

**Subsurface Exploration and Foundation Analysis
First Baptist Church
On Hwy 434
LaCombe, Louisiana**

**First Baptist Church
P.O. Box 487
LaCombe, Louisiana 70445**

**Attention: Dr. Byron Brown, Pastor
Mr. George Dantin**



Integrated Testing and Engineering Company of Louisiana

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September 2, 2010

First Baptist Church
P.O. Box 487
LaCombe, Louisiana 70445

Attention: Dr. Byron Brown, Pastor
Mr. George Dantin

Re: Subsurface Exploration and Foundation Analysis
First Baptist Church
On Hwy 434
LaCombe, Louisiana

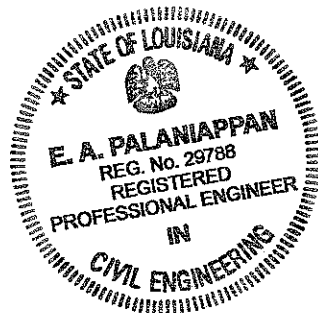
InTEC Project No. L101119

Gentlemen:

InTEC of Louisiana has completed a soil and foundation engineering report at the above referenced project site. The results of the exploration with recommendations are presented in this report.

We appreciate and wish to thank you for the opportunity to be of service to you on this project. If we can be of additional assistance during the materials testing-quality control phase of construction, please call us.

Respectfully Submitted,



Very Truly Yours,
InTEC of Louisiana

E.A. "Paul" Palaniappan, Ph.D., P.E.
CHIEF ENGINEER

Copies Submitted: Above (3)

Louisiana Registration No. 29788
Firm No. 407

EXECUTIVE SUMMARY

The soil conditions at the location of the proposed First Baptist Church on Hwy 434 in LaCombe, Louisiana, were explored by drilling 4 borings to depths of 6 to 20 feet. Laboratory tests were performed on selected specimens to evaluate the engineering characteristics of various soil strata encountered in our borings.

The proposed church may be supported by post-tensioned beam and slab foundation or stiffened grid type beam and slab foundation. Grade beams of the post tensioned beam and slab foundation or stiffened grid type beam and slab foundation founded at a depth of 18 or 24 inches below finished grade elevation may be sized for an allowable bearing capacity of 1125 or 1225 lbs per sq ft, respectively. A design plasticity index value of 26 is recommended. The P.T.I. design criteria soil parameters are presented in Table No 1.

Table No. 1

P.T.I. 2nd Edition:

<u>Design Plasticity Index</u>	<u>Differential Vertical Movement,(Ym) Inches</u>		<u>Edge Moisture Variation Distance, (Em) feet</u>	
	<u>Center Lift</u>	<u>Edge Lift</u>	<u>Center Lift</u>	<u>Edge Lift</u>
26	0.98	0.78	4.1	4.4

Groundwater was encountered at varying depths of 6 to 12-ft in our borings at the time of our drilling.

Detailed descriptions of subsurface conditions, engineering analysis, and design recommendations are included in this report.

INTRODUCTION

General

This report presents the results of our subsurface exploration and foundation analysis for First Baptist Church on Hwy 434 in LaCombe, Louisiana. This project was authorized by Dr. Byron Brown, Pastor.

Purpose and Scope of Services

The purpose of our geotechnical investigation was to evaluate the site's subsurface and ground water conditions and provide geotechnical engineering recommendations for the design and construction of the church. Based on the information provided to InTEC, it is understood that the proposed structure consists of a single story church building with an approximate foot print area of 22,700 sq ft and the associated parking areas. Our scope of services includes the following:

- 1) drilling and sampling of 4 borings - to depths of 6 to 20 feet;
- 2) observation of the ground water conditions during drilling operations;
- 3) performing laboratory tests such as Atterberg Limits, Unconfined Compression and Moisture Content tests;
- 4) review and evaluation of the field and laboratory test programs during their execution with modifications of these programs, when necessary, to adjust to subsurface conditions revealed by them;
- 5) compilation, generalization and analysis of the field and laboratory data in relation to the project requirements;

- 6) estimation of potential vertical movements;
- 7) development of recommendations for the design, construction, and earthwork phases of project; and
- 8) consultations with Prime Professional and members of the design team on findings and recommendations; and preparation of a written geotechnical engineering report for use by the members of the design team in their preparation of design, contract documents, and specifications.

SUBSURFACE EXPLORATION

Scope

The field exploration to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site, drilling the borings, performing standard penetration tests and obtaining disturbed Split-barrel and Shelby tube samples.

