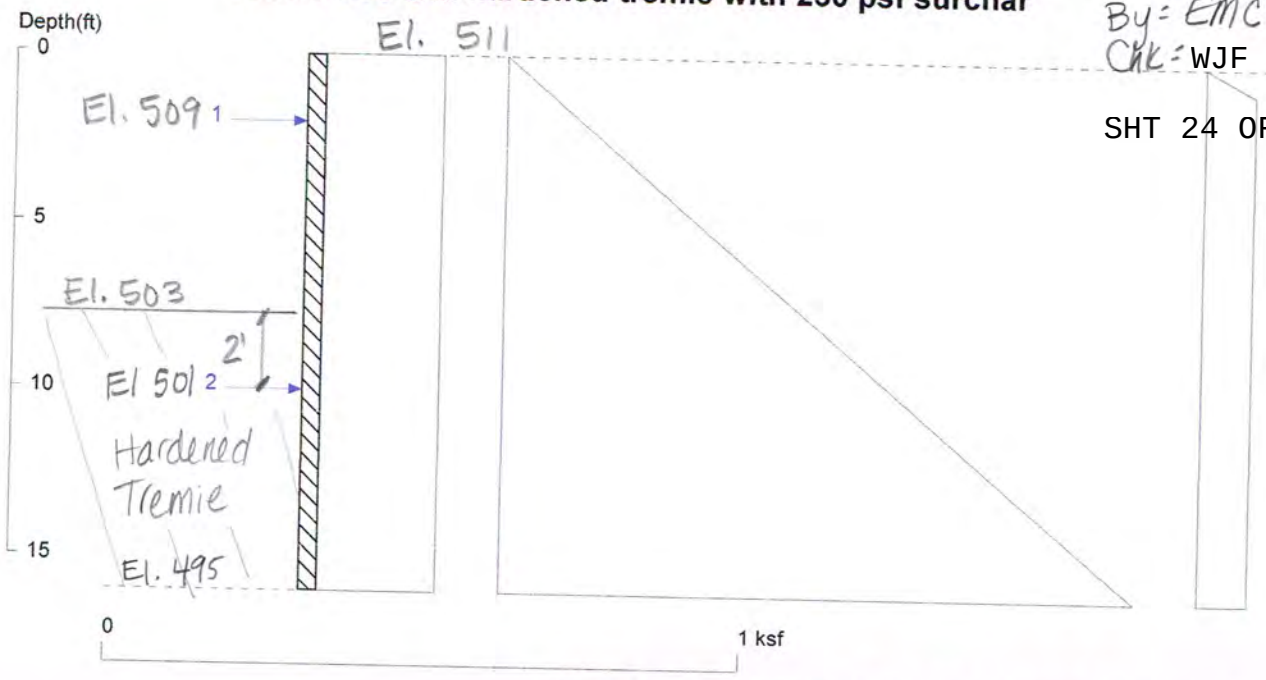
Date: 7/6/2015 File Name: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Rutland Ripley St Bridge Pier Cofferdam 14-049.04\Calculations\CT S

Ripley Pier Cofferdam

One brace and hardened tremie with 250 psf surchar

14-049.04
By: EMC 7-7-15
Chk: WJF 7-22-15

SHT 24 OF 53



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Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

MOMENT IN PILE: Max. Moment=18.25 per Pile Spacing=1.0 at Depth=10.01

PILE SELECTION: Does not control

Request Min. Section Modulus = 6.6 in3/ft=356.84 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

-> Piles meet Min. Section Requirements: Top Deflection is shown in (in)

CS60 (0.06) NSZ10 (0.05) NSZ11 (0.04) CS69 (0.05) SZ12 (0.03)
CS76 (0.05) NSZ12 (0.04) SZ14 (0.03) SZ15 (0.03) NSZ14 (0.03)
CZ67 (0.03) PDA27 (0.03) NSZ15 (0.03) CZ72 (0.03)

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

Does not control

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	N/A	N/A
1. Strut	2.0	0.0	1.0	0.6	0.6	0.0	0.0	0.0
(Tremie) 2. Strut	10.0	0.0	1.0	11.8	11.8	0.0	0.0	0.0

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.185	16.00	0.185	0.000000
*	Below	Base		
16.00	0.284	144.0	2.559	0.017768
*	Water	Pres.		
0.000	0.000	16.00	0.998	0.062400
16.00	0.998	144.0	0.998	0.000000
*	Sur-	charg		
0.000	0.000	0.800	0.078	0.097656
0.800	0.078	1.600	0.078	0.000000
1.600	0.078	2.400	0.078	0.000000

14-049.04

By = EMC 7-7-15

Chk: WJF 7-22-15

2.400	0.078	3.200	0.078	0.000000
3.200	0.078	4.000	0.078	0.000000
4.000	0.078	4.800	0.078	0.000000
4.800	0.078	5.600	0.078	0.000000
5.600	0.078	6.400	0.078	0.000000
6.400	0.078	7.200	0.078	0.000000
7.200	0.078	8.000	0.078	0.000000
8.000	0.078	8.800	0.078	0.000000
8.800	0.078	9.600	0.078	0.000000
9.600	0.078	10.40	0.078	0.000000
10.40	0.078	11.20	0.078	0.000000
11.20	0.078	12.00	0.078	0.000000
12.00	0.078	12.80	0.078	0.000000
12.80	0.078	13.60	0.078	0.000000
13.60	0.078	14.40	0.078	0.000000
14.40	0.078	15.20	0.078	0.000000
15.20	0.078	16.00	0.078	0.000000
16.00	0.078	17.60	0.078	0.000000

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.25

Z1	P1	Z2	P2	Slope
*	Below	Base		
16.00	0.000	144.0	30.54	0.238654

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

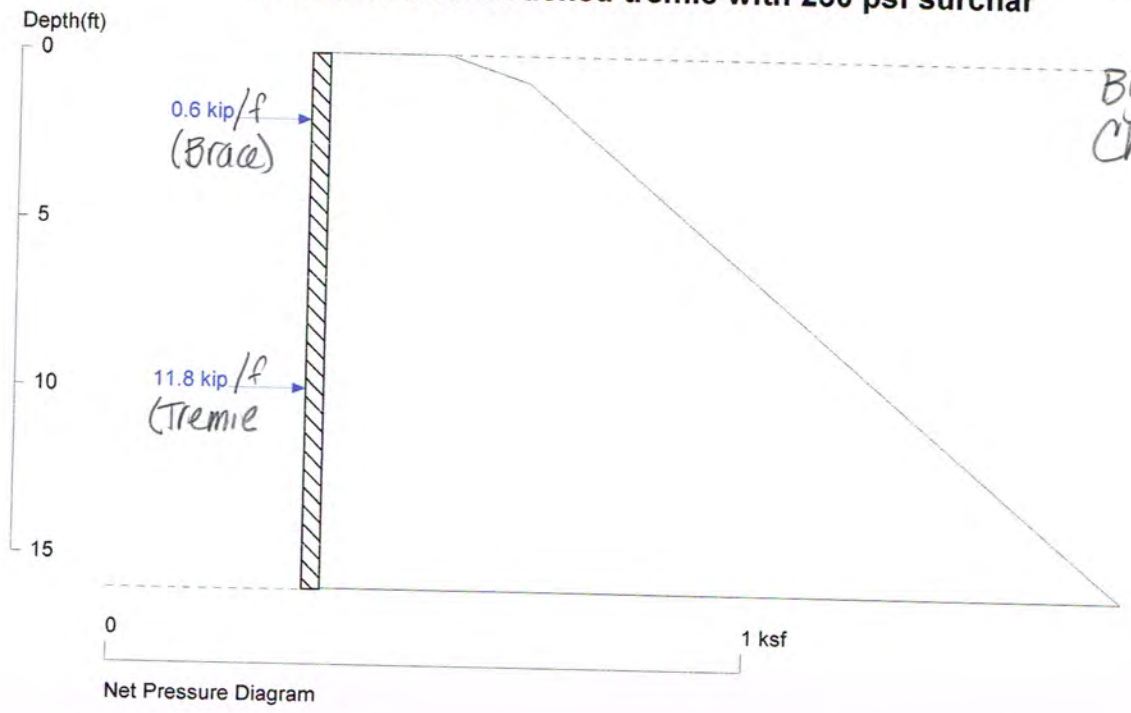
UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

