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 73

Issued **10/07/15**
Respond by 10/13/15

To

Timothy Pockette, PE

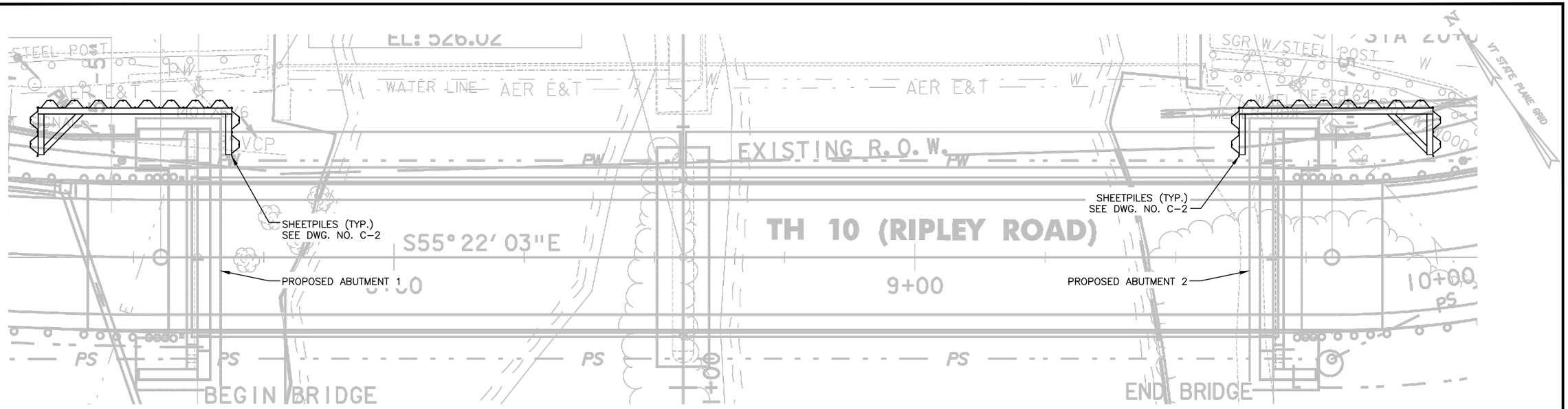
Topic	204.01B Excavation Support System (Ripley Road)
Status	For Approval
Spec section	204.01B
Responsibility	(19) Ripley Rd
Received from submitter	10/7/15
Sent to approver	10/7/15
Required from approver	10/13/15

From

Volker H.D. Burkowski

Signed by V H Burkowski Date 10/7/15

Proceed as Indicated _____ Date _____
Owner Authorized Representative



OVERALL LAYOUT PLAN

20 0 10 20

SCALE: 1" = 20'

GENERAL NOTES:

THESE PLANS AND ACCOMPANYING DESIGN SUBMITTAL ADDRESS THE EXCAVATION SUPPORT SYSTEM (ESS) TO BE USED TO FACILITATE CONSTRUCTION OF ABUTMENT FOOTING 1 AND 2 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 ESS SHOWN HEREIN IS DESIGNED FOR A UNIFORM 250 PSF VERTICAL TRAFFIC SURCHARGE ON THE ADJACENT ROADWAY. 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. IF THE WATER LEVEL EXCEEDS ELEVATION 511 FEET WORK SHALL TEMPORARILY CEASE.
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. INSPECTION OF THE INSTALLATION OF THE ESS IS BY OTHERS.

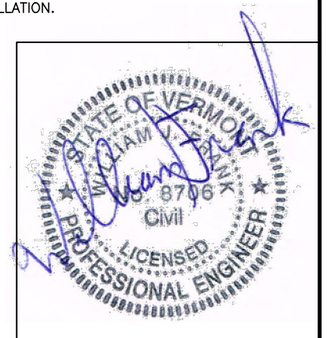
MATERIAL NOTES:

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 ESS.

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).
2. LAY OUT THE PROPOSED ABUTMENT 1 LOCATION AND ESS LIMITS.
3. DRIVE SHEETPILES TO THE REQUIRED TIP ELEVATIONS. PRE-EXCAVATE IF REQUIRED TO EASE SHEETPILE INSTALLATION.
4. EXCAVATE DOWN TO NO MORE THAN 2 FEET BELOW THE PROPOSED BRACING ELEVATION SHOWN HEREIN.
5. INSTALL BRACING AND CONNECT TO SHEETPILES.
6. CONTINUE EXCAVATION TO PROPOSED BOTTOM OF FOOTING ELEVATION SHOWN HEREIN.
7. REPEAT STEPS 2 THROUGH 6 FOR ABUTMENT 2.
8. DRIVE PROPOSED FOUNDATION PILES PER CONTRACT DOCUMENTS.
9. PREPARE SUBGRADE, CUT OFF PILES, PLACE REBAR AND POUR ABUTMENT FOOTINGS AND STEMS PER CONTRACT DOCUMENTS.
10. BACKFILL TO WITHIN 2 FEET OF THE BRACING IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
11. REMOVE BRACING AND BACKFILL TO PROPOSED GRADE.
12. REMOVE OR CUT OFF SHEET PILES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.



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

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845-490-1393

DWG. TITLE
RIPLEY ROAD BRIDGE ABUTMENT EXCAVATION PROTECTION OVERALL LAYOUT PLAN

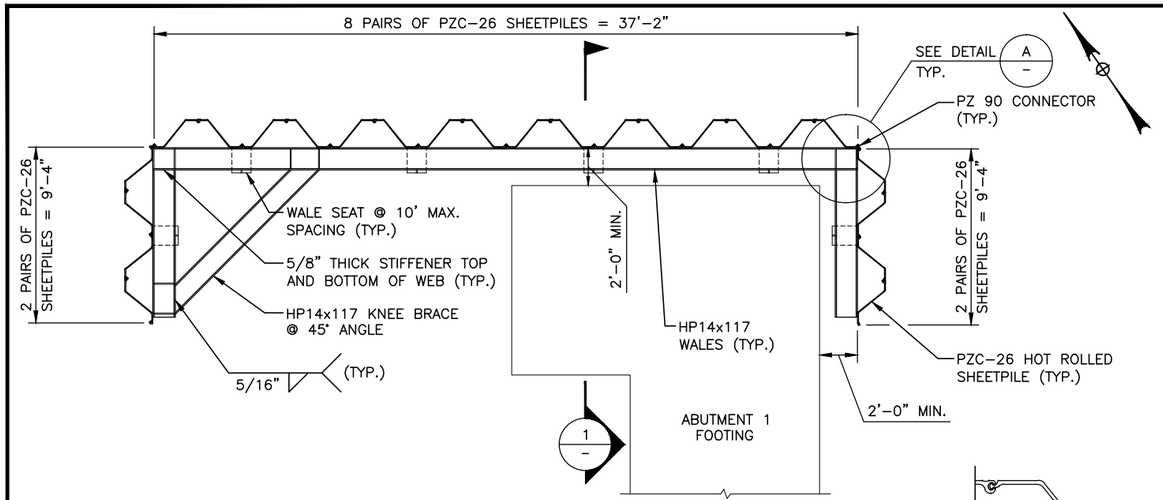
PROJECT
TH 10 RIPLEY ROAD, BRIDGE NO. 17 RUTLAND CITY VTRANS PROJECT NO. BRF 3000 (19)

PROJECT NO. 14-049.07

SCALE 1" = 20' DATE 10/07/15

DRAWING NO. C-1

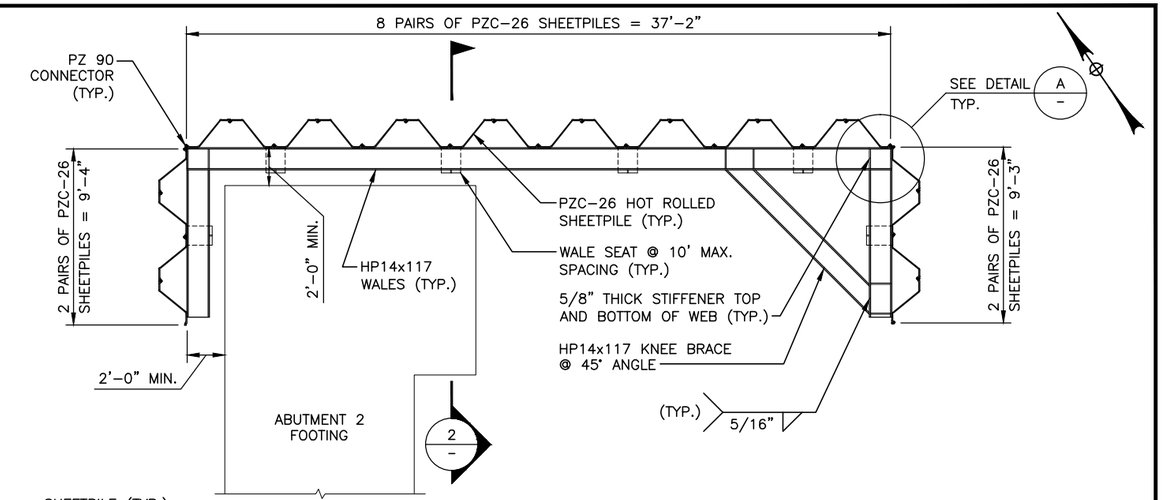
SHEET 1 OF 2



SHEETPILE LAYOUT PLAN at ABUTMENT 1

0 4' 8' 16'

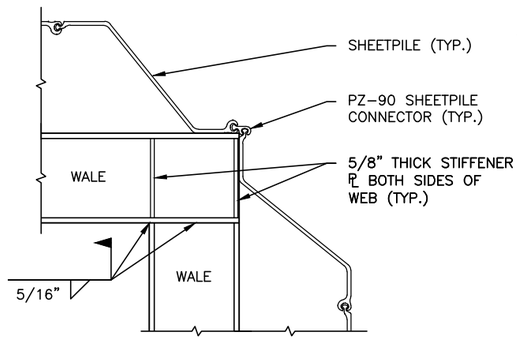
SCALE: 1/8" = 1'-0"



SHEETPILE LAYOUT PLAN at ABUTMENT 2

0 4' 8' 16'