Four soil test borings were drilled at the approximate locations shown on the Boring Location Plan, Plate 1 included in the Illustration Section of this report. The borings were drilled to depths of 6 to 20 feet below the presently existing ground surface. Boring locations were selected by the project geotechnical engineer and established in the field by the drilling crew using normal taping procedures.

Drilling and Sampling

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional solid stem augers were used to advance the holes and samples of the subsurface

materials were obtained using a standard 2.0 inch O.D. Split-barrel sampler or 3.0 inch O.D. Shelby tube sampler. The samples were identified according to boring number and depth, encased in polyethylene plastic wrapping to protect against moisture loss, and transported to our laboratory in special containers.

In summary, the following samples as presented in Table No. 2 were collected as a part of our field exploration procedure:

Table No. 2

<u>Type of Sample</u>	<u>Number Collected</u>
Split-barrel Samples	15
Shelby tube samples	8

Field Tests and Measurements

Penetration Tests - During the sampling procedures, standard penetration tests were performed in the borings in conjunction with the split-barrel sampling. The standard penetration value (N) is defined as the number of blows of a 140 pound hammer, falling thirty inches, required to advance the split-spoon sampler one foot into the soil. The sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of the three successive increments of six inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Water Level Measurements - Water level observations were made during the boring operations and the results are noted on the boring logs. In relatively pervious soils, such as sandy soils, the indicated elevations are considered reliable ground water levels. In relatively impervious soils, the accurate determination of the ground water elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the ground water table and volumes of water will depend on the permeability of the soils.

Field Log

A field log was prepared for each boring. The log contained information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as silt, clay, gravel or sand and observations of ground water. It also contained an interpretation of subsurface conditions between samples. Therefore, the log included both factual and interpretive information.

Presentation of the Data

The final logs represent our interpretation of the contents of the field logs for the purpose delineated by our client. The final logs are included on Plates 2 thru 5 included in the Illustration Section. A key to classification terms and symbols used on the logs is presented on Plate 6.

LABORATORY TESTING PROGRAM

Purpose

In addition to the field exploration, a supplemental laboratory-testing program was performed to determine additional pertinent engineering characteristics of the foundation materials necessary in evaluating the design parameters.

Laboratory Tests

All phases of the laboratory-testing program were conducted in general accordance with the indicated applicable ASTM Specifications.

In the laboratory, each sample was observed and classified by a geotechnical engineer. As a part of this classification procedure, the natural water contents of selected specimens were determined. Liquid and plastic limit tests were performed on representative specimens to determine the plasticity characteristics of the different soil strata encountered. Unconfined Compression tests were performed to evaluate the strength characteristics of the underlying soils.

Presentation of the Data

In summary, the tests presented in the following page in Table No. 3 were conducted in the laboratory to evaluate the engineering characteristics of the subsurface materials:

Table No.3

<u>Type of Test</u>	<u>Number Conducted</u>
Natural Moisture Content	23
Atterberg Limits	9
Unconfined Compression	4

The results of all these tests are presented on appropriate boring logs.

GENERAL SUBSURFACE CONDITIONS

Soil Stratigraphy

The soils underlying this site may be grouped into three generalized strata with similar physical and engineering properties. The lines designating the interface between soil strata on the logs represent approximate boundaries. Transition between materials may be gradual. The soil stratigraphy information is presented in the boring logs, Plates 2 thru 5.

Stratum I consist of medium dense brown silty sand with some clay which extends to a depth of 2-ft in the vicinity of our borings. The clays of this stratum are plastic with a tested liquid limit value of 24 and a plasticity index value of 12.

The stratum II consists of tan to reddish tan sandy clay and tan to reddish tan sandy clay to clayey sand and extends to depths of 4 to 6-ft in the vicinity of our borings. These clays are plastic with tested liquid limits ranging from 28 to 37 and plasticity index ranges from 17 to 23. The shear strength from tests performed within this stratum ranges from 0.63 to 0.93.

The stratum III consists of tan to reddish tan silty sand and extends to 20-ft, the maximum depth explored.

Ground Water Observation

Ground water was encountered at depths ranging from 6 to 12-ft in our borings at the time of our field investigation. Ground water levels may fluctuate with seasonal climatic variations and changes in land use.

It is not unusual to encounter shallow groundwater during or after periods of rainfall. The surface water tends to percolate down through the surface until it encounters a relatively imperious layer.

FOUNDATIONS ON EXPANSIVE SOIL

General

There are many plastic clays that swell considerably when water is added to them and then shrink with the loss of water. Foundations constructed on these clays are subjected to large uplifting forces caused by the swelling.

