APEX
ENGINEERS, INC.

June 12, 2017

ABI Corporation
1271 NE Delta School Road
Lee's Summit, MO 64063-1732

Re: Helix Micro Rebar Shop Drawings
405 SE Weiss Cir
Lot 176, Mill Creek
Lee's Summit Permit #2017-1816

Apex Engineers, Inc. observed the plans for the proposed house at the address referenced above. The plans were evaluated for substituting Helix micro rebar for the foundation reinforcing steel. The recommendations and attached detail sheets shall be considered shop drawings for an alternative reinforcement design.

Helix Micro Rebar may be substituted per the attached Alternate Reinforcement Design/Helix Micro Rebar Details, and per the following:

- Detail 1/H1.0 - Foundation walls, once completed, shall be laterally braced at the top by the first floor deck and at the bottom by the basement slab.
- Detail 2/H1.0 - Daylight foundation walls are concrete walls not directly connected to the floor joists via the sill plate. Daylight foundation walls shall comply with the flowing layout restrictions:
    - Daylight walls greater than 4'-0" tall shall be bookended by corners, offsets greater than 2'-0", and/or return walls at a maximum spacing of 16'-0" on center. Return walls shall be placed per 3/H2.0
    - Daylight walls greater than 6'-0" tall shall not exceed 6'-0" in length.
    - Daylight walls 4'-0" tall and less do not require return walls.
- Detail 3/H2.0 – Return walls shall be installed per plan. Additional return walls may be required to comply with the specifications above.
- Details 4/H2.0 & 5/H2.0 – Install corner reinforcing and column pads reinforcing per the attached details.

Please call if Apex Engineers, Inc. can be of further assistance.

LIMITATIONS
The scope of our services includes only those items specifically addressed herein. This report is intended for the confidential and exclusive use of Apex Engineers, Inc.'s client. No other person or company is authorized to use this report for any purpose without Apex Engineers, Inc.'s client permission.

Best Regards,
Apex Engineers, Inc.

STATE OF MISSOURI
CLAYTON J. HESS
NUMBER
PE-2003000003
06.12.17
PROFESSIONAL ENGINEER

Clayton J. Hess, P.E.
Principal

ALTERNATE REINFORCEMENT DESIGN/HELIX MICRO REBAR

HELIX NOTES:

- ALL CONCRETE SHALL BE REINFORCED WITH HELIX MICRO REBAR ALONG WITH ANY ADDITIONAL REBAR AS NOTED
  - 9.0 LB/YD³ DOSAGE OF HELIX 5-25
  - VERIFY DOSAGE AT FORM INSPECTION
  - SEE MIXING REQUIREMENTS THIS PAGE
- MIN. 3000 PSI FOOTING COMPRESSIVE CONCRETE STRENGTH
- MIN. 3000 PSI WALL COMPRESSIVE CONCRETE STRENGTH
- AIR ENTRAINED BETWEEN 5% & 7% OF CONC. VOLUME
- GRADE 40 REINFORCING STEEL UNLESS OTHERWISE NOTED
- LAP SPLICES 24" MIN.
- ASSUMED 2000 PSF BEARING (TO BE VERIFIED BY GEOTECHNICAL ENGINEER).
- WALL SHALL BE BACK-FILLED WITH CLEAN, LEAN CLAY (OR BETTER) LOW VOLUME CHANGE MATERIAL. ON-SITE MATERIAL MAY BE USED IF DEEMED ACCEPTABLE BY THE GEOTECHNICAL ENGINEER.
- HELIX ALTERNATIVE DESIGN NOT VALID IF ANY ONE OF THE FOLLOWING CONDITIONS ARE MET:
  - NON-UNIFORM FOOTING SUPPORT (I.E. CAST IN PLACE PIERS, PUSH PILES).
  - BURIED WALKOUT WALLS (BELOW BASEMENT) EXCEEDING 48" IN UNBALANCED FILL.
  - DAYLIGHT WALLS EXCEEDING 8'-8" TALL FOR A LENGTH GREATER THAN 8'-0".

HELIX DOSING INSTRUCTIONS

MIXING SHOULD BE DONE ACCORDANCE WITH ASTM C94 AND THE MIXING INSTRUCTIONS BELOW. THE DOSAGES OF HELIX ADDED TO THE MIX SHOULD BE NOTED ON THE BATCH DOCUMENTATION IN ACCORDANCE WITH UNIFORM EVALUATION SERVICE ER 279 SECTION 5.15. VERIFIED USING PROCEDURE IN ER 279 APPENDIX A.

