



MEMORANDUM

TO: Paul Hodnett, P.E.

DATE: November 26, 2001

FROM: District Laboratory

Originating Office
Fort Worth District
Lab

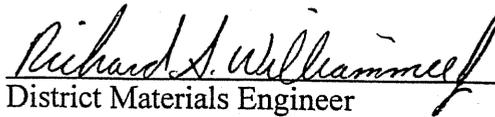
SUBJECT: Geotechnical Survey
Hwy: IH 820
CSJ: 0008-14-058/059
From: IH 35W
To: SH 26
County: Tarrant

Attached is a copy of the three reports for the subject project.

Andrew Wimsatt, District Pavement Engineer, and I have reviewed the results and after discussions with you, recommend the following:

- Item 260 Lime Treated Subgrade
 - Add the General Note for Deep Lime (18").
 - Use from Sta. 23+180 to SH 26.
- Item 275 Cement Treated Subgrade (Strength N)
 - Add the General Note for Strength N compressive strength.
 - Use for approximately 5% of the earthwork quantity.
- Item 132 Type A embankment
 - Use from Sta. 21+660 to Sta. 23+180.
- Profile grade change -
From IH 35W to Sta. 21+660, what is the possibility of raising the grade? According to the PVR calculations, we need up to 12' of select fill or raise the profile grade as much as possible to limit excavation. We estimate that raising the grade and adding select fill on top of the existing roadway will be cheaper and more expedient than excavating and replacing with select fill. Your opinions are coveted in this selection.

If you should have any questions concerning this matter, please contact this office at Ext. 6675 or by e-mail.


District Materials Engineer P.E.

RSW:rr

Attachments

cc: Andrew Wimsatt, Ph.D., P.E.

TEAM - Soil Survey Report
November 2000

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
1	10/4/2000	653+92.56	6.5 ft.	5.0 ft.	3.8 ft.
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.3 ft.
4	10/4/2000	708+71.43	10.3 ft.	8.8 ft.	7.2 ft.
5	10/5/2000	761+80.40	10.7 ft.	9.2 ft.	6.8 ft.
6	10/5/2000	791+10.64	9.3 ft.	1.3 ft.	0.0 ft.
7	10/5/2000	817+92.05	7.0 ft.	5.0 ft.	3.5 ft.
8	10/5/2000	847+69.76	6.3 ft.	4.2 ft.	2.6 ft.
9	10/5/2000	864+34.92	8.2 ft.	6.2 ft.	4.3 ft.
11	10/6/2000	908+64.80	4.5 ft.	3.8 ft.	3.2 ft.
12	10/6/2000	945+58.52	3.8 ft.	2.3 ft.	0.0 ft.
14	10/5/2000	779+43.96	5.5 ft.	3.9 ft.	2.7 ft.
15	10/5/2000	807+30.66	5.5 ft.	3.6 ft.	2.3 ft.
16	10/5/2000	856+20.74	5.7 ft.	2.7 ft.	0.2 ft.
17	10/6/2000	899+98.37	0.0 ft.	0.0 ft.	0.0 ft.

TEAM - 2nd Survey Report
September 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
2B	3/15/2001	681+00.00	6.5 ft.	5.3 ft.	4.5 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.2 ft.
3B	3/14/2001	699+75.00	11.6 ft.	10.4 ft.	8.9 ft.
4	10/4/2000	708+71.43	10.5 ft.	8.8 ft.	7.2 ft.
4B	3/13/2001	719+00.00	1.0 ft.	0.0 ft.	0.0 ft.
4C	3/13/2001	728+35.00	6.0 ft.	3.0 ft.	0.8 ft.
4D	3/13/2001	741+00.00	10.2 ft.	7.0 ft.	4.2 ft.
4E	3/13/2001	751+00.00	9.0 ft.	6.3 ft.	4.8 ft.
5	10/5/2000	761+80.40	10.8 ft.	9.0 ft.	7.0 ft.
5B	3/13/2001	770+50.00	6.7 ft.	5.0 ft.	3.5 ft.

Terra-Mar - Soil Survey Report
July 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2B1	4/6/2001	685+93	6.2 ft.	4.5 ft.	2.8 ft.
3A1	4/6/2001	695+31	9.5 ft.	6.0 ft.	2.8 ft.
3B1	4/6/2001	704+23	9.0 ft.	7.5 ft.	6.0 ft.
4A1	4/6/2001	713+85	5.5 ft.	4.5 ft.	3.6 ft.
4B1	4/1/2001	723+67	6.8 ft.	4.0 ft.	3.2 ft.
4C1	4/5/2001	734+67	6.8 ft.	5.3 ft.	3.6 ft.
4D1	4/5/2001	746+00	6.0 ft.	4.5 ft.	3.2 ft.
4E1	4/5/2001	756+40	6.9 ft.	5.3 ft.	3.5 ft.
5A1	4/5/2001	766+15	3.3 ft.	2.7 ft.	2.0 ft.



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

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FT. WORTH DIST. LAB

**IH 820 SOIL SURVEY
EAST OF IH35W TO EAST OF HALTOM ROAD
TARRANT COUNTY, TEXAS
CONTRACT NO. 02-9XXP0001
CSJ: 0008-00-1208**

TMI REPORT NO. FE99-055-34

TO

**TEXAS DEPARTMENT OF TRANSPORTATION
FORT WORTH, TEXAS**

BY

**TERRA-MAR, INC.
DALLAS / FORT WORTH / HOUSTON / AUSTIN / LONGVIEW**

JULY 9, 2001

TERRA-MAR



Consulting Engineers • Geotechnical • Environmental • Construction Materials Testing

DALLAS • FORT WORTH • HOUSTON • AUSTIN • LONGVIEW

July 9, 2001
TMI Report No. FE99-055-34

Mr. Richard S. Williammee, Jr., P.E.
District Laboratory Engineer
Texas Department of Transportation
Fort Worth District Laboratory
P.O. Box 6868
Fort Worth, Texas 76115-0868

RE: IH820 Soil Survey
East of IH35 to East of Haltom Road
Tarrant County, Texas
Contract No. 02-9XXP0001
CSJ: 0008-00-1208, Work Order No. 02-00-1208

Dear Mr. Williammee:

This report presents the results of the pavement subgrade soil investigation for IH820 from its merger with IH35 to a point between Haltom Road and Denton Highway (US377) in Tarrant County, Texas. The investigation was performed in accordance with instructions provided in your authorization by Work Order No. 02-01-276, dated March 30, 2001. The results of our investigation are reported in English units in accordance with our contract.

We appreciate the opportunity to assist on this project and trust that our field and laboratory data and engineering recommendations will be of assistance in the Fort Worth District's design efforts. Do not hesitate to call if there are questions, or when we may be of further service.

Respectfully,

TERRA-MAR, INC.

Leonel Ruiz, E.I.T.
Graduate Engineer

Garrett E. Williams, P.E.
Fort Worth Office Manager





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1.0 PROJECT DESCRIPTION, PURPOSE AND SCOPE

In order to assist the Texas Department of Transportation (TxDOT) in the design of the reconstruction of a portion of the IH820 existing roadway, Terra-Mar (TMI) has performed a soil survey along the roadway from its merger with IH35W to a point between Haltom Road and Denton Highway (US377) in Tarrant County, Texas. The majority of this alignment is located in a fill area which was placed during the original construction of IH820.

Based on information from TxDOT, TMI has the following understanding of the new pavement section. The existing section will be widened from two lanes to three lanes with a median. The median may or may not be paved. Significant cutting and filling of the subgrade is not expected.

The purpose of the investigation was to provide the following items:

- Soil classification, and Atterberg Limits of materials within the proposed stabilized subbase zone beneath the proposed pavements.
- Estimated potential vertical rise (PVR) within the active moisture zone using the TxDOT Method Tex-124-E and other industry methods.
- Estimated depth of cover to limit the PVR to 1 inch or less within the active moisture zone.
- Evaluation of suitable stabilization methods for the encountered subgrade materials.
- Evaluation of the potential for sulfate induced heaving in the tested areas where subgrade soils are to be stabilized.
- Provide comments on alternatives to reduce the PVR to 1 inch or less in lieu of replacement with an inert material. These alternatives are also desired as future considerations for other roadways.

2.0 REPORT ORGANIZATION

For ease of reading and interpretation, the figures associated with each boring location are included in separate Appendices, numbered to correspond with the boring number (i.e. Appendix 1 contains information on Boring B-2B1). Each Appendix includes: 1) the drilling log in TxDOT WinCore version 1.05 format; 2) a PVR calculation sheet with a graph showing depth of coverage vs. PVR; and 3) absorption swell test results.



3.0 FIELD INVESTIGATIONS

Per TxDOT's request, nine (9) soil borings were drilled at locations determined by TxDOT along the centerline of the median of the existing alignment. Boring logs in TxDOT WinCore version 1.05 format and excerpts from the plans showing boring locations are provided in the appropriate boring-specific Appendices. Flight augers were used to penetrate and sample the overlying pavement structure. Soil samples were recovered using Shelby tube (push barrel) samplers.

4.0 LABORATORY INVESTIGATIONS

In each boring, for each soil type within the subgrade active moisture zone, liquid limit (TEX 104-E, Part II), plastic limit (TEX 105-E, Part I), and natural moisture content (TEX 103-E) tests were conducted. Additionally, the percentage passing the no. 40 sieve was determined. The results of these laboratory tests are shown on the individual boring logs. Several samples were tested for the presence of soluble sulfates. The results of these tests are presented in Section 5.6 of this report.

5.0 RESULTS OF SOIL SURVEY

5.1 Site Geology

According to the Dallas Sheet of the Geologic Atlas of Texas, this portion of IH820 is geologically located in a mapped outcropping of the PawPaw Formation, Weno Limestone, and Denton Clay undivided of the Lower Cretaceous age. These formations consist of moderately active to highly active silty clays to clays. The parent material associated with these formations consist of shaley limestones and limey shales.

The Tarrant County Soil Survey indicates that the portion of IH820 under study is within the Sanger-Purves-Slidell Unit. The Sanger soils predominately compose this unit with lesser amounts of Purves soils. In general, these series are composed of a variety of montmorillonitic clays, dark grayish brown to brown in color. These clays often become brown and tan in color and shaley with depth.

It is noted that fill materials in this portion of the alignment probably came from the east, the closest cut area. These soils consisted of Aledo, Frio and Sanger soils which are composed of a



variety of dark grayish brown to brown clays and silty clays often containing gravel and limestone fragments.

5.2 Groundwater

At the time of this investigation, groundwater seepage was encountered during drilling in Boring B-4A1 at a depth of 10 feet with a water level of 9.5 feet measured at completion. Seepage was not encountered in the remaining borings during drilling and they were dry at completion. It is not possible to accurately predict the magnitude of subsurface water fluctuation that might occur based upon these short-term observations. Therefore, it should be recognized that groundwater levels will fluctuate with variations in seasonal precipitation and surficial runoff. During wet periods of the year seepage can occur in the limestones or in the clays which contain significant quantities of limestone fragments which tend to be more permeable than the clays.

5.3 Generalized Subsurface Conditions

The subsurface conditions encountered in the borings varied, particularly with respect to the depth of fill. The depth of fill was difficult to discern due to the amount of time the fills have been present and their similarity to the natural materials. The fill depths indicated on the Drilling Logs are based on visual observations of the soil samples and the site conditions at each boring location. It should be recognized the actual fill depth could be different than reported on the Drilling Log.

Detailed descriptions of the subsurface conditions encountered in the borings are presented on the Drilling Log in each of the Appendices. A brief description of the subsurface conditions encountered in the borings is presented below.

The surficial soils consisted of clay and silty clay fill which varied in depth from generally 4 feet to the boring termination of 20 feet in Boring B-3B1. These soils varied from dark brown, brown and grayish brown clays to brown, tan and gray silty clays with calcareous nodules and limestone fragments. Limestone boulders were occasionally present in the clays. The various clays had Liquid Limits (LL) ranging from 51 to 78 percent and Plasticity Indices (PI) ranging from 31 to 55 while the silty clays had LL's ranging from 32 to 48 percent and Plasticity Indices (PI) ranging from 15 to 30. Boring B-3B1 was apparently terminated in the fills at a depth of 20 feet.



Brown clays to brown and tan silty clays underlaid the fills in the remaining borings, except in Boring Nos. B-4D1, B-4E1 and B-5A1. These various clays and silty clays had LL's ranging from 37 to 69 percent and PI's varying from 18 to 47. Borings B-2B1, B-3B1, B-4A1, B-4B1 and B-4C1 were terminated in these clays and silty clays at a depth of 20 feet.

The various clays and silty clays, both fill and natural materials, were stiff to hard in consistency.

Tan limestone was then encountered in Borings B-4D1 and B-4E1 at depths of 16 to 18 feet and continued to termination at a depth of 20 feet and in Boring B-5A1 at a depth of 6 feet and continued to termination at a depth of 10 feet.

The laboratory results indicate the various clays encountered along this portion of the alignment are highly active while the silty clays are moderately active to active. Active clays can experience significant volume changes (expansion or contraction) with minor fluctuations in their moisture content. The results of the pressure swell tests also indicate the significant swell potential of the clays present at this site when present in a dry, hard condition.

5.4 Potential Vertical Rise (PVR) and Depth of Coverage

The potential vertical rise (PVR) of the ground surface at each of the boring locations was determined in accordance with method TEX 124-E. The PVR calculations were based on a zone of seasonal moisture fluctuation of 15 feet or to the top of limestone, whichever was less. Since a new pavement is being constructed in the area of an existing pavement, it is assumed that cutting and filling operations along the roadway will be minimal. Because of the presence of the pavement structure in this alignment, the upper one foot of the pavement subgrade was neglected in the PVR calculations. The PVR calculations were based on the moisture content of the soil during the time of the subsurface investigation, and on dry conditions that would be expected during significant drought periods during warm weather.

The results of the PVR calculations are shown in the following table. Note that some of the results of these sets of calculations for the existing and dry conditions are virtually identical. This is attributed to the fact that these sampled subsurface soils were in a "dry" condition during the investigation.



Additionally, the PVR at each boring location was determined as a function of the depth of coverage of non-expansive material (such as pavement components or non-expansive soils), as shown in the chart in each boring-specific Appendix. A summary of the required depth of coverage to reduce the estimated PVR values to 1 inch or less (as determined from the chart) is also provided in the following table.

Boring	PVR Under Existing Conditions (in)	PVR Under "Dry" Conditions (in)	Depth of Coverage to Limit PVR to 1 inch
B-2B1	2.58	2.81	6.25 feet
B-3A1	0.96	2.29	9.5 feet
B-3B1	2.94	3.78	9.0 feet
B-4A1	2.39	3.36	5.5 feet
B-4B1	1.77	3.6	6.75 feet
B-4C1	2.81	2.81	6.75 feet
B-4D1	2.21	2.82	6.0 feet
B-4E1	3.25	3.85	6.75 feet
B-5A1	2.06	2.65	3.5 feet

5.5 Suitability for Stabilization

As previously discussed the surficial soils encountered at this site varied from moderately active to active silty clays to highly active clays. These soils are subject to loss in support value with the moisture increases which occur beneath pavement sections. They react with hydrated lime, which serves to improve and maintain their support value. Treatment of these soils with hydrated lime will improve their subgrade characteristics to support area paving. Stabilization with lime should be in accordance with Item 260 of the Texas Standard Specifications, 1995. Based on the Atterberg Limits tests we recommend a minimum 7 percent of lime by dry weight be used for stabilization of the silty clays and clays present at this site. While the silty clays would require slightly less hydrated lime for stabilization than the clays the variability of the surface soils make field identification unfeasible.

5.6 Potential for "Sulfate-Induced Heaving"

In order to evaluate the potential for the occurrence of sulfate induced heaving of lime or Portland cement stabilized subgrade materials, samples were selected for water soluble sulfate testing to



represent each of the encountered soil materials that would be suitable for stabilization. Additionally, other samples were selected from various subgrade depths to evaluate the overall potential for sulfate bearing soils in this area. The test results for water soluble sulfates were below the detectable level in all samples and were performed on the following samples.

Boring	SO4 (mg/kg)*	Reporting Limit (mg/kg)*
B-2B1, 0'-2'	ND	1000
B-2B1, 4'-6'	ND	1000
B-3A1, 0'-2'	ND	1000
B-3A1, 2'-4'	ND	200
B-3B1, 0'-2'	ND	250
B-4A1, 0-2'	ND	250
B-4A1, 4-6'	ND	250
B-4B1, 0'-2'	ND	500
B-4B1, 4'-6'	2400	500

Boring	SO4 (mg/kg)*	Reporting Limit (mg/kg)*
B-4C1, 0'-2'	ND	250
B-4C1, 4'-6'	ND	1000
B-4D1, 0'-2'	ND	250
B-4D1, 6'-8'	ND	1000
B-4E1, 0-2'	ND	500
B-4E1, 4'-6'	ND	500
B-5A1, 2'-4'	ND	500
B-5A1, 2'-4'	ND	500

* ND indicates sulfate levels were below the detectable level

The results of the soluble sulfate-testing program indicate that the alignment is in an area without significant amounts of soluble sulfates in the upper 4 feet. Based on these readings it is our opinion that the risk of sulfate induced heaving in the upper 4 feet is negligible for this project.

While significant fills are not anticipated to establish finished grade, the construction documents should be worded to prohibit the use of any imported fill materials that contain water soluble sulfates for use as fill on this project.

6.0 ALTERNATIVES FOR PVR REDUCTION

Alternatives to the recommendations previously presented in this report pertaining to the depth of coverage of non-swelling material to reduce PVR have been requested. Such alternatives range from consideration of different methods of calculating the PVR to other means of reducing the PVR.



6.1 General Considerations

Soil treatment methods are frequently employed in the construction of highways and airfields. The design strategies often use similar methods as used for structures to reduce total and differential swell. Differential soil movements are the major source of pavement movements or “roughness” on expansive soils. These differential soil movements occur as a result of moisture fluctuations in response to climate changes (rainfall and evapotranspiration) and surface features such as grading and water ponding at the surface which result in shrinking and swelling of the underlying active clay soils.

Prior to determining effective methods to reduce the PVR important factors are to classify the type of expansive soils present and estimating the potential vertical rise. Available methods of identifying expansive soils include mineralogical, physical properties and soil classification systems. Physical properties (Atterberg Limits, swell tests, gradation tests) and soil classification systems (Unified Soil Classification System) are typically used in the North Texas area to identify expansive soils. Published geologic literature (county soils surveys published by the United States Department of Agriculture) can also help in identifying expansive soils. For example, the physical property tests indicate expansive soils at this site and the Tarrant County Soil Survey indicates these clays are typically composed of montmorillonite which is a clay mineral subject to significant volume changes with minor fluctuations in moisture content.

6.2 Overview of Methods to Quantify PVR

Numerous methods have been developed to quantify the potential vertical movements of the clays. These include laboratory measurement of total swell from oedometer tests, 2) empirical or semi-empirical methods of which the TxDOT Method 124-E or McDowell Method is considered and 3) soil suction methods.

Numerous empirical methods have been developed to estimate PVR. The most widely used and accepted method is the Tex-124-E Method or the PVR Method. This method yields a simple pressure-volume change relationship for swelling clays based on water content, index properties, vertical pressures and depth of active zone. Other prominent methods include the Vijayvergiya-Ghazzaly (VG) Method and the Seed-Woodward-Lundgren Method. The VG method has been found to provide good correlation with the PVR Method at average and wet conditions and predicts



slightly higher movements than the PVR method for soils in a dry condition. One of the more prominent methods to be developed from the suction method is the PTI method. This method is based on the soil suction method and correlation of moisture penetration and moisture velocity with the Thornthwaite Moisture Index (TMI). In the PTI method, variation in climate causes either an edge lift or a center lift condition.

6.2.1 Alternate Methods of Calculating PVR

The potential vertical rise (PVR) of the ground surface at each of the boring locations was alternatively determined in general accordance with the Vijayvergiya-Ghazzaly (VG) method. The PVR calculations were based on a zone of seasonal moisture fluctuation of 15 feet or to the top of limestone, whichever was less. Since a new pavement is being constructed in the area of an existing pavement, it is assumed that cutting and filling operations along the roadway will be minimal. Because of the presence of the pavement structure in this alignment, the upper one foot of the pavement subgrade was neglected in the PVR calculations. The PVR calculations were based on the actual swell tests results from the laboratory tests for the samples tested rather than the swell values based on Liquid Limit from the VG method. The results of the PVR calculations are shown in the following table along with the PVR values as determined by the TxDOT method under existing conditions.

Boring	PVR using VG Method and Actual Swell Tests (in)	PVR Under "Existing" Conditions using TxDOT Method (in)
B-2B1	1.09	2.58
B-3A1	0.17	0.96
B-3B1	0.25	2.94
B-4A1	0.83	2.39
B-4B1	1.87	1.77
B-4C1	0.26	2.81
B-4D1	1.68	2.21
B-4E1	2.53	3.25
B-5A1	0.65	2.06



Comparison of these values shows that the PVR values from the VG method are significantly less than for those calculated by the TxDOT method except for Boring B-4B1. The laboratory swell tests indicate a lower value of swell than that associated with the TxDOT method. The swell tests are a measure of the soil's swell potential at its moisture content at the time of sampling. Variations in the swell test result for each sample would be expected as the soil's moisture content varies. In addition, it can be concluded that in many instances the average or wet moisture conditions would be more appropriate for the TxDOT PVR method where the dry or average moisture conditions were used, respectively. Use of a more moist condition (ie. average instead of dry or wet instead of average) in the TxDOT PVR method would, of course, result in lower values of PVR.

Use of actual swell tests values to calculate the PVR would generally be considered to result in a more realistic calculation of swell potential rather than using empirical values based on an assumed swell value determined from the soil's plasticity index.

6.3 Methods to Reduce PVR due to Expansive Soils

As previously discussed, moisture fluctuation in active clays underlying a highway is the culpable factor in pavement roughness. The following discussion summarizes the many techniques that have been used to reduce PVR. It is not intended as an exhaustive study of such measures but only as a brief discussion of available options to reduce PVR.

A variety of techniques have been developed to stabilize expansive soils. Minimization of soil moisture variations, both laterally and vertically, will serve to reduce soil movements and correspondingly pavement roughness. Soil treatment methods to reduce PVR can typically be grouped according to 1) removal and replacement; 2) compaction control; 3) prewetting; 4) moisture barriers; and 5) chemical stabilization. In addition to these five soil treatment methods drainage control is also considered a method of reducing soil PVR.

Removal and replacement. This method, often referred to as moisture conditioning, serves to remove the expansive clay soils and replace them with non-expansive select fill consisting of a very sandy clay or clayey sand. Granular soils are not recommended as they allow water intrusion beneath the structural element and can in some instances allow a greater PVR. This is one method commonly used by TxDOT. The FAA recommends this procedure for airfield pavements



situated over highly expansive clays with the greatest recommended thickness of replacement of 36 inches. Due to the cost of imported, non-expansive select fill this method is considered relatively expensive.

Compaction control. This method is often used in combination with removal and replacement or with chemical stabilization. Expansive clay soils will swell less if they are compacted at low densities and high moisture contents. However, this procedure will reduce the bearing strength of the clays and compaction should be specified to maintain adequate strength in the clays. Compaction at a minimum of 2 to 4 percent above the soil's optimum moisture content is typically required to achieve a significant reduction in PVR.

Prewetting. This method is an attempt to raise the soil moisture content and cause the soil to swell prior to construction. This procedure is sensitive to maintaining the elevated moisture contents following construction to prevent shrinkage, particularly adjacent to the structure perimeter. The compaction control technique is a method related to the prewetting technique. The most popular prewetting technique is water pressure injection. In this method water is pressure injected into the soil on typically 5 foot centers. Due to the low permeability of the clays multiple injections are performed. Depending on the soil moisture contents prior to injection it is not unusual for 6 to 8 injections to be performed to achieve the desired results. The injections are continued until the desired moisture contents are achieved. This method has a relatively successful long term history in the North Texas area providing quality control is provided. It has been used for interior slab-on-grades for buildings and at the Dallas-Fort Worth International Airport beneath runways and apron pavements. The injection depth is dependent upon the thickness of the clay profile and swell potential and depths of up to 7 to 10 feet are common for a deep, active clay profile.

Moisture barriers. Moisture barriers are intended to minimize evaporation and surface water intrusion thereby stabilizing the moisture content beneath structures and pavements. In so doing they reduce the long term effects of differential movements adjacent to the structure perimeter. They are typically constructed around the perimeter of a structure foundation. Vertical moisture barriers are considered to be more significant for PVR reduction than a horizontal moisture barrier. The depth of the vertical moisture barrier is typically on the order of a minimum of 6 to 8 feet to achieve significant benefit for PVR reduction.



TxDOT sponsored a study published in October 1997 titled "Prediction of Expansive Clay Roughness in Pavements with Vertical Moisture Barriers". This study summarized the results and conclusions of a multi-year study of the monitoring of moisture barriers in expansive soils. The conclusions indicated that vertical moisture barriers are effective in reducing the development of roughness in pavements on expansive soils. It was also concluded that increasing the shoulder width of the pavement decreases the PVR in the travel lanes and hence decreases the roughness development. In essence, the increased shoulder width acts as a horizontal moisture barrier relative to the traffic lane.

One test section used in this study was in the TxDOT Dallas District along IH635. This vertical moisture barrier extended to a depth of about 8 feet below finished grade. It is our understanding that some problems were encountered with this test section resulting from trapped water between the vertical moisture barriers along the perimeter of the pavement. It was suspected that surface water penetrated the pavement section in joints or cracks and became trapped between the vertical moisture barriers along the edge of the pavement. If this condition actually did occur it points to the importance of insuring water cannot infiltrate the pavement section as the vertical moisture barriers not only will prevent water migration from the external side of the barrier but also from the interior side.

Chemical stabilization. These methods attempt to reduce soil PVR by altering the clay soils to a more stable type of clay, less susceptible to moisture related volume changes. The two most commonly used chemicals are lime and cement. Other organic and inorganic compounds have been tried with varying degrees of success. Both lime and cement reduce the soil's plasticity index. Most soils in the North Texas area react favorably with lime or cement; except for clay soils with a high soluble sulfate content which do not react favorably with lime and cement. The stabilization has been shown to occur in clays which react favorably to lime when they are intimately mixed with the soil. This basically limits the application of this method to the upper 8 to 12 inches unless the soils are excavated and mixed in lifts. Lime slurry injection has typically not been able to achieve significant chemical stabilization. It is our experience that removal of the expansive clays and mixing with hydrated lime to obtain a lime stabilized material and then backfilling with these materials is more expensive than importing non-expansive select fill.



Drainage control. This method, while not a soil treatment method, is included as an important method to reduce PVR. The reduction of available moisture adjacent to and beneath any structural element (including pavements) will serve to reduce the PVR. Moisture increases beneath a structural element typically occur as a result of naturally occurring capillary rise and due to external water sources such as poor drainage. In a highway structure surface water should be directed away from the pavement edge to prevent water ponding adjacent to the structure. If surface drainage is not sufficient then a closed system with surface inlets should be used to collect ponding water and carry it away from the pavement.

General Considerations. The most effective method of PVR reduction is dependent on many factors, including the type of expansive soils present, the swell potential, the depth of the expansive soil profile and other factors. Other factors that influence the method selected include the desired level of reduction, time constraints and of course economics. One of the most critical factors is the level of reduction desired for PVR. Currently, soil surveys in the Fort Worth District are performed to provide a depth of coverage of non-swelling material to reduce the PVR to one inch. This one inch level is considered to be the total swell and not the differential swell which is detrimental to pavement roughness. Correlation of the PVR calculated in the TxDOT method to the pavement roughness might permit use of a higher value of PVR in calculating the depth of coverage. For example, use of 2 inch PVR for the conditions encountered at this site would typically reduce the amount of coverage of non-swelling material to on the order of 3 to 3.5 feet which is average reduction in the non-swelling material thickness of 42%.

A combination of two methods could be used to avoid the high cost associated with the use of a non-swelling material only. For example, removal and replacement (commonly referred to as moisture conditioning) could be combined with a lesser thickness of non-swelling material to achieve reductions in PVR. For the conditions encountered at this site consideration could be given to the use of about 3 feet of non-swelling material underlain by moisture conditioned clays that in combination with the non-swelling material equal the thickness for a 1 inch PVR. This option would typically provide about 4 to 6 feet of moisture conditioned clays for the conditions encountered at this site. Additional studies would be necessary to insure a suitable subgrade modulus is provided by this combined section. In addition, care should always be taken when placing non-swelling material below grade that water cannot migrate through the more permeable



non-swelling materials and result in a potential water source to the underlying clays. This could be accomplished by placing a vertical moisture barrier to the bottom of the non-swelling material.

Another combination could be a thinner section of non-swelling material in conjunction with a vertical moisture barrier extending to minimum depth of 8 feet.

The previously referenced TxDOT sponsored study on moisture barriers could also be used as a methodology to use only vertical moisture barriers as a method to reduce PVR. In this method the roughness prediction model could be used to determine the depth of the moisture barrier to reduce the PVR.

Drainage control should be incorporated with any method used to reduce PVR. Even with extensive soil reduction techniques the presence of excessive amounts of surface water is detrimental to the pavement performance. As previously discussed, care must be taken to divert surface water away from pavement edges by means of adequate slopes and closed drainage systems, if necessary.

7.0 SUMMARY

In summary, the results of our investigation indicate that the subgrade soils encountered at this site are expansive to highly expansive. These soils are suitable for use as a pavement subgrade provided they are improved by lime stabilization. Based on the conditions encountered at this site significant PVR's are present. Based on a 15 -foot active moisture zone (or to the top of limestone if less than 15 feet) the PVR as calculated by TxDOT Method 124-E ranges from 2.29 to 3.85 inches. Use of the VG method to calculate PVR resulted in values of up to 2.5 inches.

The actual amount of PVR that will be experienced depends greatly on the moisture condition of the subgrade during construction and the amount of moisture available to the subgrade soils after construction. Drainage of the pavement surface and shoulders is considered critical to the performance of the pavement subgrade.

If it is desired to reduce the PVR in these areas, the use of significant amounts of a non-expansive cover will be required. Based on a dry subgrade condition and the TxDOT method, the amount of non-expansive fill required will range from 3.5 to 9.5 feet. Other alternatives have been presented



to reduce the PVR. These include use of a higher value of PVR according to the TxDOT Method, a combination of methods including removal and replacement, moisture conditioning and moisture barriers.

8.0 LIMITATIONS

The recommendations presented in this report are based on a discrete number of soil test borings. Although our field personnel visually survey the site for surface features indicative of variable soil conditions, subsurface conditions may be encountered that differ from these data. In this case, our office should be notified immediately so that the effects of these conditions on design and construction can be addressed.

This study was conducted for the exclusive use of the Texas Department of Transportation and their design consultants. The reproduction of this report or any part thereof, in plans or other documents supplied to persons other than the owner, should bear language indicating that the information contained therein is for general design purposes. All contractors referring to this geotechnical report should draw their own conclusions for bidding purposes.

IH820 Soil Survey, Tarrant County, T 3
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 1 – BORING B-2B1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Tests**



DRILLING LOG

WinCore
Version 1.05

County . Tarrant
Highway I H 820
Control 0008-14-059

Hole B-2B1
Structure Pavement
Station 685+93
Offset

District Fort Worth
Date 04-06-01
Grnd. Elev. 628.83
GW Elev. 0.00

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test	Properties			Additional Remarks
				Lateral Deviator Press. Stress	Moi.	LL	PI	
624.8	5		CLAY, very stiff, tan and brown, w/calcareous nodules and limestone fragments (Fill) (SC)		21.9	59	38	
					20.9	58	36	99.6% Passing #40 sieve
618.8	10		CLAY, very stiff, brown, tan and gray, w/occasional silty clay layers and limestone fragments (Fill) (CL)		21.9	54	33	99.8% Passing #40 sieve
					24.2	55	34	
					26.2	33	16	74.8% Passing #40 sieve
608.8	20		CLAY, shaley, hard, brown (CL)		19.4	56	34	
					18.4	53	34	98.1% Passing #40 sieve
					19.1	53	34	
					19.1	52	31	94.9% Passing #40 sieve
					16.0	40	22	
25								

Remarks:

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-2B1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No: FE99-055-34

Existing Conditions

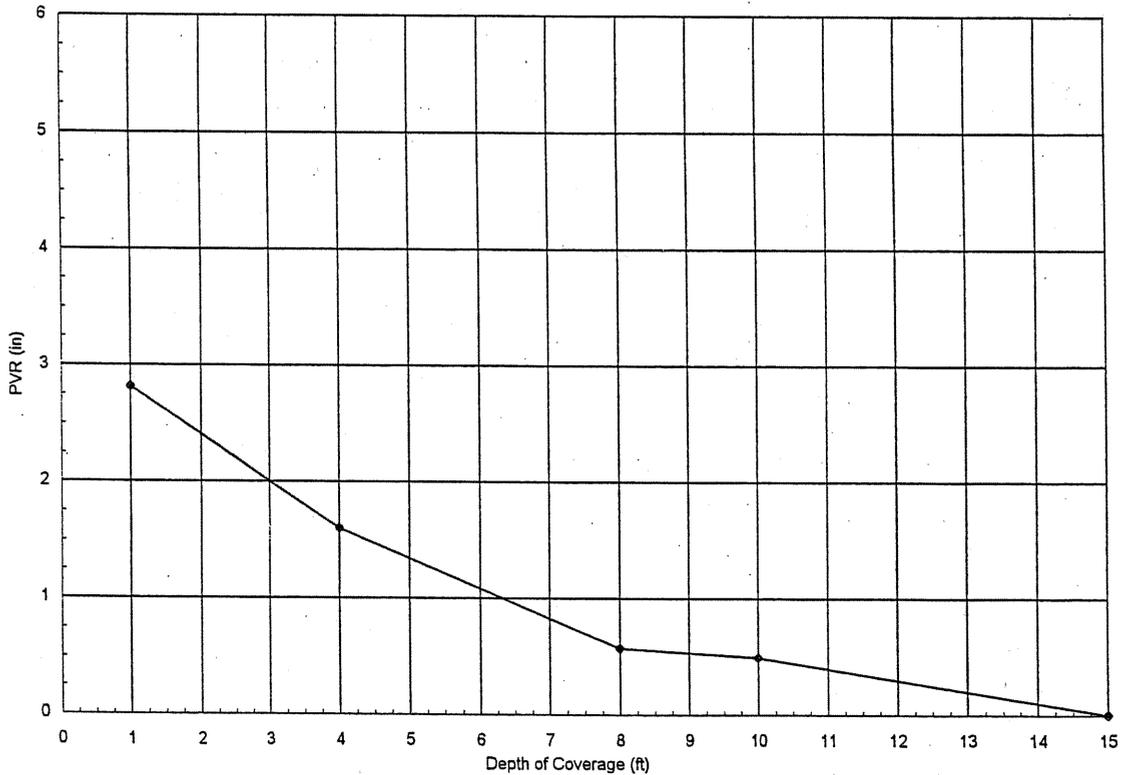
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-2B1	1	4	59	37	99.6	22.0	20.8	29.7	Dry	10.8	14.2	0.0	3.0	0.00	1.50	1.49	
	4	8	55	34	99.8	24.0	20.0	27.9	Avg	7.1	10.2	3.0	7.0	1.15	1.75	0.60	
	8	10	33	16	74.8	26.2	15.6	17.5	Wet	0.5	3.1	7.0	9.0	0.25	0.25	0.00	
	10	15	53	34	98.1	19.0	19.6	26.9	Dry	9.8	13.1	9.0	14.0	2.70	3.20	0.49	2.58

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-2B1	1	4	59	37	81.1	-	-	-	Dry	10.8	14.2	0.0	3.0	0.00	1.50	1.22	
	4	8	55	34	97.9	-	-	-	Dry	9.8	13.1	3.0	7.0	1.40	2.45	1.03	
	8	10	33	16	53.5	-	-	-	Dry	6.6	9.7	7.0	9.0	1.60	1.75	0.08	
	10	15	53	34	98.1	-	-	-	Dry	9.8	13.1	9.0	14.0	2.70	3.20	0.49	2.81

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 6.25 feet.
PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

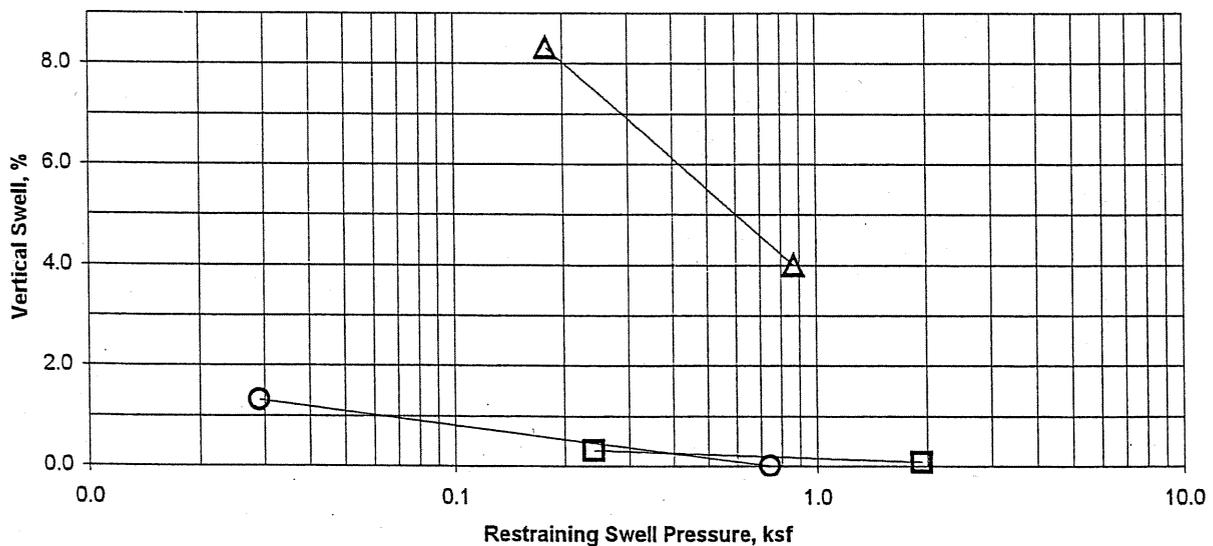
ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey

Project No.: FE99-055-034

Location: Fort Worth, Texas

Test No.	1	2	3
Legend Symbol	—△—	—□—	—○—
Boring Number	B-2B1	B-2B1	B-2B1
Depth, ft	2'-4'	8'-10'	14'-16'
Initial Dry Density, pcf	110.2	100.2	112.7
Initial Moisture Content, %	20.9	26.2	18.2
Final Moisture Content, %	26.4	28.9	20.6
Initial Penetrometer Reading, tsf	4.5+	4.50	-
Final Penetrometer Reading, tsf	2.25	2.00	-
Liquid Limit	58	33	53
Plasticity Index	36	16	34
Maximum Applied Swell Pressure, ksf	0.87	1.93	0.74
Vertical Swell at Maximum Applied Swell Pressure, %	4.0	0.08	0.00
Final Applied Swell Pressure, ksf	0.18	0.24	0.03
Vertical Swell at Final Swell Pressure, %	8.3	0.31	1.30



TERRA-MAR, INC.

IH820 Soil Survey, Tarrant County, T 3
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 2 – BORING B-3A1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test**



DRILLING LOG

WinCore
Version 1.05

County Tarrant
Highway IH 820
Control 0008-14-059

Hole B-3A1
Structure Pavement
Station 695+31
Offset

District Fort Worth
Date 04-06-01
Grnd. Elev. 635.88
GW Elev. 0.00

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test	Properties			Additional Remarks
				Lateral Deviator Press. Stress	Moi.	LL	PI	
631.9	5		CLAY, silty, stiff to very stiff, gray and tan, w/gravel (Fill) (CL)		14.1	42	24	48.7% Passing #40 sieve
					14.6	32	15	
623.9	10		CLAY, silty, very stiff to hard, brown and tan, w/gravel above 8' and limestone fragments @ 10 - 12' (Fill) (CL)		12.8	38	21	77.5% Passing #40 sieve
						46	27	
					24.7	48	30	
					13.5	38	22	
617.9	15		CLAY, very stiff, dark gray to gray, w/calcareous nodules (Fill) (CL)		38.8	78	52	90.9% Passing #40 sieve
					29.2	73	50	
					27.1	61	42	
615.9	20		CLAY, very stiff, tan and brown, w/limestone fragments (CL)		23.5	63	44	84.5% Passing #40 sieve

Remarks:

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-3A1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No.: FE99-055-34

Existing Conditions

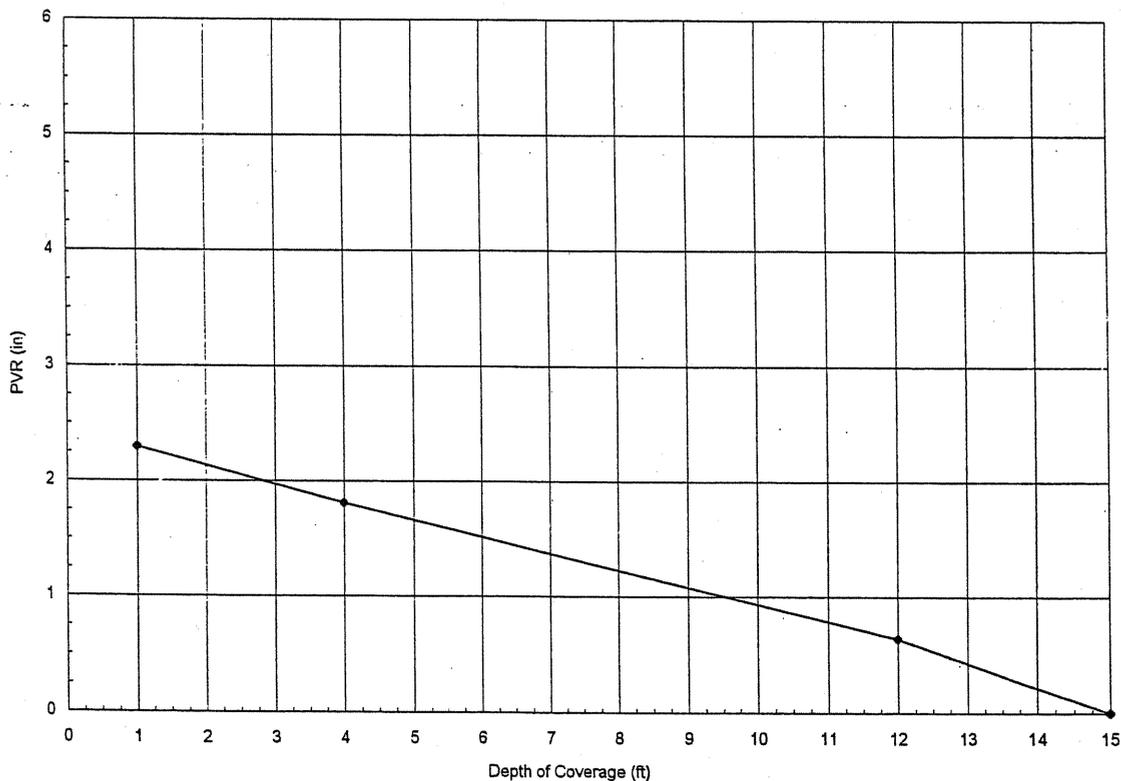
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-3A1	1	4	42	24	48.7	14.1	17.4	21.7	Dry	6.2	9.2	0.0	3.0	0.00	1.00	0.49	
	4	12	48	30	97.4	24.7	18.6	24.6	Wet	3.6	6.5	3.0	11.0	0.55	0.85	0.29	
	12	15	78	52	90.9	38.8	24.6	38.7	Wet	8.5	11.7	11.0	14.0	2.50	2.70	0.18	0.96

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-3A1	1	4	42	24	48.7	-	-	-	Dry	6.2	9.2	0.0	3.0	0.00	1.00	0.49	
	4	12	48	30	97.4	-	-	-	Dry	8.3	11.5	3.0	11.0	1.25	2.45	1.17	
	12	15	78	52	90.9	-	-	-	Dry	15.6	19.3	11.0	14.0	5.40	6.10	0.64	2.29

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 9.5 feet.
PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

TERRA-MAR

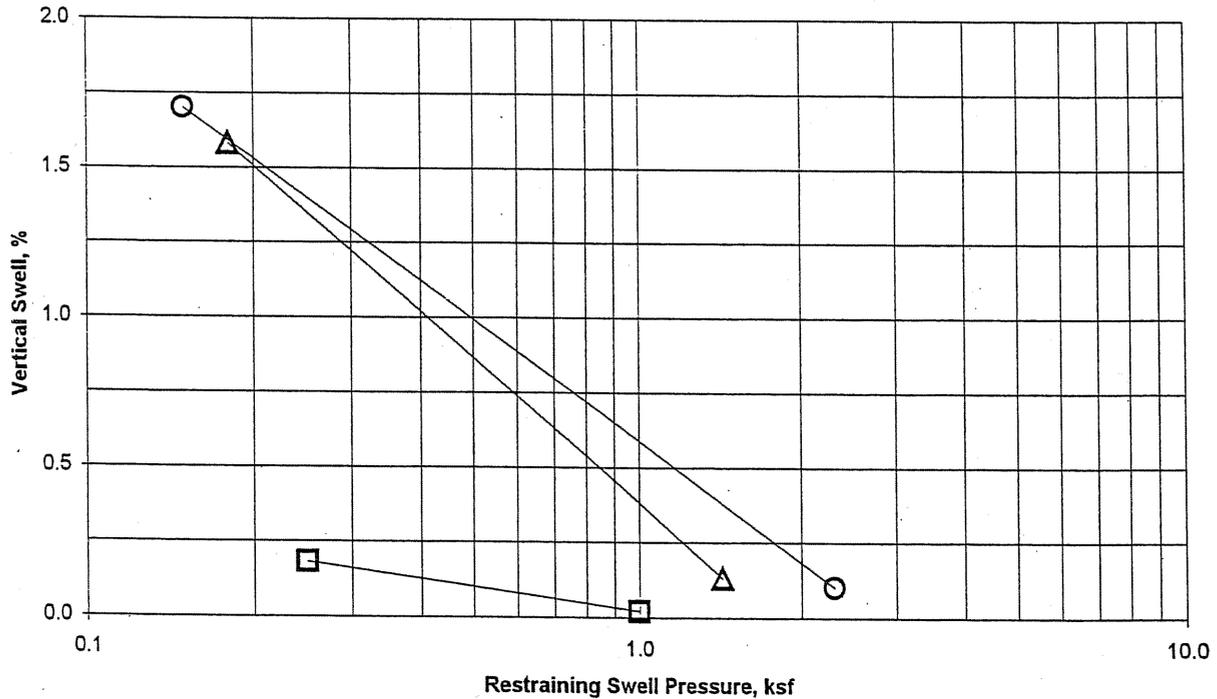
ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey

Project No.: FE99-055-034

Location: Fort Worth, Texas

Test No.	1	2	3
Legend Symbol	—△—	—□—	—○—
Boring Number	B-3A1	B-3A1	B-3A1
Depth, ft	4'-6'	8'-10'	12'-14'
Initial Dry Density, pcf	128.1	113.2	91.7
Initial Moisture Content, %	12.8	18.6	31.6
Final Moisture Content, %	13.7	20.3	33.0
Initial Penetrometer Reading, tsf	3.25	3.0	-
Final Penetrometer Reading, tsf	2.50	3.00	-
Liquid Limit	38	48	78
Plasticity Index	21	30	52
Maximum Applied Swell Pressure, ksf	1.43	1.00	2.30
Vertical Swell at Maximum Applied Swell Pressure, %	0.1	0.02	0.10
Final Applied Swell Pressure, ksf	0.18	0.25	0.15
Vertical Swell at Final Swell Pressure, %	1.6	0.18	1.70



