Submittal Transmittal

PROJECT:	Ninebark at Copper Crest East	DATE SENT:	8/9/17
TYPE:	Shop Drawing	SUBMITTAL ID:– 3.2 Helical Design Documentation	
SPEC SECTION:	3000	VIA:	Email

FROM: Chris Noble

TO: Tim Keil

Please see attached for Helical Documentation:

Helical pier installer certification letter (proof of current certification ISO 9001:2008)
ICC approval for helical piers (ICC – ES report, or equivalent)
Helical pier product data forms
Calculations to support the drawings we have from JM Williams
Addendum to Geotech report for helical pier usage (I believe you received that from IGES already).

DESCRIPTION: See attached

rudow + berry
structural engineers

This review was performed only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Modifications or comments made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the plans and specifications. Approval of a specific item does not include approval of the assembly of which the item is a component.

Contractor is Responsible for:
* Dimensions to be confirmed and correlated at the jobsite.
* Information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction.
* Coordination of the work of all trades.
* Performing all work in a safe and satisfactory manner.

- [x] Approved
- [ ] Approved As Corrected
- [ ] Reviewed For Loading Only
- [ ] Revise and Resubmit
- [ ] Rejected
- [ ] Resubmit Record Copy

Reviewed By: MAR Date: 08/14/2017

NOTE: SEE SEPARATE SUBMITTAL OF STRUCTURAL DRAWINGS FOR PERTINENT REVIEW COMMENTS.

ITEMS SHOWN ON THE SUBMITTAL MAY BE FURNISHED WITH CORRECTIONS SHOWN IN ACCORDANCE WITH THE FOLLOWING:

Correction or comments made on the submittal during this review do not relieve subcontract/supplier from compliance with requirements of the drawings, specification, and applicable building codes. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. Edge Builders does not hereby assume design responsibility. The subcontract/supplier is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction and performing his work in a safe and satisfactory manner.

Date: 8/9/17 BY: Chris Noble

- [ ] REVIEWED
- [ ] REVISE & RESUBMIT
- [ ] REJECTED
- [ ] FURNISH AS CORRECTED

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

- [ ] BUILDING
- [x] STRUCTURAL
- [ ] MECHANICAL
- [ ] PLUMBING
- [ ] ELECTRICAL
- [ ] ENERGY
- [ ] ACCESSIBILITY
- [ ] FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: MEM DATE: 08/30/17

WEST COAST CODE CONSULTANTS, INC.

Intermountain GeoEnvironmental Services, Inc.
12429 South 300 East, Ste 100, Draper, UT 84020
T: (801) 748-4044 ~ F: (801) 748-4045

4153 Commerce Drive, Salt Lake City, Utah 84107
T: (801) 270-9400 ~ F: (801) 270-9401

June 22, 2017

Edge Builders, LLC
PO Box 17404
5412 S. Wayman Lane
Salt Lake City, Utah 84117
Attn: Mr. Brigham Wilcox

IGES Project No. 02379-002

RE: Construction Observation and Consultation
Ninebranch Development (formerly Copper Crest East)
Summit Powder Mountain Resort
Weber County, Utah

Reference: IGES, 2016, Geotechnical & Geologic Hazard Investigation (Rev. 1), Copper Crest – East, Powder Mountain Resort, Weber County, Utah, Project No. 01628-010, dated July 15, 2016.

Mr. Wilcox:

As requested, IGES has provided the following letter as a summary of our site visit and subsequent meeting on June 12, 2017 regarding the Ninebranch development, formerly known as Copper Crest East, located in Summit Powder Mountain resort in Weber County, Utah.

Construction Observation

At the request of the Client, on June 12 Mr. Peter Doumit, Senior Engineering Geologist for IGES, visited the site to assess the subsurface conditions on the east side of the building footprint, adjacent to Copper Crest Road. The issue of concern was the presence of undocumented fill, which would underlie the structural foundations on the east side of the townhomes. This fill was placed as a part of the road embankment construction for Copper Crest Road. At the time of our visit, the building footprint was being excavated for the foundations. Our observations are as follows:

Adjacent to the road on the north end of the building, we observed approximately 5 to 6 feet of fill soils, generally classifying as clayey sand with gravel (SC) with some dark red fat clay mixed in; this material was apparently used as embankment fill. Underlying the fill material, we identified approximately six inches to one foot of buried topsoil, underlain by one to two feet of *colluvium* consisting of dark brown clayey gravel with cobbles, which in turn was underlain by reddish-brown weathered *Wasatch Formation* (weakly-indurated conglomerate bedrock that generally disaggregates to clayey sand with gravel). Considering that the property sloped down to the southwest, we estimated that the Wasatch Formation contact would likely be around 15 feet below road grade on the southern end of the building.

By observation, the colluvium contained abundant organic material (roots and other plant matter, and a dark, loamy appearance), and does not appear suitable for support of a structure. From a field identification perspective, the colluvium is generally much more cobbly/rocky and has larger clasts than the Wasatch Formation; also, the colluvium is not as dense, is easier to excavate, and often has a darker appearance compared to the Wasatch Formation.

In consideration of the observations above, IGES recommended that structural footings be founded on competent Wasatch Formation; alternatively, the area under the foundations could be over-excavated to competent Wasatch Formation and then the excavated material could be replaced with *structural fill* as detailed in our referenced geotechnical report (IGES, 2016).

Meeting

Following our field observation, on June 12 Mr. Brigham Wilcox (Edge Builders) and Mr. Bill Boulter (Intermountain Helical Piers) met with Mr. David Glass (IGES) at the IGES Draper office to discuss issues related to the undocumented fill, including over-excavation requirements, and possible alternative foundation solutions. Mr. Wilcox indicated that over-excavation to suitable earth materials would necessitate removal and replacement of a significant volume of soil, and could necessitate extensive temporary shoring to protect existing improvements. At the time of our meeting, IGES was asked to provide an opinion regarding the feasibility of a deep foundation alternative, which would minimize the need for removal of undocumented fill and would also reduce or eliminate the need for temporary shoring.

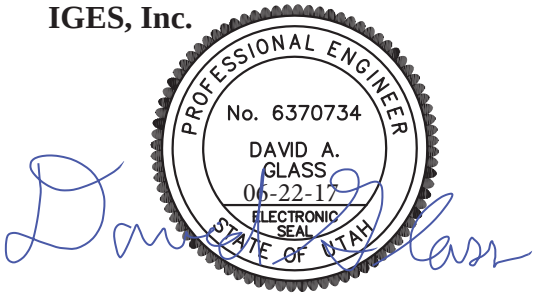
Regarding deep foundations, IGES takes no exception to the use of a deep foundation system from a geotechnical standpoint. However, IGES indicated that, if any part of the structure is supported on deep foundations, then *the entire structure should be supported on deep foundations*. This recommendation is intended to reasonably minimize the probability of differential settlement adversely impacting the new townhomes. Deep foundations may consist of a number of feasible technologies, including helical piers, micropiles, drilled piers, driven piles, ACIP, etc., although for this project it is likely that either helical piers or micropiles will be the most practical alternatives. Regarding the design, the deep foundations should be designed such that the bearing stratum consists of Wasatch Formation; reliance on undocumented fill or other potentially compressible earth materials for bearing resistance is not recommended.

Closure

All other recommendations presented in our referenced geotechnical report remain valid and should be implemented into the design and construction of the project as appropriate. We appreciate the opportunity to provide you with our services; if you have any questions, please contact the undersigned at your convenience at (801) 748-4044.

Respectfully Submitted,

IGES, Inc.



David A. Glass, P.E.
Senior Geotechnical Engineer

Intermountain HelicalPiers
"Trusted Foundation Solutions"

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Bluffdale, UT 84065
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SUBMITTAL PACKAGE
HELICAL PIER FOUNDATION

for

EDGE BUILDERS

on

NINEBARK CONDOS
COPPER CREST
EDEN, UTAH

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

☐ BUILDING	☒ STRUCTURAL
☐ MECHANICAL	☐ PLUMBING
☐ ELECTRICAL	☐ ENERGY
☐ ACCESSIBILITY	☐ FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: MEM DATE: 08/30/17

WEST COAST CODE CONSULTANTS, INC.

☑ Reviewed with no exceptions taken
☐ Make corrections noted - No resubmittal required
☐ Revise/Correct and resubmit with additional date
☐ Rejected-Resubmit according to drawings & specifications

Checking is only for general confirmation with the design concept of the project and general compliance wit hthe information given in the contract documents. Any action shown is subject to the requirements of the plans an specifications. Contractor is responsible for: Dimensions which shall be confirmed and corelated at the job site; fabrication processes and techniqes of construction; coordination of his work with that of all other trades ande the stisfactory performance of his work.

AE URBIA
ARCHITECTS & ENGINEERS

By: _____

Date: 07/28/17

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2.5 INCH SQUARE STRUCTURAL TUBE MATERIAL SPECIFICATIONS

HELICAL PIER FOUNDATION

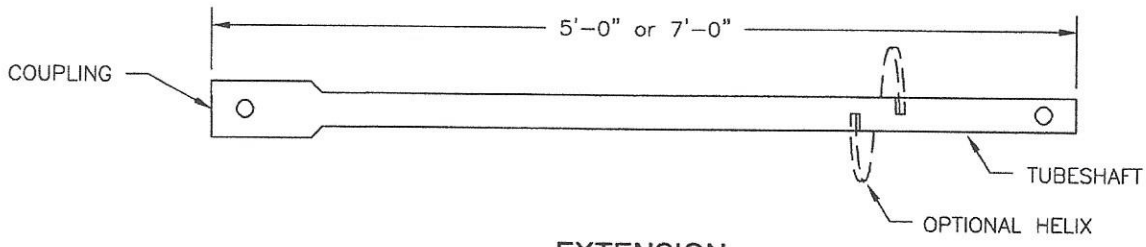
for

EDGE BUILDERS

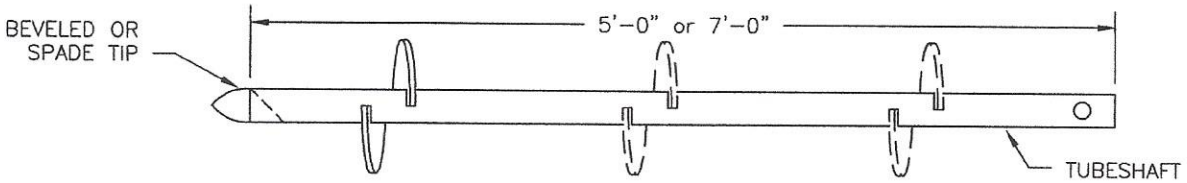
on

NINEBARK CONDOS
COPPER CREST
EDEN, UTAH

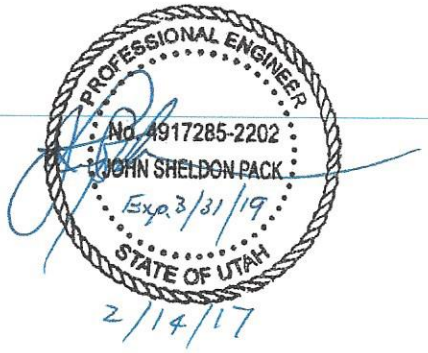
HPFT25



EXTENSION
NO SCALE



LEAD SECTION
SINGLE OR MULTIPLE HELIX
NO SCALE



NOTES:

1. THIS DRAWING COVERS 2.5" (1/4" WALL) TUBULAR HELICAL PILE MATERIAL MANUFACTURED BY IMR.
2. HPFT25: 2.5"x2.5" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.75" DIAMETER SAE J429 Gr 5 STEEL (Fy=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 7,000 FT-LBS.
3. ALL STRUCTURAL TUBING IS PER ASTM A500 Gr B, FOR 2" TO 3" Fy=60 KSI Fu=69 KSI, 4" AND LARGER Fy=60 KSI Fu=70 KSI BY SPECIAL ORDER.
4. ALL HELIX MATERIAL IS 0.5" THICK AND IS PER ASTM A656 Gr 80 TYPE 7.
5. ULTIMATE HELIX MECHANICAL CAPACITY: (UNLESS FULL-SCALE LOAD TEST SHOWS OTHERWISE)
   6" THROUGH 12" DIAMATER = 70,000 LBS
   14" DIAMETER = 56,000 LBS
6. ALL WELDS ARE 0.25" FILLET MINIMUM WITH ER70S ELECTRODE.
7. ALL STEEL MATERIAL IS GALVANIZED PER ASTM A153, A123, OR B633 FE/ZN 5, TYPE III. (LATEST REVISION)
8. ULTIMATE AXIAL CAPACITY: 70,000 LBS. COMPRESSION, 60,000 LBS TENSION.

HELI-PILE®
IMR, Inc. - DENVER
5135 Ward Road, Wheat Ridge, Colorado, 80033 USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

SPECIFICATION SHEET

HPFT25
TUBULAR
HELICAL PILES

HPFT25.dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
JGM	JSP	06/30/16	1

Mechanical Capacity Calculations

HELI-PILE® HPFT25 (2 1/2 inch x ¼ inch wall) Tubular Steel Square Shaft Helical Pile

February 14, 2017

See the attached HELI-PILE® Specification Sheet Dwg. HPFT25, Rev. 1, dated 06/30/16. Shaft and coupler steel is ASTM A500 Grade B with minimum F_y = 60 ksi and F_u = 69 ksi by special order. Factory rated ultimate compression capacity = 70 kips, ultimate tension capacity = 60 kips.

Shaft Steel

The shaft is 2 1/2 inch tubular steel square with wall thickness = 0.220 in (after corrosion per ICC AC358, both sides). The area of this shaft, A_s = 1.86 in^2 (after corrosion per ICC AC358).
Ultimate shaft mechanical compression capacity = F_u A_s = 69 ksi x 1.86 in^2 = 128 kips
Ultimate shaft mechanical tension capacity is 60 kips due to bolt hole elongation determined by full-scale load testing.

Coupler Steel

The coupler is a 3 inch tubular square steel tube with wall thickness = 0.220 in., slightly swedged to fit over the 2 1/2 inch shaft. Coupler steel cross-sectional area = 2.30 in^2 (after corrosion per ICC AC358).
Ultimate coupler mechanical tension capacity = 69 ksi x 2.30 in^2 = 159 kips. Ultimate mechanical tension capacity = 60 kips due to bolt hole elongation determined by full-scale load testing.
Coupler is fillet welded to the shaft.
Weld to shaft is a minimum 0.25 inch fillet (throat = 0.164 inch after corrosion per ICC AC358) using an ER80S electrode (Fy = 80 ksi).
Ultimate weld tension capacity = 2.49 inch (after corrosion per ICC AC358) x 4 sides x 0.164 inch x 80 ksi = 131 kips. However, through full-scale tension testing, due to bolt hole elongation, it is determined that ultimate mechanical tension capacity should be 60 kips. Elongation does not occur in compression.

Bolt

Bolt is 0.75 inch diameter (0.724 inch after corrosion per ICC AC358, area = 0.412 in^2) per SAE J429 Gr 5 (Fy = 120 ksi), or equivalent, with threads outside the shear zone. The bolt is in double shear.
Ultimate bolt shear capacity = 0.412 in^2 x 120 ksi x 2 (double shear) = 98.9 kips

Helices

Each helix is welded top and bottom to the shaft with a minimum 0.25 inch fillet weld (throat = 0.164 inch after corrosion per ICC AC358) using an ER80S electrode. Each helix is ASTM A656 Gr 80 Type 7.
Ultimate weld tension capacity = 2.49 inch x 4 sides x 2 (top & bottom) x 0.164 inch x 80 ksi = 261 kips.
Helix Ultimate Shear: Shaft perimeter, 2.49 in., x 4 sides x 0.487 inch (after corrosion per ICC AC358), x 80 ksi steel = 388 kips

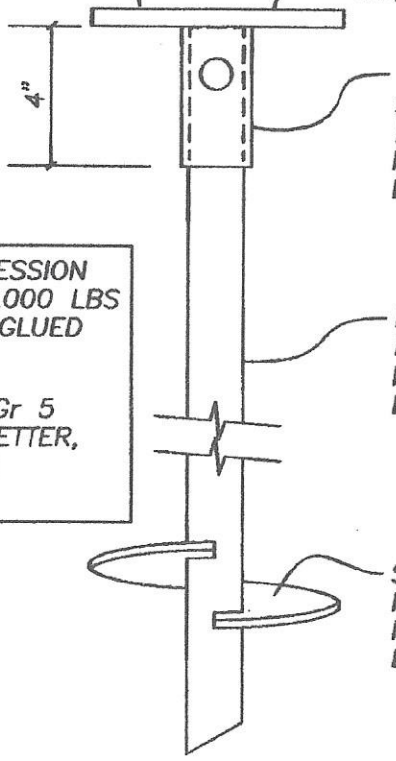
Conclusion

The HELI-PILE® HPFT25 (2 1/2 inch x ¼ inch wall) tubular steel square shaft helical pile has a rated ultimate mechanical compression capacity of 70 kips and an ultimate mechanical tension capacity of 60 kips.

2.5" TUBULAR HPT-25-PC

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
7/27/17

NEW CONSTRUCTION FLAT PLATE BRACKET FOR COMPRESSION APPLICATIONS FOR HELI-PILE® 2.5" TUBULAR HELICAL PILES.



6"x6"x1/2" A36 STEEL PLATE, WELD TO TOP OF BOX (1/4" FILLET).

3"x3"x1/4" A500 Gr B STEEL STRUCTURAL TUBE FASTENED TO TOP OF STEEL PIER SHAFT WITH WELD, BOLT OR EPOXY GLUE.

THE ULTILMATE MECHANICAL COMPRESSION CAPACITY OF THIS BRACKET IS 110,000 LBS WHEN BOLTED, WELDED OR EPOXY GLUED TO THE STEEL PIER SHAFT.

WHEN BOLTED WITH AN SAE J429 Gr 5 3/4" DIAMETER BOLT, EQUAL OR BETTER, THE ULTIMATE MECHANICAL TENSION CAPACITY IS 60,000 LBS.

HELI-PILE® 2.5" TUBULAR HELICAL PIER.
PIER DEPTH DEPENDS ON PIER LOAD AND SOIL CONDITIONS.

SINGLE OR MULTIPLE HELIX, NUMBER AND DIAMETER OF HELICES DEPENDS ON PIER LOAD AND SOIL CONDITIONS.

NEW CONSTRUCTION FLAT PLATE COMPRESSION BRACKET SQUARE COUPLER FOR HELI-PILE® 2.5" TUBULAR HELICAL PILE

NO SCALE

HELI-PILE®
IMR, Inc. – DENVER
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303-423-0591 Fax: 303-423-9155
www.helipile.com

SPECIFICATION SHEET	NEW CONSTRUCTION FLAT PLATE COMPRESSION BRKT.
	HPT-25-PC.DWG SHEET 1 OF 1

DRAWN BY:	CHECKED:	DATE:	REVISION:
JSP	RLJ	09/17/09	0

INTERNATIONAL MARKETING & RESEARCH, INC.

HPT-25-PC Flat Plate New Construction Load Transfer Bracket

Calculations
April 20, 2012

Given: Design compression load = 35 kips, design tension load = 30 kips
Determine adequacy of this bracket to take the loads.
See HELI-PILE® Drawing HPT-25-PC.DWG, Rev. 0, 9/17/09

Concrete compressive stress on 6 in x 6 in x ½ in thick A36 steel plate is 35 k / (6 in x 6 in) = 0.97 ksi. This stress should be adequate for most structural grade concrete (f_c'= 3 or 4 ksi). The flat plate is embedded in concrete.

Punching shear should be checked by concrete foundation designer.

Check plate bending assuming no support from concrete below the plate (worst case):

Corner sections use ½ load (0.97 ksi / 2 = 0.49 ksi) since corners are shared in x and y directions. Side section use full 0.97 ksi load.

Bending moment on 6 in x 6 in A36 steel plate:
The tributary area for bending on the plate is taken as the corners outside the limits of the 2.5 inch x 2.5 inch tube and the rectangular area within the limits of the tube. The moment arm is 1.75 in /2:

$\{(0.49 \text{ ksi} \times (1.75 \text{ in})^2 \times 2) + (0.97 \text{ ksi} \times 2.5 \text{ in} \times 1.75 \text{ in})\} \times (1.75 \text{ in} / 2)$
$= 6.3$ in-k

$S_{required} = M/f = 6.3 \text{ in-k} / (0.66 \times 36 \text{ ksi}) = 0.27 \text{ in}^3$
$S_{plate} = bd^2 / 6 = 6 \text{ in} \times (0.5 \text{ in})^2 / 6 = 0.25 \text{ in}^3 \approx 0.27 \text{ in}^3$ Ok

Since the entire bracket is embedded in concrete, the actual load transfer will most likely place less bending moment on the plate than calculated.

Therefore, the HPT-25-PC New Construction Bracket is adequate to take the full 35 kip design compression load. Using the same logic as presented above, this bracket is adequate for a 30 kip design tension load as well from a concrete point of view.

Regarding tension capacity, the weld of the plate to the tube is 2.5 in x 4 sides = 10 inches of weld. The weld is 0.25 in fillet (throat = 0.177 in) minimum E70 electrode. Capacity is 10 in x 0.177 in x 70 ksi x 0.4 = 50 kips > 35 kips

However, full-scale tension testing on this bracket shows the design capacity in tension should be 30 kips due to bolt hole elongation that occurs in tension loading. Bolt hole elongation does not occur in compression loading because the top of the pile bears directly under the 6 in x 6 in plate.