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

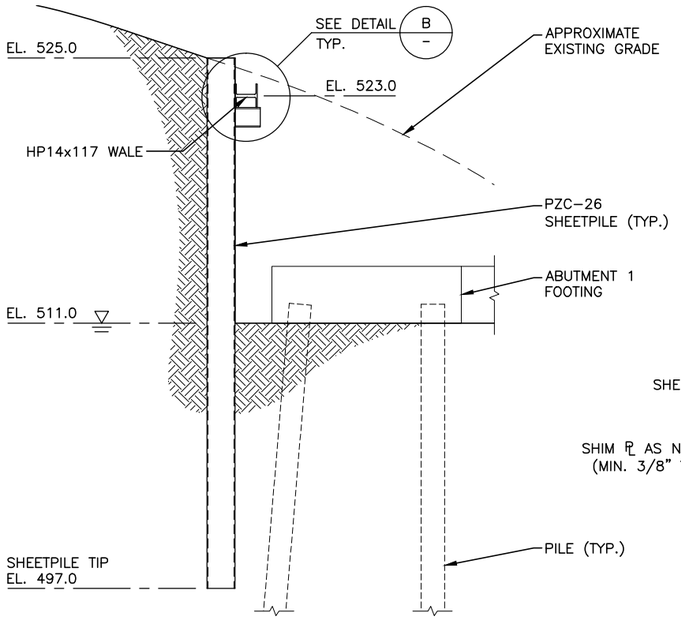


DETAIL A

0 1' 2' 4'

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

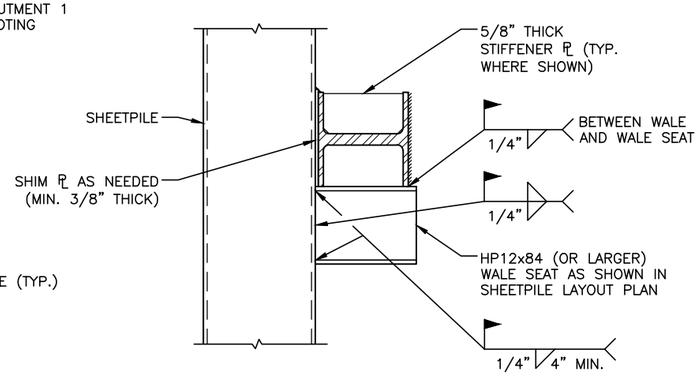
NOTE:
TYPICAL FOR ALL HP14 TO HP14 WALE CONNECTIONS



SECTION 1

0 4' 8' 16'

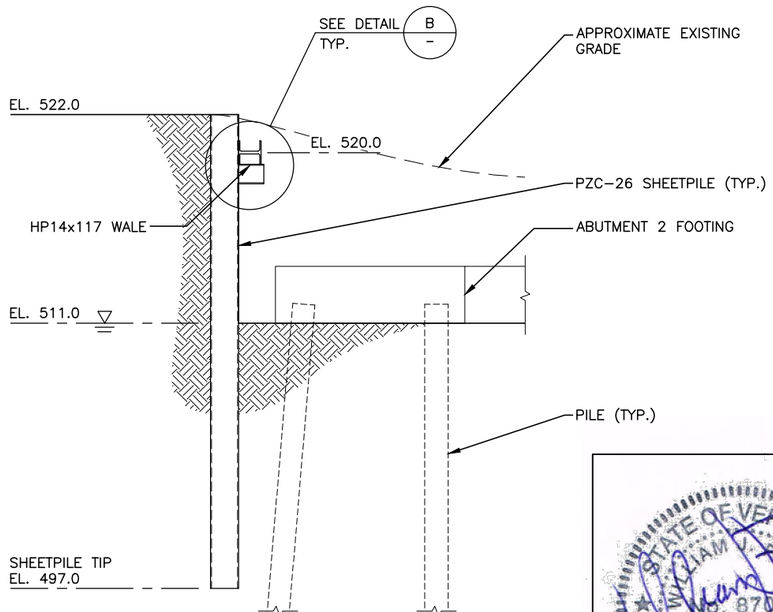
SCALE: 1/8" = 1'-0"



DETAIL B

0 1' 2' 4'

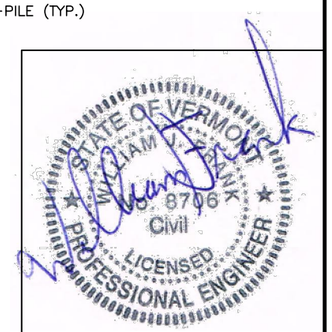
SCALE: 1/2" = 1'-0"



SECTION 2

0 4' 8' 16'

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



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

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DWG. TITLE
RIPLEY ROAD BRIDGE ABUTMENT EXCAVATION PROTECTION SHEETPILE LAYOUT PLANS and SECTIONS

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

PROJECT NO. 14-049.07

SCALE: AS NOTED DATE: 10/07/15

DRAWING NO. **C-2**

SHEET 2 OF 2

Design Submittal

Abutment Excavation Protection

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

October 1, 2015

Job No. 14-049.07

SUPPORTING DESIGN CALCULATIONS

William J. Frank Engineering, P.C.
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JOB 14-049.07
SHEET NO. 1 OF 26
CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
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 three-sided temporary excavation support systems (ESS) for construction of the proposed abutments at the Ripley Road Bridge over Otter Creek, which requires excavation to El. 511.0 (bottom of pile caps). Previously used 35-foot long PZC-26 sheetpiles will be used at these two abutment locations. Design high water elevation is El 511 feet. A uniform vertical traffic surcharge of 250 psf was assumed at 10 feet from the excavation.

The ESS for the north abutment (Abutment 1) will retain a 14-foot cut, with soil sloping up to the roadway. Based on boring logs B-101 and B102, the soil is assumed to have a friction angle of 30 degrees and a unit weight of 120 pcf. One level of bracing using HP14x117 wales and a knee brace will be used.

The ESS for the south abutment (Abutment 2) will retain an 11-foot cut, with soil sloping up to the roadway. Based on boring logs B-105 and B106, the soil is assumed to have a friction angle of 29 degrees and a unit weight of 110 pcf. One level of bracing using HP14x117 wales and a knee brace will be used.

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JOB 14-049.07
SHEET NO. 2 OF 26
CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
SCALE

Soil Properties for SOE Design

North Abutment (Abutment 1).

Subgrade El. 511.0.
Existing grade El. 525
(see Appendix A)

Ref: Boring Logs B-101 and B-102

Consider soil down to El. 490 (tip of 35' long sheets).
Blow counts range from N = 2 to N = 27, with avg. N ≈ 11.

Water El. 508 average. Use El. 511 for design.

Use for design: $\phi = 30°$, $\gamma = 120$ pcf Cut = 14'

South Abutment (Abutment 2)

Subgrade El 511.0
Existing grade El. 522

Ref: Boring Logs B-105 and B-106 (see Appendix A)

Consider soil down to El. 487 (tip of 35' long sheets).
Blow counts range from N = 0 to N = 12, with avg. N ≈ 7.

Water El. 509 average. Use El. 511 for design.

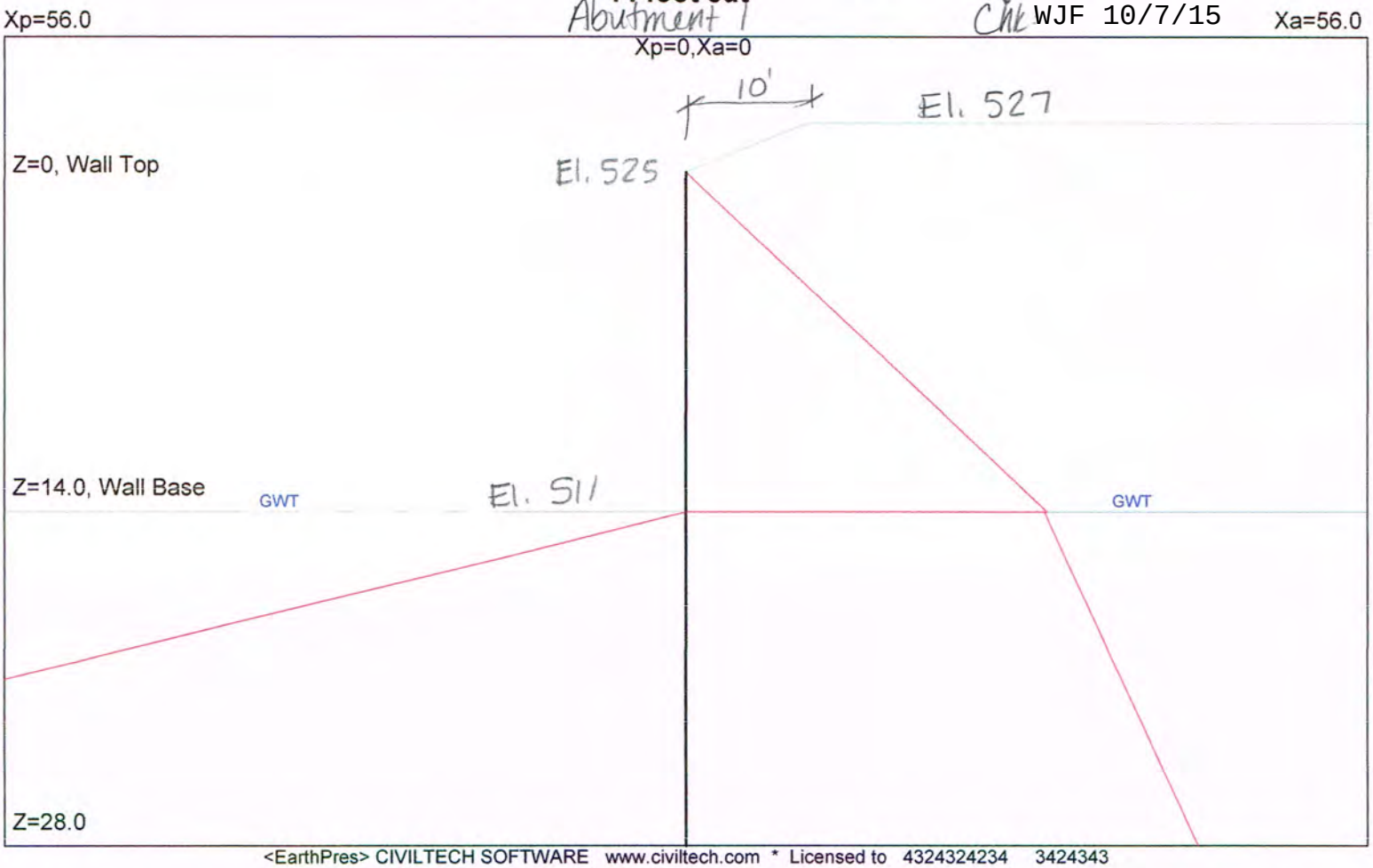
Use for design: $\phi = 29°$, $\gamma = 110$ pcf Cut = 11'

