Hooper Group, Inc.
Consulting Geotechnical Engineers

June 3, 2024

Mr. Kyle Meinert
HBR GENERAL CONTRACTORS
4535 Allencrest Lane
Dallas, Texas 75244

Re: Subsurface Investigation
PRIVATE RESIDENCE
4535 Allencrest Lane
Dallas, Texas
HGI Job No. 24.139

Dear Sir:

We have completed the subsurface investigation for the new residence that is planned at 4535 Allencrest Lane in Dallas, Texas. We have sent you a copy of the report via email.

If you have any questions relating to the recommendations or the report, please give me a call and I will be glad to discuss them with you.

I appreciate the opportunity to assist in the evaluation of this property; let me know when I can be of further assistance.

Sincerely,

David Hooper, P.E.
Geotechnical Engineer

5729 Palo Pinto Avenue Dallas, Texas 75206
(214) 824-1932 (214) 824-1943 Fax

Subsurface Investigation

HBR GENERAL CONTRACTORS
Private Residence
4535 Allencrest Lane
Dallas, Texas

Report to
HBR General Contractors
Dallas, Texas

By
Hooper Group, Inc.
5729 Palo Pinto Avenue
Dallas, Texas 75206
(214) 824-1932

HGI Job No. 24.139

June 3, 2024

TABLE OF CONTENTS

INTRODUCTION

This investigation was conducted to determine the geotechnical engineering characteristics of the soil/rock profile at the proposed location for a new residence that is planned at 4535 Allencrest Lane in Dallas, Texas. The subsurface conditions were evaluated in order to formulate recommendations for the type of foundation system that is best suited to this particular site and the residential structure that is planned.

Two test borings were drilled at specific locations that were selected by the client and the geotechnical engineer's representative to represent the area to be covered by the new residence. Each of the test borings was drilled to a depth that is sufficient to evaluate the soil/rock profile for design of a drilled pier foundation system to support the lightly loaded residential structure.

No site plan for the final development of the property was furnished to the geotechnical engineer, and consequently, there is no boring location drawing included in this report. The test borings were drilled at the following approximate locations:

Test Boring #1-	42 feet north of the south property line
	25 feet west of the east property line
Test Boring #2-	34 feet south of the north property line
	30 feet west of the east property line

FIELD EXPLORATION

The test borings were advanced with a truck mounted rotary drill using a continuous flight auger, and since this method of drilling does not require the use of water, there was no moisture contamination of the subsurface soils that were sampled.

Undisturbed samples of the subsurface cohesive soils were obtained using a thin walled Shelby tube sampler, and the samples were ejected in the field to examine for sample quality and testability. Disturbed samples of subsurface rock samples were obtained with a thick wall tube sampler for visual identification of the rock type.

The tan weathered limestone and harder grey limestone found in the subsurface soil/rock profile were tested in-place using the Texas Cone Penetrometer. The modified test consists of driving a three inch diameter cone into the soil or rock stratum with blows from a 140 pound weight dropped with a 30 inch free fall. The number of blows required to drive the cone 12 inches or the distance penetrated with 100 blows is a value that can be correlated to allowable bearing capacity for the rock stratum. The blow count is recorded on the boring log at the test depth.

Each soil and rock sample was sealed in a polyethylene bag to maintain the in-place moisture content, and packed in a protective box for transporting to the testing laboratory.

Relative elevation of the ground surface at each test boring location was determined using a hand level, and the elevations noted on the boring logs are accurate to within one foot.

LABORATORY TESTING

Each soil and rock sample was visually examined by an experienced soils technician and classified according to the Unified Soil Classification System (USCS).

Undisturbed soil samples were trimmed to required testing dimensions, and were tested for in-place water content, dry unit weight and unconfined compressive strength. The results of these tests give the normal engineering characteristics required for evaluating the shear strength and consistency of fine grain soils found in the subsurface profile.

Soil samples obtained at the time of the Texas Cone Penetration Test are disturbed from their in-place condition, and were tested for in-place water content only.

Representative samples of each fine-grained soil type found in the subsurface profile were tested for Atterberg Limit values. These index values give an indication of the potential soil volume change that might occur when there are changes in the soil moisture content.