IH820 Soil Survey, Tarrant County, Texas
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 3 – BORING B-3B1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test**



DRILLING LOG

WinCore
Version 1.05

County Tarrant
Highway I H 820
Control 0008-14-059

Hole B-3B1
Structure Pavement
Station 704+23
Offset

District Fort Worth
Date 04-06-01
Grnd. Elev. 642.88
GW Elev. 0.00

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test	Properties			Additional Remarks
				Lateral Deviator Press. Stress	Moi.	LL	PI	
5	[Hatched pattern]		CLAY, very stiff to hard, tan, brown, and gray, w/limestone fragments below 5' and dark brown clay between 5' - 7' (Fill) (CL)		31.2	61	38	
					27.6	63	41	92.8% Passing #40 sieve
					24.9	63	42	96.6% Passing #40 sieve
					20.8	51	31	54.2% Passing #40 sieve
632.9	10		LIMESTONE, tan, boulder					
630.9								
15	[Hatched pattern]		CLAY, very stiff to hard, brown, tan and gray, w/occasional dark brown clay, w/calcareous deposits (Fill) (CL)		26.1	74	50	96.0% Passing #40 sieve
					25.9	79	55	
					20.4	64	43	48.0% Passing #40 sieve
					20.9	60	41	
622.9	20							
25								

Remarks:

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-3B1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No: FE99-055-34

Existing Conditions

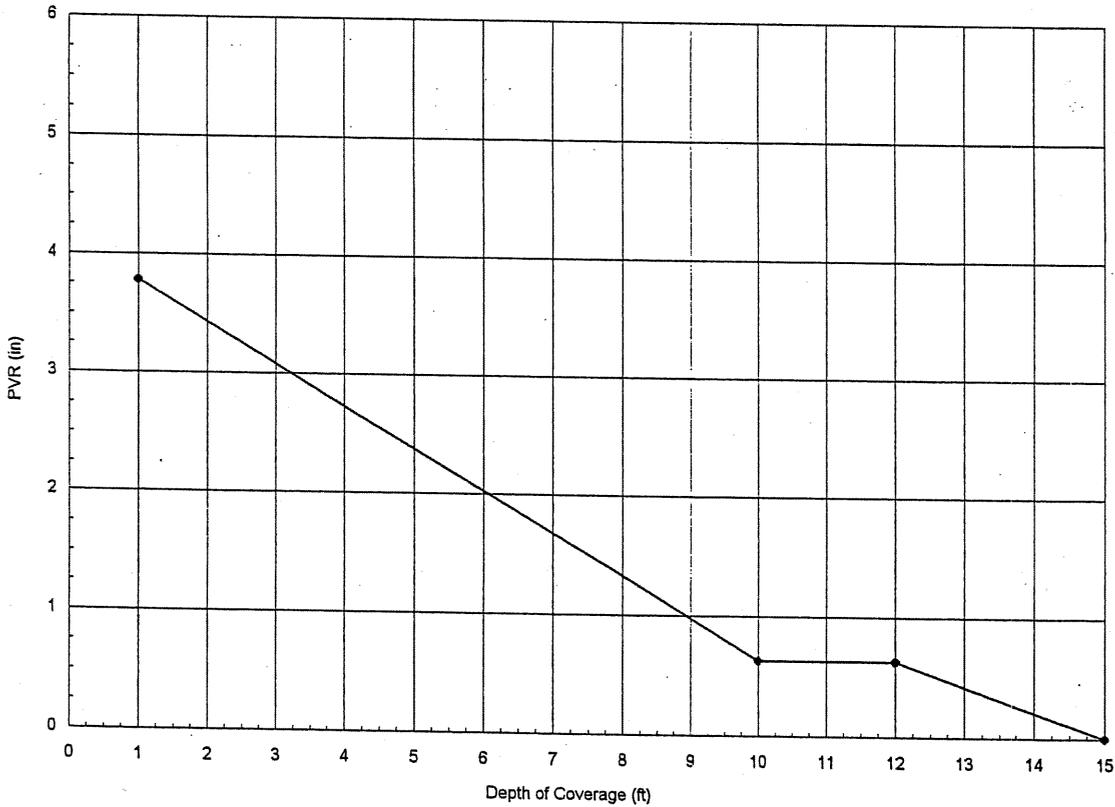
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-3B1	1	10	63	41	92.8	27.6	21.6	31.6	Avg	9.1	12.3	0.0	9.0	0.00	2.50	2.32	
	10	12	n/a	n/a													
	12	15	74	50	96.0	26.1	23.8	36.8	Dry	14.9	18.5	11.0	14.0	5.05	5.70	0.62	2.94

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-3B1	1	10	63	41	92.8	-	-	-	Dry	12.1	15.5	0.0	9.0	0.00	3.40	3.16	
	10	12	n/a	n/a													
	12	15	74	50	96.0	-	-	-	Dry	14.9	18.5	11.0	14.0	5.05	5.70	0.62	3.78

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 9.0 feet.
PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

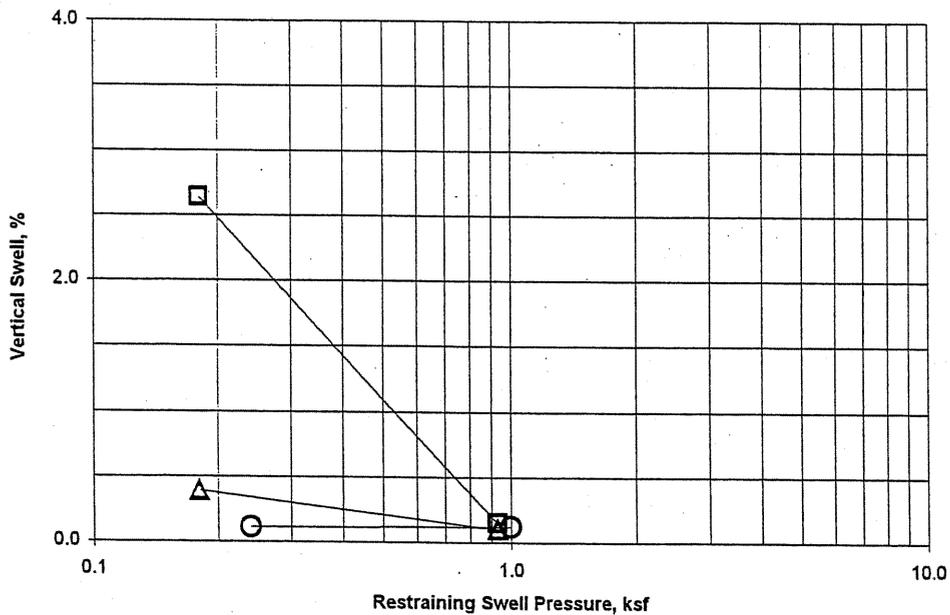
TERRA-MAR

ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey
 Location: Fort Worth, Texas

Project No.: FE99-055-034

Test No.	TEST 1	TEST 2	TEST 3
Legend Symbol	—△—	—□—	—○—
Boring Number	B-3B1	B-3B1	B-3B1
Depth, ft	2'-4'	4'-6'	12'-14'
Initial Dry Density, pcf	96.6	90.2	96.1
Initial Moisture Content, %	27.6	24.9	26.1
Final Moisture Content, %	28.6	27.1	28.6
Initial Penetrometer Reading, tsf	3.00	4.00	4.5+
Final Penetrometer Reading, tsf	2.75	3.00	4.5+
Liquid Limit	63	63	74
Plasticity Index	41	42	50
Maximum Applied Swell Pressure, ksf	0.93	0.93	1.00
Vertical Swell at Maximum Swell Pressure, %	0.1	0.2	0.12
Final Applied Swell Pressure, ksf	0.18	0.18	0.24
Vertical Swell at Final Swell Pressure, %	0.4	2.6	0.11



TERRA-MAR, INC.

IH820 Soil Survey, Tarrant County, Texas
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical – Environmental
Construction Materials Testing

APPENDIX 4 – BORING B-4A1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Tests**



DRILLING LOG

WinCore
Version 1.05

County Tarrant
Highway I H 820
Control 0008-14-059

Hole B-4A1
Structure Pavement
Station 713+85
Offset

District Fort Worth
Date 04-06-01
Grnd. Elev. 650.82
GW Elev. 641.32

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test	Properties			Additional Remarks
				Lateral Deviator Press. Stress	Moi.	LL	PI	
5 644.8			CLAY, very stiff, dark brown and brown, w/calcareous nodules (Fill) (SC)		30.2	68	44	98.0% Passing #40 sieve
					28.8	66	42	
642.8			CLAY, silty, very stiff, brown and tan, w/limestone fragments and calcareous nodules (Fill) (SC)		18.8	38	22	89.0% Passing #40 sieve
640.8 10			CLAY, silty, very stiff, tan and gray, w/calcareous nodules (CL)		22.6	48	30	87.2% Passing #40 sieve
					23.3	52	32	
636.8			CLAY, very stiff to hard, tan, brown and gray, w/calcareous nodules (CL)		24.1	59	37	98.8% Passing #40 sieve
					24.6	59	36	
15 630.8 20			CLAY, shaley, very stiff to hard, reddish brown and reddish tan (CL)		20.9	60	36	92.8% Passing #40 sieve
					25.4	56	34	
25								

Remarks: Seepage @ 10'. Water @ 9.5' @ completion.

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-4A1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No.: FE99-055-34

Existing Conditions

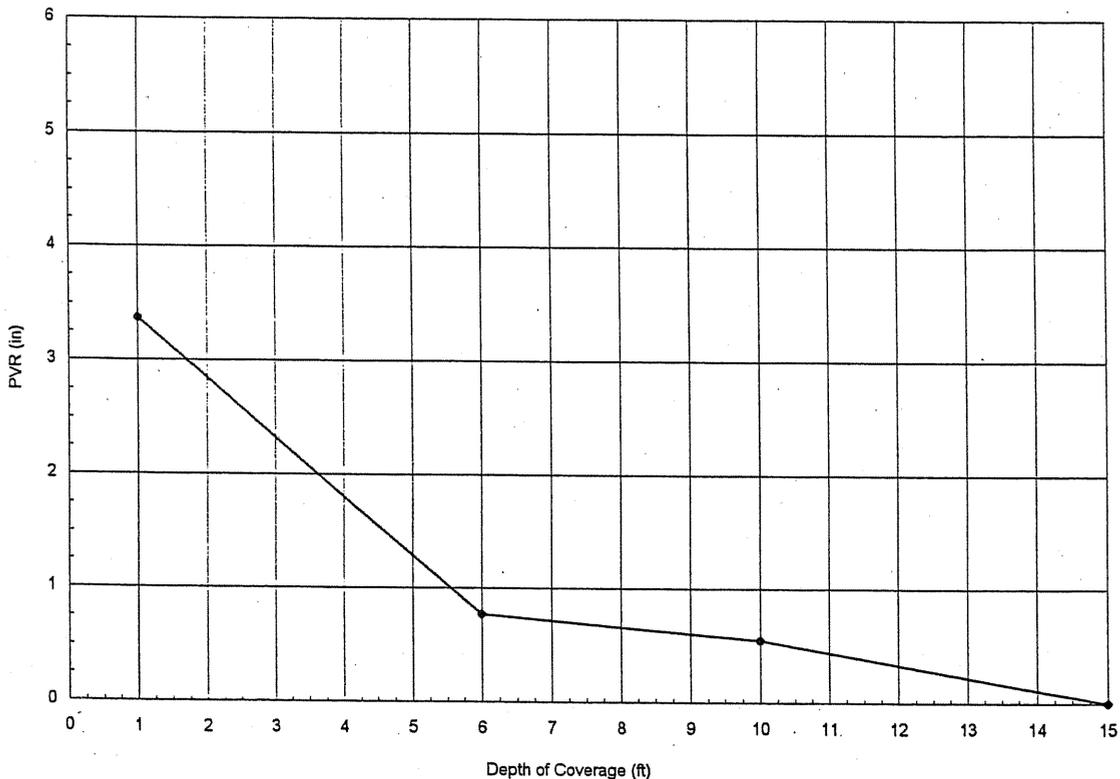
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-4A1	1	6	68	44	98.0	28.8	22.6	34.0	Avg	9.9	13.2	0.0	5.0	0.00	2.00	1.96	
	6	10	38	22	89.0	18.8	16.6	19.9	Avg	3.5	6.3	5.0	9.0	0.65	0.75	0.09	
	10	15	59	36	98.8	24.1	20.8	29.7	Avg	7.7	10.8	9.0	14.0	2.05	2.40	0.35	2.39

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-4A1	1	6	68	44	98.0	-	-	-	Dry	13.1	16.6	0.0	5.0	0.00	2.65	2.60	
	6	10	38	22	89.0	-	-	-	Dry	5.5	8.5	5.0	9.0	1.15	1.40	0.22	
	10	15	59	36	98.8	-	-	-	Dry	10.4	13.7	9.0	14.0	2.85	3.40	0.54	3.36

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For existing "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 5.5 feet.

PVR based upon existing "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

TERRA-MAR

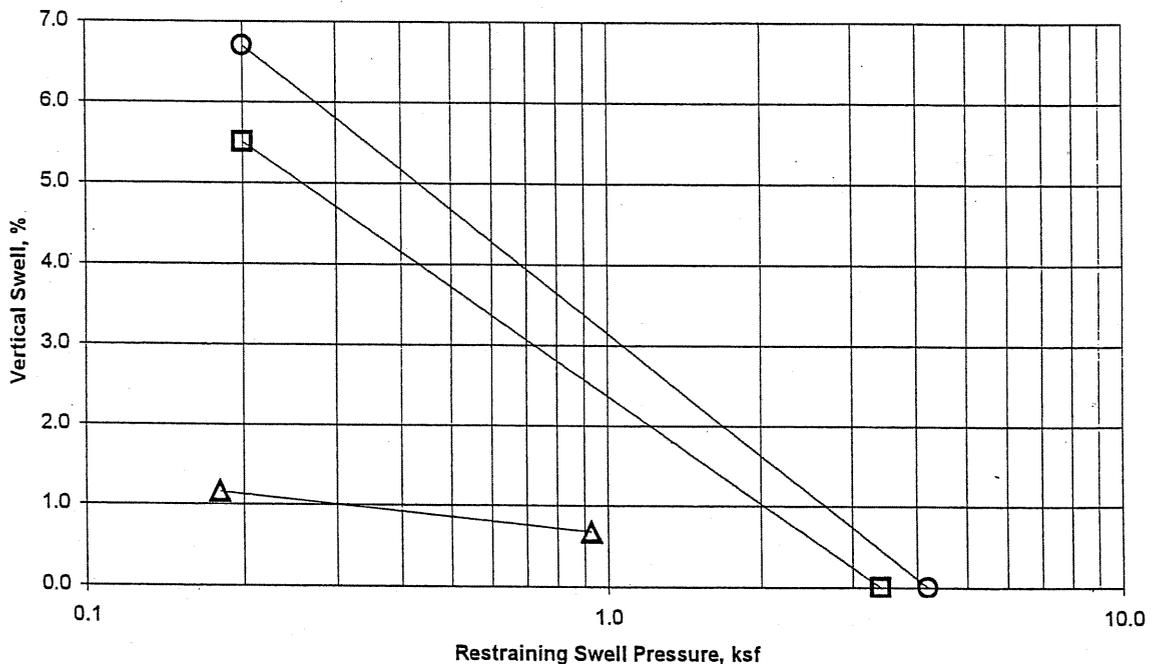
ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey

Project No.: FE99-055-034

Location: Fort Worth, Texas

Test No.	1	2	3
Legend Symbol	—△—	—□—	—○—
Boring Number	B-4A1	B-4A1	B-4A1
Depth, ft	4'-6'	10'-12'	14'-16'
Initial Dry Density, pcf	116.3	102.7	104.9
Initial Moisture Content, %	17.9	24.7	23.6
Final Moisture Content, %	18.7	28.1	26.5
Initial Penetrometer Reading, tsf	2.75	3.00	-
Final Penetrometer Reading, tsf	2.75	1.75	-
Liquid Limit	68	52	59
Plasticity Index	44	32	36
Maximum Applied Swell Pressure, ksf	0.93	3.40	4.19
Vertical Swell at Maximum Applied Swell Pressure, %	0.7	0.0	0.0
Final Applied Swell Pressure, ksf	0.18	0.20	0.20
Vertical Swell at Final Swell Pressure, %	1.2	5.5	6.7



TERRA-MAR, INC.

IH820 Soil Survey, Tarrant County, Texas
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 5 – BORING B-4B1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test Results**

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-4B1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No: FE99-055-34

Existing Conditions

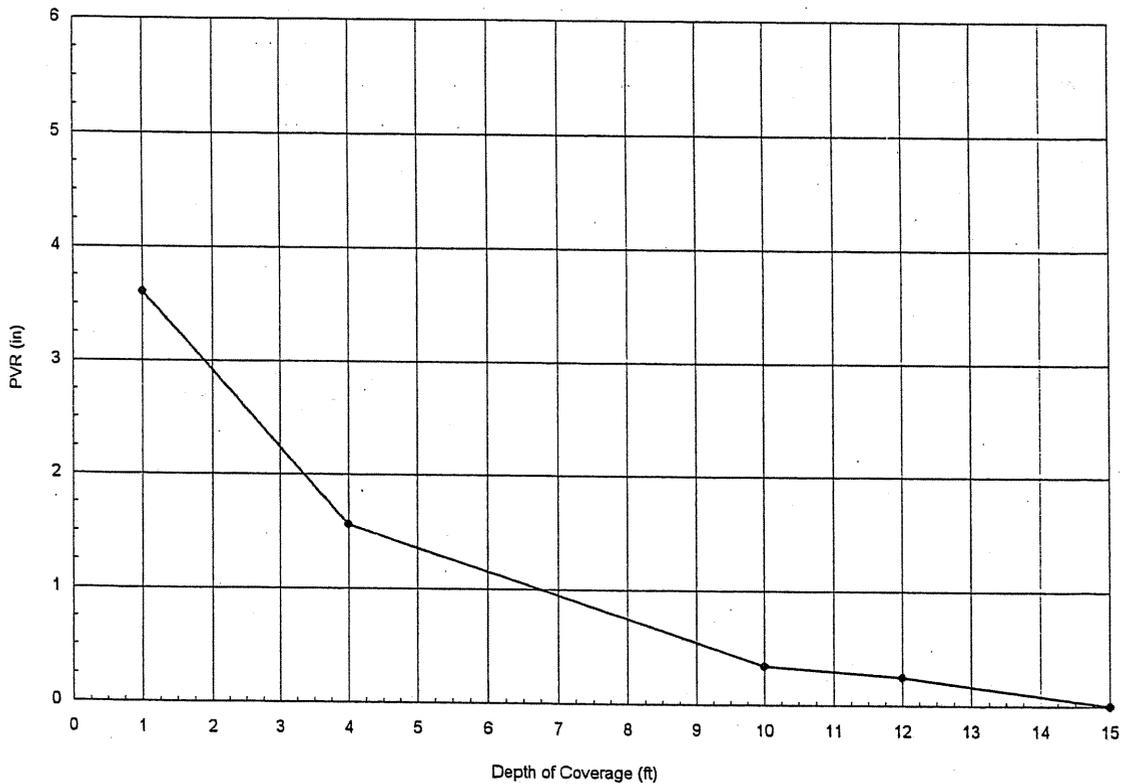
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-4B1	1	4	70	49	91.0	32.1	23.0	34.9	Wet	7.8	10.9	0.0	3.0	0.00	1.20	1.09	
	4	10	55	33	97.7	22.9	20.0	27.9	Avg	6.8	9.9	3.0	9.0	1.15	1.80	0.64	
	10	12	44	27	95.2	28.4	17.8	22.7	Wet	3.0	5.8	9.0	11.0	0.60	0.60	0.00	
	12	15	56	35	95.8	34.0	20.2	28.3	Wet	4.7	7.6	11.0	14.0	1.15	1.20	0.05	1.77

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
B-4B1	1	4	70	49	91.0	-	-	-	Dry	14.6	18.2	0.0	3.0	0.00	2.25	2.05	
	4	10	55	33	97.7	-	-	-	Dry	9.5	12.8	3.0	9.0	1.35	2.60	1.22	
	10	12	44	27	95.2	-	-	-	Dry	7.3	10.4	9.0	11.0	2.00	2.10	0.10	
	12	15	56	35	95.8	-	-	-	Dry	10.1	13.4	11.0	14.0	3.05	3.30	0.24	3.60

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



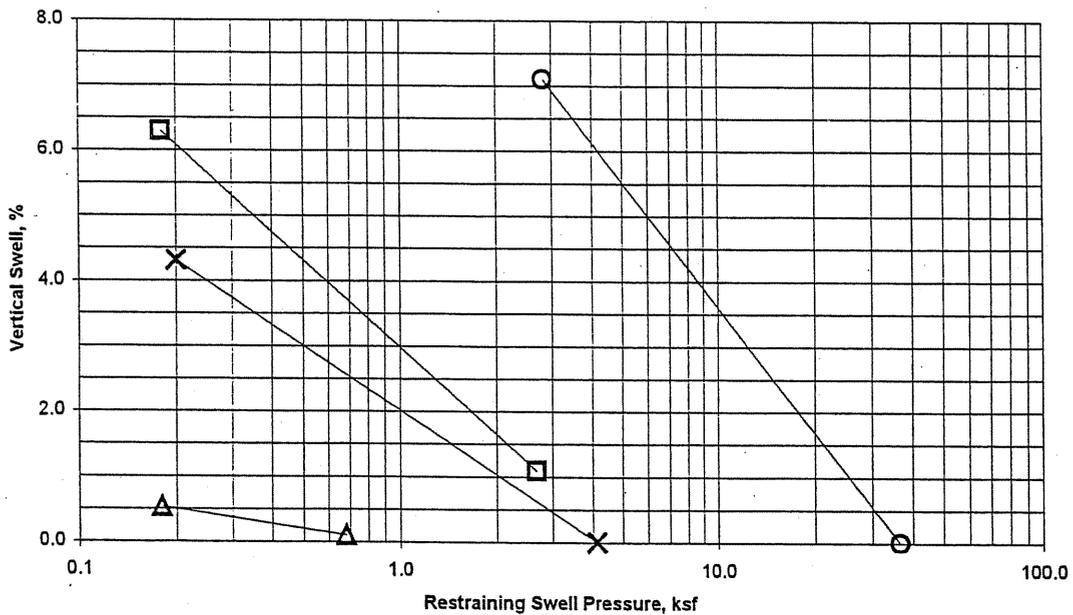
For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 6.75 feet.
PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey
 Location: Fort Worth, Texas

Project No.: FE99-055-034

Test No.	TEST 1	TEST 2	TEST 3	TEST 4
Legend Symbol	—△—	—□—	—○—	—X—
Boring Number	B-4B1	B-4B1	B-4B1	B-4B1
Depth, ft	2'-4'	6'-8'	10'-12'	14'-16'
Initial Dry Density, pcf	91.0	106.1	104.0	101.3
Initial Moisture Content, %	32.1	21.6	21.5	25.8
Final Moisture Content, %	33.1	26.4	26.9	29.4
Initial Penetrometer Reading, tsf	2.00	4.50	-	2.50
Final Penetrometer Reading, tsf	2.00	3.50	-	1.80
Liquid Limit	70	51	44	69
Plasticity Index	49	31	27	48
Maximum Applied Swell Pressure, ksf	0.68	2.68	36.61	4.14
Vertical Swell at Maximum Swell Pressure, %	0.1	1.1	0.0	0.0
Final Applied Swell Pressure, ksf	0.18	0.18	2.82	0.20
Vertical Swell at Final Swell Pressure, %	0.5	6.3	7.1	4.3



TERRA-MAR, INC.

IH820 Soil Survey, Tarrant County, T 3
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 6 – BORING B-4C1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test Results**



WinCore
Version 1.05

DRILLING LOG

County Tarrant
Highway IH 820
Control 0008-14-059

Hole B-4C1
Structure Pavement
Station 734+67
Offset

District Fort Worth
Date 04-05-01
Grnd. Elev. 657.36
GW Elev. 0.00

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test	Properties			Additional Remarks
				Lateral Deviator Press. Stress	Moi.	LL	PI	
655.4			CLAY, very stiff, dark brown and brown, w/limestone fragments (Fill) (CL)		26.6	63	36	
			CLAY, very stiff, brown, tan and gray, w/limestone fragments (Fill) (CL)		19.4	52	33	94.3% Passing #40 sieve
649.4			CLAY, hard, dark brown and brown, w/calcareous nodules (CL)		21.1	51	33	78.2% Passing #40 sieve
					23.7	61	41	
646.4			CLAY, hard, tan, brown, dark brown and gray, w/calcareous nodules (CL)		18.7	52	35	49.5% Passing #40 sieve
					22.1	68	45	
641.4			CLAY, very stiff to hard, tan, brown, dark brown and gray, w/calcareous nodules (CL)		19.3	64	43	94.4% Passing #40 sieve
					21.1	68	47	
637.4					23.5	69	47	98.7% Passing #40 sieve
25								

Remarks:

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-4C1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No.: FE99-055-34

Existing Conditions

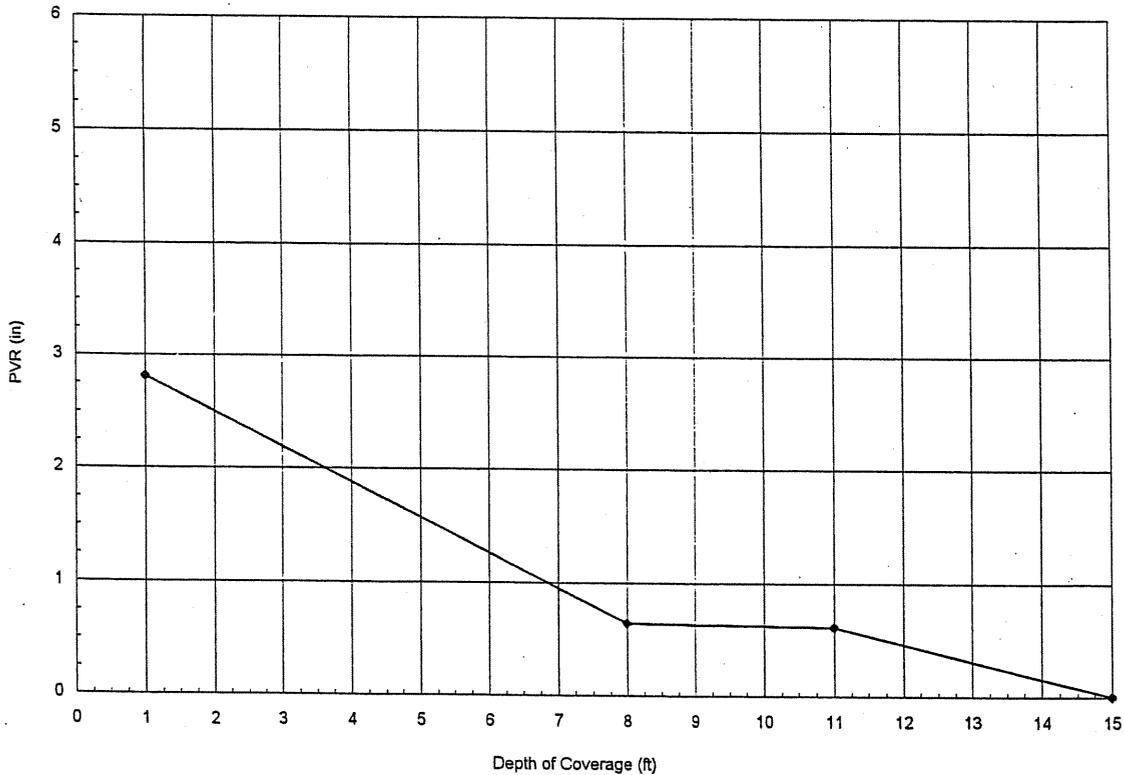
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-4C1	1	8	52	33	94.3	19.4	19.4	26.4	Dry	9.5	12.8	0.0	7.0	0.00	2.30	2.17	
	8	11	52	35	49.5	18.7	19.4	26.4	Dry	10.1	13.4	7.0	10.0	2.85	2.90	0.02	
	11	15	64	43	94.4	19.3	21.8	32.1	Dry	12.8	16.3	10.0	14.0	3.95	4.60	0.61	2.81

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-4C1	1	8	52	33	94.3	-	-	-	Dry	9.5	12.8	0.0	7.0	0.00	2.30	2.17	
	8	11	52	35	49.5	-	-	-	Dry	10.1	13.4	7.0	10.0	2.85	2.90	0.02	
	11	15	64	43	94.4	-	-	-	Dry	12.8	16.3	10.0	14.0	3.95	4.60	0.61	2.81

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 6.75 feet.

PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

TERRA-MAR

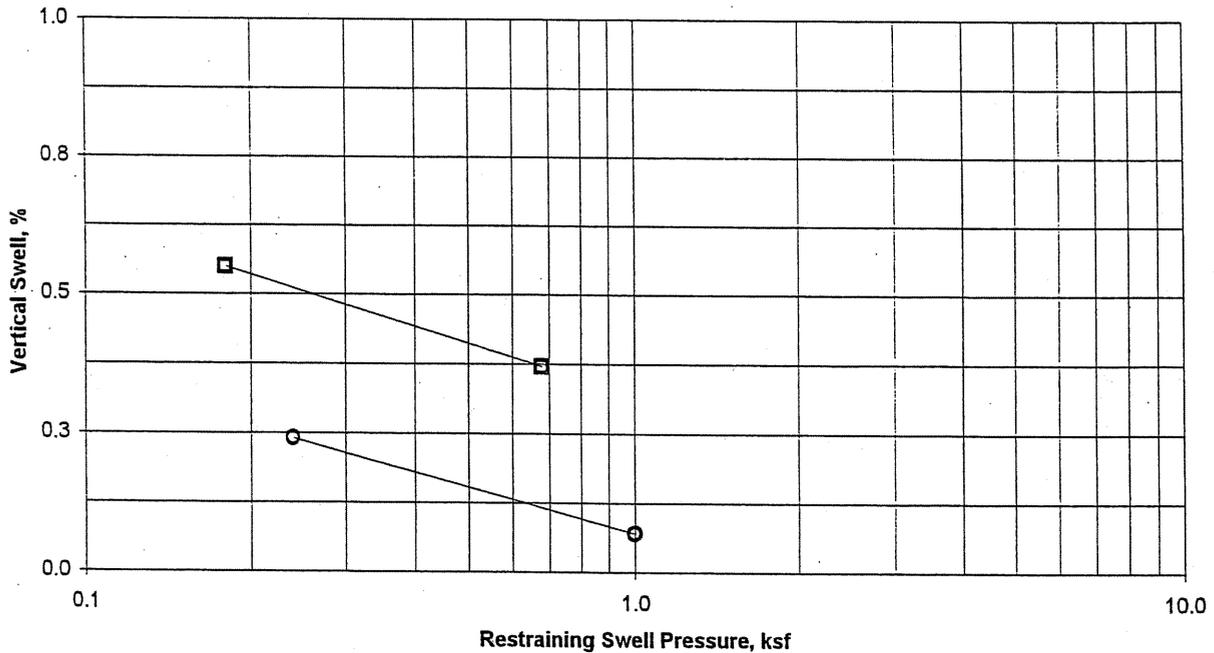
ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey

Project No.: FE99-055-034

Location: Fort Worth, Texas

Test No.	1	2
Legend Symbol	—□—	—○—
Boring Number	B-4C1	B-4C1
Depth, ft	0'-2'	8'-10'
Initial Dry Density, pcf	94.7	106.5
Initial Moisture Content, %	26.6	21.0
Final Moisture Content, %	28.7	23.0
Initial Penetrometer Reading, tsf	4.00	4.5
Final Penetrometer Reading, tsf	3.75	3.75
Liquid Limit	63	61
Plasticity Index	36	41
Maximum Applied Swell Pressure, ksf	0.68	1.00
Vertical Swell at Maximum Applied Swell Pressure, %	0.4	0.07
Final Applied Swell Pressure, ksf	0.18	0.24
Vertical Swell at Final Swell Pressure, %	0.6	0.24



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IH820 Soil Survey, Tarrant County, Texas
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 7 – BORING B-4D1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test Results**



DRILLING LOG

WinCore
Version 1.05

County Tarrant
Highway I H 820
Control 0008-14-059

Hole B-4D1
Structure Pavement
Station 746+00
Offset

District Fort Worth
Date 04-05-01
Grnd. Elev. 648.40
GW Elev. 0.00

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties			Additional Remarks
				Lateral Deviator Press.	Stress	Moi.	LL	PI	
5 640.4			CLAY, stiff to hard, brown, dark brown and gray, w/limestone fragments, occasional gravel and calcareous nodules (Fill) (SC)			28.2	64	39	
						25.7	59	37	94.7% Passing #40 sieve
						19.3	55	37	
						25.7	53	34	86.3% Passing #40 sieve
638.4	10		CLAY, silty, hard, tan and brown, w/calcareous nodules and limestone fragments (Fill) (SC)			15.2	33	18	
635.4			CLAY, silty, hard, dark brown, w/calcareous nodules and limestone fragments (Fill) (SC)			16.1	34	18	32.8% Passing #40 sieve
						23.3	72	51	
632.4	15		CLAY, hard, dark brown, w/limestone fragments and calcareous nodules (Fill) (CL)			22.6	59	43	93.5% Passing #40 sieve
628.4	20		LIMESTONE, tan						

Remarks:

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-4D1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No: FE99-055-34

Existing Conditions

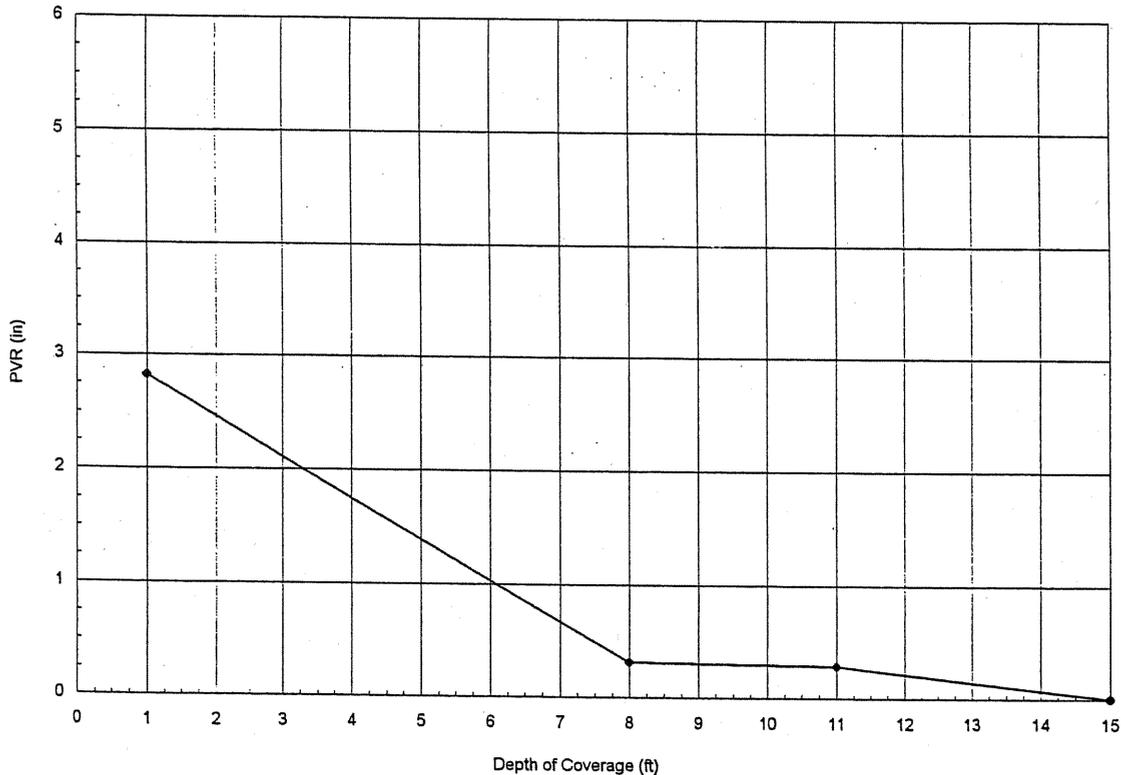
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-4D1	1	8	59	37	94.7	25.7	20.8	29.7	Avg	8.0	11.2	0.0	7.0	0.00	2.00	1.89	
	8	13	34	18	32.8	16.1	15.8	18.0	Dry	4.0	6.9	7.0	12.0	0.85	0.95	0.03	
	13	15	59	43	93.5	22.6	20.8	29.7	Dry	12.8	16.3	12.0	14.0	4.25	4.55	0.28	2.21

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-4D1	1	8	59	37	94.7	-	-	-	Dry	10.8	14.2	0.0	7.0	0.00	2.65	2.51	
	8	13	34	18	32.8	-	-	-	Dry	4.0	6.9	7.0	12.0	0.85	0.95	0.03	
	13	15	59	43	93.5	-	-	-	Dry	12.8	16.3	12.0	14.0	4.25	4.55	0.28	2.82

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 6.0 feet.
PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

TERRA-MAR

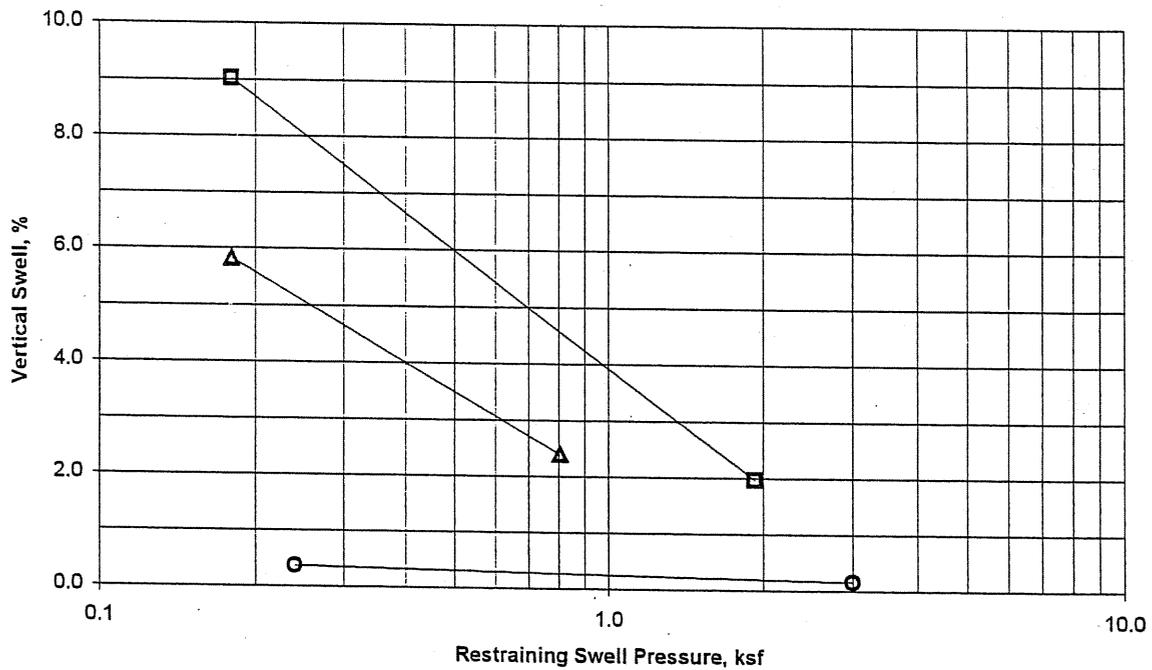
ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey

Project No.: FE99-055-034

Location: Fort Worth, Texas

Test No.	1	2	3
Legend Symbol	—△—	—□—	—○—
Boring Number	B-4D1	B-4D1	B-4D1
Depth, ft	2'-4'	6'-8'	10'-12'
Initial Dry Density, pcf	101.4	115.8	98.7
Initial Moisture Content, %	25.7	17.5	30.1
Final Moisture Content, %	30.3	23.0	33.0
Initial Penetrometer Reading, tsf	3.5	4.5+	4.5+
Final Penetrometer Reading, tsf	2.25	2.75	4.5+
Liquid Limit	59	53	34
Plasticity Index	37	34	18
Maximum Applied Swell Pressure, ksf	0.81	1.93	3.00
Vertical Swell at Maximum Applied Swell Pressure, %	2.4	2.0	0.15
Final Applied Swell Pressure, ksf	0.18	0.18	0.24
Vertical Swell at Final Swell Pressure, %	5.8	9.0	0.36



TERRA-MAR, INC.

IH820 Soil Survey, Tarrant County, T 3
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 8 – BORING B-4E1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test Results**

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-4E1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No: FE99-055-34

Existing Conditions

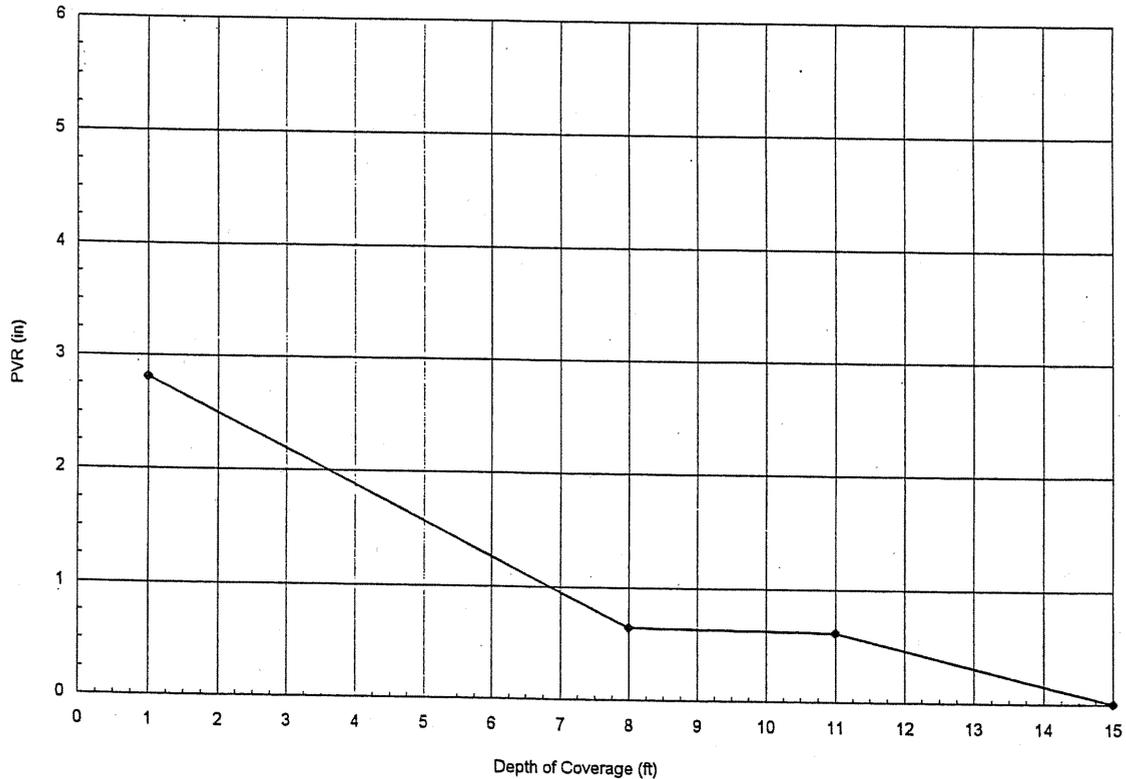
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-4E1	1	4	70	49	92.1	30.1	23.0	34.9	Avg	11.3	14.6	0.0	3.0	0.00	1.55	1.43	
	4	8	64	41	98.2	23.0	21.8	32.1	Dry	12.1	15.5	3.0	7.0	1.70	3.00	1.28	
	8	15	65	39	100.0	20.3	22.0	32.6	Dry	11.5	14.9	7.0	14.0	2.80	3.35	0.55	3.25

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-4E1	1	4	70	49	92.1	-	-	-	Dry	14.6	18.2	0.0	3.0	0.00	2.20	2.03	
	4	8	64	41	98.2	-	-	-	Dry	12.1	15.5	3.0	7.0	1.70	3.00	1.28	
	8	15	65	39	100.0	-	-	-	Dry	11.5	14.9	7.0	14.0	2.80	3.35	0.55	3.85

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 6.75 feet.
PVR based upon "dry" conditions and an active zone of 15 feet,
with upper 1 foot modeled as stable pavement materials and considered "inactive"

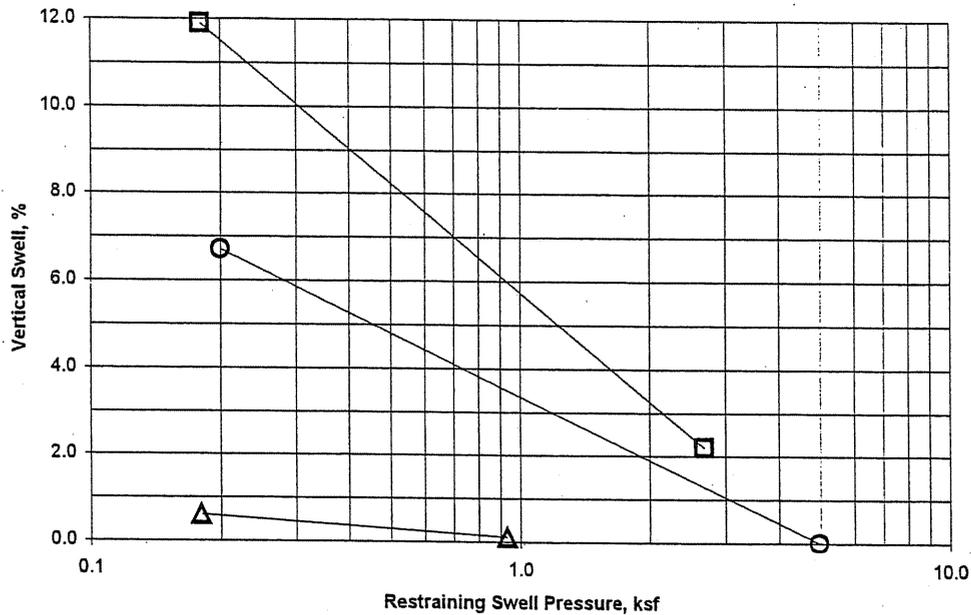
TERRA-MAR

ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey
 Location: Fort Worth, Texas

Project No.: FE99-055-034

Test No.	TEST 1	TEST 2	TEST 3
Legend Symbol	—△—	—□—	—○—
Boring Number	B-4E1	B-4E1	B-4E1
Depth, ft	2'-4'	6'-8'	10'-12'
Initial Dry Density, pcf	95.9	105.9	100.2
Initial Moisture Content, %	30.1	23.0	25.0
Final Moisture Content, %	33.0	30.9	30.3
Initial Penetrometer Reading, tsf	2.25	4.5+	-
Final Penetrometer Reading, tsf	2.25	1.25	-
Liquid Limit	70	64	68
Plasticity Index	49	41	43
Maximum Applied Swell Pressure, ksf	0.93	2.68	4.96
Vertical Swell at Maximum Swell Pressure, %	0.1	2.2	0.0
Final Applied Swell Pressure, ksf	0.18	0.18	0.20
Vertical Swell at Final Swell Pressure, %	0.6	11.9	6.7



TERRA-MAR, INC.

