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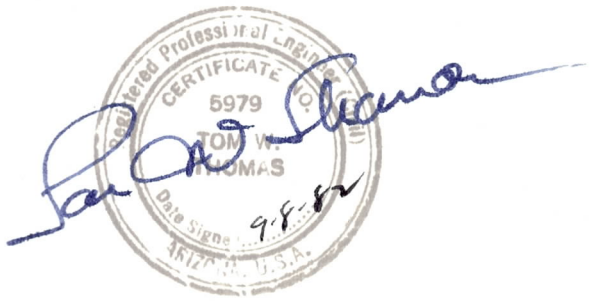
67th Avenue South of Greenway Road
Glendale, Arizona



Prepared for

E.M. Plummer, Consulting Engineers
3666 Miller Road
Scottsdale, Arizona

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THOMAS-HARTIG & ASSOCIATES, INC.
SOIL & FOUNDATION ENGINEERS

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THOMAS-HARTIG & ASSOCIATES, INC.

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30 August 1982

Attention: E.M. Plummer

Project: Arizona Canal Diversion
Channel Bridge
67th Ave. S. of Greenway Rd.
Glendale, Arizona

Project No: 82-424

This report presents the results of the soil engineering services authorized on the site for the proposed Arizona Canal Diversion Channel Bridge. The purpose of these services is to determine the soil conditions at the locations indicated which thereby provide a basis for the design discussions and recommendations presented herein. This firm should be notified for evaluation if conditions other than described herein are encountered during construction.

The services performed provide an evaluation at selected locations of the surface and subsoils throughout the zone of significant foundation influence. Our services have not included determination of underlying geologic conditions or evaluation of potential geologic hazards such as seismic activity, faulting, and ground subsidence/cracking potential due to ground water withdrawal.

The recommendations included are presented based upon the project information received and described in "Scope", Part I. This firm should be contacted for review if the design conditions are changed substantially.

Complimentary to this report, we will be pleased to review project plans and specifications relative to compliance to the intent of this report.

Respectfully submitted,

THOMAS-HARTIG & ASSOCIATES, INC.

By: _____ Reviewed by: _____
Tom W. Thomas, P.E. John P. Boyd, P.E.
8-30-82 8-30-82

/sdf

Copies to: Addressee (4)

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PART I

REPORT

SCOPE

The bridge is to span a diversion channel to be excavated parallel to and north of the Arizona Canal as shown on the accompanying site plan. It is understood that design concepts for the bridge structure and diversion channel are as follows:

Bridge Length	550 feet
Width of Bridge	68 feet
Number of Spans	6 at 91'-8"
Skew of Bridge	38°
Deck Elevation	Elev. 1215 feet
Channel Elevation	Elev. 1190 feet
Channel Bottom Width	220 feet
Channel Side Slopes	6.0 horizontal to 1.0 vertical
Channel Lining	Earth
Abutment Reactions	Dead Load = 1175 kips Live Load = 361 kips
Pier Reactions	Dead Load = 2060 kips Live Load = 565 kips

The 67th Avenue approach roadways are to be improved to current City of Glendale standards for distances of approximately 150 feet north and south of the bridge structure.

INVESTIGATION

Seven (7) test borings were drilled near abutment and pier locations as shown on the accompanying site plan. The borings were drilled with a rotary auger (CME-55) drill rig using 7 inch diameter, continuous hollow stem flight augers. Field penetration tests were made in the granular subsoils encountered for a guide to their relative in-situ density. Penetration resistance was measured by driving a 2.0 inch diameter standard split spoon sampler with a 40 inch free fall drop hammer weighing 140 pounds (ASTM: D1586). The more fine grained soils encountered were

sampled by driving a 2.42 inch I.D. ring sampler. Boring logs presenting the results of the test drilling are presented in "Part II, Field Results".

Representative soil samples obtained during the field investigation were subjected to the following laboratory analyses. The surface soils at the abutments and north and south of the bridge structure were also sampled and analyzed for evaluation relative to the approach roadways.

Test	Sample(s)	Purpose
Sieve Analyses and Plasticity Index	Bridge Site Subsoils (9) Approach Roadway Subgrade (5)	Laboratory classification and evaluation for approach roadway design
Direct Shear	Subsoils (7)	Pile capacity analyses
*Dry Density and Moisture Content	Driven Ring Sampler (40)	In-situ density and moisture determination

*Reported on boring logs.

The results of the testing are presented in "Part III, Laboratory Results".

SITE CONDITIONS

The proposed bridge alignment will coincide with the existing 67th Avenue alignment. The test borings were drilled on the roadway shoulders at the proposed abutment and pier locations.

As disclosed by the test borings, the subsoil stratification is somewhat variable. The surface soils are predominantly clays and overlie stratified granular and clayey subsoils. Specific subsoil data is presented on the boring logs, with the following tabulation presenting a generalization of the depths and thicknesses of the predominant strata.

0 - 9 feet±:	Sandy Clay; medium plasticity.
9 - 26 feet±:	Silty Sand becoming Sand and Gravel mixtures with some cobbles.
26 - 47 feet±:	Sand - Clay mixtures with some gravel and occasional cobbles.
47 - 70 feet±:	Sandy Silty Clay; medium to high plasticity.
70 - 75 feet±:	Sand and Gravel mixtures; some cobbles.

The subsoils throughout the depth of test drilling were generally described as damp, and no free ground water was encountered in the test borings.

FOUNDATION BEARING

It is understood that the Maricopa County Flood Control District requires piling for support of the structure. The subsoil conditions are quite suitable for circular drilled cast-in-place concrete piles, and for driven non-displacement piles. Displacement piles do not appear suitable due to the dense condition of the subsoils.

Due to the relatively heavy abutment and pier loads, and the relatively large load capacity of large diameter piles, circular drilled cast-in-place piles were analyzed for support of the structure. The following tabulation presents calculated pile capacities for selected diameters and depths of embedment below the depth of potential scour. Calculations for other sizes will be provided upon request.

Pile Diameter	*Pile Length	Allowable Pile Loading: Abutment Condition	Pier Condition
3.0 ft.	20 ft.	110 kips	120 kips
3.0 ft.	30 ft.	200 kips	230 kips
3.0 ft.	40 ft.	320 kips	400 kips
4.0 ft.	20 ft.	180 kips	200 kips
4.0 ft.	30 ft.	310 kips	360 kips
4.0 ft.	40 ft.	480 kips	600 kips

- con't -

Pile Diameter	*Pile Length	Allowable Pile Loading: Abutment Condition	Pier Condition
5.0 ft.	20 ft.	270 kips	290 kips
5.0 ft.	30 ft.	440 kips	500 kips
5.0 ft.	40 ft.	670 kips	820 kips
6.0 ft.	20 ft.	370 kips	390 kips
6.0 ft.	30 ft.	610 kips	675 kips
6.0 ft.	40 ft.	890 kips	1040 kips

*Depth of embedment below the depth of potential scour.

The allowable pier loads are presented for dead plus design live loads except that a one-third increase is allowable for wind or seismic forces. No reduction in pier capacity for group action should be required where pier spacings exceed 3.0 diameters. Estimated pier settlements should not exceed 3/4 inches.

Although no free ground water was encountered at the time of test drilling, the analyses is based upon the assumption that partial saturation of the subsoils may develop during periods of heavy flow. Also, it was assumed that the pier excavating would be performed without the addition of water or slurry, although some sloughing and caving may be experienced when excavations penetrate the more granular subsoils. A heavy-duty drilling rig capable of developing high torque and down pressure will probably be required.

The lateral stability of rigid pile footings could be estimated by assuming the stiffness of the subsoils to increase lineally with depth beginning with zero (0) at the level of potential scour. A 28 pci horizontal modulus of subgrade reaction is recommended for estimating the horizontal load capacity per pile. No reduction due to group action should be necessary where pile spacings exceed 3.0 diameters.