Ripley Road Abutment SOE

Sh. 3 of 26
By: EMC 10-1-15
Chk WJF 10/7/15

14 foot cut

Abutment 1



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

10/1/2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Ripley Road Bridge Abutment Excavation Protection 14-049.07\Calculations\CT Shoring\14' cu

* INPUT DATA *

Wall Height=14.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	30	0.0	0	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	-2.0	10.0	1	Sand
2	-2.0	10.0	-2.0	800.0	1	Sand
3	50.0	0.0	50.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	14.0	0.0
2	14.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	14.0	0.0	14.0	800.0	1	Sand
2	50.0	0.0	50.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	14.0	0.0
2	14.0	800.0

Wall Friction Options: 1.* No wall friction

* OUTPUT RESULTS *

Total Force above Base= 4.48 per one linear foot (or meter) width along wall height

Total Static Force above Base= 4.48. Distributed in Triangular Envelope along wall height. Ignore soil layers and water line

By: EMC 10-1-15
Chk: WJF 10/7/15

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

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	14.00	0.64	0.0457	0.3812

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

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
14.00	0.64	28.00	0.91	0.0195	0.3385

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

Z1	Pp1	Z2	Pp2	Slope	Kp
14.00	0.00	28.00	2.42	0.173	3.0000

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

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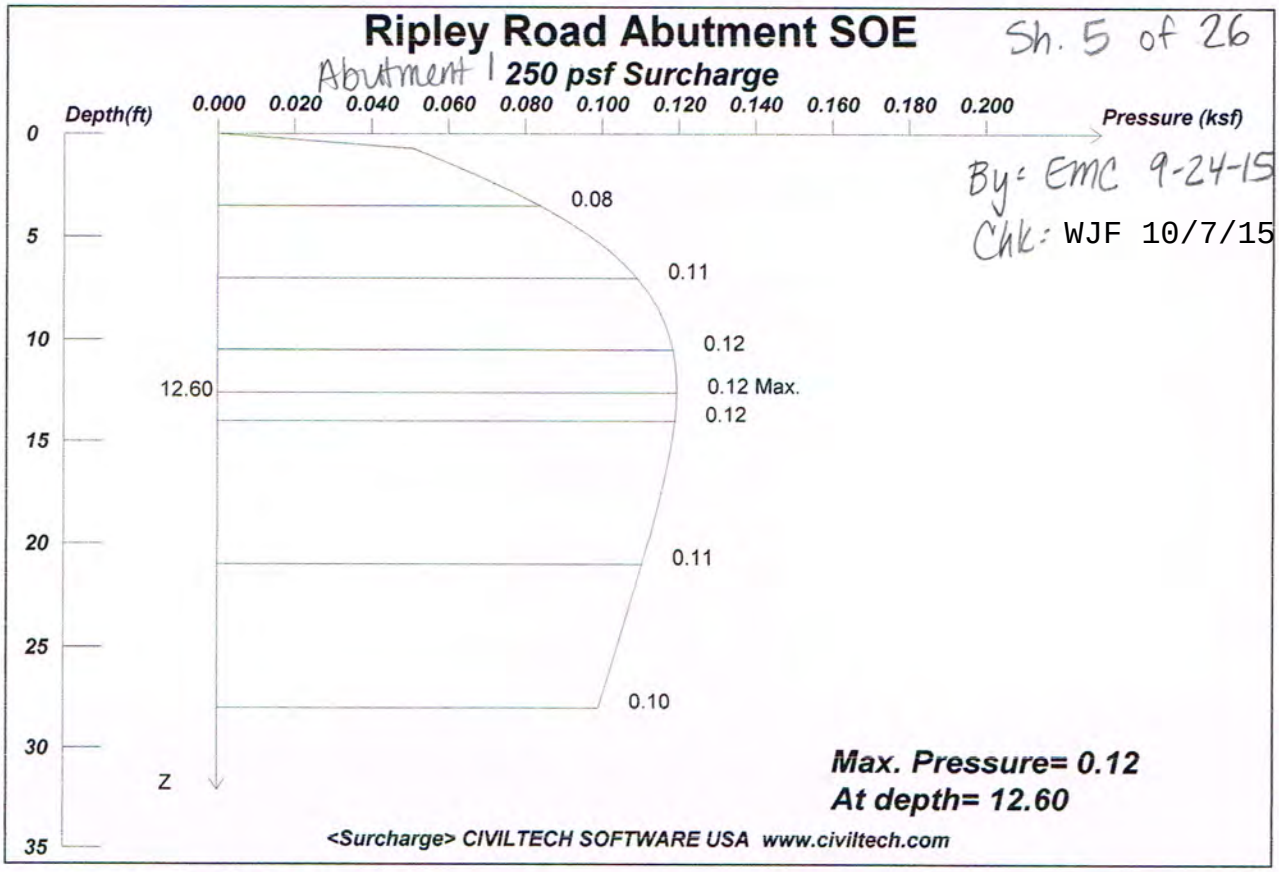

By: EMC 9-24-15
Chk: WJF 10/7/15

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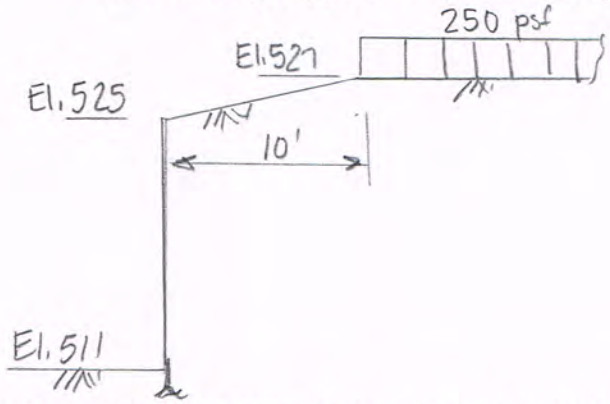
Date: 9/24/2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Ripley Road Bridge Abutment Exccavation P

Wall Height, H= 14 Load Depth at Surface, D= 0
Load Factor of Surcharge Loading = 1
Flexible Wall Condition -- Movement or deflection are allowed.
Max. Pressure = 0.120 at depth = 12.60

X	Width	Strip Load
10.0	50.0	.25

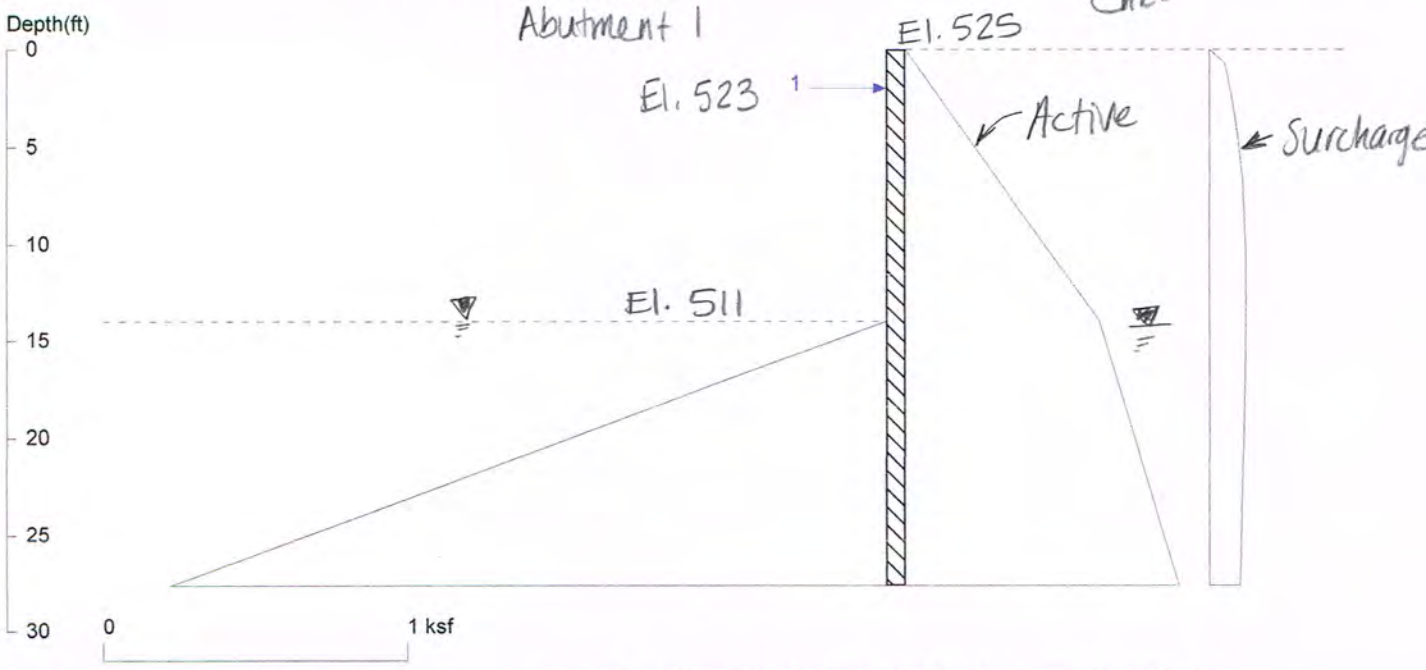
Infinite Surcharge, Q=.25 Active Wedge Approach * (recommend)



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

Ripley Road Abutment SOE

14 foot cut



Licensed to 4324324234 3424343 Date: 10/1/2015

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Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

Say 14' min. embedment

PILE LENGTH: Min. Embedment=13.61 Min. Pile Length=27.61 ← Say 28' min length sheets

MOMENT IN PILE: Max. Moment=31.48 per Pile Spacing=1.0 at Depth=12.87

PILE SELECTION: ← Use PZC-26 ($S = 48.4\ in^3/ft$)

Request Min. Section Modulus = 11.4 in3/ft=615.43 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

User Input I (Moment of Inertia):

Top Deflection = -0.06(in) based on E (ksi)=29000.00 and I (in4)/foot=428.1

Use for design of Abutment 1 Bracing

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	5.0 k/f	5.0	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	14.000	0.640	0.045745
*	Below	Base		
14.000	0.638	50.000	1.331	0.019264
*	Sur-	charge		
0.000	0.000	0.700	0.051	0.072735
0.700	0.051	1.400	0.060	0.012908
1.400	0.060	2.100	0.069	0.012326
2.100	0.069	2.800	0.077	0.011513
2.800	0.077	3.500	0.084	0.010529
3.500	0.084	4.200	0.091	0.009439
4.200	0.091	4.900	0.096	0.008302
4.900	0.096	5.600	0.101	0.007170