IH820 Soil Survey, Tarrant County, Texas
CSJ: 0008-00-1208
TMI No. FE99-055-34
July 9, 2001



TERRA-MAR, INC.
Consulting – Geotechnical - Environmental
Construction Materials Testing

APPENDIX 9 – BORING B-5A1

**Boring Log
PVR Calculations
PVR vs. Depth of Coverage
Pressure Swell Test Results**

Estimation of PVR Based on Existing and Dry Moisture Conditions Boring B-5A1

Project: IH820 Soil Survey
Location: Tarrant County, Texas

CSJ No.: 0008-14-059
TMI No.: FE99-055-34

Existing Conditions

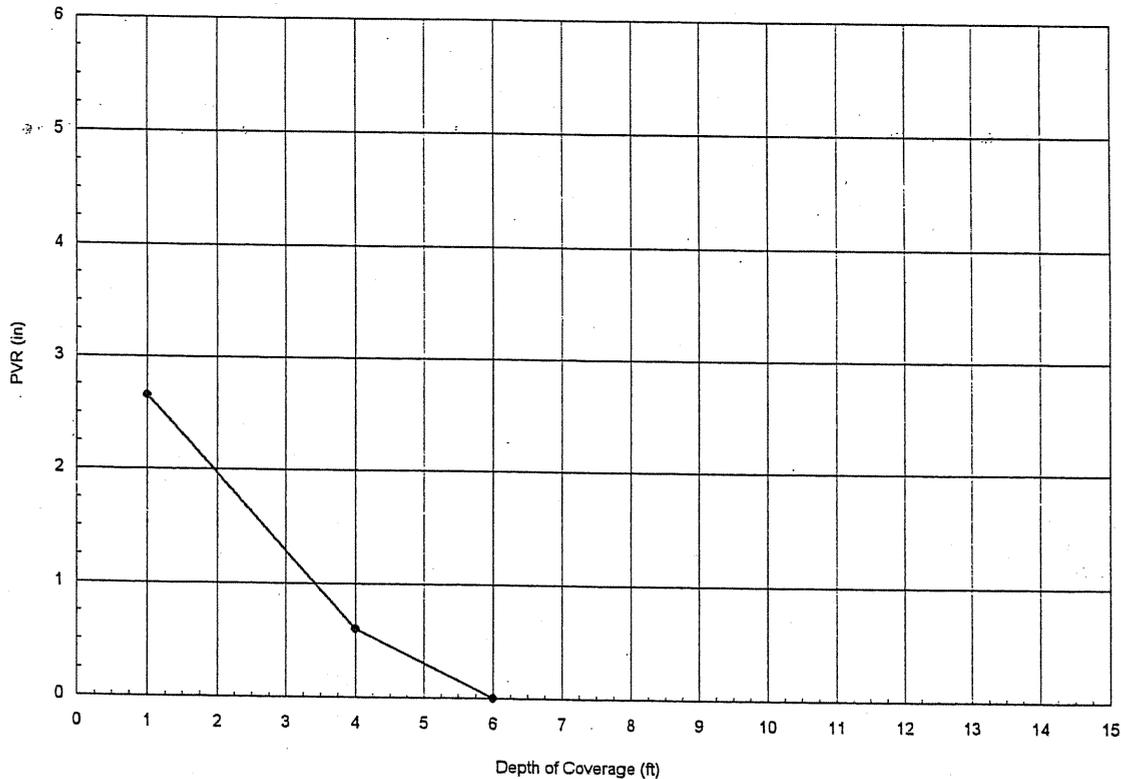
Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-5A1	1	4	69	48	97.7	28.7	22.8	34.4	Avg	11.0	14.4	0.0	3.0	0.00	1.50	1.47	
	4	6	59	36	99.9	21.7	20.8	29.7	Dry	10.4	13.7	3.0	5.0	1.45	2.05	0.60	2.06

*Note: Significant Cutting and Filling of the Subgrade is Not Expected

"Dry" Conditions

Boring	Depth @ Layer Top (ft)	Depth @ Layer Bottom (ft)	LL	PI	- No. 40 (%)	MC (%)	Dry MC (%)	Wet MC (%)	Moisture Condition	% Vol. Swell* (%)	% Free Swell (%)	Average Load		PVR @ Layer Top (in)	PVR @ Layer Bottom (in)	PVR of Layer (in)	Total PVR (in)
												Layer Top (psi)	Layer Bottom (psi)				
English																	
B-5A1	1	4	69	48	97.7	-	-	-	Dry	14.3	17.9	0.0	3.0	0.00	2.10	2.05	
	4	6	59	36	99.9	-	-	-	Dry	10.4	13.7	3.0	5.0	1.45	2.05	0.60	2.65

*Note: Significant Cutting and Filling of the Subgrade is Not Expected



For "dry" conditions the depth of coverage of non-swelling material to reduce PVR to 1.0 inch is 3.5 feet.
PVR based upon "dry" conditions and an active zone of 6 feet (top of limestone),
with upper 1 foot modeled as stable pavement materials and considered "inactive"

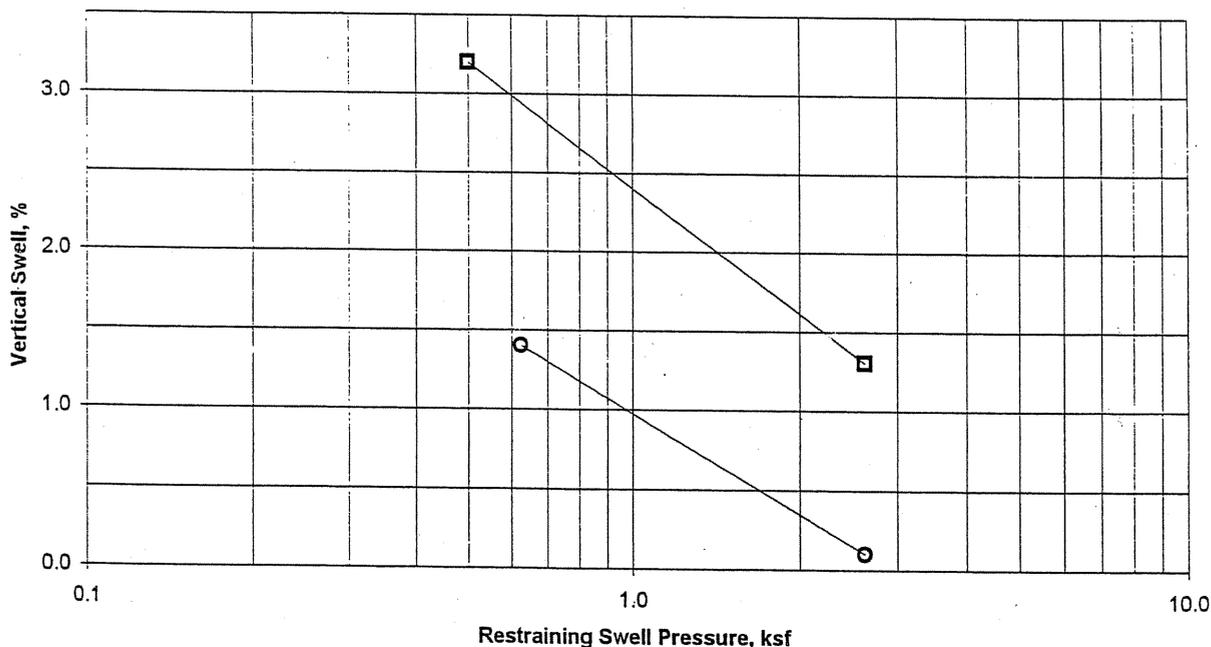
TERRA-MAR

ABSORPTION PRESSURE SWELL TEST RESULTS

Project Name: IH 820 Soil Survey
 Location: Fort Worth, Texas

Project No.: FE99-055-034

Test No.	1	2
Legend Symbol	—□—	—○—
Boring Number	B-5A1	B-5A1
Depth, ft	2'-4'	4'-6'
Initial Dry Density, pcf	96.8	109.3
Initial Moisture Content, %	28.7	21.7
Final Moisture Content, %	32.5	28.6
Initial Penetrometer Reading, tsf	2.5	3.25
Final Penetrometer Reading, tsf	1.25	1.50
Liquid Limit	69	59
Plasticity Index	48	36
Maximum Applied Swell Pressure, ksf	0.87	1.68
Vertical Swell at Maximum Applied Swell Pressure, %	0.3	0.9
Final Applied Swell Pressure, ksf	0.18	0.18
Vertical Swell at Final Swell Pressure, %	5.0	10.0



TERRA-MAR, INC.

TEAM - Soil Survey Report
November 2000

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
1	10/4/2000	653+92.56	6.5 ft.	5.0 ft.	3.8 ft.
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.3 ft.
4	10/4/2000	708+71.43	10.3 ft.	8.8 ft.	7.2 ft.
5	10/5/2000	761+80.40	10.7 ft.	9.2 ft.	6.8 ft.
6	10/5/2000	791+10.64	9.3 ft.	1.3 ft.	0.0 ft.
7	10/5/2000	817+92.05	7.0 ft.	5.0 ft.	3.5 ft.
8	10/5/2000	847+69.76	6.3 ft.	4.2 ft.	2.6 ft.
9	10/5/2000	864+34.92	8.2 ft.	6.2 ft.	4.3 ft.
11	10/6/2000	908+64.80	4.5 ft.	3.8 ft.	3.2 ft.
12	10/6/2000	945+58.52	3.8 ft.	2.3 ft.	0.0 ft.
14	10/5/2000	779+43.96	5.5 ft.	3.9 ft.	2.7 ft.
15	10/5/2000	807+30.66	5.5 ft.	3.6 ft.	2.3 ft.
16	10/5/2000	856+20.74	5.7 ft.	2.7 ft.	0.2 ft.
17	10/6/2000	899+98.37	0.0 ft.	0.0 ft.	0.0 ft.

TEAM - 2nd Survey Report
September 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
2B	3/15/2001	681+00.00	6.5 ft.	5.3 ft.	4.5 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.2 ft.
3B	3/14/2001	699+75.00	11.6 ft.	10.4 ft.	8.9 ft.
4	10/4/2000	708+71.43	10.5 ft.	8.8 ft.	7.2 ft.
4B	3/13/2001	719+00.00	1.0 ft.	0.0 ft.	0.0 ft.
4C	3/13/2001	728+35.00	6.0 ft.	3.0 ft.	0.8 ft.
4D	3/13/2001	741+00.00	10.2 ft.	7.0 ft.	4.2 ft.
4E	3/13/2001	751+00.00	9.0 ft.	6.3 ft.	4.8 ft.
5	10/5/2000	761+80.40	10.8 ft.	9.0 ft.	7.0 ft.
5B	3/13/2001	770+50.00	6.7 ft.	5.0 ft.	3.5 ft.

Terra-Mar - Soil Survey Report
July 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2B1	4/6/2001	685+93	6.2 ft.	4.5 ft.	2.8 ft.
3A1	4/6/2001	695+31	9.5 ft.	6.0 ft.	2.8 ft.
3B1	4/6/2001	704+23	9.0 ft.	7.5 ft.	6.0 ft.
4A1	4/6/2001	713+85	5.5 ft.	4.5 ft.	3.6 ft.
4B1	4/1/2001	723+67	6.8 ft.	4.0 ft.	3.2 ft.
4C1	4/5/2001	734+67	6.8 ft.	5.3 ft.	3.6 ft.
4D1	4/5/2001	746+00	6.0 ft.	4.5 ft.	3.2 ft.
4E1	4/5/2001	756+40	6.9 ft.	5.3 ft.	3.5 ft.
5A1	4/5/2001	766+15	3.3 ft.	2.7 ft.	2.0 ft.

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

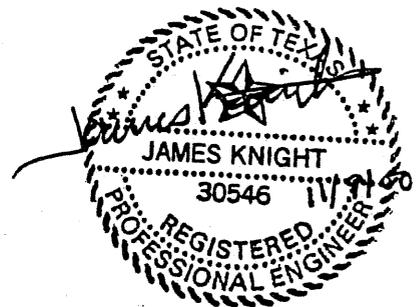
Report To

**Texas Department of Transportation
Fort Worth District**

By

**TEAM Consultants, Inc.
Arlington, Texas**

November, 2000



TEAM Consultants, Inc.

Geotechnical, Environmental, Construction Materials Testing

November 9, 2000
TEAM Project No. 002052G
Report No. 1

Texas Department of Transportation
Fort Worth District Laboratory
P.O. Box 6868
Fort Worth, Texas 76115-0868

Attn: Mr. Richard Williammee, Jr., P.E.
District Materials Engineer

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

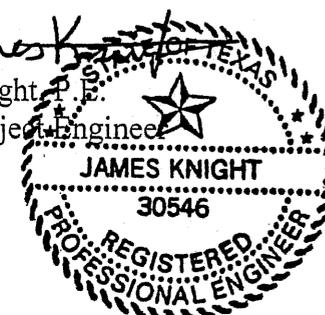
Dear Mr. Williammee:

Submitted herewith is our formal report of the soil survey for the referenced project. The investigation was accomplished in general accordance with Work Authorization No. 02-00-764/765, dated October 4, 2000.

We appreciate the opportunity to assist you on the design phase of this project. Should you have any questions or need further assistance, please call the undersigned at (817) 467-5500.

Very truly yours,

TEAM Consultants, Inc.


James Knight, P.E.
Senior Project Engineer


JK/li

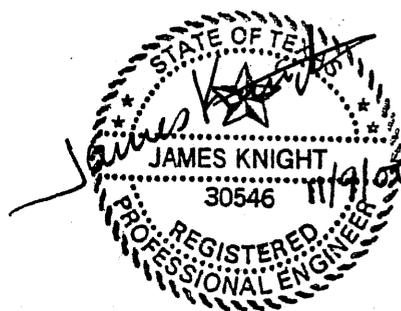
Copies submitted: 3

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INTRODUCTION

The Texas Department of Transportation (TxDOT) plans construction of roadway improvements along IH-820 North Loop from Mark IV Parkway to SH 26 in the cities of Fort Worth, Haltom City, and North Richland Hills, Tarrant County, Texas. The station limits are from approximately Station 610+00 to 962+00. The proposed section will consist of 13 inches of concrete pavement continuously reinforced (CPCR) with 4 inches of Hot Mix Asphaltic Concrete (HMAC) Type "D" (underlayment) and either eight inches or 18 inches of lime treated subgrade.

The purpose of this investigation was to evaluate subsurface conditions along the proposed roadway alignment and provide stabilization recommendations for the subgrade soils. As planned and implemented, the investigation included the drilling of test borings at selected locations to prescribed depths and performance of a series of laboratory tests. The basic boring and test results are included herein.

FIELD INVESTIGATION

Subsurface conditions along the proposed roadway alignment were evaluated by 15 sample borings drilled at the approximate locations shown on the attached Plan of Borings, Plate 1. Borehole No. 10, originally proposed to be drilled near Station 887+00 (intersection of IH-820 and Rufe Snow Drive), was deleted inasmuch as it was located in an area adjacent to a sample boring included in a Soil Survey Report for Bridge and Retaining Wall Improvements to be constructed at IH-820 and Rufe Snow Drive (see TEAM Report No. 002048G dated October 4, 2000). Borehole No. 13 was not drilled inasmuch as it was determined that it was located beyond the limits of interest for the current study. The station number, offset, and surface elevation are indicated on the Drilling Logs. The boreholes were drilled to depths ranging from 15 feet to 30 feet below existing grade. Samples of the materials penetrated by the borings were obtained using conventional auger and continuous sampler sampling procedures. Descriptions of the materials encountered in the borings are presented on the Drilling Logs, Plates 2 through 16.

As part of the soil sampling operations, standard pocket penetrometer tests were performed on cohesive continuous sampler soil samples. The results are tabulated at respective sample depths on the logs under the Additional Remarks column as "pp=". Soil samples were recovered from the continuous sampler in the field, visually classified, wrapped in aluminum foil and plastic bags, labeled according to the boring number and depth, and placed in core boxes for transport to the laboratory. Additionally, some of the samples were split for sulfate testing and the split portion provided to the TxDOT Fort Worth District Laboratory. The borings were advanced to their completion depths by dry auger drilling techniques. Groundwater observations were made in the borings during and upon completion of the drilling. These observations are noted in the Remarks Section at the bottom of the Drilling Log.

LABORATORY TESTS

To verify visual soil classifications, quantify physical properties of the soil, and determine the potential vertical rise (PVR) in the soil substrata, laboratory tests were performed on selected soil samples. These tests consisted of Liquid Limit, Plastic Limit, Natural Moisture Content, and Percent Soil Binder (Percent Passing No. 40 Sieve). The tests were performed in accordance with established TxDOT test procedures. The basic test results are tabulated on the Drilling Logs at the respective sample depths. Laboratory test results are also summarized on Plates 17 through 19.

As part of the soil survey, selected soil samples are being analyzed for soluble sulfate content in accordance with TxDOT Test Method TEX-620-J by the TxDOT laboratory in Austin, Texas. The results of these tests are not available at this time. Results will be submitted in a Supplemental Report at a later date as they become available.

GENERAL SUBSURFACE CONDITIONS

The project is located in an area overlain by alluvium and fluvial terrace deposits in the vicinity of Big Fossil Creek and Calloway Branch, by the Pawpaw, Weno Limestone, and Denton

Clay (undivided) formations west of IH-820 and Rufe Snow Drive and by the Grayson Marl and Main Street Limestone formations (undivided) east of IH-820 and Rufe Snow Drive. The Pawpaw, Weno Limestone, and Denton Clay outcrop and the Grayson Marl and Main Street Limestone outcrop in the vicinity of the project are of lower Cretaceous geologic age as shown on the Dallas Sheet of the Geologic Atlas of Texas. The Pawpaw consists primarily of claystone, mudstone, and sandstone; the Weno Limestone consists of limestone and alternating clay and limestone units; and the Denton Clay consists of alternating clay, marl, and limestone. The Grayson Marl/Main Street Limestone consists primarily of calcareous clays and marl with calcareous shale and limestone interbeds, and is the youngest of the lower Cretaceous formations.

Soil formations encountered along the IH-820 North Loop roadway alignment are shown on the Drilling Logs, Plates 2 through 16. Subsurface conditions, as revealed in the borings, include moderate to high plasticity clays, calcareous clays and sandy clays from the surface to depths varying from 1.0 feet (Borehole No. B-8) to 23.5 feet (Borehole No. B-16) to the termination depths of Boreholes No. B-3, B-4 and B-7. The surficial clay soils are underlain by limestone with occasional seams or lenses of moderate to high plasticity clays and shale to the termination depths of Boreholes No. B-1, B-2, B-11, B-12, B-16 and B-17. Shale underlies the clay soils in Boreholes No. B-8, B-9, B-14 and B-15 and the limestone in Boreholes No. B-5 and B-6 to the termination depths of these borings. Liquid Limits in the clays and shales ranged from 30 to 88 and Plasticity Indices from 13 to 64. In general, present moisture in the clays and shales were below the Plastic Limit, a condition indicative of moderate to high swell potential accompanying an increase in soil moisture content.

Water level observations made during and at the completion of drilling are indicated in the "Remarks" section at the bottom of the Drilling Logs. Groundwater was observed in Borehole No. 7 at a depth of 12.5 feet. All of the other boreholes were observed to be dry upon completion of drilling operations. In general, it should be noted that groundwater levels are not static and will fluctuate with seasonal variations in local precipitation, surficial runoff, and other factors.

ANALYSES AND RECOMMENDATIONS

Potential Vertical Rise

Potential vertical rise (PVR), expressed in inches, is the latent or potential ability of a soil to swell at a given density, moisture and loading condition when exposed to capillary or excess free water. The PVR calculations were determined in accordance with TxDOT Manual of Testing Procedures, Test Method Tex-124-E. The PVR varied from 0.18 inches for Borehole No. B-17 to 5.15 inches for Borehole No. B-5. The PVR calculations, along with a graphical representation of Potential Vertical Rise in Inches versus Depth Below Grade in Feet, are shown on Plates 20 through 34. Subsurface materials within the zone of influence of the PVR calculations for Boreholes No. B-6, B-8, B-9, B-14 and B-15 include strata of shale varying in thickness from 4.0 feet to 14.0 feet. Strata of limestone were encountered within the zone of influence at Boreholes No. B-6 and B-17.

Subgrade Preparation

Based on the presence of moderate to high plasticity clays, calcareous clays, sandy clays, and shales at the proposed pavement grade, it is recommended that the subgrade soils be stabilized with hydrated lime to provide a stable working base for placement of the HMAC underlayment and help reduce the PVR slightly, provided that testing for soluble sulfates does not indicate unacceptable levels of sulfates. The depth of lime stabilization and the percent hydrated lime to be used are design factors determined by TxDOT engineers. Lime treatment of clay soils should be accomplished in accordance with the applicable provisions of Item 260 of the Texas Highway Department Standard Specifications for Construction of Highways, Streets, Bridges, Current Edition.

In addition to the provisions of Item 260, we recommend the following additional construction guidelines. The lime should be spread uniformly and then thoroughly mixed to the proper depth until a homogeneous friable mixture is achieved. The mixture prior to compaction should have at least 60 percent of the treated soil passing the No. 4 sieve. The lime stabilized soil should be compacted to a minimum dry density of 95 percent of the maximum value as defined by

TxDOT Test Method TEX-113-E. The moisture content of the lime treated soils should be at least two percent above the Optimum value at the time of compaction. Moisture content and density must be maintained until the Hot Mix Underlayment is complete. We believe that incorporation of these guidelines will improve the long term performance of the pavements.

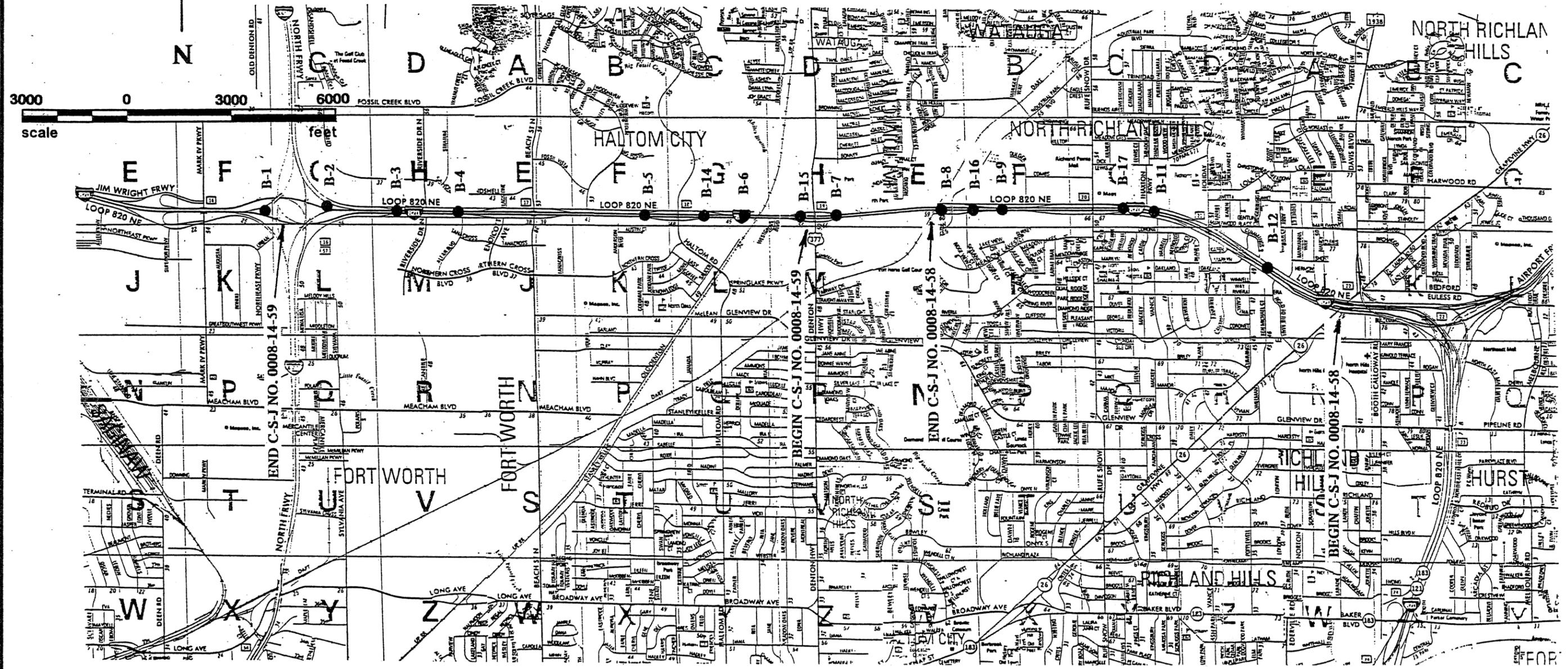
OBSERVATION AND TESTING

Many problems can be avoided in the field when proper observation and testing services are provided. It is recommended that subgrade preparation, lime stabilization, asphalt placement, and concrete placement be monitored by a qualified engineering technician.

LIMITATIONS

The recommendations presented in this report are based on the assumption that the subsurface properties throughout the proposed roadway alignment are reasonably consistent with those exhibited by the borings. The recommendations presented in this report should be reevaluated by TEAM Consultants, Inc. should there be any changes in the type, design, location, or conditions during construction of the proposed project.

ILLUSTRATIONS



PLAN OF BORINGS



DRILLING LOG

VinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-1
Structure ROADWAY IMPROVEMENTS
Station 653+92.56
Offset 66.01 Ft. Right

District Fort Worth
Date 10/04/2000
Grnd. Elev. 637.66 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties			Additional Remarks		
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI		Wet Den. (pcf)	
5	/		CLAY, dark gray & brown w/calcareous nodules - Interbedded gray limestone seams 14 to 23 ft. (CH)			12.6	68	47		Minus 40 = 99.0%, pp = 4.5+	
						15.4					
						18.2	59	39			Minus 40 = 98.3%, pp = 4.5+
						12.1					
						24.2	58	41			Minus 40 = 97.7%, pp = 4.0
						16.9					
						21.6	53	37			Minus 40 = 99.2%, pp = 4.0
						15.7	54	34			Minus 40 = 99.1%, pp = 4.5+
614.7			LIMESTONE, gray w/occasional gray clay inclusions								
612.7 25											

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.



DRILLING LOG

InCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-2
Structure ROADWAY IMPROVEMENTS
Station 671+45.64
Offset 26.26 Ft. Left

District Fort Worth
Date 10/04/2000
Grnd. Elev. 629.40 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks		
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)			
26.4 5 10 15 19.4 20	[Hatched pattern]		CLAY, dark gray w/tan sandy clay layer @ 2.5 ft. (fill) (CH)			14.5	75	52		Minus 40 = 93.3%, pp = 4.5+		
			CLAY, brown & gray w/occasional calcareous nodule - interbedded gray limestone seams 11 to 20 ft. (CH)			16.1	52	34		pp = 4.5+		
						15.3					Minus 40 = 97.5%	
						21.2	66	45			pp = 4.5+	
						20.4					Minus 40 = 96.9%, pp = 4.0	
											pp = 4.0	
											pp = 4.5+	
									18.9	70	46	Minus 40 = 84.2%, pp = 4.5+
									8.3	44	28	pp = 4.5+
									7.1			Minus 40 = 58.4%, pp = 4.5+
19.4 20	[Brick pattern]		LIMESTONE, gray w/occasional gray clay seam						pp = 4.5+			
19.4 25	[Brick pattern]											

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell Logger: James Hutt Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County	TARRANT	Hole	B-3	District	Fort Worth
Highway	IH-820 NORTH LOOP	Structure	ROADWAY IMPROVEMENTS	Date	10/04/2000
Control	0008-14-059	Station	690+86.10	Grnd. Elev.	632.69 ft
		Offset	33.14 Ft. Left	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks	
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)		
630.7	[Hatched pattern]		CLAY, dark gray w/tan limestone & gravel @ 1.5 ft. (fill) (CH)			8.7	57	35		Minus 40 = 91.7%, pp = 4.5+	
			CLAY, brown, dark brown, light gray, tan & light brown w/calcareous nodules & iron stains - tan silty sand 18 to 19 ft. (CH)			5.6					
							11.2	47	27		Minus 40 = 67.7%, pp = 4.5+
5							23.3				pp = 3.5
							24.3	83	59		Minus 40 = 96.8%
							25.3				pp = 3.0
							26.7	85	64		Minus 40 = 97.0%, pp = 3.0
10							24.5				pp = 3.0
							24.2	70	50		Minus 40 = 98.7%, pp = 2.5
											pp = 3.0
											pp = 3.5
											pp = 3.0
											pp = 4.5+
607.7 25											pp = 4.5

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-4
Structure ROADWAY IMPROVEMENTS
Station 708+71.43
Offset 54.38 Ft. Left

District Fort Worth
Date 10/04/2000
Grnd. Elev. 646.50 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
643.5			CLAY, brown, tan & dark brown w/numerous limestone fragments 1.0 to 1.5 ft. (fill) (CH)			4.5	52	35		Minus 40 = 49.1%, pp = 4.5+
						8.7				
5			CLAY, brown w/calcareous nodules - interbedded gray limestone seams 22 to 25 ft. (CH)			16.1	68	49		Minus 40 = 93.6%, pp = 4.5+
10						18.6	77	43		Minus 40 = 92.2%, pp = 3.0 pp = 3.5
						21.3				
15						22.7	67	41		Minus 40 = 93.6%, pp = 4.5 pp = 4.5 pp = 4.0
						24.1				
20										pp = 4.5+ pp = 4.5+
621.5	25									pp = 4.5+

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-5
Structure ROADWAY IMPROVEMENTS
Station 761+80.40
Offset 2.03 Ft. Left

District Fort Worth
Date 10/05/2000
Grnd. Elev. 632.36 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
5	[Hatched pattern]		CLAY, dark brown & light brown w/calcareous nodules & iron stains (CH)			18.3	70	48		Minus 40 = 96.8%, pp = 4.5+
						11.9				pp = 4.5+
						10.7	61	37		Minus 40 = 95.8%
						10.9				
						12.9	65	48		Minus 40 = 97.4%, pp = 4.5+
						15.6				
						19.2	72	51		Minus 40 = 99.5%, pp = 4.5+
						23.1	69	44		Minus 40 = 99.8%, pp = 4.0
619.4			LIMESTONE, weathered, tan w/occasional tan clay layers							
15										
614.4			LIMESTONE, gray w/occasional dark gray shale seam							
20										
25										
604.4			SHALE, dark gray							
602.4										
30										

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

1 of 1

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-6
Structure ROADWAY IMPROVEMENTS
Station 791+10.64
Offset 10 Ft. Right

District Fort Worth
Date 10/05/2000
Grnd. Elev. 575.52 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
573.			CLAY, dark gray w/tan clay & limestone fragments (fill) (CH)			8.3	58	34		Minus 40 = 80.1%, pp = 4.5+
5			LIMESTONE, gray w/occasional dark gray clay seam & lense							
566.5			SHALE, dark gray - interbedded limestone lenses 10 to 15 ft.			7.9	38	23		Minus 40 = 60.1%
10										pp = 4.5+
15						15.7	62	43		Minus 40 = 97.9%, pp = 4.5+
20										pp = 4.5+
555.5										pp = 4.5+
25										

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-7
Structure ROADWAY IMPROVEMENTS
Station 817+92.05
Offset 4.14 Ft. Right

District Fort Worth
Date 10/05/2000
Grnd. Elev. 549.82 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
544.8 5	/		CLAY, dark brown w/tan sandy clay & limestone fragments (fill) (CH)			10.6	59	40		Minus 40 = 82.9%, pp = 4.5+
						6.3				pp = 4.5+
						20.4	75	47		Minus 40 = 96.4%, pp = 4.5+
540.3 10	/		CLAY, dark brown (CH)			19.7	74	52		Minus 40 = 92.0%, pp = 4.0
										pp = 3.5
						7.0				
536.8	/		CLAY, gravelly, light brown w/sand (CL)			11.5	50	33		Minus 40 = 26.0%
						12.1				
						26.9	68	45		Minus 40 = 97.7%, pp = 3.5
534.8 15	/		CLAY, tan (CH)							
20										
25										

Remarks: Groundwater observed @ 12.5 ft. upon completion of drilling

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

MinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-058

Hole B-9
Structure ROADWAY IMPROVEMENTS
Station 864+34.92
Offset 38.18 Ft. Left

District Fort Worth
Date 10/05/2000
Grnd. Elev. 593.38 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
590.9			CLAY, dark brown & tan w/calcareous nodules & iron stains (fill) (CH)			11.0	83	52		Minus 40 = 94.8%, pp = 4.5+
						10.2	55	34		Minus 40 = 91.8%, pp = 4.5+
			SHALE, dark gray			17.5	62	38		Minus 40 = 99.8%, pp = 4.5+
5						16.6				pp = 4.5+
						18.3	66	40		Minus 40 = 99.7%, pp = 4.5+
10						13.8				pp = 4.5+
										pp = 4.5+
578.4										
15										
20										
25										

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-058

Hole B-11
Structure ROADWAY IMPROVEMENTS
Station 908+64.80
Offset 10.81 Ft. Left

District Fort Worth
Date 10/06/2000
Grnd. Elev. 610.34 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks	
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)		
5 602.3	[Diagonal Hatching]		CLAY, light brown, brown & tan w/calcareous nodules & iron stone lenses (CH)			14.5	88	63		Minus 40 = 94.3%, pp = 4.5+	
						16.4					
						18.5	49	33			Minus 40 = 82.5%, pp = 4.5+
						14.5	36	19			
						13.8					Minus 40 = 97.2%, pp = 4.5+
10 598.3	[Diagonal Hatching]	CLAY, calcareous, tan (CL)			11.5	41	25	Minus 40 = 83.1%, 4.5+			
					10.5				pp = 4.5+		
15 595.3	[Brick Pattern]		LIMESTONE, gray								
20	[Blank]										
25	[Blank]										

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

County TARRANT
 Highway IH-820 NORTH LOOP
 Control 0008-14-058

Hole B-12
 Structure ROADWAY IMPROVEMENTS
 Station 945+58.52
 Offset 1.13 Ft. Right

District Fort Worth
 Date 10/06/2000
 Grnd. Elev. 580.17 ft
 GW Elev. N/A

WinCore
 Version 2.01

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks	
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)		
572.2	[Diagonal Hatching]		CLAY, brown, reddish brown & light brown w/occasional limestone fragments, iron stains & calcareous nodules (CH)			7.0	30	13		Minus 40 = 98.5%, pp = 4.5+	
						12.9					
						11.9	50	31			Minus 40 = 98.6%, pp = 4.5+
						13.5	52	32			
						9.6					pp = 4.5+
10	[Brick Pattern]	LIMESTONE, weathered, tan w/occasional tan clay layer			12.9	35	20		Minus 40 = 75.8%, pp = 4.5+		
					11.7	36	20			Minus 40 = 71.4%, pp = 4.5+	
567.7	[Brick Pattern]		LIMESTONE, gray w/occasional gray shale lenses								
560.2	20										
25											

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-15
Structure ROADWAY IMPROVEMENTS
Station 807+30.66
Offset 1.55 Ft. Right

District Fort Worth
Date 10/05/2000
Grnd. Elev. 551.25 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks		
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)			
548.8			CLAY, dark gray w/tan clay & limestone (fill) (CH)			8.3	48	30		Minus 40 = 88.2%, pp = 4.5+		
			SHALE, dark gray w/occasional gray limestone lenses								pp = 4.5+	
								13.6				
								14.6	53	30		Minus 40 = 97.3%, pp = 4.5+
								15.0				pp = 4.5+
								15.4	57	34		Minus 40 = 99.1%, pp = 4.5+
								11.1				pp = 4.5+
								14.4	51	29		Minus 40 = 99.1%, pp = 4.5+
								14.7				pp = 4.5+
								13.4	52	32		Minus 40 = 97.5%, pp = 4.5+
												pp = 4.5+
												pp = 4.5+
521.3												

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.



VinCore
Version 2.01

DRILLING LOG

1 of 1

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-058

Hole B-16
Structure ROADWAY IMPROVEMENTS
Station 856+20.74
Offset 29 Ft. Left

District Fort Worth
Date 10/05/2000
Grnd. Elev. 582.68 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks		
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)			
581.7	[Hatched pattern]		CLAY, dark brown (fill) (CH)							pp = 4.5+		
			CLAY, tan w/numerous calcareous nodules & seams - limestone lense @ 4.5 ft & @ 6.5 ft. - dark gray shale seams 19.5 to 21.0 ft. (CH)			14.5	51	33			Minus 40 = 98.9%, pp = 4.5+	
5											pp = 4.5+	
											Minus 40 = 68.6%, pp = 4.5+	
											9.4	
											15.5 44 27	Minus 40 = 74.8%, pp = 3.0
10											19.9	pp = 4.0
											21.1 60 37	Minus 40 = 96.8%
											19.8	pp = 4.5+
15											29.2 70 47	Minus 40 = 97.3%, pp = 4.5
											22.6	pp = 2.0
												pp = 4.5+
559.2	[Brick pattern]		LIMESTONE, gray							pp = 3.5		
577.25	[Brick pattern]											

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-058

Hole B-17
Structure ROADWAY IMPROVEMENTS
Station 899+98.37
Offset 4.34 Ft. Left

District Fort Worth
Date 10/06/2000
Grnd. Elev. 614.40 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
5	[Hatched Pattern]		CLAY, sandy, grayish brown & tan w/calcareous nodules, iron stains & iron stone lenses (CL)			10.7	54	34		Minus 40 = 76.8%, pp = 4.5+
						10.1				pp = 4.5+
						13.5	39	22		pp = 4.5+
						10.3				pp = 4.5+
604.4	10		LIMESTONE, gray w/occasional gray clay, tan limestone & dark gray shale seams			17.8	57	32		Minus 40 = 99.1%, pp = 4.5+
15										
20										
589.4	25									

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller:

Logger:

Organization:

SUMMARY OF LABORATORY TEST RESULTS

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Atterberg Limits			Percent Passing Sieve No.		Soluble Sulfate Content * (ppm)
			LL	PL	PI	40	200	
B-1	1.0 - 2.5	12.6	68	21	47	99.0	96.8	
	2.5 - 4.0	15.4						
	4.0 - 5.0	18.2	59	20	39	98.3	97.1	
	5.0 - 6.0	12.1						
	6.0 - 7.5	24.2	58	17	41	97.7	95.1	
	7.5 - 9.0	16.9						
	9.0 - 10.0	21.6	53	16	37	99.2	95.9	
	12.5 - 14.0	15.7	54	20	34	99.1	96.2	
B-2	1.0 - 2.5	14.5	75	23	52	93.3	90.8	
	6.0 - 7.5	16.1	52	18	34	97.5	94.4	
	7.5 - 8.5	15.3						
	8.5 - 10.0	21.2	66	21	45	96.9	90.7	
	10.0 - 11.0	20.4						
	12.5 - 13.5	18.9	70	24	46	84.2	80.4	
	16.5 - 17.5	8.3	44	16	28	58.4	51.4	
	18.5 - 20.0	7.1						
B-3	0.0 - 1.5	8.7	57	22	35	91.7	85.3	
	2.0 - 3.5	5.6						
	3.5 - 5.0	11.2	47	20	27	67.7	62.2	
	5.0 - 6.0	23.3						
	6.0 - 7.5	24.3	83	24	59	96.8	95.5	
	7.5 - 8.5	25.3						
	8.5 - 10.0	26.7	85	21	64	97.0	96.0	
	10.0 - 11.0	24.5						
13.5 - 15.0	24.2	70	20	50	98.7	98.4		
B-4	1.0 - 2.5	4.5	52	17	35	49.1	38.9	
	2.5 - 3.0	8.7						
	3.0 - 5.0	16.1	68	19	49	93.6	91.8	
	9.0 - 10.0	18.6	77	24	53	92.2	90.0	
	10.0 - 11.0	21.3						
	12.5 - 13.5	22.7	67	26	41	93.6	92.0	
	13.5 - 15.0	24.1						
B-5	1.0 - 2.5	18.3	70	22	48	96.8	93.4	
	2.5 - 3.5	11.9						
	3.5 - 5.0	10.7	61	24	37	95.8	94.0	
	5.0 - 6.0	10.9						
	6.0 - 7.5	12.9	65	17	48	97.4	96.5	
	7.5 - 8.5	15.6						
	8.5 - 10.0	19.2	72	21	51	99.5	99.3	
	10.0 - 12.0	23.1	69	25	44	99.8	99.6	

* ANALYSES TO BE PERFORMED BY TxDOT LABORATORY

SUMMARY OF LABORATORY TEST RESULTS

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Atterberg Limits			Percent Passing Sieve No.		Soluble Sulfate Content * (ppm)
			LL	PL	PI	40	200	
B-6	0.0 - 2.5	8.3	58	24	34	80.1	73.5	
	8.0 - 9.0	7.9	38	15	23	60.1	55.0	
	10.5 - 15.0	15.7	62	19	43	97.9	96.5	
B-7	1.0 - 2.5	10.6	59	19	40	82.9	74.6	
	2.5 - 5.0	6.3						
	5.0 - 6.0	20.4	75	28	47	96.4	93.8	
	7.5 - 9.0	19.7	74	22	52	92.0	90.7	
	10.0 - 11.5	7.0						
	11.5 - 12.5	11.5	50	17	33	26.0	20.0	
	12.5 - 13.0	12.1						
	13.0 - 15.0	26.9	68	23	45	97.7	96.6	
B-8	1.0 - 2.5	11.5	61	27	34	96.4	94.4	
	3.5 - 5.0	16.4						
	5.0 - 7.0	16.3	55	24	31	99.6	98.1	
	7.0 - 9.0	17.3						
	9.0 - 10.0	15.4	54	24	30	99.8	99.1	
	10.0 - 12.0	15.1						
B-9	0.0 - 1.0	11.0	83	31	52	94.8	87.9	
	1.0 - 2.5	10.2	55	21	34	91.8	89.5	
	4.0 - 5.0	17.5	62	24	38	99.8	99.4	
	7.0 - 9.0	16.6						
	9.0 - 10.0	18.3	66	26	40	99.7	98.6	
	10.0 - 12.0	13.8						
B-11	1.0 - 2.5	14.5	88	25	63	94.3	76.2	
	2.5 - 4.0	16.4						
	4.0 - 5.0	18.5	49	16	33	82.5	74.0	
	6.5 - 7.5	14.5	36	17	19	97.2	90.0	
	7.5 - 9.0	13.8						
	9.0 - 10.0	11.5	41	16	25	83.1	70.7	
	10.0 - 11.5	10.5						
B-12	1.0 - 2.5	7.0	30	17	13	98.5	46.7	
	2.5 - 4.0	12.9						
	4.0 - 5.0	11.9	50	19	31	98.6	53.3	
	6.5 - 7.5	13.5	52	20	32	92.1	68.0	
	7.5 - 9.0	9.6						
	9.0 - 10.0	12.9	35	15	20	75.8	64.8	
	10.0 - 11.5	11.7	36	16	20	71.4	58.1	

* ANALYSES TO BE PERFORMED BY TxDOT LABORATORY

SUMMARY OF LABORATORY TEST RESULTS

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Atterberg Limits			Percent Passing Sieve No.		Soluble Sulfate Content * (ppm)
			LL	PL	PI	40	200	
B-14	2.5 - 3.5	17.1	66	25	41	99.2	97.8	
	5.0 - 7.0	19.3						
	7.0 - 9.0	19.9	63	26	37	98.8	97.5	
	9.0 - 10.0	19.6						
	11.0 - 12.5	20.0	56	22	34	98.9	97.4	
	13.0 - 15.0	15.8	59	24	35	99.2	97.8	
	15.0 - 17.5	7.5						
	17.5 - 20.0	11.2	45	19	26	75.1	70.9	
B-15	1.0 - 2.5	8.3	48	18	30	88.2	82.7	
	5.0 - 7.0	13.6						
	7.0 - 9.0	14.6	53	23	30	97.3	96.1	
	10.0 - 12.0	15.0						
	14.0 - 15.0	15.4	57	23	34	99.1	98.3	
	16.0 - 17.5	11.1						
	18.5 - 20.0	14.4	51	22	29	99.1	98.4	
	20.0 - 22.0	14.7						
24.0 - 25.0	13.4	52	20	32	97.5	92.8		
B-16	2.5 - 4.0	14.5	51	18	33	98.9	96.9	
	5.0 - 6.5	15.3	46	18	28	68.6	62.3	
	6.5 - 7.5	9.4						
	8.5 - 10.0	15.5	44	17	27	74.8	67.6	
	10.0 - 12.0	19.9						
	12.0 - 14.0	21.1	60	23	37	96.8	96.0	
	14.0 - 15.0	19.8						
	15.0 - 17.0	29.2	70	23	47	97.3	96.4	
17.0 - 19.0	22.6							
B-17	1.0 - 2.5	10.7	54	20	34	76.8	58.7	
	3.5 - 5.0	10.1						
	5.0 - 6.0	13.5	39	17	22	88.0	76.9	
	8.5 - 10.0	10.3						
	15.0 - 16.5	17.8	57	25	32	99.1	98.0	

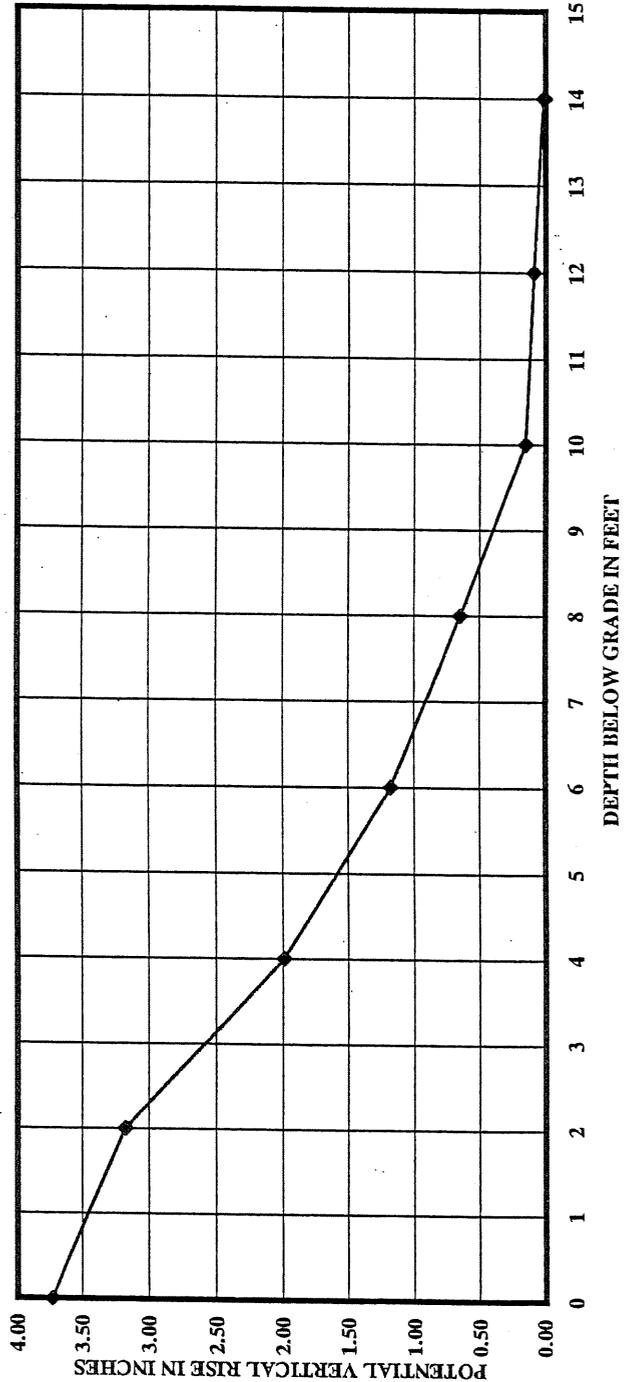
* ANALYSES TO BE PERFORMED BY TxDOT LABORATORY

POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP
 District: Fort Worth District Laboratory
 C-S-J NO.: 0008-14-059
 Hole No.: B-2
 Date: 10/04/2000
 Ground Elev.: 629.40*
 Station: 671+45.64
 Offset: 26.26 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	3.73
2.0	1	52	19.4	26.4	16.1	Dry	97.5	34	9.7	13.0	0.00	0.57	0.57	0.98	1.00	0.56	3.18
4.0	3	66	22.2	33.0	21.2	Dry	96.9	45	13.8	17.3	0.80	2.03	1.23	0.97	1.00	1.19	1.99
6.0	5.0	66	22.2	33.0	20.4	Dry	96.9	45	13.8	17.3	2.03	2.86	0.83	0.97	1.00	0.80	1.18
8.0	7.0	70	23.0	34.9	18.9	Dry	84.2	46	14.1	17.7	2.97	3.60	0.63	0.84	1.00	0.53	0.65
10.0	9.0	70	23.0	34.9	18.9	Dry	84.2	46	14.1	17.7	3.60	4.20	0.60	0.84	1.00	0.51	0.15
12.0	11.0	44	17.8	22.7	8.3	Dry	58.4	28	7.5	10.6	2.02	2.13	0.11	0.58	1.00	0.06	0.08
14.0	13.0	44	17.8	22.7	7.1	Dry	58.4	28	7.5	10.6	2.13	2.25	0.12	0.58	1.00	0.07	0.01
14.0	14.0	44	17.8	22.7	7.1	Dry	58.4	28	7.5	10.6	2.25	2.27	0.02	0.58	1.00	0.01	0.00
	7	0	2.0	2.0					-2.9	-0.5			0.00	0.00	1.00	0.00	0.00
	0	0	2.0	2.0					-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 623.4±, i.e., approximately 6.0 feet below present ground elevation.