STRUCTURE BACKFILLING

Backfill required against abutment walls and other retaining structures should be granular soils meeting the Arizona Highway Department Specifications for Select Backfill Materials. The backfill soils should be free of any silty or clayey fines so that the backfill will be free draining and not susceptible to increased loadings due to hydrostatic forces. Compaction should be accomplished to a minimum 95 percent of the AASHTO: T-180 maximum density. Retaining structures should be braced to resist equipment loadings during compaction of the backfill.

The following tabulation presents recommended soil pressures for estimation of lateral forces against retaining walls.

Equivalent "Active" Soil Pressure (Yielding structure)	30 psf/ft.
Equivalent "At-Rest" Soil Pressure (Rigid structure)	50 psf/ft.

APPROACH ROADWAYS

Since 67th Avenue is a major arterial, high traffic volumes are projected. The following tabulation presents the design parameters and indicated pavement sections for the approach roadways.

Average Daily Traffic:

Current	7,000
Projected 20 years (w/99th Ave. Loop)	18,000
Design Average	12,500
One Direction (50 percent)	6,250
Curb Lane (80 percent)	5,000
Truck Traffic (5%, 18K axle type)	250

Subgrade/Pavement Daga:

R-Value----------15
Soil Support Value----------3.1
Structural Number----------4.3

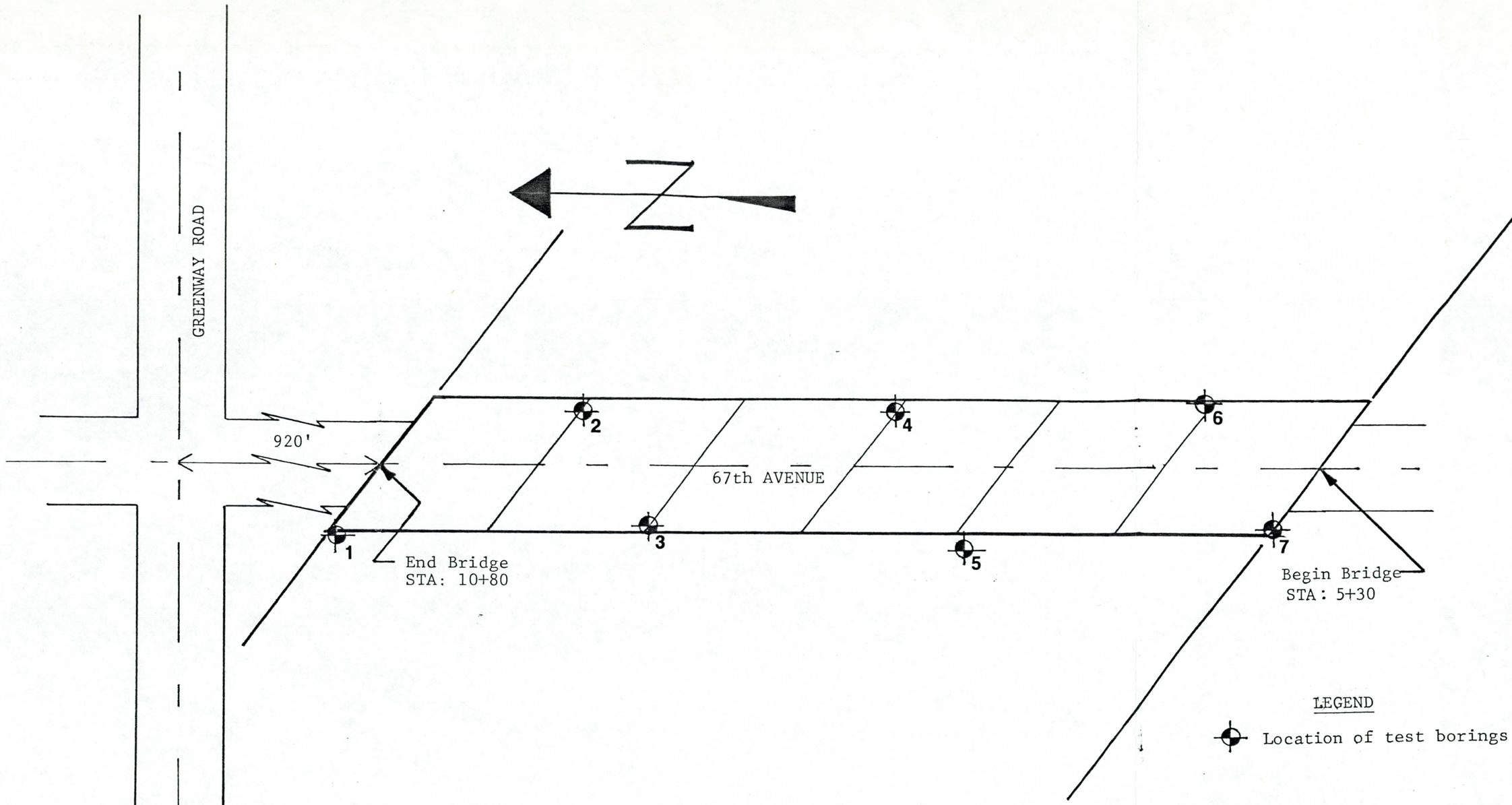
Pavement Section:

	Computed	Alternate No: 1	Alternate No: 2
Asphaltic Concrete	4 inches	6 inches	10 inches
Aggregate Base Course	4 inches	6 inches	-
Select Subbase Course	21 inches	9 inches	-
Total Thickness	29 inches	21 inches	10 inches

The subgrade preparation, pavement materials and placement should be in accordance with the Maricopa Association of Governments Standard Specificatons with current City of Glendale supplements.

PART II

FIELD RESULTS


GREENWAY ROAD
920'
67th AVENUE
1
2
3
4
5
6
7
End Bridge
STA: 10+80
Begin Bridge
STA: 5+30
LEGEND
Location of test borings

LEGEND

SOIL CLASSIFICATION ASTM: D2487

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	GRAVELS More than half of coarse fraction is larger than No. 4 Sieve size.
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	

FINE-GRAINED SOIL

MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

log denotes visual approximation unless accompanied by mechanical analysis and Atterberg limits.

GRAIN SIZES

	U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
	200	50	16	4	¾"	3"	6"	
SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND				GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE		FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ⟶)

DRY — SLIGHTLY DAMP — DAMP — MOIST — VERY MOIST — WET (SATURATED)

(PL) (LL)

DEFINITIONS

Penetration Resistance — Blows per foot using 'A' rod and 140 lb. hammer with 30 inch free fall unless otherwise noted.

N Standard Penetration Resistance (ASTM:D1586), 2.0 inch O.D. split barrel sampler.

C Continuous Penetration Resistance, 2.0 inch O.D. Bull Nose.

R Penetration Resistance, 2.42 inch I.D. Ring Sampler

Sample Type

R - Ring T - Shelby Tube S - Standard Split Barrel B - Block
G - Grab C - Cutting V - Vertical Face Cut

CONSISTENCY			RELATIVE DENSITY	
CLAYS & SILTS	BLOWS/FOOT*	STRENGTH‡	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	0-¼	VERY LOOSE	0-4
SOFT	2-4	¼-½	LOOSE	4-10
FIRM	4-8	½-1	MEDIUM DENSE	10-30
STIFF	8-16	1-2	DENSE	30-50
VERY STIFF	16-32	2-4	VERY DENSE	OVER 50
HARD	OVER 32	OVER 4		

* Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-⅜ inch I.D.) split spoon (ASTM D-1588).