In the characterization of a building site, two major factors that contribute to potential shrink-swell problems must be considered. Problems can arise if a) the soil has expansive or shrinkage properties and b) the environmental conditions that cause moisture changes to occur in the soil.

Evaluation Of The Shrink-Swell Potential Of The Soils

Subsurface sampling, laboratory testing and data analyses are used in the evaluation of the shrink-swell potential of the soils under the foundations.

The Mechanism Of Swelling

The mechanism of swelling in expansive clays is complex and is influenced by a number of factors. Basically, expansion is a result of changes in the soil-water system that disturbs the internal stress equilibrium. Clay particles in general have negative electrical charges on their surfaces and positively charged ends. The negative charges are balanced by actions in the soil water and give rise to an electrical interparticle force field. In addition, adsorptive forces exist between the clay crystals and water molecules, and Van Der Waals surface forces exist between particles. Thus, there exists an internal electro-chemical force system that must be in equilibrium with the externally applied stresses and capillary tension in the soil water. If the soil water chemistry is changed either by changing the amount of water or the chemical composition, the interparticle force field will change. If the change in internal forces is not balanced by a corresponding change in the state of stress, the particle spacing will change so as to adjust the interparticle forces until equilibrium is reached. This change in particle spacing manifests itself as a shrinkage or swelling.

Antecedent Rainfall Ratio This is a measure of the local climate and is defined as the total monthly rainfall for the month of and the month prior to laying the slab divided by twice the average monthly rate measured for the period. The intent of this ratio is to give a relative measure

of ground moisture conditions at the time the slab is placed. Thus, if a slab is placed at the end of a wet period, the slab should be expected to experience some loss of support around the perimeter as the wet soil begins to dry out and shrink. The opposite effect could be anticipated if the slab is placed at the end of an extended dry period; as the wet season occurs, uplift around the perimeter may occur as the soil at the edge of the slab gains in moisture content.

Age of Slab The length of time since the slab was cast provides an indication of the type of swelling of the soil profile that can be expected to be found beneath the slab.

Initial Moisture Condition And Moisture Variation

Volume change in an expansive soil mass is the result of increases or decreases in water content. The initial moisture content influences the swell and shrink potential relative to possible limits, or ranges, in moisture content. Moisture content alone is useless as an indicator or predictor of shrink-swell potential. The relationship of moisture content to limiting moisture contents such as the plastic limit and liquid limit must be known.

If the moisture content is below or near plastic limit, the soils have high potential to swell. It has been reported that expansive soils with liquidity index* in the range of 0.20 to 0.40 will tend to experience little additional swell.

* LIQUIDITY INDEX = $\frac{\text{NATURAL WATER CONTENT} - \text{PLASTIC LIMIT}}{\text{LIQUID LIMIT} - \text{PLASTIC LIMIT}}$

The availability of water to an expansive soil profile is influenced by many environmental and man-made factors. Generally, the upper few feet of the profile are subjected to the widest ranges of moisture variation, and is least restrained against movement by overburden. This upper stratum of the profile is referred to as the active zone. Moisture variation in the active zone of a natural soil profile is affected by climatic cycles at the surface, and fluctuating groundwater levels at simply by placing a barrier such as a building floor slab or pavement between the soil and atmospheric environment. Other obvious and direct causes of moisture variation result from altered drainage conditions or man-made sources of water, such as irrigation or leaky plumbing. The latter factors are difficult to quantify and incorporate into the analysis, but should be controlled to the extent possible for each situation. For example, proper drainage and attention to landscaping are simple means of minimizing moisture fluctuations near structures, and should always be taken into consideration.

Man Made Conditions That Can Be Altered

There are a number of factors that can influence whether a soil might shrink or swell and the magnitude of this movement. For the most part, either the owner or the designer has some control over whether the factor will be avoided altogether or if not avoided, the degree to which the factor will be allowed to influence the shrink-swell process.

Lot Drainage This provides a measure of the slope of the ground surface with respect to available free surface water that may accumulate around the slab. Most builders are aware of the importance

of sloping the final grade of the soil away from the structure so that rain water is not allowed to collect and pond against or adjacent to the foundations. If water were allowed to accumulate next to the foundation, it would provide an available source of free water to the expansive soil underlying the foundation. Similarly, surface water drainage patterns or swales must not be altered so that runoff is allowed to collect next to the foundation.

Topography This provides a measure of the downhill movement that is associated with light foundations built on slopes in expansive soil areas. The designer should be aware that as the soil swells, it heaves perpendicularly to the ground surface or slope, but when it shrinks, it recedes in the direction of gravity and gradually moves downslope in a sawtooth fashion over a number of shrink-swell cycles. In addition to the shrink-swell influence, the soil will exhibit viscoelastic properties and creep downhill under the steady influence of the weight of the soil. Therefore, if the building constructed on this slope is not to move downhill with the soil, it must be designed to compensate for this lateral soil influence.