14-049.04

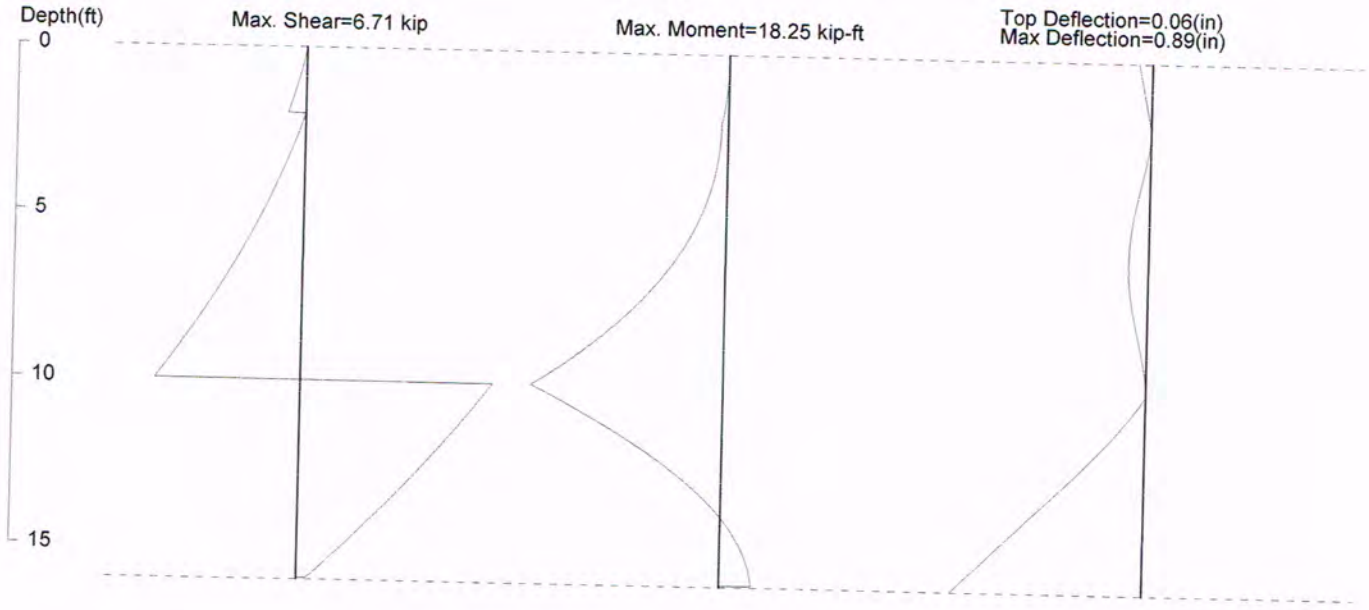
Ripley Pier Cofferdam

One brace and hardened tremie with 250 psf surchar

By: EMC 7-7-15
Chk WJF 7-22-15



Net Pressure Diagram



6.71 kip 0
Shear Diagram

18.25 kip-ft 0
Moment Diagram

0.894(in) 0
Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

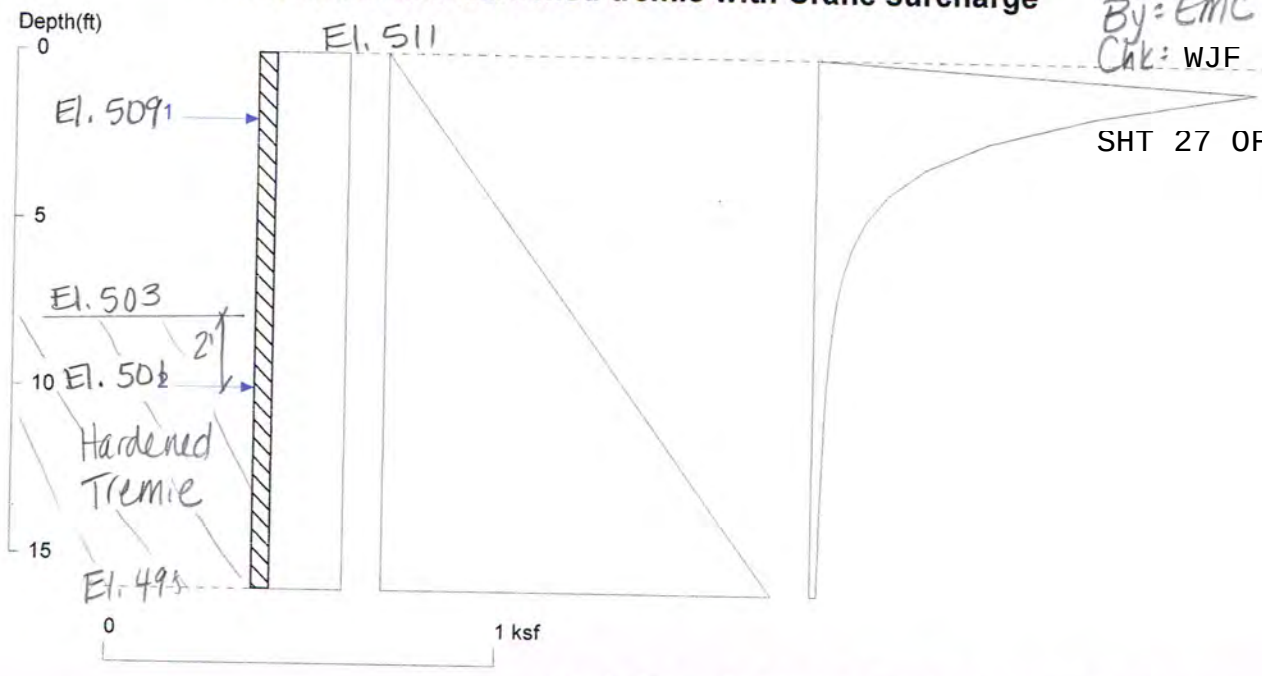
First Suitable Pile: CS60: E (ksi)=29000.0, I (in4)/foot=20.5

Ripley Pier Cofferdam

One brace and hardened tremie with Crane surcharge

14-049.04
By: EMC 7-7-15
Chk: WJF 7-22-15

SHT 27 OF 53



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Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

MOMENT IN PILE: Max. Moment=19.40 per Pile Spacing=1.0 at Depth=10.01

PILE SELECTION: Controls. Use PZC-26. $S = 48.4\ in^3/f > 7.1$

Request Min. Section Modulus = 7.1 in3/ft=379.19 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

-> Piles meet Min. Section Requirements: Top Deflection is shown in (in)

NSZ10 (0.06) NSZ11 (0.06) CS69 (0.07) SZ12 (0.05) CS76 (0.07)
NSZ12 (0.05) SZ14 (0.05) SZ15 (0.05) NSZ14 (0.04) CZ67 (0.04)
PDA27 (0.04) NSZ15 (0.04) CZ72 (0.04) 1BXN (0.05)

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

Does not control

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	N/A	N/A
1. Strut	2.0	0.0	1.0	2.5	2.5	0.0	0.0	0.0
(Tremie) 2. Strut	10.0	0.0	1.0	11.2	11.2	0.0	0.0	0.0

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.185	16.00	0.185	0.000000
*	Below	Base		
16.00	0.284	144.0	2.559	0.017768
*	Water	Pres.		
0.000	0.000	16.00	0.998	0.062400
16.00	0.998	144.0	0.998	0.000000
*	Sur-	charg		
0.000	0.000	0.800	1.123	1.404099
0.800	1.123	1.600	0.708	-0.51920
1.600	0.708	2.400	0.438	-0.33687

2.400	0.438	3.200	0.278	-0.20076
3.200	0.278	4.000	0.184	-0.11742
4.000	0.184	4.800	0.128	-0.06978
4.800	0.128	5.600	0.094	-0.04278
5.600	0.094	6.400	0.072	-0.02720
6.400	0.072	7.200	0.058	-0.01797
7.200	0.058	8.000	0.048	-0.01234
8.000	0.048	8.800	0.041	-0.00881
8.800	0.041	9.600	0.035	-0.00654
9.600	0.035	10.40	0.031	-0.00503
10.40	0.031	11.20	0.028	-0.00401
11.20	0.028	12.00	0.026	-0.00329
12.00	0.026	12.80	0.023	-0.00277
12.80	0.023	13.60	0.021	-0.00239
13.60	0.021	14.40	0.020	-0.00210
14.40	0.020	15.20	0.018	-0.00187
15.20	0.018	16.00	0.017	-0.00168
16.00	0.017	17.60	0.015	-0.00145