‡ Unconfined compressive strength in tons/sq. ft. Read from a pocket penetrometer.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 11+05, 40' left of
centerline

NO. 1 ELEV: 1215.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
1					damp	Sandy Clay; Brown.	CL			X	X									X				X	X	X	X		
2																														
3																														
4																														
5		37	R	96.2	9.2																									
6																														
7					damp	Silty Sand; Some fine	SM		X	X	X					X		X									X			
8						gravely, brown.																								
9																														
10		17	R	*	*	STRATIFIED:	GC-		X		X					X			X	X							X	X		
1					damp	Sand and Gravel Mixtures;	GM																								
2						Some cobbles; some silt	SC-																								
3						and clay fines; grey-brown.	SM																								
4																														
5		50/7"	S			Some Lenses of:																								
6						Clean Sand and/or																								
7						Gravel (SP, GP)																								
8						Silty Sand (SM)																								
9						Clayey Sand (SC).																								
20		88	S																											
1																														
2																														
3																														
4																														
5		58/6"	S																											
6																														
7																														
8																														
9																														
30		60/6"	S																											
1																														
2																														
3																														
4																														
5		50/3"	S																											
6																														
7																														
8					damp	STRATIFIED:	CL-		X		X					X			X	X					X	X		X		
9						Sandy Clay - Clayey Sand;	SC																								
40		100/9"	R	135.8	5.7	Some gravel .																									

*No sample recovery.

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Assoc. Engineers.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 1 ELEV: 1215.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X	X					X				XX						XX		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5		100/11"	R	*	*	Some Lenses of:																								
6						Sand & Gravel Mixtures																								
7						(GM, GC, SM, SC).																								
8					damp	STRATIFIED:	CL-			X										X	X				XX		X		
9						Sandy Silty Clay;	CH																							
50		100/6"	R	102.4	25.2																								
1						Some Lenses of:																								
2						Clayey Sand (SC)																								
3						Silty Sand (SM)																								
4						Gravelly Mixtures (GM,GC)																								
5		100/4"	R	113.0	25.0																								
6																													
7																													
8																													
9																													
60		100/8"	R	102.8	25.8																								
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
70																													
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
80																													

Stopped test drilling at: 60 feet

Ground water encountered: None

*No sample recovery.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

East shoulder of 67th Avenue
Sta. 9+63, 34' right of
centerline

NO. 2 ELEV: 1217.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: JT DATE: 8-3-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sandy Clay; Brown.	CL		X		X									X					X	X	X	X		
2																														
3																														
4																														
5																														
6																														
7						Some lenses of Silty Sand																									
8						(SM) below 6 feet.																									
9					damp	STRATIFIED:	GC-		X		X					X				XX								X			X
10						Sand & Gravel Mixtures;	GM																								
1						Some cobbles, some silt	SC-																								
2						and clay fines; grey-brown.	SM																								
3																														
4						Some Lenses of:																								
5		23	S			Clean Sand and/or																								
6						Gravel (SP, GP)																								
7						Silty Sand (SM)																								
8						Clayey Sand (SC).																								
9																														
20																														
1																														
2																														
3																														
4					damp	STRATIFIED:	CL-		X		X					X				XX						XX		X			
5		24	S			Sandy Clay - Clayey Sand;	SC																								
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30						Sand & Gravel Mixtures																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		50/1I"	R	124.9	6.0																									
6																														
7																														
8																														
9																														
40																														

- con't -

NOTE: Test boring elevation interpolcated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 2 ELEV: 1217.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-3-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X	X					X			X	X						X	X		X	
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5		50/8"	R	114.6	5.0																									
6						Some Lenses of:																								
7						Sand & Gravel Mixtures																								
8						(GM, GC, SM, SC).																								
9																														
50																														
1					damp	STRATIFIED:	CL-			X											X	X				XX		X		
2						Sandy Silty Clay;	CH																							
3																														
4						Some Lenses of:																								
5		100/8"	R	105.1	21.8	Clayey Sand (SC)																								
6						Silty Sand (SM)																								
7						Gravelly Mixtures (GM,GC)																								
8																														
9																														
60																														
1																														
2																														
3																														
4																														
5		50/7"	R	115.2	17.2																									
6																														
7					damp	STRATIFIED:	GM-		X			X				X	X	X	X										X		
8						Sand & Gravel Mixtures;	GC																							
9						Some cobbles, some																								
70						silt and clay fines,																								
1						grey-brown.																								
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Test Drilling Refused at: 72 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 9+22, 34' left of
centerline

NO. 3 ELEV: 1214.5 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
1					damp	Sandy Clay; Brown.	CL			X	X									X				X	X	X	X			
2																														
3																														
4																														
5																														
6																														
7																														
8					damp	Silty Sand; Some fine	SM		X	X	X					X		X									X			
9						gravel; brown.																								
10					damp	STRATIFIED:	GC-		X		X					X		X									X	X		
1						Sand & Gravel Mixtures;	GM																								
2						Some cobbles; some silt	SC-																								
3						and clay fines; grey-brown.	SM																								
4																														
5						Some Lenses of:																								
6						Clean Sand and/or																								
7						Gravel (SP, GP)																								
8						Silty Sand (SM)																								
9						Clayey Sand (SC).																								
20																														
1																														
2																														
3																														
4					damp	STRATIFIED:	CL-		X		X					X		X									X			
5						Sandy Clay - Clayey Sand;	SC																								
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30		50/9"	R	*	*	Sand & Gravel Mixtures;																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		59	S																											
6																														
7																														
8																														
9																														
40		35	S																											

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 3 ELEV: 1214.5 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X	X					X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5																														
6						Some Lenses of:																								
7						Sand & Gravel Mixtures																								
8						(GM, GC, SM, SC)																								
9					damp	STRATIFIED:	CL-			X										X	X					X	X		X		
50		50/8"	R	113.0	18.0	Sandy Silty Clay;	CH																							
1																														
2						Some Lenses of:																								
3						Clayey Sand (SC)																								
4						Silty Sand (SM)																								
5						Gravelly Mixtures (GM,GC)																								
6																														
7																														
8																														
9																														
60		50/8"	R	103.1	21.2																									
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
70																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 60 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

East shoulder of 67th Avenue
Sta. 7+80, 34' right of
centerline

NO. 4 ELEV: 1216.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-4-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8						Some lenses of Silty Sand																									
9						(SM) below 7 feet.																									
10																														
1																														
2																														
3																														
4					damp	STRATIFIED:	GC-	X			X					X		X	X								X	X		
5						Sand & Gravel Mixtures;	GM																								
6						Some cobbles; some silt	SC-																								
7						and clay fines, grey-brown.	SM																								
8																														
9						Some Lenses of:																								
20						Clean Sand and/or																								
1						Gravel (SP, GP)																								
2						Silty Sand (SM)																								
3						Clayey Sand (SC).																								
4																														
5																														
6																														
7																														
8																														
9																														
30		50/6"	R	110.4	7.2																									
1																														
2					damp	STRATIFIED:	CL-		X		X					X			X	X					X	X		X		
3						Sandy Clay - Clayey Sand;	SC																								
4						Some gravel, occasional																								
5		50/8"	R	126.8	13.9	cobbles; brown.																									
6																														
7						Some Lenses of:																								
8						Sand & Gravel Mixtures																									
9						(GM, GC, SM, SC).																									
40		50/10"	R	120.2	3.5																									

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 4 ELEV: 1216.0 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-4-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
41					damp	STRATIFIED:	CL-			X	X					X			X	X					X	X	X			
2						Sandy Clay - Clayey Sand;	SC																								
3						Some gravel, occasional																									
4						cobbles; brown.																									
5		54	R	109.8	3.9																									
6						Some Lenses of:																									
7						Sand & Gravel Mixtures																									
8						(GM , GC, SM, SC).																									
9					damp	STRATIFIED:	CL-			X										X	X					X	X	X			
50		100/4"	R	102.6	23.7	Sandy Silty Clay;	CH																								
1																														
2						Some Lenses of:																									
3						Clayey Sand (SC)																									
4						Silty Sand (SM)																									
5		100/8"	R	104.8	21.7	Gravelly Mixtures (GM,GC)																									
6																														
7																														
8																														
9																														
60		50/6"	R	108.7	22.8																										
1																														
2																														
3																														
4																														
5		50/6"	R	120.1	17.9																										
6																														
7					damp	STRATIFIED:	GC-		X			X				X	X	X	X										X		
8						Sand & Gravel Mixtures;	GM																									
9						Some cobbles, some																									
70		50/6"	R	112.8	5.2	silty and clay fines,																									
1						grey-brown.																									
2																														
3																														
4																														
5		50/9"	R	137.9	8.7																										
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 75 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 7+38, 46' left of
centerline