Pre-Construction Vegetation Large amount of vegetation existing on a site before construction may have desiccated the site to some degree, especially where large trees grew before clearing. Constructing over a desiccated soil can produce some dramatic instances of heave and associated structural distress and damage as it wets up.

Post-Construction Vegetation The type, amount, and location of vegetation that has been allowed to grow since construction can cause localized desiccation. Planting trees or large shrubs near a building can result in loss of foundation support as the tree or shrub removes water from the soil and dries it out. Conversely, the opposite effect can occur if flowerbeds or shrubs are planted next to the foundation and these beds are kept well watered or flooded. This practice can result in swelling of the soil around the perimeter where the soil is kept wet.

Summation It is beyond the scope of this investigation to do more than point out that the above factors have a definite influence on the amount and type of swell to which a slab-on-ground is subjected during its useful life. The design engineer must be aware of these factors as he develops his design and make adjustments as necessary according to the results of special measurements or from his engineering experience and judgment.

DESIGN ENGINEERING ANALYSIS

Foundation Design Considerations

Review of the borings and test data indicates that the following factors will affect the foundation design and construction at this site:

- 1) Subsoils of moderate plasticity underlie the site at shallow depths. Structure supported at shallow depths will be subjected to potential vertical movements on the order of 1 to 1 ¼ inches if water is available. Building owners are advised to

maintain a relatively constant water content around the church by maintaining proper drainage (the soil around the structure should not become too dry or too wet).

- 2) The strengths of the underlying soils are adequate to support shallow foundations.
- 3) Ground water seepage was encountered at depths ranging from 6 to 12-ft in our borings during the subsurface exploration phase.

Structural Information

Based on the information provided, it is understood that the proposed structure will be a single story church building. This structure is expected to create light to moderately heavy loads to be carried by the foundation system.

This structure will utilize wood frame construction and brick, rock or stucco exterior walls. It is assumed that the maximum column loads will not exceed 50 kips, while maximum exterior wall loading will be in the range of 1.0 kips per foot.

FOUNDATION RECOMMENDATIONS

General

A grid type beam and slab foundation or Post Tensioned Beam and Slab Foundation is used to support relatively light structures upon subgrades where soil conditions are relatively uniform, and where uplift and settlement can be tolerated. The intent of a stiffened slab-on-grade foundation or Post Tensioned Beam and Slab Foundation is to allow the structures and foundation to move up

and down freely with soil movements while providing sufficient stiffness to limit differential movements within the superstructure. This foundation type may be the most economical and practical support for the proposed structure.

Spread footings and continuous footings founded at a depth of 2-ft was considered to support the proposed structure. Since potential vertical movements on the order of 1 to 1 ¼ inches will be anticipated at this site, structures with this type of foundation system may be subjected to large Differential Movements. If enough Reinforcement can be provided to tolerate the large differential movements, an allowable bearing capacity value of 1225 lbs per sq ft is recommended for spread footing at 2-ft depth below finish grade.

Post-Tensioned Beam and Slab Foundation

Post-tensioned slab-on-grade foundation may be used to support the proposed structure. Pertinent design parameters were evaluated and are presented in the following paragraphs.

Differential vertical movements should be expected for shallow type foundations at this site due to expansive soil conditions that were encountered. Differential vertical movements have been estimated for both the center lift and edge lift conditions for post-tensioned slab-on grade construction at this site. These movements were estimated using the procedures and criteria discussed in the Post-Tensioning Institute Manual entitled "Design and Construction of Post-Tensioned Slabs-on-Ground", 2nd Edition. This procedure utilizes the soils data obtained from both the field and laboratory tests performed on the soil samples.

Differential vertical movements have been estimated for the center lift and edge lift conditions; these values are presented for the design plasticity index value of 31 in Table No. 4.

Table No. 4

P.T.I. 2nd Edition:

<u>Design Plasticity Index</u>	<u>Differential Vertical Movement,(Ym) Inches</u>		<u>Edge Moisture Variation Distance, (Em) feet</u>	
	<u>Center Lift</u>	<u>Edge Lift</u>	<u>Center Lift</u>	<u>Edge Lift</u>
26	0.98	0.78	4.1	4.4

Design and Construction of Post Tensioned Slabs-on-Ground-Third Edition Manual

was also used to evaluate the Em and Ym values. These values are presented in Table No. 5 in the following page.

