FOX Consulting Engineers and Geologists

F.M. FOX & ASSOCIATES INC.
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GEOTECHNICAL INVESTIGATION
PROPOSED MANUFACTURING FACILITY
FOR SIGNETICS, INC.
NORTH ALBUQUERQUE ACRES
ALBUQUERQUE, NEW MEXICO

Prepared For
Peter A. Lendrum Associates

Job No. 31330058000
June 5, 1980

PS 05 b Geotechnical Investigation - Proposed Manufacturing Facility.

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GENERAL

This report presents the results of a geotechnical investigation conducted at the site of the proposed manufacturing facility for Signetics, Inc., to be located west of Interstate 25 at San Diego Avenue, N.E. and Alameda Avenue, N.E., North Albuquerque Acres, Albuquerque, New Mexico.

The investigation was made to determine the best types and depths of foundations, allowable soil bearing pressures, ground water conditions, soil resistivity, pavement section thickness, and any special precautions which should be taken in the design or construction of the facility due to soil conditions.

The conclusions and recommendations presented are based on the data gathered during the site investigation, on the results of the laboratory testing, and on our experience with similar soil conditions. Factual data gathered during the field and laboratory investigations are presented in Figures 1 through 12 and Tables 1 through 3.

FIELD INVESTIGATION

Fourteen test holes, in addition to those drilled for the preliminary investigation, were drilled at the locations shown on the Test Hole Location Plan, Figure 1. The test holes were drilled with a 6-inch diameter continuous flight hollowstem auger driven by a

CME-45 or CME-55 drill rig.

Each test hole was continuously logged, Standard Penetration Tests were performed, and undisturbed samples were obtained in typical soil strata. The depth at which samples were taken and the depths at which Standard Penetration Tests were performed are shown on the Logs of Test Holes, Figure 2.

Additional borings were made across the site in the areas of trashy fill. These borings were continuously logged and cross-sections indicating the soils encountered are shown on Figures 3 and 4.

Differences in fill depths as reported in our preliminary investigation are a result of the irregularity of the arroyo sides and the precision of locating preliminary test holes. The location of final test holes and profile holes are accurate and should be used in computing trash quantities.

The areas of the site underlain by trashy fill were tested for the production of methane using a Mine Safety Appliance Company Gascope combustible gas indicator.

Resistivity tests were taken using a Bison Instruments resistivity meter. The location of these tests are shown on the Test Hole Location Plan, Figure 1, and results are discussed below.

LABORATORY TESTING

All samples were taken to our laboratory and were carefully inspected and classified. Moisture-Density Determinations, Grain Size Analyses, Atterberg Limits Tests, Swell-Consolidation Tests and Direct Shear Tests were performed on selected samples of the natural soils to determine their physical properties. The results of the Swell-Consolidation Tests and Direct Shear Tests are shown on Figures 5 through 12. Other laboratory results are shown on Table 1.

PROPOSED CONSTRUCTION

The proposed facility will include a Phase I area and a Phase II area which will be constructed at a later time. The Phase I construction includes the Manufacturing Center, the Energy Center, the Cafeteria, the Security Center, the Administration Center and the associated parking areas and connecting drives.

Basement areas are planned in the Manufacturing Center. Basement floors and portions of the floor at finished grade will be reinforced concrete slabs-on-ground. The portions of the floors spanning the basement and tunnel areas will be structural slabs of waffle-type construction. All other building floors will be reinforced concrete slabs-on-ground. Basement and foundation walls will be constructed of reinforced concrete.

The Manufacturing Center will be constructed using a reinforced concrete frame for the basement. A steel frame will be utilized for the upper portion as well as for the other buildings in the facility. All exterior walls will be masonry.

Approximate column loads in the Manufacturing Center range from 785 kips in the basement area to 20 kips in an upper floor area. In the Administration Building, column loads on the order of 70 kips are indicated. The Cafeteria has column loads on the order of 50 kips. Wall loads for all buildings are estimated to be 2 kips per lineal foot. All of the areas will be connected; however, current plans call for an expansion joint between buildings.

A diversion and channeling of drainage traversing the site will be constructed along the north and south sides of the site with flow to the west.

SITE CONDITIONS

The approximately 60-acre site is located west of Interstate Highway 25. San Mateo Boulevard, San Diego Avenue and Alameda Avenue, which are shown bounding the site on the Test Hole Location Plan, exist only in rough grading. Vacant land lies beyond the roads to the north, south and west.

Two arroyos previously traversed the site. These arroyos have been filled and are no longer obvious on the site. Two smaller drainages are located on the site to the north and south.

The site slopes irregularly to the west, showing a relief of 28.0 feet across our test holes. Topographic maps show a relief across the entire site of approximately 45.0 feet. The surface of the site is covered with a moderate to heavy growth of weeds and grass.

SUBSOIL CONDITIONS

The soils across the site are typically erratic and vary with depth. Our preliminary report, Job No. 31219052400 dated February 8, 1980, outlined an area of fill located predominantly on the western third of the site. The results of the final field investigation and profile drilling of the areas of trashy fill show that, in addition to the surface trash outlined in the preliminary report, two arroyos traverse the site in an east-west direction. These arroyos have been filled with trash, construction debris, and varying amounts of soil. The preliminary test holes encountered relatively small amounts of trashy fill, however, considering the results of methane monitoring, and subsequent drilling, it is our opinion that all of the fill on the site below soil cover should be considered as trashy, non-usable material with a potential methane hazard. For this reason, the areas of fill designated on the cross sections do not differentiate between trashy fill and fill with construction debris in it. Reusable soil cover on the fill has been outlined. In computing the quantities of reusable soil cover over the landfill, we recommend that the lower foot be considered contaminated and that it be wasted with the underlying material. Refer to Cross Sections, Figures 3 and 4.

Below the areas of fill, and on the surface across the rest of the site, silty sands were encountered. The sand is inter-layered with very sandy, silt-clay mixtures at various depths. Refer to the Logs of Test Holes, Figure 2.

No ground water or bedrock was encountered to a depth of 85 feet (elevation 5076.5), the maximum depth of exploration.

There is a general change in density with depth of the soils across the site. Generally, the soils encountered above elevations 5145 to 5160 have blow counts less than 30, while the material encountered below this range of elevations generally has a blow count greater than 30.

The method of deposition of the silty, coarse-grained soils of the area causes the soils to be highly moisture sensitive or "collapsible". These low density deposits are susceptible to large settlements upon an increase in moisture under their own weight, or under very low superimposed stresses. The phenomenon is typical in soils formed by sheet flow and water deposition in semi-arid environments. Refer to Swell-Consolidation Tests, Figures 5 and 6. Some of the soils exhibit high strengths before and after collapse due to wetting. Refer to Direct Shear Tests, Figures 7 through 12.

The amounts of possible settlement can be minimized by means of densification of the soil and other methods designed to control the moisture content of the soils supporting foundations. Other positive methods to prevent settlement include supporting heavy loads on pier or pile foundations.

EXISTING FILL AND METHANE CONSIDERATIONS

Testing was performed across portions of the site to check for the production of methane from the trashy fill encountered. The levels of methane recorded during the sampling varied from 0% to a maximum of 80% of the Lower Explosive Limit (roughly corresponding to 4% methane gas). The trashy fill was noted to be quite dry and has not had a chance to significantly decompose. Therefore, there is a high potential for more active decomposition with the addition of moisture and for higher production of methane gas. The additional moisture could be the result of infiltration of surface water, sewerline breaks, waterline breaks or landscape irrigation.

To avoid problems with methane production after construction, and to avoid problems associated with the settlement of the fill, we recommend that all trashy fill across the site be removed. It is our understanding that prior to construction of San Mateo and San Diego Streets, the trashy fill in these areas will be removed. Therefore, it is not anticipated that any methane control measures will be required other than to cover overexcavated trash embankments along the San Diego Street or San Mateo Boulevard rights-of-way.

If it is more economical to leave areas of trashy fill beneath parking lots and other non-structural areas, the following precautions should be taken:

1. Areas should be designed for an overall estimated settlement of 1 foot.
2. The owner should be willing to assume the risk of greater settlements in localized areas.
3. There should be no irrigation on the site.
4. All utilities crossing areas of trashy fill should be supported on piles and grade beams.
5. A methane monitoring system should be installed with provisions for a methane extraction system, should conditions warrant installation.
6. We should be contacted to provide further details.

The actual gas readings from our field sampling program are shown in Table 3. Although most of the gas levels monitored were very low, it is our opinion that a construction safety program should be implemented during removal of trashy fill from the site. We recommend the following steps be followed:

1. A combustible gas indicator should be utilized at all times during excavation of the trash.
2. When excavating in the presence of detectable concentrations of methane, below depth 2 feet, the material should be wetted and operating equipment should be provided with spark-proof exhaust.
3. Foam fire extinguishers should be provided for all

equipment working in the landfill area.

4. Personnel within or near the excavation should be fully clothed, should wear shoes with non-metallic soles, should wear an organic vapor mask, and should wear a hard hat and safety goggles or glasses.
5. Exhaust blowers should be on hand to be used in cases where the excavation shows a build up of methane or a lack of oxygen.
6. Smoking should not be permitted in any area within 500 feet of the excavation.
7. An attempt should be made to keep personnel away from a down wind proximity of the excavation unless the excavation is constantly monitored and declared safe.
8. The operator of any equipment should wear an organic vapor and acid gas respirator while operating equipment in the excavation.
9. Before personnel are permitted to enter the excavation, it should be carefully monitored for methane gas and oxygen sufficiency. Personnel should also be provided with a continuous methane and oxygen monitor in their work areas as long as they are in the excavation.

FOUNDATIONS

All existing man-made fill, trash, debris or soil cover over trash should be removed from all building areas prior to construction. This material will be replaced under building areas by structurally controlled fill. Removal of the trashy fill in other areas of the site is discussed in a previous section of this report.

Construction details of Phase II were not known at the time of this report. Additional information will be necessary for design criteria and detailed recommendations.

Energy Center and Manufacturing Center: Augered, Pressure-Grouted Piles

Settlements greater than 5 inches were predicted for column loads of 785 kips supported by spread-type footings, placed on the natural shallow soils. To prevent such large settlements and to prevent differential settlement in areas where depth of fill varies, we recommend that the Energy Center and Manufacturing Center be supported on grade beams and augered, pressure-grouted concrete piles.

The use of augered, pressure-grouted piles as opposed to open-drilled cast-in-place piers will prevent caving of the dry, cohesionless soil and the necessity of casing. Greater frictional bearing capacity will also be achieved.

Pile capacities were calculated considering the effects of adjacent basements, excavations and utilities and by using average soil strength values as determined by the Direct Shear Tests. The piles are assumed to act primarily as friction piles. The allowable group capacity values presented in the design charts, Figures 13 through 19, have a factor of safety of 2 applied to them. Group capacities were calculated using the Converse-Labarre pile group efficiency formula. The charts present design values for 14, 16, and 18 inch piles, as single piles and in groups of P2, P3, P4, P5, P6 and P9. Should other pile diameters or groups be employed, we should be contacted to provide the design criteria. We recommend a three diameter center-to-center spacing for piles placed in groups.

During construction, care should be taken to insure that positive pressure is maintained on the grout filling the hole. Minimum pump pressure of 300 psi should be maintained. This will prevent hole collapse and will force the grout into the coarser sand and gravel and provide better frictional characteristics.

All piles should be located laterally within a tolerance of 1 inch and plumb should be checked prior to drilling at each location. We recommend full time inspection and testing during pile installation.

The piles should be reinforced to resist any moment created by eccentric loading or lateral forces. We recommend that the piles be reinforced for the upper two-thirds of their length.

In order to meet code requirements for earthquake loading, pile groups should be braced in two horizontal directions.

Prior to foundation construction, we recommend that a minimum of 2 pile load tests be performed to verify pile capacity. Load tests should be conducted on maximum and minimum length piles at locations selected by the Soils Engineer.

Administration, Cafeteria and Security: Conventional Spread Footings

The support buildings for the facility, i.e., the Administration, Cafeteria and Security Buildings are relatively lightly loaded when compared to the Manufacturing and Energy Centers. Because of the difference in loading, it will be possible to support these buildings on conventional spread footings placed on structurally controlled fill and designed for a maximum gross soil bearing pressure of 4000 pounds per square foot.

All bearing surfaces should be excavated and backfilled so that a minimum of 3 feet of structural fill is located beneath the bearing surfaces. Excavations should extend horizontally from all footing lines a distance equal to the required depth of fill (3 feet minimum). Excavated natural soils and structurally controlled fill should be placed and compacted as specified in the Appendix.

Prior to footing placement, care should be taken to insure that all loose materials on the bearing surface are recompacted to the specified density. Footing sizes should be proportioned as much as practicable, based on total load. Exterior footings should be placed a minimum of 18 inches below final exterior grade for frost protection.

Maximum total settlements on the order of 0.25 to 0.50 inches have been calculated for buildings placed on conventional spread footings. If this calculated settlement is above tolerance, additional structural fill can be placed to reduce it. We should be contacted to provide additional design criteria if the predicted settlement is not tolerable.

It is our understanding that expansion joints will be used between adjacent buildings. The joints should be designed to accommodate the maximum differential settlement of 0.5 inches between structures founded on piles and on conventional spread footings.

INTERIOR SLAB ON GROUND CONSTRUCTION

Normally loaded interior floor slabs should be placed on compacted natural soils or structurally controlled fill. Prior to placement of slabs, the natural soils should be scarified to a minimum depth of 6 inches, moistened to optimum moisture content (± 2%), and compacted to 95% of maximum density as determined by ASTM D-1557. Fill placed for slab support should be compacted in accordance with the specifications as outlined in the attached Appendix.

It is good practice to separate the slabs from all bearing members and utility lines to allow their independent movement. Where concentrated loads are anticipated, a 4-inch thick gravel layer should be placed beneath the slab to help distribute loads. Frequent joints should be scored in the slab to control the location of any cracking.

For details of slab isolation for machine foundations, or for other special requirements, refer to final plans and specifications.

EXTERIOR SLABS

Backfill and any soil disturbed around the foundation walls should be well compacted prior to placing any exterior slabs. It is good practice to support exterior slabs on haunches to prevent differential settlement.

DESIGN CONSIDERATIONS

The active and passive earth pressures acting on basement and retaining walls may be approximated by the following equivalent fluid pressures:

Active Earth Pressure = Equivalent Fluid Pressure for a fluid whose density is 35 pcf

Passive Earth Pressure = Equivalent Fluid Pressure for a fluid whose density is 375 pcf

These forces should be assumed to act at the lower third point of a stress triangle. They are based on Rankine Theory and assumptions of a horizontal backfill and vertical wall. If these conditions are not met by current plans, we should be contacted to supply additional criteria. In addition, it is recommended that a safety factor of 2 be applied to these values.