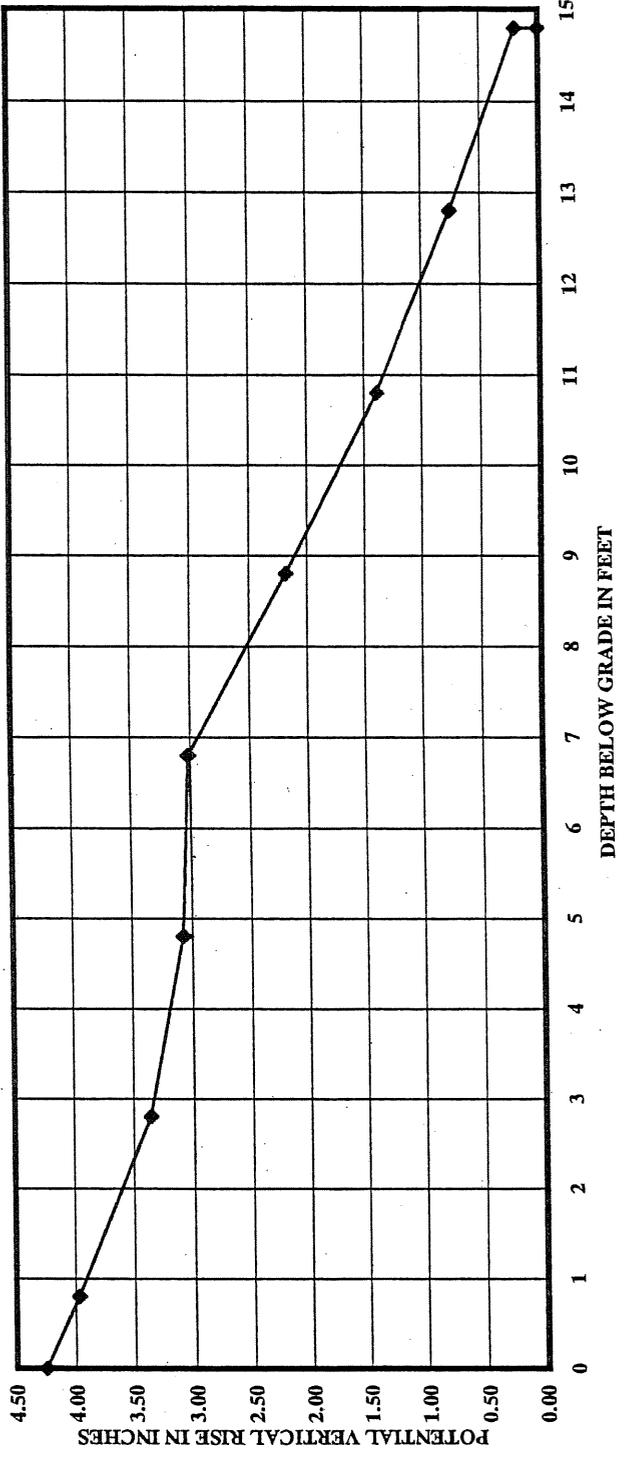


POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP
 District: Fort Worth District Laboratory
 C-S-J NO.: 0008-14-059
 Hole No.: B-3
 Date: 10/04/2000
 Ground Elev.: 632.69*
 Station: 690+86.10
 Offset: 33.14 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	#VALUE!	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. (-No. 40) Factor	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)	
0			2.0	2.0		n/a		n/a				0.00	0.00	0.00	0.00	1.00	0.00	0.00	4.25
0.8	0.4	55	20.0	27.9	24	Avg	93	35	7.4		10.5	0.00	0.30	0.30	0.93	1.00	0.28	0.28	3.97
2.8	1.8	57	20.4	28.8	8.7	Dry	91.7	35	10.1		13.4	0.30	0.97	0.67	0.92	1.00	0.61	0.61	3.36
4.8	3.8	47	18.4	24.1	11.2	Dry	67.7	27	7.1		10.2	0.90	1.32	0.42	0.68	1.00	0.28	0.28	3.07
6.8	5.8	47	18.4	24.1	23.3	Wet	67.7	27	3.0		5.8	0.49	0.57	0.08	0.68	1.00	0.05	0.05	3.02
8.8	7.8	83	25.6	41.0	24.3	Dry	96.8	59	17.7		21.5	4.30	5.16	0.86	0.97	1.00	0.83	0.83	2.19
10.8	9.8	85	26.0	42.0	26.7	Dry	97.0	64	18.9		22.8	5.53	6.35	0.82	0.97	1.00	0.80	0.80	1.39
12.8	11.8	85	26.0	42.0	24.5	Dry	97.0	64	18.9		22.8	6.35	7.00	0.65	0.97	1.00	0.63	0.63	0.76
14.8	13.8	70	23.0	34.9	24.2	Dry	98.7	50	15.6		19.3	5.53	6.10	0.57	0.99	1.00	0.56	0.56	0.20
14.8	14.8	70	23.0	34.9	24.2	Dry	98.7	50	15.6		19.3	6.10	6.30	0.20	0.99	1.00	0.20	0.20	0.00
	7.4	0	2.0	2.0	0			0	-2.9		-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 633.5±, i.e., approximately 0.8 feet above present ground elevation.

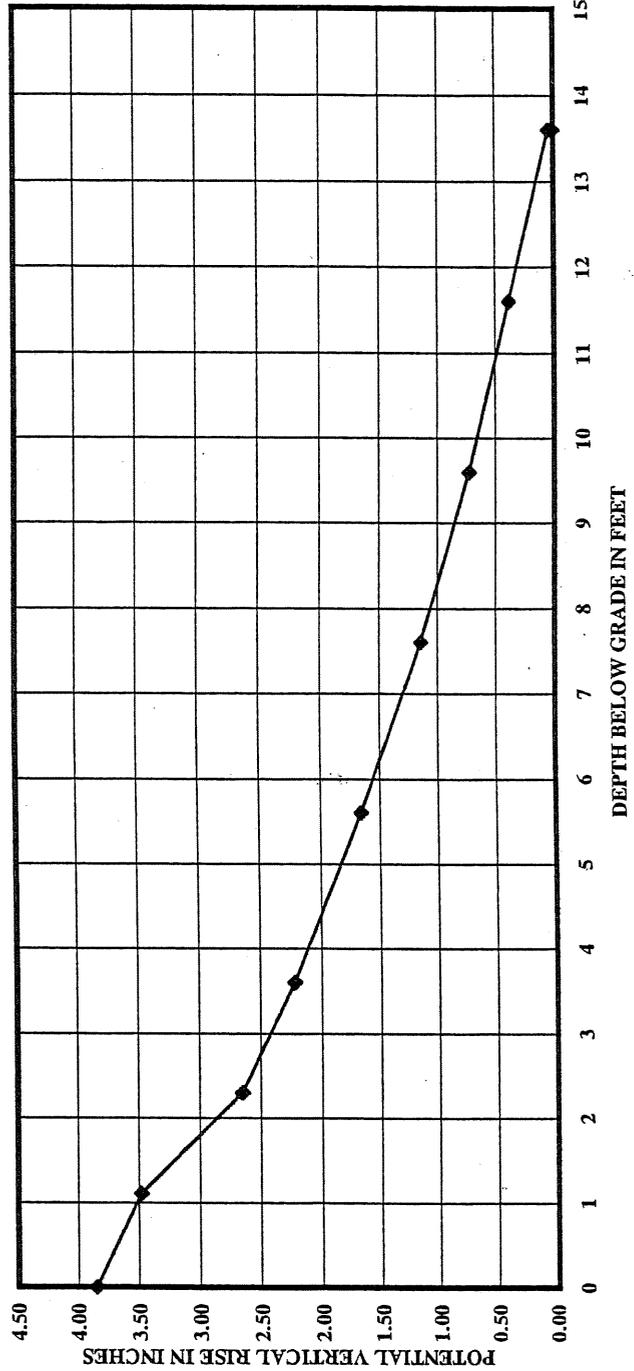


POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP
 C-S-J NO.: 0008-14-058
 District: Fort Worth District Laboratory
 Hole No.: B-9
 Date: 10/05/2000
 Ground Elev.: 593.38*
 Station: 864+34.92
 Offset: 38.18 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	#VALUE! #####	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)	
0			2.0	2.0		n/a		n/a				0.00	0.00	0.00	0.00	1.00	0.00	0.00	3.85
1.1	0.6	55	20.0	27.9	24	Avg	93	35	7.4	10.5	10.5	0.00	0.40	0.40	0.93	1.00	0.37	0.37	3.48
2.3	1.7	83	25.6	41.0	11.0	Dry	94.8	52	16.0	19.7	19.7	0.70	1.57	0.87	0.95	1.00	0.82	0.82	2.66
3.6	3.0	55	20.0	27.9	10.2	Dry	91.8	34	9.7	13.0	13.0	0.93	1.40	0.47	0.92	1.00	0.43	0.43	2.22
5.6	4.6	62	21.4	31.1	17.5	Dry	99.8	38	11.2	14.5	14.5	1.54	2.10	0.56	1.00	1.00	0.56	0.56	1.67
7.6	6.6	62	21.4	31.1	17.5	Dry	99.8	38	11.2	14.5	14.5	2.10	2.62	0.52	1.00	1.00	0.52	0.52	1.15
9.6	8.6	62	21.4	31.1	16.6	Dry	99.8	38	11.2	14.5	14.5	2.62	3.04	0.42	1.00	1.00	0.42	0.42	0.73
11.6	10.6	66	22.2	33.0	18.3	Dry	99.7	40	11.9	15.3	15.3	3.28	3.63	0.35	1.00	1.00	0.35	0.35	0.38
13.6	12.6	66	22.2	33.0	13.8	Dry	99.7	40	11.9	15.3	15.3	3.63	3.97	0.34	1.00	1.00	0.34	0.34	0.04
13.6	13.6	66	22.2	33.0	13.8	Dry	99.7	40	11.9	15.3	15.3	3.97	4.01	0.04	1.00	1.00	0.04	0.04	0.00
	6.8	0	2.0	2.0					-2.9	-0.5	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 594.5±, i.e., approximately 1.1 feet above present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IHI-820 NORTH LOOP

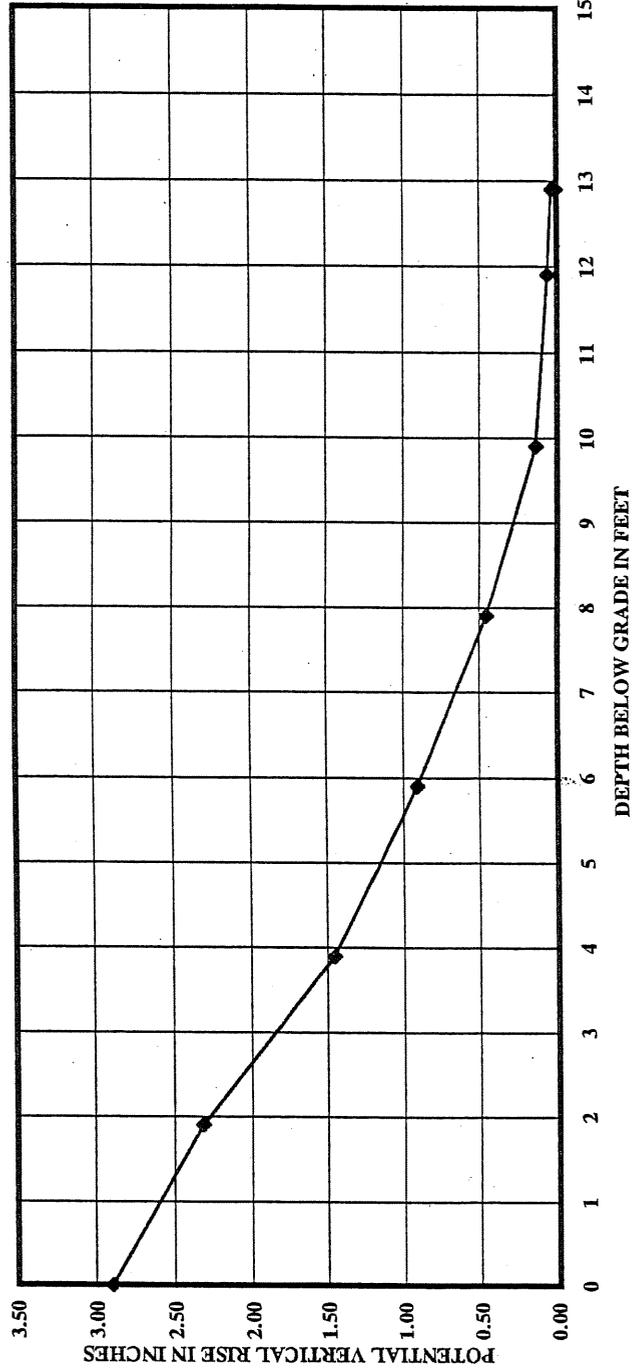
C-S-J NO.: 0008-14-059
 District: Fort Worth District Laboratory

Hole No.: B-14
 Date: 10/05/2000

Ground Elev.: 597.45*
 Station: 779+43.96
 Offset: 0.49 Ft. Rt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. (-No. 40) Factor	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)		
0			2.0	2.0		n/a		n/a	#VALUE!	#####	0.00	0.00	0.00	0.00	1.00	0.00	0.00	2.90	
1.9	1.0	63	21.6	31.6	19.9	Dry	98.8	37	10.8	14.1	0.00	0.58	0.58	0.99	1.00	0.57	0.57	2.32	
3.9	2.9	63	21.6	31.6	19.6	Dry	98.8	37	10.8	14.1	0.58	1.46	0.88	0.99	1.00	0.87	1.45	1.45	
5.9	4.9	56	20.2	28.3	20.0	Dry	98.9	34	9.7	13.0	1.40	1.95	0.55	0.99	1.00	0.54	0.91	0.91	
7.9	6.9	59	20.8	29.7	15.8	Dry	99.2	35	10.1	13.4	2.02	2.48	0.46	0.99	1.00	0.46	0.46	0.45	
9.9	8.9	59	20.8	29.7	7.5	Dry	99.2	35	10.1	13.4	2.48	2.80	0.32	0.99	1.00	0.32	0.32	0.14	
11.9	10.9	45	18.0	23.2	11.2	Dry	75.1	26	6.7	9.8	1.80	1.90	0.10	0.75	1.00	0.08	0.08	0.06	
12.9	12.4	45	18.0	23.2	11.2	Dry	75.1	26	6.7	9.8	1.90	1.94	0.04	0.75	1.00	0.03	0.03	0.03	
12.9	12.9	45	18.0	23.2	11.2	Dry	75.1	26	6.7	9.8	1.94	1.98	0.04	0.75	1.00	0.03	0.03	0.00	
	6.45	0	2.0	2.0					-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
	0	0	2.0	2.0					-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 590.4±, i.e., approximately 7.1 feet below present ground elevation.



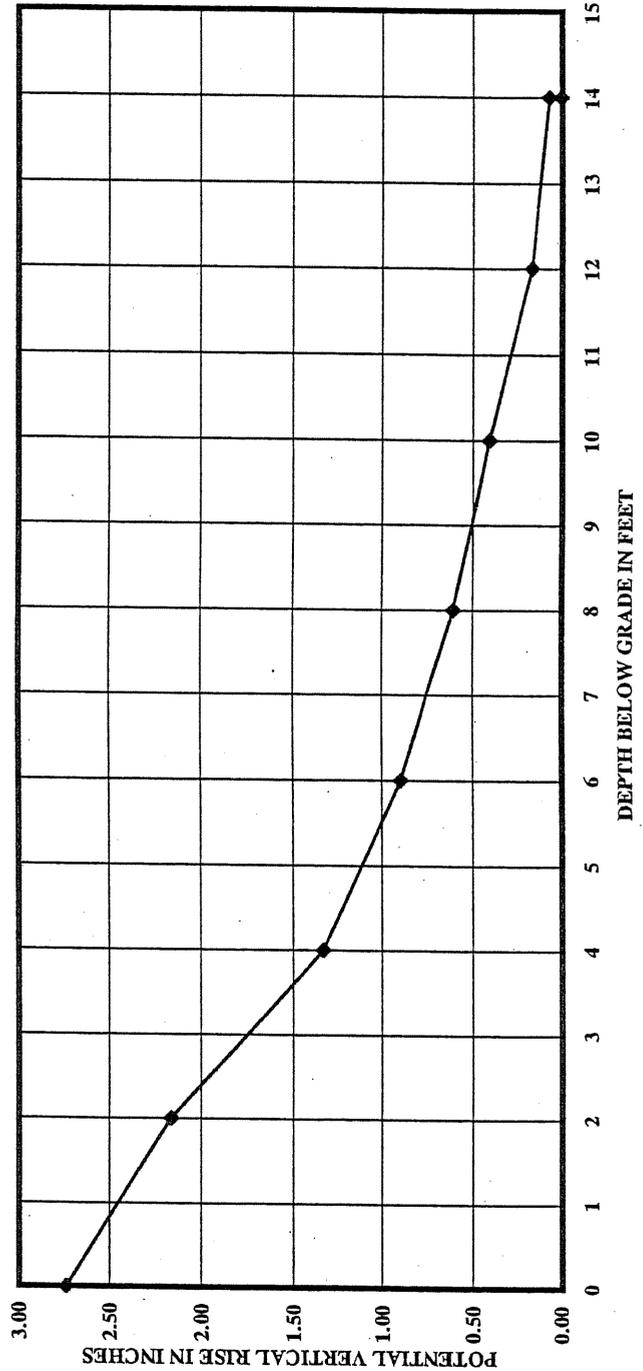
POTENTIAL VERTICAL RISE (PVR)

County: Tarrant Hole No.: B-15 Ground Elev.: 551.25*
 Highway: IH-820 NORTH LOOP District: Fort Worth District Laboratory Station: 807+30.66
 Date: 10/05/2000 Offset: 1.55 Ft. Rt.

C-S-J NO.: 0008-14-059

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)	
0			2.0	2.0		n/a		n/a	#VALUE!	#####	0.00	0.00	0.00	0.00	1.00	0.00	0.00	2.74
2.0	1.0	57	20.4	28.8	15.4	Dry	99.1	34	9.7	13.0	0.00	0.58	0.58	0.99	1.00	0.57	0.57	2.16
4.0	3.0	57	20.4	28.8	11.1	Dry	99.1	34	9.7	13.0	0.58	1.42	0.84	0.99	1.00	0.83	0.83	1.33
6.0	5.0	51	19.2	26.0	14.4	Dry	99.1	29	7.8	11.0	1.20	1.64	0.44	0.99	1.00	0.44	0.44	0.90
8.0	7.0	51	19.2	26.0	14.7	Dry	99.1	29	7.8	11.0	1.64	1.93	0.29	0.99	1.00	0.29	0.29	0.61
10.0	9.0	51	19.2	26.0	14.7	Dry	99.1	29	7.8	11.0	1.93	2.13	0.20	0.99	1.00	0.20	0.20	0.41
12.0	11.0	52	19.4	26.4	13.4	Dry	97.5	32	8.9	12.2	2.48	2.73	0.25	0.98	1.00	0.24	0.24	0.17
14.0	13.0	52	19.4	26.4	13.4	Dry	97.5	32	8.9	12.2	2.73	2.83	0.10	0.98	1.00	0.10	0.10	0.07
14.0	14	52	19.4	26.4	13.4	Dry	97.5	32	8.9	12.2	2.83	2.90	0.07	0.98	1.00	0.07	0.07	0.00
	7	0	2.0	2.0					-2.9	-0.5			0.00	0.00	1.00	0.00	0.00	0.00
	0	0	2.0	2.0					-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 537.7±, i.e., approximately 13.5 feet below present ground elevation.

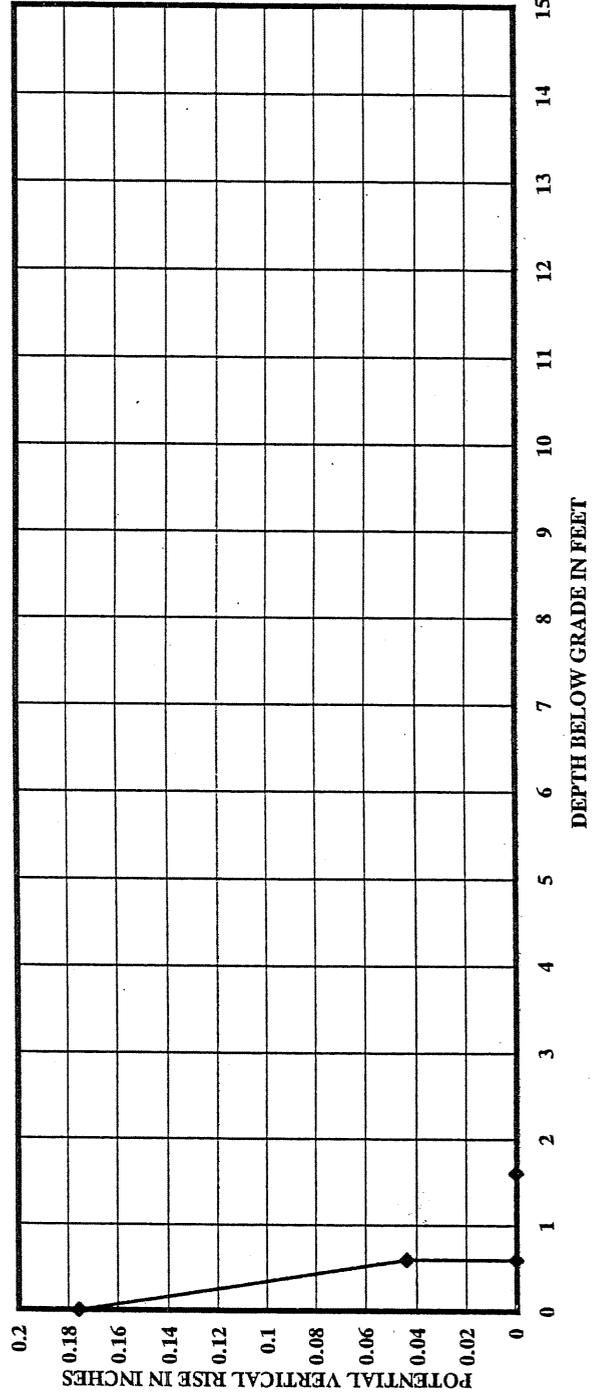


POTENTIAL VERTICAL RISE (PVR)

County: Tarrant Highway: IH-820 NORTH LOOP C-S-J NO.: 0008-14-058 District: Fort Worth District Laboratory Hole No.: B-17 Date: 10/06/2000 Ground Elev.: 614.40*
 Station: 899+98.37 Offset: 4.34 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Density Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#VALUE!	#####	0.00	0.00	0.00	1.00	1.00	0.00	0.18
0.6	0.3	39	16.8	20.3	10.3	Dry	88.0	22	5.2	8.2	0.00	0.15	0.15	1.00	1.00	0.13	0.04
0.6	0.6	39	16.8	20.3	10.3	Dry	88.0	22	5.2	8.2	0.15	0.20	0.05	1.00	1.00	0.04	0.00
1.6	1.1	-	#VALUE!	#VALUE!	-	-	100	-	#VALUE!	#####	0.00	0.00	0.00	1.00	1.00	0.00	0.00
1.6	1.6	-	#VALUE!	#VALUE!	-	-	100	-	#VALUE!	#####	0.00	0.00	0.00	1.00	1.00	0.00	0.00
	0.8		2.0	2.0					-2.9	-0.5			0.00	1.00	1.00	0.00	0.00
	0		2.0	2.0					-2.9	-0.5			0.00	1.00	1.00	0.00	0.00
	0		2.0	2.0					-2.9	-0.5			0.00	1.00	1.00	0.00	0.00
	0		2.0	2.0					-2.9	-0.5			0.00	1.00	1.00	0.00	0.00
	0		2.0	2.0					-2.9	-0.5			0.00	1.00	1.00	0.00	0.00
	0		2.0	2.0		Dry		0	-2.9	-0.5	0.00	0.00	0.00	1.00	1.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 605.0±, i.e., approximately 9.4 feet below present ground elevation.



TEAM - Soil Survey Report
November 2000

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
1	10/4/2000	653+92.56	6.5 ft.	5.0 ft.	3.8 ft.
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.3 ft.
4	10/4/2000	708+71.43	10.3 ft.	8.8 ft.	7.2 ft.
5	10/5/2000	761+80.40	10.7 ft.	9.2 ft.	6.8 ft.
6	10/5/2000	791+10.64	9.3 ft.	1.3 ft.	0.0 ft.
7	10/5/2000	817+92.05	7.0 ft.	5.0 ft.	3.5 ft.
8	10/5/2000	847+69.76	6.3 ft.	4.2 ft.	2.6 ft.
9	10/5/2000	864+34.92	8.2 ft.	6.2 ft.	4.3 ft.
11	10/6/2000	908+64.80	4.5 ft.	3.8 ft.	3.2 ft.
12	10/6/2000	945+58.52	3.8 ft.	2.3 ft.	0.0 ft.
14	10/5/2000	779+43.96	5.5 ft.	3.9 ft.	2.7 ft.
15	10/5/2000	807+30.66	5.5 ft.	3.6 ft.	2.3 ft.
16	10/5/2000	856+20.74	5.7 ft.	2.7 ft.	0.2 ft.
17	10/6/2000	899+98.37	0.0 ft.	0.0 ft.	0.0 ft.

TEAM - 2nd Survey Report
September 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
2B	3/15/2001	681+00.00	6.5 ft.	5.3 ft.	4.5 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.2 ft.
3B	3/14/2001	699+75.00	11.6 ft.	10.4 ft.	8.9 ft.
4	10/4/2000	708+71.43	10.5 ft.	8.8 ft.	7.2 ft.
4B	3/13/2001	719+00.00	1.0 ft.	0.0 ft.	0.0 ft.
4C	3/13/2001	728+35.00	6.0 ft.	3.0 ft.	0.8 ft.
4D	3/13/2001	741+00.00	10.2 ft.	7.0 ft.	4.2 ft.
4E	3/13/2001	751+00.00	9.0 ft.	6.3 ft.	4.8 ft.
5	10/5/2000	761+80.40	10.8 ft.	9.0 ft.	7.0 ft.
5B	3/13/2001	770+50.00	6.7 ft.	5.0 ft.	3.5 ft.

Terra-Mar - Soil Survey Report
July 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2B1	4/6/2001	685+93	6.2 ft.	4.5 ft.	2.8 ft.
3A1	4/6/2001	695+31	9.5 ft.	6.0 ft.	2.8 ft.
3B1	4/6/2001	704+23	9.0 ft.	7.5 ft.	6.0 ft.
4A1	4/6/2001	713+85	5.5 ft.	4.5 ft.	3.6 ft.
4B1	4/1/2001	723+67	6.8 ft.	4.0 ft.	3.2 ft.
4C1	4/5/2001	734+67	6.8 ft.	5.3 ft.	3.6 ft.
4D1	4/5/2001	746+00	6.0 ft.	4.5 ft.	3.2 ft.
4E1	4/5/2001	756+40	6.9 ft.	5.3 ft.	3.5 ft.
5A1	4/5/2001	766+15	3.3 ft.	2.7 ft.	2.0 ft.

TEAM Consultants, Inc.

Geotechnical, Environmental, Construction Materials Testing

November 20, 2000
TEAM Project No. 002052G
Supplemental Report No. 1

Texas Department of Transportation
Fort Worth District Laboratory
P.O. Box 6868
Fort Worth, Texas 76115-0868

Attn: Mr. Richard Williammee, Jr., P.E.
District Materials Engineer

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Dear Mr. Williammee:

Submitted herewith is our Supplemental Report No. 1 for the referenced project. This supplemental report presents the results of soluble sulfate content analysis performed on selected soil samples collected during soil sampling operations. The selected samples were analyzed for sulfates in accordance with TxDOT Test Method TEX-620-J by the TxDOT laboratory in Austin, Texas.

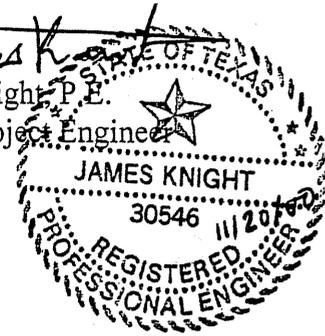
The results of the sulfate content tests indicate that sulfates are present in the subgrade soils at levels ranging from 0 parts per million (ppm) to 15,733 ppm. Sulfate content levels near, or in excess of, 2,000 ppm were observed in soil samples from Boreholes No. B-2 (3,127), B-6 (1,893), B-9 (15,733), and B-11 (4,719). The potential for sulfate induced heave should be a design factor considered by TxDOT engineers if lime or cement stabilization of the moderate to high plasticity clay, calcareous clay and sandy clay subgrade soils is included in the proposed pavement section for this project. The results of soluble sulfate content analysis performed by the TxDOT laboratory are presented on the "Revised" Plates 17 through 19. These "revised" plates should be inserted in copies of the reports for this project that were submitted previously.

We appreciate the opportunity to assist you on the design phase of this project. Should you have any questions or need further assistance, please call the undersigned at (817) 467-5500.

Very truly yours,

TEAM Consultants, Inc.


James Knight, P.E.
Senior Project Engineer



The seal is circular with a star in the center. The text around the star reads: "STATE OF TEXAS" at the top, "JAMES KNIGHT" and "30546" in the middle, and "REGISTERED PROFESSIONAL ENGINEER" at the bottom.

JK/li

Copies submitted: 3

SUMMARY OF LABORATORY TEST RESULTS

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Atterberg Limits			Percent Passing Sieve No.		Soluble Sulfate Content * (ppm)
			LL	PL	PI	40	200	
B-1	1.0 - 2.5	12.6	68	21	47	99.0	96.8	----
	2.5 - 4.0	15.4	----	----	----	----	----	1,385
	4.0 - 5.0	18.2	59	20	39	98.3	97.1	----
	5.0 - 6.0	12.1	----	----	----	----	----	----
	6.0 - 7.5	24.2	58	17	41	97.7	95.1	----
	7.5 - 9.0	16.9	----	----	----	----	----	----
	9.0 - 10.0	21.6	53	16	37	99.2	95.9	----
	12.5 - 14.0	15.7	54	20	34	99.1	96.2	----
B-2	1.0 - 2.5	14.5	75	23	52	93.3	90.8	3,127
	6.0 - 7.5	16.1	52	18	34	97.5	94.4	178
	7.5 - 8.5	15.3	----	----	----	----	----	----
	8.5 - 10.0	21.2	66	21	45	96.9	90.7	----
	10.0 - 11.0	20.4	----	----	----	----	----	----
	12.5 - 13.5	18.9	70	24	46	84.2	80.4	----
	16.5 - 17.5	8.3	44	16	28	58.4	51.4	----
	18.5 - 20.0	7.1	----	----	----	----	----	----
B-3	0.0 - 1.5	8.7	57	22	35	91.7	85.3	27
	2.0 - 3.5	5.6	----	----	----	----	----	809
	3.5 - 5.0	11.2	47	20	27	67.7	62.2	----
	5.0 - 6.0	23.3	----	----	----	----	----	----
	6.0 - 7.5	24.3	83	24	59	96.8	95.5	----
	7.5 - 8.5	25.3	----	----	----	----	----	----
	8.5 - 10.0	26.7	85	21	64	97.0	96.0	----
	10.0 - 11.0	24.5	----	----	----	----	----	----
B-4	13.5 - 15.0	24.2	70	20	50	98.7	98.4	----
	1.0 - 2.5	4.5	52	17	35	49.1	38.9	0
	2.5 - 3.0	8.7	----	----	----	----	----	----
	3.0 - 5.0	16.1	68	19	49	93.6	91.8	439
	9.0 - 10.0	18.6	77	24	53	92.2	90.0	----
	10.0 - 11.0	21.3	----	----	----	----	----	----
	12.5 - 13.5	22.7	67	26	41	93.6	92.0	----
	13.5 - 15.0	24.1	----	----	----	----	----	----
B-5	1.0 - 2.5	18.3	70	22	48	96.8	93.4	110
	2.5 - 3.5	11.9	----	----	----	----	----	69
	3.5 - 5.0	10.7	61	24	37	95.8	94.0	----
	5.0 - 6.0	10.9	----	----	----	----	----	----
	6.0 - 7.5	12.9	65	17	48	97.4	96.5	----
	7.5 - 8.5	15.6	----	----	----	----	----	----
	8.5 - 10.0	19.2	72	21	51	99.5	99.3	----
	10.0 - 12.0	23.1	69	25	44	99.8	99.6	----

* TEST PERFORMED: Tex-620-J BY TxDOT LABORATORY

REVISED: 11/17/00

SUMMARY OF LABORATORY TEST RESULTS

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Atterberg Limits			Percent Passing Sieve No.		Soluble Sulfate Content * (ppm)
			LL	PL	PI	40	200	
B-6	0.0 - 2.5	8.3	58	24	34	80.1	73.5	1,893
	8.0 - 9.0	7.9	38	15	23	60.1	55.0	-----
	10.5 - 15.0	15.7	62	19	43	97.9	96.5	-----
B-7	1.0 - 2.5	10.6	59	19	40	82.9	74.6	0
	2.5 - 5.0	6.3	-----	-----	-----	-----	-----	1,385
	5.0 - 6.0	20.4	75	28	47	96.4	93.8	-----
	7.5 - 9.0	19.7	74	22	52	92.0	90.7	-----
	10.0 - 11.5	7.0	-----	-----	-----	-----	-----	-----
	11.5 - 12.5	11.5	50	17	33	26.0	20.0	-----
	12.5 - 13.0	12.1	-----	-----	-----	-----	-----	-----
	13.0 - 15.0	26.9	68	23	45	97.7	96.6	-----
B-8	1.0 - 2.5	11.5	61	27	34	96.4	94.4	0
	3.5 - 5.0	16.4	-----	-----	-----	-----	-----	-----
	5.0 - 7.0	16.3	55	24	31	99.6	98.1	-----
	7.0 - 9.0	17.3	-----	-----	-----	-----	-----	-----
	9.0 - 10.0	15.4	54	24	30	99.8	99.1	-----
	10.0 - 12.0	15.1	-----	-----	-----	-----	-----	-----
B-9	0.0 - 1.0	11.0	83	31	52	94.8	87.9	370
	1.0 - 2.5	10.2	55	21	34	91.8	89.5	15,733
	4.0 - 5.0	17.5	62	24	38	99.8	99.4	-----
	7.0 - 9.0	16.6	-----	-----	-----	-----	-----	-----
	9.0 - 10.0	18.3	66	26	40	99.7	98.6	-----
	10.0 - 12.0	13.8	-----	-----	-----	-----	-----	-----
B-11	1.0 - 2.5	14.5	88	25	63	94.3	76.2	247
	2.5 - 4.0	16.4	-----	-----	-----	-----	-----	4,719
	4.0 - 5.0	18.5	49	16	33	82.5	74.0	-----
	6.5 - 7.5	14.5	36	17	19	97.2	90.0	-----
	7.5 - 9.0	13.8	-----	-----	-----	-----	-----	-----
	9.0 - 10.0	11.5	41	16	25	83.1	70.7	-----
	10.0 - 11.5	10.5	-----	-----	-----	-----	-----	-----
B-12	1.0 - 2.5	7.0	30	17	13	98.5	46.7	137
	2.5 - 4.0	12.9	-----	-----	-----	-----	-----	823
	4.0 - 5.0	11.9	50	19	31	98.6	53.3	-----
	6.5 - 7.5	13.5	52	20	32	92.1	68.0	-----
	7.5 - 9.0	9.6	-----	-----	-----	-----	-----	-----
	9.0 - 10.0	12.9	35	15	20	75.8	64.8	-----
	10.0 - 11.5	11.7	36	16	20	71.4	58.1	-----

* TEST PERFORMED: Tex-620-J BY TxDOT LABORATORY

REVISED: 11/17/00

SUMMARY OF LABORATORY TEST RESULTS

**SOIL SURVEY
IH-820 NORTH LOOP
FROM MARK IV PARKWAY TO SH 26
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-058/059**

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Atterberg Limits			Percent Passing Sieve No.		Soluble Sulfate Content * (ppm)
			LL	PL	PI	40	200	
B-14	2.5 - 3.5	17.1	66	25	41	99.2	97.8	82
	5.0 - 7.0	19.3	----	----	----	----	----	494
	7.0 - 9.0	19.9	63	26	37	98.8	97.5	219
	9.0 - 10.0	19.6	----	----	----	----	----	----
	11.0 - 12.5	20.0	56	22	34	98.9	97.4	----
	13.0 - 15.0	15.8	59	24	35	99.2	97.8	----
	15.0 - 17.5	7.5	----	----	----	----	----	----
	17.5 - 20.0	11.2	45	19	26	75.1	70.9	----
B-15	1.0 - 2.5	8.3	48	18	30	88.2	82.7	0
	5.0 - 7.0	13.6	----	----	----	----	----	1,097
	7.0 - 9.0	14.6	53	23	30	97.3	96.1	----
	10.0 - 12.0	15.0	----	----	----	----	----	----
	14.0 - 15.0	15.4	57	23	34	99.1	98.3	1,221
	16.0 - 17.5	11.1	----	----	----	----	----	----
	18.5 - 20.0	14.4	51	22	29	99.1	98.4	----
	20.0 - 22.0	14.7	----	----	----	----	----	----
B-16	2.5 - 4.0	14.5	51	18	33	98.9	96.9	14
	5.0 - 6.5	15.3	46	18	28	68.6	62.3	151
	6.5 - 7.5	9.4	----	----	----	----	----	----
	8.5 - 10.0	15.5	44	17	27	74.8	67.6	----
	10.0 - 12.0	19.9	----	----	----	----	----	----
	12.0 - 14.0	21.1	60	23	37	96.8	96.0	----
	14.0 - 15.0	19.8	----	----	----	----	----	----
	15.0 - 17.0	29.2	70	23	47	97.3	96.4	----
B-17	1.0 - 2.5	10.7	54	20	34	76.8	58.7	27
	3.5 - 5.0	10.1	----	----	----	----	----	----
	5.0 - 6.0	13.5	39	17	22	88.0	76.9	0
	8.5 - 10.0	10.3	----	----	----	----	----	260
	15.0 - 16.5	17.8	57	25	32	99.1	98.0	----

* TEST PERFORMED: Tex-620-J BY TxDOT LABORATORY

REVISED: 11/17/00

**SOIL SURVEY
IH-820 NORTH LOOP
FROM IH-35W TO HALTOM ROAD
TARRANT COUNTY, TEXAS
C-S-J NO. 0008-14-059**

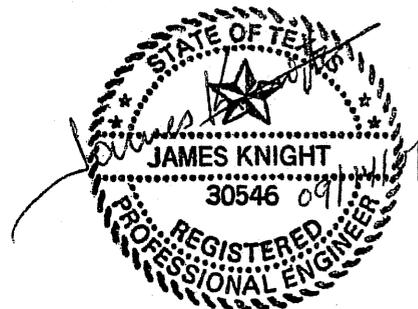
Report To

**Texas Department of Transportation
Fort Worth District**

By

**TEAM Consultants, Inc.
Dallas, Texas**

September 2001



TEAM Consultants, Inc.

Geotechnical, Environmental, Construction Materials Testing

September 14, 2001
TEAM Project No. 002052G
Report No. 2

Texas Department of Transportation
Fort Worth District Laboratory
P.O. Box 6868
Fort Worth, Texas 76115-0868

Attn: Mr. Richard S. Williammee, Jr., P.E.
District Materials Engineer

**SOIL SURVEY
IH-820 NORTH LOOP
FROM IH-35W TO HALTOM ROAD
TARRANT COUNTY, TEXAS
C-S-J NO. 0008-14-059**

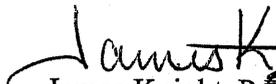
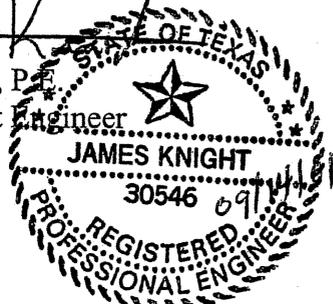
Dear Mr. Williammee:

Submitted herewith is our formal report of the soil survey for the referenced project. The investigation was accomplished in general accordance with Work Authorization No. 02-01-190, dated March 9, 2001.

We appreciate the opportunity to assist you on the design phase of this project. Should you have any questions or need further assistance, please call the undersigned at (214) 331-4395.

Very truly yours,

TEAM Consultants, Inc.


James Knight, P.E.
Senior Project Engineer


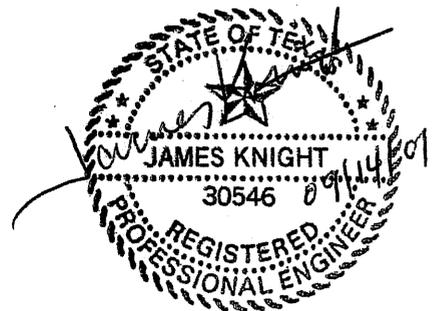
JK/li
Copies submitted: (3)

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INTRODUCTION

The Texas Department of Transportation (TxDOT) plans construction of roadway improvements along IH-820 North Loop from Mark IV Parkway to SH-26 in the cities of Fort Worth, Haltom City, and North Richland Hills, Tarrant County, Texas. The station limits are from approximately Station 610+00 to 962+00. The proposed section will consist of 13-inches of concrete pavement continuously reinforced (CPCR) with 4-inches of Hot Mix Asphaltic Concrete (HMAC) Type "D" (underlayment) and either eight inches or 18-inches of lime treated subgrade. The results of a Soil Survey completed for this project were presented in TEAM Project No. 002052G, Report No. 1 dated November 9, 2000, and in TEAM Project No. 002052G, Supplemental Report No. 1 dated November 20, 2000.

The purpose of the current investigation was (1) to evaluate subsurface conditions along the proposed roadway alignment from IH-35W to Haltom Road and (2) to determine the potential vertical rise (PVR) in subsurface soils in accordance with TxDOT Test Method TEX-124-E and by utilizing one-dimensional swell test results. PVR determinations included in the above referenced report for Boreholes No. B-2, B-3, B-4, and B-5 are incorporated herein. As planned and implemented, the investigation included the drilling of test borings at selected locations to prescribed depths and performance of a series of laboratory tests. The basic boring and test results are included herein.

FIELD INVESTIGATION

Subsurface conditions along the proposed roadway alignment included in the current investigation were evaluated in 11 sample borings drilled at the approximate locations shown on the attached Plan of Borings, Plate 1. The station number and offset are indicated on the Drilling Logs. Surface elevations for these borings were not available for incorporation on the Drilling Logs. The boreholes were drilled to depths ranging from 15.0 feet to 18.5 feet below existing grade. Samples of the materials penetrated by the borings were obtained using conventional auger and thin-walled Shelby tube samplers (ASTM D-1587). Descriptions of the materials encountered in the borings are

presented on the Drilling Logs, Plates 2 through 12. Copies of Drilling Logs No. B-2, B-3, B-4, and B-5 from the previous TEAM report are also included herein (Plates 13 through 16) for reference. The approximate locations of these sample borings are also shown on Plate 1.

As part of the soil sampling operations, standard pocket penetrometer tests were performed on cohesive soil samples. The results are tabulated at respective sample depths on the logs under the Additional Remarks column as "pp =". Soil samples were extruded from the Shelby tubes in the field, visually classified, wrapped in aluminum foil and plastic bags, labeled according to the boring number and depth, and placed in core boxes for transport to the laboratory. The borings were advanced to their completion depths by dry auger drilling techniques. Groundwater observations were made in the borings during and upon completion of the drilling. These observations are noted in the Remarks Section at the bottom of the Drilling Log.

LABORATORY TESTS

To verify visual soil classifications, quantify physical properties of the subsurface soils, and determine the potential vertical rise (PVR) in the soil substrata, laboratory tests were performed on selected soil samples. These tests consisted of Liquid Limit, Plastic Limit, Natural Moisture Content, and Percent Soil Binder (Percent Passing No. 40 Sieve). In addition to classification tests, one-dimensional Pressure-Swell tests were performed on selected samples. The tests were performed in accordance with established TxDOT test procedures and/or testing standards as set forth by the American Society for Testing and Materials (ASTM). The basic test results are tabulated on the Drilling Logs at the respective sample depths. Natural Moisture Content and Unit Weight values determined as a routine part of the Pressure-Swell test are also tabulated at respective sample depths on the logs. Laboratory test results are also summarized on Plates 17 and 18. Pressure-Swell test results are presented on Plates 19 through 44.

GENERAL SUBSURFACE CONDITIONS

The project is located in an area overlain by the Pawpaw, Weno Limestone, and Denton Clay (undivided) formations. The Pawpaw, Weno Limestone, and Denton Clay formations are of lower Cretaceous geologic age as shown on the Dallas Sheet of the Geologic Atlas of Texas. The Pawpaw consists primarily of claystone, mudstone, and sandstone; the Weno Limestone consists of limestone and alternating clay and limestone units; and the Denton Clay consists of alternating clay, marl, and limestone.

