



March 14, 2022

Gale Homes

Re: 196 SW Winter Road  
Lot 1601, Winterset Ridge Subdivision  
Lee's Summit, Missouri

Apex Engineers, Inc. performed an additional site visit at the above referenced address. The scope of our report is to determine the approximate compressive strength of the sub-grade. The sub-grade bearing conditions were evaluated. For the purposes of this report the proposed house will be referred to as facing north.

At the time of the inspection, the east side of the excavation terminated on native limestone with a minimum bearing capacity in excess of 2000 psf. The west side of the excavation terminates on a layer of native clay and/or weathered limestone. Neither material is adequate to support the proposed house.

Due to varying bearing capacities and soil types, our firm has been asked to provide a pier design to support the gravity loads on the foundation. Areas that terminate on competent native limestone will not be required to be pierced. The competency of the limestone and which piers are not required to be drilled will be determined at the time of the drilling of the piers.

Our firm recommends the following foundation system:

- Drill 18" and 24" diameter reinforced concrete piers per the attached layout.
- Piers shall be drilled to refusal and end bear on competent original limestone, sandstone or shale.
- All piers shall bear on the same bearing material.
- The concrete piers shall be reinforced with (2) #4 bars for the depth of the pier.
- (4) #4 bars shall be embedded a minimum of 24" into the top of each pier and bent & tied into the footings (minimum lap splice 24").
- The attached drawing shows the location of the piers required.
- All piers shall be inspected by our firm prior to the placement of concrete.
- Grade beams/thickened slabs shall be a minimum of 16" wide by 12" deep with (3) #4 bars continuous T&B.

Upon completion and approval of the piers, the footings and foundation walls can be placed per city approved print.

- The garage slabs and basement slab shall be structural. The retaining walls, pool and hardscapes are outside the scope of this report and are the responsibility of others. For the basement the following design shall be used.
  - Place 5" thick concrete slab with #4 bars at 12" on center each-way on 1-1/2" chairs.

- Add (4) 10'-0" long, #4 bars each-way over the column pads and slab support piers. Place with 1" to 1-1/2" slab top cover (3" chairs). See attached layout and slab details for clarity.
- The perimeter of the slab shall bear on the foundation as follows:
  - If a minimum of 3" of bearing is provided on a keyway or footing, then the slab does not need to be pinned to the wall.
  - Otherwise, drill 5" deep and pin the slab to the foundation wall with #4 bars at 12" on center.

Notes:

- Min. 3000 psi concrete
- Grade 40 reinforcing steel
- Lap splices min. 24"

The above design recommendation will support the vertical design loads placed on the piered foundation system for the house foundation only. Support of all earth retaining structures shown on the site plan shall be the responsibility of others.

***The above recommendation is based on bearing capacity only. Our firm has not been retained to determine the shrink/swell capacity of the soil and therefore cannot be held responsible for the volumetric changes of the soil (including below the basement slab). Swelling (expansive) soils are outside the scope of this report and the responsibility of others. Also, all desiccated soils below the basement slab shall be removed.***

Slope stability and final grading shall be the responsibility of others. The contractor shall take the necessary steps to stabilize the lot (i.e. proper grading & slope per code, retaining walls, etc.

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## RECOMMENDATIONS

The surface drainage must be designed to effectively move water away from the home and to prevent ponding. Poor drainage near a structure can also contribute to settlement problems. The failure to control drainage can result in the saturation and weakening of the surrounding soil causing settlement. A proper drain system, consisting of a drain tile draining to daylight and/or sump pit and pump (where applicable), shall be installed and maintained to properly move water away from beneath the structure. The drain tile shall drain to a centralized location where water can be removed by a properly sized sump pump and pit, or, shall adequately drain to daylight. The drain tile shall also be installed at the base of the footing level, wrapped with a proper filter fabric, and covered with a minimum of 12" of ¾" (minimum) clean gravel. It is also recommended, unless otherwise noted, that all slabs be placed on a minimum 4" granular base consisting of ¾" (minimum) clean gravel (do NOT use crushed rock, AB-3, or equal). A build-up of water beneath the foundation can cause heaving of the foundation (pier pads) and basement slab resulting in sheet rock cracks and damage to the structure.