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7/27/17

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3 INCH SQUARE STRUCTURAL TUBE MATERIAL SPECIFICATIONS

HELICAL PIER FOUNDATION

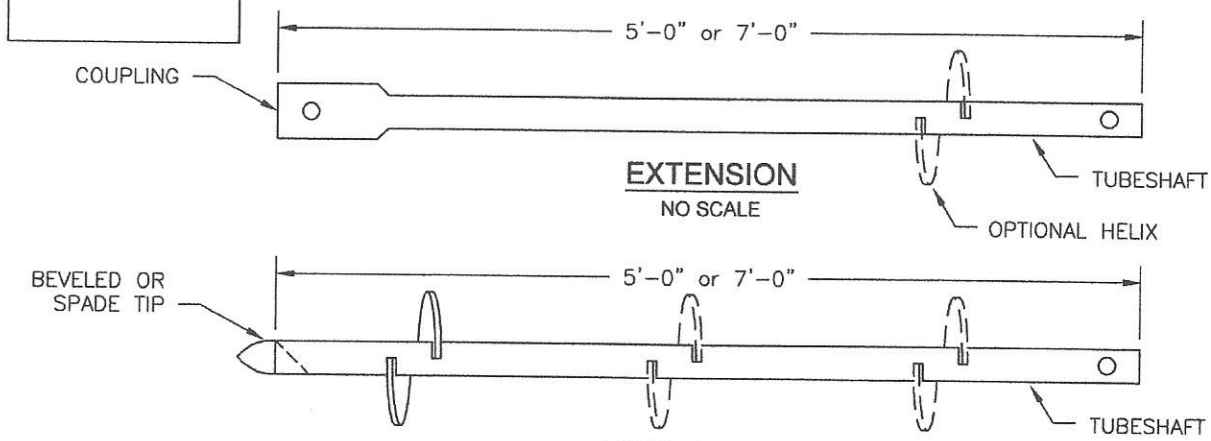
for

EDGE BUILDERS

on

NINEBARK CONDOS
COPPER CREST
EDEN, UTAH

HPFT



EXTENSION
NO SCALE

LEAD SECTION
SINGLE OR MULTIPLE HELIX
NO SCALE

NOTES:

1. THIS DRAWING COVERS 2" (1/4" WALL), 2.5" (1/4" WALL), 3" (1/4" WALL), 3" (5/16" WALL), 4" (1/4" WALL), 4" (3/8" WALL), AND 4" (1/2" WALL) TUBULAR HELICAL PILE MATERIAL MANUFACTURED BY IMR.
2. HPFT2: 2"x2" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.75" DIAMETER SAE J429 Gr 5 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 4,000 FT-LBS.
3. HPFT25: 2.5"x2.5" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.75" DIAMETER SAE J429 Gr 5 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 7,000 FT-LBS.
4. HPFT3: 3"x3" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.875" DIAMETER SAE J429 Gr 5 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 11,000 FT-LBS.
5. HPFT331: 3"x3" STRUCTURAL TUBING, 0.313" WALL THICKNESS. THE CONNECTION BOLT IS 0.875" DIAMETER ASTM A193 Gr B7 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 15,000 FT-LBS.
6. HPFT425: 4"x4" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 1.25" DIAMETER SAE J429 Gr 5 STEEL (Ft=105 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 20,000 FT-LBS.
7. HPFT438: 4"X4" STRUCTURAL TUBING, 0.375" WALL THICKNESS. THE CONNECTION BOLT IS 1.25" DIAMETER SAE J429 Gr 5 STEEL (Ft=105 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 30,000 FT-LBS.
8. HPFT4: 4"x4" STRUCTURAL TUBING, 0.5" WALL THICKNESS. THE CONNECTION BOLT IS 1.25" DIAMETER SAE J429 Gr 5 STEEL (Ft=105 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 30,000+ FT-LBS.
9. ALL STRUCTURAL TUBING IS PER ASTM A500 Gr B, FOR 2" TO 3" Fy=60 KSI Fu=69 KSI, 4" AND LARGER Fy=60 KSI Fu=70 KSI BY SPECIAL ORDER.
10. ALL HELIX MATERIAL IS 0.5" THICK AND IS PER ASTM A656 Gr 80 TYPE 7.
11. ULTIMATE HELIX MECHANICAL CAPACITY: (UNLESS FULL-SCALE LOAD TEST SHOWS OTHERWISE)
    6" THROUGH 12" DIAMATER = 70,000 LBS
    14" DIAMETER = 56,000 LBS
12. ALL WELDS ARE 0.25" FILLET MINIMUM WITH ER70S ELECTRODE.
13. ALL STEEL MATERIAL IS GALVANIZED PER ASTM A153, A123, OR B633 FE/ZN 5, TYPE III. (LATEST REVISION)
14. ULTIMATE AXIAL CAPACITY:

HPFT2:	40,000 LBS. COMPRESSION, 40,000 LBS TENSION.
HPFT25:	70,000 LBS. COMPRESSION, 60,000 LBS TENSION.
* HPFT3:	110,000 LBS. COMPRESSION, 62,000 LBS TENSION.
HPFT331:	150,000 LBS. COMPRESSION, 62,000 LBS TENSION.
HPFT425:	200,000 LBS. COMPRESSION, 65,000 LBS TENSION.
HPFT438:	300,000 LBS. COMPRESSION, 105,000 LBS TENSION.
HPFT4:	400,000 LBS. COMPRESSION, 105,000 LBS TENSION.

7/27/17

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH

HELI-PILE®

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SPECIFICATION SHEET

TUBULAR HELICAL PILES

HPFT.dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
RJV	JSP	02/04/16	17

Mechanical Capacity Calculations
HELI-PILE® HPFT3 (3 inch x ¼ inch wall) Tubular Steel Square Shaft Helical Pile
September 14, 2016

See the attached HELI-PILE® Specification Sheet Dwg. HPFT, Rev. 17, dated 02/04/16. Shaft and coupler steel is ASTM A500 Grade B with minimum F_y = 60 ksi and F_u = 69 ksi by special order. Factory rated ultimate compression capacity = 110 kips, ultimate tension capacity = 62 kips.

Shaft Steel
The shaft is 3 inch tubular steel square with wall thickness = 0.220 in (after corrosion per ICC AC358, both sides). The area of this shaft, A_s = 2.30 in^2 (after corrosion per ICC AC358).
Ultimate shaft mechanical compression capacity = F_y A_s (less bolt hole area)= 60 ksi x [2.30 in^2 –(2 x 1.0 in x 0.220 in)] = 112 kips > 110 kips

Ultimate shaft mechanical tension capacity is limited to 62 kips due to bolt hole elongation determined by full-scale load testing.

Coupler Steel
The coupler is a 3.5 inch tubular square steel tube with wall thickness = 0.220 in., slightly swedged to fit over the 3 inch shaft. Coupler steel cross-sectional area = 2.75 in^2 (after corrosion per ICC AC35).
Ultimate coupler mechanical tension capacity = 60 ksi x [2.75 in^2 –(2 x 1.0 in x0.220 in)] = 139 kips ok

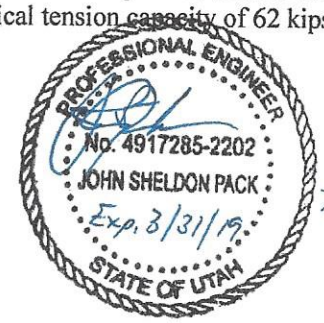
Coupler is fillet welded to the shaft.
Weld to shaft is a minimum 0.25 inch fillet (throat = 0.168 inch after corrosion per ICC AC358) using an ER80S electrode (Fy = 80 ksi).
Ultimate weld tension capacity = 2.99 inch (after corrosion per ICC AC358) x 4 sides x 0.168 inch x 80 ksi = 161 kips. However, through full-scale tension testing, due to bolt hole elongation, it is determined that ultimate mechanical tension capacity should be 62 kips. Elongation does not occur in compression.

Bolt
Bolt is 0.875 inch diameter (0.862 inch after corrosion per ICC AC358, area = 0.584 in^2) per SAE J429 Gr 5 (Ft = 120 ksi), or equivalent, with threads outside the shear zone. The bolt is in double shear.
0.584 in^2 x 120 ksi x 2 (double shear) = 140 kips Reduction = 62 kips / 140 kips = 44% ok

Helices
Each helix is welded top and bottom to the shaft with a minimum 0.25 inch fillet weld (throat = 0.168 inch after corrosion per ICC AC358) using an ER80S electrode. Each helix is ASTM A656 Gr 80 Type 7.
Ultimate weld tension capacity = 2.99 inch x 4 sides x 2 (top & bottom) x 0.168 inch x 80 ksi = 321 kips.

Helix Ultimate Shear: 2.99 in (shaft) x 4 sides x 0.487 inch (thickness after corrosion per ICC AC358) x 80 ksi steel x 0.4 = 186 kips > 110 kips

Conclusion
The HELI-PILE® HPFT3 (3 inch x ¼ inch wall) tubular steel square shaft helical pile has a rated ultimate mechanical compression capacity of 110 kips and an ultimate mechanical tension capacity of 62 kips.

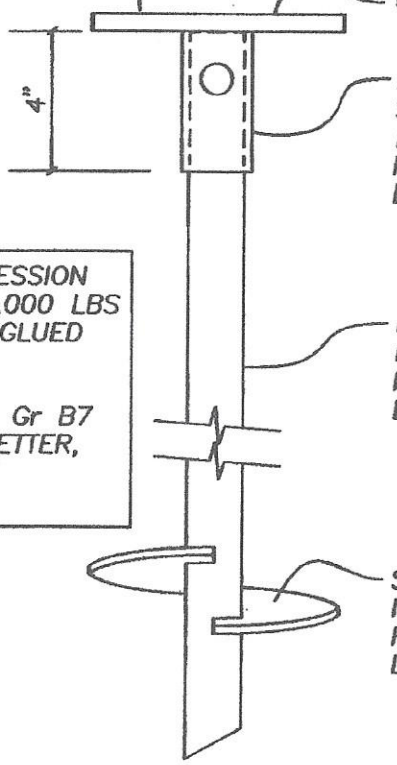


7/27/17

3" TUBULAR HPT-3-PC

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
7/27/17

NEW CONSTRUCTION FLAT PLATE BRACKET FOR COMPRESSION APPLICATIONS FOR IMR 3" TUBULAR HELICAL PILES.



6"x6"x1/2" A36 STEEL PLATE, WELD TO TOP OF BOX (1/4" FILLET).

3.5"x3.5"x3/16" A500 GrB STEEL STRUCTURAL TUBE FASTENED TO TOP OF STEEL PIER SHAFT WITH WELD, BOLT OR EPOXY GLUE.

THE ULTILMATE MECHANICAL COMPRESSION CAPACITY OF THIS BRACKET IS 110,000 LBS WHEN BOLTED, WELDED OR EPOXY GLUED TO THE STEEL PIER SHAFT.

WHEN BOLTED WITH AN ASTM A193 Gr B7 7/8" DIAMETER BOLT, EQUAL OR BETTER, THE ULTIMATE MECHANICAL TENSION CAPACITY IS 50,000 LBS.

NEW IMR 3" TUBULAR HELICAL PIER.
PIER DEPTH DEPENDS ON PIER LOAD AND SOIL CONDITIONS.

SINGLE OR MULTIPLE HELIX, NUMBER AND DIAMETER OF HELICES DEPENDS ON PIER LOAD AND SOIL CONDITIONS.

NEW CONSTRUCTION FLAT PLATE COMPRESSION BRACKET SQUARE COUPLER – FOR IMR 3" TUBULAR HELICAL PILE

NO SCALE

HELI-PILE®
IMR, Inc. – DENVER
5135 Ward Road, Wheat Ridge, Colorado, USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

SPECIFICATION SHEET	NEW CONSTRUCTION FLAT PLATE COMPRESSION BRKT.	
	HPT-3-PC.DWG	SHEET 1 OF 1

DRAWN BY:	CHECKED:	DATE:	REVISION:
JSP	RLJ	08/24/09	0

INTERNATIONAL MARKETING & RESEARCH, INC.

PROFESSIONAL ENGINEER
No. 4917285-2202
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STATE OF UTAH
7/27/17

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HPT-3-PC Flat Plate New Construction Load Transfer Bracket
Calculations
March 16, 2011

Given: Design compression load = 55 kips, design tension load = 25 kips
Determine adequacy of this bracket to take the loads.
See HELI-PILE® Drawing HPT-3-PC.DWG, Rev. 0, 8/24/09

Concrete compressive stress on 6 in x 6 in x ½ in thick A36 steel plate is 55 k / (6 in x 6 in) = 1.53 ksi. This stress should be adequate for most structural grade concrete (f_c' = 3 or 4 ksi). The flat plate is embedded in concrete.

Punching shear should be checked by concrete foundation designer.

Check plate bending assuming no support from concrete below the plate (worst case):

Corner sections use ½ load (1.53 ksi / 2 = 0.765 ksi) since corners are shared in x and y directions. Side section use full 1.53 ksi load.

Bending moment on 6 in x 6 in A36 steel plate:
The tributary area for bending on the plate is taken as the corners outside the limits of the 3.5 inch x 3.5 inch tube and the rectangular area within the limits of the tube. The moment arm is 1.25 in /2:

$\{(0.765 \text{ ksi} \times (1.25 \text{ in})^2 \times 2) + (1.53 \text{ ksi} \times 3.5 \text{ in} \times 1.25 \text{ in})\} \times (1.25 \text{ in} / 2)$
$= 5.68$ in-k

$S_{required} = M/f = 5.68 \text{ in-k} / (0.66 \times 36 \text{ ksi}) = 0.239 \text{ in}^3$
$S_{plate} = bd^2 / 6 = 6 \text{ in} \times (0.5 \text{ in})^2 / 6 = 0.25 \text{ in}^3 > 0.239 \text{ in}^3$ Ok

Since the entire bracket is embedded in concrete, the actual load transfer will most likely place less bending moment on the plate than calculated.

Therefore, the HPT-3-PC New Construction Bracket is adequate to take the full 55 kip design compression load. Using the same logic as presented above, this bracket is adequate for a 55 kip design tension load as well from a concrete point of view.

The weld of the plate to the tube is 3.5 in x 4 sides = 14 inches of weld. The weld is 0.25 in fillet (throat = 0.177 in) minimum E70 electrode. Capacity is 14 in x 0.177 in x 70 ksi x 0.4 = 69.4 kips > 55 kips Ok

On 6/13/08 this bracket was mechanically tested in tension. It was found that the *ultimate* mechanical tension capacity is 50 kips for a deflection of about ½ inch. Hence, using a safety factor of 2, the maximum design capacity is 25 kips. At 25 kips the deflection was 0.056 inch.

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3 INCH SQUARE STRUCTURAL TUBE – 5/16 INCH WALL MATERIAL SPECIFICATIONS

HELICAL PIER FOUNDATION

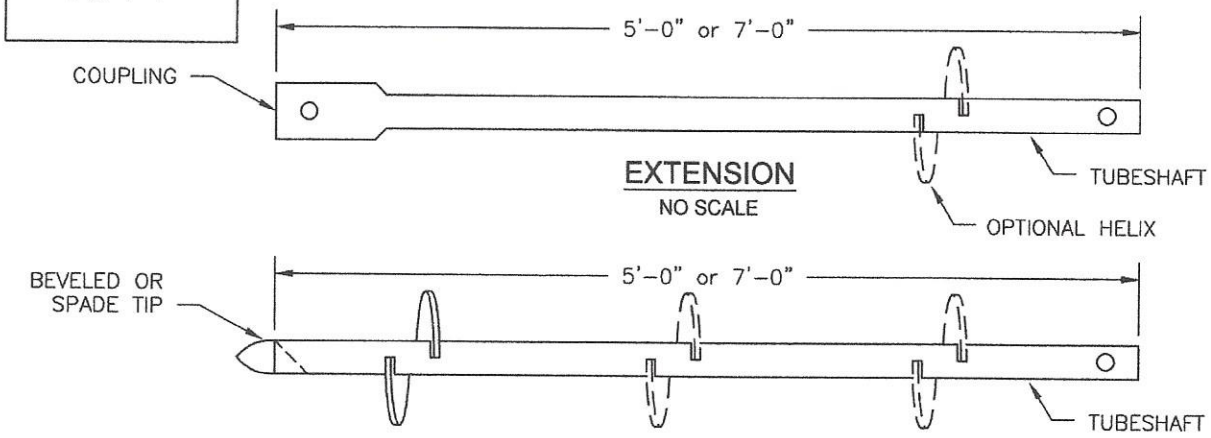
for

EDGE BUILDERS

on

NINEBARK CONDOS
COPPER CREST
EDEN, UTAH

HPFT



EXTENSION
NO SCALE

LEAD SECTION
SINGLE OR MULTIPLE HELIX
NO SCALE

NOTES:

1. THIS DRAWING COVERS 2" (1/4" WALL), 2.5" (1/4" WALL), 3" (1/4" WALL), 3" (5/16" WALL), 4" (1/4" WALL), 4" (3/8" WALL), AND 4" (1/2" WALL) TUBULAR HELICAL PILE MATERIAL MANUFACTURED BY IMR.
2. HPFT2: 2"x2" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.75" DIAMETER SAE J429 Gr 5 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 4,000 FT-LBS.
3. HPFT25: 2.5"x2.5" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.75" DIAMETER SAE J429 Gr 5 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 7,000 FT-LBS.
4. HPFT3: 3"x3" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.875" DIAMETER SAE J429 Gr 5 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 11,000 FT-LBS.
5. HPFT331: 3"x3" STRUCTURAL TUBING, 0.313" WALL THICKNESS. THE CONNECTION BOLT IS 0.875" DIAMETER ASTM A193 Gr B7 STEEL (Ft=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 15,000 FT-LBS.
6. HPFT425: 4"x4" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 1.25" DIAMETER SAE J429 Gr 5 STEEL (Ft=105 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 20,000 FT-LBS.
7. HPFT438: 4"X4" STRUCTURAL TUBING, 0.375" WALL THICKNESS. THE CONNECTION BOLT IS 1.25" DIAMETER SAE J429 Gr 5 STEEL (Ft=105 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 30,000 FT-LBS.
8. HPFT4: 4"x4" STRUCTURAL TUBING, 0.5" WALL THICKNESS. THE CONNECTION BOLT IS 1.25" DIAMETER SAE J429 Gr 5 STEEL (Ft=105 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 30,000+ FT-LBS.
9. ALL STRUCTURAL TUBING IS PER ASTM A500 Gr B, FOR 2" TO 3" Fy=60 KSI Fu=69 KSI, 4" AND LARGER Fy=60 KSI Fu=70 KSI BY SPECIAL ORDER.
10. ALL HELIX MATERIAL IS 0.5" THICK AND IS PER ASTM A656 Gr 80 TYPE 7.
11. ULTIMATE HELIX MECHANICAL CAPACITY: (UNLESS FULL-SCALE LOAD TEST SHOWS OTHERWISE)
    6" THROUGH 12" DIAMATER = 70,000 LBS
    14" DIAMETER = 56,000 LBS
12. ALL WELDS ARE 0.25" FILLET MINIMUM WITH ER70S ELECTRODE.
13. ALL STEEL MATERIAL IS GALVANIZED PER ASTM A153, A123, OR B633 FE/ZN 5, TYPE III. (LATEST REVISION)
14. ULTIMATE AXIAL CAPACITY:

HPFT2:	40,000 LBS. COMPRESSION, 40,000 LBS TENSION.
HPFT25:	70,000 LBS. COMPRESSION, 60,000 LBS TENSION.
HPFT3:	110,000 LBS. COMPRESSION, 62,000 LBS TENSION.
HPFT331:	150,000 LBS. COMPRESSION, 62,000 LBS TENSION.
HPFT425:	200,000 LBS. COMPRESSION, 65,000 LBS TENSION.
HPFT438:	300,000 LBS. COMPRESSION, 105,000 LBS TENSION.
HPFT4:	400,000 LBS. COMPRESSION, 105,000 LBS TENSION.

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
7/27/17

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www.helipile.com

SPECIFICATION SHEET

TUBULAR HELICAL PILES

HPFT.dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
RJV	JSP	02/04/16	17

Mechanical Capacity Calculations

HELI-PILE® HPFT331 (3 inch x 5/16 inch wall) Tubular Steel Square Shaft Helical Pile

February 5, 2016

See the attached HELI-PILE® Specification Sheet Dwg. HPFT, Rev. 17, dated 02/04/16. Shaft and coupler steel is ASTM A500 Grade B with minimum F_y = 60 ksi and F_u = 69 ksi by special order. Factory rated ultimate compression capacity = 150 kips, ultimate tension capacity = 62 kips.

Shaft Steel

The shaft is 3 inch tubular steel square with wall thickness = 0.278 in (after corrosion per ICC AC358, both sides). The area of this shaft, A_s = 2.81 in^2 (after corrosion per ICC AC358).
Ultimate shaft mechanical compression capacity = F_u A_s = 69 ksi x 2.81 in^2 = 194 kips
Ultimate shaft mechanical tension capacity is 62 kips due to bolt hole elongation determined by full-scale load testing.

Coupler Steel

The coupler is a 4 inch tubular square steel tube with wall thickness = 0.452 in., slightly swedged to fit over the 3 inch shaft. Coupler steel cross-sectional area = 5.85 in^2 (after corrosion per ICC AC358).
Ultimate coupler mechanical tension capacity = 69 ksi x 5.85 in^2 = 404 kips

Coupler is fillet welded to the shaft.
Weld to shaft is a minimum 0.25 inch fillet (throat = 0.164 inch after corrosion per ICC AC358) using an ER80S electrode (Fy = 80 ksi).
Ultimate weld tension capacity = 2.99 inch (after corrosion per ICC AC358) x 4 sides x 0.164 inch x 80 ksi = 157 kips. However, through full-scale tension testing, due to bolt hole elongation, it is determined that ultimate mechanical tension capacity should be 62 kips. Elongation does not occur in compression.

Bolt

Bolt is 0.875 inch diameter (0.849 inch after corrosion per ICC AC358, area = 0.566 sq. in.) per SAE J429 Gr 5 (Fy = 120 ksi), or equivalent, with threads outside the shear zone. The bolt is in double shear.
Ultimate bolt shear capacity = 0.566 in^2 x 120 ksi x 2 (double shear) = 136 kips. This is adequate for tension. Because shafts abut against each other, the bolt is never loaded in compression.

Helices

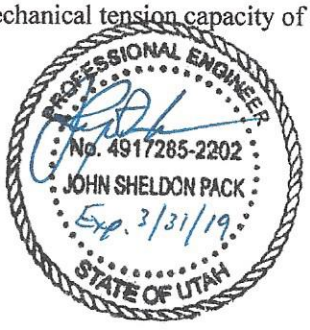
Each helix is welded top and bottom to the shaft with a minimum 0.25 inch fillet weld (throat = 0.164 inch after corrosion per ICC AC358) using an ER80S electrode. Each helix is ASTM A656 Gr 80 Type 7.
Ultimate weld tension capacity = 2.99 inch x 4 sides x 2 (top & bottom) x 0.164 inch x 80 ksi = 314 kips.