Soil formations encountered along the portion of the IH-820 North Loop roadway alignment included in the current study area are shown on the Drilling Logs, Plates 2 through 12. Subsurface conditions, as revealed in the borings, include high plasticity clays and shaley clays from the surface to depths varying from 7.0 feet (Borehole No. B-5B) to 9.0 feet (Borehole No. B-4B) to 17.0 feet (Borehole No. B-2A) and to the termination depths of Boreholes No. B-2B, B-3A, B-3B, B-4A, B-4C, B-4D, B-4E, and B-5A. The surficial clay soils are underlain by limestone from 9.0 to 11.0 feet in Borehole No. B-4B and to the termination depth of Borehole No. B-2A. The limestone in Borehole No. B-4B is underlain by high plasticity clays and shaley clays to the termination depth of the boring. The surficial materials (fill) are comprised of clay soils to depths of 7.0 feet (B-3A), 14.0 feet (B-3B), 6.0 feet (B-4A), 9.0 feet (B-4B), 15.0 feet (B-4C), 5.0 feet (B-4D), 11.0 feet (B-4E), and 4.0 feet (B-5A). Shale underlies the clay soils in Borehole No. B-5B to the termination depth of the boring. Liquid Limits in the clays and shales range from 41 to 84 and Plasticity Indices from 22 to 55. In general, present moisture in the clays and shales is below the Plastic Limit, a condition indicative of moderate to high swell potential.

Water level observations made during and at the completion of drilling are indicated in the "Remarks" section at the bottom of the Drilling Logs. All of the boreholes were observed to be dry upon completion of drilling operations. Experience in this general area suggests that groundwater seepage may be present in these types of deposits. In general, it should be noted that groundwater levels are typically not static and will fluctuate with seasonal variations in local precipitation, surficial runoff, and other factors.

ANALYSES AND RECOMMENDATIONS

Potential Vertical Rise

Potential vertical rise (PVR), expressed in inches, is the latent or potential ability of a soil to swell at a given density, moisture and loading condition when exposed to capillary or excess free water. PVR calculations were determined in accordance with TxDOT Manual of Testing Procedures, Test Method TEX-124-E, and by utilizing the results of one-dimensional Pressure-Swell tests. Utilizing Test Method TEX-124-E, the PVR varied from 1.12 inches for Borehole No. B-4B to 5.15 inches for Borehole No. B-5. The PVR calculations, along with a graphical representation of Potential Vertical Rise in Inches versus Depth Below Grade in Feet, are shown on Plates 46 through 56. PVR calculated utilizing the one-dimensional Pressure-Swell test results varied from 1.86 inches for Borehole No. B-3B to 9.73 inches for Borehole No. B-5B. A Summary of Total PVR determined by each of the test methods is presented on Plate 56. A stratum of limestone was encountered within the zone of influence at Borehole No. B-4B.

As shown by the summary presented on Plate 56, total PVR determinations vary considerably between the two methods utilized. Generally, the PVR determined utilizing the Pressure-Swell test results indicate a lower total PVR than PVR determinations obtained by the TEX-124-E test method. The exceptions are PVR determinations for Borehole Nos. B-3/B-3A, B-4B, B-4C, and B-5B. The PVR determined using Pressure-Swell test results indicates that the total PVR at these locations varies from approximately 1.7 to 6.4 times the PVR determined by use of the TEX-124-E test method.

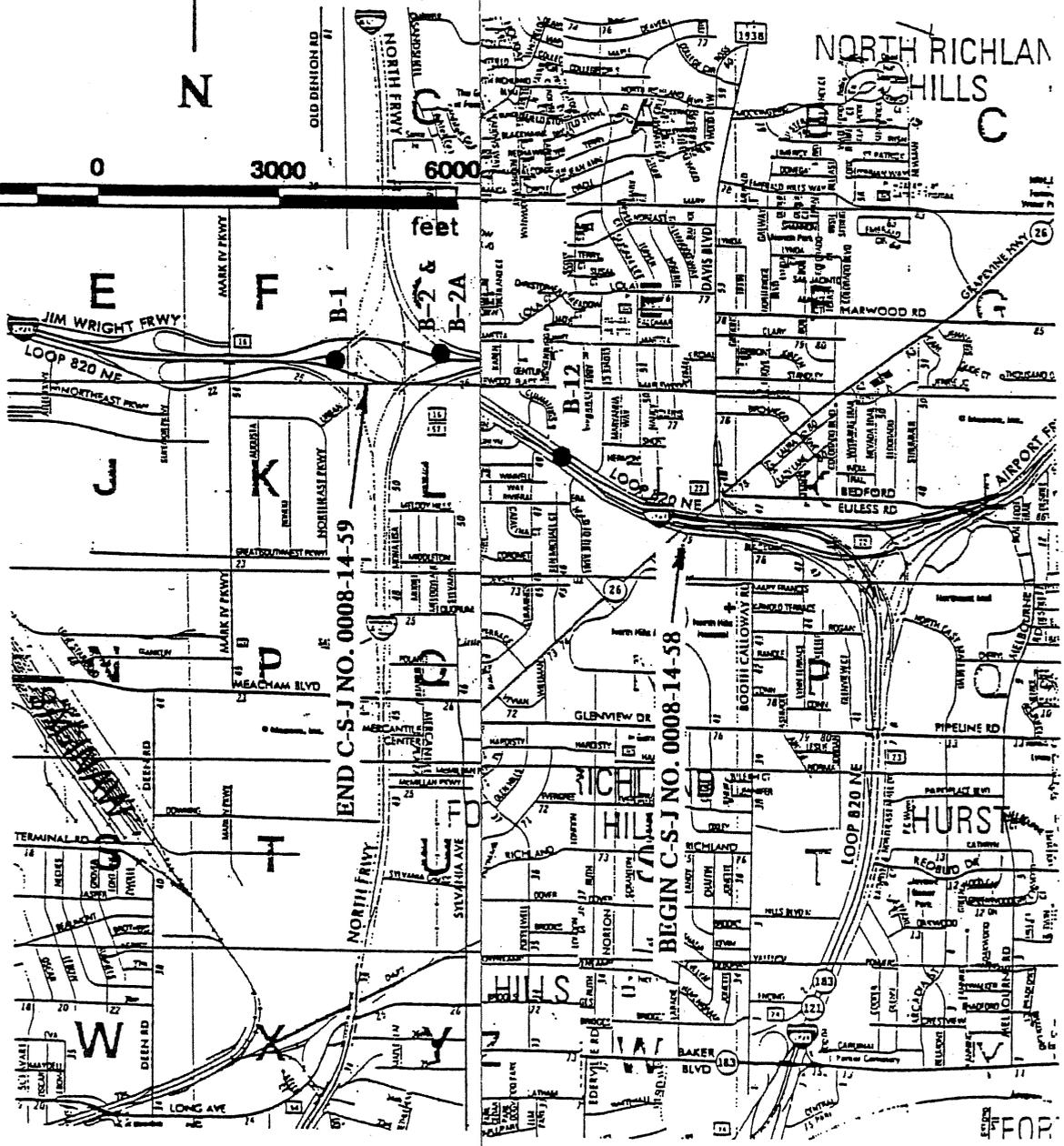
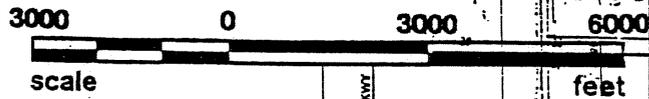
OBSERVATION AND TESTING

Many problems can be avoided in the field when proper observation and testing services are provided. It is recommended that subgrade preparation, lime stabilization, asphalt placement, and concrete placement be monitored by a qualified engineering technician.

LIMITATIONS

The recommendations presented in this report are based on the assumption that the subsurface properties throughout the proposed roadway alignment are reasonably consistent with those exhibited by the borings. The recommendations presented in this report should be reevaluated by TEAM Consultants, Inc. should there be any changes in the type, design, location, or conditions during construction of the proposed project.

ILLUSTRATIONS



PLAN OF BORINGS



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-2A
Structure ROADWAY IMPROVEMENTS
Station 671+45.64
Offset 6 Ft. North of Stake

District FT. WORTH
Date 03/15/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
			CLAY, w/calcareous nodules, brown, soft, moist (CH)							pp = 1.00
										pp = 1.00
										pp = 2.00
										pp = 2.00
-4.										pp = 4.50
5			CLAY, w/calcareous nodules, light brown & tan, hard, moist (CH)			15.6			134	pp = 4.5+
										pp = 4.50
										pp = 4.5+
										pp = 4.50
10						17.9			135	pp = 4.5+
										pp = 2.00
-11.			CLAY, w/tan weathered limestone seams, light brown, hard, moist (CH)							pp = 4.5+
										pp = 4.5+
										pp = 4.50
15										pp = 4.5+
										pp = 4.50
-16.										pp = 4.50
-17.			CLAY, w/gray limestone lenses, gray, hard, moist (CH)							pp = 4.5+
			LIMESTONE, sandy, w/shale seams, gray, hard, dry							pp = 4.5+
-18.5										
20										

Remarks: (1) Completion Depth = 18.5 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-2B
Structure ROADWAY IMPROVEMENTS
Station 681+00
Offset 8.5 Ft. North of Stake

District FT. WORTH
Date 03/15/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks	
				Lateral Deviator Press. Stress (psi)	Press. Stress (psi)	MC	LL	PI	Wet Den. (pcf)		
			CLAY, w/calcareous nodules, brown, soft, moist (CH)							pp = 1.50	
						25.4					pp = 2.00
						27.3	78	53	116		pp = 2.25, Minus 40 = 90.4%
						24.8					pp = 2.50
5											pp = 2.50
						16.1	80	54	131		pp = 3.00, Minus 40 = 92.1%
			CLAY, w/calcareous nodules, light brown, soft to hard, moist (CH)							pp = 3.00	
						15.4	58	39	134		pp = 4.5+, Minus 40 = 92.5%
											pp = 4.5+
			CLAY, w/calcareous nodules, tan & light brown, stiff to hard, moist (vuggy) (CL)							pp = 3.00	
						20.7	49	30			pp = 2.50, Minus 40 = 96.3
						23.4					pp = 3.00
										pp = 4.5+	
-15.	15										
20											

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-3A
Structure ROADWAY IMPROVEMENTS
Station 690+86.10
Offset 9 Ft. North of Stake

District FT. WORTH
Date 03/15/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. Stress (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
			CLAY, w/limestone fragments, brown, soft to hard, moist (FILL) (CH)							pp = 1.00
										pp = 3.00
										pp = 4.00
						15.3			127	pp = 4.5+
5										pp = 4.5+
										pp = 4.5+
						20.9			128	pp = 4.5+
-7.			CLAY, w/calcareous nodules, brown, soft to stiff, moist (CH)							pp = 3.50
						23.5			120	pp = 3.50
										pp = 2.50
										pp = 2.50
										pp = 2.25
										pp = 2.00
-13.			CLAY, shaley, brown & gray, stiff, moist (CH)							pp = 3.00
										pp = 3.00
-15.	15									
20										

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-3B
Structure ROADWAY IMPROVEMENTS
Station 699+75
Offset 8 Ft. North of Stake

District FT. WORTH
Date 03/14/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
-2.			CLAY, brown to light brown, soft, moist (FILL) (CH)							pp = 1.00
						27.5	64	41		
5			CLAY, w/limestone fragments, light brown, soft to stiff, moist (FILL) (CH)			22.9				pp = 2.00
										pp = 2.00
										pp = 4.00
						9.4	55	36	125	pp = 3.50, Minus 40 = 74.6%
-7.			CLAY, w/calcareous nodules & limestone fragments, dark brown, stiff, moist (FILL) (CH)			15.5				pp = 4.50
										pp = 3.00
-11.			CLAY, w/calcareous nodules, light brown & gray, hard, moist (FILL) (CH)			16.6	77	52	125	pp = 4.5+, Minus 40 = 96.5%
										pp = 4.50
						16.2				pp = 4.5+
-14.			CLAY, w/calcareous nodules, dark brown, very stiff, moist (CH)			22.3	80	53	125	pp = 4.5+, Minus 40 = 99.9%
										pp = 4.00
						27.2	84	55		pp = 4.25
-18.										pp = 4.00, Minus 40 = 96.1%
										pp = 3.25
20										pp = 3.25

Remarks: (1) Completion Depth = 18.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRAN
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-4A
Structure ROADWAY IMPROVEMENTS
Station 708+71.43
Offset 13 Ft. North of Stake

District FT. WORTH
Date 03/13/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. Stress (psi)	Press. Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
-1.			CLAY, dark brown, soft, moist (FILL) (CH)							pp = 1.00
			CLAY, w/limestone fragments, light brown, very stiff, moist (FILL) (CH)							pp = 2.50
										pp = 4.00
										pp = 2.50
5										pp = 3.00
						23.0			120	pp = 4.5+
-6.			CLAY, w/calcareous nodules, dark brown, very stiff, moist (CH)							pp = 4.5+
										pp = 4.5+
										pp = 4.50
						17.9			127	pp = 4.00
10										pp = 4.00
										pp = 3.50
-12.			CLAY, brown, stiff, moist (CH)							pp = 3.50
										pp = 3.50
										pp = 4.5+
-15. 15										
20										

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-4B
Structure ROADWAY IMPROVEMENTS
Station 719+00
Offset 11 Ft. North of Stake

District FT. WORTH
Date 03/13/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
-2.			CLAY, brown, soft, moist (FILL) (CL)			19.4				pp = <0.50
										pp = 2.00
			CLAY, w/calcareous nodules, light brown, soft, moist (FILL) (CL)			19.6	43	25	120	pp = 2.50, Minus 40 = 77.9%
						28.4				pp = 2.00
			CLAY, w/calcareous nodules, brown & gray, stiff, moist (FILL) (CH)							pp = 2.50
						15.6	56	36	133	pp = 4.50, Minus 40 = 52.0%
			CLAY, w/limestone fragments, tan, stiff, moist (FILL) (CH)			16.9				pp = 1.00
			CLAY, w/calcareous nodules, dark gray, stiff, moist (FILL) (CL)							pp = 4.50
						11.1	46	22		pp = 4.5+, Minus 40 = 33.9%
			LIMESTONE, clayey, gray & tan, soft, moist (crushed) (FILL)							pp = 4.5+
										pp = 4.5+
			CLAY, w/limestone seams, tan, hard, moist (CH)							pp = 4.5+
						13.3	52	32		pp = 2.50, Minus 40 = 51.5%
			CLAY, shaley, brown, stiff, moist (limestone @ 15 feet) (CH)							pp = 3.25
						11.1				pp = 4.5+
-15.	15									

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRAN,
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-4C
Structure ROADWAY IMPROVEMENTS
Station 728+35
Offset 8 Ft. North of Stake

District FT. WORTH
Date 03/13/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
-2.			CLAY, dark brown, soft, moist (FILL) (CL)			13.8				pp = 1.00
										pp = 2.50
			CLAY, w/limestone fragments & calcareous nodules, light brown & tan, stiff, moist (FILL) (CL)			17.5	46	29	129	pp = 4.00, Minus 40 = 70.6%
										pp = 2.00
5										pp = 4.50
						17.2				pp = 4.50
-7.			CLAY, w/calcareous nodules, brown, stiff, moist (FILL) (CH)			16.5	64	43	129	pp = 4.5+, Minus 40 = 89.4%
										pp = 2.50
-9.						23.4	65	35		pp = 3.00, Minus 40 = 89.4%
10			CLAY, w/calcareous nodules, light brown, soft, moist (FILL) (CH)			23.9				pp = 2.50
										pp = 2.00
						24.8				pp = 2.50
-12.										
			CLAY, w/limestone fragments, silty, tan, soft to stiff, moist (FILL) (CL)			17.0	41	22		pp = 3.25, Minus 40 = 76.3%
										pp = 3.00
-15.										pp = 3.25
15										
20										

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRAN
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-4E
Structure ROADWAY IMPROVEMENTS
Station 751+00
Offset 7 Ft. North of Stake

District FT. WORTH
Date 03/13/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties			Additional Remarks	
				Lateral Deviator Press. Stress (psi)	Wet Den. (pcf)	MC	LL	PI		
-4. 5 -8. -9.5 10 -11. 15 20			CLAY, w/limestone fragments, brown & gray, soft to very stiff, moist (FILL) (CH)			32.2			pp = 1.50	
									pp = 4.50	
			CLAY, w/limestone fragments, light brown, very stiff, moist (FILL) (CH)			16.8	55	34		pp = 4.5+, Minus 40 = 73.3%
										pp = 2.00
			CLAY, w/limestone fragments, shaley, gray & brown, very stiff, moist (FILL) (CH)			14.1	67	45	123	pp = 4.5+
										pp = 4.5+, Minus 40 = 80.7%
			CLAY, w/occasional calcareous nodules, brown & light brown, soft, moist (FILL) (CH)			11.6				pp = 4.5+
										pp = 4.5+, Minus 40 = 80.0%
			CLAY, w/calcareous nodules, dark brown & brown, very stiff, moist (CH)			14.5	51	28	127	pp = 2.00
										pp = 4.50
			20.0				pp = 4.50			
							pp = 4.50, Minus 40 = 98.7%			
			29.1	82	50		pp = 4.50			
							pp = 4.50			
			21.5				pp = 4.00			
							pp = 4.5+			

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-5A
Structure ROADWAY IMPROVEMENTS
Station 761+80.40
Offset 8.5 Ft. North of Stake

District FT. WORTH
Date 03/14/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties			Additional Remarks
				Lateral Deviator Press. Stress (psi)	Press. Stress (psi)	MC	LL	PI	
			CLAY, brown, soft, moist - limestone fragments @ 3 feet (FILL) (CL)						pp = 1.00
									pp = 2.25
									pp = 2.25
									pp = 2.00
-4.			CLAY, w/calcareous nodules, light brown, soft, moist (CH)						pp = 3.00
5						17.4		132	pp = 3.00
									pp = 2.50
									pp = 3.50
-8.			CLAY, shaley, slickensided, light brown & light gray, hard, moist (CH)						pp = 4.5+
						22.4		126	pp = 4.5+
10									pp = 4.5+
									pp = 4.5+
									pp = 4.00
									pp = 4.50
-15.									pp = 4.5+
15									
20									

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRAN,
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-5B
Structure ROADWAY IMPROVEMENTS
Station 770+50
Offset 6 Ft. North of Stake

District FT. WORTH
Date 03/13/01
Grnd. Elev. 0.00 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
-2.5			CLAY, brown, soft, moist (CH)			26.9				pp = 1.00
										pp = 2.00
5			CLAY, shaley, gray & brown, hard, moist (CH)			15.2	55	34		pp = 4.5+, Minus 40 = 98.3%
						18.2	59	36	132	pp = 4.5+, Minus 40 = 99.7%
						19.1				pp = 4.5+
						17.9				pp = 4.5+
-7			SHALE, gray, soft, moist							pp = 4.5+
						17.0	59	35	134	pp = 4.5+, Minus 40 = 98.2%
										pp = 4.5+
						17.9	59	32		pp = 4.5+, Minus 40 = 99.3%
10						19.0				pp = 4.5+
										pp = 4.5+
										pp = 4.5+
										pp = 4.5+
-15										pp = 4.5+
										pp = 4.5+
15										
20										

Remarks: (1) Completion Depth = 15.0 Feet (2) Borehole Dry Upon Completion of Drilling (3) pp = Pocket Penetrometer Reading

The ground water elevation was not determined during the course of this boring.

Driller: Ricardo N. Garcia

Logger: Brad Weddell

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-2
Structure ROADWAY IMPROVEMENTS
Station 671+45.64
Offset 26.26 Ft. Left

District Fort Worth
Date 10/04/2000
Grnd. Elev. 629.40 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties			Additional Remarks		
				Lateral Deviator Press. Stress (psi)	Press. Stress (psi)	MC	LL	PI		Wet Den. (pcf)	
626.4	[Hatched pattern]		CLAY, dark gray w/tan sandy clay layer @ 2.5 ft. (fill) (CH)			14.5	75	52	Minus 40 = 93.3%, pp = 4.5+		
5			CLAY, brown & gray w/occasional calcareous nodule - interbedded gray limestone seams 11 to 20 ft. (CH)			16.1	52	34	pp = 4.5+ Minus 40 = 97.5%		
							15.3			pp = 4.5+	
10							21.2	66	45	Minus 40 = 96.9%, pp = 4.0	
							20.4			pp = 4.0 pp = 4.5+	
							18.9	70	46	Minus 40 = 84.2%, pp = 4.5+	
15							8.3	44	28	Minus 40 = 58.4%, pp = 4.5+	
							7.1			pp = 4.5+	
09.4			[Brick pattern]		LIMESTONE, gray w/occasional gray clay seam						
20											
04.4	25										

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell Logger: James Hutt Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-3
Structure ROADWAY IMPROVEMENTS
Station 690+86.10
Offset 33.14 Ft. Left

District Fort Worth
Date 10/04/2000
Grnd. Elev. 632.69 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test	Properties				Additional Remarks	
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI		Wet Den. (pcf)
630.7	[Hatched Log Pattern]		CLAY, dark gray w/tan limestone & gravel @ 1.5 ft. (fill) (CH)			8.7	57	35	Minus 40 = 91.7%, pp = 4.5+	
			CLAY, brown, dark brown, light gray, tan & light brown w/calcareous nodules & iron stains - tan silty sand 18 to 19 ft. (CH)			5.6				
							11.2	47	27	Minus 40 = 67.7%, pp = 4.5+
5							23.3			pp = 3.5
							24.3	83	59	Minus 40 = 96.8%
							25.3			pp = 3.0
							26.7	85	64	Minus 40 = 97.0%, pp = 3.0
10							24.5			pp = 3.0
										pp = 3.0
							24.2	70	50	Minus 40 = 98.7%, pp = 2.5
15										pp = 3.0
										pp = 3.5
										pp = 3.0
										pp = 4.5+
20									pp = 4.5	
607.7 25										

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.



DRILLING LOG

WinCore
Version 2.01

County TARRANT
Highway IH-820 NORTH LOOP
Control 0008-14-059

Hole B-4
Structure ROADWAY IMPROVEMENTS
Station 708+71.43
Offset 54.38 Ft. Left

District Fort Worth
Date 10/04/2000
Grnd. Elev. 646.50 ft
GW Elev. N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test		Properties				Additional Remarks
				Lateral Deviator Press. (psi)	Stress (psi)	MC	LL	PI	Wet Den. (pcf)	
643.5			CLAY, brown, tan & dark brown w/numerous limestone fragments 1.0 to 1.5 ft. (fill) (CH)			4.5	52	35		Minus 40 = 49.1%, pp = 4.5+
						8.7				
5			CLAY, brown w/calcareous nodules - interbedded gray limestone seams 22 to 25 ft. (CH)			16.1	68	49		Minus 40 = 93.6%, pp = 4.5+
10						18.6	77	43		Minus 40 = 92.2%, pp = 3.0 pp = 3.5
						21.3				
15						22.7	67	41		Minus 40 = 93.6%, pp = 4.5 pp = 4.5
						24.1				
20										pp = 4.0 pp = 4.5+
621.5 25										pp = 4.5+

Remarks: Dry @ Completion

The ground water elevation was not determined during the course of this boring.

Driller: Brad Weddell

Logger: James Hutt

Organization: TEAM Consultants, Inc.

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SUMMARY OF LABORATORY TEST RESULTS

SOIL SURVEY
IH-820 NORTH LOOP
FROM IH-35W TO HALTOM ROAD
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-059

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Unit Wet Weight (pcf)	Atterberg Limits			Percent Passing Sieve No.	
				LL	PL	PI	40	200
B-2A *	4.6 - 6.0	15.6	134	----	----	----	----	----
	9.0 - 10.5	17.9	135	----	----	----	----	----
	12.0 - 13.5	20.8	131	----	----	----	----	----
B-2B	0.0 - 1.5	25.4	----	----	----	----	----	----
	1.5 - 3.0	27.3	116	78	25	53	90.4	87.7
	3.0 - 4.5	24.8	----	----	----	----	----	----
	4.5 - 6.0	16.1	131	80	26	54	92.1	90.1
	6.0 - 7.5	22.0	----	----	----	----	----	----
	7.5 - 9.0	15.4	134	58	19	39	92.5	90.2
	10.5 - 12.0	20.7	----	49	19	30	96.3	93.3
	12.0 - 13.5	23.4	----	----	----	----	----	----
B-3A *	3.0 - 4.5	15.3	127	----	----	----	----	----
	6.0 - 7.5	20.9	128	----	----	----	----	----
	7.5 - 9.0	23.5	120	----	----	----	----	----
B-3B	0.0 - 1.5	27.5	----	64	23	41	94.1	87.3
	1.5 - 3.0	22.9	----	----	----	----	----	----
	4.5 - 6.0	9.4	125	55	19	36	74.6	64.6
	6.0 - 7.5	15.5	----	----	----	----	----	----
	7.5 - 9.0	16.6	125	77	25	52	96.5	93.6
	10.5 - 12.0	16.2	----	----	----	----	----	----
	12.0 - 13.5	22.3	125	80	27	53	99.9	99.5
	15.0 - 16.5	27.2	----	84	29	55	96.1	94.0
B-4A *	4.5 - 6.0	23.0	120	----	----	----	----	----
	9.0 - 10.5	17.9	127	----	----	----	----	----
B-4B	0.0 - 1.5	19.4	----	----	----	----	----	----
	1.5 - 3.0	19.6	120	43	18	25	77.9	64.7
	3.0 - 4.5	28.4	----	----	----	----	----	----
	4.5 - 6.0	15.6	133	56	20	36	52.0	46.6
	6.0 - 7.5	16.9	----	----	----	----	----	----
	7.5 - 9.0	11.1	----	46	24	22	33.9	25.6
	12.0 - 13.5	13.3	----	52	20	32	51.5	47.3
	13.5 - 15.0	11.1	----	----	----	----	----	----

* THIS BOREHOLE DRILLED ADJACENT TO BOREHOLE REPORTED PREVIOUSLY (SEE TEAM PROJECT NO. 002052G, REPORT NO. 1 DATED 11/09/00) FOR LABORATORY TEST RESULTS

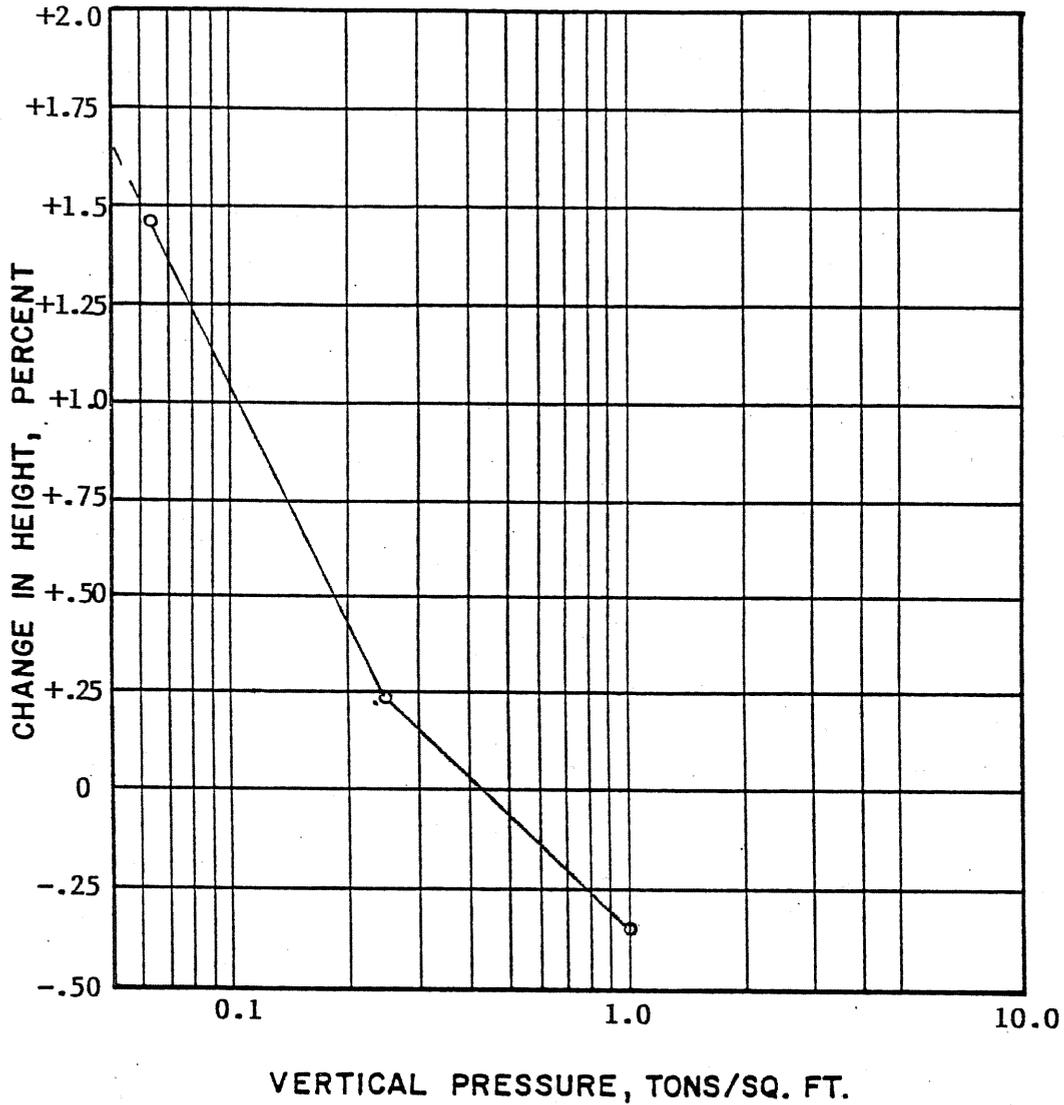
SUMMARY OF LABORATORY TEST RESULTS

SOIL SURVEY
IH-820 NORTH LOOP
FROM IH-35W TO HALTOM ROAD
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-059

Borehole No.	Sample Depth (ft.)	Moisture Content (%)	Unit Wet Weight (pcf)	Atterberg Limits			Percent Passing Sieve No.	
				LL	PL	PI	40	200
B-4C	0.0 - 1.5	13.8	----	----	----	----	----	----
	1.5 - 3.0	17.5	129	46	17	29	70.6	63.1
	4.5 - 6.0	17.2	----	----	----	----	----	----
	6.0 - 7.5	16.5	129	64	21	43	89.4	84.5
	7.5 - 9.0	23.4	----	65	30	35	89.4	86.9
	9.0 - 10.5	23.9	----	----	----	----	----	----
	10.5 - 12.0	24.8	----	----	----	----	----	----
	12.0 - 13.5	17.0	----	41	19	22	76.3	70.3
B-4D	0.0 - 1.5	22.4	----	----	----	----	----	----
	1.5 - 3.0	25.1	125	53	21	32	77.8	71.6
	4.5 - 6.0	12.6	----	----	----	----	----	----
	6.0 - 7.5	17.0	128	50	18	32	92.6	83.6
	7.5 - 9.0	13.3	----	----	----	----	----	----
	9.0 - 10.5	17.6	----	----	----	----	----	----
	10.5 - 12.0	22.0	----	68	23	45	99.5	99.0
	12.0 - 13.5	21.9	----	69	27	42	98.6	97.9
B-4E	0.0 - 1.5	32.2	----	----	----	----	----	----
	1.5 - 3.0	16.8	----	55	21	34	73.3	69.3
	4.5 - 6.0	14.1	123	67	22	45	80.7	71.7
	6.0 - 7.5	11.6	----	----	----	----	----	----
	8.0 - 9.5	14.5	127	51	23	28	80.0	77.1
	9.5 - 11.0	20.0	----	----	----	----	----	----
	11.0 - 12.5	29.1	----	82	31	50	98.7	95.5
	12.5 - 14.0	21.5	----	----	----	----	----	----
B-5A *	4.5 - 6.0	17.4	132	----	----	----	----	----
	9.0 - 10.5	22.4	126	----	----	----	----	----
B-5B	0.0 - 1.5	26.9	----	----	----	----	----	----
	1.5 - 3.0	15.2	----	55	21	34	98.3	97.1
	3.0 - 4.5	18.2	132	59	23	36	99.7	99.1
	4.5 - 6.0	19.1	----	----	----	----	----	----
	6.0 - 7.5	17.9	----	----	----	----	----	----
	7.5 - 9.0	17.0	134	59	24	35	98.2	96.5
	10.5 - 12.0	17.9	----	59	27	32	99.3	97.8
	12.0 - 13.5	19.0	----	----	----	----	----	----

* THIS BOREHOLE DRILLED ADJACENT TO BOREHOLE REPORTED PREVIOUSLY (SEE TEAM PROJECT NO. 002052G, REPORT NO. 1 DATED 11/09/00) FOR LABORATORY TEST RESULTS

BORING: B-2A DEPTH: 9'-10.5' MOISTURE CONTENT:
 DESCRIPTION: Tan Shaley Clay BEFORE: 17.9 %, AFTER: 18.8 %
 with Calcareous Nodules UNIT DRY WT.: 114.8 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

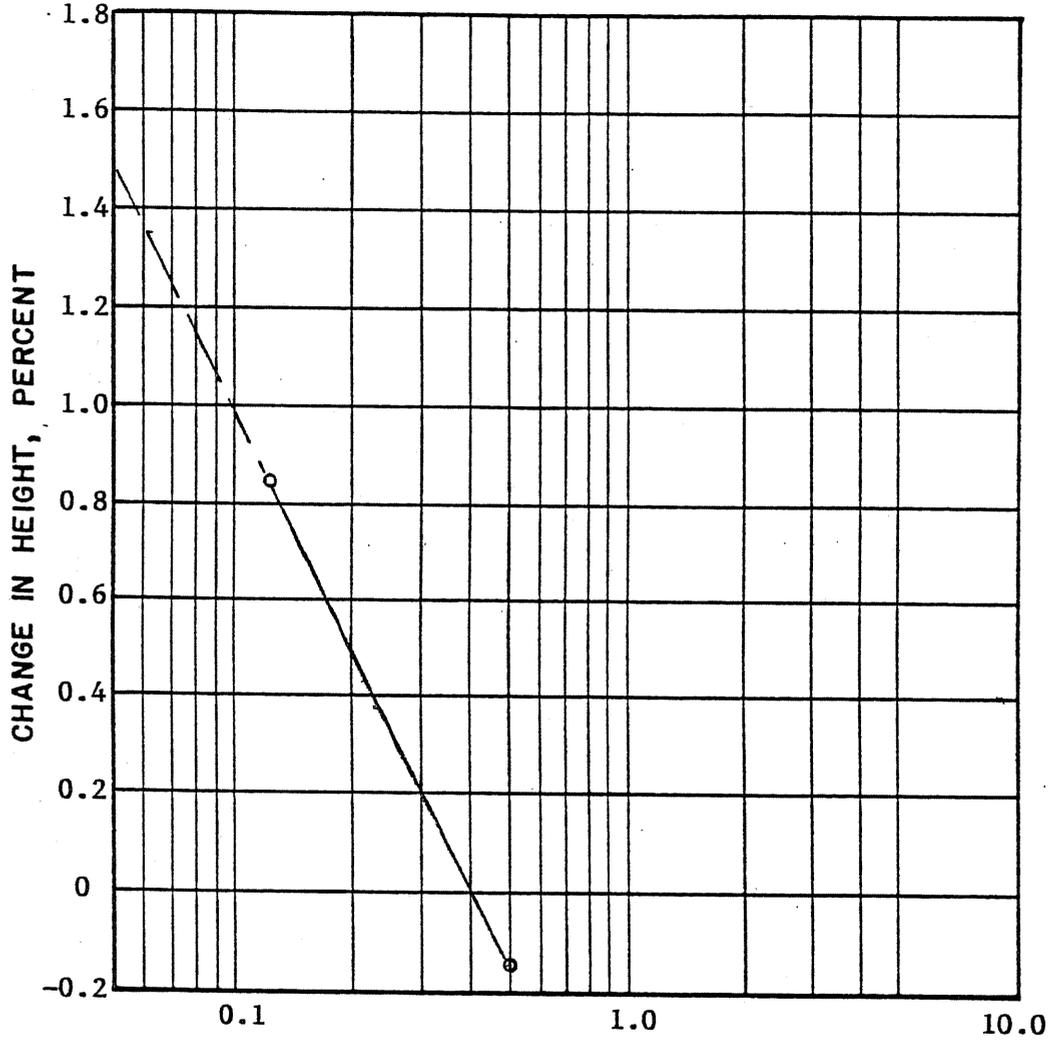


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.0	- 0.36
0.25	+ 0.24
0.0625	+ 1.45

PRESSURE-SWELL TEST

BORING: B-2A DEPTH: 12'-13.5' MOISTURE CONTENT:
 DESCRIPTION: Tan Clay with BEFORE: 20.8 %, AFTER: 23.0 %
 with Calcareous Nodules UNIT DRY WT.: 108.6 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:



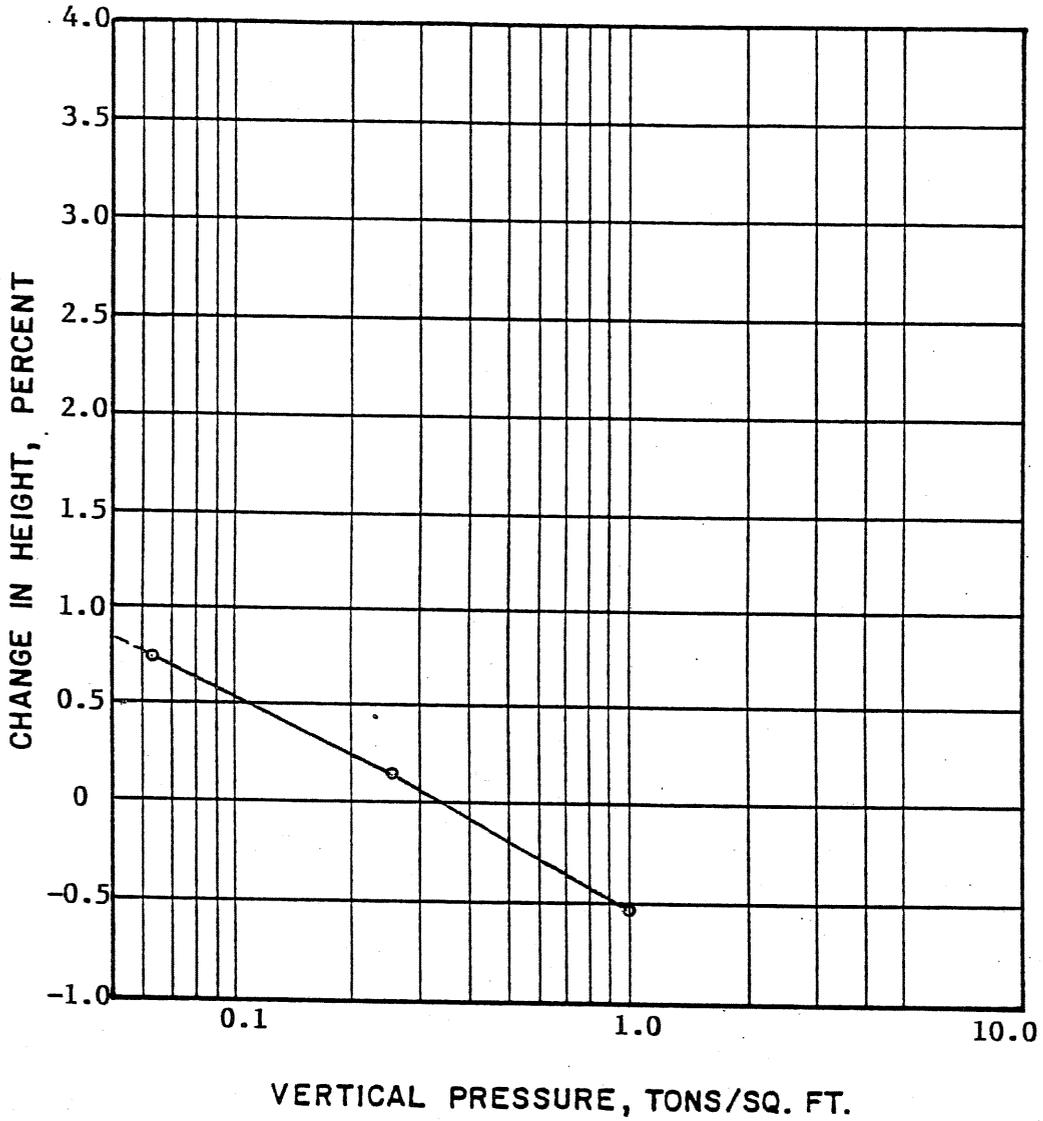
VERTICAL PRESSURE, TONS/SQ. FT.

DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
0.5	- 0.15
0.125	+ 0.84

PRESSURE-SWELL TEST

BORING: B-2B DEPTH: 1.5'-3' MOISTURE CONTENT:
 DESCRIPTION: Grayish Brown Clay BEFORE: 27.3 %, AFTER: 29.1 %
 UNIT DRY WT.: 91.0 LBS./CU.FT.
 LIQUID LIMIT: 78
 PLASTICITY INDEX: 53

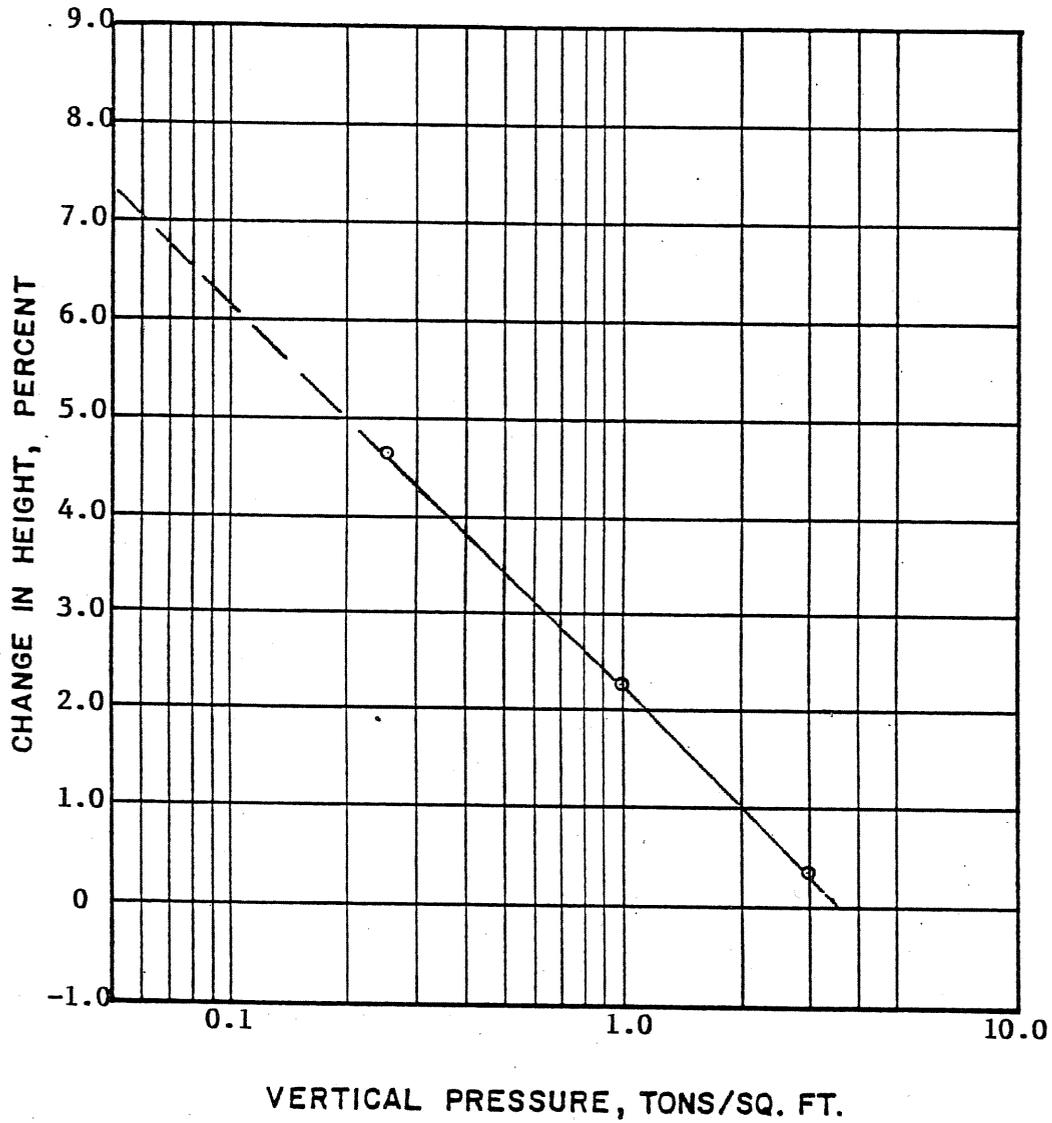


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.0	- 0.55
0.25	+ 0.13
0.0625	+ 0.72

PRESSURE-SWELL TEST

BORING: B-2B DEPTH: 4.5'-6' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay with Calcareous Nodules BEFORE: 16.1 %, AFTER: 21.1 %
 UNIT DRY WT.: 112.8 LBS./CU.FT.
 LIQUID LIMIT: 80
 PLASTICITY INDEX: 54

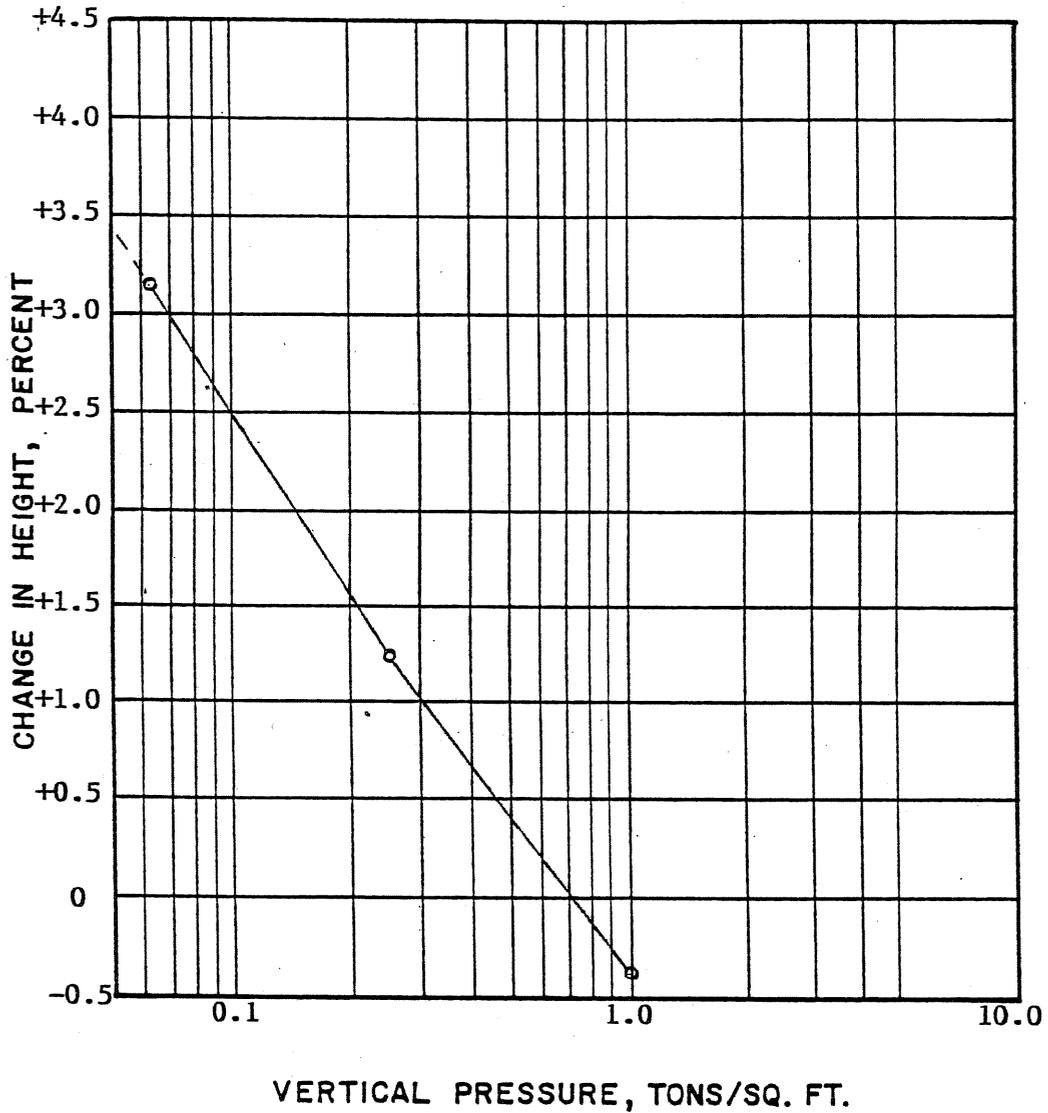


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
3.0	+ 0.32
1.0	+ 2.25
0.25	+ 4.63

PRESSURE-SWELL TEST

BORING: B-2B DEPTH: 7.5'-9' MOISTURE CONTENT:
 DESCRIPTION: Tan Calcareous Clay BEFORE: 15.4 %, AFTER: 19.2 %
 with Iron Stains UNIT DRY WT.: 116.2 LBS./CU.FT.
 LIQUID LIMIT: 58
 PLASTICITY INDEX: 39

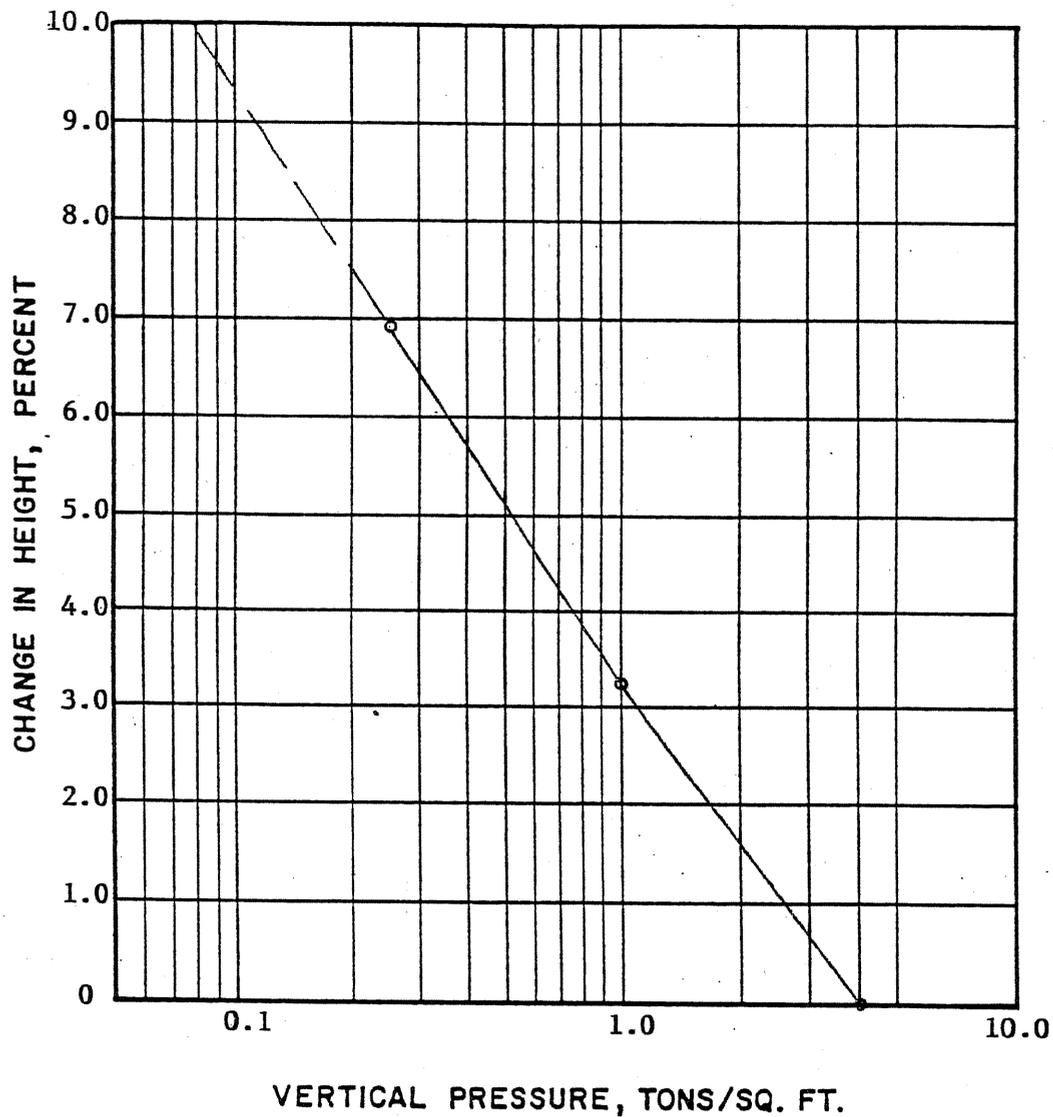


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.0	- 0.40
0.25	+ 1.21
0.0625	+ 3.14

PRESSURE-SWELL TEST

BORING: B-3A DEPTH: 3'-4.5' MOISTURE CONTENT:
 DESCRIPTION: Brown Calcareous Clay BEFORE: 15.3 %, AFTER: 25.5 %
 UNIT DRY WT.: 110.0 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

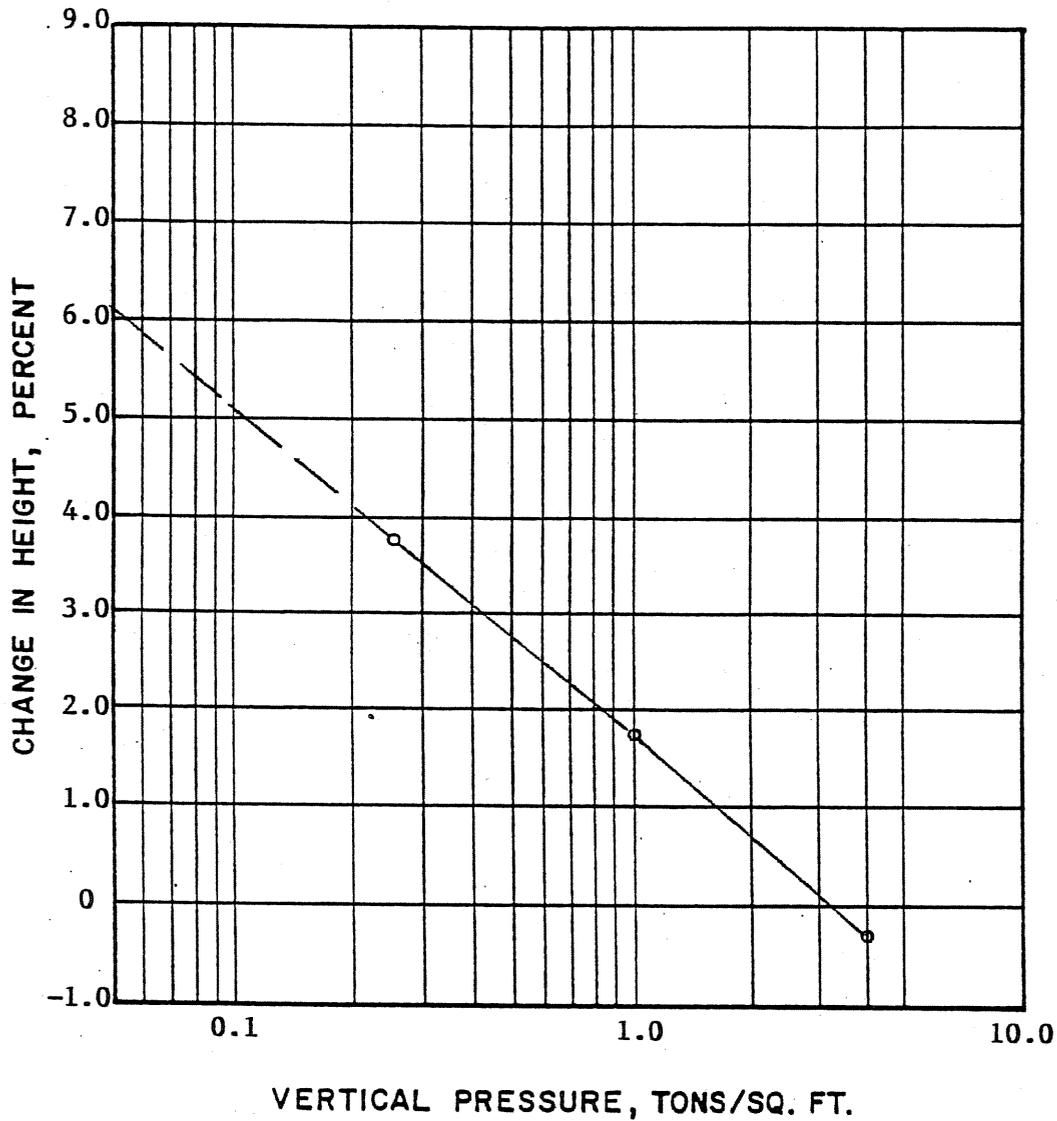


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
4.0	+ 0.02
1.0	+ 3.21
0.25	+ 6.90

PRESSURE-SWELL TEST

BORING: B-3A DEPTH: 6'-7.5' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay BEFORE: 20.9 %, AFTER: 25.3 %
 UNIT DRY WT.: 106.1 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

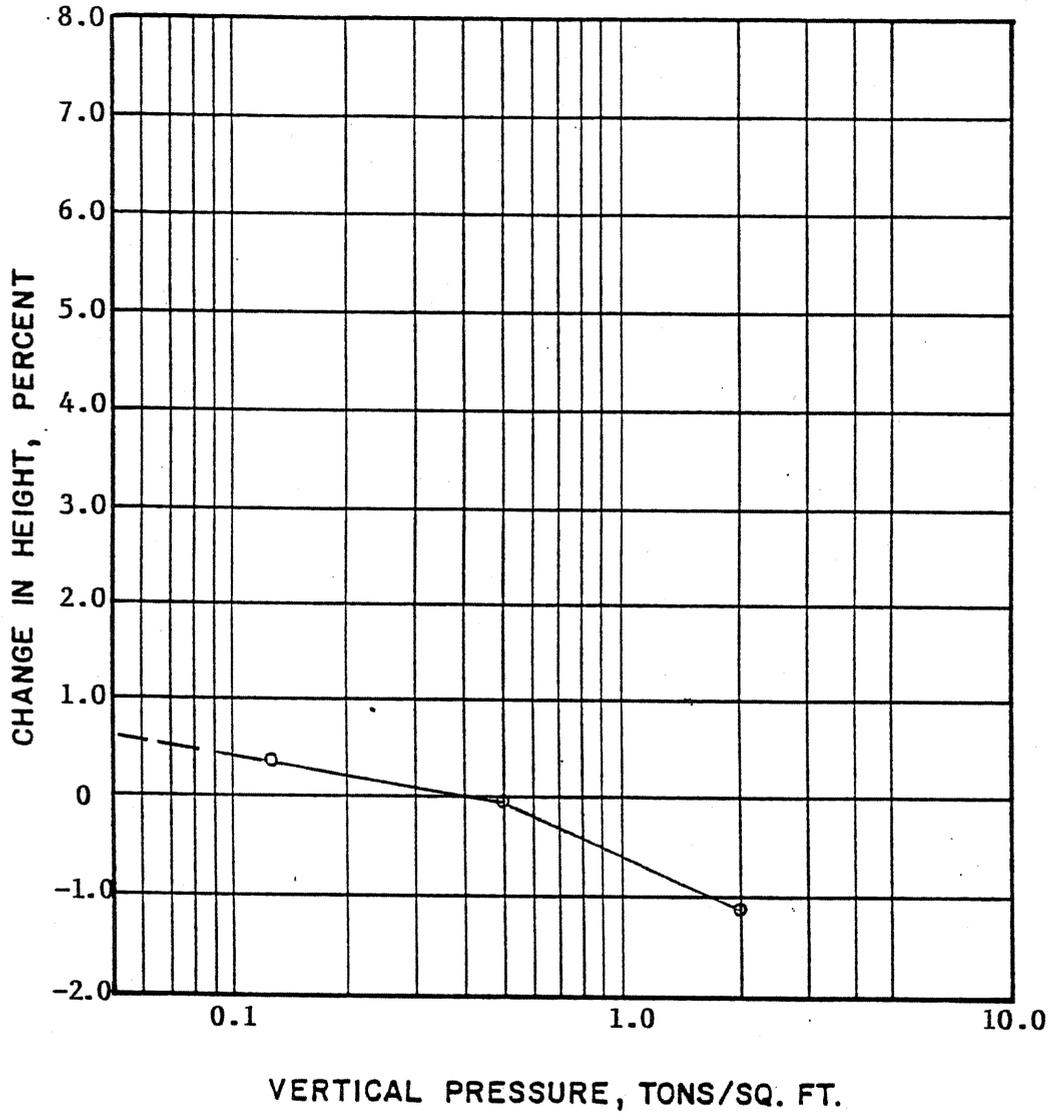


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
4.0	- 0.31
1.0	+ 1.72
0.25	+ 3.76

PRESSURE-SWELL TEST

BORING: B-3A DEPTH: 7.5'-9' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay with Calcareous Nodules BEFORE: 23.5 %, AFTER: 25.8 %
 UNIT DRY WT.: 97.3 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

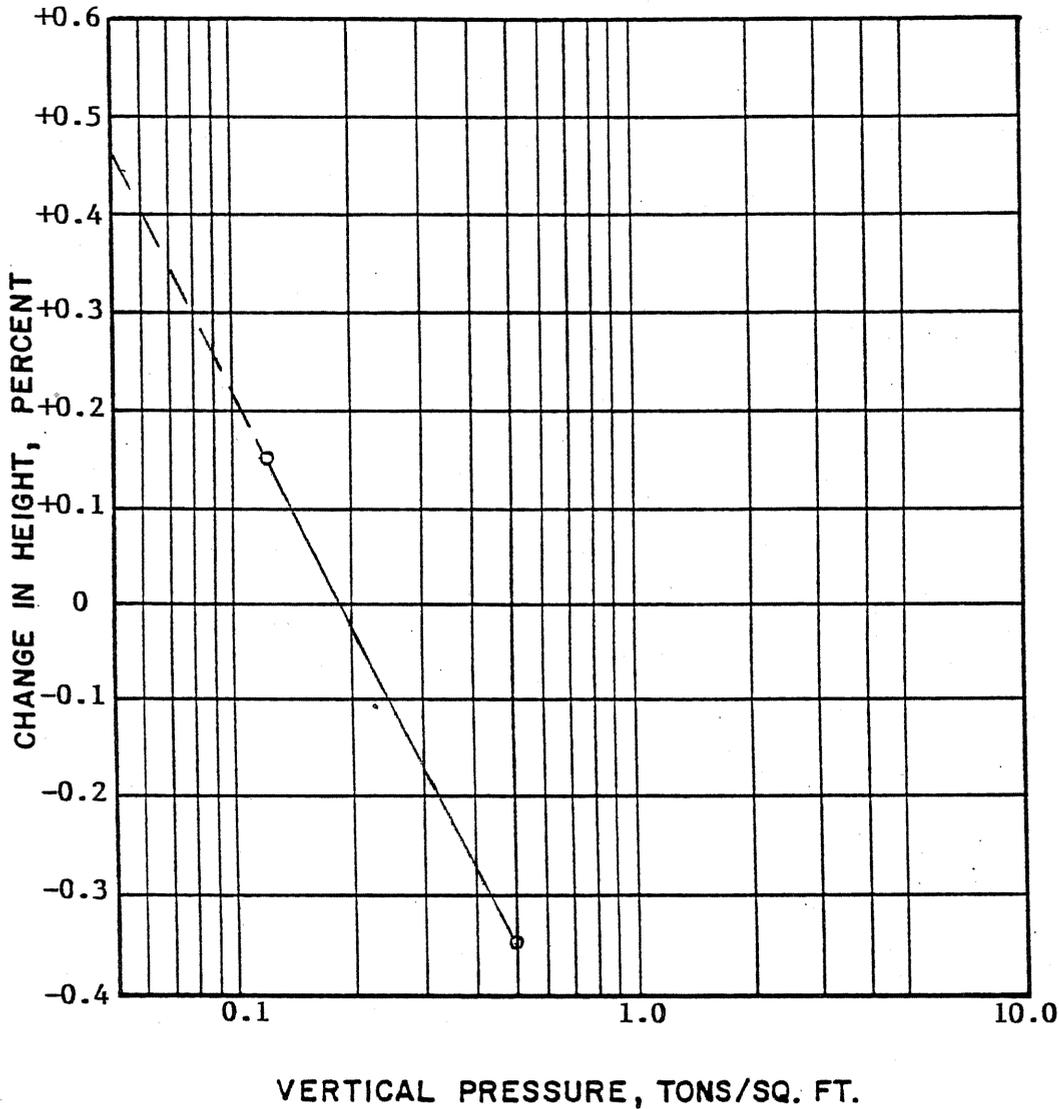


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	- 1.13
0.5	- 0.04
0.125	+ 0.33

PRESSURE-SWELL TEST

BORING: B-3B DEPTH: 4.5'-6' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay with Calcareous Nodules BEFORE: 9.4 %, AFTER: 16.2 %
 UNIT DRY WT.: 114.4 LBS./CU.FT.
 LIQUID LIMIT: 55
 PLASTICITY INDEX: 36

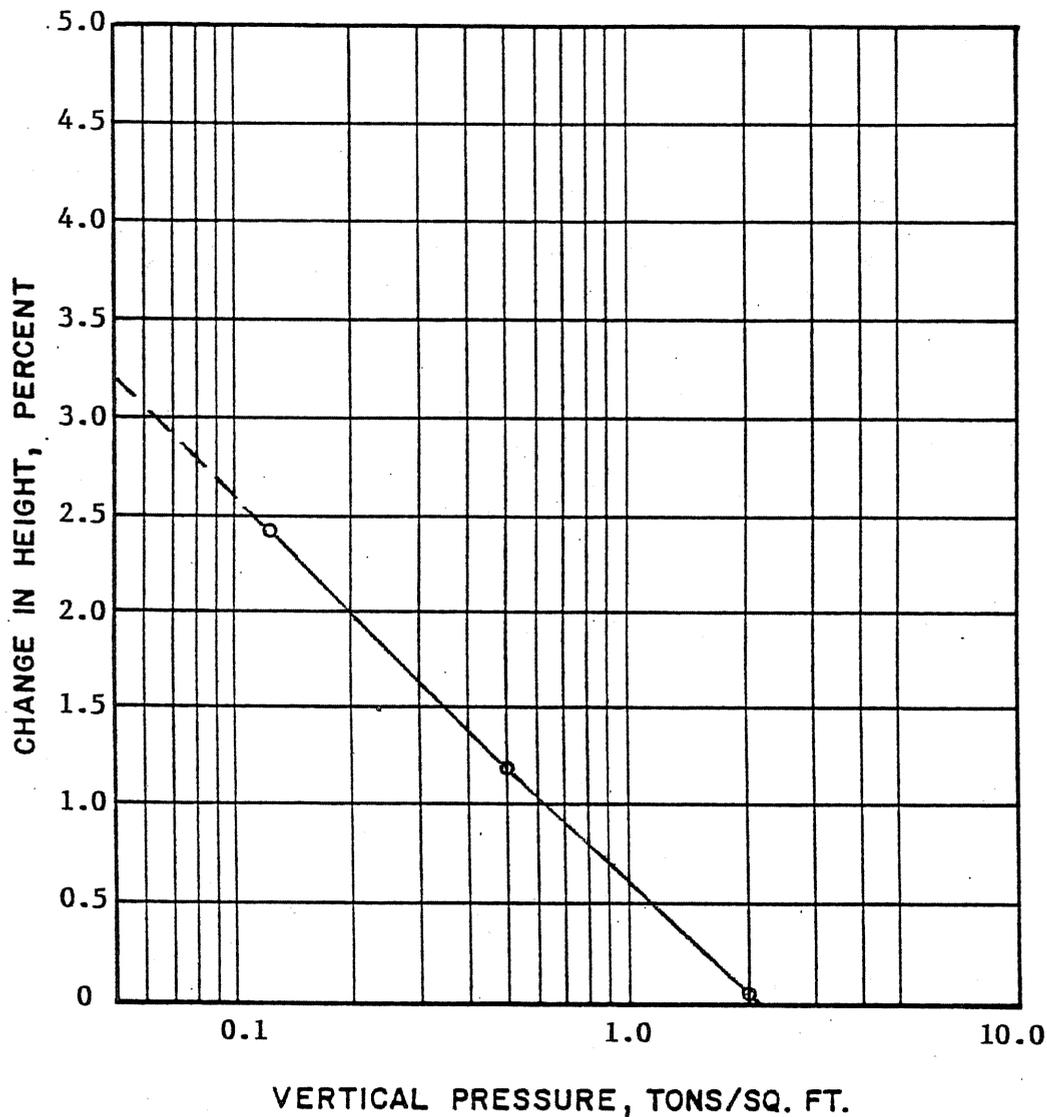


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
0.5	- 0.35
0.125	+ 0.15

PRESSURE-SWELL TEST

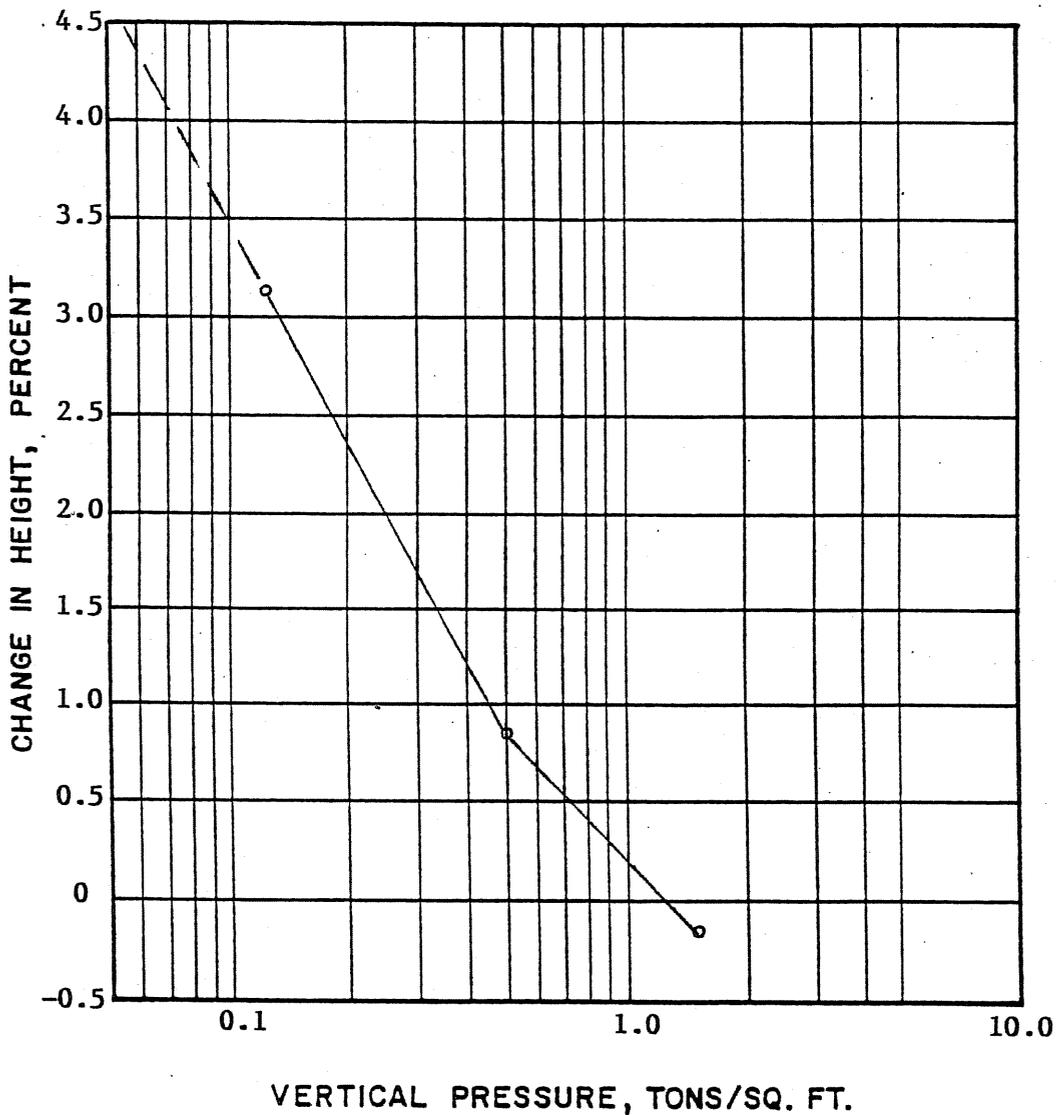
BORING: B-3B DEPTH: 7.5'-9' MOISTURE CONTENT:
 DESCRIPTION: Dark Brown and Gray BEFORE: 16.6 %, AFTER: 23.4 %
 Clay with Calcareous Nodules UNIT DRY WT.: 107.3 LBS./CU.FT.
 LIQUID LIMIT: 77
 PLASTICITY INDEX: 52



DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	+ 0.04
0.5	+ 1.18
0.125	+ 2.41

BORING: B-3B DEPTH: 12'-13.5' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay with Calcareous Nodules BEFORE: 22.3 %, AFTER: 27.1 %
 UNIT DRY WT.: 102.1 LBS./CU.FT.
 LIQUID LIMIT: 80
 PLASTICITY INDEX: 53

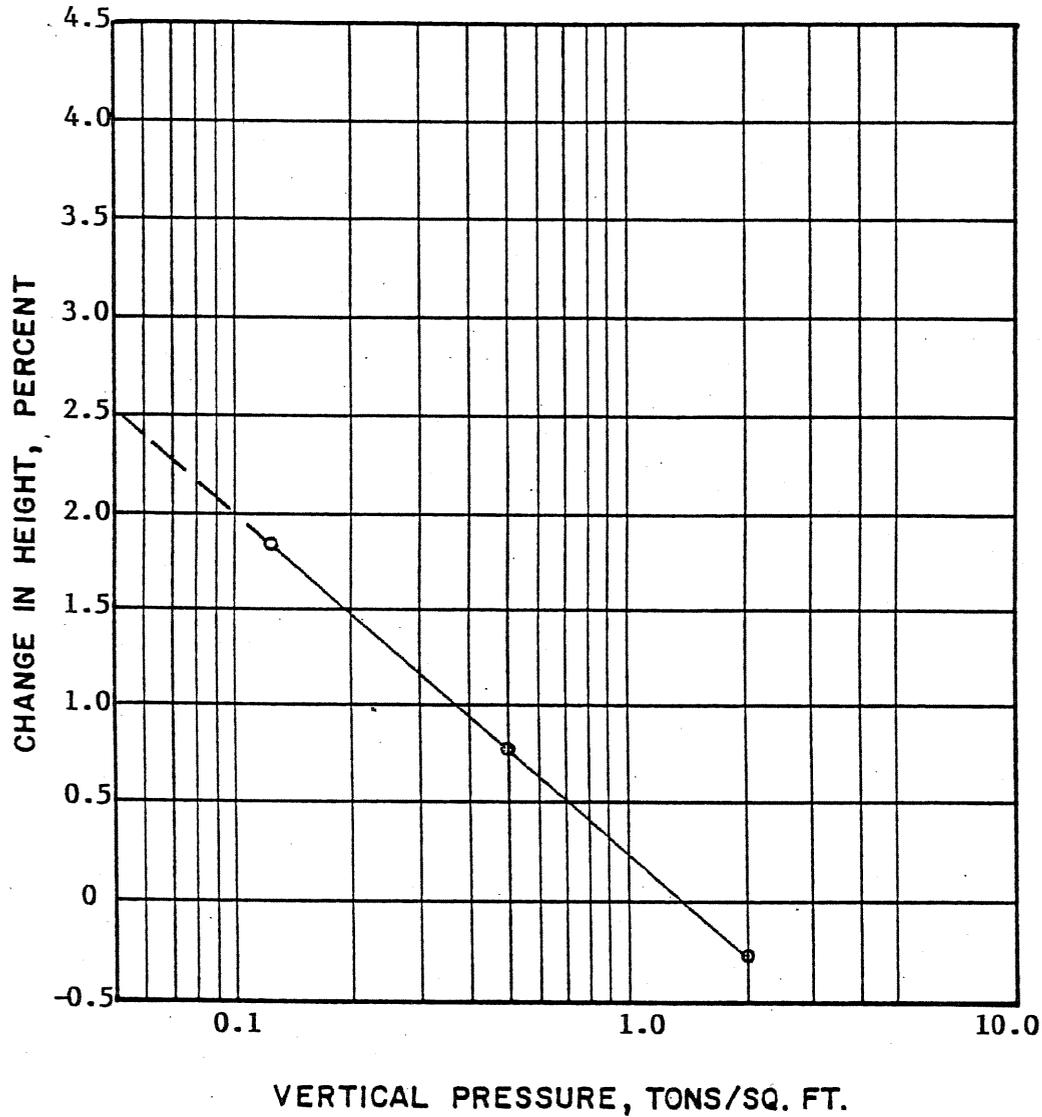


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.5	- 0.15
0.5	+ 0.83
0.125	+ 3.11

PRESSURE-SWELL TEST

BORING: B-4A DEPTH: 4.5'-6' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay BEFORE: 23.0 %, AFTER: 28.2 %
 UNIT DRY WT.: 97.6 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

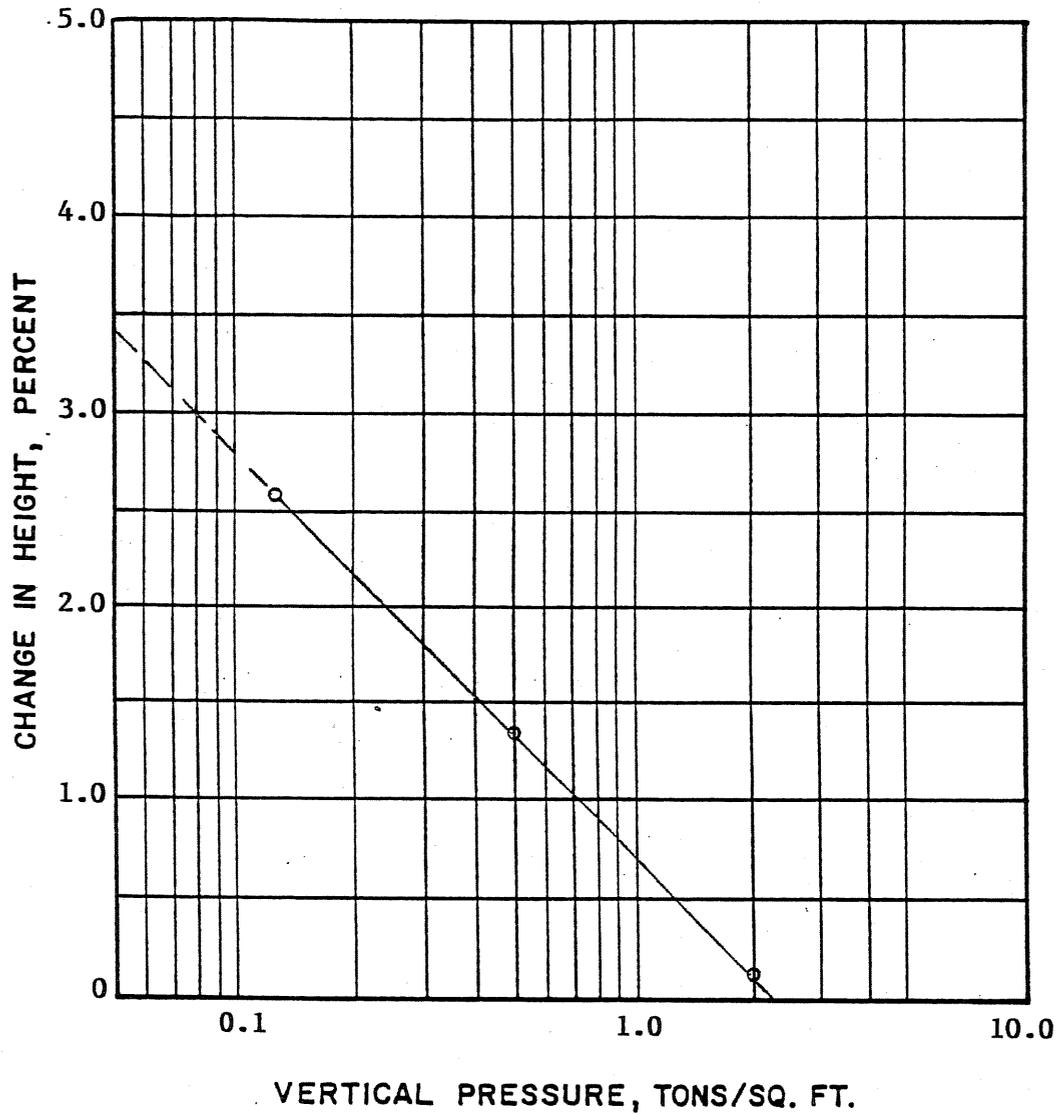


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	- 0.28
0.5	+ 0.76
0.125	+ 1.82

PRESSURE-SWELL TEST

BORING: B-4A DEPTH: 9'-10.5' MOISTURE CONTENT:
 DESCRIPTION: Grayish Brown Clay BEFORE: 17.9 %, AFTER: 21.1 %
 UNIT DRY WT.: 107.4 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

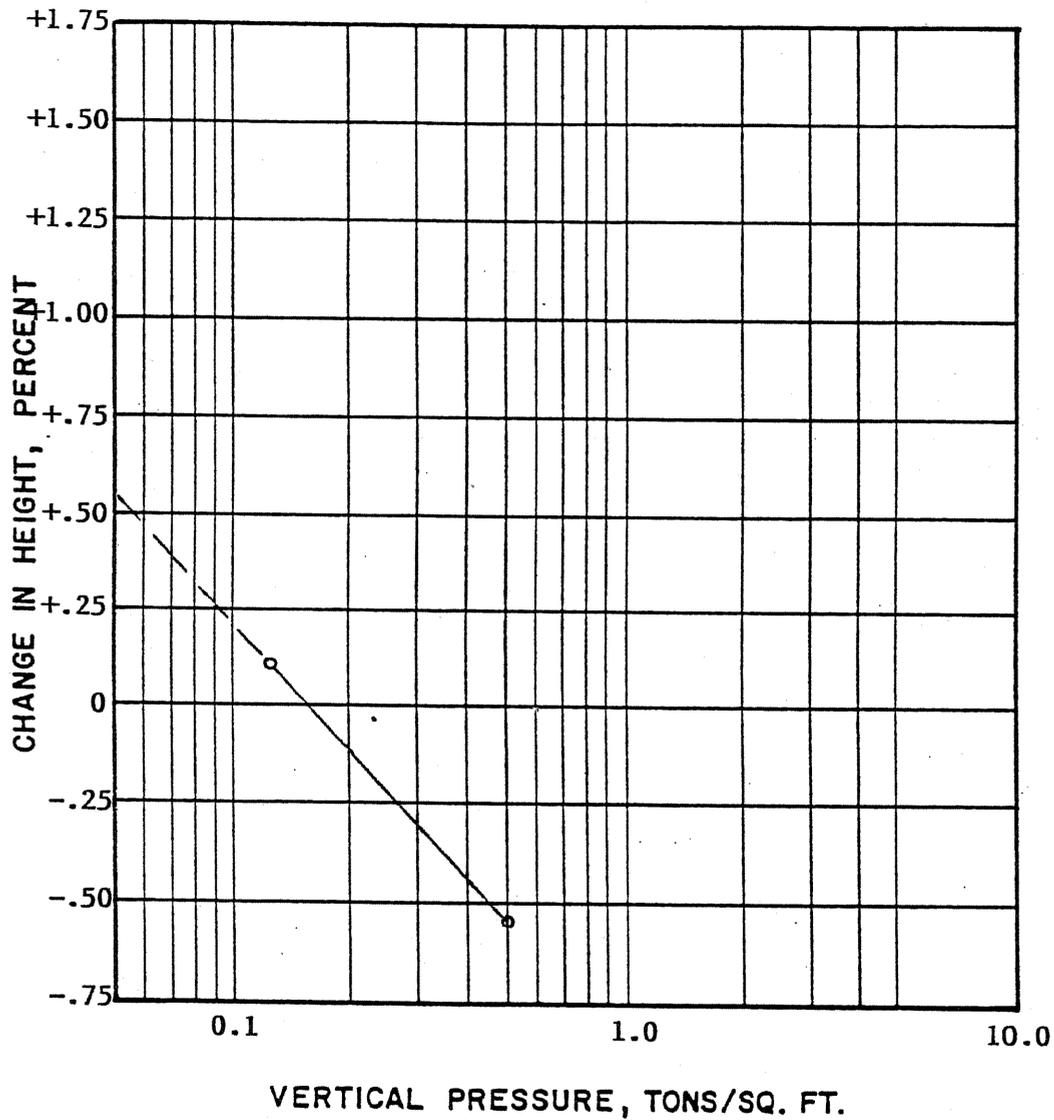


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	+ 0.11
0.5	+ 1.35
0.125	+ 2.58

PRESSURE-SWELL TEST

BORING: B-4B DEPTH: 1.5'-3' MOISTURE CONTENT:
 DESCRIPTION: Brownish Gray Clay BEFORE: 19.6 %, AFTER: 28.6 %
 UNIT DRY WT.: 100.6 LBS./CU.FT.
 LIQUID LIMIT: 43
 PLASTICITY INDEX: 25

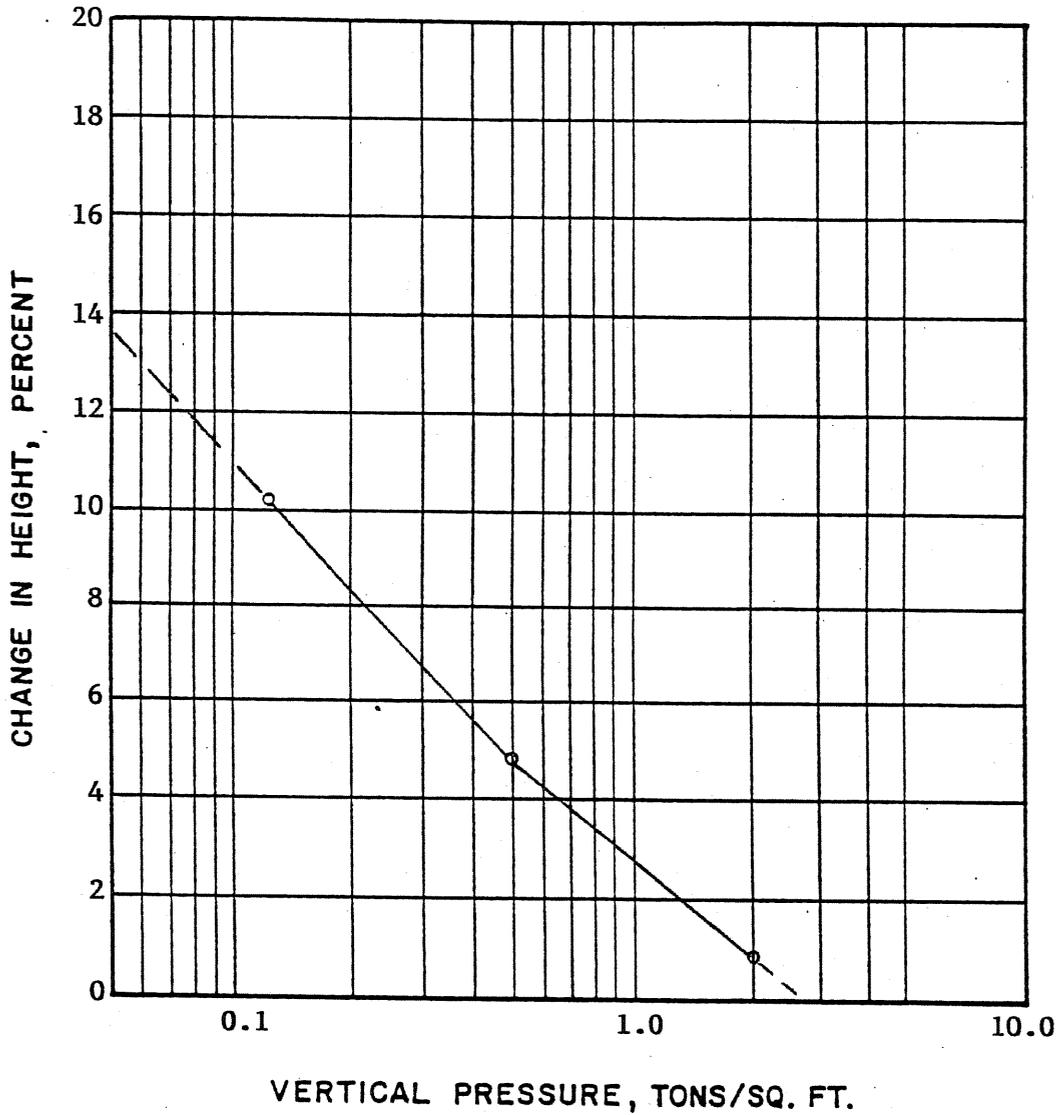


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
0.5	- 0.55
0.125	+ 0.11

PRESSURE-SWELL TEST

BORING: B-4B DEPTH: 4.5'-6' MOISTURE CONTENT :
 DESCRIPTION: Brown and Gray Clay BEFORE: 15.6 %, AFTER: 23.8 %
 UNIT DRY WT.: 114.8 LBS./CU.FT.
 LIQUID LIMIT: 56
 PLASTICITY INDEX: 36

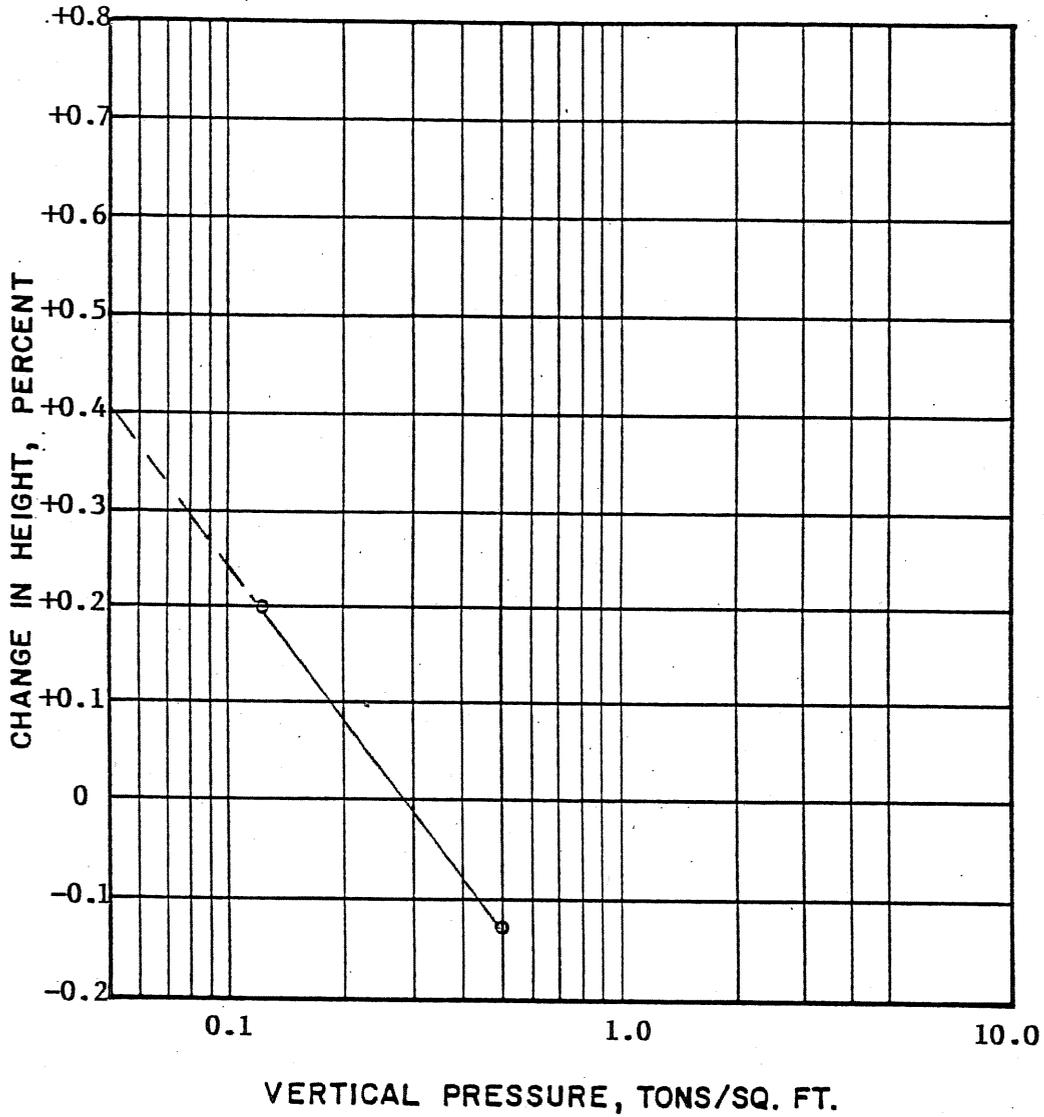


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	+ 0.74
0.5	+ 4.75
0.125	+ 10.11

