River Ridge Academy

Injection Grouted Micro Piles

Palmetto Gunite Construction Co., Inc.

November 2019

Palmetto
Gunite Construction Co., Inc.

INDEX

Geotechnical Pile Design

Palmetto
Gunite Construction Co., Inc.

November 18, 2019

Mr. Chris Pettit
M. B. Kahn Construction Co., Inc.
148 ½ East Bay Street
Charleston, S.C 29401

Subject: Micropile Geotechnical Design Submittal – River Ridge Academy

Dear Mr. Chris Pettit,

Palmetto Gunite Construction Company, Inc. has completed the geotechnical micropile design for the 400 and 600 Wing Additions at the River Ridge Academy in Bluffton, South Carolina. The geotechnical soil information was derived from the Terracon CPT Sounding C1_RRA dated November 8, 2019. The structural loading information that was used to design the micropiles were from Michael M Simpson & Associates, Inc. 'River Ridge Academy Addition' dated August 1, 2019. This submittal will include the recommendations for the micropile size and depth based on the provided information provided to Palmetto Gunite Construction Company.

Project Information

This project is located at the River Ridge Academy at 3050 River Ridge Drive in Bluffton, South Carolina. The project additions include constructing additions to the 400 and 600 wings of the school. The structural loads that will were provided to Palmetto Gunite are shown in the table below.

Geotechnical Load	**Required Allowable Capacity** (kips)
Axial Compression	32

Subsurface Conditions

The geotechnical data on the soil conditions were derived Terracon CPT Sounding C1_RRA dated November 8, 2019. The CPT sounding and location plan are attached to the submittal. The upper 24 feet consisted of loose to medium dense sands. Very soft to soft clays extend below the sand to a depth of approximately 32 feet below the existing grade.

From a depth of 32 feet until 38 feet below the existing grade was a dense sand layer. A medium stiff sandy clay layer extends until a depth of 42 feet below the existing grade. From a depth of 42 feet below grade to the termination and refusal of the CPT sounding at 49 feet below the existing grade, a dense sand layer was encountered. The groundwater was estimated to have been 7 feet below the existing grade at the time of exploration.

Micropile Installation Information

The micropiles that will be installed will consist of TITAN Injection Bore (IBO) 40 / 20 steel rods manufactured by Ischebeck. The micropiles will have a modified 150 mm diameter cutting head which will result in installing micropiles with a diameter of 8 inches. The TITAN IBO steel rods should have a yield stress of approximately 85.6 kips per square inch (ksi). The Technical data is presented in the attached Appendix.

The order of the construction activities for the installation of micropiles are as follows:

- Drilling the TITAN IBO rod into the ground with a rotary drill and pumping a lean cementitious grout to remove the soil cuttings;
- Once final depth has been achieved and the micropile bore hole is cleaned, a high strength cementitious grout with a minimum 28-day compressive strength of 4,000 pounds per square inch (psi) is injected through the rod and displaces the drilling grout.

Recommendations for Micropile Design

Based on the required axial compression loading, an 8-inch diameter micropile was analyzed for this project. A Factor of Safety of 3.0 was used to derive the allowable axial capacities since there will not be a load test performed for this project. The design length for the 8-inch micropile was 50 feet below the existing grade. The table below shows the allowable axial capacities.

Geotechnical Load	**Allowable Capacity** (kips)
Axial Compression (8” pile)	37

The micropile calculations are attached to this submittal.

Limits of Submittal

All recommendations in this submittal were developed on the information provided in the subsurface investigation by Terracon Consultants and the documents and email comments from M. B. Kahn Construction Company. If any information stated in this submittal is not accurate or project information change / becomes available, Palmetto Gunite Construction Company must be contacted in writing and must review the micropile design to determine if the design still satisfies all project requirements. If soil conditions are encountered during micropile construction that vary from the geotechnical report, Palmetto Gunite Construction Company should be notified and additional testing maybe required.

This submittal has been prepared exclusively for the use of our client for specific application to this project in accordance with generally accepted geotechnical practice. No warranties, either expressed or implied, are intended or made.

Please contact us if you have any questions about this submittal. We appreciate the opportunity to work on this project with you.

Sincerely,

Palmetto Gunite Construction Company, Inc.

William Snow, Jr., P.E.
Senior Project Engineer
South Carolina: P.E. – 33973

Appendix

Exhibit A: ISCHEBECK TITAN Technical Data

Exhibit B: Boring Location Plan

Exhibit C: CPT Sounding C1_RRA Log

Exhibit D: Micropile Calculations

Exhibit A

ISCHEBECK TITAN Technical Data

Micropiles

ISCHEBECK TITAN

- **IBO®: Injection BOring**
- **The piling solution for difficult ground conditions**
- **No harmful vibrations or noise**
- **Easily installed in confined spaces**
- **Micropiles with capacities up to 1169 kips (5200 kN)**

Con-Tech Systems Ltd.

ISCHEBECK TITAN

CTS/TITAN IBO® (Injection BOre) piles are ideally suited as micropiles, otherwise known as anchor piles, mini piles or root piles (pali radice).

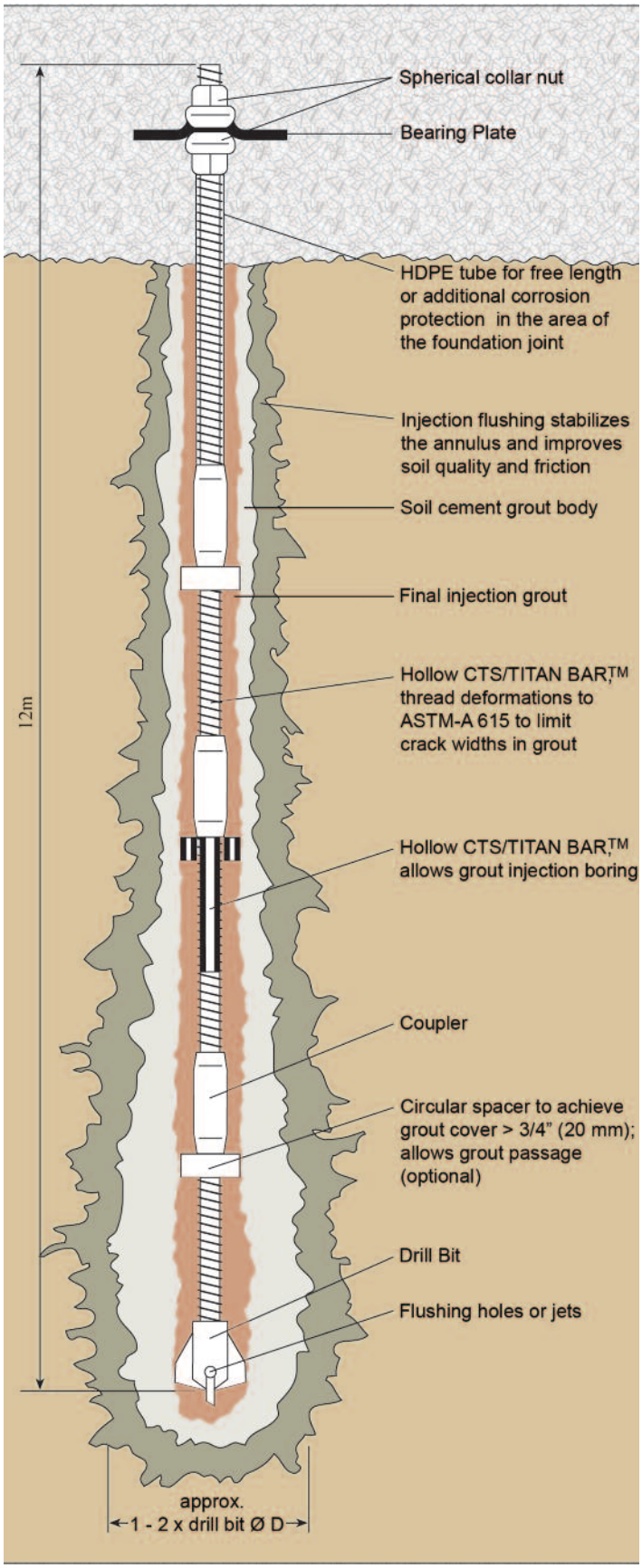
CTS/Titan IBO® micropiles consist of a continuously threaded, hollow bar as reinforcement tendon, combined with a Portland Cement grout body of a minimum 3.63 ksi (25 N/mm^2) strength. The rough, profiled surface of the grout body transfers tension and/or compression loads to the ground.

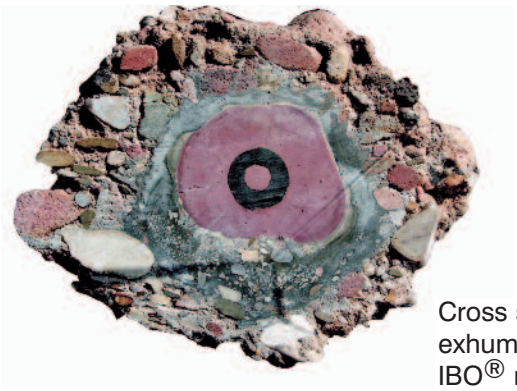
CTS/TITAN micropiles comply in Europe with DIN 4128, EAU E 28 and final draft CEN/TC288/WG/8 specifications and in North America with FHWA recommendations FHWA-SA-97-070. The material of the hollow bar, as well as the thread deformations comply with **ASTM A-615**.

