Thompson Engineering Services, LLC.

Certificate of Authorization: #26899

Mark A. Thompson P.E.

P.E. #63350

Title: Helical Pile Design and Analysis

Submitted to:

Ram Jack Solid Foundations
24526 NW 178TH PLACE
High Springs, FL 32643
Office 386-454-1920
CBC1255391

OWNER/ LOCATION:
Barbara Bebbington
222 SW Coliseum Pl
Lake City, FL 32025
Job#TES-RJ-084

Prepared by: Mark Andrew Thompson P.E. #63350

MARK A. THOMPSON LICENSE NO. 63350 STATE OF FLORIDA PROFESSIONAL ENGINEER

Digitally signed by Mark A Thompson
Date: 2022.10.27 09:48:30 -04'00'

Mark Andrew Thompson, Professional Engineer.
License No. 63350
This item has been electronically signed and sealed by Mark Andrew Thompson, PE on 10/27/2022 using a Digital Signature.
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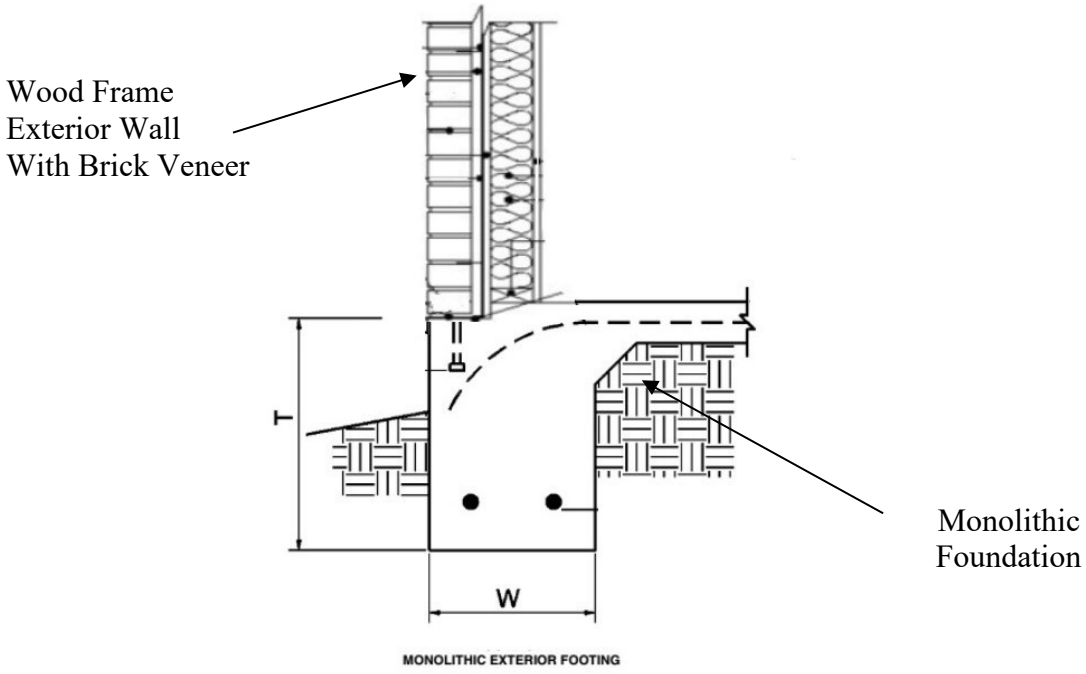
1.0 DESIGN SUMMARY

Dear Mr. Miller:
October 27, 2022
Project No. TES-R-084

Per our conversation, we understand that the above referenced project is a residential one-story wood frame structure on a Monolithic foundation construction with brick veneer.



(Assumed Frame Wall with Pier Foundation Construction Detail for Project)

The assumed minimum footing size is 12" W x 20" T with two #5 bars of reinforcement continuous at bottom. Please note that Engineer has not visited the site and the assumed footing configuration, dimensions & reinforcing must be verified by your on-site personnel.

The documents are a compiled representation of the constructed project. If site conditions differ from those outlined in this design please contact Thompson Engineering Services, LLC. for revisions as required.

This repair design is in accord with Chapter 4, "Repairs" of the Florida Building Code, 7th Edition (2020), Existing Building. Based on the information/job site measurements, digital pictures, and elevation measurements provided to Mark Andrew Thompson PE by Ram Jack Solid Foundations consultants for the listed address. The information provided by Ram Jack Solid Foundation associates is believed to be accurate and correct to the best of the engineer's knowledge, and that the accuracy of the information cannot be guaranteed.

