MIDWAY ROAD REHAB.

PAVEMENT INVESTIGATION
MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

HENLEY
JOHNSTON
& ASSOCIATES, INC.
engineering geoscience consultants

PAVEMENT INVESTIGATION
MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

For

Town of Addison, Texas

Through

Shimek, Jacobs & Finklea, L.L.P.
Dallas, Texas

INTRODUCTION

In general accordance with notice to proceed and the authorization of our 8 March 1999 proposal, we have completed a Pavement Investigation of Midway Road from Belt Line Road to Lindbergh Drive in Addison, Texas. Information relative to the scope of this project was provided through a meeting at the site and through discussions with Mr. John W. Birkhoff, P.E., of Shimek, Jacobs & Finklea, L.L.P. We understand that this section of Midway Road has experienced difficulties with seepage through the joints in the pavement and vertical displacements at the joints in a longitudinal direction. The pavement was milled to create a smooth surface within the last two or three years. The vertical displacements have re-occurred to the point that many panels have vertical offsets of one inch, or more, at the present time.

PURPOSE AND SCOPE

The purpose of this investigation was to develop specific geotechnical data at the site by means of subsurface exploration, laboratory testing and engineering and geologic analyses of the resultant data from six soil borings. Shallow (less than four feet) groundwater observation elements were to be set in four boreholes to observe the water levels under the pavement and two monitor wells were to be set to observe water levels and provide access for water sampling in the deeper strata at the site. This report presents the results of the basic field and laboratory data developed and provides findings and recommendations to guide remediation of pavement. Recommendations to facilitate design and construction were made based on geological conditions encountered and geotechnical parameters obtained from this investigation. The interpretation of these data is considered appropriate to the extent that the investigated locations are typical of conditions present at the project site.

FIELD INVESTIGATION

The field or subsurface investigation conducted consisted of advancing six (6) soil borings to depths varying from about 3.5 to 20.5 feet below ground or pavement surfaces. These borings were advanced by means of a truck-mounted rotary drilling rig which employs dry sampling techniques to advance the borings. Five (5) of the borings were drilled through the pavement section of Midway Road; the concrete was cored using a 9-inch diameter diamond concrete coring bit. The drilling was performed by a Henley-Johnston & Associates, Inc., drill crew. The approximate locations of the borings drilled are indicated on Plate 1. The borings were located on the site by an HJA Engineer, using a measuring wheel and measuring from existing landmarks (roadways, railroads, curbs, etc.). The borehole locations indicated on Plate 1 are considered accurate to the degree implied by the method used.

Samples of cohesive soils and the upper strata of the weathered limestone were obtained using conventional Shelby-tube sampling techniques (ASTM D 1587) whereby a thin-walled tube is advanced into the formation by a rapid, continuous thrust from balanced hydraulic rams on the drilling rig. Disturbed, representative samples of the weathered and unweathered primary limestone strata were obtained from the auger cuttings.

All soil and limestone samples obtained from the borings were encased in polyethylene plastic to prevent changes in moisture content and to preserve in situ physical properties. All samples were classified as to basic type and texture in the field by an experienced Engineering Geologist, labeled as to appropriate boring number and depth, and placed in core boxes for transport to the laboratory. The concrete cores were returned to the laboratory where 2-3/4-inch diameter cores were cut for compressive strength testing of the concrete.

Groundwater was not encountered during the course of this investigation. Upon completion of drilling, temporary groundwater observation elements were set in each open borehole. The risers and wellscreens set in Boring Nos. MW-1 and MW-2 were sealed from surface infiltration of water by a 10-foot grout section over a 2-foot bentonite section. Below the grout/bentonite seal, the wellscreen was surrounded by 20/40 silica sand. Valve covers were grouted over the tops of these installations. In the shallow borings (B-1 through B-4) through the pavement, the wellscreens extended up to approximately the bottom of the pavement and were surrounded by 20/40 silica sand. Above that level, grout seals which also hold valve covers in place, were formed to prevent surface water from accessing the observation units. Details depicting each specific installation are appended hereto following the report illustrations.

LABORATORY TESTING

All soil samples were classified in accordance with the Unified Soil Classification System. Rock samples of the primary strata were described using standard geologic terms. Terms and symbols used on the boring logs are described on the enclosed sheet entitled "Legend, Lithology, Soil Consistency & Relative Rock Hardness."

To aid in the classification process, Atterberg Limits, Moisture Content and Dry Unit Weight tests were performed on representative samples. All of the above test data are summarized on Plate 2. Atterberg Limits also are presented on the Plasticity Chart on Plate 3.

Compressive Strength tests were performed on cores from the concrete pavement at each boring located in the pavement section. The results of these tests are presented on Plate 4.

The strength of each cohesive sample was estimated using a hand penetrometer. The results of these estimates are tabulated on Plate 5. The strength properties of selected soil samples were investigated by Unconfined Compression tests. In this test, axial load is applied to a laterally unsupported cylindrical sample until failure occurs within the sample. This test is conducted fairly rapidly (failure within about 10 minutes) and generally conforms to ASTM D 2166. The Elastic Modulus values were interpreted from the stress-strain curves of the Unconfined Compression tests using a tangent modulus at 50 percent of peak strength. The soil strength test data are summarized on Plate 5. Stress-strain data for the Unconfined Compression tests are presented graphically on Plates 6 through 11.

Water samples obtained from each boring location and from a nearby source of tap (municipal) water were tested by Southern Spectrographic Laboratory, Irving, Texas. The results of those tests and a brief statement from Southern Spectrographic about the anticipated sources of the water are presented on Plate 12.

SUBSURFACE CONDITIONS

The site of this investigation is in Addison, Texas, along the northbound lanes of Midway Road between Belt Line Road to the south and Lindbergh Drive to the north, as shown on Plate 1. A section of the "ADDISON" USGS quad sheet topographic map which includes this area is presented on Plate 13. This indicates that the roadway drops about 10 feet in elevation from Belt Line Road to the creek/railroad track, and remains fairly level or slightly uphill from the railroad track to Lindbergh Drive. Primary sediments at the site have been identified as limestone strata of the Austin Chalk Formation of Cretaceous Age. The specific types, depths, and thicknesses of materials penetrated by the borings are reflected on the individual "Log of Boring" illustrations.

Five of the borings were drilled through the concrete pavement of Midway Road. The concrete was found to be between 0.65 and 0.7 feet in thickness. Fill materials were encountered below the pavement in all borings except Boring No. B-1 and below ground surface in Boring No. MW-1. These fill materials extend to depths ranging from about 1.1 feet in Boring No. B-2 to about 3.0 feet in Boring No. B-3. The upper portion of the fill in Boring No. B-3 and the fill in Boring No. B-4 is clay which is believed to have been lime-treated. The remaining fill is silty clay with calcareous nodules, and probably is on site material which was relocated to fill low areas. Below the fill or pavement in Boring Nos. MW-1, B-1 and B-3 are thin zones of silty clay which the Atterberg Limits indicate to be low to moderate plasticity materials. In Boring Nos. MW-2 and B-4, slightly silty clays were found below the fill materials. These materials are indicated to be high plasticity clays; this may explain why these materials were lime-treated. All of the clay strata encountered are dark shades of brown or gray in color. These materials are stiff to very stiff in consistency and contain varying amounts of calcareous nodules.

Below the surficial clays, limestone strata of the primary formation (Austin Chalk Formation of Cretaceous Age) were encountered. The uppermost portions of the limestone were found to be variably weathered, having been leached by percolating waters over time. These weathered materials are generally severely to moderately weathered, jointed and fractured and contain occasional soft clayey seams. The weathered section is typically firm to moderately hard in rock hardness and light brown and tan in color. The weathered sections of limestone materials encountered ranged in thickness from about 8.5 feet in Boring No. MW-2 to about 14.5 feet in Boring No. MW-1.

Unweathered limestone strata were encountered below the zone of differential weathering at depths varying from about 13 feet in Boring No. MW-2 to about 17 feet in Boring No. MW-1. Once encountered, the unweathered limestone strata continued to at least the 20.5-foot maximum depth explored. Data from other investigations nearby indicate that the unweathered limestone is in excess of 30 feet thick in this vicinity. The unweathered limestone is moderately hard to hard in rock hardness and gray in color.

Groundwater was not encountered during the course of this investigation prior to the installation of the water level observation elements and monitor wells. Groundwater in this vicinity is typically perched on top of the unweathered limestone and is contained within joints and fractures present within the weathered limestone materials and within the silty clay overburden soils. Groundwater levels at this site can be expected to fluctuate with seasonal variations in rainfall.

Water levels were measured in each observation element installation. The following table provides the results of these water level readings.

Location	6-25-99	7-28-99
MW-1	8.9	9.5
B-1	2.6	2.6
B-2	0.5	1.6
B-3	0.4	0.8
B-4	0.7	0.7
MW-2	4.6	6.2

All of the elements, except Boring No. B-1, were bailed to within a few inches of the bottom of the installation on 25 June 1999 after water level readings were obtained. The water found in the elements on 28 July 1999 had entered the installations since the 25 June readings.

WATER LEVELS AND SOURCES

Based on approximate elevations from the topographic map on Plate 13, we estimate that the surface elevation at Boring No. MW-1 is about Elevation 625 and the surface elevation at Boring No. MW-2 is about Elevation 622. The flow line of the creek south of the railroad is estimated to be at about Elevation 610 to 620. The water level measurements in Boring Nos. MW-1 and MW-2 ("deep" installations) indicate that these levels are probably near the flow line elevation of Rawhide Creek.

The water level observed in Boring No. B-1 has remained relatively constant, indicating that water has not been coming into the installation during the observation period. The other three "shallow" installations have shown increases in water level during a time when little or no rain has fallen in the area; consequently, these elements indicate water infiltration from sources other than rainfall. During the same period of time, the water levels in Boring Nos. MW-1 and MW-2 have decreased.

The data from Southern Spectrographic indicate that the chemistry of water found in Boring Nos. B-1, B-2, B-3, and B-4 is very close to that of the referenced tap (municipal) water. The elevated potassium levels, we understand, are generally related to water migrating through fertilized areas (landscaped areas, etc.). The chemistry of water sampled from Boring No. MW-1 is similar to that of the tap water, but has higher concentrations of sodium, chloride, and sulfate, and less fluoride than tap water. The chemistry of water from Boring No. MW-2 appears to be predominantly from some source other than tap water.

Based on the information from the water observation and sampling installations, water chemistry tests, and our observations at the site; it is our opinion that water which has emitted from the joints in the pavement on Midway Road probably is related to tap water (irrigation or water from nearby businesses) or surface run-off. It would be advantageous to be able to observe these installations and obtain samples of water during a rainy period. Water has easy access to the subgrade soils through open joints in the pavement. Water can flow from landscaped areas in the median or along the outside of the pavement through open joints in the curbs and pavement to the subgrade soils. We have observed water flowing into the street from one of the businesses near Belt Line Road; this water flows downhill on Midway Road, encounters open joints and travels transversely until it can soak into the subgrade.

PAVEMENT ANALYSES

Traffic counts on Midway Road for Tuesday and Wednesday, 30 and 31 March, 1999, were provided to us. The 24-hour traffic volume in one northbound lane (outside) was divided into thirteen types of vehicles. We have used the program "Concrete Pavement Technology, Version 2.0" from the American Concrete Pavement Association to perform pavement analyses based on available information from this investigation. This program is based on the 1986 "AASHTO Guide for the Design of Pavement Structures."

We have used the following general design parameters:

Serviceability	
Initial	4.5
Terminal	2.25
Design Life	20 Years
Reliability	90 percent
Overall Deviation	0.35
Load Transfer	3.2 - assuming edge support and aggregate interlock for existing pavement
	2.7 - assuming edge support and dowelled reinforced pavement for future pavement
Drainage Coefficient	Variable for existing pavement - 0.8, 1.0, 1.1
	For potential future pavement - 1.0
Traffic Growth Rate	0.325 percent/year

For analysis of the existing pavement, we estimated the flexural strength of the concrete from the compressive strength values of the concrete cores. These flexural strength values varied from about 640 to 700 psi. For concrete near the south end of the site, we used a value of 660 psi; for the pavement near Lindbergh Drive, we used a value of 640 psi. For potential future pavement sections, we used a value of 650 psi.

For analyses of existing and future pavement, we have assumed that the subgrade materials have a CBR value of about 3, and have used a Resilient Modulus of 4500 psi. For lime-treated soils we have used a Resilient Modulus of 20,000 psi, and for asphalt treated base, we have used a Resilient Modulus of 350,000 psi.

For 8-inch (0.65 to 0.7-foot) thick pavement, the total ESAL's for 20-year life of the pavement is about 14,100,000 assuming the traffic volume indicated by the March traffic count. For existing conditions, with a Drainage Coefficient of 0.8, indicating poor drainage as observed in place, the design life of the pavement is slightly more than one year. Assuming better drainage conditions with a Drainage Coefficient of 1.0, the design life increases to about 2.3 years and with good drainage conditions, a Drainage Coefficient of 1.1, the design life increases to about 3.2 years.

This indicates that the traffic volume currently using Midway Road is significantly in excess of the volume that would be expected for a 20 or 30-year design life for the pavement in place.

The moisture contents of the near-surface soils (subgrade materials) are relatively high at all boring locations. Indications are that these soils have been saturated and remain saturated over long periods of time. We believe that this has resulted in softening of the soils at the south end of each pavement panel and settlement of that end of the panel. In some cases, this has resulted in a reverse rocking of the panel and the creation of a void under the north end of the panel. Because of these physical movements of some of the panels and the deterioration of the subgrade under the panels, we recommend that the existing pavement be removed, the subgrade be reworked and new pavement be placed. Recommendations for the replacement of this pavement are contained in subsequent paragraphs.

Pavement analyses indicate that the following sections could be used as replacements for the pavement along Midway Road.

20-year Life

10-inch Reinforced Concrete Paving
12-inch Compacted Lime-Treated Subgrade
or
10-inch Reinforced Concrete Paving
4-inch Compacted Asphalt-Treated Base

30-year Life

11-inch Reinforced Concrete Paving
12-inch Compacted Lime-Treated Subgrade
or
11-inch Reinforced Concrete Paving
4-inch Compacted Asphalt-Treated Base

An alternative to complete replacement is to provide remediation of the loss of support under the panels and a concrete pavement overlay. Loss of support may be remediated by removal and replacement of the ends of the panels (with appropriate subgrade conditioning and compaction) or by selective grouting under the ends of the panels. The concrete overlay should be jointed, reinforced concrete with a 9-inch overlay for 20-year life and a 10-inch overlay for 30-year life. This will require transition zones where the pavement has to meet existing grades at intersections, railroad tracks and other features.

In the event concrete is to be removed and replaced, after the soil surface in each area has been brought to grade, the performance of pavement can be enhanced by treating the clay soils exposed at grade with lime-slurry for use as sub-base. Subject to modification during construction, a lime content of six (6) percent by dry soil weight (approximately 6 pounds of lime per cubic foot of soil treated) would be expected to effectively treat the subgrade soil.

Soils treated with lime-slurry for use as sub-base should be compacted to a dry density at least 95 percent of the maximum dry density as defined by ASTM D 698 and at a moisture content at least 2 percentage points above Optimum Moisture content.

Good surface drainage and treatment of adjacent landscaping areas to control irrigation water are necessary to minimize moisture changes in the subgrade. We recommend that the irrigation water be collected in a drain along the median and the sidewalk on either side of the pavement, and directed into storm drains or Rawhide Creek, as permitted. Alternatively, a moisture barrier may be formed at the backside of the curb on both sides of the pavement. We recommend that such a barrier extend at least two feet below grade. All joints should be sealed and the sealant maintained throughout the lifetime of the pavement.

For reinforced concrete paving, it is essential that any and all reinforcing be placed so as to insure a minimum of $1^1/_2$-inches of cover. Selection of the proper section should be based on anticipated traffic loads, frequency and long term maintenance, as well as project economics.

EARTHWORK

Earthwork recommendations are as follow:

1. Excavate and waste, or store for future use, surficial organic, deleterious, and concrete materials encountered at the surface.

2. Scarify subgrade soils exposed in fill areas and transitional areas (cut to fill and fill to cut) to a depth of approximately eight (8) inches, add moisture (if required), mix and recompact to a density between 95 and 98 percent of maximum density obtained by a Standard Proctor Compaction Test (ASTM D 698). The moisture content of the compacted soils should be maintained between optimum and plus four percent of the optimum value (determined by ASTM D 698) until covered by fill or pavement.

3. Place fill soils for pavement in loose lifts not exceeding eight (8) inches and compact to the moisture/density values specified in No. 2 above.

4. We recommend that imported select fill material consist of inert sandy clay (material with greater than 50 percent passing the No. 200 mesh sieve) with a Liquid Limit less than 35 and a Plasticity Index between 6 and 15, or flexible base materials meeting the requirements of Texas Department of Transportation Item 247, Type 1, Grade A.

QUALIFICATIONS

In the event that any changes in the nature, design or location of the proposed pavement are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

The analyses and recommendations submitted in this report are based in part upon the data obtained from six borings. The nature and extent of subsurface variations at the site may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.

It is recommended that the soil and foundation engineer be provided the opportunity for general review of final design drawings and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design drawings and specifications.

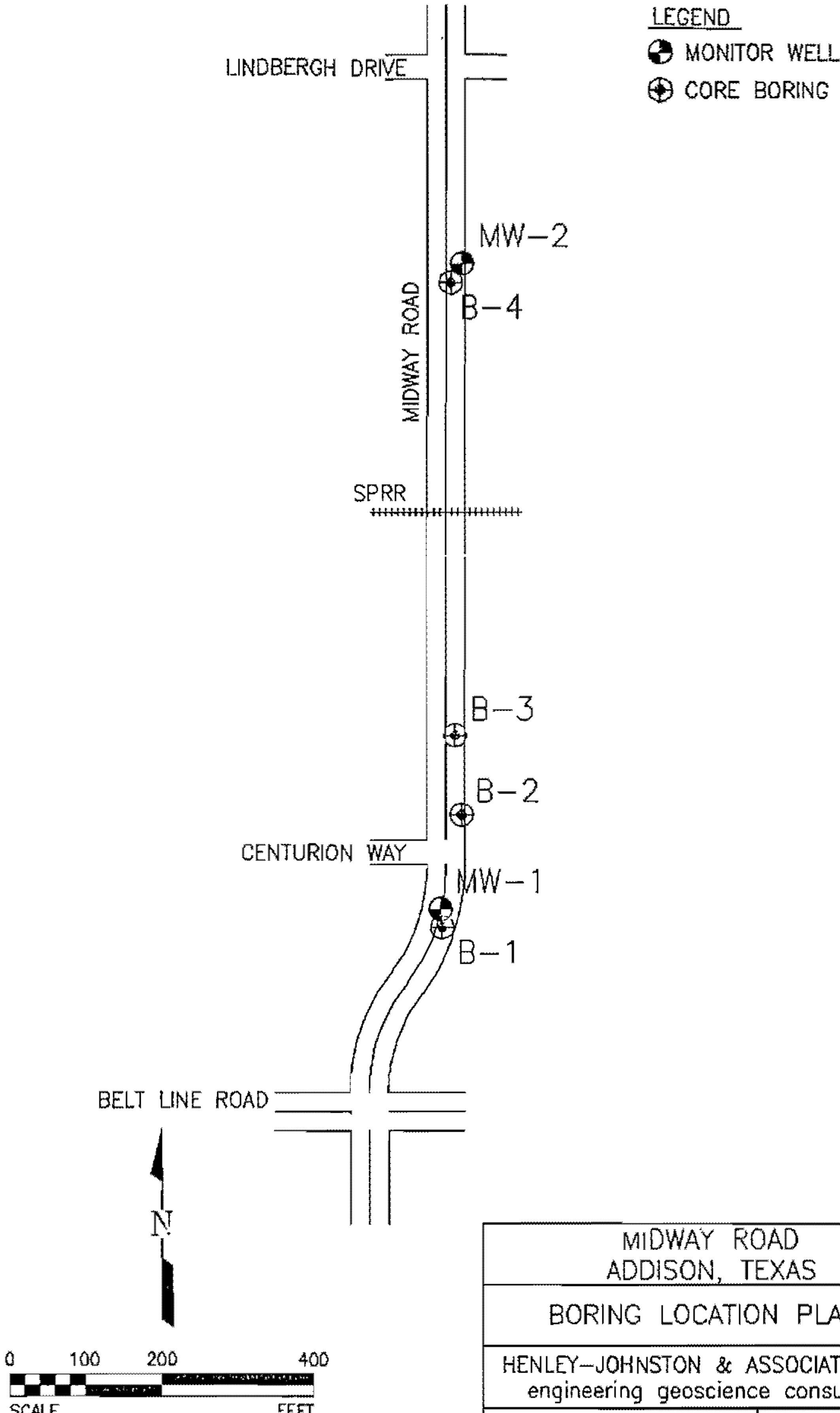
We appreciate the opportunity to work with you on this phase of the project. Please call us when we can be of further service during later stages of design or during construction.

STATE OF TEXAS
JOHN W. JOHNSTON
30968
REGISTERED
PROFESSIONAL ENGINEER

Respectfully submitted,

John W. Johnston, P.E.
Henley-Johnston & Associates, Inc.

JWJ
HJA No. 7025
9 September 1999



MIDWAY ROAD
ADDISON, TEXAS

BORING LOCATION PLAN

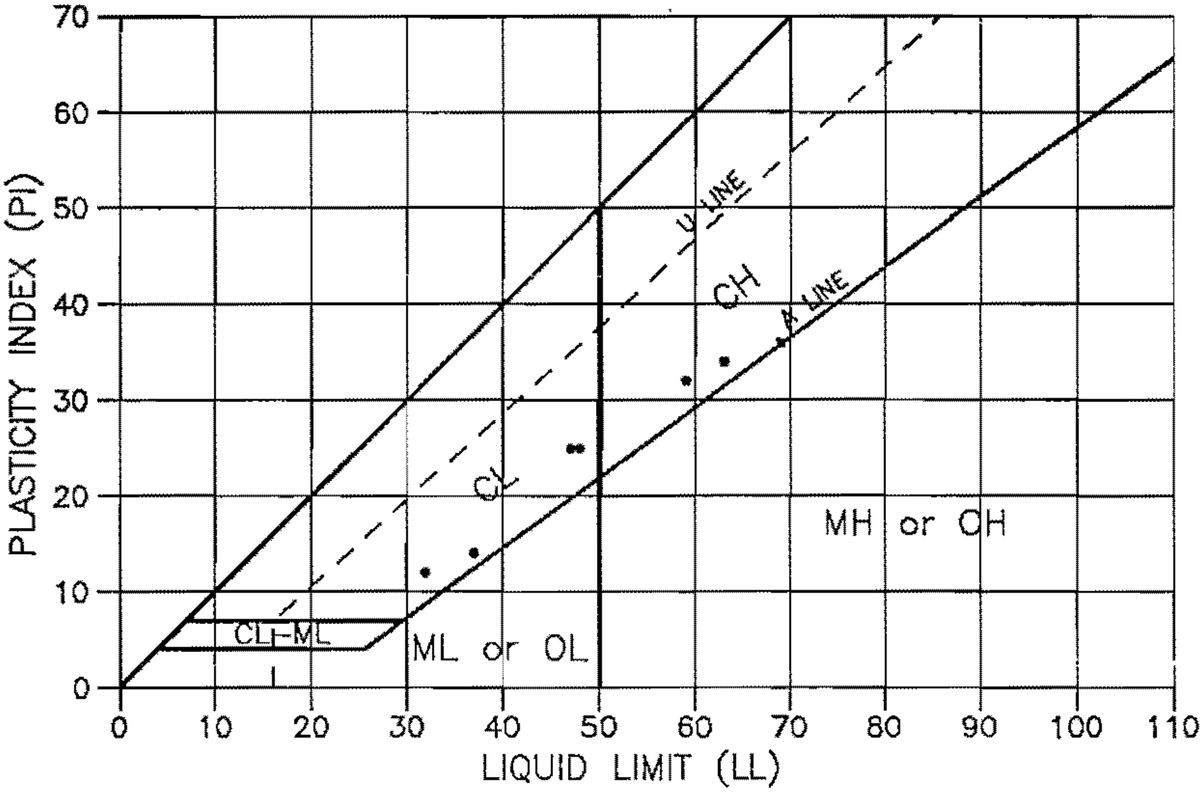
HENLEY-JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

HJA No.: 7025	PLATE 1
DATE: SEPTEMBER 1999	

MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

SUMMARY OF INDEX PROPERTIES

BORING NUMBER	DEPTH (ft.)	LL (%)	PI	MC (%)	DUW (pcf)	UNIFIED SOIL CLASSIFICATION
MW-1	0.0-1.8			15.9		
MW-1	1.8-2.5	48	25	19.0		CL
MW-1	2.5-4.0			16.3		
MW-1	9.0-10.0			17.2		
MW-1	14.0-15.0			17.6		
MW-1	19.0-20.0			17.4		
MW-2	0.6-2.2			40.4	79.1	
MW-2	2.2-3.8	69	36	39.3	79.0	CH
MW-2	3.8-5.0			23.1	103.2	
MW-2	9.0-10.0			15.3		
MW-2	14.0-15.0			11.9		
B-1	0.8-2.0	37	14	21.0	105.5	CL
B-1	2.0-3.5			16.6		
B-2	0.6-1.7	32	12	21.3		CL
B-2	1.7-3.5			14.3		
B-3	0.6-1.4			37.0		
B-3	1.4-2.2	59	32	29.6	101.4	CH
B-3	3.0-3.5	47	25	23.3		CL
B-4	0.6-1.3			23.7		
B-4	1.3-2.2	63	34	32.4	90.5	CH



SUMMARY OF ATTERBERG LIMITS

BORING NUMBER	SAMPLE DEPTH,ft.	LIQUID LIMIT	PLASTICITY INDEX	UNIFIED SOIL CLASSIFICATION
MW-1	1.8-2.5	48	25	CL
MW-2	2.2-3.8	69	36	CH
B-1	0.8-2.0	37	14	CL
B-2	0.6-1.7	32	12	CL
B-3	1.4-2.2	59	32	CH
B-3	3.0-3.5	47	25	CL
B-4	1.3-2.2	63	34	CH

MIDWAY ROAD
ADDISON, TEXAS

SUMMARY OF ATTERBERG LIMITS

HENLEY-JOHNSTON & ASSOCIATES,INC.
engineering geoscience consultants

HJA NO.: 7025
DATE TESTED: 06/28/99

PLATE 3

MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

SUMMARY OF LABORATORY TESTS ON CONCRETE CORE

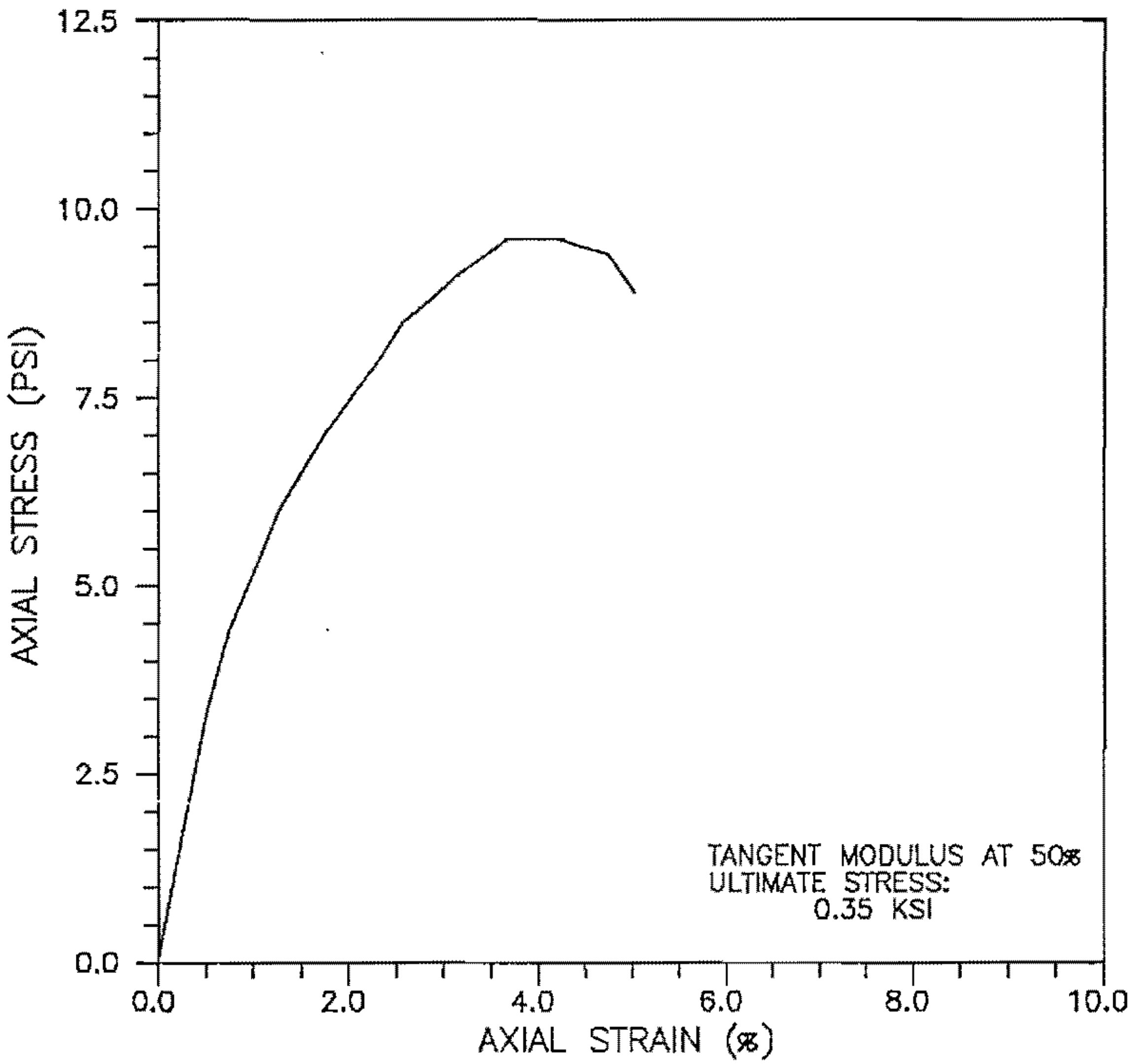
BORING NUMBER	PAVEMENT THICKNESS (in.)	SAMPLE HEIGHT (in.)	SAMPLE DIAMETER (in.)	COMPRESSIVE STRENGTH (psi)
MW-2	7.8	5.594	2.777	5018
B-1	8.4	5.679	2.775	5610
B-2	7.8	6.094	2.778	5378
B-3	7.8	5.502	2.773	5728
B-4	7.8	4.114	2.772	6060

MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

SUMMARY OF LABORATORY STRENGTH TESTS

BORING NUMBER	DEPTH (ft.)	POCKET PENETROMETER (tsf)	PEAK STRESS (psi)	FAILURE STRAIN (%)	TANGENT MODULUS (ksi)	MATERIAL TYPE
MW-2	0.6-2.2	3.0	9.6	3.7	0.35	CLAY, slightly silty, dark gray
MW-2	2.2-3.8	3.0	16.0	12.0	0.15	CLAY, slightly silty, dark gray
MW-2	3.8-5.0	4.5+	15.2	4.7	0.46	CLAY, slightly silty, dark gray
B-1	0.8-2.0	3.5 (top) 4.5+ (bottom)	22.1	3.0	0.94	CLAY, silty, brown
B-2	0.6-1.7	4.5+				LIMESTONE, weathered, light brown, brown, and tan
B-3	1.4-2.2		35.1	2.6	2.78	CLAY, silty, dark brown (FILL)
B-3	2.2-2.6	4.5+				CLAY, silty, dark brown (FILL)
B-4	1.3-2.2	3.0	25.8	14.3	0.94	CLAY, slightly silty, dark gray
B-4	2.2-3.8	3.75				CLAY, slightly silty, dark gray

BORING NO.: MW-2
DEPTH (FT): 0.6-2.2
CLAY, slightly silty,
dark gray

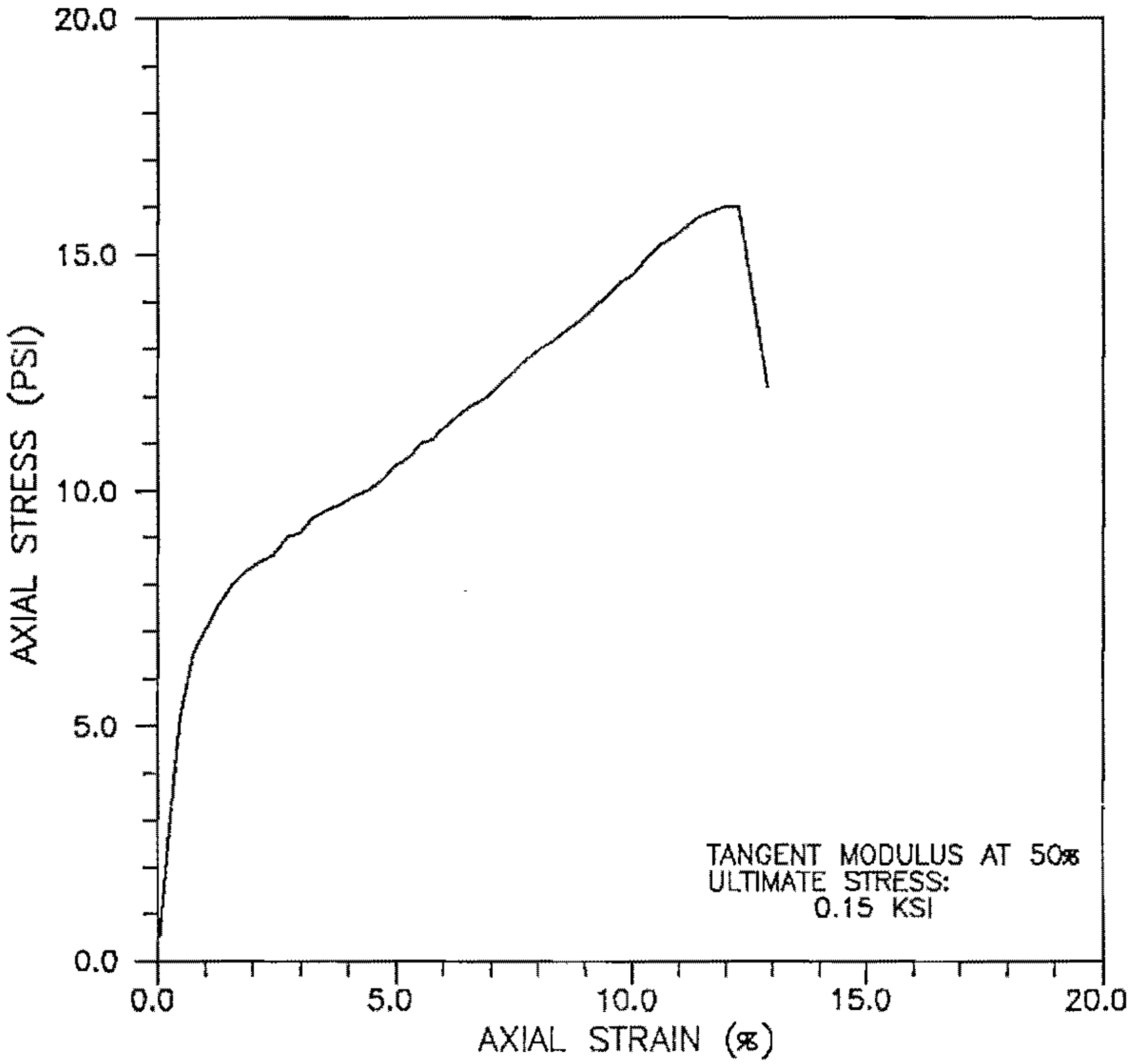


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 40.4
DRY UNIT WEIGHT (PCF): 79.1

MIDWAY ROAD ADDISON, TEXAS
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants
HJA NO.: 7025 DATE TESTED: 06/26/99 — PLATE 6

BORING NO.: MW-2
DEPTH (FT): 2.2-3.8
CLAY, slightly silty,
dark gray

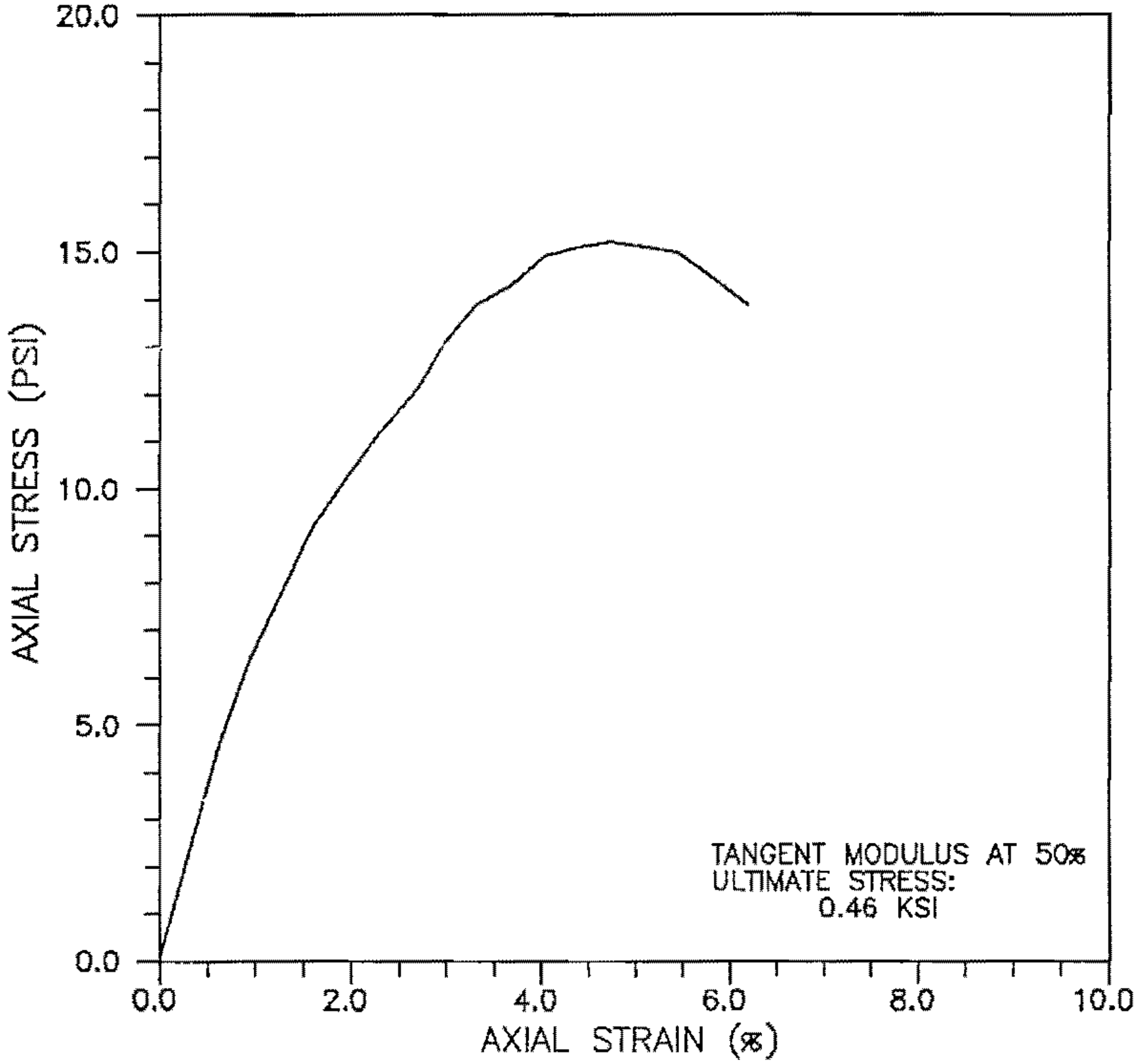


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 39.3
DRY UNIT WEIGHT (PCF): 79.0

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES,INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 7
DATE TESTED: 06/26/99	

BORING NO.: MW-2
DEPTH (FT): 3.8-5.0
CLAY, slightly silty,
dark gray

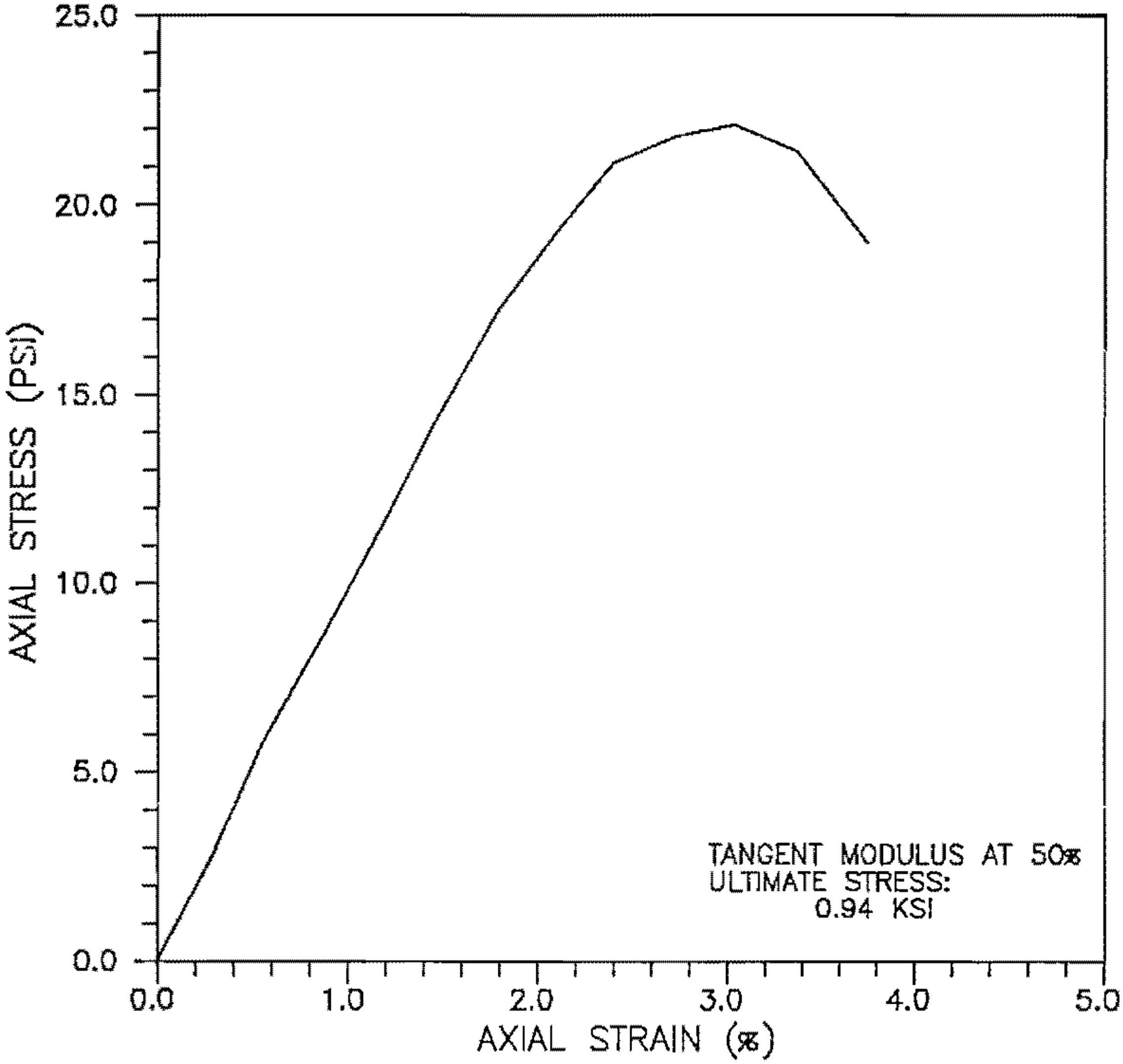


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 23.1
DRY UNIT WEIGHT (PCF): 103.2

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES,INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 8
DATE TESTED: 06/26/99	

BORING NO.: B-1
DEPTH (FT): 0.8-2.0
CLAY, silty, brown

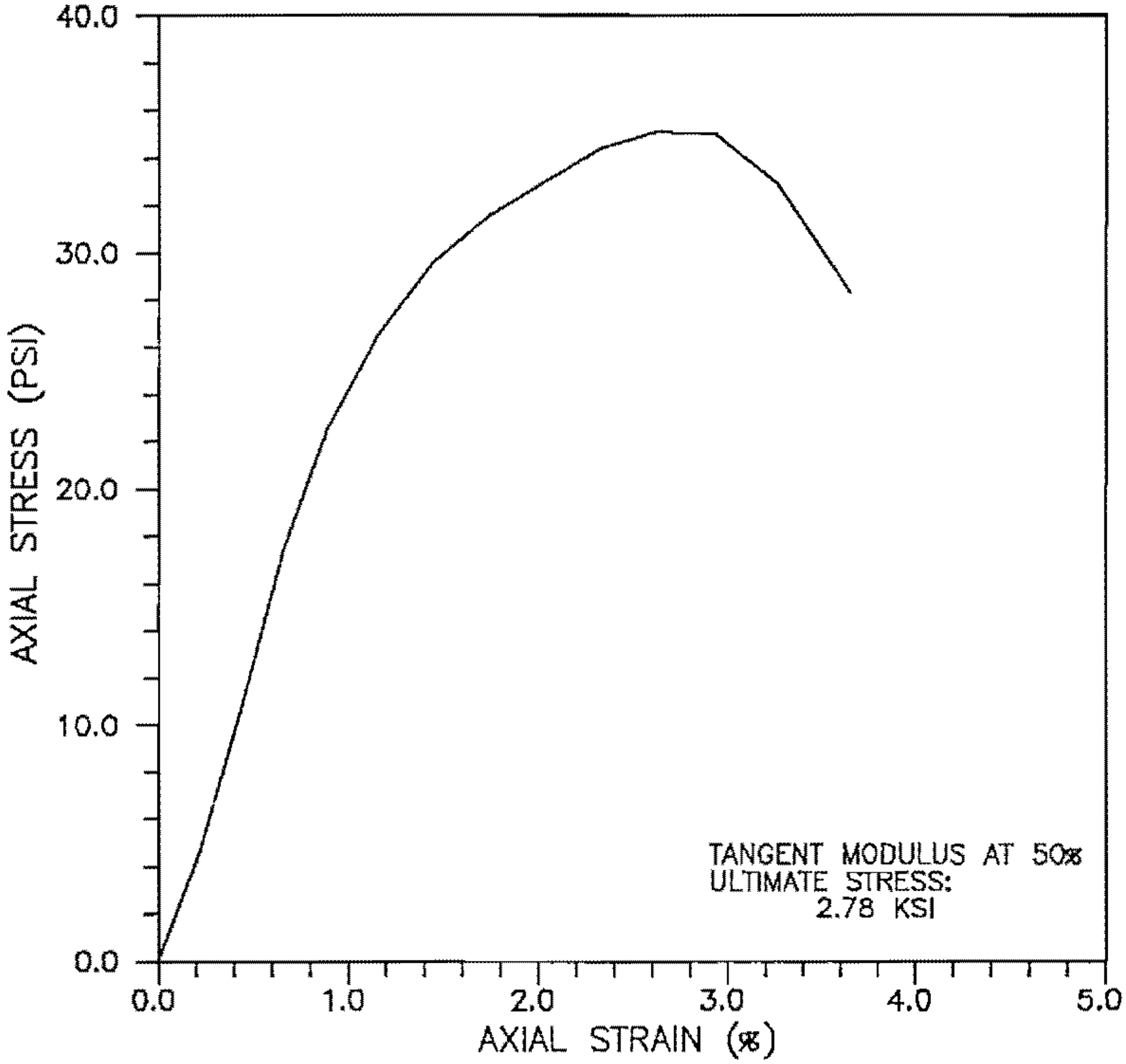


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 21.0
DRY UNIT WEIGHT (PCF): 105.5

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	
HJA NO.: 7025 DATE TESTED: 06/26/99	PLATE 9

BORING NO.: B-3
DEPTH (FT): 1.4-2.2
CLAY, silty, dark brown
(FILL)

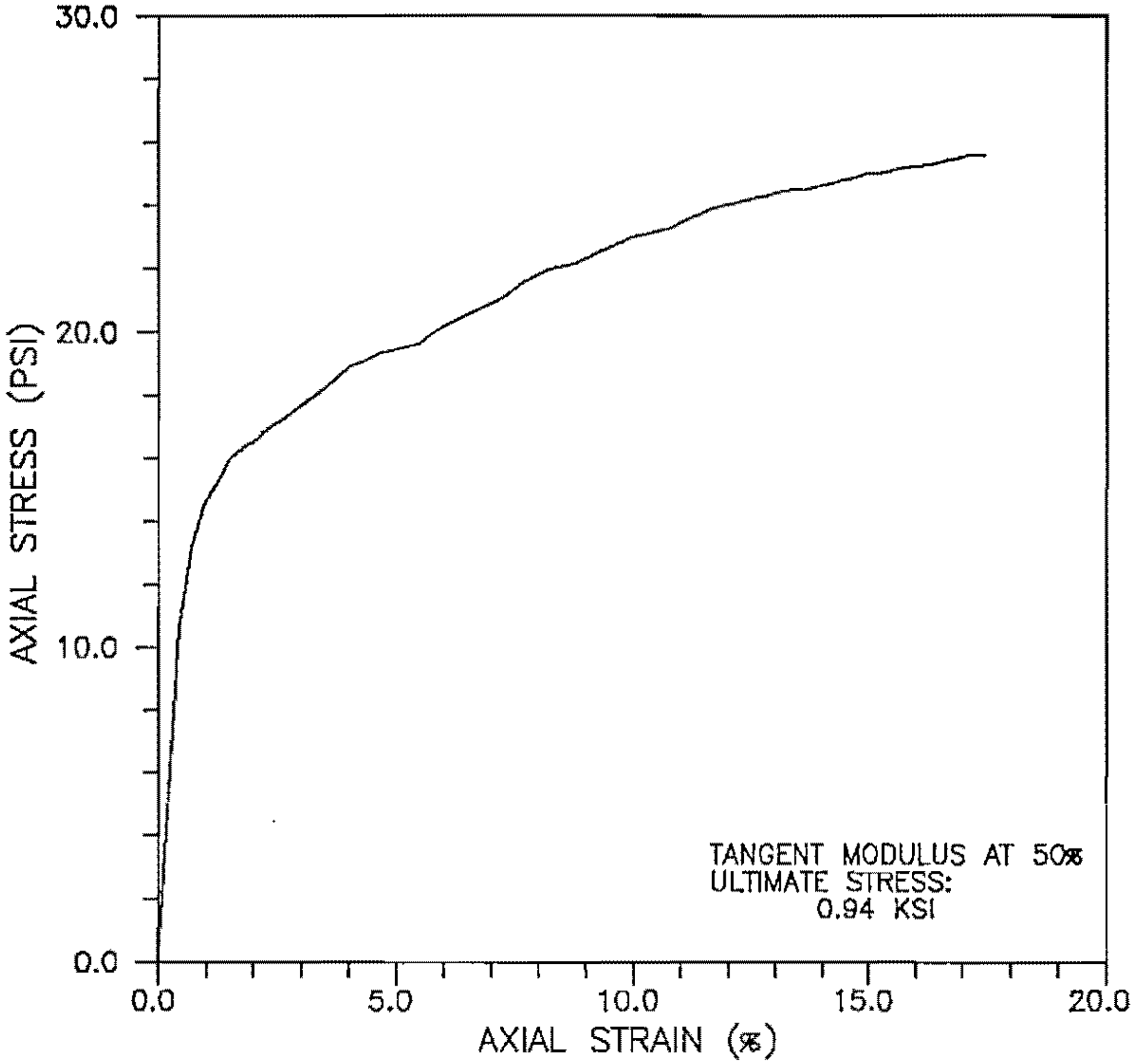


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 29.6
DRY UNIT WEIGHT (PCF): 101.4

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES,INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 10
DATE TESTED: 06/26/99	

BORING NO.: B-4
DEPTH (FT): 1.3-2.2
CLAY, slightly silty,
dark gray



TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 32.4
DRY UNIT WEIGHT (PCF): 90.5

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES,INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 11
DATE TESTED: 06/26/99	

SOUTHERN
SPECTROGRAPHIC
LABORATORY

P.O. BOX 153469
IRVING, TEXAS 75015-3469
TEL. (972) 986-1745
METRO (972) 399-1828
FAX (972) 399-1828

September 7, 1999

Henley Johnston & Associates, Inc.
Attn: John W. Johnston
235 Morgan Ave.
Dallas, Texas 75203-1088

Report#: 0737-28-160

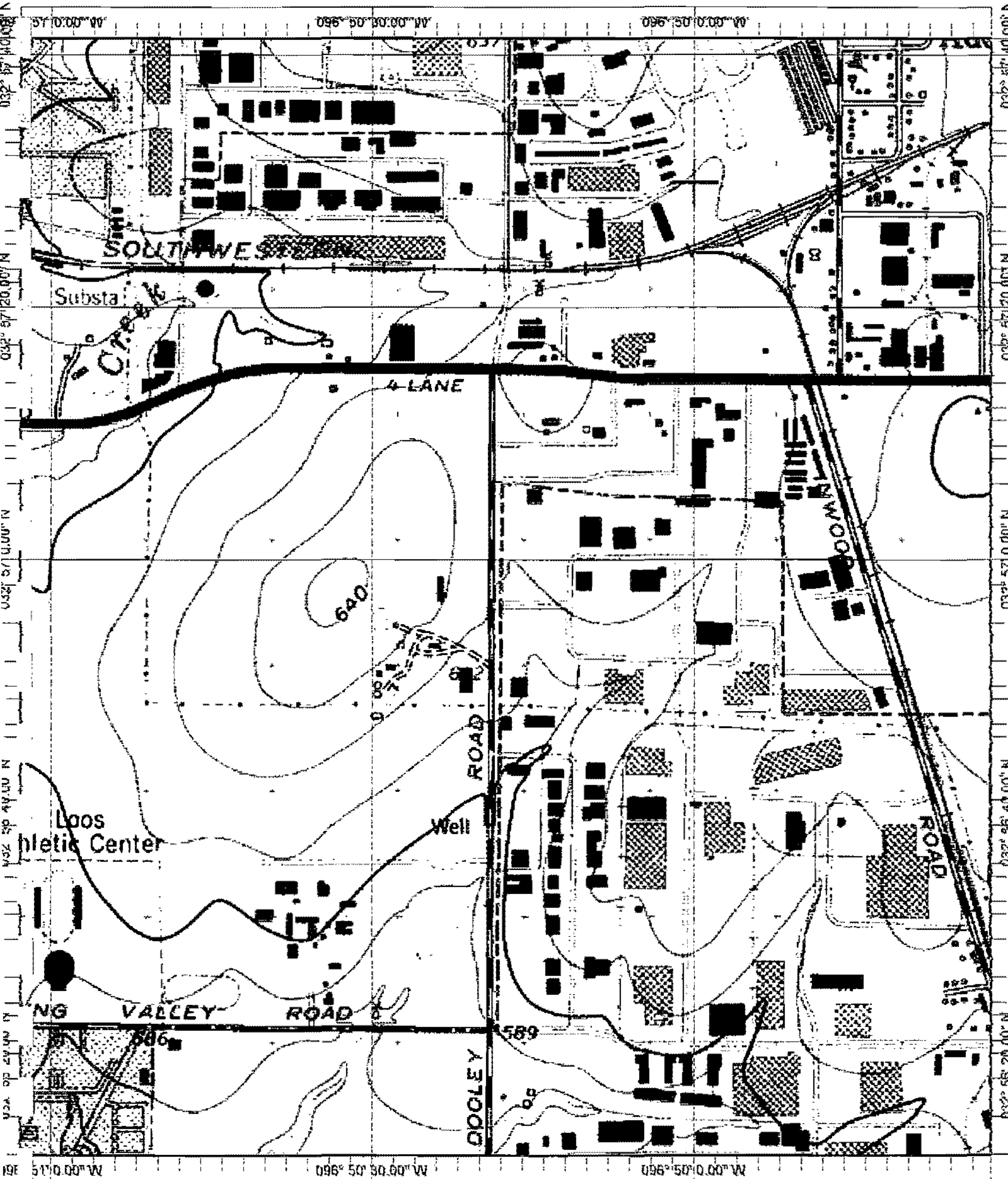
Re: Evaluation of water samples
Date Taken (7/28/99)

Sample ID	Sodium	Potassium	Chloride	Sulfate (Mg/l)	Fluoride	Total Chlorine
7025 B-1 (0612)	19.1	15.3	17	48	0.6	< 0.1
7025 B-2 (0624)	17.8	9.0	21	56	0.4	< 0.1
7025 B-3 (0637)	17.7	4.0	17	53	1.0	< 0.1
7025 B-4 (0703)	15.5	6.7	19	37	0.4	< 0.1
7025 MW-1 (0600)	22.5	3.2	24	68	0.3	< 0.1
7025 MW-2 (0654)	168	5.0	17	351	0.8	< 0.1
Reference Tap Water	12.1	3.9	17	35	0.7	< 0.1

Comments

The above listed ion ratios indicate that the water in samples B-1, B-2, B-3, & B-4 are very similar to those of the tap water. MW-1 appears to be reasonably similar to the tap water with the possibility of some evaporative concentration and/or influence from residual soluble salts in the soil. Another sample from MW-1 may show a close match to the tap water. MW-2 appears to be majorly from a source other than tap water.

Gary Cude, CPC



Name: ADDISON
Date: 9/7/99
Scale: 1 inch equals 1000 feet

Location: 032° 56' 57.2" N 096° 50' 17.5" W

PLATE 13

CLASSIFICATION SYMBOLS

SOIL	
	Asphalt or Lignite
	Concrete
	Fill
GW	Gravel or Sandy Gravel well graded
GP	Gravel or Sandy Gravel poorly graded
GM	Silty Gravel or Silty Sandy Gravel
GC	Clayey Gravel or Clayey Sandy Gravel
SW	Sand or Gravelly Sand well graded
SP	Sand or Gravelly Sand poorly graded
SM	Silty Sand or Silty Gravelly Sand
SC	Clayey Sand or Clayey Gravelly Sand
ML	Silts, Sandy Silts, Gravelly Silts, or Diatomaceous Soils
CL	Lean Clays, Sandy Clays, or Gravelly Clays
OL	Organic Silts or Lean Organic Clays
MH	Micaceous Clays or Diatomaceous Soil
CH	Fat Clays
OH	Fat Organic Clays
ROCK	
Ls	Limestone
Sh	Shale
	Marl
Ss	Sandstone
	Fracture Zone
	Weathered Zone

ABBREVIATIONS

abnt.	abundant
ang.	angular
aren.	arenaceous
arg.	argillaceous
bdd.	bedded
bdg.	bedding
bent.	bentonite
bldr.	boulder
BT	Brazil Tensile
calc.	calcareous
carb.	carbonaceous
cbl.	cobble
cgl.	conglomerate
clst.	claystone
cmt.	cemented
dia.	diameter
dk.	dark
DUW	Dry Unit Weight
El.	elevation
fossil.	fossiliferous
frac.	fracture
gyp.	gypsiferous
incl.	inclusion
intbdd.	interbedded
jnt.	joint
lam.	laminated
LL	Liquid Limit
lt.	light
MC	Moisture Content
ME	Modulus of Elasticity
med.	medium
min.	minutes
mod.	moderately
nod.	nodule
occ.	occasional
part.	particle
Pen.	Penetrometer
phos.	phosphotic
PI	Plasticity Index
py.	pyritized
Qu	Unconfined Compression
Rec.	recovery
rnd.	rounded
RQD	Rock Quality Designation
sat.	saturated
sept.	septarian
sev.	severely
sil.	siliceous
sli.	slightly
slk.	slickensided
T.D.	Total Depth
v.	very
wea.	weathered

CONSISTENCIES AND HARDNESS DESCRIPTIONS

FOR SANDS, GRAVELS, & SANDY SILTS

Peck, Hanson & Thornburn (1974)

Consistency	Standard Penetration Resistance N
Very Loose	Less than 4
Loose	4 to 10
Medium	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

FOR CLAYS & SANDY CLAYS (COHESIVE SOILS)

Peck, Hanson, & Thornburn (1974)

Consistency	Unconfined Compression tsf	Standard Penetration Resistance N
Very Soft	Less than 0.25	Less than 2
Soft	0.25 to 0.5	2 to 4
Medium	0.5 to 1.0	4 to 8
Stiff	1.0 to 2.0	8 to 15
Very Stiff	2.0 to 4.0	15 to 30
Hard	Greater than 4.0	Greater than 30

RELATIVE HARDNESS MODIFERS (ROCK) (RELATED TO FRESH SAMPLE)

Modified from SCS EWP. Tech Guide No. 4

Hardness	Rule of Thumb Test
Soft	Permits denting by moderate finger pressure
Firm	Resists denting by fingers but can be penetrated by pencil point to medium to shallow depth (No. 2 pencil)
Mod. Hard	Very shallow penetration of pencil point, can be scratched by knife and in some instances cut with knife
Hard	No pencil penetration, can be scratched with knife, can be broken by light to moderate hammer blows
Very Hard	Cannot be scratched by knife, can be broken by repeated heavy hammer blows

MIDWAY ROAD
ADDISON, TEXAS

LEGEND, LITHOLOGY, SOIL CONSISTENCY, & RELATIVE ROCK HARDNESS

HENLEY-JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

HJA No.: 7025

DATE: SEPTEMBER 1999

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL	PROJECT No.: 7025
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 20.5'	MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	BORING No.: MW-1 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
			CLAY, silty, with calcareous nodules, weathered limestone fragments, and organics, very stiff, dark brown and brown (FILL)			Valve cover installed
2.5			CLAY, silty, with occasional calcareous nodules, very stiff, brown			2" pvc pipe
5.0			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			Grout
7.5						
10.0						Bentonite Seal
12.5						20-40 Silica sand
15.0						
17.5			LIMESTONE, moderately hard to hord, gray			.010 Slot Screen
20.0						
			TOTAL DEPTH: 20.5'			
22.5						

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	PROJECT No.: 7025 BORING No.: MW-2 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 20.5'		

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
			CONCRETE			Valve cover installed
			CLAY, lime treated subgrade (FILL)			
			CLAY, slightly silty, stiff, dark gray			
2.5						2" pvc pipe
5.0			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			Grout
7.5						
10.0						Bentonite Seal
12.5			LIMESTONE, moderately hard to hard, gray			
						.010 Slot Screen
15.0						
17.5						20–40 Silica sand
20.0						
			TOTAL DEPTH: 20.5'			
22.5						

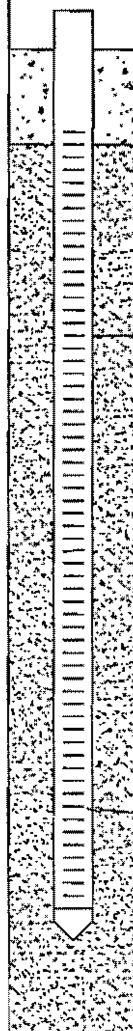
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL	PROJECT No.: 7025
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 3.5'	MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	BORING No.: B-1 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.7			CONCRETE			Valve cover installed; Grout
0.7–1.8			CLAY, silty, with occasional calcareous nodules, very stiff, brown			2" pvc pipe
1.8–3.5			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			20-40 Silica sand; .010 Slot Screen
3.5			TOTAL DEPTH: 3.5'			

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 3.5'	LOG OF BORING / MONITOR WELL MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	PROJECT No.: 7025 BORING No.: B-2 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.65			CONCRETE			Valve cover installed Grout
0.65–1.1			CLAY, silty, with calcareous nodules and weathered limestone fragments, stiff, dark brown and brown (FILL)			
1.1–3.5			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			2" pvc pipe 20-40 Silica sand .010 Slot Screen
3.5			TOTAL DEPTH: 3.5'			



Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

HENLEY-JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

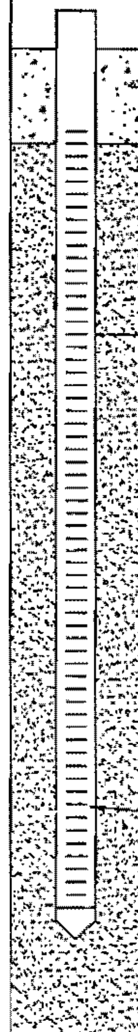
DRILL DATE: 06/19/99
METHOD: SHELBY TUBE /SPLIT SPOON TO 3.5'

LOG OF BORING / MONITOR WELL
MIDWAY ROAD
BELT LINE RD. TO LINDBERGH DR.
ADDISON, TEXAS

PROJECT No.: 7025
BORING No.: B-3
SHEET 1 of 1
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.65			CONCRETE NOTE: 1/2" VOID UNDER PAVEMENT			Valve cover installed Grout
0.65–1.4			CLAY, lime treated subgrade (FILL)			2" pvc pipe
1.4–3.0			CLAY, silty, with calcareous nodules, limestone fragments, and gravel, very stiff, dark brown (FILL)			20-40 Silica sand .010 Slot Screen
3.0–3.5			CLAY, silty, with occasional calcareous nodules, very stiff, brown			
3.5			TOTAL DEPTH: 3.5'			

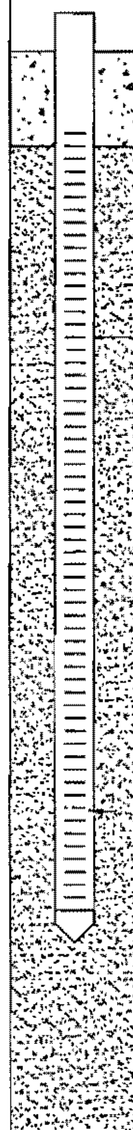
Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5



HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL MIDWAY ROAD	PROJECT No.: 7025 BORING No.: B-4
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 3.8'	BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.65			CONCRETE NOTE: 1/2" VOID UNDER PAVEMENT			Valve cover installed Grout
0.65–1.3			CLAY, lime treated subgrade (FILL)			
1.3–3.8			CLAY, slightly silty, stiff to very stiff, dark gray			2" pvc pipe 20-40 Silica sand .010 Slot Screen
			TOTAL DEPTH: 3.8'			

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5



PAVEMENT INVESTIGATION
MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

HENLEY
JOHNSTON
& ASSOCIATES, INC.
engineering geoscience consultants

(214) 941-3808 fax (214) 943-7645
235 Morgan Ave., Dallas, Texas 75203-1025

PAVEMENT INVESTIGATION
MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

For

Town of Addison, Texas

Through

Shimek, Jacobs & Finklea, L.L.P.
Dallas, Texas

INTRODUCTION

In general accordance with notice to proceed and the authorization of our 8 March 1999 proposal, we have completed a Pavement Investigation of Midway Road from Belt Line Road to Lindbergh Drive in Addison, Texas. Information relative to the scope of this project was provided through a meeting at the site and through discussions with Mr. John W. Birknoff, P.E., of Shimek, Jacobs & Finklea, L.L.P. We understand that this section of Midway Road has experienced difficulties with seepage through the joints in the pavement and vertical displacements at the joints in a longitudinal direction. The pavement was milled to create a smooth surface within the last two or three years. The vertical displacements have re-occurred to the point that many panels have vertical offsets of one inch, or more, at the present time.

PURPOSE AND SCOPE

The purpose of this investigation was to develop specific geotechnical data at the site by means of subsurface exploration, laboratory testing and engineering and geologic analyses of the resultant data from six soil borings. Shallow (less than four feet) groundwater observation elements were to be set in four boreholes to observe the water levels under the pavement and two monitor wells were to be set to observe water levels and provide access for water sampling in the deeper strata at the site. This report presents the results of the basic field and laboratory data developed and provides findings and recommendations to guide remediation of pavement. Recommendations to facilitate design and construction were made based on geological conditions encountered and geotechnical parameters obtained from this investigation. The interpretation of these data is considered appropriate to the extent that the investigated locations are typical of conditions present at the project site.

FIELD INVESTIGATION

The field or subsurface investigation conducted consisted of advancing six (6) soil borings to depths varying from about 3.5 to 20.5 feet below ground or pavement surfaces. These borings were advanced by means of a truck-mounted rotary drilling rig which employs dry sampling techniques to advance the borings. Five (5) of the borings were drilled through the pavement section of Midway Road; the concrete was cored using a 9-inch diameter diamond concrete coring bit. The drilling was performed by a Henley-Johnston & Associates, Inc., drill crew. The approximate locations of the borings drilled are indicated on Plate 1. The borings were located on the site by an HJA Engineer, using a measuring wheel and measuring from existing landmarks (roadways, railroads, curbs, etc.). The borehole locations indicated on Plate 1 are considered accurate to the degree implied by the method used.

Samples of cohesive soils and the upper strata of the weathered limestone were obtained using conventional Shelby-tube sampling techniques (ASTM D 1587) whereby a thin-walled tube is advanced into the formation by a rapid, continuous thrust from balanced hydraulic rams on the drilling rig. Disturbed, representative samples of the weathered and unweathered primary limestone strata were obtained from the auger cuttings.

All soil and limestone samples obtained from the borings were encased in polyethylene plastic to prevent changes in moisture content and to preserve in situ physical properties. All samples were classified as to basic type and texture in the field by an experienced Engineering Geologist, labeled as to appropriate boring number and depth, and placed in core boxes for transport to the laboratory. The concrete cores were returned to the laboratory where 2-3/4-inch diameter cores were cut for compressive strength testing of the concrete.

Groundwater was not encountered during the course of this investigation. Upon completion of drilling, temporary groundwater observation elements were set in each open borehole. The risers and wellscreens set in Boring Nos. MW-1 and MW-2 were sealed from surface infiltration of water by a 10-foot grout section over a 2-foot bentonite section. Below the grout/bentonite seal, the wellscreen was surrounded by 20/40 silica sand. Valve covers were grouted over the tops of these installations. In the shallow borings (B-1 through B-4) through the pavement, the wellscreens extended up to approximately the bottom of the pavement and were surrounded by 20/40 silica sand. Above that level, grout seals which also hold valve covers in place, were formed to prevent surface water from accessing the observation units. Details depicting each specific installation are appended hereto following the report illustrations.

LABORATORY TESTING

All soil samples were classified in accordance with the Unified Soil Classification System. Rock samples of the primary strata were described using standard geologic terms. Terms and symbols used on the boring logs are described on the enclosed sheet entitled "Legend, Lithology, Soil Consistency & Relative Rock Hardness."

To aid in the classification process, Atterberg Limits, Moisture Content and Dry Unit Weight tests were performed on representative samples. All of the above test data are summarized on Plate 2. Atterberg Limits also are presented on the Plasticity Chart on Plate 3.

Compressive Strength tests were performed on cores from the concrete pavement at each boring located in the pavement section. The results of these tests are presented on Plate 4.

The strength of each cohesive sample was estimated using a hand penetrometer. The results of these estimates are tabulated on Plate 5. The strength properties of selected soil samples were investigated by Unconfined Compression tests. In this test, axial load is applied to a laterally unsupported cylindrical sample until failure occurs within the sample. This test is conducted fairly rapidly (failure within about 10 minutes) and generally conforms to ASTM D 2166. The Elastic Modulus values were interpreted from the stress-strain curves of the Unconfined Compression tests using a tangent modulus at 50 percent of peak strength. The soil strength test data are summarized on Plate 5. Stress-strain data for the Unconfined Compression tests are presented graphically on Plates 6 through 11.

Water samples obtained from each boring location and from a nearby source of tap (municipal) water were tested by Southern Spectrographic Laboratory, Irving, Texas. The results of those tests and a brief statement from Southern Spectrographic about the anticipated sources of the water are presented on Plate 12.

SUBSURFACE CONDITIONS

The site of this investigation is in Addison, Texas, along the northbound lanes of Midway Road between Belt Line Road to the south and Lindbergh Drive to the north, as shown on Plate 1. A section of the "ADDISON" USGS quad sheet topographic map which includes this area is presented on Plate 13. This indicates that the roadway drops about 10 feet in elevation from Belt Line Road to the creek/railroad track, and remains fairly level or slightly uphill from the railroad track to Lindbergh Drive. Primary sediments at the site have been identified as limestone strata of the Austin Chalk Formation of Cretaceous Age. The specific types, depths, and thicknesses of materials penetrated by the borings are reflected on the individual "Log of Boring" illustrations.

7.8" 8.4"

Five of the borings were drilled through the concrete pavement of Midway Road. The concrete was found to be between 0.65 and 0.7 feet in thickness. Fill materials were encountered below the pavement in all borings except Boring No. B-1 and below ground surface in Boring No. MW-1. These fill materials extend to depths ranging from about 1.1 feet in Boring No. B-2 to about 3.0 feet in Boring No. B-3. The upper portion of the fill in Boring No. B-3 and the fill in Boring No. B-4 is clay which is believed to have been lime-treated. The remaining fill is silty clay with calcareous nodules, and probably is on site material which was relocated to fill low areas. Below the fill or pavement in Boring Nos. MW-1, B-1 and B-3 are thin zones of silty clay which the Atterberg Limits indicate to be low to moderate plasticity materials. In Boring Nos. MW-2 and B-4, slightly silty clays were found below the fill materials. These materials are indicated to be high plasticity clays; this may explain why these materials were lime-treated. All of the clay strata encountered are dark shades of brown or gray in color. These materials are stiff to very stiff in consistency and contain varying amounts of calcareous nodules.

Below the surficial clays, limestone strata of the primary formation (Austin Chalk Formation of Cretaceous Age) were encountered. The uppermost portions of the limestone were found to be variably weathered, having been leached by percolating waters over time. These weathered materials are generally severely to moderately weathered, jointed and fractured and contain occasional soft clayey seams. The weathered section is typically firm to moderately hard in rock hardness and light brown and tan in color. The weathered sections of limestone materials encountered ranged in thickness from about 8.5 feet in Boring No. MW-2 to about 14.5 feet in Boring No. MW-1.

Unweathered limestone strata were encountered below the zone of differential weathering at depths varying from about 13 feet in Boring No. MW-2 to about 17 feet in Boring No. MW-1. Once encountered, the unweathered limestone strata continued to at least the 20.5-foot maximum depth explored. Data from other investigations nearby indicate that the unweathered limestone is in excess of 30 feet thick in this vicinity. The unweathered limestone is moderately hard to hard in rock hardness and gray in color.

Groundwater was not encountered during the course of this investigation prior to the installation of the water level observation elements and monitor wells. Groundwater in this vicinity is typically perched on top of the unweathered limestone and is contained within joints and fractures present within the weathered limestone materials and within the silty clay overburden soils. Groundwater levels at this site can be expected to fluctuate with seasonal variations in rainfall.

Water levels were measured in each observation element installation. The following table provides the results of these water level readings.

	Location	6-25-99	7-28-99	Δ water level
similar tap water	MW-1	8.9	9.5	+0.6
very close to tap water	B-1	2.6	2.6	constant
	B-2	0.5	1.6	+1.1
	B-3	0.4	0.8	+0.4
	B-4	0.7	0.7	constant
not tap water	MW-2	4.6	6.2	+1.6

All of the elements, except Boring No. B-1, were bailed to within a few inches of the bottom of the installation on 25 June 1999 after water level readings were obtained. The water found in the elements on 28 July 1999 had entered the installations since the 25 June readings.

WATER LEVELS AND SOURCES

Based on approximate elevations from the topographic map on Plate 13, we estimate that the surface elevation at Boring No. MW-1 is about Elevation 625 and the surface elevation at Boring No. MW-2 is about Elevation 622. The flow line of the creek south of the railroad is estimated to be at about Elevation 610 to 620. The water level measurements in Boring Nos. MW-1 and MW-2 ("deep" installations) indicate that these levels are probably near the flow line elevation of Rawhide Creek.

The water level observed in Boring No. B-1 has remained relatively constant, indicating that water has not been coming into the installation during the observation period. The other three "shallow" installations have shown increases in water level during a time when little or no rain has fallen in the area; consequently, these elements indicate water infiltration from sources other than rainfall. During the same period of time, the water levels in Boring Nos. MW-1 and MW-2 have decreased.

The data from Southern Spectrographic indicate that the chemistry of water found in Boring Nos. B-1, B-2, B-3, and B-4 is very close to that of the referenced tap (municipal) water. The elevated potassium levels, we understand, are generally related to water migrating through fertilized areas (landscaped areas, etc.). The chemistry of water sampled from Boring No. MW-1 is similar to that of the tap water, but has higher concentrations of sodium, chloride, and sulfate, and less fluoride than tap water. The chemistry of water from Boring No. MW-2 appears to be predominantly from some source other than tap water.

Based on the information from the water observation and sampling installations, water chemistry tests, and our observations at the site; it is our opinion that water which has emitted from the joints in the pavement on Midway Road probably is related to tap water (irrigation or water from nearby businesses) or surface run-off. It would be advantageous to be able to observe these installations and obtain samples of water during a rainy period. Water has easy access to the subgrade soils through open joints in the pavement. Water can flow from landscaped areas in the median or along the outside of the pavement through open joints in the curbs and pavement to the subgrade soils. We have observed water flowing into the street from one of the businesses near Belt Line Road; this water flows downhill on Midway Road, encounters open joints and travels transversely until it can soak into the subgrade.