5.600	0.101	6.300	0.106	0.006083
6.300	0.106	7.000	0.109	0.005067
7.000	0.109	7.700	0.112	0.004138
7.700	0.112	8.400	0.114	0.003304
8.400	0.114	9.100	0.116	0.002566
9.100	0.116	9.800	0.118	0.001919
9.800	0.118	10.500	0.119	0.001357
10.500	0.119	11.200	0.119	0.000873
11.200	0.119	11.900	0.119	0.000458
11.900	0.119	12.600	0.120	0.000103
12.600	0.120	13.300	0.119	-0.000199
13.300	0.119	14.000	0.119	-0.000455
14.000	0.119	15.400	0.118	-0.000762
15.400	0.118	16.800	0.117	-0.001071
16.800	0.117	18.200	0.115	-0.001286
18.200	0.115	19.600	0.113	-0.001432
19.600	0.113	21.000	0.111	-0.001527
21.000	0.111	22.400	0.108	-0.001585
22.400	0.108	23.800	0.106	-0.001615
23.800	0.106	25.200	0.104	-0.001623
25.200	0.104	26.600	0.102	-0.001616
26.600	0.102	28.000	0.099	-0.001598

Sh. 7 of 26
By: EMC 10-1-15
Chk: WJF 10/7/15

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

Z1	P1	Z2	P2	Slope
*	Below	Base		
14.000	0.000	50.000	6.221	0.172800

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

PASSIVE SPACING:

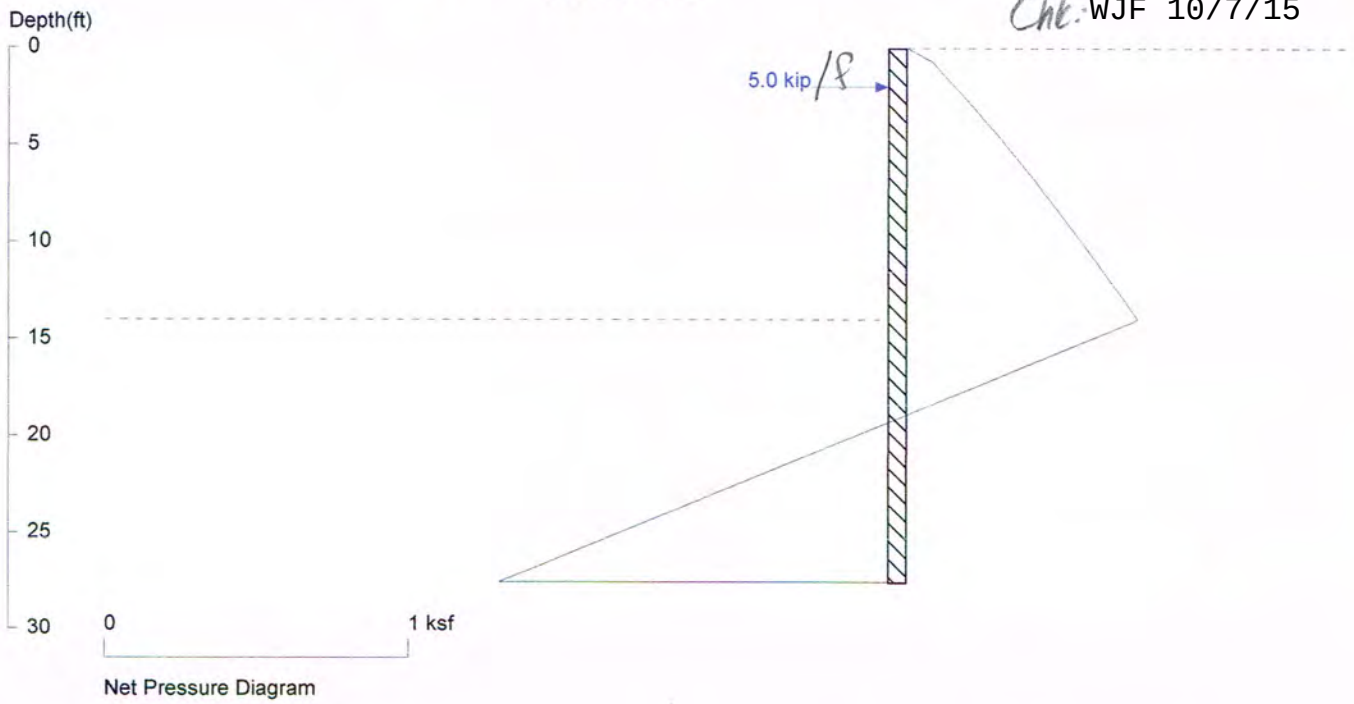
No.	Z depth	Spacing
1	0.00	1.00

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

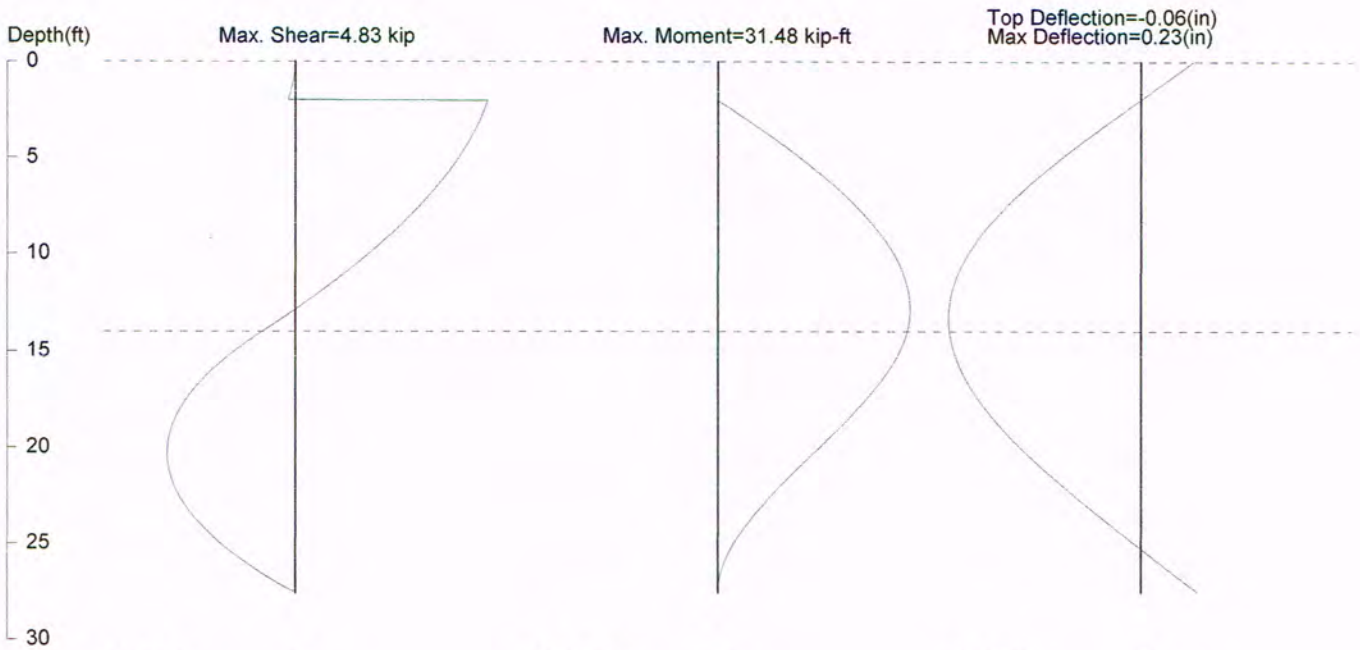
Ripley Road Abutment SOE

14 foot cut

Sh. 8 of 26
By: EMC 10-1-15
Chk. WJF 10/7/15



Net Pressure Diagram



Shear Diagram | Moment Diagram | Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=428.1

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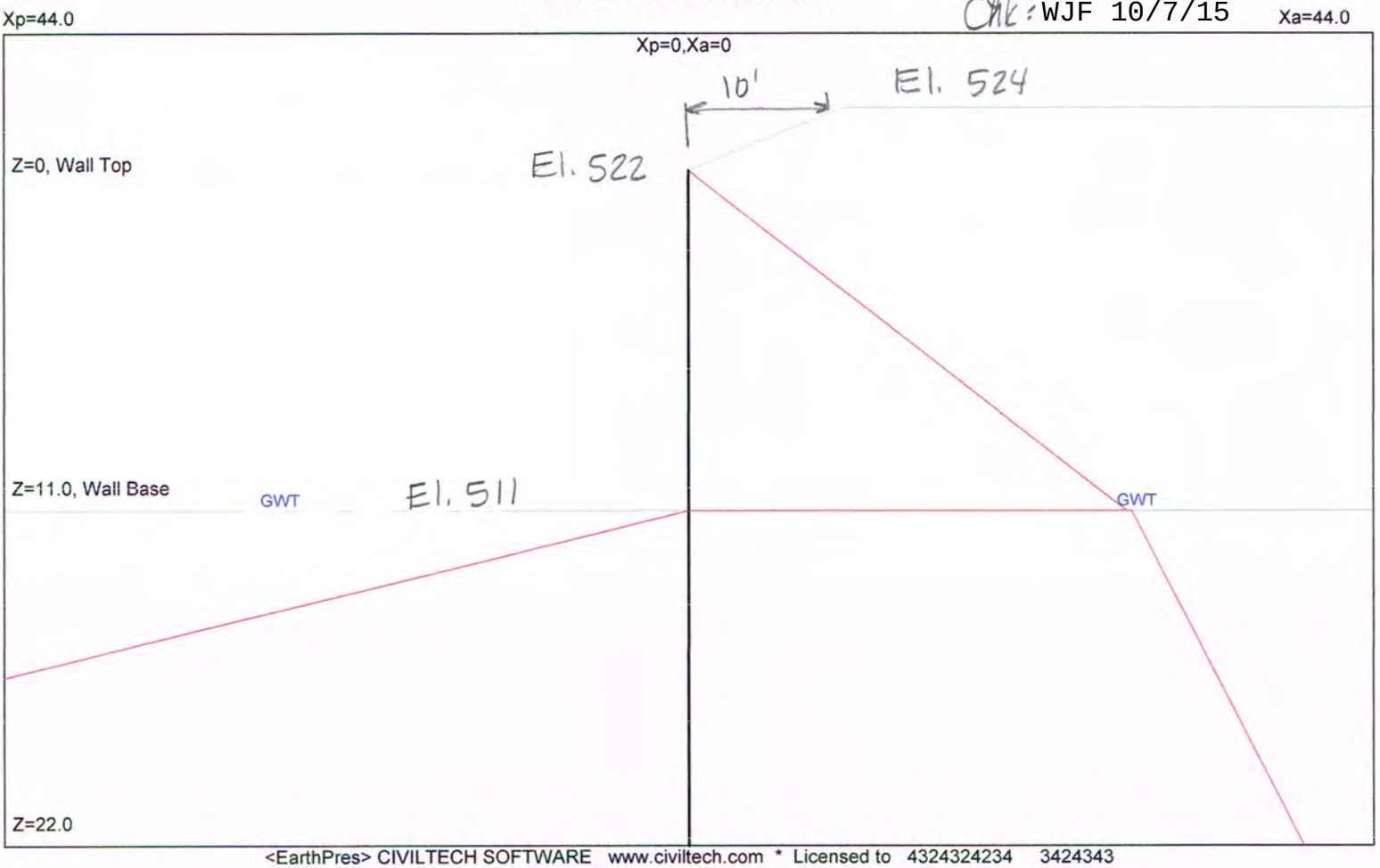
Ripley Road Abutment SOE
11 foot cut - Abutment 2