The coefficient of base friction to resist sliding should be taken as 0.5. An increase in soil bearing pressure of one third is allowable to resist overturning or earthquake loading.

We estimate that excavated slopes will stand at an approximate slope of 1 vertical to 1 horizontal. Unless a full analysis is conducted, slope stability should be the responsibility of the contractor. Stability may be affected in the field by such factors as moisture, surcharge, equipment operation, shape of excavation, material encountered, and slope maintenance procedures.

RESISTIVITY SURVEY

Surface resistivity surveys were conducted on the site at the locations shown on figure 1. The tests were relocated in the field to avoid trashy fill. The tests were conducted during our field investigation and the results are as follows:

Line	Depth (ft)	Resistivity (ohm feet)	Soil Type
1	4	245	silty SAND
	8	260	poorly graded SAND
	12	850	poorly graded SAND
2	4	264	silty SAND
	8	325	silty SAND
	12	369	silty SAND
3	4	200	silty SAND
	8	275	silty SAND
	12	240	CLAY AND SILT

BACKFILL AND SURFACE DRAINAGE

Foundations should be prevented from being wetted after construction. Backfill material should be free of trash and construction debris. The backfill should be moistened and compacted to a minimum of 90% of the maximum density as determined by ASTM D-1557. Backfill should not be puddled or jetted.

To prevent water from seeping through the relatively permeable backfill, a 2-foot thick layer of relatively impervious material should be used at the surface next to foundation walls for the full width of the backfill. Refer to Figure 20 for details. To further prevent moisture from entering into basement areas, the exterior basement walls should be moist proofed.

The final exterior grade should have a good slope away from foundation walls and exterior slabs on all sides. A minimum slope of 1 foot of fall in the first 10 feet is recommended. Drainage from roofs, and all other surface water, should not be allowed to pond in backfill areas. Backfill adjacent to the foundation walls should be protected from erosion and subsequent ponding of water by suitable means.

It is our understanding that current plans allow for surface runoff to be led to the proposed drainage channels. This will eliminate the need for surface runoff ponding areas or dry wells. If current plans are significantly modified, we should be contacted to supply additional recommendations.

IRRIGATION OF LANDSCAPED AREAS

Sprinkler system lines should not be installed next to foundation walls. If a sprinkler system is installed, the sprinklers should be placed so that the spray from the heads under full pressure does not fall within 5 feet of the foundation walls. Irrigation should be minimized and controlled. Any planters adjacent to the structures should be watertight, and we recommend employing plants native to the area which require minimal irrigation.

If it is necessary to irrigate areas adjacent to the foundation walls, it will be necessary to take further precautions to prevent wetting of the backfill. A minimum of 1 foot of impervious material should be placed near the backfill surface. A layer of polyethylene film, or equivalent, should then be sealed against the foundation walls and should extend completely across this surface. It is very important that the recommendations for final grading of the backfill surface be carefully followed. Refer to Figure 21 for details.

PAVEMENT SECTION DESIGN

The near-surface soil encountered in our test holes on the site were tested to determine their AASHTO Classification. Based on these calculations and on the New Mexico Highway Commission's, "A Project Guide for Surfacing Required" and "Structural Design Guide for Flexible Pavement", the guideline pavement section thickness requirements have been established.

The paved areas on the site are of two types. There are areas of relatively heavy use, i.e., driveways through parking lots, entrances, and truck docking areas, as well as those areas used just for parking. For this reason, it is possible to use different pavement sections.

For areas of heavy use, we recommend that the pavement consist of a 4-inch asphalt surface placed over 6 inches of aggregate base course. For areas of light use, a 2-inch asphalt surface placed over 4 inches of aggregate base course is recommended. These recommendations were established by structural coefficient factors of the AASHTO Road Tests, and on established EDLA and serviceability coefficients.

The pavement subgrade should be moistened to optimum moisture content (± 2%) for as deep as practicable and compacted to a minimum of 95% of maximum density as determined by ASTM D-1557 using a heavy vibratory roller. The base course should be compacted to 100% of maximum density as determined by ASTM D-1557, and the asphalt surface course should be compacted a minimum of 96% of Marshall density.

It is recommended that the base course material be Class I or Class II material meeting the following requirements:

BASE COURSE REQUIREMENTS

PERCENT PASSING

Sieve Size	Class I	Class II
1"	100	100

Sieve Size	Class I	Class II
3/4"	80 - 100	85 - 100
No. 4	30 - 60	40 - 70
No. 10	20 - 45	30 - 55
No. 200	3 - 10	4 - 12
Soundness	18 or less	18 or less
L.A. Abrasion	50 or less	50 or less
L.L.	25 or less	25 or less

The asphalt concrete, both surface and base courses, should conform to the New Mexico Standard Specification for Public Works as modified by the City of Albuquerque Specifications.

Paved areas over trashy or uncompacted fill may settle extensively and require frequent repair. Possible consequences of this construction have been discussed previously.

CONCLUSIONS

The recommendations outlined are based on our understanding of the current plans and on the available finished floor elevations for the proposed facility. It is our understanding that the finished floor elevations are currently being modified. When finished floor elevations are finalized, we should be notified to insure no modifications in our recommendations are necessary. If plans are significantly modified in the future, we should be contacted to review our recommendations and to provide additional consultation.

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F. M. Fox & Associates of the Southwest, Inc.

Barbara Bridgeman

Barbara Bridgeman
Project Engineer

CHARLES M. MILLER
STATE OF NEW MEXICO
No. 6018
REGISTERED PROFESSIONAL ENGINEER

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Vice President

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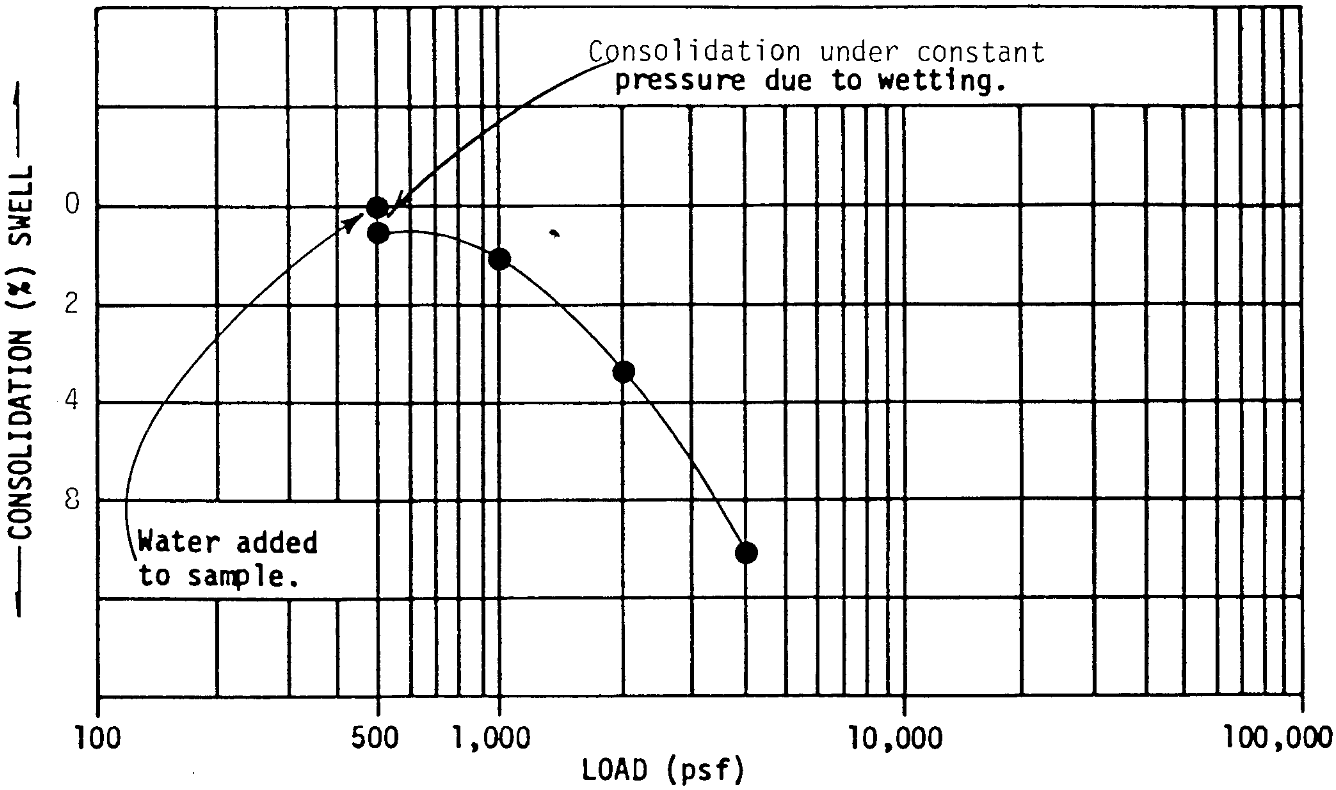
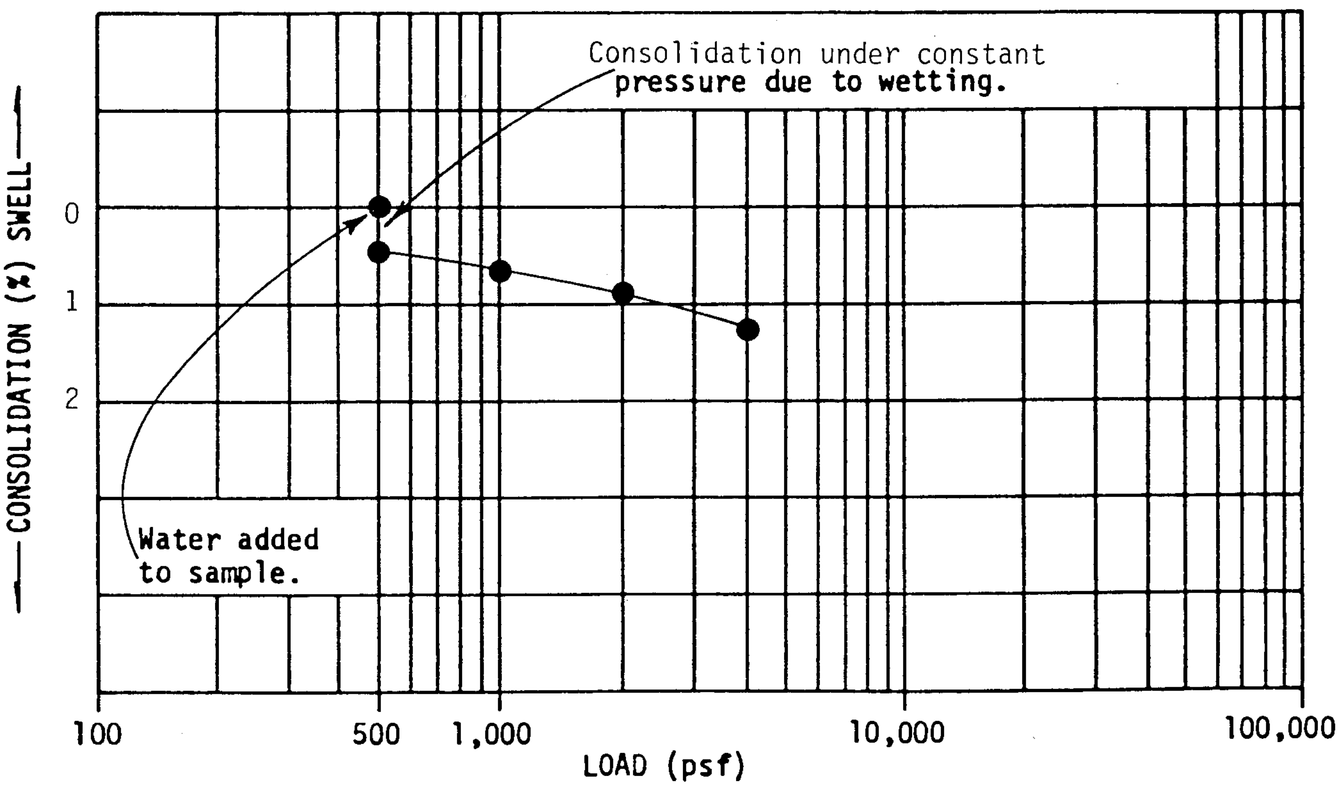
Bohannan-Huston, Inc. (1)

SWELL-CONSOLIDATION TESTS



Sample of sandy silty CLAY from test hole 2 from depth 1 feet.

Natural Moisture Content 9.2% Natural Dry Density 101 pcf



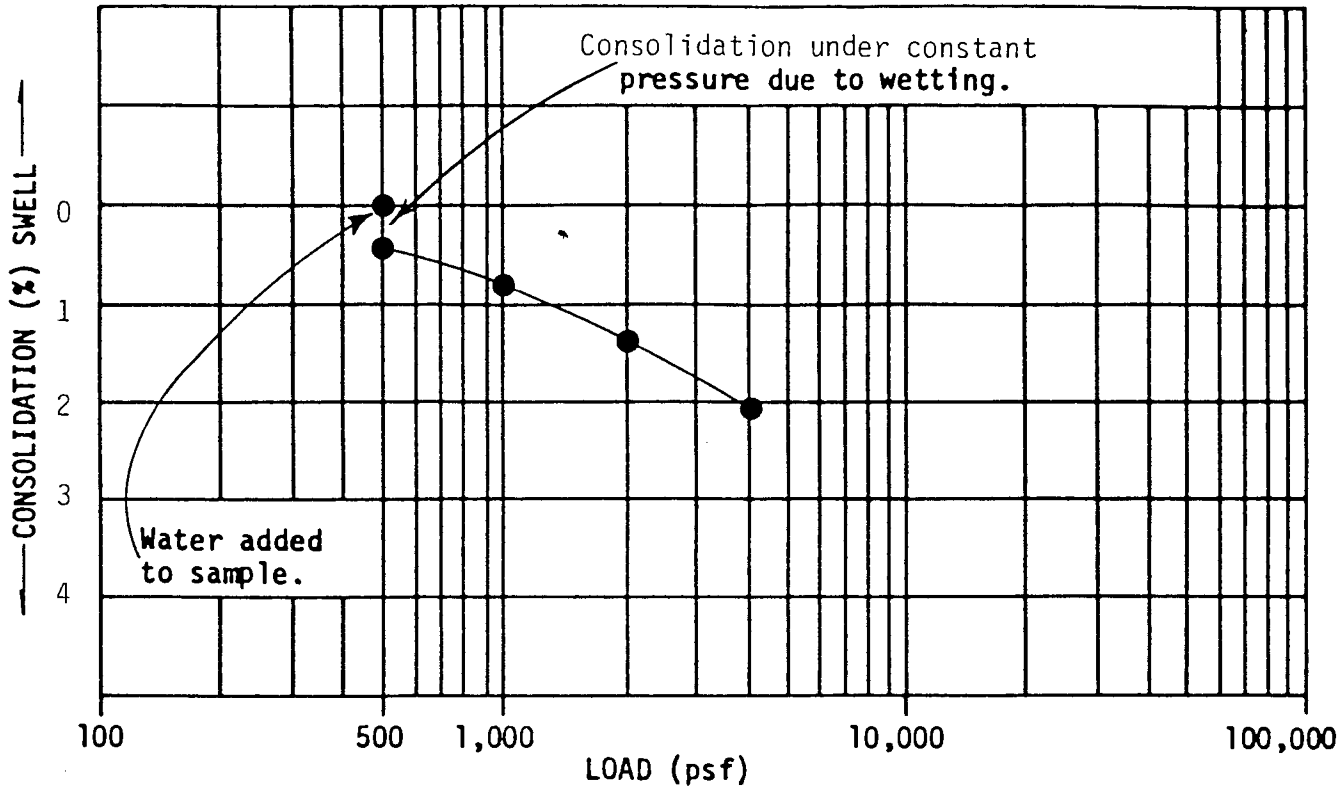
Sample of silty SAND from test hole 6 from depth 6 feet.