The surface soils encountered at this site have moderate plasticity values, and representative samples from just below the ground surface were tested for absorption/swell characteristics. This test evaluates the soil for quantity of swell that is anticipated when water is made available to the soil in a test condition that duplicates the in-place surcharge pressure. It should be noted that these test results apply to present moisture conditions and may not accurately predict the amount of swelling soil movements that could occur in the soils at other times of the year under different climatic conditions.

GENERAL CONDITIONS - Topography

The ground surface at this site is relatively flat terrain, with little change in elevation noted at the test boring locations. The relatively flat ground surface at the site will not cause surface water to drain off the site readily, and is an undesirable drainage feature that should be corrected in the design of the final grading plan for the development of the property. If any vegetation is found growing on the site at the time of construction, stripping to a depth of one to two inches will be necessary to remove this vegetation prior to construction in the building and paved areas.

Geology of the Site - Austin Chalk

This site is located in an area of Dallas County where the Austin Chalk geological formation outcrops, and the soil/rock profile at this particular site is typical of that formation. There is normally a surface layer of dark brown to grey clay, a tan chalky clay and a weathered tan limestone overlying the hard parent rock which is a grey limestone.

Long term weathering of the Austin Chalk results in a residual soil that is dark brown to black in color, and the clay minerals in the soil are very sensitive to changes in moisture content. During extended dry periods, the clay loses moisture, and there are very wide shrinkage cracks that appear in the ground surface. Subsequent wetting of these dark brown clays causes the cracks to close, and there is a rise in the ground surface associated with this absorption of moisture. The thickness of the dark brown clay layer determines the total amount of shrink/swell ground movements, and where the clay is thicker than three feet, the magnitude of movement is significant to foundation design.

The tan limestone layer is normally fractured and fissured, and contains hard clay bands and numerous high angle fractures that are stained with minerals. These discontinuities in the tan limestone reduce the capacity of the rock layer to support foundations, but the tan limestone is adequate to support single story structures with light foundation loads. Thickness of the tan limestone layer varies from one foot to twenty feet, and normally there is some groundwater found in the fractured rock layer.

The unweathered parent rock of the Austin Chalk is a grey limestone, generally found at depths of fifteen to twenty feet below the ground surface. The grey limestone is generally an excellent foundation medium, and there are very few weak bands or discontinuities encountered when coring the rock. Foundations are normally designed for high bearing capacities, both in base resistance or side resistance, and the grey limestone is a firm and reliable support medium for midrise to high rise structures.

Soil/Rock Profile

Samples obtained from the test borings show the surface soil is a brown to tan silty clay to chalky clay with moderate plasticity characteristics (PI = 20 and 22). Absorption/swell test results show the samples from just below the ground surface increased in volume by **3.07 percent and 4.80 percent** when water was made available to the samples. This represents **very significant** potential for shrink/swell volume changes from the present soil moisture content. The near surface soils are very stiff to hard in consistency, moist in water content and extended to depths of two feet and three feet at the test boring locations.

Tan weathered limestone is found below the near surface soils. In-place penetration test results indicate the weathered limestone has moderate bearing capacity, but the weathered limestone layer is too thin to be used for support of the new residential structure. The tan weathered limestone is a soft rock in consistency, is dry in water content and extended to depths of six and one half feet and seven feet at the test boring locations.

Firm grey limestone is found below the softer weathered limestone, and this is the parent rock of the Austin Chalk geological formation. In-place penetration test results indicate the grey limestone has excellent bearing capacity, and the rock could be used for support of the lightly loaded residential structure. The grey limestone is a medium hard rock in consistency, is dry in water content and extended to the termination depth of the test borings at fifteen feet.

Shrink/Swell Movement

Total shrink/swell potential for this soil/rock profile is in the range of two inches as the soils go from a dry weather condition to a point of complete saturation. If these movements can be tolerated, shrink/swell movements should be within the range of tolerance for a very stiff shallow foundation system or a drilled pier and grade beam foundation system.

Groundwater

No excess moisture or groundwater table was found in either of the test borings drilled for this investigation.

RECOMMENDATIONS - Shallow Foundations

The only way of substantially avoiding the effects of shrink/swell movements in the soil profile is to use a drilled pier and grade beam foundation system with a structurally suspended floor system. If foundation and floor slab movements in the range of two inches can be tolerated, however, a shallow foundation system could be considered for use on this site. If these movements are considered excessive for shallow foundation design, a drilled pier foundation system with a suspended floor system should be used at this site.