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This project involves exterior piers provided by Ram Jack Solid Foundations which underpin the building as noted and described in the included pier/pile location layout. As determined by these parameters & Ram Jack material specifications (attached) the project will require **11** Ram Jack 2 7/8 helical piers designed for a maximum working load of **8.13 kips** with a safety factor of 2 being applied. The uniform wall load to be resisted by the 2 7/8 piles is calculated to be **1162 plf.**

No soils information has been provided for review at this site but the upper soil stratum at this site is assumed to be **firm** (N-value > 4), in accordance with the Florida Building Code 7th edition 2020 (FBC). No lateral loading from the existing wall or foundation were provided.

The underpinning piles for this project are defined as laterally unbraced per the FBC. Per section 1810.2.1 of the FBC, "Piers standing unbraced, in air, water or fluid soils shall be designed as columns in accordance with the provisions of this code. Such piles driven into firm soils can be considered fixed and laterally supported at *5* feet below the ground surface and in soft material at 10 feet below the ground surface unless otherwise prescribed by the building official after a foundation investigation by an approved agency". Based on the information provided by RamJack Solid Foundations the piles were analyzed for an unbraced length of five (5'-0) feet. The allowable structural capacity of a 2 7/8" diameter pile bracket #4037.1 is **20.4 kips**. The product data sheets have been attached for your review.

There are two different methods for calculating the capacities for helical piles based on soil strength, Torque Correlation Method and the Individual Bearing Method. The Torque Correlation Method is an empirical method that distinguishes the relationship between helical pile capacity and installation torque and has been widely used since the 1960's. The process of a helical plate shearing through the soil in a circular motion is equivalent to a plate penetrometer test. The International Code Council Evaluation Service (ICC-ES) adopted the Torque Correlation Method in their Acceptance Criteria for Helical Foundation Systems (AC358) as well as the 2018 International Building Code (IBC). The equation for the Torque Correlation Method is shown below (Equation 1.0).

The K_t factor is a function of the diameter or geometry of the central anchor shaft and can range from 3 to 20. Where:

Torque Correlation Equation is:

$P_u = K_t T$

Pu = ultimate helical tension capacity

Kr = imperial torque factor

T = effective installation torque

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The Expected installation parameters for Piers to achieve the required pile capacities are an estimated pile depth of **17** feet below ground level unless the pile reaches the developed torque required of **1900** ft-lbs. (See attached pile worksheets), or a maximum allowable developed torque of 6000 ft-lbs., or refusal.

As previously noted, no lateral loading criteria was provided to be resisted by the pilings. Therefore, it is assumed that the lateral loading is being provided by other structural members. If the pilings are required to resist any lateral loads, please notify this office immediately with the magnitude of the lateral loads to be resisted by the pilings as the pilings will need to be redesigned.

This design is not intended for sinkhole remediation at this project location.

The design and construction of this type of helical pier foundation is not a guarantee of resistance to foundation movement. The unwanted foundation movement or cracking may still occur. Any shallow foundation system which is supported by any type of soil especially clay soils beneath it, even if undercutting and or remediation efforts are performed, has some risk for differential movement.

To the best of my knowledge and belief, this design has been performed in accord with acceptable standards of engineering principles and practice and Ram Jack material and engineering specifications (attached) Should conditions differ during the course of the project, the engineer should be notified immediately to properly assess the differing conditions and their impact on the design.

