EXHIBIT 11B - GEOTECHNICAL STUDY

PRELIMINARY
SUBSURFACE EXPLORATION
AND
GEOTECHNICAL ENGINEERING EVALUATION
FOR
AEP CERTIFICATION OF 330 ACRE PROPERTY
SHREVEPORT, LOUISIANA

PREPARED
FOR
FRANKS INVESTMENT COMPANY, LLC
P.O. BOX 7626
SHREVEPORT, LOUISIANA 71207

PREPARED
BY
ARDAMAN & ASSOCIATES, INC.
7222 GREENWOOD ROAD
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ARDAMAN PROJECT NO.: 113-13-94-8711
AAI SHREVEPORT FILE NO.: 14.94.020

FEBRUARY 17, 2014

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

February 17, 2014

Franks Investment Company, LLC
P.O. Box 7626
Shreveport, Louisiana 71137

Attention: Mr. Bobby E. Jelks
Manager

Reference: Preliminary Subsurface Exploration & Geotechnical Engineering Evaluation
AEP Certification for 330 Acre Property
Shreveport, Louisiana
Ardaman Project No.: 113-13-94-8711
AAI Shreveport File No.: 14.94.020

Gentlemen:

Attached is our Subsurface Exploration Report for the above referenced project. Ardaman & Associates, Inc. (AAI) will be happy to assist you further on this project by furnishing any Construction Materials Testing (CMT) Services you or your contractor may require if this project moves forward. AAI's local office in west Shreveport can provide all of your CMT needs during the construction phase of the project.

It has been a pleasure to perform this work for you. If we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.

Prepared By:

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SUBSURFACE EXPLORATION
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SHREVEPORT, LOUISIANA

GENERAL

This study was authorized by Mr. Bobby E. Jelks, Manager, of Franks Investment Company, LLC in November of 2014. The purposes of the study were to (1) explore representative areas of the property to estimate subsurface conditions present at this site, (2) determine the pertinent engineering properties of the materials encountered, and (3) develop preliminary recommendations for design of foundations, floor slabs, and pavement systems feasible for this site in sufficient detail to allow the client to meet requirements necessary for the property to be pre-certified as potential industrial development property. Among other things, a geotechnical investigation consisting of a minimum of one test boring per fifty (50) acres with geotechnical information sufficient to determine seismic Site Classification is required.

AAI previously conducted a geotechnical investigation of the northern 120 acres of this 330 acre property. This investigation was conducted for a third party for a potential specific industrial development. The findings of this investigation were issued in AAI's report of Preliminary Subsurface Investigation, AAI file 12.94.009, dated December 1, 2011 for Duke Realty. The owner was provided a copy of this report. The focus of this current study is on the remaining 210 acres south of the previous study area.

PROPERTY & PROJECT INFORMATION

The site of this investigation is on approximately 210 acres of an undeveloped 330 acre property situated on the north side of U.S. Highway 80, slightly to the west of the intersection of Bert Kouns Industrial Loop in the Flournoy area of west Shreveport, Louisiana. The property appears to have been in agricultural use at one time but at the time of this investigation the property was over grown in brush and re-forested in Pine timber with mature hardwoods along drainage courses.

Topography of the site can be characterized as rolling low hills dissected by erosional drainage courses. There are two (2) small ponds on the subject property, one near the southeast corner and one at the north end of the property. These ponds were constructed by placing low earthen levees across the drainage courses. Natural drainage appears to be primarily in a northeasterly direction. Small streams observed on the property do not appear to be perennial but contained flowing water at the time of this investigation. *Google™earth* indicates maximum elevation differential over the property in on the order of seventy (70) feet with an average differential of about ten (10) feet. Highest elevations appear to be to the south and southwest and along the western side of the property. Average slope south to north along the western side of the property is about 0.6%. Average slope southwest to northeast is about 2%. Maximum elevation appears to be about 295 feet above mean sea level. Average elevation is about 270 feet.

Based on the limited information provided AAI understands there are no specific developments being considered for the property. However the purpose of this preliminary study is to determine the feasibility of the site for development for general industrial use. The exact nature of the tenant(s) is not known but it is assumed infrastructure development would need to accommodate light commercial/retail warehouse operations to moderately heavy industrial/manufacturing usage.

FIELD INVESTIGATION

The subsurface exploration at this site consisted of drilling a total of six (6) test borings; five (5) to a depth of twenty-five (25) feet , and one (1) to a depth of 100 feet below the existing ground surface. This investigation was conducted between January 8th and January 15th 2014. Test boring locations were spread out over the site in areas accessible to our equipment. Access to the selected boring locations was achieved by clearing underbrush and small trees with a bulldozer to create a pathway for our ATV mounted drilling equipment and 4 wheel drive support vehicles. Pre-selected test boring locations were staked in the field by utilizing hand held GPS equipment and the geophysical coordinates determined from *Google™earth* imagery. The locations are accurate within the limitations of the methodology used. The locations of our test borings are estimated on the *Google ™earth* map included in Appendix "A" of this report.

Test borings were advanced to a maximum depth of about twenty-five (25) feet utilizing continuous-flight augers in general accordance with provisions outlined in *ASTM D1452, Standard Practice for Soil Investigation and Sampling by Auger Borings.* Below this depth mud rotary drilling methods in general accordance with applicable provisions outlined in *ASTM D 5783, Guide for Use of Direct rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and Installation of Subsurface Water Quality Monitoring Devices* were employed. Samples were obtained for laboratory evaluation in general accordance with provisions of *ASTM D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils* and/or *ASTM D1587, Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.*

Standard, thin-walled, seamless Shelby tube samplers (ASTM D1587) were used to obtain specimens of cohesive materials. Soils which contained enough cohesionless material or were sufficiently dense to prevent recovery of undisturbed specimens with Shelby Tube samplers were evaluated by means of the Standard Penetration test (ASTM D1586). This test consists of determining the number of blows required by a 140 pound hammer dropped 30 inches to achieve one foot penetration of the soil. This number is then related to "in situ" relative density of the material.

These soil samples were taken continuously to a depth of ten (10) feet below the existing ground surface. Below this depth, samples were obtained at intervals of five (5) feet as the borings were advanced. All samples obtained were logged, packaged, and sealed in the field to protect them from disturbance and maintain their in situ moisture content during transportation to our laboratory. The results of the boring program (Logs of Boring) are included as Appendix "A" of this report.

LABORATORY INVESTIGATION

Upon return to our laboratory selected samples were subjected to standard laboratory tests under the supervision of a geotechnical engineer. These soil properties were used to evaluate shear strength, to classify the soils, and to evaluate their potential for volumetric change. Our laboratory testing program included the ASTM standard methods outlined below. The results of our laboratory testing program are included on the Logs of Boring in Appendix "A".

ASTM D 1140 – Amount of Material in Soils Finer Than the No. 200 (75-µm) Sieve
ASTM D 2166 – Unconfined Compressive Strength of Cohesive Soil
ASTM D 2216 – Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318 – Liquid Limit, Plastic Limit, and Plasticity Index of Soils

SITE CONDITIONS

GEOLOGY

The origins of natural surface soils exposed in this general area of Shreveport are generally Tertiary age sediments attributed to the Lower Paleocene Wilcox Group and erosional remnants of Pleistocene Terraces. Typical topography developed on the exposed surface consists of low rolling hills dissected by natural drainage. Remnants of Terrace deposits occupy some of the higher elevations in this general area. This physiographic feature is referred to as Upland terrain. Drainage course valley floor areas are generally filled with colluvium consisting of eroded and reworked Tertiary and Pleistocene materials.

Pleistocene Terraces of this area were deposited on the alluvial flood plain of the ancestral Red River and its tributaries during several stages of glaciation in North America during the last ice age. The alluvial river valleys of the time were sites of significant deposition. Terrace remnants existing today in Upland areas are heavily eroded and consist of sandy clays, clayey sands, and silty sands usually heavily stained red or reddish tan by the development of iron oxides during the weathering process. These soils are mostly indistinguishable from underlying weathered Wilcox materials except for the occasional presence of petrified wood and fine gravel deposits.

Wilcox sediments are thought to have been deposited in a fluvial non-marine to transitional deltaic environment during Paleocene geologic time (about 60 million years before the present). Below the weathered section, these type sediments generally consist of hard lignitic clays and silts with fine sand partings or varves. Locally minor deposits of low grade Lignite are encountered along with lenticular bodies of well cemented fine sand and silt. Lignite beds vary in thickness from as little as an inch to as much as two (2) feet. The cemented zone manifests itself as cobble to boulder sized rocks that weather out of the formation. The cemented layer is not continuous in aerial extent but has been well documented at construction sites across the Upland areas of Shreveport. The Wilcox typically weathers to yellowish tan to red and gray mottled sandy clays and clayey sands frequently with iron oxide staining and nodules. Clays often classify CH or fat clay and are considered active or expansive. Top soils are loamy and generally poor draining.

SOIL PROFILE

Soil conditions described in this section are of a generalized nature and intended to emphasize key features and characteristics. For a more detailed description of the subsurface materials encountered refer to the soil profiles on each Log of Boring in Appendix "A" of this report. Strata contacts indicated on our Logs are approximate. Actual transitions may be gradual in nature.

The near surface soils encountered on this property are typical of the sedimentary sequences encountered in this general area of western Shreveport. However our test borings do indicate the subsurface conditions vary somewhat across the study area. This is not unexpected for a site of this size and variable terrain. Highly plastic clays were encountered in the northern end of the study area, which closely matches conditions encountered in our previous work on the property. Near surface clayey soils of more moderate plasticity were encountered at test boring locations taken further to the south.

The area was previously farmed and a well-developed topsoil system is not readily discernible in some areas of the site. However a residual layer consisting mostly of silt, very fine sand, and some accumulated organic matter does exist on the surface. AAI observed this surficial layer to be approximately four (4) inches or less in areas of higher elevation and six (6) inches or more along drainage courses. This type material is generally considered to be undesirable for construction purposes and would be considered the topsoil layer for this site.

Test Boring B-1 and B-2

Below the top soil veneer, the upper twenty-five (25) feet encountered at these locations appears to be highly plastic clay with minor occurrences of moderately plastic clay. Most of this clay stratum classifies *(CH) fat clay* per *ASTM D2487*, *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).* Strength consistency varies from soft at the surface to hard with depth. This clay stratum extends to the depths explored in these areas of the property.