PAVEMENT ANALYSES

Traffic counts on Midway Road for Tuesday and Wednesday, 30 and 31 March, 1999, were provided to us. The 24-hour traffic volume in one northbound lane (outside) was divided into thirteen types of vehicles. We have used the program "Concrete Pavement Technology, Version 2.0" from the American Concrete Pavement Association to perform pavement analyses based on available information from this investigation. This program is based on the 1986 "AASHTO Guide for the Design of Pavement Structures."

We have used the following general design parameters:

Serviceability	
Initial	4.5
Terminal	2.25
Design Life	20 Years
Reliability	90 percent
Overall Deviation	0.35
Load Transfer	3.2 - assuming edge support and aggregate interlock for existing pavement
	2.7 - assuming edge support and dowelled reinforced pavement for future pavement
Drainage Coefficient	Variable for existing pavement - 0.8, 1.0, 1.1
	For potential future pavement - 1.0
Traffic Growth Rate	0.325 percent/year

For analysis of the existing pavement, we estimated the flexural strength of the concrete from the compressive strength values of the concrete cores. These flexural strength values varied from about 640 to 700 psi. For concrete near the south end of the site, we used a value of 660 psi; for the pavement near Lindbergh Drive, we used a value of 640 psi. For potential future pavement sections, we used a value of 650 psi.

For analyses of existing and future pavement, we have assumed that the subgrade materials have a CBR value of about 3, and have used a Resilient Modulus of 4500 psi. For lime-treated soils we have used a Resilient Modulus of 20,000 psi, and for asphalt treated base, we have used a Resilient Modulus of 350,000 psi.

For 8-inch (0.65 to 0.7-foot) thick pavement, the total ESAL's for 20-year life of the pavement is about 14,100,000 assuming the traffic volume indicated by the March traffic count. For existing conditions, with a Drainage Coefficient of 0.8, indicating poor drainage as observed in place, the design life of the pavement is slightly more than one year. Assuming better drainage conditions with a Drainage Coefficient of 1.0, the design life increases to about 2.3 years and with good drainage conditions, a Drainage Coefficient of 1.1, the design life increases to about 3.2 years.

This indicates that the traffic volume currently using Midway Road is significantly in excess of the volume that would be expected for a 20 or 30-year design life for the pavement in place.

The moisture contents of the near-surface soils (subgrade materials) are relatively high at all boring locations. Indications are that these soils have been saturated and remain saturated over long periods of time. We believe that this has resulted in softening of the soils at the south end of each pavement panel and settlement of that end of the panel. In some cases, this has resulted in a reverse rocking of the panel and the creation of a void under the north end of the panel. Because of these physical movements of some of the panels and the deterioration of the subgrade under the panels, we recommend that the existing pavement be removed, the subgrade be reworked and new pavement be placed. Recommendations for the replacement of this pavement are contained in subsequent paragraphs.

Pavement analyses indicate that the following sections could be used as replacements for the pavement along Midway Road.

20-year Life

10-inch Reinforced Concrete Paving
12-inch Compacted Lime-Treated Subgrade
or
10-inch Reinforced Concrete Paving
4-inch Compacted Asphalt-Treated Base

30-year Life

11-inch Reinforced Concrete Paving
12-inch Compacted Lime-Treated Subgrade
or
11-inch Reinforced Concrete Paving
4-inch Compacted Asphalt-Treated Base

An alternative to complete replacement is to provide remediation of the loss of support under the panels and a concrete pavement overlay. Loss of support may be remediated by removal and replacement of the ends of the panels (with appropriate subgrade conditioning and compaction) or by selective grouting under the ends of the panels. The concrete overlay should be jointed, reinforced concrete with a 9-inch overlay for 20-year life and a 10-inch overlay for 30-year life. This will require transition zones where the pavement has to meet existing grades at intersections, railroad tracks and other features.

In the event concrete is to be removed and replaced, after the soil surface in each area has been brought to grade, the performance of pavement can be enhanced by treating the clay soils exposed at grade with lime-slurry for use as sub-base. Subject to modification during construction, a lime content of six (6) percent by dry soil weight (approximately 6 pounds of lime per cubic foot of soil treated) would be expected to effectively treat the subgrade soil.

Soils treated with lime-slurry for use as sub-base should be compacted to a dry density at least 95 percent of the maximum dry density as defined by ASTM D 698 and at a moisture content at least 2 percentage points above Optimum Moisture content.

Good surface drainage and treatment of adjacent landscaping areas to control irrigation water are necessary to minimize moisture changes in the subgrade. We recommend that the irrigation water be collected in a drain along the median and the sidewalk on either side of the pavement, and directed into storm drains or Rawhide Creek, as permitted. Alternatively, a moisture barrier may be formed at the backside of the curb on both sides of the pavement. We recommend that such a barrier extend at least two feet below grade. All joints should be sealed and the sealant maintained throughout the lifetime of the pavement.

For reinforced concrete paving, it is essential that any and all reinforcing be placed so as to insure a minimum of $1^1/_2$-inches of cover. Selection of the proper section should be based on anticipated traffic loads, frequency and long term maintenance, as well as project economics.

EARTHWORK

Earthwork recommendations are as follow:

1. Excavate and waste, or store for future use, surficial organic, deleterious, and concrete materials encountered at the surface.

2. Scarify subgrade soils exposed in fill areas and transitional areas (cut to fill and fill to cut) to a depth of approximately eight (8) inches, add moisture (if required), mix and recompact to a density between 95 and 98 percent of maximum density obtained by a Standard Proctor Compaction Test (ASTM D 698). The moisture content of the compacted soils should be maintained between optimum and plus four percent of the optimum value (determined by ASTM D 698) until covered by fill or pavement.

3. Place fill soils for pavement in loose lifts not exceeding eight (8) inches and compact to the moisture/density values specified in No. 2 above.

shouldn't need

4. We recommend that imported select fill material consist of inert sandy clay (material with greater than 50 percent passing the No. 200 mesh sieve) with a Liquid Limit less than 35 and a Plasticity Index between 6 and 15, or flexible base materials meeting the requirements of Texas Department of Transportation Item 247, Type 1, Grade A.

QUALIFICATIONS

In the event that any changes in the nature, design or location of the proposed pavement are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

The analyses and recommendations submitted in this report are based in part upon the data obtained from six borings. The nature and extent of subsurface variations at the site may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.

It is recommended that the soil and foundation engineer be provided the opportunity for general review of final design drawings and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design drawings and specifications.

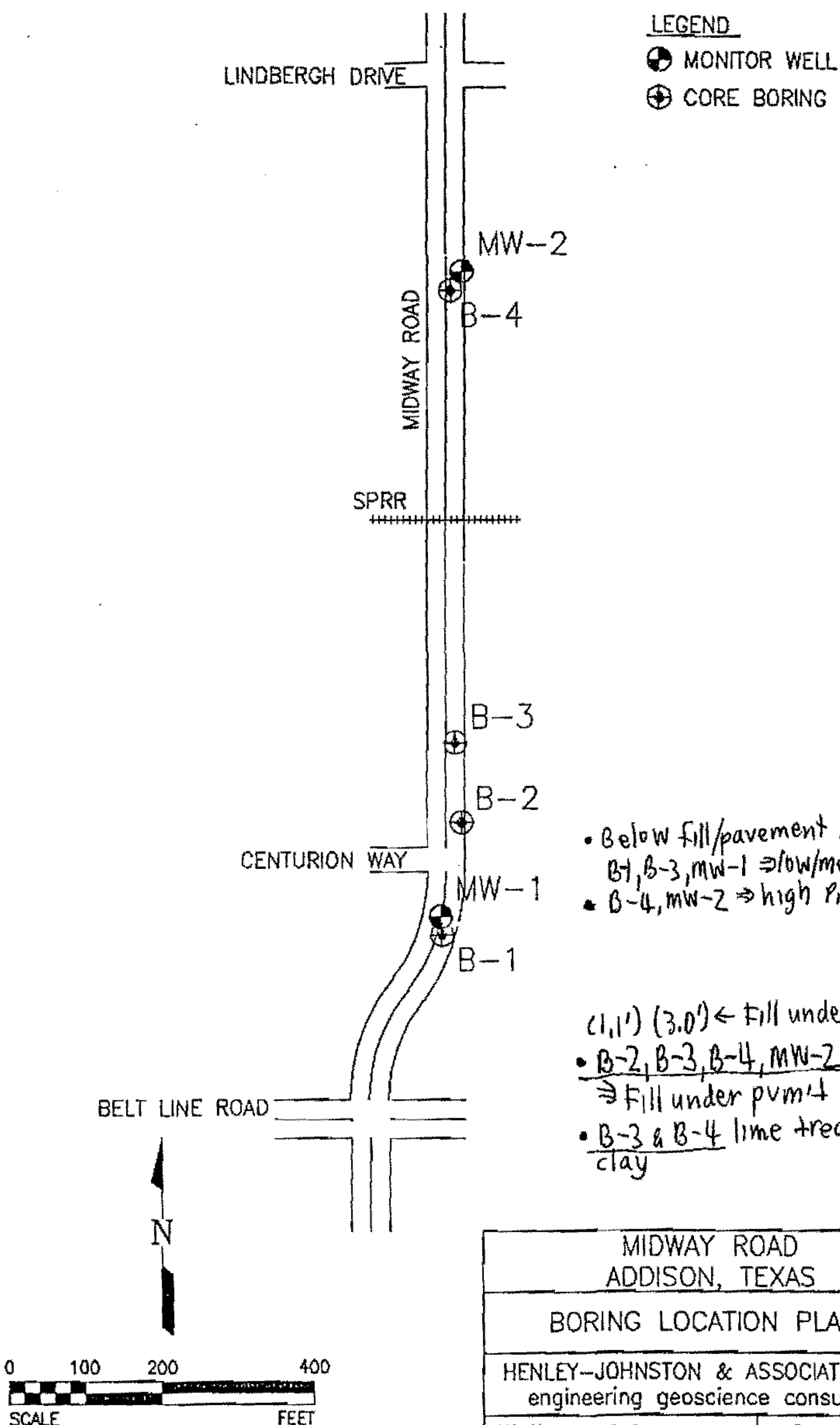
We appreciate the opportunity to work with you on this phase of the project. Please call us when we can be of further service during later stages of design or during construction.

STATE OF TEXAS
JOHN W. JOHNSTON
30968
REGISTERED
PROFESSIONAL ENGINEER

Respectfully submitted,

John W. Johnston, P.E.
Henley-Johnston & Associates, Inc.

JWJ
HJA No. 7025
9 September 1999



- Below fill/pavement at B-1, B-3, MW-1 ⇒ low/moderate P.I.
- B-4, MW-2 ⇒ high P.I.

(1.1') (3.0') ← Fill under pvmt

- B-2, B-3, B-4, MW-2 ⇒ Fill under pvmt
- B-3 & B-4 lime treated clay

MIDWAY ROAD
ADDISON, TEXAS

BORING LOCATION PLAN

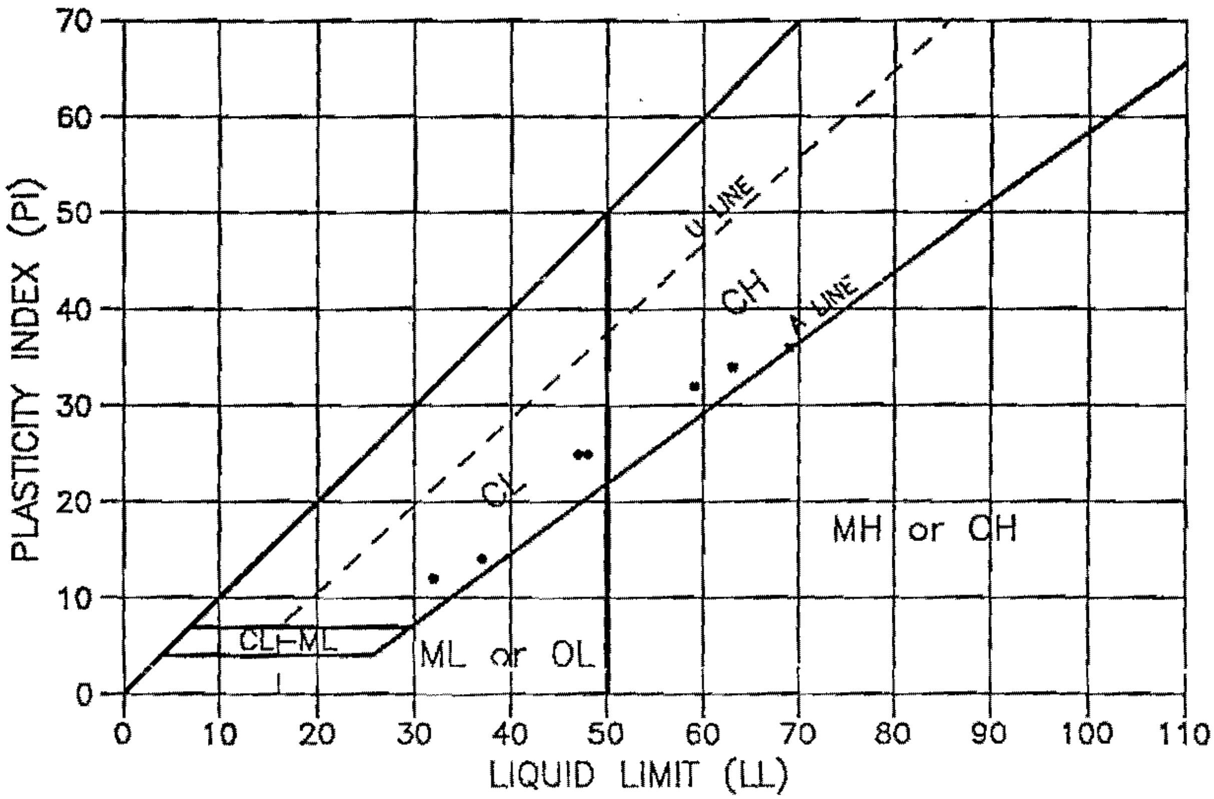
HENLEY–JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

HJA No.: 7025	PLATE 1
DATE: SEPTEMBER 1999	

MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

SUMMARY OF INDEX PROPERTIES

BORING NUMBER	DEPTH (ft.)	LL (%)	PI	MC (%)	DUW (pcf)	UNIFIED SOIL CLASSIFICATION
MW-1	0.0-1.8			15.9		
MW-1	1.8-2.5	48	25	19.0		CL
MW-1	2.5-4.0			16.3		
MW-1	9.0-10.0			17.2		
MW-1	14.0-15.0			17.6		
MW-1	19.0-20.0			17.4		
MW-2	0.6-2.2			40.4	79.1	
MW-2	2.2-3.8	69	36	39.3	79.0	CH
MW-2	3.8-5.0			23.1	103.2	
MW-2	9.0-10.0			15.3		
MW-2	14.0-15.0			11.9		
B-1	0.8-2.0	37	14	21.0	105.5	CL
B-1	2.0-3.5			16.6		
B-2	0.6-1.7	32	12	21.3		CL
B-2	1.7-3.5			14.3		
B-3	0.6-1.4			37.0		
B-3	1.4-2.2	59	32	29.6	101.4	CH
B-3	3.0-3.5	47	25	23.3		CL
B-4	0.6-1.3			23.7		
B-4	1.3-2.2	63	34	32.4	90.5	CH



SUMMARY OF ATTERBERG LIMITS

BORING NUMBER	SAMPLE DEPTH, ft.	LIQUID LIMIT	PLASTICITY INDEX	UNIFIED SOIL CLASSIFICATION
MW-1	1.8-2.5	48	25	CL
MW-2	2.2-3.8	69	36	CH
B-1	0.8-2.0	37	14	CL
B-2	0.6-1.7	32	12	CL
B-3	1.4-2.2	59	32	CH
B-3	3.0-3.5	47	25	CL
B-4	1.3-2.2	63	34	CH

MIDWAY ROAD
ADDISON, TEXAS

SUMMARY OF
ATTERBERG LIMITS

HENLEY-JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

HJA NO.: 7025
DATE TESTED: 06/28/99

PLATE 3

MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

SUMMARY OF LABORATORY TESTS ON CONCRETE CORE

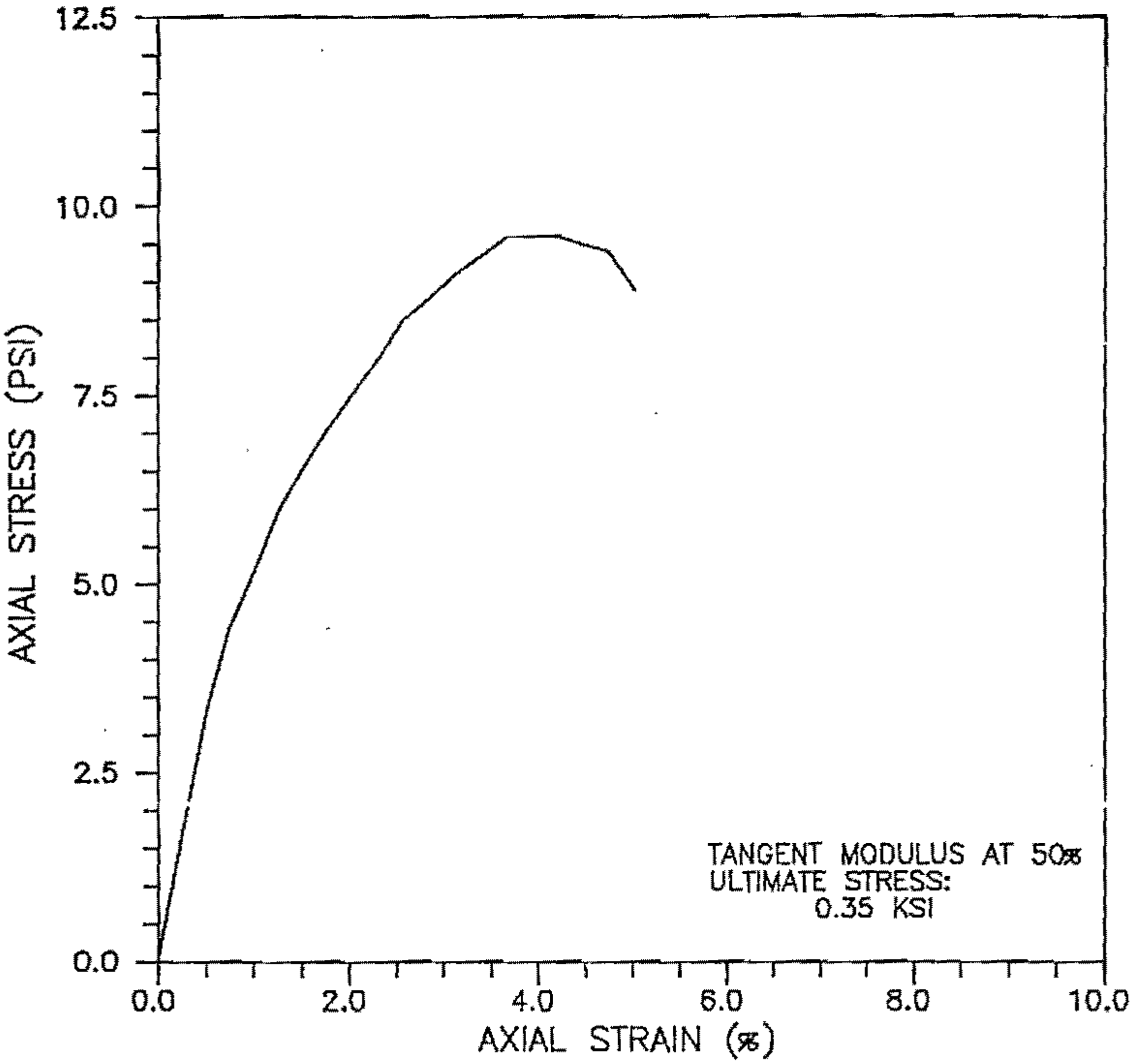
BORING NUMBER	PAVEMENT THICKNESS (in.)	SAMPLE HEIGHT (in.)	SAMPLE DIAMETER (in.)	COMPRESSIVE STRENGTH (psi)
MW-2	7.8	5.594	2.777	5018
B-1	8.4	5.679	2.775	5610
B-2	7.8	6.094	2.778	5378
B-3	7.8	5.502	2.773	5728
B-4	7.8	4.114	2.772	6060

MIDWAY ROAD
BELT LINE ROAD TO LINDBERGH DRIVE
ADDISON, TEXAS

SUMMARY OF LABORATORY STRENGTH TESTS

BORING NUMBER	DEPTH (ft.)	POCKET PENETROMETER (tsf)	PEAK STRESS (psi)	FAILURE STRAIN (%)	TANGENT MODULUS (ksi)	MATERIAL TYPE
MW-2	0.6-2.2	3.0	9.6	3.7	0.35	CLAY, slightly silty, dark gray
MW-2	2.2-3.8	3.0	16.0	12.0	0.15	CLAY, slightly silty, dark gray
MW-2	3.8-5.0	4.5+	15.2	4.7	0.46	CLAY, slightly silty, dark gray
B-1	0.8-2.0	3.5 (top) 4.5+ (bottom)	22.1	3.0	0.94	CLAY, silty, brown
B-2	0.6-1.7	4.5+				LIMESTONE, weathered, light brown, brown, and tan
B-3	1.4-2.2		35.1	2.6	2.78	CLAY, silty, dark brown (FILL)
B-3	2.2-2.6	4.5+				CLAY, silty, dark brown (FILL)
B-4	1.3-2.2	3.0	25.8	14.3	0.94	CLAY, slightly silty, dark gray
B-4	2.2-3.8	3.75				CLAY, slightly silty, dark gray

BORING NO.: MW-2
DEPTH (FT): 0.6-2.2
CLAY, slightly silty,
dark gray

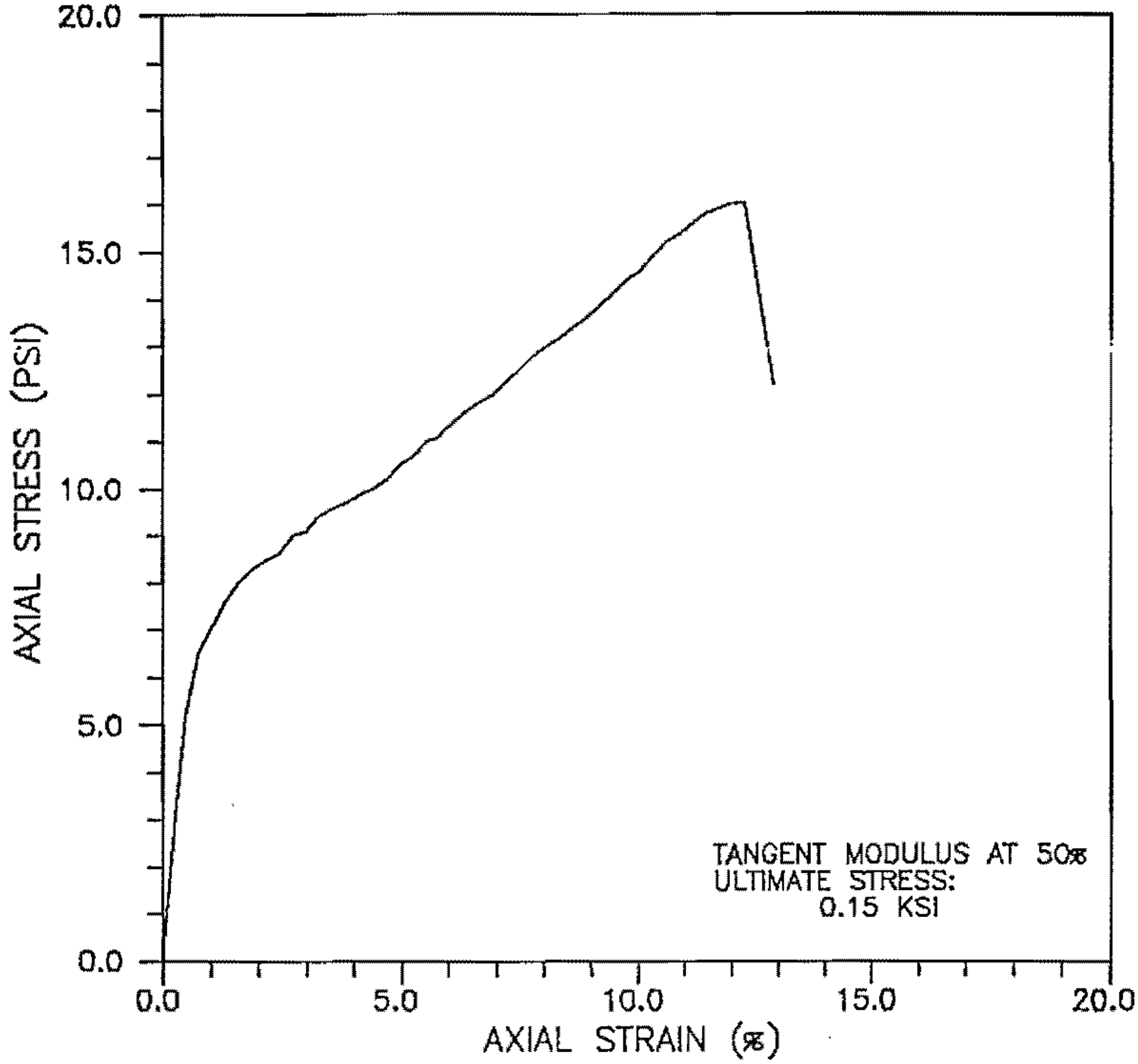


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 40.4
DRY UNIT WEIGHT (PCF): 79.1

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 6
DATE TESTED: 06/26/99	

BORING NO.: MW-2
DEPTH (FT): 2.2-3.8
CLAY, slightly silty,
dark gray



TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 39.3
DRY UNIT WEIGHT (PCF): 79.0

MIDWAY ROAD
ADDISON, TEXAS

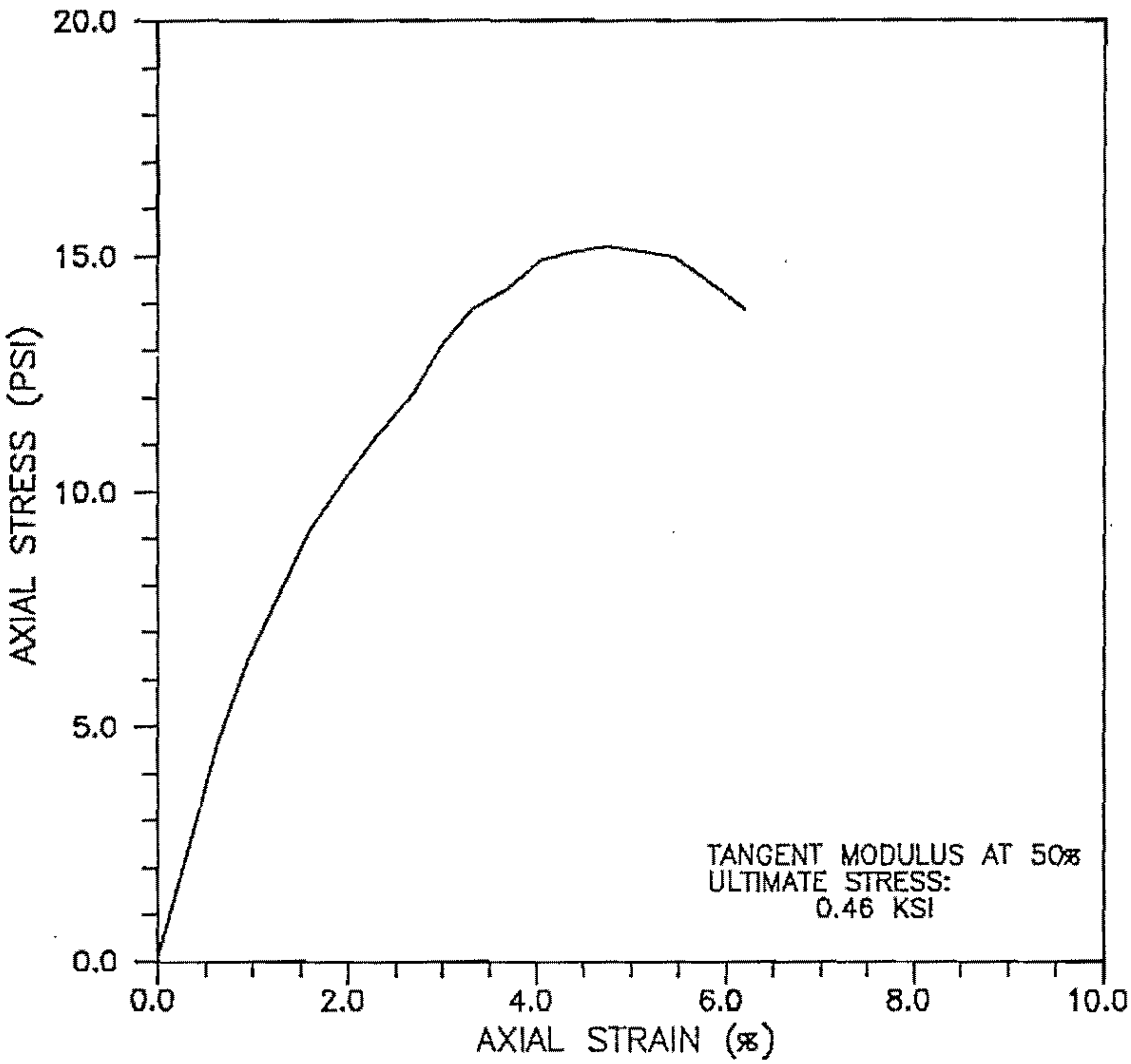
UNCONFINED COMPRESSION TEST
STRESS-STRAIN PLOT

HENLEY-JOHNSTON & ASSOCIATES,INC.
engineering geoscience consultants

HJA NO.: 7025
DATE TESTED: 06/26/99

PLATE 7

BORING NO.: MW-2
DEPTH (FT): 3.8-5.0
CLAY, slightly silty,
dark gray

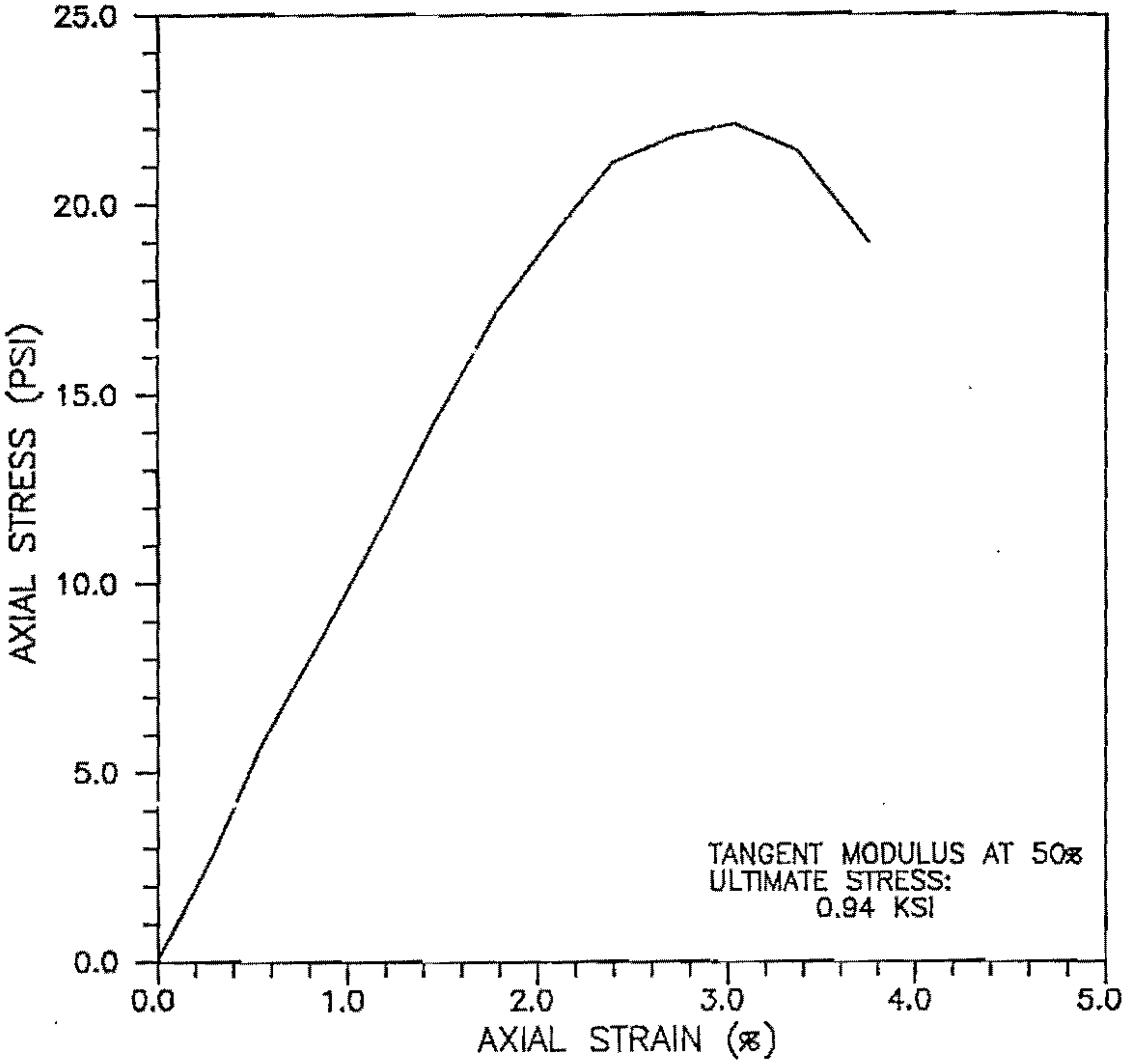


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 23.1
DRY UNIT WEIGHT (PCF): 103.2

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 8
DATE TESTED: 06/26/99	

BORING NO.: B-1
DEPTH (FT): 0.8-2.0
CLAY, silty, brown

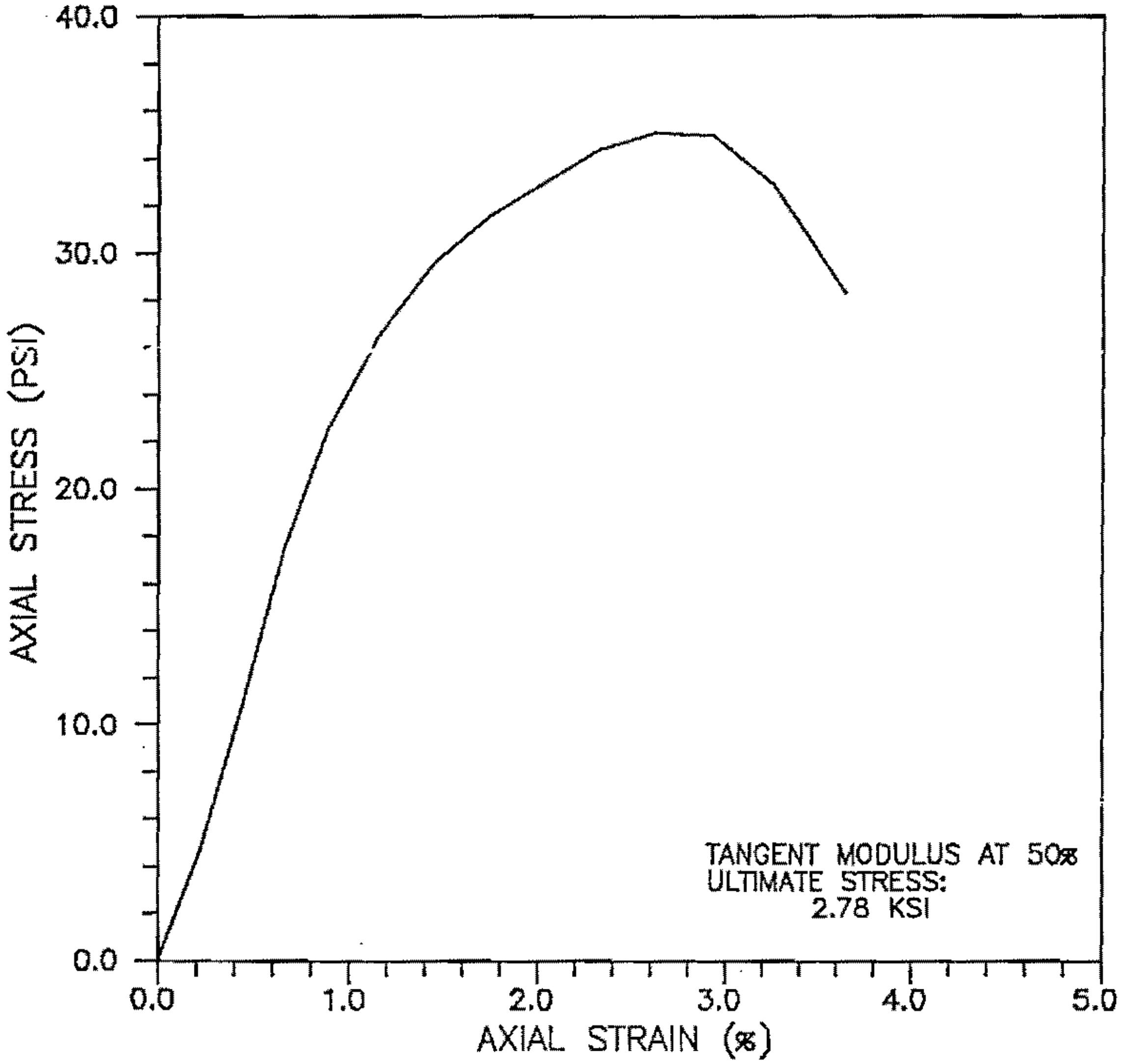


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 21.0
DRY UNIT WEIGHT (PCF): 105.5

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 9
DATE TESTED: 06/26/99	

BORING NO.: B-3
DEPTH (FT): 1.4-2.2
CLAY, silty, dark brown
(FILL)

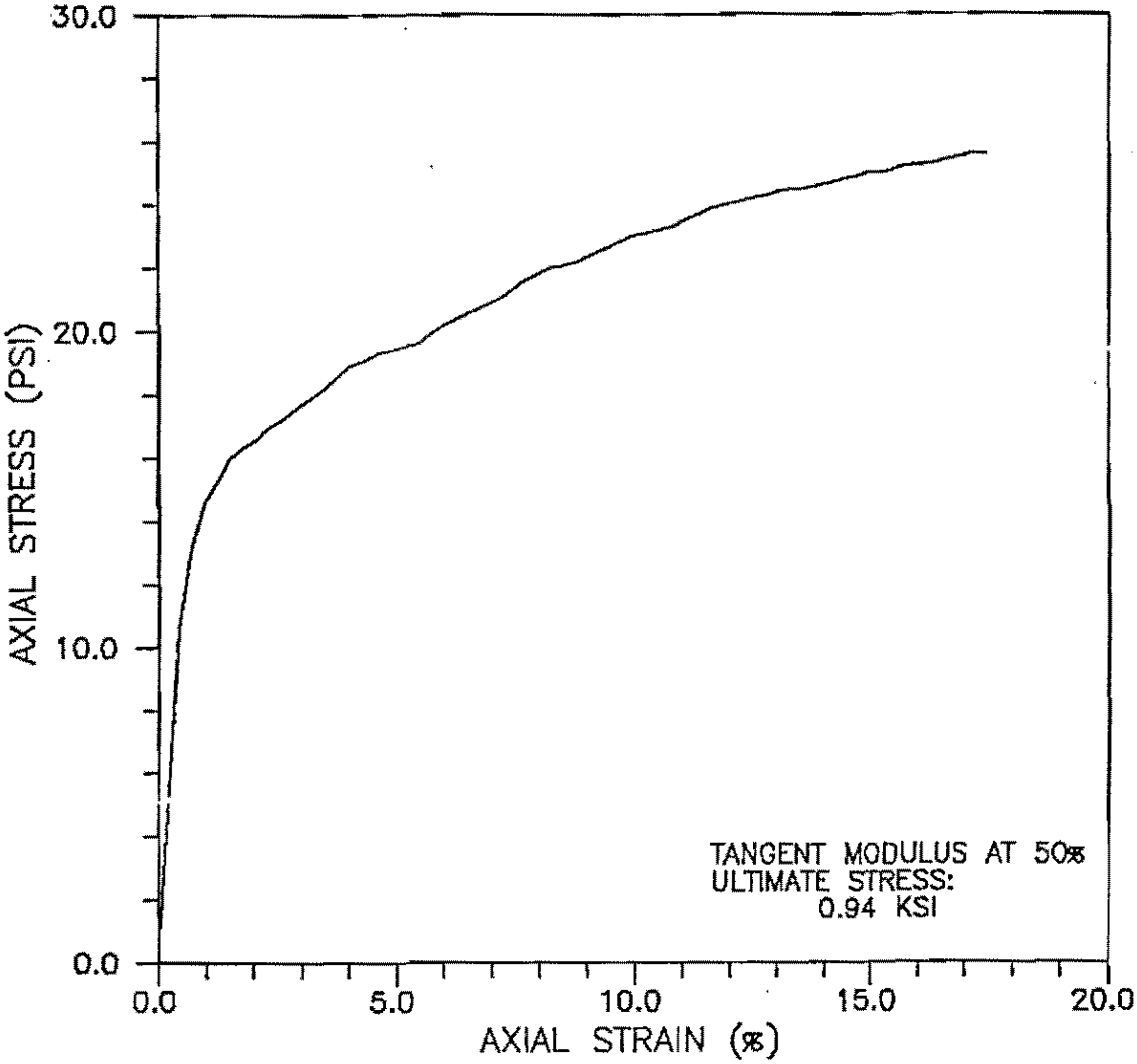


TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 29.6
DRY UNIT WEIGHT (PCF): 101.4

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES,INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 10
DATE TESTED: 06/26/99	

BORING NO.: B-4
DEPTH (FT): 1.3-2.2
CLAY, slightly silty,
dark gray



TEST TYPE: UNCONFINED COMPRESSION TEST
(ASTM D 2166)

MOISTURE CONTENT (%): 32.4
DRY UNIT WEIGHT (PCF): 90.5

MIDWAY ROAD ADDISON, TEXAS	
UNCONFINED COMPRESSION TEST STRESS-STRAIN PLOT	
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	
HJA NO.: 7025	PLATE 11
DATE TESTED: 06/26/99	

SOUTHERN SPECTROGRAPHIC LABORATORY

P.O. BOX 153469
IRVING, TEXAS 75015-3469
TEL. (972) 986-1745
METRO (972) 399-1828
FAX (972) 399-1828

September 7, 1999

Henley Johnston & Associates, Inc.
Attn: John W. Johnston
235 Morgan Ave.
Dallas, Texas 75203-1088

Report#: 0737-28-160

Re: Evaluation of water samples
Date Taken (7/28/99)

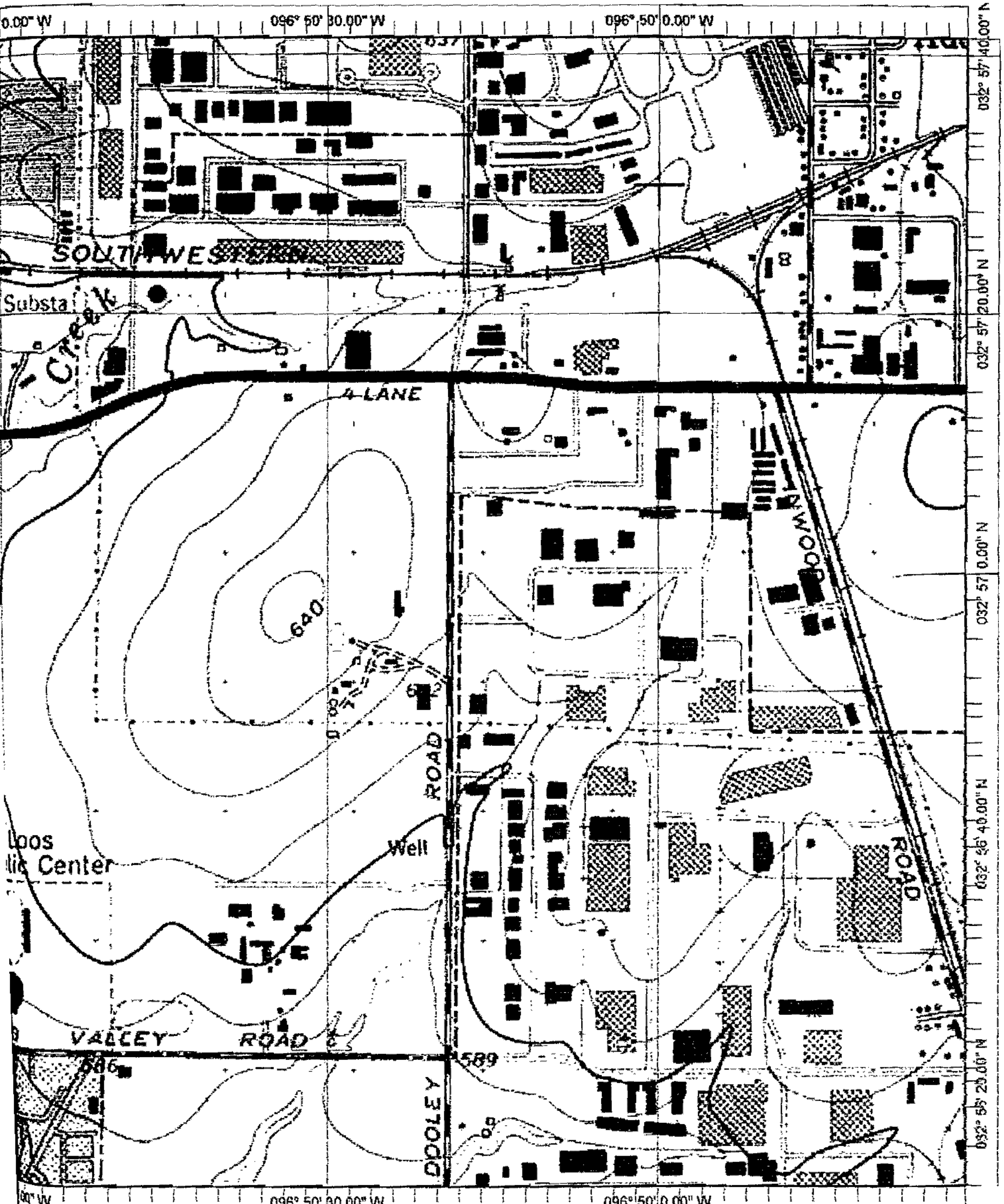
Sample ID	Mg/l Sodium	Potassium	Chloride	Sulfate	Fluoride	Total Chlorine
7025 B-1 (0612)	19.1	15.3	17	48	0.6	< 0.1
7025 B-2 (0624)	17.8	9.0	21	56	0.4	< 0.1
7025 B-3 (0637)	17.7	4.0	17	53	1.0	< 0.1
7025 B-4 (0703)	15.5	6.7	19	37	0.4	< 0.1
7025 MW-1 (0600)	22.5	3.2	24	68	0.3	< 0.1
7025 MW-2 (0654)	168	5.0	17	351	0.8	< 0.1
Reference Tap Water	12.1	3.9	17	35	0.7	< 0.1

Comments

The above listed ion ratios indicate that the water in samples B-1, B-2, B-3, & B-4 are very similar to those of the tap water. MW-1 appears to be reasonably similar to the tap water with the possibility of some evaporative concentration and/or influence from residual soluble salts in the soil. Another sample from MW-1 may show a close match to the tap water. MW-2 appears to be majorly from a source other than tap water.

Gary Cude, CPC

PLATE 12



ADDISON
7/99
1 inch equals 1000 feet

Location: 032° 56' 57.2" N 096° 50' 17.5" W

CLASSIFICATION SYMBOLS

SOIL	
	Asphalt or Lignite
	Concrete
	Fill
GW	Gravel or Sandy Gravel well graded
GP	Gravel or Sandy Gravel poorly graded
GM	Silty Gravel or Silty Sandy Gravel
GC	Clayey Gravel or Clayey Sandy Gravel
SW	Sand or Gravelly Sand well graded
SP	Sand or Gravelly Sand poorly graded
SM	Silty Sand or Silty Gravelly Sand
SC	Clayey Sand or Clayey Gravelly Sand
ML	Silts, Sandy Silts, Gravelly Silts, or Diatomaceous Soils
CL	Lean Clays, Sandy Clays, or Gravelly Clays
OL	Organic Silts or Lean Organic Clays
MH	Micaceous Clays or Diatomaceous Soil
CH	Fat Clays
OH	Fat Organic Clays
ROCK	
Ls	Limestone
Sh	Shale
	Marl
Ss	Sandstone
	Fracture Zone
	Weathered Zone

ABBREVIATIONS

abnt.	abundant
ang.	angular
aren.	arenaceous
arg.	argillaceous
bdd.	bedded
bdg.	bedding
bent.	bentonite
bldr.	boulder
BT	Brazil Tensile
calc.	calcareous
carb.	carbonaceous
cbl.	cobble
cgl.	conglomerate
clst.	claystone
cmt.	cemented
dia.	diameter
dk.	dark
DUW	Dry Unit Weight
El.	elevation
fossil.	fossiliferous
frac.	fracture
gyp.	gypsiferous
incl.	inclusion
intbdd.	interbedded
jnt.	joint
lam.	laminated
LL	Liquid Limit
lt.	light
MC	Moisture Content
ME	Modulus of Elasticity
med.	medium
min.	minutes
mod.	moderately
nod.	nodule
occ.	occasional
part.	particle
Pen.	Penetrometer
phos.	phosphatic
PI	Plasticity Index
py.	pyritized
Qu	Unconfined Compression
Rec.	recovery
rnd.	rounded
RQD	Rock Quality Designation
sat.	saturated
sept.	septarian
sev.	severely
sil.	siliceous
sli.	slightly
slk.	slickensided
T.D.	Total Depth
v.	very
wea.	weathered

CONSISTENCIES AND HARDNESS DESCRIPTIONS

FOR SANDS, GRAVELS, & SANDY SILTS

Peck, Hanson & Thornburn (1974)

Consistency	Standard Penetration Resistance N
Very Loose	Less than 4
Loose	4 to 10
Medium	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

FOR CLAYS & SANDY CLAYS (COHESIVE SOILS)

Peck, Hanson, & Thornburn (1974)

Consistency	Unconfined Compression tsf	Standard Penetration Resistance N
Very Soft	Less than 0.25	Less than 2
Soft	0.25 to 0.5	2 to 4
Medium	0.5 to 1.0	4 to 8
Stiff	1.0 to 2.0	8 to 15
Very Stiff	2.0 to 4.0	15 to 30
Hard	Greater than 4.0	Greater than 30

RELATIVE HARDNESS MODIFERS (ROCK) (RELATED TO FRESH SAMPLE)

Modified from SCS EWP. Tech Guide No. 4

Hardness	Rule of Thumb Test
Soft	Permits denting by moderate finger pressure
Firm	Resists denting by fingers but can be penetrated by pencil point to medium to shallow depth (No. 2 pencil)
Mod. Hard	Very shallow penetration of pencil point, can be scratched by knife and in some instances cut with knife
Hard	No pencil penetration, can be scratched with knife, can be broken by light to moderate hammer blows
Very Hard	Cannot be scratched by knife, can be broken by repeated heavy hammer blows

MIDWAY ROAD
ADDISON, TEXAS

LEGEND, LITHOLOGY, SOIL CONSISTENCY, & RELATIVE ROCK HARDNESS

HENLEY-JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

HJA No.: 7025

DATE: SEPTEMBER 1999

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 20.5'	LOG OF BORING / MONITOR WELL MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	PROJECT No.: 7025 BORING No.: MW-1 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
			CLAY, silty, with calcareous nodules, weathered limestone fragments, and organics, very stiff, dark brown and brown (FILL)			Valve cover installed
2.5			CLAY, silty, with occasional calcareous nodules, very stiff, brown			2" pvc pipe
5.0			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			Grout
7.5						
10.0						Bentonite Seal
12.5						
15.0						20-40 Silica sand
17.5			LIMESTONE, moderately hard to hard, gray			.010 Slot Screen
20.0						
			TOTAL DEPTH: 20.5'			
22.5						

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	PROJECT No.: 7025 BORING No.: MW-2 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 20.5'		

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
			CONCRETE			Valve cover installed
			CLAY, lime treated subgrade (FILL)			
2.5			CLAY, slightly silty, stiff, dark gray			2" pvc pipe
5.0 7.5 10.0 12.5			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			Grout Bentonite Seal
15.0 17.5 20.0			LIMESTONE, moderately hard to hard, gray			.010 Slot Screen 20-40 Silica sand
22.5			TOTAL DEPTH: 20.5'			

HENLEY-JOHNSTON & ASSOCIATES, INC.
engineering geoscience consultants

DRILL DATE: 06/19/99
METHOD: SHELBY TUBE /SPLIT SPOON TO 3.5'

LOG OF BORING / MONITOR WELL

MIDWAY ROAD
BELT LINE RD. TO LINDBERGH DR.
ADDISON, TEXAS

PROJECT No.: 7025
BORING No.: B-1
SHEET 1 of 1
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.7			CONCRETE			Valve cover installed; Grout
0.7–1.8			CLAY, silty, with occasional calcareous nodules, very stiff, brown			2" pvc pipe
1.8–3.5			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			20-40 Silica sand; .010 Slot Screen
			TOTAL DEPTH: 3.5'			

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

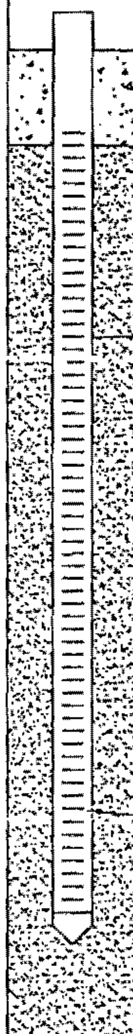
HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL	PROJECT No.: 7025
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 3.5'	MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	BORING No.: B-2 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.65			CONCRETE			Valve cover installed Grout
0.65–1.1			CLAY, silty, with calcareous nodules and weathered limestone fragments, stiff, dark brown and brown (FILL)			
1.1–3.5			LIMESTONE, moderately to severely weathered, with occasional soft clayey seams, firm to moderately hard, light brown, brown, and tan			2" pvc pipe 20–40 Silica sand .010 Slot Screen
3.5			TOTAL DEPTH: 3.5'			

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 3.5'	LOG OF BORING / MONITOR WELL MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	PROJECT No.: 7025 BORING No.: B-3 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

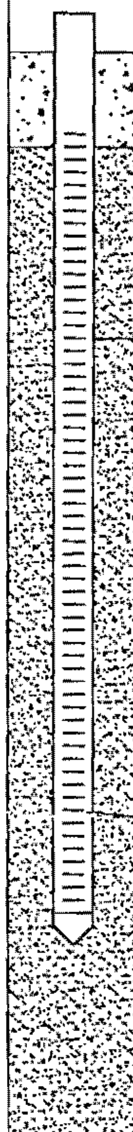
DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.0–0.65			CONCRETE NOTE: 1/2" VOID UNDER PAVEMENT			Valve cover installed Grout
0.65–1.4			CLAY, lime treated subgrade (FILL)			2" pvc pipe
1.4–3.0			CLAY, silty, with calcareous nodules, limestone fragments, and gravel, very stiff, dark brown (FILL)			20-40 Silica sand .010 Slot Screen
3.0–3.5			CLAY, silty, with occasional calcareous nodules, very stiff, brown			
			TOTAL DEPTH: 3.5'			



Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

HENLEY-JOHNSTON & ASSOCIATES, INC. engineering geoscience consultants	LOG OF BORING / MONITOR WELL	PROJECT No.: 7025
DRILL DATE: 06/19/99 METHOD: SHELBY TUBE /SPLIT SPOON TO 3.8'	MIDWAY ROAD BELT LINE RD. TO LINDBERGH DR. ADDISON, TEXAS	BORING No.: B-4 SHEET 1 of 1 LOCATION: SEE PLATE 1 GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	WELL INSTALLATION	COMMENTS
0.5			CONCRETE NOTE: 1/2" VOID UNDER PAVEMENT			Valve cover installed Grout
1.0			CLAY, lime treated subgrade (FILL)			
1.5 2.0 2.5 3.0 3.5			CLAY, slightly silty, stiff to very stiff, dark gray			2" pvc pipe 20-40 Silica sand .010 Slot Screen
4.0 4.5			TOTAL DEPTH: 3.8'			



Steve Chutchian

From: Jim Pierce
Sent: Tuesday, December 12, 2000 3:05 PM
To: 'HILL, JOHN'
Cc: Carmen Moran; Steve Chutchian; Chris Terry
Subject: RE: Airport

John: Thanks - Please send a copy of Exhibit 1. Jim.

-----Original Message-----
From: HILL, JOHN [mailto:jhill@cowlesthompson.com]
Sent: Monday, December 11, 2000 1:15 PM
To: 'jpierce@ci.addison.tx.us'
Subject: Airport

Jim--below is Section 2.A. (definitions) from the agreement with Washington Staubach relating to the Airport description:

Airport means the Addison Airport. Attached hereto as Exhibit 1 is a description of the Airport. Prior to the end of December, 2000, the City shall obtain an updated description of the Airport which shall be substituted as Exhibit 1 in place of the description attached at the time of execution of this Agreement.

Grantham, Burge & Waldbauer
Engineers, Inc.

July 25, 2000

Mr. Jim Pierce, P.E.
Assistant City Engineer
Town of Addison
Post Office Box 9010
Addison, Texas 75001

Re: Agreement for Engineering, Surveying and Geotechnical Services
Midway Road Reconstruction - Phase One Design

Dear Mr. Pierce:

Pursuant to your request, GBW has prepared this agreement for engineering, surveying and geotechnical services for the reconstruction of Midway Road from Belt Line Road to Keller Springs Road in the Town of Addison. Our subconsultants on this project will be HNTB Corporation (construction sequencing and traffic control) and Alpha Testing, Inc. (geotechnical).

The work described in this proposal represents Phase One of what is anticipated to be a two-phase design process. Phase One consists of the preparation of all the construction plans and specifications necessary for the reconstruction work (see Exhibit A) except for construction sequencing and traffic control, landscaping and irrigation, storm water pollution prevention plan and erosion control, signalization, and temporary lighting, and sidewalks. All median opening widths, turn lane lengths, and street and driveway radii will be reviewed and design changes made where appropriate. The engineering report to be prepared with Phase One will provide a basis for the Town to establish a construction phasing and funding approach for this project.

Phase Two will consist of completing the remaining construction plans along with separating the plans prepared in Phase One into a separate bid package for construction phasing purposes. Public notification and coordination with other cities, DART and affected businesses will be included in Phase Two. Bidding and construction services will also be provided. If it is determined during Phase One that the Midway Road reconstruction project will precede the Arapaho Road extension, the design of the box culvert crossing at Midway Road will be included in the Phase Two design.

This proposal consists of the following Scope of Services:

Scope of Services

<u>Surveying for Design and Construction</u>

- Establish horizontal and vertical control for the project including monumentation which shall be tied to Town of Addison horizontal and vertical datum.
- Research Town, County, State, or other documents as necessary to establish the location of existing boundary lines and easements for the project. Furnish copies of all real estate documents to the Town.
- Prepare a right-of-way strip map for the project detailing all existing right-of-way and easement lines along with property owners.

1919 S. Shiloh Road, Suite 530, L.B. 27, Garland, Texas 75042 Tel (972) 840-1916 Fax (972) 840-2156

- In cooperation with the Town and other franchised utilities, determine the approximate locations and elevations of existing underground utilities.

- Locate soil borings and furnish survey data to the geotechnical consultant.

- Perform a detailed topographic survey of the project including all driveways and intersecting streets.

Geotechnical Services

- Explore subsurface soil and/or rock conditions and groundwater seepage along Midway Road by drilling 22 test borings up to a depth of 10 feet. Borings shall be spaced approximately 250 feet apart on alternative sides of the street.

- Perform laboratory tests to evaluate the classification, gradation and other physical characteristics of the subsurface soils.

- Use the results of the field exploration and laboratory tests to prepare an engineering report which will address the following items:
  - engineering characteristics of the subsurface materials encountered
  - recommended pavement sections including alternative subgrade stabilization and base materials, and the pavement thickness required to achieve the targeted pavement life
  - evaluation of the life expectancy of the existing pavement sections
  - recommendations regarding earthwork including grading and excavation, backfilling and compacting, the treatment of in-place soils for support of pavement, and possible construction problems

Project Management and Preliminary Plan Preparation

- Prepare a schedule for the project work and provide updates as requested by Town staff.

- Attend project coordination meetings with Town staff and subconsultants.

- Review the geotechnical report results and coordinate with Town staff to determine recommended pavement sections for the project. In addition, underdrain and/or root barrier locations will also be determined.

- Prepare preliminary specifications and contract drawings for the project including the following:
  - Title Sheet with index and project location
  - General Notes and Quantities
  - Existing Right-of-Way Map including all property owners
  - Typical Sections
  - Horizontal and Vertical Control Sheet
  - Jointing Plans
  - Roadway Plan and Profiles
  - Intersection Layouts
  - Pavement Markings
  - Roadway Cross-sections
  - Underdrain Profiles at street crossings
  - Details

6/6 9AM-10AM
Meet to discuss

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

May 21, 2001

Mr. Steve Chutchian, P.E.
Town of Addison
Post Office Box 9010
Addison, Texas 75001

Re: Draft Letter Report for Midway Road
Pavement Section

GBW No. 238

Dear Steve:

Steve – for your file / disposal
Jim

This letter report sum[…] the Midway Road pavement condition performed by GBW s[…]epared by Alpha Testing, Inc. In addition, this report i[…]ives included in the Alpha Testing report and an opinion […]s that utilize alternative base materials.

Description of Probl[…]

Alpha Testing, Inc. st[…]letermine how subsurface conditions were affecting the lev[…] the field inspection and soil boring data, we have the foll[…]

- The pavemen[…]nounced than the southbound lanes.
- The worst sec[…] the railroad crossing near the Belt Line Road end of t[…]
- The cross-slo[…]e 1/8 to 1/4-inch per foot range, is significantly less than the southbound lanes, where it is mostly in the 1/4 to 1/2-inch per foot range.
- The difference between the northbound and southbound lane cross-slopes appears to have resulted from an attempt to match the existing ground at the east and west right-of-way lines when the current Midway Road pavement was designed in 1982.
- The flatter cross-slope on the northbound lanes increases the likelihood that surface water will pond or runoff slowly, resulting in a higher infiltration rate into the subgrade through pavement joints and cracks.
- In addition to rainfall, sprinkler systems in the medians and adjacent parkways are other sources of water which can infiltrate the subgrade.
- Flat longitudinal slopes along some sections of Midway Road also slow that rate of storm water runoff; for example, in the vicinity of the railroad crossing.
- Poor surface drainage appears to be the primary reason why pavement distress has been more rapid along most of the northbound lanes when compared with the southbound lanes.
- The poor condition of many pavement joints, some of which may have been widened when the pavement was milled and resealed in 1994, provide conduits for surface water to reach the subgrade.
- The plasticity index of the underlying clay soil is generally in the 18 to 55 range, which indicates a high potential to shrink and swell.
- The soil borings do not provide evidence of a ground water problem.
- Only eight of the 22 soil borings showed evidence of lime in the subgrade, which suggests that the lime stabilized subgrade was not uniformly constructed.
- A combination of moisture penetration over time and nonuniform lime stabilization during construction has probably reduced the bearing capacity of the subgrade.

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- The load transfer capability of the transverse contraction joints has been insufficient to support the heavy traffic volume, resulting in a difference in pavement elevation at the front and back ends of adjacent slabs.
- This difference, which results in a bump at the pavement joints on the northbound lanes in particular, has also resulted in a transverse crack at the midpoint of some slabs.
- Exhibit A contains a summary of data from the field inspection and the geotechnical report.

Comparable Pavement Alternatives

We received a copy of your letter to Jerry Holder dated March 23, 2001 in which you authorize the design team to proceed with pavement section Alternative 3 which included Portland Cement Concrete (PCC) on a Cement Treated Permeable Base (CTPB) with edge drains. Pursuant to our previous discussions, it is understood that the Town intends to use the same type of pavement section for both the Midway and Arapaho Road projects, given that the depths of the concrete and base layers may differ.

In a similar manner to the Terra-Mar, Inc. report for Arapaho Road, the Alpha Testing report for Midway Road analyzes several alternative pavement sections. These alternatives, which assume a 30-year project life, are summarized in the following section.

- *If the load transfer between joints is through <u>aggregate interlock</u> and the subgrade is <u>compacted</u>; either*

11.5 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Compacted subgrade

OR

10.5 inches	PCC
6 inches	CTPB
6 inches	Compacted subgrade

- *If the load transfer between joints is through <u>aggregate interlock</u> and the subgrade is <u>lime stabilized</u>; either*

11 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Lime stabilized subgrade

OR

10 inches	PCC
6 inches	CTPB
6 inches	Lime stabilized subgrade

- *If the load transfer between joints is through <u>dowels</u> and the subgrade is <u>compacted</u>; either*

10 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Compacted subgrade

OR

9 inches	PCC
6 inches	CTPB
6 inches	Compacted subgrade

- *If the load transfer between joints is through <u>dowels</u> and the subgrade is <u>lime stabilized</u>; either*

9.5 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Lime stabilized subgrade

OR

9 inches	PCC
6 inches	CTPB
6 inches	Lime stabilized subgrade

YES

Review of Alternatives

Upon a review of the pavement sections listed above, it is evident that each of the following alternatives reduce the required PCC thickness by ½ to 1 inch:

- *The use of <u>CTPB</u> in lieu of <u>Crushed Limestone Base</u>.*

  Given the Town's selection of CTPB for the Arapaho Road project, it is anticipated that CTPB will also be the base material of choice for the Midway Road project.

- *The use of <u>lime stabilized subgrade</u> in lieu of <u>compacted subgrade</u>.*

  In Section 5.4 of the Terra-Mar report, it states that 'If construction proceeds during wet weather, a lime stabilized subgrade in lieu of a compacted subgrade may be desirable in order to provide a more stable and less moisture sensitive working platform.' A representative with Jackson Brothers, the contractor on the Post and Paddock paving project for the City of Grand Prairie, strongly recommended that a lime stabilized subgrade be used with CTPB due to constructability problems which they experienced on Post and Paddock with a compacted subgrade. If the Town of Addison is willing to consider lime stabilization on Midway Road, it could be bid as an alternate to a compacted subgrade.

- *The use of dowels in lieu of aggregate interlock for load transfer between joints.*

  In Section 5.5 of the Terra-Mar report, it states that 'Steel dowels should be used for load transfer at all joints transverse to traffic.' This recommendation applies to transverse contraction joints which they indicate should typically be placed at 15 feet on-center. The Terra-Mar report does not provide an alternative pavement section for load transfer through aggregate interlock between joints. Locally, aggregate interlock is most commonly used on municipal roadways; nevertheless, both load transfer options could be bid as alternates on Midway Road.

OK

Cost Comparison of Alternatives

If lime stabilization is bid as an alternate to a compacted subgrade, and dowels are bid in lieu of aggregate interlock for load transfer between joints, the contractors that bid the Midway Road project will determine the cost effectiveness of these alternatives. If one or more or these alternatives is not acceptable to the Town, we would be pleased to do the research necessary to prepare an opinion of probable cost for each alternative.

?

Although it is anticipated that the pavement section on Midway Road will incorporate CTPB, Exhibit B provides an opinion of probable cost for informational purposes to compare it with a pavement section that incorporates Crushed Limestone Base. This comparison, which indicates a $866,805 increase in cost to use CTPB, is contained in that attached spreadsheet.

IT WOULD BE GOOD IDEA IF WE NEW BEFORE BID.

CTPB Design Memo

Given the limited use of CTPB as a base material for urban pavements in the metroplex, we have prepared a design memo based on our research of this material. The attached design memo on CTPB has been prepared following conversations with a supplier, a contractor, other local and state agency representatives, and other engineers.

This memo is to provides an evaluation of CTPB along with technical data for consideration prior to developing consistent pavement section design standards and specifications for the Midway and Arapaho Road projects.

Fly Ash

The Town of Addison's staff has expressed an interest in using fly ash in the mix design of the PCC pavement for the Midway and Arapaho Road projects. Mr. Michael Caldarone, P.E. with TXI indicated that fly ash is used in concrete paving by number of local cities including Dallas, Fort Worth Arlington, Plano and Grand Prairie, and by TxDOT on the majority of their concrete paving projects. I also contacted the City of Garland's construction manager and confirmed that they permit fly ash in concrete paving mix designs, although the amount is limited to the lesser of 15% of the cement weight or 100 lbs.

Mr. Caldarone furnished our office with sample concrete mix designs, with and without fly ash, which achieve 3,000 psi in 3 days and 7 days respectively. These mix designs are attached for you information. If the Town wishes to utilize fly ash on the subject projects, we can include appropriate limits for its use in the technical specifications.

What is the benefit of fly ash is it only the cost or are there other Benis.

Mr. Steve Chutchian, P.E.
May 21, 2001
Page 5

After reviewing the enclosed geotechnical report for Midway Road and this letter, please contact me if you any comments. I will then request that Alpha Testing finalize their report.

Very truly yours,

Bruce R. Grantham, P.E.
President

Attachments

cc: Jerry Holder, HNTB
Dave Lewis, Alpha Testing

BG/gg
J:\WPDOCS\PROJECTS\ADDISON\00-238\Chutchian.ltr

EXHIBIT A

MIDWAY ROAD - SOIL BORING/FIELD OBSERVATION SUMMARY

Boring No.	Pvm't Station	Traffic Direction	Panel Point	PI	Lime Stab.	Rock Depth	Pvm't Thickness	Pvm't Cross Slope	Joint Width	Pavement Distress
B-1	6+30	North	Front	49	No	-	8"	-1.32%	Moderate	High
B-2	6+27	North	Back	31	No	-	7 3/4"	-1.32%	Moderate	High
B-3	6+49	North	Front	21	Yes	-	8"	-1.35%	Moderate	High
B-4	6+45	North	Back	-	No	-	7 3/4"	-1.34%	Moderate	High
B-5	6+56	South	Front	21	Yes	-	8"	-3.86%	Moderate	High
B-6	6+60	South	Back	-	No	-	8"	-3.78%	Moderate	High
B-7	10+03	North	Back	-	No	8'	8 1/4"	-1.72%	Moderate	Medium
B-8	10+06	North	Front	17	Yes	8'	8 1/2"	-1.79%	Moderate	Medium
B-9	10+33	South	Front	23	Yes	-	8"	-2.93%	Moderate	Medium
B-10	10+36	South	Back	17	Yes	-	8"	-2.95%	Moderate	Medium
B-11	24+33	North	Center	-	No	-	8"	-1.35%	Moderate	Medium
B-12	24+45	North	Center	37	Yes	-	8"	-1.28%	Moderate	Medium
B-13	26+01	South	Center	41	Yes	8'	8"	-3.71%	Small	Low
B-14	27+54	South	Center	-	Yes	5'	8"	-3.75%	Small	Low
B-15	27+32	North	Front	55	No	-	8 1/4"	-0.92%	Moderate	Medium
B-16	27+28	North	Back	29	No	-	8 1/4"	-0.99%	Moderate	Medium
B-17	47+47	North	Center	55	No	5'	6 1/2"	-1.43%	Large	High
B-18	47+47	North	Center	46	No	5'	6 1/2"	-1.43%	Large	High
B-19	48+14	South	Center	45	No	6'	6 1/2"	-2.43%	Moderate	Medium
B-20	50+74	South	Center	38	No	2'	7 1/4"	-2.02%	Moderate	Medium
B-21	50+88	North	Center	-	No	2'	6 1/4"	-1.24%	Moderate	Medium
B-22	50+88	North	Center	18	No	2'	6 3/4"	-1.24%	Moderate	Medium

EXHIBIT B

OPINION OF PROBABLE COST
MIDWAY ROAD - ALTERNATIVE PAVEMENT SECTIONS

Bid Item Description	Thickness	Unit	Unit Price	Estimated Quantity	Total Item
	(inches)		($)		($)
Alternate 1					
Portland Cement Concrete	11.5	S.Y.	55	53,500	2,942,500
Crushed Limestone Base	6	S.Y.	15	57,000	855,000
Compacted Subgrade	6	S.Y.	1.5	57,000	85,500
TOTAL ESTIMATED COST					**$3,883,000**
Alternate 2					
Portland Cement Concrete	10	S.Y.	50	53,500	2,675,000
Cement Treated Permeable Base	6	S.Y.	15	57,000	855,000
Lime Stabilized Subgrade	6	S.Y.	2	57,000	114,000
Lime (@ 33 lbs/S.Y.)	-	TON	110	941	103,455
Geotextile Fabric	-	S.Y.	13	62,000	806,000
Concrete Toe Wall (6" x 18")	-	L.F.	10	3,060	30,600
Edge Drains (6" PVC)	-	L.F.	15	11,050	165,750
TOTAL ESTIMATED COST					**$4,749,805**
ADDITIONAL COST FOR ALTERNATE 2					**$866,805**

Notes:
1. Edge Drains are proposed behind both outside curbs.
2. Concrete toe walls are proposed along the inside curb lines of wider landscaped medians only.
3. Lime Stabilization is included with CTPB for constructability purposes.

GBW Engineers, Inc.

DESIGN MEMO

Date: April 2, 2001 **Job No.** 00-238

From: GBW **Job Name:** Midway Road/Arapaho Road

To: Steve Chutchian, P.E.; Jerry Holder, P.E.

Re: General Notes on Cement Treated Permeable Base

EVALUATION

- CTPB has the potential to increase the life of a roadway by providing a conduit for subsurface water to flow out from under the pavement, thereby, reducing the rate at which subgrade support is likely to deteriorate.

- CTPB slightly reduces the required concrete pavement thickness when compared with an equally thick crushed limestone base.

- CTPB has been used extensively in other states including California, Louisiana and Wisconsin.

- CTPB is more commonly used where the subsurface water flows to open road side drainage ditch; however, it is also used in conjunction with edge drains on curb and gutter roadways.

- CTPB has been used on a very limited basis locally; consequently, contractors are not as familiar with the construction requirements as they are with more commonly use non-drainable base materials such as crushed limestone.

- Grand Prairie rebid the Post and Paddock roadway reconstruction project, which utilized CTPB, because they received usually high bids at the first bid opening.

- A mandatory prebid meeting was scheduled prior to the second bid opening, which resulted in lower bids, in order to provide contractors with more detailed information about the use of CTPB.

- A representative of Jackson Brothers, the contractor on Post and Paddock, informed our staff that they would be prepared to bid another CTPB project; however, they would include money to lime stabilize the subgrade even if it was not required. Why?

- The compacted subgrade which was specified on the Post and Paddock project created constructability problems for the contractor, especially when it rained.

- Typically, where non-drainable bases are used, the goal is restrict the flow of water under the pavement. A drainage base permits the free flow of water under the pavement.

- As CTPB promotes the flow of water under the pavement, it increases the potential for future pavement problems if the drainage system does not function as designed. For example:
  - Over-rolling the CTPB can cause degradation of the material with a resulting loss of permeability.

- An uneven or inadequately sloped subgrade can cause water to pond in the CTB.
- Any break in the filter fabric layer, either during construction or during later pavement repairs, can provide a conduit for water to migrate into the subgrade.
- The CTB must be keep free of dirt during construction and during later pavement repairs.
- In addition, pavement repairs must be closely monitored to insure that the CTPB is correctly installed so that the free flow of water is not interrupted.
- The edge drains must be kept clear of dirt and debris during construction and, if they are located under the pavement, construction equipment must be monitored to insure that the pipes are not crushed.
- The edge drains must be consistently checked and cleaned out if necessary, during the pavement design life.

- As storm sewers, culverts or creeks are the most likely outfall points for edge drains, the depth of flow in these outfalls must be checked to determine if storm water will back up through the edge drains into the CTPB, and in what storm event this will occur.

- The back up of storm water from an outfall into the CTPB introduces a significantly higher volume of water under the pavement than would result from infiltration through the pavement joints.

Can we put some type of valve on the outfall

- The CTPB pavement section, which includes edge drains, filter fabric, and root barriers along wider median curbs, is significantly more expensive than an equivalent pavement section which utilizes a non-drainable base.

- There are no local examples of CTPB pavement section that have been in place on a curb and gutter roadway over the design life to quantify any improvement in durability over a non-drainable base.

BASE COURSE NOTES

<u>General</u>

- If construction traffic will be allowed on the permeable base, cement stabilization is generally needed to avoid the substantial cost of constructing a temporary adjacent haul road for side delivery of concrete to the paver.

<u>Aggregate</u>

- Quality of crushed aggregates is the single most important factor for the stability of a permeable base. Aggregate should be stored, handled, and placed in a manner to keep segregation to a minimum.

- The most popular aggregate gradations are AASHTO No. 57 and No. 67, which are characterized by having very little material finer that No. 8 sieve.

- The aggregate material should have at least two mechanically fractured faces to ensure good mechanical interlock. This will require a crushed material.

<u>Permeability</u>

- Cement-treated bases have coefficients of permeability in the range of 3,000 to 15,000 ft per day. Untreated permeable bases range from 500 to 2,000 ft per day.

- Edge drains are usually filled with the same highly permeable material that is used for the base or a material with even higher permeability.