Advantages over conventional piles

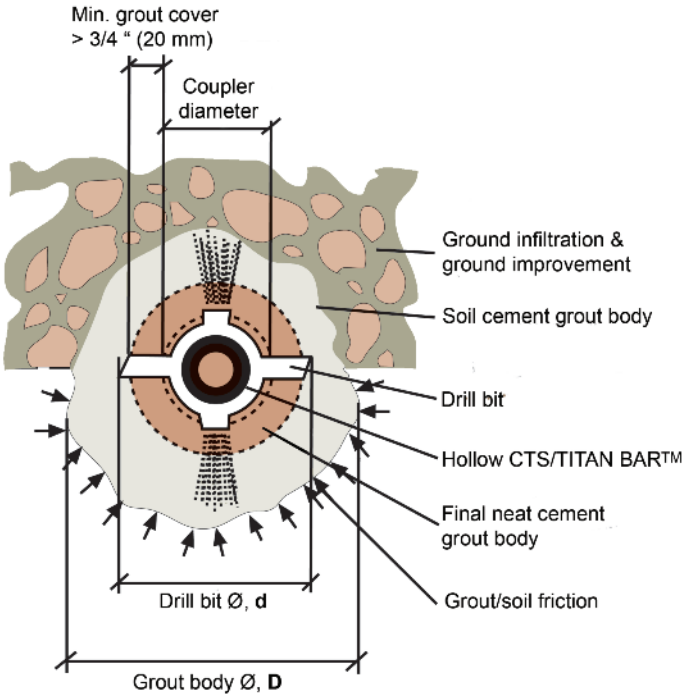
- Works in compression and tension
- Does not require temporary casing
- Improved mechanical ground/grout interaction reduces overall depth
- Dramatically increased production rates
- Lightweight rotary percussive drilling equipment
- Easily installed in confined spaces
- Permits top down mini jet grouting in saturated clays and silts complete with rebar
- Perfect for structural repairs and underpinning
- Remote de-coupling unit facilitates underwater piling from barges or drill platforms
- Injection bored CTS/TITAN micropiles provide a range of working loads from 29.7 kips (132 kN) to 1,169 kips (5,200 kN)
- No harmful vibrations or noise
- Minimal spoil

ISCHEBECK TITAN





Cross section of exhumed CTS/TITAN IBO® micropile



Grout Body Diameter, D, in different Soils

D ≥ 2.0 x d for medium & coarse gravel
1.5 x d for sand & gravelly sand
1.4 x d for cohesive soil (clay, marl)
1.0 x d for weathered rock

d: Drill bit diameter

Please Note:
The above illustration is based on actual tests and experiences using the CTS/TITAN IBO® system installed with appropriate drilling and grouting equipment.

Micropiles for new foundations

ISCHEBECK TITAN

Reticulated Micropile Wall

Owner: CN Rail
Contractor: Geo-Foundations Contractors Inc.
Location: Ontario, Canada

Installation of an array of 125 micropiles 39.4' (12 meters) deep, with half of them vertical while the other half are inclined towards the core of the embankment. The piles are then tied into a 203' (62 meter) long reinforced concrete beam. Project was completed without interruption to the rail traffic.

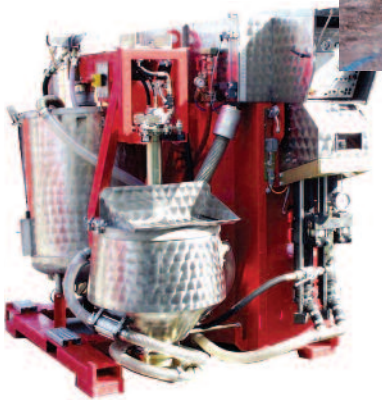
Phoenix Sky Harbor Airport Terminal 4 Expansion

Contractor: Scheffler Nevada Corp.
Location: Phoenix, AZ

CTS/TITAN IBO® micropile foundation

Obermann Grouting Stations

VS 110 (left) and VS 63 grouting stations for flushing and grouting of micropiles



Micropiles for structural underpinning

ISCHEBECK TITAN

The White Sands of La Jolla

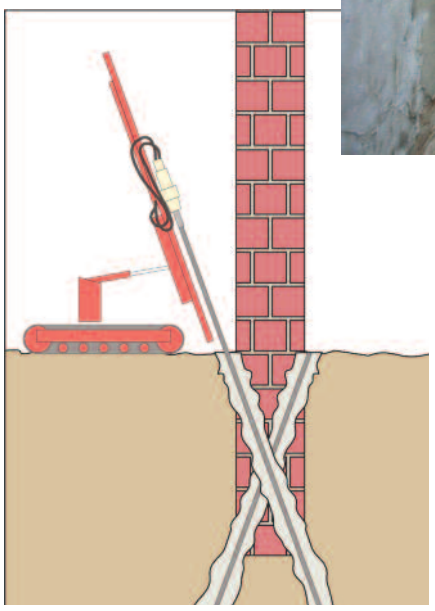
Owner: Southern California Presbyterian Home Owners
Contractor: Condon Johnson, San Diego, CA
Location: La Jolla, CA

Underpinning of soil nail shoring wall

Titan Micropiles for Underpinning

General Cont.: Levine Builders
Engineer: Mueser Rutledge Consulting Engineers
Found. Cont.: Moretrench
Location: New York City, NY

Moretrench installed hollow CTS/TITAN BARS™ 40/16 at 28 locations for micropiles. The 55' (17 m) long micropiles, underpin a turn of the century, two story, brick warehouse. The underpinning was necessary because of excavation work for the construction of a new building adjacent to the existing warehouse.



ISCHEBECK® TITAN

Utah State Capitol Building

Contractor: Becho Inc.
Engineers: Geotechnical Design Services INC.
Location: Salt Lake City, Utah

Largest micropile installation in the USA (over 3000) for seismic base-isolation and restoration.

LDS Church Temple Square

Owner: LDS Church
Contractor: Becho Inc.
Engineers: Geotechnical Design Services INC.
Location: Salt Lake City, Utah

Tabernacle seismic upgrading and renovation using CTS/TITAN IBO® micropiles.

Micropiles for tower bases

ISCHEBECK TITAN

Wind Turbine Tower Foundations

Contractor: Pacific Industrial Electric, Brea CA

Wind turbine foundations for NEGMICON 54/950 kW wind turbine generators on 180' (55 m) towers using CTS/TITAN IBO® 52/26 anchors for micropiles.

Foundation of Blast Resistant Enclosures

Numerous Job-Sites

Security tower bases using CTS/TITAN IBO® 73/45 anchors for micropiles.

ISCHEBECK TITAN®

Internal carrying capacity

The internal carrying capacity is influenced by friction behavior, crack width limitation and corrosion protection. The reinforcement type thread of the hollow CTS/TITAN BAR™ conforms to ASTM A-615 and other international standards. The related rib area of 0.13 is very close to the maximum values for reinforcing bars. Consequently, optimum bond is achieved as in reinforced concrete. **This is a unique feature of the CTS/TITAN IBO® micropile.**

Corrosion protection

As with reinforced concrete these ribs induce a uniform crack distribution in the grout. Investigations by the University of Munich on excavated grout bodies reinforced with hollow CTS/TITAN BARS™ 30/11 have shown that up to 125% of the design load (according to DIN) the characteristic crack widths are below the permissible value of 0.004" (0.1 mm) as required by ASTM A-615 and other international standards. This proves that the system complies with DIN 4128 9.2 and that the corrosion protection with minimum grout cover of 3/4" (20 mm), as with reinforced concrete, is sufficient for permanent piles

Internal carrying capacity fully utilized

The internal carrying capacity derived from the yield load can be fully utilized for permanent tension piles.

External carrying capacity

For the dimensioning of the load bearing length, L , of a pile with grout body diameter, D, the external carrying capacity is critical. It is determined by the ultimate soil friction, q_{sk}, the surface area of the grout body and a safety factor, according to DIN 4128 table 2.

End bearing capacity of the CTS TITAN IBO® micropile can be ignored. Ultimate skin friction values should be derived from site investigations and tests. DIN (German Industrial Standard) V 1054-100 table F1 offers conservative q_{sk} values for some soil types:

Type of soil	Ultimate skin friction q_{sk}	
	psi	kN/m^2
Medium to coarse gravel[1)]	29	200
sand and gravelly sand[1)]	21.75	150
cohesive soil[2)]	14.5	100

[1)] D ≥ 0.4 resp. q_{ck} ≥ 1.45 ksi (10MN/m^2)
[2)] Ic ≈ 0.1 resp. c_{uk} 14.5 psi (100 kN/m^2)

Buckling

According to DIN 4128 9.3 calculations for buckling have only to be done if the undrained shear strength of the soil Cu is below 1.45 psi (10 kN/m^2). Critical cohesive soils according to E9 EAU are:

Type of Soil	Shear Strength Cu	
	psi	kN/m^2
clay, soft & easily kneadable	1.45 - 3.6	10 - 25
loam, soft	1.45 - 3.6	10 - 25
chalk	1.45 - 7.25	10 - 50
clay	1.45 - 2.9	10 - 20
peat	0.73 - 1.45	5 - 10

For references on standards and principal tests performed, please contact us or visit our Web-Site at **www.micro-piles.com**.