NO. 5 ELEV: 1215.1 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	MED	POOR	GRAIN SHAPE: ANGULAR	SUBANGULAR	ROUNDED	SUBROUNDED	RELATIVE DENSITY: LOW	MED	HIGH	PLASTICITY: NONE	LOW	MEDIUM	HIGH	CONSISTENCY: SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION: NONE	WEAK	MEDIUM	STRONG
1					damp	Sandy Clay; Brown.	CL			X	X									X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
1																														
2					damp	Silty Sand; Some fine	SM		X	X	X					X		X										X			
3						gravel, brown.																								
4																														
5																														
6																														
7																														
8					damp	STRATIFIED:	GC-		X		X					X			X	X								X	X		
9						Sand & Gravel Mixtures;	GM																									
20						Some cobbles, some silt	SC-																									
1						and clay fines; grey-brown.	SM																									
2																														
3						Some Lenses of:																									
4						Clean Sand and/or																									
5						Gravel (SP, GP)																									
6						Silty Sand (SM)																									
7						Clayey Sand (SC)																									
8					damp	STRATIFIED:	CL-		X		X					X			X	X					X	X		X			
9						Sand Clay - Clayey Sand;	SC																									
30		50/11"	R	107.4	21.2	Some gravel, occasional																									
1						cobbles; brown.																									
2																														
3						Some Lenses of:																									
4						Sand & Gravel Mixtures																									
5						(GM, GC, SM, SC).																									
6																														
7																														
8																														
9																														
40		50/6"	R	122.9	2.6																									

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 5 ELEV: 1215.1 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X	X					X			X	X						X	X		X	
2						Sandy Clay - Clayey Sand;	SC																							
3					damp	Some gravel, occasional	CL-			X										X	X						X	X		X	
4						cobbles; brown.	CH																							
5						Some Lenses of:																								
6						Sand & Gravel Mixtures																								
7						(GM, GC, SM, SC).																								
8						STRATIFIED:																								
9						Sandy Silty Clay;																								
50		100/8"	R	114.8	16.9																									
1						Some Lenses of:																								
2						Clayey Sand (SC)																								
3						Silty Sand (SM)																								
4						Gravelly Mixtures (GM,GC).																								
5																														
6																														
7																														
8																														
9																														
60		100/9"	R	92.0	32.6																									
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
70																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 60 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

East shoulder of 67th Avenue
Sta. 5+96, 39' right of
centerline

NO. 6 ELEV: 1216.6 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-3-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
1					damp	Sandy Clay; Brown.	CL			X	X									X					X	X	X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9						Some lenses of Silty Sand																									
10						(SM) below 8 feet.																									
1																														
2																														
3					damp	STRATIFIED:	GC-	X			X					X		X	X								X	X		
4						Sand & Gravel Mixtures:	GM																								
5		67	S			Some cobbles; some silt	SC-																								
6						and clay fines; grey-brown.	SM																								
7																														
8						Some Lenses of:																								
9						Clean Sand and/or																									
20						Gravel (SP, GP)																									
1						Silty Sand (SM)																									
2						Clayey Sand (SC)																									
3																														
4					damp	STRATIFIED:	CL-			X	X					X		X	X							X	X		X	
5		50/11"	R	99.1	25.4	Sandy Clay - Clayey Sand;	SC																							
6						Some gravel, occasional																									
7						cobbles; brown.																									
8																														
9						Some Lenses of:																									
30						Sand & Gravel Mixtures																									
1						(GM, GC, SM, SC).																									
2																														
3																														
4																														
5		50/9"	R	1243	6.1																									
6																														
7																														
8																														
9																														
40																														

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No.

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 6 ELEV: 1216.6 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-3-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT C	PENETRATION RESISTANCE BLOWS/FT R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
41					damp	STRATIFIED:	CL-			X	X					X				X	X					X	X	X		
2						Sandy Clay - Clayey Sand;	SC																								
3						Some gravel, occasional																									
4						cobbles; brown.																									
5		100/10"	R	132.0	2.5																									
6						Some Lenses of:																									
7						Sand & Gravel Mixtures;																									
8						(GM, GC, SM, SC).																									
9																														
50					damp	STRATIFIED:	CL-			X										X	X					X	X	X		
1						Sandy Silty Clay;	CH																								
2																														
3						Some Lenses of:																									
4						Clayey Sand (SC)																									
5		100/4"	R	108.9	21.6	Silty Sand (SM)																									
6						Gravelly Mixtures (GM,GC).																									
7																														
8																														
9																														
60																														
1																														
2																														
3																														
4																														
5		100/9"	R	120.2	17.1																									
6																														
7																														
8																														
9					damp	STRATIFIED:	GC-		X			X				X	X	X											X		
70						Sand & Gravel Mixtures;	GM																								
1						Some cobbles, some silt																									
2						and clay fines; grey-brown.																									
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Test Drilling Refused at: 73 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 5+54, 34' left of
centerline

NO. 7 ELEV: 1214.7 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-30-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION: WELL	GRADATION: MED	GRADATION: POOR	GRAIN SHAPE: ANGULAR	GRAIN SHAPE: SUBANGULAR	GRAIN SHAPE: ROUNDED	GRAIN SHAPE: SUBROUNDED	RELATIVE DENSITY: LOW	RELATIVE DENSITY: MED	RELATIVE DENSITY: HIGH	PLASTICITY: NONE	PLASTICITY: LOW	PLASTICITY: MEDIUM	PLASTICITY: HIGH	CONSISTENCY: SOFT	CONSISTENCY: FIRM	CONSISTENCY: STIFF	CONSISTENCY: VERY STIFF	CONSISTENCY: HARD	CEMENTATION: NONE	CEMENTATION: WEAK	CEMENTATION: MEDIUM	CEMENTATION: STRONG
1					damp	Sand Clay; Brown.	CL			X	X									X				X	X		X	X		
2																														
3																														
4																														
5		25	R	107.3	16.3																									
6																														
7																														
8																														
9					damp	Silty Sand; Some fine	SM		X	X	X					X	X											X			
10		19	R	126.2	2.6	gravel, brown.																								
1																														
2																														
3					damp	STRATIFIED:	GC-		X		X					X			X	X							X	X		
4						Sand & Gravel Mixtures;	SC																								
5		50	S			Some cobbles, some silt	GM-																								
6						and clay fines; grey-brown.	SM																								
7																														
8						Some Lenses of:																								
9						Clean Sand and/or																								
20		50/4"	S			Gravel (SP, GP)																								
1						Silty Sand (SM)																								
2						Clayey Sand (SC).																								
3																														
4					damp	STRATIFIED:	CL-		X		X					X			X	X							X			
5		75	S			Sandy Clay - Clayey Sand;	SC																								
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30		100/9"	R	121.2	16.3	Sand & Gravel Mixtures																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		50/11"	R	115.5	3.8																									
6																														
7																														
8																														
9																														
40		50/9"	R	128.7	2.6																									

NOTE: Test boring elevation interpolated from topographic data received from Dashmey Associates, Engineers