Cement

- While 200 lb cement per cubic yard has been the amount most generally specified, agencies have used amounts varying from 150 to 300 lb.
- Mixes with 150 lb/c.y. cement content should be restricted to areas subjected to only a few truck hauls over stable subgrade.
- Mixes with 200 lb/c.y. cement content are appropriate for general use (average trucking and subgrade conditions.)
- Mixes with 250 lb/c.y. cement should be used where heavy trucking will occur or where support conditions are questionable.
- From the low to the high cement content, 7 day field compressive strengths varied from 150 to 600 psi; however, cement content rather than strength should be used to select the most appropriate mix.

Water Content

- Water contents for workable mixtures are usually in the range of 100 to 120 lb/yd3. Water content should be based on the contractor's assessment of the mix workability.
- A water/cement ratio at the higher end of the range may encourage the cement paste to flow to points of aggregate contact where its cementing action is needed. The FHWA recommends this design approach.

Pavement Section

- The thickness of permeable bases used has varied from 3 to 6 inches, with 4 inches being the most common. The thickness should be adequate to overcome any construction variances and provide an adequate hydraulic conduit to transmit the water to the edge drain.
- A minimum resultant slope of 2 percent is recommended wherever possible.

Construction

- Most commonly, the base is compacted by vibratory plates or screeds. The objective is to solidly seat the material.
- Over-rolling can cause degradation of the material with a resulting loss of permeability
- Cement-treated permeable bases are cured by water misting several times a day or by covering with polyethylene sheets for 3 to 5 days.
- The need for curing is one of the least understood aspects of constructing cement treated permeable bases.
- Some agencies are studying the cost-effectiveness of curing; Wisconsin found little difference between material covered with polyethylene and that left exposed.

- During construction, care must be taken to prevent contamination of the permeable base from mud and dirt carried by truck tires. Construction traffic should be kept to a minimum and sharp truck turning should be avoided.

SEPARATOR NOTES

General

- Beneath the permeable base course, a separator or filter layer prevents fine particles in the subgrade soil from infiltrating the open-graded base.
- An asphalt prime coat placed on the stabilized subgrade/subbase would provide additional protection.
- A separator layer can be provided by an aggregate separator layer or by a geotextile.

Aggregate Layer

- The aggregate layer must be strong enough to provide a stable working platform for constructing the permeable base.
- The gradation of this layer must be carefully selected to prevent fines from pumping up from the subgrade into the permeable base.
- The aggregate layer must have a low permeability to deflect infiltrated water over to the edge drain.
- The FHWA recommends the percent of fines passing the No. 200 sieve should not exceed 12 percent and the coefficient of uniformity should be greater the 20 (preferably greater the 40.)
- A minimum thickness of 4 inches is recommended for the aggregate separator layer.

Geotextile

- In subgrades with a high percentage of fines, a geotextile might be a preferred choice.
- The geotextile must have enough strength to survive the construction phase.
- The principal advantage of a geotextile is its filtration capability. A geotextile will allow any rising water, due to capillary action or a rising water table, to enter the permeable base and rapidly drain to the edge drain system.

Wont rising water saturate under drainage conditions?

- The main disadvantage is if the geotextile becomes clogged, rising water will be trapped under the geotextile, saturating the subgrade and reducing subgrade support.
- Pore openings should be sized to retain larger soil particles and pass smaller soil particles. Large numbers of openings should be provided in case there is some clogging.
- The geotextile should have a permeability several times greater than the subgrade so that any vertical draining water will not be unduly impeded by the geotextile.
- The geotextile should be specified based on performance rather than type (woven or non-woven).

- Geotextiles are subject to degradation when exposed to sunlight for extended periods of time. To prevent this, geotextiles should be placed and covered as quickly as possible.

LONGITUDINAL EDGE DRAIN NOTES

General

- For crowned pavement, edge drains are installed along both the inner and outer pavement edge. For uncrowned sections, only one edge drain is installed at the low side.

- For the longitudinal edge drain pipe, most agencies use 6-inch diameter flexible corrugated polyethylene tubing (perforated and meeting AASHTO M252.) Rigid PVC pipe (slotted, AASHTO M278-PC50) has also been used but is more expensive. If the pipe is to be installed in trenches that are to be backfilled with asphalt-stabilized permeable material, the pipe must be capable of withstanding the temperature.

- The trench backfill material should be of the same material as the permeable base course to ensure adequate capacity.

- The preferred location for the edge drain is 2 or 3 feet outside the curb to avoid settlement problems or crushing the collector pipe beneath construction equipment. Sometimes, the permeable base is extended under the shoulder with the edge drain placed at the outside shoulder edge.

- The suggested minimum pipe size is 4 inches and the minimum slope should be 0.0035 ft/ft.

- Depending on the pipe size, the trench width should be between 8 and 10 inches. The trench should be deep enough to allow the top of the pipe to be located 2 inches below the bottom of the permeable base.

- The edge drain trench should be lined with a geotextile, but the top of the trench adjacent to the permeable base is left open to allow a direct path for the water into the edge drain pipe.

- The ability to flush or jet rod the system is important in the maintenance scheme. The edge drain and outlet pipes must have proper bends (2 to 3-feet radii) and vents to facilitate this operation.

- Videotaping the completed edge drain with flexible fiber optic equipment is suggested for final acceptance of the project.

Lateral Pipes

- Lateral outlet pipes are rigid PVC or metal. Rigid pipe provides more protection against crushing due to construction operations.

- The Federal Highway Administration recommends a maximum outlet spacing of 250 feet to ensure rapid drainage. The pipes should be placed on a 3 percent grade with the outlet at least 6 inches above the 10-year design flow in the ditch or storm sewer.

- Pipe outlets into open ditches are usually protected by concrete headwalls and are equipped with rodent screens.

Construction

- Edge drains may be installed before or after construction of the permeable base and concrete surface. This will affect the edge drain location and geotextile placement.

- Pre-pavement installation of the edge drain may be necessary in some urban situations, but in general, the option should be given to the contractor.

- Post-pavement installation has several advantages: less threat of pipe damage and trench cave-ins due to construction traffic, less susceptibility to bad weather delays, and better line and grade because these are taken off the previously constructed concrete pavements.

Maintenance

- Flushing and rodding of the edge drain system should be done on a routine schedule.

- Edge drain outlets and pipe systems should be inspected at least once a year using flexible fiber optic video equipment to determine their condition.

- If regular maintenance is not done, the pavement section will become flooded, increasing the rate of pavement damage.

DESIGN NOTES

- When rainfall events occur that are greater than the design storm, the permeable base will fill with water and excess water will simply run off on the pavement surface. After the storm event, the permeable base will drain as designed.

- A time to drain 50 percent of the drainable water of 1 hour is recommended for the highest class roads with the greatest amount of traffic. For most other highways and freeways, a time to drain 50 percent of the drainable water of 2 hours is recommended.

- Construction traffic on the completed base course is the single most important parameter in the selection of the type of permeable base to be used.

CONSTRUCTION NOTES

- Central plant mixing of permeable cement-treated base course is essentially the same as that for conventional concrete.

- The City may want to construct a test strip of the base course to determine which curing method to employ as well as which method of compaction should be used. Requirements for moist curing should be investigated to see if they might be eliminated without substantial loss of performance under actual job conditions.

- The FHWA recommends that a control strip be constructed at the beginning of construction so that the combination of aggregate materials and construction practices be tested, and if necessary, adjusted to produce a stable permeable base with adequate drainage characteristics. A minimum length of 500 feet is recommended, and this section can become part of the finished roadway if found to be acceptable.

Tel.: (972) 840-1916 / *FAX:* (972) 840-2156 / *E-mail:* Info@gbwengineers.com

Mix #:	9053
Description:	7.00SK ADMIX/AEA 1"CS
Strength:	5000 psi @ 28 Days

3000 PSI @ 3 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.392 lbs/lb
Cement/Cementitious Content:	7.00 sacks (per cubic yard)
Maximum Placement Slump:	4.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

658 lbs.	ASTM C 150 TYPE I CEMENT
1840 lbs.	1" - #4 CRUSHED STONE
1193 lbs.	CONCRETE SAND
258 lbs.	or 31.0 Gallons of Water
2.0 to	4.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%

Placement Slump: 3.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9053 Strength: 3000 psi @ 3 Days

3 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	3 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	04/18/97	43	72	80	4.50	5.8%	3170		3170	3170		
2	06/24/97			91	4.25	5.0%	3610		3610	3390		
3	03/17/98	31	56	66	2.00	4.0%	3890		3890	3557	3557	
4	08/25/98	43		88	5.00	N/A	3050		3050	3430	3517	
5	08/28/98	43	86	93	4.50	1.8%	3760		3760	3496	3567	
6	09/04/98	43	96	84	5.00	N/A	3680		3680	3527	3497	
7	09/18/98	31	72	84	5.75	4.8%	3500		3500	3523	3647	
8	10/05/98	50	82	80	4.75	N/A	4630		4630	3661	3937	
9	08/09/99	43	85	96	5.00	N/A	4220		4220	3723	4117	
10	08/23/99	31	92	86	5.00	4.8%	4400		4400	3791	4417	
11	02/08/00	18	43	58	4.75	N/A	2960		2960	3715	3860	
*** Averages ***			76	82	4.59	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9053 **Strength: 3000 psi @ 3 Days**

Paragraph 5.5 of ACI 318-89 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

```
**************************************************
*                                                *
*   Unable to calculate standard deviation due   *
*                                                *
*   to the fact that less than 15 tests exist    *
*                                                *
**************************************************
```

SUMMARY OF STATISTICAL ANALYSIS
3 Day Test Data

Number of Tests..........................	11
Maximum Value............................	4630 psi
Minimum Value............................	2960 psi
Range....................................	1670 psi
Average Strength.........................	3715 psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-89 Section 5.3.2.1...............	
Design excess beyond code requirements...	

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9053 Strength: 5000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	28 Day PSI 2	28 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	08/09/99	43	85	96	5.00	N/A	6280	6110	6195	6195		170
2	08/11/99	31	90	91	5.00	N/A	5880	5920	5900	6048		40
3	08/13/99	43	92	99	3.75	N/A	6050	6150	6100	6065	6065	100
4	08/16/99	31	92	95	6.00	N/A	5470	5350	5410	5901	5803	120
5	08/23/99	31	92	86	5.00	4.8%	6560	6420	6490	6019	6000	140
6	09/27/99	41	92	88	5.00	4.3%	6520	6490	6505	6100	6135	30
7	09/27/99	41	82	84	5.25	4.1%	6090	6110	6100	6100	6365	20
8	09/27/99	41	89	82	5.50	3.3%	5820	5730	5775	6059	6127	90
9	09/27/99	41	74	83	5.00	3.8%	6510	6480	6495	6108	6123	30
10	09/29/99	41	68	84	5.00	N/A	6160	6220	6190	6116	6153	60
11	09/29/99	41	74	90	5.00	N/A	6700	6650	6675	6167	6453	50
12	09/29/99	41	70	85	5.00	N/A	6320	6400	6360	6183	6408	80
13	09/29/99	41	62	86	4.50	N/A	6660	6580	6620	6217	6552	80
14	10/01/99	41	78	82	6.00	5.8%	5520	5490	5505	6166	6162	30
15	10/01/99	41	82	85	6.00	5.3%	5750	5680	5715	6136	5947	70
16	10/01/99	41	70	80	5.50	6.0%	5640	5770	5705	6109	5642	130
17	10/06/99	41	80	84	5.25	N/A	5240	5290	5265	6059	5562	50
18	10/06/99	41	73	81	5.00	N/A	5110	5210	5160	6009	5377	100
19	10/06/99	41	66	78	5.50	N/A	5440	5210	5325	5973	5250	230
20	10/13/99	41	76	84	6.00	N/A	5410	5200	5305	5940	5263	210
21	10/28/99	43	74	79	4.50	N/A	5450	5550	5500	5919	5377	100
22	10/28/99	43	70	76	5.00	N/A	5430	5350	5390	5895	5398	80
23	11/11/99	41	66	76	5.50	3.3%	5710	5550	5630	5883	5507	160
24	11/16/99	41	67	75	5.50	4.8%	5490	5490	5490	5867	5503	0
25	01/05/00	13	48	60	5.00	4.0%	5000	5110	5055	5834	5392	110
26	01/05/00	13	52	63	5.25	3.9%	5880	6000	5940	5838	5495	120
27	01/05/00	13	43	59	6.00	3.9%	5510	6160	5835	5838	5610	650
28	02/08/00	18	43	58	4.75	N/A	5020	5110	5065	5811	5613	90
29	02/23/00	13	72	74	5.75	N/A	5770	5390	5580	5803	5493	380
30	08/21/00	31	80	95	5.00	4.0%	6170	6220	6195	5816	5613	50
*** Averages ***			73	81	5.22	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9053 **Strength: 5000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$
\begin{aligned}
F'cr &= F'c + 1.34(SD) \\
&= 5000 + 1.34(485) \\
&= 5650
\end{aligned}
$$

$$
\begin{aligned}
F'cr &= F'c + 2.33(SD) - 500 \\
&= 5000 + 2.33(485) - 500 \\
&= 5630
\end{aligned}
$$

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests........................	30	
Maximum Value..........................	6675	psi
Minimum Value..........................	5055	psi
Range..................................	1620	psi
Average Strength.......................	5816	psi
Standard Deviation.....................	485	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	5650	psi
Design excess beyond code requirements...	166	psi

Mix #: 9567
Description: 658# ADMIX/AEA 1"CS
Strength: 5000 psi @ 28 Days

3000 PSI @ 3 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.406 lbs/lb
Cement/Cementitious Content:	7.36 sacks (per cubic yard)
Maximum Placement Slump:	5.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

526 lbs.	ASTM C 150 TYPE I CEMENT
132 lbs.	ASTM C 618 FLY ASH
1840 lbs.	1" - #4 CRUSHED STONE
1148 lbs.	CONCRETE SAND
267 lbs.	or 32.0 Gallons of Water
2.0 to	6.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%
Placement Slump: 4.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9567 Strength: 3000 psi @ 3 Days

3 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	3 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	08/11/98	38	85	98	5.00	2.5%	3910		3910	3910		
2	08/11/98	38	83	96	4.50	2.5%	4230		4230	4070		
3	08/11/98	38	80	95	5.00	2.5%	3960		3960	4033	4033	
4	08/11/98	38	80	98	5.50	3.5%	4330		4330	4108	4173	
5	01/06/99	38	47	61	5.50	N/A	2840		2840	3854	3710	
6	01/06/99	38	46	64	5.25	N/A	3320		3320	3765	3497	
7	01/06/99	38	47	63	5.25	N/A	2680		2680	3610	2947	
8	01/06/99	38	44	60	5.00	N/A	3020		3020	3536	3007	
9	01/06/99	38	45	61	5.25	N/A	3710		3710	3556	3137	
10	02/11/99	38	65	55	5.00	N/A	4230	4170	4200	3620	3643	60
11	02/11/99	38	68	55	7.00	N/A	4230	4170	4200	3673	4037	60
*** Averages ***			63	73	5.30	2.8%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9567 **Strength: 3000 psi @ 3 Days**

Paragraph 5.5 of ACI 318-89 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

```
**************************************************
*                                                *
*   Unable to calculate standard deviation due   *
*                                                *
*   to the fact that less than 15 tests exist    *
*                                                *
**************************************************
```

SUMMARY OF STATISTICAL ANALYSIS
3 Day Test Data

Number of Tests.........................	11
Maximum Value...........................	4330 psi
Minimum Value...........................	2680 psi
Range...................................	1650 psi
Average Strength........................	3673 psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-89 Section 5.3.2.1...............	
Design excess beyond code requirements...	

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9567 Strength: 5000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	28 Day PSI 2	28 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	11/25/98	35	65	69	5.00	7.1%	6330	6470	6400	6400		140
2	11/25/98	35	65	70	5.00	6.0%	5590	5730	5660	6030		140
3	11/25/98	35	65	69	5.00	5.8%	5610	5750	5680	5913	5913	140
4	11/25/98	35	65	68	5.00	7.1%	5360	5460	5410	5788	5583	100
5	11/25/98	35	60	68	5.00	6.8%	5490	5650	5570	5744	5553	160
6	12/31/98	38	45	68	5.25	N/A	5220	4880	5050	5628	5343	340
7	12/31/98	38	46	68	5.50	N/A	5480	5900	5690	5637	5437	420
8	12/31/98	38	47	66	5.25	N/A	5550	5360	5455	5614	5398	190
9	02/04/99	38	52	63	5.00	N/A	5510	5590	5550	5607	5565	80
10	02/04/99	38	53	64	5.25	N/A	6590	6380	6485	5695	5830	210
11	02/11/99	38	65	55	5.00	N/A	5870	6020	5945	5718	5993	150
12	02/11/99	38	68	55	7.00	N/A	5430	5620	5525	5702	5985	190
13	02/16/99	38	68	64	7.50	5.5%	6430	6540	6485	5762	5985	110
14	02/16/99	38	60	66	8.50	5.8%	5130	5470	5300	5729	5770	340
15	05/19/99	35	78	70	6.00	4.2%	5800	5730	5765	5731	5850	70
16	06/03/99	35	90	64	6.00	N/A	5210	5150	5180	5697	5415	60
17	06/04/99	35	84	73	5.00	4.6%	6090	6370	6230	5728	5725	280
18	07/06/99	35	92	90	5.50	4.0%	5750	5660	5705	5727	5705	90
19	07/08/99	35	76	87	6.00	2.2%	4940	4870	4905	5684	5613	70
20	10/28/99	38	80	82	5.50	4.1%	5960	6130	6045	5702	5552	170
21	11/05/99	38	81	89	4.50	N/A	6970	7010	6990	5763	5980	40
22	12/01/99	38	68	70	5.00	N/A	6000	6110	6055	5776	6363	110
23	12/03/99	38	72	77	4.00	4.4%	5610	5320	5465	5763	6170	290
24	12/07/99	31	58	65	4.00	N/A	6680	6770	6725	5803	6082	90
25	12/09/99	38	60	65	5.00	N/A	6080	5940	6010	5811	6067	140
26	12/14/99	31	54	62	3.75	3.8%	5940	6000	5970	5817	6235	60
27	12/17/99	47	60	65	5.00	N/A	6420	6330	6375	5838	6118	90
28	12/21/99	31	42	55	4.00	N/A	6600	6720	6660	5867	6335	120
29	08/22/00	44	100	94	4.00	4.1%	5660	5650	5655	5860	6230	10
30	08/24/00	44	99	82	5.00	N/A	6050	6120	6085	5868	6133	70
*** Averages ***			67	70	5.25	5.0%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9567 **Strength: 5000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$
\begin{aligned}
F'cr &= F'c + 1.34(SD) \\
&= 5000 + 1.34(513) \\
&= 5688
\end{aligned}
$$

$$
\begin{aligned}
F'cr &= F'c + 2.33(SD) - 500 \\
&= 5000 + 2.33(513) - 500 \\
&= 5696
\end{aligned}
$$

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	6990	psi
Minimum Value...........................	4905	psi
Range...................................	2085	psi
Average Strength........................	5868	psi
Standard Deviation......................	513	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	5696	psi
Design excess beyond code requirements...	172	psi

Mix #: 8274
Description: 6.00SK ADMIX/AEA 1"CS
Strength: 4000 psi @ 28 Days

3000 PSI @ 7 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.457 lbs/lb
Cement/Cementitious Content:	6.00 sacks (per cubic yard)
Maximum Placement Slump:	5.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

564 lbs.	ASTM C 150 TYPE I CEMENT
1840 lbs.	1" - #4 CRUSHED STONE
1273 lbs.	CONCRETE SAND
258 lbs.	or 31.0 Gallons of Water
2.0 to	4.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%
Placement Slump: 4.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8274 Strength: 3000 psi @ 7 Days

7 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	7 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	09/28/00	38	87	96	4.00	N/A	3480	3660	3570	3570		180
2	09/29/00			80	3.75	3.5%	3950		3950	3760		
3	10/04/00	38	82	90	6.00	N/A	3040	3020	3030	3517	3517	20
4	10/05/00	38	90	92	5.75	N/A	4060	3830	3945	3624	3642	230
5	10/06/00	46	68	79	5.50	N/A	4220	4000	4110	3721	3695	220
6	10/10/00	38	68	74	4.00	N/A	4800	4820	4810	3903	4288	20
7	10/13/00	46	60	82	4.00	N/A	3810	3590	3700	3874	4207	220
8	10/13/00	38	83	87	3.50	N/A	3970	4120	4045	3895	4185	150
9	10/16/00	38	73	83	4.00	N/A	3900	3920	3910	3897	3885	20
10	10/17/00	38	74	81	4.50	N/A	3940	4000	3970	3904	3975	60
11	10/18/00	38	83	86	5.25	N/A	3670		3670	3883	3850	
12	10/19/00	50	82	78	3.00	N/A	3840	3960	3900	3884	3847	120
13	10/19/00	38	79	82	4.75	N/A	4200	4100	4150	3905	3907	100
14	10/20/00			77	4.50	N/A	4400		4400	3940	4150	
15	10/20/00	38	74	76	4.75	N/A	4170	4170	4170	3955	4240	0
16	10/25/00	38	80	79	4.00	N/A	4040		4040	3961	4203	
17	10/27/00			74	3.75	5.8%	4310	4400	4355	3984	4188	90
18	11/20/00			55	4.00	25.0%	4120	4000	4060	3988	4152	120
19	11/21/00		52	65	4.75	5.8%	3960		3960	3987	4125	
20	11/22/00		56	60	5.00	5.5%	3990		3990	3987	4003	
21	11/22/00	50	50	62	2.50	N/A	4350		4350	4004	4100	
22	11/29/00			65	3.75	5.0%	4920	5110	5015	4050	4452	190
23	12/01/00	25	54	63		N/A	3180		3180	4012	4182	
24	12/07/00			59	5.00	4.7%	3340		3340	3984	3845	
25	12/14/00	40	41	57	5.25	N/A	4780		4780	4016	3767	
26	12/15/00			53	5.00	4.5%	4010		4010	4016	4043	
27	12/15/00			53	5.00	4.6%	3540		3540	3998	4110	
28	12/20/00	40	65	67	4.75	N/A	4130		4130	4003	3893	
29	12/22/00	40	49	51	5.25	N/A	3900		3900	3999	3857	
30	03/05/01	38	69	77	4.50	4.0%	4870	4730	4800	4026	4277	140
*** Averages ***			70	73	4.47	6.8%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8274 **Strength: 3000 psi @ 7 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$

$$= 3000 + 1.34(458)$$
$$= 3614$$

$$F'cr = F'c + 2.33(SD) - 500$$

$$= 3000 + 2.33(458) - 500$$
$$= 3568$$

SUMMARY OF STATISTICAL ANALYSIS
7 Day Test Data

Number of Tests..........................	30	
Maximum Value............................	5015	psi
Minimum Value............................	3030	psi
Range....................................	1985	psi
Average Strength.........................	4026	psi
Standard Deviation.......................	458	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1...............	3614	psi
Design excess beyond code requirements...	412	psi

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8274 Strength: 4000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit)		Placement Slump(in)	Percent of Air	28 Day			Cumulative Average	Moving Avg of 3	Range
			Ambient	Concrete			PSI 1	PSI 2	PSI AVG			
1	09/28/00	38	87	96	4.00	N/A	4340	4500	4420	4420		160
2	09/29/00			80	3.75	3.5%	4770	4710	4740	4580		60
3	10/04/00	38	82	90	6.00	N/A	4070	4130	4100	4420	4420	60
4	10/05/00	38	90	92	5.75	N/A	4730	4640	4685	4486	4508	90
5	10/06/00	46	68	79	5.50	N/A	5340	5580	5460	4681	4748	240
6	10/10/00	38	68	74	4.00	N/A	5270	5350	5310	4786	5152	80
7	10/13/00	46	80	82	4.00	N/A	4560	4580	4570	4755	5113	20
8	10/13/00	38	83	87	3.50	N/A	5290	5390	5340	4828	5073	100
9	10/16/00	38	73	83	4.00	N/A	4370	4480	4425	4783	4778	110
10	10/17/00	38	74	81	4.50	N/A	5080	5090	5085	4814	4950	10
11	10/18/00	38	83	86	5.25	N/A	4640	4570	4605	4795	4705	70
12	10/19/00	50	82	78	3.00	N/A	4280	4440	4360	4758	4683	160
13	10/19/00	38	79	82	4.75	N/A	5250	4760	5005	4777	4657	490
14	10/20/00			77	4.50	N/A	5250	5360	5305	4815	4890	110
15	10/20/00	38	74	76	4.75	N/A	5280	5650	5465	4858	5258	370
16	10/25/00	38	80	79	4.00	N/A	4990	4960	4975	4866	5248	30
17	10/27/00			74	3.75	5.8%	5310	5210	5260	4889	5233	100
18	11/20/00			55	4.00	25.0%	4750	4820	4785	4883	5007	70
19	11/21/00		52	65	4.75	5.8%	4940	4970	4955	4887	5000	30
20	11/22/00		56	60	5.00	5.5%	5060	4970	5015	4893	4918	90
21	11/22/00	50	50	62	2.50	N/A	5000	5190	5095	4903	5022	190
22	11/29/00			65	3.75	5.0%	6310	6350	6330	4968	5480	40
23	12/01/00	25	54	63		N/A	4560	4400	4480	4947	5302	160
24	12/07/00			59	5.00	4.7%	4390	4490	4440	4925	5083	100
25	12/14/00	40	41	57	5.25	N/A	5110	5200	5155	4935	4692	90
26	12/15/00			53	5.00	4.5%	5570	5270	5420	4953	5005	300
27	12/15/00			53	5.00	4.6%	5000	5100	5050	4957	5208	100
28	12/20/00	40	65	67	4.75	N/A	5180	5070	5125	4963	5198	110
29	12/22/00	40	49	51	5.25	N/A	5130	5200	5165	4970	5113	70
30	03/05/01	38	69	77	4.50	4.0%	5730	5790	5760	4996	5350	60
*** Averages ***			70	73	4.47	6.8%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8274 **Strength: 4000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$
$$= 4000 + 1.34(471)$$
$$= 4631$$

$$F'cr = F'c + 2.33(SD) - 500$$
$$= 4000 + 2.33(471) - 500$$
$$= 4598$$

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	6330	psi
Minimum Value...........................	4100	psi
Range...................................	2230	psi
Average Strength........................	4996	psi
Standard Deviation......................	471	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1...............	4631	psi
Design excess beyond code requirements...	365	psi

Mix #:	8206
Description:	564# ADMIX/AEA 1"CS
Strength:	4000 psi @ 28 Days

3000 PSI @ 7 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.457 lbs/lb
Cement/Cementitious Content:	6.31 sacks (per cubic yard)
Maximum Placement Slump:	5.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

451 lbs.	ASTM C 150 TYPE I CEMENT
113 lbs.	ASTM C 618 FLY ASH
1840 lbs.	1" - #4 CRUSHED STONE
1254 lbs.	CONCRETE SAND
258 lbs.	or 31.0 Gallons of Water
2.0 to	6.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%

Placement Slump: 4.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8206 Strength: 3000 psi @ 7 Days

7 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	7 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	10/03/00		84	83	4.00	4.3%	3560	3780	3670	3670		220
2	10/03/00		84	85	4.75	4.3%	3730	3650	3690	3680		80
3	10/03/00		84	84	5.00	4.3%	3740	3820	3780	3713	3713	80
4	10/03/00		81	83	4.00	3.5%	3730	3830	3780	3730	3750	100
5	10/04/00		87	90	2.75	4.7%	3850		3850	3754	3803	
6	10/06/00	31	55	73	5.00	4.9%	4110	4220	4165	3823	3932	110
7	10/09/00	38	47	64	4.50	4.6%	3700	3910	3805	3820	3940	210
8	10/12/00		78	84	5.25	4.5%	3850	3590	3720	3808	3897	260
9	10/12/00		78	83	4.25	4.0%	4880	4720	4800	3918	4108	160
10	10/12/00		79	83	4.75	4.0%	4670	4700	4685	3995	4402	30
11	10/12/00		79	84	4.50	4.0%	4130	4080	4105	4005	4530	50
12	10/12/00		78	83	6.50	3.5%	4060	4120	4090	4012	4293	60
13	10/12/00	31	82	80	5.50	5.1%	3720	3780	3750	3992	3982	60
14	10/19/00	31	75	89	5.25	N/A	3580	3650	3615	3965	3818	70
15	10/20/00	31	68	72	4.00	4.4%	4370	4540	4455	3997	3940	170
16	11/02/00	38	80	84	6.00	N/A	4440	4160	4300	4016	4123	280
17	11/16/00	31	52	65	5.25	N/A	4090	3970	4030	4017	4262	120
18	11/16/00	31	52	67	4.75	N/A	4720	4660	4690	4054	4340	60
19	11/28/00	31	69	71	5.50	N/A	3570	3440	3505	4026	4075	130
20	12/04/00	31	53	63	5.00	N/A	3700	3810	3755	4012	3983	110
21	12/05/00	31	50	63	5.00	N/A	4460	4420	4440	4032	3900	40
22	12/05/00	31	53	62	4.50	5.3%	4020	4000	4010	4031	4068	20
23	12/06/00	31	47	61	5.00	N/A	4350	4720	4535	4053	4328	370
24	12/07/00		30	60	5.50	N/A	3590		3590	4034	4045	
25	12/07/00	40	32	73	5.50	4.5%	4620		4620	4057	4248	
26	12/07/00	40	33	68	5.50	4.5%	4280		4280	4066	4163	
27	12/07/00	40	29	68	5.75	4.6%	3960		3960	4062	4287	
28	12/07/00	31	49	65	4.00	N/A	4060	3990	4025	4061	4088	70
29	12/08/00	38	55	60	5.50	N/A	4020	4070	4045	4060	4010	50
30	12/19/00	12	60	58	5.00	4.5%	4640		4640	4080	4237	
*** Averages ***			63	74	4.93	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8206 **Strength: 3000 psi @ 7 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$

$$= 3000 + 1.34(382)$$
$$= 3511$$

$$F'cr = F'c + 2.33(SD) - 500$$

$$= 3000 + 2.33(382) - 500$$
$$= 3389$$

SUMMARY OF STATISTICAL ANALYSIS
7 Day Test Data

Number of Tests........................	30	
Maximum Value..........................	4800	psi
Minimum Value..........................	3505	psi
Range..................................	1295	psi
Average Strength.......................	4080	psi
Standard Deviation.....................	382	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	3511	psi
Design excess beyond code requirements...	569	psi

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8206 Strength: 4000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	10/03/00		84	85	4.75	4.3%	5300	5200	5250	5250		100
2	10/03/00		82	83	5.00	4.0%	4620	4720	4670	4960		100
3	10/03/00		81	83	5.00	4.0%	4660	4770	4715	4878	4878	110
4	10/03/00		81	83	4.00	3.5%	5240	5320	5280	4979	4888	80
5	10/04/00		87	90	2.75	4.7%	5130	5060	5095	5002	5030	70
6	10/06/00	31	55	73	5.00	4.9%	4910	5080	4995	5001	5123	170
7	10/09/00	38	47	64	4.50	4.6%	5140	5430	5285	5041	5125	290
8	10/12/00		79	84	4.50	4.0%	5460	5250	5355	5081	5212	210
9	10/12/00		79	83	4.75	4.0%	5730	5720	5725	5152	5455	10
10	10/12/00		78	84	5.25	4.5%	5010	5090	5050	5142	5377	80
11	10/12/00		78	83	4.25	4.0%	5880	5710	5795	5201	5523	170
12	10/12/00		78	83	6.50	3.5%	5440	5330	5385	5217	5410	110
13	10/12/00	31	82	80	5.50	5.1%	5080	5170	5125	5210	5435	90
14	10/19/00	31	75	89	5.25	N/A	4440	4620	4530	5161	5013	180
15	10/20/00	31	68	72	4.00	4.4%	5020	5350	5185	5163	4947	330
16	11/02/00	38	80	84	6.00	N/A	5200	5250	5225	5167	4980	50
17	11/16/00	31	52	65	5.25	N/A	5740	5680	5710	5199	5373	60
18	11/16/00	31	52	67	4.75	N/A	6030	5950	5990	5243	5642	80
19	11/28/00	31	69	71	5.50	N/A	5120	4840	4980	5229	5560	280
20	12/04/00	31	53	63	5.00	N/A	5610	5280	5445	5240	5472	330
21	12/05/00	31	50	63	5.00	N/A	5730	5870	5800	5266	5408	140
22	12/05/00	31	53	62	4.50	5.3%	5260	5420	5340	5270	5528	160
23	12/06/00	31	47	61	5.00	N/A	6650	6650	6650	5330	5930	0
24	12/07/00		30	60	5.50	N/A	4550	4810	4680	5303	5557	260
25	12/07/00	40	33	68	5.50	4.5%	5900	5990	5945	5328	5758	90
26	12/07/00	40	32	73	5.50	4.5%	5910	5850	5880	5349	5502	60
27	12/07/00	40	29	68	5.75	4.6%	5480	5560	5520	5356	5782	80
28	12/07/00	31	49	65	4.00	N/A	5420	5250	5335	5355	5578	170
29	12/08/00	38	55	60	5.50	N/A	5620	5870	5745	5368	5533	250
30	12/19/00	12	60	58	5.00	4.5%	6240	6020	6130	5394	5737	220
*** Averages ***			63	74	4.96	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8206 **Strength: 4000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$

$$= 4000 + 1.34(480)$$
$$= 4643$$

$$F'cr = F'c + 2.33(SD) - 500$$

$$= 4000 + 2.33(480) - 500$$
$$= 4617$$

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests..........................	30	
Maximum Value............................	6650	psi
Minimum Value............................	4530	psi
Range....................................	2120	psi
Average Strength.........................	5394	psi
Standard Deviation.......................	480	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1...............	4643	psi
Design excess beyond code requirements...	751	psi

EXHIBIT C

OPINION OF PROBABLE COST
(For Design Contract)

Date: June 27, 2000

Midway Road Reconstruction Project
Belt Line Road to Keller Springs
Town of Addison

Item No.	Quantity	Unit	Item	Unit Price	Item Total
				($)	($)
1	55.00	STA	ROW Preparation	5000.00	275000.00
2	10,000.00	C.Y.	Unclassified Excavation (for 4" Base)	12.00	120000.00
3	1.00	L.S.	Barricade, Sign, Traffic Control	0.00	0.00
4	53,500.00	S.Y.	Remove Concrete Pavement, Haul, Dispose	10.00	535000.00
5	700.00	S.Y.	Remove Concrete Drive, Haul, Dispose	15.00	10500.00
6	2,000.00	S.Y.	Remove/Replace 6" Concr. Median Pavemt.	40.00	80000.00
7	14,000.00	L.F.	Sawcut Breakout Groove	4.00	56000.00
8	57,000.00	S.Y.	4" Asphalt Treated Base	10.00	570000.00
9	700.00	S.Y.	6" Reinforced Concrete Drives	40.00	28000.00
10	53,500.00	S.Y.	11" Reinf. Concr. Pavement (4,000 psi)	55.00	2942500.00
11	8,900.00	L.F.	6" Integral Curb	3.00	26700.00
12	3,000.00	S.Y.	Temporary Asphalt	0.00	0.00
13	10,000.00	S.Y.	Block Sodding Disturbed Areas	5.00	50000.00
14	20.00	EA.	Reconstruct Inlet Tops	1500.00	30000.00
15	24.00	EA.	Remove and Replace Street Lights	0.00	0.00
16	2,200.00	EA.	4" Buttons	5.00	11000.00
17	10,000.00	L.F.	Geocomposite Edge Drain	20.00	200000.00
18	1.00	L.S.	Pavement Markings	50000.00	50000.00
19	1.00	L.S.	Traffic Signal/Loop Adjustments	0.00	0.00
20	1.00	L.S.	Storm Water Pollution Prevention Plan	0.00	0.00
21	1.00	L.S.	Replace Landscape	0.00	0.00
22	1.00	L.S.	Utility Adjustments	100000.00	100000.00
			Subtotal:		$4,984,700.00
			20% Contingency:		$996,940.00
			TOTAL:		$5,981,640.00

Notes:

1. No sidewalk cost is included.
2. Existing inlet bases will remain in place while the top is reconstructed.
3. The edge drain will be placed behind the outside curbs for the length of the project.
4. Early strength concrete would add about $500,000 to the project cost.
5. Phase Two design items have been excluded from the total cost.

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
972/620-8911 - 972/263-4937 (Metro)
FAX: 972/406-8023

DRAFT

April 2, 2001

GBW ENGINEERS, INC.
1919 Shiloh S. Road, Suite 530, LB 27
Garland, Texas 75042
Attention: Mr. Bruce R. Grantham, P.E.

*******DRAFT COPY******

Re: Remedial Geotechnical Exploration
MIDWAY ROAD RECONSTRUCTION
Beltline Road to Keller Springs Road
Addison, Texas
ALPHA Report No. 00988

Attached is the report of the remedial geotechnical exploration performed for the project referenced above. This study has been authorized by Mr. Bruce Grantham, P.E. on December 28, 2000 and performed in accordance with ALPHA Proposal No. GT 7371 dated June 27, 2000.

This report contains results of field explorations and laboratory testing and an engineering interpretation of these with respect to available project characteristics. The results and analyses have been used to develop recommendations for remedial design and reconstruction of a segment of Midway Road in Addison, Texas.

ALPHA TESTING, INC. appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing services during construction, please contact our office.

Sincerely yours,

ALPHA TESTING, INC.

David A. Lewis, P.E.
Manager of Engineering Services

Jim L. Hillhouse, P.E.
President

DAL JLH dal
Copies: (3) Client

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on

MIDWAY ROAD RECONSTRUCTION
Beltline Road to Keller Springs Road
Addison, Texas
ALPHA Report No. 00988

1.0 PURPOSE AND SCOPE

The purpose of this remedial geotechnical exploration is to evaluate some of the physical and engineering properties of subsurface materials at the subject study area with respect to design and reconstruction of a segment of Midway Road in Addison, Texas. The field exploration has been accomplished by securing subsurface samples (including concrete pavement) from widely spaced test borings performed along the study area. Engineering analyses have been performed from results of the field exploration and results of laboratory tests performed on representative samples. The analyses have been used to develop recommended pavement section options for the subject reconstructed roadway.

Also included is an evaluation of the site with respect to potential construction problems and recommendations concerning earthwork and quality control testing during construction. This information can be used to verify subsurface conditions and to aid in ascertaining all construction phases meet project specifications.

Recommendations provided in this report have been developed from information obtained in test borings depicting subsurface conditions only at the specific boring locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those observed at the boring locations. The scope of work is not intended to fully define the variability of subsurface materials that may be present on the study area.

The nature and extent of variations between borings may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and tests.

Professional services provided in this geotechnical exploration have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater.

ALPHA TESTING, INC. is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for exclusive use of the Client (and their design representatives) and design of the specific pavement outlined in Section 2.0. Recommendations presented in this report should not be used for design of any other pavements except those specifically described in this report. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than two (2) years after completion of this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may materially alter the recommendations. Further, ALPHA TESTING, INC. is not responsible for damages resulting from workmanship of designers or contractors and it is recommended that the owner retain qualified personnel to verify work is performed in accordance with plans and specifications.

2.0 PROJECT CHARACTERISTICS

It is proposed to reconstruct a segment of Midway Road located between Beltline Road and Keller Springs Road in Addison, Texas. A site plan illustrating the general outline of the study area is provided as Figure 1, the Location Plan, in the Appendix of this report. At the time the field exploration was performed, the study area was developed with the existing concrete roadway.

Present plans provide for reconstruction of the existing pavement. The existing pavement has experienced some distress. The distress is generally in the form of depressed areas adjacent to the existing pavement joints and generally occur in the direction of traffic flow from the pavement joints. Joints in the pavement were noted to be unusually large (up to about ½" wide) and in some areas it appears surface water is entering the pavement subgrade through these wide joints. At the north end of the study area (north of Borings 21 and 22; north-bound lane) in particular, water was actually noted emerging from the joints immediately after passage of large trucks. In general, transverse cracking was noted across the pavement panel near their midpoint in areas where significant pavement distress was noted.

3.0 FIELD EXPLORATION

Subsurface conditions along the study area have been explored by drilling 22 test borings in general accordance with ASTM D 420 to a depth of 10 ft using standard rotary drilling equipment. The approximate location of each test boring is shown on the Boring Location Plans, Figures 2-7, enclosed in the Appendix of this report. Some borings were drilled in distressed areas while others were drilled in non-distressed areas for comparison. Details of drilling and sampling operations are briefly summarized in Methods of Field Exploration, Section A-1 of the Appendix.

Soil and rock (shaly limestone) types encountered during the field exploration are presented on Record of Subsurface Exploration sheets included in the Appendix of this report. The boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, these boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are approximate and the actual transition between strata may be gradual.

Fill materials have been encountered at some boring locations as will be discussed in Section 5.0. There may be fill in other borings than noted or at other locations, but could not be readily identified. Composition of the fill has been evaluated based on samples retrieved from 6-inch maximum diameter boreholes. It is anticipated this fill was placed and compacted during construction of the existing concrete roadway. However, since no records were made available of fill placement, compaction or uniformity, subsurface conditions immediately adjacent to test borings could be substantially different than conditions observed in test borings.

4.0 LABORATORY TESTS

Selected samples of the subsurface materials have been tested in the laboratory to evaluate their engineering properties as a basis in providing recommendations for pavement design and earthwork construction. A brief description of testing procedures used in the laboratory can be found in Methods of Laboratory Testing, Section B-1 of the Appendix. Individual test results are presented either on Record of Subsurface Exploration sheets or on summary data sheets also enclosed in the Appendix.

5.0 GENERAL SUBSURFACE CONDITIONS

In general, the existing concrete pavement is underlain by soils derived from the Austin Chalk formation. Within the 10-ft maximum depth explored during this study, subsurface materials consist generally of clay (CH) underlain by calcareous clay (CL) and deeper shaly limestone. In the southern and central portions of the study area (Borings 1-16), the existing pavement sectiongenerally consists of about 8 inches of Portland cement concrete overlying lime treated subgrade soils. (It should be noted that lime treated subgrade soils were *not* encountered in all of these boring locations.) In the northern portion of the study area (Borings 17-22), the existing pavement section generally consists of 6.5 to 7 inches of Portland cement concrete overlying a clayey (CH/CL) subgrade. The letters in parenthesis represent the soils' classification according to the Unified Soil Classification System (ASTM D 2488). More detailed stratigraphic information is presented on the Record of Subsurface Exploration Sheets attached to this report.

Most of the subsurface materials are relatively impermeable and are anticipated to have a slow response to water movement. Therefore, several days of observation will be required to evaluate actual groundwater levels within the depths explored. Also, the groundwater level at the study area is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions and subsurface drainage characteristics.

During field explorations, free groundwater has been noted in Borings 1-4 on drilling tools and in open boreholes upon completion at depths of 4.5 to 8 ft. Free groundwater was not observed in the other borings during drilling or in the other open boreholes upon completion. In our opinion, the current groundwater level on the study area may be located below the bottom of the borings and water within the depths explored may be "perched" groundwater which has percolated downward through desiccation cracks in the clayey type soils. It is not uncommon to detect seasonal groundwater either from natural fractures within the clay matrix, near the soil/rock interface or from fractures in the rock, particularly after a wet season. If more detailed groundwater information is required, monitoring wells or piezometers can be installed.

Further details concerning subsurface materials and conditions encountered can be obtained from the Record of Subsurface Exploration sheets provided in the Appendix of this report.

6.0 DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described Project Characteristics (Section 2.0) and Subsurface Conditions (Section 5.0). If project criteria should change, our office should conduct a review to determine if modifications to the recommendations are required. Further, it is recommended our office be provided with a copy of the final plans and specifications for review prior to construction.

6.1 Pavement

Clay or calcareous clay encountered near the existing ground surface will probably constitute the subgrade for the new pavement. Therefore, it is recommended these materials be improved prior to construction of pavement. Due to the wide spacing of the borings, division of the study area into areas with similar subgrade conditions was not possible. Delineation of areas with similar subgrade conditions, if required, should be performed during construction after the subgrade material has been exposed. The specific type of improvement procedures required in given pavement areas will be dependent upon the type of subgrade material present after final subgrade elevation has been achieved.

Calculations used to determine the required pavement thickness are based only on the physical and engineering properties of the materials and conventional thickness determination procedures. Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, reinforcing steel, joint design and environmental factors will significantly affect the service life and must be included in preparation of the construction drawings and specifications, but were not included in the scope of this study. Normal periodic maintenance will be required for all pavement to achieve the design life of the pavement system.

Please note, the recommended pavement section options provided below are considered the minimum necessary to provide satisfactory performance based on the expected traffic loading. In some cases, City minimum standards for pavement section construction may exceed those provided below.

The following design information has been provided by the Client:

- New pavement will consist of Portland-cement concrete and the design life is 30 years.
- Daily traffic based on 1999 information for the study area is about 51,000 vehicles per day.

- The projected daily traffic volume by Year 2020 will be up to about 60,000 vehicles per day.
- It is anticipated the new pavement will be subject to significant truck traffic.
- Truck traffic will be about 20 percent of the daily traffic volume. Therefore, the design traffic used for the new pavement is 15,118,000 18-kip equivalent axle load applications for a 30-year design life.

6.1.1 Pavement Subgrade Preparation

Due to the relatively heavy truck traffic expected, it is recommended a non-erodable base material be provided immediately below the Portland-cement concrete pavement. The non-erodable base material could consist of either a crushed limestone base material or a cement treated permeable base. The non-erodable base should be supported on an improved subgrade consisting of either a re-compacted subgrade or a mechanically lime stabilized subgrade. It should be noted that a geotextile fabric (e.g., Marafi 180N or equivalent) should be provided between the improved subgrade soils and the cement treated permeable base to prevent fines from the improved soils from penetrating into the permeable base material. If a permeable base is used, the subgrade must be carefully graded (i.e., no birdbaths and minimum slope of 1.5 percent) to provide positive flow of percolated water through the permeable base to collection points at the extreme perimeter of the pavement. Collected water at the perimeter of the pavement should be drained to an appropriate receptacle.

If the subgrade soils are mechanically lime stabilized, it is recommended lime stabilization procedures extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement. The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the mixture's optimum moisture content. In all areas where hydrated lime is used to stabilize subgrade soil, routine Atterberg-limit tests should be performed to verify the resulting plasticity index of the soil-lime mixture is at/or below 15.

Mechanical lime stabilization of the pavement subgrade soil will not prevent normal seasonal movement of the underlying untreated materials. Normal maintenance of pavement should be expected over the pavement design life.

6.1.2 Pavement Sections Options

California Bearing Ratio (CBR) tests performed on composite samples from the test borings indicate the CBR value for the existing clay subgrade soils will be about 3 whereas the CBR value for the same material after mechanical lime stabilization would increase to about 20. Using the above values and assuming normal traffic for a 30-year project life, the following pavement sections are recommended if load transfer between joints is through *aggregate interlock*:

Compacted Subgrade

11.5 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	compacted subgrade

OR

10.5 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	compacted subgrade

Lime Stabilized Subgrade

11 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	lime stabilized subgrade

OR

10 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	lime stabilized subgrade

If dowels are provided for load transfer at the joints in the new pavement, the following pavement section options are provided:

Compacted Subgrade

10 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	compacted subgrade

OR

9 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	compacted subgrade

Lime Stabilized Subgrade

Redo? Stab? lime subgrade?

9.5 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	lime stabilized -subgrade

OR

9 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	lime stabilized subgrade

6.1.3 Pavement Specifications

Pavement should be specified, constructed and tested to meet the following requirements:

1. Portland-Cement Concrete: Texas SDHPT Item 360. Specify a minimum flexural strength of 650 lbs per sq inch at 28 days. Concrete should be designed with 5 $\pm$ 1 percent entrained air.

2. Crushed Limestone Base Material: Texas SDHPT Item 247, Type A or B, Grade 2 or better. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 698) and within three percentage points of the material's optimum moisture content.

3. Cement Treated Permeable Base Material: Cement treated permeable base should have a minimum hydraulic conductivity of 3,000 feet per day after compaction. Permeable base material shall consist of coarse aggregate with no fine aggregate (sand, etc.) and shall be treated with 6 percent Portland cement by dry weight of the aggregate. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 558) and within three percentage points of the material's optimum moisture content. The material supplier shall submit an acceptable mix design for approval.

4. Lime Stabilized Subgrade: Texas SDHPT Item 260. An estimated 3 and 8 percent of hydrated lime (by dry soil weight) should be applied to existing calcareous clay and clay soils, respectively, which have been scarified to a depth of 6 inches. The actual amount of lime required should be confirmed by additional laboratory tests prior to construction.

a. The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above optimum moisture. The moisture content of the subgrade should be maintained until the pavement surface is placed.

b. In all areas where hydrated lime is utilized to stabilize the subgrade soil, routine Atterberg-limit tests should be performed prior to completion of construction to assure the resulting plasticity index of the soil-lime mixture will be at/or below 15. Gradation, Atterberg-limits and density tests should be performed at a frequency of 1 test per 5000 sq ft of pavement.

5. Re-compacted Subgrade: On-site materials should be scarified to a depth of at least 6 inches and re-compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content. The moisture content of the subgrade should be maintained until the pavement surface is placed. Density tests should be performed at a frequency of 1 test per 5000 sq ft of pavement.

7.0 GENERAL CONSTRUCTION PROCEDURES AND RECOMMENDATIONS

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Geotechnical Engineer be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be anticipated until the course of construction. The recommendations offered in the following paragraphs are intended, not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the borings.

7.1 Site Preparation and Grading

All areas supporting pavement should be properly prepared.

After completion of the necessary stripping, clearing, and excavating and prior to placing any required fill, the exposed subgrade should be carefully inspected by probing and testing. Any undesirable material (organic material, wet, soft, or loose soil) still in place should be removed.

The exposed subgrade should be further inspected by proof-rolling with a heavy pneumatic tired roller, loaded dump truck or similar equipment weighing approximately 10 tons to check for pockets of soft or loose material hidden beneath a thin crust of possibly better soil.

Proof-rolling procedures should be observed by the project geotechnical engineer or his representative.

Any unsuitable materials exposed should be removed and replaced with well-compacted material as outlined in Section 7.2.

Slope stability analysis of embankments (natural or constructed) was not within the scope of this study. Trench excavations should be braced or cut at stable slopes in accordance with Occupational Safety and Health Administration (OSHA) requirements, Title 29, Items 1926.650-1926.653 and other applicable building codes.

7.2 Fill Compaction

Calcareous or sandy materials with a plasticity index below 25 should be compacted to a dry density of at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content.

Clay soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 95 and 100 percent of standard Proctor maximum dry density (ASTM D 698). The compacted moisture content of the clays during placement should be within the range of 0 to 4 percentage points above optimum. Clay fill should be processed and the largest particle or clod should be less than 6 inches prior to compaction.

Limestone or other rock-like materials used as random fill should be compacted to at least 95 percent of standard Proctor maximum dry density. The compacted moisture content of limestone or other rock-like materials used as random fill is not considered crucial to proper performance. However, if the material's moisture content during placement is within 3 percentage points of optimum, the compactive effort required to achieve the minimum compaction criteria may be minimized. Individual rock pieces larger than 6 inches in dimension should not be used as fill. However, if rock fill is utilized within 1 ft below the bottom of the pavement, the maximum allowable size of individual rock pieces should be reduced to 3 inches.

In cases where either mass fills or utility lines are more than 10 ft deep, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D-698) and within 2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as outlined above.

Compaction should be accomplished by placing fill in about 8-inch thick loose lifts and compacting each lift to at least the specified minimum dry density. Field density and moisture content tests should be performed on each lift. As a guide, a test frequency of one test per 5000 sq ft or greater per lift may be used. Utility trench backfill should be tested at a rate of one test per lift per each 300 lineal feet of trench.

7.3 Groundwater

No significant de-watering problems are anticipated during pavement excavations. However, if any minor water seepage is encountered during construction, pumping from excavations with pumps or other conventional de-watering equipment should be sufficient.

In any areas where significant cuts (1.5 ft or more) are made to establish final grades for the pavement, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. Subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other de-watering devices on the pavement subgrade should be carefully addressed during construction. Our office could be contacted to visually observe the subgrade to evaluate the need for such drains.

APPENDIX

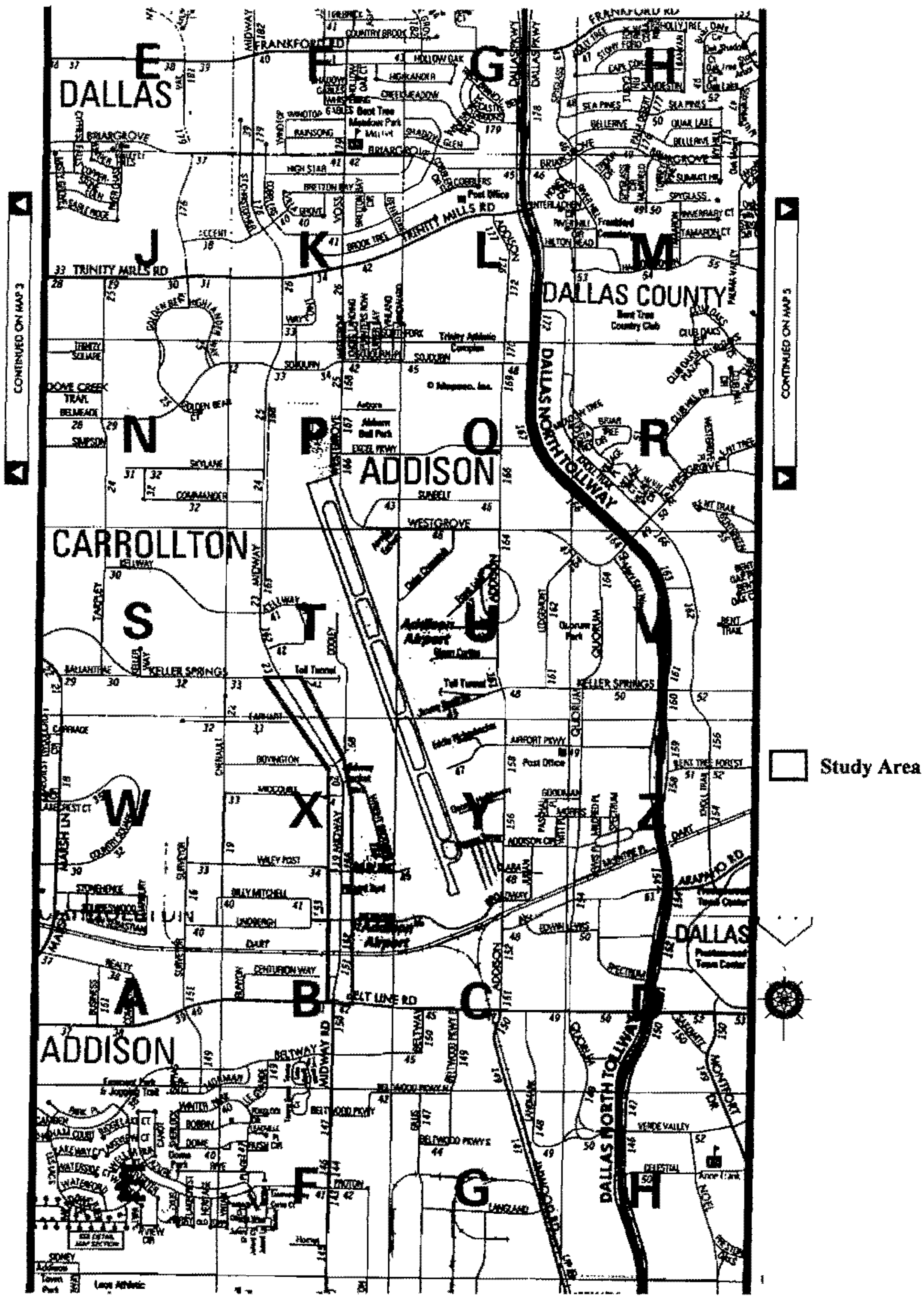
A-1 METHODS OF FIELD EXPLORATION

Using standard rotary drilling equipment, a total of 22 test borings have been performed for this geotechnical exploration at the approximate locations shown on the Boring Location Plans, Figures 2-7. The test boring locations have been staked by either pacing or taping and estimating right angles from landmarks which could be identified in the field and as shown on the site plans provided during this study. The location of test borings shown on the Boring Location Plan is considered accurate only to the degree implied by the method used to locate the borings. The surface elevations provided on the Record of Subsurface Exploration sheets have been obtained by plotting the boring locations on the site plans and interpolating the surface elevation. Surface elevations given on the boring logs are approximate.

Relatively undisturbed samples of the cohesive subsurface materials have been obtained by hydraulically pressing 3-inch O.D. thin-wall sampling tubes into the underlying soils at selected depths (ASTM D 1587). These samples have been removed from the sampling tubes in the field and examined visually. One representative portion of each sample has been sealed in a plastic bag for use in future visual examinations and possible testing in the laboratory.

Modified Texas Cone Penetration (TCP) tests have also been completed in the field to determine the apparent in-place strength characteristics of the rock type materials. A 3-inch diameter steel cone driven by a 170-pound hammer dropped 24 inches is the basis for Texas State Department of Highways and Public Transportation strength correlations. In this case, ALPHA TESTING, INC. has modified the procedure allowing the use of a 140-pound hammer dropping 30-inches for completion of the field test. Depending on the resistance (strength) of the materials, either the number of blows of the hammer required to provide 12 inches of penetration, or the inches of penetration of the cone due to 100 blows of the hammer are recorded on the field logs and are shown on the Record of Subsurface Exploration sheets as TCP (reference: Texas State Department of Highways and Public Transportation, Bridge Design Manual), using the modified procedure.

Logs of all borings have been included in the Appendix of this report. The logs show visual descriptions of all soil and rock (shaly limestone) strata encountered using the Unified Soil Classification System. Sampling information, pertinent field data, and field observations are also included. Soil and rock samples not consumed by testing will be retained in our laboratory for at least 30 days and then discarded unless the Client requests otherwise.



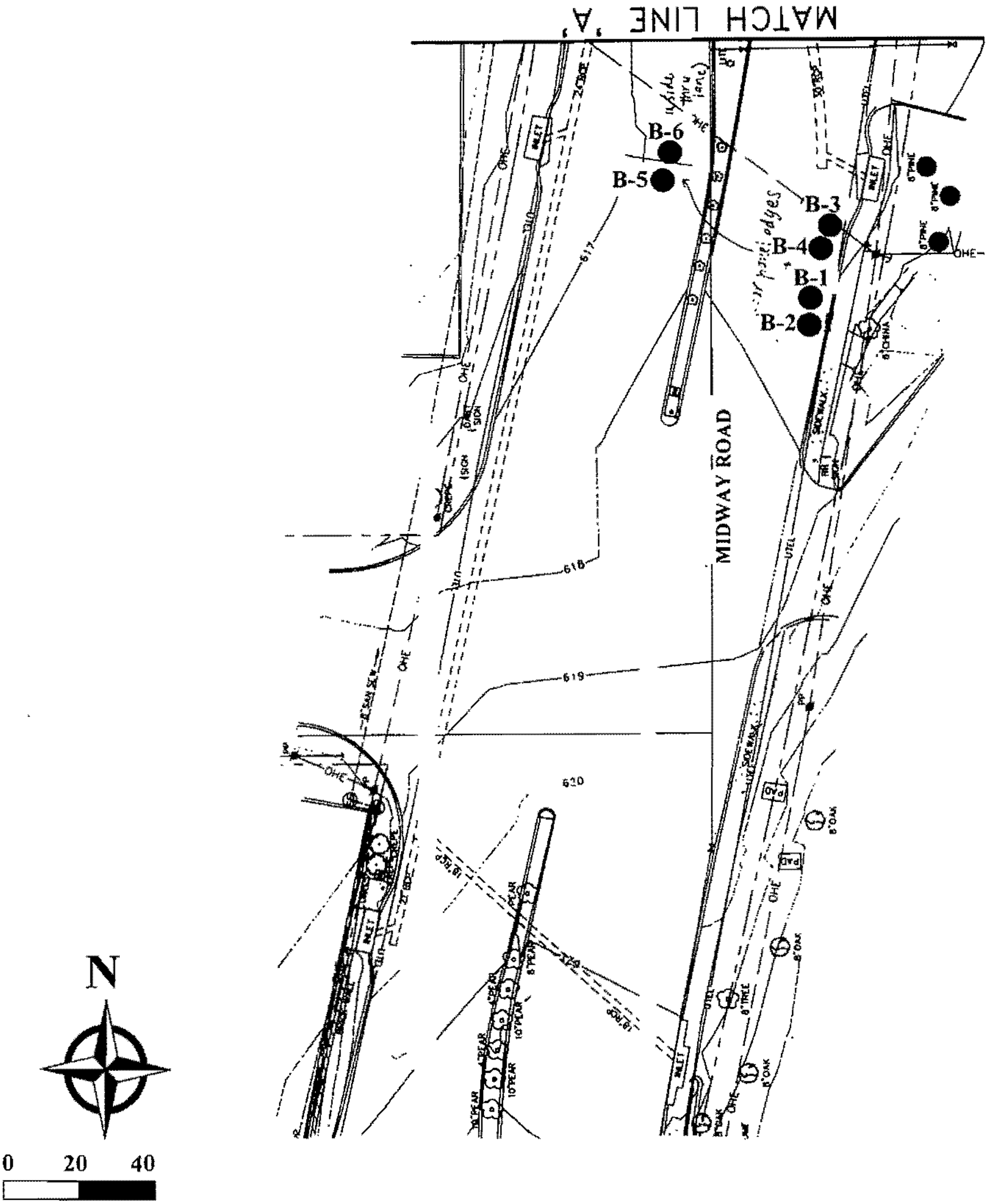
GBW Engineers, Inc.
Garland, Texas

Midway Road Reconstruction
Addison, Texas

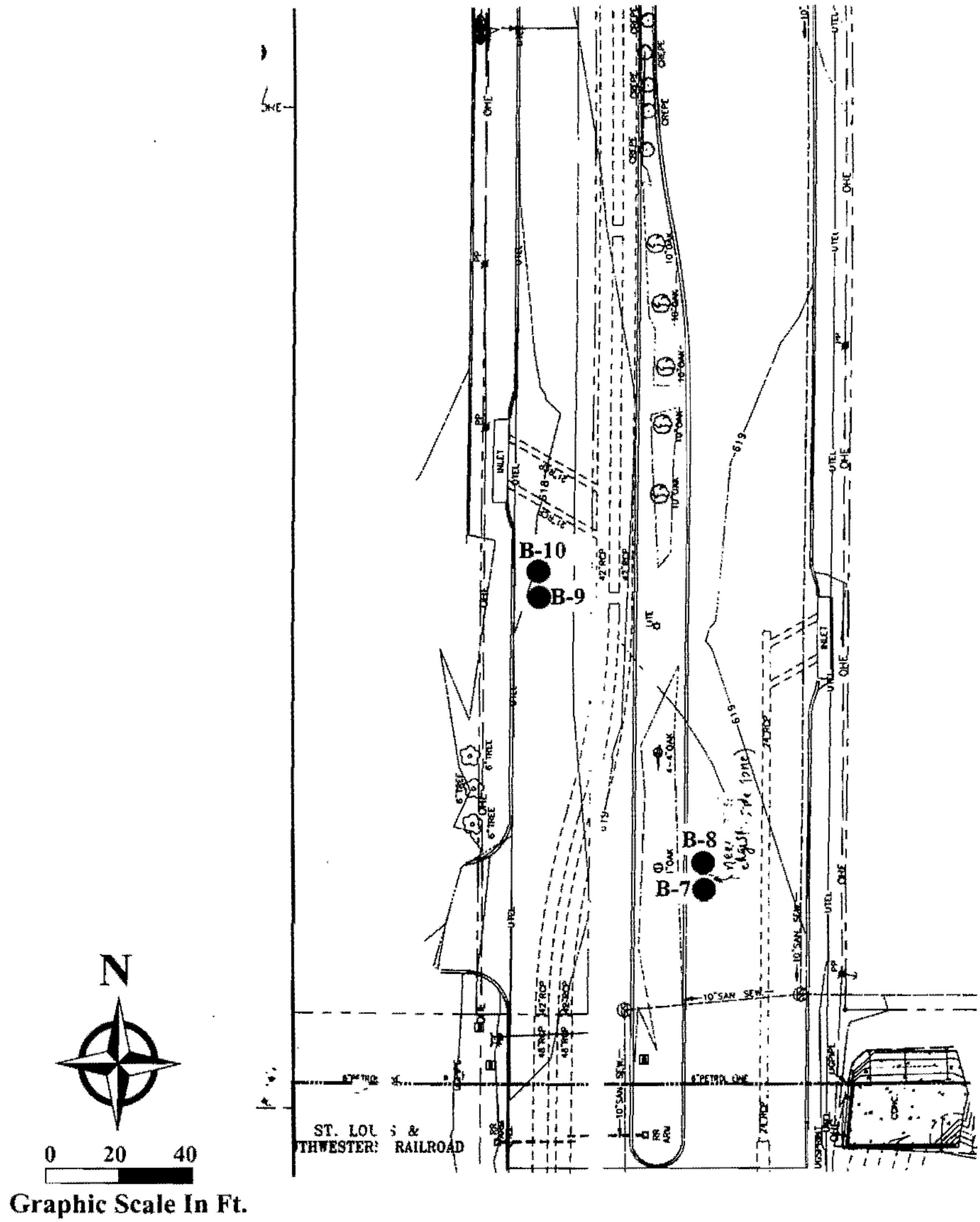
General Location
Figure 1

00988

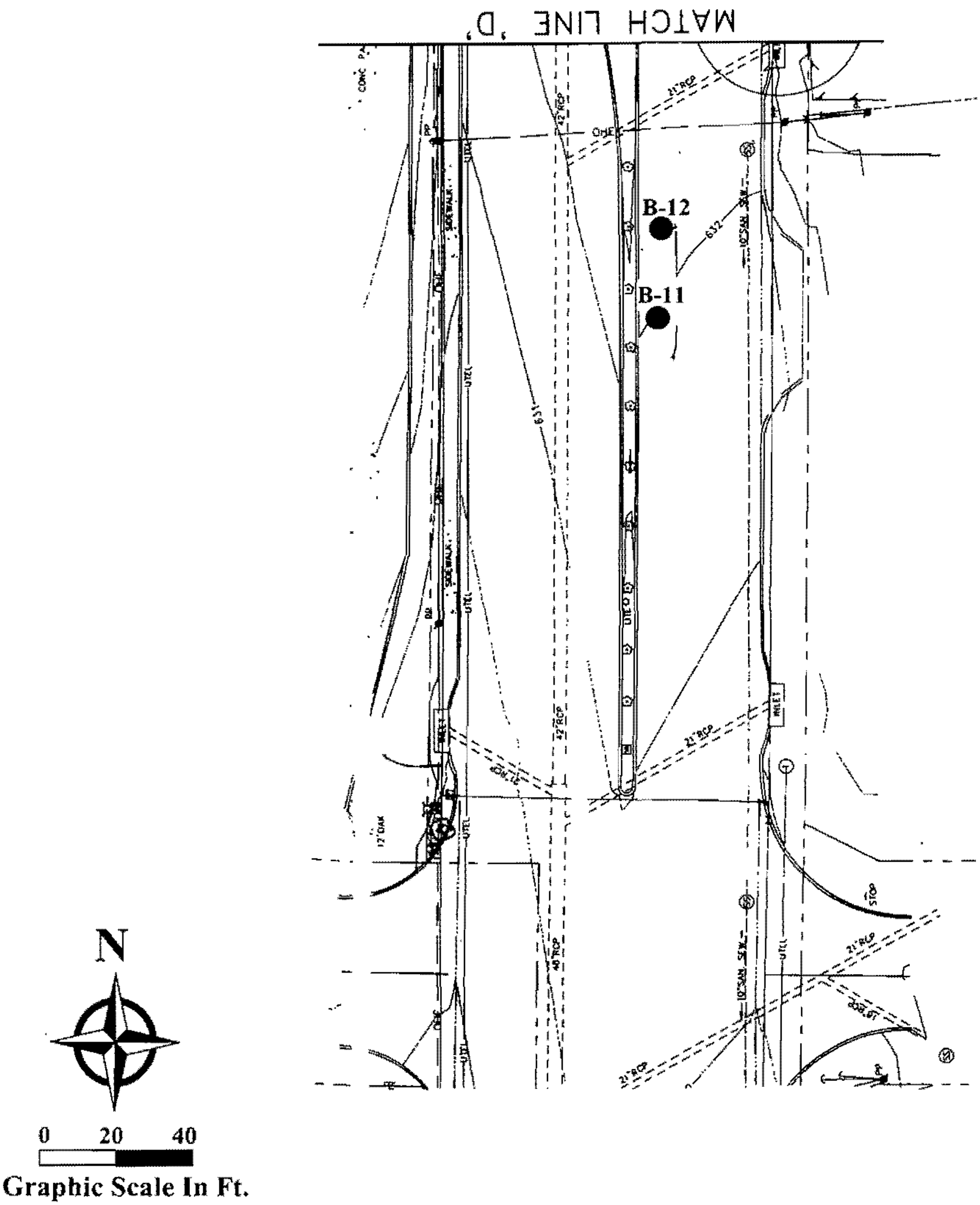
4/02/01



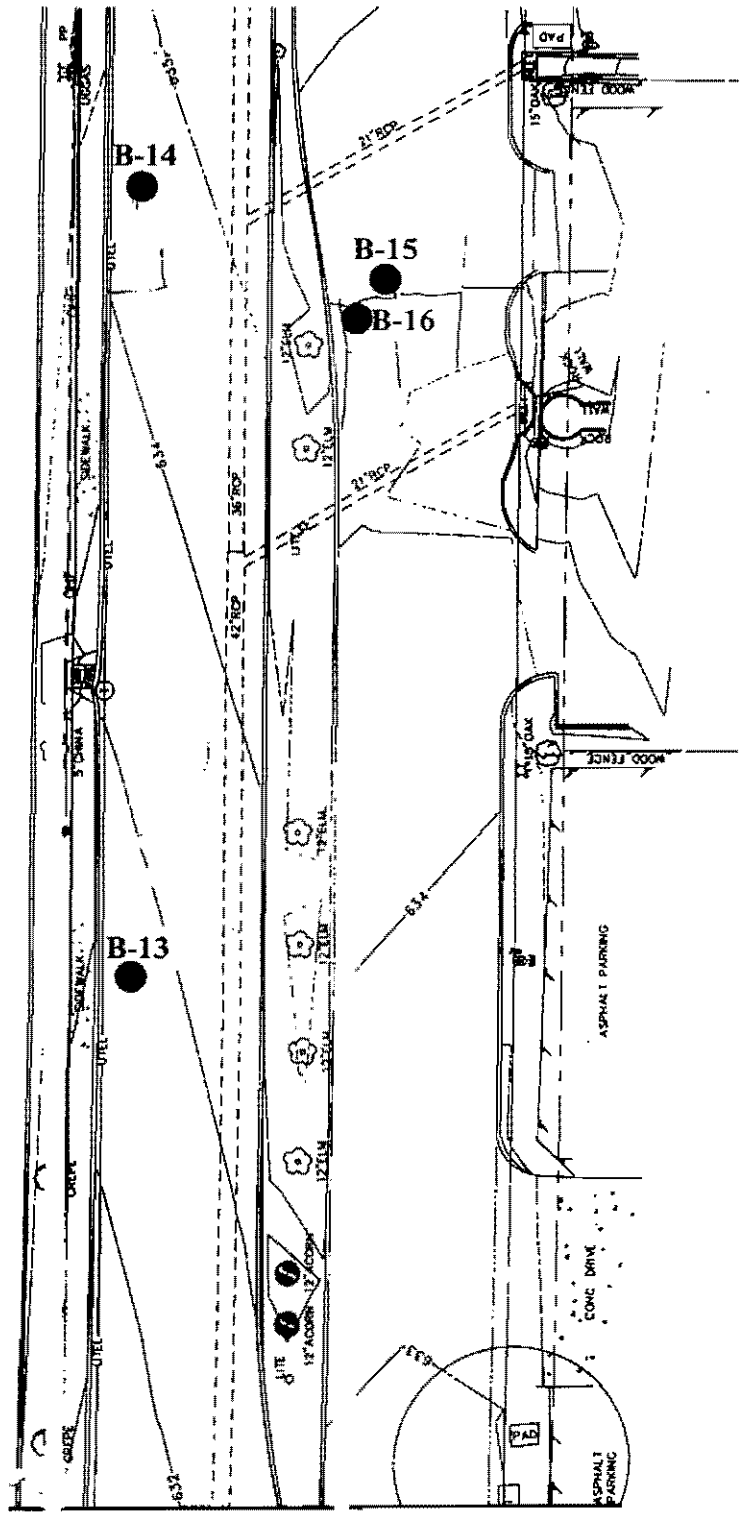
GBW Engineers, Inc. Garland, Texas	Boring Location Plan Figure 2	
Midway Road Reconstruction Addison, Texas	00988	4/02/01



GBW Engineers, Inc. Garland, Texas		Boring Location Plan Figure 3
Midway Road Reconstruction Addison, Texas	00988	4/02/01

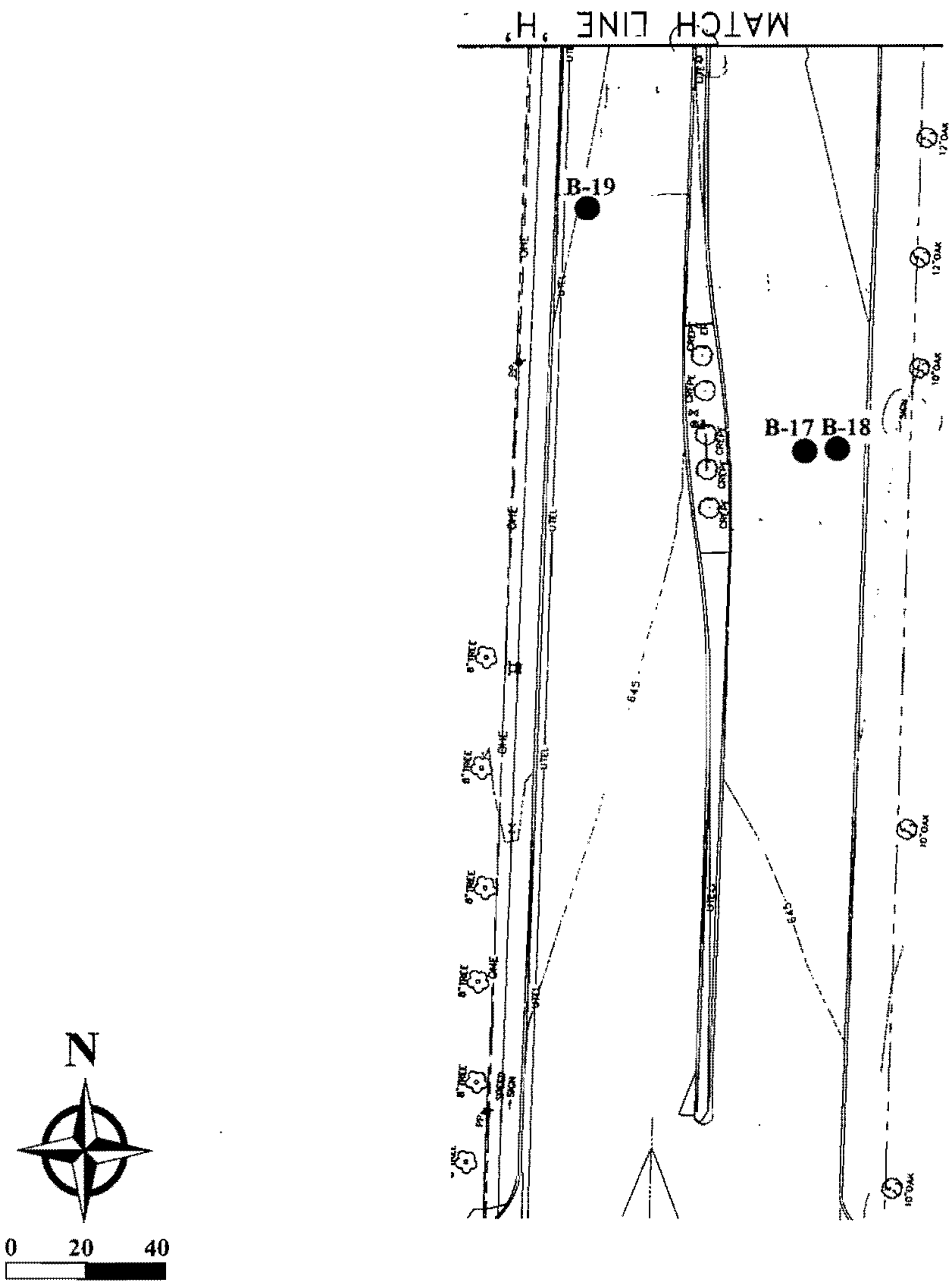


GBW Engineers, Inc. Garland, Texas		Boring Location Plan Figure 4	
Midway Road Reconstruction Addison, Texas		00988	4/02/01



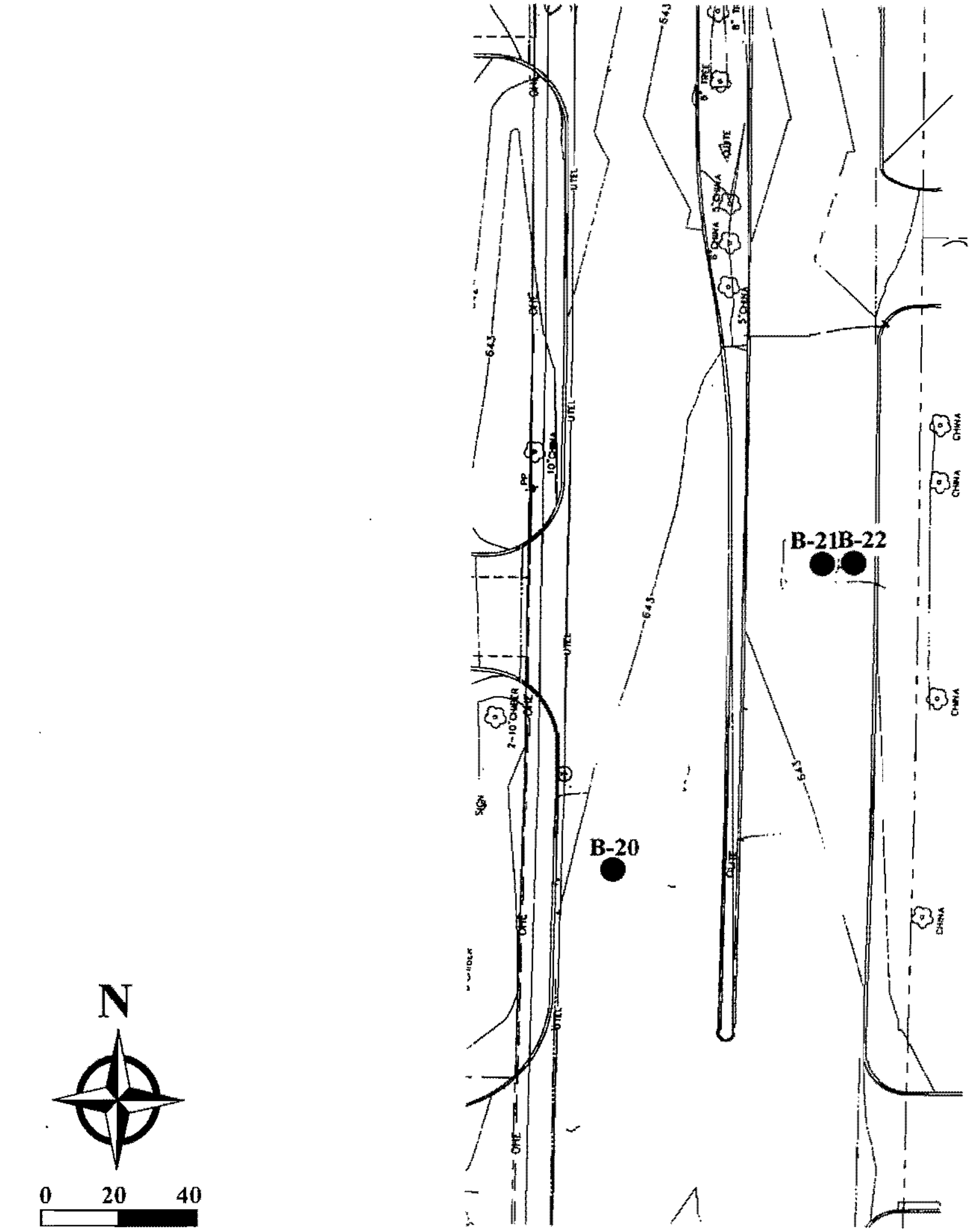
Graphic Scale In Ft.