Test Boring B-3

Below the top soil veneer, the upper fifteen (15) feet encountered at this location appears to be moderately plastic clay with minor occurrences of highly plastic clay. Most of this clay stratum classifies *(CL) lean clay* per *ASTM D2487*, *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).* Strength consistency varies from soft at the surface to hard with depth. Below this upper stratum very dense *silty sand (SM)* with silt partings exists to a depth of approximately forty-five (45) feet. Below this layer very stiff to hard highly plastic *fat clay (CH)* and moderately plastic *lean clay (CL)* with silt partings exists to a depth of approximately eighty (80) feet. Below this depth, very dense *silty sand (SM)* with clay partings exists to approximately 100 feet.

Test Boring B-4 and B-6

Below the top soil veneer, the upper twenty-five (25) feet encountered at these locations appear to be moderate to highly plastic clayey sand with minor occurrences of non-plastic silt and silty sand. Most of this sand stratum classifies *(SC) clayey sand* per *ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).* Strength consistency varies from medium just below the surface to very stiff or very dense with depth. This sandy stratum extends to the depth explored in these areas of the property.

Test Boring B-5

Below the top soil veneer, the upper four (4) feet encountered at this location appears to be non-plastic silt. This surficial material classifies *(ML) sandy silt* per *ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).* Below this upper stratum moderately plastic *lean clay (CL)* with minor occurrences of highly plastic *fat clay (CH)* exist to a depth of approximately twenty (20) feet. Strength consistency of this clay stratum is generally hard. Below twenty (20) feet, dense *silty sand (SM)* exists to the depth explored in this area of the property.

SIESMIC CLASSIFICATION

Based on the soil types encountered at out test boring locations and our estimation of soil strength, a Seismic Site Classification of "Class D" per the 2009 International Building Code (IBC) is recommended for this site. AAI estimates the project area has mapped acceleration parameters for 1.0 second and 0.2 second spectral response of approximately S_1 = 0.07g and S_s = 0.15g per 2009 IBC Figures 1613.5(2) and 1613.5(1) respectively. Site Coefficient's of F_v = 2.4 and F_a = 1.6 are appropriate per 2009 IBC Tables 1613.5.3(1) and (2) for a Seismic Site Classification of "D" and the mapped acceleration parameters above. The adjusted maximum considered earthquake spectral response acceleration parameters of S_{M1} = 0.168g and S_{Ms} = 0.240g were determined from the preceding values. The estimated design spectral accelerations of S_{D1} and S_{Ds} are 0.112g and 0.160g respectively.

GROUNDWATER

Shallow groundwater was encountered during advancement of two (2) of the test borings performed on this site. Water was observed at depths of nine (9) feet and thirteen (13) feet respectively at borings B-3 and B-6. The remaining test borings were dry and open upon completion. Upon completion of sampling activities all boreholes were backfilled. Therefore the absence of water may not be representative of any slow seepage condition which could exist in the shallow subsurface.

We do not anticipate shallow groundwater to adversely affect general construction activity on this site. However based on our experience during the field operations on this site, surface moisture may be problematic. The surficial soils retain “perched” water in many areas resulting in soft saturated surface soils. Our crew had difficulty moving our ATV equipment about the property. Perched water is temporary but can produce significant seepage from fractures, fissures or root holes and can seriously impair construction activities during the wetter seasons of the year. This condition is particularly common on sites recently cleared of standing timber. The establishment and maintaining of positive site drainage of prospective construction areas will minimize development of surficial perched water on most sites.

GEOTECHNICAL RECOMMENDATIONS

SUBGRADE PREPARATION

Prior to subsequent construction activity any remaining surficial vegetation, stumps, and unwanted trees should be removed and wasted. Top soil stripping on the order of four (4) inches to six (6) inches should be anticipated. However, additional excavation and backfill may be required if previously undetected weak spots are encountered during the stripping operation or if stumps and trees are removed. Provide drainage of the exposed subgrade by sloping grades and ditching away from the construction site.

After stripping and rough site grading is complete the exposed surface of areas where fill, structures, or paving are to be placed should be proof rolled to identify any isolated weak soils. Isolated weak spots should be investigated, removed, or repaired under the supervision of the geotechnical engineer prior to subsequent construction activity. After establishment of a stable subgrade layer, the exposed soils should be scarified to a minimum of eight (8) inches, the moisture content adjusted to within one (1) percent below to three (3) percent above optimum and recompacted to ninety-five (95) percent of the laboratory maximum as determined by *ASTM D698, Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbs/ft^3)* prior to placement of any fill or base materials.

It is imperative future contractors understand the importance of establishing and maintaining proper site drainage to maintain the prepared subgrade's suitability for subsequent construction activity. Failure to follow good site water control practices may result in construction delays and additional costs for reconditioning or replacing saturated materials. Earthwork performed during wet periods of the climatic cycle may warrant special considerations. The use of hydrated lime, fly ash or Portland cement stabilization should be considered to provide a working platform if work is expected to occur during these periods. The need for such techniques is dependent upon earthwork scheduling with respect to weather patterns and good site management of drainage during the construction phase. The suitability of any area left exposed to the elements should be verified by proof roll prior to subsequent construction activity.

FILL MATERIAL CONTROL

Where fill materials are required to achieve the desired finished grade elevations, the material should be placed in controlled lifts. Lifts should be placed in thin horizontal layers not exceeding eight (8) inches compacted thickness. In sloped areas, horizontal lifts should be benched or stair stepped into the slope as the wedge of fill is constructed. Each lift of select fill should be moisture conditioned to within two (2) percentage points of optimum moisture and compacted to a minimum of ninety-five (95) percent of the laboratory maximum as determined by ASTM D698.

All imported fill material should be *"select"*. Select materials classify SC or CL (clayey sand or sandy lean clay) in accordance with ASTM D2487 and should have liquid limits no greater than thirty-eight (38), plasticity indices (PI) between eight (8) and eighteen (18), and no more than seventy (70) percent passing the U.S. Standard No. 200 Sieve and deviation from the above shall be approved by the Geotechnical Engineer.

Onsite soils classifying CL, CL-ML, SC, and SM, free of organic materials or construction debris, is suitable for use as fill with adequate processing and moisture conditioning. Soils classifying CH or those otherwise suitable but containing organics, construction debris or excessively wet are not suitable for reuse as fill under structures or pavements. Onsite soils classifying CH can be used for landscaping or general fill use outside structures or paved areas. Typical specifications for compaction of sandy clay and clayey sand type soils are included in Appendix "B" or this report.

FOUNDATION SYSTEMS

In areas where CL soils were encountered on or near the surface of this site the subgrade is generally considered to have slight potential for volumetric instability with changes in moisture content. These soils are generally considered non-expansive, are of good bearing quality, and generally are considered suitable for shallow foundation support of lightly loaded structures. Areas where CH soils were encountered on and near the surface of this site are generally considered to have significant potential for volumetric instability with changes in moisture content. Although of good bearing quality these soils are considered expansive and are not suitable for shallow foundation support of lightly loaded structures without certain subgrade modifications, or special design considerations. We would anticipate a minimum of (1) to (2) feet of fill would be required to establish positive drainage around any building pads.

Moderately loaded structures likely can be supported on conventionally reinforced shallow footings or reinforced mat foundations. Heavily loaded structures may require support from a deep foundation system of moderate depth piers or deep piles to minimize differential consolidation settlement in deep fills or insitu clays encountered at this site.

The recommendations provided in this section are of a generalized nature and represent our professional opinion based on a very limited amount of subsurface information without regards to any project specific requirements. The recommendations provided are not suitable for final design use. The information provided in this report must be supplemented with additional project specific geotechnical investigation and analysis for final design purposes.

General Requirements for Shallow Foundations

Stiffened, monolithic slab/foundation slab-on-grade designs such as post-tensioned or rebar reinforced ribbed slabs are better suited to the soil conditions encountered for support of light to moderately loaded structures. However, where fill depths will be such a minimum of four (4) feet of select fill or native CL soil can be maintained between the bottom of foundations and the underlying CH soil (6 feet between the bottom of slabs and CH soils), conventionally reinforced continuous and isolated spread footings can be used.

The base of the footings (or turned down slabs) can be placed approximately two (2) feet below finished floor elevations in the prepared suitable subgrade or in density controlled select fill. Continuous (strip) footings can be proportioned for an allowable bearing pressure of 2,500 PSF. A minimum footing width of eighteen (18) inches should be maintained for all continuous footings. Areas of concentrated load can be supported by isolated spread (spot) footings. The base of the footings should be placed as previously described. An allowable bearing pressure of 3,000 PSF can be used to proportion spread footings. A minimum footing width of twenty-four (24) inches should be maintained for all spread footings. The bearing pressures provided above contain a minimum factor of safety of two (2) against shear failure of the bearing stratum and were selected to limit settlement potential to an inch or less.

Non-load bearing floor slabs for proposed structures can be placed directly on the density controlled fill or prepared suitable subgrade. Use of a polyethylene moisture (vapor) barrier is recommended under all climate controlled areas. A Resilient Modulus (M_R) of 15,000 PSI and Modulus of Subgrade Reaction (k) of 150 PCI can be assumed for density controlled *select* fill in slab design calculations. Load bearing slabs must be structurally designed (reinforced) to support the anticipated loading. AAI recommends the reinforced load bearing floor slab is placed on a base course layer over density controlled fill. The base course material should be a durable crushed stone. A minimum thickness of eight (8) inches is recommended.

General Requirements for Deep Foundations

The use of straight-sided cast in place concrete caissons (drilled shafts), augured-cast-in-place (ACIP) piles, and all types of driven piles are feasible at this site. Drilled shafts installed to tip depth of less than thirty-five (35) feet are feasible to support moderately heavy loads. AAI recommends drilled shafts are installed to a minimum tip depth of twenty (20) feet below the finished subgrade elevation. ACIP piles or driven piles will be more suitable to support heavy vertical loading or loading with a significant lateral component.

For drilled shafts and ACIP piles, shaft stems need to be reinforced to resist tensile forces that may develop in the soils active moisture zone. The active zone should be considered to extend from the ground surface to a depth of approximately ten (10) feet for purposes of steel reinforcement design. This typically requires tensile reinforcement for the entire shaft lengths.

Preliminary *ultimate* capacities for various diameter straight-sided shafts are outlined in Appendix "C". The drilled shaft curves can also be used to estimate capacities for ACIP piles. Casing of drilled shaft boreholes may be required at this site due to perched water encountered and the slicken-sided nature of the clay soils. It is recommended at a minimum one (1) test shaft be drilled prior to production installation of the foundation to establish an installation procedure for production piles.