Natural Moisture Content 3.1% Natural Dry Density 95 pcf

Form 1-109

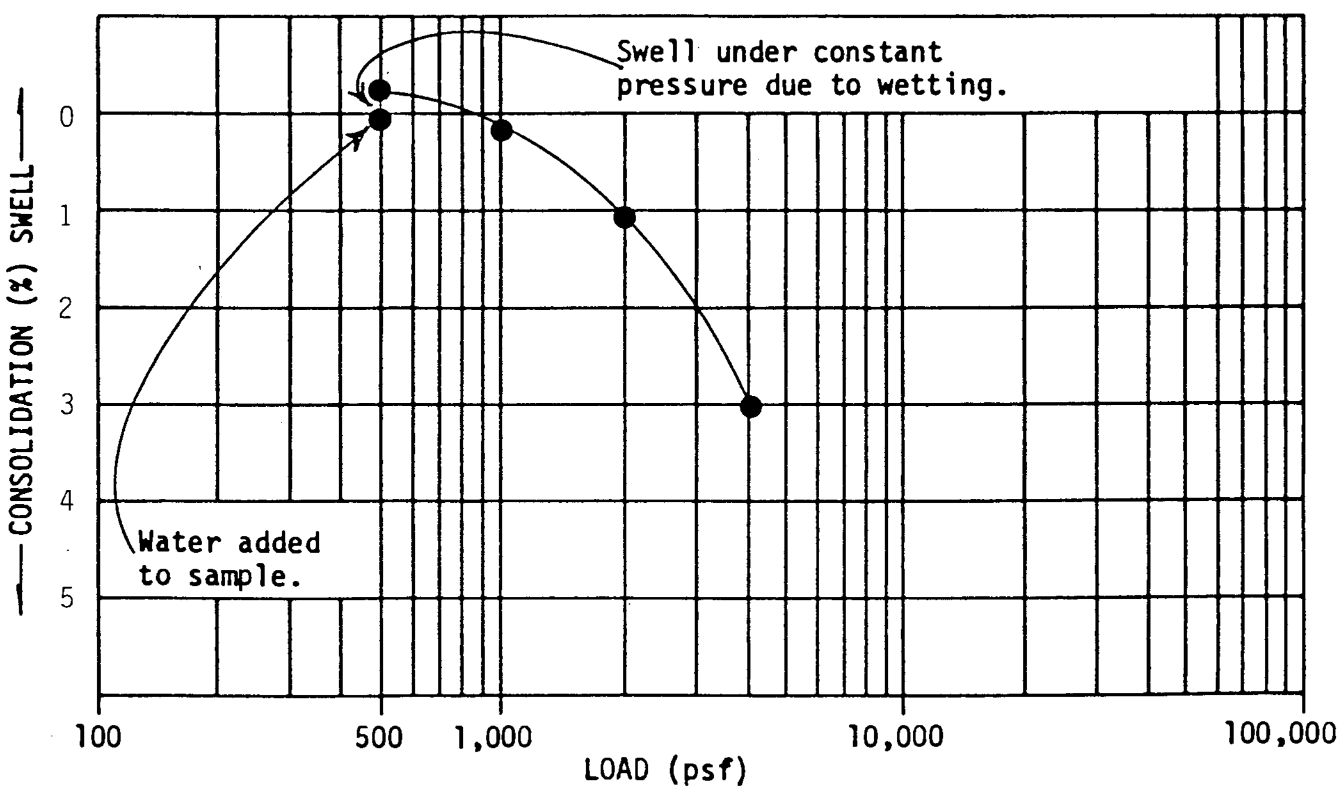
FIGURE 5

SWELL-CONSOLIDATION TESTS



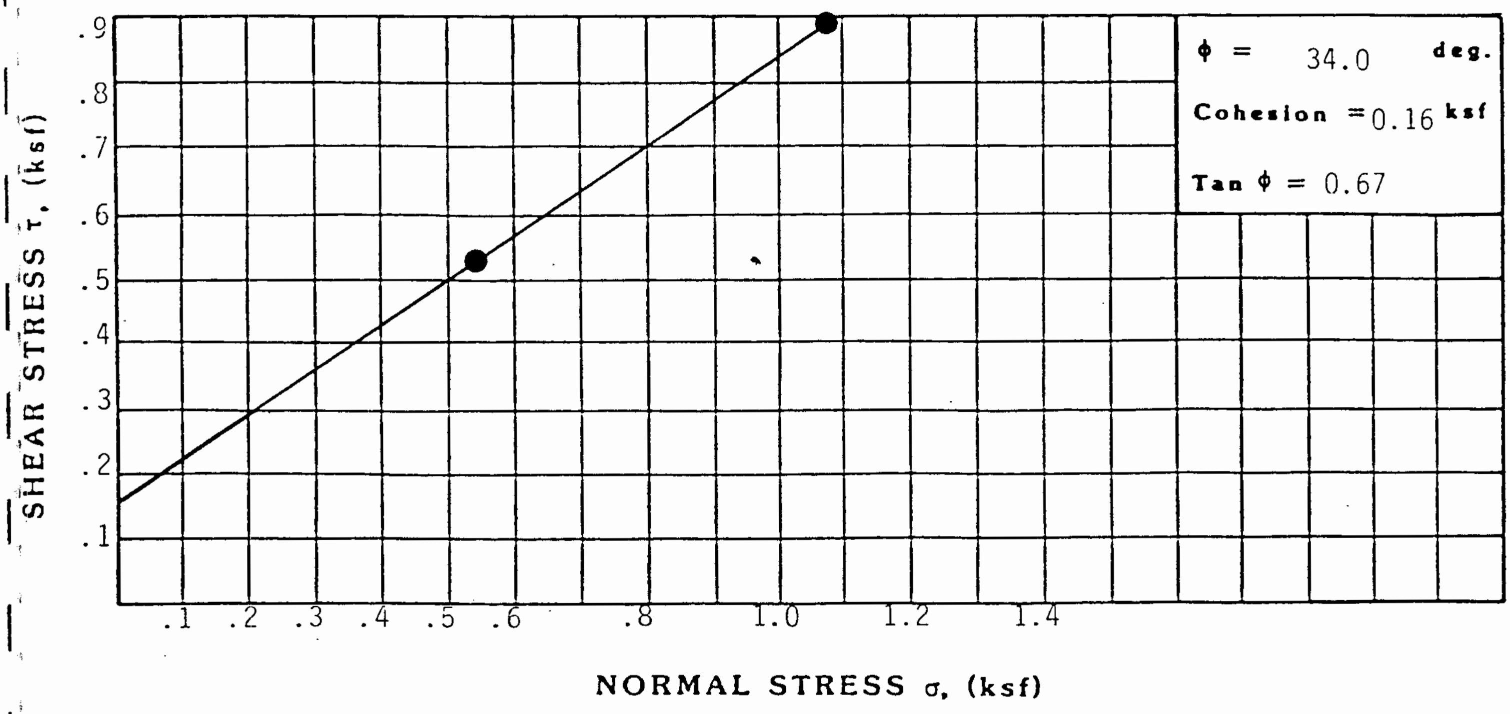
Sample of very silty SAND from test hole 7 from depth 19 feet.

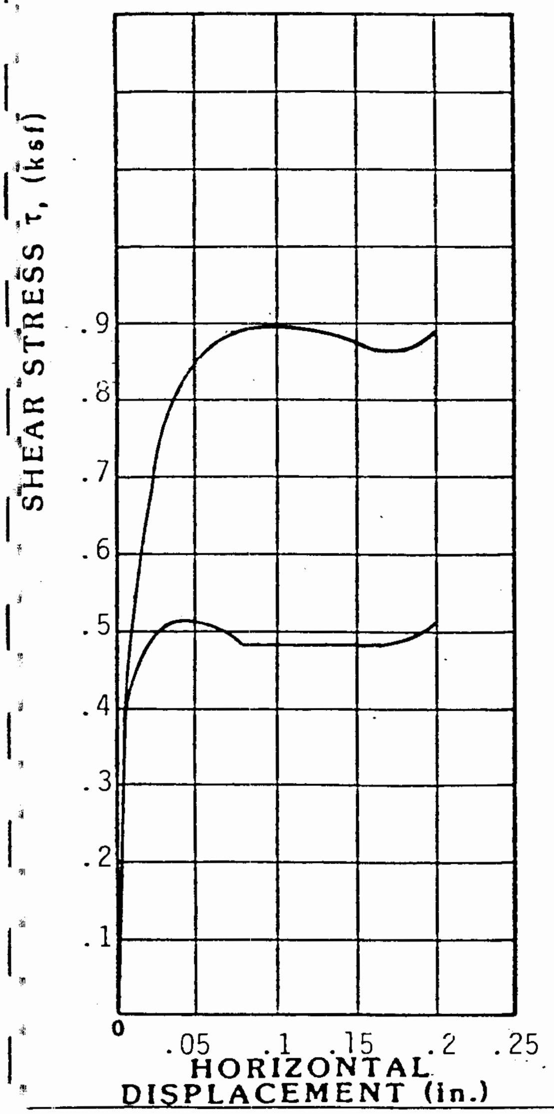
Natural Moisture Content 5.2%   Natural Dry Density 107 pcf



Sample of sandy CLAY from test hole 13 from depth 4 feet.

Natural Moisture Content 7.2%   Natural Dry Density 93 pcf





Sample of very silty SAND from test hole 1

at depth 59 feet.

Type of Test undisturbed, dry

Test No.		1	2		
Height (in.)	H_o	1.5	1.5		
Area (in.^{2})	A_o	2.952	2.952		
Natural Moisture Content (%)	W_n	5.1	5.1		
Dry Density (psf)	γ_{d_o}	93	93		
Consolidation Pressure (ksf)	σ_c	.54	1.04		
Normal Stress (ksf)	σ	.54	1.04		
Maximum Shear Stress (ksf)	τ	.52	.89		
Residual Shear Stress (ksf)	τ_r	-	-		
Strain Rate (in./min.)		.048	.048		

DIRECT SHEAR TEST RESULTS

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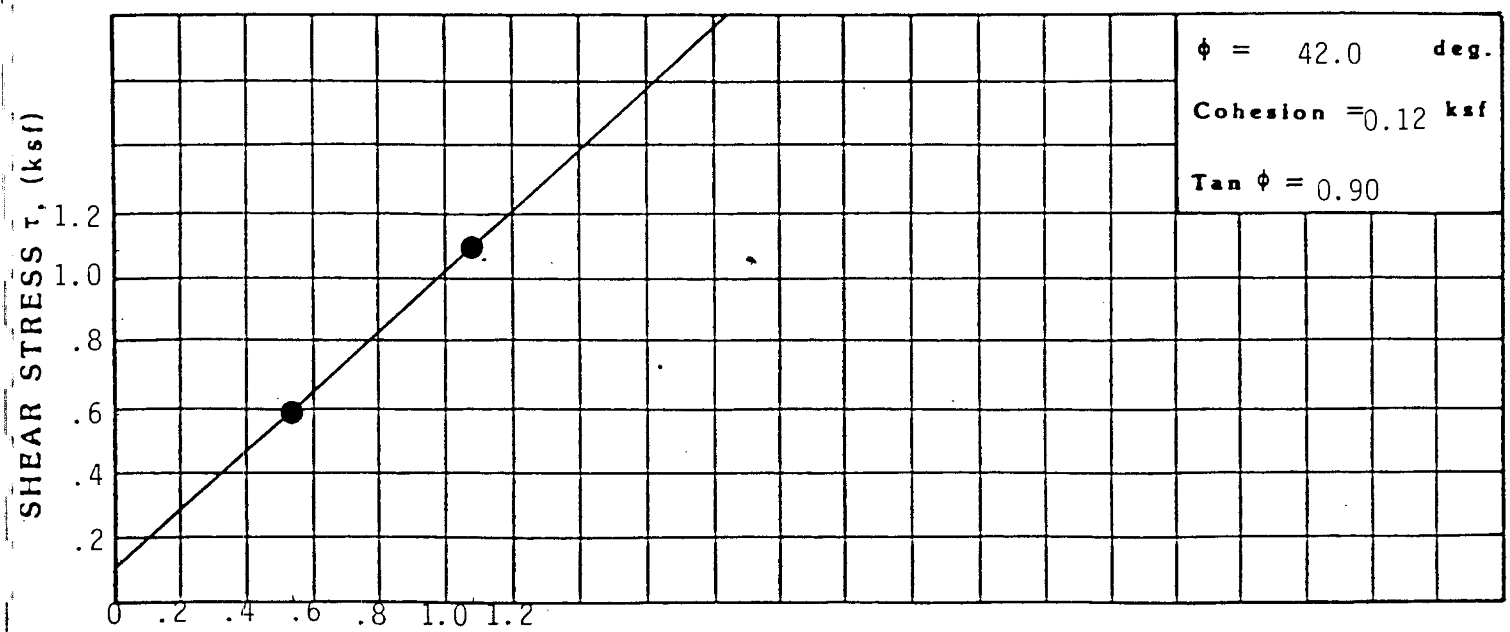
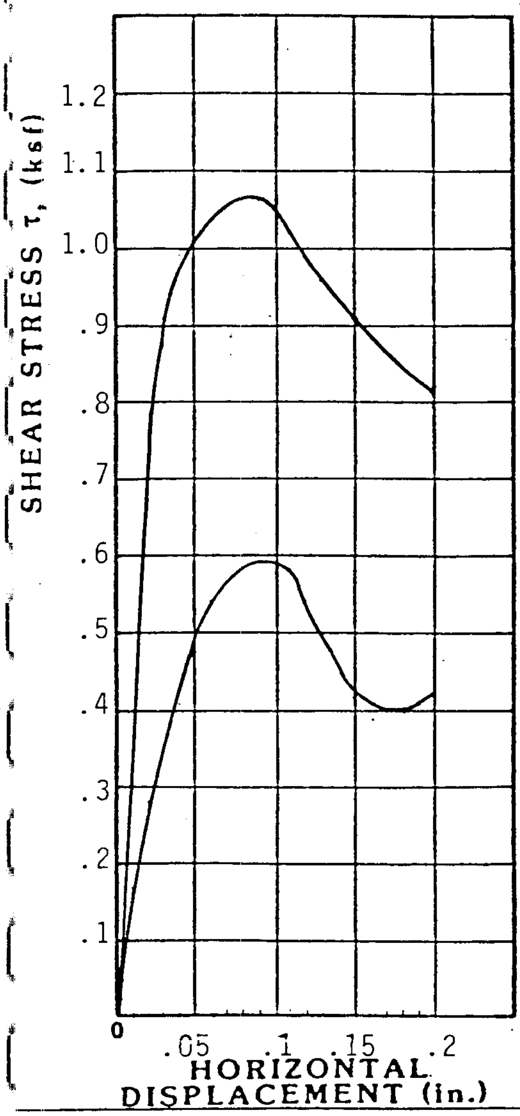
Figure 7