If a shallow foundation system is chosen for use at this site, some preparation of the near surface soil profile will be necessary. After the vegetation has been stripped from the building area, the top twelve inches of subgrade soil should be scarified, wetted and recompacted. The on-site soil should be compacted to the range of 92 to 98 percent of ASTM D698 (Standard Proctor) maximum density at a moisture content at least three percent above optimum.

A minimum of eight inches of select fill should then be used immediately beneath the floor slab. The select fill should be a non-expansive soil with a plasticity index between four and twelve. The select fill should be placed in thin lifts (six to twelve inches) and compacted to a minimum of ninety five percent of ASTM D698 (Standard Proctor) maximum density. Moisture content of the select fill should be within three percent of optimum during compaction.

Moisture content a density of the on-site soil and the select fill is very important, and each compacted lift should be tested in-place at a frequency of **two tests per compacted lift**, to verify that the fill is properly placed.

The weighted plasticity index for the soil/rock profile is **18**, and according to the BRAB criteria, a very stiff "waffle" slab foundation system may be appropriate for these conditions. Potential vertical rise (PVR) calculations and absorption/swell test results indicate a potential for movement in the range of **two inches** for the top twelve feet of **modified** soil/rock profile.

The following parameters should be used for the design of a post-tension foundation system, based on the 3rd edition of the PTI manual:

Differential soil movement for edge lift	=	1.69 inches
Differential soil movement for center lift	=	1.02 inches
Edge moisture variation, edge lift	=	5.2 feet
Edge moisture variation, center lift	=	9.0 feet

Grade beams should be set in the natural soil profile or in uniformly compacted and tested select fill at a minimum depth of twelve inches below finished grades, and an allowable bearing capacity of **1,750 psf** should be used to size these structural members. The beams should be cast monolithic with the floor slab to give added stiffness to the foundation system.

Finished floor elevations should be set high enough above the final exterior grades around the perimeter of the structure to assure a positive flow of water away from the structure. The ground surface should slope away from the perimeter of the structure a minimum of one foot vertical in ten feet horizontal, and should be maintained for a minimum distance of ten feet.

Drilled Pier Alternate

If a drilled pier foundation system is preferred, or if the predicted soil movements are considered excessive, there is excellent bearing capacity available in the grey limestone, and the rock could be used to support the light residential foundation loads. The following maximum allowable bearing capacities are recommended for the design of a drilled pier foundation system:

> For straight shaft drilled piers that penetrate into the firm grey limestone a minimum of **3 feet**, found at a depth of 7 feet below the existing ground surface at the site;

- base resistance allowable	**30,000 psf**
- side resistance allowable	**3,000 psf**
- uplift resistance allowable	**3,000 psf**
- uplift resistance in tan limestone (2')	**2,000 psf**

Swelling soil movement will result in an uplift skin friction applied to the top three feet of pier, and the amount of force should be computed using a skin friction value of **2,000 psf** applied for the full three feet. Tensile stresses resulting from the uplift force will require that reinforcing steel is used in the pier shaft, and the quantity of steel should be sufficient to resist the full uplift force that could occur prior to the time that dead load is applied to the top of the pier shaft. Reinforcing steel should extend for the full length of the shaft.

Extensions of the piers should be the same diameter as the piers, and the cross section of the pier shaft should not be allowed to enlarge at the ground level. A ***mushroom*** at the top of the pier would allow very large uplift pressures to develop, and the enlargement should not be allowed to occur. Pier caps should have void box protection.

Water may be encountered during the drilling of some piers, and may require the use of temporary casing to prevent the intrusion of water into the pier hole. Temporary casing will not be required if the drilling operations can be handled in such a way that no more than one inch of water is in the hole at the time of concreting. If casing is used, penetration should be counted only below the bottom of the casing.

The limestone will deteriorate with exposure to drying air, and concrete should be placed in the pier hole within eight hours of completing the drilling. Pier holes left open longer than eight hours should be re-evaluated prior to filling with concrete.

Concrete for the piers should be designed for a slump of four to six inches (five to seven inches in cased piers), and a collection hopper should be specified to assure that the concrete drops vertically into the pier hole without segregating.