EXCAVATIONS

The United States Department of Labor's Occupational Safety & Health Administration (OSHA) requires certain excavations with a depth of five (5) or more feet to have a safety system in-place to protect workers from exposure to hazards in and around the excavation. The owner should be aware his contractor is generally responsible for jobsite safety, however contractual agreements should be reviewed to ensure the responsibility is clearly defined. In part, the safety system requires inspection by a competent person, provisions for safe access and egress of the excavation, use of barricades to prevent surface traffic from inadvertently entering the excavation, testing for hazardous atmospheres, and protection from water accumulation, support of side walls, and support as necessary to ensure stability of adjacent structures or equipment.

The clay soils generally encountered within the upper twenty (20) feet at this site classify as Type B (cohesive soil) per Appendix B to Subpart P of OSHA 29 CFR 1926 (Sloping and Benching Guidelines). If water is present, the soils must be considered Type C. Where soft clays or cohesionless soils are locally encountered, a classification of Type C must also be used.

Open excavations into Type "B" soils generally will require side slopes of no greater than one horizontal to one vertical (1:1). Type "C" soils will require flatter slopes of not more than one and one half to one (1.5:1). Any temporary sheeting and shoring should be designed to withstand lateral forces exerted by earth pressure. The relative active and passive pressure coefficients to use for calculating the lateral pressures exerted by an equivalent fluid on temporary sheeting and shoring in the stiff clay is $K_a = K_o = K_p = 1.0$. A moist unit weight of one hundred twenty (120) PCF can be assumed for the lean clay stratum. This value will be reduced to approximately fifty-eight (58) PCF below the water table.

PAVEMENT SYSTEMS

The pavement section recommendations for this site are based upon subsurface conditions implied by the test borings and the assumption traffic will be inclusive of typical private vehicle and commercial truck loading. Actual traffic type and volume are not defined at this time and the suggested pavement sections are typical of what would be sufficient for an industrial facility with a moderate level of traffic loading. Facilities with very high or exclusive volumes of tractor trailer traffic may need a heavier section.

The existing (CL) surface soils, recompacted as required in the Subgrade Preparation Section of this report will have a California Bearing Ratio (CBR) value in the range of four (4) to seven (7) or Modulus of Subgrade Reaction (k) in the order of 100 PCI. Density controlled select fill materials of the type specified will have CBR values in the order of ten (10) to fifteen (15) with "k_s" values of 150 PSI per inch.

AAI recommends the clay subgrade soil be chemically stabilized to create a stable pavement base or subbase layer. This office recommends the upper twelve (12) inches of the prepared pavement subgrade be chemically stabilized with Type I Portland cement. The cement stabilized soil or "soil-cement" subgrade/base layer should achieve a minimum unconfined compressive strength of 150 PSI at seven (7) days of age. Eight (8) percent by volume cement can be used for cost estimation for cement stabilization. The actual quantity required should be verified by the geotechnical engineer during the construction phase of the project in accordance with Louisiana Department of Transportation and Development Test Method TR 432.

Construction of the soil-cement subgrade layer should be in accordance with the provisions outlined in Section 303 of the *Louisiana Standard Specifications for Roads and Bridge, 2006 Edition.* Compaction of the finished subbase layer should not be less than 95% of the maximum laboratory density as determined by LDOTD TR 418. Heavy construction traffic should not utilize cement stabilized areas until the materials have cured sufficiently to obtain minimum specified strength.

Soils classifying (CH) are unsuitable for pavement subgrade support or Portland cement stabilization without chemical treatment to stabilize the strength and potential for shrinking and swelling. Where (CH) soils will exist within two (2) feet of finished pavement subgrade elevation, the active soil should either be removed and replaced with select fill or treated with Hydrated Lime such that a minimum of two (2) feet of inactive materials will exist beneath the pavement base layer and any active clay soils. Fifteen (15) percent hydrated lime by volume be used for estimation cost of lime treatment operations. Lime treatment should reduce the "in-situ" plasticity index to fifteen (15) or less. The actual Lime quantity should be verified by the geotechnical engineer during the construction phase of the project in accordance with Louisiana Department of Transportation and Development Test Method TR 433.

General recommended procedures for lime treatment are included in Appendix "B" of this report. Lime treated subgrade should be compacted to a minimum of ninety-five (95) percent of the laboratory maximum as determined by ASTM D698 at a moisture content of one (1) to three (3) percent *above* optimum moisture content.

Rigid Pavement

Based on soil types encountered and our experience in this geographic area, AAI recommends rigid pavement sections be utilized for all heavy duty applications. Minimum flexural strength of the concrete should be 650 pounds per square inch (PSI) at twenty-eight (28) days of age or have compressive strength value of 4,000 PSI. AAI recommends the use of air entrainment chemicals that improve workability of the concrete mix and improve durability of the pavement surface. Control joint spacing should not exceed twelve (12) feet for un-reinforced pavement of the thicknesses outlined below. All concrete paving should include provisions to mechanically control temperature induced shrinkage cracking and provide for load transfer across construction joints. Rigid pavement sections suggested for various applications at this site are summarized in the table below.

<u>RIGID PAVEMENT SECTIONS</u>

Pavement Layer	Light Duty Auto Parking Applications	Medium Duty Channelized Auto Applications	Heavy Duty Access Drives and Truck Parking/Staging Applications
Portland Cement Concrete Thickness	5 inches	6 inches	9 inches
Base/Drainage Course Thickness	4 inches crushed stone base material	4 inches crushed stone base material	6 inches crushed stone base material
Geotechnical Fabric Layer Requirement	Optional	Optional	Optional
Subbase Course Thickness	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled, cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report
Subgrade Layer	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report

Flexible Pavement

Flexible paving structurally similar to the above light and medium duty rigid sections are provided for your cost comparison. Hot mixed asphaltic concrete (HMAC) mixtures should meet applicable requirements for materials, production, placement and acceptance as outlined in the *Louisiana Standard Specifications for Roads and Bridges, 2000 Edition*, Section 501 for Marshall mixtures or *LSSRB, 2006,* Section 502 for level 1 Superpave mixtures. For parking lot and light duty drive applications we recommend utilizing the ½ inch Nominal HMAC mix of either type. This mix produces a more aesthetic surface finish and generally holds up well under automobile parking lot use. The following flexible pavement sections are suggested for this site:

FLEXIBLE PAVEMENT SECTIONS

Pavement Layer	**Light duty Auto Parking Applications**	**Medium Duty Channelized Auto Applications**	**Heavy Duty Access Drives and Truck Parking/Staging Areas,**
Hot Mixed Asphaltic Concrete Wearing and Binder Course Thickness	2.0 inches	3.5 inches	6.0 inches
Base Course Thickness	6.0 inches crushed stone base material	6.0 inches crushed stone base material	12.0 inches crushed stone base material
Geotechnical Fabric Layer Requirement	Yes	Yes	Yes
Subbase Course Thickness	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report
Subgrade Layer	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report

AAI's recommendation of typical specifications for crushed aggregate base material and geotechnical fabric materials included in our proposed pavement sections are outlined in Appendix "B" of this report. Aggregate base course layers in excess of four (4) inches in thickness should be compacted to not less than 98% of the laboratory maximum as determined by ASTM D698, Method C. Layers of four (4) inches or less can be compacted by establishing a rolling pattern under the direction of the geotechnical engineer that produces the maximum density.

CONSTRUCTION CONSIDERATIONS

The upper soils at the site are fine-grained materials composed of a significant silt and/or clay fraction. Silty and clayey soils are subject to extreme changes in shear strength with varying moisture conditions and, if construction is initiated during wetter seasons of the year, it may be very difficult to move equipment about the site. Once the silt or clay becomes saturated, compaction operations can be seriously hampered by a tendency of the silt to "pump" or the clay to shear. Consequently, it is imperative adequate site drainage be established and maintained prior to and during construction operations to prevent water ponding on or adjacent to the site resulting in subsequent saturation of the soil. Compaction operations may be expedited by using light compaction equipment and thin lifts of soil. Rolling only as necessary to obtain compaction is advisable because further repetitive loading may cause the subgrade to "pump" or fail.

Compaction operations and installation of the foundations should be supervised by an AAI inspector. All foundation excavations should be inspected to verify cleanliness and bearing stratum suitability. Concrete should be placed in foundation excavations as soon as practical after forming and imbed placements have been approved, to avoid prolonged exposure of the bearing stratum and possible disturbance due to standing water, desiccation or construction operations.

When the structures are complete, the ground surface should slope away from the structure and downspouts should carry runoff water several feet away from the structure, preferably into paved areas or sewers, before discharging.

The placement of irrigated landscaping adjacent to the foundation perimeter is not recommended without use of properly designed moisture barriers that permanently prevent water infiltration under the building's foundation. It is also recommended all trees with canopy drip lines overlapping the building foot print be removed prior to construction. New plantings should be limited to small or dwarf varieties whose root zones will not infiltrate the bearing soil of the foundation when mature.

LIMITATIONS

This study has been prepared in accordance with generally accepted geotechnical engineering principles and practices in this area at this time. We make no other warranty either express or implied.

The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings drilled at the locations indicated in Appendix "A", the proposed type of construction and our experience in the area. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory borings and variations in the subsurface conditions may not become evident until excavations are performed. If conditions encountered during construction appear to be different from those described in this report, we should be notified at once so that supplemental recommendations if required can be made.

This study has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our exploratory information, which has not been described or documented in this report. As the project evolves, we should provide continued consultation and field services during design and construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Design changes may require additional analysis or modifications of the recommendations presented herein.