Due to the unpredictable nature of expansive clay soils, no guarantees can be made as to if and when future movement may occur. However, precautionary measures can be taken. Poor drainage increases the stresses on foundation walls, and therefore, a proper grade

must be maintained away from the foundation. A positive slope of 1 inch per foot drop for 6 to 10 feet away from the house is required. Rain gutters and downspouts with extensions should be installed to direct water safe distances away from the house and from existing structures that could be adversely affected. Proper watering of the foundation system should also be maintained throughout the year, especially during extremely dry periods. In addition, all permanent slopes should be no steeper than 3:1 (horizontal to vertical) to help ensure their future stability and the accommodation of normal mowing equipment.

Apex Engineers, Inc. cannot be held responsible for the impact and/or damages caused to the structure if the aforementioned recommendations are not followed and maintained.

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### **LIMITATIONS**

The scope of our services was only to visually observe and report the existing bearing conditions (capacity only) beneath the foundation elements for the new home. When making visual observations, it should be clearly understood that certain assumptions must be made regarding the existing conditions without the aid of drilling and/or testing, which could reveal additional information that could change the recommendations and conclusions given in this report. No evaluation of slope stability, foundation wall backfill, slab-on-grade support, pavements, retaining wall structures or the suitability of any material removed from the basement excavation for any particular purpose was made unless specifically addressed herein. As a result, Apex Engineers, Inc. cannot be held responsible for the impact of those conditions on the project or future performance of the structure. Finally, a standard footing inspection should be made to verify the actual bearing conditions prior to the placement of reinforcing steel and concrete.

Shrink, swell characteristics are inherent with all clay soils and can adversely affect or jeopardize the performance of the foundation system. Apex Engineers, Inc. has not been retained to evaluate the potential expansive properties of any existing bearing material(s). Apex Engineers, Inc.'s services are not insurance, nor can it guarantee or predict future movement caused by the natural movement attributed to the shrinking and swelling of clay sub soils. Therefore, Apex Engineers, Inc. cannot be held responsible for future movement and/or damage to the structure associated with such movement (including, but not limited to, foundations elements supported by continuous strip footings, isolated pier pads, or drilled piers). The contractor shall retain sole liability and responsibility for the quality of work, for adhering to plans, specifications, appropriate codes, and for repairing defects, deficiencies, or damages regardless of cause and/or when they are found. Apex Engineers, Inc. has performed our services in a manner consistent with the standard of care and skill ordinarily exercised by firms of our type practicing under similar conditions at this time and locality.

To the fullest extent permitted and allowed by law, Apex Engineers, Inc.'s client shall indemnify and hold harmless Apex Engineers, Inc., his or her owners, partners, officers, directors, employees, agents and sub-consultants from and against all damage, liability and costs, including reasonable attorney's fees and cost of defense, to the extent caused by the performance of the services under this report, excepting only those damages, liabilities or costs attributable to the sole negligence or willful misconduct of Apex Engineers, Inc. or Apex Engineers Inc.'s consultants.

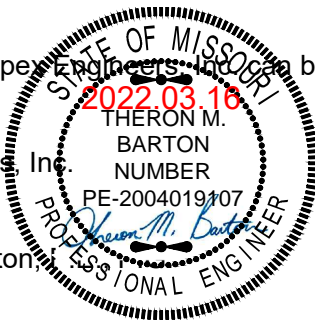
The recommendations and conclusions given in this report are based on the observed conditions at the time of this site visit. These conditions may be altered over time and/or with changes in the weather. If ground water ponds in the basement excavation, soft soil conditions may require further excavation and/or filling to provide uniform support beneath all the footings and floor slab. Therefore, if water ponds in this excavation or other changes occur that could affect any of the recommendations given in this report, Apex Engineers, Inc. shall be called back and allowed to re-evaluate our previous recommendations and/or conclusions. If changes in the condition of the site occur and Apex Engineers, Inc. is not allowed the opportunity to re-evaluate the site to respond to any of these changes, our firm cannot be responsible for the effect of any of the conditions that differed from those reported herein.