MIXING INSTRUCTIONS

READY MIX PLANTS (WET OR DRY) - PREFERRED

TO PREVENT HELIX FROM CLUMPING (SMALL CLUSTER OF HELIX), RIGOROUSLY FOLLOW THE FOLLOWING PROCEDURES:

- DUMP ALL OF THE HELIX INTO THE TRUCK DRUM AT ONCE. NO NEED TO SLOWLY SHAKE.
- ADD A MINIMUM OF 20% OF THE MIX WATER INTO THE DRUM, WITH THE DRUM TURNING AT CHARGING SPEED.
- TURN TRUCK DRUM AT CHARGING SPEED FOR SIX MINUTES (AS THE CLUMPS FALL OVER THE MIXING FINS THEY ARE BROKEN UP INTO 2D LAYERS, WITH WATER ACTING AS A LUBRICANT).
- ADD THE SAND, AGGREGATE, AND CEMENT (OR CONCRETE) IN THE NORMAL MANNER.
- MIX AN ADDITIONAL 5 MINUTES TO ENSURE THE HELIX IS COMPLETELY DISBURSED THROUGHOUT THE CONCRETE.

SITE BATCHING INTO MIX TRUCKS (LOADED TRUCK AT CONSTRUCTION SITE)

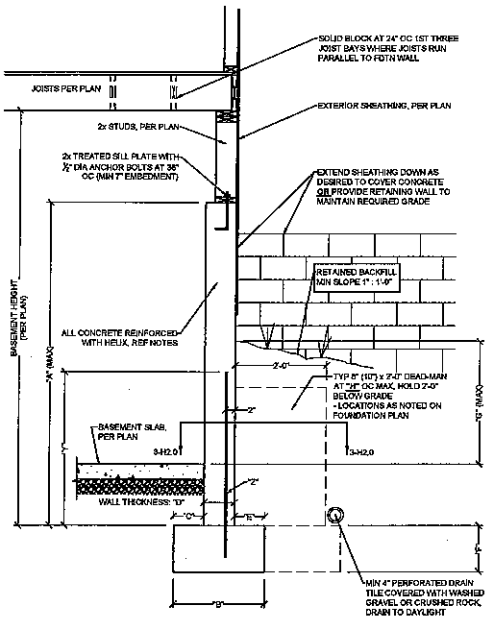
- SET THE DRUM TO CHARGING SPEED.
- USE HELIX DOSING UNIT (CONTACT HELIX TO ORDER). THE DOSING UNIT BREAKS UP CLUMPS AND ENSURES HELIX GOES INTO THE TRUCK AT A CONTROLLED RATE (ABOUT 1 BOX PER MINUTE). WHEN HELIX IS ADDED AT THIS STAGE, IT MUST ENTER THE MIXER DUMP FREE, ENSURING NO DUMPS LAGER THAN 2" ENTER THE MIXER.
- WHEN ADDING HELIX, IT MAY COLLECT ON ANY RESIDUAL CONCRETE ON THE INTERIOR SURFACES OF THE HOPPER. PUSH THE HELIX INTO THE DRUM AVOIDING DUMPS. ADDING A SLIPPERY LINING SUCH AS PVC SHEETING TO THE HOPPER MAY HELP AVOID THESE BUILDUPS.
- MIX AT CHARGING SPEED FOR 5 MINUTES (50 REVOLUTIONS) AFTER HELIX IS ADDED

EFFECTS ON SLUMP

A SLUMP OF 125MM OR 5" OR HIGHER WILL FACILITATE STRIKE OFF. A SLUMP OF LESS THAN 5" IS NOT RECOMMENDED AS THIS WILL PREVENT SURFACE SEGREGATION OF THE CEMENT AND FINES FROM THE AGGREGATE AND HELIX. SLUMP SHOULD BE MEASURED ON THE INITIAL LOAD AND ADJUSTMENTS MADE WITH A WATER REDUCER OR PLASTICIZER NOT WATER.