Helix Ultimate Shear: Shaft perimeter, 2.99 in., x 4 sides x 0.487 inch (after corrosion per ICC AC358), x 80 ksi steel = 466 kips

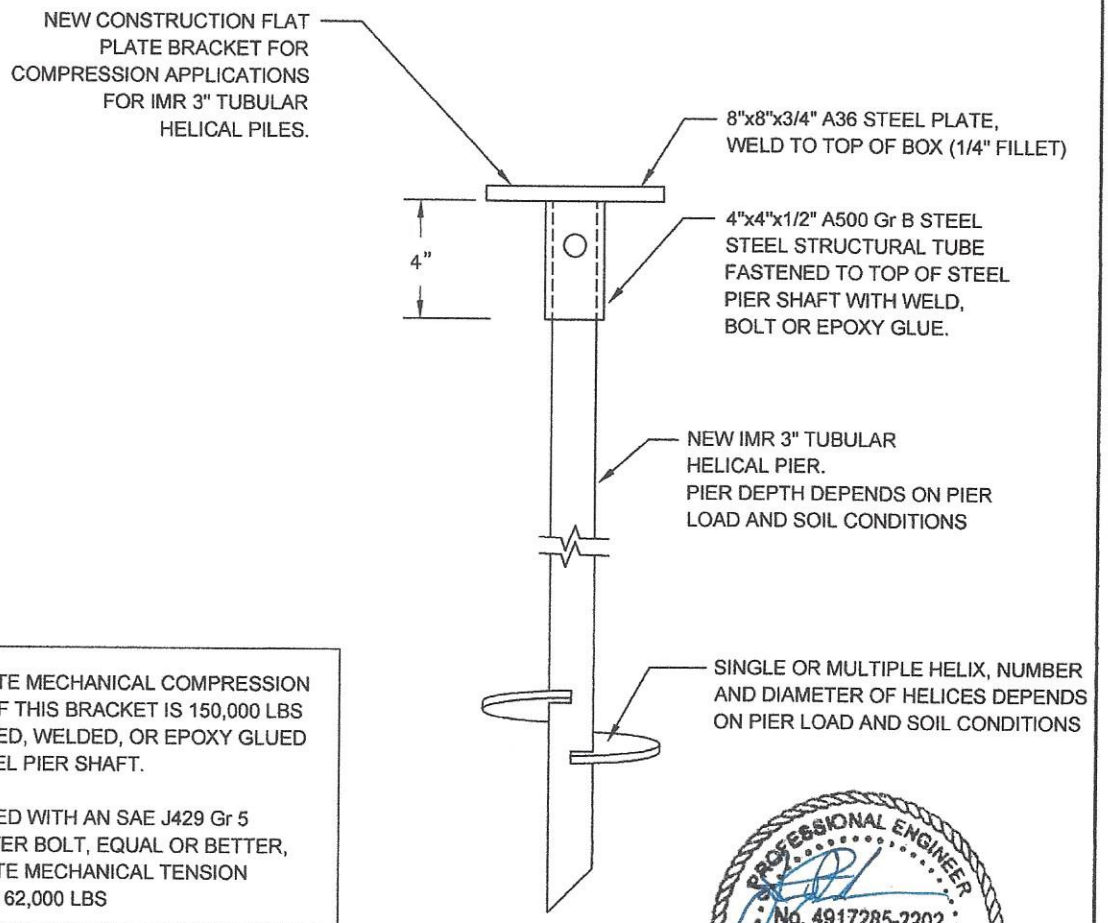
Conclusion

The HELI-PILE® HPFT331 (3 inch x 5/16 inch wall) tubular steel square shaft helical pile has a rated ultimate mechanical compression capacity of 150 kips and an ultimate mechanical tension capacity of 62 kips.

7/27/17



3" TUBULAR
HPT-331-PC (8S)



THE ULTIMATE MECHANICAL COMPRESSION CAPACITY OF THIS BRACKET IS 150,000 LBS WHEN BOLTED, WELDED, OR EPOXY GLUED TO THE STEEL PIER SHAFT.

WHEN BOLTED WITH AN SAE J429 Gr 5 1.25" DIAMETER BOLT, EQUAL OR BETTER, THE ULTIMATE MECHANICAL TENSION CAPACITY IS 62,000 LBS

PROFESSIONAL ENGINEER
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JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
7/27/17

NEW CONSTRUCTION FLAT PLATE COMPRESSION BRACKET - SQUARE COUPLER FOR HELI-PILE® 3" TUBULAR HELICAL PILE

NO SCALE

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303-423-0591 Fax: 303-423-9155
www.helipile.com

SPECIFICATION SHEET

NEW CONSTRUCTION FLAT PLATE COMPRESSION BRACKET

HPT-331-PC-(8S).dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
FR	JSP	03/02/16	0

HPT-331-PC (8S) Flat Plate New Construction Load Transfer Bracket
Calculations
April 12, 2017

Given: Design compression load = 75 kips, design tension load = 31 kips
Determine adequacy of this bracket to take the loads.
See HELI-PILE® Drawing HPT-331-PC (8S).DWG, Rev. 0, 03/02/16 attached.

Concrete compressive stress on 8 in x 8 in x 3/4 in thick A36 steel plate is 75 k / (8 in x 8 in) = 1.2 ksi. This stress should be adequate for most structural grade concrete (f_c'= 3 ksi or 4 ksi). The flat plate is embedded in concrete.

Punching shear should be checked by concrete foundation designer.

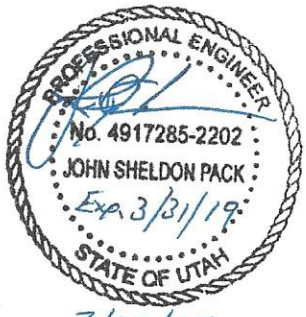
Check plate bending assuming no support from concrete below the plate (worst case):

Corner sections use ½ load (1.2 ksi / 2 = 0.6 ksi) since corners are shared in x and y directions. Side section use full 1.2 ksi load.

Bending moment on 8 in x 8 in A36 steel plate:
The tributary area for bending on the plate is taken as the corners outside the limits of the 4 inch x 4 inch coupler and the rectangular area within the limits of the tube. The moment arm is 2 in /2:

$\{(0.6 \text{ ksi} \times (2 \text{ in})^2 \times 2) + (1.2 \text{ ksi} \times 4 \text{ in} \times 2 \text{ in})\} \times (2 \text{ in} / 2)$
$= 14.4$ in-k

$S_{required} = M/f = 14.4 \text{ in-k} / (0.66 \times 36 \text{ ksi}) = 0.61 \text{ in}^3$
$S_{plate} = bd^2 / 6 = 8 \text{ in} \times (0.75 \text{ in})^2 / 6 = 0.75 \text{ in}^3 > 0.61 \text{ in}^3$ Ok



7/27/17

Therefore, the HPT-331-PC (8S) New Construction Bracket is adequate to take the full 75 kip design compression load.
Using the same logic as presented above, this bracket is adequate for a 31 kip design tension load as well from a concrete point of view.

Regarding tension capacity, the weld of the plate to the tube is 3 in x 4 sides = 12 inches of weld. The weld is 0.25 in fillet (throat = 0.177 in) minimum E70 electrode. Capacity is 12 in x 0.177 in x 70 ksi x 0.4 = 59 kips > 31 kips

The bolt is 7/8" F_y = 120 ksi in double shear. Capacity = $\pi(0.875")^2/4)$x2x0.4x120ksi = 58k > 31k

Full-scale tension testing on this bracket shows the design capacity in tension should be 31 kips due to bolt hole elongation that occurs in tension loading. Bolt hole elongation does not occur in compression loading because the top of the pile bears directly under the 8 in x 8 in plate. The bolt is not sheared in compression loading because the pile shaft takes all tension load.

Intermountain HelicalPiers
"Trusted Foundation Solutions"

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1.75 INCH SQUARE SOLID BAR MATERIAL SPECIFICATIONS

HELICAL PIER FOUNDATION

for

EDGE BUILDERS

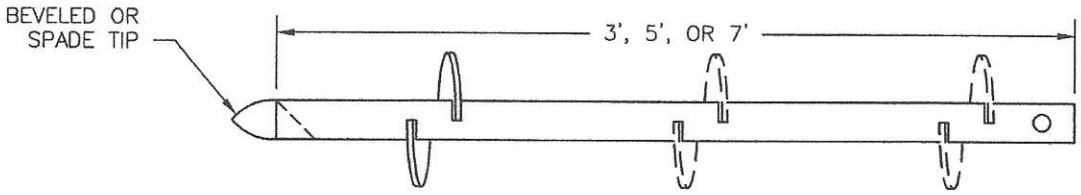
on

NINEBARK CONDOS
COPPER CREST
EDEN, UTAH

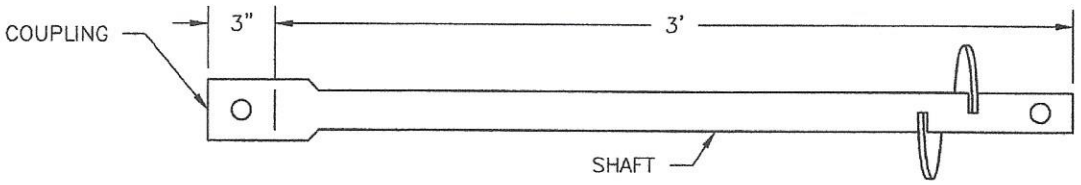
HPC-17

1.75" HELI-PILE® CONVENTIONAL HELICAL PILE

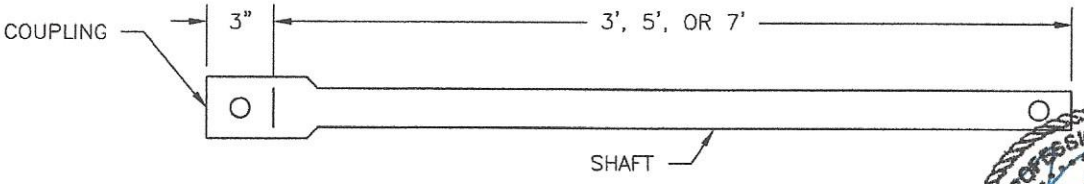
CATALOG NUMBERS BEGINNING WITH HPCL-17 AND HPCE-17
(EXTRA HIGH STRENGTH SHAFT STEEL, Fy=90 KSI)



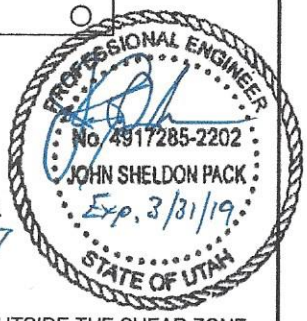
LEAD SECTION
SINGLE OR MULTIPLE HELIX
NO SCALE



HELIX EXTENSION
NO SCALE



PLAIN EXTENSION
NO SCALE



7/27/17

1. THIS DRAWING COVERS 1.75" HELI-PILE® SOLID ROUND CORNER SQUARE SHAFT HELICAL PILES. (CATALOG NUMBERS BEGINNING WITH HPCL-17 & HPCE-17)
2. SOLID ROUND CORNER SQUARE SHAFT MATERIAL IS PER ASTM A29 OR AISI 1530, Fy=90 KSI
3. ALL HELIX MATERIAL IS 0.5" THICK AND IS PER ASTM A656 Gr 80 TYPE 7 (Fy=80 KSI).
4. CONNECTION BOLTS ARE 0.875" DIAMETER A193 GRADE B7 (Ft = 120 KSI), 3.5" LONG, THREADS OUTSIDE THE SHEAR ZONE.
5. WELDS ARE 0.375" MIN FILLET FOR COUPLER, 0.25" MIN FOR HELICES (T&B), ER80S (80KSI) ELECTRODE.
6. ALL STEEL IS GALVANIZED PER ASTM A153, A123, OR B633 FE/ZN 5, TYPE III (LATEST REVISION).
7. ULTIMATE AXIAL MECHANICAL CAPACITY IS 110,000 LBS, TENSION OR COMPRESSION.
8. ULTIMATE SHAFT TORQUE CAPACITY IS 11,000 FT-LBS.
9. ULTIMATE HELIX MECHANICAL CAPACITY: 6"-12" DIAMETER = 70,000 LBS, 14" DIAMETER = 56,000 LBS
10. COUPLER STEEL 3.25" OD, 0.438" WALL DOM PIPE PER ASTM A513 Gr 1026 (Fy = 45 KSI) COLD FORGED SQUARE

HELI-PILE®
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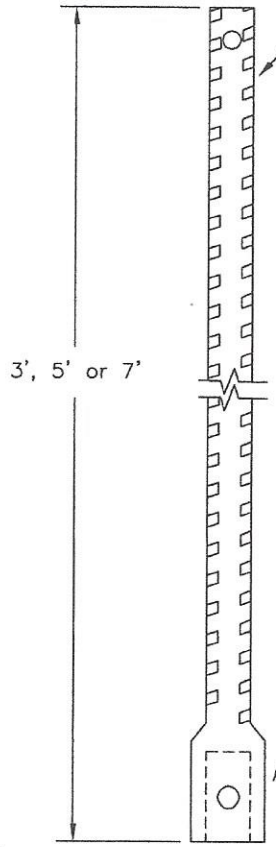
SPECIFICATION SHEET

1.75" CONVENTIONAL EXTRA HIGH STRENGTH HELICAL PILES

HPC-17.DWG SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
RJV	JSP	02/05/15	7

HP-15X & HP-17



THREADED HELI-PILE® TERMINATION,
1.5 INCH SQUARE SOLID BAR,
90 KSI STEEL, ASTM A29
GALZANIZED PER ASTM B633-85
FE/ZN 5, TYPE III, APPLIED BY
AN ISO 9000 COMPANY.
RATED MECHANICAL AXIAL CAPACITY:
70 KIPS COMPRESSION
70 KIPS TENSION

OR

* THREADED HELI-PILE® TERMINATION,
1.75 INCH SQUARE SOLID BAR,
90 KSI STEEL, ASTM A29
GALZANIZED PER ASTM B633-85
FE/ZN 5, TYPE III, APPLIED BY
AN ISO 9000 COMPANY.
RATED MECHANICAL AXIAL CAPACITY:
110 KIPS COMPRESSION
110 KIPS TENSION

COUPLER BOX, BOLT TO
1.5 INCH SQUARE HELICAL PIER
SHAFT W/ 0.75 INCH DIA. BOLT
PER SAE J429 Gr 5

OR

* COUPLER BOX, BOLT TO
1.75 INCH SQUARE HELICAL PIER
SHAFT W/ 0.875 INCH DIA. BOLT
PER ASTM A193 Gr B7

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
7/27/17

TERMINATION, HP-15X & HP-17

NO SCALE

* HELI-PILE® TERMINATIONS ARE COMPATIBLE WITH ALL CONVENTIONAL HELICAL PILE MATERIAL.

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SPECIFICATION SHEET

HELI-PILE® TERMINATION FOR 1.5 INCH AND 1.75 INCH HELICAL PILES

HP-15X-17.DWG SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
RJV	JSP	11/8/11	1

Mechanical Capacity Calculations
HELI-PILE® HPC-17 and HP-17 Modular (1.75 inch) Solid Steel Square Bar Helical Pile
April 18, 2017

See the attached HELI-PILE® Specification Sheet Dwg. HPC-17, Rev. 7, dated 02/05/15. This drawing applies equally to the HP-17 modular because structural properties are identical. These calculations account for 50 years corrosion per ICC AC358-13 Sec. 3.9 (0.5 x 0.013 inch = 0.0065 inch metal reduction all around the shaft). Factory rated ultimate mechanical compression and tension capacity = 110 kips

Shaft Steel
The shaft is a nominal 1.75 inch round corner square solid steel bar with Fy = 90 ksi. The gross area of this bar is 2.96 in^2.
Ultimate shaft compression and tension capacity = 2.96 in^2 x 90 ksi = 266 kips > 110 kips

Coupler Steel
The coupler is a 3.235 inch OD 0.423 inch wall thickness DOM pipe per ASTM A513/5 Gr 1026 (Fy = 45 ksi) cold forged to the square shape. Coupler steel cross-sectional area = 3.74 in^2 less the bolt hole area = 3.74 in^2 – (2 x 1.0 in x 0.423 in.) = 2.89 in^2
Tension loading puts all loading on the bolt and coupler. Compression loading is shaft end to shaft end. Therefore, tension loading on the coupler steel and bolt is worst case.
Ultimate coupler tension capacity = 2.89 sq. in. x 45 ksi = 130 kips > 110 kips

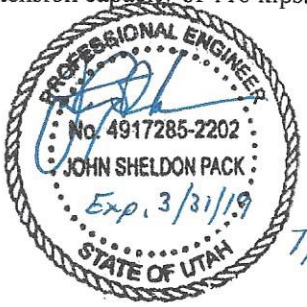
Coupler is fillet welded to the shaft.
Weld to shaft is a minimum 0.360 inch fillet (throat = 0.255 inch) using an ER80S electrode (Fy = 80 ksi).
Ultimate weld tension capacity = 1.74 inch x 4 sides x 0.255 inch x 80 ksi = 142 kips > 110 kips

Bolt
Bolt is 0.875 inch diameter (area = 0.566 in^2 after corrosion) per ASTM A449 (Fy = 105 ksi) with threads outside the shear zone. The bolt is in double shear.
Ultimate bolt shear capacity = 0.566 in^2 x 105 ksi x 2 (double shear) = 119 kips > 110 kips

Helices
Each helix is welded top and bottom to the shaft with a minimum 0.235 inch fillet weld (throat = 0.153 inch after corrosion) using an ER80S electrode.
Ultimate weld tension capacity = 1.74 inch x 4 sides x 2 (top & bottom) x 0.153 inch x 80 ksi = 170 kips > 110 kips

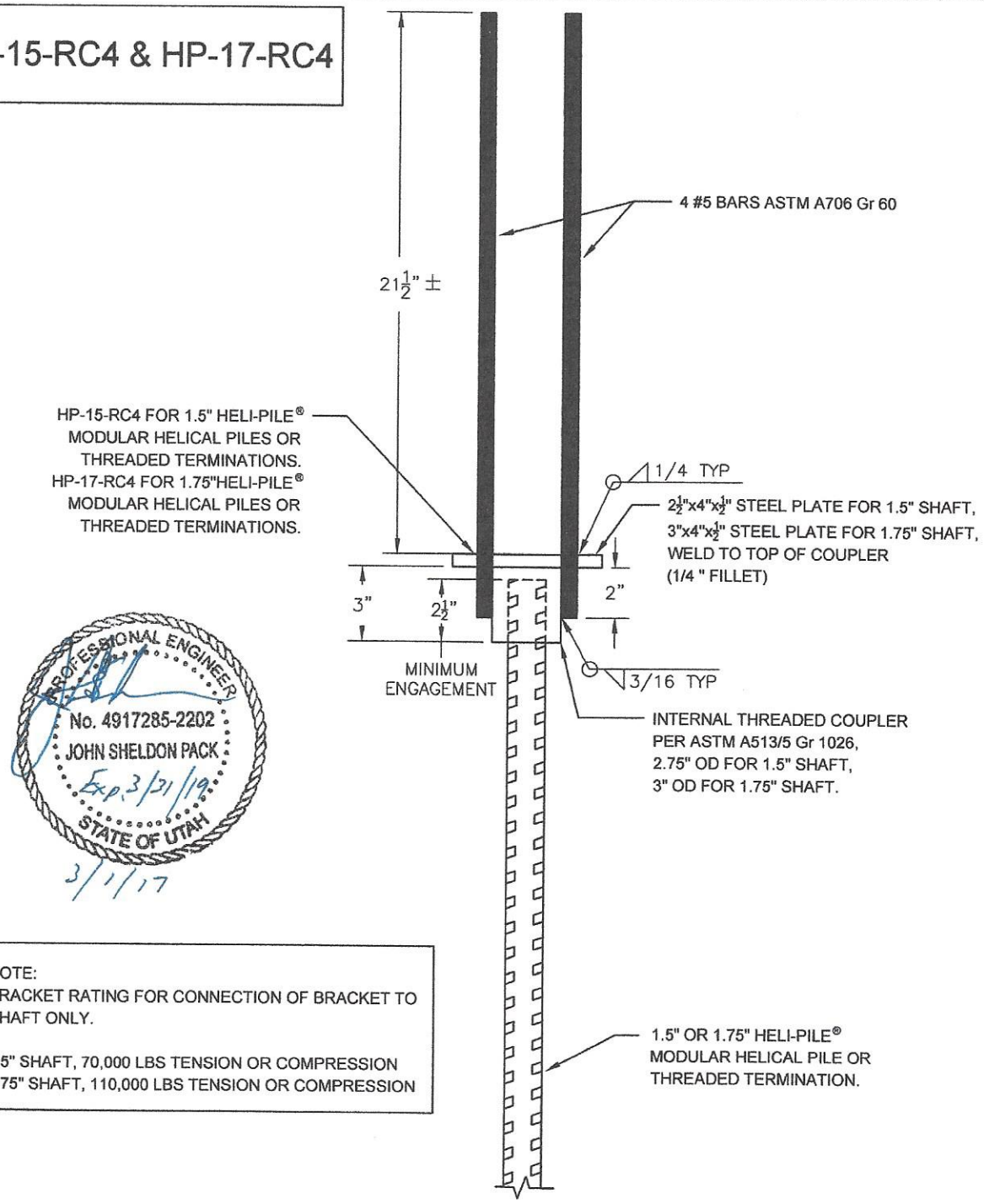
Helix Shear: use shaft perimeter, 1.74 in x 4 sides x thickness, 0.487 in, x 80 ksi = 271 kips > 110 kips

Conclusion
The HELI-PILE® HPC-17 and HP-17 modular (1.75 inch) solid steel square bar helical pile exceeds the factory rated ultimate mechanical compression and tension capacity of 110 kips.



7/27/17

HP-15-RC4 & HP-17-RC4



PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
3/1/17

NOTE:
BRACKET RATING FOR CONNECTION OF BRACKET TO SHAFT ONLY.

1.5" SHAFT, 70,000 LBS TENSION OR COMPRESSION
1.75" SHAFT, 110,000 LBS TENSION OR COMPRESSION

NEW CONSTRUCTION COMPRESSION BRACKET, HP-15-RC4 & HP-17-RC4

NO SCALE

HELI-PILE®
IMR, Inc. - DENVER
5135 Ward Road, Wheat Ridge, Colorado, 80033 USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

SPECIFICATION SHEET

HP-15-RC4 AND HP-17-RC4 LOAD TRANSFER BRACKET

HP-15-17-RC4.DWG SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
JGM	JSP	09/30/14	1

INTERNATIONAL MARKETING & RESEARCH, INC.