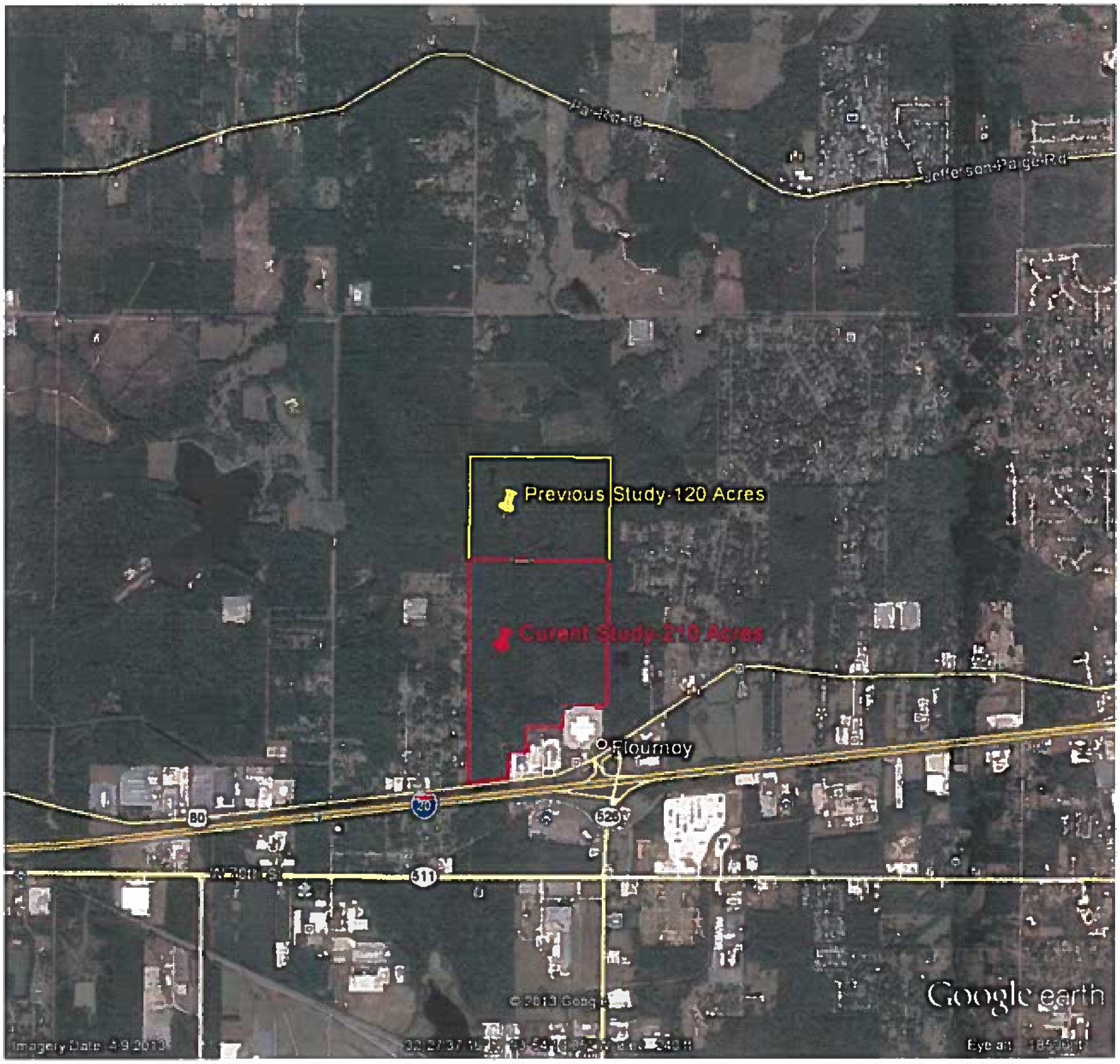
We recommend the geotechnical engineer of record (AAI) be retained to provide, construction materials testing, on-site observation of excavations, and verification of foundation bearing strata during the construction phase of this project.

APPENDIX A

SITE MAPS
AND
LOGS OF BORING

A.1.

SITE MAPS



SITE LOCATION

AEP CERTIFICATION FOR 330 ACRE PROPERTY
SHREVEPORT, LOUISIANA

TEST BORING LOCATIONS

AEP CERTIFICATION FOR 330 ACRE PRPOERTY
SHREVEPORT, LOUISIANA

A.2.

LOGS OF BORING

LOG OF BORING NO. B-1

PROJECT: AEP CERT 330 Acre Property
SHEET 1 of 1

CLIENT: Franks Investment Company LLC
LOCATION: North - Center

DATE: 1/11/14
SURFACE ELEV: +/- 267'

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
▨		■	P=0.5	21		33	16	17	59				Soft to medium reddish tan sandy lean clay (CL)
▨		■	P=1.5	26					50				4.0
▨	5	■	P=1.5	26	95	51	20	31	59	2.46	7.5		Stiff to very stiff reddish tan to tan sandy fat clay (CH)
▨		■	P=3.5	29									8.0
▨	10	■	P=3.5	26		58	24	34					Very stiff tan and gray fat clay (CH) with silt partings
▨	15	■	P=3.0	28									
▨	20	■	P=4.0	22		49	19	30					--Hard, mostly gray with fine sand partings
▨	25	■	P=5.0	28	95					8.41	4.5		25.0
	30												Bottom of boring at 25 feet

TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-2

PROJECT: AEP CERT 330 Acre Property

SHEET 1 of 1

CLIENT: Franks Investment Company LLC

LOCATION: Northwest

DATE: 1/10/14

SURFACE ELEV: +/- 269'

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
		☒	N=2	26		NP	NP	NP	69				Very loose, wet brown sandy silt (ML) 2.0
		☒	N=6	24		38	19	19					Soft to medium red and tan sandy lean clay (CL) 4.0
		■	P=1.5	26	99	87	25	62	95	5.43	11.6		Very stiff red and tan fat clay (CH)
	5	■	P=5.0	25									--Hard tan and gray with silt and fine sand partings
		■	P=5.0	23	97					9.88	2.7		
	10												
		■		27	92	69	23	46	93	11.62	9.4		
	15												16.5
		☒	N=23	19					56				Stiff tan sandy lean clay (CL)
	20												21.5
		☒	N=36	29									Very stiff gray fat clay (CH) 25.0
	25												Bottom of boring at 25 feet
	30												

■	◧	☒	⌶	◪	⊡
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

14.94.020

ARDAMAN & ASSOCIATES,INC.

LOG OF BORING NO. B-3

PROJECT: AEP CERT 330 Acre Property

SHEET 1 of 2

CLIENT: Franks Investment Company LLC

LOCATION: Center - West

DATE: 1/12/14

SURFACE ELEV: +/- 280'

DRILLING METHOD(S): Auger 0 - 25 feet Rotary 25-100feet

GROUNDWATER INFORMATION: Water encountered at nine (9) feet depth

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
▥		■	P=0	23		NP	NP	NP	65				Very loose brown sandy silt (ML) 2.0
▨		☒	N=5	23		36	18	18					Soft red and tan sandy lean clay (CL)
▨	5	■	P=1.5	27	96	37	21	16		1.52	7.7		--Medium stiff
▨		■	P=1.0	23	103	41	17	24		3.13	9.4		--Stiff with little sand 8.0
▨	10	■	P=5.0▼	21	103					10.68	1.9		Hard tan and gray clay (CH) 11.5
▨		■	P=0.5	16		42	26	16	54				Very stiff clay with sand seams (CL) 15.0
░	15												
░		☒	N=50/1"										Two (2) inch rock layer at 18 feet in fine silty sand
░	20												
░		☒	N=31	20					35				--Dense grayish tan silty sand (SM) with silt partings
░	25												
░		☒	N=40	21									
░	30												
░		☒	N=37	26					22				
░	35												
░		☒	N=42	26									
░	40												
░		☒	N=38	30					17				
░	45												46.5
▨		☒	N=31	33		66	31	35					Very stiff gray clay (CH) with fine sand partings
▨	50												
▨		☒	N=47	31									
▨	55												

■	◧	☒	⌶	◩	⊡
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-3

PROJECT: AEP CERT 330 Acre Property

SHEET 2 of 2

CLIENT: Franks Investment Company LLC

LOCATION: Center - West

DATE: 1/12/14

SURFACE ELEV: +/- 280'

DRILLING METHOD(S): Auger 0 - 25 feet Rotary 25-100feet

GROUNDWATER INFORMATION: Water encountered at nine (9) feet depth

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
▨		☒	N=44	31									--Very stiff gray clay (CH) with silt partings
▨	60												
▨		☒	N=52	32		72	27	45					--Hard
▨	65												
▨		☒	N=52	39									
▨	70												74.0
▨	75												Very stiff gray lean clay (CL) with silt partings
▨		☒	N=48	27		47	20	27					
▨	80												84.0
░	85												Very dense gray fine silty sand (SM) with clay partings
░		☒	N=85/11"	30					35				
░	90												
░	95												
░		☒	N=50/1.5"	29					43				100.0
	100												Bottom of boring at 100 feet
	105												
	110												

▮	◨	☒	⌶	◣	⌼
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-4

PROJECT: AEP CERT 330 Acre Property

SHEET 1 of 1

CLIENT: Franks Investment Company LLC

LOCATION: South Center

DATE: 1/9/14

SURFACE ELEV: +/- 285'

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
▨		■	P=2.0	29	91	45	22	23	47	2.98	7.1		Stiff reddish brown to tan clayey sand (SC)
▨		■	P=2.0	27	90					3.46	7.4		
▨		■	P=2.5	26	96	41	24	17	46	3.24	6.7		
▨	5	■											6.0
░		☒	N=24	17									Medium dense tan silty sand (SM) 8.0
▨		☒	N=27	18		45	24	21	36				Very stiff tan clayey sand
▨	10												
▨		☒	N=18	22									
▨	15												
▨		☒	N=31	29		47	25	22	24				
▨	20												
▨		☒	N=37	30									25.0
	25												Bottom of boring at 25 feet
	30												

■	◧	☒	⌶	◩	⊡
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-5

PROJECT: AEP CERT 330 Acre Property

SHEET 1 of 1

CLIENT: Franks Investment Company LLC

LOCATION: West

DATE: 1/8/14

SURFACE ELEV: +/- 283'

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA		LABORATORY DATA									
DEPTH (FT)	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
		18					52				Medium dense tan sandy silt (ML)
	N = 9	15		NP	NP	NP	53				4.0
5		26	98	70	27	43	89	12.11	2.2		Hard gray clay (CH) with trace sand and silt partings
		22	100	55	25	30	94	12.76	3.1		8.0
10	N = 62	18									Hard gray and tan lean clay (CL) with fine sand partings
15	N = 53	20		48	21	27	86				17.0
20	N = 50/6.5"	17		39	23	16					Hard tan sandy lean clay (CL) 21.5
25	N = 48	20					41				Dense tan silty sand (SM) with clay partings 25.0
30											Bottom of boring at 25 feet

TUBE SAMPLE	AUGER SAMPLE	SPLIT SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-6