PUMPING HELIX

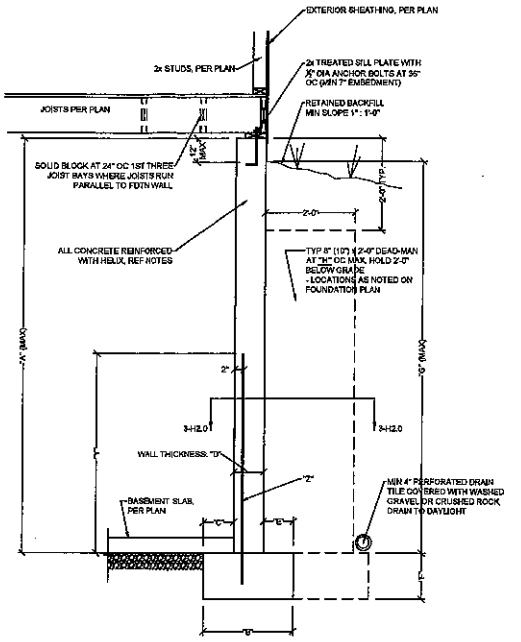
HELIX ARE 1" LONG AND PRESENT MINIMAL PUMPING RESISTANCE. A MINIMUM 3" LINE SHOULD BE USED TO PUMP HELIX REINFORCED CONCRETE.



CONCRETE DIMENSIONS								HEIGHT ABOVE FOOTING	REINFORCING BARS (GRADE 40)	HELIX DOSAGE
"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"[1]	"Y"	"Z"	
4'-0"	1'-4"	4"	8"	4"	8"	3'-2"	16'-0"	2'-8"	#4 BARS AT 24" O.C.	9.0 LB/YD³
6'-0"	1'-4"	4"	8"	4"	8"	5'-2"	16'-0"	2'-8"	#4 BARS AT 24" O.C.	9.0 LB/YD³

1. DIMENSION SHOWN IS FOR MAXIMUM UNINTERRUPTED WALL PANEL LENGTH BEFORE A DEAD-MAN SHALL BE INSTALLED. NOTE, A MINIMUM 2'-0" RETURN OR OFFSET IN THE FOUNDATION WALL SHALL SUBSTITUTE AS A DEAD-MAN AND/OR BREAK IN THE WALL PANEL LENGTH.
2. THE BASEMENT SLAB IS AN INTEGRAL PART OF THE 'UNRESTRAINED' FOUNDATION WALL DESIGN. THEREFORE, IF THE WALL IS BACKFILLED PRIOR TO PLACEMENT OF THE BASEMENT SLAB, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY BRACING THE WALL UNTIL THE BASEMENT SLAB HAS BEEN PLACED.

2 / H1.0 TYPICAL 'UNRESTRAINED' FOUNDATION WALL DETAIL
$\frac{1}{2}$" = 1'-0"



CONCRETE DIMENSIONS								HEIGHT ABOVE FOOTING	REINFORCING BARS (GRADE 40)	HELIX DOSAGE
"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"[1]	"Y"	"Z"	
8'-0"	1'-4"	4"	8"	4"	8"	7'-8"	N/A	2'-0"	#4 BARS AT 24" O.C.	9.0 LB/YD³
9'-0"	1'-4"	4"	8"	4"	8"	8'-8"	N/A	2'-0"	#4 BARS AT 24" O.C.	9.0 LB/YD³

1. DIMENSION SHOWN IS FOR MAXIMUM UNINTERRUPTED WALL PANEL LENGTH BEFORE A DEAD-MAN SHALL BE INSTALLED. NOTE, A MINIMUM 2'-0" RETURN OR OFFSET IN THE FOUNDATION WALL SHALL SUBSTITUTE AS A DEAD-MAN AND/OR BREAK IN THE WALL PANEL LENGTH.
2. WALL WILL NOT ACHIEVE FULL STRENGTH UNTIL FIRST FLOOR DECK AND BASEMENT SLAB HAVE BEEN PLACED.

1 / H1.0 TYPICAL FOUNDATION WALL DETAIL
$\frac{1}{2}$" = 1'-0"

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STRUCTURAL DESIGN REVIEW
KANSAS ENGINEERING LICENSE: 992
MISSOURI ENGINEERING LICENSE: 2003004673

PROJECT: 405 SE Weiss Cir, Lot 176, Mill Creek Lee's Summit Permit #2017-1816
CLIENT: ABI