Continuous inspection of the pier drilling operations by a representative of a qualified independent testing laboratory is required. The inspector can assure that the proper bearing stratum is penetrated, that the pier holes are clean and dry at the time of concreting, and that proper concreting procedures are used in constructing the piers.

Grade Beams

If a drilled pier and grade beam foundation system is used, grade beams should not be placed directly on the moderate plasticity soil, and should be protected from the shrink/swell movements in the soil profile. Void box forms or some other method of protection should be used to allow for **4 inches** of upward soil movement to take place without stressing the grade beams. Walls are very sensitive to movements in the supporting grade beam, and the void boxes are necessary to isolate the grade beam from the shrink/swell activity in the soil profile.

Landscaping Near Building Lines

Irrigation water for landscaping is a source of problems where a shallow foundation system or a crawl space is used. Landscaping beds should be designed to be above the finished grades around the structure, so that excess irrigation water is not allowed to penetrate into the subgrade soils or the crawl space. Some form of perimeter waterproofing should be considered to prevent irrigation water from penetrating into the crawl space or subgrade soils. See suggested details, pages 19 and 20.

Trees draw moisture in an irregular pattern and will cause some movement in surface structures and shallow foundations. Surface structures, sidewalks, and pavements are particularly susceptible to these movements, and some differential movement can be expected if they are constructed within one half the mature height from these trees.

Surface Drainage Plan

The subsurface soils at this site are sensitive to changes in soil moisture content, and an effective surface drainage plan is vital to the successful performance of the foundation system. All surface moisture should be drained away from the structure and not allowed to pond near the building perimeter. Allowing moisture to penetrate into the subsurface soils will result in swelling soil movements that will have an adverse effect on surface structures, and should be avoided.

Currently there are poor drainage conditions due to the relatively flat ground surface at the site, and final grades should be designed to correct this undesirable drainage condition.

Gutters and downspouts will collect a significant amount of water at distance locations around the building line. It is important that this water is discharged far enough away from the grade beam to prevent the water from entering the subgrade soils or the crawl space. A distance of three feet should be considered a minimum. It is preferable that this rainwater is drained on the ground surface rather than to use subsurface drains that can become clogged or broken without being noticed.

SUMMARY

This site on Allencrest Lane is located in an area of Dallas County where the Austin Chalk geological formation outcrops, and the soil/rock profile is fairly typical of that formation. There is a surface layer of moderate plasticity silty clay to chalky clay and a layer of tan weathered limestone overlying a grey limestone that extended to the termination depth of the test borings at fifteen feet. No groundwater was found in either of the test borings drilled for this investigation.

There will be fairly significant shrink/swell activity in the soil/rock profile at this site, and a shallow foundation system should be considered only if these movements can be tolerated. A minimum of eight inches of select fill should be used on top of the prepared clay subgrade. Grade beams should be set in the natural soil profile at a minimum depth of twelve inches below finished grades, and the beams should be cast monolithic with the floor slab to give added stiffness to the foundation system.

An alternate recommendation for a pier and beam foundation system is included if little or no movement in the foundation system can be tolerated, or if this type of foundation system is preferred.

Finished floor elevations should be set high enough above final exterior grades around the structure to assure the positive flow of water away from the foundations.

Landscaping water is a problem where a shallow foundation system or a crawl space is used. Landscaping beds at this site should be set high enough above the final exterior grades so that excess irrigation water drains away from the grade beam and is not allowed to penetrate into the subgrade soils or the crawl space.

Effective control of surface water is very important where there is high plasticity clay in the soil profile. The final grading plan should be designed to assure that all surface water flows away from the structure without allowing substantial penetration of water into the active clay soils.

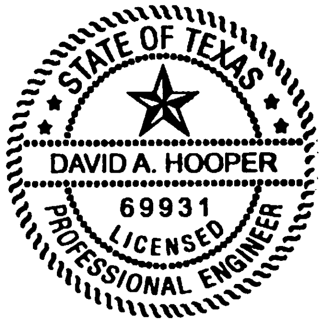
Downspouts should discharge rainwater at least three feet from the building line to prevent water entering the expansive subgrade soils.