GBW Engineers, Inc. **Garland, Texas**		**Boring Location Plan** **Figure 5**
Midway Road Reconstruction **Addison, Texas**	**00988**	**4/02/01**



Graphic Scale In Ft.

GBW Engineers, Inc. Garland, Texas	Boring Location Plan Figure 6
Midway Road Reconstruction Addison, Texas	00988 4/02/01



GBW Engineers, Inc.
Garland, Texas

Midway Road Reconstruction
Addison, Texas

Boring Location Plan
Figure 7

00988

4/02/01

B-1 METHODS OF LABORATORY TESTING

Representative samples are inspected and classified by a qualified member of the Geotechnical Division and the boring logs are edited as necessary. To aid in classifying the subsurface materials and to determine the general engineering characteristics, natural moisture content tests (ASTM D 2216), Atterberg-limit tests (ASTM D 4318) and dry unit weight determinations are performed on selected samples. In addition, unconfined compression (ASTM D 2166) and pocket-penetrometer tests are conducted on selected soil samples to evaluate the soil shear strength. Results of all laboratory tests described above are provided on the accompanying Record of Subsurface Exploration sheets or on summary data sheets as noted.

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
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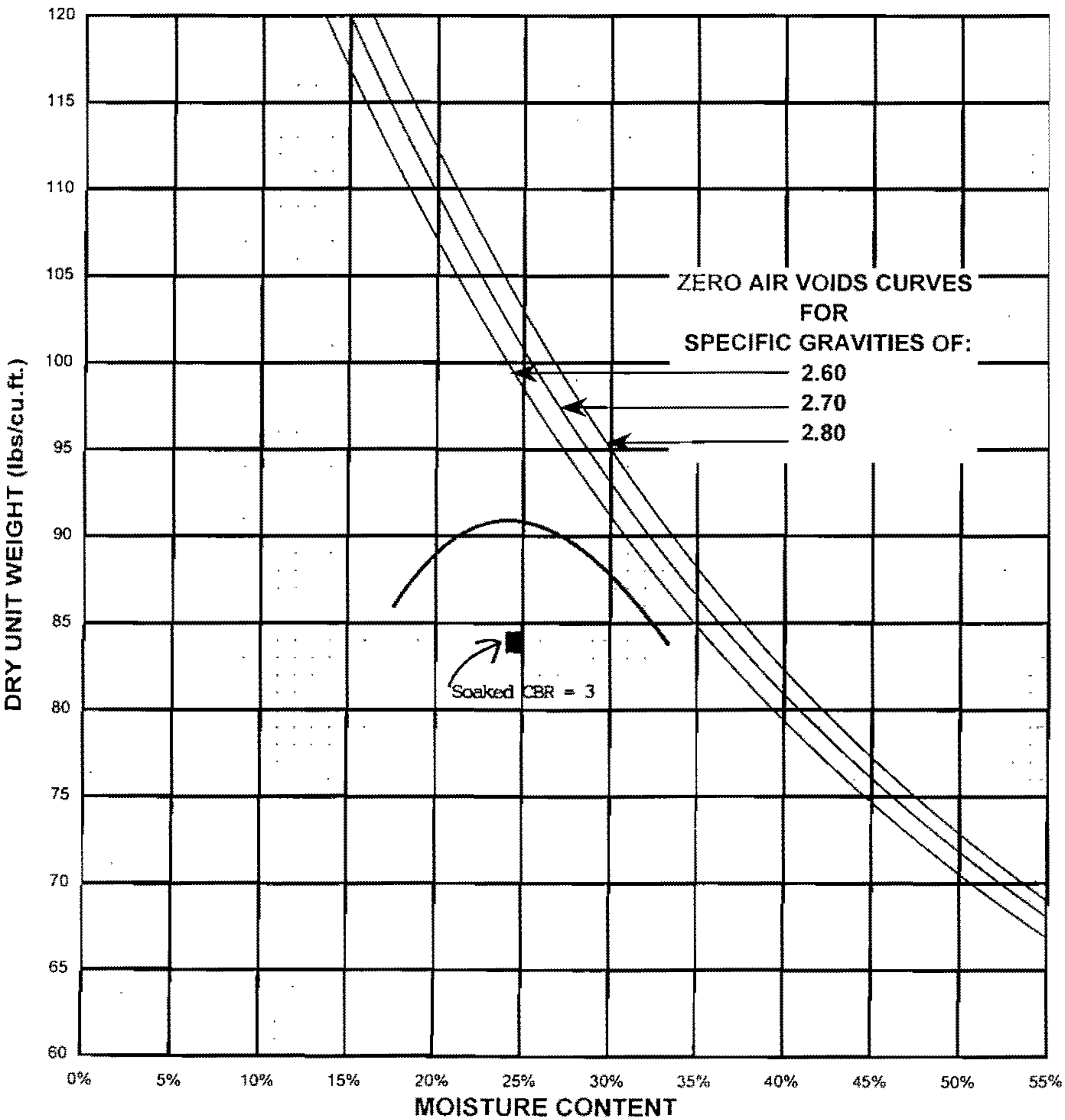
FAX: 972/406-8023

Client: BGW ENGINEERS, INC.
Garland, Texas
Project: Midway Road Reconstruction
Addison, Texas

Our Report Number.:	00988 Date: 1/29/01
Material Description:	Dark Brown Clay
Classification:	(CH)
Sample Location:	Composite Sample B-3 to B-16
Method of Test:	ASTM-D-698-A
Soil Identification Number:	Composite
Maximum Dry Unit Weight:	91.0 pcf
Optimum Moisture Content:	24.5 %
Liquid Limit:	77
Plasticity Index:	48

MOISTURE DENSITY RELATIONSHIP



ALPHA TESTING, INC.

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Dallas, Texas 75229
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FAX: 972/406-8023

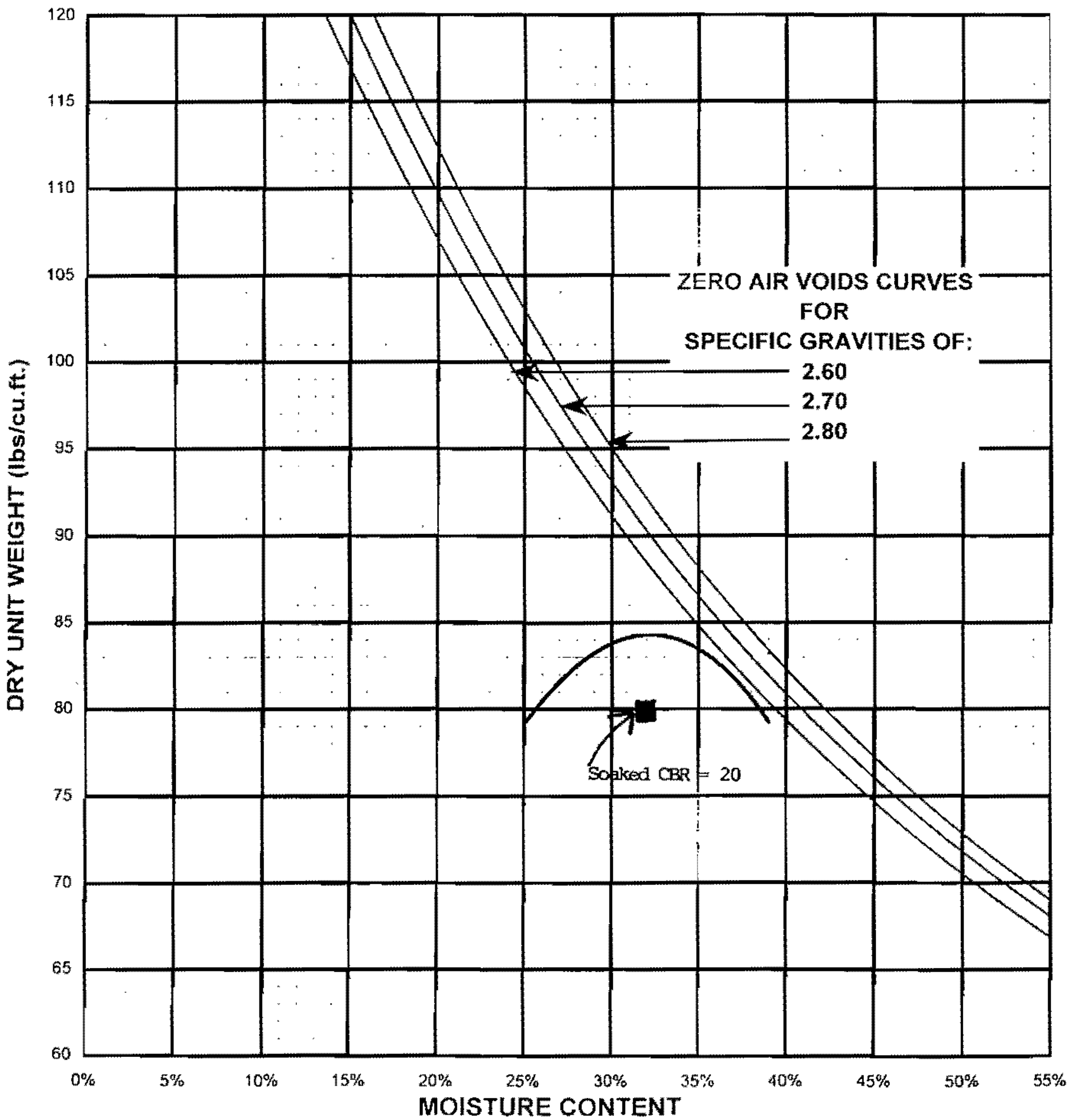
Client: GBW ENGINEERS, INC.
Garland, Texas

Project: Midway Road Reconstruction
Addison, Texas

Our Report Number.: 00988 Date: 1/29/01
Material Description: Dark Brown Clay
Classification: with 8 percent lime added
Sample Location: Composite Sample B-3 to B-16

Method of Test: ASTM-D-698-A
Soil Identification Number: Composite
Maximum Dry Unit Weight: 84.5 pcf
Optimum Moisture Content: 32.0 %
Liquid Limit: 61
Plasticity Index: 14

MOISTURE DENSITY RELATIONSHIP



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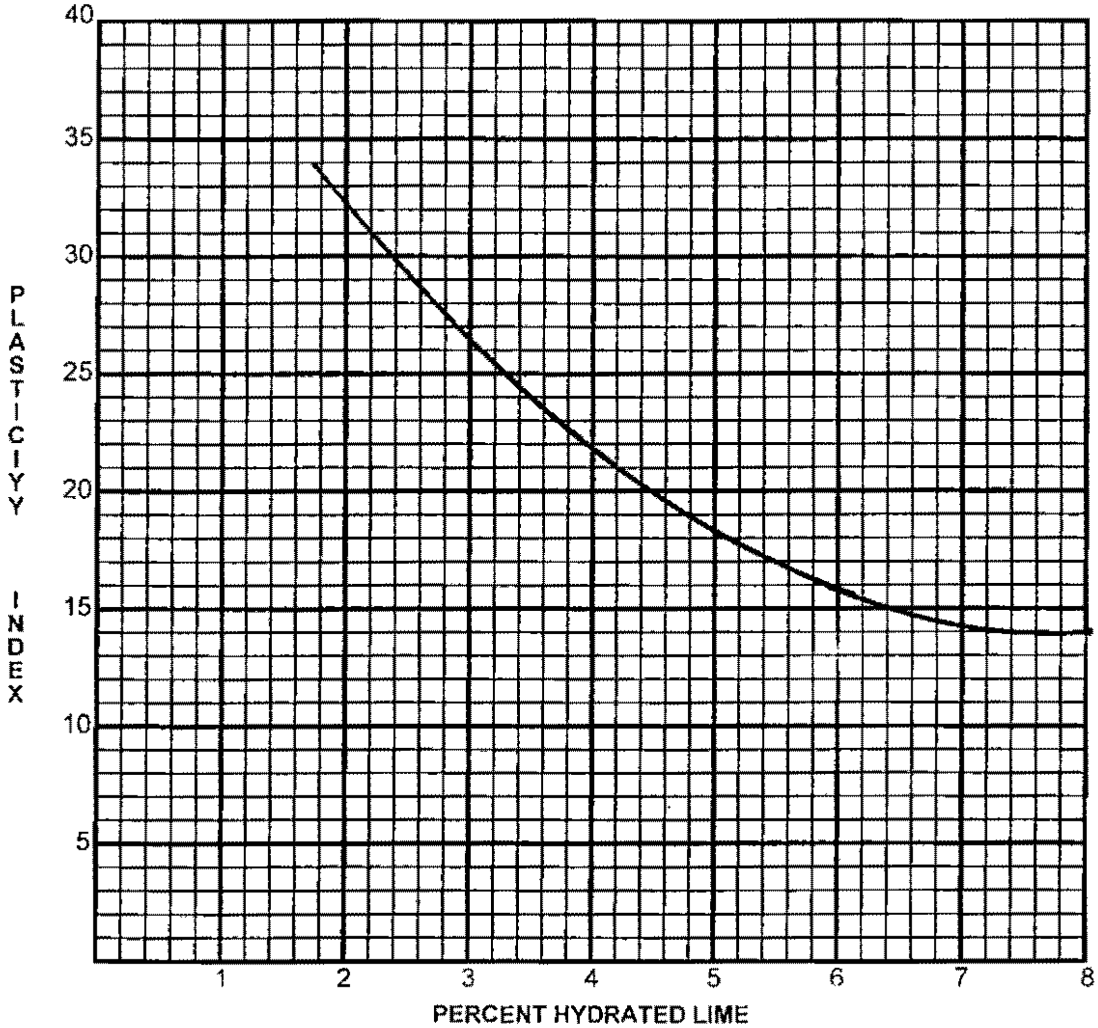
FAX: 972/406-8023

MECHANICAL LIME STABILIZATION



SAMPLE NO. Composite Sample (Borings 3-16)

DESCRIPTION: Brown Clay

CLIENT:	LABORATORY TEST:
GBW ENGINERRS, INC. GARLAND, TEXAS	LIME SERIES Figure 10

PROJECT NAME:	ALPHA PROJECT NO	DATE:
MIDWAY ROAD RECONSTRUCTION ADDISON, TEXAS	00988	April 3, 2001

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-1
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ______ lbs.
Hammer Drop ______ in.
Spoon Sample OD ______ in.
Rock Core Dia. ______ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown very stiff CLAY(CH) with some sand and gravel. -8" of concrete at surface.		0	1	ST					2.2		39	LL=76 PL=27 PI=49
	2'	2										
Reddish Brown very stiff CLAY(CH/CL) with some sand, calcareous nodules and gravel. -hard 2'-3'. -stiff below 5'.			2	ST					4.5+		26	
			3	ST					2.7		26	LL=53 PL=20 PI=33
		4	4	ST					2.2		25	
			5	ST					1.7		24	
	6'	6										
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel. -stiff 6'-7'.			6	ST					1.0		28	LL=33 PL=15 PI=18
			7	ST					0.7		27	
		8	8	ST					0.5		28	
			9	ST					0.5		46	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP - TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 5 FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS 8 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD - MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-2
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard CLAY(CH) with some sand and gravel. -7.75" of concrete at surface.		0	1	ST					4.5+		33	LL=68 PL=37 PI=31
	2'	2										
Reddish Brown and Tan very stiff CLAY(CH/CL) with some sand, calcareous nodules and gravel. -hard 2'-3'. -stiff below 5'.			2	ST					4.5+		26	
			3	ST					3.5		22	
		4	4	ST					2.5		20	
	5'											
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel. -very stiff 5'-6'. -stiff 6'-7'.			5	ST					2.2		21	
		6	6	ST					1.2		24	
			7	ST					0.5		29	
		8	8	ST					0.5		30	
			9	ST					0.5		32	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 5 FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS 8 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-3
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand and calcareous nodules and gravel. -8" of concrete at surface.		0	1	ST					4.5+		38	LL=57 PL=36 PI=21
		2	2	ST					4.0		31	
Brown very stiff CLAY(CH) with some sand, calcareous nodules and gravel. -reddish brown below 4'. -stiff below 5'.	3'		3	ST					2.7		30	
		4	4	ST					3.2		22	
			5	ST					1.7		22	
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel. -stiff 6'-7'.	6'	6	6	ST					1.5		25	
			7	ST					0.5		26	
		8	8	ST					0.7		32	
			9	ST					0.5		35	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 5.5 FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS 8 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-4
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ______ lbs.
Hammer Drop ______ in.
Spoon Sample OD ______ in.
Rock Core Dia. ______ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard CLAY(CH) with some sand and calcareous nodules and gravel. -7.75" of concrete at surface.		0	1	ST					4.5+		31	
		2	2	ST					4.0		33	
	3'											
Reddish Brown and Tan very stiff CLAY(CH/CL) with some silty sand, calcareous nodules and gravel. -hard 3'-4'. -stiff below 5'.			3	ST					4.0		25	
		4	4	ST					3.2		20	
			5	ST					3.2		23	
	6'	6										
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel.			6	ST					0.7		26	
			7	ST					0.7		29	
		8	8	ST					0.5		30	
			9	ST					0.5		28	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 4.5 FT.
AFTER HRS. FT.
WATER ON RODS 7 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-5
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD 3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 617±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand and calcareous nodules. -8" of concrete at surface.		0	1	ST					4.5+		37	LL=56 PL=35 PI=21
Dark Brown very stiff CLAY(CH) with some sand. -brown with calcareous nodules below 4'. -tannish brown below 8'.	2'	2	2	ST					3.0		40	
		4	3	ST					3.2		29	
		6	4	ST					3.2		28	
		8	5	ST					3.0		28	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD - MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-6
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 617±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown very Dense SAND(SP) with some gravel and clay. -8" of concrete at surface.		0	1	ST	13				-		30	
	2'	2										
Brown very stiff CLAY(CH) with some sand. -tannish brown with calcareous nodules and gravel below 4'. -tannish brown below 8'.			2	ST				1.2	2.7	80	34	LL=80 PL=30 PI=50
		4	3	ST					3.7		26	
		6	4	ST					3.0		24	LL=66 PL=24 PI=42
		8	5	ST					2.2		29	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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2209 Wisconsin St., Suite 100
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(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-7
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 619 ±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown very stiff CLAY(CH) with some sand and gravel. -8.25" of concrete at surface.		0	1	ST					2.5		26	
	2'	2										
Dark Brown very stiff CLAY(CH) with some sand, calcareous nodules and a trace of gravel. -brown below 6'. -tannish brown below 8'.			2	ST					3.7		27	
		4	3	ST					3.2		28	
		6	4	ST					3.0		24	
	8'	8										
Tan weathered SHALY LIMESTONE.			5	TCP		100/3.3"					5	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-8
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sample OD: in.
Rock Core Dia.: in.
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 619 ±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand and gravel. -8.5" of concrete at surface.		0	1	ST					-		23	LL=46 PL=29 PI=17
	2'		2	ST					3.7		29	
Dark Brown very stiff CLAY(CH) with sand laminations. -with limestone seams below 6'.		5	3	ST					2.7		28	
			4	ST					2.7		26	
	8'											
Tan weathered SHALY LIMESTONE.			5	TCP		100/3"					9	
BOTTOM OF TEST BORING AT 10'.		10										
		15										
		20										
		25										
		30										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-9
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff Lime Treated CLAY(CH) with some sand, calcareous nodules and gravel. -8" of concrete at surface		0	1	ST				0.9	1.2	79	37	LL=55 PL=32 PI=23
	2'	2										
Dark Brown very stiff CLAY(CH) with sand laminations and a trace of calcareous nodules.			2	ST					2.2		33	
		4	3	ST					2.2		35	
		6	4	ST					2.2		31	
		8	5	ST					2.2		31	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS
Boring No.: B-10
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA
Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand, calcareous nodules and gravel. -8" of concrete at surface -with lime to 17".		0	1	ST					4.5+		38	LL=53 PL=38 PI=17
	3'		2	ST					2.5		35	
Dark Brown very stiff CLAY(CH) with sand laminations. -stiff with limestone gravel below 8'.		5	3	ST					3.0		36	LL=83 PL=31 PI=52
			4	ST					2.0		29	
			5	ST					1.5		33	
BOTTOM OF TEST BORING AT 10'.		10										
		15										
		20										
		25										
		30										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Boring No.: B-11
Architect/Engineer:
Job No.: 00988
Project Name: MIDWAY ROAD RECONSTRUCTION
Drawn By: AM
Project Location: ADDISON, TEXAS
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Hammer Wt. ______ lbs.
Date Completed: 1-21-01
Hammer Drop ______ in.
Drill Foreman: EDI
Spoon Sample OD ______ in.
Inspector:
Rock Core Dia. ______ in.
Boring Method: CFA
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION 632±

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff CLAY(CH) with some sand. -8" of concrete at surface		0	1	ST					1.7		34	
	2'	2										
Dark Brown very stiff CLAY(CH) with some sand and a trace of calcareous nodules and gravel.			2	ST					2.5		31	
		4	3	ST					3.0		32	
		6	4	ST					2.5		38	
	8'	8										
Tan and Gray hard CALCAREOUS CLAY(CL) with some silty sand and gravel.			5	ST					4.5+		18	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER ______ HRS. ______ FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-12
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 632±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff Lime Treated CLAY(CH) with some sand. -8" of concrete at surface		0	1	ST				0.6	1.2	78	40	LL=60 PL=23 PI=37
Dark Brown very stiff CLAY(CH) with sand laminations. -stiff 2'-4'.	2'	2	2	ST					1.7		35	
		4	3	ST					2.0		34	LL=46 PL=29 PI=17
		6	4	ST					2.0		34	
Tannish Brown very stiff CALCAREOUS CLAY(CL) with some silty and and gravel.	7.5'	8	5	ST					3.0		22	LL=38 PL=18 PI=20
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-13
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140	lbs.
Date Completed	1-21-01	Hammer Drop	30	in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 633 ±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff Lime Treated CLAY(CH) with some sand. -8" of concrete at surface.		0	1	ST				1.1	1.2	70	42	LL=79 PL=38 PI=41
Dark Brown stiff CLAY(CH) with sand laminations.	2'	2	2	ST					1.5		35	
		4	3	ST					1.5		34	
Tan and Gray hard CALCAREOUS CLAY(CL) with limestone seams.	6'	6	4	ST					4.5+		24	
Tan weathered SHALY LIMESTONE.	8'	8	5	TCP		100/1"					18	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-14
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sample OD: in.
Rock Core Dia.: in.
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 634±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff Lime Treated CLAY(CH) with some sand. -8" of concrete at surface.		0	1	ST					2.0		36	
Dark Brown very stiff CLAY(CH) with sand laminations. -brown below 4'.	2'	2	2	ST					2.2		30	
		4										
Tan weathered SHALY LIMESTONE.	5'		3	ST					2.2		30	
		6										
		8										
			4	TCP		100/1.5"					18	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-15
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 635±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff CLAY(CH) with some sand and a trace of gravel. -8.25" of concrete at surface -brown with calcareous nodules below 8'.		0	1	ST					3.5		37	LL=85 PL=30 PI=55
		2	2	ST					2.0		32	
		4	3	ST					2.2		37	
		6	4	ST					2.5		32	
		8	5	ST					2.7		34	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-16
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 635±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown hard CLAY(CH) with some sand and a trace of gravel. -8.25" of concrete at surface -very stiff below 4'.		0	1	ST					4.5+		35	LL=65 PL=36 PI=29
		2	2	ST					1.7		33	
		4	3	ST					2.2		31	LL=83 PL=30 PI=53
Dark Brown very stiff CLAY(CH) with some sand.	6'	6	4	ST					2.2		32	
Tannish Brown stiff CALCAREOUS CLAY(CL/CH) with petro-chemical odor.	8'	8	5	ST					1.5		22	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-17
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140	lbs.
Date Completed	1-21-01	Hammer Drop	30	in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 644±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff CLAY(CH) with calcareous deposit and some sand - poss. fill -6.5" of concrete at surface.		0	1	ST					2.0		27	LL=85 PL=30 PI=55
		2	2	ST					2.7		38	
	3'											
Tannish Brown and Gray very stiff CALCAREOUS CLAY(CL/CH) with clay zones. -hard with limestone seams below 4'.			3	ST					2.5		27	
		4	4	ST					4.5+		15	
	5'											
Tan weathered SHALY LIMESTONE.		6										
	8'	8										
Tan weathered SHALY LIMESTONE.			5	TCP		100/1"					15	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-18
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140 lbs.
Date Completed	1-21-01	Hammer Drop	30 in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SURFACE ELEVATION 644±

SOIL CLASSIFICATION	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff CLAY(CH) with some sand and calcareous nodules - poss. fill		0	1	ST					3.2		32	LL=73 PL=27
-6.5" of concrete at surface.	3'		2	ST					3.2		38	PI=46
Tan and Gray hard CALCAREOUS CLAY(CL/CH) with limestone			3	ST					4.5+		19	
seams.	5'	5	4	ST					4.5+		14	
Tan weathered SHALY LIMESTONE.	8'											
Gray SHALY LIMESTONE.			5	TCP		100/1"					14	
BOTTOM OF TEST BORING AT 10'.		10										
		15										
		20										
		25										
		30										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-19
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sample OD: in.
Rock Core Dia.: in.
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION *644±*	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown and Tan hard CLAY(CH) with calcareous deposit, gravel and some sand. - poss. fill -6.5" of concrete at surface.		0	1	ST					4.5+		21	LL=73 PL=28 PI=45
		2	2	ST					4.5+		32	
Tan and Gray hard CALCAREOUS CLAY(CL) with limestone seams.	4'	4	3	ST					4.5+		20	LL=48 PL=20 PI=28
Tan weathered SHALY LIMESTONE.	6'	6										
Gray SHALY LIMESTONE.	8'	8	4	TCP		100 / 1.3"					13	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-20
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sample OD: in.
Rock Core Dia.: in.
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 643±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Tannish Brown and Gray hard CALCAREOUS CLAY(CL) with limestone seams. -7.25" of concrete at surface.		0	1	ST					4.5+			LL=59 PL=21 PI=38
	2'	2										
Gray SHALY LIMESTONE.		4	2	TCP		100/1.3"					13	
		6										
		8	3	TCP		100/1.3"					15	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-21
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140	lbs.
Date Completed	1-21-01	Hammer Drop	30	in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 643±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Tannish Brown very stiff to hard CALCAREOUS CLAY(CL) with limestone seams. -6.75" of concrete at surface.		0	1	ST					2.7		22	
	2'	2										
Gray SHALY LIMESTONE.		4	2	TCP		100/1.5"					13	
		6										
		8	3	TCP		100/1.3"					16	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-22
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140 lbs.
Date Completed	1-21-01	Hammer Drop	30 in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 643±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Tannish Brown and Gray hard CALCAREOUS CLAY(CL) with limestone seams. -6.75" of concrete at surface.		0	1	ST					4.5+		18	LL=35 PL=17 PI=18
	2'	2										
Gray SHALY LIMESTONE.			2	CA							13	
		4	3	TCP		100/1"					12	
		6										
		8	4	TCP		100/1.5"					16	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD - MUD DRILLING

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KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

THE ABBREVIATIONS COMMONLY EMPLOYED ON EACH "RECORD OF SUBSURFACE EXPLORATION", ON THE FIGURES AND IN THE TEXT OF THE REPORT, ARE AS FOLLOWS:

SOIL OR ROCK TYPES
(SHOWN IN SYMBOLS COLUMN)

CLAY — SILT — SAND — LIMESTONE — SHALE — ASPHALT/CONCRETE

I. SOIL DESCRIPTION

(A) COHESIONLESS SOILS

RELATIVE DENSITY	N, BLOWS/FT
VERY LOOSE	D TO 4
LOOSE	5 TO 10
COMPACT	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

(B) COHESIVE SOILS

CONSISTENCY	Qu, TSF
VERY SOFT	LESS THAN .25
SOFT	.25 TO .50
FIRM	.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

II. PLASTICITY

DEGREE OF PLASTICITY	PLASTICITY INDEX
NONE TO SLIGHT	0 - 4
SLIGHT	5 - 10
MEDIUM	11 - 30
HIGH TO VERY HIGH	OVER 30

NOTE: ALL SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

III. RELATIVE PROPORTIONS

DESCRIPTIVE TERM	PERCENT
TRACE	1 - 10
LITTLE	11 - 2D
SOME	21 - 35
AND	36 - 50

IV. PARTICLE SIZE IDENTIFICATION

BOULDERS:	-8 INCH DIAMETER OR MORE	
COBBLES :	-3 TO 8 INCH DIAMETER	
GRAVEL :	-COARSE - 3/4 TO 3 INCH	
	-FINE - 5.0 MM TO 3/4 INCH	
SAND :	-COARSE - 2.0 MM TO 5.0 MM	
	-MEDIUM - 0.4 MM TO 2.0 MM	
	-FINE - 0.07 MM TO 0.4 MM	
SILT :	-0.002 MM TO 0.07 MM	
CLAY :	-0.002 MM	

V. DRILLING AND SAMPLING SYMBOLS

AU: AUGER SAMPLE
RC: ROCK CORE
TCP: TEXAS CONE PENETRATION TEST
SS: SPLIT-SPOON 1 3/8" I.D. 2" O.D. EXCEPT WHERE NOTED
ST: SHELBY TUBE = 3" O.D. EXCEPT WHERE NOTED
WS: WASHED SAMPLE
HSA: HOLLOW STEM AUGERS
CFA: CONTINUOUS FLIGHT AUGERS
MD: MUD DRILLING

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 10/9/02 Claim # ______ Check $ 18,815.55

Vendor No. ______

Vendor Name ______

Address GRANTHAM & ASSOCIATES, INC.

Address 1919 S. SHILOH RD., SUITE 310, LB 8

Address GARLAND, TEXAS 75042

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
# 9003	46	000	56570	04300		18,815.55

TOTAL 18,815.55

EXPLANATION MIDWAY RD. DESIGN

Steve Chutchian
Authorized Signature

Finance

Grantham & Associates, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 9003

Date: October 1, 2002

G&A Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 8/1/02 to 9/21/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 18,815.55
Total Previous Invoices	$293,248.93
Total Billed to Date	$312,064.48
Less Payments/Credits	($293,248.93)
Total Amount Now Due	$ 18,815.55
Amount This Invoice	$ 18,815.55

O.K. to PAY! SZC 10/9/02

Please Retain This
Page For Your Records

Invoice No.: 9003
Date: October 1, 2002
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$	29,681.47		
100% complete			$	29,681.47

2. Geotechnical Services

Total Phase Amount	$	19,440.00		
Billed Previously			$	20,038.75

3. Preliminary Plans

Total Phase Amount	$	231,409.23		
100% complete			$	231,409.23

4. Design Report

Total Phase Amount	$	29,384.12		
Billed Previously	$	26,021.85		
<u>HNTB</u> (See attached invoice)			$	1,128.00

5. Reimbursables

Total Phase Amount	$	3,785.18		
100% complete			$	3,785.18

TOTAL BILLED TO DATE >>> $ 312,064.48

Grantham & Associates, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 9003

Date: October 1, 2002

G&A Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	18,815.55
TOTAL AMOUNT ENCLOSED	$	________

Pay to the Order Of: Grantham & Associates, Inc.
1919 S. Shiloh Road
Suite 310
L.B. 8
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 8/21/02 Claim # ______ Check $ 1,128.00

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH, SUITE 50, L.B. 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
#1796	46	00	56570	09300		1,128.00

TOTAL $ 1,128.00

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
20th. PAYMENT

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1796

Date: August 15, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 7/1/02 to 7/31/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 1,128.00
Total Previous Invoices	$292,120.93
Total Billed to Date	$293,248.93
Less Payments/Credits	($292,120.93)
Total Amount Now Due	$ 1,128.00
Amount This Invoice	$ 1,128.00

O.K. to pay!
SC
8/21/02

Please Retain This
Page For Your Records

Invoice No.: 1796
Date: August 15, 2002
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
92% complete		$ 212,896.49

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 22,779.14	
HNTB (See attached invoice)		$ 1,128.00

5. Reimbursables

Total Phase Amount	$ 3,785.18	
92% complete		$ 3,482.37
TOTAL BILLED TO DATE >>>		$ 293,248.93

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1796

Date: August 15, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	1,128.00
TOTAL AMOUNT ENCLOSED	$	____________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

HNTB ARCHITECTS ENGINEERS PLANNERS

5910 W. Plano Parkway
Suite 200
Plano, Texas
75093
(972) 661-5626
FAX (972) 661-5614
www.hntb.com

July 16, 2002

GBW Engineers, Inc.
Bruce Grantham, P.E.
1919 S. Shiloh Road
Suite 530, L.B. 27
Garland, Texas 75042

Re: Midway Road Replacement - Belt Line to Keller Springs Roadway

Dear Mr. Grantham,

We are enclosing the original and one copy of our Invoice No. 2-32921-PL-001 in the amount of $1,128.00. This is for professional engineering services rendered on the above referenced project.

We trust you will find this invoice in proper order and place in line for further processing.

Very truly yours,

HNTB CORPORATION

Benjamin J. Biller

Benjamin J. Biller
Vice President, Central Division

BJB:lgb

Enclosures

cc: Finance Department

TEXAS DEPARTMENT OF TRANSPORTATION

BILLING STATEMENT

FORM 132 REV 9-90

BILLING INSTRUCTIONS: To facilitate handing and prompt payment show the information in the spaces provided below. Submit five copies. Submit a separate statement for each requisition. Charges for freight or express, if any, must be supported by the prepaid freight or express bill. This statement cannot be processed for payment without a valid vendor ID number.

Name of Payee: HNTB CORPORATION DATE: July 16, 2002

Address: 5910 W. Plano Parkway - Suite 200 City & State: Plano, TX 75093

DELIVERY DATE: July 16, 2002 VENDOR ID NUMBER: 14316230920008

LINK	S W	INVOICE DATE	INVOICE NUMBER	FY	S	SOURCE UNIT	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
		7/16/2002	2-32921-PL-001	02		051	Period Covered:			
							For Period 5/26/01 through 6/28/02			
							Total Earned to Date		$ 6,294	
							Less Previously Invoiced		$ 5,166	
							Due this invoice			$ 1,128
							Work Authorization No. 1			
							This agreement authorized by Article 664-4 VSC			
							CASH DISCOUNT ____% ____DAYS			
									TOTAL	$ 1,128

IAC or MISC CONTRACT NO: 22-845P5004 SDHPT REQ. NO: HW PURCHASE ORDER NO: DATE:

CARD CODE 3 INFORMATION

LINK (15 16 17)	SEQ (18 19 20)	DIST OR DIV (21 22)	SEG. I.D. 26 / 09 10 / 70 THRU 79 (23 24)	DETAIL (25 - 41)	AMOUNT (42 - 53)	± (54)	MOO. / FUNC. (55 56 57)	OBJ. OF EXP. (58 59 60)	ACTY. / TASK / WORK ORDER (61 62 63 64 65 66)	CO (67 68 69)	SYS. (70 71)	NUMBER (72 73 74 75)	S U F (76)	CL (77 78)	REF. MARKER (BEG)	AMT. OF WORK PERF. (END)
		22	76	0037-03-063	1,128		162	423								

DHT ITEM NO; I S EQUIPMENT NUMBER; TRADE-IN ALLOWANCE; TRADED EQUIP NO; M O D; DHT ITEM NO; EQUIP NO; COST CENTER; SFI; EQUIP NO.; F I; ACTY; HIGHWAY

MMIS Tracked Functions Only

Agency Verification/Audit has been performed, the services rendered and/or goods received, and the invoice(s) correctly corresponds with the authority under which procurement was made. The invoice(s) is (are) true and unpaid.

By____________________

HNTB ARCHITECTS ENGINEERS PLANNERS

July 16, 2002

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530, LB 27
Garland, Texas 75042

In Account With

HNTB CORPORATION
Dallas, Texas

Invoice No. 2-32921-PL-001 — Work Authorization No. 1

Project: Midway Road Replacement — W.A. No. 1 Contract Maximum: $10,530.00

Invoice Summary: From: 05/26/01 To: 06/28/02

Total Contract Amount		$10,530.00
Total Due This Invoice	59.8% Complete	$6,294.00
Total Previous Invoices		$5,166.00
Total Billed to Date		$6,294.00
Less Previous Invoices		$5,166.00
Total Amount Now Due		$1,128.00

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 7/19/02 Claim # ________ Check $ 3,242.71

Vendor No. ________

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH, SUITE 50 L.B. 27

Address GARLAND, TEXAS 75042

Address ________

Zip Code ________

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
#: 1757	46	000	56570	04300		3,242.71

TOTAL $ 3,242.71

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
19th. PAYMENT

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1757

Date: July 3, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 6/1/02 to 6/30/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 3,242.71
Total Previous Invoices	$288,878.22
Total Billed to Date	$292,120.93
Less Payments/Credits	($288,878.22)
Total Amount Now Due	$ 3,242.71
Amount This Invoice	$ 3,242.71

O.K. to pay!
SZC
7/19/02

Please Retain This
Page For Your Records

Invoice No.: 1757
Date: July 3, 2002
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
92% complete		$ 212,896.49

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 22,779.14	

GBW Standard Rate Schedule 2000:

Project Manager	18	@	$ 127.25/hr	$ 2,290.50
Project Engineer	6.5	@	$ 60.32/hr	$ 392.08
CADD Technician	3	@	$ 41.38/hr	$ 124.14
CADD Technician	2.5	@	$ 33.40/hr	$ 83.50
CADD Technician	4	@	$ 30.49/hr	$ 121.96
Clerical	3.5	@	$ 47.19/hr	$ 165.17
Clerical	2.5	@	$ 26.14/hr	$ 65.35
			Total Labor >>	$ 3,242.71

5. Reimbursables

Total Phase Amount	$ 3,785.18	
92% complete		$ 3,482.37

TOTAL BILLED TO DATE >>> $ 292,120.93

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1757

Date: July 3, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	3,242.71
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
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TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 6/20/02 **Claim #** ______ **Check $** 2,705.38

Vendor No.

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH, SUITE 50 L.B. 27

Address GARLAND, TEXAS 75042

Address

Zip Code

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
#1722	46	000	56570	04300		2,705.38

TOTAL 2,705.38

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
18th. PAYMENT

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer
GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1722

Date: June 12, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 5/1/02 to 5/31/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 2,705.38
Total Previous Invoices	$286,172.84
Total Billed to Date	$288,878.22
Less Payments/Credits	($286,172.84)
Total Amount Now Due	$ 2,705.38
Amount This Invoice	$ 2,705.38

O.K. to pay
SLC
6/20/02

Please Retain This Page For Your Records

1919 S. Shiloh Road, Suite 500, L.B. 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916 Fax (972) 840-215

Invoice No.: 1722
Date: June 12, 2002
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
92% complete		$ 212,896.49

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 20,073.76	

GBW Standard Rate Schedule 2000:

Design Engineer	34 @ $ 79.57/hr	$ 2,705.38
	Total Labor >>	$ 2,705.38

5. Reimbursables

Total Phase Amount	$ 3,785.18	
92% complete		$ 3,482.37

TOTAL BILLED TO DATE >>> $ 288,878.22

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1722

Date: June 12, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	2,705.38
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
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TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 5/16/02 **Claim #** ______ **Check $** 8,126.25

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH, SUITE 500 L.B. 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
	46	000	56570	04300		8,126.25

TOTAL # 8,126.25

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
17th. PAYMENT

Steve Chutchian
Authorized Signature

______
Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1695

Date: May 8, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 4/1/02 to 4/30/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 8,126.25
Total Previous Invoices	$278,046.59
Total Billed to Date	$286,172.84
Less Payments/Credits	($278,046.59)
Total Amount Now Due	$ 8,126.25
Amount This Invoice	$ 8,126.25

o.k. to pay.
SZC
5/16/02

**Please Retain This
Page For Your Records**

1919 S. Shiloh Road, Suite 500, L.B. 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916 Fax (972) 840-2156

Invoice No.:	1695
Date:	May 8, 2002
Project:	Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
92% complete		$ 212,896.49

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 19,003.35	

GBW Standard Rate Schedule 2000:

Project Manager	5 @	$127.25/hr	$ 636.25
Design Engineer	4 @	$ 79.57/hr	$ 318.28
Clerical Support	2 @	$ 44.87/hr	$ 89.74
Clerical Support	1 @	$ 26.14/hr	$ 26.14
		Total Labor >>	$ 1,070.41

5. Reimbursables

Total Phase Amount	$ 3,785.18	
92% complete		$ 3,482.37

TOTAL BILLED TO DATE >>> $ 286,172.84

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1695

Date: May 8, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	8,126.25
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
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TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 4/9/02 Claim # ______ Check $ 9,407.77

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH, SUITE 500 L.B.27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
#1654	46	000	56570	04300		9,407.77

TOTAL 9,407.77

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
16th. PAYMENT

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1654

Date: April 2, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 2/1/02 to 3/31/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 9,407.77
Total Previous Invoices	$268,638.82
Total Billed to Date	$278,046.59
Less Payments/Credits	($268,638.82)
Total Amount Now Due	$ 9,407.77
Amount This Invoice	$ 9,407.77

o.k. to pay
SC
4/9/02

Please Retain This Page For Your Records

Invoice No.:	1654
Date:	April 2, 2002
Project:	Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$	29,681.47		
100% complete			$	29,681.47

2. Geotechnical Services

Total Phase Amount	$	19,440.00		
Billed Previously			$	20,038.75

3. Preliminary Plans

Total Phase Amount	$	231,409.23		
89% complete			$	205,954.21

4. Design Report

Total Phase Amount	$	29,384.12		
Billed Previously	$	19,003.35		

5. Reimbursables

Total Phase Amount	$	3,785.18		
89% complete			$	3,368.81

TOTAL BILLED TO DATE >>> $ 278,046.59

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1654

Date: April 2, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	9,407.77
TOTAL AMOUNT ENCLOSED	$	______

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 2/21/02 **Claim #** ______ **Check $** 7,055.83

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD.

Address SUITE 500, L.B. 27

Address GARLAND, TEXAS

Zip Code 75042

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
# 1617	46	000	56570	04300		7,055.83

TOTAL 7,055.83

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
15th PAYMENT

Steve Chutchian
Authorized Signature

Finance

GBW Engineers, Inc.
Grantham, Burge & Waldbauer

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1617

Date: February 7, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 1/1/02 to 1/31/02

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 7,055.83
Total Previous Invoices	$261,582.99
Total Billed to Date	$268,638.82
Less Payments/Credits	($259,444.08)
Total Amount Now Due	$ 9,194.74
Amount This Invoice	$ 7,055.83

o.k. to pay.
SZC
2/20/02

Please Retain This
Page For Your Records

1919 S. Shiloh Road, Suite 500, L.B. 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916 Fax (972) 840-2156

Invoice No.: 1617
Date: February 7, 2002
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
85% complete		$ 196,697.85

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 19,003.35	

5. Reimbursables

Total Phase Amount	$ 3,785.18	
85% complete		$ 3,217.40

TOTAL BILLED TO DATE >>> $ 268,638.82

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1617

Date: February 7, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	7,055.83
TOTAL AMOUNT ENCLOSED	$	______

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 1/28/02 Claim # ______ Check $ 2,138.91

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD.

Address SUITE 500, L.B. 27

Address GARLAND, TEXAS

Zip Code 75042

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1590	46	000	56570	04300		2,138.91

TOTAL 2,138.91

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
14th. PAYMENT

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer
GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1590

Date: January 8, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 12/1/01 to 12/31/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 2,138.91
Total Previous Invoices	$259,444.08
Total Billed to Date	$261,582.99
Less Payments/Credits	($259,444.08)
Total Amount Now Due	$ 2,138.91
Amount This Invoice	$ 2,138.91

O.K. to PAY!
SZC
1/28/02

Please Retain This
Page For Your Records

1919 S. Shiloh Road, Suite 500, L.B. 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916 Fax (972) 840-2156

Invoice No.: 1590
Date: January 8, 2002
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
82% complete		$ 189,755.57

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 16,864.44	

Standard Rate Schedule (2000)

Professional Staff	17 @	$ 79.57hr	$ 1,352.69
Technical Staff	19 @	$ 41.38hr	$ 786.22
Total Labor, Task 04		>>>	$ 2,138.91

5. Reimbursables

Total Phase Amount	$ 3,785.18	
82% complete		$ 3,103.85

TOTAL BILLED TO DATE >>> $ 261,582.99

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1590

Date: January 8, 2002

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	2,138.91
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

**Please Return This Page With Payment
For Prompt And Accurate Credit**

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 12/13/01 **Claim #** ______ **Check $** 1,123.47

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD.

Address SUITE 500, L.B. 27

Address GARLAND, TEXAS

Zip Code 75042

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1574	46	000	56570	04300		1,123.47

TOTAL 1,123.47

EXPLANATION MIDWAY RD. RECONSTRUCTION, PHASE I
13th PAYMENT

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1574

Date: December 7, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 11/1/01 to 11/30/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 1,123.47
Total Previous Invoices	$258,320.61
Total Billed to Date	$259,444.08
Less Payments/Credits	($258,320.61)
Total Amount Now Due	$ 1,123.47
Amount This Invoice	$ 1,123.47

O.K. to PAY.
SZC.
12/13/01

Please Retain This Page For Your Records

Invoice No.: 1574
Date: December 7, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
82% complete		$ 189,755.57

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 15,740.97	

<u>Standard Rate Schedule</u> (2000)

Professional Staff	1 @	$127.25/hr	$ 127.25
Professional Staff	12 @	$ 79.57hr	$ 954.84
Technical Staff	1 @	$ 41.38hr	$ 41.38
Total Labor, Task 04		>>>	$ 1,123.47

5. Reimbursables

Total Phase Amount	$ 3,785.18	
82% complete		$ 3,103.85

TOTAL BILLED TO DATE >>> $ 259,444.08

GBW Engineers, Inc.

Grantham, Burge & Waldbauer

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1574

Date: December 7, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	1,123.47
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 500
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
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TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 11/14/01 Claim # ______ Check $ 3,119.02

Vendor No. GBW ENGINEERS, INC.

Vendor Name 1919 S. SHILOH, SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address

Address

Zip Code

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
# 1548	46	000	56570	04300		3119.02

TOTAL 3119.02

EXPLANATION 12th. PAYMENT TO GBW ENGINEERS FOR DESIGN OF MIDWAY RD. RECONSTRUCTION

Steve Chutchian

Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1548

Date: November 9, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 10/1/01 to 10/31/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 3,119.02
Total Previous Invoices	$255,201.59
Total Billed to Date	$258,320.61
Less Payments/Credits	($244,317.21)
Total Amount Now Due	$ 14,003.40
Amount This Invoice	$ 3,119.02

O.K. to PAY
SZC
11/14/01

Please Retain This Page For Your Records

Invoice No.: 1548
Date: November 9, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
82% complete		$ 189,755.57

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 12,621.95	

Standard Rate Schedule (2000)

Professional Staff	2	@	$127.25/hr	$ 254.50
Professional Staff	36	@	$ 79.57hr	$ 2,864.52
Total Labor, Task 04			>>>	$ 3,119.02

5. Reimbursables

Total Phase Amount	$ 3,785.18	
82% complete		$ 3,103.85

TOTAL BILLED TO DATE >>> $ 258,320.61

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1548

Date: November 9, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	3,119.02
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

**Please Return This Page With Payment
For Prompt And Accurate Credit**

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 10/23/01 **Claim #** ______ **Check $** 10,884.38

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH, SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
# 1511	46	000	56570	04300		10,884.38

TOTAL 10,884.38

EXPLANATION 11th. PAYMENT TO GBW ENGINEERS FOR DESIGN OF MIDWAY RD. RECONSTRUCTION.

Steve Chutchian

Authorized Signature

Finance

GBW Engineers, Inc.

Grantham, Burge & Waldbauer

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1511

Date: October 8, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 9/1/01 to 9/30/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 10,884.38
Total Previous Invoices	$244,317.21
Total Billed to Date	$255,201.59
Less Payments/Credits	($244.317.21)
Total Amount Now Due	$ 10,884.38
Amount This Invoice	$ 10,884.38

O.K. to PAY
SZC
10/23/01

**Please Retain This
Page For Your Records**

Invoice No.: 1511
Date: October 8, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously		$ 20,038.75

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
82% complete		$ 189,755.57

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 11,145.35	

Standard Rate Schedule (2000)

Professional Staff	9	@	$127.25/hr	$ 1,145.25
Professional Staff	4	@	$ 79.57hr	$ 318.28
Clerical Staff	0.5	@	$ 26.14/hr	$ 13.07

Total Labor This Invoice >>> $ 1,476.60

5. Reimbursables

Total Phase Amount	$ 3,785.18	
82% complete		$ 3,103.85

TOTAL BILLED TO DATE >>> $ 255,201.59

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1511

Date: October 8, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	10,884.38
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment For Prompt And Accurate Credit

GBW Engineers, Inc.

MEMO

1919 S. Shiloh Rd., Suite 530, LB 27, Garland, TX 75042

Date: **September 13, 2001** **GBW No. 00-238**

To: **Steve Chutchian, P.E.**

From: **Bruce Grantham**

Re: **Summary of September 12, Midway Road Meeting**

I have prepared the following summary of our discussion with Jim Pierce and Robin Jones yesterday on the Midway Road project:

- The Midway Road reconstruction project has a budget of approximately $4.75 million which includes the engineering design.
- Steve will check with Slade, and Bruce will contact Dave Baldwin, to determine if the landscape and irrigation design and construction cost needs to be included in the budget.
- The base bid for this project will consist of the northbound lanes from Belt Line Road to Keller Springs Road, and the southbound lanes from Belt Line Road to Lindberg Drive provided that the opinion of probable cost for this work is less than the budget.
- The proposed construction sequence where the adjacent northbound and southbound lanes are being reconstructed has previously been approved by the Town. This construction sequence includes the removal and replacement of the entire median.
- Where the northbound lanes only are to be reconstructed and the adjacent southbound lanes are to remain, GBW proposed a construction sequence which includes removing a portion of the median only in order to reconstruct one lane at a time.
- Bid alternate No. 1 will consist of the southbound lanes from Keller Springs Road to Boyington Drive.
- Bid alternate No. 2 will consist of the southbound lanes from Boyington Drive to Lindberg Drive.
- GBW will prepare an opinion of probable cost for the project which will include the base bid and the two bid alternates.
- GBW will complete an analysis of the Midway Road drainage system and include an estimate to bring the system up to current Town standards in the opinion of probable cost.
- The project is scheduled for construction in 2004; the bid process may begin in 2003.
- GBW will need to recheck the plans prior to bidding the project. In addition, the scope of work items which were not included in GBW's current engineering contract, such as construction sequencing, will need to be completed.
- GBW will furnish the Town with a final letter report which will document the results of the aforementioned work.

Please contact me if you have any questions or comments.

Regards,

Bruce

cc: Liz Metting, HNTB

BIRKHOFF, HENDRICKS & CONWAY, L.L.P.
CONSULTING ENGINEERS

7502 Greenville Ave., #220 Dallas, Texas 75231 Fax (214) 361-0204 Phone (214) 361-7900

JOHN W. BIRKHOFF, P.E.
RONALD V. CONWAY, P.E.
GARY C. HENDRICKS, P.E.
JOE R. CARTER, P.E.
PAUL A. CARLINE, P.E.
MATT HICKEY, P.E.
ROSS L. JACOBS, P.E.
I. C. FINKLEA, P.E.

September 4, 2001

Mr. Steven Z. Chutchian, P.E.
Assistant City Engineer
P. O. Box 9010
Addison, Texas 75001-9010

Re: Driveway Improvements
Beltline Road and Midway Road

Dear Mr. Chutchian:

Our original scope of services for the driveway improvements at the intersection of Beltline Road and Midway Road did not include the preparation of construction plans, specifications, bidding documents or the distribution of plans during the bidding phase. The original scope was for a study of alternatives. The alternatives envisioned was limited to one, once the Town had discussions with the property owner. We attempted to complete our services for the construction phase within the limits of the study; however, we exceeded the contract amount by $2,950.00. Accordingly, we request that the contract be amended to increase the contract amount for the increase in scope. If you are in agreement, please have one copy of this letter agreement signed by the Town of Addison and returned to our office.

We are available at your convenience to discuss this request further and appreciate your consideration.

Sincerely,

John W. Birkhoff

John W. Birkhoff, P.E.

APPROVED FOR THE TOWN OF ADDISON

By: Steve Z. Chutchian

Date: 9/4/01

j:\clerical\addison\6160\letters\drivewayamendment.doc

GBW Engineers, Inc.

1919 S. Shiloh Rd., Suite 530, LB 27, Garland, TX 75042

MEMO

Date: September 13, 2001 **GBW No. 00-238**

To: Steve Chutchian, P.E.

From: Bruce Grantham

Re: Summary of September 12, Midway Road Meeting

I have prepared the following summary of our discussion with Jim Pierce and Robin Jones yesterday on the Midway Road project:

- The Midway Road reconstruction project has a budget of approximately $4.75 million which includes the engineering design.
- Steve will check with Slade, and Bruce will contact Dave Baldwin, to determine if the landscape and irrigation design and construction cost needs to be included in the budget.
- The base bid for this project will consist of the northbound lanes from Belt Line Road to Keller Springs Road, and the southbound lanes from Belt Line Road to Lindberg Drive provided that the opinion of probable cost for this work is less than the budget.
- The proposed construction sequence where the adjacent northbound and southbound lanes are being reconstructed has previously been approved by the Town. This construction sequence includes the removal and replacement of the entire median.
- Where the northbound lanes only are to be reconstructed and the adjacent southbound lanes are to remain, GBW proposed a construction sequence which includes removing a portion of the median only in order to reconstruct one lane at a time.
- Bid alternate No. 1 will consist of the southbound lanes from Keller Springs Road to Boyington Drive.
- Bid alternate No. 2 will consist of the southbound lanes from Boyington Drive to Lindberg Drive.
- GBW will prepare an opinion of probable cost for the project which will include the base bid and the two bid alternates.
- GBW will complete an analysis of the Midway Road drainage system and include an estimate to bring the system up to current Town standards in the opinion of probable cost.
- The project is scheduled for construction in 2004; the bid process may begin in 2003.
- GBW will need to recheck the plans prior to bidding the project. In addition, the scope of work items which were not included in GBW's current engineering contract, such as construction sequencing, will need to be completed.
- GBW will furnish the Town with a final letter report which will document the results of the aforementioned work.

Please contact me if you have any questions or comments.

Regards,

Bruce

cc: Liz Metting, HNTB

Tel.: (972) 840-1916 / *FAX:* (972) 840-2156 / *E-mail:* info@gbwengineers.com

Facsimile Transmittal

Date: 9/13/01

Fax To: Mr. Steve Chutchian

Of: Town of Addison

Fax# 972-450-2837

Ref:

# of Pages (including this sheet): 2

From: **GBW Engineers, Inc.**
1919 S. Shiloh Rd.
Suite 530, L.B. 27
Garland, Texas 75042
Tel. (972) 840-1916
Fax (972) 840-2156

Fax From: Bruce Grantham

Comments:

GBW Job No: 00-238

Preliminary

MIDWAY ROAD RECONSTRUCTION
BELTLINE ROAD TO KELLER SPRINGS
ADDISON, TEXAS

DATE: September 5, 2001

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL COST
1	MOBILIZATION	LS	$110,000.00	1	$110,000.00
2	PREPARE RIGHT OF WAY	STA	$2,500.00	57	$142,500.00
3	UNCLASSIFIED ROADWAY EXCAVATION	CY	$10.00	10,000	$100,000.00
4	SAWCUT EXISTING PAVEMENT / DRIVEWAY	LF	$3.00	11,600	$34,800.00
5	REMOVE EXISTING CONCRETE PAVEMENT	SY	$7.50	49,300	$369,750.00
6	REMOVE EXISTING CONCRETE DRIVEWAY	SY	$10.00	5,000	$50,000.00
7	10" REINFORCED CONCRETE PAVEMENT (DOWELLED JOINTS)	SY	$50.00	49,300	$2,465,000.00
8	6" CRUSHED STONE BASE	SY	$6.00	50,600	$303,600.00
9	6" LIME STABILIZED SUBGRADE	SY	$3.00	53,900	$161,700.00
10	HYDRATED LIME	TONS	$100.00	865	$86,500.00
11	6" INTEGRAL CONCRETE CURB	LF	$3.00	17,750	$53,250.00
12	MONOLITHIC MEDIAN NOSE	EA	$1,000.00	23	$23,000.00
13	6" CONCRETE DRIVEWAY	SY	$25.00	5,000	$125,000.00
14	MEDIAN BRICK PAVERS	SF	$7.50	8,900	$66,750.00
15	REMOVE / REPLACE 4" REINFORCED CONCRETE SIDEWALK (5')	SY	$45.00	1,000	$45,000.00
16	TEMPORARY 8" ASPHALT (PLACE AND REMOVE)	SY	$20.00	3,900	$78,000.00
17	TACK COAT (0.05 GAL / SY)	GAL	$2.00	200	$400.00
18	RAILROAD HEADER	LF	$200.00	162	$32,400.00
19	RELOCATE EXISTING FIRE HYDRANT ASSEMBLY	EA	$1,200.00	2	$2,400.00
20	REMOVE / REPLACE STORM SEWER INLET	EA	$2,500.00	26	$65,000.00
21	ADJUST EXISTING WATER METER COVER	EA	$300.00	2	$600.00
22	ADJUST EXISTING WATER VALVE COVERS	EA	$250.00	33	$8,250.00
23	ADJUST EXISTING SANITARY SEWER MANHOLES	EA	$600.00	8	$4,800.00
24	ADJUST EXISTING UTILITY MANHOLES	EA	$750.00	12	$9,000.00
25	ADJUST STORM SEWER MANHOLES	EA	$600.00	1	$600.00
26	REMOVE SHRUBS	EA	$20.00	94	$1,880.00
27	REMOVE TREE 0" - 6"	EA	$75.00	16	$1,200.00
28	REMOVE TREE GREATER THAN 6"	EA	$150.00	29	$4,350.00
29	HYDROMULCH FOR MEDIANS	SY	$2.50	9,100	$22,750.00
30	BLOCK SODDING FOR PARKWAYS	SY	$5.00	3,900	$19,500.00
31	24" SOLID WHITE THERMOPLASTIC STOP BAR	LF	$10.00	650	$6,500.00
32	6" SOLID WHITE THERMOPLASTIC STRIPES	LF	$2.50	1,950	$4,875.00
33	4" WHITE REFLECTIVE TYPE I-W-C CERAMIC BUTTON	EA	$6.00	2,970	$17,820.00
34	6"x 6" WHITE REFLECTIVE JIGGLE BAR TILES	EA	$15.00	240	$3,600.00
35	WHITE THERMO DIRECTIONAL PAVEMENT MARKINGS	EA	$250.00	35	$8,750.00
36	RR CROSSING SYMBOL	EA	$500.00	6	$3,000.00
37	REMOVE RR ARM ASSEMBLY	EA	$5,000.00	2	$10,000.00
38	REMOVE LIGHT POLE ASSEMBLY	EA	$2,000.00	26	$52,000.00
39	TEMPORARY RR ARM ASSEMBLY (SEQUENCING)	EA	$10,000.00	2	$20,000.00
40	TEMPORARY 4" WHITE TRAFFIC STRIPE	LF	$0.50	8,500	$4,250.00
41	TEMPORARY 4" YELLOW TRAFFIC STRIPE	LF	$0.50	28,200	$14,100.00
42	TEMPORARY TRAFFIC SIGNALIZATION AT INTERSECTIONS	EA	$20,000.00	4	$80,000.00
43	2" PVC CONDUIT FOR LIGHT POLES	LF	$2.50	5,550	$13,875.00
44	PULL BOXES FOR LIGHT POLES	EA	$350.00	24	$8,400.00
45	INLET EROSION PROTECTION	EA	$100.00	26	$2,600.00
46	SILT FENCE	LF	$4.00	2,700	$10,800.00
47	TEMPORARY CONSTRUCTION ENTRANCE	EA	$2,500.00	9	$22,500.00
48	MAINTAIN EROSION CONTROL DEVICES	LS	$10,000.00	1	$10,000.00
49	REMOVE TRAFFIC SIGNALS (MEDIANS)	EA	$5,000.00	2	$10,000.00
50	SIGNS, BARRICADES, TRAFFIC CONTROL	MO	$10,000.00	18	$180,000.00
51	ADJUST EXISTING UTILITIES	LS	$100,000.00	1	$100,000.00
52	ROOT BARRIER	LF	$5.00	1,500	$7,500.00
				SUB-TOTAL	$4,971,050.00
				10 % CONTINGENCY	$497,105.00
				TOTAL	$5,468,155.00

OTHER ITEMS:

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL COST
1	REPLACE LIGHT POLE ASSEMBLY	EA		26	$0.00
2	PERMANENT TRAFFIC SIGNALS AT INTERSECTIONS	EA		2	$0.00
3	REPLACE RR ARM ASSEMBLY	EA		2	$0.00
4	TEMPORARY LIGHTING	LS		1	$0.00
5	STORM DRAINAGE IMPROVEMENTS	LS		1	$0.00
				SUB-TOTAL	$0.00
				10 % CONTINGENCY	$0.00
				TOTAL	$0.00

TOTAL PROJECT COST:

SUB-TOTAL	$0.00
10 % CONTINGENCY	$0.00
TOTAL	$0.00

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 9/12/01 **Claim #** ______ **Check $** 7,055.82

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
# 1480	46	000	56570	04300		7,055.82

TOTAL 7,055.82

EXPLANATION 10th PAYMENT TO GBW ENGINEERS FOR DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I

Steve Chutchian

Authorized Signature

Finance

Grantham, Burge & Waldbauer
GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1480

Date: September 6, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 8/1/01 to 8/31/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 7,055.82
Total Previous Invoices	$237,261.39
Total Billed to Date	$244,317.21
Less Payments/Credits	($237,261.39)
Total Amount Now Due	$ 7,055.82
Amount This Invoice	$ 7,055.82

o.k. to
PAY!
SZC
9/12/01

Please Retain This
Page For Your Records

Invoice No.: 1480
Date: September 6, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously	$ 20,038.75	

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
78% complete		$ 180,499.20

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 11,145.35	

5. Reimbursables

Total Phase Amount	$ 3,785.18	
78% complete		$ 2,952.44

TOTAL BILLED TO DATE >>> $ 244,317.21

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1480

Date: September 6, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	7,055.82
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 8/15/01 **Claim #** ________ **Check $** 35,279.17

Vendor No. ________

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB.27

Address GARLAND, TEXAS 75042

Address ________

Zip Code ________

INVOICE # OR DESCRIPTION		FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
		(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
	1461	46	000	56570	04300		35,279.17

TOTAL 35,279.17

EXPLANATION 9th. PAYMENT TO GBW ENGINEERS FOR DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer
GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1461

Date: August 6, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 7/1/01 to 7/31/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 35,279.17
Total Previous Invoices	$201,982.22
Total Billed to Date	$237,261.39
Less Payments/Credits	($201,982.22)
Total Amount Now Due	$ 35,279.17
Amount This Invoice	$ 35,279.17

O.K. to pay.
SZC
8/15/01

**Please Retain This
Page For Your Records**

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

Invoice No.: 1461
Date: August 6, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously	$ 20,038.75	

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
75% complete		$ 173,556.93

4. Design Report

Total Phase Amount	$ 29,384.12	
Billed Previously	$ 11,145.35	

5. Reimbursables

Total Phase Amount	$ 3,785.18	
75% complete		$ 2,838.89

TOTAL BILLED TO DATE >>> $ 237,261.39

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1461

Date: August 6, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	35,279.17
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 7/19/01 **Claim #** ______ **Check $** ______

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION		FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
		(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
	1424	46	000	56570	04300		17,561.97

TOTAL 17,561.97

EXPLANATION 8th PAYMENT TO GBW ENGINEERS FOR DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1424

Date: July 5, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 6/1/01 to 6/30/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 17,561.97
Total Previous Invoices	$184,420.25
Total Billed to Date	$201,982.22
Less Payments/Credits	($184,420.25)
Total Amount Now Due	$ 17,561.97
Amount This Invoice	$ 17,561.97

o.k. to pay
SZC
7/19/01

Please Retain This
Page For Your Records

Invoice No.: 1424
Date: July 5, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$	29,681.47		
100% complete			$	29,681.47

2. Geotechnical Services

Total Phase Amount	$	19,440.00		
Billed Previously	$	20,038.75		

3. Preliminary Plans

Total Phase Amount	$	231,409.23		
60% complete			$	138,845.54

4. Design Report

Total Phase Amount	$	29,384.12		
Billed Previously	$	5,343.10		

GBW Standard Rate Schedule:

Professional Engineer	5 @ $127.25/hr	$	636.25
HNTB Invoice No. 1-32921-PL-001 (attached)		$	5,166.00
Total Labor Charges, Task 4 >>			$11,145.35

Invoice No.: 1424
Date: July 5, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

5. Reimbursables

Total Phase Amount	$	3,785.18		
60% complete			$	2,271.11
TOTAL BILLED TO DATE >>>			$	201,982.22

Engineers, Inc.

Grantham, Burge & Waldbauer

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1424

Date: July 5, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	17,561.97
TOTAL AMOUNT ENCLOSED	$	________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

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1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

HNTB ARCHITECTS ENGINEERS PLANNERS

14114 Dallas
Parkway, Suite 630
Dallas, Texas
75240-4381
(972) 661-5626
FAX (972) 661-5614

June 22, 2001

GBW Engineers, Inc.
Bruce Grantham, P.E.
1919 S. Shiloh Road
Suite 530, L.B. 27
Garland, Texas 75042

Re: Midway Road Replacement - Belt Line to Keller Springs Roadway

Dear Mr. Grantham,

We are enclosing the original and one copy of our Invoice No. 1-32921-PL-001 in the amount of $5,166.00. This is for professional engineering services rendered on the above referenced project.

We trust you will find this invoice in proper order and place in line for further processing.

Very truly yours,

HNTB CORPORATION

Benjamin J. Biller

Benjamin J. Biller
Vice President, Central Division

BJB:lgb

Enclosures

cc: Finance Department

TEXAS DEPARTMENT OF TRANSPORTATION

BILLING STATEMENT

FORM 132 REV 9-90

BILLING INSTRUCTIONS: To facilitate handling and prompt payment show the information in the spaces provided below. Submit five copies. Submit a separate statement for each requisition. Charges for freight or express, if any, must be supported by the prepaid freight or express bill. This statement cannot be processed for payment without a valid vendor ID number.

Name of Payee: HNTB CORPORATION DATE: Jun 22, 2001

Address: 85 N.E. Loop 410 - Suite 304 City & State: San Antonio, TX 78216-5866

DELIVERY DATE: Jun. 22, 2001 VENDOR ID NUMBER: 14316230920006

LINK	SW	DATE	INVOICE NUMBER	FY	S	SOURCE UNIT	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
		6/22/2001	1-32921-PL-001	01		051	Period Covered:			
							For Period 2/24/01 through 5/25/01			
							Total Earned to Date		$ 5,166	
							Less Previously Invoiced		$ -	
							Due this invoice			$ 5,166
							Work Authorization No. 1			
							This agreement authorized by Article 664-4 VSC			
							CASH DISCOUNT ____ % ____ DAYS			
									TOTAL	$ 5,166

IAC or MISC CONTRACT NO: 22-845P5004 SDHPT REQ. NO: HW PURCHASE ORDER NO: DATE:

CARD CODE 3 INFORMATION

MMIS Tracked Functions Only

LINK (15-17)	SEQ (18-20)	DIST OR DIV (21-22)	SEG. I.D. 26 / 09 10 / 70 THRU 79 (23-24)	DETAIL (25-41)	AMOUNT (42-53)	± (54)	FUNC. / MOD. / IS (55-57)	OBJ. OF EXP. (58-60)	TASK / WORK ORDER (61-66)	CO (67-69)	SYS. (70-71)	NUMBER (72-75)	SUF (76)	CL (77-78)	REF. MARKER BEG	REF. MARKER END	AMT. OF WORK PERF.
		22	76	0037-03-063	5,166		162	423									

Other card code fields: DHT ITEM NO; EQUIPMENT NUMBER; TRADE-IN ALLOWANCE; TRADED EQUIP NO; MOD; ACTY.; EQUIP NO; COST CENTER; SFI; ACTY; HIGHWAY.

Agency Verification/Audit has been performed, the services rendered and/or goods received, and the invoice(s) correctly corresponds with the authority under which procurement was made. The invoice(s) is (are) true and unpaid.

By ______________________________

HNTB ARCHITECTS ENGINEERS PLANNERS

June 22, 2001

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530, LB 27
Garland, Texas 75042

In Account With

HNTB CORPORATION
Dallas, Texas

Invoice No. 1-32921-PL-001 — Work Authorization No. 1
Project: Midway Road Replacement — W.A. No. 1 Contract Maximum: $10,530.00

Invoice Summary: From: 02/24/01 To: 05/25/01

Total Contract Amount		$10,530.00
Total Due This Invoice	49.1% Complete	$5,166.00
Total Previous Invoices		$0.00
Total Billed to Date		$5,166.00
Less Previous Invoices		$0.00
Total Amount Now Due		$5,166.00

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 6/12/01 **Claim #** ______ **Check $** 16,466.57

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1387	46	000	56570	04300		16,466.57

TOTAL $16,466.57

EXPLANATION 7th. PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I.

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1387

Date: June 5, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 5/1/01 to 5/31/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 16,466.57
Total Previous Invoices	$167,953.68
Total Billed to Date	$184,420.25
Less Payments/Credits	($167,953.68)
Total Amount Now Due	$ 16,466.57
Amount This Invoice	$ 16,466.57

O.K. to pay.
SZC
6/12/01

Please Retain This
Page For Your Records

Invoice No.: 1387
Date: June 5, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
100% complete		$ 29,681.47

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
Billed Previously	$ 20,038.75	

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
55% complete		$ 127,275.08

4. Design Report

Total Phase Amount	$ 29,384.12
Billed Previously	$ 636.25

<u>Standard Rate Schedule</u>:

Professional Engineer	30	@	$127.25/hr	$3,817.50
Design Technician	14	@	$ 60.32/hr	$ 844.48
Clerical Staff	1	@	$ 44.87/hr	$ 44.87
			Total Labor Charges >>	$4,706.85

Invoice No.: 1387
Date: June 5, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

5. Reimbursables

Total Phase Amount	$	3,785.18		
55% complete			$	2,081.85
TOTAL BILLED TO DATE >>>			$	184,420.25

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1387

Date: June 5, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$	16,466.57
TOTAL AMOUNT ENCLOSED	$	______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

May 21, 2001

Mr. Steve Chutchian, P.E.
Town of Addison
Post Office Box 9010
Addison, Texas 75001

Re: Draft Letter Report for Midway Road
Pavement Section

GBW No. 238

Dear Steve:

This letter report summarizes data from an in-depth field inspection of the Midway Road pavement condition performed by GBW staff and the enclosed draft geotechnical report prepared by Alpha Testing, Inc. In addition, this report includes a review of the pavement section alternatives included in the Alpha Testing report and an opinion of probable cost for two of the pavement sections that utilize alternative base materials.

Description of Problem

Alpha Testing, Inc. strategically selected boring locations in order to determine how subsurface conditions were affecting the level of pavement distress. Following an analysis of the field inspection and soil boring data, we have the following observations:

- The pavement distress along the northbound lanes is more pronounced than the southbound lanes.
- The worst section of the southbound lanes is in the vicinity of the railroad crossing near the Belt Line Road end of the project where a sag is located.
- The cross-slope on the northbound lanes, which is mostl[redacted] 1/4-inch per foot range, is significantly less than the southbound lanes, where it is mostly in the 1/4 to 1/2-inch per foot range.
- The difference between the northbound and southbound lane cross-slopes appears to have resulted from an attempt to match the existing ground at the east and west right-of-way lines when the current Midway Road pavement was designed in 1982.
- The flatter cross-slope on the northbound lanes increases the likelihood that surface water will pond or runoff slowly, resulting in a higher infiltration rate into the subgrade through pavement joints and cracks.
- In addition to rainfall, sprinkler systems in the medians and adjacent parkways are other sources of water which can infiltrate the subgrade.
- Flat longitudinal slopes along some sections of Midway Road also slow that rate of storm water runoff; for example, in the vicinity of the railroad crossing.
- Poor surface drainage appears to be the primary reason why pavement distress has been more rapid along most of the northbound lanes when compared with the southbound lanes.
- The poor condition of many pavement joints, some of which may have been widened when the pavement was milled and resealed in 1994, provide conduits for surface water to reach the subgrade.
- The plasticity index of the underlying clay soil is generally in the 18 to 55 range, which indicates a high potential to shrink and swell.
- The soil borings do not provide evidence of a ground water problem.
- Only eight of the 22 soil borings showed evidence of lime in the subgrade, which suggests that the lime stabilized subgrade was not uniformly constructed.
- A combination of moisture penetration over time and nonuniform lime stabilization during construction has probably reduced the bearing capacity of the subgrade.

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

- The load transfer capability of the transverse contraction joints has been insufficient to support the heavy traffic volume, resulting in a difference in pavement elevation at the front and back ends of adjacent slabs.
- This difference, which results in a bump at the pavement joints on the northbound lanes in particular, has also resulted in a transverse crack at the midpoint of some slabs.
- Exhibit A contains a summary of data from the field inspection and the geotechnical report.

Comparable Pavement Alternatives

We received a copy of your letter to Jerry Holder dated March 23, 2001 in which you authorize the design team to proceed with pavement section Alternative 3 which included Portland Cement Concrete (PCC) on a Cement Treated Permeable Base (CTPB) with edge drains. Pursuant to our previous discussions, it is understood that the Town intends to use the same type of pavement section for both the Midway and Arapaho Road projects, given that the depths of the concrete and base layers may differ.

In a similar manner to the Terra-Mar, Inc. report for Arapaho Road, the Alpha Testing report for Midway Road analyzes several alternative pavement sections. These alternatives, which assume a 30-year project life, are summarized in the following section.