PRESSURE-SWELL TEST

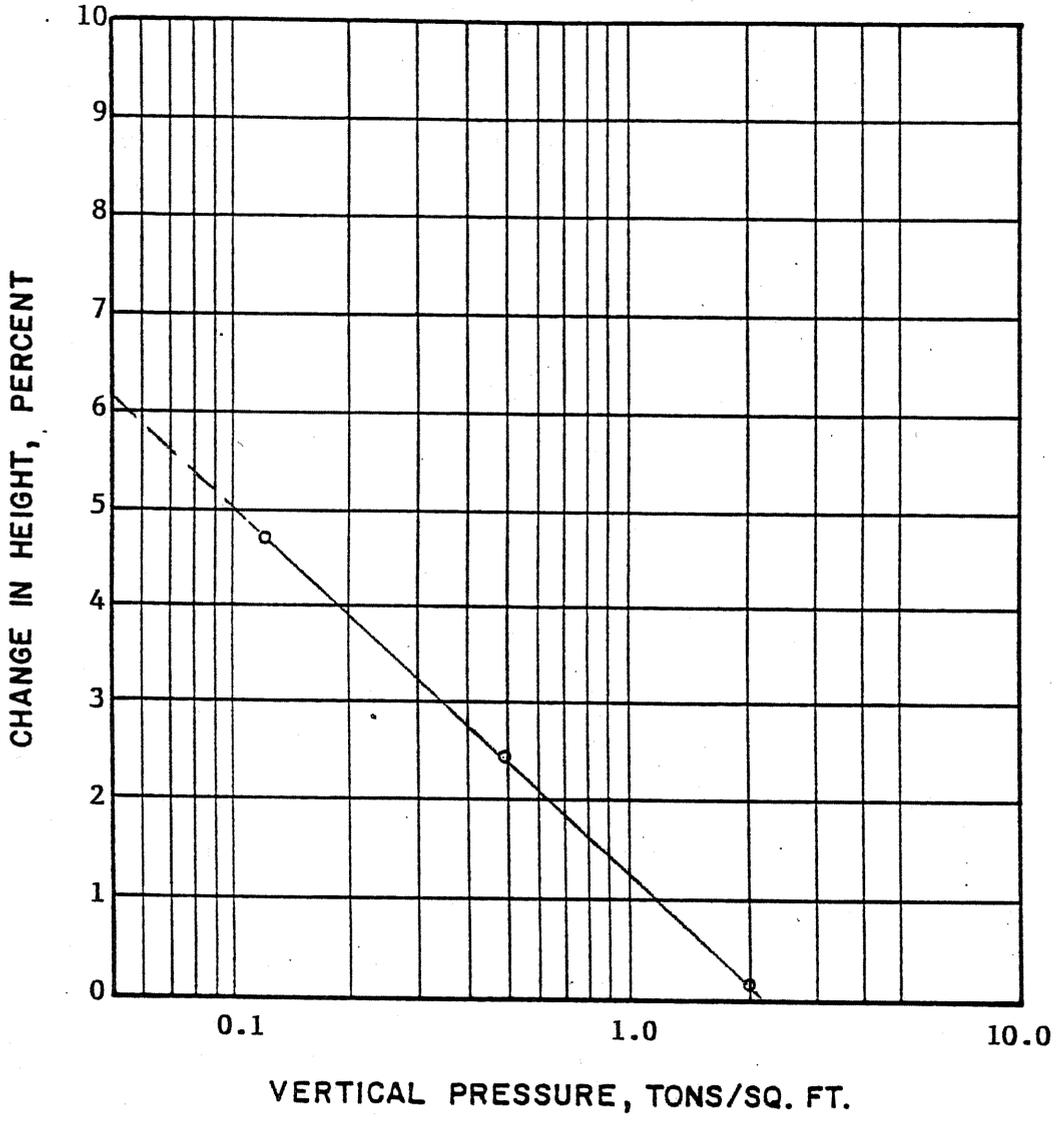
BORING: B-4C DEPTH: 1.5'-3' MOISTURE CONTENT:
 DESCRIPTION: Tan and Brown Clay BEFORE: 17.5 %, AFTER: 21.4 %
 with Calcareous Nodules UNIT DRY WT.: 109.5 LBS./CU.FT.
 LIQUID LIMIT: 46
 PLASTICITY INDEX: 29



DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
0.5	- 0.13
0.125	+ 0.20

BORING: B-4C DEPTH: 6'-7.5' MOISTURE CONTENT:
 DESCRIPTION: Dark Brown Clay BEFORE: 16.5 %, AFTER: 23.0 %
 with Calcareous Nodules UNIT DRY WT.: 110.4 LBS./CU.FT.
 LIQUID LIMIT: 64
 PLASTICITY INDEX: 43

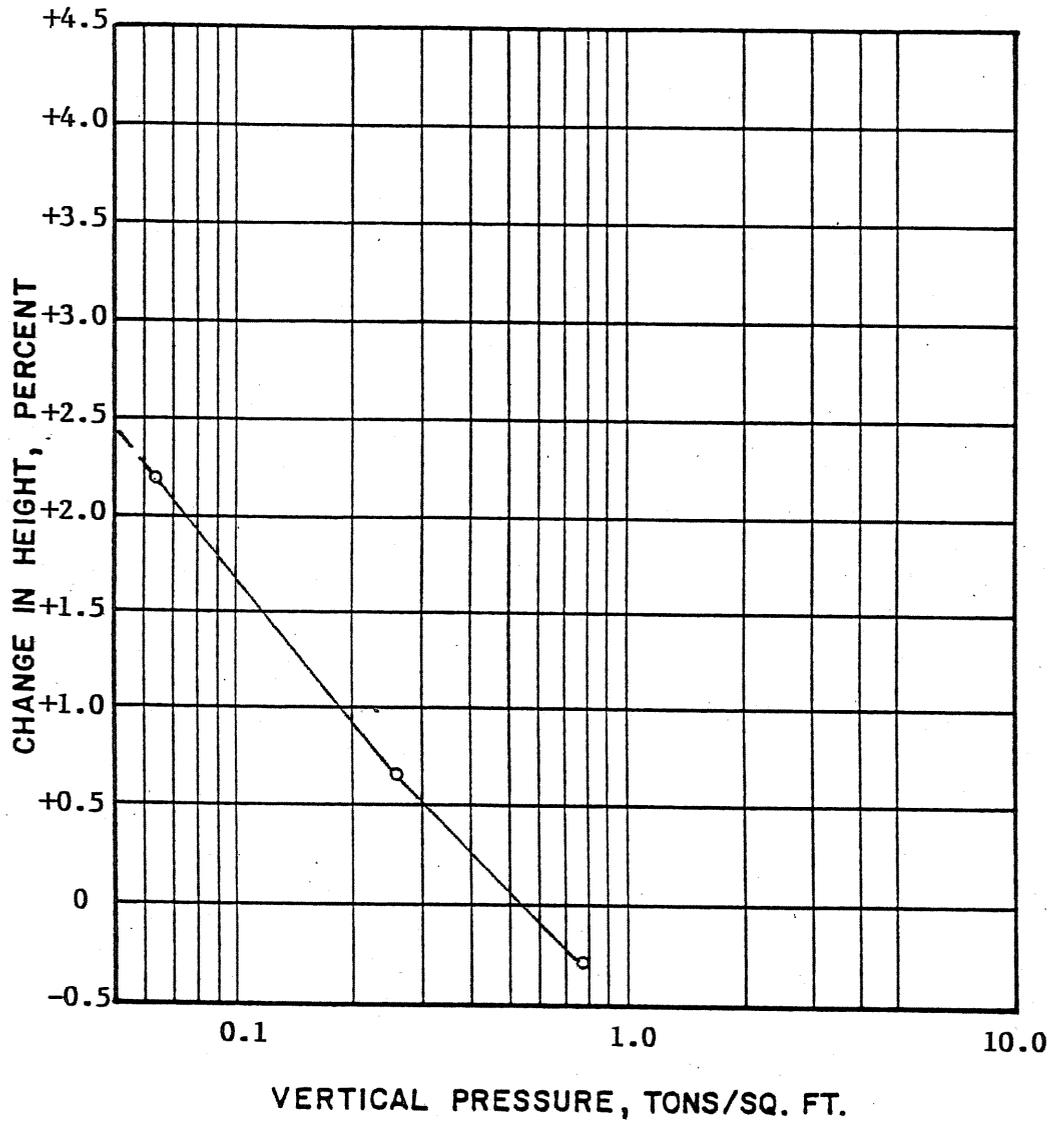


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	+ 0.13
0.5	+ 2.41
0.125	+ 4.68

PRESSURE-SWELL TEST

BORING: B-4D DEPTH: 1.5'-3' MOISTURE CONTENT:
 DESCRIPTION: Brown Clay with Calcareous Nodules BEFORE: 25.1 %, AFTER: 28.3 %
 UNIT DRY WT.: 99.8 LBS./CU.FT.
 LIQUID LIMIT: 53
 PLASTICITY INDEX: 32

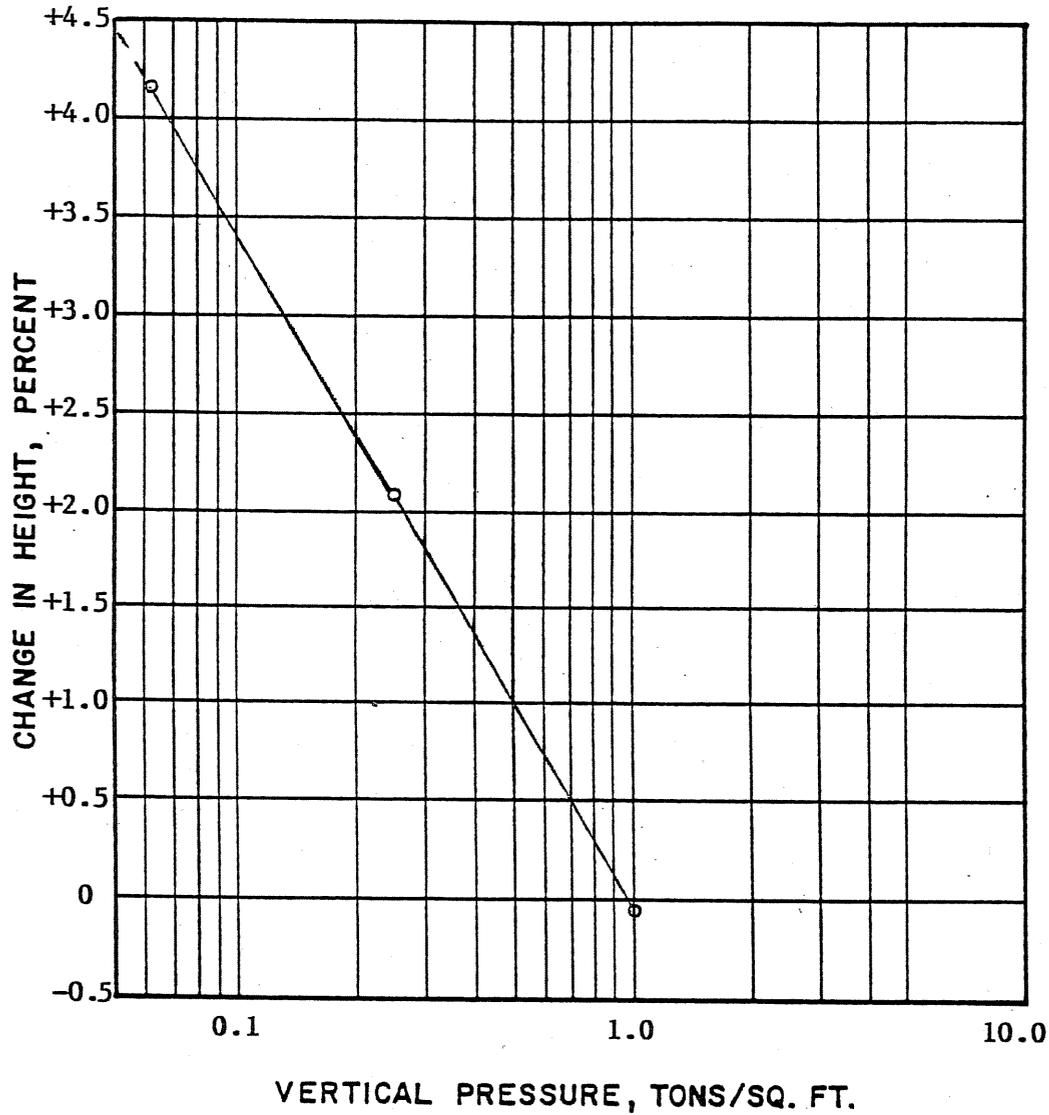


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
0.75	- 0.29
0.25	+ 0.64
0.0625	+ 2.19

PRESSURE-SWELL TEST

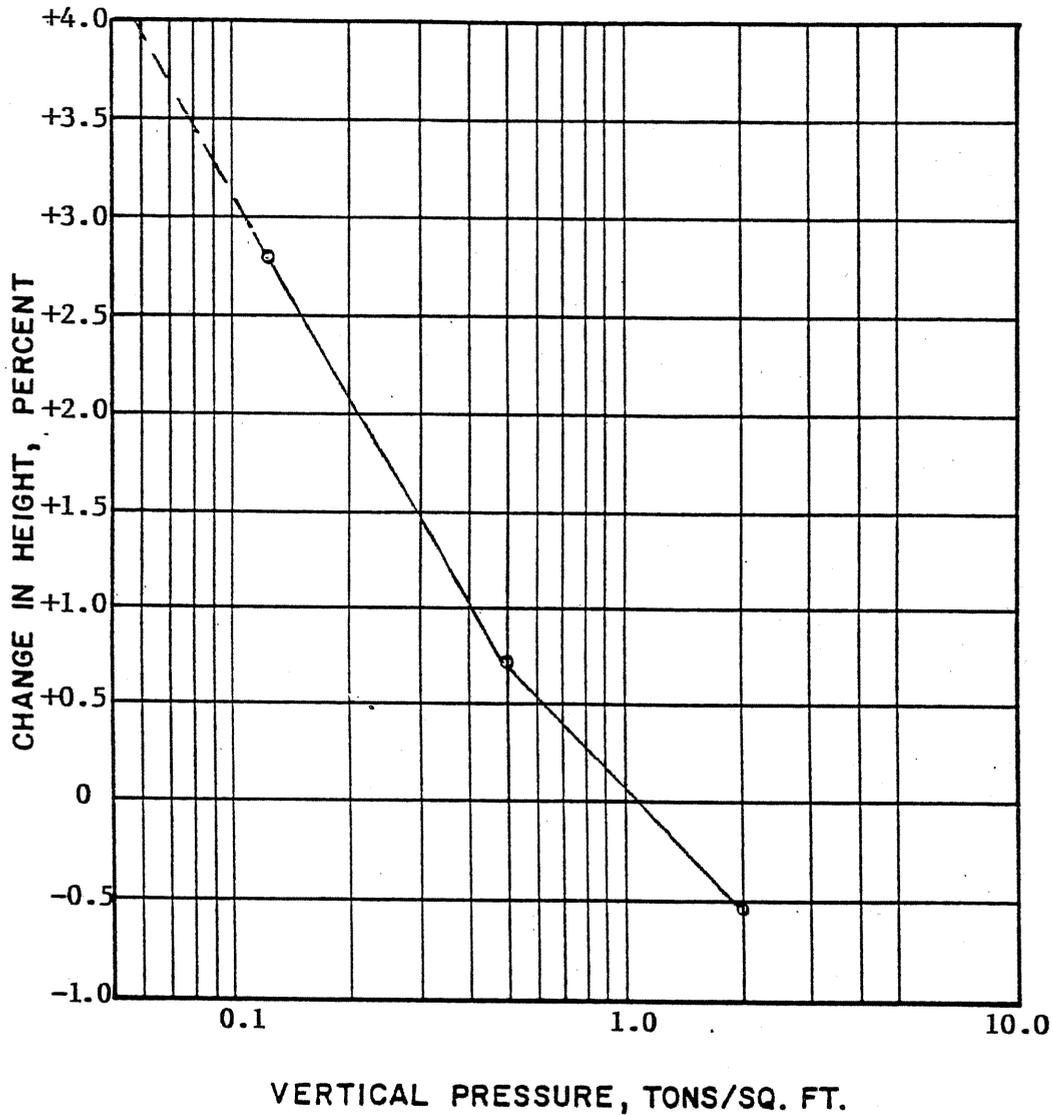
BORING: B-4D DEPTH: 6'-7.5' MOISTURE CONTENT:
 DESCRIPTION: Tan Clay with Calcareous Nodules BEFORE: 17.0 %, AFTER: 24.1 %
 UNIT DRY WT.: 109.5 LBS./CU.FT.
 LIQUID LIMIT: 50
 PLASTICITY INDEX: 32



DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.0	- 0.04
0.25	+ 2.08
0.0625	+ 4.15

BORING: B-4E DEPTH: 4.5'-6' MOISTURE CONTENT:
 DESCRIPTION: Dark Brown Clay BEFORE: 14.1 %, AFTER: 22.7 %
 with Calcareous Nodules UNIT DRY WT.: 107.4 LBS./CU.FT.
 LIQUID LIMIT: 67
 PLASTICITY INDEX: 45

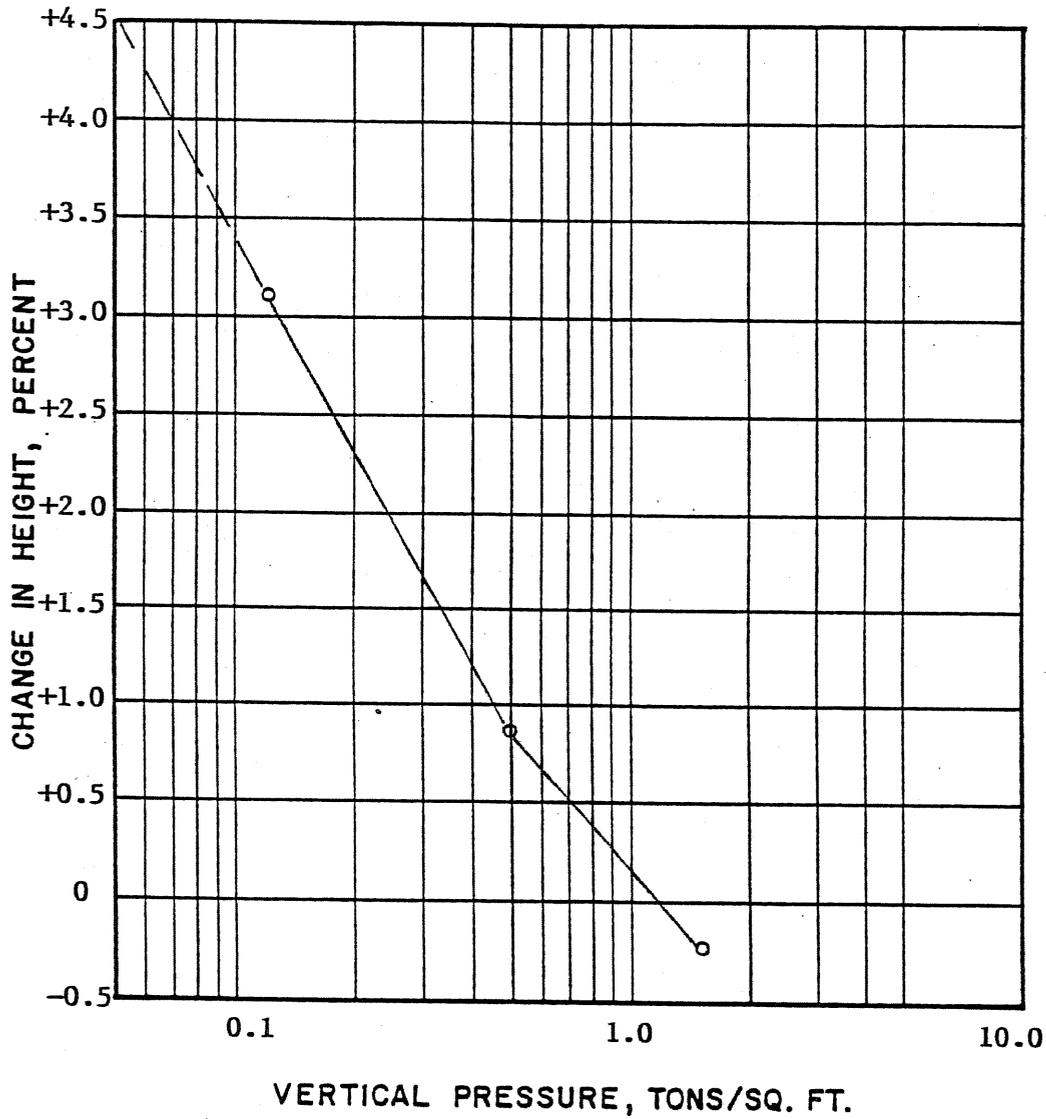


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
2.0	- 0.54
0.5	+ 0.72
0.125	+ 2.78

PRESSURE-SWELL TEST

BORING: B-4E DEPTH: 8'-9.5' MOISTURE CONTENT:
 DESCRIPTION: Dark Brown Clay BEFORE: 14.5 %, AFTER: 21.4 %
 UNIT DRY WT.: 111.2 LBS./CU.FT.
 LIQUID LIMIT: 51
 PLASTICITY INDEX: 28

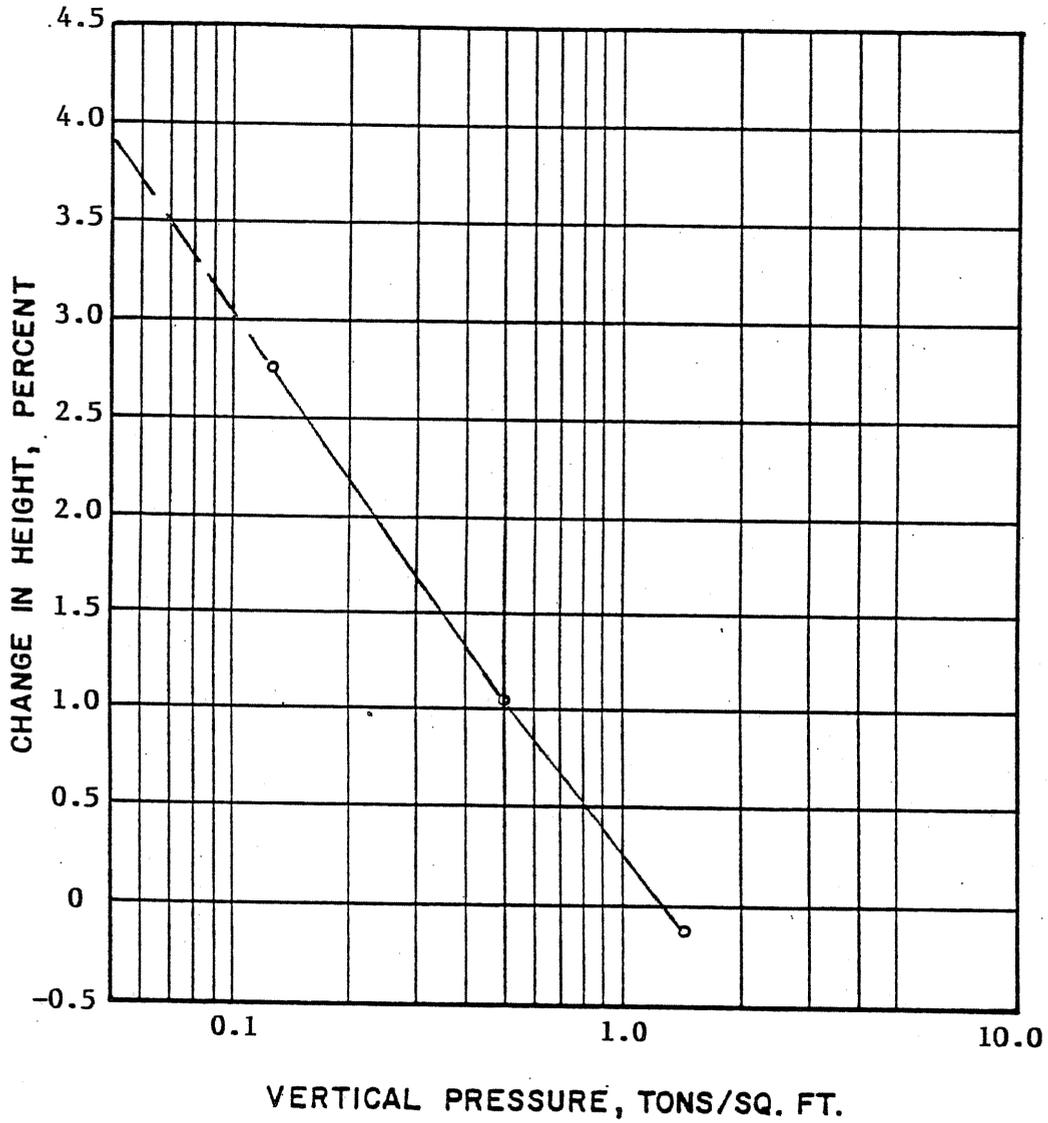


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.5	- 0.26
0.5	+ 0.87
0.125	+ 3.10

PRESSURE-SWELL TEST

BORING: B-5A DEPTH: 4.5'-6' MOISTURE CONTENT: BEFORE: 17.4 %, AFTER: 19.7 %
 DESCRIPTION: Tan Clay UNIT DRY WT.: 112.5 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

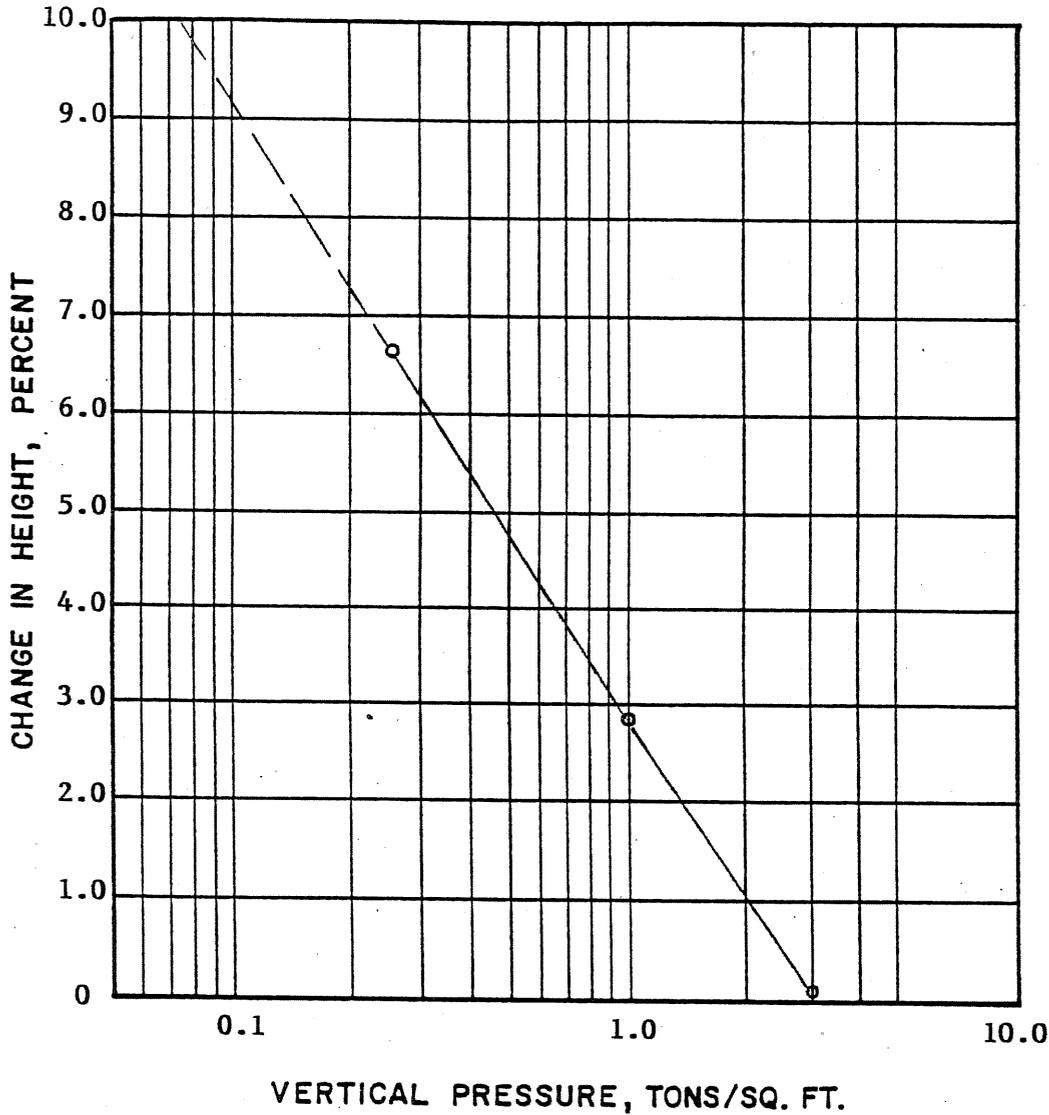


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
1.5	- 0.11
0.5	+ 1.04
0.125	+ 2.76

PRESSURE-SWELL TEST

BORING: B-5A DEPTH: 9'-10.5' MOISTURE CONTENT:
 DESCRIPTION: Brown Shaley Clay BEFORE: 22.4 %, AFTER: 27.5 %
 UNIT DRY WT.: 103.3 LBS./CU.FT.
 LIQUID LIMIT:
 PLASTICITY INDEX:

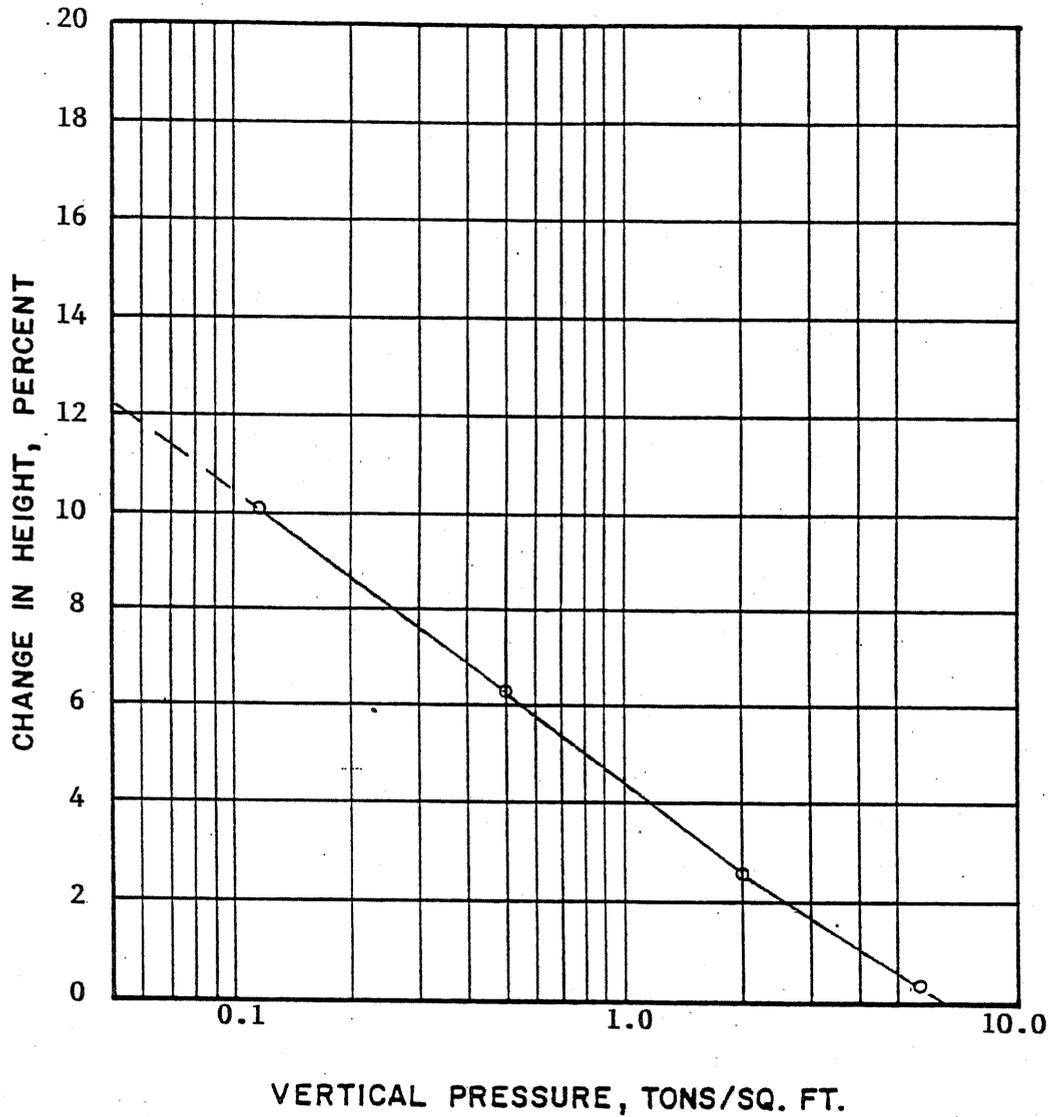


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
3.0	+ 0.09
1.0	+ 2.84
0.25	+ 6.61

PRESSURE-SWELL TEST

BORING: B-5B DEPTH: 3'-4.5' MOISTURE CONTENT:
 DESCRIPTION: Grayish Brown Clay BEFORE: 18.2 %, AFTER: 25.8 %
 with Iron Stains UNIT DRY WT.: 111.9 LBS./CU.FT.
 LIQUID LIMIT: 59
 PLASTICITY INDEX: 36

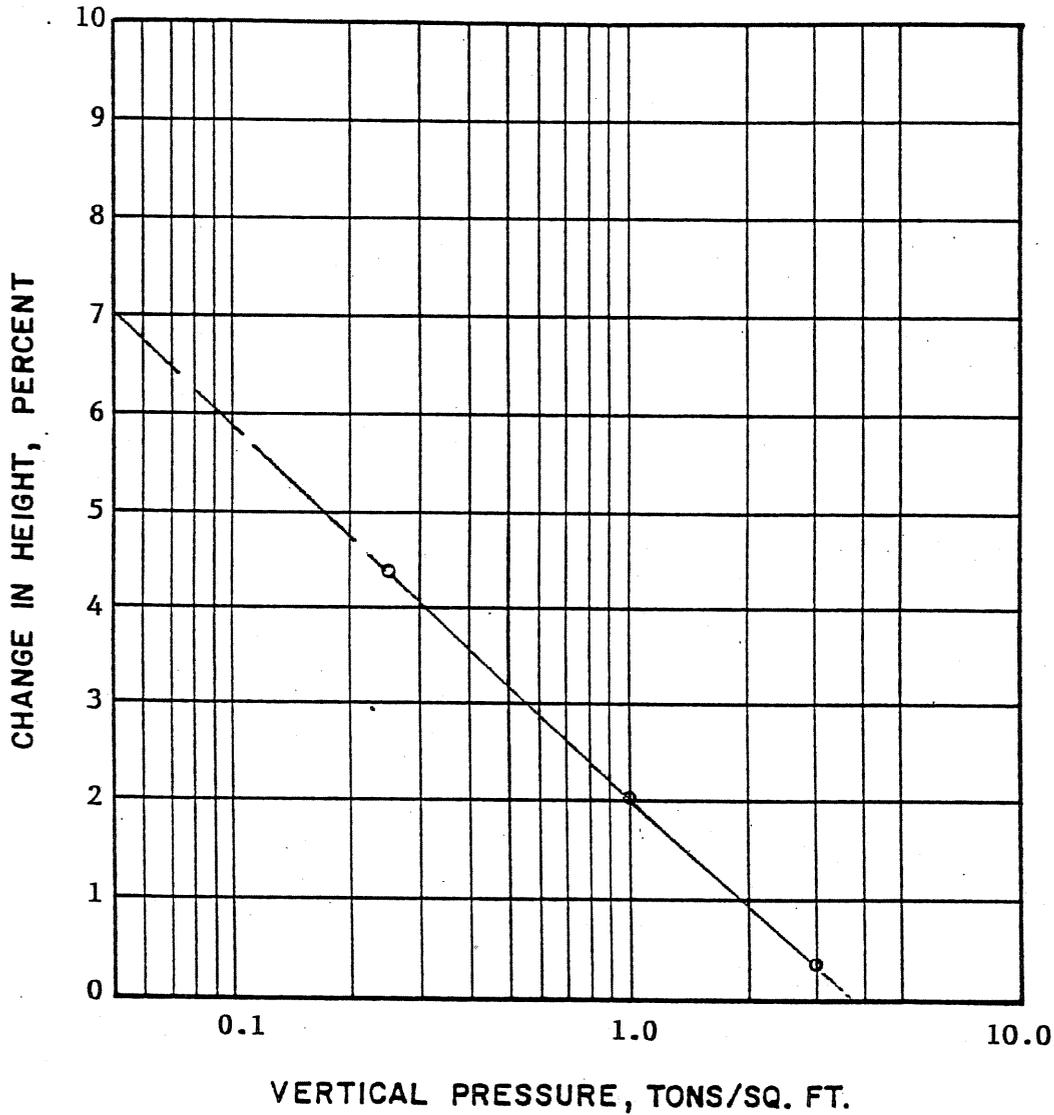


DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
6.0	+ 0.24
2.0	+ 2.54
0.5	+ 6.25
0.125	+ 10.04

PRESSURE-SWELL TEST

BORING: B-5B DEPTH: 7.5'-9' MOISTURE CONTENT:
 DESCRIPTION: Dark Gray Shaley Clay BEFORE: 17.0 %, AFTER: 20.4 %
 UNIT DRY WT.: 114.9 LBS./CU.FT.
 LIQUID LIMIT: 59
 PLASTICITY INDEX: 35



DATA POINTS

<u>VERTICAL PRESSURE (TSF)</u>	<u>CHANGE IN HEIGHT (%)</u>
4.0	+ 0.35
1.0	+ 2.04
0.25	+ 4.37

PRESSURE-SWELL TEST

POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

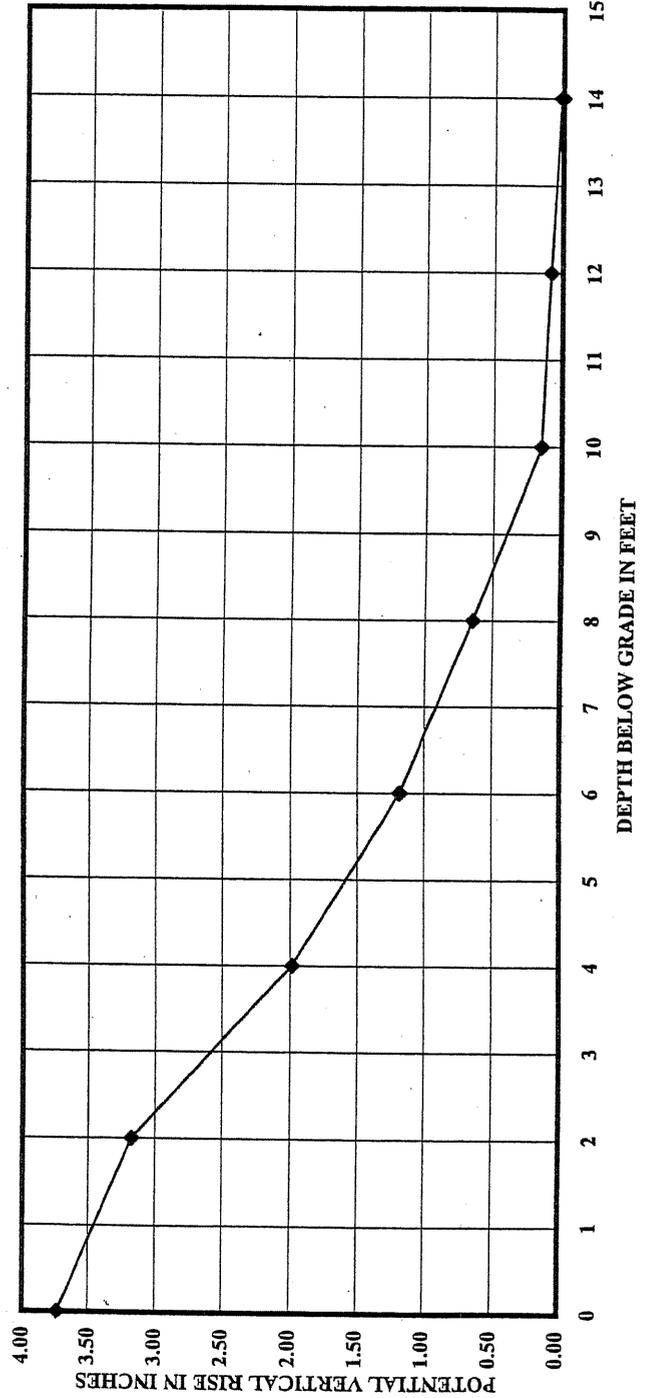
C-S-J NO.: 0008-14-059
 District: Fort Worth District Laboratory

Hole No.: B-2
 Date: 10/04/2000

Ground Elev.: 629.40*
 Station: 671+45.64
 Offset: 26.26 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	FVR (In.) Top of Layer	FVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	3.73
2.0	1	52	19.4	26.4	16.1	Dry	97.5	34	9.7	13.0	0.00	0.57	0.57	0.98	1.00	0.56	3.18
4.0	3	66	22.2	33.0	21.2	Dry	96.9	45	13.8	17.3	0.80	2.03	1.23	0.97	1.00	1.19	1.99
6.0	5.0	66	22.2	33.0	20.4	Dry	96.9	45	13.8	17.3	2.03	2.86	0.83	0.97	1.00	0.80	1.18
8.0	7.0	70	23.0	34.9	18.9	Dry	84.2	46	14.1	17.7	2.97	3.60	0.63	0.84	1.00	0.53	0.65
10.0	9.0	70	23.0	34.9	18.9	Dry	84.2	46	14.1	17.7	3.60	4.20	0.60	0.84	1.00	0.51	0.15
12.0	11.0	44	17.8	22.7	8.3	Dry	58.4	28	7.5	10.6	2.02	2.13	0.11	0.58	1.00	0.06	0.08
14.0	13.0	44	17.8	22.7	7.1	Dry	58.4	28	7.5	10.6	2.13	2.25	0.12	0.58	1.00	0.07	0.01
14.0	14.0	44	17.8	22.7	7.1	Dry	58.4	28	7.5	10.6	2.25	2.27	0.02	0.58	1.00	0.01	0.00
	7	0	2.0	2.0					-2.9	-0.5			0.00	0.00	1.00	0.00	0.00
	0	0	2.0	2.0					-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 623.4±, i.e., approximately 6.0 feet below present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant

C-S-J NO.: 0008-14-059

Hole No.: B-2B Ground Elev.: NA

Highway: IH-820 NORTH LOOP

District: Fort Worth District Laboratory

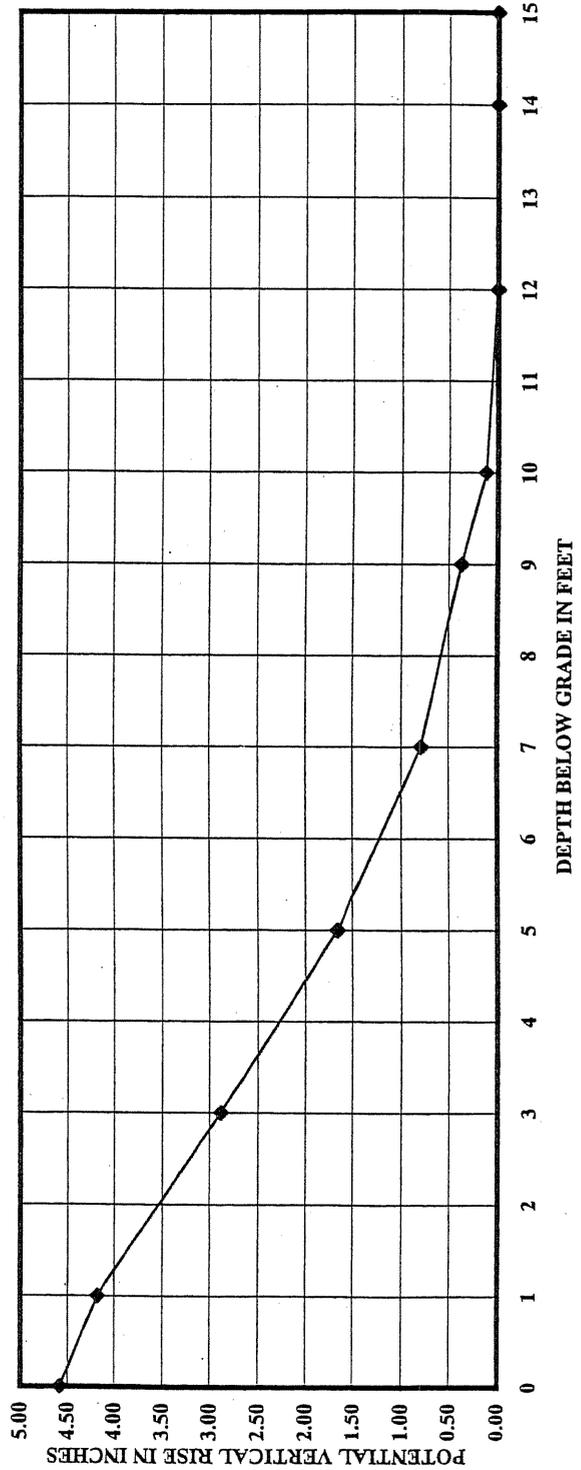
Date: 3/15/01

Station: 681+00

Offset: 8.5 Ft. N.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a	#####	#####			0.00	0.00	0.00	0.00	1.00	0.00	4.58
1.0	0.5	78	24.6	38.7	25.4	Dry	90.4	53	16.2	20.0	0.00	0.44	0.44	0.90	1.00	0.40	4.18
3.0	2.0	78	24.6	38.7	27.3	Dry	90.4	53	16.2	20.0	0.44	1.88	1.44	0.90	1.00	1.30	2.88
5.0	4.0	80	25.0	39.6	16.1	Dry	92.1	54	16.5	20.2	1.82	3.14	1.32	0.92	1.00	1.22	1.67
7.0	6.0	80	25.0	39.6	22.0	Dry	92.1	54	16.5	20.2	3.14	4.09	0.95	0.92	1.00	0.87	0.79
9.0	8.0	58	20.6	29.3	15.4	Dry	92.5	39	11.5	14.9	2.55	3.00	0.45	0.93	1.00	0.42	0.37
10.0	9.5	58	20.6	29.3	15.4	Dry	92.5	39	11.5	14.9	3.00	3.27	0.27	0.93	1.00	0.25	0.13
12.0	11.0	49	18.8	25.0	20.7	Dry	96.3	30	8.2	11.4	2.30	2.43	0.13	0.96	1.00	0.13	0.00
14.0	13.0	49	18.8	25.0	23.4	Wet	96.3	30	3.6	6.5	0.75	0.75	0.00	0.96	1.00	0.00	0.00
15.0	14.5	49	18.8	25.0	23.4	Wet	96.3	30	3.6	6.5	0.75	0.75	0.00	0.96	1.00	0.00	0.00
15.0	15.0	49	18.8	25.0	23.4	Wet	96.3	20	1.4	4.1	0.31	0.31	0.00	0.96	1.00	0.00	0.00

* PVR calculations based on pavement grade at approximately present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