1 mm = 0.03937 in 1 m = 3.281 ft 1 MPa = 0.145 ksi 1kN/m^2 = 0.02088 kips/sqft

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Load bearing length, L, for tension or compression piles

$$L = \frac{F_W \cdot S}{\pi \cdot D \cdot q_{sk}}$$

Fw	Safe working load
S	Safety factor
π	3.142
D	Grout body diameter
q_{sk}	Ultimate skin friction

Example:

Required load:	22.5 kips
Material:	sand
Drill bit diameter, d:	4.4”
Ultimate skin friction q_{sk}	21 psi

1) Grout body diameter, D:
D = d · (enlargement factor for sand)
The enlargement factor for sand is 1.5 (please see page 3).

2) Load bearing length, L:

$$L = \frac{(22.5 \text{ kips} \cdot 1000) \cdot 3}{\pi \cdot (4.4 \text{ inch} \cdot 1.5) \cdot 21 \text{ psi}}$$

$$L \geq 155 \text{ inch} = 12.9 \text{ ft}$$

Load bearing capacity, F_{CP}, of compression only piles

Compression only piles have the ability to spread the load over the steel section and the grout body as a composite pile.

Example:

CTS/TITAN BAR™	52/26
Outer bar diameter	2”
Ultimate strength of bar, **F_U**	209 kips
Drill bit diameter, **d**	6.9”
Enlargement factor for ground (conservative estimate)	1
Grout compressive strength **G_C** after 28 days	5.8 ksi

Load taken on grout (conservative estimate)

$$F_G = A_G \cdot \frac{G_C}{4}$$

F_G	Load taken on grout
A_G	Grout area
G_C	Grout compressive strength

The area of the grout is calculated as the area of the grout body minus the steel area. (In the example, the grout body diameter is assumed to be the same as the drill bit diameter):

$$A_G = ((6.9)^2 - 2^2) \cdot \frac{\pi}{4} = 10.9 \cdot \pi \text{ inch}^2$$

Consequently, the load taken by the grout is

$$F_G = 10.9 \cdot \pi \cdot \frac{5.8}{4} \text{ kips}$$

$$F_G \approx 50 \text{ kips}$$

The Design Load taken on steel, F_S

$$F_S = F_U \cdot 0.6$$

becomes, with the ultimate strength F_U of the CTS/TITAN BAR™ 52/26,

$$F_S = 125 \text{ kips}$$

The total working load, **F_{CP}**, of the pile in this conservative estimate is

$$F_{CP} = F_G + F_S \approx 50 + 125 \text{ kips or}$$

$F_{CP} \approx$ 175 kips

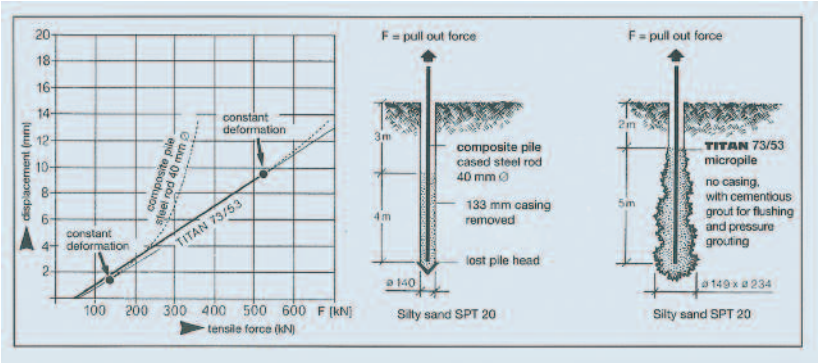
Please Note: These examples are applicable to CTS/TITAN IBO® micro piles only. Design requirements and safety factors may vary.

Drilled and pressure grouted micropiles

ISCHEBECK TITAN

Load deformation chart of 7m (23 ft) long grouted piles

Load deformations are compared in the same silty sand for a solid steel bar 40 mm (1 1/2") diameter with cased hole and a CTS/TITAN IBO® 73/53 (2 7/8" / 2 1/8") micropile with grout flushing W/C ratio 0.7 and final grout W/C 0.4 pressure grouted at max. 60 bar (870 psi).



Installation procedure for CTS/TITAN IBO® micropiles

To utilize the CTS/TITAN IBO® micropiles to their full potential, it is essential that they are installed properly. We do not advise using air instead of grout while drilling, as it will potentially lead to reduced skin friction of the finished pile.

Please contact Con-Tech Systems Ltd. for best practices when installing CTS/TITAN IBO® micropiles.

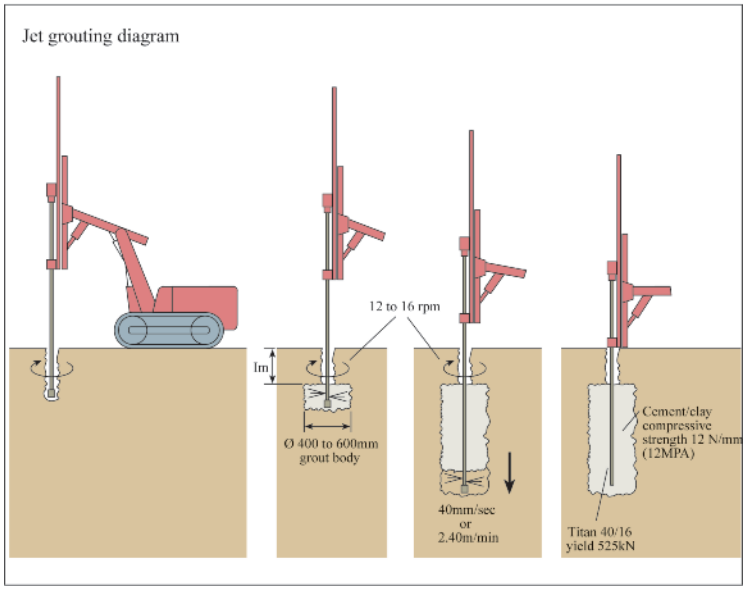
Mini jet grouting

In order to install a working micropile in plastic clays and/or silty (SPT 3-4) conditions, Ischebeck Titan mini jet grouted micropiles can be used.

The system involves installing the pile without grout for the first 3 feet (1 meter) and then injecting a grout mix with a W/C ratio in the range of 0.8, at a grout pump pressure of up to 2900 psi (200 bar).

A grout body in the order of 15 3/4" (400 mm) to 23 5/8" (600 mm), with a compressive strength of 1.7 ksi (12 MPa) can be achieved in these ground conditions.

The 40/16 CTS/Titan IBO® micropile, together with a 4 3/8" (110 mm) hardened clay drill bit with adapted nozzles, is used for this application.

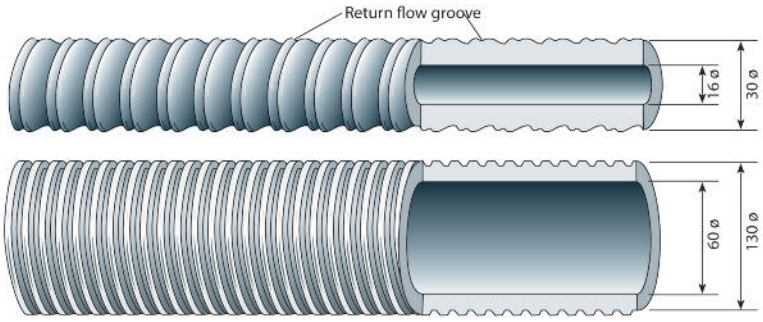


1 mm = 0.03937 in 1 m = 3.281 ft 1 MPa = 0.145 ksi 1kN/m^2 = 0.02088 kips/sqft

ISCHEBECK TITAN

Product specifications

Ischebeck hollow CTS/TITAN BAR™ type denotes external diameter of bar followed by its internal diameter. For example, a Titan 30/16 bar has an external diameter of 30mm and an internal diameter of 16mm.



Bar Type	Unit	30/16	30/14	30/11	40/20	40/16	52/26	73/56	73/53	73/45	73/35	103/78	103/51	127/111	130/60
Nom. outside dia.	mm	30	30	30	40	40	52	73	73	73	73	103	103	127	130
Nominal Inside dia.	mm	16	14	11	20	16	26	56	53	45	35	78	51	111	60
Ultimate load	kN	220	260	320	539	660	929	1194	1160	1630	1980	2282	3460	2400	7940
Yield Point	kN	180	220	260	430	525	730	785	970	1180	1355	1800	2750	1810	5250
Yield Stress	N/mm^2	471	557	583	592	597	546	555	594	522	500	572	500	603	550
Cross Section	mm^2	382	395	446	726	879	1337	1414	1631	2260	2710	3146	5501	3000	9540
Weight	kg/m	2.7	2.9	3.3	5.6	7	10	11.1	12.3	17.8	21.2	24.9	43.4	23.5	75
Thread direct.	-	left	left	left	left	left	left	right	right	right	right	right	right	right	right
Lengths	m	3/4	3/4	3/4	3	3	3	6.25	3	3	3	3	3	3	3

The ultimate load at yield (or the corresponding load which occurs at a constant elongation of 0.2%) was tested by MPA, (the material testing institute of the state of Northrhine Westfalia, Dortmund/Germany). This also applies to the cross sections. Above figures are valid for INOX anchors as well. The stresses mentioned were calculated from the load and cross section values of MPA.