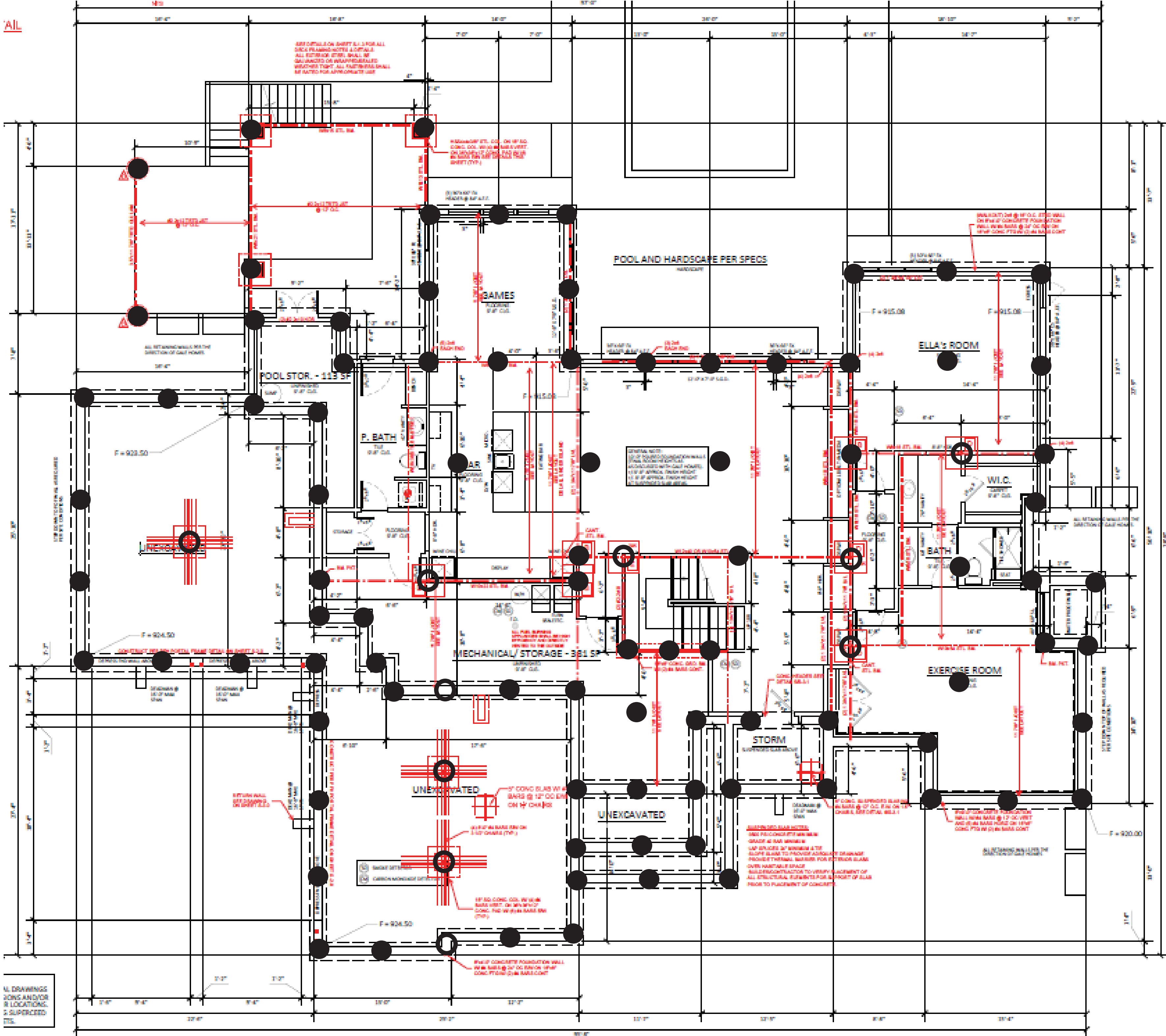
The scope of our services does not include any environmental assessment (such as, but not limited to mold, mildew, presence of hazardous or toxic materials in the soil, surface water, ground water, etc.). An environmental specialist should be consulted for these types of issues.

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

Best Regards,  
Apex Engineers, Inc.


Theron M. Barton,  
*Principal*





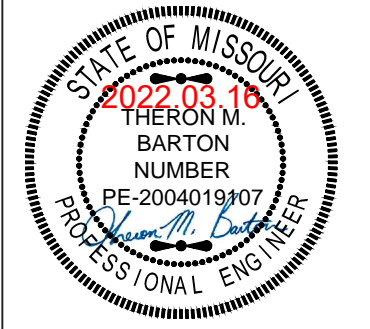
ALL DRAWINGS  
SHOW AND/OR  
LOCATIONS  
SUPERSEDED  
E.T.C.