- con't -

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 7 ELEV: 1214.7 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-30-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT C	PENETRATION RESISTANCE BLOWS/FT R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X	X					X			X	X					X	X	X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles, brown.																								
5		56	R	127.9	3.9	Some Lenses of:																								
6						Sand & Gravel Mixtures																								
7						(GM, GC, SM, SC)																								
8					damp	STRATIFIED:	CL-			X										X	X					X	X	X		
9						Sandy Silty Clay;	CH																							
50		50/10"	R	112.7	17.5																									
1						Some Lenses of:																								
2						Clayey Sand (SC)																								
3						Silty Sand (SM)																								
4						Gravelly Mixtures (GM,GC).																								
5		50/7"	R	111.8	16.2																									
6																														
7																														
8																														
9																														
60		100/9"	R	122.8	4.2																									
1																														
2																														
3																														
4																														
5		89	R	125.8	4.8																									
6																														
7																														
8					damp	STRATIFIED:	GC-	X			X					X	X	X	X										X		
9						Sand & Gravel Mixtures;	GM																								
70		75	S			Some cobbles; some silt																								
1						and clay fines; grey-brown.																								
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 70 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

PART III

LABORATORY RESULTS

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test Borings - See Site Plan

Type Auger Cuttings and Drive Samples

Material Subsoil

Sampled By Thompson

TESTED: Gradation and Plasticity Index

RESULTS:

Sample	LL	PI	Sieve Size - Accum. % Passing 200	100	50	30	16	8	4	3/4"	1"	2"	3"	(1) Class
1; 0'-6'	41	21	71	80	86	90	94	97	100					CL
1; 6'-9'	26	5	36	53	66	71	73	75	76	83	89	100		SC-SM
1; 9'-13'	33	15	27	35	42	46	51	61	69	97	100			SC
1; 13'-37'	38	21	22	26	29	31	36	52	71	98	100			SC
*1; 49'-59'	56	25	79	85	88	90	91	92	94	100				CH
7; 0'-8'	46	28	70	76	80	85	90	94	97	100				CL
7; 8'-12'	19	3	25	30	38	52	65	75	83	100				SM
*7; 24'	42	12	56	72	82	88	92	94	98	100				CL
*7; 49'&59'	24	3	18	24	34	48	64	81	93	100				SM
*Composite of drive samples.														

(1) Unified Soil Classification

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 1; 39'-40'

Type Driven ring sample

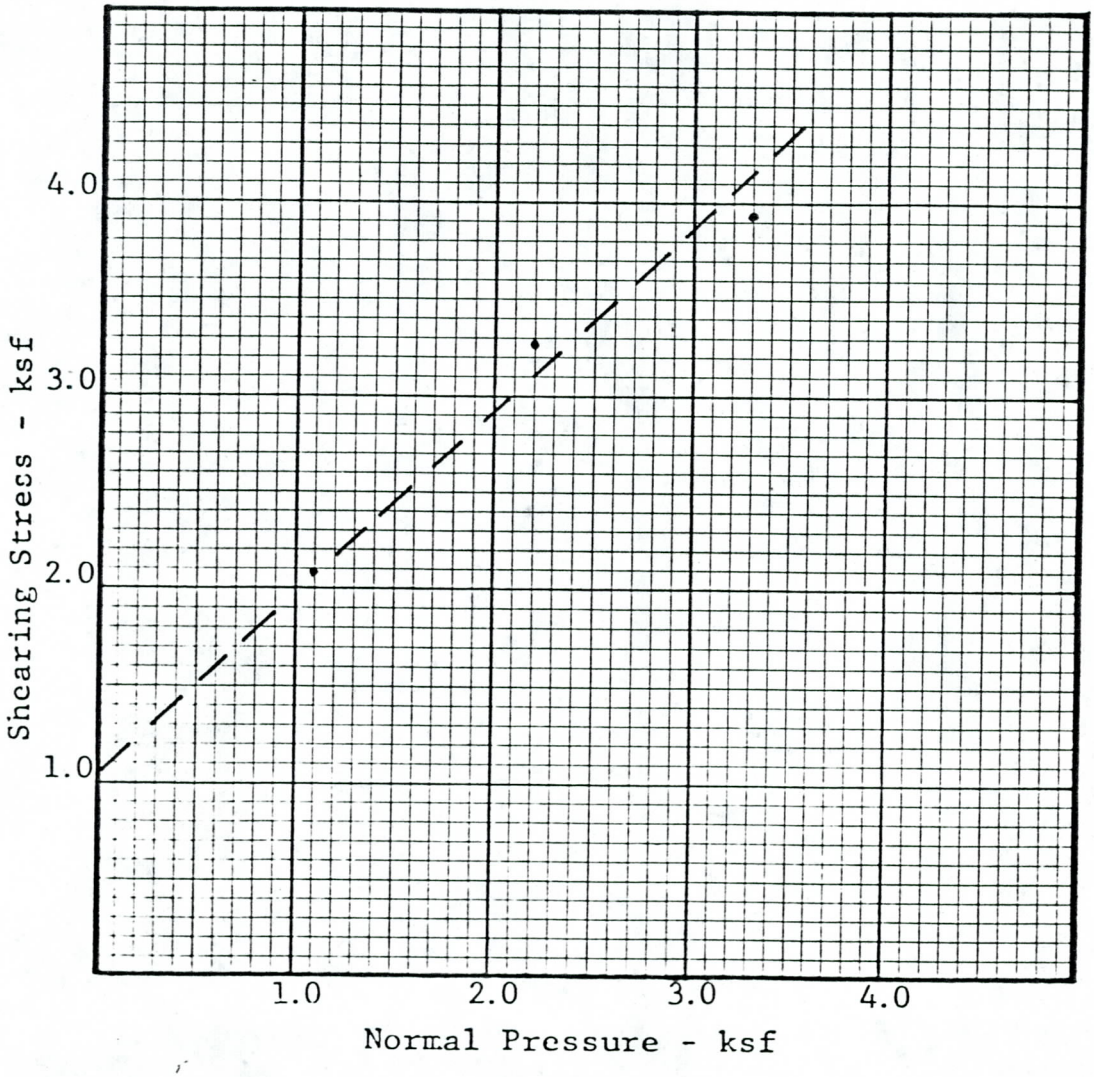
Material Subsoil; 135.8 pcf dry density; 5.7% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 43° Cohesion (c) = 1.05 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 34'-35'