Key features

1. **Utilization of a steel hollow bar as the tendon** From the static point of view, a hollow bar is superior to a solid rod of the same cross sectional area with respect to bending moment, shear resistance and surface bond/friction.

2. **Hollow TITAN BAR™ is manufactured from high yield micro alloy high quality structural steel offering** high notch toughness > 39J. This steel is not affected by hydrogen embrittlement or by stress crack corrosion.

3. **The threads on hollow TITAN BAR™ are formed much like the ribs on a reinforcing bar fabricated according to DIN 488 & ASTM-A 615.** The deep Titan threads result in 2.4 times higher bond friction compared to standard drill steel coil-threads of R 32 (1¼") or R 38 (1½")

4. **Continuous threads guarantee the TITAN BAR™ can be cut or coupled anywhere along its length.** Cutting, extending, pre-stressing and load releasing on the tendon are possible. A thread pitch of 6° eliminates the need for locking nuts at each coupling.

1 mm = 0.03937 in 1 m = 3.281 ft 1 kN = 0.225 kips 1 N/mm^2 = 0.145 ksi 1kg/m = 0.672 lbs/ft

Contacts

Tom Miller Dam, Texas, USA
Owner: Lower Colorado River Authority
Engineer: Freese and Nichols
Contractor: Nicholson Construction

CTS/TITAN IBO® 40/20 Stitch Anchors , installed under Water

Con-Tech Systems Ltd.

Head Office and Western Division
8150 River Road
Delta, BC V4G 1B5, Canada
Toll Free: 1-888-818 4826
Fax: 604 946-5548

Plants: Delta, BC; & Blaine, WA

Eastern Division
4502 Hanna Drive
Elizabethtown, ON K6T 1A9
Canada
Tel: 613 342-0041
Fax: 613 342-0609

East Stroudsburg, PA USA
Tel: (570) 872-9090
Fax: (570) 872-0901
Cell: (570) 807-9617

Charlotte, NC USA
Toll Free: 1-866-848-6800
Cell: 704 506-8472
Cell: 727 992-4142

Plants: Elizabethtown, ON &
Charlotte, NC

World Wide Web
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ctswest@contechsystems.com

Eastern Division
ctseast@contechsystems.com

Con-Tech Systems Ltd.

Ver: 1208

Exhibit B

Boring Location Plan

Image Courtesy of
Google Earth™

Project Manager:	TCB
Drawn by:	TCB
Checked by:	GL
Approved by:	GL

Project No.	HG195027
Scale:	N.T.S.
File Name:	
Date:	11/12/2019

Terracon
Consulting Engineers & Scientists
2201 Rowland Avenue Savannah, Georgia 31404
Phone (912) 629 4000 Fax (912) 629 4001

EXPLORATION LOCATION PLAN

Bluffton Schools
River Ridge Academy, 3050 River Ridge Drive
Bluffton, Beaufort County, South Carolina

Exhibit:
A-1-2

Exhibit C

CPT Sounding C1_RRA Log

CPT CORRELATIVE PARAMETER LOG NO. C1_RRA

SEE CPT LOG NO. C1_RRA FOR DETAILED TEST RESULTS

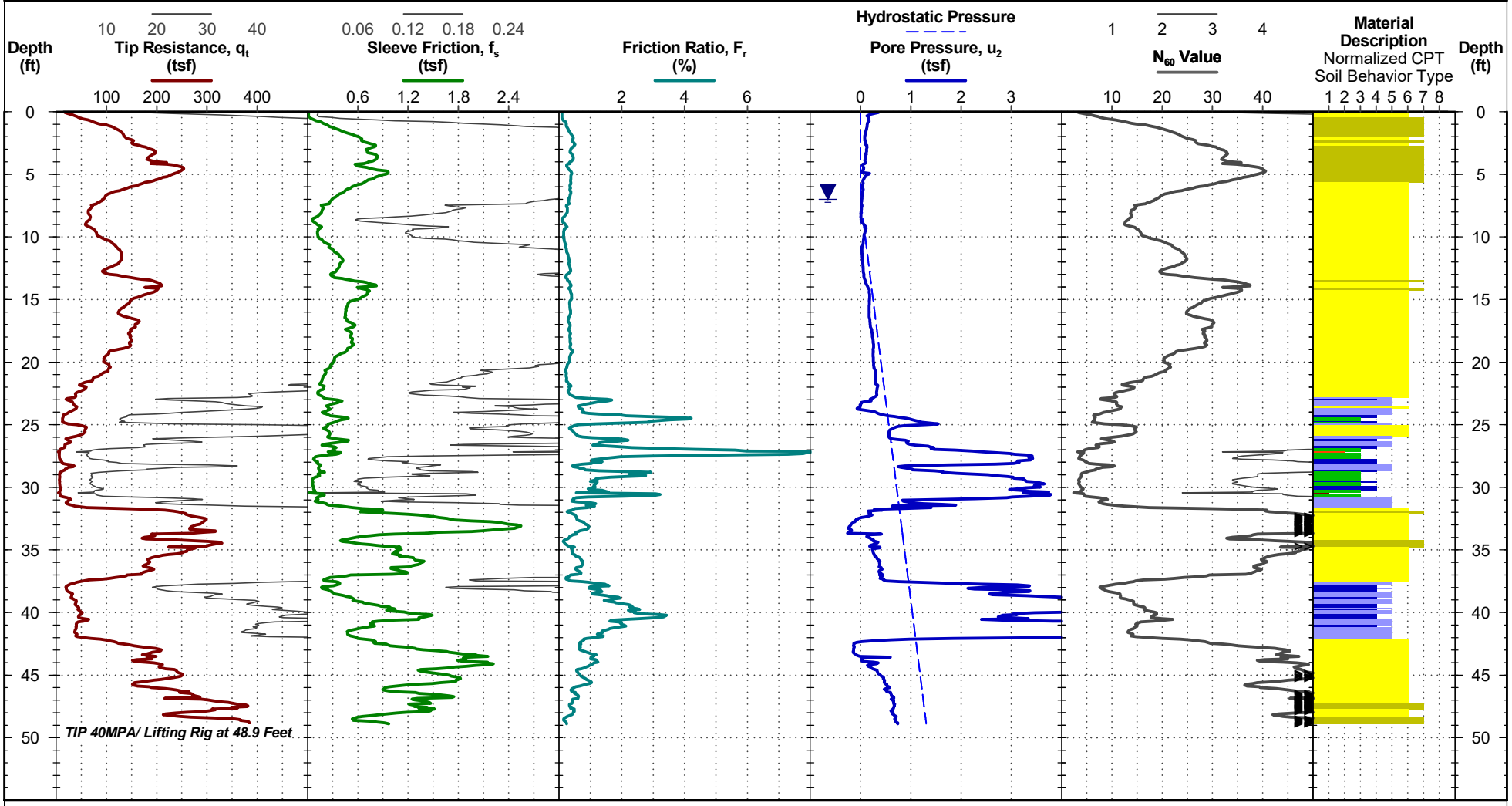
PROJECT: Bluffton Schools

CLIENT: Palmetto Gunite Construction Company, Inc.
Ravenel, SC

TEST LOCATION: See Exhibit A-1

SITE: May River HS/ River Ridge Academy
Bluffton, SC

Latitude: 32.271726°
Longitude: -80.941882°



Tip resistance, sleeve resistance, porewater pressure, and tilt angle are measured. Other parameters presented are derived from interpretations of the measured data, based upon published correlations, but do not necessarily represent actual values that would be derived from direct testing.