- *If the load transfer between joints is through <u>aggregate interlock</u> and the subgrade is <u>compacted</u>; either*

11.5 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Compacted subgrade

OR

10.5 inches	PCC
6 inches	CTPB
6 inches	Compacted subgrade

- *If the load transfer between joints is through <u>aggregate interlock</u> and the subgrade is <u>lime stabilized</u>; either*

11 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Lime stabilized subgrade

OR

10 inches	PCC
6 inches	CTPB
6 inches	Lime stabilized subgrade

- *If the load transfer between joints is through dowels and the subgrade is compacted; either*

10 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Compacted subgrade

OR

9 inches	PCC
6 inches	CTPB
6 inches	Compacted subgrade

- *If the load transfer between joints is through dowels and the subgrade is lime stabilized; either*

9.5 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Lime stabilized subgrade

OR

9 inches	PCC
6 inches	CTPB
6 inches	Lime stabilized subgrade

Review of Alternatives

Upon a review of the pavement sections listed above, it is evident that each of the following alternatives reduce the required PCC thickness by ½ to 1 inch:

- *The use of CTPB in lieu of Crushed Limestone Base.*

  Given the Town's selection of CTPB for the Arapaho Road project, it is anticipated that CTPB will also be the base material of choice for the Midway Road project.

- *The use of lime stabilized subgrade in lieu of compacted subgrade.*

  In Section 5.4 of the Terra-Mar report, it states that 'If construction proceeds during wet weather, a lime stabilized subgrade in lieu of a compacted subgrade may be desirable in order to provide a more stable and less moisture sensitive working platform.' A representative with Jackson Brothers, the contractor on the Post and Paddock paving project for the City of Grand Prairie, strongly recommended that a lime stabilized subgrade be used with CTPB due to constructability problems which they experienced on Post and Paddock with a compacted subgrade. If the Town of Addison is willing to consider lime stabilization on Midway Road, it could be bid as an alternate to a compacted subgrade.

- *The use of <u>dowels</u> in lieu of <u>aggregate interlock</u> for load transfer between joints.*

  In Section 5.5 of the Terra-Mar report, it states that 'Steel dowels should be used for load transfer at all joints transverse to traffic.' This recommendation applies to transverse contraction joints which they indicate should typically be placed at 15 feet on-center. The Terra-Mar report does not provide an alternative pavement section for load transfer through aggregate interlock between joints. Locally, aggregate interlock is most commonly used on municipal roadways; nevertheless, both load transfer options could be bid as alternates on Midway Road.

Cost Comparison of Alternatives

If lime stabilization is bid as an alternate to a compacted subgrade, and dowels are bid in lieu of aggregate interlock for load transfer between joints, the contractors that bid the Midway Road project will determine the cost effectiveness of these alternatives. If one or more or these alternatives is not acceptable to the Town, we would be pleased to do the research necessary to prepare an opinion of probable cost for each alternative.

Although it is anticipated that the pavement section on Midway Road will incorporate CTPB, Exhibit B provides an opinion of probable cost for informational purposes to compare it with a pavement section that incorporates Crushed Limestone Base. This comparison, which indicates a $866,805 increase in cost to use CTPB, is contained in that attached spreadsheet.

CTPB Design Memo

Given the limited use of CTPB as a base material for urban pavements in the metroplex, we have prepared a design memo based on our research of this material. The attached design memo on CTPB has been prepared following conversations with a supplier, a contractor, other local and state agency representatives, and other engineers.

This memo is to provides an evaluation of CTPB along with technical data for consideration prior to developing consistent pavement section design standards and specifications for the Midway and Arapaho Road projects.

Fly Ash

The Town of Addison's staff has expressed an interest in using fly ash in the mix design of the PCC pavement for the Midway and Arapaho Road projects. Mr. Michael Caldarone, P.E. with TXI indicated that fly ash is used in concrete paving by number of local cities including Dallas, Fort Worth Arlington, Plano and Grand Prairie, and by TxDOT on the majority of their concrete paving projects. I also contacted the City of Garland's construction manager and confirmed that they permit fly ash in concrete paving mix designs, although the amount is limited to the lesser of 15% of the cement weight or 100 lbs.

Mr. Caldarone furnished our office with sample concrete mix designs, with and without fly ash, which achieve 3,000 psi in 3 days and 7 days respectively. These mix designs are attached for you information. If the Town wishes to utilize fly ash on the subject projects, we can include appropriate limits for its use in the technical specifications.

After reviewing the enclosed geotechnical report for Midway Road and this letter, please contact me if you any comments. I will then request that Alpha Testing finalize their report.

Very truly yours,

Bruce R. Grantham, P.E.
President

Attachments

cc: Jerry Holder, HNTB
Dave Lewis, Alpha Testing

BG/gg
J:\WPDOCS\PROJECTS\ADDISON\00-238\Chutchian.ltr

EXHIBIT A

MIDWAY ROAD - SOIL BORING/FIELD OBSERVATION SUMMARY

Boring No.	Pvm't Station	Traffic Direction	Panel Point	PI	Lime Stab.	Rock Depth	Pvm't Thickness	Pvm't Cross Slope	Joint Width	Pavement Distress
B-1	6+30	North	Front	49	No	-	8"	-1.32%	Moderate	High
B-2	6+27	North	Back	31	No	-	7 3/4"	-1.32%	Moderate	High
B-3	6+49	North	Front	21	Yes	-	8"	-1.35%	Moderate	High
B-4	6+45	North	Back	-	No	-	7 3/4"	-1.34%	Moderate	High
B-5	6+56	South	Front	21	Yes	-	8"	-3.86%	Moderate	High
B-6	6+60	South	Back	-	No	-	8"	-3.78%	Moderate	High
B-7	10+03	North	Back	-	No	8'	8 1/4"	-1.72%	Moderate	Medium
B-8	10+06	North	Front	17	Yes	8'	8 1/2"	-1.79%	Moderate	Medium
B-9	10+33	South	Front	23	Yes	-	8"	-2.93%	Moderate	Medium
B-10	10+36	South	Back	17	Yes	-	8"	-2.95%	Moderate	Medium
B-11	24+33	North	Center	-	No	-	8"	-1.35%	Moderate	Medium
B-12	24+45	North	Center	37	Yes	-	8"	-1.28%	Moderate	Medium
B-13	26+01	South	Center	41	Yes	8'	8"	-3.71%	Small	Low
B-14	27+54	South	Center	-	Yes	5'	8"	-3.75%	Small	Low
B-15	27+32	North	Front	55	No	-	8 1/4"	-0.92%	Moderate	Medium
B-16	27+28	North	Back	29	No	-	8 1/4"	-0.99%	Moderate	Medium
B-17	47+47	North	Center	55	No	5'	6 1/2"	-1.43%	Large	High
B-18	47+47	North	Center	46	No	5'	6 1/2"	-1.43%	Large	High
B-19	48+14	South	Center	45	No	6'	6 1/2"	-2.43%	Moderate	Medium
B-20	50+74	South	Center	38	No	2'	7 1/4"	-2.02%	Moderate	Medium
B-21	50+88	North	Center	-	No	2'	6 1/4"	-1.24%	Moderate	Medium
B-22	50+88	North	Center	18	No	2'	6 3/4"	-1.24%	Moderate	Medium

EXHIBIT B

OPINION OF PROBABLE COST
MIDWAY ROAD - ALTERNATIVE PAVEMENT SECTIONS

Bid Item Description	Thickness	Unit	Unit Price	Estimated Quantity	Total Item
	(inches)		($)		($)
Alternate 1					
Portland Cement Concrete	11.5	S.Y.	55	53,500	2,942,500
Crushed Limestone Base	6	S.Y.	15	57,000	855,000
Compacted Subgrade	6	S.Y.	1.5	57,000	85,500
TOTAL ESTIMATED COST					**$3,883,000**
Alternate 2					
Portland Cement Concrete	10	S.Y.	50	53,500	2,675,000
Cement Treated Permeable Base	6	S.Y.	15	57,000	855,000
Lime Stabilized Subgrade	6	S.Y.	2	57,000	114,000
Lime (@ 33 lbs/S.Y.)	-	TON	110	941	103,455
Geotextile Fabric	-	S.Y.	13	62,000	806,000
Concrete Toe Wall (6" x 18")	-	L.F.	10	3,060	30,600
Edge Drains (6" PVC)	-	L.F.	15	11,050	165,750
TOTAL ESTIMATED COST					**$4,749,805**
ADDITIONAL COST FOR ALTERNATE 2					**$866,805**

Notes:
1. Edge Drains are proposed behind both outside curbs.
2. Concrete toe walls are proposed along the inside curb lines of wider landscaped medians only.
3. Lime Stabilization is included with CTPB for constructability purposes.

GBW Engineers, Inc.

DESIGN MEMO

Date: April 2, 2001 **Job No.** 00-238

From: GBW **Job Name:** Midway Road/Arapaho Road

To: Steve Chutchian, P.E.; Jerry Holder, P.E.

Re: General Notes on Cement Treated Permeable Base

EVALUATION

- CTPB has the potential to increase the life of a roadway by providing a conduit for subsurface water to flow out from under the pavement, thereby, reducing the rate at which subgrade support is likely to deteriorate.

- CTPB slightly reduces the required concrete pavement thickness when compared with an equally thick crushed limestone base.

- CTPB has been used extensively in other states including California, Louisiana and Wisconsin.

- CTPB is more commonly used where the subsurface water flows to open road side drainage ditch; however, it is also used in conjunction with edge drains on curb and gutter roadways.

- CTPB has been used on a very limited basis locally; consequently, contractors are not as familiar with the construction requirements as they are with more commonly use non-drainable base materials such as crushed limestone.

- Grand Prairie rebid the Post and Paddock roadway reconstruction project, which utilized CTPB, because they received usually high bids at the first bid opening.

- A mandatory prebid meeting was scheduled prior to the second bid opening, which resulted in lower bids, in order to provide contractors with more detailed information about the use of CTPB.

- A representative of Jackson Brothers, the contractor on Post and Paddock, informed our staff that they would be prepared to bid another CTPB project; however, they would include money to lime stabilize the subgrade even if it was not required.

- The compacted subgrade which was specified on the Post and Paddock project created constructability problems for the contractor, especially when it rained.

- Typically, where non-drainable bases are used, the goal is restrict the flow of water under the pavement. A drainage base permits the free flow of water under the pavement.

- As CTPB promotes the flow of water under the pavement, it increases the potential for future pavement problems if the drainage system does not function as designed. For example:
    - Over-rolling the CTPB can cause degradation of the material with a resulting loss of permeability.

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- An uneven or inadequately sloped subgrade can cause water to pond in the CTB.
- Any break in the filter fabric layer, either during construction or during later pavement repairs, can provide a conduit for water to migrate into the subgrade.
- The CTB must be keep free of dirt during construction and during later pavement repairs.
- In addition, pavement repairs must be closely monitored to insure that the CTPB is correctly installed so that the free flow of water is not interrupted.
- The edge drains must be kept clear of dirt and debris during construction and, if they are located under the pavement, construction equipment must be monitored to insure that the pipes are not crushed.
- The edge drains must be consistently checked and cleaned out if necessary, during the pavement design life.

- As storm sewers, culverts or creeks are the most likely outfall points for edge drains, the depth of flow in these outfalls must be checked to determine if storm water will back up through the edge drains into the CTPB, and in what storm event this will occur.

- The back up of storm water from an outfall into the CTPB introduces a significantly higher volume of water under the pavement than would result from infiltration through the pavement joints.

- The CTPB pavement section, which includes edge drains, filter fabric, and root barriers along wider median curbs, is significantly more expensive than an equivalent pavement section which utilizes a non-drainable base.

- There are no local examples of CTPB pavement section that have been in place on a curb and gutter roadway over the design life to quantify any improvement in durability over a non-drainable base.

BASE COURSE NOTES

General

- If construction traffic will be allowed on the permeable base, cement stabilization is generally needed to avoid the substantial cost of constructing a temporary adjacent haul road for side delivery of concrete to the paver.

Aggregate

- Quality of crushed aggregates is the single most important factor for the stability of a permeable base. Aggregate should be stored, handled, and placed in a manner to keep segregation to a minimum.

- The most popular aggregate gradations are AASHTO No. 57 and No. 67, which are characterized by having very little material finer that No. 8 sieve.

- The aggregate material should have at least two mechanically fractured faces to ensure good mechanical interlock. This will require a crushed material.

Permeability

- Cement-treated bases have coefficients of permeability in the range of 3,000 to 15,000 ft per day. Untreated permeable bases range from 500 to 2,000 ft per day.

- Edge drains are usually filled with the same highly permeable material that is used for the base or a material with even higher permeability.

Cement

- While 200 lb cement per cubic yard has been the amount most generally specified, agencies have used amounts varying from 150 to 300 lb.

- Mixes with 150 lb/c.y. cement content should be restricted to areas subjected to only a few truck hauls over stable subgrade.

- Mixes with 200 lb/c.y. cement content are appropriate for general use (average trucking and subgrade conditions.)

- Mixes with 250 lb/c.y. cement should be used where heavy trucking will occur or where support conditions are questionable.

- From the low to the high cement content, 7 day field compressive strengths varied from 150 to 600 psi; however, cement content rather than strength should be used to select the most appropriate mix.

Water Content

- Water contents for workable mixtures are usually in the range of 100 to 120 lb/yd3. Water content should be based on the contractor's assessment of the mix workability.

- A water/cement ratio at the higher end of the range may encourage the cement paste to flow to points of aggregate contact where its cementing action is needed. The FHWA recommends this design approach.

Pavement Section

- The thickness of permeable bases used has varied from 3 to 6 inches, with 4 inches being the most common. The thickness should be adequate to overcome any construction variances and provide an adequate hydraulic conduit to transmit the water to the edge drain.

- A minimum resultant slope of 2 percent is recommended wherever possible.

Construction

- Most commonly, the base is compacted by vibratory plates or screeds. The objective is to solidly seat the material.

- Over-rolling can cause degradation of the material with a resulting loss of permeability

- Cement-treated permeable bases are cured by water misting several times a day or by covering with polyethylene sheets for 3 to 5 days.

- The need for curing is one of the least understood aspects of constructing cement treated permeable bases.

- Some agencies are studying the cost-effectiveness of curing; Wisconsin found little difference between material covered with polyethylene and that left exposed.

- During construction, care must be taken to prevent contamination of the permeable base from mud and dirt carried by truck tires. Construction traffic should be kept to a minimum and sharp truck turning should be avoided.

SEPARATOR NOTES

General

- Beneath the permeable base course, a separator or filter layer prevents fine particles in the subgrade soil from infiltrating the open-graded base.
- An asphalt prime coat placed on the stabilized subgrade/subbase would provide additional protection.
- A separator layer can be provided by an aggregate separator layer or by a geotextile.

Aggregate Layer

- The aggregate layer must be strong enough to provide a stable working platform for constructing the permeable base.
- The gradation of this layer must be carefully selected to prevent fines from pumping up from the subgrade into the permeable base.
- The aggregate layer must have a low permeability to deflect infiltrated water over to the edge drain.
- The FHWA recommends the percent of fines passing the No. 200 sieve should not exceed 12 percent and the coefficient of uniformity should be greater the 20 (preferably greater the 40.)
- A minimum thickness of 4 inches is recommended for the aggregate separator layer.

Geotextile

- In subgrades with a high percentage of fines, a geotextile might be a preferred choice.
- The geotextile must have enough strength to survive the construction phase.
- The principal advantage of a geotextile is its filtration capability. A geotextile will allow any rising water, due to capillary action or a rising water table, to enter the permeable base and rapidly drain to the edge drain system.
- The main disadvantage is if the geotextile becomes clogged, rising water will be trapped under the geotextile, saturating the subgrade and reducing subgrade support.
- Pore openings should be sized to retain larger soil particles and pass smaller soil particles. Large numbers of openings should be provided in case there is some clogging.
- The geotextile should have a permeability several times greater than the subgrade so that any vertical draining water will not be unduly impeded by the geotextile.
- The geotextile should be specified based on performance rather than type (woven or non-woven).

- Geotextiles are subject to degradation when exposed to sunlight for extended periods of time. To prevent this, geotextiles should be placed and covered as quickly as possible.

LONGITUDINAL EDGE DRAIN NOTES

General

- For crowned pavement, edge drains are installed along both the inner and outer pavement edge. For uncrowned sections, only one edge drain is installed at the low side.
- For the longitudinal edge drain pipe, most agencies use 6-inch diameter flexible corrugated polyethylene tubing (perforated and meeting AASHTO M252.) Rigid PVC pipe (slotted, AASHTO M278-PC50) has also been used but is more expensive. If the pipe is to be installed in trenches that are to be backfilled with asphalt-stabilized permeable material, the pipe must be capable of withstanding the temperature.
- The trench backfill material should be of the same material as the permeable base course to ensure adequate capacity.
- The preferred location for the edge drain is 2 or 3 feet outside the curb to avoid settlement problems or crushing the collector pipe beneath construction equipment. Sometimes, the permeable base is extended under the shoulder with the edge drain placed at the outside shoulder edge.
- The suggested minimum pipe size is 4 inches and the minimum slope should be 0.0035 ft/ft.
- Depending on the pipe size, the trench width should be between 8 and 10 inches. The trench should be deep enough to allow the top of the pipe to be located 2 inches below the bottom of the permeable base.
- The edge drain trench should be lined with a geotextile, but the top of the trench adjacent to the permeable base is left open to allow a direct path for the water into the edge drain pipe.
- The ability to flush or jet rod the system is important in the maintenance scheme. The edge drain and outlet pipes must have proper bends (2 to 3-feet radii) and vents to facilitate this operation.
- Videotaping the completed edge drain with flexible fiber optic equipment is suggested for final acceptance of the project.

Lateral Pipes

- Lateral outlet pipes are rigid PVC or metal. Rigid pipe provides more protection against crushing due to construction operations.
- The Federal Highway Administration recommends a maxiınum outlet spacing of 250 feet to ensure rapid drainage. The pipes should be placed on a 3 percent grade with the outlet at least 6 inches above the 10-year design flow in the ditch or storm sewer.
- Pipe outlets into open ditches are usually protected by concrete headwalls and are equipped with rodent screens.

Construction

- Edge drains may be installed before or after construction of the permeable base and concrete surface. This will affect the edge drain location and geotextile placement.

- Pre-pavement installation of the edge drain may be necessary in some urban situations, but in general, the option should be given to the contractor.

- Post-pavement installation has several advantages: less threat of pipe damage and trench cave-ins due to construction traffic, less susceptibility to bad weather delays, and better line and grade because these are taken off the previously constructed concrete pavements.

Maintenance

- Flushing and rodding of the edge drain system should be done on a routine schedule.

- Edge drain outlets and pipe systems should be inspected at least once a year using flexible fiber optic video equipment to determine their condition.

- If regular maintenance is not done, the pavement section will become flooded, increasing the rate of pavement damage.

DESIGN NOTES

- When rainfall events occur that are greater than the design storm, the permeable base will fill with water and excess water will simply run off on the pavement surface. After the storm event, the permeable base will drain as designed.

- A time to drain 50 percent of the drainable water of 1 hour is recommended for the highest class roads with the greatest amount of traffic. For most other highways and freeways, a time to drain 50 percent of the drainable water of 2 hours is recommended.

- Construction traffic on the completed base course is the single most important parameter in the selection of the type of permeable base to be used.

CONSTRUCTION NOTES

- Central plant mixing of permeable cement-treated base course is essentially the same as that for conventional concrete.

- The City may want to construct a test strip of the base course to determine which curing method to employ as well as which method of compaction should be used. Requirements for moist curing should be investigated to see if they might be eliminated without substantial loss of performance under actual job conditions.

- The FHWA recommends that a control strip be constructed at the beginning of construction so that the combination of aggregate materials and construction practices be tested, and if necessary, adjusted to produce a stable permeable base with adequate drainage characteristics. A minimum length of 500 feet is recommended, and this section can become part of the finished roadway if found to be acceptable.

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Mix #: 9053
Description: 7.00SK ADMIX/AEA 1"CS
Strength: 5000 psi @ 28 Days

3000 PSI @ 3 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.392 lbs/lb
Cement/Cementitious Content:	7.00 sacks (per cubic yard)
Maximum Placement Slump:	4.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

658 lbs.	ASTM C 150 TYPE I CEMENT
1840 lbs.	1" - #4 CRUSHED STONE
1193 lbs.	CONCRETE SAND
258 lbs.	or 31.0 Gallons of Water
2.0 to	4.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%
Placement Slump: 3.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9053 Strength: 3000 psi @ 3 Days

3 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	3 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	04/18/97	43	72	80	4.50	5.8%	3170		3170	3170		
2	06/24/97			91	4.25	5.0%	3610		3610	3390		
3	03/17/98	31	56	66	2.00	4.0%	3890		3890	3557	3557	
4	08/25/98	43		88	5.00	N/A	3050		3050	3430	3517	
5	08/28/98	43	86	93	4.50	1.8%	3760		3760	3496	3567	
6	09/04/98	43	96	84	5.00	N/A	3680		3680	3527	3497	
7	09/18/98	31	72	84	5.75	4.8%	3500		3500	3523	3647	
8	10/05/98	50	82	80	4.75	N/A	4630		4630	3661	3937	
9	08/09/99	43	85	96	5.00	N/A	4220		4220	3723	4117	
10	08/23/99	31	92	86	5.00	4.8%	4400		4400	3791	4417	
11	02/08/00	18	43	58	4.75	N/A	2960		2960	3715	3860	
*** Averages ***			76	82	4.59	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9053 **Strength: 3000 psi @ 3 Days**

Paragraph 5.5 of ACI 318-89 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

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*                                                *
*   Unable to calculate standard deviation due   *
*                                                *
*   to the fact that less than 15 tests exist    *
*                                                *
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SUMMARY OF STATISTICAL ANALYSIS
3 Day Test Data

Number of Tests..........................	11
Maximum Value............................	4630 psi
Minimum Value............................	2960 psi
Range....................................	1670 psi
Average Strength.........................	3715 psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-89 Section 5.3.2.1...............	
Design excess beyond code requirements...	

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9053 Strength: 5000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	28 Day PSI 2	28 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	08/09/99	43	85	96	5.00	N/A	6280	6110	6195	6195		170
2	08/11/99	31	90	91	5.00	N/A	5880	5920	5900	6048		40
3	08/13/99	43	92	.99	3.75	N/A	6050	6150	6100	6065	6065	100
4	08/16/99	31	92	95	6.00	N/A	5470	5350	5410	5901	5803	120
5	08/23/99	31	92	86	5.00	4.8%	6560	6420	6490	6019	6000	140
6	09/27/99	41	92	88	5.00	4.3%	6520	649D	6505	6100	6135	30
7	09/27/99	41	82	84	5.25	4.1%	6090	6110	6100	6100	6365	20
8	09/27/99	41	89	82	5.50	3.3%	5820	5730	5775	6059	6127	90
9	09/27/99	41	74	83	5.00	3.8%	6510	6480	6495	6108	6123	30
10	09/29/99	41	68	84	5.00	N/A	6160	6220	6190	6116	6153	60
11	09/29/99	41	74	90	5.00	N/A	6700	6650	6675	6167	6453	50
12	09/29/99	41	70	85	5.00	N/A	6320	6400	6360	6183	6408	80
13	09/29/99	41	62	86	4.50	N/A	6660	6580	6620	6217	6552	80
14	10/01/99	41	78	82	6.00	5.8%	5520	5490	5505	6166	6162	30
15	10/01/99	41	82	85	6.00	5.3%	5750	5680	5715	6136	5947	70
16	10/01/99	41	70	80	5.50	6.0%	5640	5770	5705	6109	5642	130
17	10/06/99	41	80	84	5.25	N/A	5240	5290	5265	6059	5562	50
18	10/06/99	41	73	81	5.00	N/A	5110	5210	5160	6009	5377	100
19	10/06/99	41	66	78	5.50	N/A	5440	5210	5325	5973	5250	230
20	10/13/99	41	76	84	6.00	N/A	5410	5200	5305	5940	5263	210
21	10/28/99	43	74	79	4.50	N/A	5450	5550	5500	5919	5377	100
22	10/28/99	43	70	76	5.00	N/A	5430	5350	5390	5895	5398	80
23	11/11/99	41	66	76	5.50	3.3%	5710	5550	5630	5883	5507	160
24	11/16/99	41	67	75	5.50	4.8%	5490	5490	5490	5867	5503	0
25	01/05/00	13	48	60	5.00	4.0%	5000	5110	5055	5834	5392	110
26	01/05/00	13	52	63	5.25	3.9%	5880	6000	5940	5838	5495	120
27	01/05/00	13	43	59	6.00	3.9%	5510	6160	5835	5838	5610	650
28	02/08/00	18	43	58	4.75	N/A	5020	5110	5065	5811	5613	90
29	02/23/00	13	72	74	5.75	N/A	5770	5390	5580	5803	5493	380
30	08/21/00	31	80	95	5.00	4.0%	6170	6220	6195	5816	5613	50
*** Averages ***			73	81	5.22	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9053 **Strength: 5000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

F'cr = F'c + 1.34(SD)

= 5000 + 1.34(485)
= 5650

F'cr = F'c + 2.33(SD) - 500

= 5000 + 2.33(485) - 500
= 5630

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	6675	psi
Minimum Value...........................	5055	psi
Range...................................	1620	psi
Average Strength........................	5816	psi
Standard Deviation......................	485	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	5650	psi
Design excess beyond code requirements...	166	psi

Mix #: 9567
Description: 658# ADMIX/AEA 1"CS
Strength: 5000 psi @ 28 Days

3000 PSI @ 3 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.406 lbs/lb
Cement/Cementitious Content:	7.36 sacks (per cubic yard)
Maximum Placement Slump:	5.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

526 lbs.	ASTM C 150 TYPE I CEMENT
132 lbs.	ASTM C 618 FLY ASH
1840 lbs.	1" - #4 CRUSHED STONE
1148 lbs.	CONCRETE SAND
267 lbs.	or 32.0 Gallons of Water
2.0 to	6.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%
Placement Slump: 4.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9567 Strength: 3000 psi @ 3 Days

3 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	3 Day PSI 1	3 Day PSI 2	3 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	08/11/98	38	85	98	5.00	2.5%	3910		3910	3910		
2	08/11/98	38	83	96	4.50	2.5%	4230		4230	4070		
3	08/11/98	38	80	95	5.00	2.5%	3960		3960	4033	4033	
4	08/11/98	38	80	98	5.50	3.5%	4330		4330	4108	4173	
5	01/06/99	38	47	61	5.50	N/A	2840		2840	3854	3710	
6	01/06/99	38	46	64	5.25	N/A	3320		3320	3765	3497	
7	01/06/99	38	47	63	5.25	N/A	2680		2680	3610	2947	
8	01/06/99	38	44	60	5.00	N/A	3020		3020	3536	3007	
9	01/06/99	38	45	61	5.25	N/A	3710		3710	3556	3137	
10	02/11/99	38	65	55	5.00	N/A	4230	4170	4200	3620	3643	60
11	02/11/99	38	68	55	7.00	N/A	4230	4170	4200	3673	4037	60
*** Averages ***			63	73	5.30	2.8%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9567 **Strength: 3000 psi @ 3 Days**

Paragraph 5.5 of ACI 318-89 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

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(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

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**************************************************
*                                                *
*   Unable to calculate standard deviation due   *
*                                                *
*   to the fact that less than 15 tests exist    *
*                                                *
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SUMMARY OF STATISTICAL ANALYSIS
3 Day Test Data

Number of Tests..........................	11
Maximum Value............................	4330 psi
Minimum Value............................	2680 psi
Range....................................	1650 psi
Average Strength.........................	3673 psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-89 Section 5.3.2.1...............	
Design excess beyond code requirements...	

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01

** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 9567 Strength: 5000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	28 Day PSI 2	28 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	11/25/98	35	65	69	5.00	7.1%	6330	6470	6400	6400		140
2	11/25/98	35	65	70	5.00	6.0%	5590	5730	5660	6030		140
3	11/25/98	35	65	69	5.00	5.8%	5610	5750	5680	5913	5913	140
4	11/25/98	35	65	68	5.00	7.1%	5360	5460	5410	5788	5583	100
5	11/25/98	35	60	68	5.00	6.8%	5490	5650	5570	5744	5553	160
6	12/31/98	38	45	68	5.25	N/A	5220	4880	5050	5628	5343	340
7	12/31/98	38	46	68	5.50	N/A	5480	5900	5690	5637	5437	420
8	12/31/98	38	47	66	5.25	N/A	5550	5360	5455	5614	5398	190
9	02/04/99	38	52	63	5.00	N/A	5510	5590	5550	5607	5565	80
10	02/04/99	38	53	64	5.25	N/A	6590	6380	6485	5695	5830	210
11	02/11/99	38	65	55	5.00	N/A	5870	6020	5945	5718	5993	150
12	02/11/99	38	68	55	7.00	N/A	5430	5620	5525	5702	5985	190
13	02/16/99	38	68	64	7.50	5.5%	6430	6540	6485	5762	5985	110
14	02/16/99	38	60	66	8.50	5.8%	5130	5470	5300	5729	5770	340
15	05/19/99	35	78	70	6.00	4.2%	5800	5730	5765	5731	5850	70
16	06/03/99	35	90	64	6.00	N/A	5210	5150	5180	5697	5415	60
17	06/04/99	35	84	73	5.00	4.6%	6090	6370	6230	5728	5725	280
18	07/06/99	35	92	90	5.50	4.0%	5750	5660	5705	5727	5705	90
19	07/08/99	35	76	87	6.00	2.2%	4940	4870	4905	5684	5613	70
20	10/28/99	38	80	82	5.50	4.1%	5960	6130	6045	5702	5552	170
21	11/05/99	38	81	89	4.50	N/A	6970	7010	6990	5763	5980	40
22	12/01/99	38	68	70	5.00	N/A	6000	6110	6055	5776	6363	110
23	12/03/99	38	72	77	4.00	4.4%	5610	5320	5465	5763	6170	290
24	12/07/99	31	58	65	4.00	N/A	6680	6770	6725	5803	6082	90
25	12/09/99	38	60	65	5.00	N/A	6080	5940	6010	5811	6067	140
26	12/14/99	31	54	62	3.75	3.8%	5940	6000	5970	5817	6235	60
27	12/17/99	47	60	65	5.00	N/A	6420	6330	6375	5838	6118	90
28	12/21/99	31	42	55	4.00	N/A	6600	6720	6660	5867	6335	120
29	08/22/00	44	100	94	4.00	4.1%	5660	5650	5655	5860	6230	10
30	08/24/00	44	99	82	5.00	N/A	6050	6120	6085	5868	6133	70
*** Averages ***			67	70	5.25	5.0%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 9567 **Strength: 5000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$
$$= 5000 + 1.34(513)$$
$$= 5688$$

$$F'cr = F'c + 2.33(SD) - 500$$
$$= 5000 + 2.33(513) - 500$$
$$= 5696$$

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	6990	psi
Minimum Value...........................	4905	psi
Range...................................	2085	psi
Average Strength........................	5868	psi
Standard Deviation......................	513	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	5696	psi
Design excess beyond code requirements...	172	psi

Mix #: 8274
Description: 6.00SK ADMIX/AEA 1"CS
Strength: 4000 psi @ 28 Days

3000 PSI @ 7 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.457 lbs/lb
Cement/Cementitious Content:	6.00 sacks (per cubic yard)
Maximum Placement Slump:	5.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

564 lbs.	ASTM C 150 TYPE I CEMENT
1840 lbs.	1" - #4 CRUSHED STONE
1273 lbs.	CONCRETE SAND
258 lbs.	or 31.0 Gallons of Water
2.0 to	4.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%
Placement Slump: 4.00 + or - 1.00 inches

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistice Compiled From Independent Laboratory Test Specimens **

Mix Number: 8274 Strength: 3000 psi @ 7 Days

7 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	7 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	09/28/00	38	87	96	4.00	N/A	3480	3660	3570	3570		180
2	09/29/00			80	3.75	3.5%	3950		3950	3760		
3	10/04/00	38	82	90	6.00	N/A	3040	3020	3030	3517	3517	20
4	10/05/00	38	90	92	5.75	N/A	4060	3830	3945	3624	3642	230
5	10/06/00	46	68	79	5.50	N/A	4220	4000	4110	3721	3695	220
6	10/10/00	38	68	74	4.00	N/A	4800	4820	4810	3903	4288	20
7	10/13/00	46	80	82	4.00	N/A	3810	3590	3700	3874	4207	220
8	10/13/00	38	83	87	3.50	N/A	3970	4120	4045	3895	4185	150
9	10/16/00	38	73	83	4.00	N/A	3900	3920	3910	3897	3885	20
10	10/17/00	38	74	81	4.50	N/A	3940	4000	3970	3904	3975	60
11	10/18/00	38	83	86	5.25	N/A	3670		3670	3883	3850	
12	10/19/00	50	82	78	3.00	N/A	3840	3960	3900	3884	3847	120
13	10/19/00	38	79	82	4.75	N/A	4200	4100	4150	3905	3907	100
14	10/20/00			77	4.50	N/A	4400		4400	3940	4150	
15	10/20/00	38	74	76	4.75	N/A	4170	4170	4170	3955	4240	0
16	10/25/00	38	80	79	4.00	N/A	4040		4040	3961	4203	
17	10/27/00			74	3.75	5.8%	4310	4400	4355	3984	4188	90
18	11/20/00			55	4.00	25.0%	4120	4000	4060	3988	4152	120
19	11/21/00		52	65	4.75	5.8%	3960		3960	3987	4125	
20	11/22/00		56	60	5.00	5.5%	3990		3990	3987	4003	
21	11/22/00	50	50	62	2.50	N/A	4350		4350	4004	4100	
22	11/29/00			65	3.75	5.0%	4920	5110	5015	4050	4452	190
23	12/01/00	25	54	63		N/A	3180		3180	4012	4182	
24	12/07/00			59	5.00	4.7%	3340		3340	3984	3845	
25	12/14/00	40	41	57	5.25	N/A	4780		4780	4016	3767	
26	12/15/00			53	5.00	4.5%	4010		4010	4016	4043	
27	12/15/00			53	5.00	4.6%	3540		3540	3998	4110	
28	12/20/00	40	65	67	4.75	N/A	4130		4130	4003	3893	
29	12/22/00	40	49	51	5.25	N/A	3900		3900	3999	3857	
30	03/05/01	38	69	77	4.50	4.0%	4870	4730	4800	4026	4277	140
*** Averages ***			70	73	4.47	6.8%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8274 **Strength: 3000 psi @ 7 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$

$$= 3000 + 1.34(\ 458\ )$$
$$= 3614$$

$$F'cr = F'c + 2.33(SD) - 500$$

$$= 3000 + 2.33(\ 458\ ) - 500$$
$$= 3568$$

SUMMARY OF STATISTICAL ANALYSIS
7 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	5015	psi
Minimum Value...........................	3030	psi
Range...................................	1985	psi
Average Strength........................	4026	psi
Standard Deviation......................	458	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1...............	3614	psi
Design excess beyond code requirements...	412	psi

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CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8274 Strength: 4000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	28 Day PSI 2	28 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	09/28/00	38	87	96	4.00	N/A	4340	4500	4420	4420		160
2	09/29/00			80	3.75	3.5%	4770	4710	4740	4580		60
3	10/04/00	38	82	90	6.00	N/A	4070	4130	4100	4420	4420	60
4	10/05/00	38	90	92	5.75	N/A	4730	4640	4685	4486	4508	90
5	10/06/00	46	68	79	5.50	N/A	5340	5580	5460	4681	4748	240
6	10/10/00	38	68	74	4.00	N/A	5270	5350	5310	4786	5152	80
7	10/13/00	46	80	82	4.00	N/A	4560	4580	4570	4755	5113	20
8	10/13/00	38	83	87	3.50	N/A	5290	5390	5340	4828	5073	100
9	10/16/00	38	73	83	4.00	N/A	4370	4480	4425	4783	4778	110
10	10/17/00	38	74	81	4.50	N/A	5080	5090	5085	4814	4950	10
11	10/18/00	38	83	86	5.25	N/A	4640	4570	4605	4795	4705	70
12	10/19/00	50	82	78	3.00	N/A	4280	4440	4360	4758	4683	160
13	10/19/00	38	79	82	4.75	N/A	5250	4760	5005	4777	4657	490
14	10/20/00			77	4.50	N/A	5250	5360	5305	4815	4890	110
15	10/20/00	38	74	76	4.75	N/A	5280	5650	5465	4858	5258	370
16	10/25/00	38	80	79	4.00	N/A	4990	4960	4975	4866	5248	30
17	10/27/00			74	3.75	5.8%	5310	5210	5260	4889	5233	100
18	11/20/00			55	4.00	25.0%	4750	4820	4785	4883	5007	70
19	11/21/00		52	65	4.75	5.8%	4940	4970	4955	4887	5000	30
20	11/22/00		56	60	5.00	5.5%	5060	4970	5015	4893	4918	90
21	11/22/00	50	50	62	2.50	N/A	5000	5190	5095	4903	5022	190
22	11/29/00			65	3.75	5.0%	6310	6350	6330	4968	5480	40
23	12/01/00	25	54	63		N/A	4560	4400	4480	4947	5302	160
24	12/07/00			59	5.00	4.7%	4390	4490	4440	4925	5083	100
25	12/14/00	40	41	57	5.25	N/A	5110	5200	5155	4935	4692	90
26	12/15/00			53	5.00	4.5%	5570	5270	5420	4953	5005	300
27	12/15/00			53	5.00	4.6%	5000	5100	5050	4957	5208	100
28	12/20/00	40	65	67	4.75	N/A	5180	5070	5125	4963	5198	110
29	12/22/00	40	49	51	5.25	N/A	5130	5200	5165	4970	5113	70
30	03/05/01	38	69	77	4.50	4.0%	5730	5790	5760	4996	5350	60
*** Averages ***			70	73	4.47	6.8%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8274 **Strength: 4000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

F'cr = F'c + 1.34(SD)

= 4000 + 1.34(471)
= 4631

F'cr = F'c + 2.33(SD) - 500

= 4000 + 2.33(471) - 500
= 4598

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	6330	psi
Minimum Value...........................	4100	psi
Range...................................	2230	psi
Average Strength........................	4996	psi
Standard Deviation......................	471	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1...............	4631	psi
Design excess beyond code requirements...	365	psi

Mix #:	8206
Description:	564# ADMIX/AEA 1"CS
Strength:	4000 psi @ 28 Days

3000 PSI @ 7 DAYS

Maximum Size Coarse Aggregate:	1" - #4 CRUSHED STONE
Maximum Water/Cement Ratio:	0.457 lbs/lb
Cement/Cementitious Content:	6.31 sacks (per cubic yard)
Maximum Placement Slump:	5.00 inches
Air Entraining Agent:	ASTM C-260
Admixture:	ASTM C-494 Type A or D

MATERIAL QUANTITIES PER 1.0 CUBIC YARD AT S.S.D

451 lbs.	ASTM C 150 TYPE I CEMENT
113 lbs.	ASTM C 618 FLY ASH
1840 lbs.	1" - #4 CRUSHED STONE
1254 lbs.	CONCRETE SAND
258 lbs.	or 31.0 Gallons of Water
2.0 to	6.0 oz/cwt of ASTM C-494 Type A

Specified Air Content: 3.0% - 6.0%
Placement Slump: 4.00 + or - 1.00 inches

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CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8206 Strength: 3000 psi @ 7 Days

7 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Temperature (Fahrenheit) Concrete	Placement Slump(in)	Percent of Air	7 Day PSI 1	7 Day PSI 2	7 Day PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	10/03/00		84	83	4.00	4.3%	3560	3780	3670	3670		220
2	10/03/00		84	85	4.75	4.3%	3730	3650	3690	3680		80
3	10/03/00		84	84	5.00	4.3%	3740	3820	3780	3713	3713	80
4	10/03/00		81	83	4.00	3.5%	3730	3830	3780	3730	3750	100
5	10/04/00		87	90	2.75	4.7%	3850		3850	3754	3803	
6	10/06/00	31	55	73	5.00	4.9%	4110	4220	4165	3823	3932	110
7	10/09/00	38	47	64	4.50	4.6%	3700	3910	3805	3820	3940	210
8	10/12/00		78	84	5.25	4.5%	3850	3590	3720	3808	3897	260
9	10/12/00		78	83	4.25	4.0%	4880	4720	4800	3918	4108	160
10	10/12/00		79	83	4.75	4.0%	4670	4700	4685	3995	4402	30
11	10/12/00		79	84	4.50	4.0%	4130	4080	4105	4005	4530	50
12	10/12/00		78	83	6.50	3.5%	4060	4120	4090	4012	4293	60
13	10/12/00	31	82	80	5.50	5.1%	3720	3780	3750	3992	3982	60
14	10/19/00	31	75	89	5.25	N/A	3580	3650	3615	3965	3818	70
15	10/20/00	31	68	72	4.00	4.4%	4370	4540	4455	3997	3940	170
16	11/02/00	38	80	84	6.00	N/A	4440	4160	4300	4016	4123	280
17	11/16/00	31	52	65	5.25	N/A	4090	3970	4030	4017	4262	120
18	11/16/00	31	52	67	4.75	N/A	4720	4660	4690	4054	4340	60
19	11/28/00	31	69	71	5.50	N/A	3570	3440	3505	4026	4075	130
20	12/04/00	31	53	63	5.00	N/A	3700	3810	3755	4012	3983	110
21	12/05/00	31	50	63	5.00	N/A	4460	4420	4440	4032	3900	40
22	12/05/00	31	53	62	4.50	5.3%	4020	4000	4010	4031	4068	20
23	12/06/00	31	47	61	5.00	N/A	4350	4720	4535	4053	4328	370
24	12/07/00		30	60	5.50	N/A	3590		3590	4034	4045	
25	12/07/00	40	32	73	5.50	4.5%	4620		4620	4057	4248	
26	12/07/00	40	33	68	5.50	4.5%	4280		4280	4066	4163	
27	12/07/00	40	29	68	5.75	4.6%	3960		3960	4062	4287	
28	12/07/00	31	49	65	4.00	N/A	4060	3990	4025	4061	4088	70
29	12/08/00	38	55	60	5.50	N/A	4020	4070	4045	4060	4010	50
30	12/19/00	12	60	58	5.00	4.5%	4640		4640	4080	4237	
*** Averages ***			63	74	4.93	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8206 **Strength: 3000 psi @ 7 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$

$$= 3000 + 1.34(382)$$
$$= 3511$$

$$F'cr = F'c + 2.33(SD) - 500$$

$$= 3000 + 2.33(382) - 500$$
$$= 3389$$

SUMMARY OF STATISTICAL ANALYSIS
7 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	4800	psi
Minimum Value...........................	3505	psi
Range...................................	1295	psi
Average Strength........................	4080	psi
Standard Deviation......................	382	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	3511	psi
Design excess beyond code requirements...	569	psi

TEXAS INDUSTRIES

CONCRETE DESIGN EVALUATION

Date: 04/04/01 ** Statistics Compiled From Independent Laboratory Test Specimens **

Mix Number: 8206 Strength: 4000 psi @ 28 Days

28 Day Test Data

Test Number	Date	Plant Number	Temperature (Fahrenheit) Ambient	Concrete	Placement Slump(in)	Percent of Air	28 Day PSI 1	PSI 2	PSI AVG	Cumulative Average	Moving Avg of 3	Range
1	10/03/00		84	85	4.75	4.3%	5300	5200	5250	5250		100
2	10/03/00		82	83	5.00	4.0%	4620	4720	4670	4960		100
3	10/03/00		81	83	5.00	4.0%	4660	4770	4715	4878	4878	110
4	10/03/00		81	83	4.00	3.5%	5240	5320	5280	4979	4888	80
5	10/04/00		87	90	2.75	4.7%	5130	5060	5095	5002	5030	70
6	10/06/00	31	55	73	5.00	4.9%	4910	5080	4995	5001	5123	170
7	10/09/00	38	47	64	4.50	4.6%	5140	5430	5285	5041	5125	290
8	10/12/00		79	84	4.50	4.0%	5460	5250	5355	5081	5212	210
9	10/12/00		79	83	4.75	4.0%	5730	5720	5725	5152	5455	10
10	10/12/00		78	84	5.25	4.5%	5010	5090	5050	5142	5377	80
11	10/12/00		78	83	4.25	4.0%	5880	5710	5795	5201	5523	170
12	10/12/00		78	83	6.50	3.5%	5440	5330	5385	5217	5410	110
13	10/12/00	31	82	80	5.50	5.1%	5080	5170	5125	5210	5435	90
14	10/19/00	31	75	89	5.25	N/A	4440	4620	4530	5161	5013	180
15	10/20/00	31	68	72	4.00	4.4%	5020	5350	5185	5163	4947	330
16	11/02/00	38	80	84	6.00	N/A	5200	5250	5225	5167	4980	50
17	11/16/00	31	52	65	5.25	N/A	5740	5680	5710	5199	5373	60
18	11/16/00	31	52	67	4.75	N/A	6030	5950	5990	5243	5642	80
19	11/28/00	31	69	71	5.50	N/A	5120	4840	4980	5229	5560	280
20	12/04/00	31	53	63	5.00	N/A	5610	5280	5445	5240	5472	330
21	12/05/00	31	50	63	5.00	N/A	5730	5870	5800	5266	5408	140
22	12/05/00	31	53	62	4.50	5.3%	5260	5420	5340	5270	5528	160
23	12/06/00	31	47	61	5.00	N/A	6650	6650	6650	5330	5930	0
24	12/07/00		30	60	5.50	N/A	4550	4810	4680	5303	5557	260
25	12/07/00	40	33	68	5.50	4.5%	5900	5990	5945	5328	5758	90
26	12/07/00	40	32	73	5.50	4.5%	5910	5850	5880	5349	5502	60
27	12/07/00	40	29	68	5.75	4.6%	5480	5560	5520	5356	5782	80
28	12/07/00	31	49	65	4.00	N/A	5420	5250	5335	5355	5578	170
29	12/08/00	38	55	60	5.50	N/A	5620	5870	5745	5368	5533	250
30	12/19/00	12	60	58	5.00	4.5%	6240	6020	6130	5394	5737	220
*** Averages ***			63	74	4.96	4.4%						

COMMENTARY OF STATISTICAL EVALUATION OF CONCRETE DESIGN RESULTS

Mix Num: 8206 **Strength: 4000 psi @ 28 Days**

Paragraph 5.5 of ACI 318-99 provides that as data becomes available during construction, the amount by which (F'cr) must exceed the specified value of (F'c) may be reduced, provided:

(a) 30 or more test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.1, or

(b) 15 to 29 test results are available and average of test results exceeds that required by Section 5.3.2.1, using a standard deviation calculated in accordance with Section 5.3.1.2.

The required average compressive strength has been calculated using a standard deviation calculated in accordance with ACI 318-89 Section 5.3.1.1 or Section 5.3.1.2 and is the larger value of these calculations:

$$F'cr = F'c + 1.34(SD)$$
$$= 4000 + 1.34(480)$$
$$= 4643$$

$$F'cr = F'c + 2.33(SD) - 500$$
$$= 4000 + 2.33(480) - 500$$
$$= 4617$$

SUMMARY OF STATISTICAL ANALYSIS
28 Day Test Data

Number of Tests.........................	30	
Maximum Value...........................	6650	psi
Minimum Value...........................	4530	psi
Range...................................	2120	psi
Average Strength........................	5394	psi
Standard Deviation......................	480	psi
Required Average Strength to satisfy minimum probability conditions of ACI 318-99 Section 5.3.2.1..............	4643	psi
Design excess beyond code requirements...	751	psi

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
972/620-8911 - 972/263-4937 (Metro)
FAX: 972/406-8023

DRAFT

April 2, 2001

GBW ENGINEERS, INC.
1919 Shiloh S. Road, Suite 530, LB 27
Garland, Texas 75042
Attention: Mr. Bruce R. Grantham, P.E.

****DRAFT COPY***

Re: Remedial Geotechnical Exploration
MIDWAY ROAD RECONSTRUCTION
Beltline Road to Keller Springs Road
Addison, Texas
ALPHA Report No. 00988

Attached is the report of the remedial geotechnical exploration performed for the project referenced above. This study has been authorized by Mr. Bruce Grantham, P.E. on December 28, 2000 and performed in accordance with ALPHA Proposal No. GT 7371 dated June 27, 2000.

This report contains results of field explorations and laboratory testing and an engineering interpretation of these with respect to available project characteristics. The results and analyses have been used to develop recommendations for remedial design and reconstruction of a segment of Midway Road in Addison, Texas.

ALPHA TESTING, INC. appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing services during construction, please contact our office.

Sincerely yours,

ALPHA TESTING, INC.

David A. Lewis, P.E.
Manager of Engineering Services

Jim L. Hillhouse, P.E.
President

DAL JLH dal
Copies: (3) Client

TABLE OF CONTENTS

on

MIDWAY ROAD RECONSTRUCTION
Beltline Road to Keller Springs Road
Addison, Texas
ALPHA Report No. 00988

1.0 PURPOSE AND SCOPE

The purpose of this remedial geotechnical exploration is to evaluate some of the physical and engineering properties of subsurface materials at the subject study area with respect to design and reconstruction of a segment of Midway Road in Addison, Texas. The field exploration has been accomplished by securing subsurface samples (including concrete pavement) from widely spaced test borings performed along the study area. Engineering analyses have been performed from results of the field exploration and results of laboratory tests performed on representative samples. The analyses have been used to develop recommended pavement section options for the subject reconstructed roadway.

Also included is an evaluation of the site with respect to potential construction problems and recommendations concerning earthwork and quality control testing during construction. This information can be used to verify subsurface conditions and to aid in ascertaining all construction phases meet project specifications.

Recommendations provided in this report have been developed from information obtained in test borings depicting subsurface conditions only at the specific boring locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those observed at the boring locations. The scope of work is not intended to fully define the variability of subsurface materials that may be present on the study area.

The nature and extent of variations between borings may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and tests.

Professional services provided in this geotechnical exploration have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater.

ALPHA TESTING, INC. is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for exclusive use of the Client (and their design representatives) and design of the specific pavement outlined in Section 2.0. Recommendations presented in this report should not be used for design of any other pavements except those specifically described in this report. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than two (2) years after completion of this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may materially alter the recommendations. Further, ALPHA TESTING, INC. is not responsible for damages resulting from workmanship of designers or contractors and it is recommended that the owner retain qualified personnel to verify work is performed in accordance with plans and specifications.

2.0 PROJECT CHARACTERISTICS

It is proposed to reconstruct a segment of Midway Road located between Beltline Road and Keller Springs Road in Addison, Texas. A site plan illustrating the general outline of the study area is provided as Figure 1, the Location Plan, in the Appendix of this report. At the time the field exploration was performed, the study area was developed with the existing concrete roadway.

Present plans provide for reconstruction of the existing pavement. The existing pavement has experienced some distress. The distress is generally in the form of depressed areas adjacent to the existing pavement joints and generally occur in the direction of traffic flow from the pavement joints. Joints in the pavement were noted to be unusually large (up to about ½" wide) and in some areas it appears surface water is entering the pavement subgrade through these wide joints. At the north end of the study area (north of Borings 21 and 22; north-bound lane) in particular, water was actually noted emerging from the joints immediately after passage of large trucks. In general, transverse cracking was noted across the pavement panel near their midpoint in areas where significant pavement distress was noted.

3.0 FIELD EXPLORATION

Subsurface conditions along the study area have been explored by drilling 22 test borings in general accordance with ASTM D 420 to a depth of 10 ft using standard rotary drilling equipment. The approximate location of each test boring is shown on the Boring Location Plans, Figures 2-7, enclosed in the Appendix of this report. Some borings were drilled in distressed areas while others were drilled in non-distressed areas for comparison. Details of drilling and sampling operations are briefly summarized in Methods of Field Exploration, Section A-1 of the Appendix.

Soil and rock (shaly limestone) types encountered during the field exploration are presented on Record of Subsurface Exploration sheets included in the Appendix of this report. The boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, these boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are approximate and the actual transition between strata may be gradual.

Fill materials have been encountered at some boring locations as will be discussed in Section 5.0. There may be fill in other borings than noted or at other locations, but could not be readily identified. Composition of the fill has been evaluated based on samples retrieved from 6-inch maximum diameter boreholes. It is anticipated this fill was placed and compacted during construction of the existing concrete roadway. However, since no records were made available of fill placement, compaction or uniformity, subsurface conditions immediately adjacent to test borings could be substantially different than conditions observed in test borings.

4.0 LABORATORY TESTS

Selected samples of the subsurface materials have been tested in the laboratory to evaluate their engineering properties as a basis in providing recommendations for pavement design and earthwork construction. A brief description of testing procedures used in the laboratory can be found in Methods of Laboratory Testing, Section B-1 of the Appendix. Individual test results are presented either on Record of Subsurface Exploration sheets or on summary data sheets also enclosed in the Appendix.

5.0 GENERAL SUBSURFACE CONDITIONS

In general, the existing concrete pavement is underlain by soils derived from the Austin Chalk formation. Within the 10-ft maximum depth explored during this study, subsurface materials consist generally of clay (CH) underlain by calcareous clay (CL) and deeper shaly limestone. In the southern and central portions of the study area (Borings 1-16), the existing pavement sectiongenerally consists of about 8 inches of Portland cement concrete overlying lime treated subgrade soils. (It should be noted that lime treated subgrade soils were *not* encountered in all of these boring locations.) In the northern portion of the study area (Borings 17-22), the existing pavement section generally consists of 6.5 to 7 inches of Portland cement concrete overlying a clayey (CH/CL) subgrade. The letters in parenthesis represent the soils' classification according to the Unified Soil Classification System (ASTM D 2488). More detailed stratigraphic information is presented on the Record of Subsurface Exploration Sheets attached to this report.

Most of the subsurface materials are relatively impermeable and are anticipated to have a slow response to water movement. Therefore, several days of observation will be required to evaluate actual groundwater levels within the depths explored. Also, the groundwater level at the study area is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions and subsurface drainage characteristics.

During field explorations, free groundwater has been noted in Borings 1-4 on drilling tools and in open boreholes upon completion at depths of 4.5 to 8 ft. Free groundwater was not observed in the other borings during drilling or in the other open boreholes upon completion. In our opinion, the current groundwater level on the study area may be located below the bottom of the borings and water within the depths explored may be "perched" groundwater which has percolated downward through desiccation cracks in the clayey type soils. It is not uncommon to detect seasonal groundwater either from natural fractures within the clay matrix, near the soil/rock interface or from fractures in the rock, particularly after a wet season. If more detailed groundwater information is required, monitoring wells or piezometers can be installed.

Further details concerning subsurface materials and conditions encountered can be obtained from the Record of Subsurface Exploration sheets provided in the Appendix of this report.

6.0 DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described Project Characteristics (Section 2.0) and Subsurface Conditions (Section 5.0). If project criteria should change, our office should conduct a review to determine if modifications to the recommendations are required. Further, it is recommended our office be provided with a copy of the final plans and specifications for review prior to construction.

6.1 Pavement

Clay or calcareous clay encountered near the existing ground surface will probably constitute the subgrade for the new pavement. Therefore, it is recommended these materials be improved prior to construction of pavement. Due to the wide spacing of the borings, division of the study area into areas with similar subgrade conditions was not possible. Delineation of areas with similar subgrade conditions, if required, should be performed during construction after the subgrade material has been exposed. The specific type of improvement procedures required in given pavement areas will be dependent upon the type of subgrade material present after final subgrade elevation has been achieved.

Calculations used to determine the required pavement thickness are based only on the physical and engineering properties of the materials and conventional thickness determination procedures. Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, reinforcing steel, joint design and environmental factors will significantly affect the service life and must be included in preparation of the construction drawings and specifications, but were not included in the scope of this study. Normal periodic maintenance will be required for all pavement to achieve the design life of the pavement system.

Please note, the recommended pavement section options provided below are considered the minimum necessary to provide satisfactory performance based on the expected traffic loading. In some cases, City minimum standards for pavement section construction may exceed those provided below.

The following design information has been provided by the Client:

- New pavement will consist of Portland-cement concrete and the design life is 30 years.
- Daily traffic based on 1999 information for the study area is about 51,000 vehicles per day.

- The projected daily traffic volume by Year 2020 will be up to about 60,000 vehicles per day.
- It is anticipated the new pavement will be subject to significant truck traffic.
- Truck traffic will be about 20 percent of the daily traffic volume. Therefore, the design traffic used for the new pavement is 15,118,000 18-kip equivalent axle load applications for a 30-year design life.

6.1.1 Pavement Subgrade Preparation

Due to the relatively heavy truck traffic expected, it is recommended a non-erodable base material be provided immediately below the Portland-cement concrete pavement. The non-erodable base material could consist of either a crushed limestone base material or a cement treated permeable base. The non-erodable base should be supported on an improved subgrade consisting of either a re-compacted subgrade or a mechanically lime stabilized subgrade. It should be noted that a geotextile fabric (e.g., Marafi 180N or equivalent) should be provided between the improved subgrade soils and the cement treated permeable base to prevent fines from the improved soils from penetrating into the permeable base material. If a permeable base is used, the subgrade must be carefully graded (i.e., no birdbaths and minimum slope of 1.5 percent) to provide positive flow of percolated water through the permeable base to collection points at the extreme perimeter of the pavement. Collected water at the perimeter of the pavement should be drained to an appropriate receptacle.

If the subgrade soils are mechanically lime stabilized, it is recommended lime stabilization procedures extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement. The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the mixture's optimum moisture content. In all areas where hydrated lime is used to stabilize subgrade soil, routine Atterberg-limit tests should be performed to verify the resulting plasticity index of the soil-lime mixture is at/or below 15.

Mechanical lime stabilization of the pavement subgrade soil will not prevent normal seasonal movement of the underlying untreated materials. Normal maintenance of pavement should be expected over the pavement design life.

6.1.2 Pavement Sections Options

California Bearing Ratio (CBR) tests performed on composite samples from the test borings indicate the CBR value for the existing clay subgrade soils will be about 3 whereas the CBR value for the same material after mechanical lime stabilization would increase to about 20. Using the above values and assuming normal traffic for a 30-year project life, the following pavement sections are recommended if load transfer between joints is through *aggregate interlock*:

Compacted Subgrade

11.5 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	compacted subgrade

OR

10.5 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	compacted subgrade

Lime Stabilized Subgrade

11 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	lime stabilized subgrade

OR

10 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	lime stabilized subgrade

If dowels are provided for load transfer at the joints in the new pavement, the following pavement section options are provided:

Compacted Subgrade

10 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	compacted subgrade

OR

9 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	compacted subgrade

Lime Stabilized Subgrade

9.5 inches	Portland-cement concrete
6 inches	crushed limestone base material
6 inches	lime stabilized -subgrade

OR

9 inches	Portland-cement concrete
6 inches	cement treated permeable base
6 inches	lime stabilized subgrade

6.1.3 Pavement Specifications

Pavement should be specified, constructed and tested to meet the following requirements:

1. Portland-Cement Concrete: Texas SDHPT Item 360. Specify a minimum flexural strength of 650 lbs per sq inch at 28 days. Concrete should be designed with 5 $\pm$ 1 percent entrained air.

2. Crushed Limestone Base Material: Texas SDHPT Item 247, Type A or B, Grade 2 or better. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 698) and within three percentage points of the material's optimum moisture content.

3. Cement Treated Permeable Base Material: Cement treated permeable base should have a minimum hydraulic conductivity of 3,000 feet per day after compaction. Permeable base material shall consist of coarse aggregate with no fine aggregate (sand, etc.) and shall be treated with 6 percent Portland cement by dry weight of the aggregate. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 558) and within three percentage points of the material's optimum moisture content. The material supplier shall submit an acceptable mix design for approval.

4. Lime Stabilized Subgrade: Texas SDHPT Item 260. An estimated 3 and 8 percent of hydrated lime (by dry soil weight) should be applied to existing calcareous clay and clay soils, respectively, which have been scarified to a depth of 6 inches. The actual amount of lime required should be confirmed by additional laboratory tests prior to construction.

a. The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above optimum moisture. The moisture content of the subgrade should be maintained until the pavement surface is placed.

b. In all areas where hydrated lime is utilized to stabilize the subgrade soil, routine Atterberg-limit tests should be performed prior to completion of construction to assure the resulting plasticity index of the soil-lime mixture will be at/or below 15. Gradation, Atterberg-limits and density tests should be performed at a frequency of 1 test per 5000 sq ft of pavement.

5. Re-compacted Subgrade: On-site materials should be scarified to a depth of at least 6 inches and re-compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content. The moisture content of the subgrade should be maintained until the pavement surface is placed. Density tests should be performed at a frequency of 1 test per 5000 sq ft of pavement.

7.0 GENERAL CONSTRUCTION PROCEDURES AND RECOMMENDATIONS

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Geotechnical Engineer be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be anticipated until the course of construction. The recommendations offered in the following paragraphs are intended, not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the borings.

7.1 Site Preparation and Grading

All areas supporting pavement should be properly prepared.

After completion of the necessary stripping, clearing, and excavating and prior to placing any required fill, the exposed subgrade should be carefully inspected by probing and testing. Any undesirable material (organic material, wet, soft, or loose soil) still in place should be removed.

The exposed subgrade should be further inspected by proof-rolling with a heavy pneumatic tired roller, loaded dump truck or similar equipment weighing approximately 10 tons to check for pockets of soft or loose material hidden beneath a thin crust of possibly better soil.

Proof-rolling procedures should be observed by the project geotechnical engineer or his representative.

Any unsuitable materials exposed should be removed and replaced with well-compacted material as outlined in Section 7.2.

Slope stability analysis of embankments (natural or constructed) was not within the scope of this study. Trench excavations should be braced or cut at stable slopes in accordance with Occupational Safety and Health Administration (OSHA) requirements, Title 29, Items 1926.650-1926.653 and other applicable building codes.

7.2 Fill Compaction

Calcareous or sandy materials with a plasticity index below 25 should be compacted to a dry density of at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content.

Clay soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 95 and 100 percent of standard Proctor maximum dry density (ASTM D 698). The compacted moisture content of the clays during placement should be within the range of 0 to 4 percentage points above optimum. Clay fill should be processed and the largest particle or clod should be less than 6 inches prior to compaction.

Limestone or other rock-like materials used as random fill should be compacted to at least 95 percent of standard Proctor maximum dry density. The compacted moisture content of limestone or other rock-like materials used as random fill is not considered crucial to proper performance. However, if the material's moisture content during placement is within 3 percentage points of optimum, the compactive effort required to achieve the minimum compaction criteria may be minimized. Individual rock pieces larger than 6 inches in dimension should not be used as fill. However, if rock fill is utilized within 1 ft below the bottom of the pavement, the maximum allowable size of individual rock pieces should be reduced to 3 inches.

In cases where either mass fills or utility lines are more than 10 ft deep, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D-698) and within 2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as outlined above.

Compaction should be accomplished by placing fill in about 8-inch thick loose lifts and compacting each lift to at least the specified minimum dry density. Field density and moisture content tests should be performed on each lift. As a guide, a test frequency of one test per 5000 sq ft or greater per lift may be used. Utility trench backfill should be tested at a rate of one test per lift per each 300 lineal feet of trench.

7.3 Groundwater

No significant de-watering problems are anticipated during pavement excavations. However, if any minor water seepage is encountered during construction, pumping from excavations with pumps or other conventional de-watering equipment should be sufficient.

In any areas where significant cuts (1.5 ft or more) are made to establish final grades for the pavement, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. Subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other de-watering devices on the pavement subgrade should be carefully addressed during construction. Our office could be contacted to visually observe the subgrade to evaluate the need for such drains.

APPENDIX

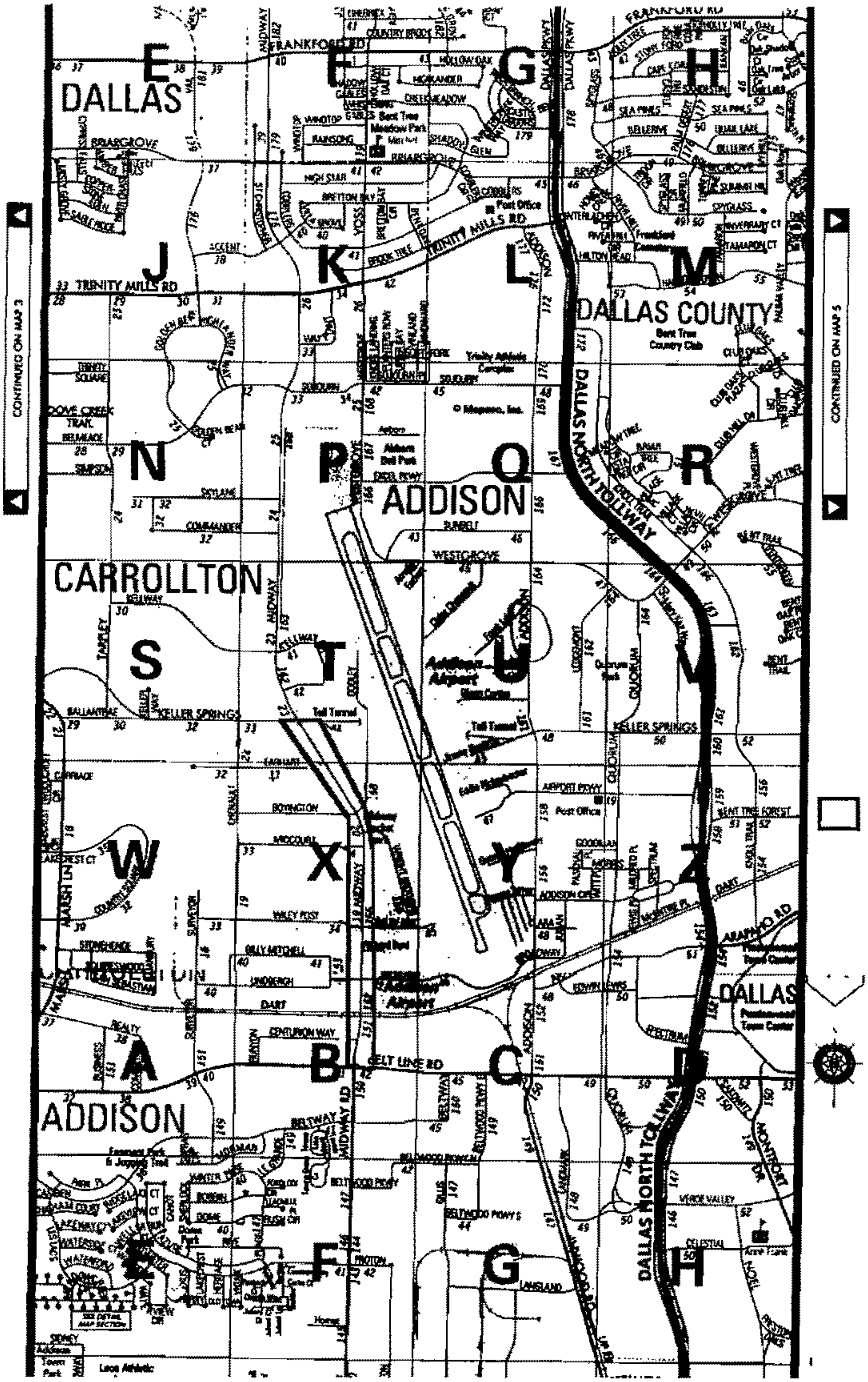
A-1 METHODS OF FIELD EXPLORATION

Using standard rotary drilling equipment, a total of 22 test borings have been performed for this geotechnical exploration at the approximate locations shown on the Boring Location Plans, Figures 2-7. The test boring locations have been staked by either pacing or taping and estimating right angles from landmarks which could be identified in the field and as shown on the site plans provided during this study. The location of test borings shown on the Boring Location Plan is considered accurate only to the degree implied by the method used to locate the borings. The surface elevations provided on the Record of Subsurface Exploration sheets have been obtained by plotting the boring locations on the site plans and interpolating the surface elevation. Surface elevations given on the boring logs are approximate.

Relatively undisturbed samples of the cohesive subsurface materials have been obtained by hydraulically pressing 3-inch O.D. thin-wall sampling tubes into the underlying soils at selected depths (ASTM D 1587). These samples have been removed from the sampling tubes in the field and examined visually. One representative portion of each sample has been sealed in a plastic bag for use in future visual examinations and possible testing in the laboratory.

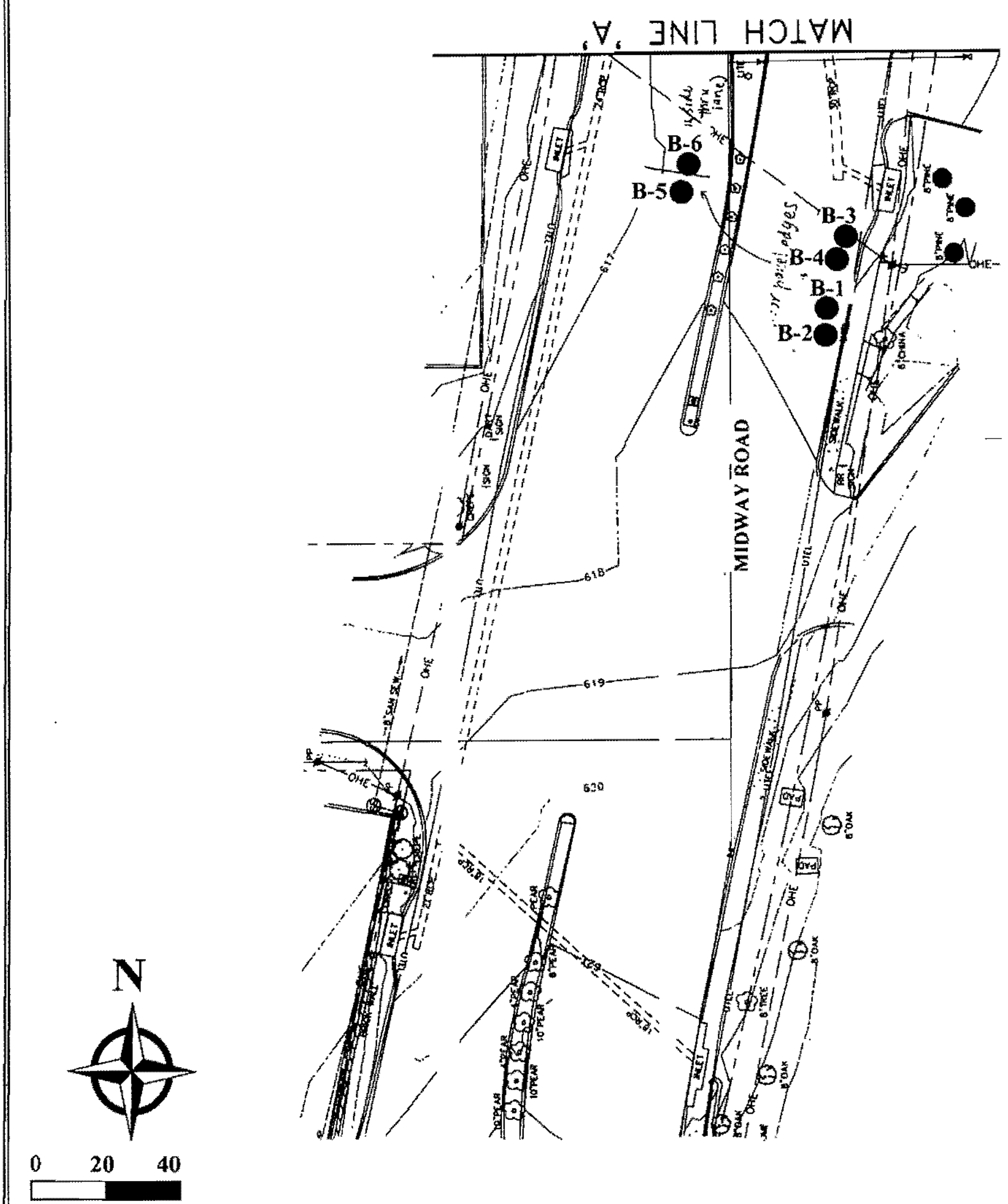
Modified Texas Cone Penetration (TCP) tests have also been completed in the field to determine the apparent in-place strength characteristics of the rock type materials. A 3-inch diameter steel cone driven by a 170-pound hammer dropped 24 inches is the basis for Texas State Department of Highways and Public Transportation strength correlations. In this case, ALPHA TESTING, INC. has modified the procedure allowing the use of a 140-pound hammer dropping 30-inches for completion of the field test. Depending on the resistance (strength) of the materials, either the number of blows of the hammer required to provide 12 inches of penetration, or the inches of penetration of the cone due to 100 blows of the hammer are recorded on the field logs and are shown on the Record of Subsurface Exploration sheets as TCP (reference: Texas State Department of Highways and Public Transportation, Bridge Design Manual), using the modified procedure.

Logs of all borings have been included in the Appendix of this report. The logs show visual descriptions of all soil and rock (shaly limestone) strata encountered using the Unified Soil Classification System. Sampling information, pertinent field data, and field observations are also included. Soil and rock samples not consumed by testing will be retained in our laboratory for at least 30 days and then discarded unless the Client requests otherwise.



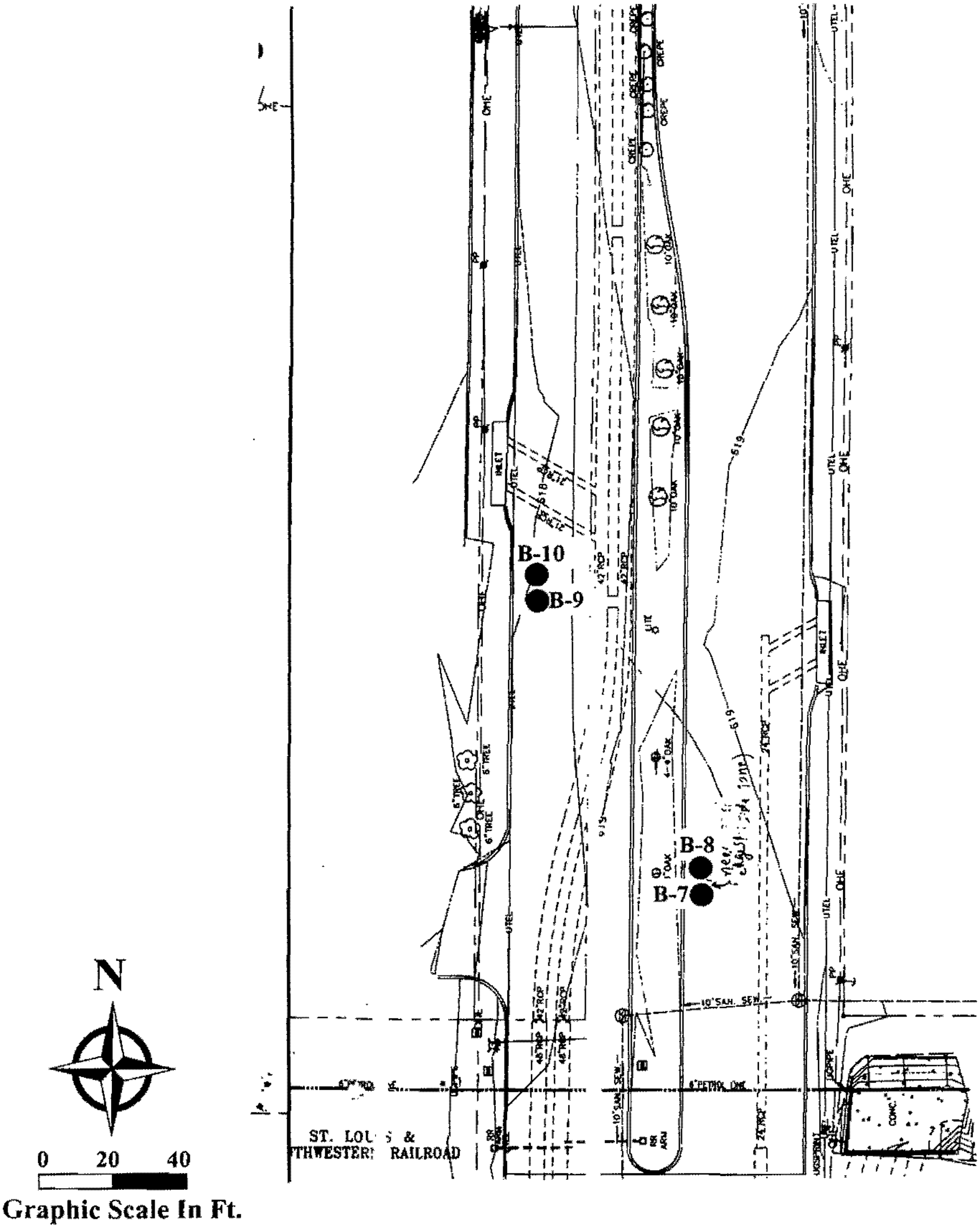
Study Area

GBW Engineers, Inc. Garland, Texas		General Location Figure 1
Midway Road Reconstruction Addison, Texas		00988 4/02/01

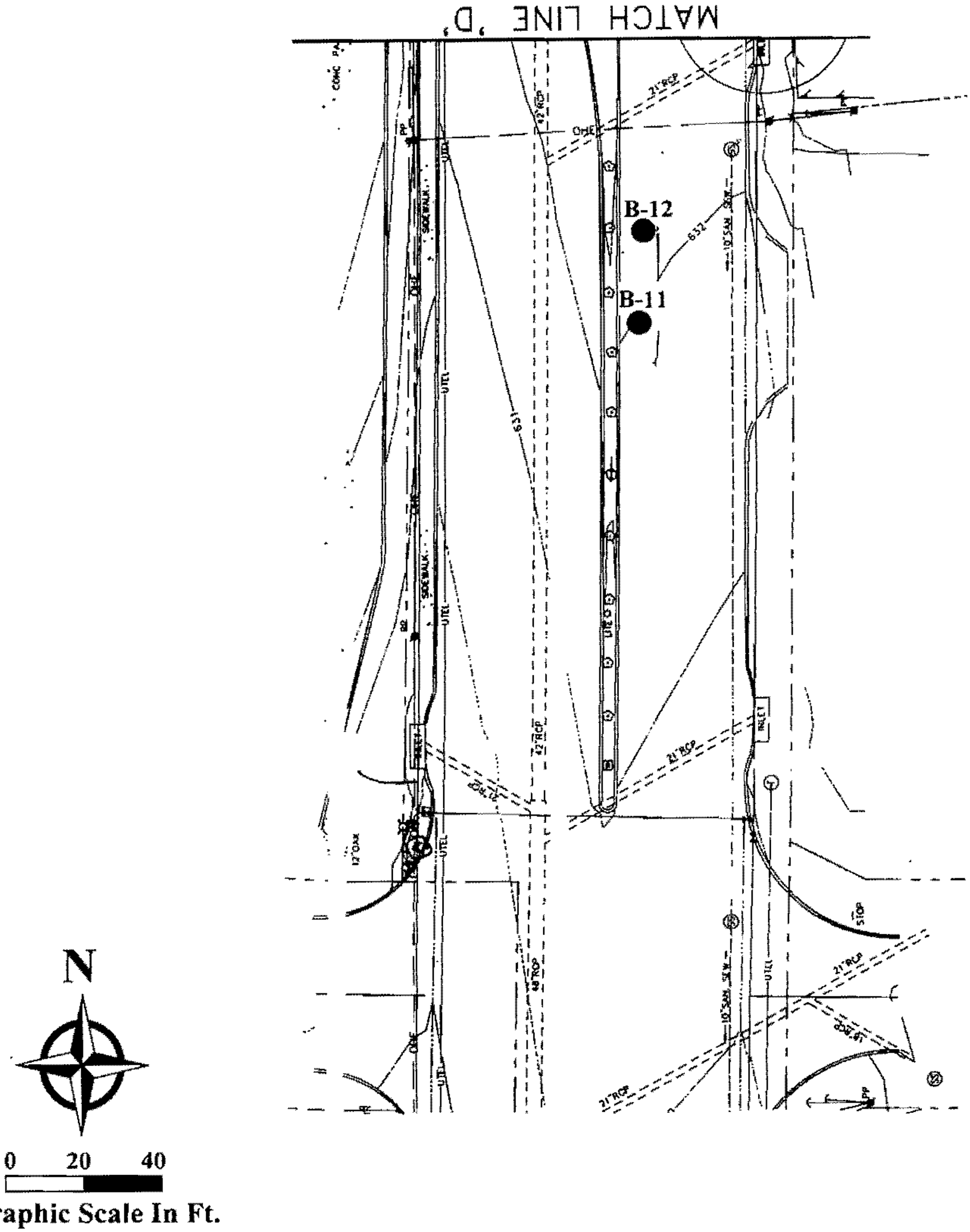


Graphic Scale In Ft.