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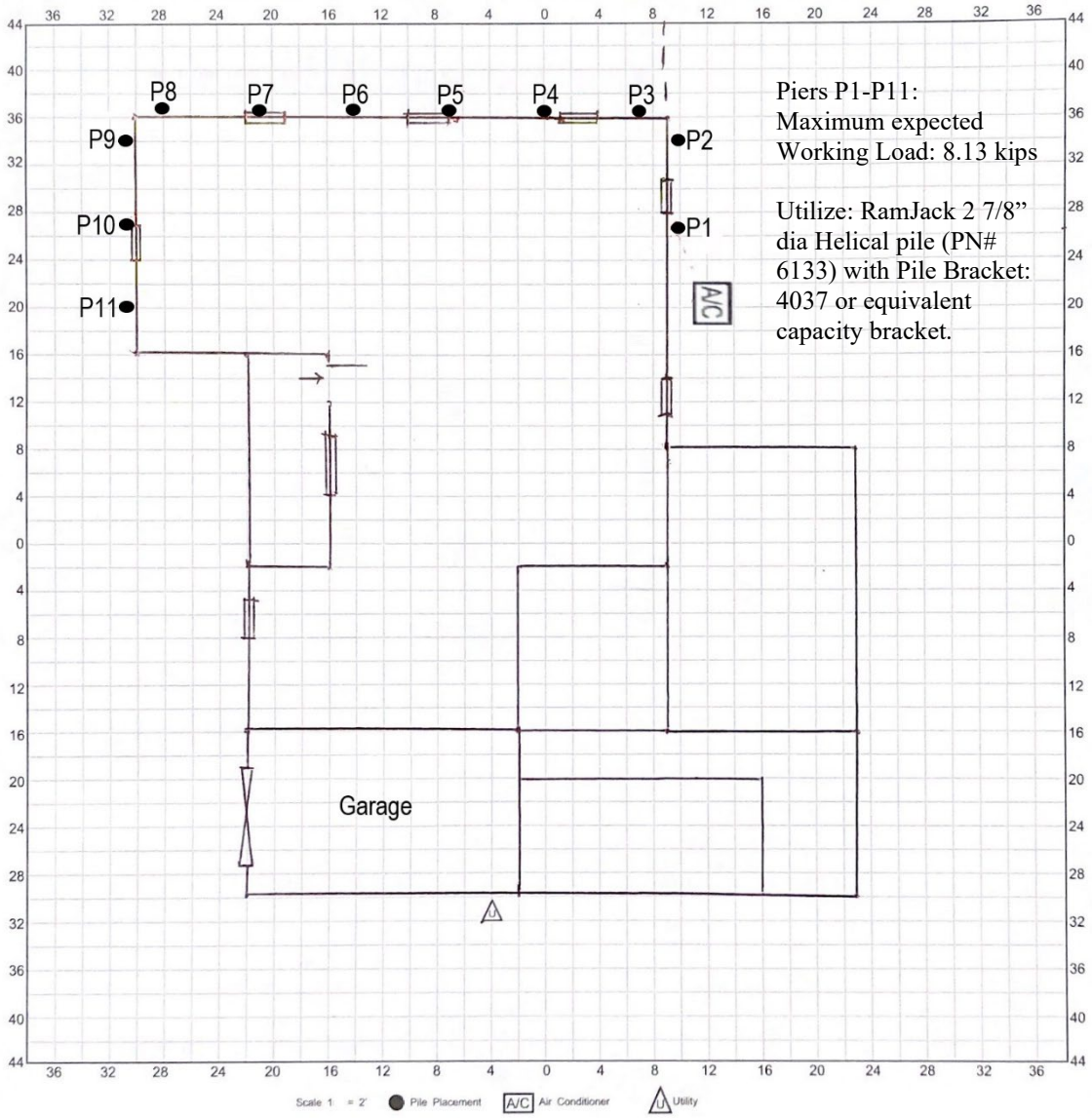
2.0 PLAN VIEW & PIER LOCATIONS

2.1 PIER LOADS/LOCATION LAYOUT



Barbara Bebbington
Pier Locations

Thompson Engineering Services, LLC.