Mechanical Capacity Calculations
HP-17-RC4 4-bar New Construction Bracket for 1.75" Modular Shaft
September 30, 2014

Please see the attached HELI-PILE® Drawing HP-15-17-RC4.DWG Rev. 1 dated 09/30/14.

These calculations are for the connection of the bracket to the threaded shaft only. Due to concrete strength variability, the analysis of this bracket embedded in concrete is beyond the scope of these calculations.

These calculations are for the tension case which is worst case. In compression load transfer is directly to the shaft via the plate and coupler, no welded connections are involved.

Capacity of Internal Threaded Coupler Engaged in Threaded Shaft
Coupler has been tested to 110 kips tension or compression load transfer with 2.5 inches of thread engagement. Axial deflection at 110,400 lbs was 0.150 inch.

Capacity of 3" x 4" x 1/2" steel plate welded to the coupler
Plate weld direct to coupler:
Use 7 total inches of ¼" fillet weld across plate, both sides of coupler.
For ¼" fillet weld (0.177 inch throat)
Use 70 ksi welds.
7 inch x 0.177 inch x 70 ksi = 86.7 kips

4 #5 bars Gr 60 ASTM A706 welded between plate and coupler:
4 bars x 0.31 sq. in/bar x 60 ksi = 74.4.2 kips

Total tension capacity = 86.7 kips + 74.4 kips = 161 kips > 110 kips OK

Check Weld of 4 #5 bars to sides of ½" thick plate:
Welds are ½" long, 3/16" fillet (0.133 inch throat) welds on each side of bar.
4 bars x 2 welds /bar x 0.133 inch x 70 ksi = 74.4 kips OK

Conclusion: The HP-17-RC4 4-bar New Construction Bracket is has a maximum ultimate mechanical compression or tension capacity that exceeds 110,000 lbs.

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
Exp. 3/31/19
STATE OF UTAH
3/1/17

5135 Ward Road
Wheat Ridge, CO 80033
Phone: (303) 423-0591
Fax: (303) 423-9155

Intermountain HelicalPiers
"Trusted Foundation Solutions"

14712 So. Heritage Crest Way
Bluffdale, UT 84065
p: 801-495-1830
f: 801-495-1833

IHPC Documents Submittal

EDGE BUILDERS
NINEBARK
5474 COPPER CREST
EDEN, UTAH 84310

DATE: 07/25/2017

INCLUDED DOCUMENTS
Cover Letter
State of Utah Active License
Company Information
Compliance Sheet for HELI-PILE HPFT-3
ICC Evaluation Reports
HPFT3 Specification Sheet
HPFT331 Specification Sheet
Mechanical Capacity Calculations
HPT-331-PC Transfer Bracket
HPT-331-PC(8S) 3" Tubular Specification Sheet
HPT-RCT 3" Tubular Specification Sheet
New Structural Slab Construction Detail
New Foundation Construction Detail

Intermountain HelicalPiers
"Trusted Foundation Solutions"

14712 So. Heritage Crest Way
Bluffdale, UT 84065
p: 801-495-1830
f: 801-495-1833

July 25, 2017

Jeff Morton, P.E., S.E.
AEUrbia/JM Williams and Associates
2875 South Decker Lake Dr. Suite 275
Salt Lake City, Utah 84119

Dear Mr. Morton:

Thank you for the opportunity to work with and assist regarding the goals and requirements associated within this project. Due to the nature and scope of work coupled within and as per your documents requests, I have detailed your enquiries throughout this information packet. Please note that ISO 9001:2008 certification is handled through the manufacturer I.M.R. (International Marketing Research) consisting of the Heli-Pile brand. Below is the contact information of their vice president of engineering:

John S. Pack, P.E.
Vice President - Engineering
International Marketing & Research, Inc.,
HELI-PILE®
Helical Piles and Anchors
5135 Ward Road, Wheat Ridge, Colorado 80033 [suburb of Denver]
Office: 303-423-0591 Fax: 303-423-9155
Mobile: 303-478-2586 Email: jpack@helipile.com
Web: www.helipile.com

Should the need for further questions and concerns arise, please contact John for a detailed discussion on I.M.R's products.

Please feel free to get in touch with me should any questions or concerns occur.

Sincerely,

Dan Dalton
Estimator/Project Manager
Cell: 803.556.9692
dan@intermountainhelicalpier.com

STATE OF UTAH
DEPARTMENT OF COMMERCE
ACTIVE LICENSE

Intermountain Helical-Piers Corp.
14712 S Heritage Way
Bluffdale UT 84065

EFFECTIVE 08/01/2001
EXPIRATION 11/30/2017

REFERENCE NUMBER(S), CLASSIFICATION(S) & DETAIL(S)
349614-5551 Contractor Without LRF
S480

DBAs:
None Associated

IMPORTANT LICENSURE REMINDERS:

- Your license is valid until the expiration date listed on this form.
- Please note the address listed below. This is your public address of record for the division, and all future correspondence from the division will be mailed to this address. If you move, it is your responsibility to notify us directly of the change. Maintaining your current address with us is the easiest way to ensure continuous licensure.
- This license has been issued to the business entity. Any change in the license's original entity structure requires a new license (i.e. DBA to a Corporation, etc.). Please contact the division before you make such changes.

INTERMOUNTAIN HELICAL-PIERS CORP.
14712 S HERITAGE WAY
BLUFFDALE UT 84065

Please visit our web site at www.dopl.utah.gov should you have any questions in the future.

STATE OF UTAH
DEPARTMENT OF COMMERCE
DIVISION OF OCCUPATIONAL & PROFESSIONAL LICENSING

ACTIVE LICENSE

EFFECTIVE DATE: 08/01/2001

EXPIRATION DATE: 11/30/2017

ISSUED TO: **Intermountain Helical-Piers Corp.**
14712 S Heritage Way
Bluffdale UT 84065

REFERENCE NUMBER(S), CLASSIFICATION(S) & DETAIL(S)
349614-5551 Contractor Without LRF DBAs: None Associated

S480

Form #1

Intermountain HelicalPiers
"Trusted Foundation Solutions"

14712 So. Heritage Crest Way
Bluffdale, UT 84065
p: 801-495-1830
f: 801-495-1833

Company Information

Business Name: Intermountain Helical Piers Corporation

Federal ID #: 84-1389620 ***Form of Business:*** Corporation

Started Business: Jan. 1, 1993 (24 years specializing in the helical pier business only)

Principals of Business:

Pres: Jared Dalton, 11047 South 1280 East, Sandy, UT

VP: Richard Dalton, 2548 West 12270 South, Riverton, UT

Utah Contractors License#: 349614-5551

Idaho Contractors License#: RCE-27050

NAICS #: 238990

Bonding Agent: Aaron Griffith, Beehive Insurance, 801-685-2779
Our insurance policy limits are 2 and 5 million aggregate
Bonding rate: $15 per $1,000 for project $100k to $500k

Key Personnel:

Project Manager/Estimator: Bill Boulter – 16 years experience

Project Manager/Estimator: Ryan Oborn – 15 years experience

Field Superintendant: Jared Dalton - 18 years experience

Field Superintendant: Richard Dalton – 18 years experience

Field Superintendent: Shane Christiansen 10 years experience

Safety Program:

- Safety Advisor: Bill Boulter, Weekly safety training following OSHA safety manual and specialized training for the helical industry.
- Emod rate: 0.87
- Listed on ISNET, Browz, and PICS auditing programs

Specialized Training:

- UITC trained installation crews to meet safety standards for industrial and oil refinery requirements.
- Heli-Pile & AB Chance factory certified installation crews to attain working knowledge of helical piers and installation practices and standards.
- MSHA trained to meet all mine requirements
- Field workers are OSHA 30 trained

Structural Engineer:

Seamark Engineering – Clark Seaman, P.E. (209) 275-0109

Technical Engineering Support:

International Marketing Research – John Pack P.E. (303) 423-0591

Notable Project Experience:

1. **University of Utah Utility Tunnel –** Salt Lake City, Utah, April 2017, 174 Helical Piers. DFCM project Structural: Reaveley Engineers (801) 486-3883
2. **Pentalon Network School Building –** Salt Lake City, Utah, August 2015, 137 Helical Piers, Structural: Ensign Engineering (801) 255-0529
3. **Holly Frontier Refinery** - expansion project, Woods Cross Utah, 2014, (approx. 1000) helical piers, Architect and Engineer - JOB Industrial 801-433-0901
4. **Cinema Courts -** Moab, Utah, October 2011, (500) helical piers. Affordable Housing project, Arch: Bryan Bowen Architects Structural: JVA Inc.
5. **Snow College Library -** Ephraim, Utah, March 2009, (700) helical piers. DFCM project Arch: Cooper Roberts Simonsen Structural: Reaveley Engineers (801) 486-3883
6. **The Ridge Condominiums** - Sandy Utah, September 2008, (80) helical piers and 24,000 square feet of shoring, Arch: Beecher Walker & Assoc. (801)438-9500 Structural: Dunn & Assoc. (801) 575-8877, Seamark Eng. (209) 275-0109, GSH Geotechnical (801) 293-3478
7. **SUU, Student Housing phase 2** - August 2008, (400) helical piers, DFCM project Arch: MHTN (801) 595-6700 Structural: Reaveley Eng. (801) 486-3883

8. **High Desert Milk Plant** - Burley Idaho, July 2007, (1200) helical piers. Arch. & Structural: Skyline A/E/S Inc. (435) 752-8501

Compliance Sheet for HELI-PILE® HPFT-3 (3 Inch Tubular) Helical Piles
With the 2009 International Building Code
August 30, 2010

HPFT-3 (3 inch tubular) helical pile material is manufacture by International Marketing & Research, Inc. (IMR) under the brand name HELI-PILE® in Arvada, Colorado, a suburb of Denver.

Attached please find HELI-PILE® drawing HPFT.DWG, Revision 3 dated 05/21/10. This drawing contains the specification for HPFT-3 (3 inch tubular) helical piles upon which this analysis for determining compliance with the 2009 International Building Code (2009 IBC) is based.

Chapter 18 Soils and Foundations is the chapter in the 2009 IBC that deals with the physical specification and capabilities of helical piles. This compliance sheet will deal with each specific provision for helical piles within Chapter 18 and how HELI-PILE® HPFT-3 complies with that provision. All provision numbers in **bold** below refer to the 2009 IBC.

1802 Definitions: As can be seen on the attached drawing, HELI-PILE® HPFT-3 helical pile material complies with the definition given.

1810.3.1.5: HELI-PILE® HPFT-3 helical pile material complies with this provision as shown in the attached Mechanical Capacity Calculations sheet dated August 27, 2010.

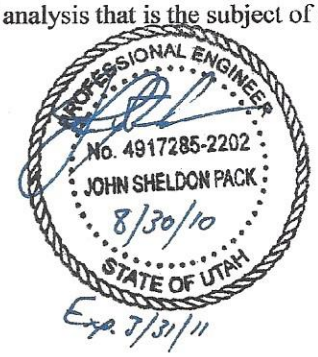
1810.3.2.3 Structural steel: HELI-PILE® HPFT-3 helical pile material is fabricated from ASTM A500 Gr C (F_y = 50 ksi) structural tubing. Therefore this provision is not applicable to HELI-PILE® HPFT-3 helical pile material. ASTM A500 structural tubing is a helical pile industrial standard.

1810.3.2.5 Protection of materials: All HELI-PILE® HPFT-3 helical pile material is galvanized per ASTM B633 which is considered a standard corrosion protection coating in the helical pile industry.

1810.3.2.6 Allowable stresses: Per Table 1810.3.2.6, the maximum allowable compression or tension stress for the HELI-PILE® HPFT-3 helical pile material is 0.6 $F_y \leq 0.5\ F_u$. For HPFT-3 helical pile material F_y = 50 ksi and F_u = 62 ksi. Therefore the maximum allowable stress is 0.6 x 50 ksi $\leq$ 0.5 x 62 ksi = 30 ksi $\leq$ 31 ksi. Therefore, the maximum allowable stress is 30 ksi. Given the gross shaft area of 2.59 sq. in., the maximum allowable axial compression or tension load is 2.59 sq. in. x 30 ksi = 77.7 kips. Since the factory rated maximum allowable axial load is 55 kips compression and 31 kips tension, using a factor of safety of 2, the HELI-PILE® HPFT-3 helical pile material complies with this provision.

Section 1810.3.3.1.9 Helical piles: $P_a = 0.5\ P_u$ where P_u is the least value determined by the six items listed. Each item is addressed individually in accordance with the numbers listed:

1. The sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil is site specific and not part of the HELI-PILE® HPFT-3 helical pile material analysis that is the subject of this document.



2. The ultimate capacity determined from well-documented correlations with installation torque is well known throughout the industry for square helical pile material. The industrial standard uses the relationship $P_u = k_t \times T$ where P_u is the ultimate pile capacity, k_t is the empirical torque coefficient, and T is the installation torque. The helical pile industry standard empirical torque coefficient and the standard used for HELI-PILE® HPFT-3 helical pile material is $10ft^{-1}$. Therefore, for HELI-PILE® HPFT-3 helical pile material the maximum factory rated installation torque is 11,000 ft-lbs. Thus, $P_u = 10ft^{-1} \times 11{,}000$ ft-lbs = 110,000 lbs. Therefore, $P_a = 0.5 \times 110{,}000$ lbs = 55,000 lbs.

3. The ultimate capacity determined from load tests is site specific and not part of the HELI-PILE® HPFT-3 helical pile material analysis that is the subject of this document.

4. The ultimate axial shaft capacity of the pile shaft is the shaft gross area of 2.59 sq. in. x the ultimate pile capacity, 62 ksi. Thus, 2.59 sq. in. x 62 ksi = 161 kips

5. The ultimate axial capacity of pile shaft couplings in compression is equal to the shaft capacity because shafts abut against each other in the coupling, no bolt dependence. Therefore, the ultimate compression capacity is 2.59 sq. in. x 62 ksi = 161 kips.

The ultimate axial capacity of pile shaft couplings in tension is equal to 1) to the ultimate shear capacity of the bolt in double shear with the threads outside the shear zone or 2) the bolt hole elongation limit.

1) For bolt capacity, the bolt steel is F_y = 120 ksi, 0.875 inch diameter (A = 0.601 in^2). Thus, the bolt capacity is 0.601 in^2 x 120 ksi x 2 for double shear = 144 kips.
2) For bolt elongation, IMR has load tested the HPFT-3 coupling and found that to limit bolt hole elongation, ultimate tension load must be limited to 62 kips.

6. The sum of the ultimate axial bearing capacity of helical bearing plates affixed to the pile is the ultimate capacity of each helix. For 6 inch to 12 inch diameter the ultimate capacity is 70 kips; for 14 inch diameter the ultimate capacity is 56 kips.

Conclusion: Compression: The least P_u value is 110 kips where *at least two* 6 inch to 12 inch diameter helices are being used, 70 kips where a *single* 6 inch to 12 inch diameter helix is being used. Thus $P_a = 0.5\ P_u = 0.5 \times 110$ kips = 55 kips, 05. x 70 kips = 35 kips respectively. Where a 14 inch diameter helix is the *only* helix, $P_a = 0.5 \times 56$ kips = 28 kips. Tension: The least P_u value is 62 kips. Thus $P_a = 0.5\ P_u = 0.5 \times 62$ kips = 31 kips. Where a 14 inch diameter helix is the *only* helix, $P_a = 0.5 \times 56$ kips = 28 kips.

1810.3.5.3.3 Helical piles: As shown in the provision above, design loads must not exceed 55 kips compression or 31 kips tension for HELI-PILE® HPFT-3 helical pile material to be in compliance with this provision.

1810.4.11 Helical piles: The requirements of this section are site specific and not part of the HELI-PILE® HPFT-3 helical pile material analysis that is the subject of this document.

1810.4.12 Special inspection: Inspection requirements are not part of the HELI-PILE® HPFT-3 helical pile material analysis that is the subject of this document.

CONCLUSION: HELI-PILE® HPFT-3 helical pile material meets all of the helical pile provisions of Chapter 18 Soils and Foundations of the 2009 International Building Code.

INTERNATIONAL
MARKETING &
RESEARCH, INC.

May 12, 2009

To: All IMR Network Installation Contractors

Re: International Code Council (ICC) Evaluation Reports

IMR is committed to obtaining an ICC Evaluation Report on HELI-PILE® Helical Piles. CTL/Thompson, Fort Collins, Colorado, the only accredited AC358 helical pile testing lab in the U.S., has been retained to assist in this process. We hope to the have a report number from ICC by summer's end.

Until the ICC listing is obtained, engineers and building departments are accepting stamped cut sheets in lieu of an ICC report. IMR has prepared cut sheets for the HELI-PILE® HPC15, HPC15X, and HPC17 Conventional Helical Piles, the HPT200, HPT250, and HPT300 Tubular Helical Piles, and the HPM15 Modular Helical Piles. Electronic copies of these cut sheets are attached.

A review of the cut sheets shows the specifications and load ratings of HELI-PILE® Helical Piles meet or exceed the specifications and capabilities of all competing helical pile material on the market today. This can be verified by comparing specifications.

It is important that engineers and building departments understand that no manufacturers currently have ICC listing, not even Hubbell. If a manufacturer wants current ICC listing, the ICC is requiring it to obtain a new evaluation report, even if it has an old "Legacy Report." To date, no manufacturers have completed the requirements for an ICC listing.

MacLean Dixie, Ram Jack, and Hubbell have "Legacy Reports" that are based on the old 1997 Uniform Building Code. Since that code is no longer in use, those evaluation reports are temporarily grandfathered as "Legacy Reports." Hubbell's ER-5110 is a "Legacy Report." How long the Legacy Reports will continue to be accepted depends on the engineers and building departments who use them.

If an engineer or building department expresses concern that HELI-PILE® material does not have an ICC report, explain that no manufacturers have an ICC report. Explain that IMR is in process of obtaining it. Submit stamped cut sheets that verify the specifications and load ratings of HELI-PILE® material. If questions persist, please have the engineer or building official give me a call.

Thanks for your continued support of HELI-PILE®. Our commitment to you has never changed in 23 years: To get you what you need, when you need it.

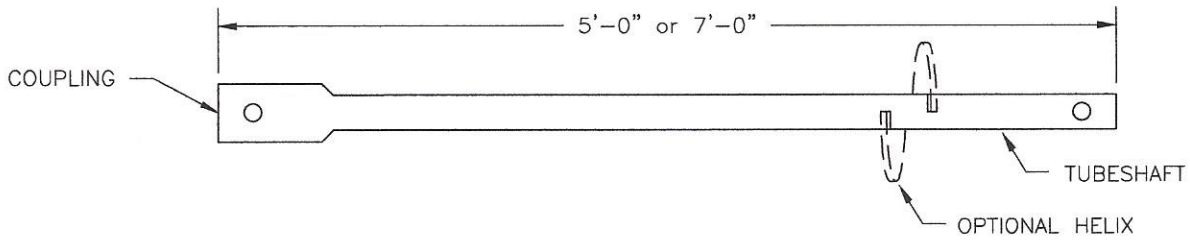
Sincerely,

John S. Pack, P.E.
Vice President—Engineering

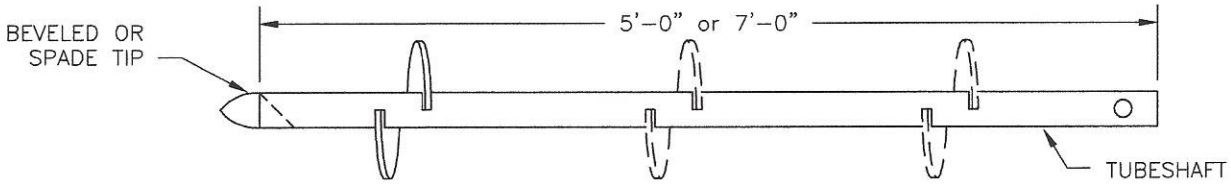
Attachments

5135 Ward Road
Wheat Ridge, CO 80033
Phone: (303) 423-0591
Fax: (303) 423-9155

HPFT3



EXTENSION
NO SCALE



LEAD SECTION
SINGLE OR MULTIPLE HELIX
NO SCALE

NOTES:

1. THIS DRAWING COVERS 3" (1/4" WALL) TUBULAR HELICAL PILE MATERIAL MANUFACTURED BY IMR.
2. HPFT3: 3"x3" STRUCTURAL TUBING, 0.25" WALL THICKNESS. THE CONNECTION BOLT IS 0.875" DIAMETER SAE J429 Gr 5 STEEL (Fy=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 11,000 FT-LBS.
3. ALL STRUCTURAL TUBING IS PER ASTM A500 Gr B, FOR 2" TO 3" Fy=60 KSI Fu=69 KSI, 4" AND LARGER Fy=60 KSI Fu=70 KSI BY SPECIAL ORDER.
4. ALL HELIX MATERIAL IS 0.5" THICK AND IS PER ASTM A656 Gr 80 TYPE 7.
5. ULTIMATE HELIX MECHANICAL CAPACITY: (UNLESS FULL-SCALE LOAD TEST SHOWS OTHERWISE)
   6" THROUGH 12" DIAMATER = 70,000 LBS
   14" DIAMETER = 56,000 LBS
6. ALL WELDS ARE 0.25" FILLET MINIMUM WITH ER70S ELECTRODE.
7. ALL STEEL MATERIAL IS GALVANIZED PER ASTM A153, A123, OR B633 FE/ZN 5, TYPE III. (LATEST REVISION)
8. ULTIMATE AXIAL CAPACITY: 110,000 LBS. COMPRESSION, 62,000 LBS TENSION.