Sh. 9 of 26
By: EMC 10-1-15
Chk: WJF 10/7/15



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

10/1/2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Ripley Road Bridge Abutment Excavation Protection 14-049.07\Calculations\CT Shoring\11' cu

* INPUT DATA *

Wall Height=11.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	110.0	110.0	29	0.0	0	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	-2.0	10.0	1	Sand
2	-2.0	10.0	-2.0	800.0	1	Sand
3	50.0	0.0	50.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	11.0	0.0
2	11.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	11.0	0.0	11.0	800.0	1	Sand
2	50.0	0.0	50.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	11.0	0.0
2	11.0	800.0

Wall Friction Options: 1.* No wall friction

* OUTPUT RESULTS *

Total Force above Base= 2.65 per one linear foot (or meter) width along wall height

Total Static Force above Base= 2.65. Distributed in Triangular Envelope along wall height. Ignore soil layers and water line

By: EMC 10-1-15

Chk: WJF 10/7/15

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

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	11.00	0.48	0.0439	0.3988

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

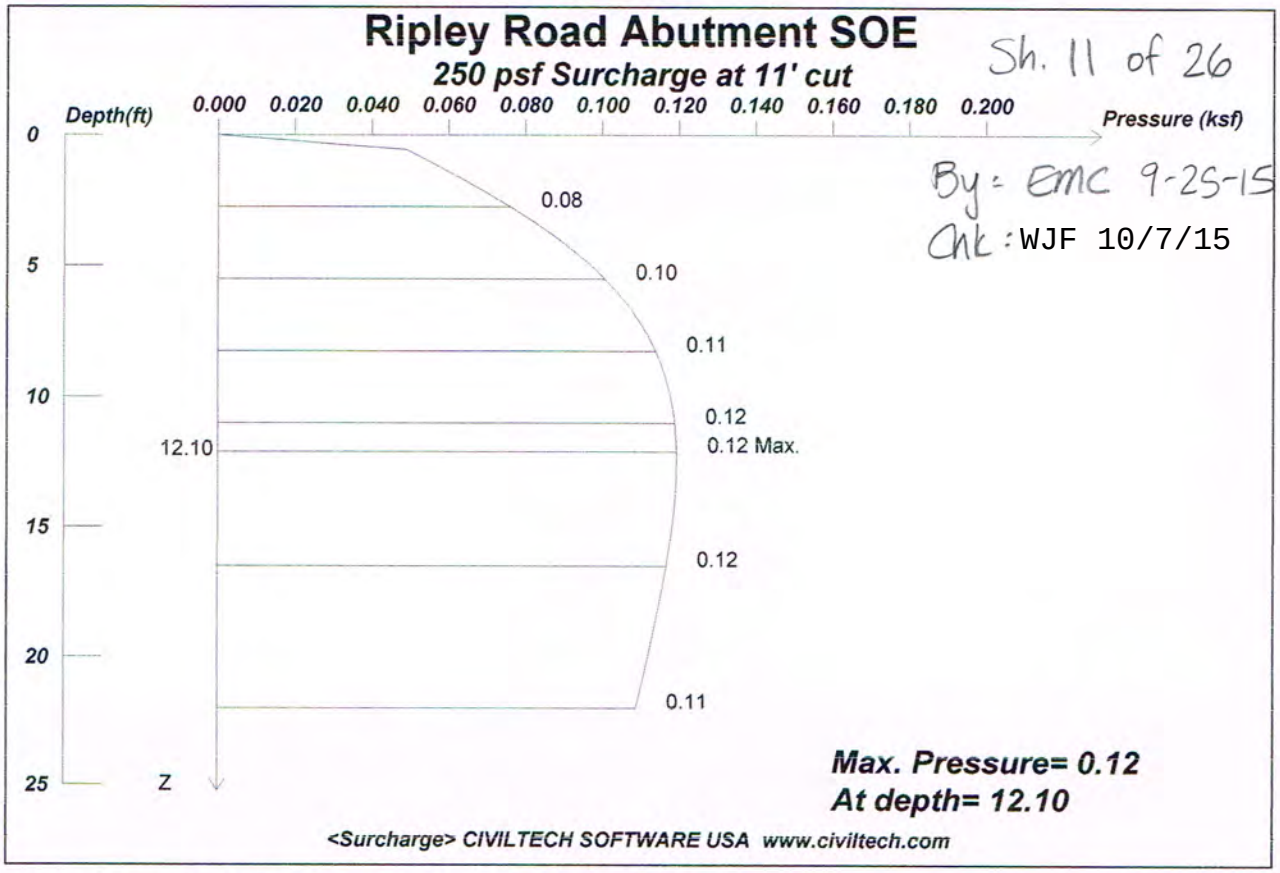
Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
11.00	0.49	22.00	0.68	0.0172	0.3622

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

Z1	Pp1	Z2	Pp2	Slope	Kp
11.00	0.00	22.00	1.51	0.137	2.8826

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

Date: 10/1/2015 File Name: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Ripley Road Bridge Abutment Excavation Protection 14-049.07\Calcu



By: EMC 9-25-15
Chk: WJF 10/7/15

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Date: 9/25/2015 File: C:\Users\Ellen Connell\Desktop\Projects\Kubricky Ripley Road Bridge Abutment Excavation Pro

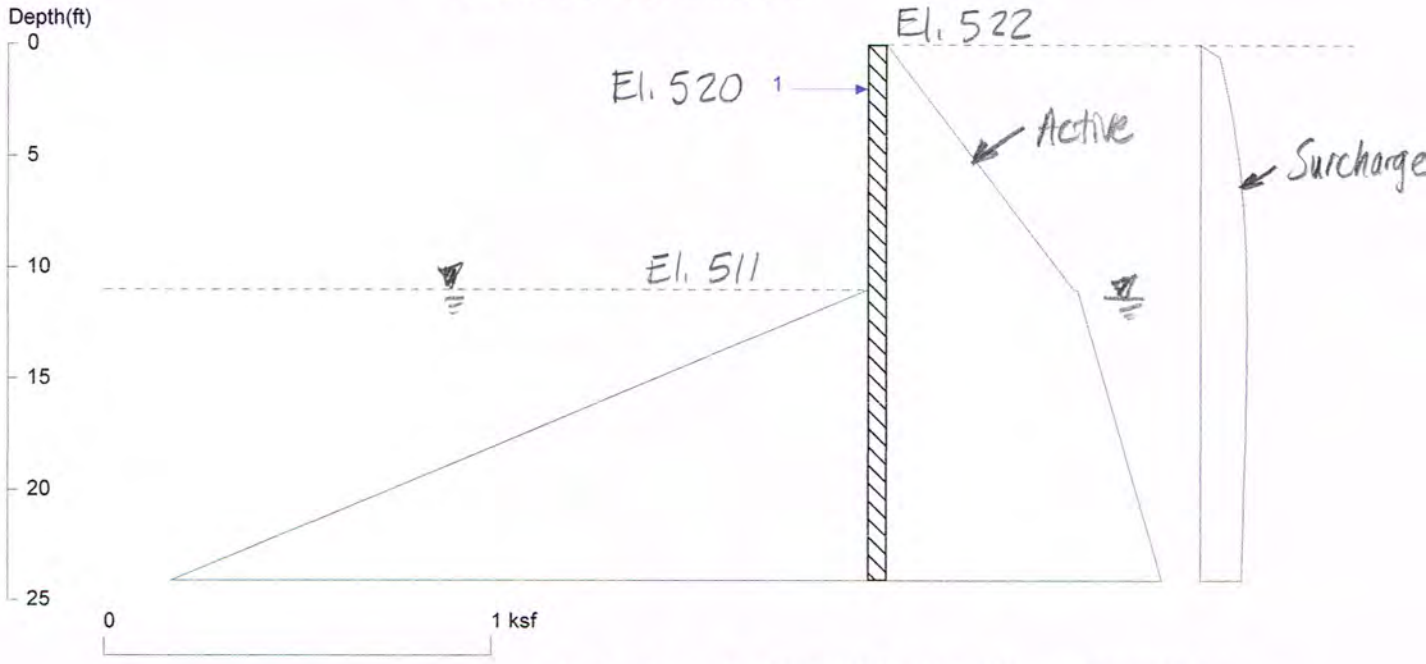
Wall Height, H= 11 Load Depth at Surface, D= 0
Load Factor of Surcharge Loading = 1
Flexible Wall Condition -- Movement or deflection are allowed.
Max. Pressure = 0.120 at depth = 12.10

X	Width	Strip Load
10.0	50.0	.25

Infinite Surcharge, Q=.25 Active Wedge Approach * (recommend)

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

Ripley Road Abutment SOE
11 foot cut - Abutment 2



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Wall Height=11.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=13.12 Min. Pile Length=24.12
MOMENT IN PILE: Max. Moment=18.07 per Pile Spacing=1.0 at Depth=10.92

Use same sheeting size and embedment as Abutment 1

PILE SELECTION:
Request Min. Section Modulus = 6.6 in3/ft=353.31 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
User Input I (Moment of Inertia):
Top Deflection = -0.03(in) based on E (ksi)=29000.00 and I (in4)/foot=428.1

Use for design of Abutment 2 bracing

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	3.6 k/f	3.6	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	11.000	0.483	0.043871
*	Below	Base		
11.000	0.492	50.000	1.141	0.016653
*	Sur-	charge		
0.000	0.000	0.550	0.049	0.088989
0.550	0.049	1.100	0.056	0.013042
1.100	0.056	1.650	0.063	0.012674
1.650	0.063	2.200	0.070	0.012146
2.200	0.070	2.750	0.076	0.011483
2.750	0.076	3.300	0.082	0.010717
3.300	0.082	3.850	0.087	0.009877
3.850	0.087	4.400	0.092	0.008995