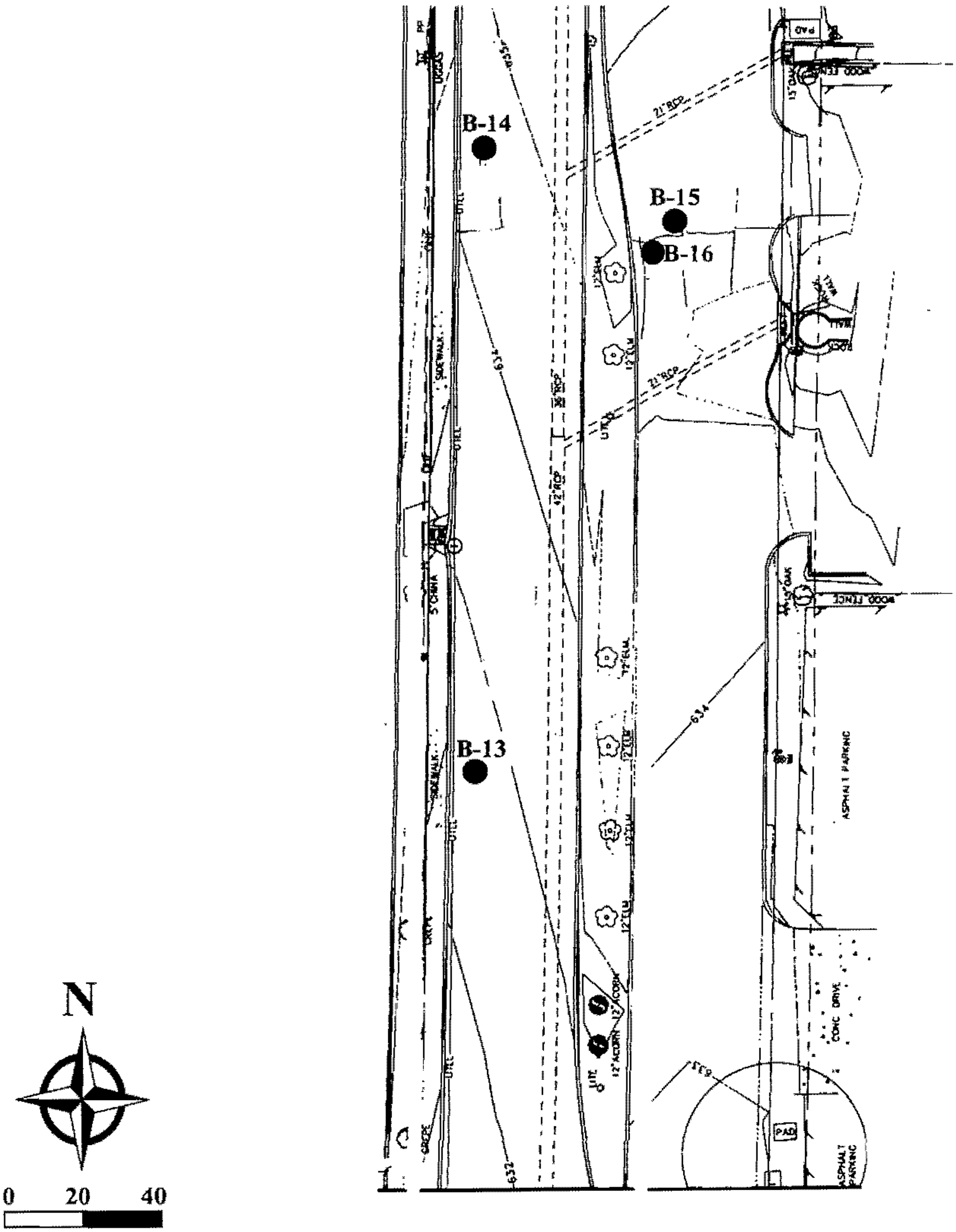
GBW Engineers, Inc. Garland, Texas	Boring Location Plan Figure 2	
Midway Road Reconstruction Addison, Texas	00988	4/02/01



GBW Engineers, Inc. Garland, Texas	Boring Location Plan Figure 3	
Midway Road Reconstruction Addison, Texas	00988	4/02/01

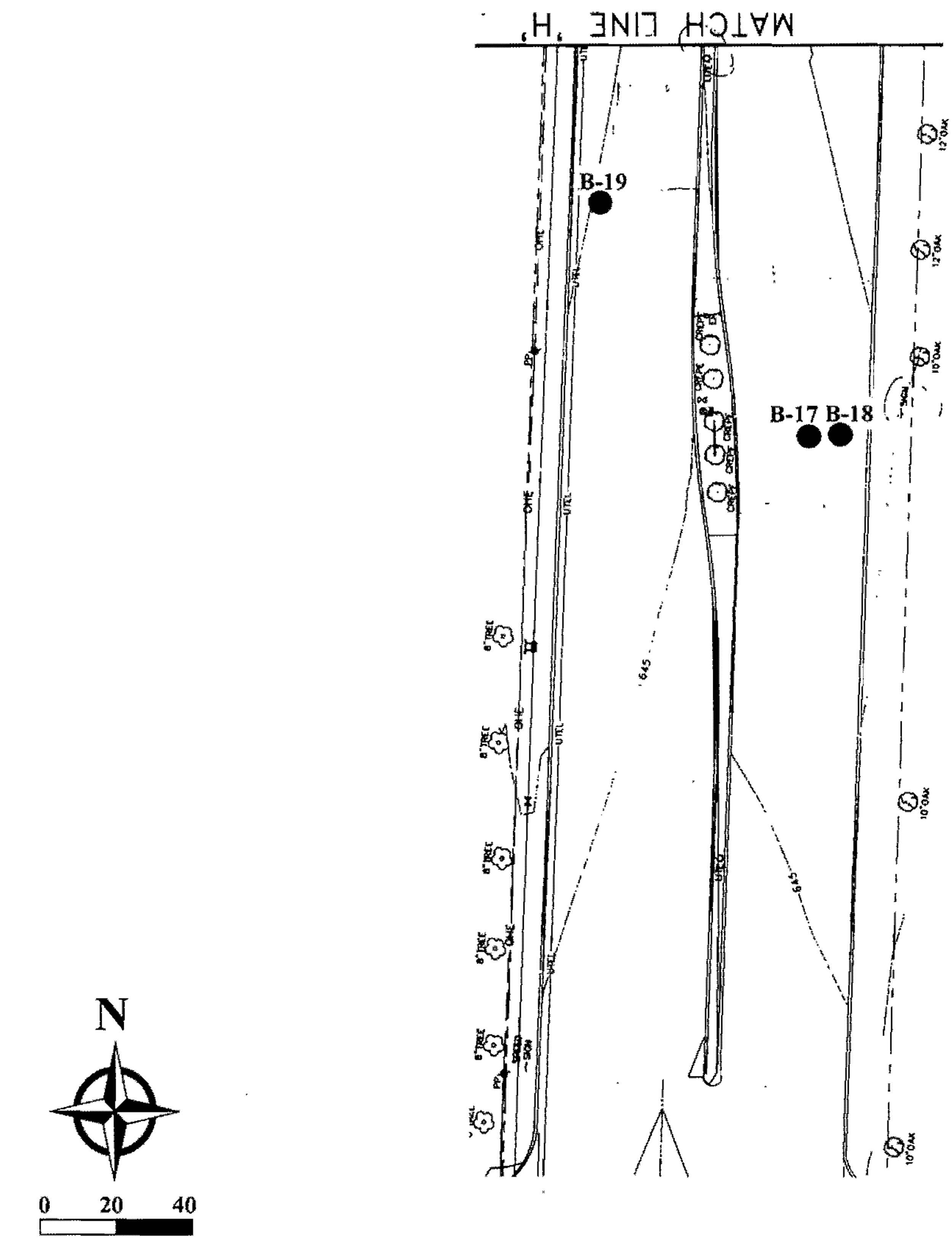


GBW Engineers, Inc. Garland, Texas		Boring Location Plan Figure 4	
Midway Road Reconstruction Addison, Texas		00988	4/02/01



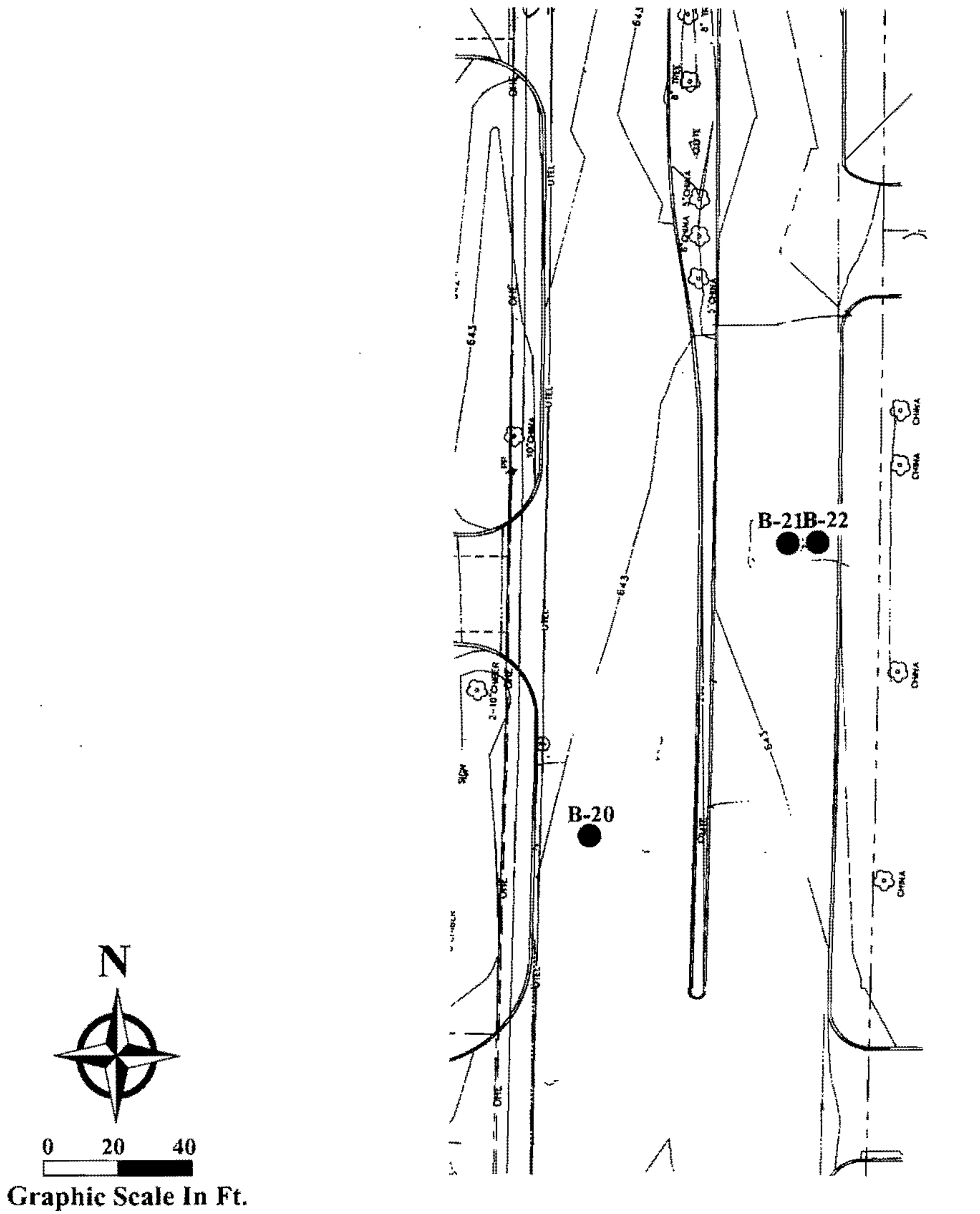
Graphic Scale In Ft.

GBW Engineers, Inc. Garland, Texas		Boring Location Plan Figure 5
Midway Road Reconstruction Addison, Texas	00988	4/02/01



Graphic Scale In Ft.

GBW Engineers, Inc. Garland, Texas		Boring Location Plan Figure 6	
Midway Road Reconstruction Addison, Texas		00988	4/02/01



GBW Engineers, Inc. Garland, Texas		Boring Location Plan Figure 7
Midway Road Reconstruction Addison, Texas	00988	4/02/01

B-1 METHODS OF LABORATORY TESTING

Representative samples are inspected and classified by a qualified member of the Geotechnical Division and the boring logs are edited as necessary. To aid in classifying the subsurface materials and to determine the general engineering characteristics, natural moisture content tests (ASTM D 2216), Atterberg-limit tests (ASTM D 4318) and dry unit weight determinations are performed on selected samples. In addition, unconfined compression (ASTM D 2166) and pocket-penetrometer tests are conducted on selected soil samples to evaluate the soil shear strength. Results of all laboratory tests described above are provided on the accompanying Record of Subsurface Exploration sheets or on summary data sheets as noted.

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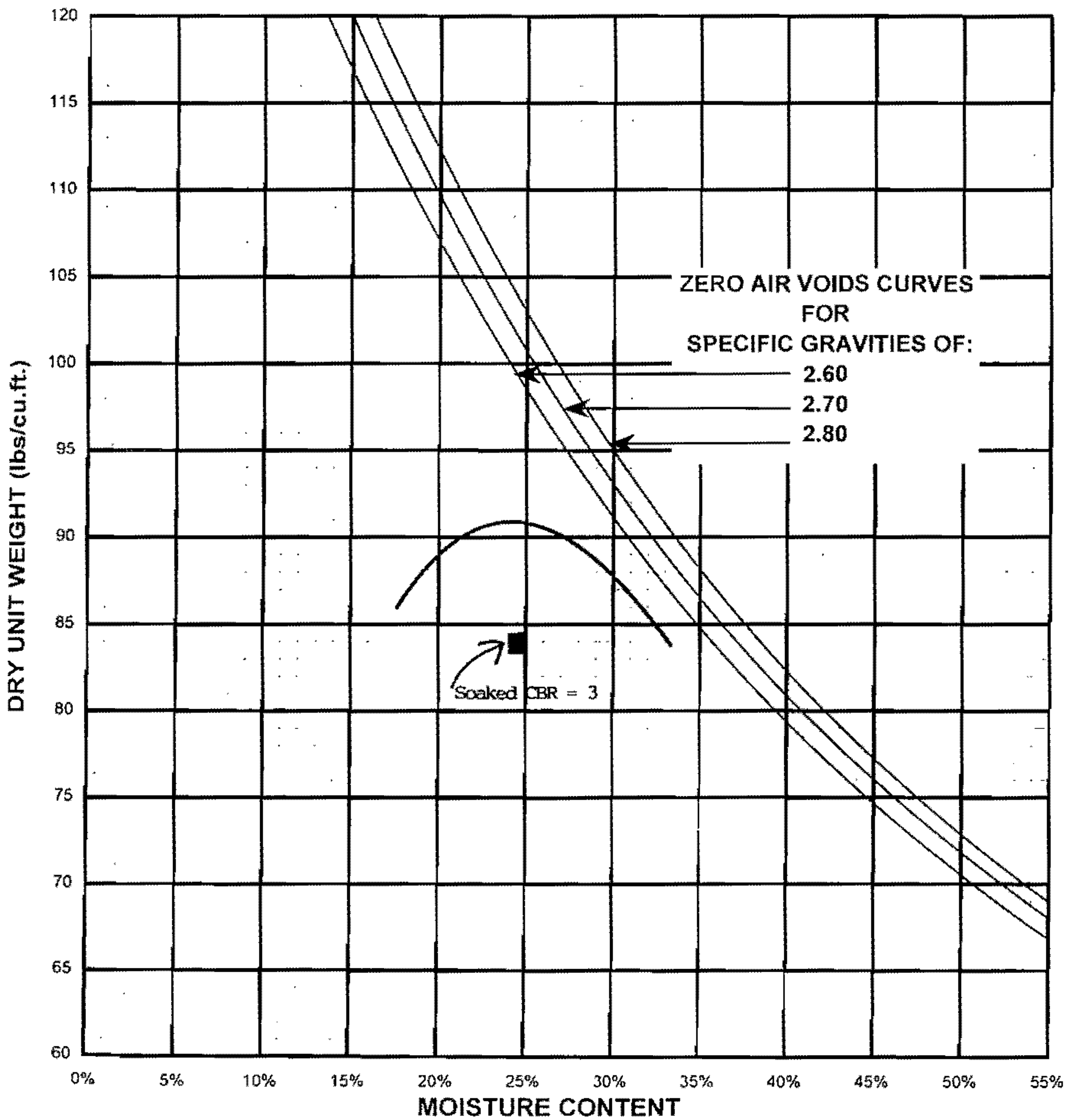
Client: BGW ENGINEERS, INC.
Garland, Texas

Project: Midway Road Reconstruction
Addison, Texas

Our Report Number.:	00988	Date: 1/29/01
Material Description:	Dark Brown Clay	
Classification:	(CH)	
Sample Location:	Composite Sample B-3 to B-16	
Method of Test:	ASTM-D-698-A	
Soil Identification Number:	Composite	
Maximum Dry Unit Weight:	91.0 pcf	
Optimum Moisture Content:	24.5 %	
Liquid Limit:	77	
Plasticity Index:	48	

MOISTURE DENSITY RELATIONSHIP



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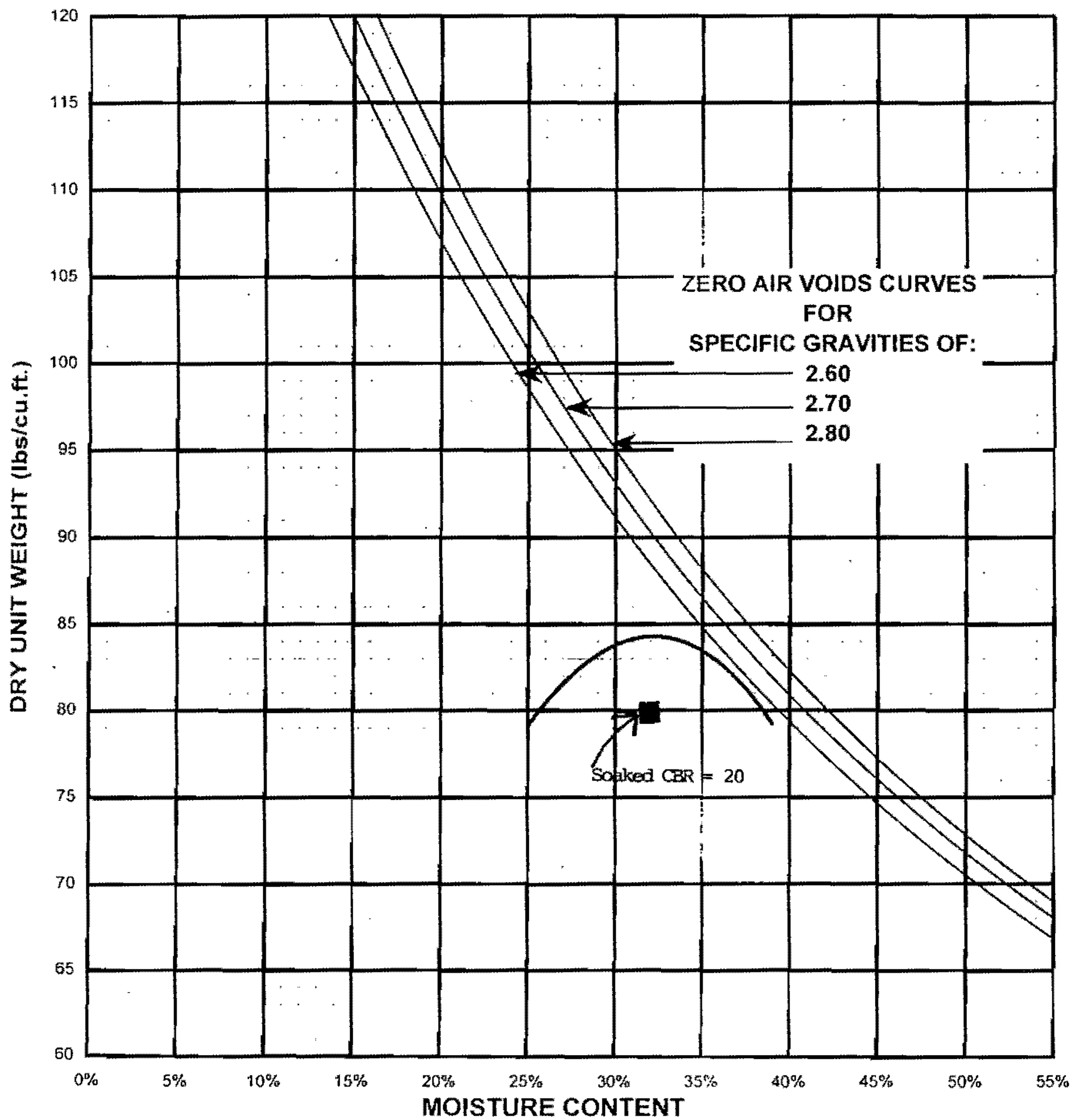
FAX: 972/406-8023

Client: GBW ENGINEERS, INC.
Garland, Texas
Project: Midway Road Reconstruction
Addison, Texas

Our Report Number.:	00988 Date: 1/29/01
Material Description:	Dark Brown Clay
Classification:	with 8 percent lime added
Sample Location:	Composite Sample B-3 to B-16
Method of Test:	ASTM-D-698-A
Soil Identification Number:	Composite
Maximum Dry Unit Weight:	84.5 pcf
Optimum Moisture Content:	32.0 %
Liquid Limit:	61
Plasticity Index:	14

MOISTURE DENSITY RELATIONSHIP



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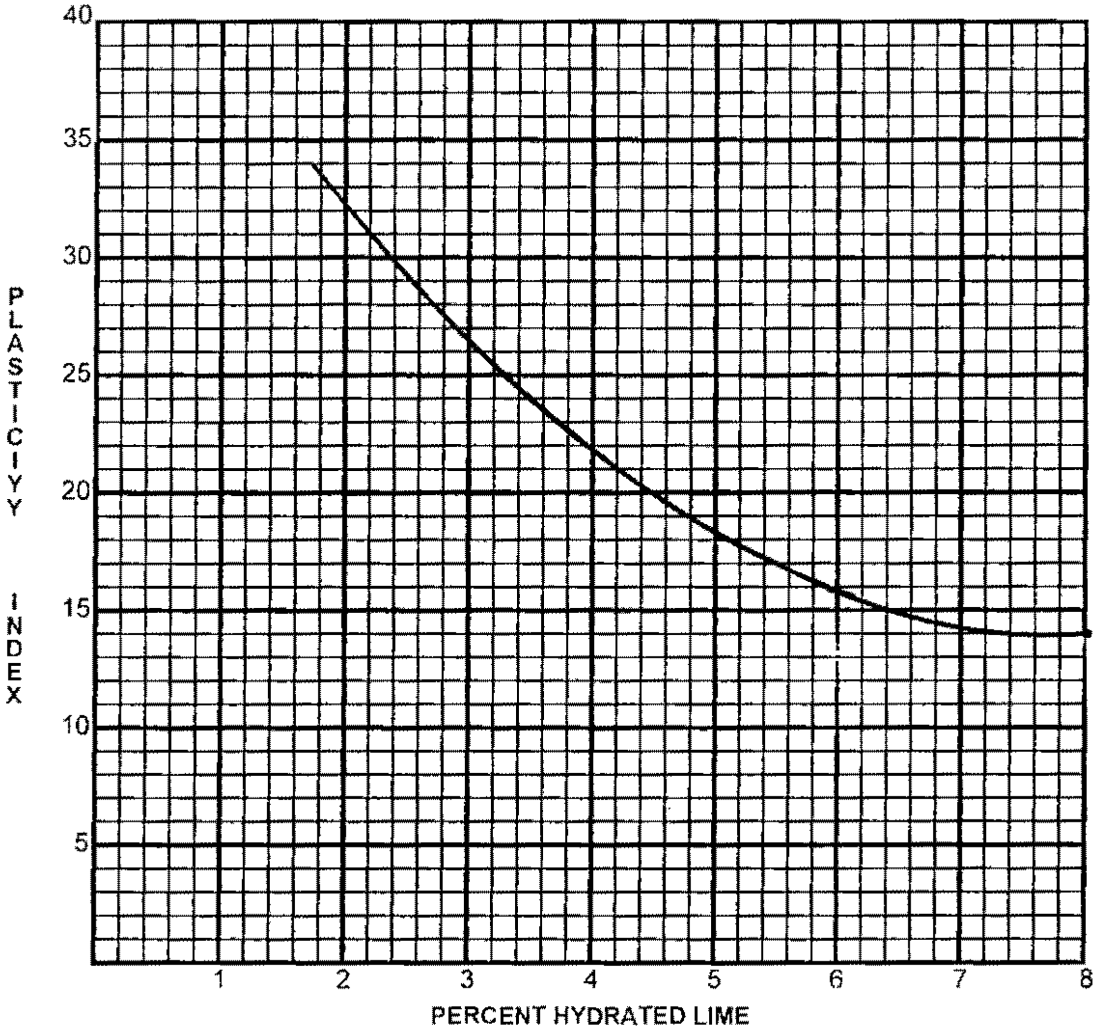
Dallas, Texas 75229
972/620-8911 - 972/263-4937 (Metro)
FAX: 972/406-8023

MECHANICAL LIME STABILIZATION



SAMPLE NO. Composite Sample (Borings 3-16)

DESCRIPTION: Brown Clay

CLIENT:	LABORATORY TEST:
GBW ENGINERRS, INC. GARLAND, TEXAS	LIME SERIES Figure 10

PROJECT NAME:	ALPHA PROJECT NO	DATE:
MIDWAY ROAD RECONSTRUCTION ADDISON, TEXAS	00988	April 3, 2001

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-1
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA
Hammer Wt. ___ lbs.
Hammer Drop ___ in.
Spoon Sample OD ___ in.
Rock Core Dia. ___ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown very stiff CLAY(CH) with some sand and gravel. -8" of concrete at surface.		0	1	ST					2.2		39	LL=76 PL=27 PI=49
	2'	2										
Reddish Brown very stiff CLAY(CH/CL) with some sand, calcareous nodules and gravel. -hard 2'-3'. -stiff below 5'.			2	ST					4.5+		26	
			3	ST					2.7		26	LL=53 PL=20 PI=33
		4	4	ST					2.2		25	
			5	ST					1.7		24	
	6'	6										
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel. -stiff 6'-7'.			6	ST					1.0		28	LL=33 PL=15 PI=18
			7	ST					0.7		27	
		8	8	ST					0.5		28	
			9	ST					0.5		46	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 5 FT.
AFTER ___ HRS. ___ FT.
WATER ON RODS 8 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-2
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard CLAY(CH) with some sand and gravel. -7.75" of concrete at surface.		0	1	ST					4.5+		33	LL=68 PL=37 PI=31
Reddish Brown and Tan very stiff CLAY(CH/CL) with some sand, calcareous nodules and gravel. -hard 2'-3'. -stiff below 5'.	2'	2	2	ST					4.5+		26	
			3	ST					3.5		22	
		4	4	ST					2.5		20	
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel. -very stiff 5'-6'. -stiff 6'-7'.	5'		5	ST					2.2		21	
		6	6	ST					1.2		24	
			7	ST					0.5		29	
		8	8	ST					0.5		30	
			9	ST					0.5		32	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 5 FT.
AFTER HRS. FT.
WATER ON RODS 8 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-3
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.		lbs.
Date Completed	1-21-01	Hammer Drop		in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand and calcareous nodules and gravel. -8" of concrete at surface.		0	1	ST					4.5+		38	LL=57 PL=36 PI=21
		2	2	ST					4.0		31	
Brown very stiff CLAY(CH) with some sand, calcareous nodules and gravel. -reddish brown below 4'. -stiff below 5'.	3'		3	ST					2.7		30	
		4	4	ST					3.2		22	
			5	ST					1.7		22	
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel. -stiff 6'-7'.	6'	6	6	ST					1.5		25	
			7	ST					0.5		26	
		8	8	ST					0.7		32	
			9	ST					0.5		35	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 5.5 FT.
AFTER HRS. FT.
WATER ON RODS 8 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-4
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ______ lbs.
Hammer Drop ______ in.
Spoon Sample OD ______ in.
Rock Core Dia. ______ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard CLAY(CH) with some sand and calcareous nodules and gravel. -7.75" of concrete at surface.		0	1	ST					4.5+		31	
		2	2	ST					4.0		33	
Reddish Brown and Tan very stiff CLAY(CH/CL) with some silty sand, calcareous nodules and gravel. -hard 3'-4'. -stiff below 5'.	3'		3	ST					4.0		25	
		4	4	ST					3.2		20	
			5	ST					3.2		23	
Tan firm CALCAREOUS CLAY(CL) with some silty sand and limestone gravel.	6'	6	6	ST					0.7		26	
			7	ST					0.7		29	
		8	8	ST					0.5		30	
			9	ST					0.5		28	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION 4.5 FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS 7 FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD - MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-5
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ______ lbs.
Hammer Drop ______ in.
Spoon Sample OD ______ in.
Rock Core Dia. ______ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION *617±*	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand and calcareous nodules. -8" of concrete at surface.	2'	0	1	ST					4.5+		37	LL=56 PL=35 PI=21
Dark Brown very stiff CLAY(CH) with some sand. -brown with calcareous nodules below 4'. -tannish brown below 8'.		2	2	ST					3.0		40	
		4	3	ST					3.2		29	
		6	4	ST					3.2		28	
		8	5	ST					3.0		28	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-6
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 617±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown very Dense SAND(SP) with some gravel and clay. ·8" of concrete at surface.		0	1	ST	13				-		30	
	2'	2										
Brown very stiff CLAY(CH) with some sand. -tannish brown with calcareous nodules and gravel below 4'. -tannish brown below 8'.			2	ST				1.2	2.7	80	34	LL=80 PL=30 PI=50
		4	3	ST					3.7		26	
		6	4	ST					3.0		24	LL=66 PL=24 PI=42
		8	5	ST					2.2		29	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-7
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 619±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown very stiff CLAY(CH) with some sand and gravel. -8.25" of concrete at surface.		0	1	ST					2.5		26	
Dark Brown very stiff CLAY(CH) with some sand, calcareous nodules and a trace of gravel. -brown below 6'. -tannish brown below 8'.	2'	2	2	ST					3.7		27	
		4	3	ST					3.2		28	
		6	4	ST					3.0		24	
Tan weathered SHALY LIMESTONE.	8'	8	5	TCP		100/3.3"					5	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-8
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sample OD: in.
Rock Core Dia.: in.
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 619±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand and gravel. -8.5" of concrete at surface.		0	1	ST					-		23	LL=46 PL=29 PI=17
	2'											
Dark Brown very stiff CLAY(CH) with sand laminations. -with limestone seams below 6'.			2	ST					3.7		29	
		5	3	ST					2.7		28	
			4	ST					2.7		26	
	8'											
Tan weathered SHALY LIMESTONE.			5	TCP		100/3"					9	
BOTTOM OF TEST BORING AT 10'.		10										
		15										
		20										
		25										
		30										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-9
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff Lime Treated CLAY(CH) with some sand, calcareous nodules and gravel. -8" of concrete at surface		0	1	ST				0.9	1.2	79	37	LL=55 PL=32 PI=23
Dark Brown very stiff CLAY(CH) with sand laminations and a trace of calcareous nodules.	2'	2	2	ST					2.2		33	
		4	3	ST					2.2		35	
		6	4	ST					2.2		31	
		8	5	ST					2.2		31	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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2209 Wisconsin St., Suite 100
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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-10
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 618±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown hard Lime Treated CLAY(CH) with some sand, calcareous nodules and gravel. -8" of concrete at surface -with lime to 17".		0	1	ST					4.5+		38	LL=53 PL=38 PI=17
	3'		2	ST					2.5		35	
Dark Brown very stiff CLAY(CH) with sand laminations. -stiff with limestone gravel below 8'.		5	3	ST					3.0		36	LL=83 PL=31 PI=52
			4	ST					2.0		29	
			5	ST					1.5		33	
BOTTOM OF TEST BORING AT 10'.		10										
		15										
		20										
		25										
		30										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER ____ HRS. ____ FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-11
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ___ lbs.
Hammer Drop ___ in.
Spoon Sample OD ___ in.
Rock Core Dia. ___ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 632±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff CLAY(CH) with some sand. -8" of concrete at surface	2'	0	1	ST					1.7		34	
Dark Brown very stiff CLAY(CH) with some sand and a trace of calcareous nodules and gravel.		2	2	ST					2.5		31	
		4	3	ST					3.0		32	
	8'	6	4	ST					2.5		38	
Tan and Gray hard CALCAREOUS CLAY(CL) with some silty sand and gravel.		8	5	ST					4.5+		18	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER ___ HRS. ___ FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD - MUD DRILLING

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Dallas, Texas 75229
(972) 620-8911

RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-12
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 632±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff Lime Treated CLAY(CH) with some sand. -8" of concrete at surface		0	1	ST				0.6	1.2	78	40	LL=60 PL=23 PI=37
Dark Brown very stiff CLAY(CH) with sand laminations. -stiff 2'-4'.	2'	2	2	ST					1.7		35	
		4	3	ST					2.0		34	LL=46 PL=29 PI=17
		6	4	ST					2.0		34	
Tannish Brown very stiff CALCAREOUS CLAY(CL) with some silty and and gravel.	7.5'	8	5	ST					3.0		22	LL=38 PL=18 PI=20
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-13
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140	lbs.
Date Completed	1-21-01	Hammer Drop	30	in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 633±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown stiff Lime Treated CLAY(CH) with some sand. -8" of concrete at surface.		0	1	ST				1.1	1.2	70	42	LL=79 PL=38 PI=41
Dark Brown stiff CLAY(CH) with sand laminations.	2'	2	2	ST					1.5		35	
		4	3	ST					1.5		34	
Tan and Gray hard CALCAREOUS CLAY(CL) with limestone seams.	6'	6	4	ST					4.5+		24	
Tan weathered SHALY LIMESTONE.	8'	8	5	TCP		100/1"					18	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-14
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140 lbs.
Date Completed	1-21-01	Hammer Drop	30 in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 634±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff Lime Treated CLAY(CH) with some sand. -8" of concrete at surface.		0	1	ST					2.0		36	
Dark Brown very stiff CLAY(CH) with sand laminations. -brown below 4'.	2'	2	2	ST					2.2		30	
		4										
Tan weathered SHALY LIMESTONE.	5'		3	ST					2.2		30	
		6										
		8										
			4	TCP		100/1.5"					18	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-15
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	lbs.
Date Completed	1-21-01	Hammer Drop	in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 635±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff CLAY(CH) with some sand and a trace of gravel. -8.25" of concrete at surface -brown with calcareous nodules below 8'.		0										
			1	ST					3.5		37	LL=85 PL=30 PI=55
		2										
			2	ST					2.0		32	
		4										
			3	ST					2.2		37	
		6										
			4	ST					2.5		32	
		8										
			5	ST					2.7		34	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-16
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt. ____ lbs.
Hammer Drop ____ in.
Spoon Sample OD ____ in.
Rock Core Dia. ____ in.
Shelby Tube OD 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 635 ±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown hard CLAY(CH) with some sand and a trace of gravel. -8.25" of concrete at surface -very stiff below 4'.		0	1	ST					4.5+		35	LL=65 PL=36 PI=29
		2	2	ST					1.7		33	
		4	3	ST					2.2		31	LL=83 PL=30 PI=53
Dark Brown very stiff CLAY(CH) with some sand.	6'	6	4	ST					2.2		32	
Tannish Brown stiff CALCAREOUS CLAY(CL/CH) with petro-chemical odor.	8'	8	5	ST					1.5		22	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-17
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140 lbs.
Date Completed	1-21-01	Hammer Drop	30 in.
Drill Foreman	EDI	Spoon Sample OD	in.
Inspector		Rock Core Dia.	in.
Boring Method	CFA	Shelby Tube OD	3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 644 ±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff CLAY(CH) with calcareous deposit and some sand - poss. fill -6.5" of concrete at surface.		0	1	ST					2.0		27	LL=85 PL=30 PI=55
		2	2	ST					2.7		38	
	3'											
Tannish Brown and Gray very stiff CALCAREOUS CLAY(CL/CH) with clay zones. -hard with limestone seams below 4'.			3	ST					2.5		27	
		4	4	ST					4.5+		15	
	5'											
Tan weathered SHALY LIMESTONE.		6										
	8'	8										
Tan weathered SHALY LIMESTONE.			5	TCP		100/1"					15	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-18
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140	lbs.
Date Completed	1-21-01	Hammer Drop	30	in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 644±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Dark Brown very stiff CLAY(CH) with some sand and calcareous nodules - poss. fill -6.5" of concrete at surface.		0	1	ST					3.2		32	LL=73 PL=27 PI=46
	3'		2	ST					3.2		38	
Tan and Gray hard CALCAREOUS CLAY(CL/CH) with limestone seams.			3	ST					4.5+		19	
	5'	5	4	ST					4.5+		14	
Tan weathered SHALY LIMESTONE.	8'											
Gray SHALY LIMESTONE.			5	TCP		100/1"					14	
BOTTOM OF TEST BORING AT 10'.		10										
		15										
		20										
		25										
		30										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC. | Boring No.: B-19
Architect/Engineer: | Job No.: 00988
Project Name: MIDWAY ROAD RECONSTRUCTION | Drawn By: AM
Project Location: ADDISON, TEXAS | Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01 | Hammer Wt.: 140 lbs.
Date Completed: 1-21-01 | Hammer Drop: 30 in.
Drill Foreman: EDI | Spoon Sample OD: in.
Inspector: | Rock Core Dia.: in.
Boring Method: CFA | Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION 644±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Brown and Tan hard CLAY(CH) with calcareous deposit, gravel and some sand. - poss. fill -6.5" of concrete at surface.		0	1	ST					4.5+		21	LL=73 PL=28 PI=45
		2	2	ST					4.5+		32	
Tan and Gray hard CALCAREOUS CLAY(CL) with limestone seams.	4'	4	3	ST					4.5+		20	LL=48 PL=20 PI=28
Tan weathered SHALY LIMESTONE.	6'	6										
Gray SHALY LIMESTONE.	8'	8	4	TCP		100/1.3"					13	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP - TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD - MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-20
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01
Date Completed: 1-21-01
Drill Foreman: EDI
Inspector:
Boring Method: CFA

Hammer Wt.: 140 lbs.
Hammer Drop: 30 in.
Spoon Sample OD: in.
Rock Core Dia.: in.
Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 643±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Tannish Brown and Gray hard CALCAREOUS CLAY(CL) with limestone seams. -7.25" of concrete at surface.		0	1	ST					4.5+			LL=59 PL=21 PI=38
	2'	2										
Gray SHALY LIMESTONE.		4	2	TCP		100/1.3"					13	
		6										
		8	3	TCP		100/1.3"					15	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client	GBW ENGINEERS, INC.	Boring No.	B-21
Architect/Engineer		Job No.	00988
Project Name	MIDWAY ROAD RECONSTRUCTION	Drawn By	AM
Project Location	ADDISON, TEXAS	Approved By	DAL

DRILLING AND SAMPLING INFORMATION

Date Started	1-21-01	Hammer Wt.	140	lbs.
Date Completed	1-21-01	Hammer Drop	30	in.
Drill Foreman	EDI	Spoon Sample OD		in.
Inspector		Rock Core Dia.		in.
Boring Method	CFA	Shelby Tube OD	3	in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 643±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Tannish Brown very stiff to hard CALCAREOUS CLAY(CL) with limestone seams. -6.75" of concrete at surface.		0	1	ST					2.7		22	
	2'	2										
Gray SHALY LIMESTONE.												
		4	2	TCP		100 / 1.5"					13	
		6										
		8	3	TCP		100 / 1.3"					16	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

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RECORD OF SUBSURFACE EXPLORATION

Client: GBW ENGINEERS, INC.
Architect/Engineer:
Project Name: MIDWAY ROAD RECONSTRUCTION
Project Location: ADDISON, TEXAS

Boring No.: B-22
Job No.: 00988
Drawn By: AM
Approved By: DAL

DRILLING AND SAMPLING INFORMATION

Date Started: 1-21-01 | Hammer Wt.: 140 lbs.
Date Completed: 1-21-01 | Hammer Drop: 30 in.
Drill Foreman: EDI | Spoon Sample OD: in.
Inspector: | Rock Core Dia.: in.
Boring Method: CFA | Shelby Tube OD: 3 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 643±	STRATUM DEPTH	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	Percent Passing No. 200 Sieve	Texas Cone Penetration Test or Standard Penetration Test (Blows/Ft)	Soil Suction Test (Total), pF	Unconfined Compressive Strength Tons/Sq Ft.	Pocket Penetrometer Tons/Sq Ft.	Dry Unit Weight lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index
Tannish Brown and Gray hard CALCAREOUS CLAY(CL) with limestone seams. -6.75" of concrete at surface.		0	1	ST					4.5+		18	LL=35 PL=17 PI=18
	2'	2										
Gray SHALY LIMESTONE.			2	CA							13	
		4	3	TCP		100/1"					12	
		6										
		8	4	TCP		100/1.5"					16	
BOTTOM OF TEST BORING AT 10'.		10										
		12										

SAMPLER TYPE
SS - STANDARD PENETRATION TEST
ST - SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
TCP- TEXAS CONE PENETRATION TEST

GROUNDWATER OBSERVATIONS
AT COMPLETION DRY FT.
AFTER HRS. FT.
WATER ON RODS NONE FT.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVEN CASINGS
MD -MUD DRILLING

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229

(972) 620-8911

KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

THE ABBREVIATIONS COMMONLY EMPLOYED ON EACH "RECORD OF SUBSURFACE EXPLORATION", ON THE FIGURES AND IN THE TEXT OF THE REPORT, ARE AS FOLLOWS:

SOIL OR ROCK TYPES
(SHOWN IN SYMBOLS COLUMN)

CLAY SILT SAND LIMESTONE SHALE ASPHALT/CONCRETE

I. SOIL DESCRIPTION

(A) COHESIONLESS SOILS

RELATIVE DENSITY	N, BLOWS/FT
VERY LOOSE	0 TO 4
LOOSE	5 TO 10
COMPACT	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

(B) COHESIVE SOILS

CONSISTENCY	Qu, TSF
VERY SOFT	LESS THAN .25
SOFT	.25 TO .50
FIRM	.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

II. PLASTICITY

DEGREE OF PLASTICITY	PLASTICITY INDEX
NONE TO SLIGHT	0 - 4
SLIGHT	5 - 10
MEDIUM	11 - 30
HIGH TO VERY HIGH	OVER 30

NOTE: ALL SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

III. RELATIVE PROPORTIONS

DESCRIPTIVE TERM	PERCENT
TRACE	1 - 10
LITTLE	11 - 20
SOME	21 - 35
AND	36 - 50

IV. PARTICLE SIZE IDENTIFICATION

BOULDERS:	-8 INCH DIAMETER OR MORE
COBBLES :	-3 TO 8 INCH DIAMETER
GRAVEL :	-COARSE - 3/4 TO 3 INCH
	-FINE - 5.0 MM TO 3/4 INCH
SAND :	-COARSE - 2.0 MM TO 5.0 MM
	-MEDIUM - 0.4 MM TO 2.0 MM
	-FINE - 0.07 MM TO 0.4 MM
SILT :	-0.002 MM TO 0.07 MM
CLAY :	-0.002 MM

V. DRILLING AND SAMPLING SYMBOLS

- AU: AUGER SAMPLE
- RC: ROCK CORE
- TCP: TEXAS CONE PENETRATION TEST
- SS: SPLIT-SPOON 1 3/8" I.D. 2" O.D. EXCEPT WHERE NOTED
- ST: SHELBY TUBE = 3" O.D. EXCEPT WHERE NOTED
- WS: WASHED SAMPLE
- HSA: HOLLOW STEM AUGERS
- CFA: CONTINUOUS FLIGHT AUGERS
- MD: MUD DRILLING

May 21, 2001

Mr. Steve Chutchian, P.E.
Town of Addison
Post Office Box 9010
Addison, Texas 75001

Re: Draft Letter Report for Midway Road
Pavement Section

GBW No. 238

Dear Steve:

This letter report summarizes data from an in-depth field inspection of the Midway Road pavement condition performed by GBW staff and the enclosed draft geotechnical report prepared by Alpha Testing, Inc. In addition, this report includes a review of the pavement section alternatives included in the Alpha Testing report and an opinion of probable cost for two of the pavement sections that utilize alternative base materials.

Description of Problem

Alpha Testing, Inc. strategically selected boring locations in order to determine how subsurface conditions were affecting the level of pavement distress. Following an analysis of the field inspection and soil boring data, we have the following observations:

- The pavement distress along the northbound lanes is more pronounced than the southbound lanes.
- The worst section of the southbound lanes is in the vicinity of the railroad crossing near the Belt Line Road end of the project where a sag is located.
- The cross-slope on the northbound lanes, which is mostly in the 1/8 to 1/4-inch per foot range, is significantly less than the southbound lanes, where it is mostly in the 1/4 to 1/2-inch per foot range.
- The difference between the northbound and southbound lane cross-slopes appears to have resulted from an attempt to match the existing ground at the east and west right-of-way lines when the current Midway Road pavement was designed in 1982.
- The flatter cross-slope on the northbound lanes increases the likelihood that surface water will pond or runoff slowly, resulting in a higher infiltration rate into the subgrade through pavement joints and cracks.
- In addition to rainfall, sprinkler systems in the medians and adjacent parkways are other sources of water which can infiltrate the subgrade.
- Flat longitudinal slopes along some sections of Midway Road also slow that rate of storm water runoff; for example, in the vicinity of the railroad crossing.
- Poor surface drainage appears to be the primary reason why pavement distress has been more rapid along most of the northbound lanes when compared with the southbound lanes.
- The poor condition of many pavement joints, some of which may have been widened when the pavement was milled and resealed in 1994, provide conduits for surface water to reach the subgrade.
- The plasticity index of the underlying clay soil is generally in the 18 to 55 range, which indicates a high potential to shrink and swell.
- The soil borings do not provide evidence of a ground water problem.
- Only eight of the 22 soil borings showed evidence of lime in the subgrade, which suggests that the lime stabilized subgrade was not uniformly constructed.
- A combination of moisture penetration over time and nonuniform lime stabilization during construction has probably reduced the bearing capacity of the subgrade.

- The load transfer capability of the transverse contraction joints has been insufficient to support the heavy traffic volume, resulting in a difference in pavement elevation at the front and back ends of adjacent slabs.
- This difference, which results in a bump at the pavement joints on the northbound lanes in particular, has also resulted in a transverse crack at the midpoint of some slabs.
- Exhibit A contains a summary of data from the field inspection and the geotechnical report.

Comparable Pavement Alternatives

We received a copy of your letter to Jerry Holder dated March 23, 2001 in which you authorize the design team to proceed with pavement section Alternative 3 which included Portland Cement Concrete (PCC) on a Cement Treated Permeable Base (CTPB) with edge drains. Pursuant to our previous discussions, it is understood that the Town intends to use the same type of pavement section for both the Midway and Arapaho Road projects, given that the depths of the concrete and base layers may differ.

In a similar manner to the Terra-Mar, Inc. report for Arapaho Road, the Alpha Testing report for Midway Road analyzes several alternative pavement sections. These alternatives, which assume a 30-year project life, are summarized in the following section.

- *If the load transfer between joints is through <u>aggregate interlock</u> and the subgrade is <u>compacted</u>; either*

11.5 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Compacted subgrade

OR

10.5 inches	PCC
6 inches	CTPB
6 inches	Compacted subgrade

- *If the load transfer between joints is through <u>aggregate interlock</u> and the subgrade is <u>lime stabilized</u>; either*

11 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Lime stabilized subgrade

OR

10 inches	PCC
6 inches	CTPB
6 inches	Lime stabilized subgrade

- *If the load transfer between joints is through <u>dowels</u> and the subgrade is <u>compacted</u>; either*

10 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Compacted subgrade

OR

9 inches	PCC
6 inches	CTPB
6 inches	Compacted subgrade

- *If the load transfer between joints is through <u>dowels</u> and the subgrade is <u>lime stabilized</u>; either*

9.5 inches	PCC
6 inches	Crushed Limestone Base
6 inches	Lime stabilized subgrade

OR

9 inches	PCC
6 inches	CTPB
6 inches	Lime stabilized subgrade

Review of Alternatives

Upon a review of the pavement sections listed above, it is evident that each of the following alternatives reduce the required PCC thickness by ½ to 1 inch:

- *The use of <u>CTPB</u> in lieu of <u>Crushed Limestone Base</u>.*

  Given the Town's selection of CTPB for the Arapaho Road project, it is anticipated that CTPB will also be the base material of choice for the Midway Road project.

- *The use of <u>lime stabilized subgrade</u> in lieu of <u>compacted subgrade</u>.*

  In Section 5.4 of the Terra-Mar report, it states that 'If construction proceeds during wet weather, a lime stabilized subgrade in lieu of a compacted subgrade may be desirable in order to provide a more stable and less moisture sensitive working platform.' A representative with Jackson Brothers, the contractor on the Post and Paddock paving project for the City of Grand Prairie, strongly recommended that a lime stabilized subgrade be used with CTPB due to constructability problems which they experienced on Post and Paddock with a compacted subgrade. If the Town of Addison is willing to consider lime stabilization on Midway Road, it could be bid as an alternate to a compacted subgrade.

- *The use of __dowels__ in lieu of __aggregate interlock__ for load transfer between joints.*

  In Section 5.5 of the Terra-Mar report, it states that 'Steel dowels should be used for load transfer at all joints transverse to traffic.' This recommendation applies to transverse contraction joints which they indicate should typically be placed at 15 feet on-center. The Terra-Mar report does not provide an alternative pavement section for load transfer through aggregate interlock between joints. Locally, aggregate interlock is most commonly used on municipal roadways; nevertheless, both load transfer options could be bid as alternates on Midway Road.

Cost Comparison of Alternatives

If lime stabilization is bid as an alternate to a compacted subgrade, and dowels are bid in lieu of aggregate interlock for load transfer between joints, the contractors that bid the Midway Road project will determine the cost effectiveness of these alternatives. If one or more or these alternatives is not acceptable to the Town, we would be pleased to do the research necessary to prepare an opinion of probable cost for each alternative.

Although it is anticipated that the pavement section on Midway Road will incorporate CTPB, Exhibit B provides an opinion of probable cost for informational purposes to compare it with a pavement section that incorporates Crushed Limestone Base. This comparison, which indicates a $866,805 increase in cost to use CTPB, is contained in that attached spreadsheet.

CTPB Design Memo

Given the limited use of CTPB as a base material for urban pavements in the metroplex, we have prepared a design memo based on our research of this material. The attached design memo on CTPB has been prepared following conversations with a supplier, a contractor, other local and state agency representatives, and other engineers.

This memo is to provides an evaluation of CTPB along with technical data for consideration prior to developing consistent pavement section design standards and specifications for the Midway and Arapaho Road projects.

Fly Ash

The Town of Addison's staff has expressed an interest in using fly ash in the mix design of the PCC pavement for the Midway and Arapaho Road projects. Mr. Michael Caldarone, P.E. with TXI indicated that fly ash is used in concrete paving by number of local cities including Dallas, Fort Worth Arlington, Plano and Grand Prairie, and by TxDOT on the majority of their concrete paving projects. I also contacted the City of Garland's construction manager and confirmed that they permit fly ash in concrete paving mix designs, although the amount is limited to the lesser of 15% of the cement weight or 100 lbs.

Mr. Caldarone furnished our office with sample concrete mix designs, with and without fly ash, which achieve 3,000 psi in 3 days and 7 days respectively. These mix designs are attached for you information. If the Town wishes to utilize fly ash on the subject projects, we can include appropriate limits for its use in the technical specifications.

After reviewing the enclosed geotechnical report for Midway Road and this letter, please contact me if you any comments. I will then request that Alpha Testing finalize their report.

Very truly yours,

Bruce R. Grantham, P.E.
President

Attachments

cc: Jerry Holder, HNTB
Dave Lewis, Alpha Testing

BG/gg
J:\WPDOCS\PROJECTS\ADDISON\00-238\Chutchian.ltr

EXHIBIT A

MIDWAY ROAD - SOIL BORING/FIELD OBSERVATION SUMMARY

Boring No.	Pvm't Station	Traffic Direction	Panel Point	PI	Lime Stab.	Rock Depth	Pvm't Thickness	Pvm't Cross Slope	Joint Width	Pavement Distress
B-1	6+30	North	Front	49	No	-	8"	-1.32%	Moderate	High
B-2	6+27	North	Back	31	No	-	7 3/4"	-1.32%	Moderate	High
B-3	6+49	North	Front	21	Yes	-	8"	-1.35%	Moderate	High
B-4	6+45	North	Back	-	No	-	7 3/4"	-1.34%	Moderate	High
B-5	6+56	South	Front	21	Yes	-	8"	-3.86%	Moderate	High
B-6	6+60	South	Back	-	No	-	8"	-3.78%	Moderate	High
B-7	10+03	North	Back	-	No	8'	8 1/4"	-1.72%	Moderate	Medium
B-8	10+06	North	Front	17	Yes	8'	8 1/2"	-1.79%	Moderate	Medium
B-9	10+33	South	Front	23	Yes	-	8"	-2.93%	Moderate	Medium
B-10	10+36	South	Back	17	Yes	-	8"	-2.95%	Moderate	Medium
B-11	24+33	North	Center	-	No	-	8"	-1.35%	Moderate	Medium
B-12	24+45	North	Center	37	Yes	-	8"	-1.28%	Moderate	Medium
B-13	26+01	South	Center	41	Yes	8'	8"	-3.71%	Small	Low
B-14	27+54	South	Center	-	Yes	5'	8"	-3.75%	Small	Low
B-15	27+32	North	Front	55	No	-	8 1/4"	-0.92%	Moderate	Medium
B-16	27+28	North	Back	29	No	-	8 1/4"	-0.99%	Moderate	Medium
B-17	47+47	North	Center	55	No	5'	6 1/2"	-1.43%	Large	High
B-18	47+47	North	Center	46	No	5'	6 1/2"	-1.43%	Large	High
B-19	48+14	South	Center	45	No	6'	6 1/2"	-2.43%	Moderate	Medium
B-20	50+74	South	Center	38	No	2'	7 1/4"	-2.02%	Moderate	Medium
B-21	50+88	North	Center	-	No	2'	6 1/4"	-1.24%	Moderate	Medium
B-22	50+88	North	Center	18	No	2'	8 3/4"	-1.24%	Moderate	Medium

EXHIBIT B

OPINION OF PROBABLE COST
MIDWAY ROAD - ALTERNATIVE PAVEMENT SECTIONS

Bid Item Description	Thickness	Unit	Unit Price	Estimated Quantity	Total Item
	(inches)		($)		($)
Alternate 1					
Portland Cement Concrete	11.5	S.Y.	55	53,500	2,942,500
Crushed Limestone Base	6	S.Y.	15	57,000	855,000
Compacted Subgrade	6	S.Y.	1.5	57,000	85,500
TOTAL ESTIMATED COST					**$3,883,000**
Alternate 2					
Portland Cement Concrete	10	S.Y.	50	53,500	2,675,000
Cement Treated Permeable Base	6	S.Y.	15	57,000	855,000
Lime Stabilized Subgrade	6	S.Y.	2	57,000	114,000
Lime (@ 33 lbs/S.Y.)	-	TON	110	941	103,455
Geotextile Fabric	-	S.Y.	13	62,000	806,000
Concrete Toe Wall (6" x 18")	-	L.F.	10	3,060	30,600
Edge Drains (6" PVC)	-	L.F.	15	11,050	165,750
TOTAL ESTIMATED COST					**$4,749,805**
ADDITIONAL COST FOR ALTERNATE 2					**$866,805**

Notes:
1. Edge Drains are proposed behind both outside curbs.
2. Concrete toe walls are proposed along the inside curb lines of wider landscaped medians only.
3. Lime Stabilization is included with CTPB for constructability purposes.

Engineers, Inc.

DESIGN MEMO

Date:	**April 2, 2001**	**Job No. 00-238**
From:	**GBW**	**Job Name: Midway Road/Arapaho Road**
To:	**Steve Clutchian, P.E.; Jerry Holder, P.E.**	
Re:	**General Notes on Cement Treated Permeable Base**	

EVALUATION

- CTPB has the potential to increase the life of a roadway by providing a conduit for subsurface water to flow out from under the pavement, thereby, reducing the rate at which subgrade support is likely to deteriorate.

- CTPB slightly reduces the required concrete pavement thickness when compared with an equally thick crushed limestone base.

- CTPB has been used extensively in other states including California, Louisiana and Wisconsin.

- CTPB is more commonly used where the subsurface water flows to open road side drainage ditch; however, it is also used in conjunction with edge drains on curb and gutter roadways.

- CTPB has been used on a very limited basis locally; consequently, contractors are not as familiar with the construction requirements as they are with more commonly use non-drainable base materials such as crushed limestone.

- Grand Prairie rebid the Post and Paddock roadway reconstruction project, which utilized CTPB, because they received usually high bids at the first bid opening.

- A mandatory prebid meeting was scheduled prior to the second bid opening, which resulted in lower bids, in order to provide contractors with more detailed information about the use of CTPB.

- A representative of Jackson Brothers, the contractor on Post and Paddock, informed our staff that they would be prepared to bid another CTPB project; however, they would include money to lime stabilize the subgrade even if it was not required.

- The compacted subgrade which was specified on the Post and Paddock project created constructability problems for the contractor, especially when it rained.

- Typically, where non-drainable bases are used, the goal is restrict the flow of water under the pavement. A drainage base permits the free flow of water under the pavement.

- As CTPB promotes the flow of water under the pavement, it increases the potential for future pavement problems if the drainage system does not function as designed. For example:
  - Over-rolling the CTPB can cause degradation of the material with a resulting loss of permeability.

- An uneven or inadequately sloped subgrade can cause water to pond in the CTB.
- Any break in the filter fabric layer, either during construction or during later pavement repairs, can provide a conduit for water to migrate into the subgrade.
- The CTB must be keep free of dirt during construction and during later pavement repairs.
- In addition, pavement repairs must be closely monitored to insure that the CTPB is correctly installed so that the free flow of water is not interrupted.
- The edge drains must be kept clear of dirt and debris during construction and, if they are located under the pavement, construction equipment must be monitored to insure that the pipes are not crushed.
- The edge drains must be consistently checked and cleaned out if necessary, during the pavement design life.

- As storm sewers, culverts or creeks are the most likely outfall points for edge drains, the depth of flow in these outfalls must be checked to determine if storm water will back up through the edge drains into the CTPB, and in what storm event this will occur.

- The back up of storm water from an outfall into the CTPB introduces a significantly higher volume of water under the pavement than would result from infiltration through the pavement joints.

- The CTPB pavement section, which includes edge drains, filter fabric, and root barriers along wider median curbs, is significantly more expensive than an equivalent pavement section which utilizes a non-drainable base.

- There are no local examples of CTPB pavement section that have been in place on a curb and gutter roadway over the design life to quantify any improvement in durability over a non-drainable base.

BASE COURSE NOTES

General

- If construction traffic will be allowed on the permeable base, cement stabilization is generally needed to avoid the substantial cost of constructing a temporary adjacent haul road for side delivery of concrete to the paver.

Aggregate

- Quality of crushed aggregates is the single most important factor for the stability of a permeable base. Aggregate should be stored, handled, and placed in a manner to keep segregation to a minimum.

- The most popular aggregate gradations are AASHTO No. 57 and No. 67, which are characterized by having very little material finer that No. 8 sieve.

- The aggregate material should have at least two mechanically fractured faces to ensure good mechanical interlock. This will require a crushed material.

Permeability

- Cement-treated bases have coefficients of permeability in the range of 3,000 to 15,000 ft per day. Untreated permeable bases range from 500 to 2,000 ft per day.

- Edge drains are usually filled with the same highly permeable material that is used for the base or a material with even higher permeability.

Cement

- While 200 lb cement per cubic yard has been the amount most generally specified, agencies have used amounts varying from 150 to 300 lb.
- Mixes with 150 lb/c.y. cement content should be restricted to areas subjected to only a few truck hauls over stable subgrade.
- Mixes with 200 lb/c.y. cement content are appropriate for general use (average trucking and subgrade conditions.)
- Mixes with 250 lb/c.y. cement should be used where heavy trucking will occur or where support conditions are questionable.
- From the low to the high cement content, 7 day field compressive strengths varied from 150 to 600 psi; however, cement content rather than strength should be used to select the most appropriate mix.

Water Content

- Water contents for workable mixtures are usually in the range of 100 to 120 lb/yd3. Water content should be based on the contractor's assessment of the mix workability.
- A water/cement ratio at the higher end of the range may encourage the cement paste to flow to points of aggregate contact where its cementing action is needed. The FHWA recommends this design approach.

Pavement Section

- The thickness of permeable bases used has varied from 3 to 6 inches, with 4 inches being the most common. The thickness should be adequate to overcome any construction variances and provide an adequate hydraulic conduit to transmit the water to the edge drain.
- A minimum resultant slope of 2 percent is recommended wherever possible.

Construction

- Most commonly, the base is compacted by vibratory plates or screeds. The objective is to solidly seat the material.
- Over-rolling can cause degradation of the material with a resulting loss of permeability
- Cement-treated permeable bases are cured by water misting several times a day or by covering with polyethylene sheets for 3 to 5 days.
- The need for curing is one of the least understood aspects of constructing cement treated permeable bases.
- Some agencies are studying the cost-effectiveness of curing; Wisconsin found little difference between material covered with polyethylene and that left exposed.

Tel.: (972) 840-1916 / *FAX:* (972) 840-2156 / *E-mail:* Info@gbwengineers.com

- During construction, care must be taken to prevent contamination of the permeable base from mud and dirt carried by truck tires. Construction traffic should be kept to a minimum and sharp truck turning should be avoided.

SEPARATOR NOTES

General

- Beneath the permeable base course, a separator or filter layer prevents fine particles in the subgrade soil from infiltrating the open-graded base.
- An asphalt prime coat placed on the stabilized subgrade/subbase would provide additional protection.
- A separator layer can be provided by an aggregate separator layer or by a geotextile.

Aggregate Layer

- The aggregate layer must be strong enough to provide a stable working platform for constructing the permeable base.
- The gradation of this layer must be carefully selected to prevent fines from pumping up from the subgrade into the permeable base.
- The aggregate layer must have a low permeability to deflect infiltrated water over to the edge drain.
- The FHWA recommends the percent of fines passing the No. 200 sieve should not exceed 12 percent and the coefficient of uniformity should be greater the 20 (preferably greater the 40.)
- A minimum thickness of 4 inches is recommended for the aggregate separator layer.

Geotextile

- In subgrades with a high percentage of fines, a geotextile might be a preferred choice.
- The geotextile must have enough strength to survive the construction phase.
- The principal advantage of a geotextile is its filtration capability. A geotextile will allow any rising water, due to capillary action or a rising water table, to enter the permeable base and rapidly drain to the edge drain system.
- The main disadvantage is if the geotextile becomes clogged, rising water will be trapped under the geotextile, saturating the subgrade and reducing subgrade support.
- Pore openings should be sized to retain larger soil particles and pass smaller soil particles. Large numbers of openings should be provided in case there is some clogging.
- The geotextile should have a permeability several times greater than the subgrade so that any vertical draining water will not be unduly impeded by the geotextile.
- The geotextile should be specified based on performance rather than type (woven or non-woven).

- Geotextiles are subject to degradation when exposed to sunlight for extended periods of time. To prevent this, geotextiles should be placed and covered as quickly as possible.

LONGITUDINAL EDGE DRAIN NOTES

General

- For crowned pavement, edge drains are installed along both the inner and outer pavement edge. For uncrowned sections, only one edge drain is installed at the low side.

- For the longitudinal edge drain pipe, most agencies use 6-inch diameter flexible corrugated polyethylene tubing (perforated and meeting AASHTO M252.) Rigid PVC pipe (slotted, AASHTO M278-PC50) has also been used but is more expensive. If the pipe is to be installed in trenches that are to be backfilled with asphalt-stabilized permeable material, the pipe must be capable of withstanding the temperature.

- The trench backfill material should be of the same material as the permeable base course to ensure adequate capacity.

- The preferred location for the edge drain is 2 or 3 feet outside the curb to avoid settlement problems or crushing the collector pipe beneath construction equipment. Sometimes, the permeable base is extended under the shoulder with the edge drain placed at the outside shoulder edge.

- The suggested minimum pipe size is 4 inches and the minimum slope should be 0.0035 ft/ft.

- Depending on the pipe size, the trench width should be between 8 and 10 inches. The trench should be deep enough to allow the top of the pipe to be located 2 inches below the bottom of the permeable base.

- The edge drain trench should be lined with a geotextile, but the top of the trench adjacent to the permeable base is left open to allow a direct path for the water into the edge drain pipe.

- The ability to flush or jet rod the system is important in the maintenance scheme. The edge drain and outlet pipes must have proper bends (2 to 3-feet radii) and vents to facilitate this operation.

- Videotaping the completed edge drain with flexible fiber optic equipment is suggested for final acceptance of the project.

Lateral Pipes

- Lateral outlet pipes are rigid PVC or metal. Rigid pipe provides more protection against crushing due to construction operations.

- The Federal Highway Administration recommends a maximum outlet spacing of 250 feet to ensure rapid drainage. The pipes should be placed on a 3 percent grade with the outlet at least 6 inches above the 10-year design flow in the ditch or storm sewer.

- Pipe outlets into open ditches are usually protected by concrete headwalls and are equipped with rodent screens.

Construction

- Edge drains may be installed before or after construction of the permeable base and concrete surface. This will affect the edge drain location and geotextile placement.

- Pre-pavement installation of the edge drain may be necessary in some urban situations, but in general, the option should be given to the contractor.

- Post-pavement installation has several advantages: less threat of pipe damage and trench cave-ins due to construction traffic, less susceptibility to bad weather delays, and better line and grade because these are taken off the previously constructed concrete pavements.

Maintenance

- Flushing and rodding of the edge drain system should be done on a routine schedule.

- Edge drain outlets and pipe systems should be inspected at least once a year using flexible fiber optic video equipment to determine their condition.

- If regular maintenance is not done, the pavement section will become flooded, increasing the rate of pavement damage.

DESIGN NOTES

- When rainfall events occur that are greater than the design storm, the permeable base will fill with water and excess water will simply run off on the pavement surface. After the storm event, the permeable base will drain as designed.

- A time to drain 50 percent of the drainable water of 1 hour is recommended for the highest class roads with the greatest amount of traffic. For most other highways and freeways, a time to drain 50 percent of the drainable water of 2 hours is recommended.

- Construction traffic on the completed base course is the single most important parameter in the selection of the type of permeable base to be used.

CONSTRUCTION NOTES

- Central plant mixing of permeable cement-treated base course is essentially the same as that for conventional concrete.

- The City may want to construct a test strip of the base course to determine which curing method to employ as well as which method of compaction should be used. Requirements for moist curing should be investigated to see if they might be eliminated without substantial loss of performance under actual job conditions.

- The FHWA recommends that a control strip be constructed at the beginning of construction so that the combination of aggregate materials and construction practices be tested, and if necessary, adjusted to produce a stable permeable base with adequate drainage characteristics. A minimum length of 500 feet is recommended, and this section can become part of the finished roadway if found to be acceptable.

J:\WPDOCS\PROJECTS\ADDISON\00-238\DESIGNMEMO.CTPB

Facsimile Transmittal

Date: 5/21/01

Fax To: Steve Chutchian/Jerry Holder

Of: Addison

Fax#

Ref: Midway Road

\# of Pages (including this sheet): 14

From: **GBW Engineers, Inc.**
1919 S. Shiloh Rd.
Suite 530, L.B. 27
Garland, Texas 75042
Tel. (972) 840-1916
Fax (972) 840-2156

Fax From: Bruce Grantham

Comments: I will bring the attachments to our Tuesday meeting. Regards Bruce

Mike, Jim - For your Review! 5/7/0
SZC

GBW Engineers, Inc.

MEMO

1919 S. Shiloh Rd., Suite 530, LB 27, Garland, TX 75042

Date: May 7, 2001

To: Steve Chutchian, P.E.
cc: Jerry Holder, P.E. (HNTB)

From: Bruce Grantham

Re: Ductbank

This memo provides a summary to a meeting I recently had with Catherine Lisenbee, Utility Franchise Coordinator for the City of Irving, and Mike Lisenbee, Construction Manager for Future Telecom Inc.

- Irving has adopted Ordinance No. 7533 (attached) which governs right-of-way construction.
- Ms. Lisenbee communicates the ordinance requirements with all franchise utility companies that plan to install utilities within the City's right-of-way.
- Irving investigated the viability of the City installing ductbanks with street construction projects but rejected this notion for the following reasons:
  - After reviewing House Bill 1777, the City attorney ruled that Irving would assume liability for future maintenance of the ductbank and for potential damages if fiber service were disrupted due to problems with the ductbank.
  - HB 1777 does not allow the ductbank owner to profit from the sale or lease of ducts.
- HB 1777 no longer allows cities to collect permit fees for reviewing and processing requests from franchise utility companies to install ducts within their right-of-ways.
- Irving is currently having discussions with two companies that install and sell ducts to determine their interest in installing ductbanks in conjunction with future City street projects.

Another approach Irving is considering involves contacting all known utility companies that operate in the region and informing them that no future franchise utility construction will be allowed in a right-of-way after the street is constructed; consequently, sufficient ducts must be installed by and for these utility companies prior to construction. The downside of this approach is that new utility companies may enter the region in the future and require service along the right-of-way.

According to Ms. Lisenbee, many businesses today require that comprehensive fiber facilities be available in the right-of-way near their buildings. The availability of these facilities assists in the economic development of commercial sectors of the City like Las Colinas.

Mr. and Ms. Lisenbee recommended that any ductbank installation be designed by a qualified firm that is currently working in the industry and knows the requirements of the fiber companies such as:

- Manholes are typically spaced 800' to 1,000' apart unless a Central Bell Office is located along the corridor, in which case more manholes are required. Three or four manholes are typically installed at each location so that the ducts can be separated and routed through different manholes.
- For security purposes, the fiber companies prefer to have their own 3' x 5' x 4' (deep) manholes installed and reserved for the use of one company; however, larger 8' x 6' x 4' (deep) manholes are used on ductbanks where the future users are not known and the manholes will need to be shared. These larger manholes will have security partitions installed inside the manhole and, whenever a utility needs to access the manholes, all the utilities with services in that manhole are called so that their inspectors can be onsite when the manhole is accessed.
- Service laterals are typically installed from the ductbank to the back of curb at the manhole locations.
- The type of duct used in ductbanks can vary; a form of ribbed PVC pipe is typically used for fiber.
- The size of ducts used for fiber has increase from 1.25" to 1.5" diameter recently.
- Mr. and Ms. Lisenbee suggested that 12 - 6" ducts would be a good choice for a ductbank where the future users are unknown. A 6" duct would allow for several smaller 1.5" fiber ducts inside in addition to providing a larger duct for other types of cable such as telephone or electric.
- Ms. Lisenbee supported Addison's proposal to have a ductbank installed prior to street construction.

Fort Worth also has also taken a progressive approach to franchise utility management within its right-of-ways. Mr. Mitch Montgomery at (817) 998-0937 is the utility coordinator. Ms. Lisenbee and Mr. Montgomery are members of a Right-of-Way Management committee which meets every second Thursday at 2 p.m. in Irving's City Hall. This committee is open to City representatives who have questions regarding the issues summarized in this memo.

Bm

DUCT BANK ISSUE!

Catherine Lisenbee
Utility Franchise Coordinator

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MIKE LISENBEE
CONSTRUCTION MANAGER

P.O. BOX 852728
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ORDINANCE NO. 7533

AN ORDINANCE AMENDING CHAPTER 34A OF THE CODE OF CIVIL AND CRIMINAL ORDINANCES OF THE CITY OF IRVING, TEXAS, BY ADDING SECTIONS PROVIDING FOR RIGHT-OF-WAY CONSTRUCTION; PROVIDING FOR REGISTRATION AND CONSTRUCTION PERMITS; PROVIDING FOR CONSTRUCTION STANDARDS, PROVIDING FOR "PLANS OF RECORD" PLANS; PROVIDING FOR CONFORMANCE WITH PUBLIC IMPROVEMENTS; PROVIDING FOR IMPROPERLY INSTALLED FACILITIES; PROVIDING FOR TYPE OF FACILITIES; PROVIDING FOR RESTORATION OF PROPERTY; PROVIDING FOR REVOCATION OR DENIAL OF PERMIT AND PROVIDING A SEVERABILITY CLAUSE.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF IRVING, TEXAS:

SECTION 1. That Chapter 34A the Code of Civil and Criminal Ordinances of the City of Irving, Texas, is amended by amending Section 34A-7 and Section 34A-8 and adding Section 34A-9 through Section 34A-16 to read as follows:

Sec. 34A-7. Right-of-way construction.

No person shall commence or continue with the construction, installation or operation of facilities within the right-of-way in the city except as provided by the ordinances of the city and the directives of the public works department. All construction activity in city right-of-way will be in accordance with this chapter.