PROJECT: AEP CERT 330 Acre Property
SHEET 1 of 1

CLIENT: Franks Investment Company LLC
LOCATION: South

DATE: 1/8/14
SURFACE ELEV: +/- 284'

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at thirteen (13) feet depth

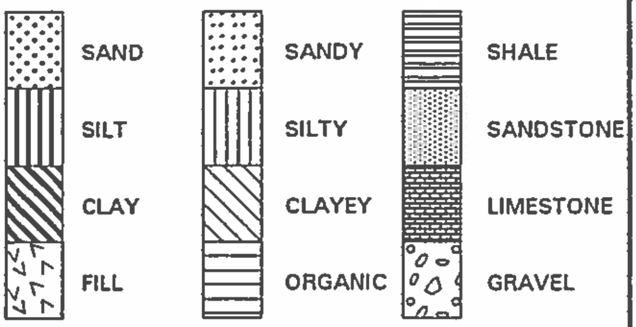
FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
▥		■		13									Medium dense tan sandy silt (ML) 2.0
▨		☒	N=12	25		49	23	26	63				Medium stiff reddish tan sandy lean clay (CL) 4.0
▨	5	■		35		54	32	22	42				Stiff red and tan clayey sand (SC)
▨		■		35		62	24	38	40				8.0
▥	10	■		25									Dense gray silty sand (SM) 11.5
▨	15	☒	N=30 ▼	29		47	26	21	25				Very stiff tan clayey sand (SC) 16.5
▥	20	☒	N=39	30									Dense tan silty sand (SM)
▥		☒	N=27/4"	28		NP	NP	NP	23				25.0
	25												Bottom of boring at 25 feet
	30												

■	◧	☒	◫	◩	⌶
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

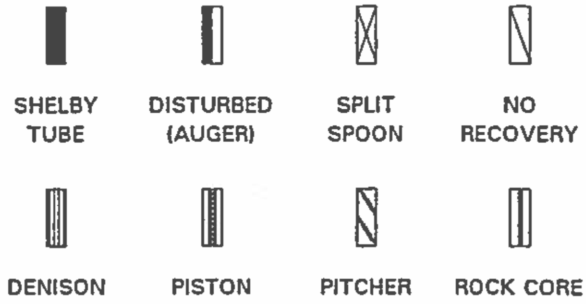
REMARKS:

KEY TO SOIL CLASSIFICATION TERMS AND SYMBOLS

SOIL OR ROCK TYPES



SAMPLER TYPES



CONSISTENCY OF COHESIVE SOILS (MAJOR PORTION PASSING NO. 200 SIEVE)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH,TONS/SQ FT
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.5
FIRM	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

RELATIVE DENSITY OF GRANULAR SOILS (MAJOR PORTION RETAINED ON NO. 200 SIEVE)

DESCRIPTIVE TERM	RELATIVE DENSITY,%
VERY LOOSE	LESS THAN 15
LOOSE	15 TO 35
MEDIUM DENSE	35 TO 65
DENSE	65 TO 85
VERY DENSE	GREATER THAN 85

WATER LEVELS

▼ - DEPTH GROUNDWATER FIRST ENCOUNTERED DURING DRILLING

▽ - GROUNDWATER LEVEL AFTER 24 HOURS (UNLESS OTHERWISE NOTED)

TERMS DESCRIBING SOIL STRUCTURE

Parting:	paper thin in thickness
Seam:	1/8" - 3" in thickness
Layer:	greater than 3" in thickness
Calcareous:	containing appreciable quanties of calcium carbonate
Ferrous:	containing appreciable quantities of iron
Well-graded:	having wide range in grain size & similar proportions of all intermediate sizes
Poorly graded:	predominately one grain size or having a range of sizes with few or no particles of some intermediate sizes
Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical
Interbedded:	composed of alternate layers of different soil types
Laminated:	composed of thin layers of varying color and texture
Slickensided:	having inclined planes of weakness that are slick & glossy in appearance

<u>NOTE:</u> Clays possessing slickensided or fissured structure may exhibit lower measured shear strength than indicated by the described consistency. The consistency of such soil is interpreted using the measured shear strength along with pocket penetrometer results.

APPENDIX B

SPECIFICATIONS
AND
PROCEDURES

B.1.

SPECIFICATIONS FOR COMPACTION
Sandy Clay and Clayey Sand Soils

The thickness of lifts used should be no more than the height of the teeth on sheepsfoot rollers. Generally, for a forty-eight (48) inch diameter or smaller drum roller, the maximum compacted lift thickness acceptable is six (6) inches. For rollers with drums of sixty (60) inches in diameter and larger with teeth about nine (9) inches long, a nine (9) inch final compacted lift thickness will be acceptable. The sole determination of the thickness of a lift will be the capability of the contractor's equipment to obtain the required compaction.

When obtaining the average density of a lift to determine its conformance to specifications, the lift should be immediately rejected if any density is more than 2% below the required average.

Generally, sheepsfoot rollers are most suitable for compaction of sandy clay and clayey sand soils, the contractor may use spiketooth rollers, rubber tired rollers, or any fill compaction equipment that has sufficient mass to compact the soil. Generally, the drums of sheepsfoot rollers should be filled with water or for additional weight with both water and sand. Tractors or other vehicles used primarily for hauling should not be allowed as fill compaction equipment. The contractor should also have smooth wheel rollers to seal the working area at the end of the day's operations so overnight rains will not saturate the soil and delay his work. These rollers should also be used to seal the surface whenever rainfall is imminent.

The soil engineer or his representative will perform density tests and will accept or reject a lift within two (2) hours after being tested. No material will be placed on any lift that has not been accepted by the engineer.

B.2.

CRUSHED AGGREGATE BASE SPECIFICATIONS

Crushed Stone
Crushed Concrete

Crushed stone base course shall be composed of crusher-run broken stone. The material shall be crushed and consist of durable particles of stone mixed with approved soil binder material.

Gradation

The base material shall meet the following requirements:

Pass #1-1/2"	100%
Pass #1"	90 -100%
Pass #3/4"	70 -100%
Pass #4	35 - 65%
Pass #40	12 - 32%
Pass #200	5 -12%

Soil Binder

Material passing the No. 40 sieve shall be known as "soil binder" and shall meet the following requirements:

Liquid Limit < 25
Plasticity Index < 5

Note

Extra binder material may be added with the approval of the geotechnical or design engineer.

Soundness and Los Angeles abrasion tests should meet Louisiana Department of Transportation and Development (LDOT) specifications.

B.3.

GEOTEXTILE FABRIC SPECIFICATIONS

The following proven woven Geotextile Fabrics are approved:

1. Amoco Pro Pex 2006
2. Beltech Style 980
3. ConTech C300
4. Mirafi 600X
5. Hanes (Terra Tex) HD

If alternate geotextile fabric from above is requested, the following qualifications should be met:

SPECIFICATIONS

Property	**Test Method**	**Minimum Requirements**
Fabric Structure	-	Woven
Polymer Composition	-	Polypropylene
Fabric Width	-	12½', 15', 17½'
Weight	ASTM D-3776C	5 oz. / yd.
Grab Strength	ASTM D-4632	300 x 300 lbs.
Elongation	ASTM D-4632	20%
Trap Tear Strength	ASTM D-4533	115 lbs. x 115 lbs.
Burst Strength	ASTM D-3786	575 psi.
Puncture	ASTM D-4833	120 lbs.
UV Resistance	ASTM D-4355	> 70%
A.O.S.	ASTM D-4751	35

NOTE:

1. Requires Mill Certification from manufacturer.

2. Minimum requirements are not minimum average values. Minimum average values per roll are not an acceptable specification.

B.4.

LIME TREATMENT

The work consists of constructing one or more courses of a mixture of lime and soil and water in accordance with these specifications. The percentage of lime should be determined by the construction materials division of the geotechnical laboratories.

Lime shall be protected from moisture prior to use. Water shall be added as needed during mixing and re-mixing operations, during the curing period, and to keep the cured material uniformly moist until covered. Lime shall not be applied on a frozen foundation or when the ambient air temperature is below 35° F (2° C).

Lime shall be incorporated in the following sequence: spreading the lime; initial mixing (12 inch depth); watering; sealing and mellowing for at least 48 hours; and re-mixing until pulverization requirements are met; compacting; finishing; and maintaining as necessary. After lime treatment, the treated soil shall have a maximum PI of eighteen (18).

The percentage of lime to be incorporated shall be as specified. A unit weight of thirty-five (35) pounds per cubic foot (560 kg/cu m) will be used to compute the required application rate of hydrated lime regardless of the actual unit weight of the lime used. Lime may be furnished in bags or bulk and distributed, in powder form, granular or in slurry, and in the required proportion. Dry lime shall be prevented from blowing by adding water or by other suitable means.

Lime shall be uniformly spread and mixed with the soil to the width and depth shown on the plans or as directed. Any procedure, which results in excessive loss, or displacement of lime, shall be discontinued. Areas to which lime is applied shall be processed on the same day as application is made.

Lime exposed to air for more than six (6) hours and lime lost or damaged before incorporation due to rain, wind, or other cause will be rejected, deducted from measured quantities, and shall be replaced by contractor at no direct pay.

The pulverization mixture shall meet the gradation requirements below.

U.S. Sieve, Inches (mm)	Percent Passing By Weight (Mass)
3/4 (19.0)	95
No.4 (4.75)	50

Pulverization requirements shall be met prior to final compaction and finishing. After meeting the pulverization requirement, the mixture shall be uniformly compacted to at least ninety-five (95) percent of maximum dry weight density determined by the Standard Proctor (ASTM D698). Compaction and finishing operations shall be completed within six (6) hours after meeting pulverization requirements.

Density test will be required per geotechnical engineer recommendations. At places inaccessible to rollers the mixture shall be compacted using devices that will obtain uniform compaction to required density without damage to adjacent structures. Any section not meeting the required density shall be reconstructed in accordance with these specifications. Reconstruction shall include the addition of the specified amount of time.

The final finish shall meet grade and cross-slope requirements and shall have a smooth, uniform, closely knit surface, free from ridges, waves, loose material or laitance.

Construction methods shall prevent contamination, segregation, soft spots, wet spots, laminations and other deficiencies. The contractor shall be responsible for taking such tests as necessary to adequately control the work. The contractor shall control the grade, cross-slope, lime spread, mixing, pulverization, thickness, width, density and curing to construct a completed course that is uniform and conforms to the acceptance requirements.