WATER LEVEL OBSERVATION

▼ 7 ft estimated water depth
(used in normalizations and correlations)

Notes:
Probe no. 5311 with net area ratio of .892
Manufactured by Geotech A.B.; calibrated 1/25/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
Savannah, GA

CPT Started: 11/8/2019
CPT Completed: 11/8/2019
Rig: Truck-mounted
Operator: BR
Project No.: HG195027

EXHIBIT A-2-2

Exhibit D

Micropile Calculations

Micropile Calculations

Project: River Ridge Academy
Date: 11/18/2019

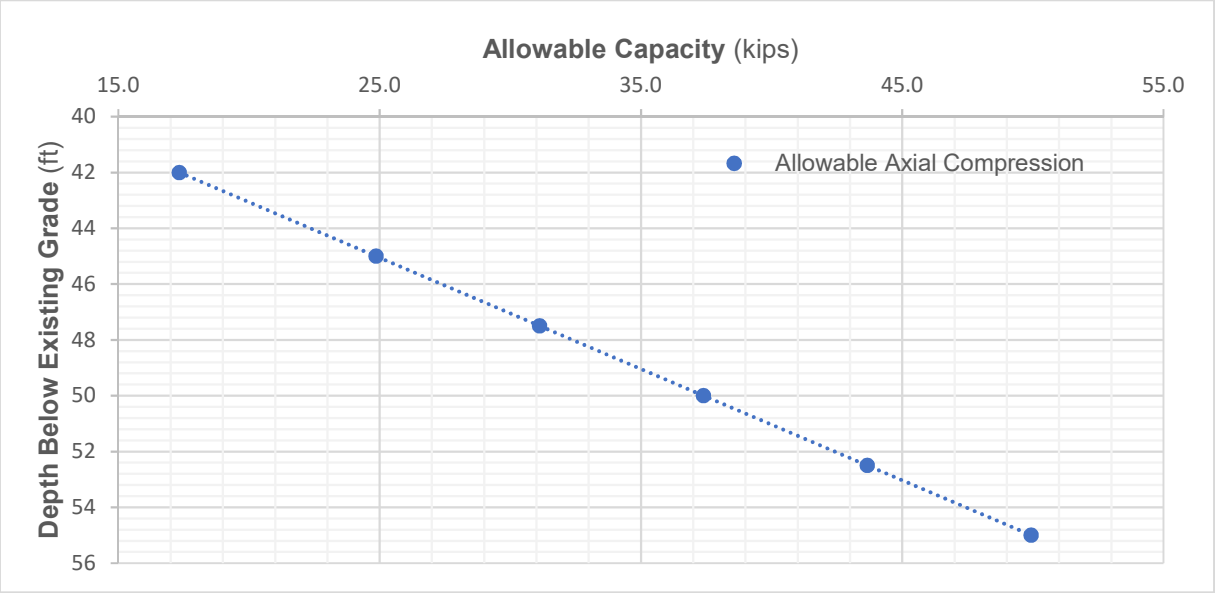
Soil Profile

*Soil Profile is based on CPT C1_RRA data provided by Terracon Consultants dated 11-8-19

Stratum	**Soil Type**	**Top of Layer** (ft)	**Bottom of Layer** (ft)	**Friction Angle** (deg)	**Cohesion** (ksf)	**Bond Strength** (psi)
1	Dense Sands	32	38	33	N/A	25
2	Medium Stiff Sandy Clays	38	42	N/A	0.72	5
3	Dense Sands	42	50	33	N/A	25

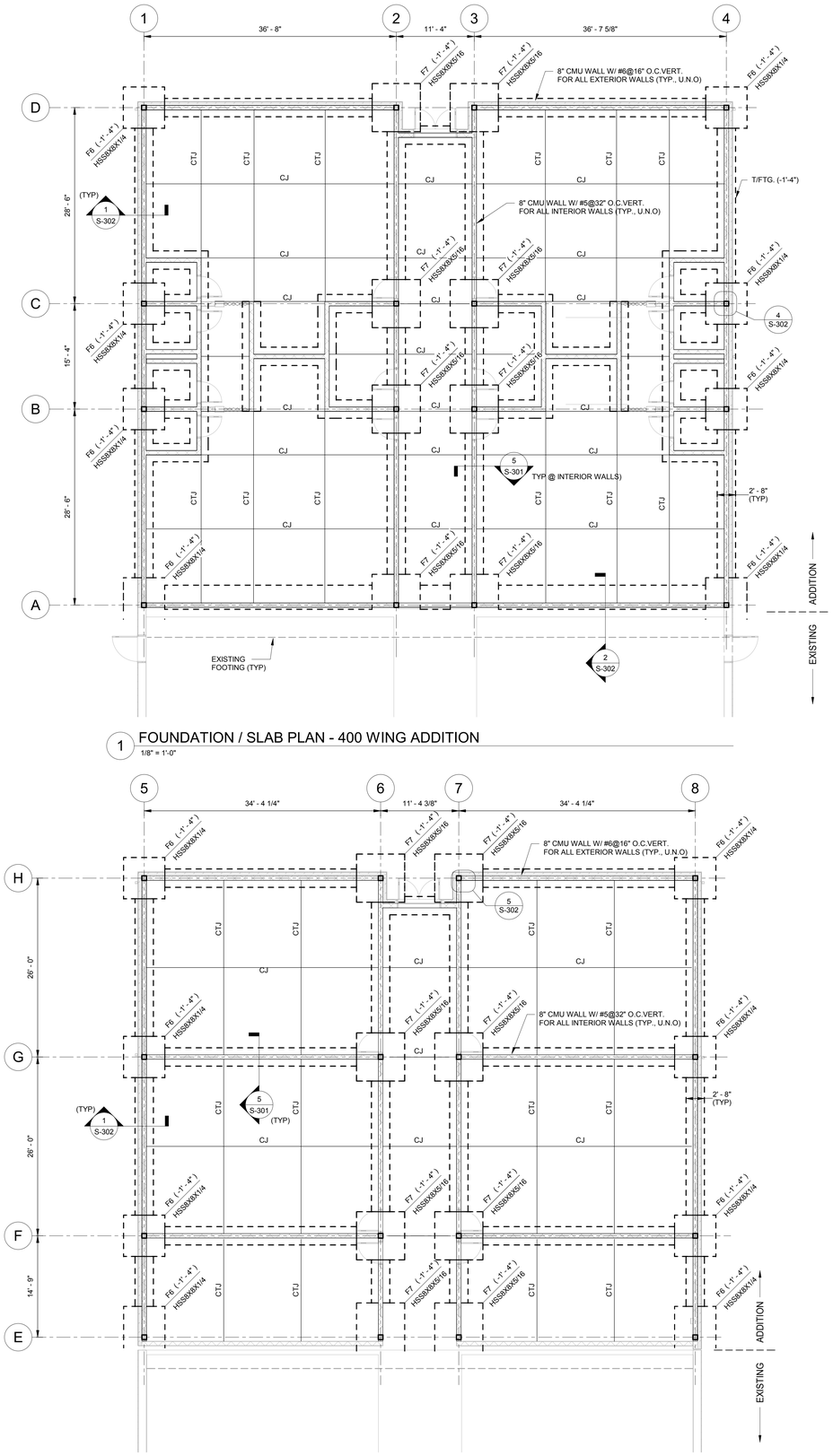
Axial Capacity

Pile Type	**Allowable Axial Capacity** (kips)	**Total Length** (ft)	**Factor of Safety**
8-inch	37	50	3



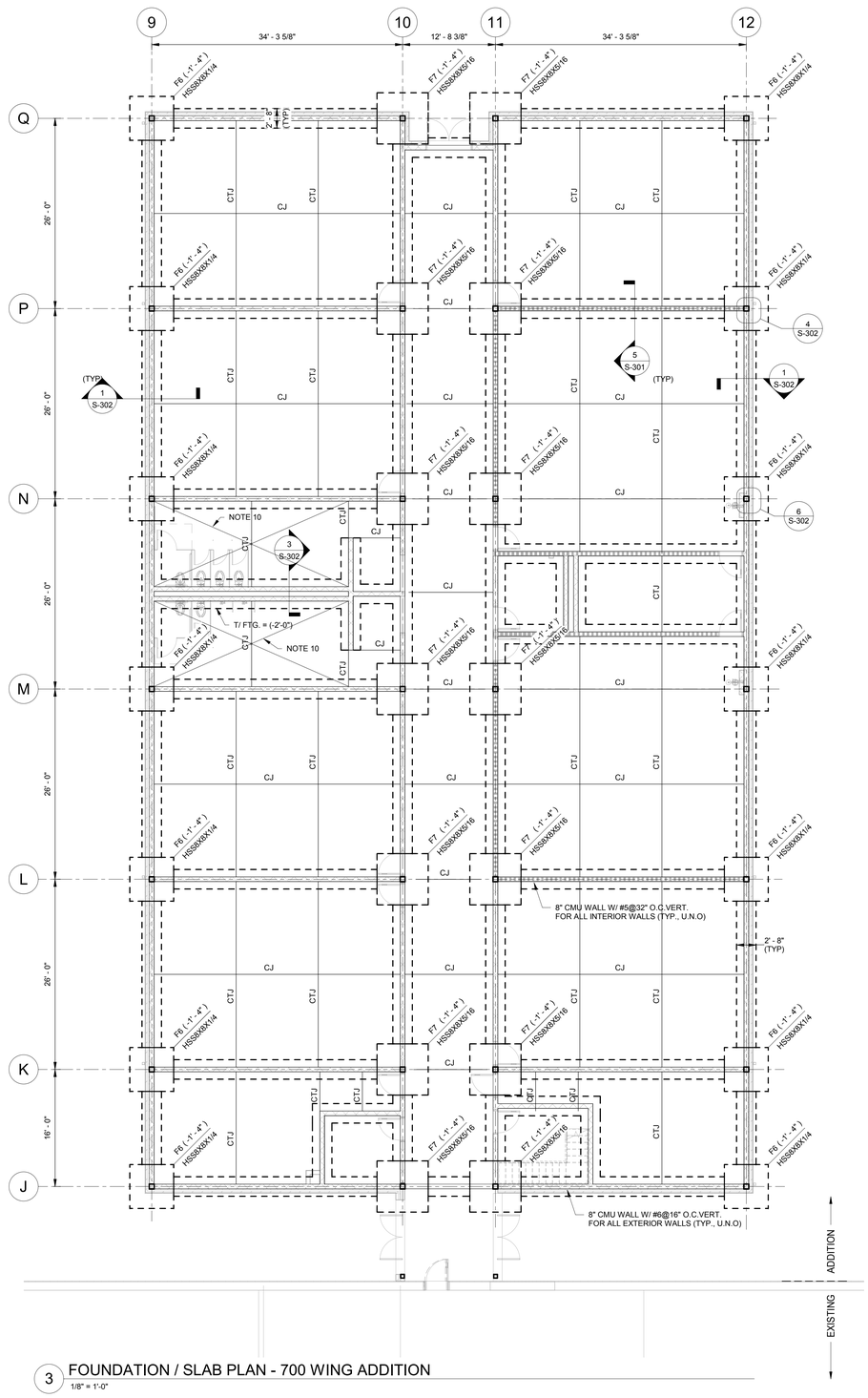
Palmetto
Gunite Construction Co., Inc.