Sh. 13 of 26
By: EMC 10-1-15
Chk: WJF 10/7/15

4.400	0.092	4.950	0.097	0.008098
4.950	0.097	5.500	0.101	0.007209
5.500	0.101	6.050	0.104	0.006348
6.050	0.104	6.600	0.107	0.005527
6.600	0.107	7.150	0.110	0.004757
7.150	0.110	7.700	0.112	0.004043
7.700	0.112	8.250	0.114	0.003388
8.250	0.114	8.800	0.116	0.002792
8.800	0.116	9.350	0.117	0.002253
9.350	0.117	9.900	0.118	0.001770
9.900	0.118	10.450	0.118	0.001338
10.450	0.118	11.000	0.119	0.000953
11.000	0.119	12.100	0.120	0.000461
12.100	0.120	13.200	0.119	-0.000073
13.200	0.119	14.300	0.119	-0.000486
14.300	0.119	15.400	0.118	-0.000803
15.400	0.118	16.500	0.117	-0.001044
16.500	0.117	17.600	0.116	-0.001226
17.600	0.116	18.700	0.114	-0.001362
18.700	0.114	19.800	0.112	-0.001461
19.800	0.112	20.900	0.111	-0.001530
20.900	0.111	22.000	0.109	-0.001577
22.000	0.109	24.200	0.105	-0.001613

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

Z1	P1	Z2	P2	Slope
*	Below	Base		
11.000	0.000	50.000	5.351	0.137213

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	11.00	1.00

PASSIVE SPACING:

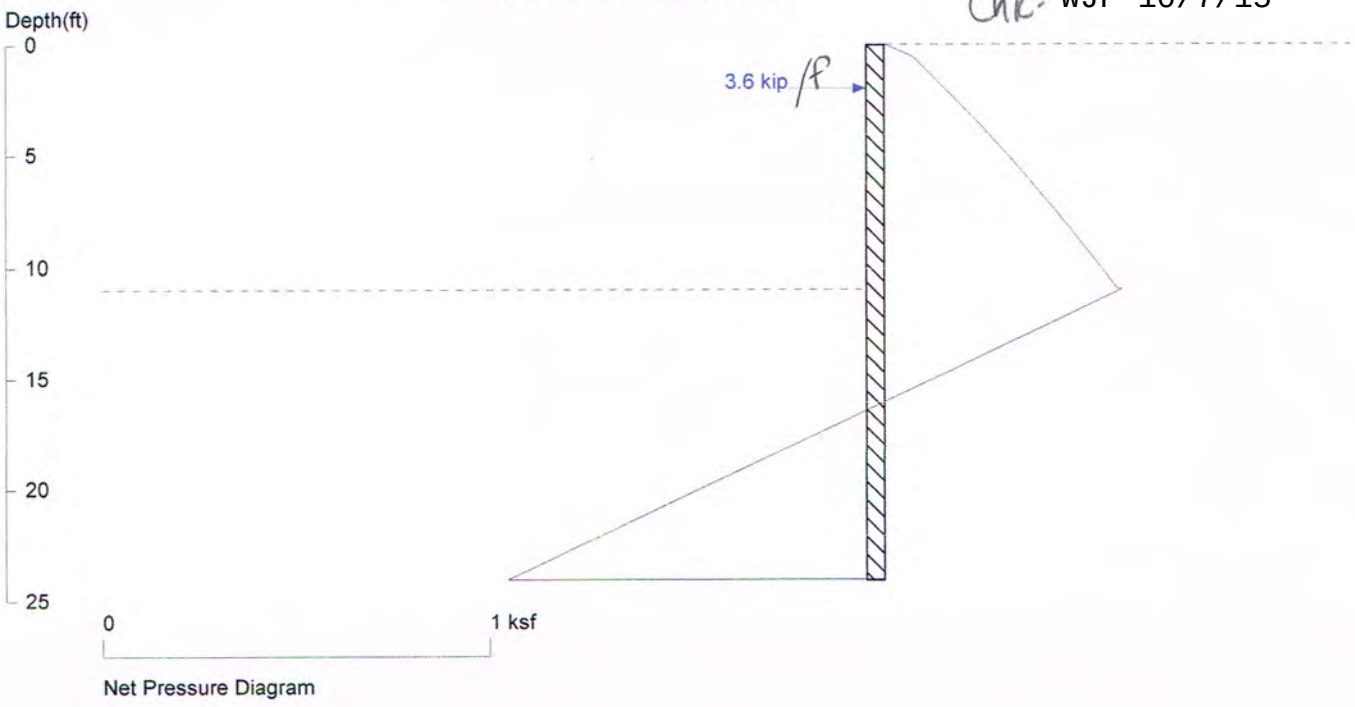
No.	Z depth	Spacing
1	0.00	1.00

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

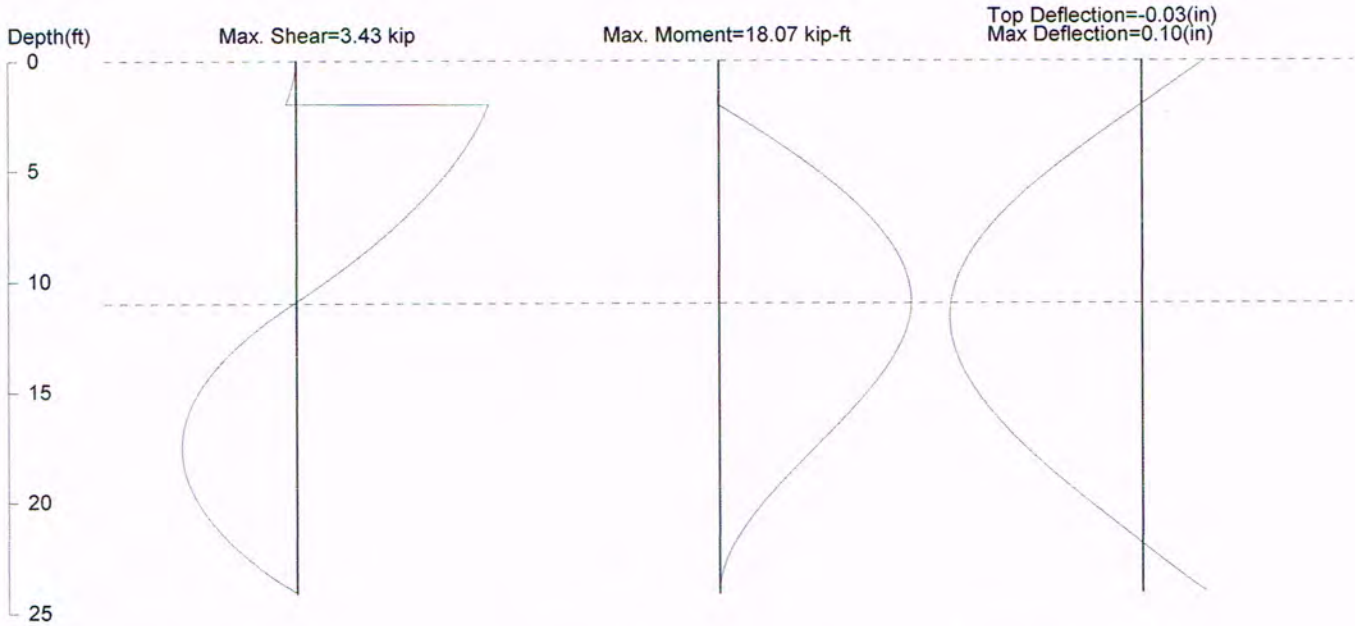
Ripley Road Abutment SOE

11 foot cut - Abutment 2

Sh. 14 of 26
By: EMC 10-1-15
Chk: WJF 10/7/15



Net Pressure Diagram



Shear Diagram | Moment Diagram | Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=428.1

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SHEET NO. 15 OF 26
CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
SCALE

Abutment 1 Long Wale Design Try HP14x117 Fy = 50 ksi

$\ell = 36'$

$w = 5.0$ k/f Try with no knee brace.

$M_x = \frac{w\ell^2}{8} = \frac{5.0 \times 36^2}{8} = 810$ k-f (with no knee brace)

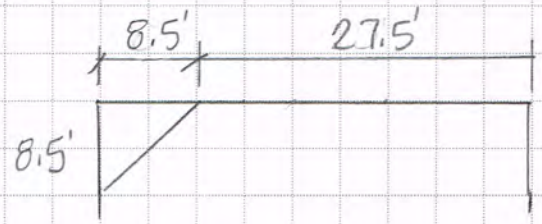
$V = \frac{w\ell}{2} = \frac{5.0 \times 36}{2} = 90$ k

For $\ell_b < L_p = 12.68'$

$M_n = M_p = F_y Z_x = 50 \times 194/12 = 808$ k-f

$\frac{M_n}{\Omega} = \frac{808}{1.67} = 483$ k-f $< M_x = 810$ k-f (NG)

∴ Add a knee brace.



$\ell = 27.5'$ Supported every 10'

$M_x = \frac{5.0 \times 27.5^2}{8} = 473$ k-f (conservative)

$M_y = \frac{0.117 \times 10^2}{8} = 1.5$ k-f

$V = \frac{5.0 \times 27.5}{2} = 69^k$

Axial load from short wale and knee brace:

$P = 5.0 \times 9.33 = 47^k$

See attached analysis. ok

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SCALE

User Inputs:

Wale Name:	Abut 1 Long Wale		*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:	12.5	ft	*Unbraced length. CAN VARY.*
Fy	50	ksi	*Yield stress. CAN VARY. 30 or 33 is typical for older rolled shapes*
Strut Spacing =	27.5	ft	*Wale span between struts*
Pr	47	kips	*Required axial capacity*
Vr =	70	kips	*Required shear capacity*
Mrx =	472.7	kip-ft	*Required strong axis moment*
Mry =	1.5	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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JOB 14-049.07
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CALCULATED BY EMC DATE 10-1-2015
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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		
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

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

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

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

Lb < Lp therefore use F2-1

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

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

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

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

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Mnx =	9700 kip-in	=	808.3333 kip-ft		
Mcx = Mnx/1.67 =	5808.38 kip-in	=	484.03 kip-ft	>	**472.70 kip-ft**

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	>	**1.50 kip-ft**

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	>	**70.00 kips**		Therefore OK

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CALCULATED BY EMC DATE 10-1-2015
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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		

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

Fe = 163.78 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 = 44.00 ksi

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

Pn = 1513.68 kips

Pc = Pn/1.67 = 906.40 kips > **47.00 kips**

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JOB 14-049.07
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CALCULATED BY EMC DATE 10-1-2015
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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

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

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,	1.01	=<	1.0	NG

1% overload. Say OK due to conservative analysis.