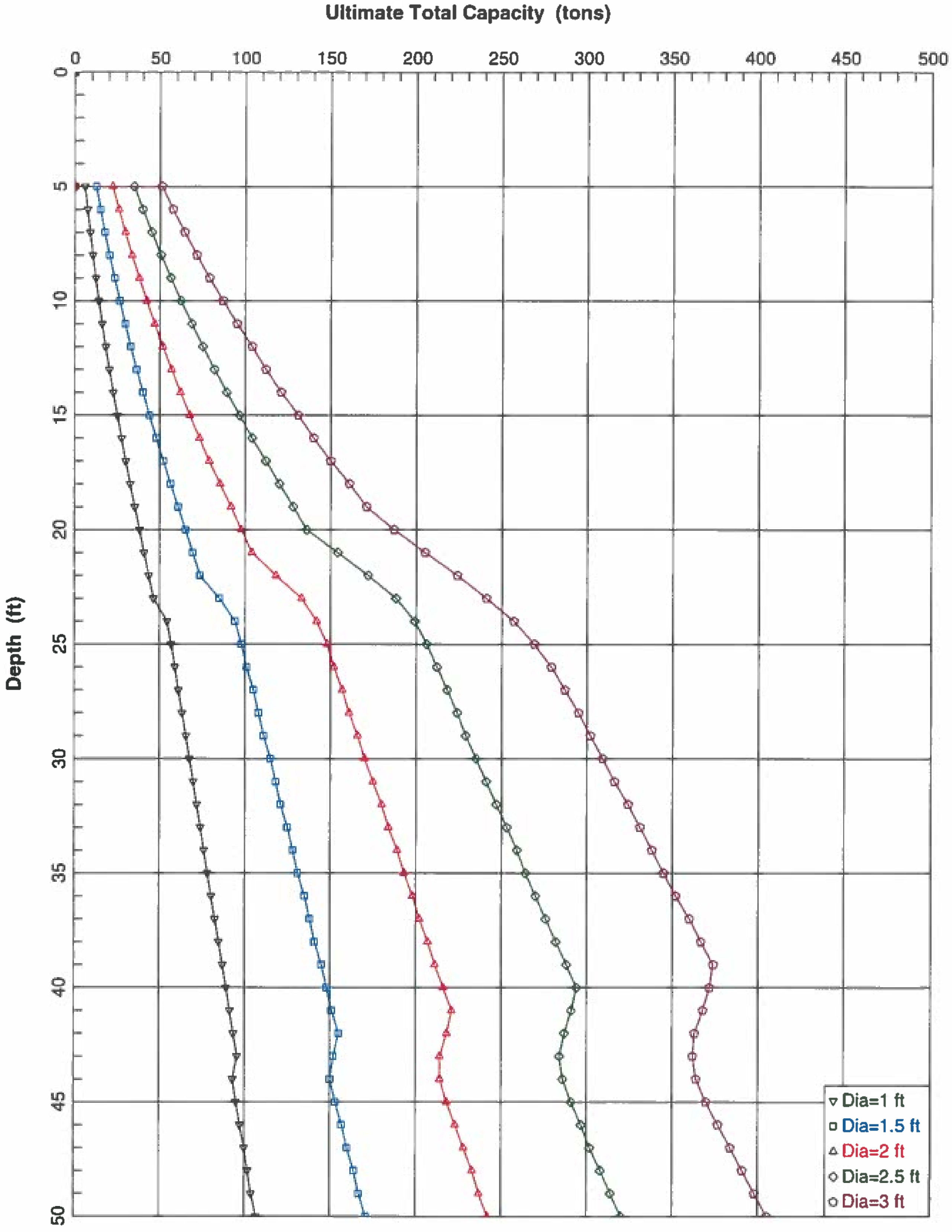
After finishing operations have been completed, the material shall be protected against rapid drying for seventy-two (72) hours by applying an asphalt curing membrane. The application shall be placed immediately following smooth rolling and shall be adequately maintained during the seventy-two (72) hour curing period.

APPENDIX C

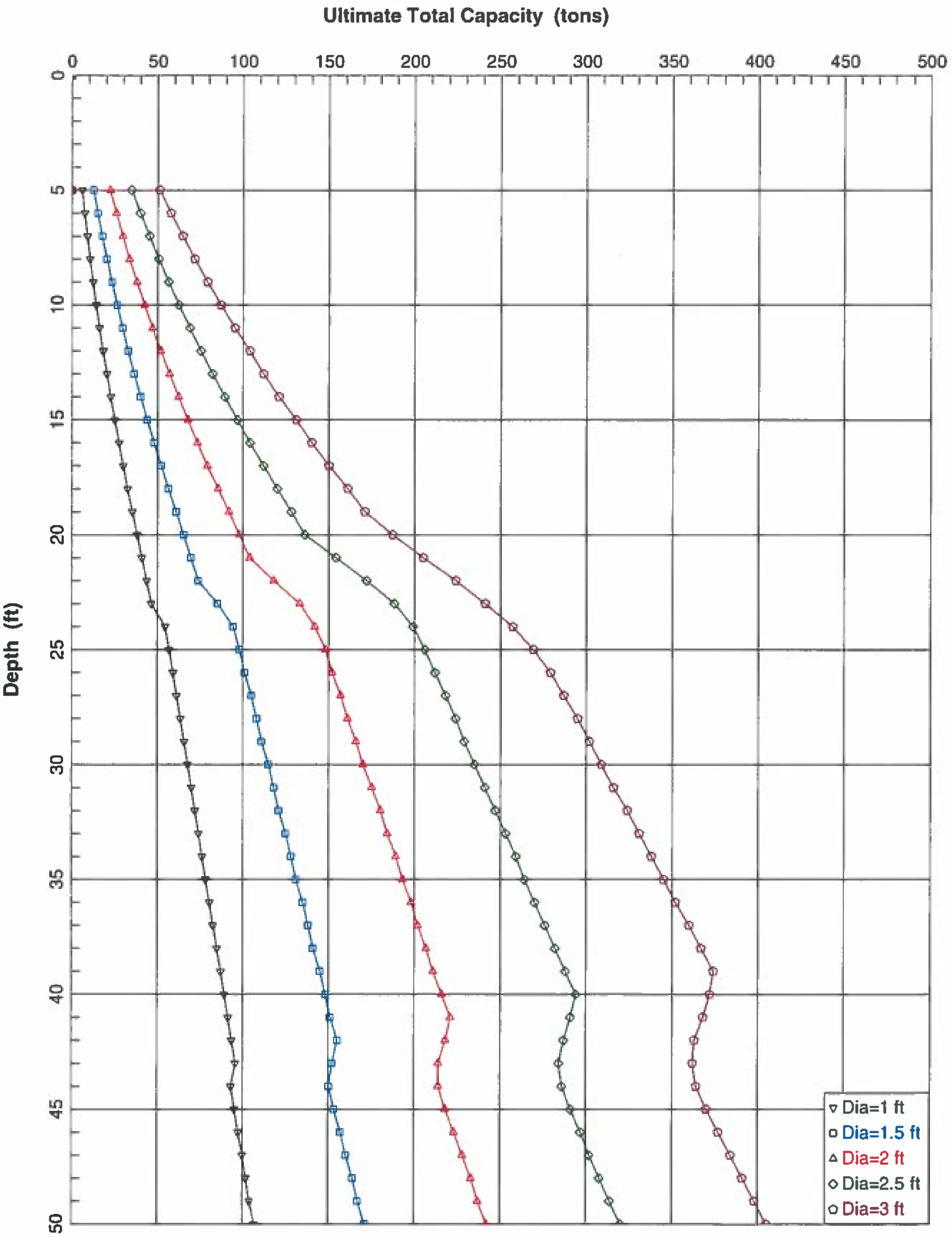
DRILLED SHAFT
CAPACITY CURVES

C.1.