HELI-PILE®
IMR, Inc. - DENVER
5135 Ward Road, Wheat Ridge, Colorado, 80033 USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

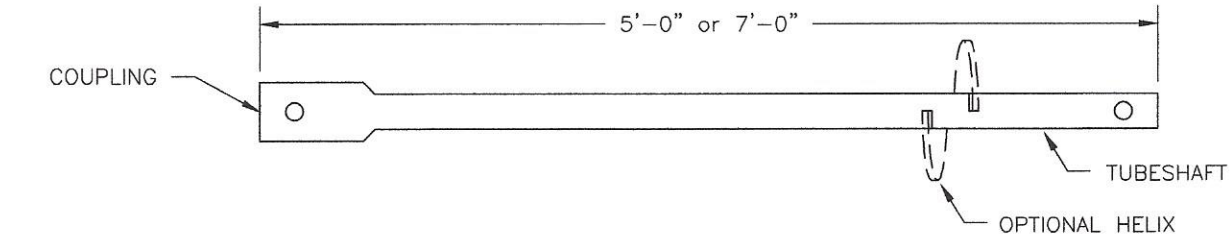
SPECIFICATION SHEET

HPFT3
TUBULAR
HELICAL PILES

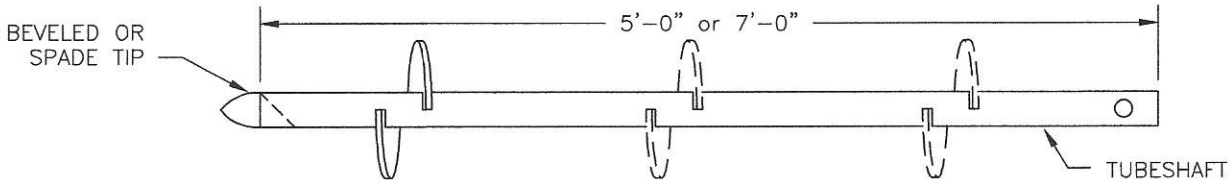
HPFT3.dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
JGM	JSP	06/30/16	1

HPFT331



EXTENSION
NO SCALE



LEAD SECTION
SINGLE OR MULTIPLE HELIX
NO SCALE

NOTES:

1. THIS DRAWING COVERS 3" (5/16" WALL) TUBULAR HELICAL PILE MATERIAL MANUFACTURED BY IMR.
2. HPFT331: 3"x3" STRUCTURAL TUBING, 0.313" WALL THICKNESS. THE CONNECTION BOLT IS 0.875" DIAMETER ASTM A193 Gr B7 STEEL (Fy=120 KSI) OR EQUIVALENT. MAX. TORQUE CAPACITY IS 15,000 FT-LBS.
3. ALL STRUCTURAL TUBING IS PER ASTM A500 Gr B, FOR 2" TO 3" Fy=60 KSI Fu=69 KSI, 4" AND LARGER Fy=60 KSI Fu=70 KSI BY SPECIAL ORDER.
4. ALL HELIX MATERIAL IS 0.5" THICK AND IS PER ASTM A656 Gr 80 TYPE 7.
5. ULTIMATE HELIX MECHANICAL CAPACITY: (UNLESS FULL-SCALE LOAD TEST SHOWS OTHERWISE)
   6" THROUGH 12" DIAMATER = 70,000 LBS
   14" DIAMETER = 56,000 LBS
6. ALL WELDS ARE 0.25" FILLET MINIMUM WITH ER70S ELECTRODE.
7. ALL STEEL MATERIAL IS GALVANIZED PER ASTM A153, A123, OR B633 FE/ZN 5, TYPE III. (LATEST REVISION)
8. ULTIMATE AXIAL CAPACITY: 150,000 LBS. COMPRESSION, 62,000 LBS TENSION.

HELI-PILE®
IMR, Inc. - DENVER
5135 Ward Road, Wheat Ridge, Colorado, 80033 USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

SPECIFICATION SHEET

HPFT331
TUBULAR
HELICAL PILES

HPFT331.dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
JGM	JSP	06/30/16	1

INTERNATIONAL MARKETING & RESEARCH, INC.

Mechanical Capacity Calculations
HELI-PILE® HPFT-3 (3 inch) Tubular Steel Square Bar Helical Pile
July 28, 2011

See the attached HELI-PILE® Specification Sheet Dwg. HPFT, Rev. 4, dated 05/12/11.

Shaft Steel
The shaft is a 3 inch tubular steel square bar with Fy = 50 ksi, wall thickness = 0.237 in (after corrosion per ICC AC358). The area of this bar is 2.46 in^2 (after corrosion per ICC AC358).
Ultimate shaft tension capacity = 2.46 in^2 x 50 ksi = 123 kips > 110 kips OK
Ultimate shaft compression capacity is the same.

Coupler Steel
The coupler is a 3.5 inch tubular square steel bar with Fy = 50 ksi, wall thickness = 0.237 in., slightly swedged to fit over the 3 inch shaft. Coupler steel cross-sectional area = 2.93 in^2 (after corrosion per ICC AC358) less the bolt hole area = 2.93 in^2 – 2 x 1.0 sq. in. x 0.237 in. = 2.46 in^2. Ultimate coupler tension capacity = 2.46 in^2 x 50 ksi = 123 kips > 110 kips OK

Coupler is fillet welded to the shaft.
Weld to shaft is a minimum 0.25 inch fillet (throat = 0.177 inch) using an ER80S electrode (Fy = 80 ksi).
Ultimate weld tension capacity = 3 inch x 4 sides x 0.177 inch x 80 ksi = 170 kips > 110 kips OK
Through full-scale tension testing, due to bolt hole elongation, it is determined that ultimate mechanical tension capacity should be 62 kips. Elongation does not occur in compression.

Bolt
Bolt is 0.875 inch diameter (area = 0.601 sq. in.) per SAE J429 Gr 5 (Fy = 120 ksi) with threads outside the shear zone. The bolt is in double shear.
Ultimate bolt shear capacity = 0.601 sq. in. x 120 ksi x 2 (double shear) = 144 kips > 110 kips OK

Helices
Each helix is welded top and bottom to the shaft with a minimum 0.25 inch fillet weld (throat = 0.177 inch) using an ER80S electrode.
Ultimate weld tension capacity = 3 inch x 4 sides x 2 (top & bottom) x 0.177 inch x 80 ksi = 340 kips > 110 kips OK

Helix Shear: use shaft perimeter, 3 in x 4 = 12 in, times thickness, 0.5 in, x 80 ksi steel: 12 in x 0.5 in x 80 ksi = 480 kips > 110 kips OK

Conclusion
The HELI-PILE® HPFT-3 (3 inch) tubular steel square bar helical pile has a rated ultimate mechanical compression capacity of 110 kips and ultimate mechanical tension capacity of 62 kips.

5135 Ward Road
Wheat Ridge, CO 80033
Phone: (303) 423-0591
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HPT-331-PC (8S) Flat Plate New Construction Load Transfer Bracket

Calculations
April 12, 2017

Given: Design compression load = 75 kips, design tension load = 31 kips
Determine adequacy of this bracket to take the loads.
See HELI-PILE® Drawing HPT-331-PC (8S).DWG, Rev. 0, 03/02/16 attached.

Concrete compressive stress on 8 in x 8 in x 3/4 in thick A36 steel plate is 75 k / (8 in x 8 in) = 1.2 ksi. This stress should be adequate for most structural grade concrete (f_c'= 3 ksi or 4 ksi). The flat plate is embedded in concrete.

Punching shear should be checked by concrete foundation designer.

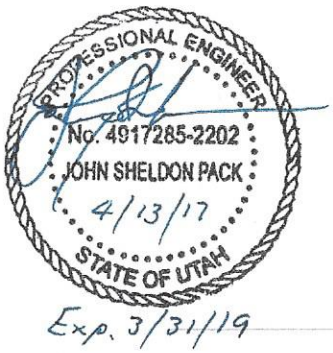
Check plate bending assuming no support from concrete below the plate (worst case):

Corner sections use ½ load (1.2 ksi / 2 = 0.6 ksi) since corners are shared in x and y directions. Side section use full 1.2 ksi load.

Bending moment on 8 in x 8 in A36 steel plate:
The tributary area for bending on the plate is taken as the corners outside the limits of the 4 inch x 4 inch coupler and the rectangular area within the limits of the tube. The moment arm is 2 in /2:

$\{(0.6 \text{ ksi} \times (2 \text{ in})^2 \times 2) + (1.2 \text{ ksi} \times 4 \text{ in} \times 2 \text{ in})\} \times (2 \text{ in} / 2)$
$= 14.4$ in-k

$S_{required} = M/f = 14.4 \text{ in-k} / (0.66 \times 36 \text{ ksi}) = 0.61 \text{ in}^3$
$S_{plate} = bd^2 / 6 = 8 \text{ in} \times (0.75 \text{ in})^2 / 6 = 0.75 \text{ in}^3 > 0.61 \text{ in}^3$ Ok



Exp. 3/31/19

Therefore, the HPT-331-PC (8S) New Construction Bracket is adequate to take the full 75 kip design compression load.
Using the same logic as presented above, this bracket is adequate for a 31 kip design tension load as well from a concrete point of view.

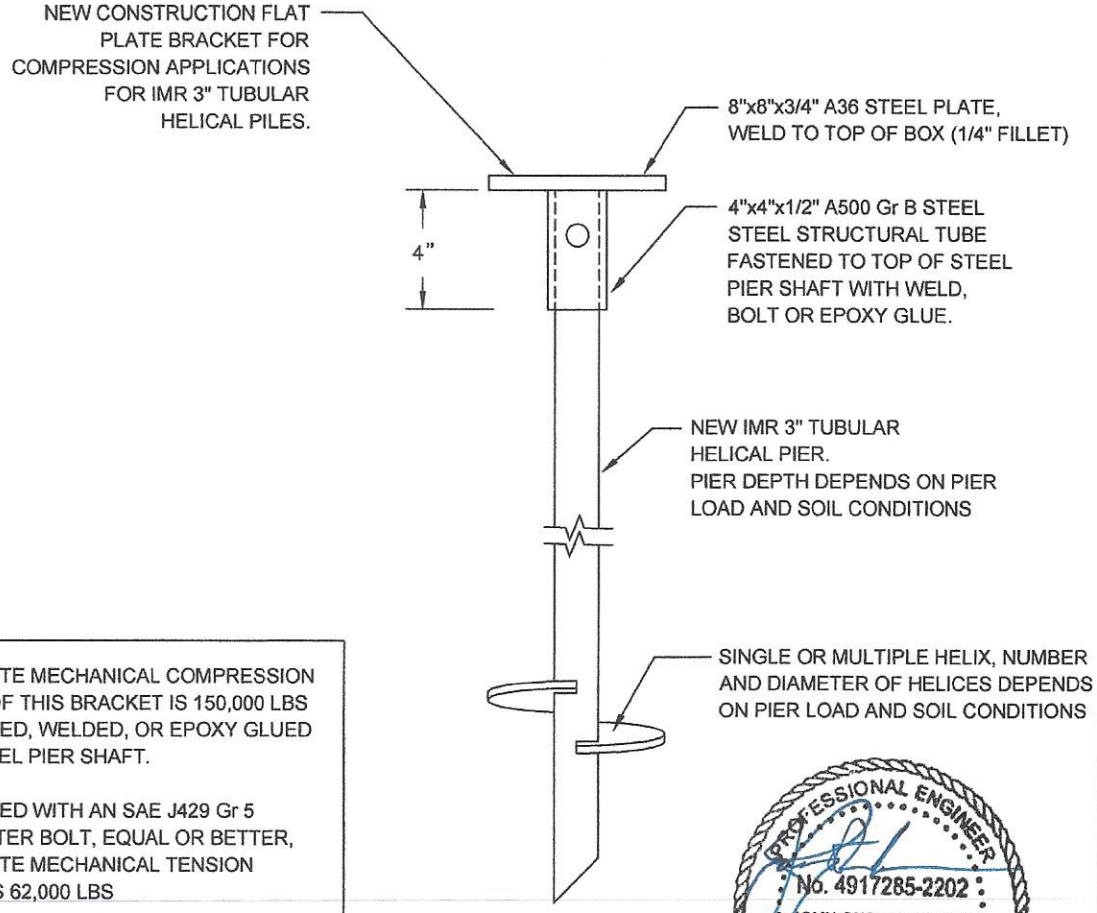
Regarding tension capacity, the weld of the plate to the tube is 3 in x 4 sides = 12 inches of weld. The weld is 0.25 in fillet (throat = 0.177 in) minimum E70 electrode. Capacity is 12 in x 0.177 in x 70 ksi x 0.4 = 59 kips > 31 kips

The bolt is 7/8" F_y = 120 ksi in double shear. Capacity = $\pi(0.875")^2/4)$x2x0.4x120ksi = 58k > 31k

Full-scale tension testing on this bracket shows the design capacity in tension should be 31 kips due to bolt hole elongation that occurs in tension loading. Bolt hole elongation does not occur in compression loading because the top of the pile bears directly under the 8 in x 8 in plate. The bolt is not sheared in compression loading because the pile shaft takes all tension load.

5135 Ward Road Wheat Ridge, CO 80033 • Phone (303) 423-0591 • Fax (303) 423-9155 • Web HELI-PILE.com

3" TUBULAR
HPT-331-PC (8S)



THE ULTIMATE MECHANICAL COMPRESSION CAPACITY OF THIS BRACKET IS 150,000 LBS WHEN BOLTED, WELDED, OR EPOXY GLUED TO THE STEEL PIER SHAFT.

WHEN BOLTED WITH AN SAE J429 Gr 5 0.875" DIAMETER BOLT, EQUAL OR BETTER, THE ULTIMATE MECHANICAL TENSION CAPACITY IS 62,000 LBS

PROFESSIONAL ENGINEER
No. 4917285-2202
JOHN SHELDON PACK
4/13/17
STATE OF UTAH
Exp. 3/31/19

NEW CONSTRUCTION FLAT PLATE COMPRESSION BRACKET - SQUARE COUPLER FOR HELI-PILE® 3" TUBULAR HELICAL PILE

NO SCALE

HELI-PILE®
IMR, Inc. - DENVER
5135 Ward Road, Wheat Ridge, Colorado, 80033 USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

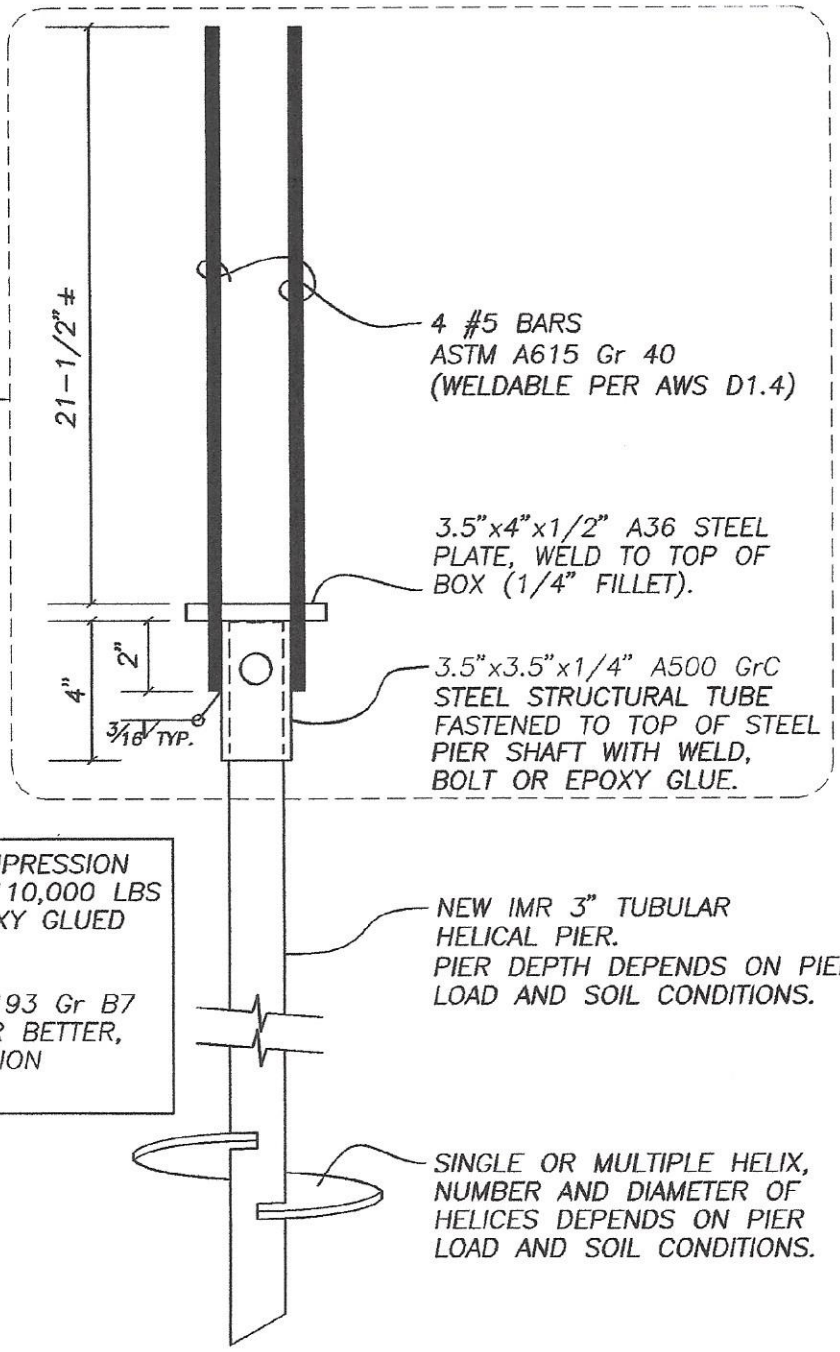
SPECIFICATION SHEET

NEW CONSTRUCTION FLAT PLATE COMPRESSION BRACKET

HPT-331-PC-(8S).dwg SHEET 1 OF 1

DRAWN BY:	ENGINEER:	DATE:	REVISION:
FR	JSP	03/02/16	0

3" TUBULAR HPT-3-RCT



NEW CONSTRUCTION BRACKET FOR IMR 3" TUBULAR HELICAL PIERS.

4 #5 BARS
ASTM A615 Gr 40
(WELDABLE PER AWS D1.4)

3.5"x4"x1/2" A36 STEEL PLATE, WELD TO TOP OF BOX (1/4" FILLET).

3.5"x3.5"x1/4" A500 GrC STEEL STRUCTURAL TUBE FASTENED TO TOP OF STEEL PIER SHAFT WITH WELD, BOLT OR EPOXY GLUE.

THE ULTILMATE MECHANICAL COMPRESSION CAPACITY OF THIS BRACKET IS 110,000 LBS WHEN BOLTED, WELDED OR EPOXY GLUED TO THE STEEL PIER SHAFT.

WHEN BOLTED WITH AN ASTM A193 Gr B7 7/8" DIAMETER BOLT, EQUAL OR BETTER, THE ULTIMATE MECHANICAL TENSION CAPACITY IS 62,000 LBS.

NEW IMR 3" TUBULAR HELICAL PIER.
PIER DEPTH DEPENDS ON PIER LOAD AND SOIL CONDITIONS.

SINGLE OR MULTIPLE HELIX, NUMBER AND DIAMETER OF HELICES DEPENDS ON PIER LOAD AND SOIL CONDITIONS.

NEW CONSTRUCTION BRACKET – SQUARE TUBE FOR IMR 3" TUBULAR HELICAL PIER WITH 4 REINFORCING BARS

NO SCALE

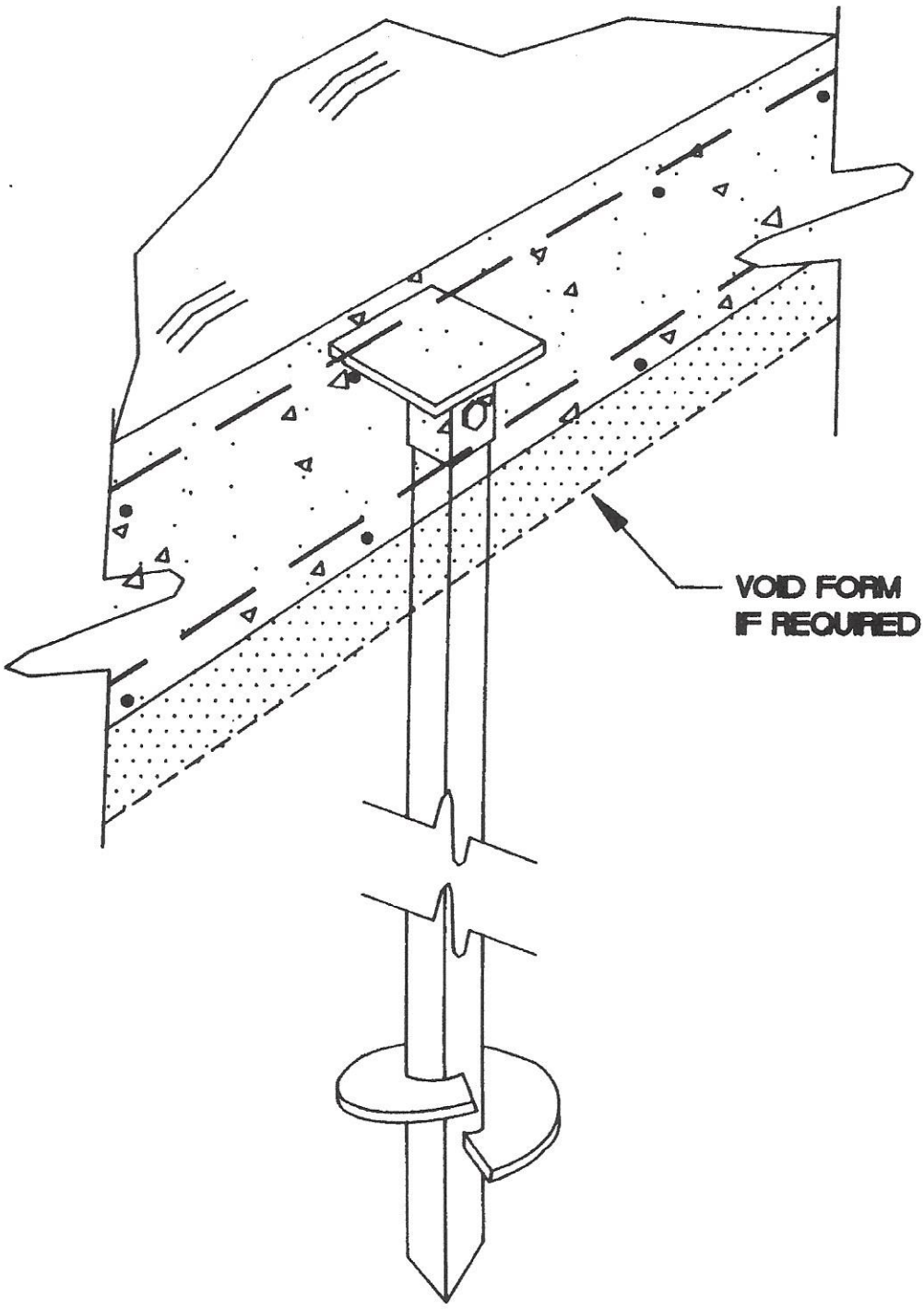
THIS DRAWING SUPERSEDES ALL PREVIOUS IMR HPT-3-RC DRAWINGS.