LIMITATIONS

Every effort has been made to properly evaluate the subsurface conditions at this site based on the samples recovered from the test borings and the results of laboratory tests on these samples. However, it must be recognized that the conclusions reached in this report were based on the conditions at the two test boring locations. Our professional services were performed, our findings were obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices.

To assure that recommendations made in this report are properly interpreted and implemented in the final plans and specifications, a general review of the final plans and specifications by the geotechnical engineer is recommended. If the geotechnical engineer is not provided an opportunity to make this review, he can assume no responsibility for misinterpretation of his recommendations.

Should any unusual conditions be encountered during construction of this project, this office should be notified immediately so that further investigation and supplemental recommendations can be made.



Respectfully submitted,

David Hooper, M. Engr., P.E.
Consulting Geotechnical Engineer
Texas 69931

SUMMARY OF LABORATORY TEST RESULT

HGI Job No. : 24.139
Date : 6/3/24

Boring No.	Depth Feet	Soil Description	Class	Water Content %	Dry Unit Weight pcf	Liquid Limit %	Plasticity Index %	Unconfined Compressive Strength ksf	Unit Strain %
1	0	SILTY CLAY, brown	CL	23.8	93	41	22		
1	2	CHALKY CLAY, tan	CL	16.3					
2	0	SILTY CLAY, brown	CL	23.2	94	40	20		

ABSORPTION/SWELL TEST RESULTS

HGI Job No. : 24.139
Date: 6/3/24

Boring No.	Depth Feet	In-Situ Dry Unit Weight pcf	In-Situ Water Content %	Final Water Content %	Surcharge Pressure psf	Vertical Swell %
1	0	74	33.7	45.7	125	3.07
2	0	72	32.9	47.5	125	4.80

PROCEDURE:

In-situ water content sample (2.50 inch diameter x 0.75 inch) placed in confining ring, surcharge pressure equal to the in-situ pressure applied, free water made available to the sample, and sample allowed to swell completely. Load removed and final water content determined.

LOG OF BORINGS

The boring logs and related information depict subsurface conditions at the specific locations and at the particular time designated on the logs. Soil conditions at other locations may differ from the conditions found at these boring locations, and with the passage of time, soil conditions at these borings may change.

LOG OF BORING

PROJECT : Private Residence   **BORING NO :** 1

CLIENT : HBR General Contractors   **LOCATION :** 4535 Allencrest Ln. Dallas, Texas

JOB NO : 24.139   **BORING TYPE :** Continuous Flight Auger

DATE : 5/24/24   **DRILLER:** Gibson   **GROUND ELEVATION:** 100

Legend:
- S - Shelby Tube
- P - STD Penetration Test
- T - THD Cone Penetration Test
- B - Bag
- C - Core
- X - No Recovery
- ∇- Water Table

Depth - Feet	Symbol	Sample Type	Penetrometer Readings, TSF	Penetration Test, Blows/6"	Description of Stratum	
		S	3.00		Brown silty clay, very stiff and moist	1.5'
		S	4.5+		Tan chalky clay, hard and moist	3.0'
5		T		100/1.75"	Tan weathered limestone, soft and dry	6.5'
					Grey limestone, medium hard and dry	
10		T		100/1.00"		
15		T		100/0.75"	End of Boring 15'	
20						
25						
30						
35						
40						