Type Driven ring sample

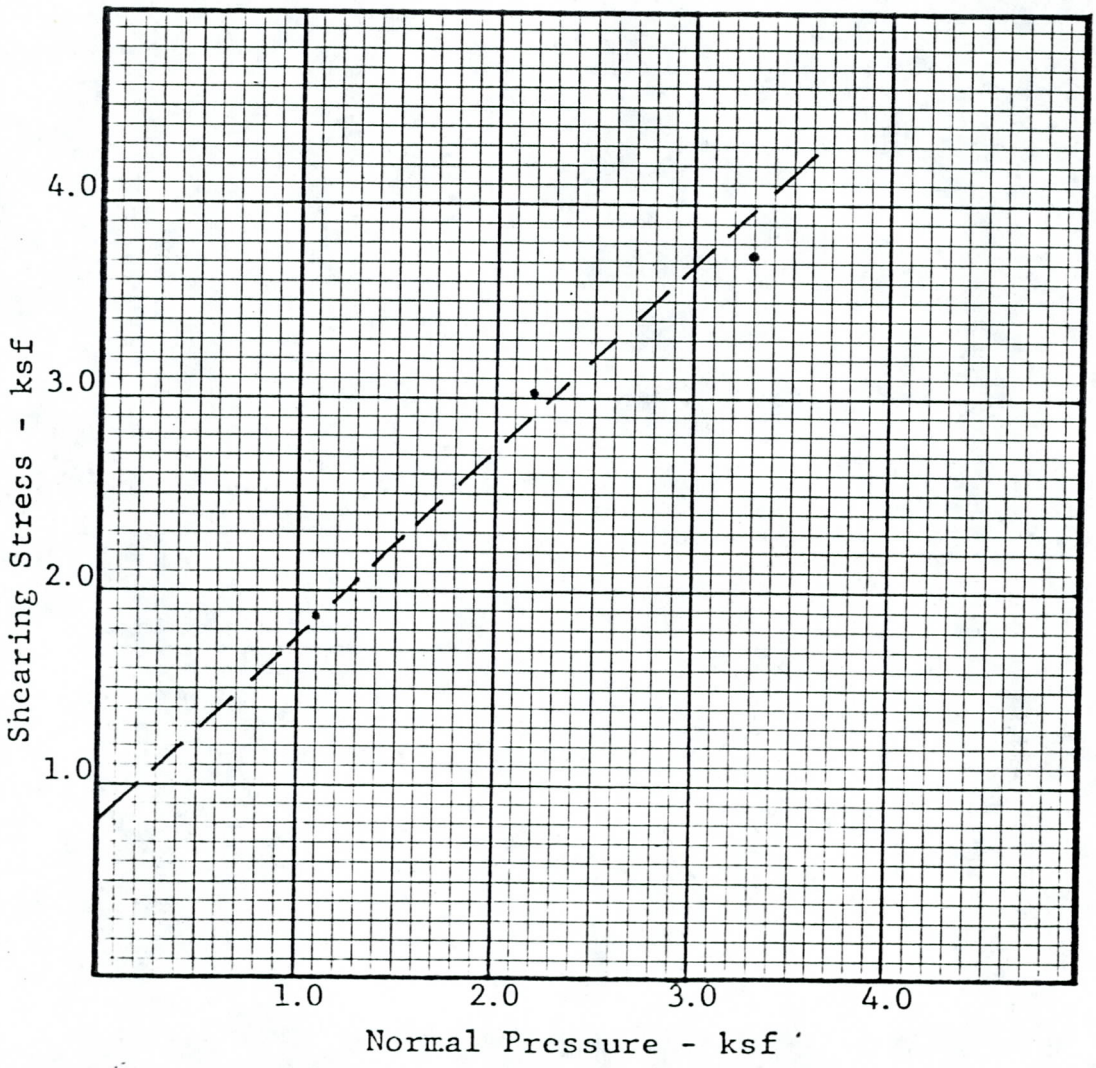
Material Subsoil; 126.8 pcf dry density; 13.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 44° Cohesion (c) = 0.80 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 44'-45'

Type Driven ring sample

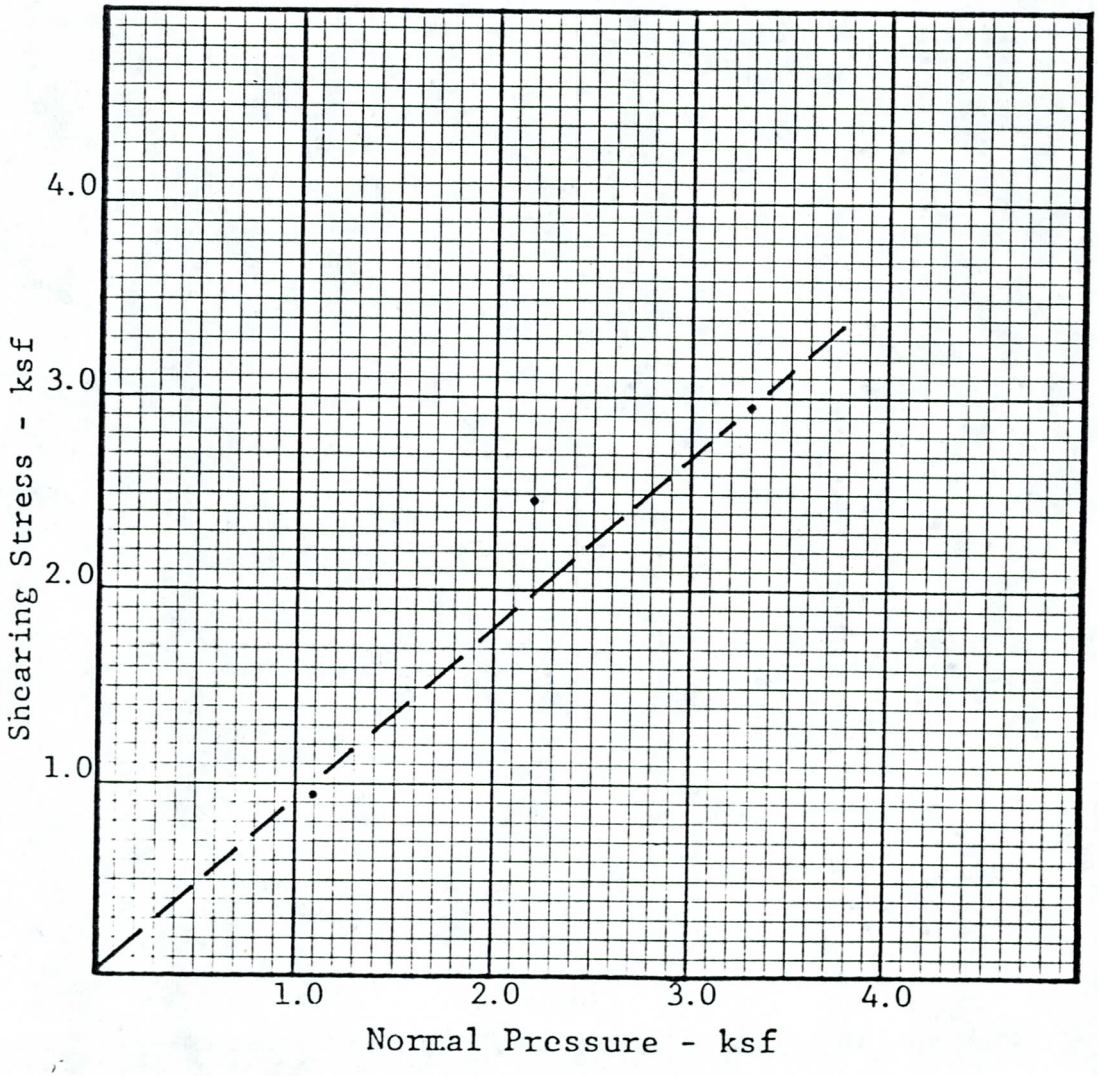
Material Subsoil; 109.8 pcf dry density; 3.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (∅) = 42° Cohesion (c) = Nil



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 54'-55'