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JOB 14-049.07
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CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
SCALE

Abutment 2 Long Wale Design (no knee brace)

Try HP14x117 $F_y = 50$ ksi Supported at every 10'

$\ell = 36'$ $W = 3.6$ k/f Try with no knee brace.

$M_x = \frac{3.6 \times 36^2}{8} = 583$ k-f $> \frac{M_n}{\Omega} = 483$ k-f (NG)

∴ Add a knee brace similar to Abutment 1 (See Sh. 15)

$\ell = 27.5'$ Supported every 10'

$M_x = \frac{3.6 \times 27.5^2}{8} = 340$ k-f (conservative)

$M_y = \frac{0.117 \times 10^2}{8} = 1.5$ k-f

$V = \frac{3.6 \times 27.5}{2} = 50^k$

Axial load from short wale and knee brace:

$P = 3.6 \times 9.33 = 34^k$

Since loading is less than at Abutment 1, HP14x117 is ok.

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JOB 14-049.07
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CHECKED BY WJF DATE 10/7/15
SCALE

Knee Brace Design

Say axial load $P = 5.0\ k/f \times \left(\frac{8.5'}{2} + \frac{27.5'}{2}\right) / \cos 45° = 127^k$

$\ell = 8.5' / \cos 45° = 12.0'$

Use HP14x117, $F_y = 50$ ksi

$P_{all} = 916^k > P = 127^k$ ok (AISC p. 4-26)

Connection of Knee Brace to Wales

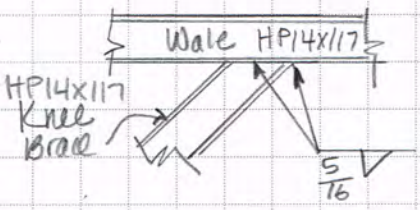
$V = 127^k \cos 45° = 90^k$

Try a 5/16" weld on top of knee brace web and a vertical flange-to-flange weld

HP14x117: $T = 11.25"$ $\ell = (11.25 / \cos 45°) + 14.9"\ (b_f) = 30.8"$

$R_r = 0.6 F_{ex} A_{weld} = 0.6 \times 70 \times 0.707 \times \frac{5}{16} \times 30.8 = 285^k$

$\frac{R_r}{\Omega} = \frac{285^k}{2.0} = 142^k > V = 90^k$ ok



Connection of Wales at Corners

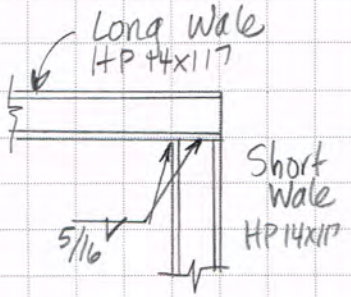
$V = 5.0\ k/f \times 9.33' / 2 = 23.3^k$ at end of short wale

Try a 5/16" weld on top of web $\ell = 11.25"$

$R_r = 0.6 \times 70 \times 0.707 \times \frac{5}{16} \times 11.25 = 104.4^k$

$\frac{R_r}{\Omega} = \frac{104.4}{2.0} = 52.2^k > V = 23.3^k$ ok

Also add a vertical flange-to-flange weld



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JOB 14-049.07
SHEET NO. 23 OF 26
CALCULATED BY EMC DATE 10-1-20F
CHECKED BY WJF DATE 10/7/15
SCALE

Check need for stiffeners in Wales

$P_{max} = 127^k \cos 45° = 90^k$ (at knee brace)
Bearing length = 14.2" at wale to wale connection
Bearing length = 14.2"/cos 45° = 20". Use 14.2"

See next calculation sheets. No stiffeners required.

However, use 5/8" thick stiffeners Top & Bottom at Knee Braces and Wale connections.

Wale Seats

Use HP12x84 or larger Wale seats at 10' maximum spacing.

By inspection, ok for bending and shear.

Try a 1/4" weld to sheeting on both sides of web.

HP12x84: T = 9.5"

$R_n = 0.6 \times 70 \times 0.707 \times 1/4 \times 2 \times 9.5 = 141^k$

$\frac{R_n}{\Omega} = \frac{141}{2.0} = 70.5^k$

$V = 0.117^{k/f} \times 10' = 1.2^k << 70.5^k$ ok

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JOB 14-049.07
SHEET NO. 24 OF 26
CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
SCALE

AISC J10.2: Web Local Yielding **HP14x117 Wale at Connections**

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=	96 in

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

Rn = 873.43 kips

Rn/Ω = 582.28 kips **> 90 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 =	20 in
tw =	0.805 in	Le = Distance from Force to End of Member =	96 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 = 19743.48 kips

Rn/Ω = 9871.74 kips **> 90 kips Therefore OK**

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

JOB 14-049.07
SHEET NO. 25 OF 26
CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
SCALE

AISC J10.4: Web Sidesway Buckling **HP14x117 Wale at Connections**

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 **> 90 kips Therefore OK**

Compression Flange not Restrained Against Rotation:

Rn = 538.17 kips

Rn/Ω = 305.78 kips **> 90 kips Therefore OK**

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JOB 14-049.07
SHEET NO. 26 OF 26
CALCULATED BY EMC DATE 10-1-2015
CHECKED BY WJF DATE 10/7/15
SCALE

AISC J10.5: Web Compression Buckling **HP14x117 Wale at Connections**

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:

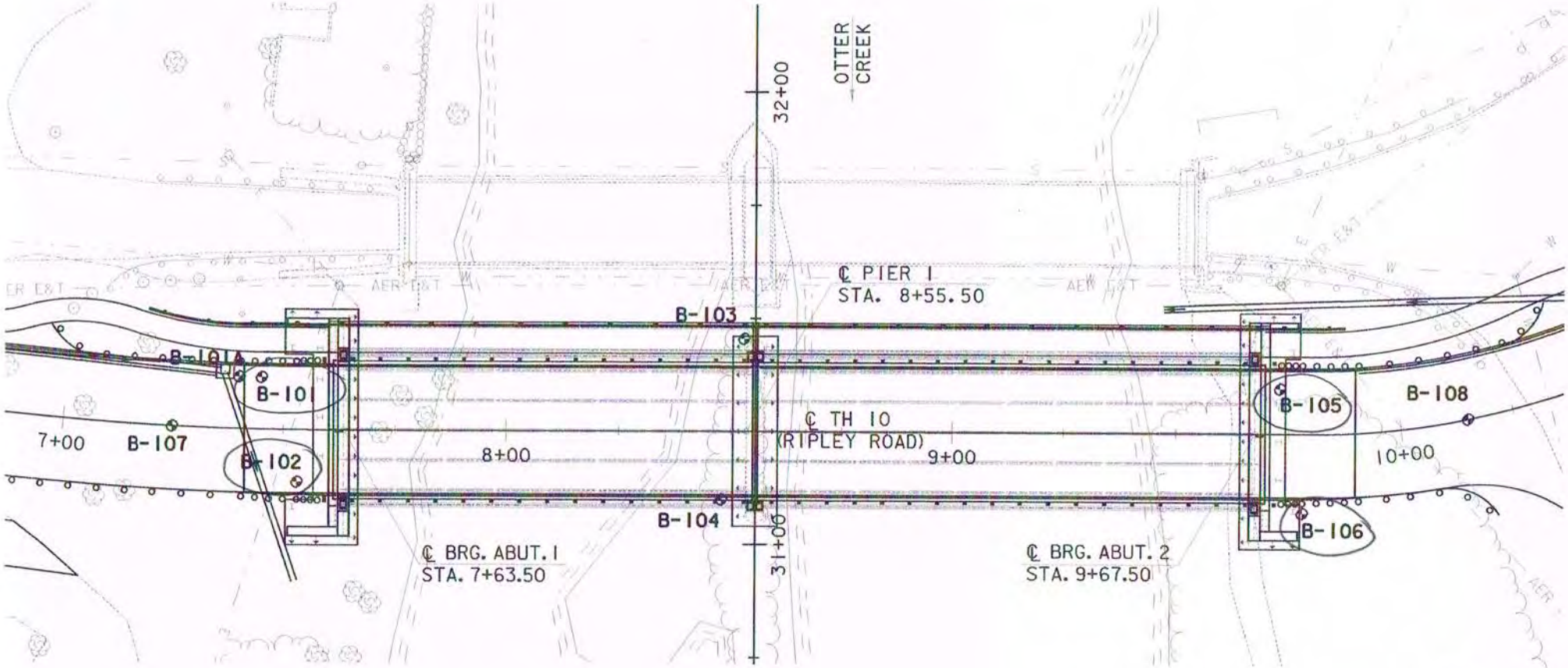
Reduction does not Apply

Rn = 1318.98 kips

Rn/Ω = 789.81 kips **> 90 kips Therefore OK**

APPENDIX 'A'

Boring Logs


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

Sh. A1 of 5

BOTTOM OF ABUT. 1
FOOTING EL. 511.00

ESTIMATED MIN. PILE TIP
EL. 471.00

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-101
Page No: 1 of 1
Pin No.: 08J096
Checked By: CAA

Boring Crew: PORTER, GARROW, WELLS
Date Started: 5/27/10 Date Finished: 6/02/10
VTSPG NAD83: N 402148.07 ft E 1507184.27 ft
Station: 7+45 Offset: -11.50
Ground Elevation: 517.0 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
06/01/10	7.9	Prior to drilling