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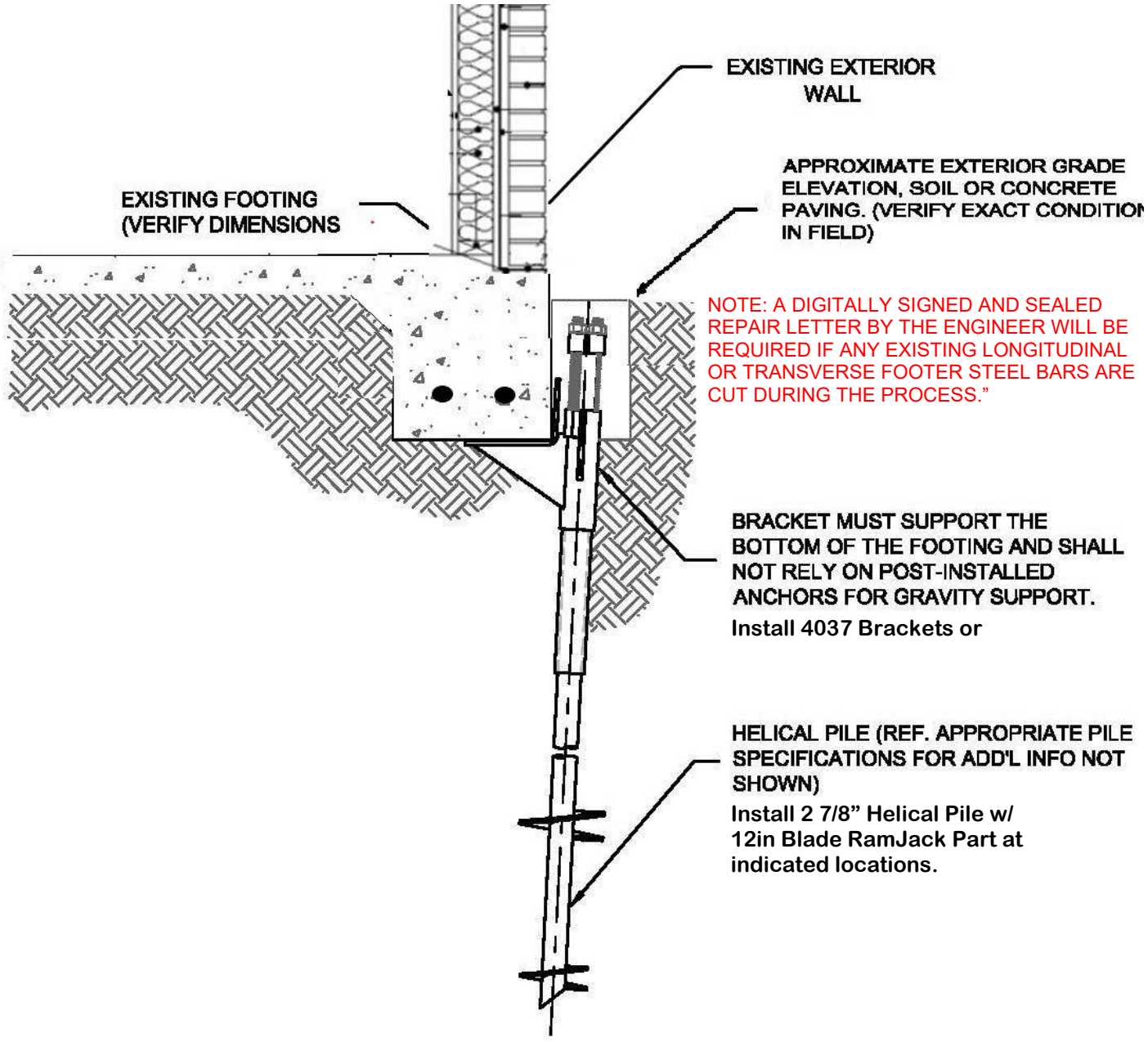

Detail of Installation: Piers P1 – P11

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2.2 Pier/Pile Calculations:

Building parameters	qty	units	Notes
overall length	66	ft	
overall width	31	ft	Truss/Rafter Direction
1st floor exterior wall height	8	ft	
typical truss length	33.66	ft	Calculated from OAW and overhang
typical truss spacing	2	ft	
typical truss overhang	1.33	ft	
monolithic slab height/depth	20	in	
footing width	12	in	

Desired footer/wall length supported	7	ft

Building loads			Notes	qty	units
Footing/Slab DL	200	plf	Concrete density	120	pcf
1st Floor Exterior Wall DL	120	plf	Typical frame construction DL 16in OC	15	psf
1st Floor Brick Veneer DL	320	plf	Typical 4in Brick Veneer Weight	40	psf
Roof/Ceiling DL	252	plf	Combined Roof /Ceiling dead load	15	psf
Roof LL	269	plf	Roof slope between 1:3 and 1:1	16	psf

Unit load required by foundation:	1162	plf
Total Load Supported by Pier	8.13	Kips

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2.3 RamJack pile software results

2 7/8 diameter pile results:

RAMJACK FOUNDATION SOLUTIONS ™

Helical Pile/Anchor Information:

Req. Allowable Pile Capacity :	8.13	kip
Applied Factor of Safety	2	
Helical Pile Diameter	2.875	in
Helix Configuration	12	in
Torque Correlation Factor	9	lbs/ft-lbs

Estimated Pile Capacity:

Compression Results

Allowable Frictional Resistance:	4.7	kip
Allowable End Bearing Capactiy:	3.43	kip
Allowable Pile Capactiy:	8.13	kip
Appr. Pile Embedment Depth:	17	ft
Required Min. Installation Torque:	1900	ft-lbs

Installation parameters
2 7/8 dia pile

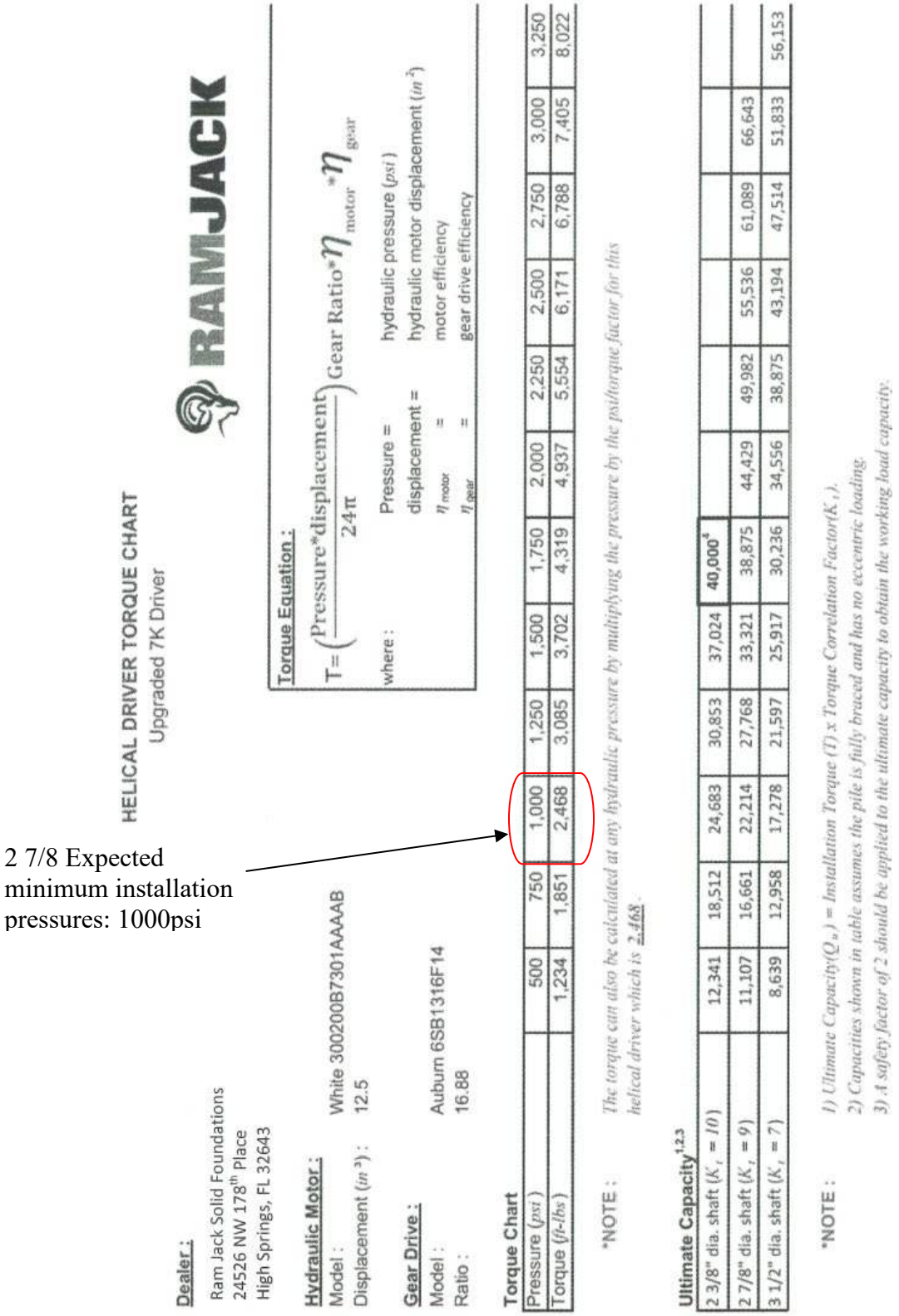
NOTE:

1.The reported "Appr. Pile Embedment Depth" is only an approximate estimate of the embedment depth and may vary based on the actual field conditions.