LEGEND	
	= 18" DIAMETER PIER
	= 24" DIAMETER PIER



**APEX**  
ENGINEERS

1625 LOCUST ST  
KANSAS CITY, MO 64108  
816.421.3222  
www.apex-engineers.com



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

PROJECT:  
1906 SW Winter Rd  
Lot 1601 Winterset Ridge

CLIENT:  
Gate Homes

PROJECT #  
XXXXX

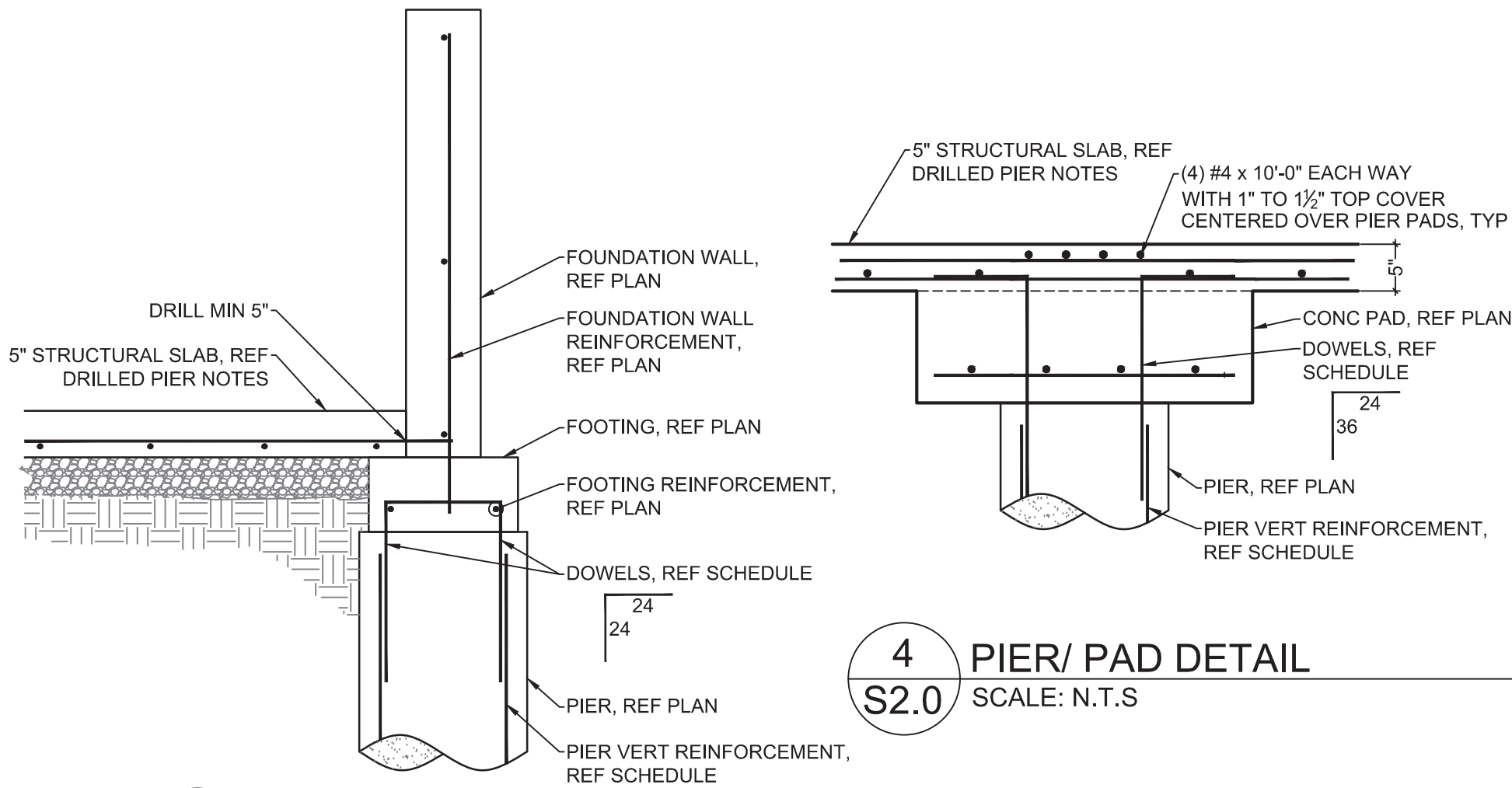
DRAWING NAME  
DRILLED PIER  
PLAN

DATE:	COMMENTS:

DRAWN BY: APEX  
CHECKED BY: XXX

SHEET #  
1 OF 2



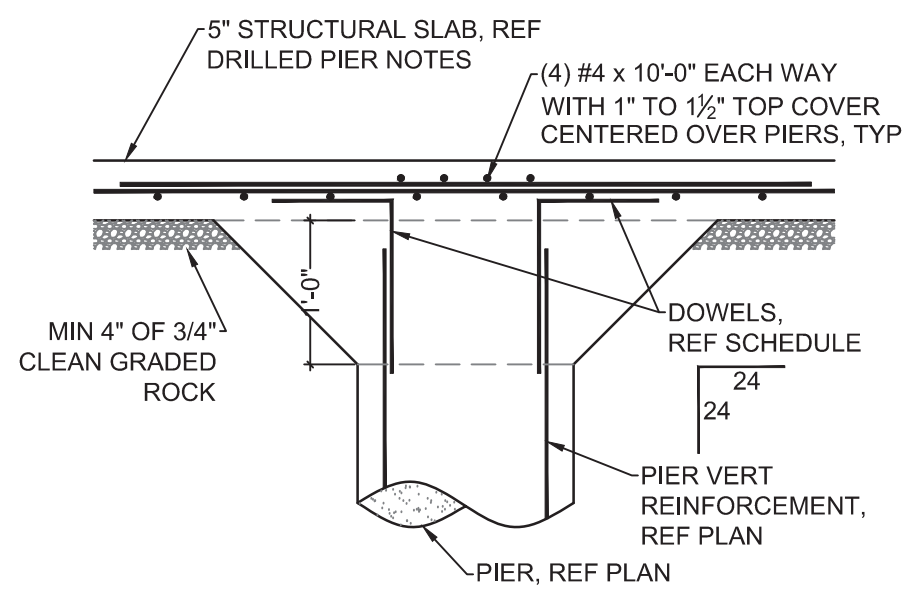


4 PIER/ PAD DETAIL  
S2.0 SCALE: N.T.S

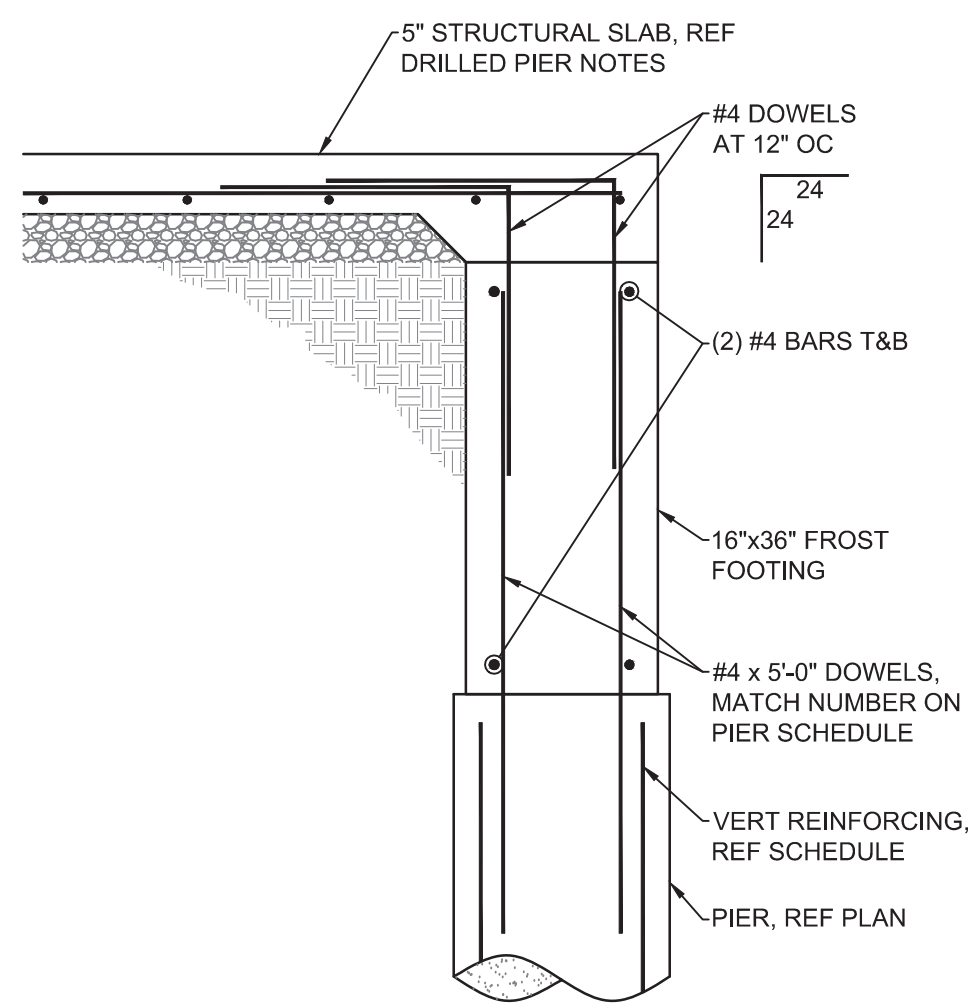