LOG OF BORING

PROJECT : Private Residence | **BORING NO :** 2

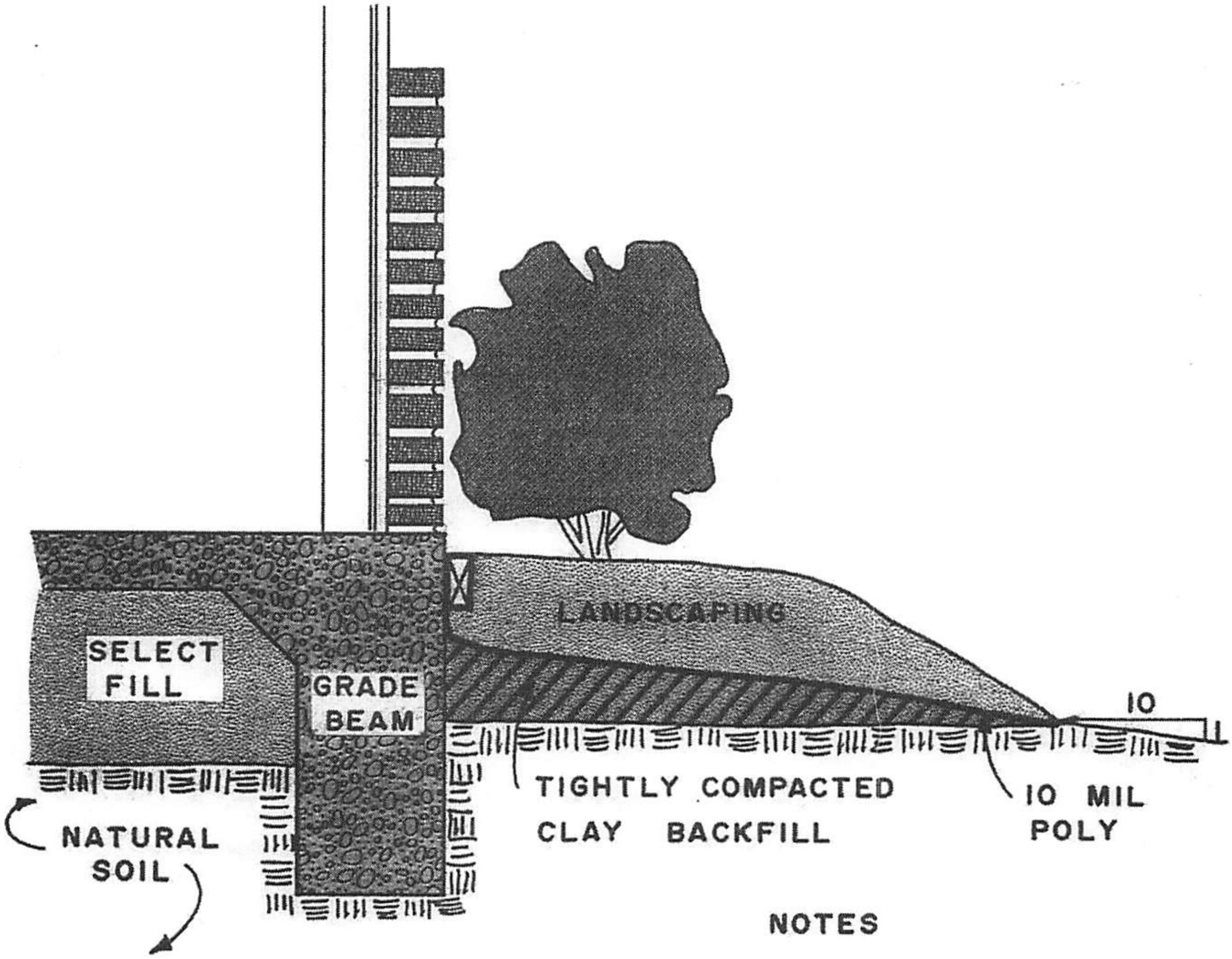
CLIENT : HBR General Contractors | **LOCATION :** 4535 Allencrest Ln. Dallas, Texas

JOB NO : 24.139 | **BORING TYPE :** Continuous Flight Auger

DATE : 5/24/24 | **DRILLER:** Gibson | **GROUND ELEVATION:** 100

Legend:
S - Shelby Tube
P - STD Penetration Test
T - THD Cone Penetration Test
B - Bag
C - Core
X - No Recovery
∇- Water Table

Depth - Feet	Symbol	Sample Type	Penetrometer Readings, TSF	Penetration Test, Blows/6"	Description of Stratum	
		S	4.25		Brown silty clay, hard and moist	1.0'
					Tan chalky clay, hard and moist	2.0'
					Tan weathered limestone, soft and dry	
5		T		100/1.50"		
						7.0'
					Grey limestone, medium hard and dry	
10		T		100/1.00"		
15		T		100/0.75"	End of Boring 15'	
20						
25						
30						
35						
40						