ϕ = 42.0	deg.
Cohesion = 0.12	ksf
Tan ϕ = 0.90	

NORMAL STRESS σ, (ksf)



Sample of slightly silty SAND from test hole 4

at depth 14 feet.

Type of Test undisturbed, saturated

Test No.		1	2		
Height (in.)	H_o	1.75	1.75		
Area (in.^{2})	A_o	2.952	2.952		
Natural Moisture Content (%)	W_n	0.9	0.9		
Dry Density (psf)	γ_{d_o}	118	118		
Consolidation Pressure (ksf)	σ_c	.54	1.08		
Normal Stress (ksf)	σ	.54	1.08		
Maximum Shear Stress (ksf)	τ	.59	1.08		
Residual Shear Stress (ksf)	τ_r				
Strain Rate (in./min.)		.048	.048		

DIRECT SHEAR TEST RESULTS

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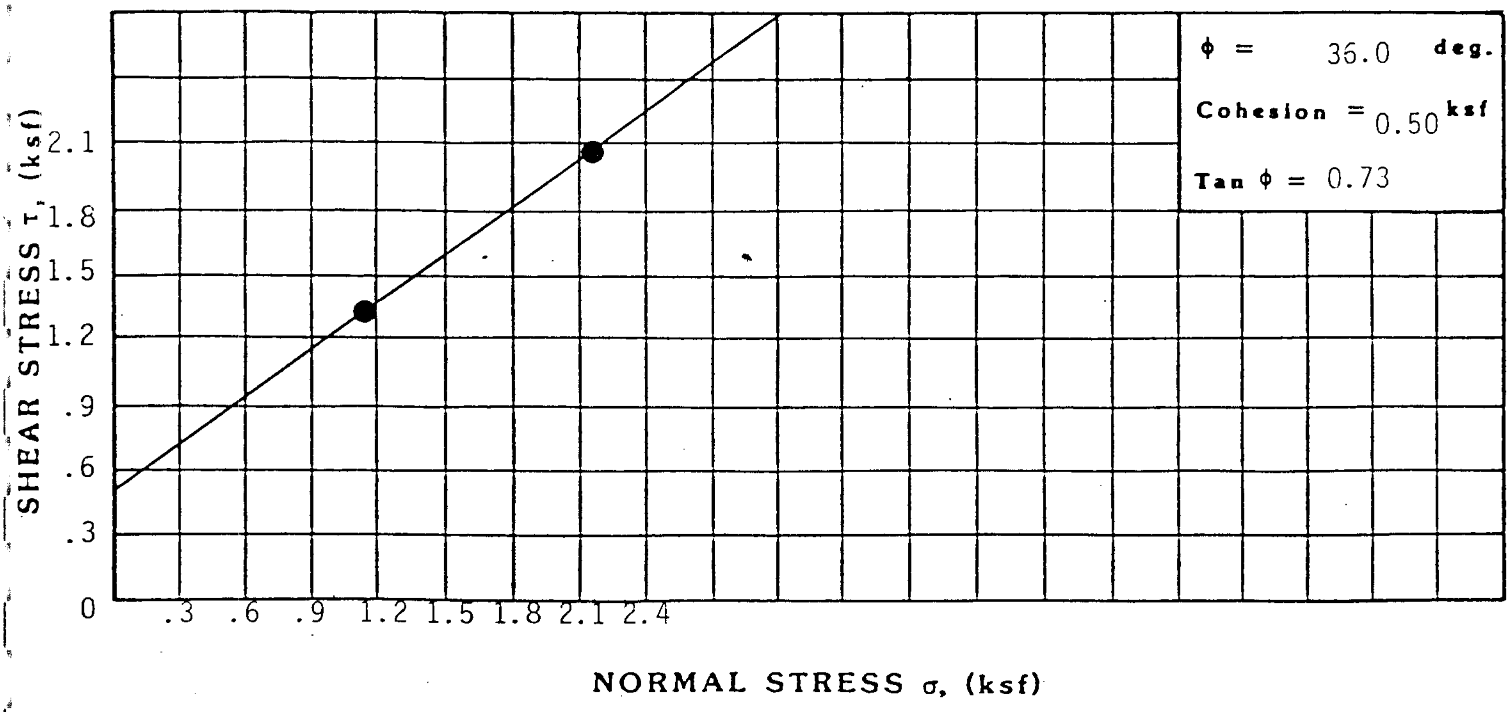
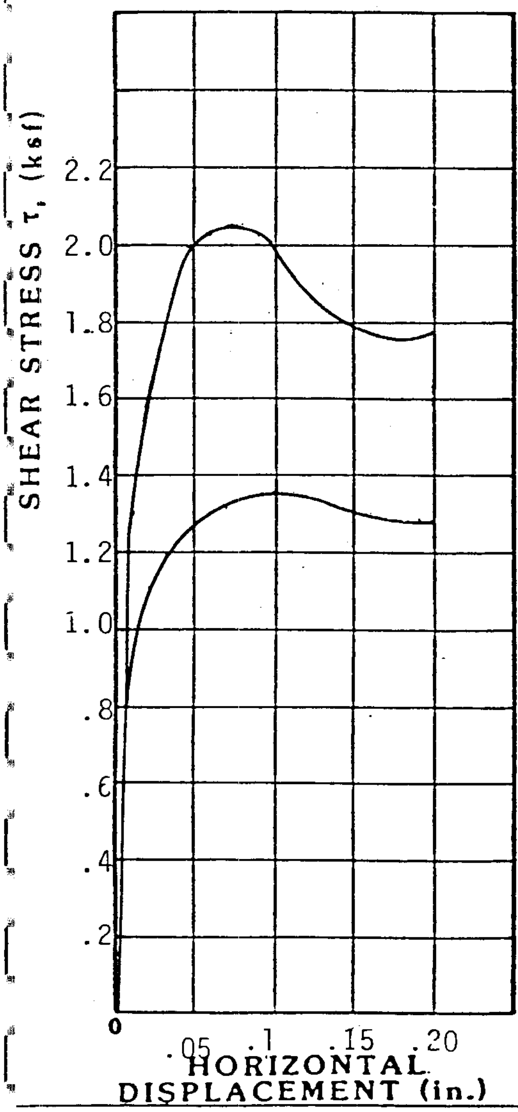
Figure 8





Sample of silty SAND from test hole 5

at depth 69 feet.

Type of Test undisturbed, dry

Test No.		1	2		
Height (in.)	H_o	1.75	1.75		
Area (in.^{2})	A_o	2.952	2.952		
Natural Moisture Content (%)	W_n	2.9	2.9		
Dry Density (psf)	γ_{d_o}	106	106		
Consolidation Pressure (ksf)	σ_c	1.08	2.16		
Normal Stress (ksf)	σ	1.08	2.16		
Maximum Shear Stress (ksf)	τ	1.33	2.05		
Residual Shear Stress (ksf)	τ_r	-	-		
Strain Rate (in./min.)		.048	.048		

DIRECT SHEAR TEST RESULTS

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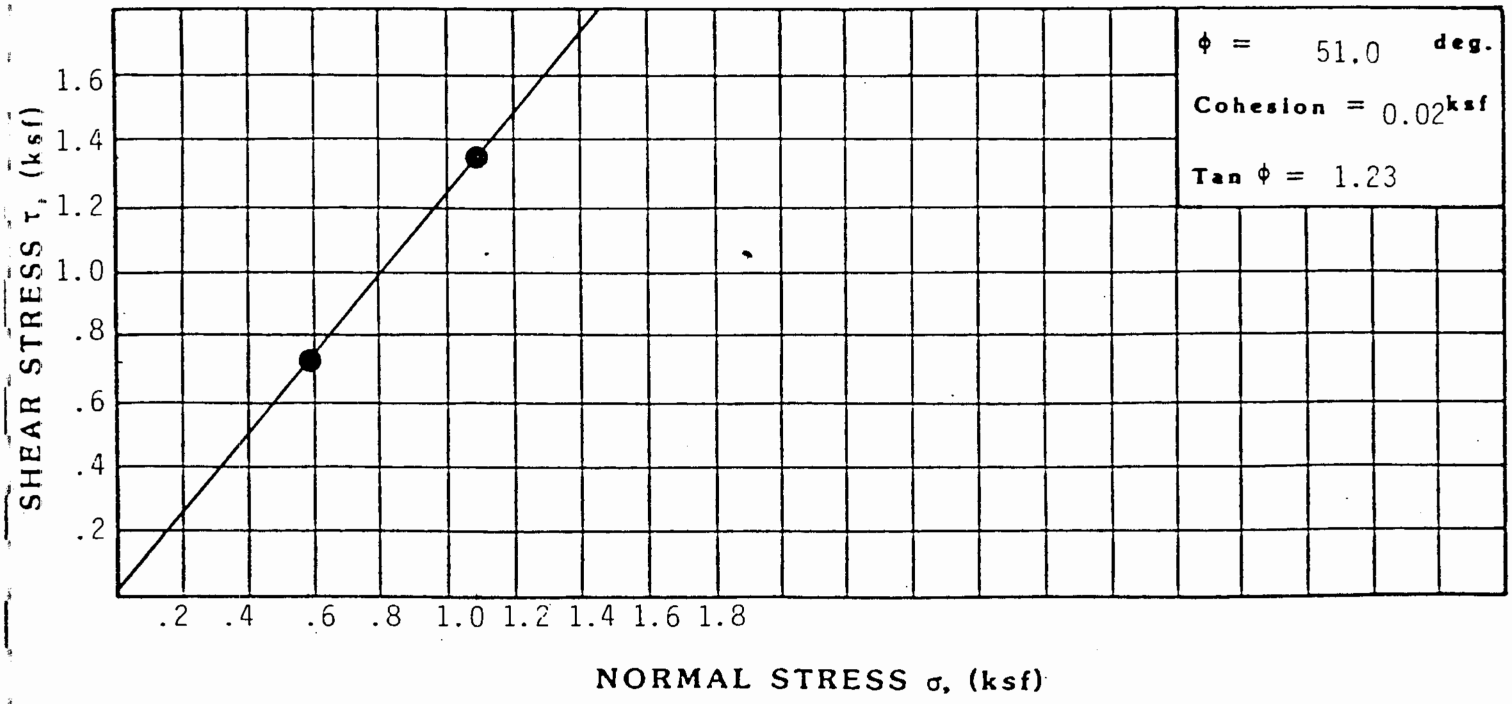
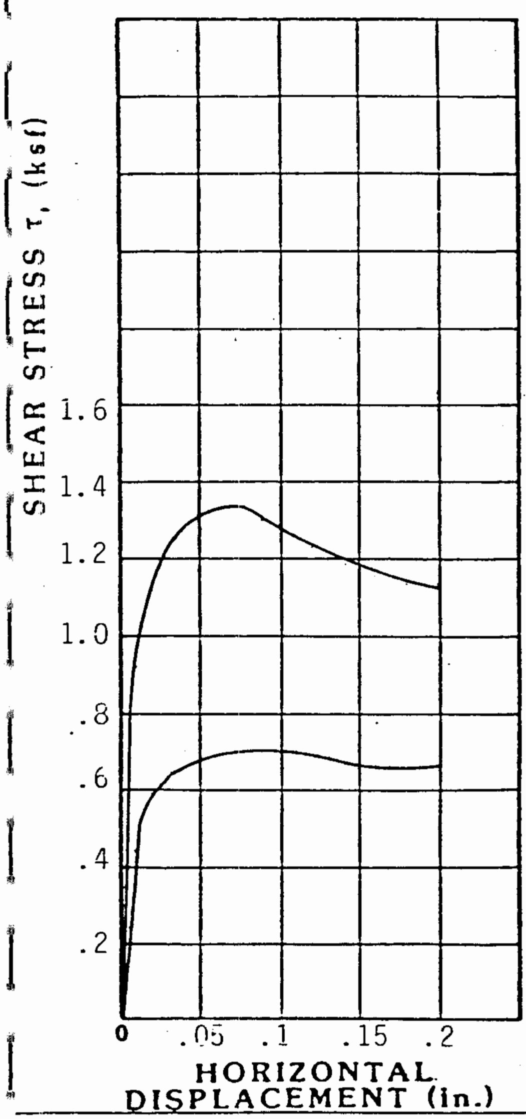
Figure 9





Sample of silty SAND from test hole 10

at depth 59 feet.