6 PIER/ FOOTING DETAIL  
S2.0 SCALE: N.T.S

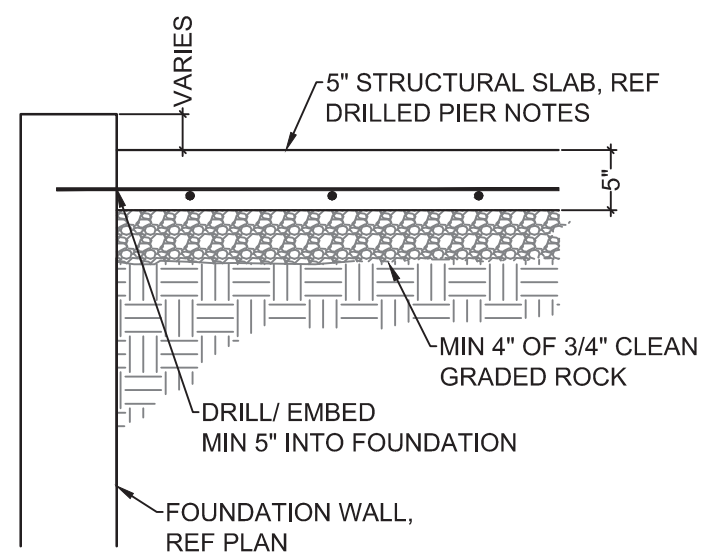
NOTE: TIES IN PIERS NOT SHOWN FOR CLARITY. REF SCHEDULE AND TYP DRILLED PIER DETAIL