C-S-J NO.: 0008-14-052
 District: Fort Worth District Laboratory

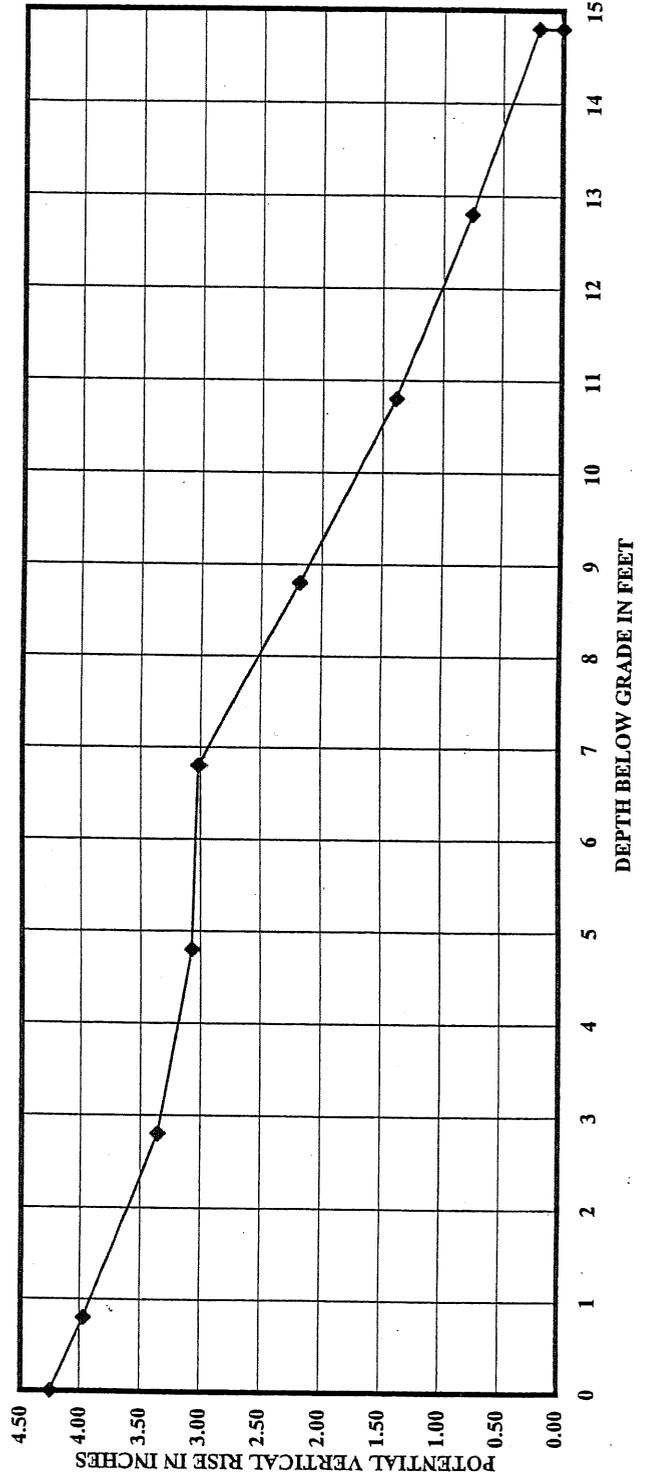
Hole No.: B-3
 Date: 10/04/2000

Ground Elev.: 632.69*
 Station: 690+86.10

Offset: 33.14 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Dry Wet	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. (-No. 40) Factor	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#VALUE!	#####	0.00	0.00	0.00	0.00	1.00	0.00	4.25
0.8	0.4	55	20.0	27.9	24	AVG	93	35	7.4	10.5	0.00	0.30	0.30	0.93	1.00	0.28	3.97
2.8	1.8	57	20.4	28.8	8.7	Dry	91.7	35	10.1	13.4	0.30	0.97	0.67	0.92	1.00	0.61	3.36
4.8	3.8	47	18.4	24.1	11.2	Dry	67.7	27	7.1	10.2	0.90	1.32	0.42	0.68	1.00	0.28	3.07
6.8	5.8	47	18.4	24.1	23.3	Wet	67.7	27	3.0	5.8	0.49	0.57	0.08	0.68	1.00	0.05	3.02
8.8	7.8	83	25.6	41.0	24.3	Dry	96.8	59	17.7	21.5	4.30	5.16	0.86	0.97	1.00	0.83	2.19
10.8	9.8	85	26.0	42.0	26.7	Dry	97.0	64	18.9	22.8	5.53	6.35	0.82	0.97	1.00	0.80	1.39
12.8	11.8	85	26.0	42.0	24.5	Dry	97.0	64	18.9	22.8	6.35	7.00	0.65	0.97	1.00	0.63	0.76
14.8	13.8	70	23.0	34.9	24.2	Dry	98.7	50	15.6	19.3	5.53	6.10	0.57	0.99	1.00	0.56	0.20
14.8	14.8	70	23.0	34.9	24.2	Dry	98.7	50	15.6	19.3	6.10	6.30	0.20	0.99	1.00	0.20	0.00
	7.4	0	2.0	2.0	0			0	-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 633.5±, i.e., approximately 0.8 feet above present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

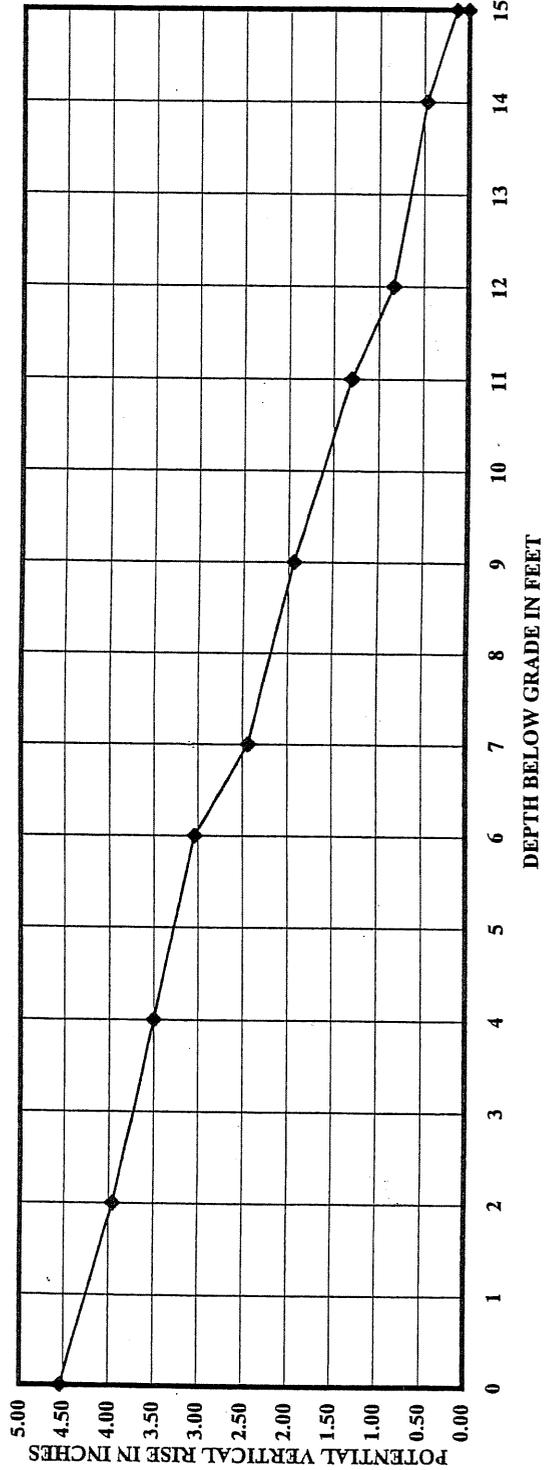
C-S-J NO.: 0008-14-059
 District: Fort Worth District Laboratory

Hole No.: B-3B
 Date: 3/14/01

Ground Elev.: NA
 Station: 699+75
 Offset: 8 Ft. N.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	4.54
2.0	1	64	21.8	32.1	27.5	Avg	94.1	41	9.2	12.4	0.00	0.62	0.62	0.94	1.00	0.58	3.96
4.0	3	55	20.0	27.9	22.9	Avg	74.6	36	7.7	10.8	0.60	1.21	0.61	0.75	1.00	0.46	3.50
6.0	5.0	55	20.0	27.9	9.4	Dry	74.6	36	10.4	13.7	1.45	2.07	0.62	0.75	1.00	0.46	3.04
7.0	6.5	77	24.4	38.2	15.5	Dry	96.5	52	16.0	19.7	3.56	4.18	0.62	0.97	1.00	0.60	2.44
9.0	8.0	77	24.4	38.2	16.6	Dry	96.5	52	16.0	19.7	4.18	4.70	0.52	0.97	1.00	0.50	1.94
11.0	10.0	80	25.0	39.6	16.2	Dry	99.9	53	16.2	20.0	4.75	5.39	0.64	1.00	1.00	0.64	1.30
12.0	11.5	80	25.0	39.6	22.3	Dry	99.9	53	16.2	20.0	5.39	5.85	0.46	1.00	1.00	0.46	0.84
14.0	13.0	80	25.0	39.6	22.3	Dry	99.9	53	16.2	20.0	5.85	6.22	0.37	1.00	1.00	0.37	0.47
15.0	14.5	84	25.8	41.5	27.2	Dry	96.1	55	16.7	20.5	6.45	6.80	0.35	0.96	1.00	0.34	0.13
15.0	15.0	84	25.8	41.5	27.2	Dry	96.1	55	16.7	20.5	6.80	6.94	0.14	0.96	1.00	0.13	0.00

* PVR calculations based on pavement grade at approximately present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

C-S-J NO.: 0008-14-059

District: Fort Worth District Laboratory

Hole No.: B-4

Date: 10/04/2000

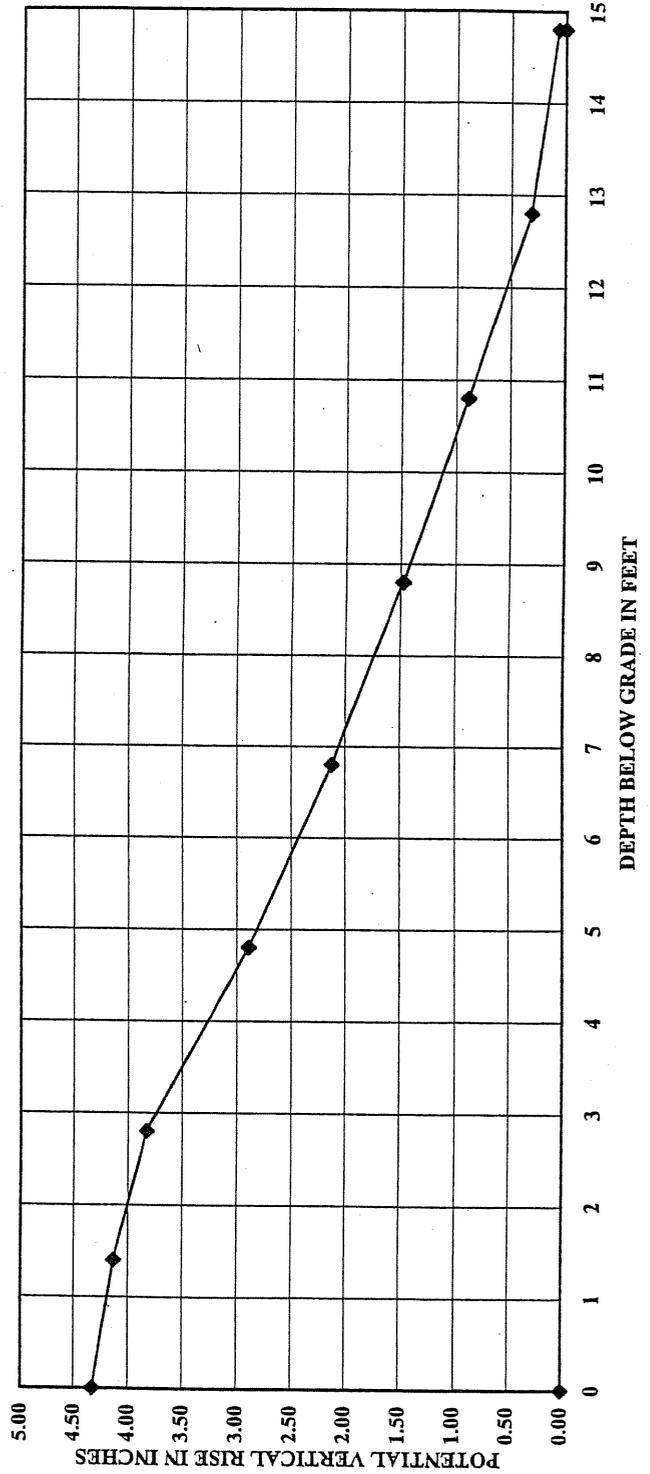
Ground Elev.: 646.50*

Station: 708+71.43

Offset: 54.38 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#VALUE!	#####	0.00	0.00	0.00	0.00	1.00	0.00	4.33
1.4	0.7	52	19.4	26.4	4.5	Dry	49.1	35	10.1	13.4	0.00	0.40	0.40	0.49	1.00	0.20	4.13
2.8	2.1	52	19.4	26.4	8.7	Dry	49.1	35	10.1	13.4	0.40	1.02	0.62	0.49	1.00	0.30	3.83
4.8	3.8	68	22.6	34.0	16.1	Dry	93.6	49	15.2	18.9	1.78	2.78	1.00	0.94	1.00	0.94	2.89
6.8	5.8	68	22.6	34.0	16.1	Dry	93.6	49	15.2	18.9	2.78	3.60	0.82	0.94	1.00	0.77	2.13
8.8	7.8	68	22.6	34.0	16.1	Dry	93.6	49	15.2	18.9	3.60	4.29	0.69	0.94	1.00	0.65	1.48
10.8	9.8	77	24.4	38.2	18.6	Dry	92.2	53	16.2	20.0	4.71	5.35	0.64	0.92	1.00	0.59	0.89
12.8	11.8	77	24.4	38.2	21.3	Dry	92.2	53	16.2	20.0	5.35	5.97	0.62	0.92	1.00	0.57	0.32
14.8	13.8	67	22.4	33.5	22.7	Dry	93.6	41	12.3	15.7	3.98	4.25	0.27	0.94	1.00	0.25	0.07
14.8	14.8	67	22.4	33.5	22.7	Dry	93.6	41	12.3	15.7	4.25	4.32	0.07	0.94	1.00	0.07	0.00
	7.4	0	2.0	2.0	0			0	-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 646.3±, i.e., approximately 0.2 feet below present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant

C-S-J NO.: 0008-14-052

Hole No.: B-4B

Ground Elev.: NA

Highway: IH-820 NORTH LOOP

District: Fort Worth District Laboratory

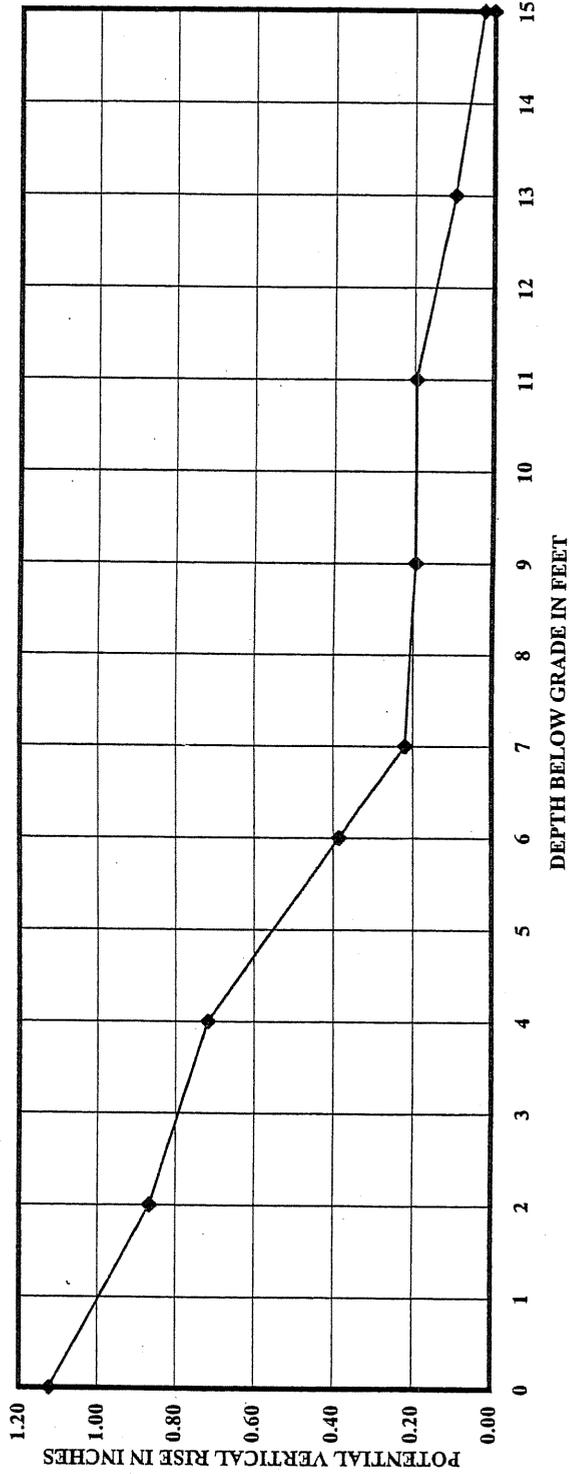
Date: 3/13/2001

Station: 719+00

Offset: 11' N.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Swell	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)	
0			2.0	2.0		n/a			#####	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.12
2.0	1	43	17.6	22.2	19.4	Avg	77.9	25	4.5	7.4	7.4	0.00	0.33	0.33	0.78	1.00	0.26	0.87	
4.0	3	43	17.6	22.2	28.4	Wet	77.9	25	2.5	5.3	5.3	0.18	0.37	0.19	0.78	1.00	0.15	0.72	
6.0	5.0	56	20.2	28.3	15.6	Dry	52.0	36	10.4	13.7	13.7	1.44	2.08	0.64	0.52	1.00	0.33	0.39	
7.0	6.5	56	20.2	28.3	16.9	Dry	52.0	36	10.4	13.7	13.7	2.08	2.40	0.32	0.52	1.00	0.17	0.22	
9.0	8.0	46	18.2	23.6	11.1	Dry	33.9	22	5.2	8.2	8.2	1.18	1.25	0.07	0.34	1.00	0.02	0.20	
11.0	10.0	NP	#VALUE!	#VALUE!	NA	NA	0.0	NP	#####	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	0.20	
13.0	12.0	52	19.4	26.4	13.3	Dry	51.5	32	8.9	12.2	12.2	2.57	2.76	0.19	0.52	1.00	0.10	0.10	
15.0	14.0	52	19.4	26.4	11.1	Dry	51.5	32	8.9	12.2	12.2	2.76	2.90	0.14	0.52	1.00	0.07	0.03	
15.0	15.0	52	19.4	26.4	11.1	Dry	51.5	32	8.9	12.2	12.2	2.90	2.95	0.05	0.52	1.00	0.03	0.00	
	7.5		2.0	2.0					-2.9	-0.5	-0.5			0.00	0.00	1.00	0.00	0.00	

* PVR calculations based on pavement grade at approximately present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

C-S-J NO.: 0008-14-052

District: Fort Worth District Laboratory

Hole No.: B-4C

Date: 3/13/2001

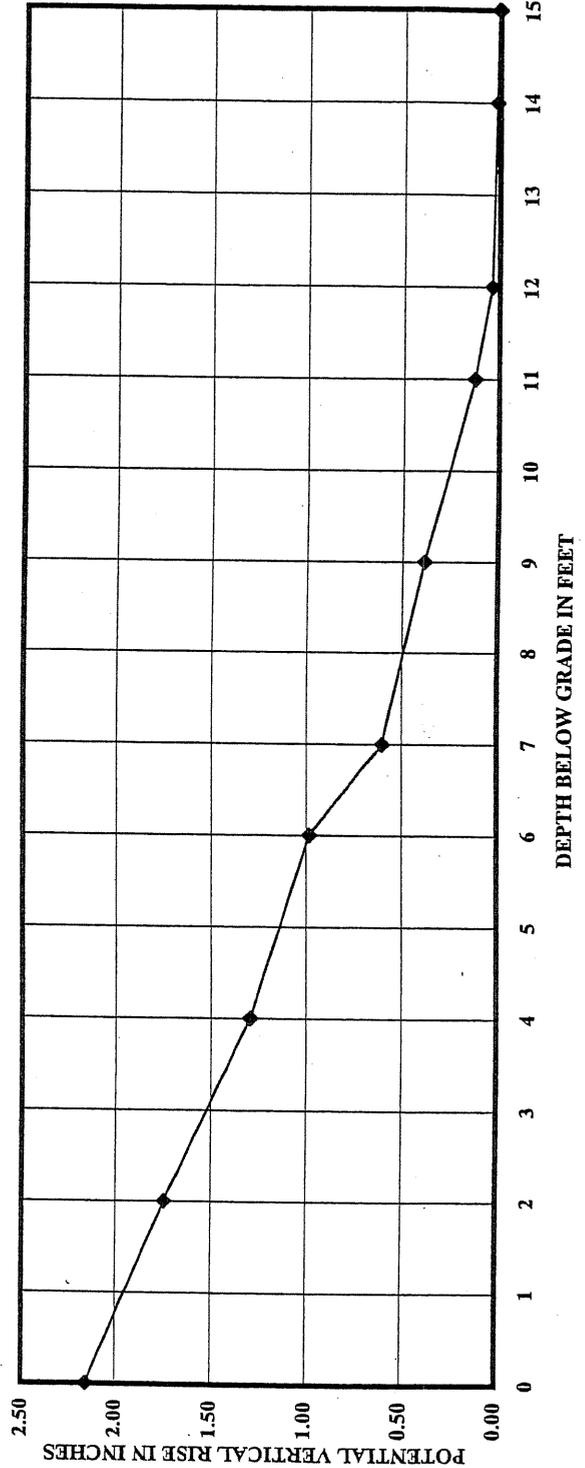
Ground Elev.: NA

Station: 728+35

Offset: 8' N

Depth, Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Swell	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0		2.0	2.0		n/a		n/a	#####	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	2.16
2.0	46	18.2	23.6	13.8	Dry	70.6	29	7.8	7.8	11.0	0.00	0.58	0.58	0.71	1.00	0.41	1.75
4.0	46	18.2	23.6	17.5	Dry	70.6	29	7.8	7.8	11.0	0.58	1.22	0.64	0.71	1.00	0.45	1.30
6.0	46	18.2	23.6	17.2	Dry	70.6	29	7.8	7.8	11.0	1.22	1.66	0.44	0.71	1.00	0.31	0.99
7.0	64	21.8	32.1	16.5	Dry	89.4	43	13.0	13.0	16.5	2.69	3.12	0.43	0.89	1.00	0.38	0.60
9.0	65	22.0	32.6	23.4	Dry	89.4	35	10.1	10.1	13.4	2.37	2.61	0.24	0.89	1.00	0.21	0.39
11.0	65	22.0	32.6	23.9	Dry	89.4	35	10.1	10.1	13.4	2.61	2.90	0.29	0.89	1.00	0.26	0.13
12.0	65	22.0	32.6	24.8	Avg	89.4	35	7.4	7.4	10.5	2.05	2.15	0.10	0.89	1.00	0.09	0.04
14.0	41	17.2	21.3	17.0	Dry	76.3	22	5.2	5.2	8.2	1.36	1.39	0.03	0.76	1.00	0.02	0.02
15.0	41	17.2	21.3	17.0	Dry	76.3	22	5.2	5.2	8.2	1.39	1.40	0.01	0.76	1.00	0.01	0.01
15.0	41	17.2	21.3	17.0	Dry	76.3	22	5.2	5.2	8.2	1.40	1.41	0.01	0.76	1.00	0.01	0.00

* PVR calculations based on pavement grade at approximately present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

C-S-J NO.: 0008-14-059

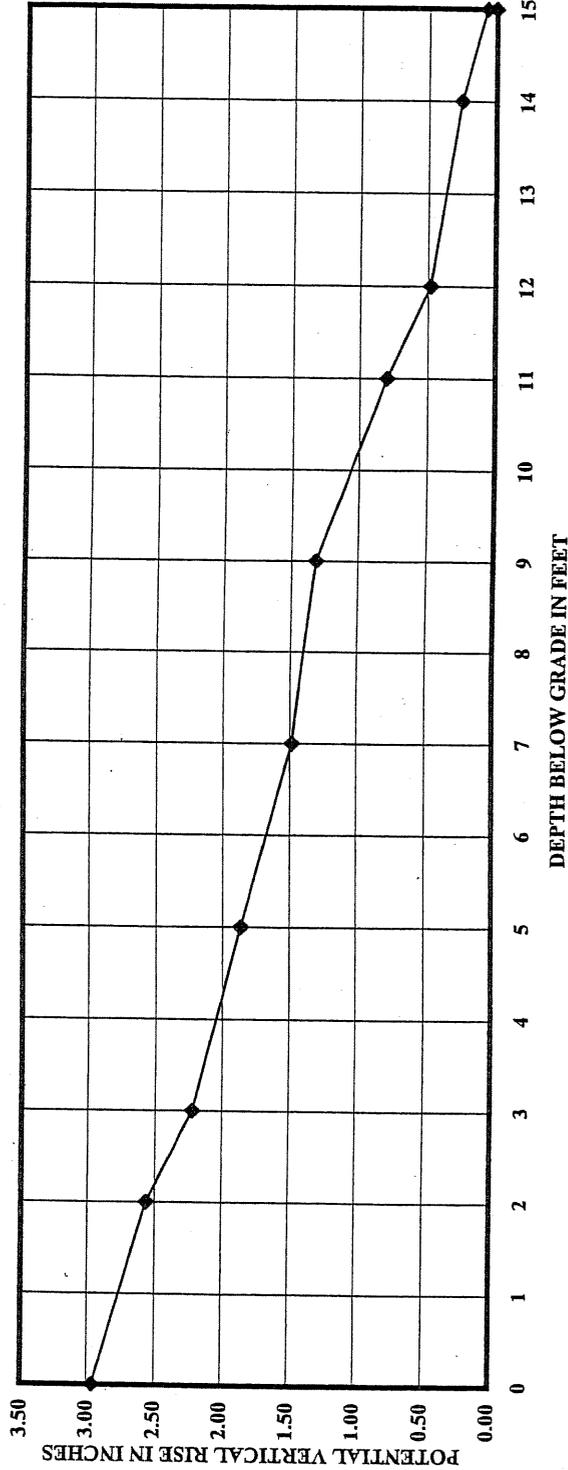
District: Fort Worth District Laboratory

Hole No.: B-4D
 Date: 3/13/2001

Ground Elev.: NA
 Station: 741+00
 Offset: 8' N

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Swell	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0			2.0	2.0		n/a		n/a	#####	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	2.96
2.0	1	53	19.6	26.9	22.4	Avg	77.8	32	6.5	6.5	9.6	0.00	0.51	0.51	0.78	1.00	0.40	2.57
3.0	2.5	53	19.6	26.9	25.1	Avg	77.8	32	6.5	6.5	9.6	0.51	0.95	0.44	0.78	1.00	0.34	2.22
5.0	4.0	53	19.6	26.9	12.6	Dry	77.8	32	8.9	8.9	12.2	1.17	1.63	0.46	0.78	1.00	0.36	1.87
7.0	6.0	50	19.0	25.5	17.0	Dry	92.6	32	8.9	8.9	12.2	1.63	2.04	0.41	0.93	1.00	0.38	1.49
9.0	8.0	50	19.0	25.5	23.3	Avg	92.6	32	6.5	6.5	9.6	1.48	1.66	0.18	0.93	1.00	0.17	1.32
11.0	10.0	68	22.6	34.0	17.6	Dry	99.5	45	13.8	13.8	17.3	3.78	4.30	0.52	1.00	1.00	0.52	0.80
12.0	11.5	68	22.6	34.0	22.0	Dry	99.5	45	13.8	13.8	17.3	4.30	4.62	0.32	1.00	1.00	0.32	0.48
14.0	13.0	69	22.8	34.4	21.9	Dry	98.6	42	12.6	12.6	16.1	4.09	4.32	0.23	0.99	1.00	0.23	0.26
15.0	14.5	69	22.8	34.4	21.9	Dry	98.6	42	12.6	12.6	16.1	4.32	4.51	0.19	0.99	1.00	0.19	0.07
15.0	15.0	69	22.8	34.4	21.9	Dry	98.6	42	12.6	12.6	16.1	4.51	4.58	0.07	0.99	1.00	0.07	0.00

* PVR calculations based on pavement grade at approximately present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTHLOOP

C-S-J NO.: 0008-14-059

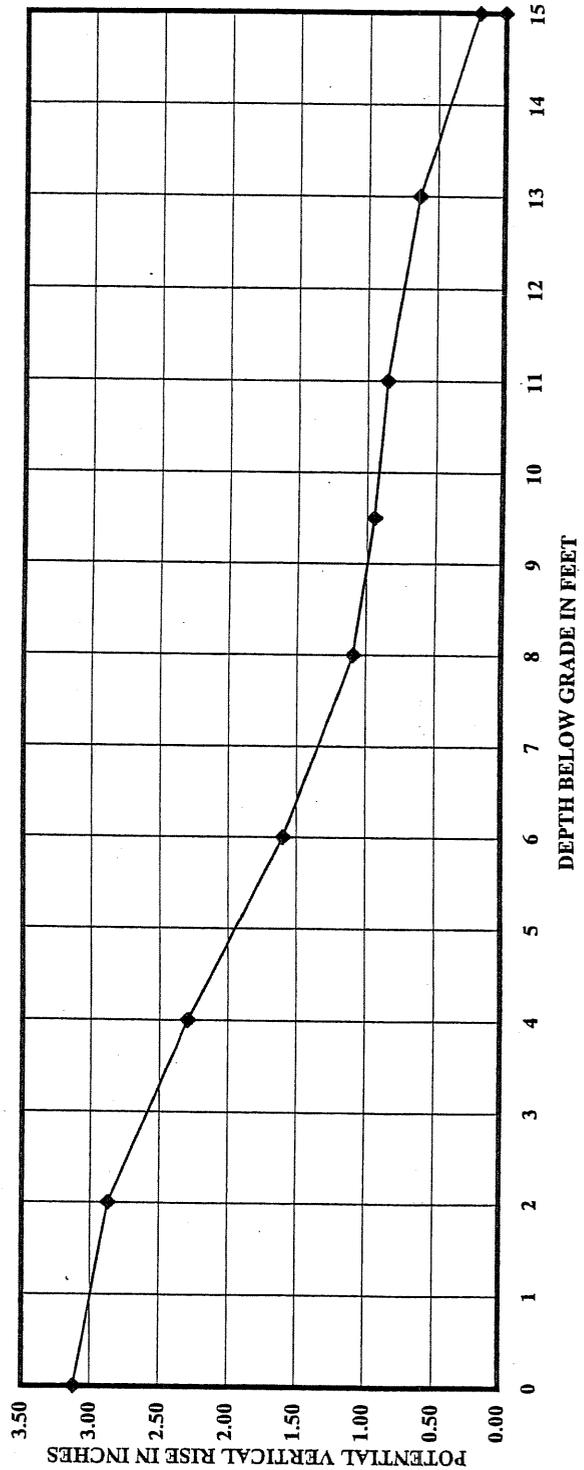
District: Fort Worth District Laboratory

Hole No.: B-4E
 Date: 3/13/2001

Ground Elev.: NA
 Station: 751+00
 Offset: 7' N.

Depth, Average Ft.	Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Swell	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)	
0			2.0	2.0		n/a		n/a	#####	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	0.00	3.12
2.0	1	55	20.0	27.9	32.2	Wet	73.3	34	4.5	7.4	7.4	0.00	0.34	0.34	0.73	1.00	0.25	0.25	2.87
4.0	3	55	20.0	27.9	16.8	Dry	73.3	34	9.7	13.0	13.0	0.61	1.40	0.79	0.73	1.00	0.58	0.58	2.29
6.0	5.0	67	22.4	33.5	14.1	Dry	80.7	45	13.8	17.3	17.3	2.02	2.88	0.86	0.81	1.00	0.69	0.69	1.60
8.0	7.0	67	22.4	33.5	11.6	Dry	80.7	45	13.8	17.3	17.3	2.88	3.51	0.63	0.81	1.00	0.51	0.51	1.09
9.5	8.8	51	19.2	26.0	14.5	Dry	80.0	28	7.5	10.6	10.6	1.83	2.01	0.18	0.80	1.00	0.14	0.14	0.95
11.0	10.3	51	19.2	26.0	20.0	Dry	80.0	28	7.5	10.6	10.6	2.01	2.12	0.11	0.80	1.00	0.09	0.09	0.86
13.0	12.0	82	25.4	40.5	29.1	Avg	98.7	50	11.8	15.2	15.2	3.53	3.76	0.23	0.99	1.00	0.23	0.23	0.63
15.0	14.0	82	25.4	40.5	21.5	Dry	98.7	50	15.6	19.3	19.3	5.67	6.12	0.45	0.99	1.00	0.44	0.44	0.19
15.0	15.0	82	25.4	40.5	21.5	Dry	98.7	50	15.6	19.3	19.3	6.12	6.31	0.19	0.99	1.00	0.19	0.19	0.00
	7.5		2.0	2.0					-2.9	-0.5	-0.5			0.00	0.00	1.00	0.00	0.00	0.00

* PVR calculations based on pavement grade at approximately present ground elevation.

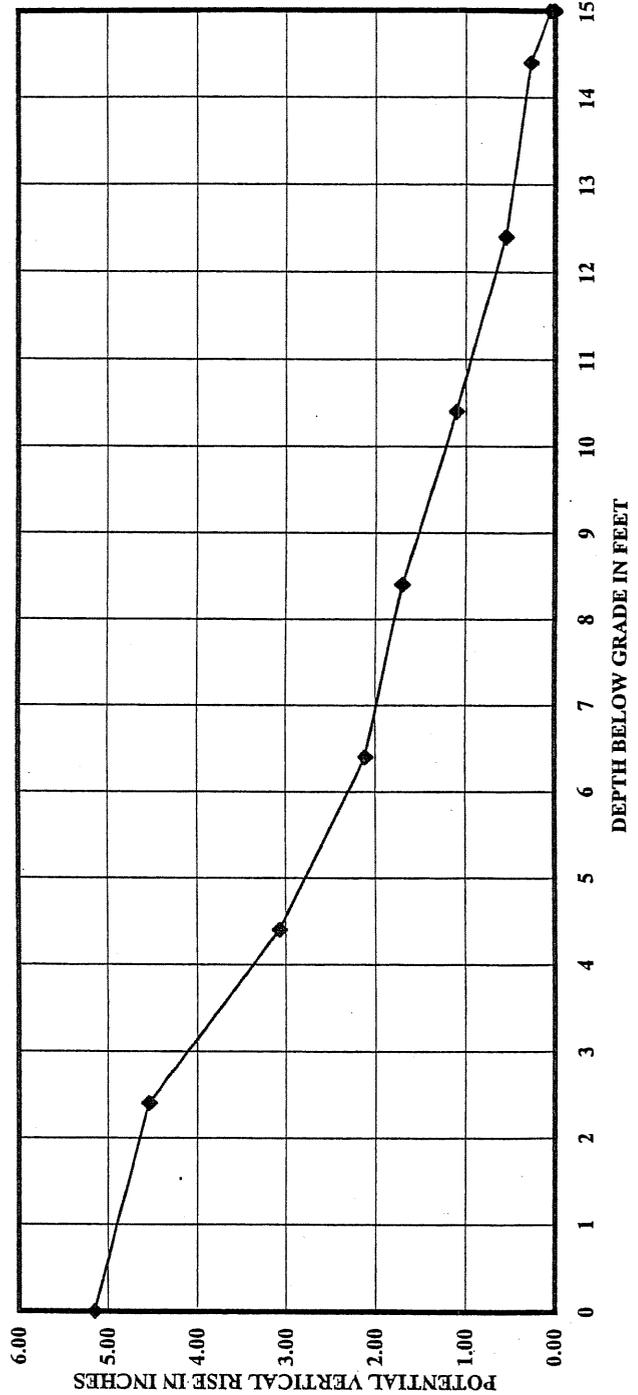


POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP
 C-S-J NO.: 0008-14-052
 District: Fort Worth District Laboratory
 Hole No.: B-5
 Date: 10/05/2000
 Ground Elev.: 632.36*
 Station: 761+80.40
 Offset: 2.03 Ft. Lt.

Depth, Ft.	Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)	
0			2.0	2.0		n/a		n/a	#VALUE!	#####	0.00	0.00	0.00	0.00	1.00	0.00	0.00	5.15
2.4	1.2	55	20.0	27.9	20	Avg	93	35	7.4	10.5	0.00	0.65	0.65	0.93	1.00	0.60	0.60	4.54
4.4	3.4	70	23.0	34.9	18.3	Dry	96.8	48	14.9	18.5	0.97	2.49	1.52	0.97	1.00	1.47	1.47	3.07
6.4	5.4	70	23.0	34.9	11.9	Dry	96.8	48	14.9	18.5	2.49	3.48	0.99	0.97	1.00	0.96	0.96	2.11
8.4	7.4	61	21.2	30.7	10.7	Dry	95.8	37	10.8	14.1	2.26	2.69	0.43	0.96	1.00	0.41	0.41	1.70
10.4	9.4	65	22.0	32.6	12.9	Dry	97.4	48	14.9	18.5	4.05	4.66	0.61	0.97	1.00	0.59	0.59	1.11
12.4	11.4	72	23.4	35.8	19.2	Dry	99.5	51	15.7	19.4	5.02	5.58	0.56	1.00	1.00	0.56	0.56	0.55
14.4	13.4	69	22.8	34.4	23.1	Dry	99.8	44	13.4	16.9	4.45	4.73	0.28	1.00	1.00	0.28	0.28	0.27
15.0	14.7	69	22.8	34.4	23.1	Dry	99.8	44	13.4	16.9	4.73	4.95	0.22	1.00	1.00	0.22	0.22	0.05
15.0	15	69	22.8	34.4	23.1	Dry	99.8	44	13.4	16.9	4.95	5.00	0.05	1.00	1.00	0.05	0.05	0.00
	7.5	0	2.0	2.0	0	Dry		0	-2.9	-0.5	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00

* PVR calculations based on pavement grade at Elev. 634.8±, i.e., approximately 2.4 feet above present ground elevation.



POTENTIAL VERTICAL RISE (PVR)

County: Tarrant
 Highway: IH-820 NORTH LOOP

C-S-J NO.: 0008-14-059

District: Fort Worth District Laboratory

Hole No.: B-5B

Date: 3/13/2001

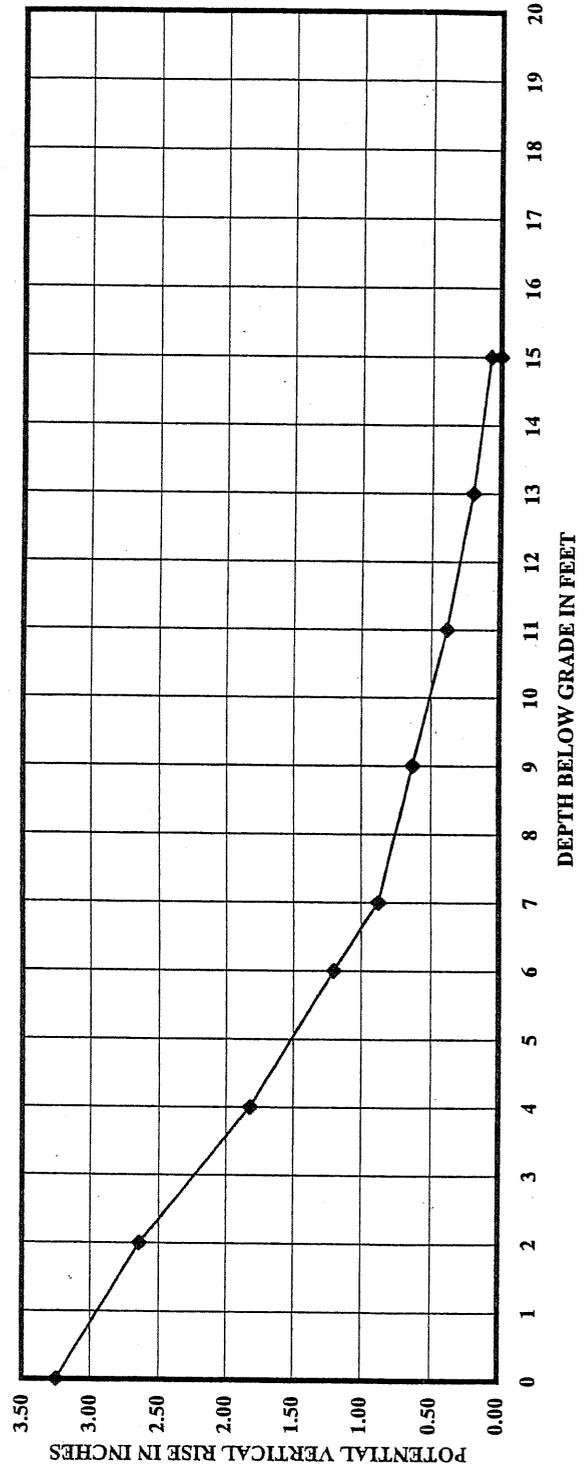
Ground Elev.: NA

Station: 770+50

Offset: 6' N.

Depth, Average Load (psi)	Liquid Limit (LL)	Dry 0.2 LL+9	Wet 0.47 LL+2	% Moisture	Dry Avg Wet	% (-No. 40)	Plasticity Index (PI)	% Swell	% Vol. Swell	% Free Swell	PVR (In.) Top of Layer	PVR (In.) Bottom of Layer	Diff. (In.)	Mod. Factor (-No. 40)	Mod. Density Factor	PVR In Layer (In.)	Total PVR (In.)
0		2.0	2.0		n/a		n/a	#####	#####	#####	0.00	0.00	0.00	0.00	1.00	0.00	3.25
2.0	55	20.0	27.9	15.2	Dry	98.3	34	9.7	13.0	13.0	0.00	0.62	0.62	0.98	1.00	0.61	2.64
4.0	59	20.8	29.7	18.2	Dry	99.7	36	10.4	13.7	13.7	0.63	1.45	0.82	1.00	1.00	0.82	1.82
6.0	59	20.8	29.7	19.1	Dry	99.7	36	10.4	13.7	13.7	1.45	2.07	0.62	1.00	1.00	0.62	1.21
7.0	59	20.8	29.7	17.9	Dry	98.2	35	10.1	13.4	13.4	2.04	2.37	0.33	0.98	1.00	0.32	0.88
9.0	59	20.8	29.7	17.0	Dry	98.2	35	10.1	13.4	13.4	2.37	2.62	0.25	0.98	1.00	0.25	0.64
11.0	59	20.8	29.7	17.9	Dry	99.3	32	8.9	12.2	12.2	2.33	2.58	0.25	0.99	1.00	0.25	0.39
13.0	59	20.8	29.7	19.0	Dry	99.3	32	8.9	12.2	12.2	2.58	2.77	0.19	0.99	1.00	0.19	0.20
15.0	59	20.8	29.7	19.0	Dry	99.3	32	8.9	12.2	12.2	2.77	2.90	0.13	0.99	1.00	0.13	0.07
15.0	59	20.8	29.7	19.0	Dry	99.3	32	8.9	12.2	12.2	2.90	2.97	0.07	0.99	1.00	0.07	0.00
7.5		2.0	2.0					-2.9	-0.5	-0.5			0.00	0.00	1.00	0.00	0.00

* PVR calculations based on pavement grade at approximately present ground elevation.



**SUMMARY OF TOTAL
POTENTIAL VERTICAL RISE DETERMINATIONS**

**SOIL SURVEY
IH-820 NORTH LOOP
FROM IH-35W TO HALTOM ROAD
TARRANT COUNTY, TEXAS
C-S-J NOS. 0008-14-059**

<u>BOREHOLE NO.</u>	<u>TOTAL POTENTIAL VERTICAL RISE (in.) TxDOT TEX-124-E TEST METHOD</u>	<u>ONE-DIMENSIONAL PRESSURE-SWELL TEST RESULTS</u>
B-2 *	3.73	
B-2A **		2.19
B-2B	4.58	1.92
B-3 *	4.25	
B-3A **		7.27
B-3B	4.54	1.86
B-4 *	4.33	
B-4A **		2.41
B-4B	1.12	7.14
B-4C	2.16	3.97
B-4D	2.96	1.88
B-4E	3.12	2.41
B-5 *	5.15	
B-5A **		3.96
B-5B	3.25	9.73

* THIS BOREHOLE DRILLED & REPORTED PREVIOUSLY - SEE TEAM PROJECT NO. 002052G, REPORT NO. 1 DATED 11/09/00

** THIS BOREHOLE DRILLED ADJACENT TO BOREHOLE REPORTED PREVIOUSLY - SEE TEAM REPORT NO. 002052G, REPORT NO. 1 DATED 11/09/00

TEAM - Soil Survey Report
November 2000

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
1	10/4/2000	653+92.56	6.5 ft.	5.0 ft.	3.8 ft.
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.3 ft.
4	10/4/2000	708+71.43	10.3 ft.	8.8 ft.	7.2 ft.
5	10/5/2000	761+80.40	10.7 ft.	9.2 ft.	6.8 ft.
6	10/5/2000	791+10.64	9.3 ft.	1.3 ft.	0.0 ft.
7	10/5/2000	817+92.05	7.0 ft.	5.0 ft.	3.5 ft.
8	10/5/2000	847+69.76	6.3 ft.	4.2 ft.	2.6 ft.
9	10/5/2000	864+34.92	8.2 ft.	6.2 ft.	4.3 ft.
11	10/6/2000	908+64.80	4.5 ft.	3.8 ft.	3.2 ft.
12	10/6/2000	945+58.52	3.8 ft.	2.3 ft.	0.0 ft.
14	10/5/2000	779+43.96	5.5 ft.	3.9 ft.	2.7 ft.
15	10/5/2000	807+30.66	5.5 ft.	3.6 ft.	2.3 ft.
16	10/5/2000	856+20.74	5.7 ft.	2.7 ft.	0.2 ft.
17	10/6/2000	899+98.37	0.0 ft.	0.0 ft.	0.0 ft.

TEAM - 2nd Survey Report
September 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2	10/4/2000	671+45.64	6.7 ft.	5.2 ft.	4.0 ft.
2B	3/15/2001	681+00.00	6.5 ft.	5.3 ft.	4.5 ft.
3	10/4/2000	690+86.10	12.0 ft.	10.5 ft.	9.2 ft.
3B	3/14/2001	699+75.00	11.6 ft.	10.4 ft.	8.9 ft.
4	10/4/2000	708+71.43	10.5 ft.	8.8 ft.	7.2 ft.
4B	3/13/2001	719+00.00	1.0 ft.	0.0 ft.	0.0 ft.
4C	3/13/2001	728+35.00	6.0 ft.	3.0 ft.	0.8 ft.
4D	3/13/2001	741+00.00	10.2 ft.	7.0 ft.	4.2 ft.
4E	3/13/2001	751+00.00	9.0 ft.	6.3 ft.	4.8 ft.
5	10/5/2000	761+80.40	10.8 ft.	9.0 ft.	7.0 ft.
5B	3/13/2001	770+50.00	6.7 ft.	5.0 ft.	3.5 ft.

Terra-Mar - Soil Survey Report
July 2001

Boring #	Date	Stations	PVR 1"	PVR 1 ½"	PVR 2"
2B1	4/6/2001	685+93	6.2 ft.	4.5 ft.	2.8 ft.
3A1	4/6/2001	695+31	9.5 ft.	6.0 ft.	2.8 ft.
3B1	4/6/2001	704+23	9.0 ft.	7.5 ft.	6.0 ft.
4A1	4/6/2001	713+85	5.5 ft.	4.5 ft.	3.6 ft.
4B1	4/1/2001	723+67	6.8 ft.	4.0 ft.	3.2 ft.
4C1	4/5/2001	734+67	6.8 ft.	5.3 ft.	3.6 ft.
4D1	4/5/2001	746+00	6.0 ft.	4.5 ft.	3.2 ft.
4E1	4/5/2001	756+40	6.9 ft.	5.3 ft.	3.5 ft.
5A1	4/5/2001	766+15	3.3 ft.	2.7 ft.	2.0 ft.