Type of Test undisturbed, dry

Test No.		1	2		
Height (in.)	H_o	1.75	1.75		
Area (in.^{2})	A_o	2.952	2.952		
Natural Moisture Content (%)	W_n	4.4	4.4		
Dry Density (psf)	γ_{d_o}	102	102		
Consolidation Pressure (ksf)	σ_c	.54	1.08		
Normal Stress (ksf)	σ	.54	1.08		
Maximum Shear Stress (ksf)	τ	.72	1.34		
Residual Shear Stress (ksf)	τ_r	-	-		
Strain Rate (in./min.)		.048	.048		

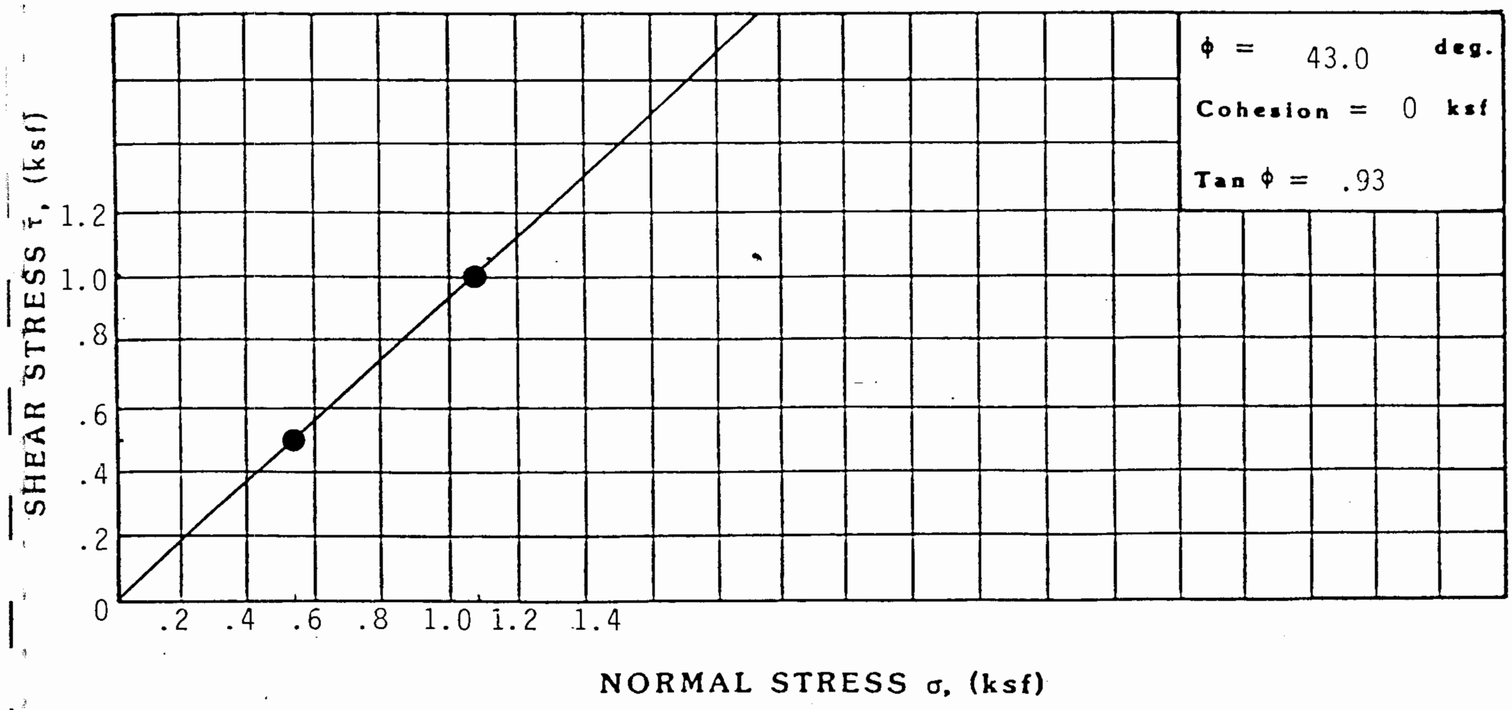
DIRECT SHEAR TEST RESULTS

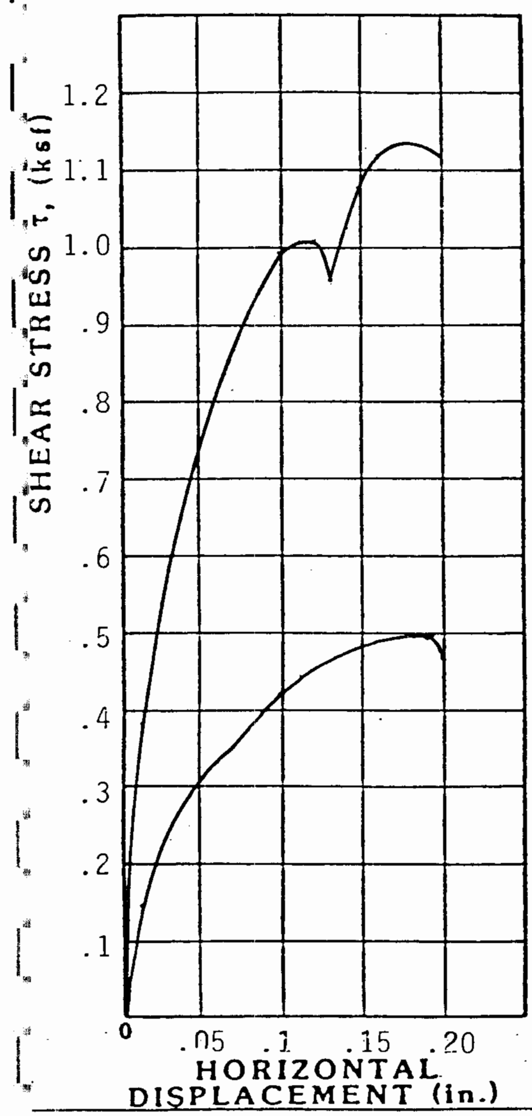
FOX Consulting Engineers and Geologists

Job No: 31330058000

Date: June 5, 1980

Figure 10





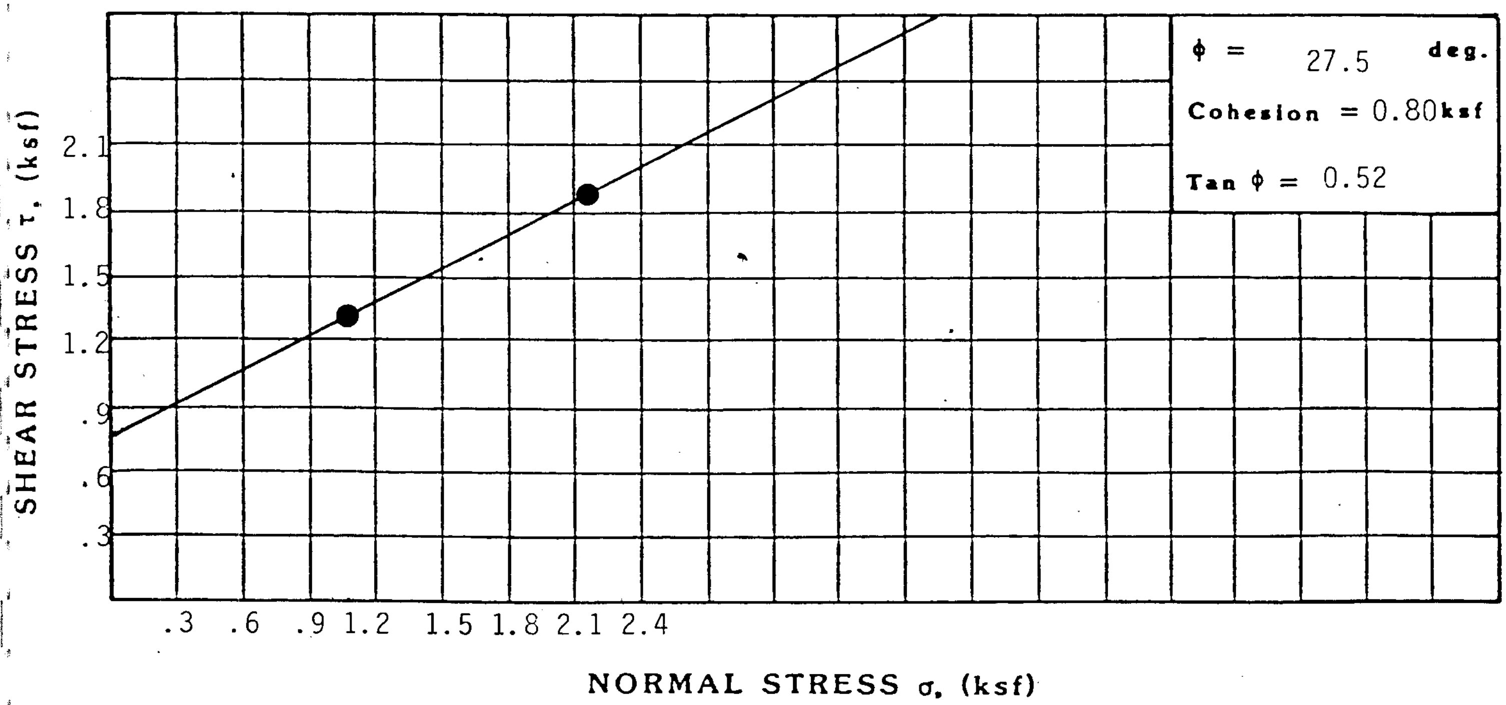
Sample of silty SAND from test hole 12

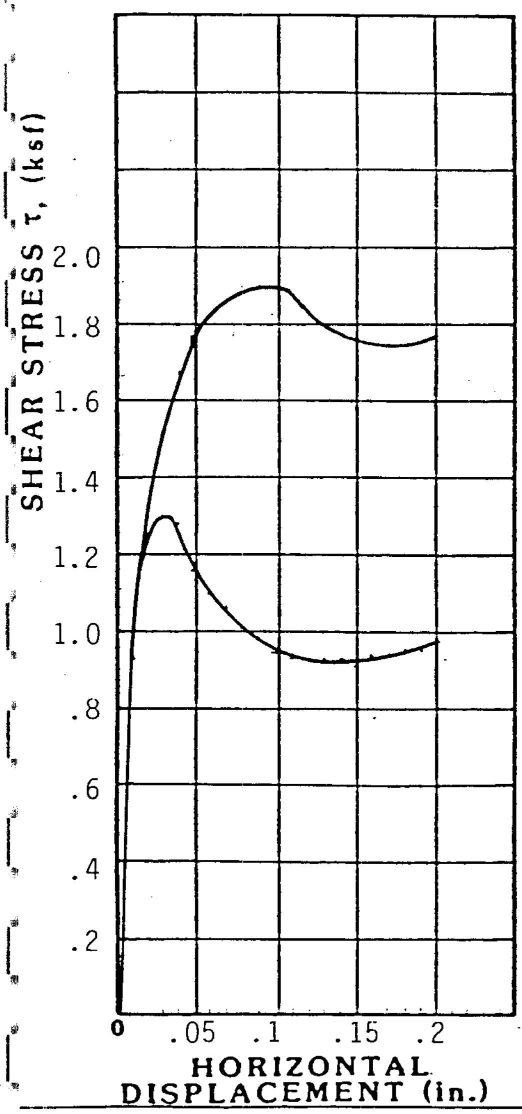
at depth 19 feet.

Type of Test undisturbed, saturated

Test No.		1	2		
Height (in.)	H_o	1.75	1.75		
Area (in.^{2})	A_o	2.952	2.952		
Natural Moisture Content (%)	W_n	5.4	5.4		
Dry Density (psf)	γ_{d_o}	104	104		
Consolidation Pressure (ksf)	σ_c	.54	1.08		
Normal Stress (ksf)	σ	.54	1.08		
Maximum Shear Stress (ksf)	τ	.495	1.01		
Residual Shear Stress (ksf)	τ_r	-	-		
Strain Rate (in./min.)		.048	.048		

DIRECT SHEAR TEST RESULTS	Job No: 31330058000
FOX Consulting Engineers and Geologists	Date: June 5, 1980
	Figure 11





Sample of silty SAND from test hole 12

at depth 59 feet.

Type of Test undisturbed, dry

Test No.		1	2		
Height (in.)	H_o	2.0	1.75		
Area (in.^{2})	A_o	2.952	2.952		
Natural Moisture Content (%)	W_n	4.8	4.8		
Dry Density (psf)	γ_{d_o}	108	108		
Consolidation Pressure (ksf)	σ_c	1.08	2.16		
Normal Stress (ksf)	σ	1.08	2.16		
Maximum Shear Stress (ksf)	τ	1.30	1.90		
Residual Shear Stress (ksf)	τ_r	-	-		
Strain Rate (in./min.)		.048	.048		