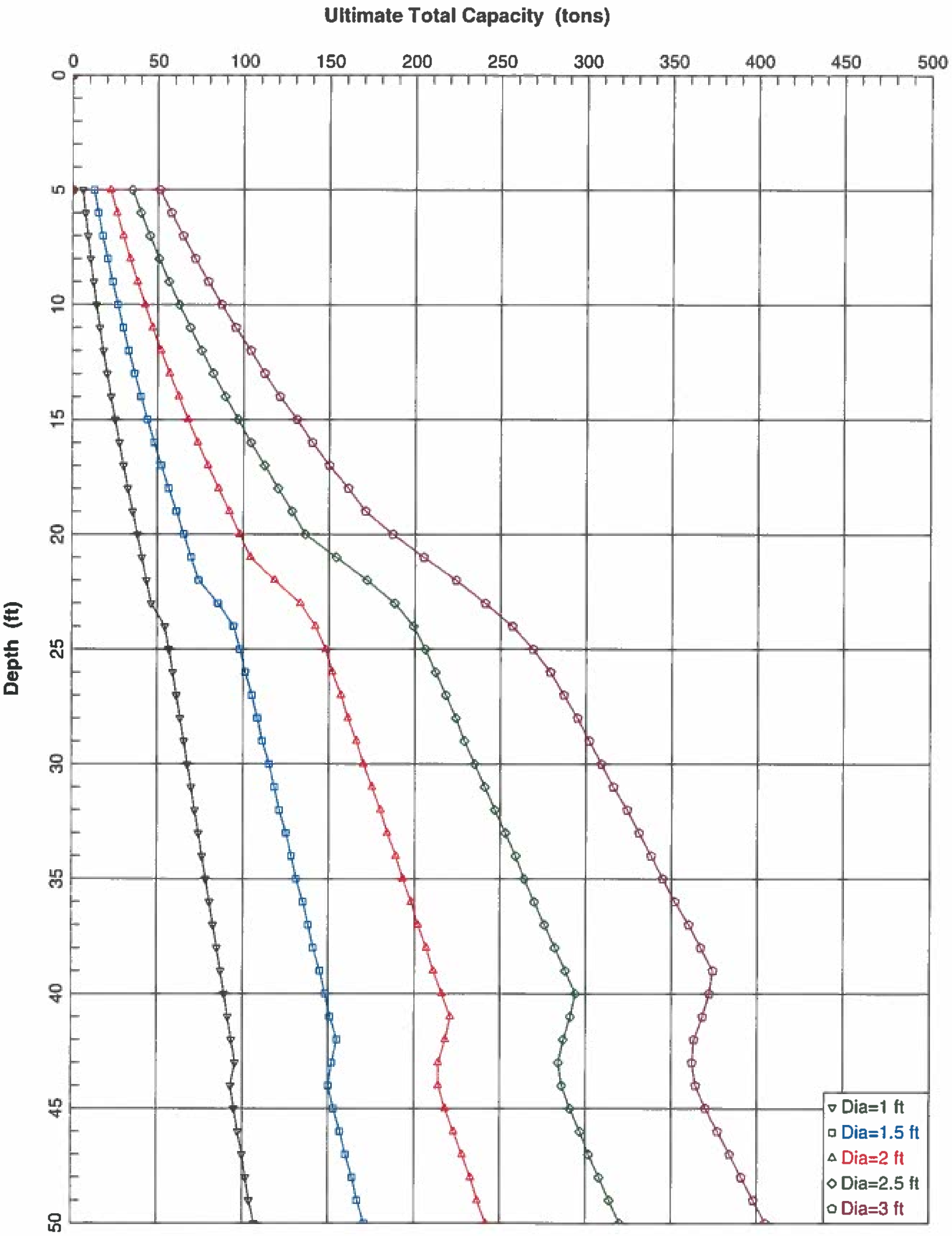
ULTIMATE TOTAL CAPACITY



PRELIMINARY ULTIMATE TOTAL CAPACITIES FOR DRILLED SHAFTS OR ACIP PILES



PRELIMINARY ULTIMATE TOTAL CAPACITIES FOR DRILLED SHAFTS OR ACIP PILES



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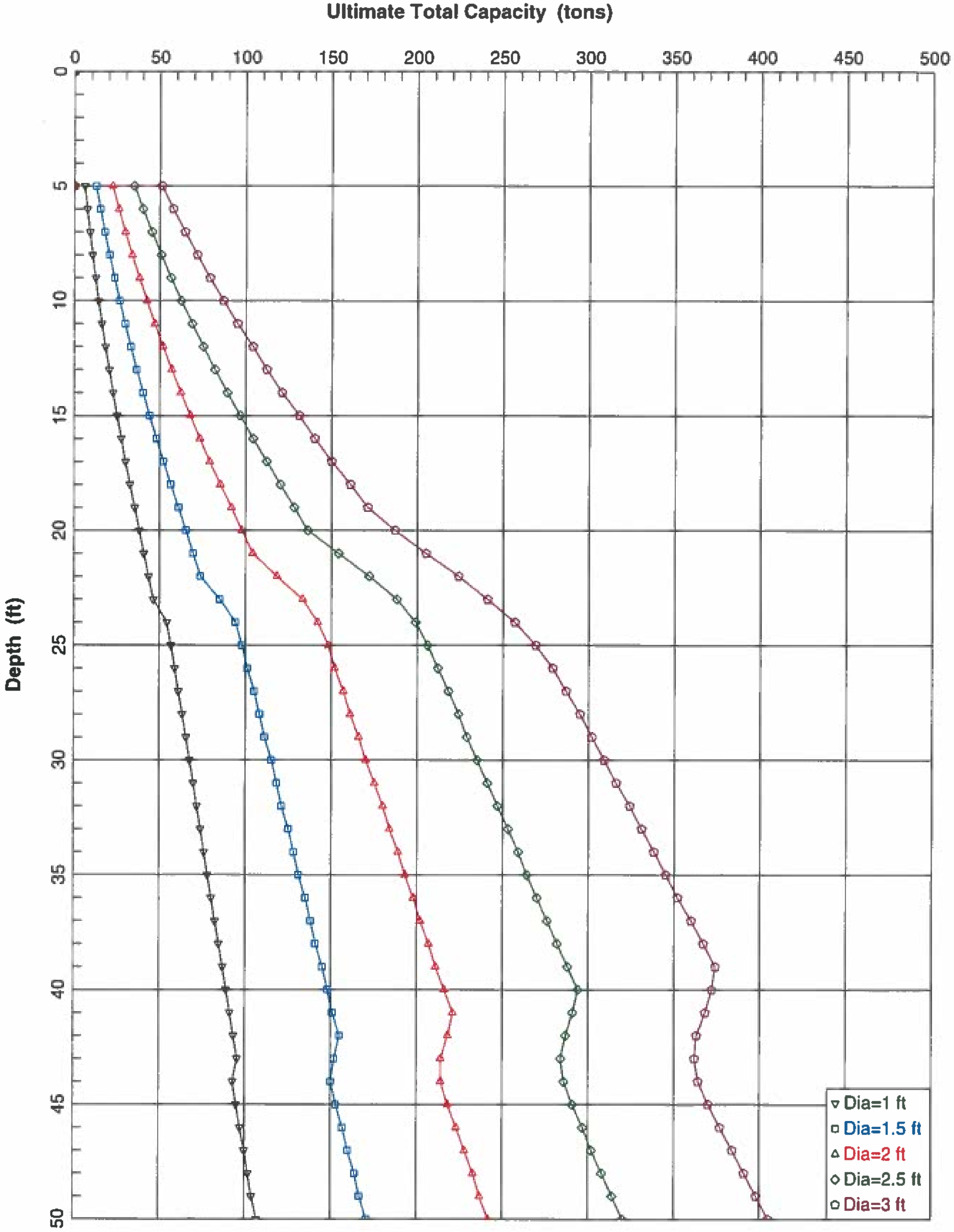
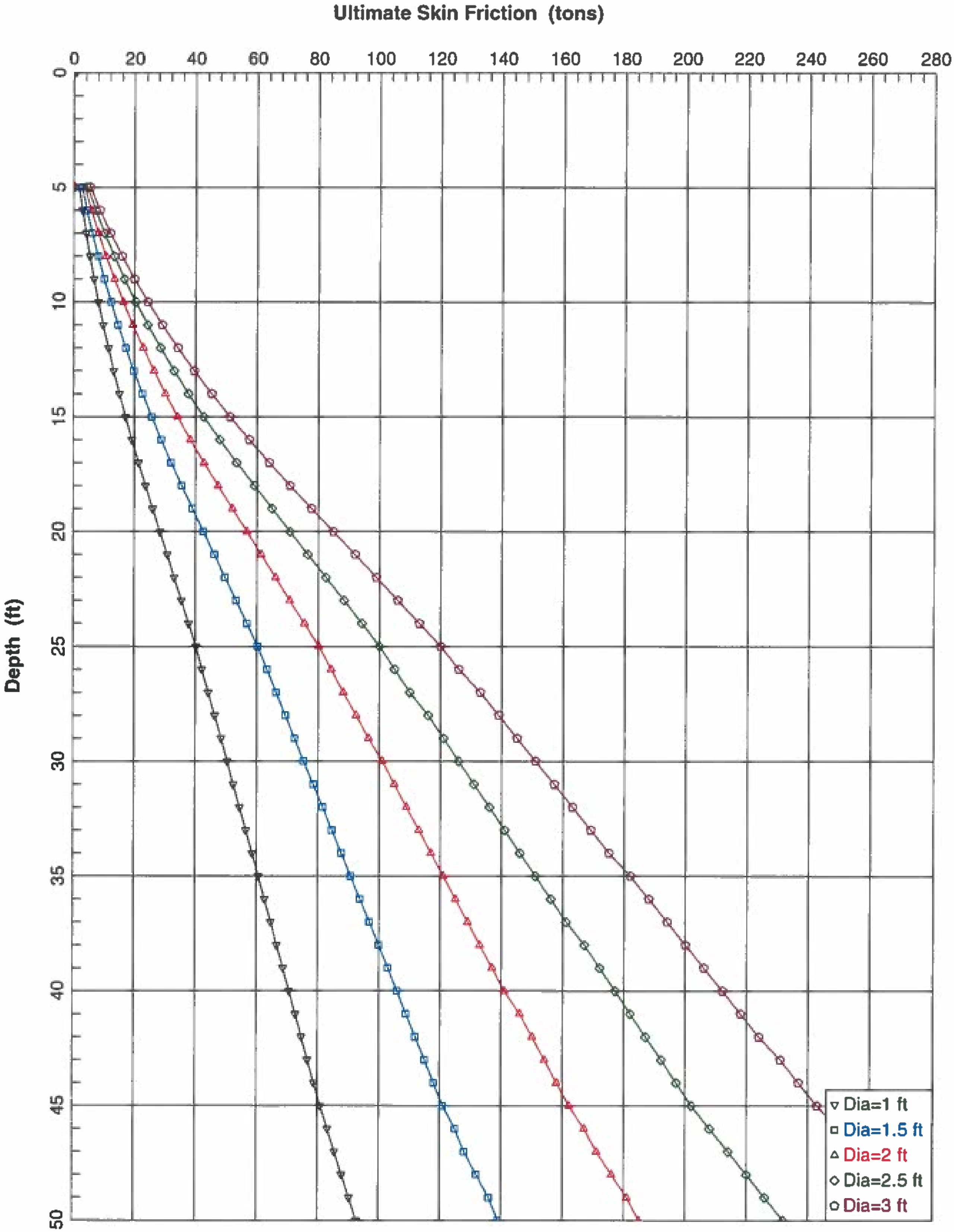