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.25

Z1	P1	Z2	P2	Slope
*	Below	Base		
16.00	0.000	144.0	30.54	0.238654

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Ripley Pier Cofferdam

One brace and hardened tremie with Crane surcharge

14-049.04

By: EMC 7-7-15

Chk WJF 7-22-15

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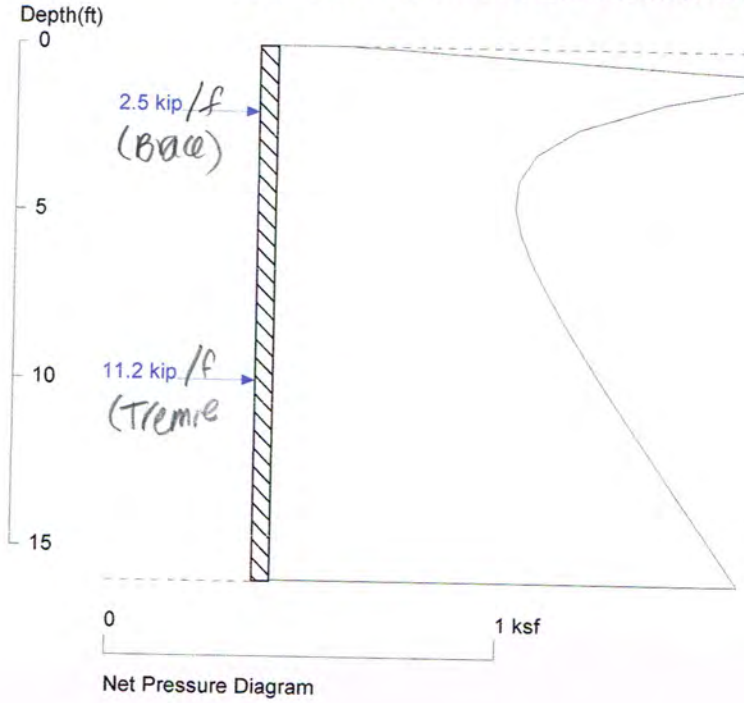
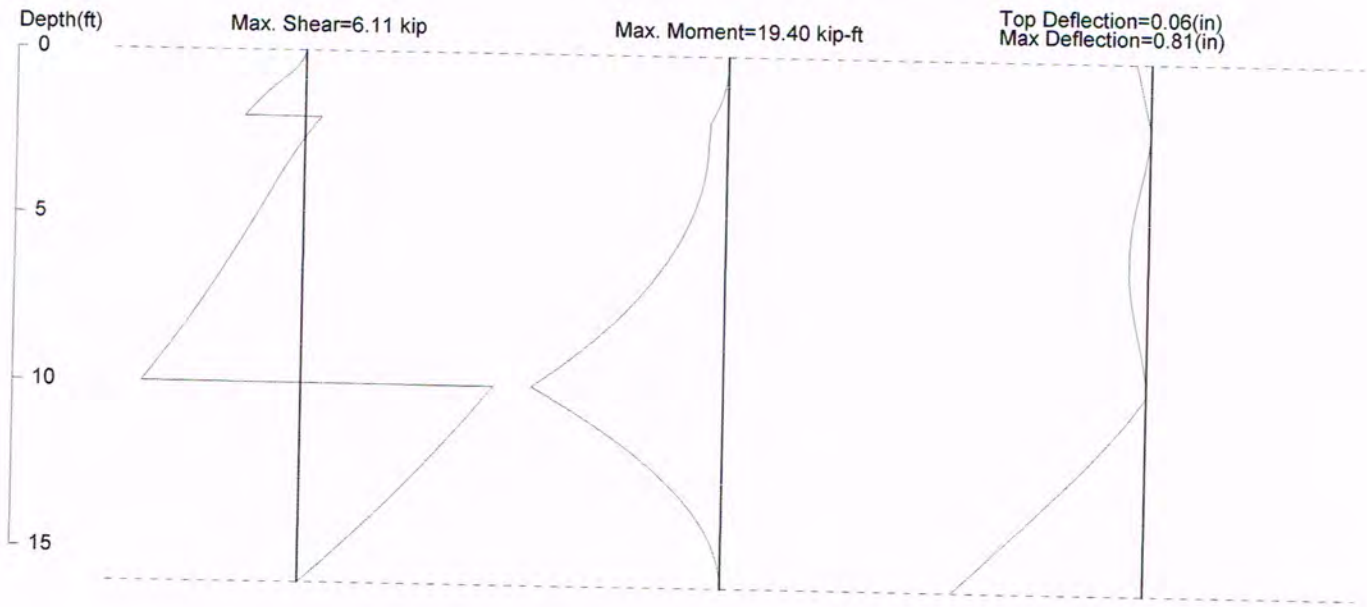


Net Pressure Diagram



Shear Diagram

Moment Diagram

Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

First Suitable Pile: NSZ10: E (ksi)=29000.0, I (in4)/foot=27.4

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JOB 14-049.04
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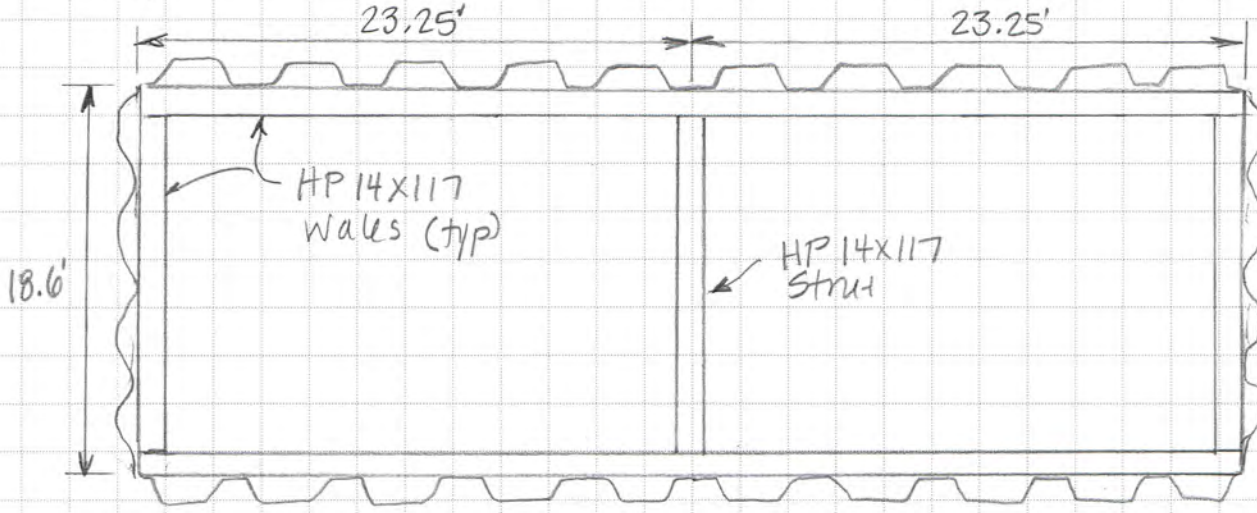
CALCULATED BY EMC DATE 7-9-2015
CHECKED BY WJF DATE 7-22-15
SCALE

Design Bracing at El 509

Max. loading = 3.8 k/f (see Sh. 19)

Use HP14x117 (Fy = 50 ksi) wales and strut.

Try one strut at center as shown below



Short wale: $\ell \approx 16.5'$ $V = 16.5' \times 3.8^k/f / 2 = 31.4^k$

$M = 3.8 \times 16.5^2/8 = 129$ k-f

$P = \frac{3}{8} \times 23.25 \times 3.8 = 33.1^k$

Long wale: $\ell \approx 23'$ $V_{max} = \frac{5}{8} \times 23' \times 3.8^k/f = 54.6^k$

$M_{max} = 3.8 \times 23^2/8 = 251$ k-f

$P = 3.8 \times 18.6/2 = 35.3^k$

Strut: $P = \frac{10}{8} \times 23.25' \times 3.8^k/f = 110^k$ $\ell \approx 16.5'$

Assume wale seats at ends of wales and midpoint of long wale.

$My = \frac{0.117^k/f \times 23.25^2}{8} = 7.9$, say 8 k-f for long wale

$My = \frac{0.117 \times 16.5^2}{8} = 4.0$, say 4 k-f for short wale

$My = \frac{0.117 \times 16.5^2}{8} = 4.0$, say 4 k-f for strut

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CALCULATED BY EMC DATE 7-9-2015
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SCALE

LONG WALE INPUT

User Inputs:

Wale Name:	Long Wales		*Wale Name/Label*
Shape:	HP14x117		*Enter Shape in format: W12x34. Shape is referenced in Steel Shape Database tab and all information is pulled as required.*
Lb:	23	ft	*Unbraced length. CAN VARY.*
Fy	50	ksi	*Yield stress. CAN VARY. 30 or 33 is typical for older rolled shapes*
Strut Spacing =	23	ft	*Wale span between struts*
Pr	35.3	kips	*Required axial capacity*
Vr =	54.6	kips	*Required shear capacity*
Mrx =	251	kip-ft	*Required strong axis moment*
Mry =	8	kip-ft	*Required weak axis moment*
K value =	1.0	-	*K value*
E =	29000	ksi	*Modulus of elasticity*

Color Indication:

	User Input
	Calculation
	Reference
	Hard number
	Member can withstand loading
	Member cannot withstand loading

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MOMENT CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable moment of a rolled W-shape in accordance with AISC 14th Edition Section F2 Note: Compact flanges and webs are assumed

HP14x117 flanges are non-compact. However equation F2-2 controls over equation F3-1 (see Sh. 50)

Member Information:

Designation:	HP14x117		
Zx =	194 in^3	rts =	4.15 in
Zy =	91.4 in^3	ry =	3.59 in
Sx =	172 in^3	J =	8.02 in^4
Sy =	59.5 in^3	ho =	13.4 in

Mp = Fy * Zx = 9700 kip-in

$$L_p = 1.76 r_y \sqrt{\frac{E}{F_y}} \qquad \text{(F2-5)}$$

$$L_r = 1.95 r_{ts} \frac{E}{0.7F_y} \sqrt{\frac{J_c}{S_x h_o}} \sqrt{1 + \sqrt{1 + 6.76\left(\frac{0.7F_y}{E}\frac{S_x h_o}{J_c}\right)}} \qquad \text{(F2-6)}$$

Lp = 12.68 ft
Lr = 50.49 ft

STRONG AXIS

Mnx is governed by one of the following equations:

Lb < Lp use F2-1; Lp<Lb<Lr use F2-2; Lb>Lr use F2-3 and F2-4

Lp < Lb < Lr therefore use F2-2

$$M_n = M_p = F_y Z_x \qquad \text{(F2-1)}$$

$$M_n = C_b\left[M_p - (M_p - 0.7F_y S_x)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right] \le M_p \qquad \text{(F2-2)}$$

$$M_n = F_{cr} S_x \le M_p \qquad \text{(F2-3)}$$

$$F_{cr} = \frac{C_b \pi^2 E}{\left(\frac{L_b}{r_{ts}}\right)^2} \sqrt{1 + 0.078 \frac{J_c}{S_x h_o}\left(\frac{L_b}{r_{ts}}\right)^2} \qquad \text{(F2-4)}$$

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Mnx =	8695.647 kip-in	=	724.6373 kip-ft			
Mcx = Mnx/1.67 =	5206.97 kip-in	=	433.91 kip-ft	>	**251.00 kip-ft**	OK