HELI-PILE®
IMR, Inc. – DENVER
5135 Ward Road, Wheat Ridge, Colorado, USA
303-423-0591 Fax: 303-423-9155
www.helipile.com

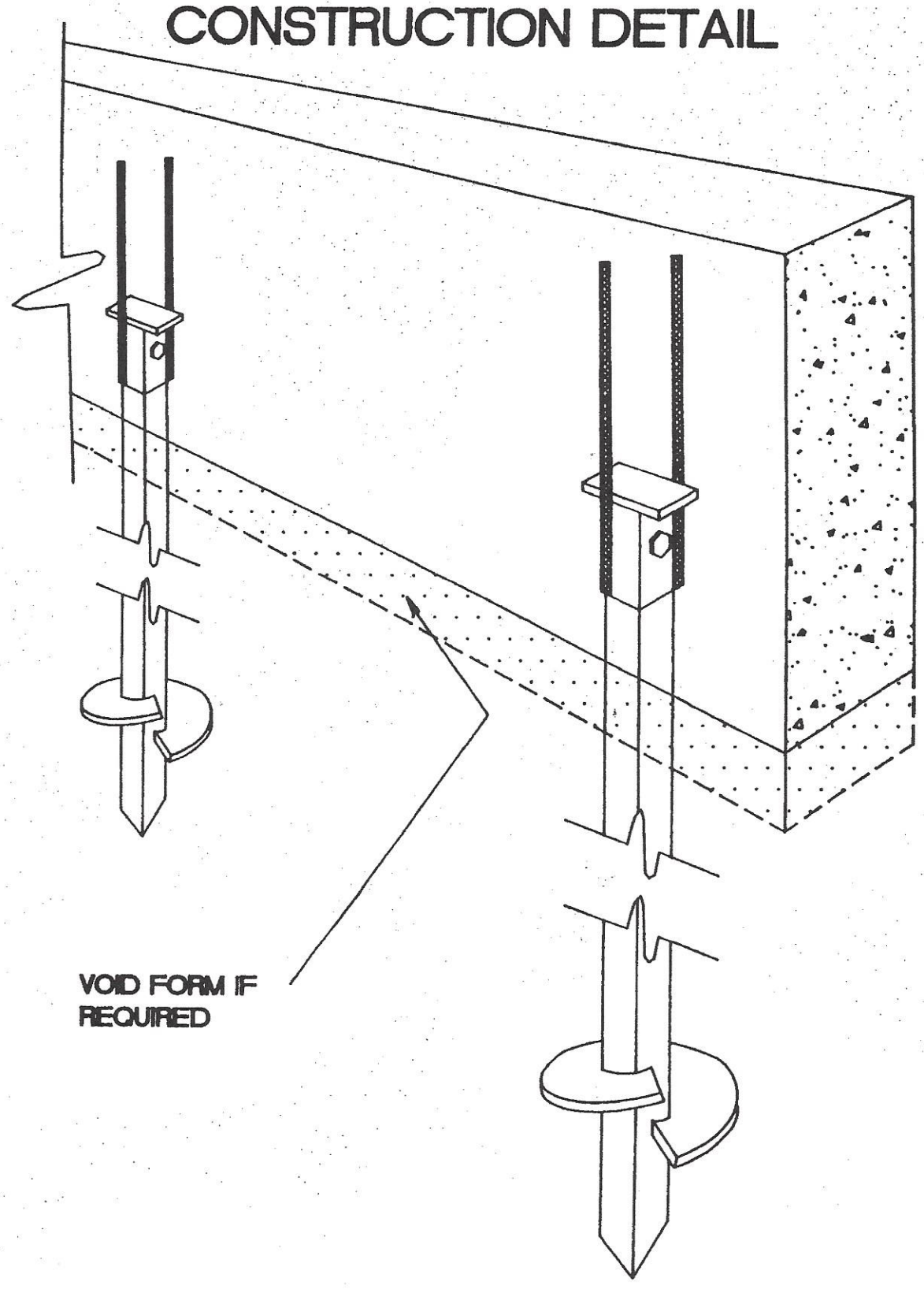
SPECIFICATION SHEET	NEW CONSTRUCTION BRACKET W/ 4 BARS
	HPT-3-RCT.DWG SHEET 1 OF 1

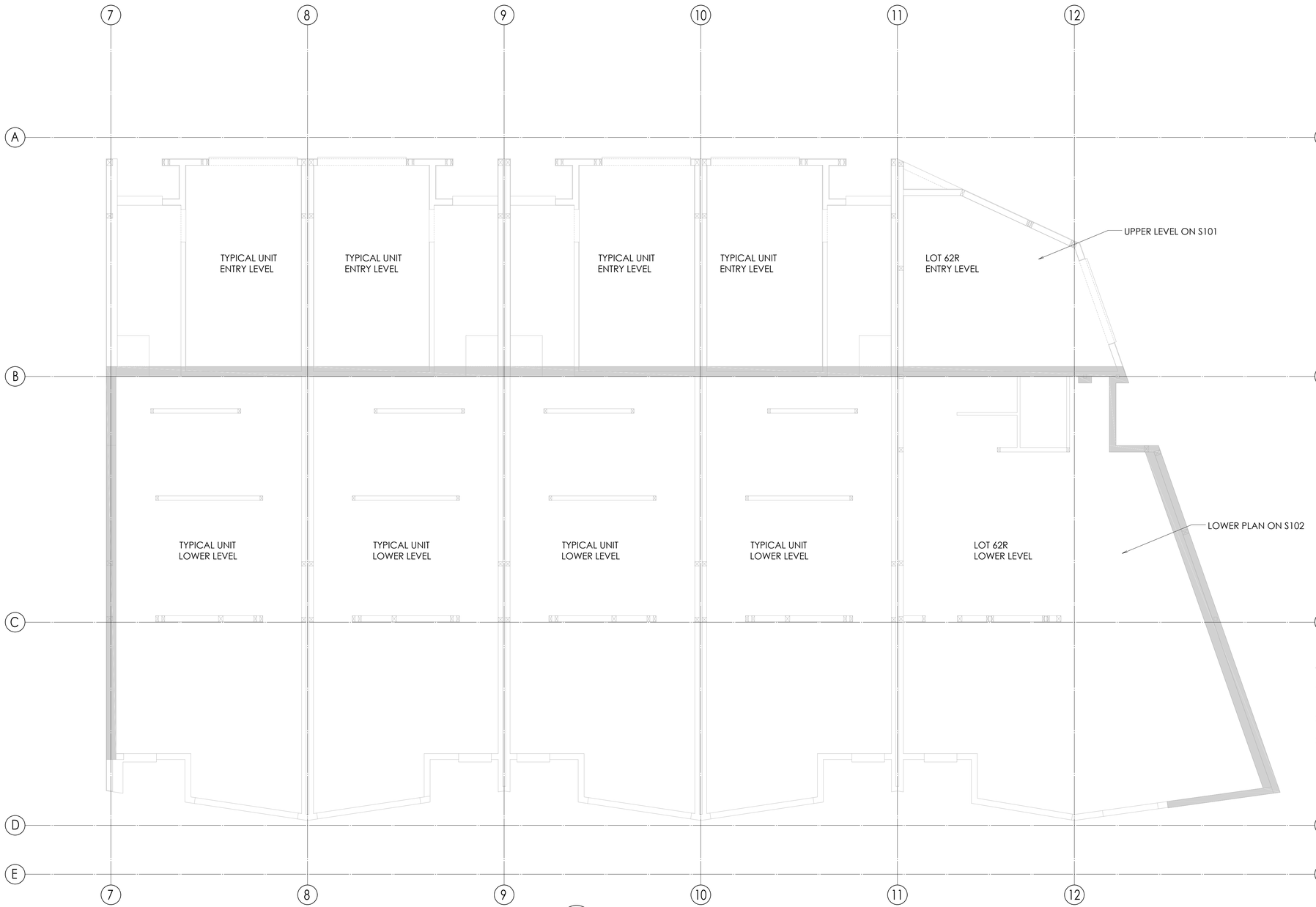
DRAWN BY:	CHECKED:	DATE:	REVISION:
JSP	RLJ	01/07/11	0

NEW STRUCTURAL SLAB CONSTRUCTION DETAIL



NEW FOUNDATION CONSTRUCTION DETAIL





1 S100 OVERALL PLAN

SCALE (24x36): 3/16"=1'-0"

CONCRETE NOTES:

1. ALL WORK SHALL BE IN STRICT ACCORDANCE WITH THE 2015 IBC, ACI 318, AND LOCAL ORDINANCES.
2. CONTRACTOR SHALL COORDINATE WITH MECHANICAL, ELECTRICAL, AND ARCHITECTURAL PRIOR TO PLACING CONCRETE. PROVIDE SLEEVES, BLOCK OUTS, ETC... AS REQUIRED.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER PLACEMENT OF ALL ANCHOR BOLTS, SEISMIC ANCHORS OR STRAPS, ETC... INSTALL PER MANUFACTURER'S SPECIFICATIONS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, DETAILING, CARE, PLACEMENT AND REMOVAL OF ALL FORMWORK AND SHORES.
5. DO NOT REMOVE FORMS AND SHORING UNTIL STRUCTURAL MEMBERS ACQUIRE SUFFICIENT STRENGTH TO SUPPORT THEIR OWN WEIGHT PLUS CONSTRUCTION LOADS.
6. SEE ORIGINAL DRAWINGS BY RUDOW + BERRY INC. FOR ADDITIONAL REQUIREMENTS.

CONCRETE AND REINFORCING MATERIAL

1. REQUIRED MIN. 28 DAY COMPRESSIVE STRENGTH OF CONCRETE:
   A. GRADE BEAMS : 4000 PSI
   B. INTERIOR SLABS ON GRADE: 4000 PSI U.N.O.
2. PROVIDE NORMAL WEIGHT AGGREGATES PER ASTM C-33, U.N.O.
3. PROVIDE TYPE I OR II CEMENT PER ASTM C-150 FOR ALL CONCRETE, U.N.O.
4. MAXIMUM WATER TO CEMENT RATIO IS EQUAL TO 0.45 FOR ALL CONCRETE, U.N.O.
5. MAXIMUM SLUMP OF CONCRETE IS EQUAL TO 4 INCHES PLUS OR MINUS 1 INCH.
6. PROVIDE AIR ENTRAINING AS RECOMMENDED BY ACI 318 AND ASTM C-260.
7. DO NOT ADD CALCIUM CHLORIDE TO CONCRETE MIX.
8. THE MAX. CHLORIDE ION CONTENT FOR CORROSION PROTECTION OF REINFORCEMENT IS 0.15% BY WEIGHT OF CEMENT.
9. SEE PROJECT SPECIFICATIONS FOR ADDITIONAL CONCRETE DESIGN REQUIREMENTS.

REINFORCEMENT

1. ALL REINFORCING STEEL SHALL BE GRADE 60 BARS PER ASTM A615. FIELD BENT DOWELS MAY BE GRADE 40.
2. ALL DEFORMED BAR ANCHORS SHALL CONFORM TO ASTM A496.
3. ALL HEADED STUD ANCHORS SHALL CONFORM TO ASTM A108.
4. ALL REINFORCING STEEL SHALL BE DETAILED AND PLACED IN ACCORDANCE WITH THE ACI DETAILING MANUAL AND ACI STANDARDS (LATEST ADDITION).
5. REINFORCING STEEL AND EMBEDS SHALL BE PROPERLY TIED INTO PLACE PRIOR TO PLACING CONCRETE.
6. ALL SPLICES IN REINFORCING BARS SHALL LAP A MINIMUM OF 40 BAR DIAMETERS (U.N.O.). ALL SPLICES SHALL OCCUR IN A COMPRESSION ZONE UNLESS NOTED OTHERWISE. TERMINATE ALL REINFORCING BARS WITH A 90 DEG. BEND OR WITH SEPARATE CORNER BARS.
7. MECHANICAL SPLICES SHALL BE POSITIVE CONNECTING COUPLERS AND SHALL MEET ALL APPLICABLE CODE REQUIREMENTS. ADJACENT MECHANICAL SPLICES SHALL BE STAGGERED A MINIMUM OF 24 INCHES ALONG THE REINFORCING BARS. TENSILE CAPACITY OF MECHANICAL SPLICES SHALL BE 125% OF THE SPLICED BAR.
8. HORIZONTAL REINFORCEMENT SHALL BE CONTINUOUS THROUGH CONSTRUCTION AND CONTROL JOINTS.
9. DO NOT SPLICE TIES OR STIRRUPS.
10. DO NOT WELD REINFORCING BARS. DO NOT SUBSTITUTE REINFORCING BARS FOR DEFORMED BAR ANCHORS OR HEADED STUD ANCHORS.
11. REINFORCEMENT SHALL HAVE THE FOLLOWING CLEAR COVER:
    i. CAST AGAINST/PERMANENTLY EXPOSED TO EARTH 3"
    ii. FORMED CONCRETE EXPOSED TO EARTH/WEATHER:
        a. #6 THRU #18 BARS 2"
        b. #5 AND SMALLER BARS 1-1/2"
    iii. CONCRETE NOT EXPOSED EARTH/WEATHER:
        a. SLABS, WALLS, JOISTS (#11 AND SMALLER) 3/4"
        b. BEAMS, COLUMNS, TIES, STIRRUPS

NOTE:
THESE DRAWINGS ARE TO BE USED WITH THE ORIGINAL DRAWINGS BY RUDOW + BERRY, INC. COORDINATE ALL STRUCTURAL BETWEEN GRADE BEAM FOUNDATION AND STRUCTURE ABOVE.

PLAN REVIEW ACCEPTANCE
FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW

- ☐ BUILDING
- ☐ MECHANICAL
- ☐ ELECTRICAL
- ☐ ACCESSIBILITY
- ☒ STRUCTURAL
- ☐ PLUMBING
- ☐ ENERGY
- ☐ FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY MEM DATE 08/30/17

WEST COAST CODE CONSULTANTS, INC.

J M WILLIAMS and Associates
2875 South Decker Lake Drive, Suite 275, Salt Lake City, Utah 84119
Ph. 801.575.6455 Fax. 801.575.6456 Web. WWW.JMWA.COM

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No. 5051
JEFFERY S. WILLIAMS
STATE OF UTAH

07/25/2017

PLAN AND NOTES (UPPER)

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

SCALE	3/16" = 1'-0"
DATE:	JULY. 14, 2017
DRAWN BY:	
JOB NO.	2017.028
FILE:	2017.028

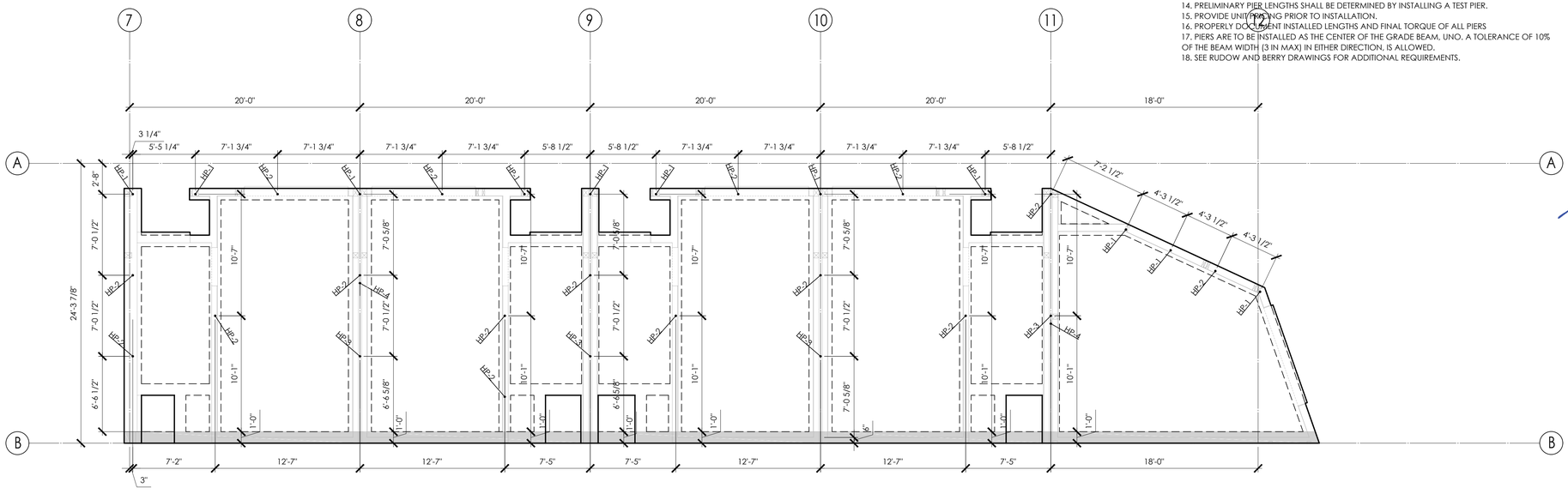
SHEET NO.
S100

HELICAL PIER SCHEDULE				
	MODEL	CAP	BOLT	NOTES
HP-1	HPF25	HPT25-PC	3/4"Ø SEA J429 GRS	PIER BY HELI-PILE
HP-2	HPF3	HPT3-PC	7/8"Ø ASTM A193 GR 37 OR EQ.	PIER BY HELI-PILE
HP-3	HPF331	HPT331-PC	1 1/4"Ø SEA J427 GR 5 OR EQ.	PIER BY HELI-PILE
HP-4	HP-17	HP-17-RC14	SCREW ON CAP	PIER BY HELI-PILE

●—— INDICATES BATTERED PIER PER DET. 3/S203

HELICAL PIER SPECIFICATION

1. PIERS SHALL BE INSTALLED BY AN AUTHORIZED INSTALLING CONTRACTOR WHO HAS SATISFIED THE CERTIFICATION REQUIREMENTS RELATING TO THE TECHNICAL ASPECTS OF THE PRODUCT AND THE ASCRIBED INSTALLATION TECHNIQUES. PROOF OF CURRENT CERTIFICATION MUST BE PROVIDED.
2. ALL WORK AS DESCRIBED HEREIN SHALL BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE SAFETY CODES IN EFFECT AT THE TIME OF INSTALLATION.
3. HELICAL PIERS SHALL HAVE AN ICC APPROVAL.
4. THE HELICAL LEAD SECTIONS AND EXTENSIONS SHALL BE TUBULAR STEEL, ROUNDED CORNER SQUARE SHAFT CONFIGURATION, WITH ONE OR MORE HELICAL BEARING PLATES WELDED TO SHAFT.
5. ALL PIERS MUST BE CORROSION PROTECTED BY HOT DIP GALVANIZATION.
6. INSTALLATION UNITS SHALL CONSIST OF A ROTARY TYPE TORQUE MOTOR WITH FORWARD AND REVERSE CAPABILITIES. THESE UNITS SHALL BE EITHER ELECTRICALLY OR HYDRAULICALLY POWERED.
7. INSTALLATION UNITS SHALL BE CAPABLE OF DEVELOPING THE MINIMUM TORQUE AS REQUIRED.
8. INSTALLATION UNITS SHALL BE CAPABLE OF POSITIONING THE HELICAL PIER AT THE PROPER INSTALLATION ANGLE. THIS ANGLE MAY VARY BETWEEN VERTICAL AND 5 DEGREES DEPENDING UPON APPLICATION AND TYPE OF LOAD TRANSFER DEVICE SPECIFIED OR REQUIRED.
9. INSTALLATION TORQUE SHALL BE MONITORED THROUGHOUT THE INSTALLATION PROCESS.
10. HELICAL PIERS SHALL BE INSTALLED TO THE MINIMUM TORQUE VALUE REQUIRED TO PROVIDE THE LOAD CAPACITIES SHOWN ON THE PLANS.
11. THE APPROPRIATE STEEL UNDERPINNING BRACKET OR NEW CONSTRUCTION LOAD TRANSFER DEVICE SHALL BE USED.
12. APPROPRIATE HELICAL PIER SELECTION WILL CONSIDER LOAD PLUS SAFETY FACTOR (MIN SAFETY FACTOR OF 2), SOIL PARAMETERS AND THE INSTALLATION TORQUE VERSUS CAPACITY EQUATION AS PER THE MANUFACTURERS RECOMMENDATIONS.
13. HELICAL PIERS ARE A PRE-ENGINEERED SYSTEM. PROVIDE SHOP DRAWINGS BEARING AN ENGINEER'S SEAL.
14. PRELIMINARY PIER LENGTHS SHALL BE DETERMINED BY INSTALLING A TEST PIER.
15. PROVIDE UNIT PRICING PRIOR TO INSTALLATION.
16. PROPERLY DOCUMENT INSTALLED LENGTHS AND FINAL TORQUE OF ALL PIERS
17. PIERS ARE TO BE INSTALLED AS THE CENTER OF THE GRADE BEAM, UNO. A TOLERANCE OF 10% OF THE BEAM WIDTH (3 IN MAX) IN EITHER DIRECTION, IS ALLOWED.
18. SEE RUDOW AND BERRY DRAWINGS FOR ADDITIONAL REQUIREMENTS.



1 / S101 HELICAL PIER LAYOUT - UPPER PLAN

SCALE (24x36): 3/16"=1'-0"

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW:

☐ BUILDING ☒ STRUCTURAL
☐ MECHANICAL ☐ PLUMBING
☐ ELECTRICAL ☐ ENERGY
☐ ACCESSIBILITY ☐ FIRE

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BY MEM DATE 08/30/17

WEST COAST CODE CONSULTANTS, INC.