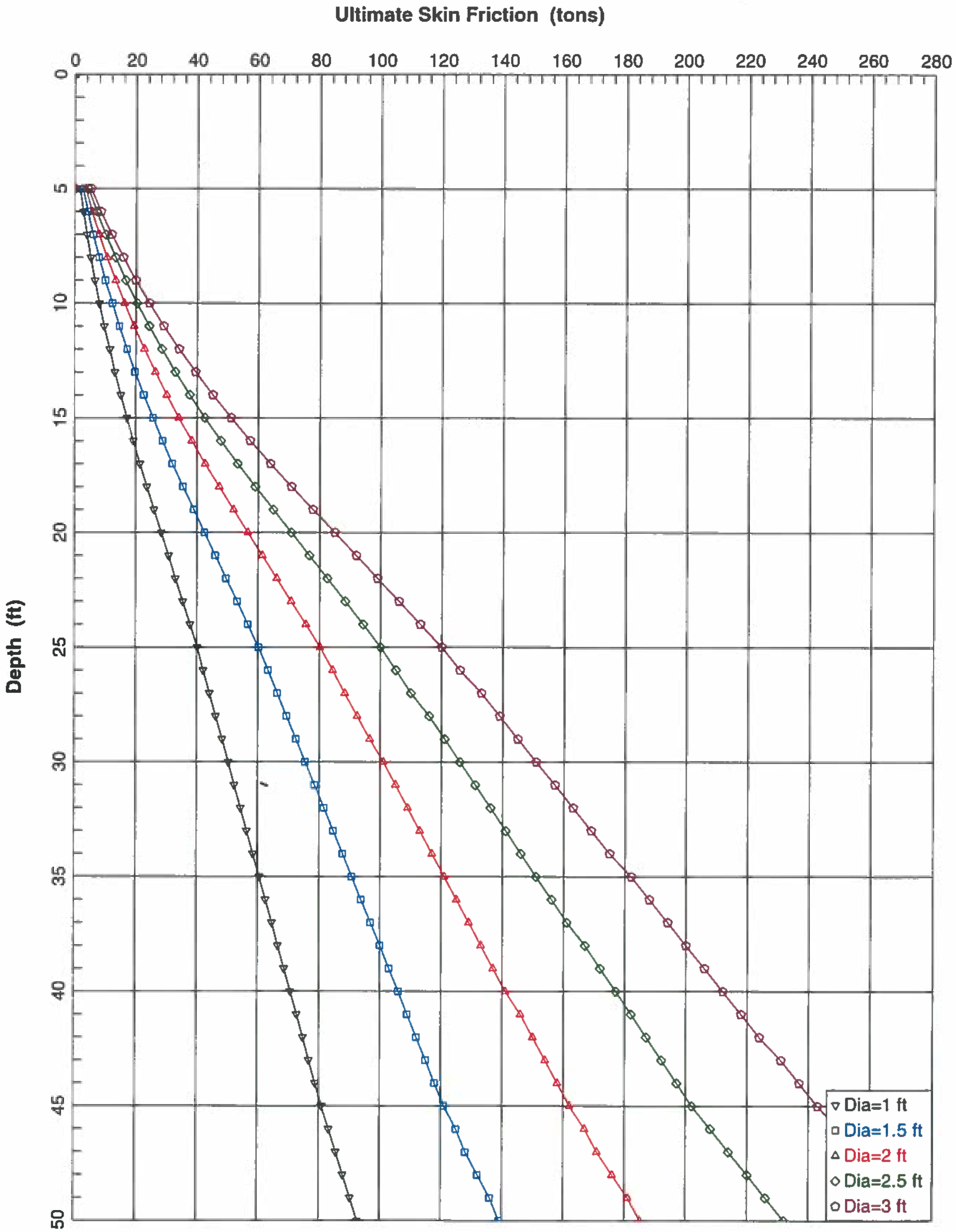
PRELIMINARY ULTIMATE TOTAL CAPACITIES FOR DRILLED SHAFTS OR ACIP PILES

C.2.

ULTIMATE UPLIFT CAPACITY



PRELIMINARY ULTIMATE CAPACITIES FOR DRILLED SHAFTS OR ACIP PILES



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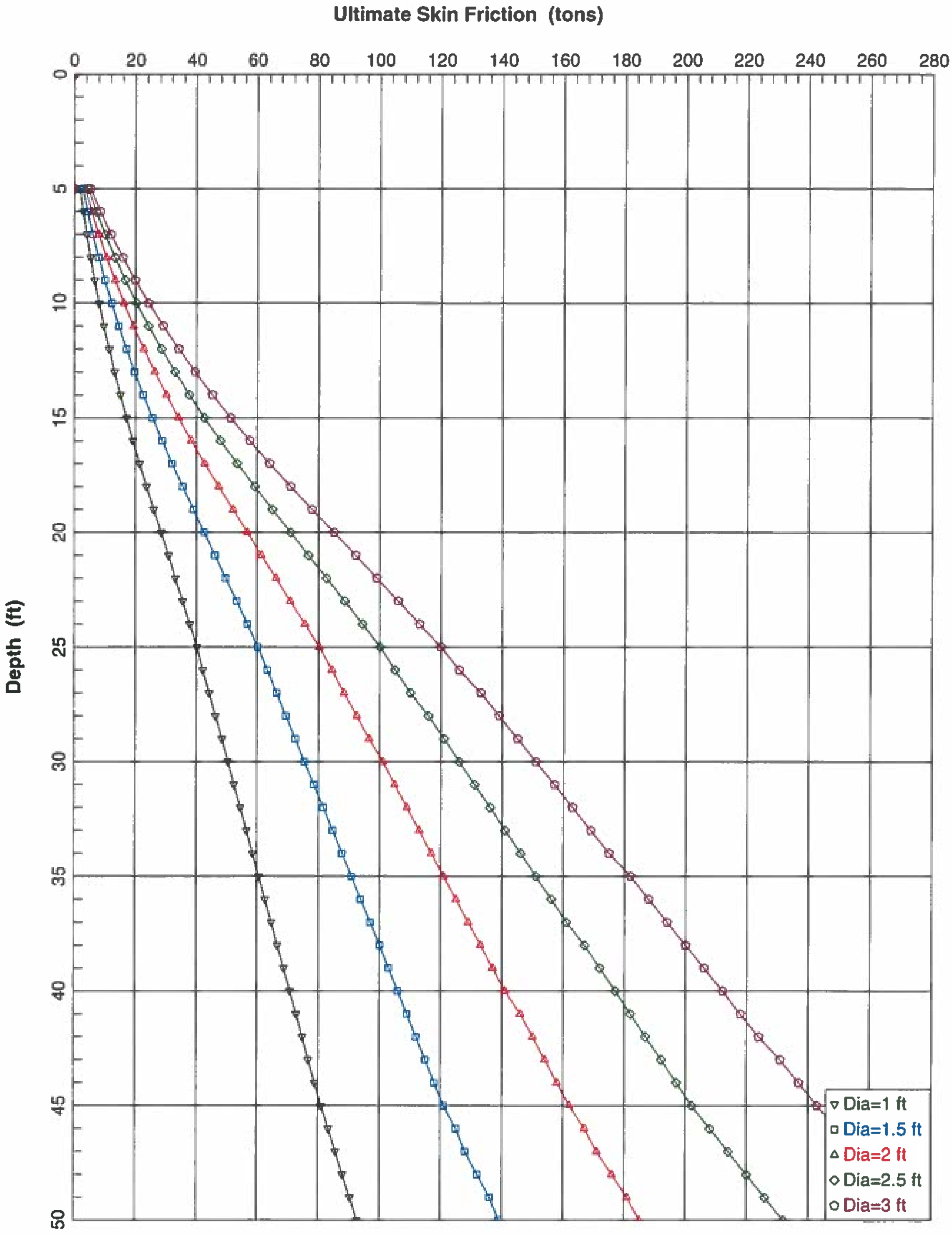
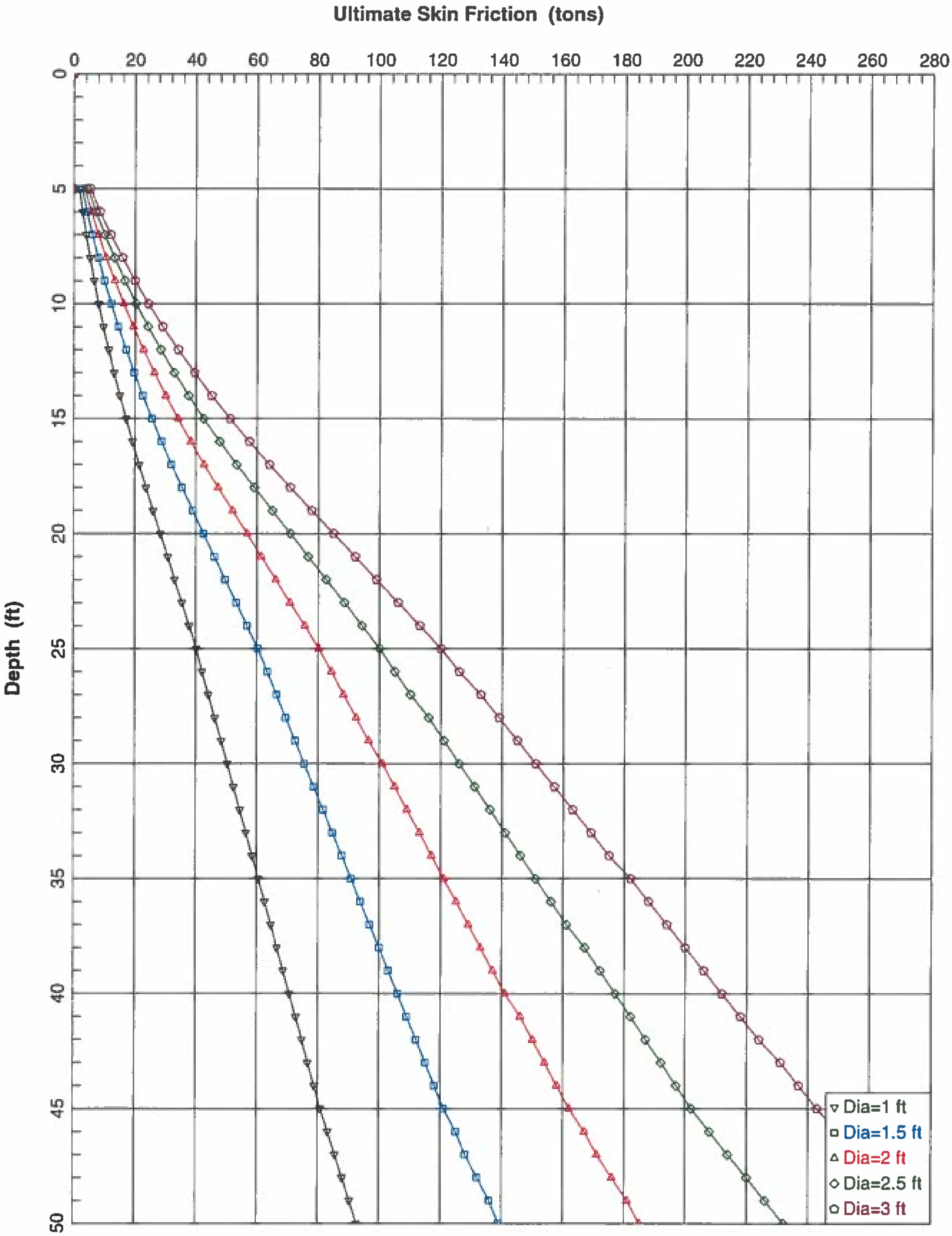


PRELIMINARY ULTIMATE CAPACITIES FOR DRILLED SHAFTS OR ACIP PILES



PRELIMINARY ULTIMATE CAPACITIES FOR DRILLED SHAFTS OR ACIP PILES