Construction Documents



1 FOUNDATION / SLAB PLAN - 400 WING ADDITION
1/8" = 1'-0"

2 FOUNDATION / SLAB PLAN - 600 WING ADDITION
1/8" = 1'-0"



3 FOUNDATION / SLAB PLAN - 700 WING ADDITION
1/8" = 1'-0"

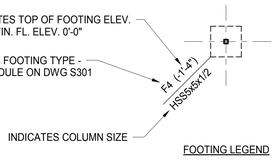
BUILDING FINISH FLOOR EL. 0'-0" (U.N.O.) + DATUM EL. xx'-x" (SEE CIVIL DWG)

SLAB-ON-GRADE = 4" CONCRETE SLAB W/ FIBERMESH REINFORCING
OVER 15 MIL VAPOR BARRIER AND 4" - #57 STONE BASE. (TYP, U.N.O.)

^ ~ - INDICATES VERTICAL HSS BRACING, SEE DRAWING S601
CJ - INDICATES CONSTRUCTION JOINT, SEE DETAIL 1/S301
CTJ - INDICATES CONTROL JOINT, SEE DETAIL 1/S301
$ - INDICATES STEPPED FOOTING, SEE DETAIL 4/S301

NOTES:

1. SEE DRAWING S-001 - S-003 FOR GENERAL NOTES AND BASIS OF DESIGN.
2. SEE ARCH. DRAWINGS FOR ALL BUILDING/WALL PLAN DIMENSIONS NOT SHOWN ON STRUCTURAL DWGS.
3. SEE ARCH. DRAWINGS FOR SLAB EDGE DIMENSIONS.
4. ALL FOOTINGS SHALL BE CENTERED ON COLUMNS, U.N.O.
5. CONTINUOUS WALL FOOTING REINFORCEMENT AND TURNED DOWN GRADE BEAMS, LONG-WAY BARS, SHALL BE CONTINUOUS THRU COLUMN FOOTINGS.
6. WHERE CONTINUOUS FOOTINGS OF DIFFERENT SIZES MERGE TOGETHER, THE SMALLER FOOTING LONG-WAY BARS SHALL EXTEND, (TENSION LAP SPLICE), INTO THE LARGER FOOTING.
7. COORDINATE ALL SLAB RECESS LOCATIONS, SIZE AND DEPTHS W/ ARCH. DWGS.
8. SEE PLUMBING DRAWINGS FOR ADD'L INFORMATION.
9. PLACE CJ AT INTERIOR/EXTERIOR SLAB TRANSITION LOCATIONS.
10. SLOPE SLAB TO DRAIN (MIN. 1/8" SLOPE). 1" SLAB RECESS COORDINATE RECESS WITH ARCHITECTURAL DRAWINGS.



FOOTING LEGEND

BEAUFORT COUNTY SCHOOL DISTRICT

RIVER RIDGE ACADEMY ADDITION

LS3P
205 1/2 KING STREET
CHARLESTON, SOUTH CAROLINA 29401
TEL. 843.577.4444 FAX 843.722.4789
WWW.LS3P.COM

SOUTH CAROLINA
MICHAEL M. SIMPSON & ASSOCIATES, INC
No. C02038
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
REG. NO. 16718
MICHAEL M. SIMPSON
REGISTERED ARCHITECT
8/1/19

MEMBERS OF THE AMERICAN INSTITUTE OF ARCHITECTS

REVISIONS:

No.	Description	Date

PROJECT: 1201-192350
DATE: 08/01/2019
DRAWN BY: ERB
CHECKED BY: MMS

FOUNDATION / SLAB PLAN

S-101

OSF CONSTRUCTION DOCUMENTS

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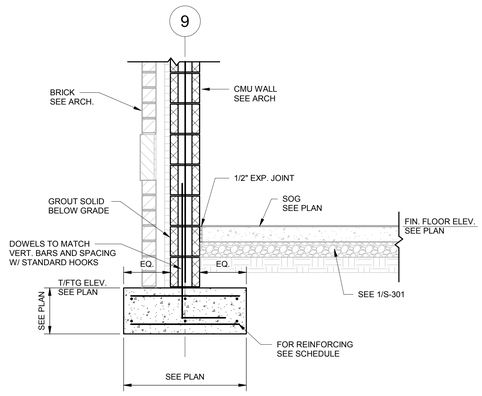
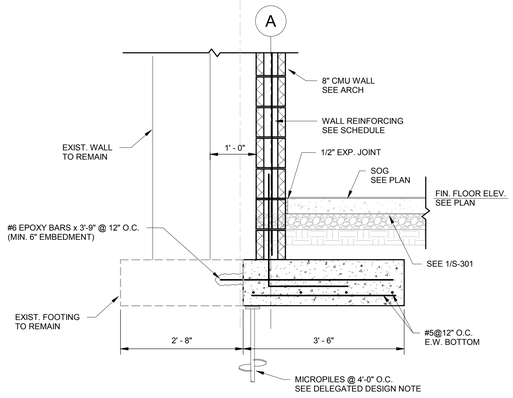


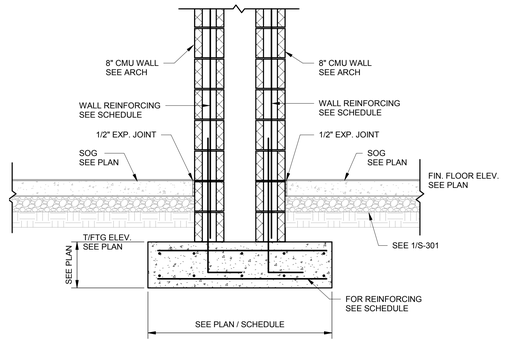
1 SECTION
3/4" = 1'-0"



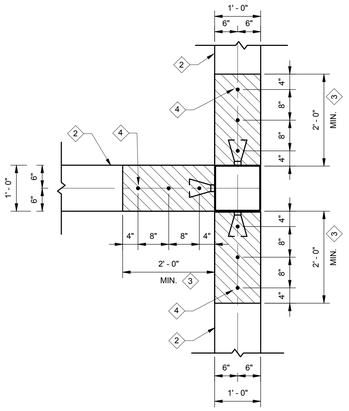
2 SECTION
3/4" = 1'-0"

DELEGATED DESIGN:

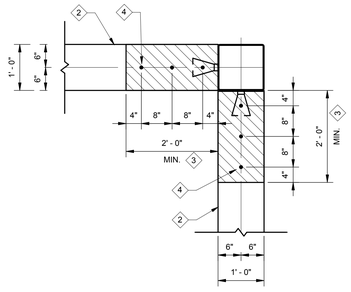
MICROPILE
32 KIP WORKING CAPACITY (COMPRESSION).
MICROPILE TOP DEFLECTION AND LATERAL ANALYSIS SHALL BE PERFORMED BY SPECIALTY FOUNDATION ENGINEER.