J M WILLIAMS and Associates
2875 South Decker Lake Drive, Suite 275, Salt Lake City, Utah 84119
Ph. 801.575.6455 Fax. 801.575.6456 Web. WWW.JMWA.COM

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No. 8357
JEFFERY S. BERRY
STATE OF UTAH

07/25/2017

PIER UPPER PLAN

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

SCALE:
DATE: JULY. 14, 2017
DRAWN BY:
JOB NO. 2017.028
FILE: 2017.028

SHEET NO.
S101

HELICAL PIER SCHEDULE				
	MODEL	CAP	BOLT	NOTES
HP-1	HPF25	HPT25-PC	3/4"Ø SEA J429 GR5	PIER BY HELI-PILE
HP-2	HPF3	HPT3-PC	7/8"Ø ASTM A193 GR 37 OR EQ.	PIER BY HELI-PILE
HP-3	HPF331	HPT331-PC	1 1/4"Ø SEA J427 GR 5 OR EQ.	PIER BY HELI-PILE
HP-4	HP-17	HP-17-RC14	SCREW ON CAP	PIER BY HELI-PILE

●—— INDICATES BATTERED PIER PER DET. 3/S203

HELICAL PIER SPECIFICATION

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2. ALL WORK AS DESCRIBED HEREIN SHALL BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE SAFETY CODES IN EFFECT AT THE TIME OF INSTALLATION.
3. HELICAL PIERS SHALL HAVE AN ICC APPROVAL.
4. THE HELICAL LEAD SECTIONS AND EXTENSIONS SHALL BE TUBULAR STEEL, ROUNDED CORNER SQUARE SHAFT CONFIGURATION, WITH ONE OR MORE HELICAL BEARING PLATES WELDED TO SHAFT.
5. ALL PIERS MUST BE CORROSION PROTECTED BY HOT DIP GALVANIZATION.
6. INSTALLATION UNITS SHALL CONSIST OF A ROTARY TYPE TORQUE MOTOR WITH FORWARD AND REVERSE CAPABILITIES. THESE UNITS SHALL BE EITHER ELECTRICALLY OR HYDRAULICALLY POWERED.
7. INSTALLATION UNITS SHALL BE CAPABLE OF DEVELOPING THE MINIMUM TORQUE AS REQUIRED.
8. INSTALLATION UNITS SHALL BE CAPABLE OF POSITIONING THE HELICAL PIER AT THE PROPER INSTALLATION ANGLE. THIS ANGLE MAY VARY BETWEEN VERTICAL AND 5 DEGREES DEPENDING UPON APPLICATION AND TYPE OF LOAD TRANSFER DEVICE SPECIFIED OR REQUIRED.
9. INSTALLATION TORQUE SHALL BE MONITORED THROUGHOUT THE INSTALLATION PROCESS.
10. HELICAL PIERS SHALL BE INSTALLED TO THE MINIMUM TORQUE VALUE REQUIRED TO PROVIDE THE LOAD CAPACITIES SHOWN ON THE PLANS.
11. THE APPROPRIATE STEEL UNDERPINNING BRACKET OR NEW CONSTRUCTION LOAD TRANSFER DEVICE SHALL BE USED.
12. APPROPRIATE HELICAL PIER SELECTION WILL CONSIDER LOAD PLUS SAFETY FACTOR (MIN SAFETY FACTOR OF 2), SOIL PARAMETERS AND THE INSTALLATION TORQUE VERSUS CAPACITY EQUATION AS PER THE MANUFACTURERS RECOMMENDATIONS.
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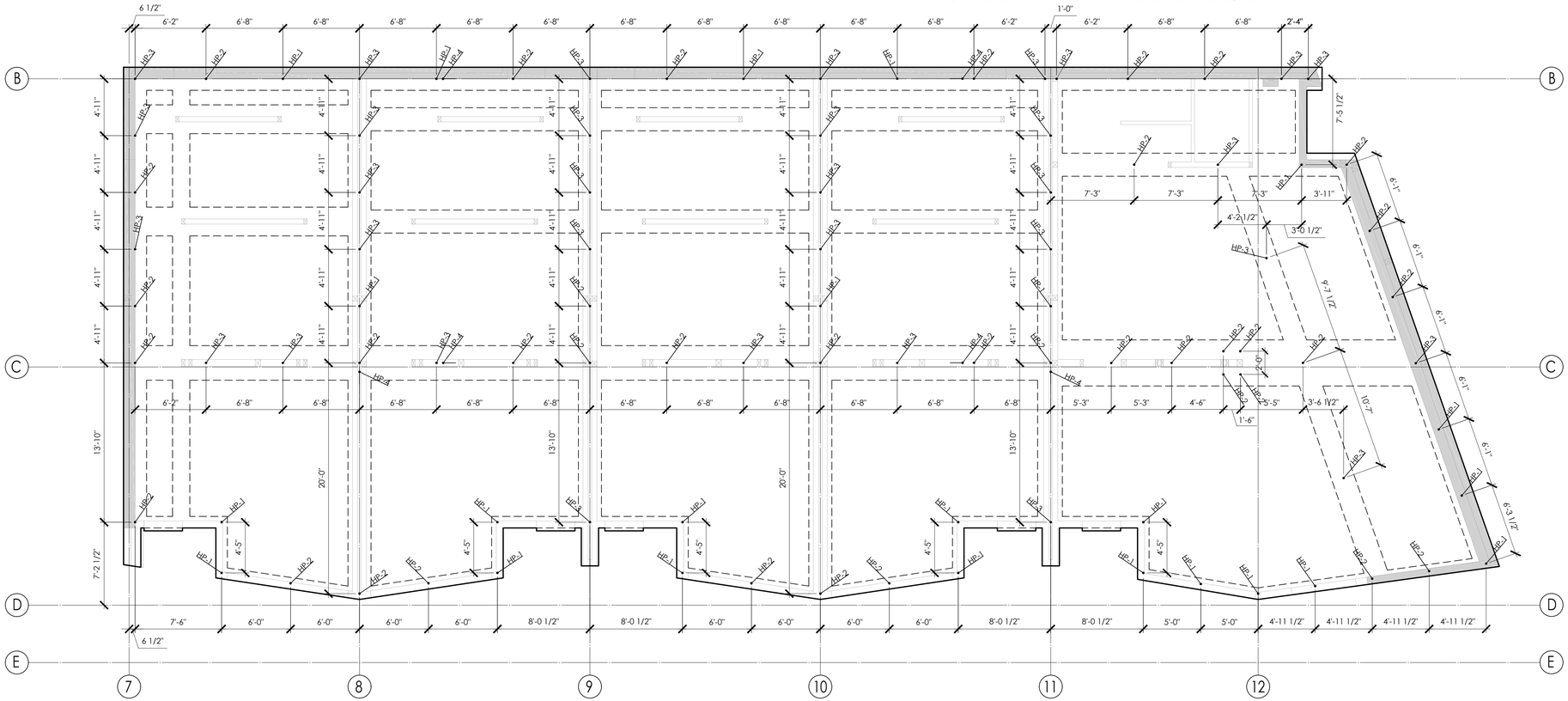
18. SEE RUDOW AND BERRY DRAWINGS FOR ADDITIONAL REQUIREMENTS.



1 / S102 HELICAL PIER LAYOUT - LOWER PLAN

SCALE (24x36): 3/16"=1'-0"

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW

- ☐ BUILDING
- ☐ MECHANICAL
- ☐ ELECTRICAL
- ☐ ACCESSIBILITY
- ☒ STRUCTURAL
- ☐ PLUMBING
- ☐ ENERGY
- ☐ FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY MEM DATE 08/30/17

WEST COAST CODE CONSULTANTS, INC.

J M WILLIAMS and Associates
2875 South Decker Lake Drive, Suite 275, Salt Lake City, Utah 84119
Ph. 801.575.6455 Fax. 801.575.6456 Web. WWW.JMWA.COM

JEFFERY S. BERRY — No. 5251 — LICENSED PROFESSIONAL STRUCTURAL ENGINEER — STATE OF UTAH

07/25/2017

PIER LOWER PLAN

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

SCALE:

DATE: JULY. 14, 2017

DRAWN BY:

JOB NO. 2017.028

FILE: 2017.028

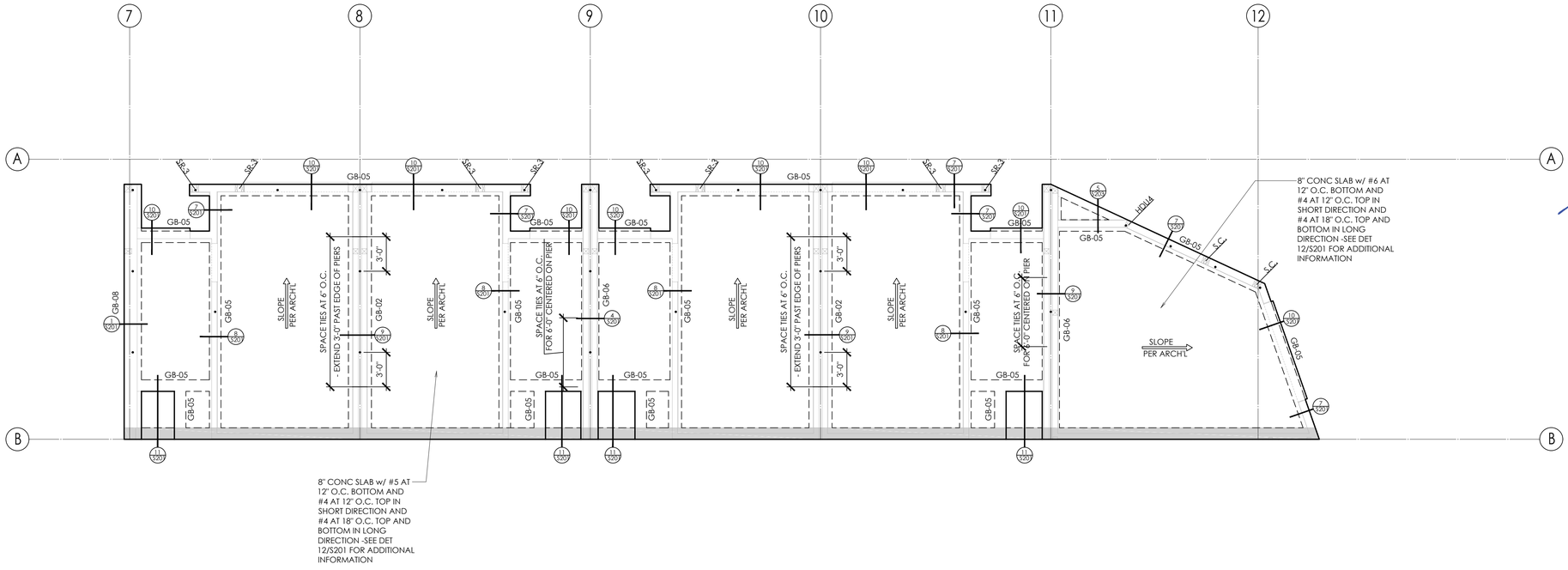
SHEET NO.

S102

GRADE BEAM SCHEDULE					
	HEIGHT	WIDTH	REINFORCING	TIES	NOTES
GB01	24"	18"	(3)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB02	24"	24"	(4)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB03	30"	36"	(5)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB04	36"	48"	(5)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB05	48"	12"	(2)#5 TOP AND BOTTOM	#3 AT 12" O.C.	
GB06	48"	18"	(3)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB07	60"	12"	(2)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB08	60"	18"	(3)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB09	24"	30"	(5)#6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB10	12"	18"	(2)#6 TOP AND BOTTOM	#3 AT 12" O.C.	

HOLDOWN SCHEDULE				
HOLDOWN	EDGE MEMBER	FOUNDATION ANCHOR	EDGE MEMBER ATTACHMENT	NOTES
HDU4	SEE RUDOW & BERRY DWGS	5/8"Ø HEAVY HEX BOLT WITH 15" EMBEDMENT	(10) SDS 1/4" x 2 1/2" SIMPSON SCREWS	
HDU8	SEE RUDOW & BERRY DWGS	7/8"Ø HEAVY HEX BOLT w/ 15" EMBEDMENT INTO FOOTING	(20) SDS 1/4X2-1/2" SIMPSON SCREWS	
HDU14	SEE RUDOW & BERRY DWGS	1"Ø HEAVY HEX BOLT w/ 15" EMBEDMENT INTO FOOTING	(34) SDS 1/4X2-1/2" SIMPSON SCREWS	
SR-1	SEE RUDOW & BERRY DWGS	1 1/2"Ø THREADED ROD W/ DOUBLE NUT W/ 24" EMBEDMENT		
SR-2	SEE RUDOW & BERRY DWGS	1"Ø THREADED ROD W/ DOUBLE NUT W/ 15" EMBEDMENT		
SR-3	SEE RUDOW & BERRY DWGS	1 3/8"Ø THREADED ROD W/ DOUBLE NUT W/ _ EMBEDMENT		SEE DET 2/S203
S.C.	SEE RUDOW & BERRY DWGS	ANCHORAGE PER RUDOW & BERRY DWGS		S.C. = STEEL COLUMN

NOTE: SEE RUDOW & BERRY DWGS FOR ADDITIONAL INFORMATION



1 / S103 UPPER GRADE BEAM PLAN

SCALE (24x36): 3/16"=1'-0"

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

☐ BUILDING ☒ STRUCTURAL
☐ MECHANICAL ☐ PLUMBING
☐ ELECTRICAL ☐ ENERGY
☐ ACCESSIBILITY ☐ FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: MEM DATE: 08/30/17

WEST COAST CODE CONSULTANTS, INC.

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LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No. 5301
JEFFERY S. WILLIAMS
STATE OF UTAH

07/25/2017

GRADE BEAM UPPER PLAN

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

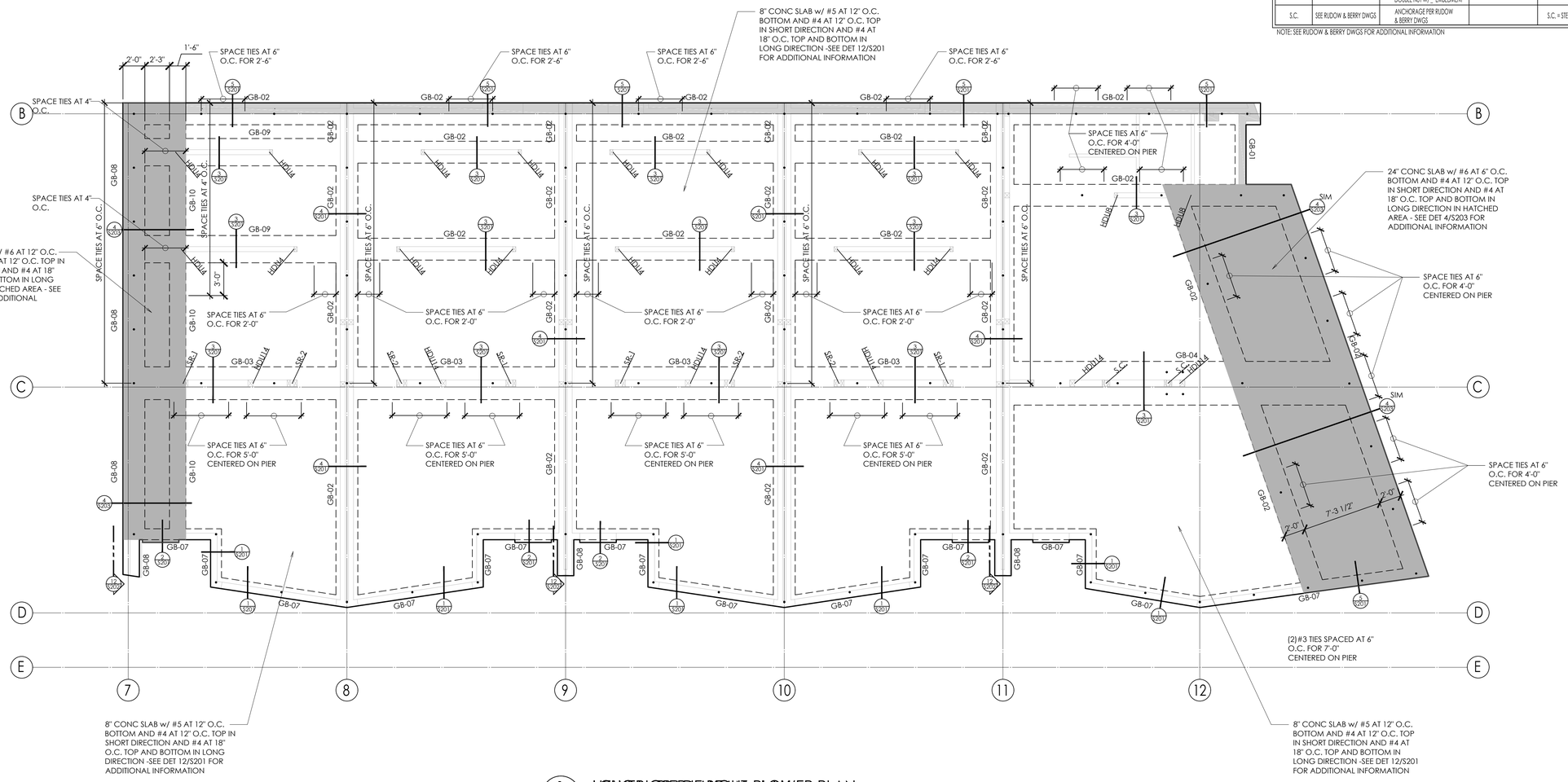
SCALE:
DATE: JULY. 14, 2017
DRAWN BY:
JOB NO. 2017.028
FILE: 2017.028

SHEET NO.
S103

GRADE BEAM SCHEDULE					
	HEIGHT	WIDTH	REINFORCING	TIES	NOTES
GB01	24"	18"	(3) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB02	24"	24"	(4) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB03	30"	36"	(5) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB04	36"	48"	(5) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB05	48"	12"	(2) #5 TOP AND BOTTOM	#3 AT 12" O.C.	
GB06	48"	18"	(3) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB07	60"	12"	(2) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB08	60"	18"	(3) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB09	24"	30"	(5) #6 TOP AND BOTTOM	#3 AT 12" O.C.	
GB10	12"	18"	(2) #6 TOP AND BOTTOM	#3 AT 12" O.C.	

HOLDOWN SCHEDULE				
HOLDOWN	EDGE MEMBER	FOUNDATION ANCHOR	EDGE MEMBER ATTACHMENT	NOTES
HDU4	SEE RUDOW & BERRY DWGS	5/8"Ø HEAVY HEX BOLT WITH 15" EMBEDMENT	(10) SDS 1/4" x 2 1/2" SIMPSON SCREWS	
HDU8	SEE RUDOW & BERRY DWGS	7/8"Ø HEAVY HEX BOLT w/ 15" EMBEDMENT INTO FOOTING	(20) SDS 1/4X2-1/2" SIMPSON SCREWS	
HDU14	SEE RUDOW & BERRY DWGS	1"Ø HEAVY HEX BOLT w/ 15" EMBEDMENT INTO FOOTING	(36) SDS 1/4X2-1/2" SIMPSON SCREWS	
SR-1	SEE RUDOW & BERRY DWGS	1 1/2"Ø THREADED ROD W/ DOUBLE NUT W/ 24" EMBEDMENT		
SR-2	SEE RUDOW & BERRY DWGS	1"Ø THREADED ROD W/ DOUBLE NUT W/ 15" EMBEDMENT		
SR-3	SEE RUDOW & BERRY DWGS	1 3/8"Ø THREADED ROD W/ DOUBLE NUT W/ _ EMBEDMENT		SEE DET 2/S203
S.C.	SEE RUDOW & BERRY DWGS	ANCHORAGE PER RUDOW & BERRY DWGS		S.C. = STEEL COLUMN

NOTE: SEE RUDOW & BERRY DWGS FOR ADDITIONAL INFORMATION



1 S104 LOWER GRADE BEAM PLAN

LOWER GRADE BEAM PLAN

SCALE (24x36): 3/16"=1'-0"

PLAN REVIEW ACCEPTANCE

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- ☐ BUILDING
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- ☐ PLUMBING
- ☐ ENERGY
- ☐ FIRE

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07/25/2017

GRADE BEAM LOWER PLAN

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

SCALE:

DATE: JULY. 14, 2017

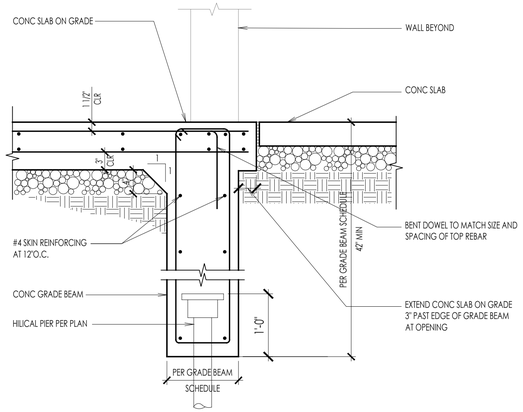
DRAWN BY:

JOB NO. 2017.028

FILE: 2017.028

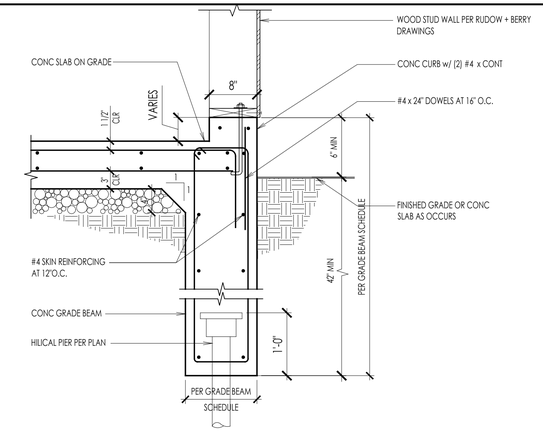
SHEET NO.