Type Driven ring sample

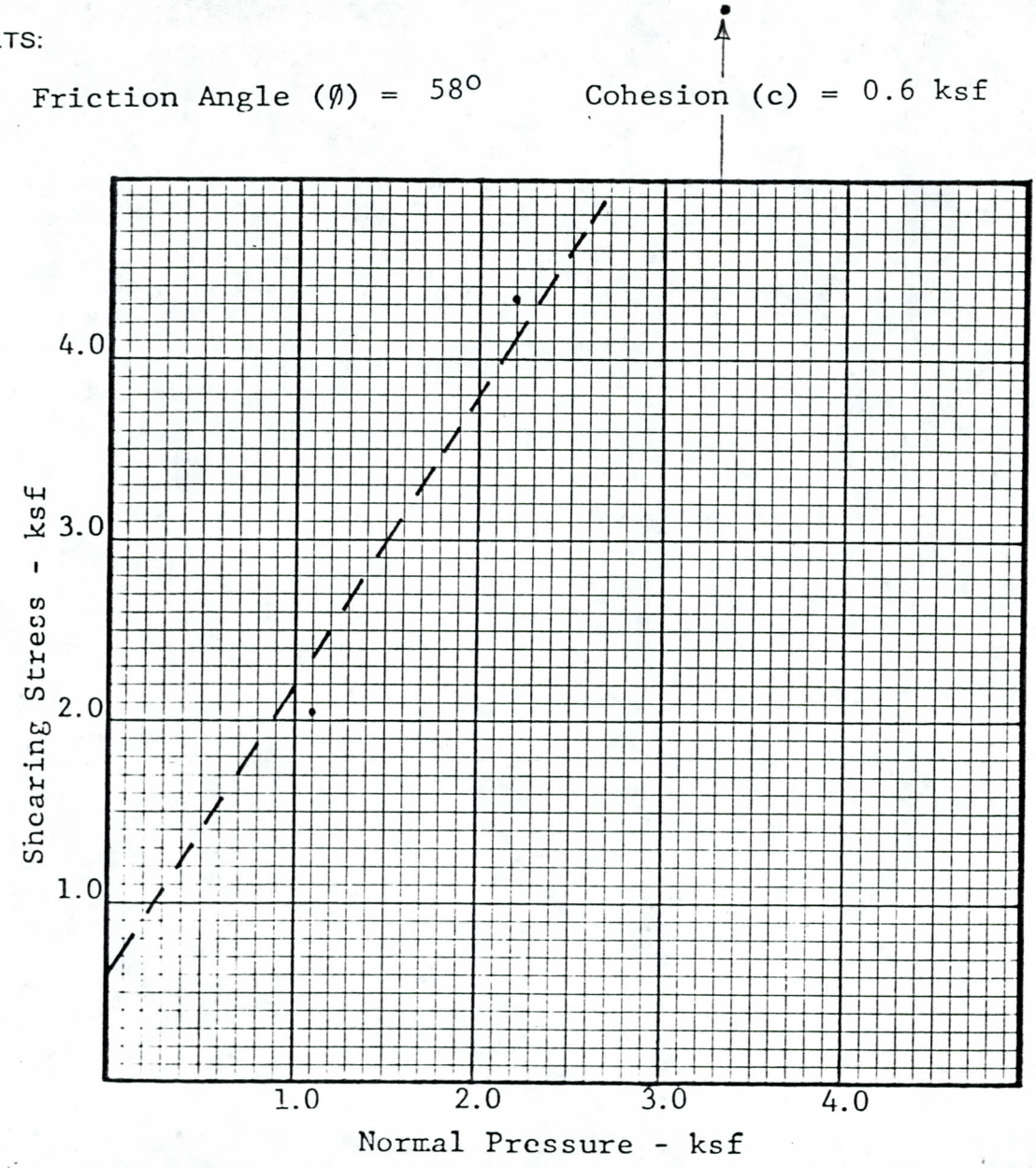
Material Subsoil; 104.8 pcf dry density; 21.7% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (∅) = 58° Cohesion (c) = 0.6 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

NOTE: Normal pressure 3.3 ksf, shearing stress 5.95 kfs.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 64'-65'

Type Driven ring sample

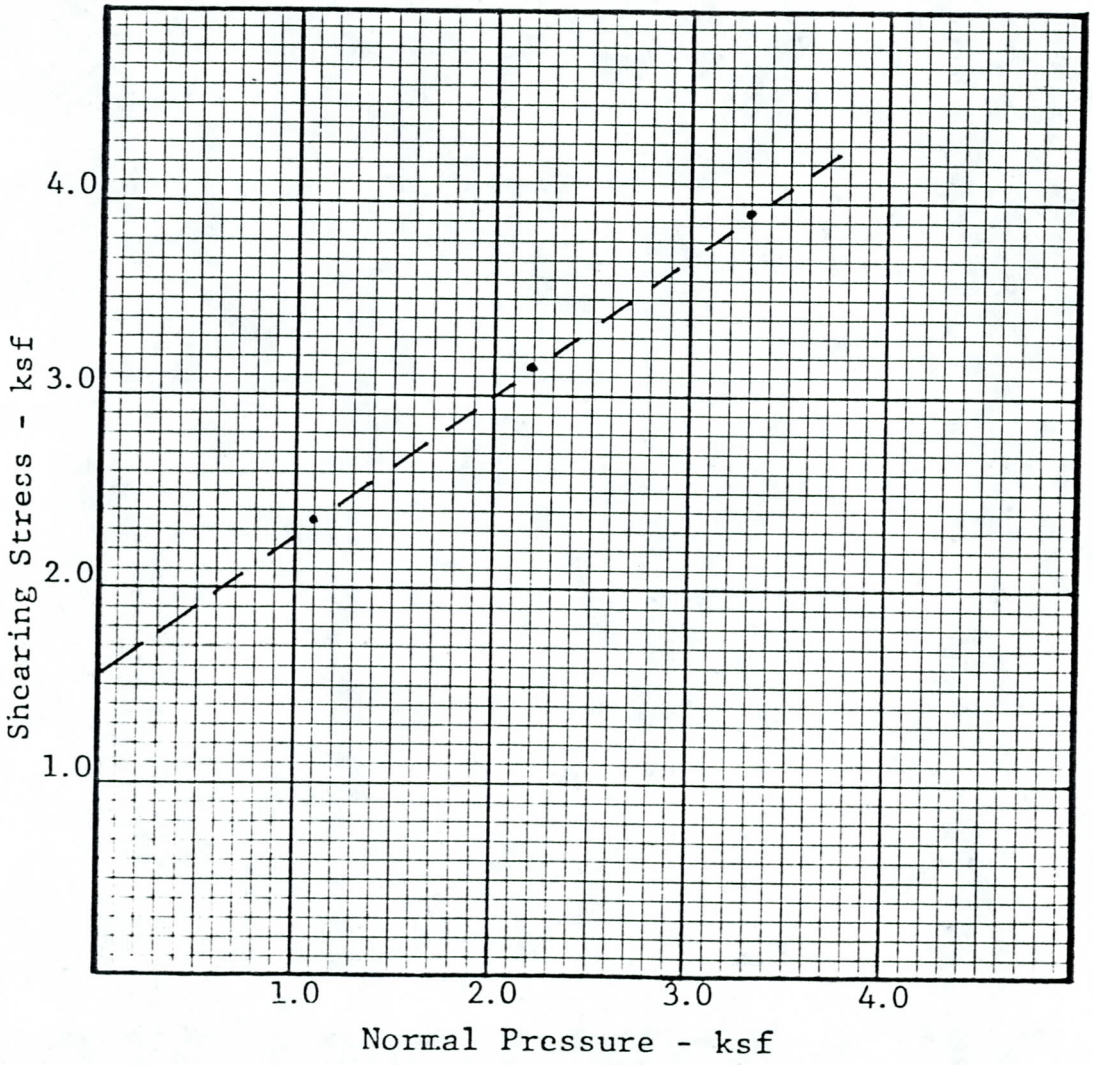
Material Subsoil; 120.1 pcf dry density; 17.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (∅) = 36° Cohesion (c) = 1.55 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 7; 29'-30'