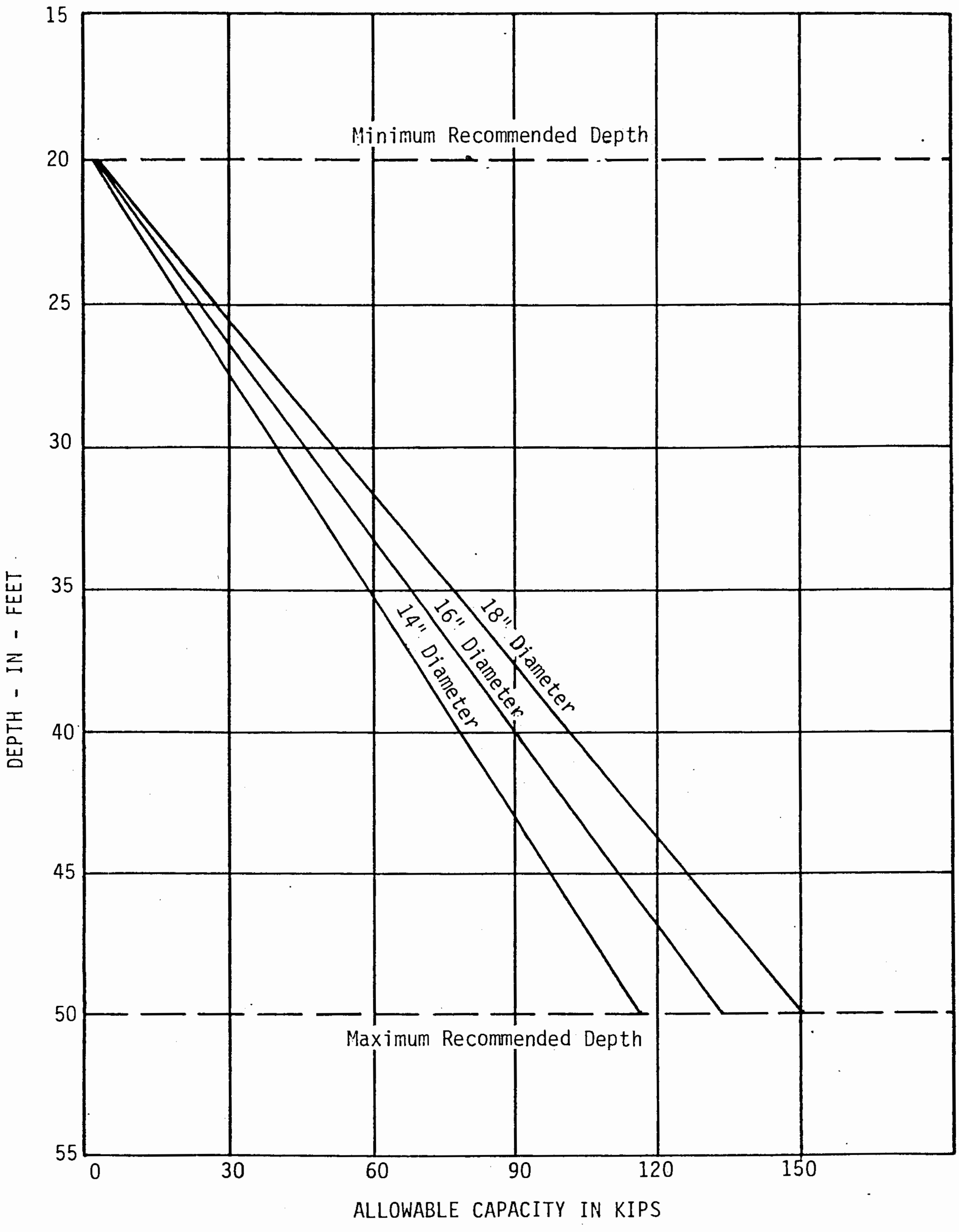
DIRECT SHEAR TEST RESULTS

FOX Consulting Engineers and Geologists

Job No: 31330058000

Date: June 5, 1980

Figure 12

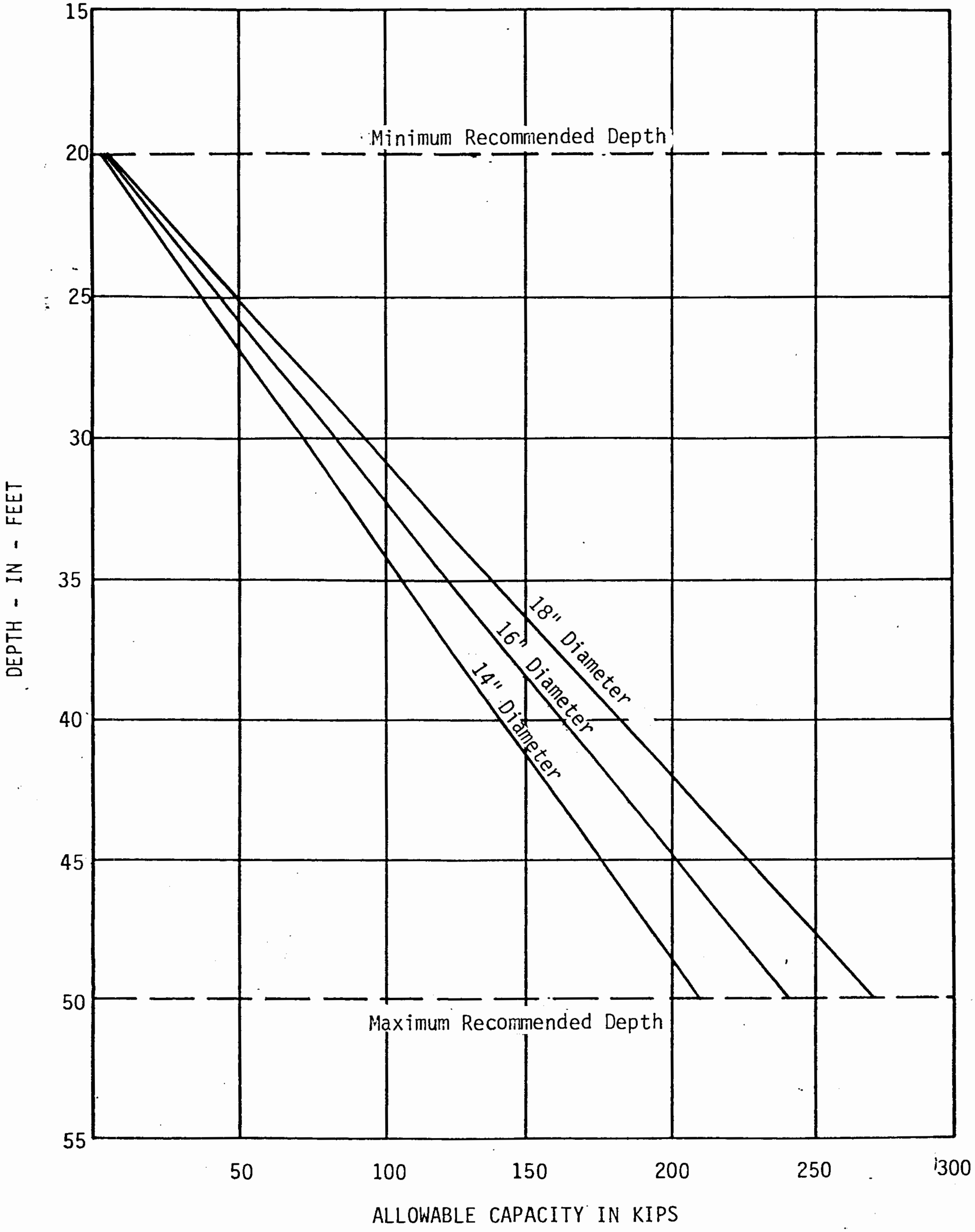


PILE GROUP P-1

PILE CAPACITY DESIGN CURVES

FOX **Consulting Engineers and Geologists**

Job No:	31330058000
Date:	June 5, 1980
Figure	13



PILE GROUP P-2

3d

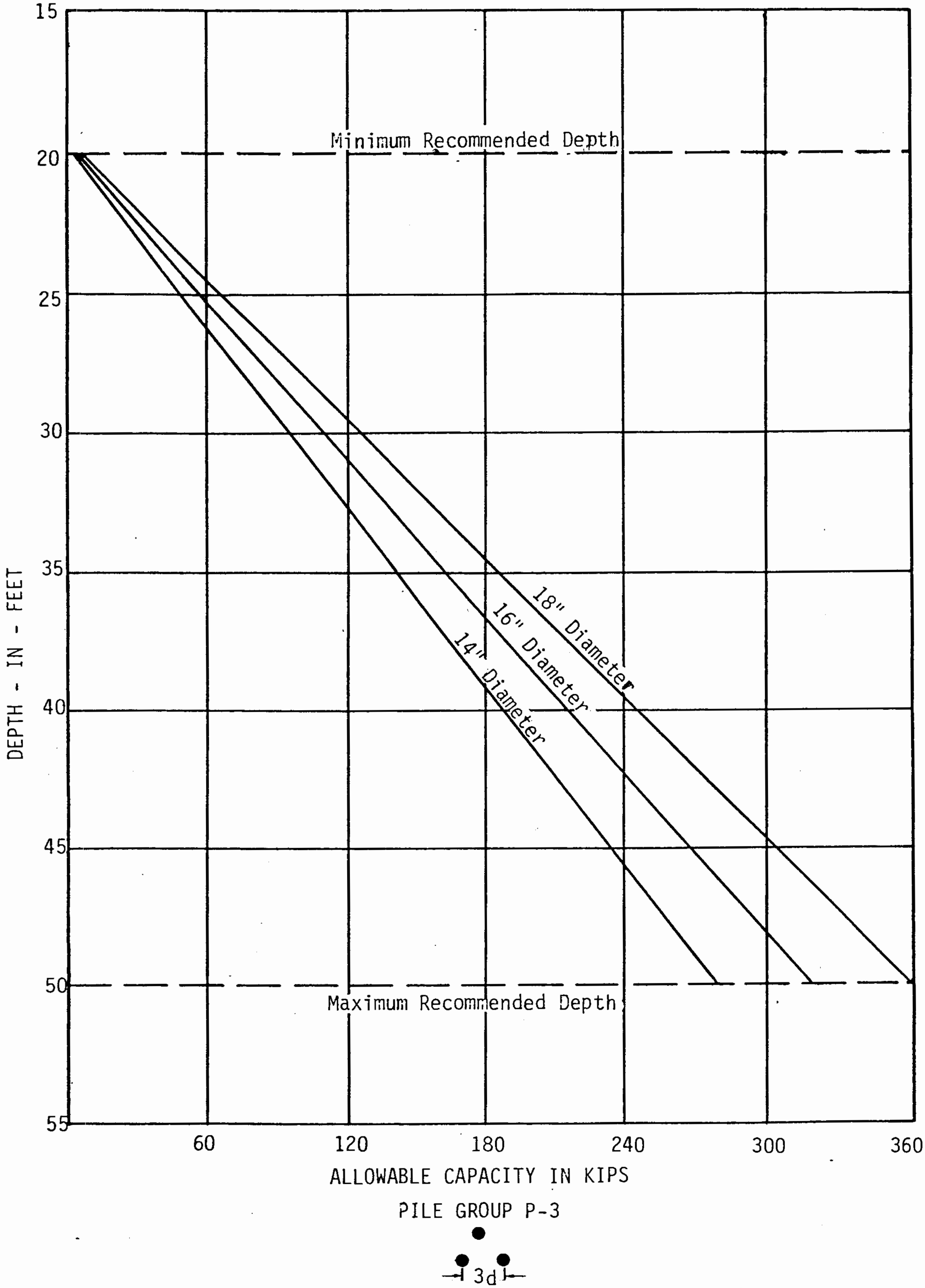
PILE CAPACITY DESIGN CURVES

FOX Consulting Engineers and Geologists