S104



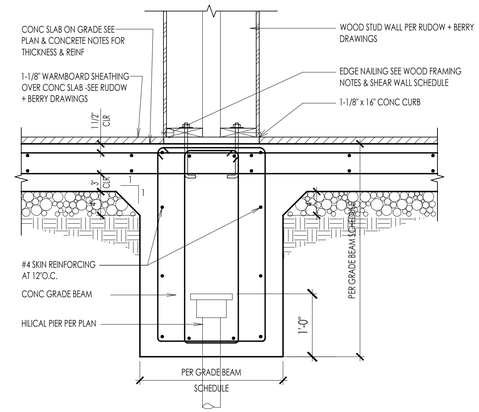
10 S201 EXTERIOR WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



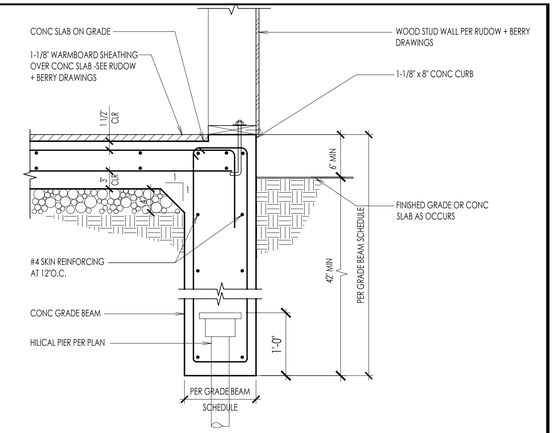
7 S201 EXTERIOR WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



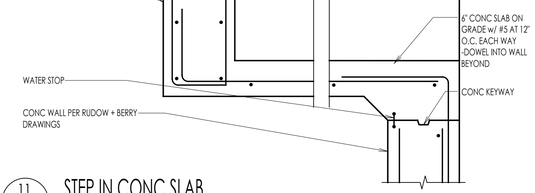
4 S201 INTERIOR PARTY WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



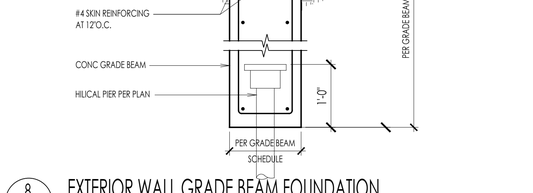
1 S201 EXTERIOR WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



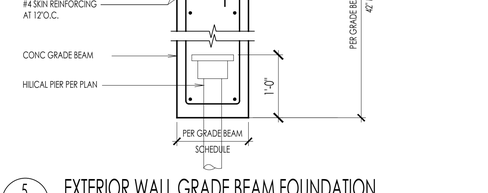
11 S201 STEP IN CONC SLAB

SCALE: N.T.S.



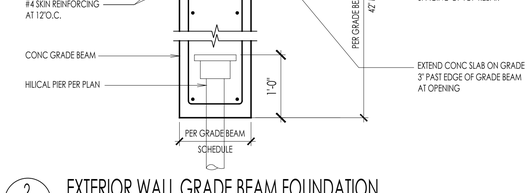
8 S201 EXTERIOR WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



5 S201 EXTERIOR WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



2 S201 EXTERIOR WALL GRADE BEAM FOUNDATION

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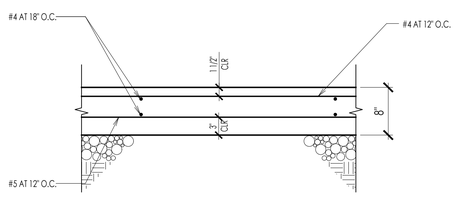
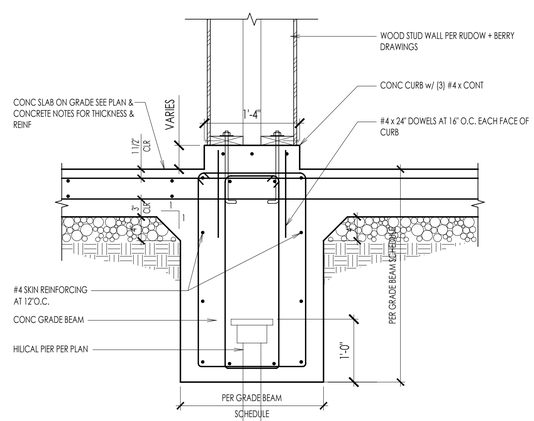


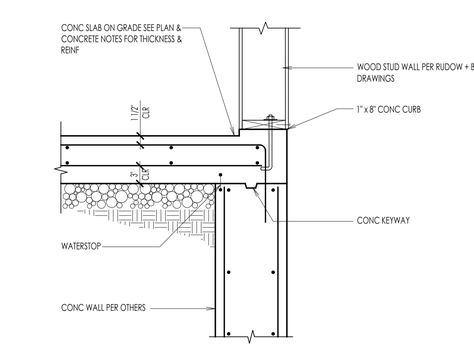
12 S201 TYPICAL CONC SLAB SECTION

SCALE: N.T.S.



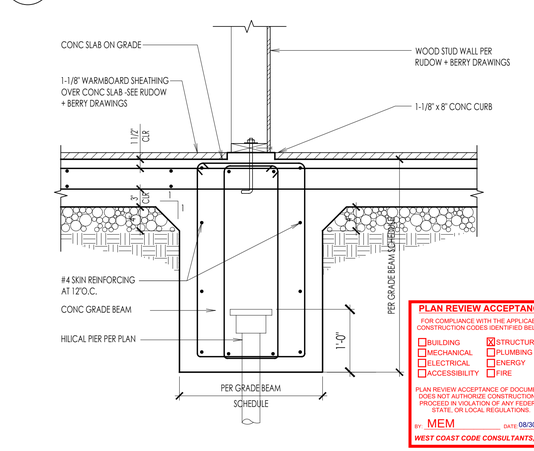
9 S201 INTERIOR PARTY WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.



6 S201 CONC SLAB AT CONC WALL

SCALE: N.T.S.



3 S201 INTERIOR WALL GRADE BEAM FOUNDATION

SCALE: N.T.S.

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DETAILS

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

SCALE:

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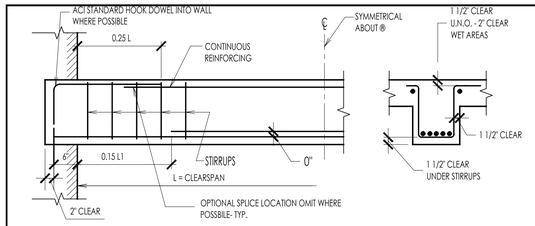
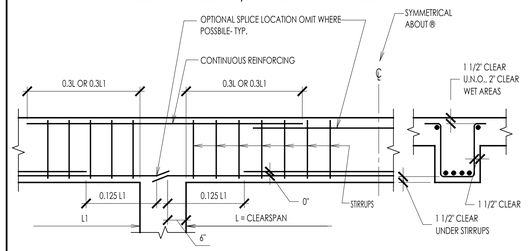
SHEET NO.

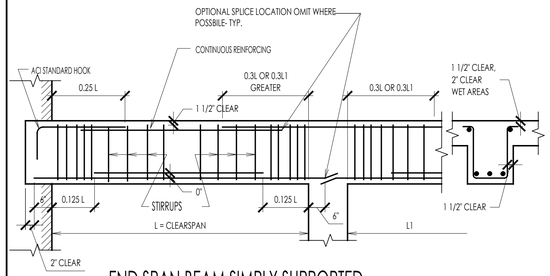
S201



SINGLE SPAN BEAM, SIMPLY SUPPORTED



INTERIOR SPAN OF CONTINUOUS BEAM



END SPAN BEAM SIMPLY SUPPORTED

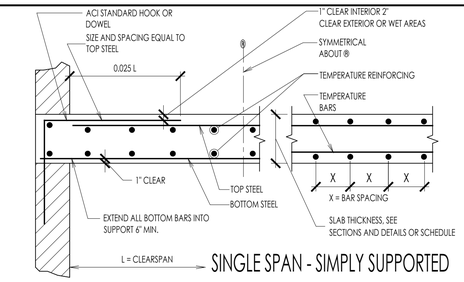
NOTE: CHECK AVAILABLE DEPTH, TOP AND BOTTOM, FOR REQUIRED COVER ON ACI STANDARD HOOKS. AT EACH END SUPPORT, ADD TOP BAR 0.25 L IN.

LENGTH TO EQUAL THE AREA OF BARS REQUIRED. SEE ALSO ACI 318-95

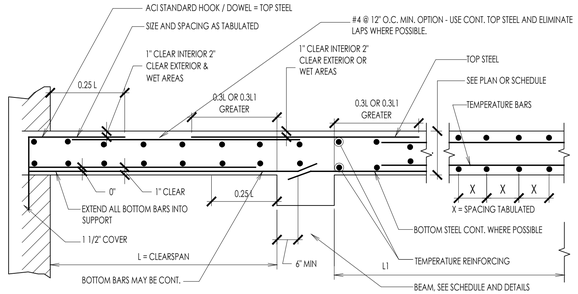
NOTE: SLAB REINFORCING STEEL NOT SHOWN EXTEND OVER BEAM REINFORCING - TYP.

11 S202 STANDARD CONC. BEAM DETAILS (TYP.)

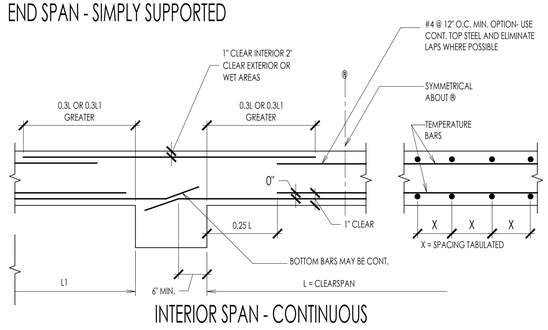
SCALE: N.T.S.



SINGLE SPAN - SIMPLY SUPPORTED



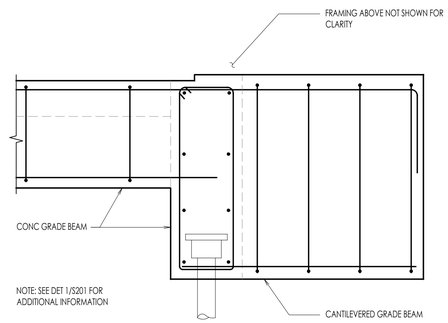
END SPAN - SIMPLY SUPPORTED



INTERIOR SPAN - CONTINUOUS

8 S202 SUSPENDED CONC. SLAB DETAILS (TYP)

SCALE: N.T.S.



12 S201 CANTILEVERED GRADE BEAM AT GRADE BEAM

SCALE: N.T.S.

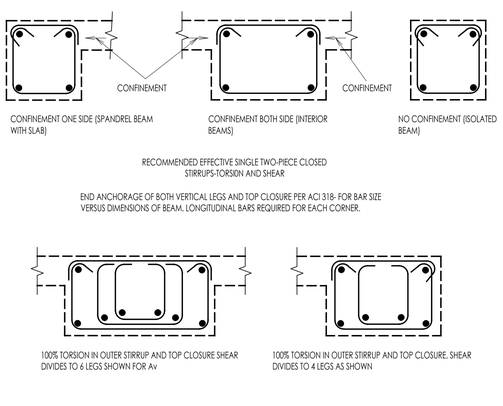
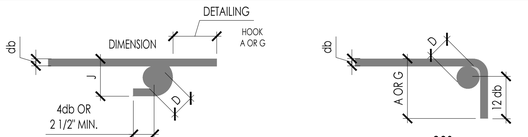


FIG. 13- RECOMMENDED TWO-PIECE CLOSED SINGLE AND MULTIPLE U-STIRRUPS

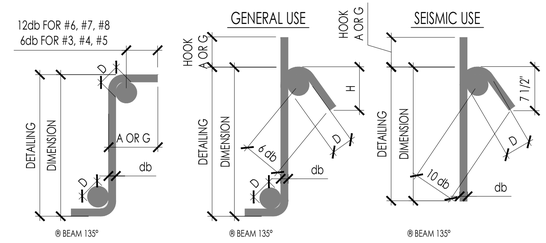
9 S202 STANDARD BEAM SUPPORT (TYP.)

SCALE: N.T.S.



RECOMMENDED END HOOKS, ALL GRADES

BAR SIZE	FINISHED BEND DIAMETER D, IN.	180-DEG HOOKS		90-DEG HOOKS
		A OR G	J	A OR G
#3	2 1/4	5"	3"	6"
#4	3	6"	4"	8"
#5	3 3/4	7"	5"	10"
#6	4 1/2	8"	6"	1'-0"
#7	5 1/4	10"	7"	1'-2"
#8	6	11"	8"	1'-4"
#9	9 1/2	1'-3"	11 3/4"	1'-7"
#10	10 3/4	1'-5"	1'-1 1/4"	1'-10"
#11	12	1'-7"	1'2 3/4"	2'-0"
#14	18 1/4	2'3"	1'-9 3/4"	2'-7"
#18	24	3'-0"	2'-4 1/2"	3'-5"

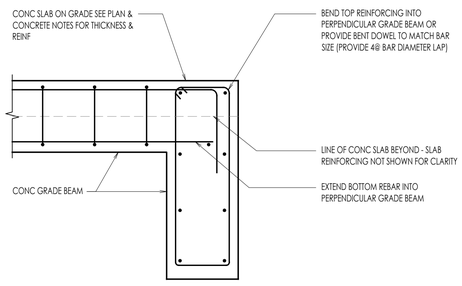


STIRRUP AND TIE HOOKS, ALL GRADES

BAR SIZE	D, IN.	GENERAL USE			SEISMIC USE	
		90-DEG HOOK	135-DEG HOOK		135-DEG HOOK	
		A OR G	A OR G	H, APPROX.	A OR G	H, APPROX.
#3	1 1/2	4"	4"	2 1/2"	5"	3 1/2"
#4	2	4 1/2"	4 1/2"	3"	6 1/2"	4 1/2"
#5	2 1/2	6"	5 1/2"	3 3/4"	8"	5 1/2"
#6	4 1/2	1'-0"	8"	4 1/2"	11"	6 1/2"
#7	5 1/4	1'-2"	9"	5 1/4"	1'-0 1/2"	7 3/4"
#8	6	1'-4"	10 1/2"	6"	1'-2 1/2"	9"

5 S202 HOOKS / STIRRUPS - TYP. BENDS

SCALE: N.T.S.



6 S201 GRADE BEAM AT GRADE BEAM

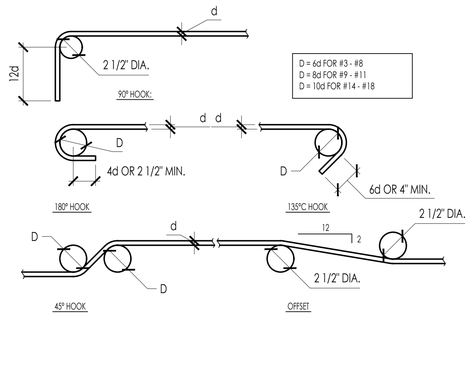
SCALE: N.T.S.

REINFORCING LAP SPLICE SCHEDULE

BAR SIZE	f'c = 3000 PSI				f'c = 4000 PSI				f'c = 5000 PSI				f'c = 6000 PSI			
	REGULAR		TOP		REGULAR		TOP		REGULAR		TOP		REGULAR		TOP	
	CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
#3	13"	17"	17"	21"	12"	16"	16"	21"	12"	16"	16"	21"	12"	16"	16"	21"
#4	17"	22"	22"	28"	15"	19"	19"	25"	13"	17"	17"	22"	12"	16"	16"	21"
#5	21"	27"	27"	35"	18"	24"	24"	31"	16"	21"	21"	27"	15"	19"	19"	25"
#6	27"	36"	36"	46"	24"	31"	31"	40"	21"	28"	28"	36"	20"	25"	25"	33"
#7	37"	48"	48"	63"	32"	42"	42"	54"	29"	38"	38"	49"	27"	34"	34"	44"
#8	49"	64"	64"	82"	42"	55"	55"	71"	38"	49"	49"	64"	35"	45"	45"	58"
#9	62"	80"	80"	104"	54"	70"	70"	90"	48"	62"	62"	81"	44"	57"	57"	74"
#10	78"	102"	102"	132"	68"	88"	88"	115"	61"	79"	79"	102"	56"	72"	72"	94"
#11	96"	125"	125"	162"	83"	108"	108"	141"	76"	97"	97"	126"	68"	88"	88"	115"

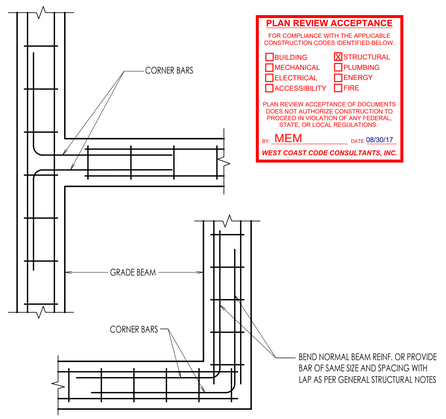
NOTE:

1. THESE NOTES SHALL BE USED FOR ALL SPLICES, UNLESS NOTED OTHERWISE.
2. CLASS 'A' SPLICES MAY BE USED ONLY IN CASES WHERE 50% OR LESS OF THE BARS ARE SPLICED WITHIN THE LAP SPLICE LENGTH.
3. CLASS 'B' SPLICES SHALL BE USED FOR ALL SPLICES UNLESS THE REQUIREMENTS OF NOTE #2 ABOVE ARE MET.
4. TIES AND STIRRUPS SHALL NOT BE SPLICED.
5. a. FOR BUNDLED BARS OF THREE OR LESS, LAP SPLICE LENGTHS SHALL BE MULTIPLIED BY 1.2.
   b. FOR BUNDLED BARS OF FOUR OR MORE, LAP SPLICE LENGTHS SHALL BE MULTIPLIED BY 1.33.
   c. INDIVIDUAL BAR SPLICES WITHIN A BUNDLE SHALL NOT OVERLAP.
   d. ENTIRE BUNDLES SHALL NOT BE LAP SPLICED.
6. FOR ALL LIGHTWEIGHT CONCRETE, LAP LENGTHS SHALL BE MULTIPLIED BY 1.3.
7. FOR ALL EPOXY COATED BARS, LAP LENGTHS SHALL BE MULTIPLIED BY 1.3 FOR TOP BARS AND 1.5 FOR REGULAR BARS.
8. TOP BARS ARE CLASSIFIED AS HORIZONTAL BARS WHERE 12", OR MORE, OF FRESH CONCRETE IS CAST BELOW THE REINFORCING BAR.



2 S202 REINFORCING LAP SPLICE SCHEDULE & BAR BENDING DIAGRAMS

SCALE: N.T.S.



3 S202 TYP. CORNER WALL REINF. DETAIL

SCALE: N.T.S.

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WEST COAST CODE CONSULTANTS, INC.

J M WILLIAMS and Associates
2975 South Decker Lake Drive, Suite 275, Salt Lake City, Utah 84119
Ph. 801.575.6455 Fax. 801.575.6456 Web. WWW.JMWA.COM

LICENSED PROFESSIONAL STRUCTURAL ENGINEER No. 8362 JEFFREY S. WILLIAMS STATE OF UTAH

07/25/2017

DETAILS

NINE BARK TOWNHOMES FOUNDATION

REVISIONS:

SCALE:

DATE: JULY. 14, 2017

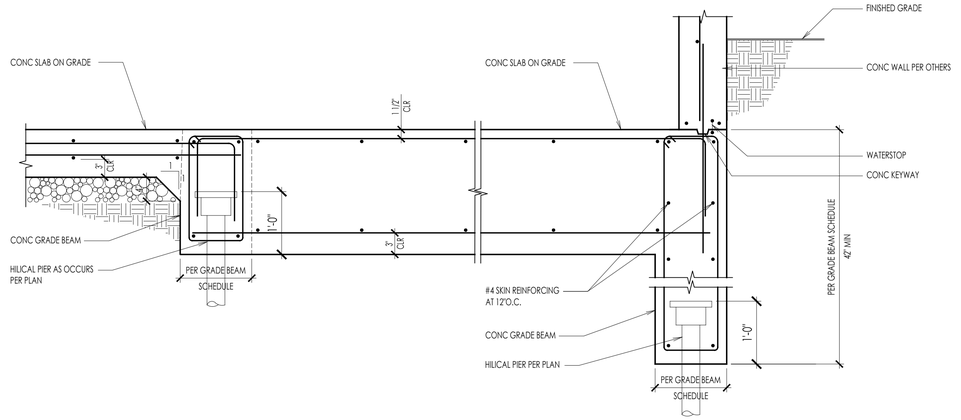
DRAWN BY:

JOB NO. 2017.028

FILE: 2017.028

SHEET NO.

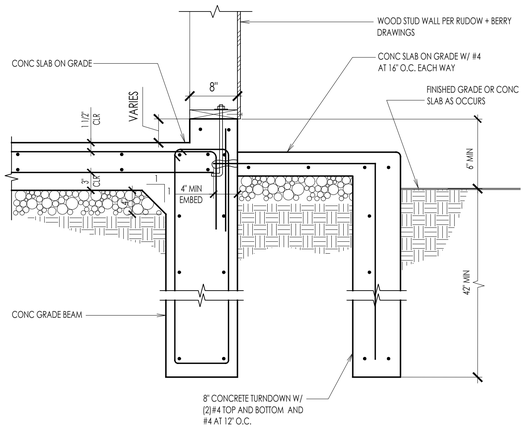
S202



4 S203

EXTERIOR WALL GRADE BEAM FOUNDATION

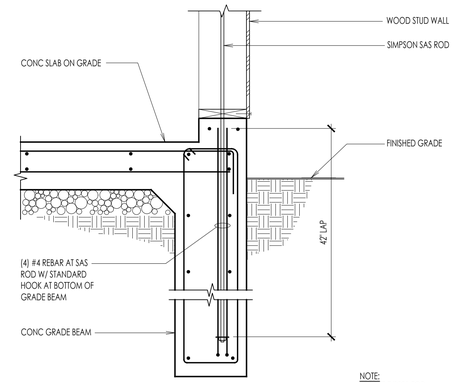
SCALE: N.T.S.



5 S203

EXTERIOR WALL GRADE BEAM FOUNDATION

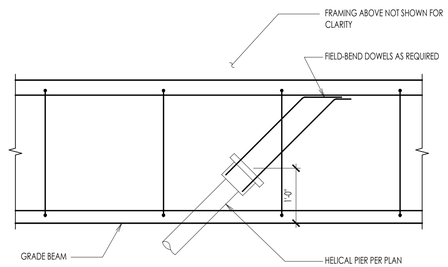
SCALE: N.T.S.



2 S203

SAS ROD AT GRADE BEAM

SCALE: N.T.S.



3 S203

BATTERED HELICAL PIER AT GRADE BEAM

SCALE: N.T.S.

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

☐ BUILDING ☒ STRUCTURAL
☐ MECHANICAL ☐ PLUMBING
☐ ELECTRICAL ☐ ENERGY
☐ ACCESSIBILITY ☐ FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: MEM DATE: 08/30/17

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LICENSED PROFESSIONAL STRUCTURAL ENGINEER No. 9351447 JEFFERY S. JOHNSON STATE OF UTAH

07/25/2017

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