Sec. 34A-8. Registration and Construction Permits

(a) *Registration.* In order to protect the public health, safety and welfare, all users of the right-of-way will register with the City of Irving. Registration and permits will be issued in the name of the person who will own the facilities. Registration must be renewed every five (5) years. For utilities with a current franchise or license, the franchise or license will be evidence of renewal. If a registration is not renewed and subject to sixty (60) day notification to the owner, the facilities of the user will be deemed to have been abandoned. When any information provided for the registration changes, the user will inform the City of Irving of the change no more than thirty (30) days after the date the change is made. Registration shall include:

(1) The name of the user of the right-of-way;

(2) The name, address and telephone number of people who will be contact person(s) for the user;

(3) The name, address and telephone number of any contractor or subcontractor, if known, who will be working in the right-of-way on behalf of the user;

(4) The name(s) and telephone number of an emergency contact who shall be available twenty-four (24) hours a day;

(5) Proof of insurance and bonds;

a. An applicant must provide acceptable proof of liability insurance in the total amount of six million dollars ($6,000,000); one million dollars ($1,000,000.00) primary plus five million dollars ($5,000,000.00) umbrella if requested by the owner of the facilities, or other provisions as acceptable to the director of financial services or his/her designee.

b. The coverage must be on an "occurrence" basis and must include coverage for personal injury, contractual liability, premises liability, medical damages, underground, explosion and collapse hazards.

c. Each policy must include a cancellation provision in which the insurance company is required to notify the city in writing not fewer than thirty (30) days before canceling, failing to renew, or reducing policy limits.

d. The applicant shall file the required original certificate of insurance prior to any commencement of work. The certificate shall state the policy number; name of the insurance company; name and address of the agent or authorized representative of the insurance company; name, address and telephone number of insured; policy expiration date; and specific coverage amounts.

e. Applicant shall file an annual surety bond which will be valid each year construction will occur through one (1) full year after the completion of the construction from a surety company authorized to do business in the State of Texas in the amount of the estimated amount of the cost to restore the right-of-way for the work anticipated to be done in that year, in the event the applicant leaves a job site in the right-of-way unfinished, incomplete or unsafe or other provisions as acceptable to the director of financial services or his/her designee.

f. The above requirements may be met by utilities with a current franchise or license if their current franchise or license adequately provides for insurance or bonds or provides an indemnity in favor of the city.

(b) *Construction permits.*

(1) No person shall perform any construction or installation of facilities in the right-of-way without first obtaining a construction permit, except as provided herein. The permit will be in the name of the person who will own the facilities to be constructed. The permit must be completed and signed by a representative of the owner of the facilities to be constructed.

a. Emergency responses related to existing facilities may be undertaken without first obtaining a permit; however the public works department should be notified in writing within two (2) business days of any construction related to an emergency response; including a reasonably detailed description of the work performed in the right-of-way and an updated map of any facilities that were relocated, if applicable.

b. The phrase "construction or installation of facilities" does not include the installation of facilities necessary to initiate service to a customer's property, or repair or maintenance of existing facilities unless such repair or maintenance requires the breaking of pavement; the closure of a nonresidential traffic lane; excavation or boring.

(2) The permit shall state to whom it is issued, location of work, location of facilities, dates and times work is to take place and any other conditions set out by the director of public works or his/her designee.

(3) The person requesting a permit will provide the director of public works or his/her designee with documentation in the format specified by the public works department describing:

a. The proposed, approximate location and route of all facilities to be constructed or installed and the applicant's plan for right-of-way construction.

b. Engineering plans which will be on a scale of one (1) inch equals fifty (50) feet unless otherwise approved by public works department.

c. Detail of the location of all right-of-way and utility easements which applicant plans to use.

d. Detail of all existing city utilities in relationship to applicant's proposed route.

e. Detail of what applicant proposes to install, such as pipe size, number of interducts, valves, etc.

f. Detail of plans to remove and replace asphalt or concrete in streets (include City of Irving standard construction details).

g. Drawings of any bores, trenches, handholes, manholes, switch gear, transformers, pedestals, etc. including depth located in public right-of-way.

h. Handhole and/or manhole typicals of type of manholes and/or handholes applicant plans to use or access.

i. Complete legend of drawings submitted by applicant.

j. Five (5) sets of engineering plans must be submitted with permit application.

k. The name, address and phone numbers of the contractor or subcontractor who will perform the actual construction, including the name and telephone number of an individual with the contractor who will be available at all times during construction. Such information shall be required prior to the commencement of any work.

l. The construction and installation methods to be employed for the protection of existing structures, fixtures, and facilities within or adjacent to the right-of-way, and the dates and times work will occur, all of which (methods, dates, times, etc.) are subject to approval of the director of public works or his/her designee.

m. A statement that the requirements of 34A-8 (a) (5) are met.

(4) All construction and installation in the right-of-way shall be in accordance with the permit for the facilities. The director of public works or his/her designee shall be provided access to the work and to such further information as he or she may reasonable require to ensure compliance with the permit.

(5) A copy of the construction permit and approved engineering plans shall be maintained at the construction site and made available for inspection by the director of public works or his/her designee at all times when construction or installation work is occurring.

(6) All construction or installation work authorized by permit must be completed in the time specified in the construction permit. If the work cannot be completed in the specified time periods, the permittee may request an extension from the director of public works or his/her designee. The director of public works or his/her designee will use his/her best efforts to approve or disapprove a request for permit as soon as possible.

(7) A copy of any permit or approval issued by federal or state authorities for work in federal or state right-of-way located in the City of Irving, if requested by the public works department.

(8) A request for a permit must be submitted at least ten (10) working days before the proposed commencement of work in the request, unless waived by the director of public works or his/her designee.

(9) Requests for permits will be approved or disapproved by the director of public works or his/her designee within a reasonable time or receiving all the necessary information. The director of public works or his/her designee will use his/her best efforts to approve or disapprove a request for permit as soon as possible.

(10) The public works department or the applicant can request a pre-construction meeting with the permittee and their construction contractor.

(11) Permit applications are required for construction on new, replacement or upgrading of the company's facilities in the right-of-way either aerial or underground.

Sec. 34A-9. Construction standards.

(a) Department of public works must be notified twenty-four (24) hours in advance that construction is ready to proceed by either the right-of-way user, their contractor or representative. At the time of notification, the right-of-way user will inform the public works department of the number (or other information) assigned from the one-call system.

(b) All construction shall be in conformance with all city codes and applicable local, state and federal laws.

(c) Three by three (3 x 3) feet information signs stating the identity of the person doing the work, telephone number and permittee's identity and telephone number shall be placed at the location where construction is to occur forty-eight (48) hours prior to the beginning of work in the right-of-way and shall continue to be posted at the location during the entire time the work is occurring. An informational sign will be posted on public right-of-way one hundred (100) feet before the construction location commences and each one hundred (100) feet thereafter, unless other posting arrangements are approved or required by the public works director.

(d) Erosion control measures (e.g. silt fence) and advance warning signs, markers, cones and barricades must be in place before work begins.

(e) Lane closures on major thoroughfares will be limited after 8:30 a.m. and before 4:00 p.m. unless the public works department grants prior approval. Arrow boards will be required on lane closures, with all barricades, advanced warning signs and thirty-six (36) inch reflector cones placed according to the specifications of the public works department.

(f) Permittees are responsible for the workmanship and any damages by a contractors or subcontractors. A responsible representative of the permittee will be available to public works at all times during construction.

(g) Permittee shall be responsible for storm water management erosion control that complies with city, state and federal guidelines. Requirements shall include, but not be limited to, silt fencing around any excavation that will be left overnight, silt fencing in erosion areas until reasonable vegetation is established, barricade fencing around open holes, and high erosion areas will require wire backed silt fencing. Upon request permittee may be required to furnish documentation submitted or received from federal or state government.

(h) Permittee or contractor or subcontractor will notify the public works department immediately of any damage to other utilities, either city or privately owned.

(i) It is the city's policy not to cut streets or sidewalks; however, when a street or sidewalk cut is required, prior approval must be obtained by the public works department and all requirements of the public works department shall be followed. Repair of all street and sidewalk removals must be made promptly to avoid safety hazards to vehicle and pedestrian traffic.

(j) Installation of facilities must not interfere with city utilities, in particular gravity dependent facilities.

(k) New facilities must be installed to a depth approved by the public works department.

(l) All directional boring shall have locator place bore marks and depths while bore is in progress. Locator shall place mark at each stem with paint dot and depth at least every other stem.

(m) The working hours in the right-of-ways are 7:00 a.m. to 6:00 p.m., Monday through Friday. Work that needs to be performed after 6:00 p.m. Monday through Friday must be approved in advance. Any work performed on Saturday must be approved twenty-four (24) hours in advance by the public works department. Directional boring is permitted only Monday through Friday 7:00 a.m. to 6:00 p.m., unless approved in advance. No work will be done, except for emergencies, on city holidays.

(n) People working in the right-of-way are responsible for obtaining line locates from all affected utilities or others with facilities in the right-of-way prior to any excavation. Use of the Geographic Information System or the plans of records does not satisfy this requirement.

(o) Permittee will be responsible for verifying the location, both horizontal and vertical, of all facilities. When required by public works, permittee shall verify locations by pot holing, hand digging or other method approved by the public works department prior to any excavation or boring with the exception of work involving lane closures, as discussed above.

(p) Placement of all manholes and/or hand holes must be approved in advance by public works department. Handholes or manholes will not be located in sidewalks, unless approved by the public works director.

(q) Locate flags shall not be removed from a location while facilities are being constructed.

(r) Construction which requires pumping of water or mud shall be contained in accordance with City of Irving ordinances and federal and state law and the directives of the public works department.

Sec. 34A-10. "Plans of record" plans.

(a) Right-of-way users will provide the public works director or his/her designee with "plans of record" within ninety (90) days of completion of facilities in the right-of-way. Users which have facilities in the right-of-way existing as of the date of this ordinance who have not provided "plans of record" plans shall provide one (1) quarter of the information concerning facilities in city right-of-way within one (1) year after the passage of the ordinance and one (1) quarter each six (6) months thereafter. The plans shall be provided to the city with as much detail and accuracy as required by the public works director. All the requirements specified for the plans submitted for the initial permit, as set forth in Section 34A-8, shall be submitted and updated in the plans of record. The detail and accuracy will concern issues such as location, size of facilities, materials used, and any other health, safety and welfare concerns. The detail will not include matters such as capacity of lines, customers, or competitively sensitive details. Submittal of "plans of record" shall be in digital format.

(b) This requirement, or portions of this requirement, may be waived by the director of information services and the director of public works for good cause.

Sec. 34A-11. Conformance with public improvements.

Whenever by reasons of widening or straightening of streets, water or sewer line projects, or any other public works projects, (e.g. install or improve storm drains, water lines, sewer lines, etc.) it shall be deemed necessary by the governing body of the city to remove, alter, change, adapt, or conform the underground or overhead facilities of a right-of-way user to another part of the right-of-way, such alterations shall be made by the owner of the facilities at their expense (unless provided otherwise by state law or a franchise in effect on August 26, 1999 until that franchise expires or is otherwise terminated) within the time limits set by the public works director or his/her designee working in conjunction with the owner of the facilities, or if no time frame can be agreed upon, within ninety (90) days from the day the notice was sent to make the alterations, unless a different schedule has been approved by the public works director or his/her designee. Facilities not moved after ninety (90) days or within the approved schedule, as same may be extended from time to time, shall be deemed abandoned after thirty (30) days notice.

Sec. 34A-12. Improperly installed facilities.

(a) Any person doing work in the city right-of-way shall properly install, repair, upgrade and maintain facilities.

(b) Facilities shall be considered to be improperly installed, repaired, upgraded or maintained if:

(1) The installation, repairs, upgrade or maintenance endangers people;

(2) The facilities do not meet the applicable city codes;

(3) The facilities are not capable of being located using standard practices;

(4) The facilities are not located in the proper place at the time of construction in accordance with the directions provided by the public works department.

Sec. 34A-13. Restoration of property.

(a) Users of the right-of-way shall restore property affected by construction of facilities to a condition that is equal to or better than the condition of the property prior to the performance of the work. Restoration must be approved by the public works department.

(b) Restoration must be to the reasonable satisfaction of the public works department and the property owner. The restoration shall include, but not be limited to:

(1) Replacing all ground cover with the type of ground cover damaged during work or better either by sodding or seeding, as directed by public works;

(2) Installation of all manholes and handholes, as required;

(3) Backfilling all bore pits, potholes, trenches or any other holes shall be filled in daily, unless other safety requirements are approved by public works;

(4) Leveling of all trenches and backhoe lines;

(5) Restoration of excavation site to city specifications;

(6) Restoration of all landscaping, ground cover, and sprinkler systems.

(c) All locate flags shall be removed during the clean up progress by the permittee or his/her contractor at the completion of the work.

(d) Restoration must be made in a timely manner as specified by approved public works schedules and to the satisfaction of public works director or his/her designee. If restoration is not satisfactory and performed in a timely manner all work in progress, except that related to the problem, including all work previously permitted but not complete may be halted and a hold may be placed on any permits not approved until all restoration is complete.

Sec. 34A-15. Revocation or denial of permit.

If any of the provisions of this ordinance are not followed, a permit may be revoked by the public works director or designee. If a person has not followed the terms and conditions of this ordinance in work done pursuant to a prior permit, new permits may be denied or additional terms required.

Sec. 34A-16. Appeal from denial or revocation of permit.

Appeal from denial or revocation of permit or from the decision of the public works director shall be to the City Council. Appeal shall be filed with the city secretary within fifteen (15) days from the date of the decision being appealed.

SECTION 2. That the terms and provisions of this ordinance shall be deemed to be severable and that if the validity of any section, subsection, sentence, clause or phrase of this ordinance should be declared to be invalid, the same shall not affect the validity of any other section, subsection, sentence, clause or phrase of this ordinance.

SECTION 3. The fact that the present ordinances and regulations of the City of Irving, due to state legislation, have become inadequate to control right-of-way management within the corporate limits of the City of Irving, creates an emergency for the immediate preservation of the public business, property, health, safety and general welfare of the public which requires that this ordinance shall become effective from and after the date of its passage as provided by the Charter of the City of Irving.

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF IRVING, TEXAS, this 26th day of August, A.D., 1999.

Joe Putnam

JOE PUTNAM
MAYOR

CITY OF IRVING
SEAL
STATE OF TEXAS

ATTEST:

Janice Carroll

Janice Carroll, CMC
City Secretary

APPROVED AS TO FORM:

David Caylor

David Caylor
City Attorney

GBW Engineers, Inc.
1919 S. Shiloh Rd., Suite 530, LB 27, Garland, TX 75042

MEMO

Date: April 30, 2001

To: Steve Chutchian, P.E., Town of Addison
cc: Jerry Holder, P.E., HNTB

From: Bruce Grantham

Re: Ductbank along Arapaho and Midway

I spoke with Robert Cure at (504) 416-5339 recently regarding typical ductbank installation requirements. Robert's comments are summarized below:

- The ductbank which his firm designed through Addison is part of a 40 mile loop.
- This ductbank was designed to be used by three different telecommunication companies.
- Of the 20 - 1½" ducts in the ductbank, two companies own four each and the third company owns the remaining sixteen.
- The company which owns sixteen ducts has some spare for future sale or lease.
- These ducts, which were bundled together, are designed exclusively for the installation of fiber.
- It is typical for each telecommunication company to have its own manhole details; consequently, there is no industry standard for manholes.
- Manholes are typically located 700' to 1,000' apart.
- The typical minimum depth of 42"-48" to the top of the ductbank is regulated by the City having jurisdiction.
- Some companies require the use of spacers to separate the conduits although the ductbank installed through Addison did not include spacers.
- Robert initially suggested the installation of a single, larger carrier pipe, 12"-18" in diameter, rather than a ductbank, so that different duct sizes could be pulled through the carrier pipe in the future. However, he later discounted this suggestion because the telecommunication companies do not want to share manholes for security reasons. When a company constructs a manhole, it is built alongside the ductbank and only those ducts owned or leased by the company are pulled into the manhole.
- Robert is not familiar with ductbanks being installed for cable other than fiber; for example, electric cable. He suggested contacting TXU to find out what their future duct needs might be, and whether or not their cable would be compatible with fiber.

I have a lunch meeting on Tuesday, May 1 with Mike Lisenbee to obtain a contractor's input into ductbank construction. In addition, I will contact TXU this week to get their input on this matter.

Regards,

Bruce

Tel.: (972) 840-1916 / *FAX:* (972) 840-2156 / *E-mail:* Info@gbwengineers.com

GBW Engineers, Inc.

1919 S. Shiloh Rd., Suite 530, LB 27, Garland, TX 75042

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Bruce

Steve Chutchian

From: Bruce Grantham [Bgrantham@gbwengineers.com]
Sent: Monday, April 30, 2001 5:49 PM
To: schutchian@ci.addison.tx.us
Subject: ductbank

To: Steve Chutchian

From: Bruce Grantham

Re: Ductbank

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ROBIN - WHAT DO YOU THINK?
Steve

Steve - Robin #1
Jim

Steve - ask Robin for his comments.

I like alts 1 & 3.

Its a function of how much traffic we want to impede

Get Mike's comments -
Then lets get together & discuss.

Jim

Mike votes for #1

I VOTE
1

Rob

JIM - WHENEVER YOU WANT TO TALK TO MIKE, LET ME KNOW.

THE CONSENSUS APPEARS TO BE ALT. #1, & BASED ON CONSTRUCTION OF THE ENTIRE PROJECT

Steve C.

Addison!

STEVEN Z. CHUTCHIAN, P.E.
Assistant City Engineer
(972) 450-2886
(972) 450-2837 FAX
(214) 673-2518 Mobile
schutchian@ci.addison.tx.us E-mail

Town of Addison 16801 Westgrove Dr. P.O. Box 9010, Addison, Texas 75001-9010

JIM -

4/10/01

ATTACHED ARE ALTERNATIVES FOR A PROPOSED CONSTRUCTION SEQUENCE ON MIDWAY RD., AS PREPARED BY GBW/HNTB. I THINK ALTERNATIVE 1 IS THE BEST CHOICE, DUE TO OUR ABILITY TO MAINTAIN A RELATIVELY HIGH LEVEL OF TRAFFIC FLOW, WITH LEFT TURN CAPABILITIES. ALT. 2 WOULD BE CHEAPER TO CONSTRUCTION, BUT TRAFFIC WOULD BE SEVERLY HINDERED. ALT. 3 PROVIDES MORE THROUGH TRAFFIC, BUT IT WILL BE VERY EXPENSIVE TO CONSTRUCT. DO YOU CONCUR WITH ALTERNATIVE 1? THANKS!

Steve

Town of Addison
Midway Road Reconstruction
Beltline to Keller Springs
Sequence of Alternatives Construction

Alternative 1: Maintain 2 lanes of traffic each direction plus a continuous left turn lane
Provide safer turning movements

Pros

- Removes left turning vehicles from through traffic lanes
- No splits in same direction traffic
- Curb offsets in stages 1 and 2

Cons

- 10-foot lanes
- Left turns in stage 3 in very few locations
- Vertical panels in stage 3 do not provide positive protection from pavement drop off
- No curb offsets in stage 3
- Some driveways may be closed temporarily

Alternative 2: Maintain 2 lanes of traffic each direction
Maximum construction area

Pros

- Lower construction costs likely
- Shorter duration project likely
- Safer construction process due to positive protection for pavement drop offs
- No splits in same direction traffic
- Curb offsets in stages 1 and 2

Cons

- Left and right turning movements will impede through traffic
- Lower capacity than other two options (due to turns)
- 10-foot lanes
- No curb offsets in stage 3
- Good signing and sign maintenance is critical

Alternative 3: Maintain 3 lanes of traffic each direction
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- Allows for 3 lanes of traffic each direction throughout construction
- Curb offsets in stages 2, 3, 4, and 5

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- Splits same direction traffic during construction process causing safety concerns and potential to confuse motorists
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- Longer duration construction likely
- More costly construction likely

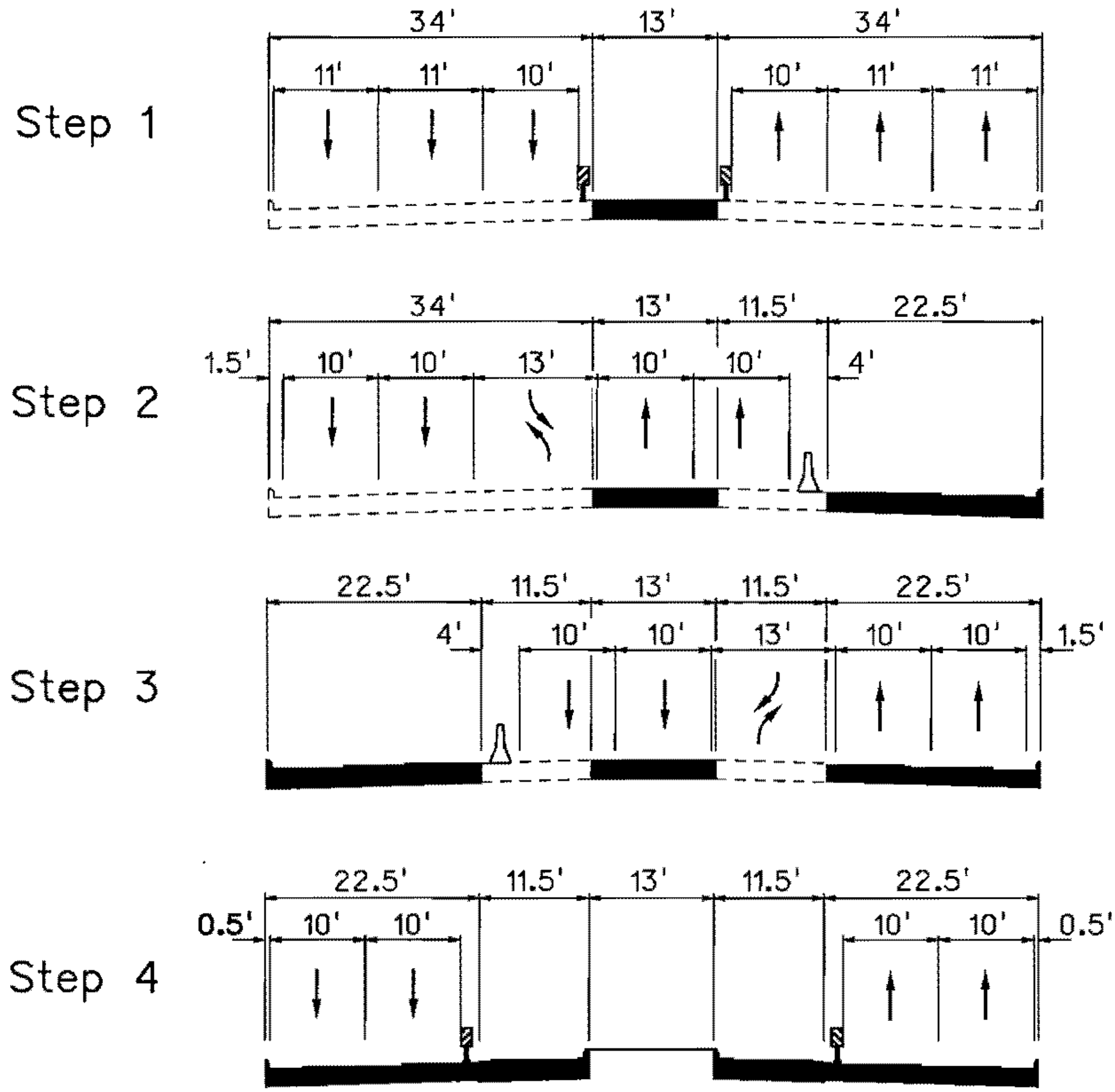
Note:
All alternatives remove center median illumination. If temporary lighting is necessary, each alternative would require special detailing for CTB-mounted lighting or permanent lighting behind curb.

TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 1



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

EXISTING PAVEMENT

TOWN OF ADDISON

HNTB

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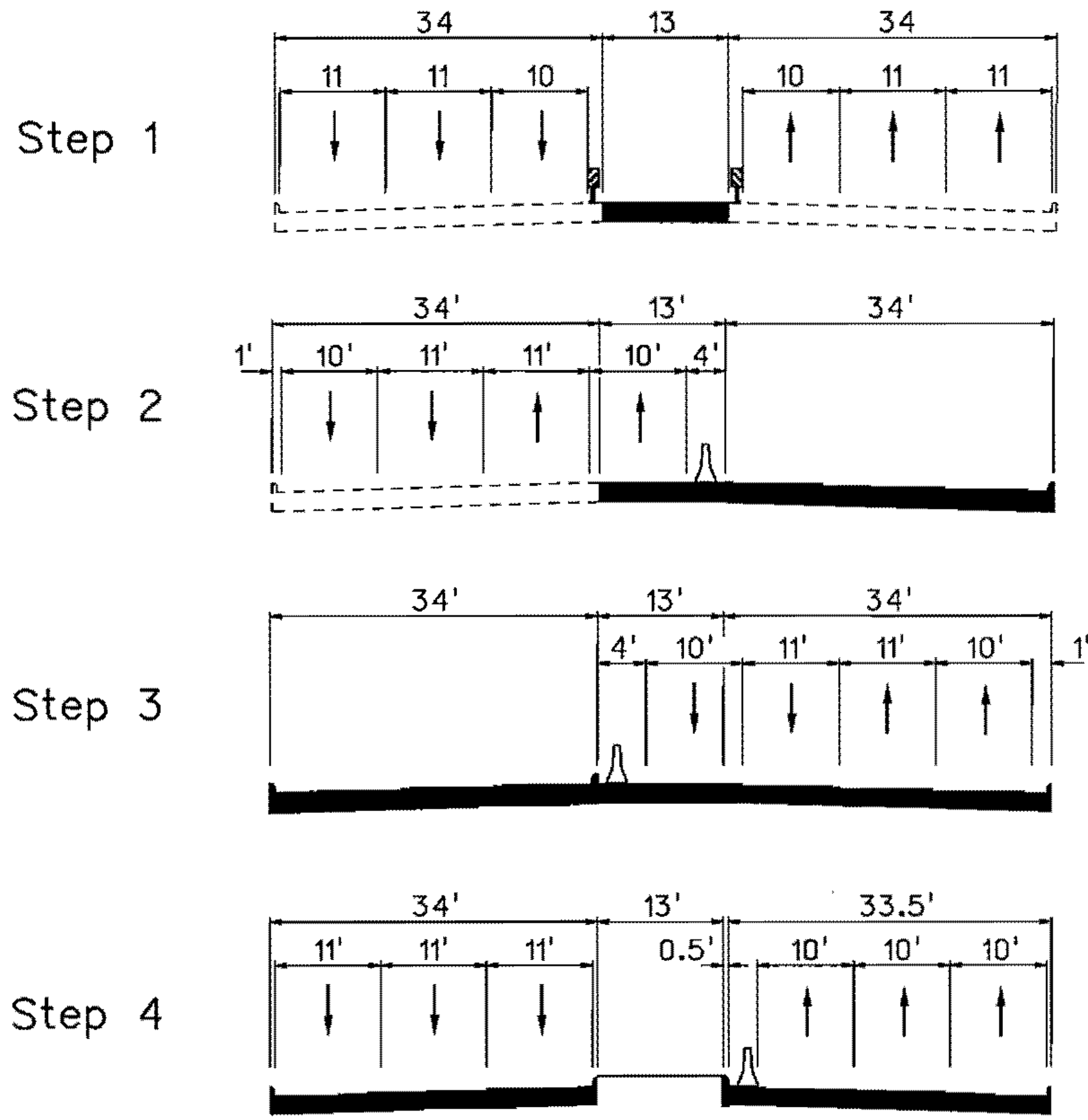
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 2



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

EXISTING PAVEMENT

TOWN OF ADDISON

HNTB

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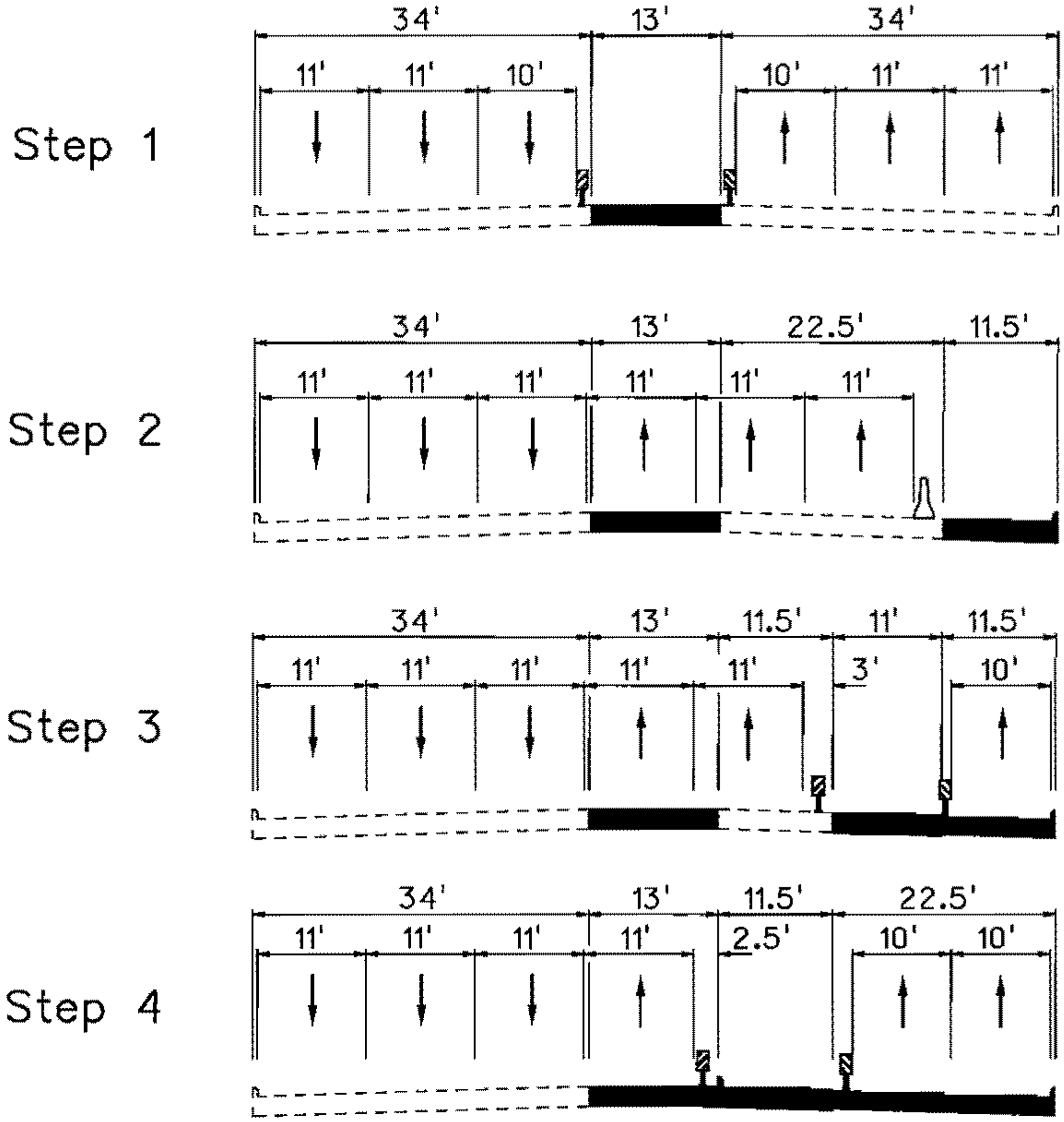
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3



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NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

- TEMPORARY ASPHALT
- PERMANENT CONSTRUCTION THIS STEP
- PERMANENT CONSTRUCTION PREVIOUS STEP
- EXISTING PAVEMENT

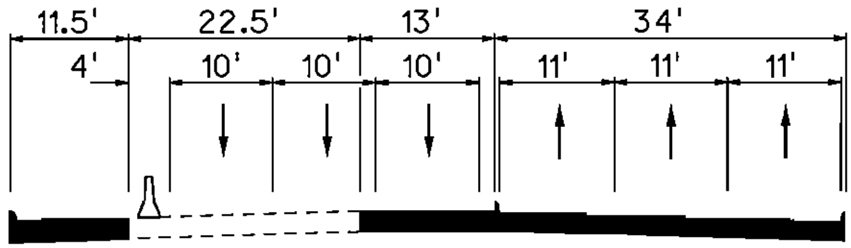
TOWN OF ADDISON

HNTB

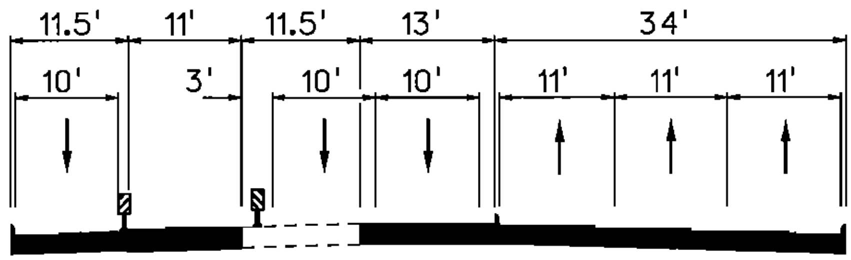
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3 (CONTINUED)

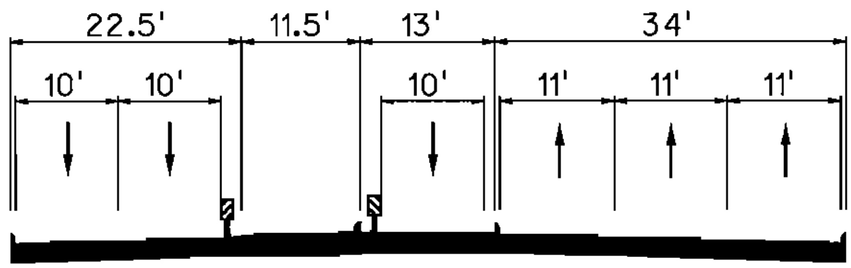
Step 5



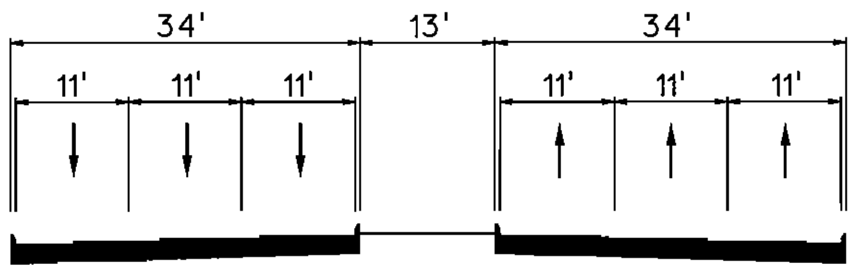
Step 6



Step 7



Step 8



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

- TEMPORARY ASPHALT
- PERMANENT CONSTRUCTION THIS STEP
- PERMANENT CONSTRUCTION PREVIOUS STEP
- EXISTING PAVEMENT

TOWN OF ADDISON

HNTB

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Town of Addison
Midway Road Reconstruction
Beltline to Keller Springs
Sequence of Alternatives Construction

<u>Alternative 1: Maintain 2 lanes of traffic each direction plus a continuous left turn lane</u>
Provide safer turning movements

Pros
- Removes left turning vehicles from through traffic lanes
- No splits in same direction traffic
- Curb offsets in stages 1 and 2

Cons
- 10-foot lanes
- Left turns in stage 3 in very few locations
- Vertical panels in stage 3 do not provide positive protection from pavement drop off
- No curb offsets in stage 3
- Some driveways may be closed temporarily

<u>Alternative 2: Maintain 2 lanes of traffic each direction</u>
Maximum construction area

Pros
- Lower construction costs likely
- Shorter duration project likely
- Safer construction process due to positive protection for pavement drop offs
- No splits in same direction traffic
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Cons
- Left and right turning movements will impede through traffic
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Pros
- Allows for 3 lanes of traffic each direction throughout construction
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Note:
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TOWN OF ADDISON

HNTB

04/10/01
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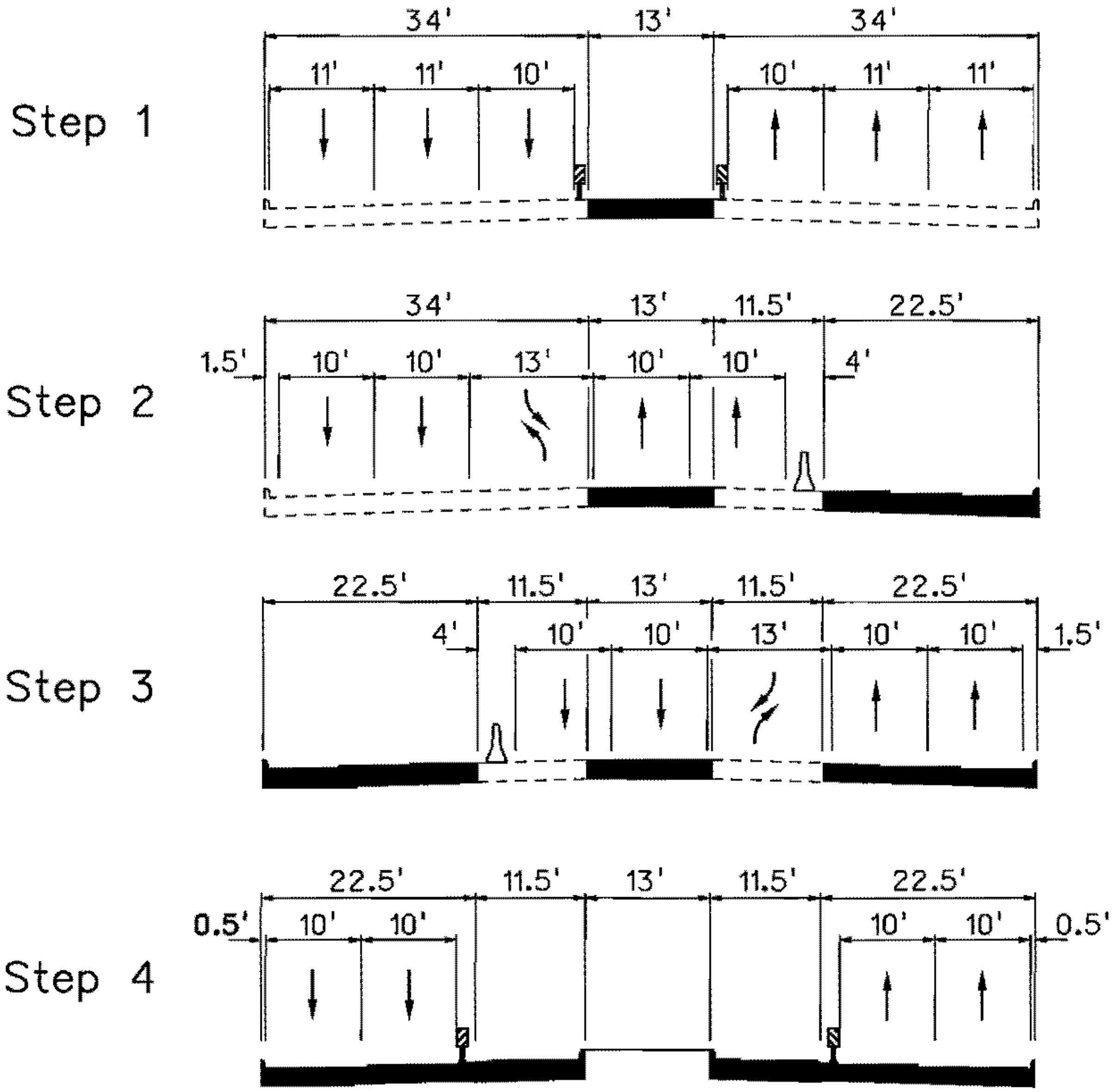
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 1



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

EXISTING PAVEMENT

TOWN OF ADDISON

HNTB

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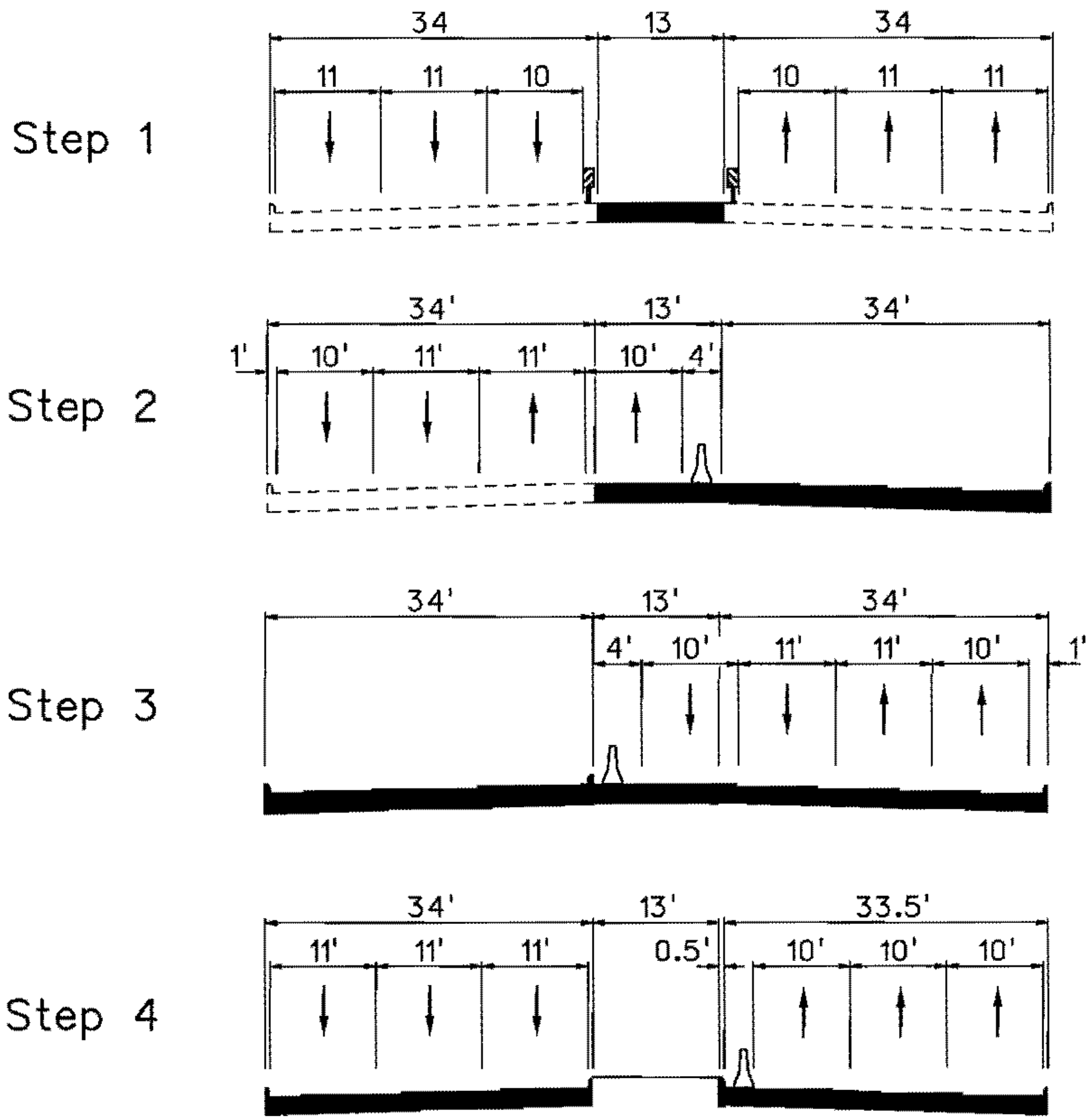
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 2



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

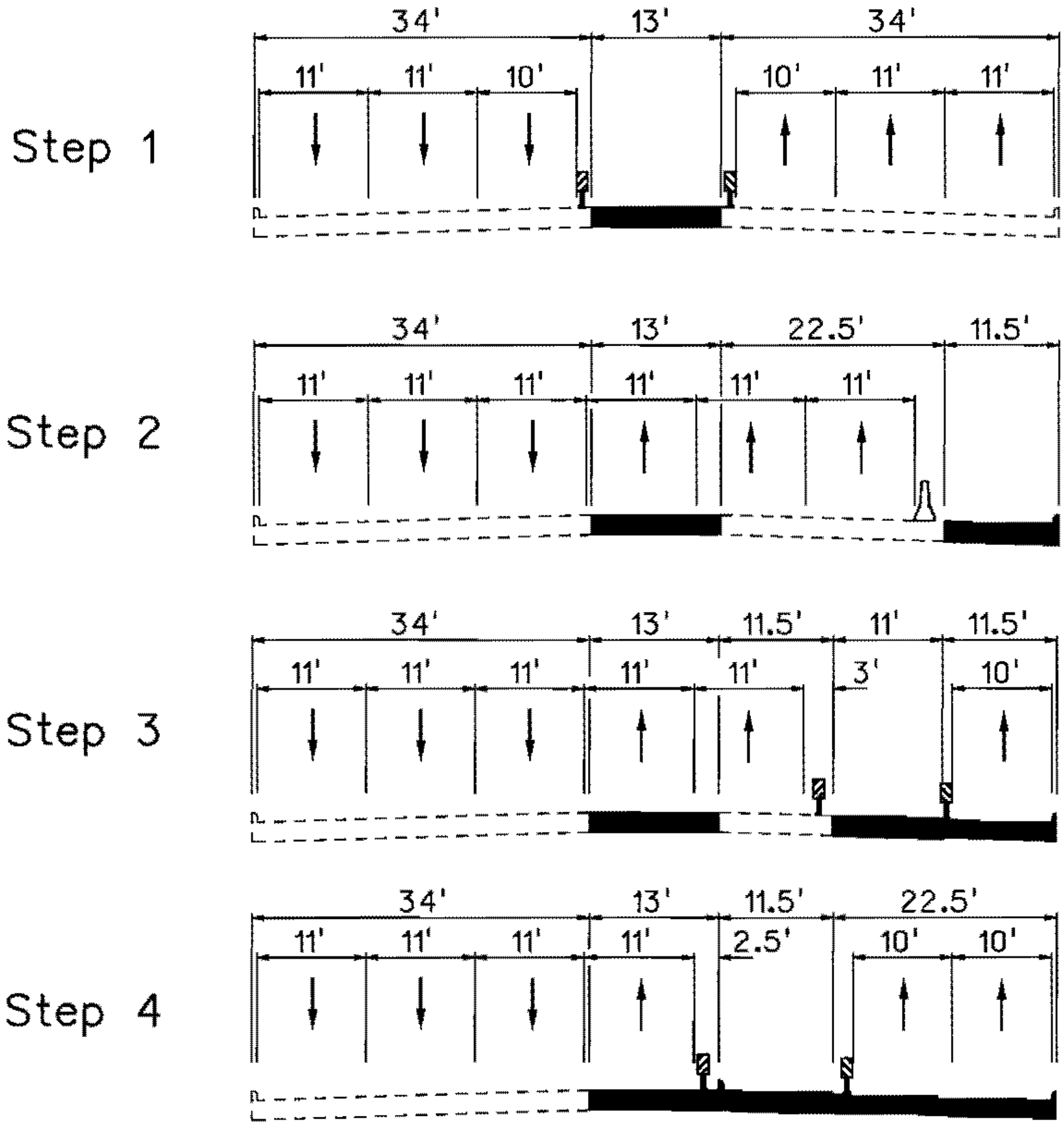
- TEMPORARY ASPHALT
- PERMANENT CONSTRUCTION THIS STEP
- PERMANENT CONSTRUCTION PREVIOUS STEP
- EXISTING PAVEMENT

TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3



(CONTINUED ON NEXT PAGE)

NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

EXISTING PAVEMENT

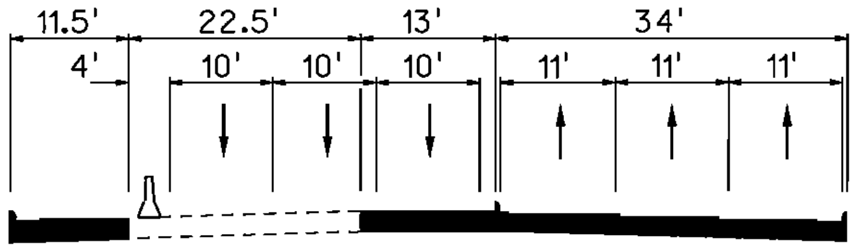
TOWN OF ADDISON

HNTB

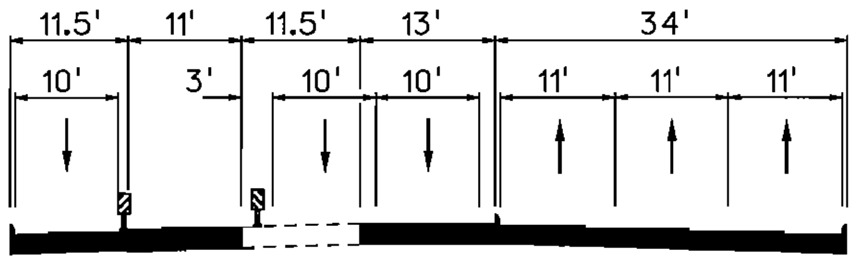
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3 (CONTINUED)

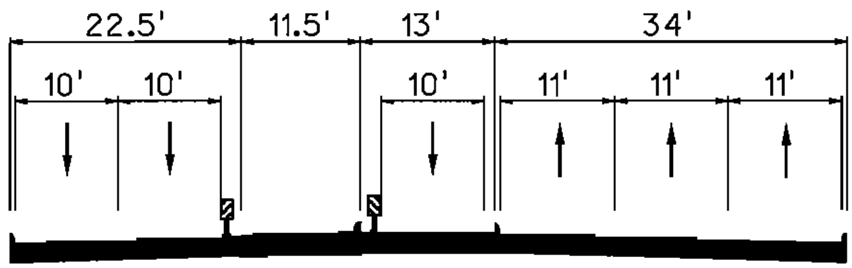
Step 5



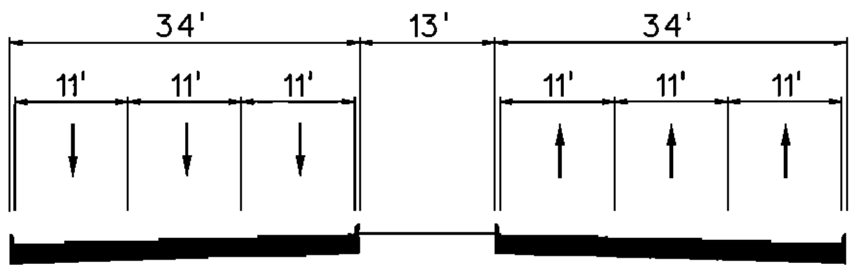
Step 6



Step 7



Step 8



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LEGEND:

- TEMPORARY ASPHALT
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TOWN OF ADDISON

HNTB

Town of Addison
Midway Road Reconstruction
Beltline to Keller Springs
Sequence of Alternatives Construction

<u>Alternative 1: Maintain 2 lanes of traffic each direction plus a continuous left turn lane</u>
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Pros

- Removes left turning vehicles from through traffic lanes
- No splits in same direction traffic
- Curb offsets in stages 1 and 2

Cons

- 10-foot lanes
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<u>Alternative 2: Maintain 2 lanes of traffic each direction</u>
Maximum construction area

Pros

- Lower construction costs likely
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- Left and right turning movements will impede through traffic
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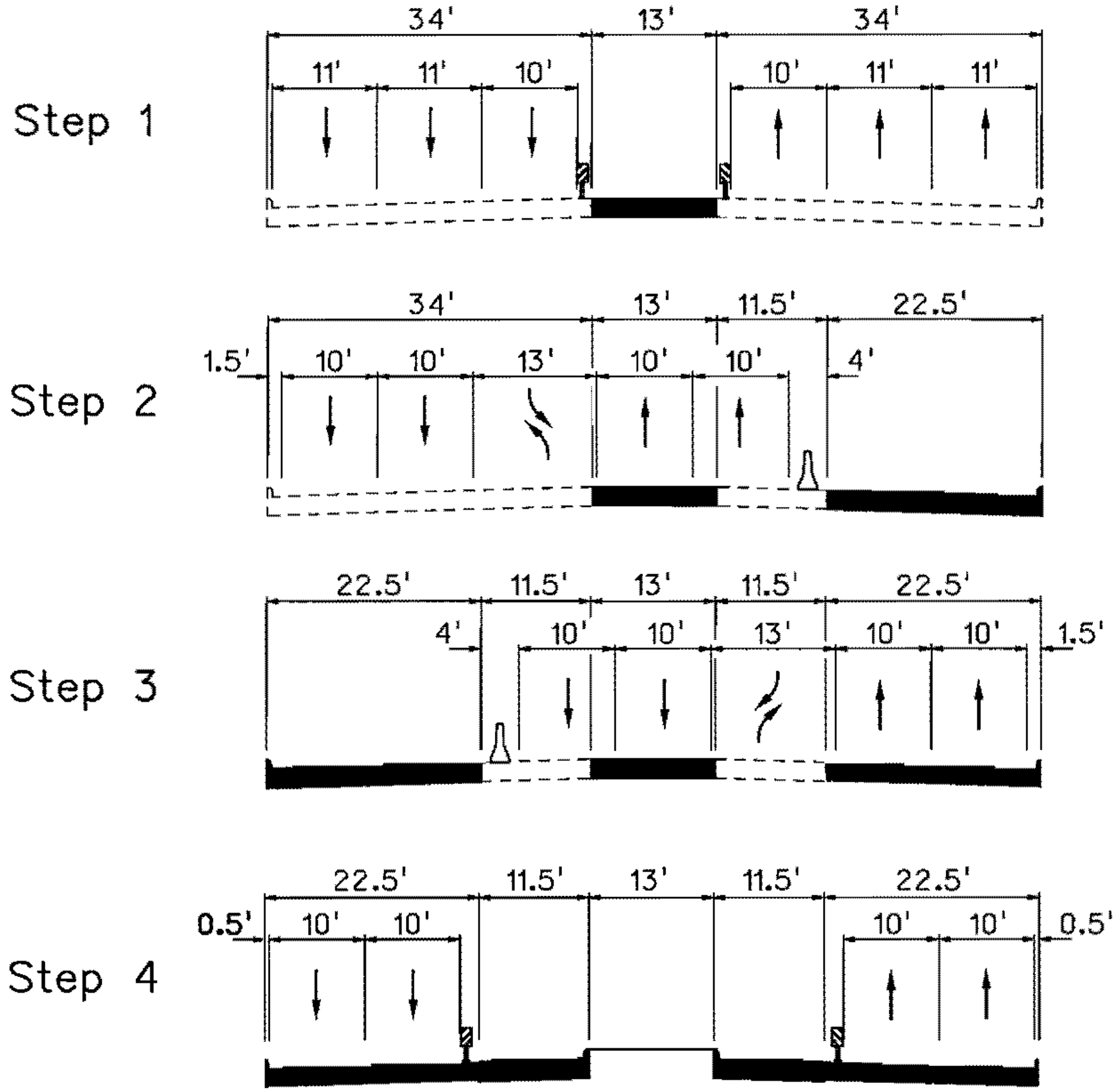
Note:
All alternatives remove center median illumination. If temporary lighting is necessary, each alternative would require special detailing for CTB-mounted lighting or permanent lighting behind curb.

TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 1



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

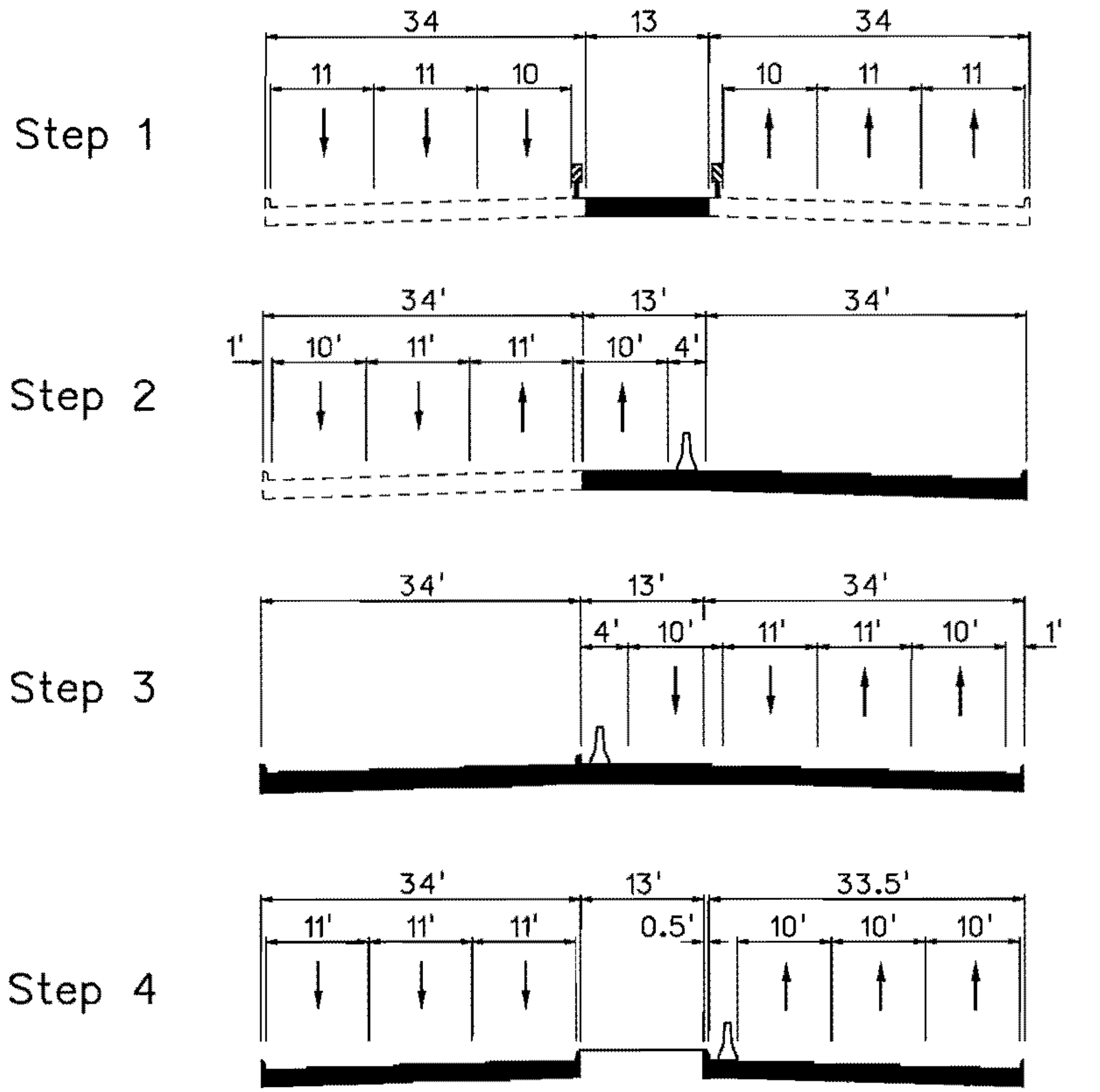
EXISTING PAVEMENT

TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 2



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TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

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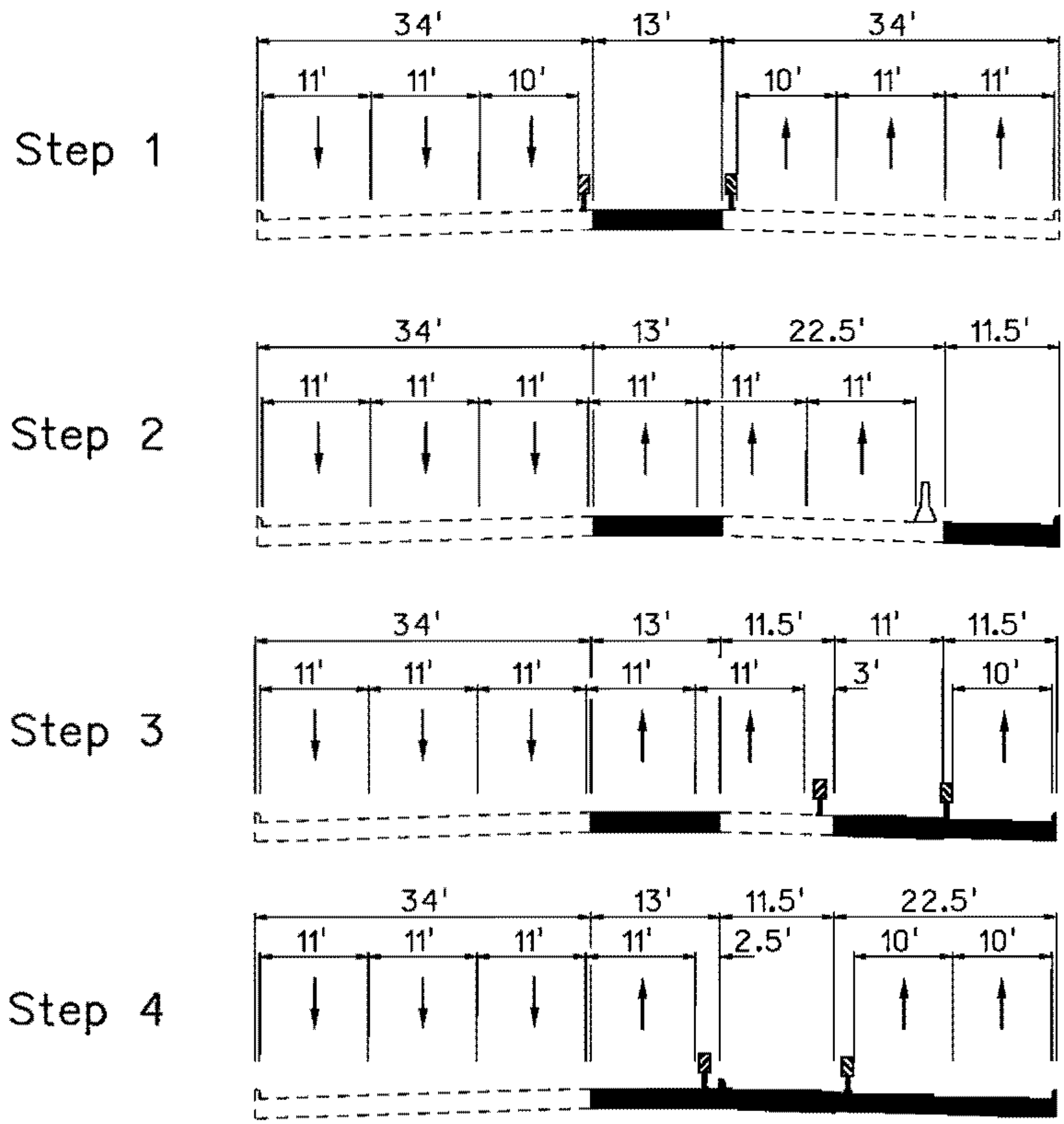
TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3



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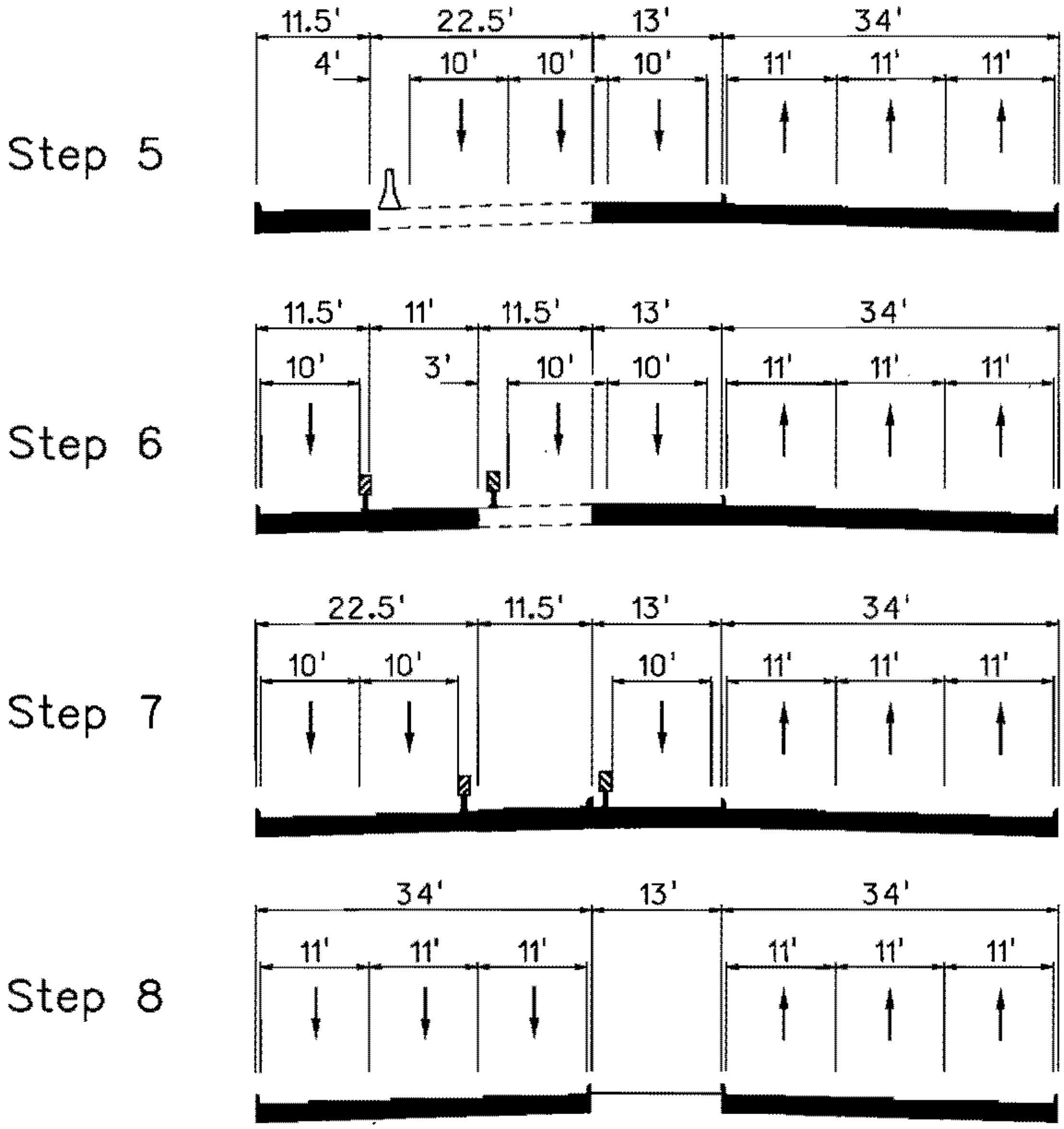
TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3 (CONTINUED)



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- PERMANENT CONSTRUCTION PREVIOUS STEP
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TOWN OF ADDISON

HNTB

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Town of Addison
Midway Road Reconstruction
Beltline to Keller Springs
Sequence of Alternatives Construction

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TOWN OF ADDISON

HNTB

04/10/01
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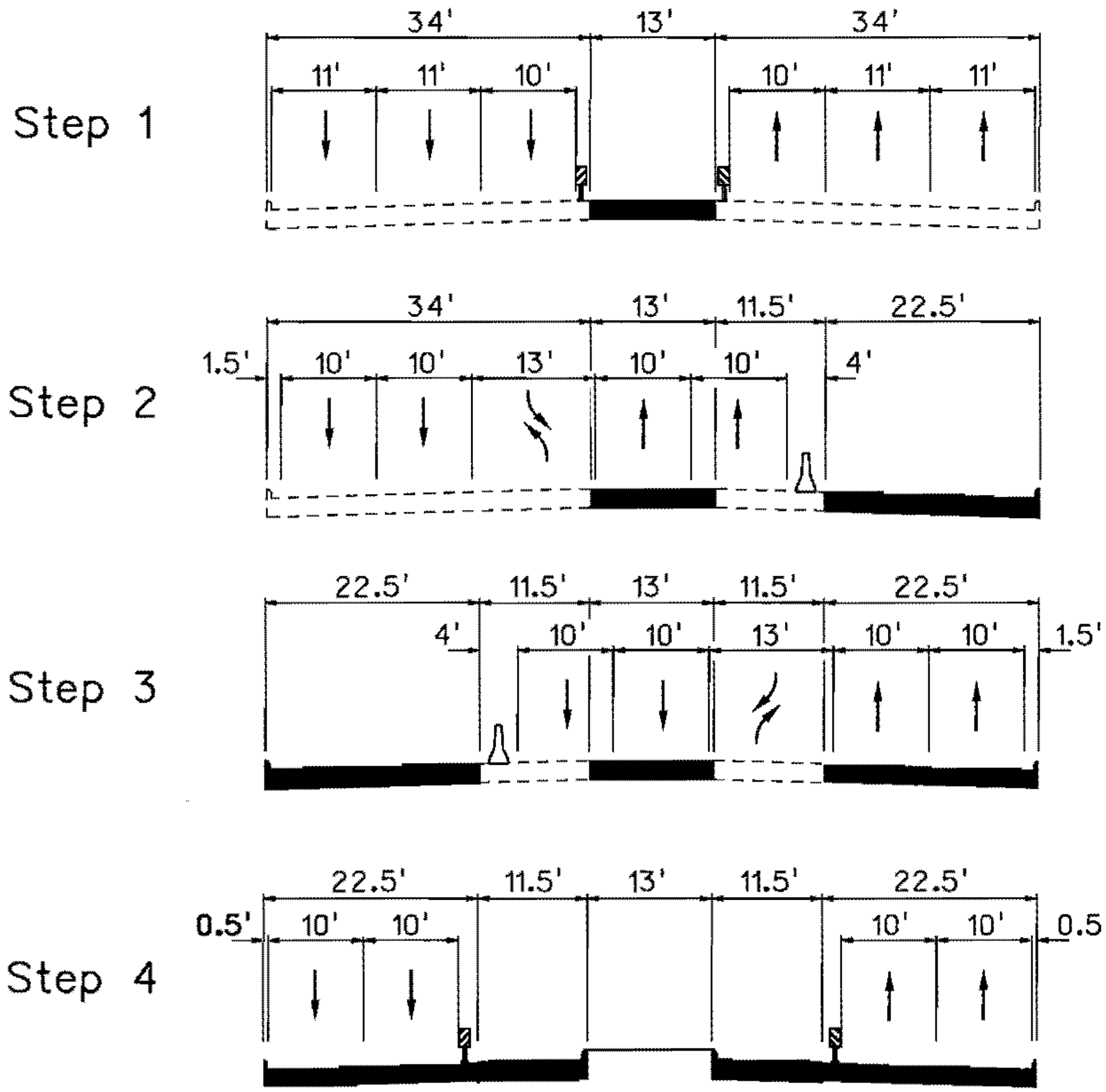
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 1



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LEGEND:

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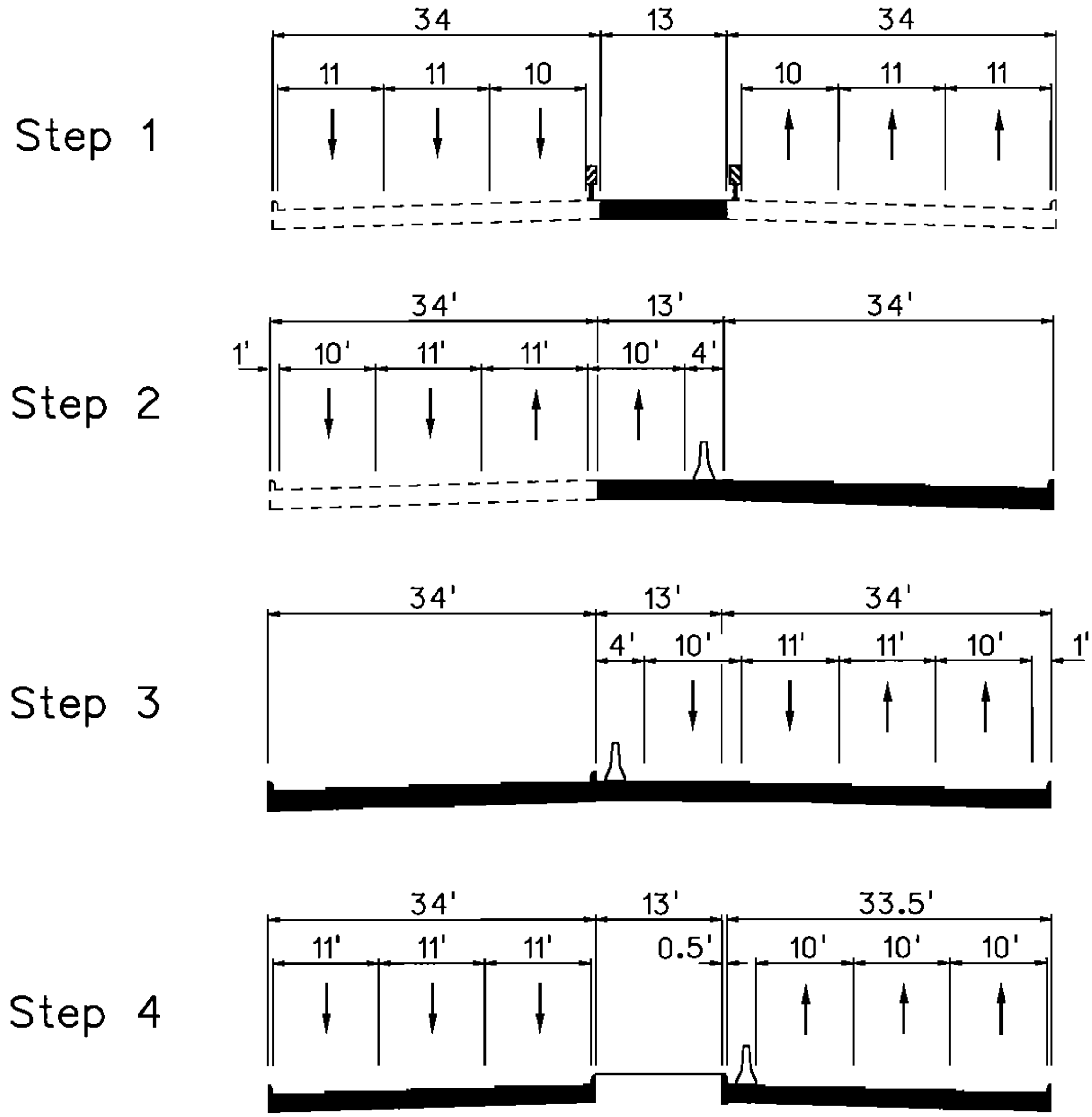
TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 2



NOTE: WIDTHS ARE TO BACK OF CURB

LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

EXISTING PAVEMENT

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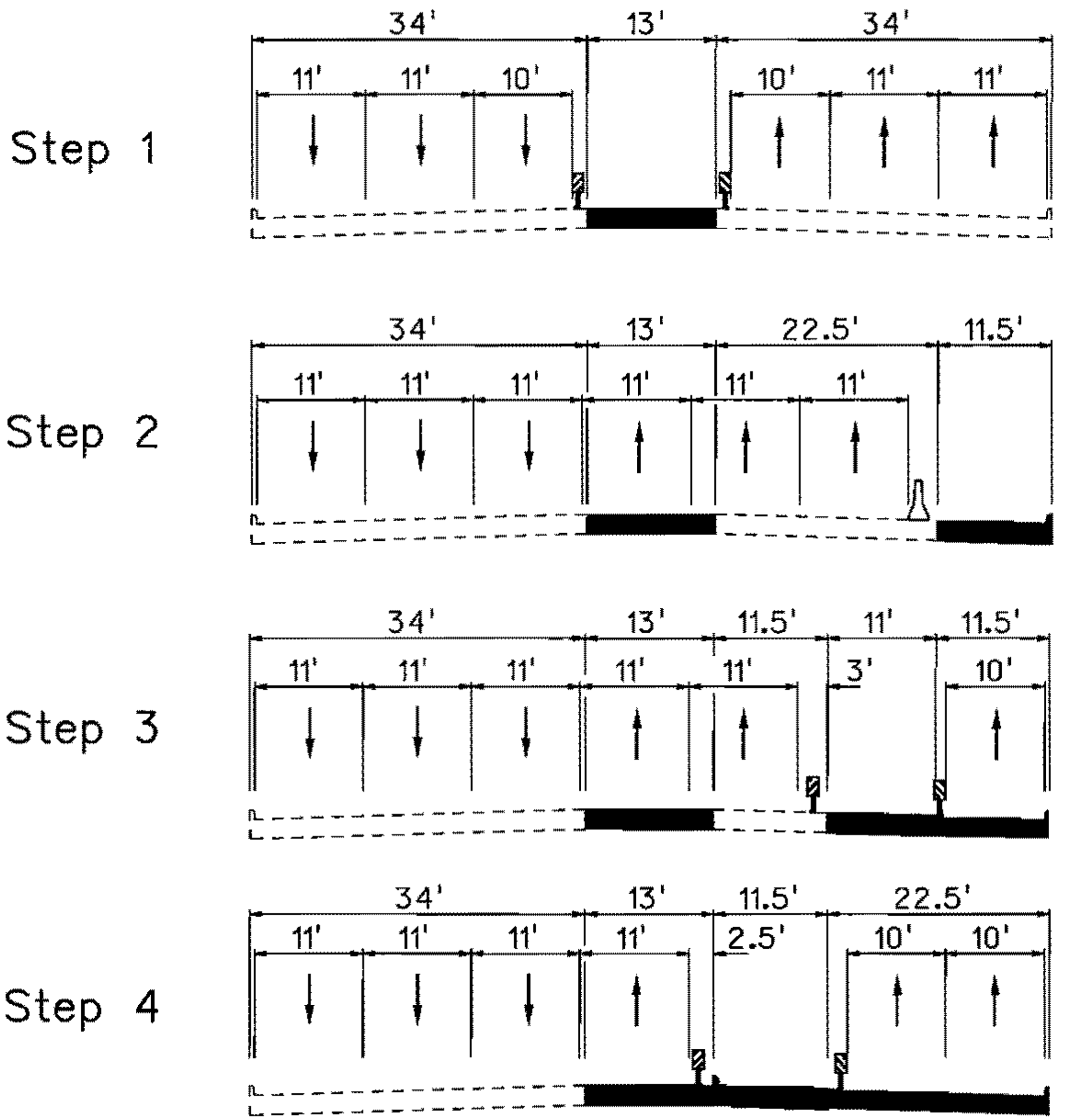
Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3



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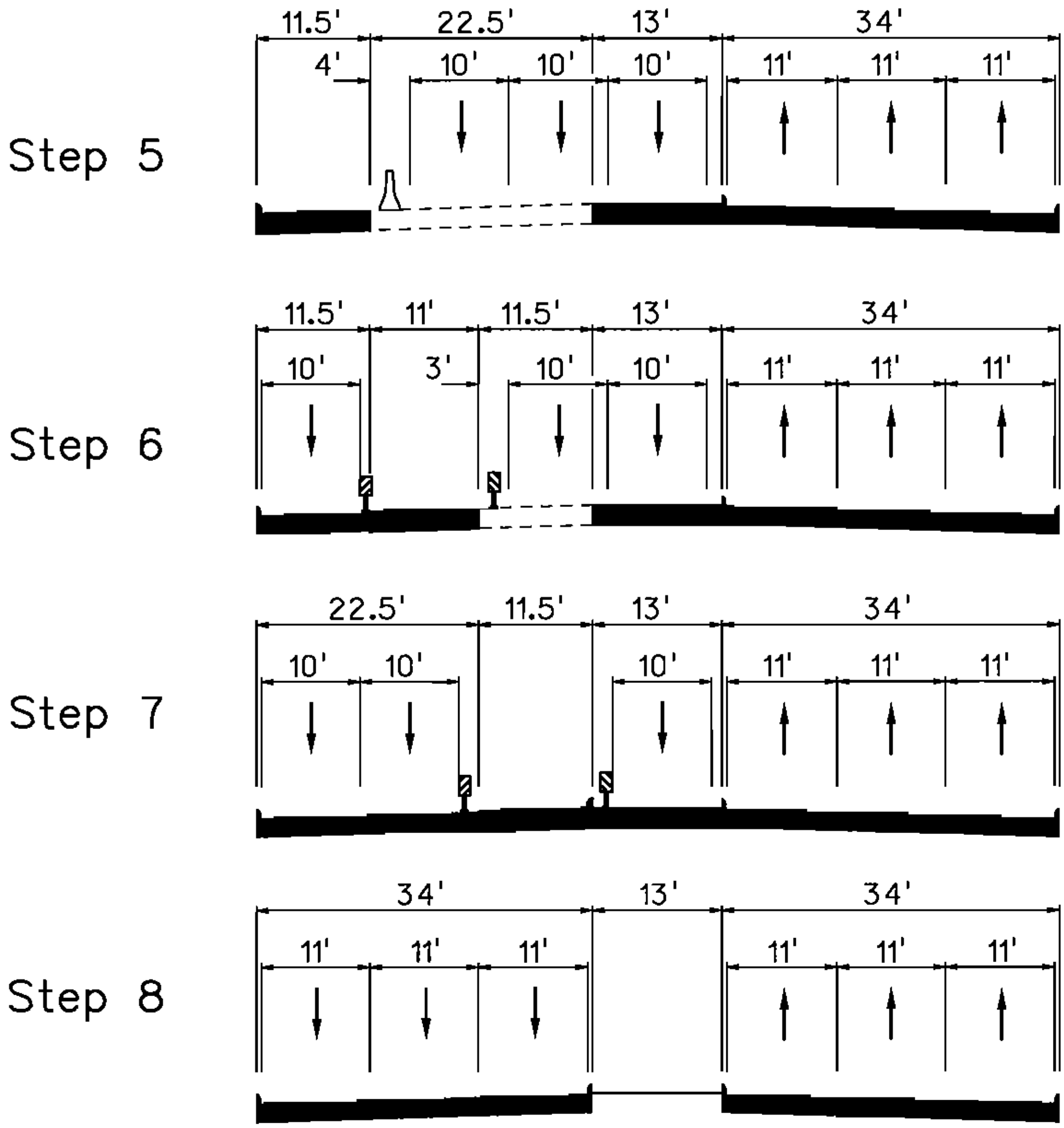
TOWN OF ADDISON

HNTB

Midway Road Reconstruction
Beltline Road to Keller Springs

ALTERNATIVE 3 (CONTINUED)



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LEGEND:

TEMPORARY ASPHALT

PERMANENT CONSTRUCTION THIS STEP

PERMANENT CONSTRUCTION PREVIOUS STEP

EXISTING PAVEMENT

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TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 3/16/01 **Claim #** ______ **Check $** 37,943.93

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1301	~~41~~	000	56570	~~63301~~		$37,943.93
	46			04300		
	[redacted]					

EXPLANATION FIFTH P [redacted] ERS, INC.
FOR ENGINEER [redacted] TO THE
DESIGN OF MI [redacted] N, PHASE I

RECEIVED
MAR 19 2001
TOWN OF ADDISON
ACCOUNTING

Steve Chutchian
Authorized Signature

Finance

COPY

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 5/16/01 **Claim #** ____________ **Check $** 43,392.26

Vendor No. ____________

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD, SUITE 530, LB27

Address GARLAND, TEXAS 75042

Address ____________

Zip Code ____________

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1350	46	000	56570	04300		43,392.26

TOTAL 43,392.26

EXPLANATION SIXTH PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I.