Job No: 31330058000

Date: June 5, 1980

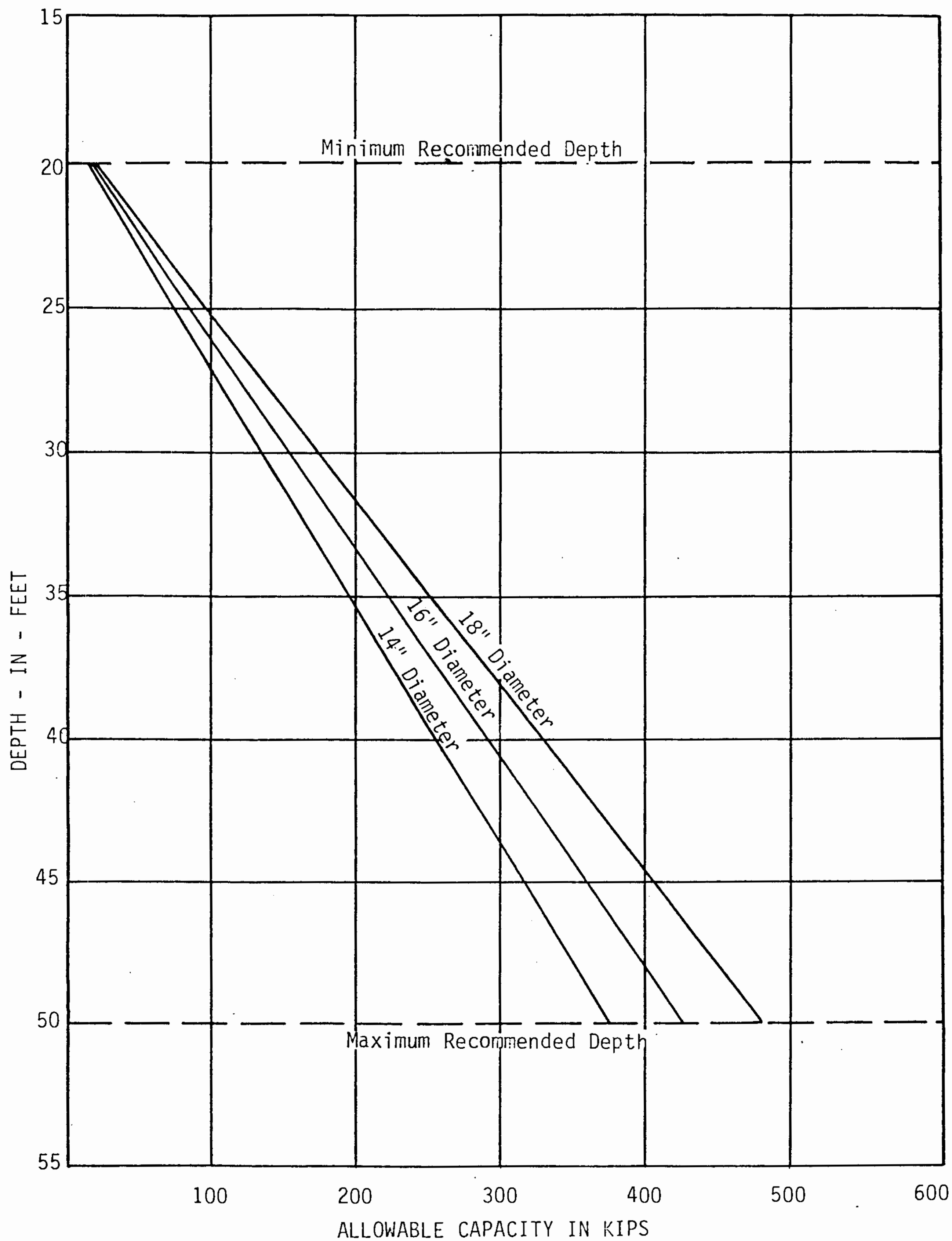
Figure 14



PILE CAPACITY DESIGN CURVES

FOX Consulting Engineers and Geologists

Job No:	31330058000
Date:	June 5, 1980
Figure	15



PILE GROUP P-4

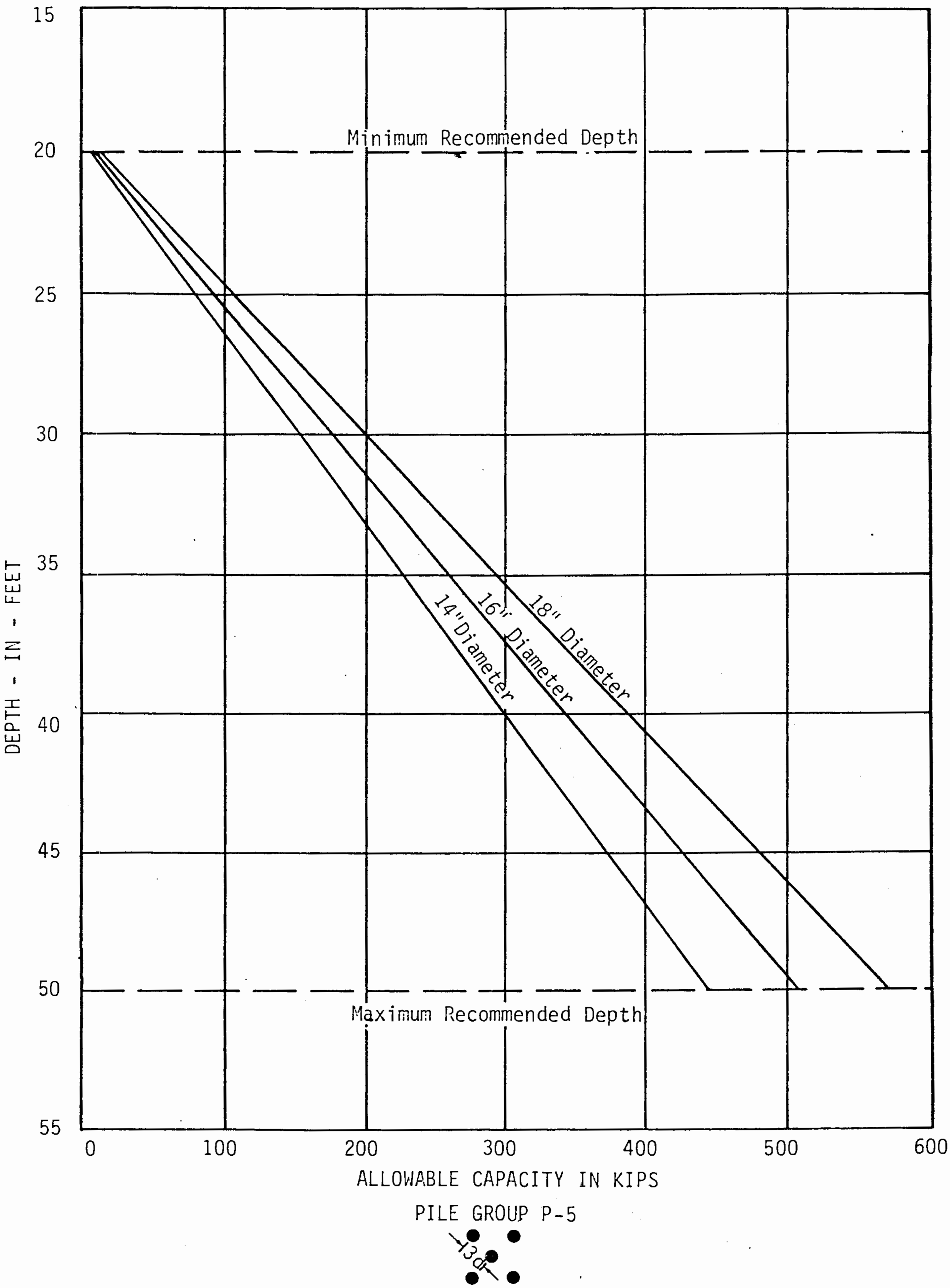
3d

PILE CAPACITY DESIGN CURVES

FOX

Consulting Engineers and Geologists

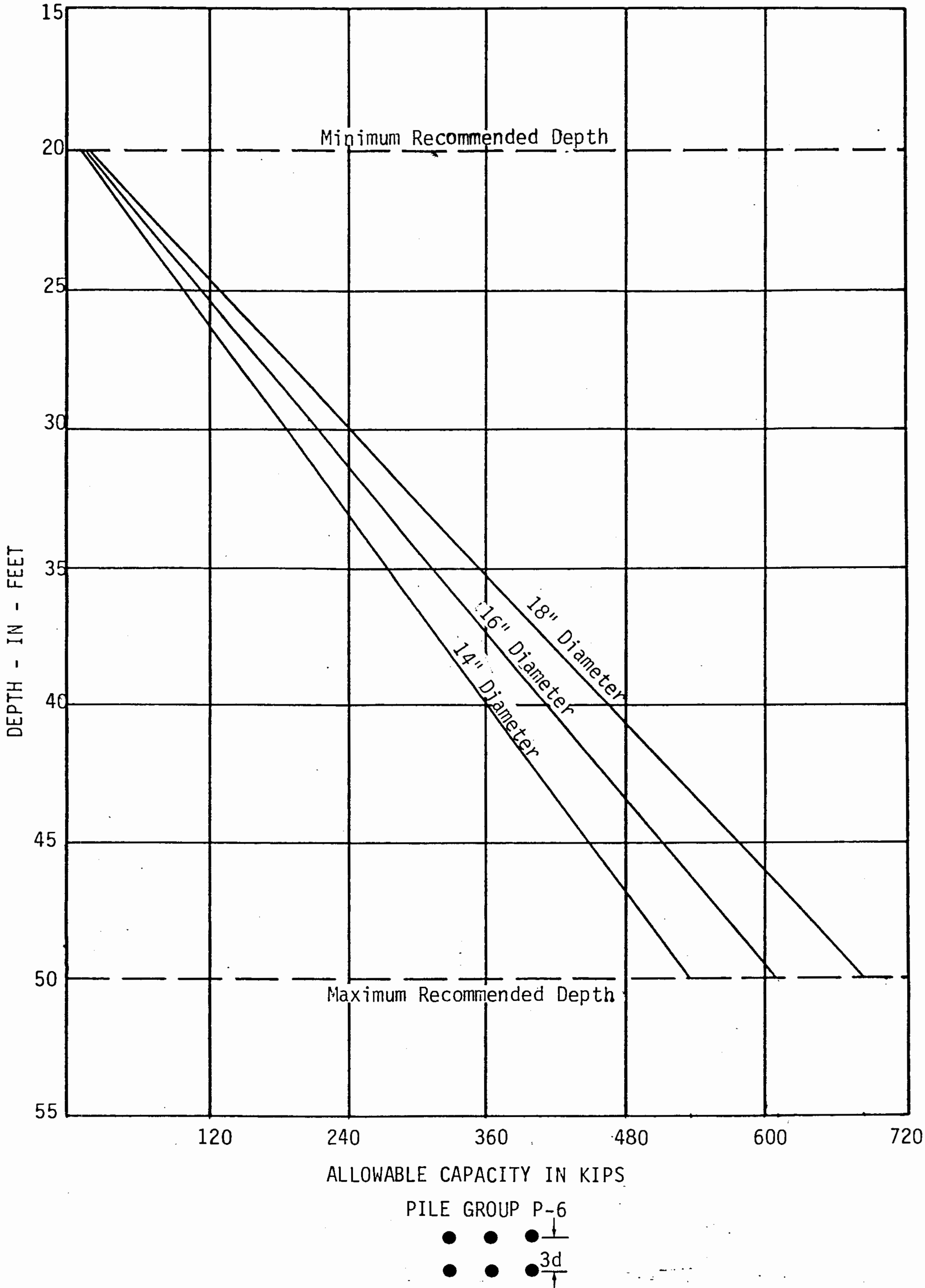
Job No:	31330058000
Date:	June 5, 1980.
Figure	16