Type Driven ring sample

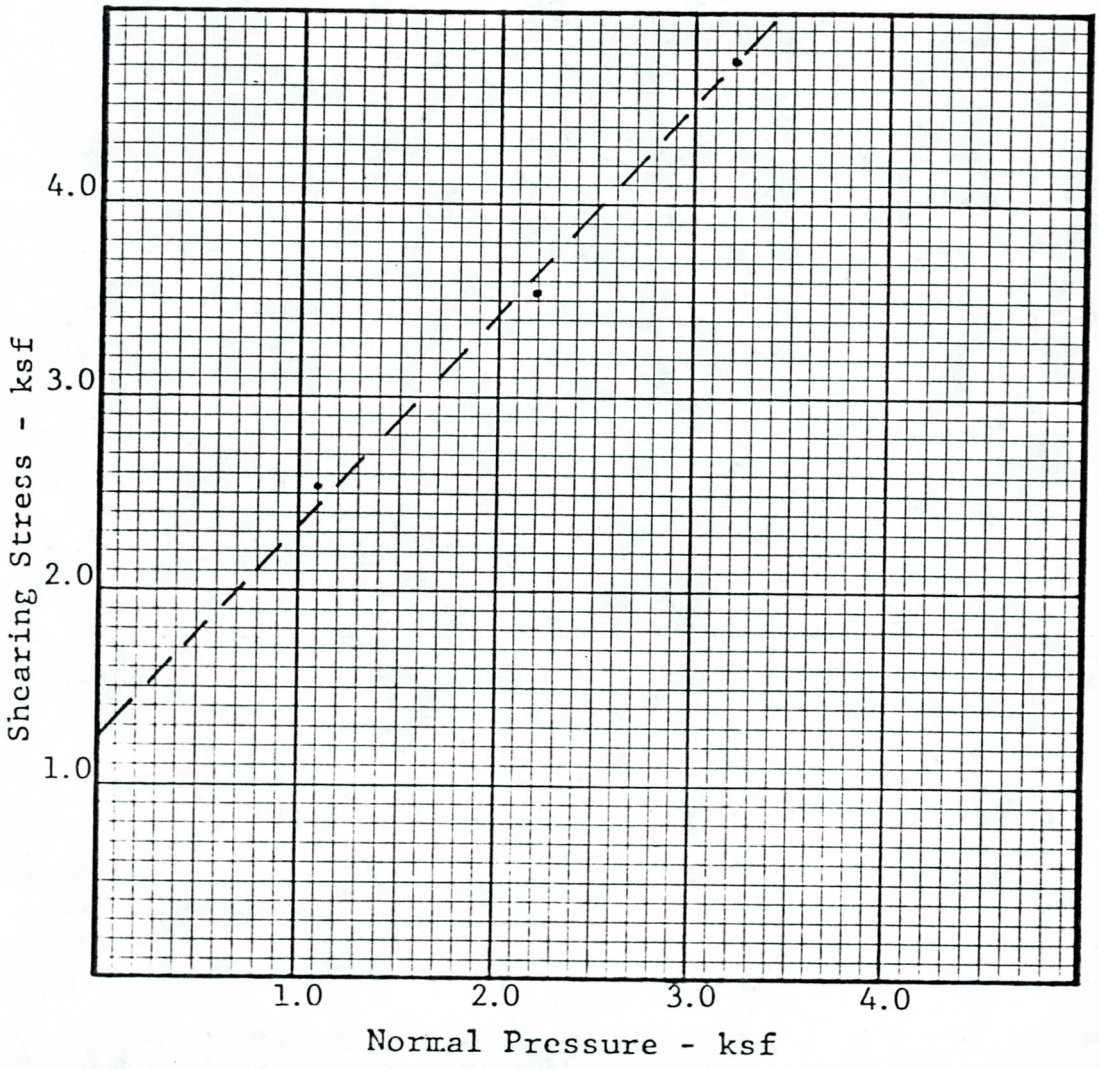
Material Subsoil; 121.2 pcf dry density; 16.3% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition

RESULTS:

Friction Angle (Ø) = 47^{o} Cohesion (c) = 1.25 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 7; 44'-45'

Type Driven ring sample

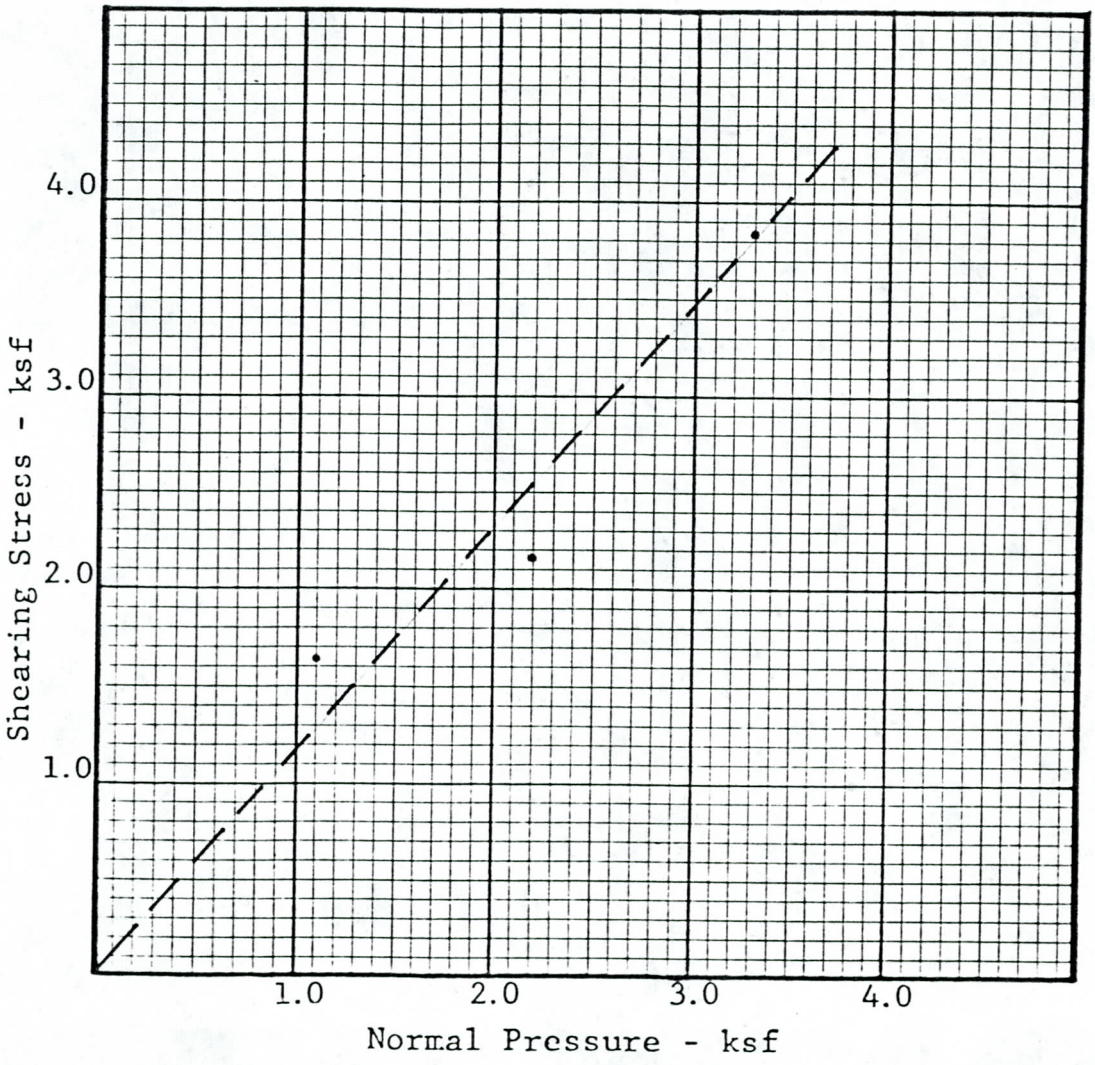
Material Subsoil; 127.9 pcf dry density; 3.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition

RESULTS:

Friction Angle (Ø) = 50° Cohesion (c) = Nil



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8-24-82

Source 67th Avenue Approach Roadways to Bridge

Type Bulk

Material Pavement Subgrade

Sampled By TH/White

TESTED: Gradation, Plasticity Index and R-Value

RESULTS:

Sample/Location	Percent Passing No. 200 Sieve	Plasticity Index	R Value
#1; Sta. 0+00, 40'left of ceterline	68	20	-
#2; Sta. 5+54, 34'left of centerline	70	28	15
#3; Sta. 11+50, 40'left of centerline	71	21	-
#4; Sta. 14+50, 90'left of centerline	49	11	-
#5; Sta. 18+00, 90'left of centerline	61	13	-