WEAK AXIS

$$M_n = M_p = F_y Z_y \leq 1.6 F_y S_y \qquad \text{(F6-1)}$$

Mny =	4570.00 kip-in	=<	4760.00 kip-in	**OK**	
Mcy = Mny/1.67 =	2736.53 kip-in	=	228.04 kip-ft	>	**8.00 kip-ft** OK

SHEAR CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable shear of a rolled W-shape in accordance with AISC 14th Edition Section G. Only applicable to members where Cv = 1

$$V_n = 0.6 F_y A_{web} C_v \qquad \text{(G2-1)}$$

Cv = 1

d =	14.2 in			
tw =	0.805 in			
Fy =	50 ksi			
Vn =	342.93 kips			
Vn / 1.50	228.62 kips	>	**54.60 kips**	Therefore OK

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JOB 14-049.04
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AXIAL CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable axial load of a rolled W-shape in accordance with
AISC 14th Edition Section E3 Note: Non-slender flanges and webs are assumed

Member Information:

Designation:	HP14x117		
Zx =	194 in^3	rts =	4.15 in
Zy =	91.4 in^3	ry =	3.59 in
Sx =	172 in^3	J =	8.02 in^4
Sy =	59.5 in^3	ho =	13.4 in
Ag =	34.4 in^2		

$$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} \qquad \text{(E3-4)}$$

Fe = 48.38 ksi

Pn is governed by one of the following equations:

(a) When $\frac{KL}{r} \le 4.71\sqrt{\frac{E}{F_y}}$ $\left(\text{or } \frac{F_y}{F_e} \le 2.25\right)$

$$F_{cr} = \left[0.658^{\frac{F_y}{F_e}}\right] F_y \qquad \text{(E3-2)}$$

(b) When $\frac{KL}{r} > 4.71\sqrt{\frac{E}{F_y}}$ $\left(\text{or } \frac{F_y}{F_e} > 2.25\right)$

$$F_{cr} = 0.877 F_e \qquad \text{(E3-3)}$$

Fcr = 32.44 ksi

$$P_n = F_{cr} A_g \qquad \text{(E3-1)}$$

Pn = 1115.97 kips

Pc = Pn/1.67 = 668.24 kips > **35.30 kips**

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SHEET NO. 35 OF 53
CALCULATED BY EMC DATE 7-9-2015
CHECKED BY WJF DATE 7-22-15
SCALE

COMBINED MOMENT AND AXIAL FORCES OF ROLLED W SHAPE:

This spreadsheet checks the combined bending and axial capacity of a rolled W-shape in accordance with AISC 14th Edition Section H1

Note: Compact flanges and webs are assumed

Member Information:

Designation:	HP14x117				
Zx =	194	in^3	rts =	4.15	in
Zy =	91.4	in^3	ry =	3.59	in
Sx =	172	in^3	J =	8.02	in^4
Sy =	59.5	in^3	ho =	13.4	in

Doubly and Singly Symetric Members Subject to Flexure and Compression

(a)For $\frac{P_r}{P_c} \geq 0.2$

$$\frac{P_r}{P_c} + \frac{8}{9}\left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0 \qquad \text{(H1-1a)}$$

(a)For $\frac{P_r}{P_c} < 0.2$

$$\frac{P_r}{2P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0 \qquad \text{(H1-1b)}$$

Pr/Pc =	0.05	<	0.2	
therefore,	0.64	=<	1.0	OK

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SCALE

SHORT WALE DESIGN

User Inputs:

Wale Name:	Short Wales		*Wale Name/Label*
Shape:	HP14x117		*Enter Shape in format: W12x34. Shape is referenced in Steel Shape Database tab and all information is pulled as required.*
L_b:	16.5	ft	*Unbraced length. CAN VARY.*
F_y	50	ksi	*Yield stress. CAN VARY. 30 or 33 is typical for older rolled shapes*
Strut Spacing =	16.5	ft	*Wale span between struts*
Pr	33.1	kips	*Required axial capacity*
V_r =	31.4	kips	*Required shear capacity*
M_{rx} =	129	kip-ft	*Required strong axis moment*
M_{ry} =	4	kip-ft	*Required weak axis moment*
K value =	1.0	-	*K value*
E =	29000	ksi	*Modulus of elasticity*

Color Indication:

	User Input
	Calculation
	Reference
	Hard number
	Member can withstand loading
	Member cannot withstand loading

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MOMENT CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable moment of a rolled W-shape in accordance with AISC 14th Edition Section F2 Note: Compact flanges and webs are assumed

Member Information:

Designation:	HP14x117		
Zx =	194 in^3	rts =	4.15 in
Zy =	91.4 in^3	ry =	3.59 in
Sx =	172 in^3	J =	8.02 in^4
Sy =	59.5 in^3	ho =	13.4 in

Mp = Fy * Zx = 9700 kip-in

$$L_p = 1.76 r_y \sqrt{\frac{E}{F_y}} \qquad \text{(F2-5)}$$

$$L_r = 1.95 r_{ts} \frac{E}{0.7F_y} \sqrt{\frac{J_c}{S_x h_o}} \sqrt{1 + \sqrt{1 + 6.76\left(\frac{0.7F_y}{E}\frac{S_x h_o}{J_c}\right)}} \qquad \text{(F2-6)}$$

Lp = 12.68 ft
Lr = 50.49 ft

STRONG AXIS

Mnx is governed by one of the following equations:

Lb < Lp use F2-1; Lp<Lb<Lr use F2-2; Lb>Lr use F2-3 and F2-4

Lp < Lb < Lr therefore use F2-2

$$M_n = M_p = F_y Z_x \qquad \text{(F2-1)}$$

$$M_n = C_b\left[M_p - \left(M_p - 0.7F_y S_x\right)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right] \le M_p \qquad \text{(F2-2)}$$

$$M_n = F_{cr} S_x \le M_p \qquad \text{(F2-3)}$$

$$F_{cr} = \frac{C_b \pi^2 E}{\left(\frac{L_b}{r_{ts}}\right)^2}\sqrt{1 + 0.078\frac{J_c}{S_x h_o}\left(\frac{L_b}{r_{ts}}\right)^2} \qquad \text{(F2-4)}$$

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Mnx =	9328.271	kip-in	=	777.3559	kip-ft			
Mcx = Mnx/1.67 =	5585.79	kip-in	=	465.48	kip-ft	>	**129.00** **kip-ft**	OK

WEAK AXIS

$$M_n = M_p = F_y Z_y \leq 1.6 F_y S_y \qquad \text{(F6-1)}$$

Mny =	4570.00	kip-in	=<	4760.00	kip-in		**OK**	
Mcy = Mny/1.67 =	2736.53	kip-in	=	228.04	kip-ft	>	**4.00** **kip-ft**	OK

SHEAR CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable shear of a rolled W-shape in accordance with AISC 14th Edition Section G. Only applicable to members where Cv = 1

$$V_n = 0.6 F_y A_{web} C_v \qquad \text{(G2-1)}$$

Cv = 1

d =	14.2	in				
tw =	0.805	in				
Fy =	50	ksi				
Vn =	342.93	kips				
Vn / 1.50	228.62	kips	>	**31.40**	**kips**	Therefore OK

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AXIAL CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable axial load of a rolled W-shape in accordance with AISC 14th Edition Section E3 Note: Non-slender flanges and webs are assumed

Member Information:

Designation: HP14x117

Zx =	194 in^3	rts =	4.15 in
Zy =	91.4 in^3	ry =	3.59 in
Sx =	172 in^3	J =	8.02 in^4
Sy =	59.5 in^3	ho =	13.4 in
Ag =	34.4 in^2		

$$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} \qquad \text{(E3-4)}$$

Fe = 130.57 ksi

Pn is governed by one of the following equations:

(a) When $\frac{KL}{r} \le 4.71\sqrt{\frac{E}{F_y}}$ $\left(\text{or } \frac{F_y}{F_e} \le 2.25\right)$

$$F_{cr} = \left[0.658^{\frac{F_y}{F_e}}\right] F_y \qquad \text{(E3-2)}$$

(b) When $\frac{KL}{r} > 4.71\sqrt{\frac{E}{F_y}}$ $\left(\text{or } \frac{F_y}{F_e} > 2.25\right)$

$$F_{cr} = 0.877 F_e \qquad \text{(E3-3)}$$

Fcr = 42.60 ksi

$$P_n = F_{cr} A_g \qquad \text{(E3-1)}$$

Pn = 1465.27 kips

Pc = Pn/1.67 = 877.41 kips > **33.10 kips**

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SCALE

COMBINED MOMENT AND AXIAL FORCES OF ROLLED W SHAPE:

This spreadsheet checks the combined bending and axial capacity of a rolled W-shape in accordance with AISC 14th Edition Section H1

Note: Compact flanges and webs are assumed

Member Information:

Designation:	HP14x117				
Zx =	194	in^3	rts =	4.15	in
Zy =	91.4	in^3	ry =	3.59	in
Sx =	172	in^3	J =	8.02	in^4
Sy =	59.5	in^3	ho =	13.4	in

Doubly and Singly Symetric Members Subject to Flexure and Compression

(a)For $\frac{P_r}{P_c} \geq 0.2$

$$\frac{P_r}{P_c} + \frac{8}{9}\left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0 \qquad \text{(H1-1a)}$$

(a)For $\frac{P_r}{P_c} < 0.2$

$$\frac{P_r}{2P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0 \qquad \text{(H1-1b)}$$

Pr/Pc =	0.04	<	0.2	
therefore,	0.31	=<	1.0	OK

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SCALE

STRUT DESIGN

User Inputs:

Name:	Strut		
Shape:	HP14x117		*Enter Shape in format: W12x34. Shape is referenced in Steel Shape Database tab and all information is pulled as required.*
L_b:	16.5	ft	*Unbraced length. CAN VARY.*
F_y	50	ksi	*Yield stress. CAN VARY. 30 or 33 is typical for older rolled shapes*
Strut Spacing =	0	ft	*Wale span between struts*
Pr	110	kips	*Required axial capacity*
V_r =	0	kips	*Required shear capacity*
M_{rx} =	0	kip-ft	*Required strong axis moment*
M_{ry} =	4	kip-ft	*Required weak axis moment*
K value =	1.0	-	*K value*
E =	29000	ksi	*Modulus of elasticity*

Color Indication:

	User Input
	Calculation
	Reference
	Hard number
	Member can withstand loading
	Member cannot withstand loading

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SCALE

MOMENT CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable moment of a rolled W-shape in accordance with AISC 14th Edition Section F2 Note: Compact flanges and webs are assumed

Member Information:

Designation:	HP14x117				
Z_x =	194	in^3	r_{ts} =	4.15	in
Z_y =	91.4	in^3	r_y =	3.59	in
S_x =	172	in^3	J =	8.02	in^4
S_y =	59.5	in^3	h_o =	13.4	in

$M_p = F_y * Z_x$ = 9700 kip-in

$$L_p = 1.76 r_y \sqrt{\frac{E}{F_y}} \qquad \text{(F2-5)}$$

$$L_r = 1.95 r_{ts} \frac{E}{0.7F_y} \sqrt{\frac{J_c}{S_x h_o}} \sqrt{1 + \sqrt{1 + 6.76\left(\frac{0.7F_y}{E}\frac{S_x h_o}{J_c}\right)}} \qquad \text{(F2-6)}$$

L_p = 12.68 ft
L_r = 50.49 ft

WEAK AXIS

$$M_n = M_p = F_y Z_y \leq 1.6 F_y S_y \qquad \text{(F6-1)}$$

M_{ny} = 4570.00 kip-in =< 4760.00 kip-in **OK**

$M_{cy} = M_{ny}/1.67$ = 2736.53 kip-in = 228.04 kip-ft > **4.00 kip-ft** OK

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SCALE

AXIAL CAPACITY OF ROLLED W SHAPE:

This spreadsheet determines the allowable axial load of a rolled W-shape in accordance with AISC 14th Edition Section E3 Note: Non-slender flanges and webs are assumed

Member Information:

Designation: HP14x117

Zx =	194 in^3	rts =	4.15 in
Zy =	91.4 in^3	ry =	3.59 in
Sx =	172 in^3	J =	8.02 in^4
Sy =	59.5 in^3	ho =	13.4 in
Ag =	34.4 in^2		

$$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} \quad \text{(E3-4)}$$

Fe = 177.71 ksi

Pn is governed by one of the following equations:

(a) When $\frac{KL}{r} \le 4.71\sqrt{\frac{E}{F_y}}$ $\left(\text{or } \frac{F_y}{F_e} \le 2.25\right)$

$$F_{cr} = \left[0.658^{\frac{F_y}{F_e}}\right] F_y \quad \text{(E3-2)}$$

(b) When $\frac{KL}{r} > 4.71\sqrt{\frac{E}{F_y}}$ $\left(\text{or } \frac{F_y}{F_e} > 2.25\right)$

$$F_{cr} = 0.877 F_e \quad \text{(E3-3)}$$

Fcr = 44.45 ksi

$$P_n = F_{cr} A_g \quad \text{(E3-1)}$$

Pn = 1528.92 kips

Pc = Pn/1.67 = 915.52 kips > **110.00 kips** OK

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SCALE

COMBINED MOMENT AND AXIAL FORCES OF ROLLED W SHAPE:

This spreadsheet checks the combined bending and axial capacity of a rolled W-shape in accordance with AISC 14th Edition Section H1

Note: Compact flanges and webs are assumed

Member Information:

Designation:	HP14x117				
Zx =	194	in^3	rts =	4.15	in
Zy =	91.4	in^3	ry =	3.59	in
Sx =	172	in^3	J =	8.02	in^4
Sy =	59.5	in^3	ho =	13.4	in

Doubly and Singly Symetric Members Subject to Flexure and Compression

(a)For $\frac{P_r}{P_c} \geq 0.2$

$$\frac{P_r}{P_c} + \frac{8}{9}\left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0 \qquad \text{(H1-1a)}$$

(a)For $\frac{P_r}{P_c} < 0.2$

$$\frac{P_r}{2P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \leq 1.0 \qquad \text{(H1-1b)}$$

Pr/Pc =	0.13	<	0.2	
therefore,	0.08	=<	1.0	OK

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SCALE

AISC J10.2: Web Local Yielding **HP14x117 at Strut**

Note: Tension and compression concentrated forces.

Fy =	50 ksi	Lb = Length of Bearing =	14.2 in
tw =	0.805 in	d =	14.2 in
k =	1.5 in	Le = Distance from Force to End of Member=	279 in

Rn = Fy x tw x (5k + Lb)

Rn = 873.43 kips

Rn/Ω = 582.28 kips **> 110 kips Therefore OK**

AISC J10.3: Web Local Crippling **HP14x117 at Strut**

Note: Applies to compressive forces only.

Fy =	50 ksi	Lb = Length of Bearing =	14.2 in
tw =	0.805 in	Le = Distance from Force to End of Member =	279 in
tf =	805 in	d = Depth of Member =	14.2 in

for Le > d/2: APPLIES

$$R_n = 0.80 t_w^2 \left[1 + 3\left(\frac{N}{d}\right)\left(\frac{t_w}{t_f}\right)^{1.5}\right]\sqrt{\frac{EF_{yw}t_f}{t_w}}$$

for Le < d/2 and Lb/d < 0.2:

$$R_n = 0.40 t_w^2 \left[1 + 3\left(\frac{N}{d}\right)\left(\frac{t_w}{t_f}\right)^{1.5}\right]\sqrt{\frac{EF_{yw}t_f}{t_w}}$$

for Le < d/2 and Lb/d > 0.2:

$$R_n = 0.40 t_w^2 \left[1 + \left(\frac{4N}{d} - 0.2\right)\left(\frac{t_w}{t_f}\right)^{1.5}\right]\sqrt{\frac{EF_{yw}t_f}{t_w}}$$

Rn = 19742.72 kips

Rn/Ω = 9871.36 kips **> 110 kips Therefore OK**

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AISC J10.4: Web Sidesway Buckling **HP14x117 at Strut**

Note: Compressive forces in bearing connections where relative lateral movement between tension and compression flange not restrained.

tw =	0.805 in	L brace* =	279 in	* Largest laterally unbraced length along either flange at the point of load
tf =	0.805 in	bf =	14.9 in	
h*** =	11.43 in	Mr/My** =	0	**Required Moment / Yield Moment at Point of Load.
(h/tw) = (Lb/bf)	0.758285			***clear distance between flanges less the fillet or corner radius
Cr =	960000 ksi			

(a) If the compression flange is restrained against rotation:

(i) For $(h/t_w)/(l/b_f) \le 2.3$

$$R_n = \frac{C_r t_w^3 t_f}{h^2}\left[1 + 0.4\left(\frac{h/t_w}{l/b_f}\right)^3\right] \qquad \text{(J10-6)}$$

(ii) For $(h/t_w)/(l/b_f) > 2.3$, the limit state of web sidesway buckling does not apply.

(b) If the compression flange is not restrained against rotation:

(i) For $(h/t_w)/(l/b_f) \le 1.7$

$$R_n = \frac{C_r t_w^3 t_f}{h^2}\left[0.4\left(\frac{h/t_w}{l/b_f}\right)^3\right] \qquad \text{(J10-7)}$$

(ii) For $(h/t_w)/(l/b_f) > 1.7$, the limit state of web sidesway buckling does not apply.

Compression Flange Restrained Against Rotation:

Rn = 3623.93 kips

Rn/Ω = 2059.05 kips **> 110 kips Therefore OK**

Compression Flange not Restrained Against Rotation:

Rn = 538.17 kips

Rn/Ω = 305.78 kips **> 110 kips Therefore OK**

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AISC J10.5: Web Compression Buckling **HP14x117 at Strut**

Note: Applies to compressive forces applied to both flanges at the same location.

Fy =	50	ksi
tw =	0.805	in
h =	11.43	in
d =	14.2	in
Le =	279	in

$$R_n = \frac{24 t_w^3 \sqrt{E F_{yw}}}{h}$$

Reduce Rn by 50% for forces that are applied with a distance of d/2 from the member end:

Reduction does not Apply

Rn = 1318.98 kips

Rn/Ω = 789.81 kips **> 110 kips Therefore OK**

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Connection of Wales at Corners

$V = 31.4^k$ (see Sh. 30)

Try 5/16" web at top of web of short wale.

HP14x117 $T = 11.25"$

$R_n = 0.6 F_{ex} A_{weld}$

$= 0.6 \times 70 \times (0.707 \times \frac{5}{16} \times 11.25) = 104^k$

$R_n/\Omega = 104^k/2.0 = 52^k > V = 31.4^k$ (OK)

Wale Seats

Use HP12x84 wale seats.

By inspection, ok for bending and shear.