3 SECTION
3/4" = 1'-0"



1. MAIN BUILDING FRAME COLUMN
2. CMU WALL
3. FILL CELLS 100% SOLID FOR 2'-0" AT BUILDING COLUMN
4. 3 -#6 VERTICAL BARS AT 3 FILLED CELLS
5. ADJUSTABLE WALL TIES WELDED TO COLUMN WALL AT 16" O.C. VERTICALLY. SEE GENERAL NOTES



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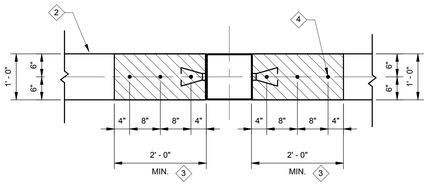

1. MAIN BUILDING FRAME COLUMN
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3. FILL CELLS 100% SOLID FOR 2'-0" AT BUILDING COLUMN
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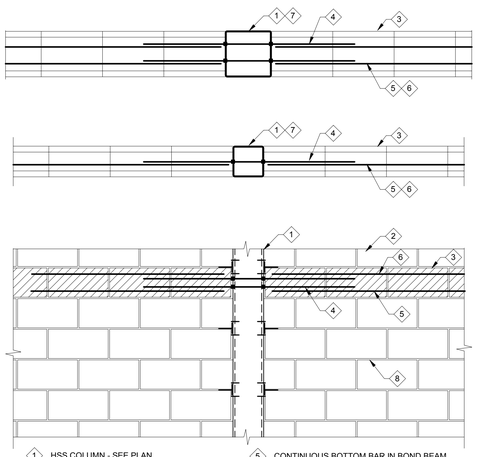
5. ADJUSTABLE WALL TIES WELDED TO COLUMN WALL AT 16" O.C. VERTICALLY. SEE GENERAL NOTES

4 CMU TEE WALL TIE TO BUILDING COLUMN
3/4" = 1'-0"

5 CMU CORNER WALL TIE TO BUILDING COLUMN
3/4" = 1'-0"

6 CMU IN-LINE WALL TIE TO BUILDING COLUMN
3/4" = 1'-0"



1. HSS COLUMN - SEE PLAN
2. CMU WALL - SEE PLAN
3. CONTINUOUS BOND BEAM
4. #5 X 6'-8" DOWELS TO MATCH THE TOP AND BOTTOM CONT. BARS IN THE BOND BEAM. SHOP DRILL 13/16" DIA. HOLES THROUGH THE COLUMN. PLACE THE TOP HOLES 2" DOWN FROM THE TOP OF THE BOND BEAM AND THE BOTTOM HOLES 2" UP FROM THE BOTTOM OF THE BOND BEAM
5. CONTINUOUS BOTTOM BAR IN BOND BEAM
6. CONTINUOUS TOP BAR IN BOND BEAM
7. ADJUSTABLE MASONRY WALL TIES. SEE S-302 AS APPLICABLE FOR TYPICAL CMU WALL TIES TO HSS COLUMNS
8. TYPICAL HORIZONTAL JOINT REINFORCING NOT SHOW FOR CLARITY

7 TYP. BOND BEAM REINFORCEMENT THRU HSS COLUMN
3/4" = 1'-0"

BIM 360://BCSD - River Ridge Academy addition/2018-RRA-Structural.rvt
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WHERE LEARNING LEADS THE WAY
BEAUFORT COUNTY SCHOOL DISTRICT

RIVER RIDGE ACADEMY ADDITION

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MEMBERS OF THE AMERICAN INSTITUTE OF ARCHITECTS

REVISIONS:

No.	Description	Date

PROJECT: 1201-192350
DATE: 08/01/2019
DRAWN BY: ERB
CHECKED BY: MMS

SECTIONS AND DETAILS

S-302

OSF CONSTRUCTION DOCUMENTS

Micropile Material

Exhibit A: Grout Mix Design

Exhibit B: Compressive Strength Data – Pile Grout

Exhibit C: Micropile Shop Drawings

Exhibit A

Grout Mix Design

Micro Pile Grout Design Mix

94 lbs. Type I / II Portland Cement (by Holcim)

5 gallons of potable water

35 pounds of FA-10 sand

Exhibit B

Compressive Strength Data – Pile Grout

GROUT COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN185109.0008
Service Date: 08/08/18
Report Date: 09/06/18 Revision 1 - 7-day results
Task: Field Work/Cylinders/Testing

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Palmetto Gunite Construction Company, Inc.
Attn: Bill Snow
5330 Savannah Hwy
PO Box 388
Ravenel, SC 29470-5451

Project

194 East Bay St. Micropiles
194 East Bay ST
Charleston, SC

Project Number: EN185109

Material Information

Specified Strength: 5,000 psi @ 28 days

Mix ID:
Supplier:
Batch Time: **Plant:**
Truck No.: **Ticket No.:**

Sample Information

Sample Date: 08/08/18 **Sample Time:**
Sampled By: David Olive
Weather Conditions:
Accumulative Yards: **Batch Size:**
Sample Size:
Sample Location:
Placement Location: Pile 134-1
Form Material: Plastic Mold **No. Units:** 1
Samples Plumb: Yes
Temperature Range:

Field Test Data

Test	Result	Specification
Slump (in):		
Grout Temp. (F):		
Ambient Temp. (F):		

Laboratory Test Data

Set No.	Specimen ID	Date Received	Date Tested	Age (days)	Area (sq in)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	08/10/18	08/11/18	3	12.57	67,935	5,410	2	DRC
1	2	08/10/18	08/15/18	7	12.57	81,844	6,510	3	DRC

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments:

Samples Made By: Terracon
Services: Obtain sample of grout used for production piles and cast compressive strength samples.

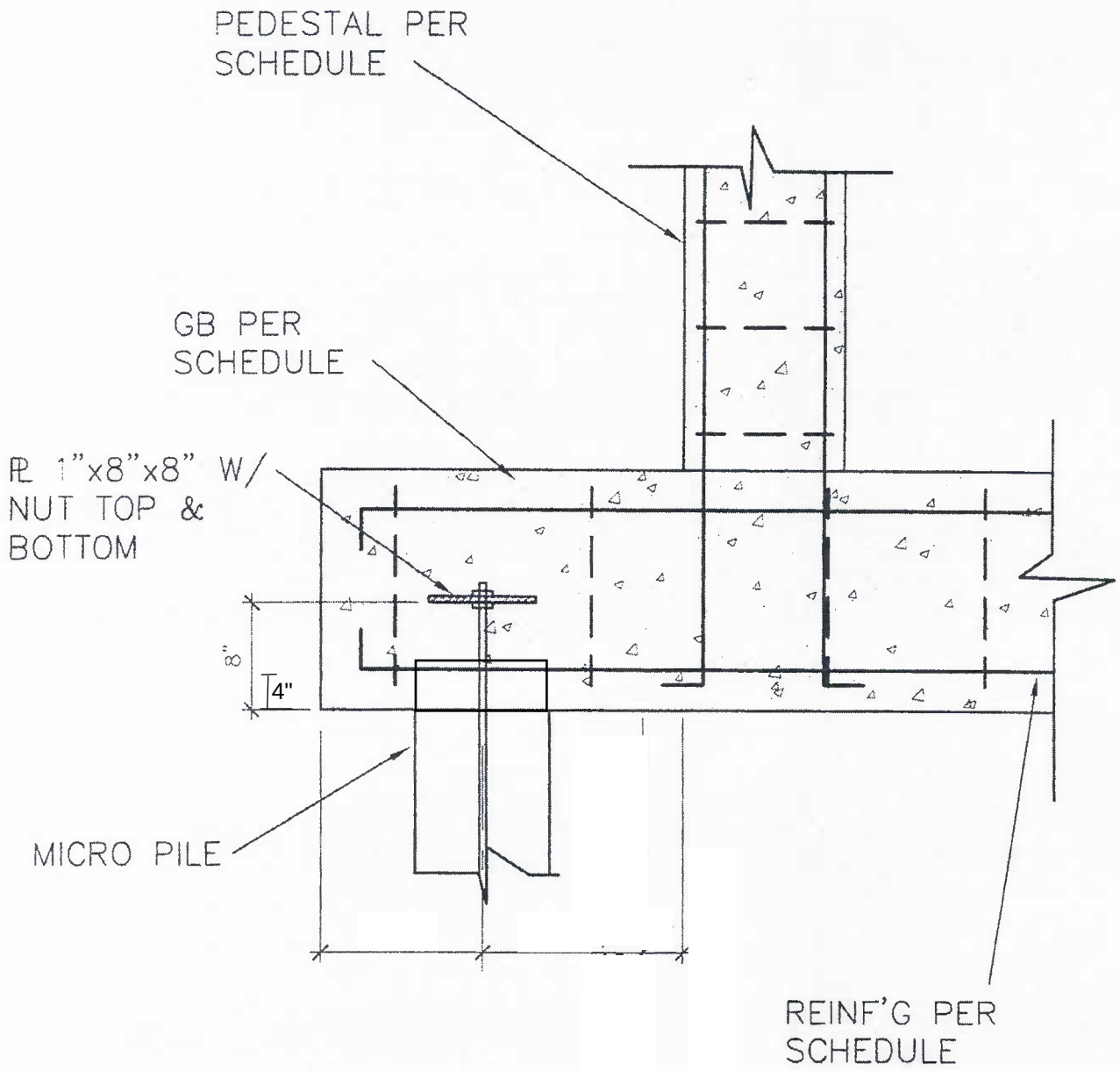
Terracon Rep.: David Olive
Reported To:
Contractor:
Report Distribution:
(1) Palmetto Gunite Construction Company, Inc., Bill Snow
(1) Palmetto Gunite Construction Company, Inc., Will Snow, Jr

Reviewed By: Jonathan Ard

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C1019, ASTM C1064

Exhibit C

Micropile Shop Drawings


PEDESTAL PER SCHEDULE
GB PER SCHEDULE
PL 1"x8"x8" W/ NUT TOP & BOTTOM
8"
4"
MICRO PILE
REINF'G PER SCHEDULE

Installation Procedure & Equipment

Installation Procedures

Installation

A. One Step Drilling / Flushing / Grouting

1. Connect hollow reinforcing bar to swivel and thread on drill bit.

2. Mix sufficient flushing grout (W / C=0.70) and pump into holding tank

3. Start pumping to assure that grout will exit drill bit.

4. Start rotary drilling while pumping grout continuously out of the holding tank. Grout in holding tank shall be agitated throughout. Make sure that the grout flushes constantly out of drill hole.