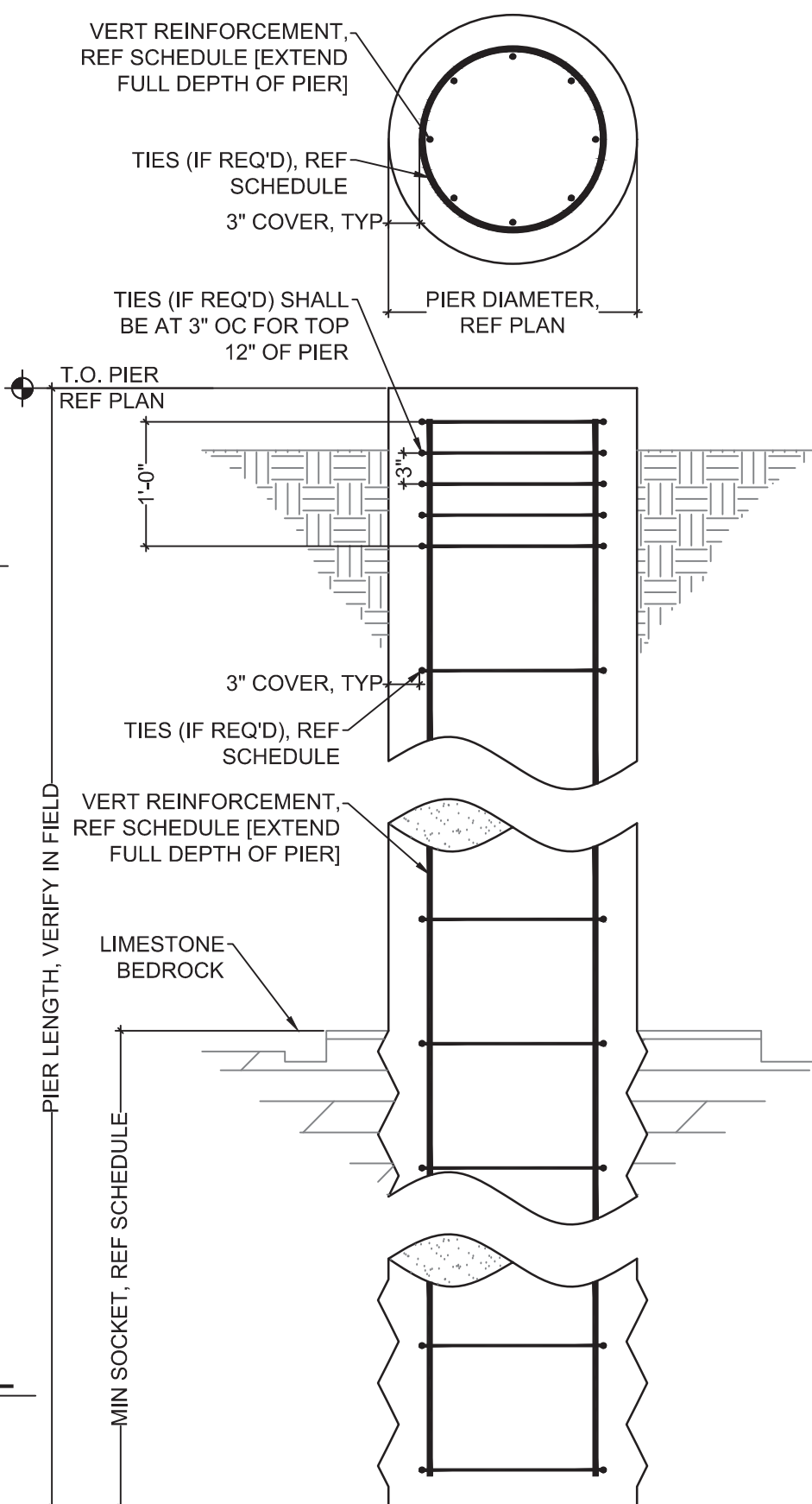
3 SLAB SUPPORT PIER DETAIL  
S2.0 SCALE: N.T.S



5 PIER/ FROST FOOTING DETAIL  
S2.0 SCALE: N.T.S



2 STRUCTURAL SLAB/ WALL SECTION  
S2.0 SCALE: N.T.S



1 TYPICAL DRILLED PIER  
S2.0 SCALE: N.T.S.

DRILLED PIER SCHEDULE				
DIAMETER	MIN. SOCKET	TIES	VERT REINFORCING	DOWELS
18"	NOT REQ'D	NOT REQ'D	(2) #4 [FULL HEIGHT]	(4) #4 x 4'-0"
24"	NOT REQ'D	NOT REQ'D	(2) #4 [FULL HEIGHT]	(4) #4 x 4'-0"
30"	NOT REQ'D	NOT REQ'D	(4) #4 [FULL HEIGHT]	(4) #4 x 4'-0"
36"	NOT REQ'D	NOT REQ'D	(4) #4 [FULL HEIGHT]	(4) #4 x 4'-0"

1. TIES SHALL BE FULL DEPTH ACCORDING TO SCHEDULE SIZE AND SPACING. TIES SHALL BE 3" OC FOR TOP 12" OF PIER.
2. MIN 3000 PSI CONCRETE FOR PIERS.
3. #4 AND SMALLER BARS, MIN GRADE 40. #5 AND LARGER BARS, MIN GRADE 60. MIN 24" LAP SPLICES.