NOTES

1. WRAP POLY AROUND 2X4 3 TIMES BEFORE NAILING TO GRADE BEAM TO SEAL.

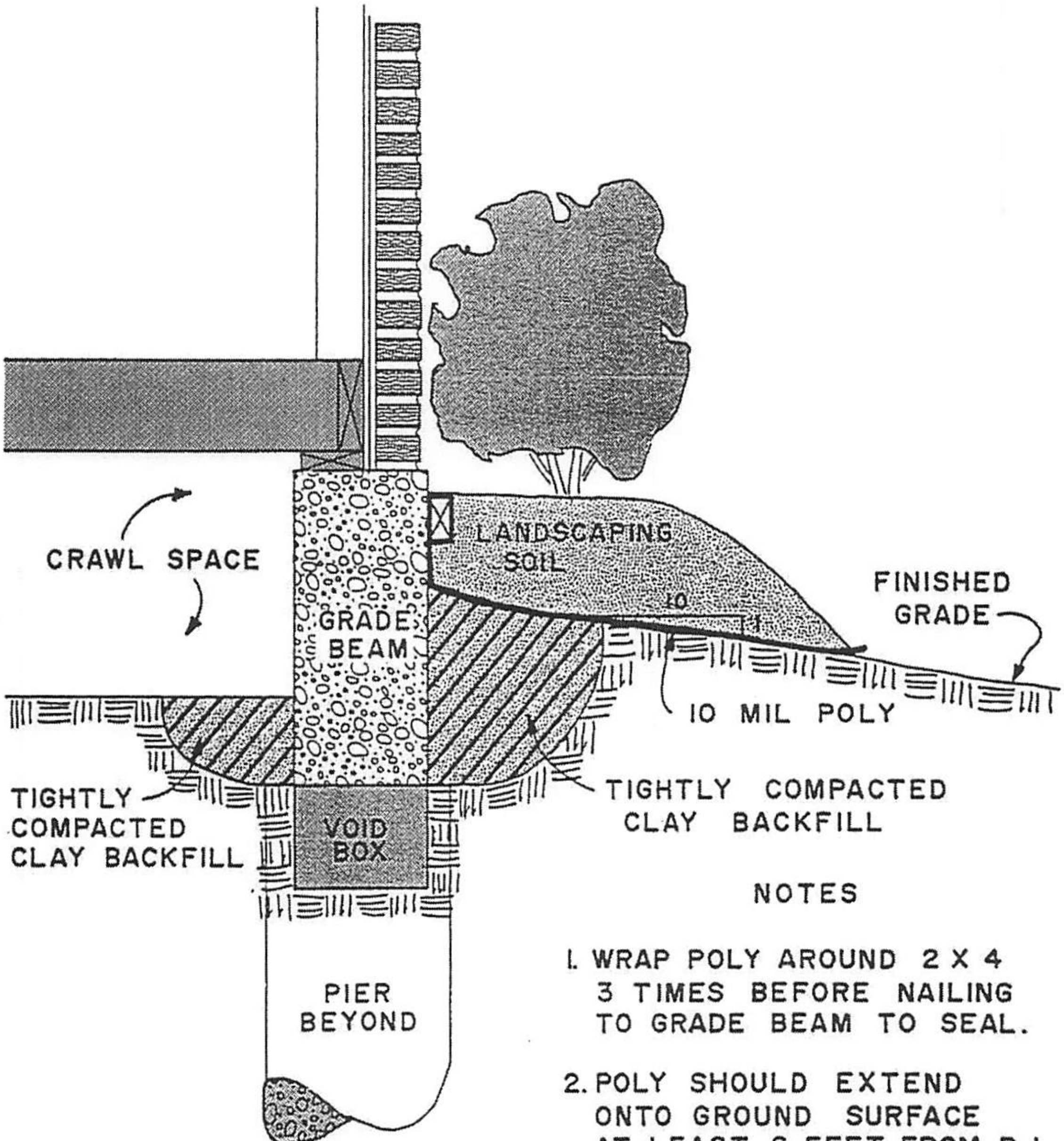
2. POLY SHOULD EXTEND ONTO GROUND SURFACE AT LEAST 6 FEET FROM B.L.

TYPICAL WALL SECTION

GRADE BEAM DETAIL

11/87

HOOPER ENGINEERING LABORATORIES, INC.



NOTES

1. WRAP POLY AROUND 2 X 4 3 TIMES BEFORE NAILING TO GRADE BEAM TO SEAL.
2. POLY SHOULD EXTEND ONTO GROUND SURFACE AT LEAST 6 FEET FROM B.L.

TYPICAL WALL SECTION
SECTION BETWEEN PIERS