Try 1/4" weld to sheeting at both sides of web

HP12x84 = $T = 9.5"$

At wale seat below strut:

$P = \frac{10}{8} \times 0.117^k/f \times 23.25' = 3.4^k$

$R_n = 0.6 \times 70 \times (0.707 \times \frac{1}{4} \times 2 \times 9.5) = 141^k$

$R_n/\Omega = 141^k/2.0 = 70.5^k > P = 3.4^k$ (OK)

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SCALE

Design of Temporary Causeway

Clear span = 26' between two traffic barriers.

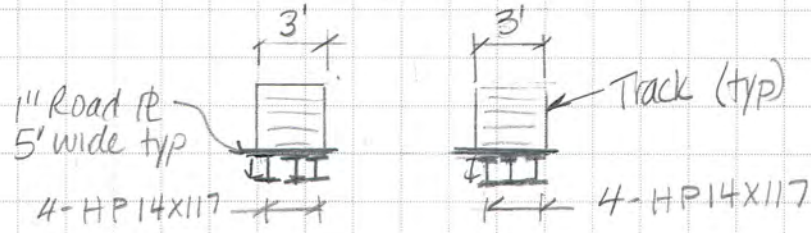
Design span = 28'

Live Load: LinkBelt 308 crane (see Appendix C)

Track pressure = 12 psi x $(12)^2$ = 1728 psf

Tracks are 3' wide and ~20' long

Try 8 HP14x17 (F_y=50 ksi) beams and 1-inch road plates as shown below:



Dead Load per beam:

$$w_D = \left(\tfrac{1}{12} \times 16 \times 490\ pcf / 4\ beams\right) + 117\ lb/f = 179\ lb/f$$

Live Load per beam:

$$w_L = 1728\ psf \times 3' / 4\ beams = 1296\ lb/f$$

$$M = (0.179 + 1.296) \times 28^2/8 = 145\ k\text{-}f$$

$L_b = 28'$

$\lambda = \frac{b}{t} = 9.25 > 0.38\sqrt{\frac{E}{F_y}} = 9.15$ ← AISC Table B4.1b (λ_{pf}) ∴ Non-compact flanges

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SCALE

Temporary Causeway (cont)

$\frac{h}{t_w} = 14.2 < 3.76\sqrt{\frac{E}{F_y}} = 90 \therefore$ Compact Web

← AISC Table B4.1b

$L_p = 1.76\, r_y \sqrt{E/F_y}$ (AISC F2-5)

$= 1.76 \times 3.59 \sqrt{29000/50} = 152" = 12.7' < L_b = 28'$

$r_{ts}^2 = \frac{I_y h_o}{2S_x} = \frac{443 \times 13.4}{2 \times 172} = 17.26$

$r_{ts} = \sqrt{17.26} = 4.15"$

$L_r = 1.95\, r_{ts} \frac{E}{0.7F_y} \sqrt{\frac{J_c}{S_x h_o} + \sqrt{\left(\frac{J_c}{S_x h_o}\right)^2 + 6.76\left(\frac{0.7F_y}{E}\right)^2}}$ (AISC F2-6)

$= 1.95 \times 4.15 \times \frac{29000}{0.7 \times 50} \sqrt{0.00348 + \sqrt{(0.00348)^2 + 6.76\left(\frac{0.7 \times 50}{29000}\right)^2}}$

$= 606" = 50.5' > L_b = 28'$

$M_p = F_y Z_x = 50 \times 194 = 9700$ k-in (AISC F2-1)

$M_n = C_b\left[M_p - (M_p - 0.7F_y S_x)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right]$ (AISC F2-2)

$= 1.0\left[9700 - (9700 - 0.7 \times 50 \times 172)\left(\frac{28 - 12.7}{50.5 - 12.7}\right)\right] = \underline{8210 \text{ k-in}}$ Controls

$\lambda_{pf} = 9.15 \qquad \lambda_{rf} = 1.0\sqrt{E/F_y} = 24.1$ (Table B4.1b)

$M_n = M_p - (M_p - 0.7F_y S_x)\left(\frac{\lambda - \lambda_{pf}}{\lambda_{rf} - \lambda_{pf}}\right)$ (AISC F3-1)

$= 9700 - (9700 - 0.7 \times 50 \times 172)\left(\frac{9.25 - 9.15}{24.1 - 9.15}\right) = 9675$ k-in

$\frac{M_n}{\Omega} = \frac{8210}{1.67} = 4916$ k-in $= 410$ k-f $> M = 145$ k-f (OK)

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SCALE

ORDINARY HIGH WATER TABLE

Q = 2800 cfs ; WATER ELEV. 509.00

CHANNEL CROSS SECTION "A" = 513 sf.

VELOCITY V = Q/A = 2800cfs / 513 sf = 5.46 fps

CENTRALLY LOCATED ISLAND (TOP ELEV. ± 511.00) DIVIDES OTTER CREEK ONTO TWO CHANNELS (NORTHWEST & SOUTHEAST). CROSS SECTION OF NORTHWEST CHANNEL (PROPOSED CRANE PAD LOCATION) IS 155 SF. THEREFORE FLOW IN NORTHWEST CHANNEL IS:

Q = A x V = 155 sf x 5.46 fps = 846 cfs

CREATING A CRANE PAD IN NORTHWEST CHANNEL REDUCES AREA OF FLOW BY 97 sf

THEREFORE V = Q/A = 846 cfs / (155 sf - 97 sf) = 14.6 fps

FLOW IN SOUTHEAST CHANNEL OF THE CREEK WILL NOT BE AFFECTED BY THE CRANE PAD INSTALLATION. Say ok.

William J. Frank Engineering, P.C.
Construction, GeoStructural, Structural
& Value Engineering
4 Old Route 6, Brewster, NY 10509
www.WilliamJFrankEngineering.com

JOB 14-049.04
SHEET NO. 52 OF 53
CALCULATED BY RK DATE 7/9/15
CHECKED BY WJF DATE 7/22/15
SCALE

2.33 YR STORM FLOW

Q = 6500 cfs, WATER ELEV. 512.10

CHANNEL CROSS SECTION "A" = 1030 sf

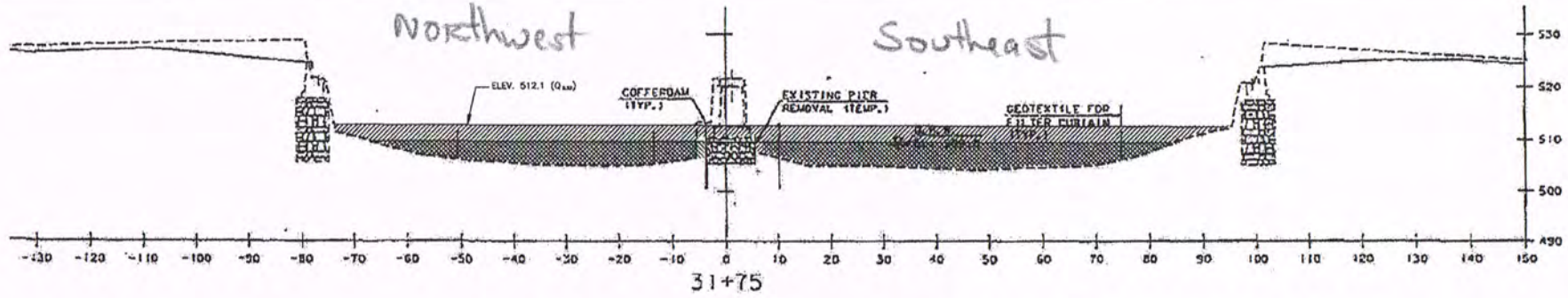
VELOCITY $V = Q/A = 6500 \text{ cfs} / 1030 \text{ sf} = 6.31 \text{ fps}$

IN THIS MODEL THERE IS NO DIVISION OF THE CREEK ONTO TWO SEPARATE CHANNELS. WATER WILL FLOW OVER THE MEDIAN ISLAND AND OVER THE CRANE PAD.

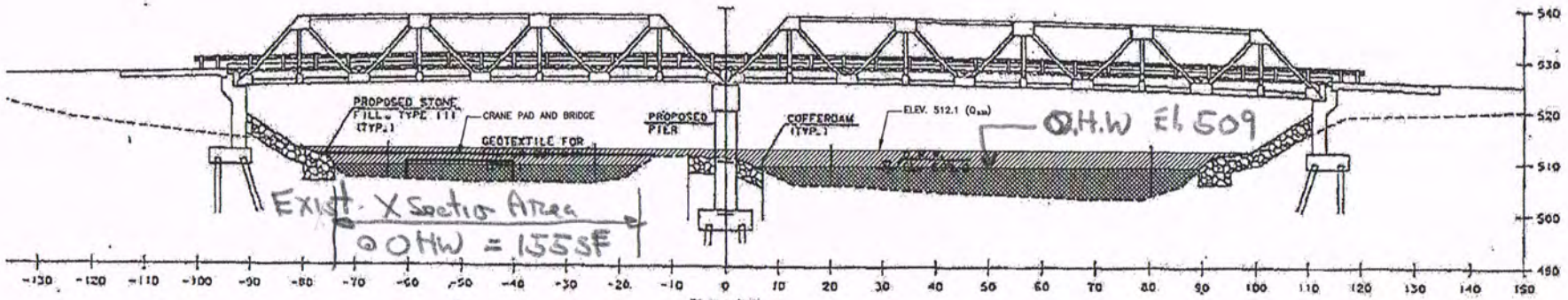
CRANE PAD WILL REDUCE AREA OF FLOW BY 204 sf; THEREFORE INCREASED VELOCITY IS:

$V = Q/A = 6500 \text{ cfs} / (1030 \text{ sf} - 204 \text{ sf}) = 7.87 \text{ fps}$

Conclusion: Presence of Temporary Stone causeway with 26' wide openings in northwest channel portion of creek will not adversely affect overall flow in creek during O.H.W OR Q2.33 YR storm.