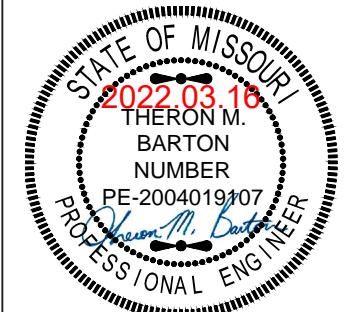
DRILLED PIER NOTES:

1. REFERENCE THE DRILLED PIER PLAN FOR THE DIAMETER AND LOCATION OF ALL PIERS REQUIRED.
2. PIERS SHALL BE DRILLED TO END BEARING ON LIMESTONE, SANDSTONE OR SHALE BEDROCK WITH A MIN 15KSF ALLOWABLE BEARING CAPACITY.
3. ALL PIER HOLES SHALL BE INSPECTED TO BE CLEAR OF SPOILS, DEBRIS AND EXCESS WATER FOR ENTIRE DEPTH.
4. UNLESS NOTED ON PLAN OR SCHEDULE, ALL PIERS SHALL BE REINFORCED WITH A MINIMUM OF THE FOLLOWING: (2) #4 LONGITUDINAL BARS FOR THE ENTIRE DEPTH. BEND AND DOWEL (4) #4 X 4'-0" BARS FROM TOP OF EACH PIER TO TIE INTO THE FOUNDATION. PROPER LAP SPLICE LENGTHS SHALL BE USED. REFERENCE DEEP FOUNDATION DETAILS.
5. ALL PIERS SHALL BE INSPECTED BY THE ENGINEER OF RECORD (APEX ENGINEERS) OR GEOTECHNICAL ENGINEER OF RECORD PRIOR TO PLACEMENT OF CONCRETE. UPON COMPLETION AND APPROVAL OF THE PIERS AND FOOTINGS THE FOUNDATION WALLS MAY BE PLACED PER PERMIT APPROVED DRAWINGS, UNLESS OTHERWISE DICTATED BY SUPPLEMENTAL STRUCTURAL RECOMMENDATIONS.
6. ALL SLABS SHALL BE STRUCTURAL. FOR THE BASEMENT THE FOLLOWING DESIGN SHALL BE USED.
  - a. PLACE 5" THICK CONCRETE SLAB WITH #4 BARS AT 12" OC EACH WAY ON 1 1/2" CHAIRS.
  - b. ADD (4) 10'-0" LONG #4 BARS EACH WAY OVER THE COLUMN PADS AND SLAB SUPPORT PIERS. PLACE WITH 1" TO 1 1/2" SLAB TOP COVER (3" CHAIRS).
  - c. THE PERIMETER OF THE SLAB SHALL BEAR ON THE FOUNDATION AS FOLLOWS:  
IF A MINIMUM OF 3" OF BEARING IS PROVIDED ON A KEYWAY OR FOOTING, THEN THE SLAB DOES NOT NEED TO BE PINNED TO THE WALL. OTHERWISE, DRILL 5" DEEP AND PIN THE SLAB TO THE FOUNDATION WALL WITH #4 BARS AT 12" OC.
  - d. DO NOT SAW CUT STRUCTURAL SLABS UNLESS SPECIFICALLY INDICATED TO DO SO ON THE STRUCTURAL SLAB PLAN.
  - e. PROVIDE (2) #4 X 4'-0" DIAGONAL BARS AT MID-DEPTH OF SLAB AT ALL RE-ENTRANT CORNERS.
8. MIN 3000 PSI CONCRETE FOR PIERS. MIN 4000 PSI CONCRETE FOR STRUCTURAL SLAB.
9. #4 AND SMALLER BARS, MIN GRADE 40. #5 AND LARGER BARS, MIN GRADE 60. MIN 24" LAP SPLICES.
10. REFERENCE PIER FOUNDATION DETAILS FOR MORE INFORMATION.
11. CONTRACTOR TO FIELD VERIFY ALL FOUNDATION ELEVATIONS AND STEP LOCATIONS PER SITE CONDITIONS.



**APEX ENGINEERS**

1625 LOCUST ST  
KANSAS CITY, MO 64108  
816.421.3222  
www.apex-engineers.com



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

PROJECT:  
1906 SW Winter Rd  
Lot 1601 Winterset Ridge

CLIENT:  
Gate Homes

PROJECT #

XXXXXX

DRAWING NAME

DRILLED PIER  
SCHEDULE,  
DETAILS, AND  
NOTES

COMMENTS:

DATE:

DRAWN BY: APEX  
CHECKED BY: XXX

SHEET #

2 OF 2