Steve Chutchian

Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1350

Date: May 7, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 3/1/01 to 4/30/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 43,392.26
Total Previous Invoices	$124,561.42
Total Billed to Date	$167,953.68
Less Payments/Credits	($124,561.42)
Total Amount Now Due	$ 43,392.26
Amount This Invoice	$ 43,392.26

O.K. to PAY, SZC 5/16/01

Please Retain This Page For Your Records

Invoice No.: 1350
Date: May 7, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$	29,681.47		
100% complete			$	29,681.47

2. Geotechnical Services

Total Phase Amount	$	19,440.00		
Billed Previously	$	14,613.75		
Alpha Testing, Inc. (Inv. 23045)			$	5,425.00

3. Preliminary Plans

Total Phase Amount	$	231,409.23		
50% complete			$	115,704.62

4. Design Report

Total Phase Amount $ 29,384.12

<u>Standard Rate Schedule</u>:

Professional Engineer	5 @ $127.25/hr	$	636.25
	Total Labor Charges >>	$	636.25

Invoice No.: 1350
Date: May 7, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

5. Reimbursables

Total Phase Amount	$ 3,785.18	
50% complete		$ 1,892.59
TOTAL BILLED TO DATE >>>		$ 167,953.68

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1350

Date: May 7, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$ 42,256.71
TOTAL AMOUNT ENCLOSED	$ ______________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

ALPHA TESTING, INC.
2209 Wisconsin St., Suite 100
Dallas, Texas 75229
(972) 620-8911
Fax: (972) 406-8023

PROJECT NAME: MIDWAY ROAD RECONSTRUCTION
BELTLINE ROAD TO
KELLER SPRINGS ROAD
ADDISON, TX

PROJECT NO: 00988

CLIENT:

BRUCE R. GRANTHAM
GBW ENGINEERS, INC.
1919 SHILOH ROAD, SUITE 530
LB 27
GARLAND, TX 75042

972-840-1916

INVOICE DATE: Apr 6, 2001

TERMS: **Net 10 days**

CUSTOMER P.O. NO:

CLOSING DATE OF THIS INVOICE: Apr 2, 2001

INVOICE NO: 23045

QUANTITY	DESCRIPTION OF WORK	UNIT PRICE	PER	EXTENSION
	STAFF ENGINER, 22HRS AT 60$@HR			1,320.00
	SENIOR ENGINEER,34HRS AT $95@HR			3,230.00
	PRINCIPLE EMP., 7HRS AT 125/HR			875.00
		Invoice Total		**$ 5,425.00**

TO INSURE PROPER CREDIT, PLEASE INCLUDE INVOICE NUMBER ON ALL REMITTANCES.

White-ORIGINAL INVOICE -- Green-SECOND -- Canary-FILE -- Pink-ACCOUNTING -- Goldenrod-BOOKKEEPING

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 3/16/01 **Claim #** ______ **Check $** 37,943.93

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION		FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
		(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
	1301	~~45~~	000	56570	~~63307~~		$37,943.93
		46			04300		

TOTAL ______

EXPLANATION FIFTH PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I

Steve Chutchian

Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1301

Date: March 7, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 2/1/01 to 2/28/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 37,943.93
Total Previous Invoices	$ 86,617.49
Total Billed to Date	$124,561.42
Less Payments/Credits	($ 86,617.49)
Total Amount Now Due	$ 37,943.93
Amount This Invoice	$ 37,943.93

O.K.
to pay.
SZC

Please Retain This
Page For Your Records

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

Invoice No.: 1301
Date: March 7, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$	29,681.47		
95% complete			$	28,197.40

2. Geotechnical Services

Total Phase Amount	$	19,440.00		
Alpha Testing (Invoice #22971)			$	14,613.75

3. Preliminary Plans

Total Phase Amount	$	231,409.23		
35% complete			$	80,993.23

4. Design Report

Total Phase Amount	$	29,384.12		
0% complete			$	0.00

5. Reimbursables

Total Phase Amount	$	3,785.18		
20% complete			$	757.04

TOTAL BILLED TO DATE >>> $ 124,561.42

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1301

Date: March 7, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$ 37,943.93
TOTAL AMOUNT ENCLOSED	$ ____________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 2/09/01 **Claim #** ______ **Check $** 34,900.65

Vendor No.

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, L.B. 27

Address GARLAND, TEXAS 75042

Address

Zip Code

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1267	41	000	56570	63301		34,900.65

TOTAL 34,900.65

EXPLANATION FOURTH PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I.

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1267

Date: February 1, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 1/01/01 to 1/31/01

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 34,900.65
Total Previous Invoices	$ 51,716.84
Total Billed to Date	$ 86,617.49
Less Payments/Credits	($ 36,988.97)
Total Amount Now Due	$ 49,628.52
Amount This Invoice	$ 34,900.65

2/09/01

THIS VALUE REFLECTS THAT INVOICE #1252 DATED 1/9/01, IN THE AMOUNT OF $14,727.87 HAS NOT BEEN RECEIVED BY THE ENGINEERING FIRM.
SZC

O.K. TO PAY
SZC

Please Retain This
Page For Your Records

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

Invoice No.: 1267
Date: February 1, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
95% complete		$ 28,197.40

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
0% complete		$ 0.00

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
25% complete		$ 57,852.31

4. Design Report

Total Phase Amount	$ 29,384.12	
0% complete		$ 0.00

5. Reimbursables

Total Phase Amount	$ 3,785.18	
15% complete		$ 567.78

TOTAL BILLED TO DATE >>> $ 86,617.49

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1267

Date: February 1, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$ 34,900.65
TOTAL AMOUNT ENCLOSED	$ ____________

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 1/17/01 **Claim #** ________ **Check $** 14,727.87

Vendor No. ________

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, L.B, 27

Address GARLAND, TEXAS 75042

Address ________

Zip Code ________

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1252	4645	000	56570	~~63301~~		14,727.87
				04300		

TOTAL 14,727.87

EXPLANATION THIRD PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I.

Steve Chutchian
Authorized Signature

Finance

GBW Engineers, Inc.

Grantham, Burge & Waldbauer

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1252

Date: January 9, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 12/01/00 to 12/31/00

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 14,727.87
Total Previous Invoices	$ 36,988.97
Total Billed to Date	$ 51,716.84
Less Payments/Credits	($ 36,988.97)
Total Amount Now Due	$ 14,727.87
Amount This Invoice	$ 14,727.87

O.K. to pay!
SZC
1/17/01

Please Retain This
Page For Your Records

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

Invoice No.: 1252
Date: January 9, 2001
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
95% complete		$ 28,197.40

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
0% complete		$ 0.00

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
10% complete		$ 23,140.92

4. Design Report

Total Phase Amount	$ 29,384.12	
0% complete		$ 0.00

5. Reimbursables

Total Phase Amount	$ 3,785.18	
10% complete		$ 378.52

TOTAL BILLED TO DATE >>> $ 51,716.84

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1252

Date: January 9, 2001

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$ 14,727.87
TOTAL AMOUNT ENCLOSED	$ ________

Pay to the Order Of:

GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment For Prompt And Accurate Credit

Steve Chutchian

From: Randy Moravec
Sent: Wednesday, February 14, 2001 6:58 PM
To: Steve Chutchian
Subject: Project Numbers

Steve,

I noticed you submitted PAMs with incorrect fund and project numbers. Please note the following:

Arapaho Road Phase II/III	Fund 46	Project # 83300
Midway Road Reconstruction	Fund 46	Project # 04300

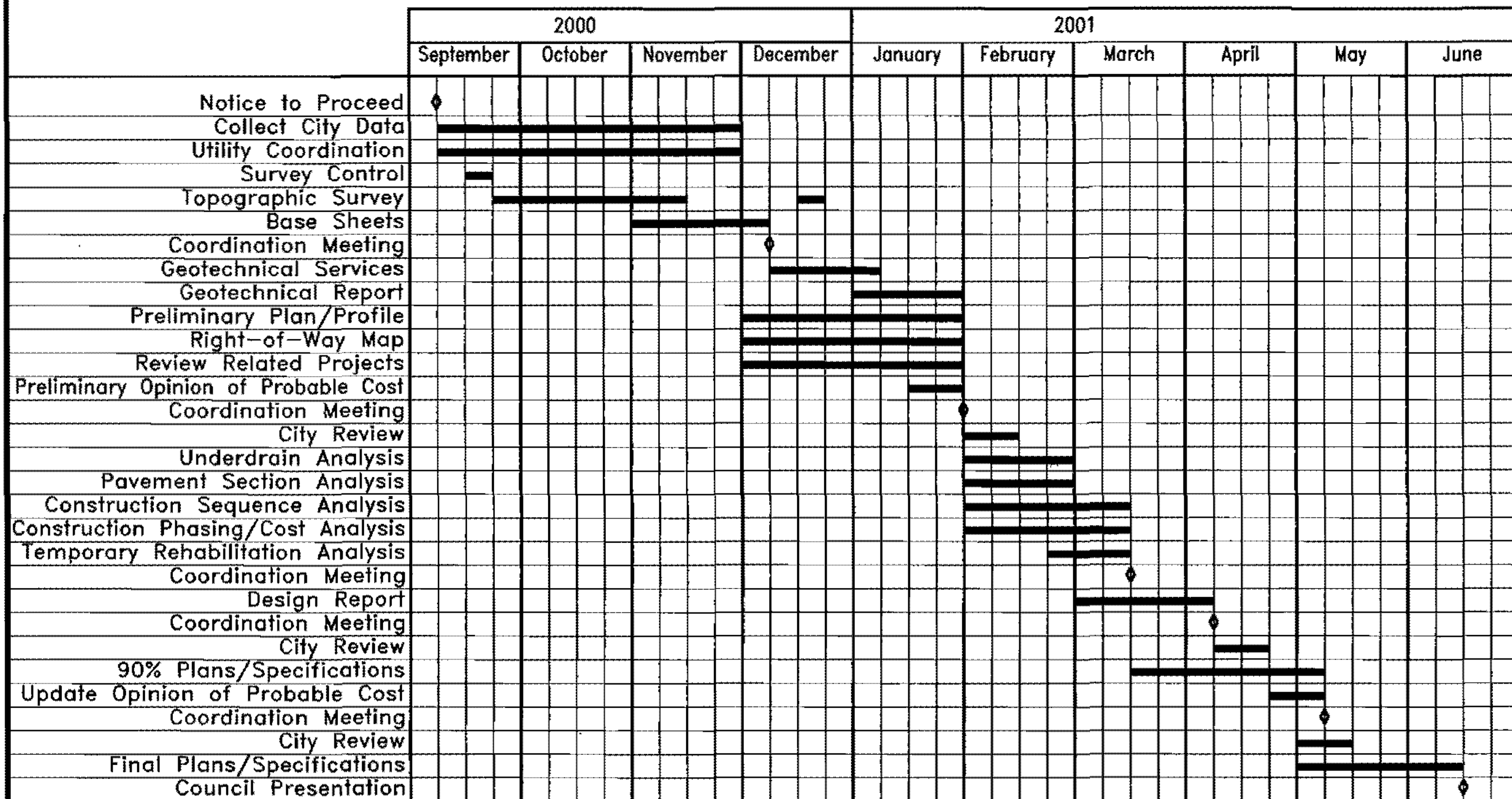
Please contact me should you have any questions.

Randy

Midway Roadway Reconstruction
Project Schedule

Grantham, Burge & Waldbauer
Engineers, Inc.

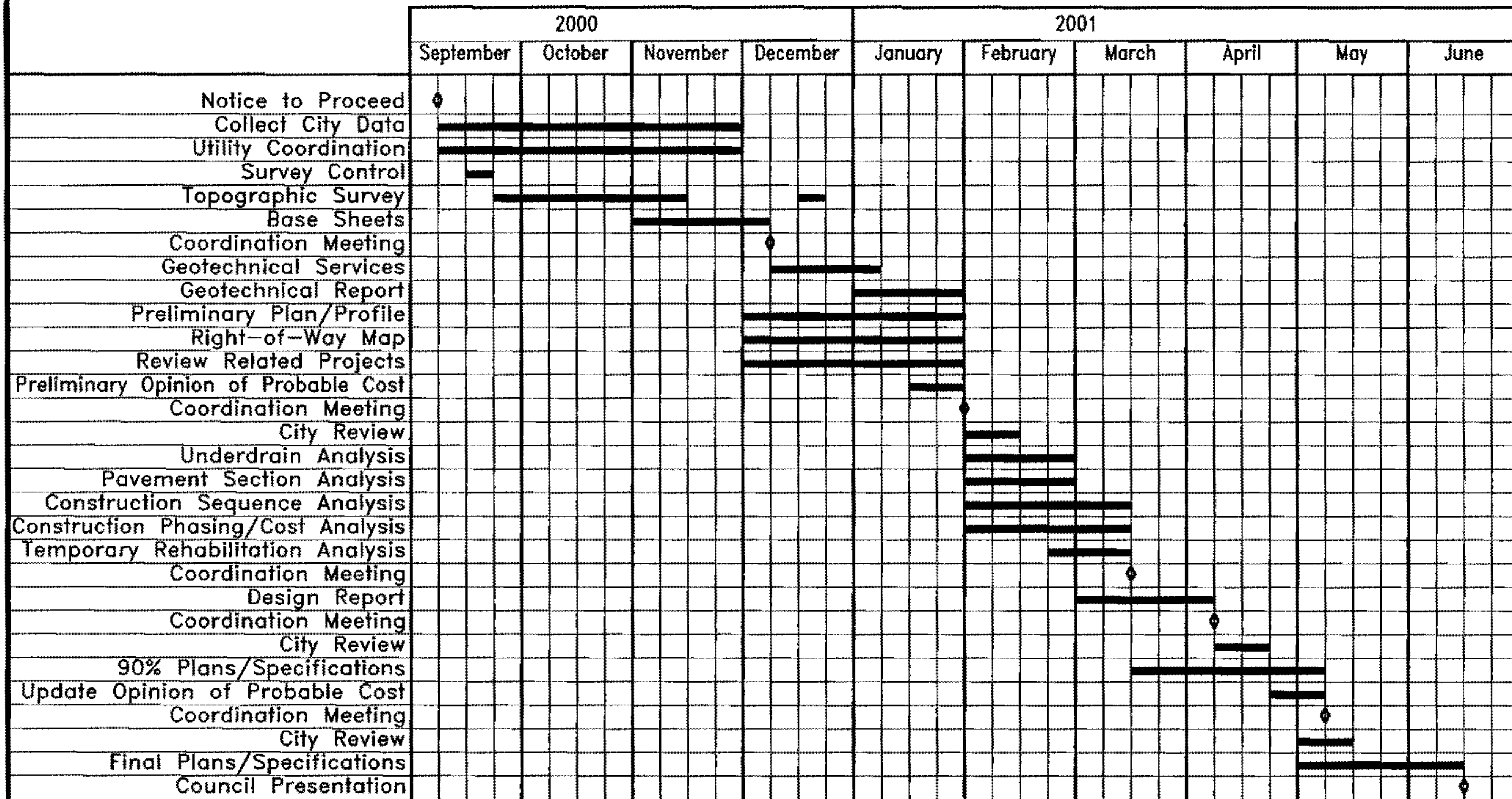
TOWN OF ADDISON



Midway Roadway Reconstruction
Project Schedule

Grantham, Burge & Waldbauer
Engineers, Inc.

TOWN OF
ADDISON

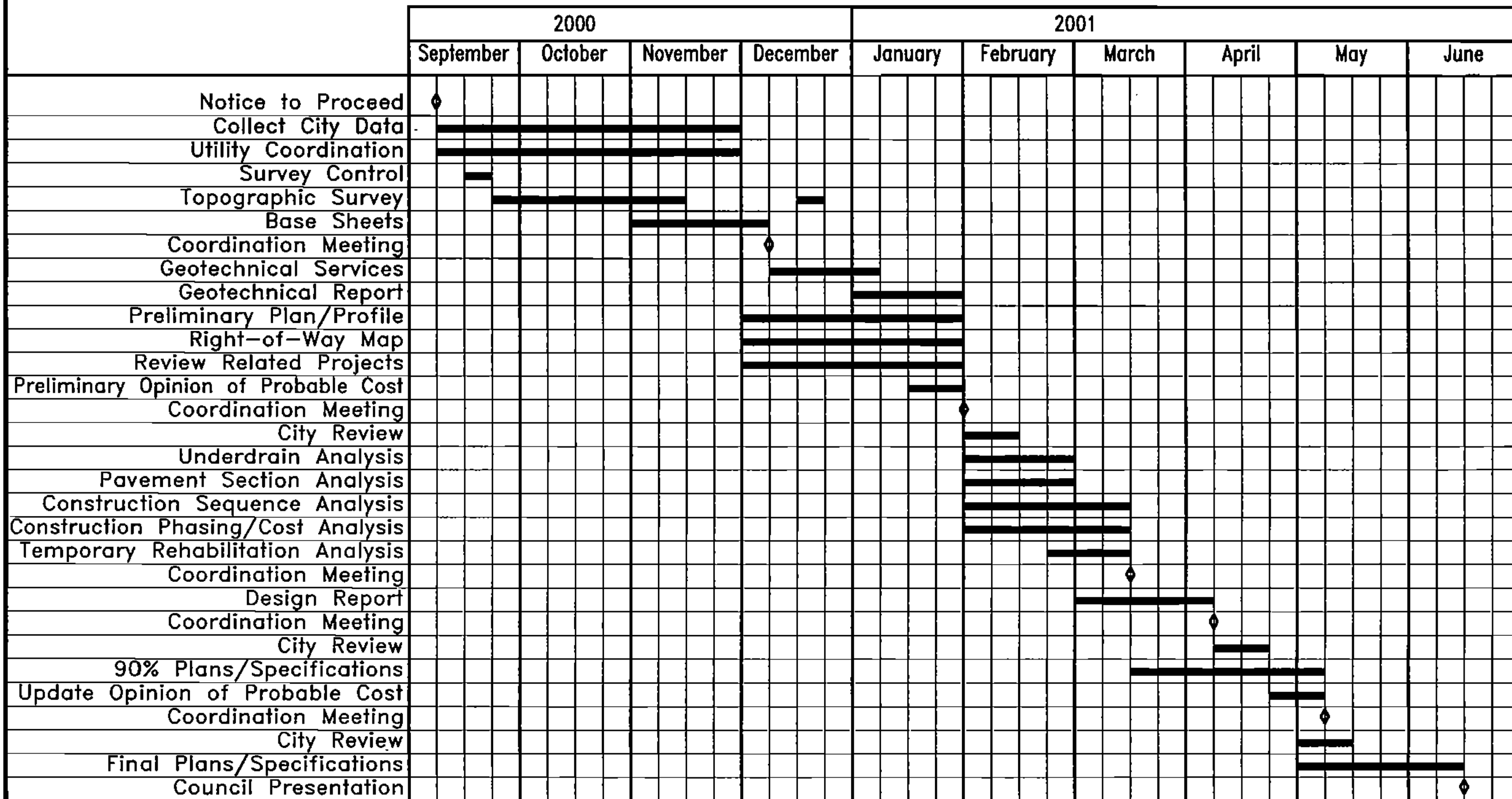


Midway Roadway Reconstruction
Project Schedule

BELT LINE to KELLER SPRINGS

GBW Grantham, Burge & Waldbauer Engineers, Inc.

TOWN OF ADDISON



Agenda Item

Mike will get contract signed

Mike gave it to Bill Shipp

Bill will keep a copy

July 31, 2000

MEMORANDUM

To: Chris Terry, Assistant City Manager

Through: Mike Murphy, P.E., Director of Public Works

From: Jim Pierce, P.E., Assistant City Engineer

Subject: Proposal from GBW Engineers. Inc. for Engineering, Surveying and Geotechnical Services, Midway Road Reconstruction, Phase One Design

Attached is a proposal from GBW Engineers, Inc. for engineering services for the reconstruction of Midway Road from Belt Line Road to Keller Springs Road. The proposal represents Phase One of what is anticipated to be a two-phase design process. Phase One consists of the preparation of all the construction plans and specifications necessary for the reconstruction work except for construction sequencing and traffic control, landscaping and irrigation, storm water pollution prevention plan and erosion control, signalization, temporary lighting, and sidewalks. All median opening widths, turn lane lengths, and street and driveway radii will be reviewed and design changes made where appropriate. The engineering report to be prepared with Phase One will provide a basis for the Town to establish a construction phasing and funding approach for this project.

Phase Two will consist of completing the remaining construction plans along with separating the plans prepared in Phase One into a separate bid packages for construction phasing purposes. Public notification and coordination with other cities, DART and affected businesses will be included in Phase Two. Bidding and construction phase services will also be provided. If it is determined during Phase One that the Midway Road reconstruction project will precede the Arapaho Road extension, the design of the box culvert crossing at Midway Road will be included in the Phase Two design.

The total proposed cost for the Phase One Design is $313,700.00. The design is estimated to take 200 calendar days exclusive of review time. Funding for this project will come from the 2000 Bond Sale.

Staff recommends that Council authorize the City Manager to enter into a contract with GBW Engineers, Inc. for Phase One Engineering Design for $313,700.00.

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 12/8/00 **Claim #** ______ **Check $** 13,708.59

Vendor No. ______

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB, 27

Address GARLAND, TEXAS 75042

Address ______

Zip Code ______

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1212	41	000	56570	63301		13,708.59

TOTAL 13,708.59

EXPLANATION SECOND PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I.

Steve Chutchian
Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1212

Date: December 1, 2000

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 11/01/00 to 11/30/00

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 13,708.59
Total Previous Invoices	$ 23,280.38
Total Billed to Date	$ 36,988.97
Less Payments/Credits	($ 0.00)
Total Amount Now Due	$ 36,988.97
Amount This Invoice	$ 13,708.59

O.K.
SZC
12/8/00

Please Retain This
Page For Your Records

1919 S. Shiloh Road, Suite 530, LB 27, Garland, Texas 75042 www.gbwengineers.com Tel (972) 840-1916, Fax (972) 840-2156

Invoice No.: 1212
Date: December 1, 2000
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
85% complete		$ 25,229.25

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
0% complete		$ 0.00

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
5% complete		$ 11,570.46

4. Design Report

Total Phase Amount	$ 29,384.12	
0% complete		$ 0.00

5. Reimbursables

Total Phase Amount	$ 3,785.18	
5% complete		$ 189.26

TOTAL BILLED TO DATE >>> $ 36,988.97

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1212

Date: December 1, 2000

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$ 13,708.59
TOTAL AMOUNT ENCLOSED	$ 13,708.59

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

O.K.
SZC.

Please Return This Page With Payment
For Prompt And Accurate Credit

TOWN OF ADDISON
PAYMENT AUTHORIZATION MEMO

DATE: 11/6/00 **Claim #** ________ **Check $** 23,280.38

Vendor No. ________

Vendor Name GBW ENGINEERS, INC.

Address 1919 S. SHILOH RD., SUITE 530, LB. 27

Address GARLAND, TEXAS 75042

Address ________

Zip Code ________

INVOICE # OR DESCRIPTION	FUND	DEPT	OBJ	PROJ	SAC	AMOUNT
	(00)	(000)	(00000)	(00000)	(000)	($000,000.00)
1184	41	000	56570	63301		23,280.38

TOTAL 23,280.38

EXPLANATION 1ST. PAYMENT TO GBW ENGINEERS, INC. FOR ENGINEERING SERVICES RELATED TO THE DESIGN OF MIDWAY RD. RECONSTRUCTION, PHASE I.

Authorized Signature

Finance

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

INVOICE

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1184

Date: November 2, 2000

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

INVOICE SUMMARY
From 9/07/00 to 10/31/00

Total Contract Amount	$313,700.00
Total Due This Invoice	$ 23,280.38
Total Previous Invoices	$ 0.00
Total Billed to Date	$ 23,280.38
Less Payments/Credits	($ 0.00)
Total Amount Now Due	$ 23,280.38
Amount This Invoice	$ 23,280.38

**Please Retain This
Page For Your Records**

Invoice No.: 1184
Date: November 2, 2000
Project: Midway Road Reconstruction -- Phase One Design

---

1. Design Survey

Total Phase Amount	$ 29,681.47	
70% complete		$ 20,777.03

2. Geotechnical Services

Total Phase Amount	$ 19,440.00	
0% complete		$ 0.00

3. Preliminary Plans

Total Phase Amount	$ 231,409.23	
1% complete		$ 2,314.09

4. Design Report

Total Phase Amount	$ 29,384.12	
0% complete		$ 0.00

5. Reimbursables

Total Phase Amount	$ 3,785.18	
5% complete		$ 189.26

TOTAL BILLED TO DATE >>> $ 23,280.38

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Mr. Steve Chutchian, P.E.
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Invoice No.: 1184

Date: November 2, 2000

GBW Project No.: 00-238

PROJECT: Midway Road Reconstruction -- Phase One Design

REMITTANCE PAGE:

Total Current Invoice	$ 23,280.38
TOTAL AMOUNT ENCLOSED	$ 23,280.38

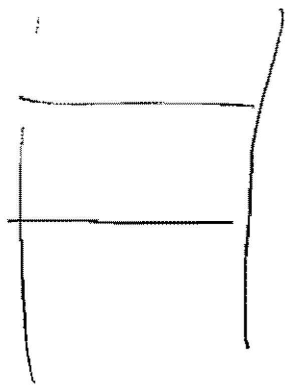
o.k. to pay!
SZC
11/6/00

Pay to the Order Of: GBW Engineers, Inc.
1919 S. Shiloh Road
Suite 530
L.B. 27
Garland, Texas 75042

Please Return This Page With Payment
For Prompt And Accurate Credit

7-25-00

Landscape design & Irrigation will be done separate, but before plans & Specs go out to bid



#2h -	Award of bid in the amount of $35,775.00 to August Industries for purchase of a Mobile Compressor, Fill Station & Air Storage to replace bottled air compressor that currently refills the SCBA (Self Contained Breathing Apparatus) for the Addison Fire Department.
#2i -	Award of bid in the amount of $25,227.00 to Motorola for purchase of nine mobile radios for the Police Department.
#2j -	Rejection of all bids for Bid #00-42, Swimming Pool Resurfacing for Athletic Club.
#2k -	Award of a contract in an amount not to exceed $313,700.00 for engineering, surveying and geotechnical services to GBW for Midway Road Reconstruction – Phase One Design.
#2l -	Approval of a Hangar Development and an Amendment to the Ground Lease for Addison Express.
#2m -	Consideration of a Resolution authorizing the City Manager to enter into an agreement with Clarence A. West of the law firm of Dow Cogburn & Friedman to address right-of-way issues.

TOWN OF ADDISON

Public Works / Engineering
16801 Westgrove • P.O. Box 144
Addison, Texas 75001
Telephone: (214) 450-2871 • Fax: (214) 931-6643

LETTER OF TRANSMITTAL

DATE 8-18-00	JOB NO.
ATTENTION	
RE: Midway Rd. Recnst.	

TO Bruce Grantham
GBW Engrs

GENTLEMAN:
WE ARE SENDING YOU ☑ Attached ☐ Under separate cover via ______ the following items:
☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
1			Engr Agreement for Phase 1

THESE ARE TRANSMITTED as checked below:
☐ For approval ☐ Approved as submitted ☐ Resubmit ______ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit ______ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return ______ corrected prints
☐ For review and comment ☐ ______
☐ FOR BIDS DUE ______ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Signed by City Manager

COPY TO ______

SIGNED: Jim Pierce

If enclosures are not as noted, please notify us at once.

GBW Engineers, Inc.
Grantham, Burge & Waldbauer

8-17

Jim,
I kept one original for my files.
Bill

July 25, 2000

Mr. Jim Pierce, P.E.
Assistant City Engineer
Town of Addison
Post Office Box 9010
Addison, Texas 75001

Re: Agreement for Engineering, Surveying and Geotech
Midway Road Reconstruction - Phase One Design

Dear Mr. Pierce:

Pursuant to your request, GBW has prepared this agreement [illegible] services for the reconstruction of Midway Road from Belt Line Road to Keller Springs Road in the Town of Addison. Our subconsultants on this project will be HNTB Corporation (construction sequencing and traffic control) and Alpha Testing, Inc. (geotechnical).

The work described in this proposal represents Phase One of what is anticipated to be a two-phase design process. Phase One consists of the preparation of all the construction plans and specifications necessary for the reconstruction work (see Exhibit A) except for construction sequencing and traffic control, landscaping and irrigation, storm water pollution prevention plan and erosion control, signalization, and temporary lighting, and sidewalks. All median opening widths, turn lane lengths, and street and driveway radii will be reviewed and design changes made where appropriate. The engineering report to be prepared with Phase One will provide a basis for the Town to establish a construction phasing and funding approach for this project.

Phase Two will consist of completing the remaining construction plans along with separating the plans prepared in Phase One into a separate bid package for construction phasing purposes. Public notification and coordination with other cities, DART and affected businesses will be included in Phase Two. Bidding and construction services will also be provided. If it is determined during Phase One that the Midway Road reconstruction project will precede the Arapaho Road extension, the design of the box culvert crossing at Midway Road will be included in the Phase Two design.

This proposal consists of the following Scope of Services:

Scope of Services

<u>Surveying for Design and Construction</u>

- Establish horizontal and vertical control for the project including monumentation which shall be tied to Town of Addison horizontal and vertical datum.

- Research Town, County, State, or other documents as necessary to establish the location of existing boundary lines and easements for the project. Furnish copies of all real estate documents to the Town.

- Prepare a right-of-way strip map for the project detailing all existing right-of-way and easement lines along with property owners.

1919 S. Shiloh Road, Suite 530, L.B. 27, Garland, Texas 75042 Tel (972) 840-1916 Fax (972) 840-2156

- In cooperation with the Town and other franchised utilities, determine the approximate locations and elevations of existing underground utilities.

- Locate soil borings and furnish survey data to the geotechnical consultant.

- Perform a detailed topographic survey of the project including all driveways and intersecting streets.

Geotechnical Services

- Explore subsurface soil and/or rock conditions and groundwater seepage along Midway Road by drilling 22 test borings up to a depth of 10 feet. Borings shall be spaced approximately 250 feet apart on alternative sides of the street.

- Perform laboratory tests to evaluate the classification, gradation and other physical characteristics of the subsurface soils.

- Use the results of the field exploration and laboratory tests to prepare an engineering report which will address the following items:
    - engineering characteristics of the subsurface materials encountered
    - recommended pavement sections including alternative subgrade stabilization and base materials, and the pavement thickness required to achieve the targeted pavement life
    - evaluation of the life expectancy of the existing pavement sections
    - recommendations regarding earthwork including grading and excavation, backfilling and compacting, the treatment of in-place soils for support of pavement, and possible construction problems

Project Management and Preliminary Plan Preparation

- Prepare a schedule for the project work and provide updates as requested by Town staff.

- Attend project coordination meetings with Town staff and subconsultants.

- Review the geotechnical report results and coordinate with Town staff to determine recommended pavement sections for the project. In addition, underdrain and/or root barrier locations will also be determined.

- Prepare preliminary specifications and contract drawings for the project including the following:
    - Title Sheet with index and project location
    - General Notes and Quantities
    - Existing Right-of-Way Map including all property owners
    - Typical Sections
    - Horizontal and Vertical Control Sheet
    - Jointing Plans
    - Roadway Plan and Profiles
    - Intersection Layouts
    - Pavement Markings
    - Roadway Cross-sections
    - Underdrain Profiles at street crossings
    - Details

- Review other proposed construction projects, including CMAQ intersection improvements, and account for these improvements in the contract drawings.

Design Report

- In partnership with Town staff, prepare an engineering design report, including an opinion of probable construction cost, to address the following project issues:
  - a recommended construction sequencing and traffic control approach for the project
  - phasing alternatives for the reconstruction work
  - the limits of reconstruction work which can be accomplished with available bond funds
  - identify temporary rehabilitation measures, if necessary due to funding constraints, to prolong existing pavement life.
- Attend a Council meeting to assist Town staff in presenting the findings of the design report.

Schedule

It is anticipated that the proposed scope of services will be complete within 200 calendar days after the issuance of a Notice to Proceed, exclusive City review time.

Proposed Fee

A manhour projection (see Exhibit B), which has been prepared for the scope of services described in this proposal, provides the basis for the fees listed below. In addition, Exhibit D provides an estimated fee based on TSPE Curve A for reference purposes. The construction cost used for this calculation (see Exhibit C) has no cost for those items which will be designed with Phase Two.

Survey	$ 29,681.47	(Fixed Fee)
Geotechnical Services		
– Soil borings	$ 5,305.00	(Fixed Fee)
– Laboratory Tests	$ 5,535.00	(Fixed Fee)
– Engineering Report	$ 8,600.00	(Time and Materials)
Preliminary Plans	$231,409.23	(Fixed Fee)
Design Report	$ 29,384.12	(Time and Materials)
Reimbursables	$ 3,785.18	(Fixed Fee)
TOTAL FEE	$313,700.00	

All of the scope of services referenced above have been proposed as a fixed fee except for the Geotechnical Report and the Design Report. As the extent of the work effort required for these reports is difficult to define at this time, it is proposed that they be completed on a Time and Materials basis in accordance with the Standard Rate Schedules of the respective firms. The estimated fee for these reports will not be exceeded without written approval from the Town of Addison.

Assumptions

This proposal is based upon the following assumptions:

- Traffic counts will be furnished by the Town of Addison.
- No railroad gate design will be performed.

Terms and Conditions

- **Access to Site:** Unless otherwise stated, GBW Engineers, Inc. (GBW) will have access to the site for activities necessary for the performance of the services. GBW will take precautions to minimize damage due to these activities, but has not included in the fee the cost of restoration of any resulting damage.
- **Dispute Resolution:** Any claims or disputes made during design, construction or post construction between the Client and GBW will be submitted to nonbinding mediation. Client and GBW agree to include a similar mediation agreement with all contractors, subcontractors, subconsultants, suppliers and fabricators, thereby providing for mediation as the primary method for dispute resolution among all parties.
- **Billings/Payments:** Invoices for GBW's services will be submitted on a monthly basis. Invoices will be payable within 30 days after the invoice date.
- **Indemnification:** The Client will, to the fullest extent permitted by law, indemnify and hold harmless GBW, its officers, directors, employees, agents and subconsultants from and against all damage, liability and cost including reasonable attorney's fees and defense costs, arising out of or in any way connected with the performance of the services under this agreement by any of the parties above named, excepting only those damages, liabilities or costs attributable to the sole negligence or willful misconduct of GBW.
- **Certifications/Responsibilities:** GBW will not be required to execute any document that would result in its certifying, guaranteeing or warranting the existence of conditions whose existence GBW cannot ascertain. Furthermore, GBW will not be responsible for the means, methods, procedures, techniques, or sequences of construction, nor for safety on the job site.
- **Termination of Services:** This agreement may be terminated by the Client or GBW should the other fail to perform its obligations hereunder. In the event of termination, the Client will pay GBW for all services rendered to the date of termination, all reimbursable expenses and reimbursable termination expenses.
- **Ownership of Documents:** All documents produced by GBW under this agreement will remain the property of GBW, unless otherwise stated, and may not be used by the Client for any other endeavor without the written consent of GBW.

Please contact me if you need any additional information.

Very truly yours,	Approved by:
Bruce R. Grantham, P.E.	Ron Whitehead 8-17-00
President	Town of Addison Date

Attachments
BG/gg
J:\WPDOCS\PROPOSAL\ADDISON\MIDWAY\PhaseOne.ltr

EXHIBIT A

Midway Road Reconstruction from Belt Line Road to Keller Springs Road

Phase One Design

Sheet Index

Sheet Description	No. of Sheets
Title	1
General Notes & Quantities	1
Right-of-way Map / Survey Control	3
Typical Sections	2
Demolition	3
Jointing Plans	3
Paving Plan and Profiles	12
Intersection Layouts	3
Pavement Markings	3
Roadway Cross Sections	15
Underdrain Profiles (at street crossings)	2
Details	2
TOTAL SHEETS	50

EXHIBIT B-1

MIDWAY ROAD RECONSTRUCTION FROM BELT LINE ROAD TO KELLER SPRINGS ROAD
PHASE ONE DESIGN
MANHOUR ESTIMATE
(GBW Engineers, Inc.)

	PROJECT MANAGER	SENIOR ENGINEER	E.I.T.	DESIGN TECHNICIAN	CADD OPERATOR	CLERICAL	SURVEY MANAGER	SURVEY COORDINATOR	SURVEY TECHNICIAN	3-MAN CREW	TOTAL HOURS	LABOR COST
SURVEYING FOR DESIGN & CONSTRUCTION												
HORIZONTAL AND VERTICAL CONTROL	1						2	4	16	20	43	$3,419.73
RESEARCH BOUNDARY LINES AND EASEMENTS	1						8	2	40		51	$2,765.87
RIGHT-OF-WAY STRIP MAP	2						16	2	120		140	$7,159.22
LOCATE UNDERGROUND UTILITIES	1						2	4	6	12	25	$2,108.53
LOCATE SOIL BORINGS	1						1	2	4	12	20	$1,823.54
TOPOGRAPHIC SURVEY	2						4	8	8	100	122	$12,404.58
SUBTOTAL SURVEYING	8						33	22	194	144	401	$29,681.47
PROJECT MANAGEMENT & PRELIMINARY PLANS												
UPDATE PROJECT SCHEDULE	8				16						24	$1,699.12
PROJECT MEETINGS/SITE VISITS	40	8	40			20					108	$9,781.80
REVIEW CITY RECORD DRAWINGS	8	16	40		40						104	$7,176.48
UTILITY COORDINATION	16		40		16	16					88	$6,077.84
RECOMMEND PAVEMENT SECTIONS	24	16		8							48	$5,728.16
TITLE SHEET	1				24						25	$1,093.27
GENERAL NOTES AND QUANTITIES	4	16	40	4	40	8					112	$7,325.52
TYPICAL SECTIONS	16	16	8	8	80						128	$8,384.64
HORIZONTAL AND VERTICAL CONTROL SHEET	4		8	4	40						56	$2,940.16
DEMOLITION SHEETS	4	16	24	4	120						168	$9,124.48
JOINTING PLANS	8	16	80	24	120						248	$14,723.84
ROADWAY PLAN AND PROFILES	24	60	192	360	120						756	$54,383.88
INTERSECTION LAYOUTS	8	16	80	24	120						248	$14,723.84
PAVEMENT MARKINGS	4	16	40	4	120						184	$10,148.00
ROADWAY CROSS-SECTIONS	8	16	80	180	120						404	$26,328.68
UNDERDRAIN PROFILES/ROOT BARRIERS	16	40	80	8	80						224	$15,928.88
DETAILS	16	40	8	16	80						160	$11,916.16
INCORPORATE OTHER CONSTRUCTION PROJECTS	16	40	8	16	80						160	$11,916.16
DETERMINE CONSTR. SEQUENCE APPROACH	16	8									24	$3,095.76
TECHNICAL SPECIFICATIONS	16	40				40					96	$8,914.56
SUBTOTAL MANAGEMENT AND PLANS	257	380	768	660	1,216	84					3,365	$231,409.23
DESIGN REPORT												
ENGINEERING DESIGN REPORT	40	8	40	4	24	40					156	$11,992.12
OPINIONS OF PROBABLE COST	16	24	16								56	$6,076.88
COUNCIL MEETING	4		4								8	$785.12
SUBTOTAL DESIGN REPORT	60	32	60	4	24	40					220	$18,854.12
TOTAL HOURS	325	412	828	664	1,240	124	33	22	194	144	3,986	
TOTAL LABOR COST	$43,000.75	$50,408.20	$52,967.16	$49,394.96	$49,649.60	$5,901.16	$3,347.19	$1,070.52	$8,365.28	$15,840.00		$279,944.82

June 30, 2000

EXHIBIT B-2

MIDWAY ROAD RECONSTRUCTION FROM BELT LINE ROAD TO KELLER SPRINGS ROAD
PHASE ONE DESIGN
MANHOUR ESTIMATE
(HNTB Corporation)

	ASSISTANT PROJECT MANAGER	SENIOR ENGINEER	ENGINEER	CADD OPERATOR	CLERICAL	TOTAL HOURS	LABOR COST
PROJECT MANAGEMENT & PRELIMINARY PLANS							
ATTEND COUNCIL MEETING (1)	4	4				8	$900.00
ATTEND PROJECT MEETINGS (3)	8		8			16	$1,560.00
FIELD OBSERVATION		1	8			9	$705.00
TURN BAY STORAGE ANALYSIS (10)			6			6	$450.00
INTERSECTION ANALYSIS		2	6			8	$660.00
TEMPORARY LIGHTING ANALYSIS		1	4			5	$405.00
DEVELOP TRAFFIC CONTROL CONCEPTS	4	4	16			24	$2,100.00
PHASING/DIVISION OF WORK PLAN	2	4	4			10	$960.00
PREPARE SKETCHES FOR REPORT (8)			4	16		20	$1,548.00
WRITE RECOMMENDATIONS FOR DESIGN REPORT	2	4	2		8	16	$1,242.00
TOTAL HOURS	20	20	58	16	8	122	
TOTAL LABOR COST	$2,400.00	$2,100.00	$4,350.00	$1,248.00	$432.00		**$10,530.00**

June 30, 2000

EXHIBIT C

OPINION OF PROBABLE COST
(For Design Contract)

Date: June 27, 2000

Midway Road Reconstruction Project
Belt Line Road to Keller Springs
Town of Addison

Item No.	Quantity	Unit	Item	Unit Price ($)	Item Total
1	55.0	STA	ROW Preparation	5,000.00	$275,000.00
2	10,000	C.Y.	Unclassified Excavation (for 4" Base)	12.00	120,000.00
3	1	L.S.	Barricade, Sign, Traffic Control	0.00	0.00
4	53,500	S.Y.	Remove Concrete Pavement, Haul, Dispose	10.00	535,000.00
5	700	S.Y.	Remove Concrete Drive, Haul, Dispose	15.00	10,500.00
6	2,000	S.Y.	Remove/Replace 6" Concr. Median Pavemt.	40.00	80,000.00
7	14,000	L.F.	Sawcut Breakout Groove	4.00	56,000.00
8	57,000	S.Y.	4" Asphalt Treated Base	10.00	570,000.00
9	700	S.Y.	6" Reinforced Concrete Drives	40.00	28,000.00
10	53,500	S.Y.	11" Reinf. Concr. Pavement (4,000 psi)	55.00	2,942,500.00
11	8,900	L.F.	6" Integral Curb	3.00	26,700.00
12	3,000	S.Y.	Temporary Asphalt	0.00	0.00
13	10,000	S.Y.	Block Sodding Disturbed Areas	5.00	50,000.00
14	20	EA.	Reconstruct Inlet Tops	1,500.00	30,000.00
15	24	EA.	Remove and Replace Street Lights	0.00	0.00
16	2,200	EA.	4" Buttons	5.00	11,000.00
17	10,000	L.F.	Geocomposite Edge Drain	20.00	200,000.00
18	1	L.S.	Pavement Markings	50,000.00	50,000.00
19	1	L.S.	Traffic Signal/Loop Adjustments	0.00	0.00
20	1	L.S.	Storm Water Pollution Prevention Plan	0.00	0.00
21	1	L.S.	Replace Landscape	0.00	0.00
22	1	L.S.	Utility Adjustments	100,000.00	100,000.00
			Subtotal:		$4,984,700.00
			20% Contingency:		$996,940.00
			TOTAL:		$5,981,640.00

Notes:
1. No sidewalk cost is included.
2. Existing inlet bases will remain in place while the top is reconstructed.
3. The edge drain will be placed behind the outside curbs for the length of the project.
4. Early strength concrete would add about $500,000 to the project cost.
5. Phase Two design items have been excluded from the total cost.

Bruce R. Grantham, P.E.

cell 972-345-7230

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

1919 S. Shiloh Road
Suite 530, L.B. 27
Garland, Texas 75042

Tel (972) 840-1916
Fax (972) 840-2156

8:35

Target this for 1st council meeting in Aug

Grantham, Burge & Waldbauer

GBW Engineers, Inc.

Landscape design N/C

Bruce LV Aug 25 for 2 weeks to N. Zealand

July 5, 2000

Mr. Jeff Markiewicz
Project Manager
Town of Addison
Post Office Box 9010
Addison, Texas 75001

Re: Proposal for Engineering, Surveying and Geotechnical Services
Midway Road Reconstruction - Phase One Design

Dear Mr. Markiewicz:

Pursuant to your request, GBW has prepared this proposal for engineering, surveying and geotechnical services for the reconstruction of Midway Road from Belt Line Road to Keller Springs Road in the Town of Addison. Our subconsultants on this project will be HNTB Corporation (construction sequencing and traffic control) and Alpha Testing, Inc. (geotechnical).

The work described in this proposal represents Phase One of what is anticipated to be a two-phase design process. Phase One consists of the preparation of all the construction plans and specifications necessary for the reconstruction work (see Exhibit A) except for construction sequencing and traffic control, landscaping and irrigation, storm water pollution prevention plan and erosion control, signalization, and temporary lighting, and sidewalks. All median opening widths, turn lane lengths, and street and driveway radii will be reviewed and design changes made where appropriate. The engineering report to be prepared with Phase One will provide a basis for the Town to establish a construction phasing and funding approach for this project.

Phase Two will consist of completing the remaining construction plans along with separating the plans prepared in Phase One into a separate bid package for construction phasing purposes. Public notification and coordination with other cities, DART and affected businesses will be included in Phase Two. Bidding and construction services will also be provided. If it is determined during Phase One that the Midway Road reconstruction project will precede the Arapaho Road extension, the design of the box culvert crossing at Midway Road will be included in the Phase Two design.

This proposal consists of the following Scope of Services:

Scope of Services

<u>Surveying for Design and Construction</u>

- Establish horizontal and vertical control for the project including monumentation which shall be tied to Town of Addison horizontal and vertical datum.

- Research Town, County, State, or other documents as necessary to establish the location of existing boundary lines and easements for the project. Furnish copies of all real estate documents to the Town.

- Prepare a right-of-way strip map for the project detailing all existing right-of-way and easement lines along with property owners.

- In cooperation with the Town and other franchised utilities, determine the approximate locations and elevations of existing underground utilities.

- Locate soil borings and furnish survey data to the geotechnical consultant.

- Perform a detailed topographic survey of the project including all driveways and intersecting streets.

Geotechnical Services

- Explore subsurface soil and/or rock conditions and groundwater seepage along Midway Road by drilling 22 test borings up to a depth of 10 feet. Borings shall be spaced approximately 250 feet apart on alternative sides of the street.

- Perform laboratory tests to evaluate the classification, gradation and other physical characteristics of the subsurface soils.

- Use the results of the field exploration and laboratory tests to prepare an engineering report which will address the following items:
  - engineering characteristics of the subsurface materials encountered
  - recommended pavement sections including alternative subgrade stabilization and base materials, and the pavement thickness required to achieve the targeted pavement life
  - evaluation of the life expectancy of the existing pavement sections
  - recommendations regarding earthwork including grading and excavation, backfilling and compacting, the treatment of in-place soils for support of pavement, and possible construction problems

Project Management and Preliminary Plan Preparation

- Prepare a schedule for the project work and provide updates as requested by Town staff.

- Attend project coordination meetings with Town staff and subconsultants.

- Review the geotechnical report results and coordinate with Town staff to determine recommended pavement sections for the project. In addition, underdrain and/or root barrier locations will also be determined.

- Prepare preliminary specifications and contract drawings for the project including the following:
  - Title Sheet with index and project location
  - General Notes and Quantities
  - Existing Right-of-Way Map including all property owners
  - Typical Sections
  - Horizontal and Vertical Control Sheet
  - Roadway Plan and Profiles
  - Intersection Layouts
  - Pavement Markings
  - Roadway Cross-sections
  - Underdrain Profiles at street crossings — need complete profiles?
  - Details

- Review other proposed construction projects, including CMAQ intersection improvements, and account for these improvements in the contract drawings.

Design Report

- In partnership with Town staff, prepare an engineering design report, including an opinion of probable construction cost, to address the following project issues:
  - a recommended construction sequencing and traffic control approach for the project
  - phasing alternatives for the reconstruction work
  - the limits of reconstruction work which can be accomplished with available bond funds
  - identify temporary rehabilitation measures, if necessary due to funding constraints, to prolong existing pavement life.

- Attend a Council meeting to assist Town staff in presenting the findings of the design report.

Schedule

It is anticipated that the proposed scope of services will be complete within 200 calendar days after the issuance of a Notice to Proceed, exclusive City review time.

Proposed Fee

A manhour projection (see Exhibit B), which has been prepared for the scope of services described in this proposal, provides the basis for the fees listed below. In addition, Exhibit D provides an estimated fee based on TSPE Curve A for reference purposes. The construction cost used for this calculation (see Exhibit C) has no cost for those items which will be designed with Phase Two.

Survey	$ 29,681.47	(Fixed Fee)
Geotechnical Services		
– Soil borings	$ 5,305.00	(Fixed Fee)
– Laboratory Tests	$ 5,535.00	(Fixed Fee)
– Engineering Report	$ 8,600.00	(Time and Materials)
Preliminary Plans	$216,685.39	(Fixed Fee)
Design Report	$ 29,384.12	(Time and Materials)
Reimbursables	$ 3,609.02	(Fixed Fee)
TOTAL FEE	$298,800.00	

All of the scope of services referenced above have been proposed as a fixed fee except for the Geotechnical Report and the Design Report. As the extent of the work effort required for these reports is difficult to define at this time, it is proposed that they be completed on a Time and Materials basis in accordance with the Standard Rate Schedules of the respective firms. The estimated fee for these reports will not be exceeded without written approval from the Town of Addison.

Assumptions

This proposal is based upon the following assumptions:

- Traffic counts will be furnished by the Town of Addison.
- No railroad gate design will be performed.

Please contact me if you need any additional information.

Very truly yours,

Bruce R. Grantham, P.E.
Project Manager

Attachment

BG/gg
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EXHIBIT A

Midway Road Reconstruction from Belt Line Road to Keller Springs Road

Phase One Design

Sheet Index

Sheet Description	No. of Sheets
Title	1
General Notes & Quantities	1
Right-of-way Map / Survey Control	3
Typical Sections	2
Demolition	3
Paving Plan and Profiles	12
Intersection Layouts	3
Pavement Markings	3
Roadway Cross Sections	15
Underdrain Profiles (at street crossings)	2
Details	2
TOTAL SHEETS	47

Sawed joints layout plan
address restoration of irrigation systems / laydown areas
Grass in un irrigated areas shall be watered by a temp watering system until grass is established
Concrete Finish
Dust control - Vacuum sweeping
ADA compliance
Project Signs

EXHIBIT B-1

MIDWAY ROAD RECONSTRUCTION FROM BELT LINE ROAD TO KELLER SPRINGS ROAD PHASE ONE DESIGN MANHOUR ESTIMATE (GBW Engineers, Inc.)	PROJECT MANAGER	SENIOR ENGINEER	E.I.T.	DESIGN TECHNICIAN	CADD OPERATOR	CLERICAL	SURVEY MANAGER	SURVEY COORDINATOR	SURVEY TECHNICIAN	3-MAN CREW	TOTAL HOURS	LABOR COST
SURVEYING FOR DESIGN & CONSTRUCTION												
HORIZONTAL AND VERTICAL CONTROL	1						2	4	16	20	43	$3,419.73
RESEARCH BOUNDARY LINES AND EASEMENTS	1						8	2	40		51	$2,765.87
RIGHT-OF-WAY STRIP MAP	2						16	2	120		140	$7,159.22
LOCATE UNDERGROUND UTILITIES	1						2	4	6	12	25	$2,106.53
LOCATE SOIL BORINGS	1						1	2	4	12	20	$1,823.54
TOPOGRAPHIC SURVEY	2						4	8	8	100	122	$12,404.58
SUBTOTAL SURVEYING	8						33	22	194	144	401	$29,881.47
PROJECT MANAGEMENT & PRELIMINARY PLANS												
UPDATE PROJECT SCHEDULE	8				16						24	$1,699.12
PROJECT MEETINGS/SITE VISITS	40	8	40			20					108	$9,781.80
REVIEW CITY RECORD DRAWINGS	8	16	40		40						104	$7,176.48
UTILITY COORDINATION	16		40		16	16					88	$6,077.84
RECOMMEND PAVEMENT SECTIONS	24	16		8							48	$5,728.16
TITLE SHEET	1				24						25	$1,093.27
GENERAL NOTES AND QUANTITIES	4	16	40	4	40	8					112	$7,325.52
TYPICAL SECTIONS 2 Sheets	16	16	8	8	80						128	$8,384.64
HORIZONTAL AND VERTICAL CONTROL SHEET	4		8	4	40						56	$2,940.16
DEMOLITION SHEETS 3 Sheets	4	16	24	4	120						168	$9,124.48
ROADWAY PLAN AND PROFILES 12 Sheets	24	60	192	360	120						756	$54,383.88
INTERSECTION LAYOUTS 3 Sheets	8	16	80	24	120						248	$14,723.84
PAVEMENT MARKINGS 3 Sheets	4	16	40	4	120						184	$10,148.00
ROADWAY CROSS-SECTIONS 15 Sheets	8	16	80	180	120						404	$26,328.68
UNDERDRAIN PROFILES/ROOT BARRIERS 2 Sheets	16	40	80	8	80						224	$15,926.88
DETAILS 2 Sheets	16	40	8	16	80						160	$11,916.16
INCORPORATE OTHER CONSTRUCTION PROJECTS	16	40	8	16	80						160	$11,916.16
DETERMINE CONSTR. SEQUENCE APPROACH	16	8									24	$3,095.76
TECHNICAL SPECIFICATIONS	16	40				40					96	$8,914.56
SUBTOTAL MANAGEMENT AND PLANS	249	364	688	636	1,096	84					3,117	$216,685.39
DESIGN REPORT												
ENGINEERING DESIGN REPORT	40	8	40	4	24	40					156	$11,992.12
OPINIONS OF PROBABLE COST	16	24	16								56	$6,076.88
COUNCIL MEETING	4		4								8	$785.12
SUBTOTAL DESIGN REPORT	60	32	60	4	24	40					220	$18,854.12
TOTAL HOURS	317	396	748	640	1,120	124	33	22	194	144	3,738	
TOTAL LABOR COST	$41,942.27	$48,450.60	$47,849.56	$47,609.60	$44,844.80	$5,901.16	$3,347.19	$1,070.52	$8,365.28	$15,840.00		$265,220.98

60 ?

June 30, 2000

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EXHIBIT B-2

MIDWAY ROAD RECONSTRUCTION FROM BELT LINE ROAD TO KELLER SPRINGS ROAD PHASE ONE DESIGN MANHOUR ESTIMATE (HNTB Corporation)							
	ASSISTANT PROJECT MANAGER	SENIOR ENGINEER	ENGINEER	CADD OPERATOR	CLERICAL	TOTAL HOURS	LABOR COST
PROJECT MANAGEMENT & PRELIMINARY PLANS							
ATTEND COUNCIL MEETING (1)	4	4				8	$900.00
ATTEND PROJECT MEETINGS (3)	8		8			16	$1,560.00
FIELD OBSERVATION		1	8			9	$705.00
TURN BAY STORAGE ANALYSIS (10)			6			6	$450.00
INTERSECTION ANALYSIS		2	6			8	$660.00
TEMPORARY LIGHTING ANALYSIS		1	4			5	$405.00
DEVELOP TRAFFIC CONTROL CONCEPTS	4	4	16			24	$2,100.00
PHASING/DIVISION OF WORK PLAN	2	4	4			10	$960.00
PREPARE SKETCHES FOR REPORT (8)			4	16		20	$1,548.00
WRITE RECOMMENDATIONS FOR DESIGN REPORT	2	4	2		8	16	$1,242.00
TOTAL HOURS	20	20	58	16	8	122	
TOTAL LABOR COST	$2,400.00	$2,100.00	$4,350.00	$1,248.00	$432.00		**$10,530.00**

June 30, 2000

EXHIBIT D

TSPE Charges for Engineering Services

Construction Cost (from Exhibit C without contingency)	$4,984,700
Curve A (for Urban Streets)	6.35%
Fee Based on Curve A	$316,528
85% of Curve A (No Construction Services)	$269,049

Note: TSPE Curve A excludes surveying and geotechnical services.

EXHIBIT C

OPINION OF PROBABLE COST
(For Design Contract)

Date: June 27, 2000

Midway Road Reconstruction Project
Belt Line Road to Keller Springs
Town of Addison

Item No.	Quantity	Unit	Item	Unit Price ($)	Item Total
1	55.0	STA	ROW Preparation	5,000.00	$275,000.00
2	10,000	C.Y.	Unclassified Excavation (for 4" Base)	12.00	120,000.00
3	1	L.S.	Barricade, Sign, Traffic Control	0.00	0.00
4	53,500	S.Y.	Remove Concrete Pavement, Haul, Dispose	10.00	535,000.00
5	700	S.Y.	Remove Concrete Drive, Haul, Dispose	15.00	10,500.00
6	2,000	S.Y.	Remove/Replace 6" Concr. Median Pavemt.	40.00	80,000.00
7	14,000	L.F.	Sawcut Breakout Groove	4.00	56,000.00
8	57,000	S.Y.	4" Asphalt Treated Base	10.00	570,000.00
9	700	S.Y.	6" Reinforced Concrete Drives	40.00	28,000.00
10	53,500	S.Y.	11" Reinf. Concr. Pavement (4,000 psi)	55.00	2,942,500.00
11	8,900	L.F.	6" Integral Curb	3.00	26,700.00
12	3,000	S.Y.	Temporary Asphalt	0.00	0.00
13	10,000	S.Y.	Block Sodding Disturbed Areas	5.00	50,000.00
14	20	EA.	Reconstruct Inlet Tops	1,500.00	30,000.00
15	24	EA.	Remove and Replace Street Lights	0.00	0.00
16	2,200	EA.	4" Buttons	5.00	11,000.00
17	10,000	L.F.	Geocomposite Edge Drain	20.00	200,000.00
18	1	L.S.	Pavement Markings	50,000.00	50,000.00
19	1	L.S.	Traffic Signal/Loop Adjustments	0.00	0.00
20	1	L.S.	Storm Water Pollution Prevention Plan	0.00	0.00
21	1	L.S.	Replace Landscape	0.00	0.00
22	1	L.S.	Utility Adjustments	100,000.00	100,000.00
			Subtotal:		$4,984,700.00
			20% Contingency:		$996,940.00
			TOTAL:		$5,981,640.00

Notes:
1. No sidewalk cost is included.
2. Existing inlet bases will remain in place while the top is reconstructed.
3. The edge drain will be placed behind the outside curbs for the length of the project.
4. Early strength concrete would add about $500,000 to the project cost.
5. Phase Two design items have been excluded from the total cost.

EXHIBIT D

TSPE Charges for Engineering Services

Construction Cost (from Exhibit C without contingency)	\$4,984,700
Curve A (for Urban Streets)	6.35%
Fee Based on Curve A	\$316,528
85% of Curve A (No Construction Services)	\$269,049

Note: TSPE Curve A excludes surveying and geotechnical services.

OPINION OF PROBABLE COST
McMahon Contracting, Inc.

Date: May 26, 2000

Based on std concrete
24 hr conc adds $2.5X10^6

Midway Road Reconstruction Project
Belt Line Road to Keller Springs
Town of Addison

Item No.	Quantity	Unit	Item	Unit Price ($)	Item Total
1	55.0	STA	ROW Preparation	5,000.00	275,000.00
2	10,000	C.Y.	Unclassified Excavation (for 4" Base)	6.00	60,000.00
3	1	L.S.	Barricade, Sign, Traffic Control	25,000.00	25,000.00
4	53,500	S.Y.	Remove Concrete Pavement, Haul, Dispose	5.50	294,250.00
5	700	S.Y.	Remove Concrete Drive, Haul, Dispose	6.00	4,200.00
6	2,000	S.Y.	Remove/Replace 6" Concr. Median Pavemt.	34.00	68,000.00
7	14,000	L.F.	Sawcut Breakout Groove	2.75	38,500.00
8	57,000	S.Y.	4" Asphalt Treated Base or C.T.B	9.90	564,300.00
9	700	S.Y.	6" Reinforced Concrete Drives	29.00	20,300.00
10	53,500	S.Y.	11" Reinf. Concr. Pavement (4,000 psi)	39.00	2,086,500.00
11	8,900	L.F.	6" Integral Curb	1.00	8,900.00
12	3,000	S.Y.	Temporary Asphalt	25.00	75,000.00
13	10,000	S.Y.	Block Sodding Disturbed Areas	4.50	45,000.00
14	20	EA.	Reconstruct Inlet Tops	1,600.00	32,000.00
15	24	EA.	Remove and Replace Street Lights	900.00	21,600.00
16	2,200	EA.	4" Buttons	5.00	11,000.00
17	10,000	L.F.	Geocomposite Edge Drain	29.00	290,000.00
18	1	L.S.	Pavement Markings	50,000.00	50,000.00
19	1	L.S.	Traffic Signal/Loop Adjustments	150,000.00	150,000.00
20	1	L.S.	Storm Water Pollution Prevention Plan	20,000.00	20,000.00
21	1	L.S.	Replace Landscape	150,000.00	150,000.00
22	1	L.S.	Utility Adjustments	100,000.00	100,000.00
			Subtotal:		$4,389,550.00
			20% Contingency & Escalation:		$877,910.00
			TOTAL:		$5,267,460.00

Notes:
1. No sidewalk cost is included.
2. Existing inlet bases will remain in place while the top is reconstructed.
3. The edge drain will be placed behind the outside curbs for the length of the project.
4. Early strength concrete would add about $500,000 to the project cost.

OPINION OF PROBABLE COST Date: May 26, 2000
Ed Bell Construction

Midway Road Reconstruction Project
Belt Line Road to Keller Springs
Town of Addison

Item No.	Quantity	Unit	Item	Unit Price	Item Total
				($)	
1	55.0	STA	ROW Preparation	5,000.00	275,000.00
2	10,000	C.Y.	Unclassified Excavation (for 4" Base)	10.00	100,000.00
3	1	L.S.	Barricade, Sign, Traffic Control	250,000.00	250,000.00
4	53,500	S.Y.	Remove Concrete Pavement, Haul, Dispose	10.00	535,000.00
5	700	S.Y.	Remove Concrete Drive, Haul, Dispose	12.00	8,400.00
6	2,000	S.Y.	Remove/Replace 6" Concr. Median Pavemt.	50.00	100,000.00
7	14,000	L.F.	Sawcut Breakout Groove	5.00	70,000.00
8	57,000	S.Y.	4" Asphalt Treated Base or C.T.B	12.00	684,000.00
9	700	S.Y.	6" Reinforced Concrete Drives	40.00	28,000.00
10	53,500	S.Y.	11" Reinf. Concr. Pavement (4,000 psi)	33.00	1,765,500.00
11	8,900	L.F.	6" Integral Curb	1.00	8,900.00
12	3,000	S.Y.	Temporary Asphalt	25.00	75,000.00
13	10,000	S.Y.	Block Sodding Disturbed Areas	4.00	40,000.00
14	20	EA.	Reconstruct Inlet Tops	1,500.00	30,000.00
15	24	EA.	Remove and Replace Street Lights	2,500.00	60,000.00
16	2,200	EA.	4" Buttons	7.00	15,400.00
17	10,000	L.F.	Geocomposite Edge Drain	25.00	250,000.00
18	1	L.S.	Pavement Markings	50,000.00	50,000.00
19	1	L.S.	Traffic Signal/Loop Adjustments	150,000.00	150,000.00
20	1	L.S.	Storm Water Pollution Prevention Plan	20,000.00	20,000.00
21	1	L.S.	Replace Landscape	150,000.00	150,000.00
22	1	L.S.	Utility Adjustments	100,000.00	100,000.00
			Subtotal:		$4,765,200.00
			20% Contingency & Escalation:		$953,040.00
			TOTAL:		$5,718,240.00

Notes:
1. No sidewalk cost is included.
2. Existing inlet bases will remain in place while the top is reconstructed.
3. The edge drain will be placed behind the outside curbs for the length of the project.
4. Early strength concrete would add about $500,000 to the project cost.

OPINION OF PROBABLE COST
Composite of Bids from Other Projects

Date: May 26, 2000

Midway Road Reconstruction Project
Belt Line Road to Keller Springs
Town of Addison

Item No.	Quantity	Unit	Item	Unit Price ($)	Item Total
1	55.0	STA	ROW Preparation	6,000.00	330,000.00
2	10,000	C.Y.	Unclassified Excavation (for 4" Base)	12.00	120,000.00
3	1	L.S.	Barricade, Sign, Traffic Control	100,000.00	100,000.00
4	53,500	S.Y.	Remove Concrete Pavement, Haul, Dispose	10.00	535,000.00
5	700	S.Y.	Remove Concrete Drive, Haul, Dispose	10.00	7,000.00
6	2,000	S.Y.	Remove/Replace 6" Concr. Median Pavemt.	35.00	70,000.00
7	14,000	L.F.	Sawcut Breakout Groove	3.00	42,000.00
8	57,000	S.Y.	4" Asphalt Treated Base or C.T.B.	15.00	855,000.00
9	700	S.Y.	6" Reinforced Concrete Drives	35.00	24,500.00
10	53,500	S.Y.	11" Reinf. Concr. Pavement (4,000 psi)	55.00	2,942,500.00
11	8,900	L.F.	6" Integral Curb	2.00	17,800.00
12	3,000	S.Y.	Temporary Asphalt	25.00	75,000.00
13	10,000	S.Y.	Block Sodding Disturbed Areas	4.00	40,000.00
14	20	EA.	Reconstruct Inlet Tops	1,600.00	32,000.00
15	24	EA.	Remove and Replace Street Lights	1,000.00	24,000.00
16	2,200	EA.	4" Buttons	5.00	11,000.00
17	10,000	L.F.	Geocomposite Edge Drain	30.00	300,000.00
18	1	L.S.	Pavement Markings	50,000.00	50,000.00
19	1	L.S.	Traffic Signal/Loop Adjustments	150,000.00	150,000.00
20	1	L.S.	Storm Water Pollution Prevention Plan	20,000.00	20,000.00
21	1	L.S.	Replace Landscape	150,000.00	150,000.00
22	1	L.S.	Utility Adjustments	100,000.00	100,000.00
			Subtotal:		$5,995,800.00
			20% Contingency & Escalation:		$1,199,160.00
			TOTAL:		$7,194,960.00

Notes:
1. No sidewalk cost is included.
2. Existing inlet bases will remain in place while the top is reconstructed.
3. The edge drain will be placed behind the outside curbs for the length of the project.
4. Early strength concrete would add about $500,000 to the project cost.

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

Project No. 1999137

Client: Town of Addison

Date: 7/14/99

Project: Midway Road Paving Improvements

Spring Valley Road to Beltline Road (5,100 Linear Feet)

By: PAC/JWB

ENGINEER'S OPINION OF CONSTRUCTION COST

Item No.	Description	Quantity	Unit	Price	Amount
1	Furnish and Install 10-Inch Reinforced Concrete Pavement	41,389	S.Y.	$ 60.00	$ 2,483,340.00
2	Furnish and Install 6-Inch Crushed Stone Free Draining Subgrade	7,500	C.Y.	$ 55.00	$ 412,500.00
3	Furnish and Install Street Light and Base	28	EA.	$ 4,750.00	$ 133,000.00
4	Furnish and Install 6-Inch Monolithic Curb	17,600	L.F.	$ 2.00	$ 35,200.00
5	Furnish and Install 10-Inch Reinforced Concrete Driveway Return	1,750	S.Y.	$ 40.00	$ 70,000.00
6	Furnish and Install Barrier Free Ramp	102	S.Y.	$ 50.00	$ 5,100.00
7	Furnish and Install 4-Inch Reinforced Concrete Sidewalk	4,133	S.Y.	$ 30.00	$ 123,990.00
8	Furnish and Install Landscaping (Medians and Parkways)	4,325	L.F.	$ 35.00	$ 151,375.00
9	Unclassified Roadway Excavation	12,907	C.Y.	$ 15.00	$ 193,605.00
10	Furnish and Install 3-Inch Traffic Signal Conduit	1,300	L.F.	$ 20.00	$ 26,000.00
11	Furnish and Install 4-Inch Street Light Conduit	5,100	L.F.	$ 22.00	$ 112,200.00
12	Furnish and Install Traffic Buttons	4,080	EA.	$ 5.00	$ 20,400.00
13	Furnish, Install and Maintain Traffic Control	5,100	L.F.	$ 18.00	$ 91,800.00
14	Remove Existing Reinforced Concrete Pavement Inc. Curb and Gutte	41,389	S.Y.	$ 15.00	$ 620,835.00
15	Remove Existing Concrete Sidewalk	4,133	S.Y.	$ 8.00	$ 33,064.00
16	Furnish and Install Solid Sod	5,600	S.Y.	$ 9.00	$ 50,400.00
16	Drainage @ 15% of Paving Cost	1	L.S.	15%	$ 684,421.35
	Subtotal:				$ 5,247,230.35

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

Project No. 1999137

Client: Town of Addison
Project: Midway Road Paving Improvements
Spring Valley Road to Beltline Road (5,100 Linear Feet)

Date: 7/14/99
By: PAC/JWB

ENGINEER'S OPINION OF CONSTRUCTION COST

Item No.	Description	Quantity	Unit	Price	Amount
	Contingencies and Miscellaneous Items:	20%			$ 1,049,446.07
	Engineering:	8%			$ 503,734.11
	Quality Control:	4%			$ 251,867.06
	Total:				$ 7,052,277.59
				USE:	**$ 7,100,000.00**

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

Project No. 1999137

Client: Town of Addison
Project: Midway Road Paving Improvements
Beltine Road to Keller Springs (5,240 Linear Feet)

Date: 7/14/99
By: PAC/JWB

ENGINEER'S OPINION OF CONSTRUCTION COST

Item No.	Description	Quantity	Unit	Price	Amount
1	Furnish and Install 10-Inch Reinforced Concrete Pavement	42,245	S.Y.	$ 60.00	$ 2,534,700.00
2	Furnish and Install 6-Inch Crushed Stone Free Draining Subgrade	7,500	C.Y.	$ 55.00	$ 412,500.00
3	Furnish and Install Street Light and Base	30	EA.	$ 4,750.00	$ 142,500.00
4	Furnish and Install 6-Inch Monolithic Curb	18,600	L.F.	$ 2.00	$ 37,200.00
5	Furnish and Install 10-Inch Reinforced Concrete Driveway Return	2,028	S.Y.	$ 40.00	$ 81,120.00
6	Furnish and Install Barrier Free Ramp	136	S.Y.	$ 50.00	$ 6,800.00
7	Furnish and Install 4-Inch Reinforced Concrete Sidewalk	4,196	S.Y.	$ 30.00	$ 125,880.00
8	Furnish and Install Landscaping (Medians and Parkways)	4,550	L.F.	$ 35.00	$ 159,250.00
9	Unclassified Roadway Excavation	13,262	C.Y.	$ 15.00	$ 198,930.00
10	Furnish and Install 3-Inch Traffic Signal Conduit	400	L.F.	$ 20.00	$ 8,000.00
11	Furnish and Install 4-Inch Street Light Conduit	5,240	L.F.	$ 22.00	$ 115,280.00
12	Furnish and Install Traffic Buttons	4,192	EA.	$ 5.00	$ 20,960.00
13	Furnish, Install and Maintain Traffic Control	5,240	L.F.	$ 18.00	$ 94,320.00
14	Remove Existing Reinforced Concrete Pavement Inc. Curb and Gutte	42,245	S.Y.	$ 15.00	$ 633,675.00
15	Remove Existing Concrete Sidewalk	8	S.Y.	$ 8.00	$ 64.00
16	Furnish and Install Solid Sod	5,800	S.Y.	$ 9.00	$ 52,200.00
17	Drainage @ 10% of Paving Cost	1	L.S.	10%	$ 462,337.90
	Subtotal:				$ 5,085,716.90

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

Project No. 1999137

Client: Town of Addison
Project: Midway Road Paving Improvements
Beltine Road to Keller Springs (5,240 Linear Feet)

Date: 7/14/99

By: PAC/JWB

ENGINEER'S OPINION OF CONSTRUCTION COST

Item No.	Description	Quantity	Unit	Price	Amount
	Contingencies and Miscellaneous Items:	20%			$ 1,017,143.38
	Engineering:	8%			$ 488,228.82
	Quality Control:	4%			$ 244,114.41
	Total:				$ 6,835,203.51
				USE:	**$ 6,850,000.00**