2.It is crucial to install the pile to the reported "Required Min. Installation Torque" value to realize the required allowable load capacity unless approved otherwise by a licensed professional engineer.

Compression Results		
Embedment (ft)	Ultimate Anchor Capacity (lbs)	Torsinal Resistance (lb ft)
3	4693	357
4	5571	485
5	8615	901
6	9460	1068
7	10098	1144
8	10737	1220
9	11376	1296
10	12014	1372
11	12653	1447
12	13291	1523
13	13930	1599
14	14569	1675
15	15207	1751
16	15846	1827
17	16485	1903
18	17123	1978
19	17762	2054
20	18400	2130
21	19039	2206
22	19678	2282
23	20316	2358
24	20955	2434
25	21593	2509
26	22232	2585
27	22871	2661
28	23509	2737
29	24148	2813
30	24787	2889
31	25425	2965
32	26065	3041
33	26703	3116
34	27342	3192
35	27981	3268

3.0 Product Information documents



HELICAL DRIVER TORQUE CHART

Upgraded 7K Driver

RAMJACK

Dealer :

Ram Jack Solid Foundations
24526 NW 178th Place
High Springs, FL 32643

Hydraulic Motor :

Model : White 300200B7301AAAAB
Displacement (in^3) : 12.5

Gear Drive :

Model : Auburn 6SB1316F14
Ratio : 16.88

Torque Equation :

$$T = \left(\frac{Pressure * displacement}{24\pi}\right) Gear\ Ratio * \eta_{motor} * \eta_{gear}$$

where : Pressure = hydraulic pressure (psi)
displacement = hydraulic motor displacement (in^3)
η_{motor} = motor efficiency
η_{gear} = gear drive efficiency

Torque Chart

Pressure (psi)	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000	3,250
Torque (ft-lbs)	1,234	1,851	2,468	3,085	3,702	4,319	4,937	5,554	6,171	6,788	7,405	8,022

*NOTE : *The torque can also be calculated at any hydraulic pressure by multiplying the pressure by the psi/torque factor for this helical driver which is 2.468.*

Ultimate Capacity[1,2,3]

2 3/8" dia. shaft ($K_t = 10$)	12,341	18,512	24,683	30,853	37,024	40,000[4]						
2 7/8" dia. shaft ($K_t = 9$)	11,107	16,661	22,214	27,768	33,321	38,875	44,429	49,982	55,536	61,089	66,643	
3 1/2" dia. shaft ($K_t = 7$)	8,639	12,958	17,278	21,597	25,917	30,236	34,556	38,875	43,194	47,514	51,833	56,153

*NOTE : *1) Ultimate Capacity(Q_u) = Installation Torque (T) x Torque Correlation Factor(K_t).*
2) Capacities shown in table assumes the pile is fully braced and has no eccentric loading.
3) A safety factor of 2 should be applied to the ultimate capacity to obtain the working load capacity.

2 7/8 Expected minimum installation pressures: 1000psi

2 7/8" DIAMETER HELICAL PILE

Upset Connection

Primary Applications

- Ram Jack's 2 7/8" external connection helical lead sections can be used in either tension or compression. Ram Jack's most economic connection
- Can be used for new construction, remedial repair or tieback applications with all brackets with a 3 1/2" diameter bracket or external sleeve
- Not recommended for brackets requiring a long external sleeve due to the upset ends and thru bolt connection
- Maximum ultimate compression strength is 54 kips. Recommended allowable loads should be limited to 27 kips for axial load (non-eccentric) pile. Maximum torque is 6,000 ft-lbs.
- All recommended allowable loads assume proper helix configurations and torque required for soil conditions is achieved.

Features/Benefits

- One end of each piling is upset so the non-upset end of an adjoining piling section will insert into it
- Piles can be loaded same day as installed. No more waiting days or weeks for concrete to cure
- Lead sections come in a variety of lengths for flexibility in installation
- Helices are available in specialty configurations and 1/2" blade thicknesses
- Thermoplastic polymer powder coated

Materials/Parts

- Helical Blades – minimum Fy 50 ksi
- 2 7/8" O.D. pipe – minimum Fy of 65 ksi
- (2) 3/4" thru bolts

sdjh#:

To order custom product please email orders@ramjack.com

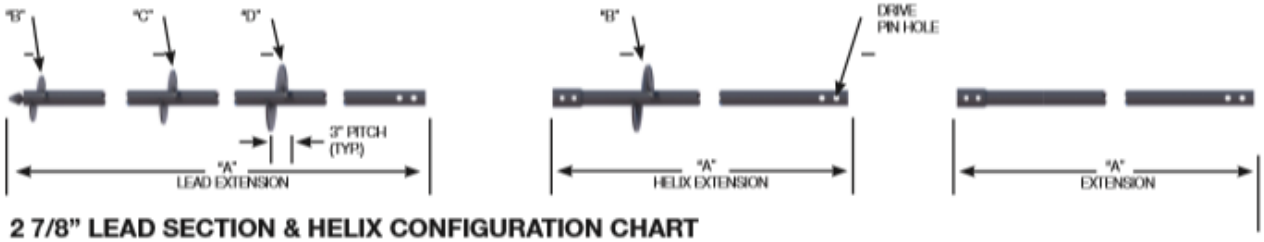
2 7/8" DIAMETER HELICAL PILE

Upset Connection

STRENGTH RATING

MAX TORQUE STRENGTH - 6,000 FT-LB
ULTIMATE CAPACITY (TENS/COMP) - 54 KIP*
ALLOWABLE CAPACITY (TENS/COMP) - 27 KIP**

* BASED ON A TORQUE FACTOR (Kt) = 9
**W/ SAFETY FACTOR OF 2 BEING APPLIED CAPACITIES ASSUME PILES ARE FULLY BRACED WITH NO ECCENTRICITY



2 7/8" LEAD SECTION & HELIX CONFIGURATION CHART

PART#	HELIX BLADE SIZE (B-C-D)	BLADE THICKNESS	LENGTH (ft) (A)	PARTS PER PALLET
6127	10"	3/8"	2'-0	50
6134	12"	3/8"	2'-0	40
6125	8"	3/8"	5'-0	25
6129	10"	3/8"	5'-0	25
6132	12"	3/8"	5'-0	25
6140	8"-10"	3/8"-3/8"	5'-0	25
6142	10"-12"	3/8"-3/8"	5'-0	25
6130	10"	3/8"	7'-0	25
6133	12"	3/8"	7'-0	25
6143	10"-12"	3/8"-3/8"	7'-0	25
6147	8"-10"-12"	3/8"-3/8"-3/8"	7'-0	25
6148	10"-12"-14"	3/8"-3/8"-1/2"	7'-0	20
6151	8"-10"-12"	3/8"-3/8"-3/8"	10'-0	20
6159	10"-12"	3/8"-3/8"	10'-0	20
6189	10"-12"	3/8"-3/8"	12'-0	25

RamJack Pile #

TABLE 6—ALLOWABLE TENSION AND COMPRESSION LOADS FOR HELICAL PLATES (KIPS)

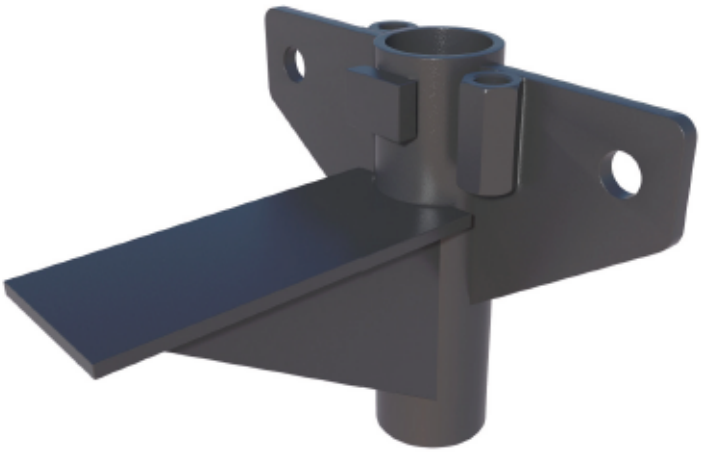
Helical Plate Diameter[1] (inches)	Helical Pile Shaft Diameter (inches)		
	$2^{7}/_{8}$	3½	4½ [2]
8	63.29	79.84	-
10	55.51	66.29	84.4
12	39.40	65.74	84.4
14	42.07	60.42	84.4

For **SI:** 1 inch = 25.4 mm; 1 kip = 1000 lbf = 4.45 kN.