PROJECT #

DRAWING NAME: HELIX DETAILS

DATE:	COMMENTS:
12.22.16	

DRAWN BY: APEX
CHECKED BY: —

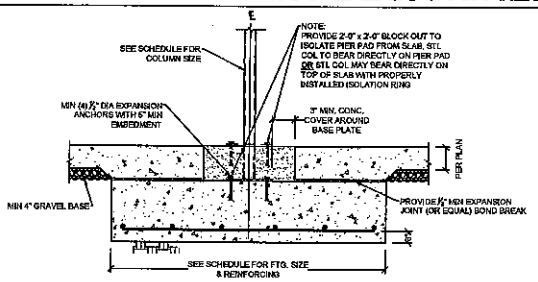
STATE OF MISSOURI
CLAYTON J. [illegible]
NUMBER PE-2003000003
08.12.17
PROFESSIONAL ENGINEER

SHEET # H1.0

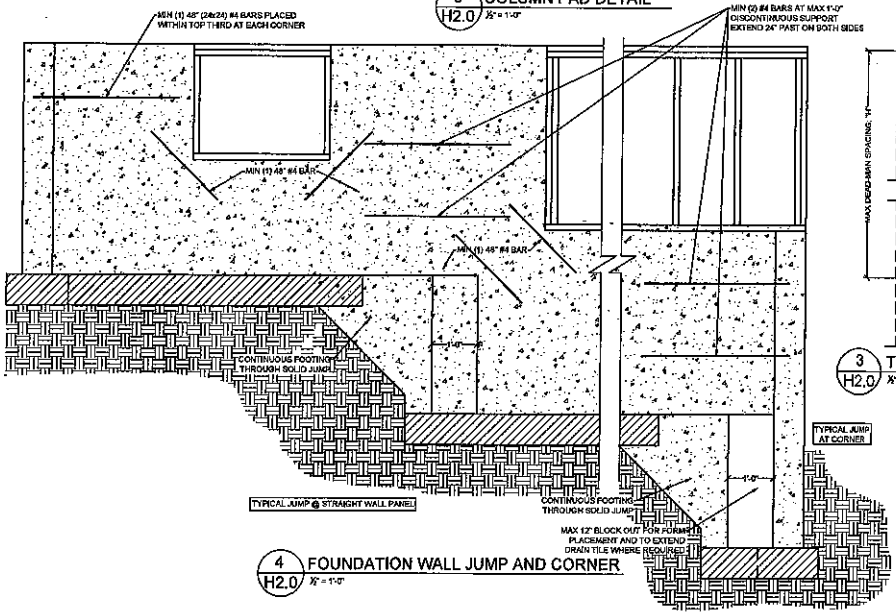
ALTERNATE REINFORCEMENT DESIGN/HELIX MICRO REBAR

COLUMN & PIER PAD SCHEDULE		
PAD SIZE	REINFORCEMENT	HELIX DOSAGE
30" x 30" x 12"	(4) #4 BARS E.W.	9.0 LB/YD^3
36" x 36" x 12"	(4) #4 BARS E.W.	9.0 LB/YD^3
42" x 42" x 12"	(5) #4 BARS E.W.	9.0 LB/YD^3
48" x 48" x 12"	(6) #4 BARS E.W.	9.0 LB/YD^3
54" x 54" x 16"	(6) #4 BARS E.W.	9.0 LB/YD^3
60" x 60" x 16"	(10) #4 BARS E.W.	9.0 LB/YD^3

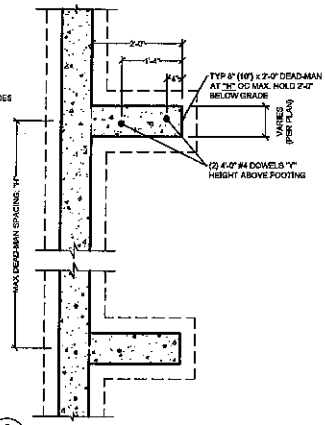
1. COLUMN & PAD SIZES SHOWN ARE FOR MAXIMUM COLUMN HEIGHT OF 10'-0", REQUIRES SEPARATE ENGR'D DESIGN IF GREATER THAN 10'-0" TALL.
2. COLUMN & PIER PAD SIZES SHOWN ARE BASED ON AN ASSUMED MINIMUM ALLOWABLE SOIL BEARING CAPACITY OF 2,000psf.



5 H2.0 COLUMN PAD DETAIL
½" = 1'-0"



4 H2.0 FOUNDATION WALL JUMP AND CORNER
½" = 1'-0"



3 H2.0 TYPICAL DEAD-MAN SECTION
½" = 1'-0"

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