El. 509.1

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-1-b, SaGr, brn, Moist, Rec. = 0.7 ft, Broken rock was within sample	WH-WH-4-6 (4)	16.5	43.0	42.6	14.4
		A-1-b, SaGr, white, Moist, Rec. = 0.8 ft, Sample was mostly broken rock (Marble)	10-4-7-10 (11)	12.1	59.3	30.0	10.7
5		A-1-a, SaGr, brn, Moist, Rec. = 0.9 ft, Concrete & Broken rock (Quartzite) were within sample	5-5-4-4 (9)	17.6	69.0	22.1	8.9
		A-2-4, SiSa, brn, MTW, Rec. = 0.5 ft	4-3-2-3 (4)	29.6	8.8	64.6	34.6
		A-4, SaSi, brn-gry, MTW, Rec. = 1.3 ft	2-1-1-2 (2)	31.0		28.6	71.4
10		A-4, SiSa, brn-gry, MTW, Rec. = 1.7 ft, A small amount of decayed wood pieces were within sample	1-1-1-1 (2)	37.7		56.4	43.6
		A-4, SaSi, gry, MTW, Rec. = 1.3 ft, A small amount of decayed wood pieces were within sample	WH-8-10-18 (18)	31.1	14.4	41.6	44.0
15		Field Note:, NXDC, Cobbles					
		A-2-4, SiGrSa, gry, Moist, Rec. = 1.0 ft	6-8-8-18 (16)	13.2	30.0	49.2	20.8
		Field Note:, NXDC, Cobbles					
20							
		Field Note:, NXDC, Cobbles, Cleaned out casing					
		Field Note:, No recovery, Appears to be Broken Rock	R/6" (R)				
25		Field Note:, Boulder					
		Field Note:, NXDC, Advanced casing to 26.0 ft., Cleaned out casing					
		A-2-4, SiSa, brn, Moist, Rec. = 1.4 ft	4-22-32-36 (54)	18.5	8.4	62.7	28.9
30							
		A-1-b, SiSaGr, gry, MTW, Rec. = 0.9 ft, Broken rock was within sample	18-39-40-R/1.5" (79)	9.2	54.8	24.2	21.0
35		Field Note:, Advanced and cleaned out casing					
		A-4, SaSi, gry, Moist, Rec. = 1.5 ft	20-24-45-50 (69)	16.3	11.7	20.2	68.1
40		Hole stopped @ 40.0 ft Casing broke off at 35.0 ft					
45							

Navg ≈ 8

El. 490

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

BOTTOM OF ABUT. I
FOOTING EL. 511.00

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-102
Page No: 1 of 2
Pin No: 08J096
Checked By: CAA

Boring Crew: PORTER, GARROW
Date Started: 6/02/10 Date Finished: 6/08/10
VTSPG NAD83: N 402124.63 ft E 1507177.59 ft
Station: 7+53 Offset: 11.50
Ground Elevation: 515.4 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
06/03/10	7.6	Prior to drilling

El. 507.8

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate min/ft/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-4, SaSi, Dk/brn, Moist, Rec. = 0.5 ft				4-4-7-9 (11)	27.2	13.0	43.4	43.6
		A-1-a, SaGr, brn, Moist, Rec. = 0.7 ft, Some broken rock (Marble) was within sample.					2.5	62.6	30.6	6.8
		A-1-b, SaGr, brn-white, Moist, Rec. = 1.0 ft, Lots of broken pieces of Marble rock were within sample.				4-7-12-17 (19)	8.9	55.0	35.6	9.4
5		Visual Classification, Broken Marble rock pieces, white, Moist, Rec. = 0.5 ft				20-7-3-3 (10)				
		A-4, SiSa, brn, MTW, Rec. = 1.1 ft				4-1-1-1 (2)	35.1	0.1	60.6	39.3
		A-4, SiSa, brn, MTW, Rec. = 1.5 ft				1-1-1-1 (2)	32.3		50.5	49.5
10		A-2-4, SiGrSa, brn, MTW, Rec. = 1.1 ft				WH-3-6-12 (9)	19.9	32.5	40.4	27.1
		A-1-b, SaGr, gry, Wet, Rec. = 0.7 ft, Broken rock was within sample.				14-13-10-10 (23)	8.6	52.1	29.2	18.7
15		A-1-b, SaGr, gry, Wet, Rec. = 0.9 ft				13-13-14-19 (27)	12.4	55.7	25.9	18.4
		Visual Classification, Broken rock (Quartzite) pieces, gry, Moist, Rec. = 0.3 ft				10-9-9-9 (18)				
		Visual Classification, Broken rock (Quartzite) pieces, gry, Moist, Rec. = 0.3 ft				9-13-14-20 (27)				
20										
		NXDC, Boulder, 21.5 ft - 23.0 ft								
		A-1-a, SaGr, gry, Moist, Rec. = 0.3 ft, Broken rock (Quartzite) pieces were within sample.				15-R/6" (R)	7.9	62.3	23.5	14.2
25										
		NXDC, Cobbles, 26.7 ft - 28.0 ft								
		A-1-b, SaGr, gry, Moist, Rec. = 0.8 ft				6-30-30-30 (60)	7.3	55.6	26.1	18.3
30										
		NXDC, Cobbles, 32.0 ft - 33.0 ft								
		A-1-b, GrSa, gry, Moist, Rec. = 1.2 ft				20-47-R/6" (R)	12.9	43.2	45.7	11.1
35										
		NXDC, Cobbles, 37.0 ft - 38.0 ft								
		A-1-b, GrSa, gry-brn, Moist, Rec. = 1.0 ft				23-R/6" (R)	11.4	41.5	43.3	15.2

Navg = 15

El. 490

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

BOTTOM OF ABUT. 2
FOOTING EL. 511.00

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-105
Page No: 1 of 2
Pin No: 08J096
Checked By: CAA

Boring Crew: PORTER, GARROW
Date Started: 6/10/10 Date Finished: 6/15/10
VTSPG NAD83: N 402017.30 ft E 1507370.82 ft
Station: 9+73 Offset: -10.00
Ground Elevation: 519.0 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
06/11/10	8.4	Prior to drilling

El. 510.6

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, GrSiSa, brn, Moist, Rec. = 0.5 ft, Insufficient sample for a true gradation				WH-WH-2-2 (2)	25.3	24.9	40.5	34.6
		Visual Classification, Broken rock, Rec. = 0.3 ft. (Quartzite & Marble)				7-7-3-3 (10)				
5		A-2-4, GrSa, brn, Moist, Rec. = 0.8 ft, Broken rock (Marble) was within sample				3-3-7-5 (10)	6.0	41.5	42.1	16.4
		A-1-b, SaGr, white, Moist, Rec. = 0.4 ft, Broken rock (Marble) was within sample				6-4-4-2 (8)	12.4	50.5	38.2	11.3
		Field Note: , No Recovery				1-2-3-6 (5)				
10		A-2-4, GrSa, brn-white, Moist, Rec. = 0.3 ft, Broken rock (Marble) was within sample.				6-4-2-1 (6)	16.7	41.8	43.2	15.0
		A-4, SaSi with Trace of Organics (6.2%), brn, Moist, Rec. = 1.1 ft				2-2-2-4 (4)	5.5	1.4	41.5	57.1
		Field Note: , No Recovery. Appears to be silt				1-2-1-1 (3)				
15		Field Note: , No Recovery. Appears to be silty sand				2-4-8-4 (12)				
		A-1-b, SaGr, gry, Moist, Rec. = 0.6 ft				7-6-5-4 (11)	12.3	48.6	39.4	12.0
20										
		A-3, Sa, brn, MTW, Rec. = 0.8 ft				1-1-1-1 (2)	26.1	0.1	93.0	6.9
25										
		A-3, Sa, brn, Wet, Rec. = 0.5 ft				WR-WH-1-1 (1)	27.6		95.0	5.0
30										
		A-3, Sa, gry, MTW, Rec. = 1.2 ft				3-4-5-6 (9)	18.4	8.7	81.8	9.5

Navg ≈ 8

El. 487

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

BOTTOM OF ABUT. 2
FOOTING EL. 511.00

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-106
Page No: 1 of 2
Pin No.: 08J096
Checked By: CAA

Boring Crew: PORTER, GARROW
Date Started: 6/16/10 Date Finished: 6/17/10
VTSPG NAD83: N 40195/1.83 ft E 1507359.30 ft
Station: 9+78 Offset: 17.50
Ground Elevation: 519.3 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
06/17/10	11.6	Prior to drilling

El. 507.7

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate min/ft/in	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %	LL %	PI %
		A-2-4, SiGrSa, brn, Moist, Rec. = 0.7 ft. Broken rock (Marble) was within sample.				1-2-8-3 (10)	13.7	35.8	43.5	20.4		
		Visual Classification, Broken rock (Marble) with sand, brn-white, Moist, Rec. = 0.4 ft				1-2-2-3 (4)	3.8					
5		Visual Classification, Broken rock (Marble) with sand, brn-white, Moist, Rec. = 0.6 ft				2-3-5-6 (8)	4.7					
		Visual Classification, Broken rock (Marble) with sandy silt, brn-white, Moist, Rec. = 1.0 ft				5-5-3-4 (8)	3.7					
		Visual Classification, Broken rock (Marble), white, Moist, Rec. = 0.4 ft				2-3-7-5 (10)						
10		Field Note:, No Recovery				3-3-2-3 (5)						
		A-4, SaSi with Trace of Organics (6.3%), gry, Moist, Rec. = 1.6 ft				1-1-2-3 (3)	54.1	1.4	39.4	59.2		
15		A-1-b, GrSa, gry, Moist, Rec. = 1.0 ft, Some Wood particles were within sample.				4-3-3-3 (6)	29.1	26.7	56.4	16.9		
		A-2-4, GrSiSa, gry, Wet, Rec. = 0.4 ft				1-1-5-3 (6)	31.8	21.0	44.5	34.5		
		A-1-b, SiGrSa, brn, Wet, Rec. = 0.7 ft, Sample was very rusty colored.				9-5-3-3 (8)	21.8	27.5	50.1	22.4		
20												
		A-3, Sa, gry, MTW, Rec. = 2.0 ft				WR-WR-WH-WH (0)	24.9	0.4	93.2	6.4		
25												
		Field Note:, No Recovery, Appears to be Fine Sand				1-1-1-1 (2)						
30												
		A-2-4, Sa, gry, MTW, Rec. = 1.0 ft				1-2-2-2 (4)	21.4	0.1	85.8	14.1		
35												

Navg ≈ 6

El. 487

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

APPENDIX 'B'

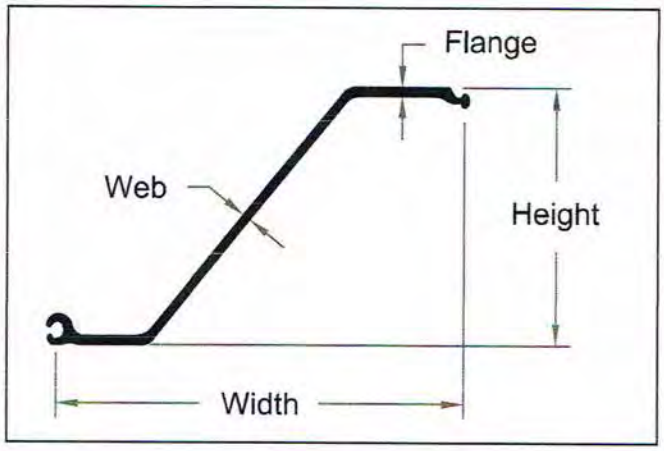
PZC 26 Sheet Piling

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

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