31+75



Exist. X Section Area @ OHW = 155SF

31+25

Existing Creek X-Section Area: OHW = 513SF @ El. 509

Q 2.33 yr ≈ 1030SF @ El. 512.1

LEGEND

FLOW CROSS SECTION FOR 2.33 STORM

FLOW CROSS SECTION AT ORDINARY HIGH WATER

CRANE PAD AND BRIDGE

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 20 ft.

Via CAD

Reduced Creek X Section Area in Northwest channel @ OHW ≈ 58SF (assuming 20' wide opening) (conservative)

By: BK 7/9/15

ck WSF 7/22/15

DESIGNED BY						
DRAWN BY						
CHECKED BY						
APPROVED BY	NO.	DATE	REVISIONS	DRWN.	CHKD.	APPVD.

William J. Frank Engineering, P.C.
Construction, Structural, GeoStructural, and Value Engineering
4 Old Route 6
Brewster, New York 10509
wjfrankengineering.com
845-490-1393

DWG. TITLE: r

PROJECT: TH 10 RIPLEY ROAD, BRIDGE NO. 17 RUTLAND CITY
VTRANS PROJECT NO. BRF 3000 (19)

PROJECT NO. 14-049.04

SCALE AS NOTED

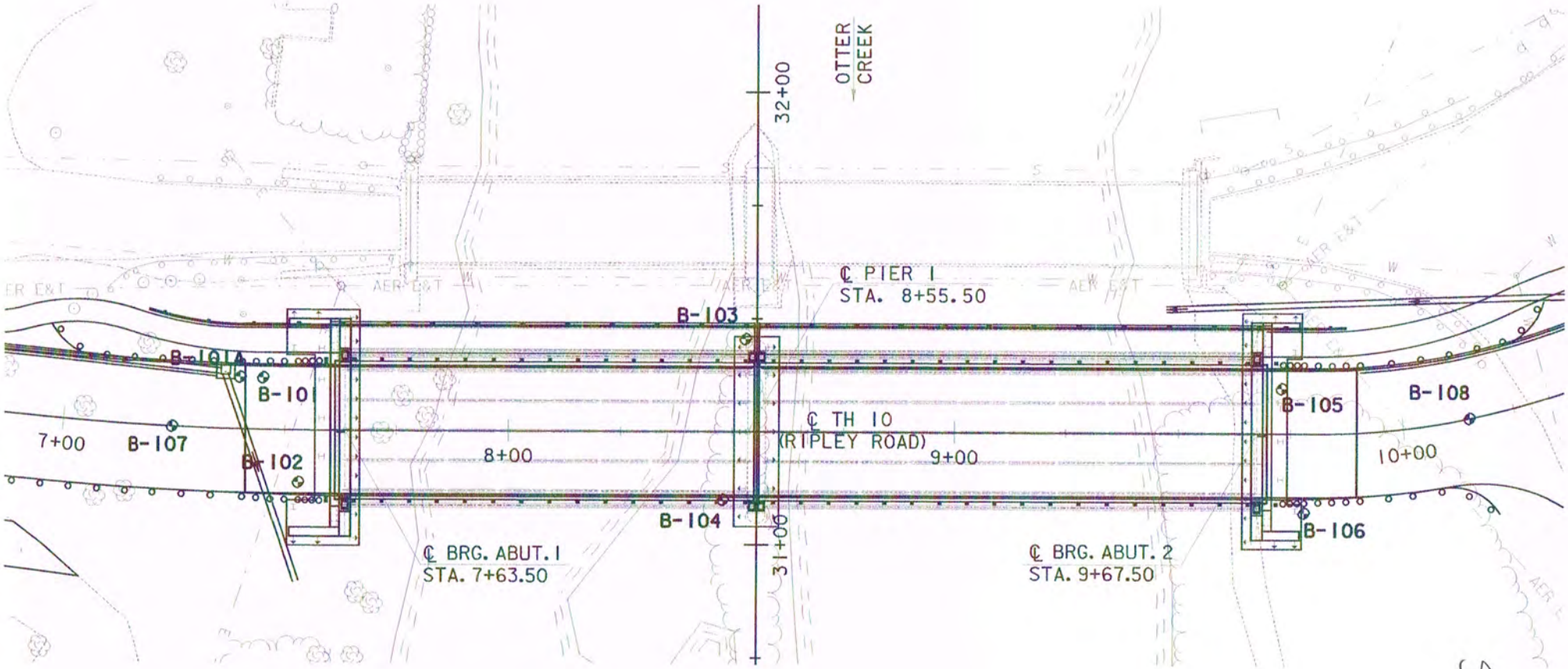
DRAWING NO.

SHEET

53/53

APPENDIX 'A'

Boring Logs


OTTER
CREEK
32+00
℄ PIER 1
STA. 8+55.50
B-103
B-101A
B-101
B-107
B-102
7+00
8+00
℄ TH 10
(RIPLEY ROAD)
9+00
B-105
B-108
10+00
B-104
31+00
B-106
℄ BRG. ABUT. 1
STA. 7+63.50
℄ BRG. ABUT. 2
STA. 9+67.50

Sh. A1 of 3

BOTTOM OF PIER I
FOOTING EL. 503.00

ESTIMATED MIN. PILE TIP
EL. 453.00

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

RUTLAND CITY
BRF 3000(19)
TH-10 BR-17

Boring No.: B-103
Page No.: 1 of 1
Pin No.: 08J096
Checked By: CAA

Boring Crew: PORTER, GARROW
Date Started: 6/22/10 Date Finished: 6/24/10
VTSPG NAD83: N 402094.14 ft E 1507278.05 ft
Station: 8+53 Offset: -20.50
Ground Elevation: 511.0 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type	Auto/AWJ	
Rig:	CME 55 TRACK	C_1 = 1.46

Groundwater Observations

Date	Depth (ft)	Notes

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-2-4, SiSa, brn, Moist, Rec. = 1.1 ft				1-1-1-1 (2)	25.3	1.0	75.0	24.0
		A-2-4, SiGrSa, brn, Moist, Rec. = 1.0 ft, Wood & Concrete pieces were within sample.				2-2-2-1 (4)	24.4	22.1	57.7	20.2
		NXDC, Cobbles, 5.5 ft - 7.0 ft								
		A-1-a, SaGr, white, Moist, Rec. = 1.0 ft, Broken rock was within sample.				7-15-12-7 (27)	12.7	65.3	31.9	2.8
10		Field Note:, NXDC, Possible Cobbles & Grave, Hard drilling.								
		Field Note:, No Recovery. Appears to be sand, gry. Moist				4-4-4-4 (8)				
		Field Note:, NXDC, Boulder, Pulled casing and changed bit.								
		A-4, SiSa, brn, MTW, Rec. = 0.8 ft				2-3-4-4 (7)	21.7	6.7	47.1	46.2
20		A-1-b, SaGr, gry, MTW, Rec. = 0.5 ft				6-8-6-6 (14)	12.7	49.0	43.1	7.9
		Field Note:, NXDC, Cobbles								
		Field Note:, No Recovery. Appears to be sand				6-7-7-5 (14)				
30		Field Note:, NXDC, Gravel								
		A-2-4, SiSaGr, white-brn, MTW, Rec. = 0.9 ft, Broken rock was within sample.				32-18-5-5 (23)	15.7	41.5	31.4	27.1
		A-2-4, SiSaGr, gry, Moist, Rec. = 1.0 ft, Broken rock was within sample.				23-R/6" (R)	11.9	47.6	23.1	29.3
40		Field Note:, NXDC, Cobbles								
		Field Note:, NXDC, (HP)								
		A-4, SaGrSi (HP), gry, Moist, Rec. = 1.0 ft				4-50-R/2.5" (R)	10.5	31.7	29.8	38.5
		Field Note:, NXDC, (HP)								
		A-4, GrSaSi (HP), gry, Moist, Rec. = 0.5 ft				50-R/3.5" (R)	10.2	25.5	26.0	48.5
50		A-4, SaGrSi (HP), gry, Moist, Sample from NXDC core.					9.5	28.4	21.7	49.9
		A-4, SaGrSi (HP), gry, Moist, Rec. = 1.5 ft				28-40-R/6" (R)	10.1	27.9	21.9	50.2
		Field Note:, NXDC, Cored ahead								
		Field Note:, No Recovery	1	70	12	Top of Bedrock @ 57.3 ft				
60		57.3 ft - 59.3 ft, Light gray, Quartzite, with closely spaced iron stained jointing.. Very hard, Fresh, Fair rock, NXDC	(?)	(0)	13					
		59.3 ft - 63.3 ft, Same as Run #1. NXMDC	2 (?)	100 (55)	14 15					
		63.3 ft - 67.3 ft, Same as Run #1. NXMDC	3 (?)	93 (48)	18 21					
					8					
		Hole stopped @ 67.3 ft			8					
70					7					
					8					

Remarks:
1. Drillers hit an aquifer in bedrock.
2. They installed 12.0 feet of solid casing and water overflowed pipe.
3. Hole collapsed and sealed aquifer.