5. Generally advance rotary drilling no faster than three to four feet per minute. Rotation speed shall be approximately 60 to 120 RPM. Work hollow reinforcing bars in and out several times for each 10 foot length of pile installed.

6. When final depth is reached, change W / C ratio or 0.45. Under constant rotation and working hollow reinforcing bars in and out 5 feet to 10 feet, pump final grout to replace flushing grout.

Equipment

A. Micropile drilling equipment shall be a Bobcat #E45T4.The Bobcat shall be equipped with a skidsteer drill attachment as manufactured by WORD International, Elon, North Carolina.

B. Grouting Equipment shall be a CG600 Pneumatic Grout Plant, as manufactured by Chem Grout Company, Le Grange Park, Illinois.

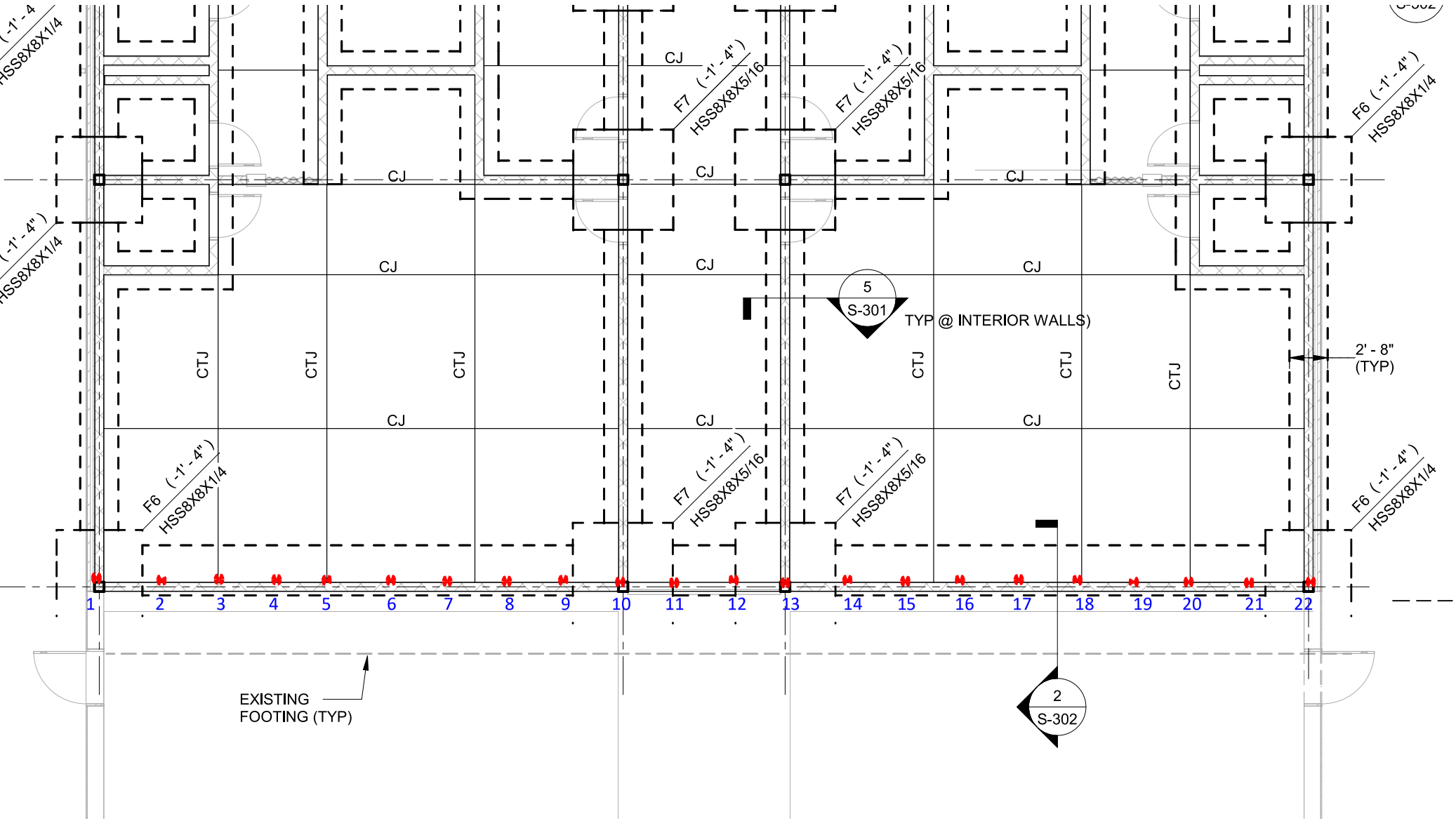
Micropile Installation Record

Micro Pile Installation Log

Project Name:		Field Supervisor:		Date:	1.35 cf/bag		Drilling Grout
Pile #	Diameter	Bar Size	# of Bags	Length	Start Time	Finish Time	# of Bags
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

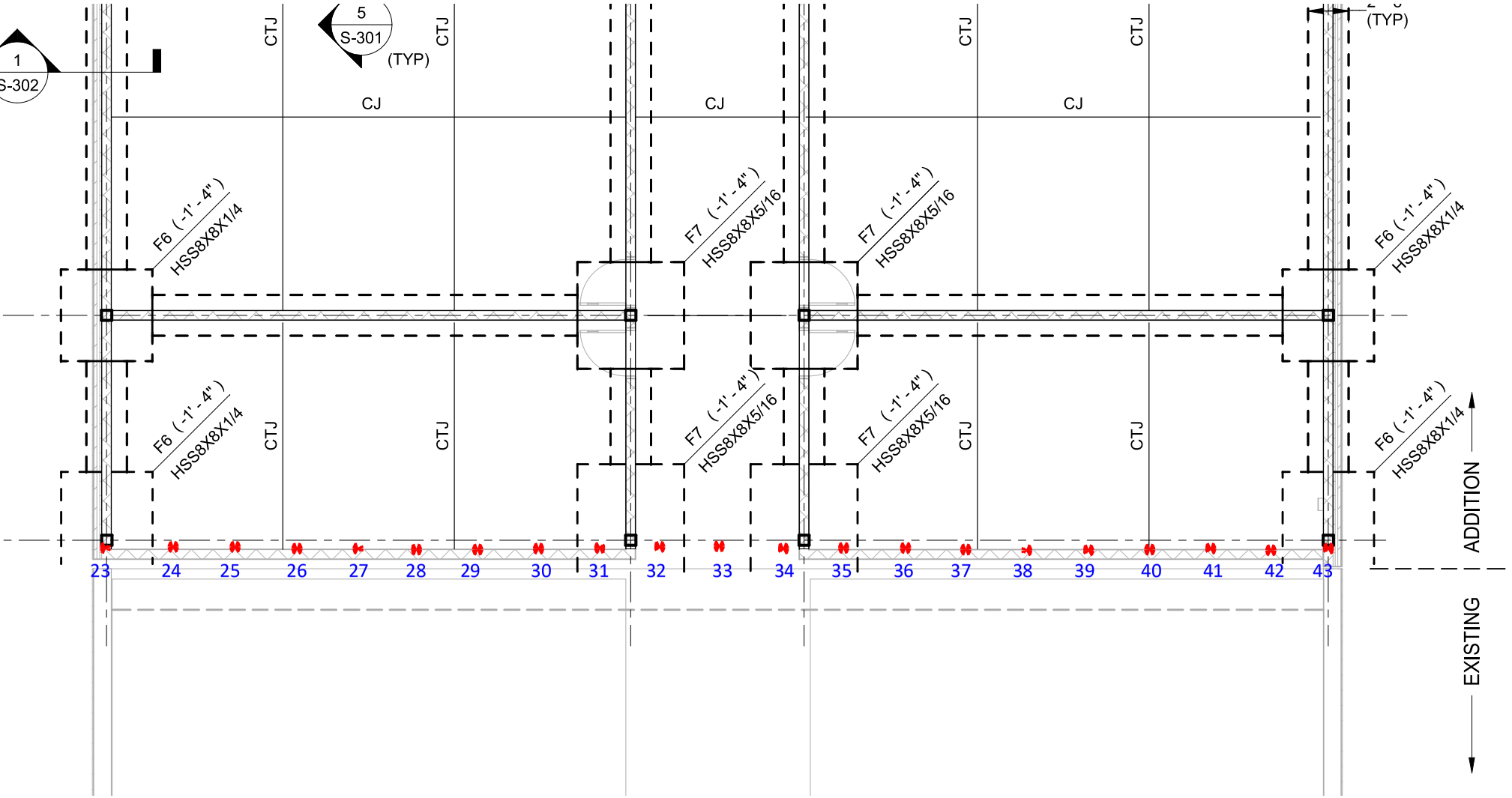
Notes:

Micropile Layout Drawing



1 FOUNDATION / SLAB PLAN - 400 WING ADDITION

1/8" = 1'-0"



2 FOUNDATION / SLAB PLAN - 600 WING ADDITION

1/8" = 1'-0"