PILE CAPACITY DESIGN CURVES

FOX Consulting Engineers and Geologists

Job No:	31330058000
Date:	June 5, 1980
Figure	17



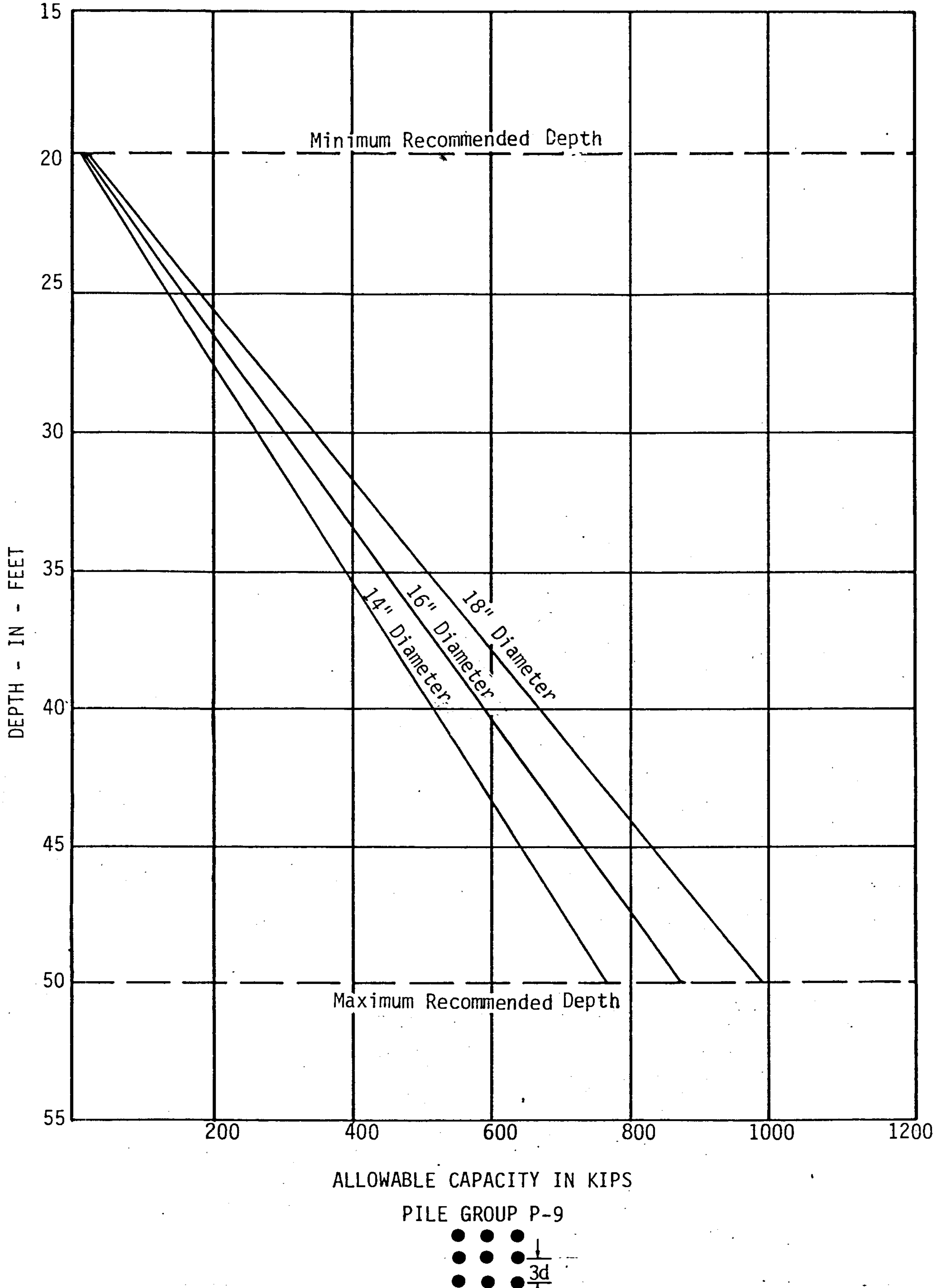
PILE CAPACITY DESIGN CURVES

FOX Consulting Engineers and Geologists

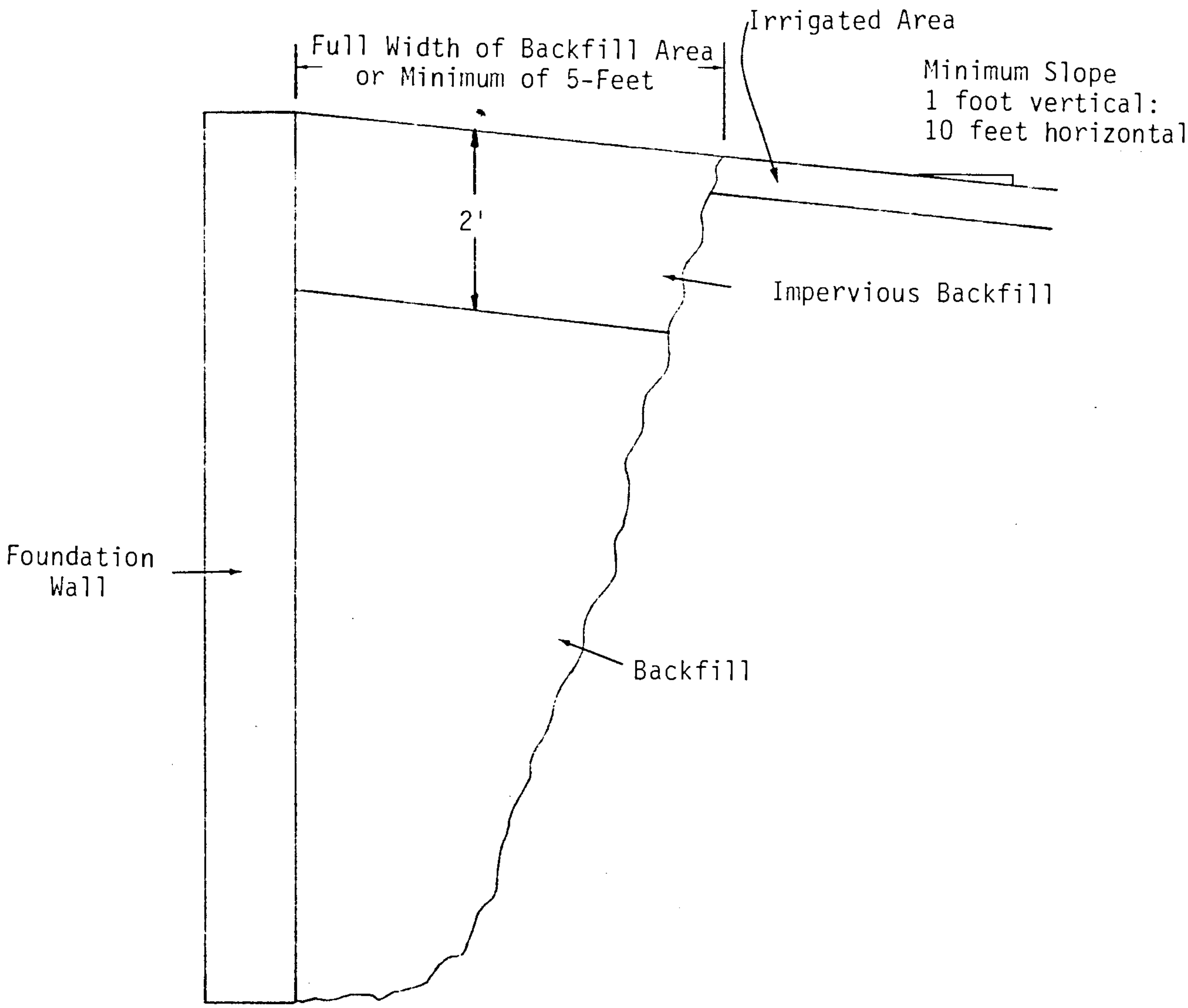
Job No: 31330058000

Date: June 5, 1980

Figure 18

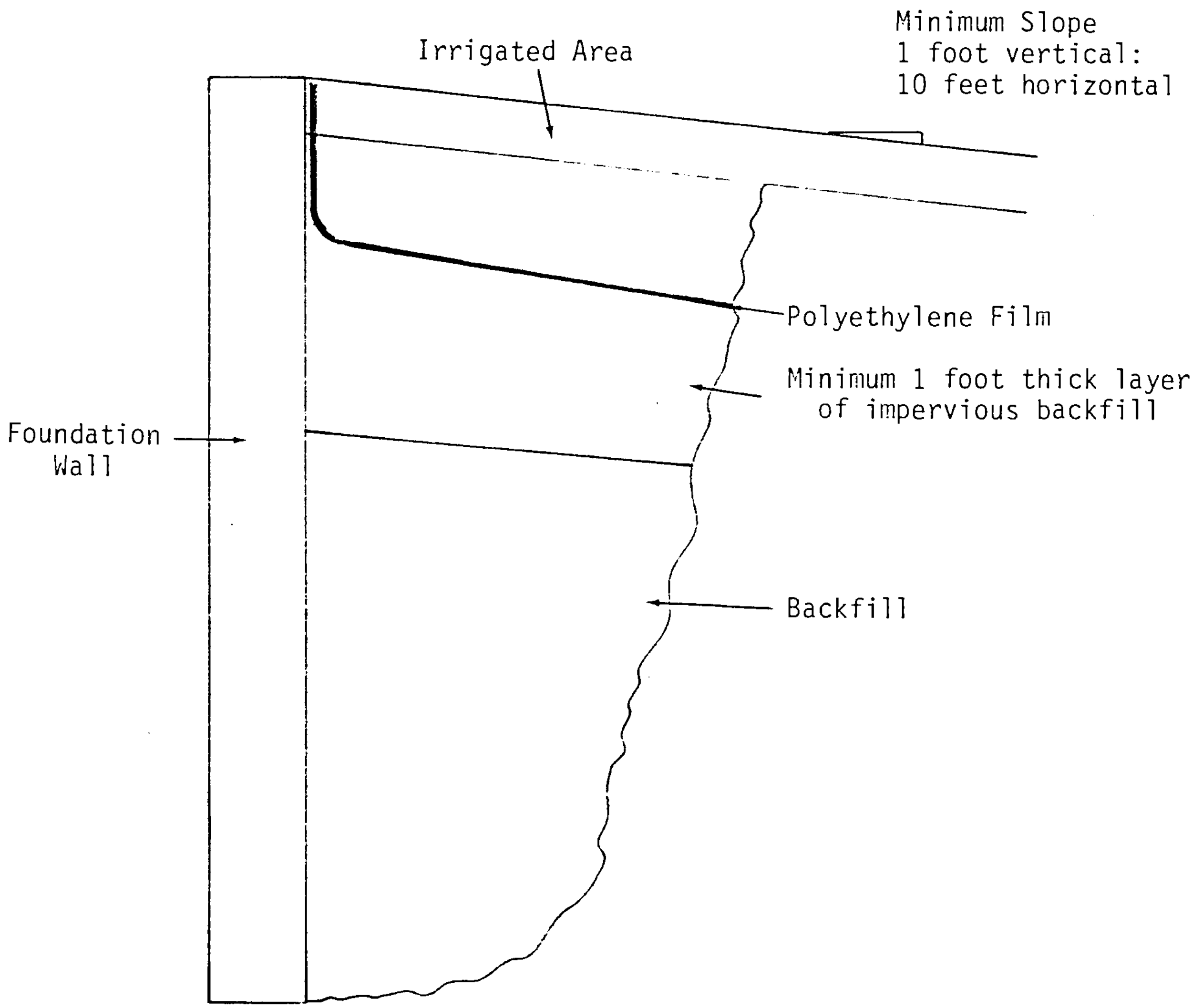


PILE CAPACITY DESIGN CURVES	Job No:	31330058000
FOX Consulting Engineers and Geologists	Date:	June 5, 1980
	Figure	19



DETAILS OF IMPERVIOUS BACKFILL LAYER

FOX Consulting Engineers and Geologists	Job No:	31330058000
	Date:	June 5, 1980
	Figure	20



DETAILS OF POLYETHYLENE MOISTURE BARRIER

FOX Consulting Engineers and Geologists	Job No: 31330058000
	Date: June 5, 1980
	Figure 21

SUMMARY OF LABORATORY TEST DATA

Hole No.	Depth of Sample (ft)	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits LL	Atterberg Limits PI	Sieve Analysis % Passing No. 4	No. 10	No. 40	No. 200	Soil Description	Remarks
1	59	93	5.1	NV	NP	-	100	100	48	very silty SAND	Fig. 7
2	1	101	9.2	27	7	95	90	83	64	SILT-CLAY	Fig. 5
3	59	108	3.1	NV	NP	100	100	83	13	silty SAND	
4	14	118	0.9	NV	NP	100	86	34	10	slightly silty SAND	Fig. 8
5	34	101	2.5	NV	NP	98	93	75	24	silty SAND	
5	69	106	2.9	NV	NP	91	83	74	25	silty SAND	Fig. 9
6	6	95	3.1	NV	NP	100	100	99	14	silty SAND	Fig. 5
7	19	107	5.2	NV	NP	98	82	65	32	very silty SAND	
8	6	95	5.7	26	7	98	92	85	59	very sandy SILT-CLAY	Fig. 6
9	3	96	4.9	28	9	99	86	73	55	very sandy CLAY	
10	24	108	3.9	NV	NP	100	93	81	40	very silty SAND	

NV - indicates No Value

NP - indicates Non-Plastic

Table 1

SUMMARY OF LABORATORY TEST DATA

Hole No.	Depth of Sample (ft)	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits LL	Atterberg Limits PI	Sieve Analysis % Passing No. 4	No. 10	No. 40	No. 200	Soil Description	Remarks
10	59	102	4.4	NV	NP	98	94	80	24	silty SAND	Fig. 10
11	28	99	9.5	23	NP	-	100	100	67	very sandy SILT	
12	19	104	5.4	NV	NP	92	77	54	21	silty SAND	Fig. 11
12	29	116	1.8	NV	NP	97	64	24	6	slightly silty SAND	
12	59	108	4.8	NV	NP	100	98	94	14	silty SAND	Fig. 12
13	4	93	7.2	28	8	100	100	99	82	sandy CLAY	Fig. 6

NV - indicates No Value

NP - indicates Non-Plastic

Table 1 (cont.)

SUMMARY OF PAVEMENT THICKNESS AND DESIGN THICKNESS

GROUP	DESIGN CRITERION *					ALTERNATE	RECOMMENDED & ALTERNATE PAVEMENT SECTION - INCHES				
	CBR	R	EDLA	RF	WSN		ACS	ACB	ABC	ASC	TOTAL
Light Use	-	40	5	1.5	1.5		2		4		6
Heavy Use	-	40	201	1.5	2.9		4		6		10

CBR - CALIFORNIA BEARING RATIO
R - RESISTANCE BY STABILOMETER
EDLA - EQUIVALENT DAILY LOAD APPLICATION
RF - REGIONAL FACTOR
WSN - WEIGHTED STRUCTURAL NUMBER

ACS - ASPHALTIC CEMENT SURFACE
ACB - ASPHALTIC CEMENT BASE COURSE
ABC - AGGREGRATE BASE COURSE
ASC - AGGREGRATE SUB - BASE COURSE

Table 2

Table 3

RESULTS OF METHANE TESTING

Date	Location	Depth	Reading LEL	Gas
5/15/80	W-2	1	0	
		5	0	
		10	0	
	S-2	1	0	
		5	0	
		10	0	
	S-3	1	0	
		5	0	
	S-4	1	0	
		5	2	
		10	2	
	Q-6	1	0	
		5	0	
		10	0	
		15	0	
		20	0	
	Q-5	1	0	
		5	0	
		10	0	
		15	2	
		20	2	
5/15/80	Q-4	0	0	
		5	8	
		10	32	
		15	74	
		20	80	
	Q-3	1	0	
	Q-2	1	0	
		5	0	
	Q-1	1	0	
		5	0	
	W-4	1	0	
		5	0	
		10	0	
		15	0	
	W-3	1	0	
		5	0	
		10	0	
		15	0	
5/16/80	W-4	1	0	
		5	4	
		10	6	

Table 3

RESULTS OF METHANE TESTING

Date	Location	Depth	Reading LEL	Reading Gas
5/16/80	E-5	1	0	
		5	0	
	E-4	1	6	
		5	10	
		10	17	
	Z-5	1	0	
		5	0	
	M-7	1	0	
		5	0	
		10	0	
	J-2	1	0	
		5	1	
		10	1	
5/31/80	W-4	1	0	
		5	0	
		10	0	
		15	0	
		20	0	
	W-3	1	0	
		5	0	
		10	0	
5/31/80	W-3	15	0	
		20	0	
	W-2	1	0	
		5	0	
		10	0	
		15	0	
	S-4	1	0	
		5	0	
		10	0	
	S-3	1	0	
		5	0	
	S-2	1	-	
		5	0	
	Z-9	1	0	
		5	0	
		10	0	
		15	0	
	Q-6	1	0	
		5	0	
		10	0	
		15	0	

Table 3

RESULTS OF METHANE TESTING

Date	Location	Depth	Reading LEL	Reading Gas
5/31/80	Q-5	1	0	
		5	0	
		10	0	
		15	1	
		20	1	
	Q-4	1	27	0
		5	82	2
	Q-3	1	0	
		5	2	
	Z-5	1	0	
		5	0	
		10	0	
	M-7	1	0	
		5	0	
		10	0	
	J-2	1	0	
		5	0	
	J-1	1	0	
		5	0	

Date	Location	Depth	Reading LEL	Reading Gas
6/2/80	A-2	1	42	1
		5	60	1.5
	E-5	1	0	
		5	0	
	E-4	1	0	
		5	11	
		10	13	

Table 3

RESULTS OF METHANE TESTING

Date	Location	Depth	Reading LEL	Reading Gas
5/16/80	W-4	15	6	
		20	5	
	W-3	1	0	
		5	1	
		10	1	
		15	2	
	W-2	1	0	
		5	0	
		10	1	
		15	1	
		20	1	
	S-4	1	0	
		5	0	
		10	1	
		15	1	
	S-3	1	0	
	S-2	1	0	
		5	0	
		10	0	
	Z-9	1	0	
		5	0	

Date	Location	Depth	Reading LEL	Reading Gas
5/16/80	Z-9	10	1	
		15	1	
	Q-6	1	0	
		5	0	
		10	0	
		15	0	
		20	0	
	Q-5	1	1	
		5	2	
		10	3	
		15	4	
		20	4	
	Q-4	1	4	
		5	57	
		10	74	
		15	74	
		20	76	
	Q-3	1	8	
		3	8	
	Q-2	1	18	
		5	84	

APPENDIX

GUIDE SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

GENERAL

The Soils Engineer shall be the owner's representative to control the fill operations. The Soils Engineer shall approve the material, the method of placing and compacting, and shall give written approval of the completed fill after have taken sufficient tests to assure compliance with the specifications.

Non-Expansive Fill Material

Non-expansive fill material shall be sands or gravels which have a plasticity index not greater than 12. The following criteria should be used for determination of acceptable amounts of fines in the non-swelling fill materials.

Liquid Limit (%)	% Passing the 200 Sieve
Greater than 50%	0 - 10%
From 30% to 50%	0 - 20%
Less than 30%	0 - 30%
Non-Plastic	0 - 45%

Material larger than 6 inches shall not be placed in the fill, and material larger than 4 inches shall not be placed within 1 foot of bearing surfaces of slabs, foundations or pavements. Material shall be approved by the Soils Engineer.

Preparation of Overexcavated Surfaces

The overexcavated surface under the areas to be filled shall be scarified, brought to optimum moisture content (± 2%), and compacted to a minimum of 95% of the maximum Proctor density.

Preparation of Natural Ground - Site Fill and Treatment of Cut Sections

Prior to the placement of site fill, and subsequent to final grading in cut sections, the natural ground shall be scarified, brought to optimum moisture content (+ 2%), and compacted to a minimum of 95% maximum Proctor density. All vegetation and topsoil shall be removed before beginning preparation of natural ground.

Preparation of Bearing Surfaces

The bearing surface under the foundations shall be brought to optimum moisture content (± 2%) for as deep as practicable, and compacted to a minimum of 95% maximum Proctor density.

Preparation of Natural Ground for Slab Support

Prior to the placement of floor slabs, the natural ground at slab elevation shall be scarified and moistened to optimum moisture content (± 2%) for a minimum depth of 6 inches, and compacted to 95% of maximum Proctor density.

PLACING FILL

No brush, sod, frozen material, or other perishable or unsuitable material shall be placed in the fill. Distribution of material shall be such as to avoid lenses differing substantially from the surrounding material. The materials shall be delivered to the fill in such a manner as to result in a well and uniformly compacted fill.

Before compacting, the fill material shall be spread in approximately horizontal layers not greater than 8 inches thick.

MOISTURE CONTROL

The material, while being compacted, shall contain the optimum moisture for compaction distributed uniformly throughout the layers. The contractor shall be required to add moisture to the material in the excavation if, in the opinion of the Soils Engineer, it is not possible to obtain proper and uniform moisture by adding water on the fill surface.

COMPACTION

When the moisture content and condition of each individual layer is satisfactory, it shall be compacted by method approved by the Soils

TO VIEW THE MAP AND/OR MAPS WITH THIS DOCUMENT, PLEASE CALL THE HAZARDOUS WASTE BUREAU AT 505-476-6000 TO MAKE AN APPOINTMENT