Notes
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_1 is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 RUTLAND CITY BRF 3000(19).GPJ VERMONT.AGT.GDT 11/3/10

BOTTOM OF PIER 1
FOOTING EL. 503.00

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

RUTLAND CITY
BRF 3000(19)
TH-10 BR-17

Boring No.: B-104
Page No.: 1 of 2
Pin No.: 08J096
Checked By: CAA

Boring Crew: PORTER, GARROW
Date Started: 6/25/10 Date Finished: 6/30/10
VTSPG NAD83: N 402067.77 ft E 1507253.76 ft
Station: 8+48 Offset: 15.00
Ground Elevation: 511.0 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 55 TRACK	C_E = 1.46

Groundwater Observations

Date	Depth (ft)	Notes
06/28/10	1.8	After heavy rain
06/30/10	3.3	Prior to drilling.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-2-4, Sa, brn, Moist, Rec. = 1.4 ft				WH-WH-2-1 (2)	20.5	0.2	80.1	19.7
		A-2-4, SiSa, brn, MTW, Rec. = 1.4 ft, Pieces of Wood were within sample.				1-1-1-1 (2)	37.5		67.1	32.9
5										
		NXDC, Wood and Gravel (3"+), 6.8 ft - 8.0 ft								
		A-1-a, SaGr, brn, Moist, Rec. = 0.5 ft, Broken rock was within sample.				8-7-6-8 (13)	13.1	71.9	26.2	1.9
10										
		Field Note:, NXDC, Cobbles								
		A-3, Sa, brn, Wet, Rec. = 0.9 ft				2-2-2-2 (4)	23.6	0.7	91.5	7.8
15										
		Field Note:, No Recovery, Appears to be Fine Sand.				3-3-3-2 (6)				
20										
		A-4, SaSi, brn, Wet, Rec. = 1.0 ft				4-3-3-2 (6)	42.7	0.1	25.5	74.4
25										
		Field Note:, NXDC, Gravel								
		A-1-a, SaGr, gry, Wet, Rec. = 0.7 ft				10-10-7-5 (17)	14.4	50.0	38.7	11.3
30										
		Field Note:, NXDC, Gravel								
		A-4, SaSi, gry, Wet, Rec. = 0.9 ft				6-4-3-5 (7)	21.4	11.2	31.6	57.2

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_E is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 RUTLAND CITY BRF 3000(19).GPJ VERMONT AOT.GDT 11/3/10

APPENDIX 'B'

PZC 26 Sheet Piling

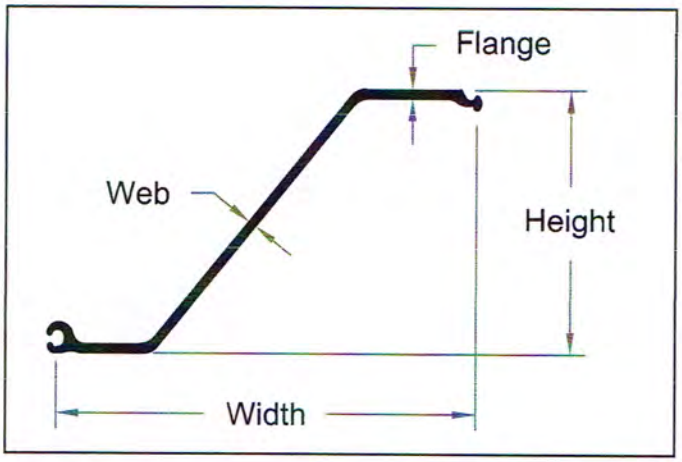
Sh. B1 of 1

LBFoster
Piling

PZC™ 26

WIDER - LIGHTER - STRONGER

Hot Rolled
Domestically Produced
Ball & Socket Sheet Pile



Available Grades: ASTM A572 Gr. 50 and 60, A588 and A690

The innovative PZC series of steel sheet piling is manufactured to be wider, lighter and stronger than the traditional PZ piling.

PZC sheet piling is made wider than PZ sections to maximize jobsite production in setting and driving. They are lighter than PZ piling to minimize the required amount of steel needed for project installation. And PZC sections are stronger per pound than PZ sections in both section modulus and moment of inertia.

PZC 26 compared to the currently produced PZ 35:

- 23% wider laying dimension
- 11% stronger per pound

Dimensions and Properties

Section	Width	Height	Web Thickness	Flange Thickness	Weight		Moment of Inertia		Section Modulus		Nominal Coating Area
	in.	in.	in.	in.	lb / lft	lb / ft²	in⁴	in⁴ / wft	in³	in³ / wft	ft² / lft
	mm	mm	mm	mm	kg / lm	kg / m²	cm⁴	cm⁴ / wm	cm³	cm³ / wm	m² / lm
PZC 25	27.88	17.66	0.485	0.560	69.4	29.9	938.7	404.1	106.3	45.7	6.15
	708	449	12.3	14.2	103.3	145.9	39,070	55,190	1,740	2,455	1.87
PZC 26	**27.88**	**17.70**	**0.525**	**0.600**	**73.9**	**31.8**	**994.3**	**428.1**	**112.4**	**48.4**	**6.15**
	708	450	13.3	15.2	110.0	155.4	41,390	58,460	1,840	2,600	1.87
PZC 28	27.88	17.75	0.570	0.645	79.0	34.0	1,057	455.1	119.1	51.3	6.15
	708	451	14.5	16.4	117.6	166.1	44,000	62,150	1,950	2,755	1.87

(800) 848-6249
www.lbfoster.com

APPENDIX 'C'

LinkBelt 308 Crane Info

Sh. C1 of 2

5421 (supersedes 5410)–1004–J3

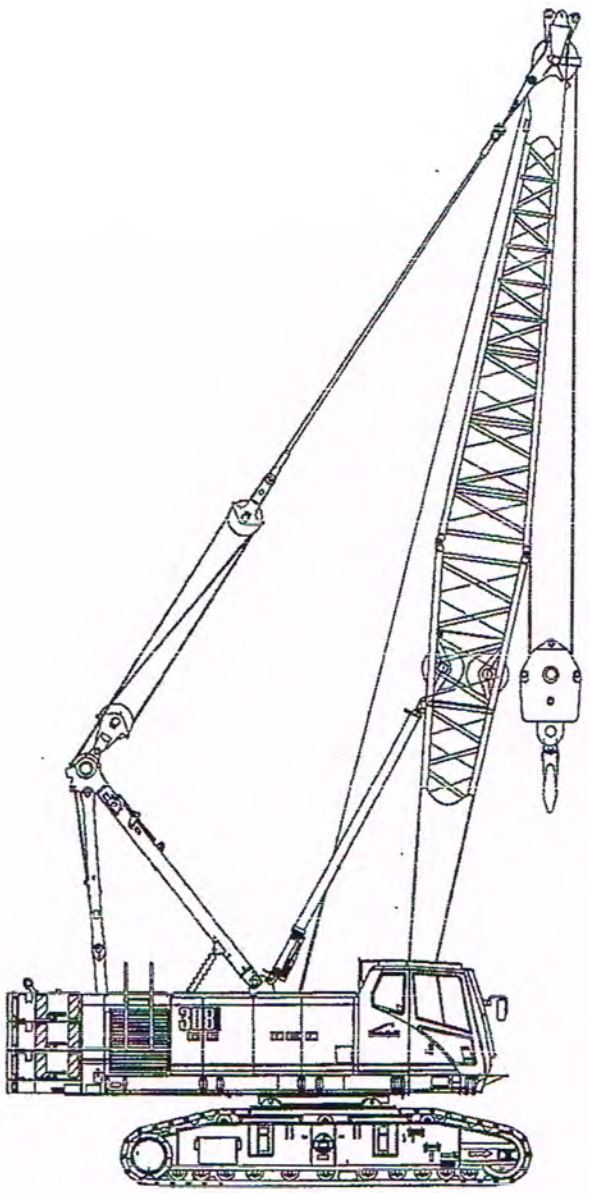
Technical Data

Specifications & Capacities

308 HYLAB 3

Crawler Crane

110 Ton *(100 metric ton)*



TRACK WEIGHTS: 23,543#/EACH
CARBODY: 88K#+/- W/BASE BOOM
COUNTERWEIGHT A: 10K# BASE + 2 WEDGES
TOTAL - 23,668#
CWT AB: 50,851# (BASE + 6 WEDGES)

ACTUAL FOOTPRINT: 21×26'
PAD REQUIRED: 30×30'
WORKING AREA (W/ TAILSWING): 30×45'

TRAVEL WIDTH: 10'-8"
RETRACTED: 12' WIDE
TRACKS EXTENDED: 17'-6"

BEARING PRESSURE: 12PSI
TOTAL WT: 165-206K#
CONTACT AREA: 111 SF

CAUTION: This material is supplied for reference use only. Operator must refer to in-cab Crane Rating Manual to determine allowable crane lifting capacities and operating procedures.

General Dimensions

	General Description	Dimension
A	Side Frame Height	46.6"
B	Ground Clearance – CTWT	4'–8.4"
C	Overall Height – CTWT	9'–11.3"
D	Working Height – Gantry	20'–11.4"
E	Counterweight Tailswing	15'–11.7"
F	Side Frame Length	20'–10.6"
G	Operator's Cab Height	11'–3.9"
H	Height Of Boom Foot Pin	7'–5.0"
J	Upper Width	10'–5.2"
K	Width Over Catwalks	13'–2.9"
L	Retracted Width	11'–11.9"
M	Extended Width	17'–6.0"
N	Track Shoe Width	36.0"
P	Minimum Ground Clearance	12.0"