[1]Allowable load values are for helical plates made from $^{3}/_{8}$-inch thick steel, except for the 14-inch diameter plate, which is made from ½-inch thick steel.
[2] Helical plates are made from ½-inch thick steel.

HELICAL PILE BRACKET

With Narrow Seat



#4037

Primary Applications
- Underpinning grade beams and footings of existing structures with Ram Jack's 2 7/8" diameter helical pile system.
- Used on lighter structures where the structure has an insufficient reaction load to install Ram Jack's driven pile.
- Bracket can also be used with 2 3/8" diameter helical pile with 2 7/8" guide sleeve.

Features/Benefits
- Similar to 4038 but with 4.5" wide seat (bearing area = 40.5 in²)
- Bracket installed on a 2 7/8" diameter or 2 3/8" diameter pile with minimum 4'-0 long guide sleeve pile has a maximum allowable load of 20.4 kips
- Helical pile can be driven through bracket
- No welding required for installation
- Easily adjusts foundation elevation
- Thermoplastic polymer powder coated

Materials/Parts
- Steel plates – minimum Fy of 36 ksi
- 3 1/2" O.D. bracket sleeve – minimum Fy of 65 ksi
- Two (2) 1" diameter all-thread bolts with nuts (ASTM-A36)
- One (1) support strap

Additional Pile Assembly Items
- 2 7/8" O.D. helical leads and extensions (Ref. page 13-18)
- 2 3/8" O.D. helical leads and extensions (Ref. page 7-12)
- 2 7/8" O.D. guide sleeve (Ref. page 27)

Product Information Chart

PART#	PARTS PER PALLET
4037	25

4.0 PROFESSIONAL SERVICES by Thompson Engineering Services, LLC.

PLANS AND SPECIFICATIONS

The plans and specifications presented herein are applicable only for the anticipated construction at the locations indicated on the included location layout. If construction plans change, the Design Professional should be notified so the plans and specifications can be re-evaluated. The Design Professional should be given the opportunity to review final plans and specifications to see if the intent of the plans and specifications has been followed and/or if supplemental details and recommendations are needed. The Design Professional warrants that the plans and specifications contained herein have been prepared in accordance with generally accepted professional engineering practice. No other warranties are implied or expressed.

CORPORATE PROTECTION

It is understood and agreed that the Design Professional's Basic Services under this Agreement do not include project observation or review of the Contractor's performance or any other construction phase services, and that such services will be provided by the Client. The Client assumes all responsibility for interpretation of the contractor Documents and for construction observation and supervision and waives any claims against the Design Professional that may be in any way connected thereto.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any loss, claim or cost, Including reasonable attorney's fees and costs of defense, arising or resulting from the performance of such services by other person or entitles and from any and all claims arising from modifications, clarifications, interpretations, adjustments or changes made to Contract Documents to reflect changed field or other conditions, except for claims arising from the sole negligence or willful misconduct to the Design Professional.

OWNERSHIP OF INSTRUMENTS OF SERVICE

All reports, plans, specifications, computer flies, field data, notes and other documents and Instruments prepared by the Design Professionals instruments of service shall remain the property of the Design Professional. The Design Professional shall retain all common law, statutory and other reserved rights, including the copyright thereto.

DEFECTS IN SERVICE

The Client shall promptly report to the Design Professional any defects or suspected defects in the Design Professionals work or services of which the Client becomes aware, so that the Design Professional may take measures to minimize the consequences of such a defect. The Client warrants that he or she will impose a similar notification requirement on all contractors in his or her Client/Contractor contract and shall require subcontractors at any level to contain a like requirement. Failure by the Client, and the Client's contractors or subcontractors to notify the Design Professional, shall relieve the Design Professional of the costs of remedying the defects above the sum such remedy would have cost had prompt notification been given.

VERIFICATION OF EXISTING CONDITIONS

In as much as the remodeling and/or rehabilitation of an existing building requires that certain assumptions be made regarding existing conditions, and because some of these assumptions may not be verifiable without expending additional sums of money or destroying otherwise adequate or serviceable portions of the building, the Client agrees, to the fullest extent permitted by law, to Indemnify and hold the Design Professional harmless from any claim, liability or cost (including reasonable attorney's fees and costs of defense) for injury or economic loss arising or allegedly arising out of the professional services provided under this Agreement, excepting only those damages, liabilities, or costs attributable to the sole negligence or willful misconduct of the Design Professional.

Regards,
Mark Andrew Thompson P.E. #63350
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