Table No. 53rd Edition

<u>Center Lift (Ym values)</u>	<u>Inches</u>
Wet to dry soil moisture condition	0.58
Wet to dry and 18* inch vertical moisture barrier applied to final moisture profile	0.50
Wet to dry and 24** inch vertical moisture barrier applied to final moisture profile	0.36
<u>Edge Lift (Ym values)</u>	
Dry to wet soil moisture condition	1.18
Dry to wet and 18* inch vertical moisture barrier applied to final moisture profile	1.07
Dry to wet and 24** inch vertical moisture barrier applied to final moisture profile	0.84

Em – Center Lift = 7.9 -ft

Em – Edge Lift = 4.7 -ft

- * minimum 18 inches penetration into the undisturbed clays or compacted select fill and minimum 24 inches below finish grade
- ** minimum 24 inches penetration into the undisturbed clays or compacted select fill and minimum 30 inches below finish grade

The grade beams may be founded at a minimum depth of 18-inches below the finish grade elevation and supported on or within the natural undisturbed soils or compacted select fill. The grade beam depth below the finish grade elevation and the respective allowable bearing capacity values are presented in Table No. 6.

Table No. 6

<u>Depth in Inches below Finish Grade</u>	<u>Allowable Bearing Capacity in P.S.F.</u>
18	1125
24	1225

The soil and environmental parameters which are used to arrive at the values in Table No. 3 are listed in Table No. 7.

Table No. 7

Thornthwaite Index, IM	+35
Depth to Constant Soil Suction	7 feet
Constant Soil Suction	3.2 PF
Moisture Velocity.....	0.7 inch/month
Edge Moisture Variation Distance (Center Lift).....	4.1-ft
Edge Moisture Variation Distance (Edge Lift).....	4.4 -ft
Predominant Clay Material	Montmorillonite
Percent Clay.....	59

Stiffened Grid Type Beam and Slab Foundation

If it is desirable to design the foundation system utilizing the simplifying assumption that the loads are carried by the beams, a maximum allowable unit load as presented in Table No. 8 is recommended for grade beams, founded within or on the existing clays or compacted select fill at a depth of 18 to 24 inches below finish grade elevation.

Table No. 8

<u>Depth below finish grade elevation, ft</u>	<u>Allowable bearing capacity, PSF</u>
18	1125
24	1225

The beams should be a minimum of 12 inches wide to prevent local shear failure. A design plasticity index value of 26 is recommended.

A climatic rating value of 25 and soil support index value of 0.70 are also recommended.

Utilities

Utilities, which project through slab-on-grade floors, should be designed with either some degree of flexibility or with sleeves in order to prevent damage to these lines should vertical movement occur.

Contraction, Control or Expansion Joints

Contraction, control or expansion joints should be designed and placed in various portions of the structures. Properly planned placement of these joints will assist in controlling the degree and location of material cracking which normally occurs due to soil movements, material shrinkage, thermal affects, and other related structural conditions.

CONSTRUCTION CONSIDERATIONS

Site Drainage

A majority of foundation related problems in the local area are attributable, at least in part, to poor drainage and expansive soils. Poor drainage, and the resulting ponded water, can cause high plasticity clays to swell or even induce settlement in very low plasticity silts or coarser grained materials. We recommend that an effective site drainage plan be devised by others prior to commencement of construction to provide positive drainage away from the foundation perimeter and off the site, both during and after construction.

Site Preparation

In any areas where soil-supported floor slabs or pavement are to be used vegetation and all loose or organic material should be stripped and removed from the site. Subsequent to stripping operations, the subgrade should be proof rolled to 95 percent of the maximum dry density as determined by ASTM D 698, within two percent below or three percent above optimum moisture content. The exposed subgrade should not be allowed to dry out prior to placing structural fill.

Proof rolling can generally be accomplished using a heavy (25 ton or greater total weight) pneumatic tired roller or fully loaded dumptruck making several passes over the areas. Where soft or compressible zones are encountered, these areas should be removed to a firm subgrade. Wet or very moist superficial materials may need to be undercut and either dried, or replaced with material which can be properly compacted. Any resulting void areas should be backfilled to finish subgrade in 6 inch compacted lifts compacted to 95 percent maximum dry density as determined by ASTM D 698.

Select or Structural Fill

Any select or structural fill material used at the site should have a maximum liquid limit of 40 percent and a maximum plasticity index in between 5 and 20. The select fill should be placed in 8 inch loose lifts and compacted at least 95 percent of the maximum dry density as determined by ASTM D 698. The compaction water content should be within two percent below or three percent above the optimum moisture content. Each lift should be tested for compaction compliance by an InTEC representative and approved before placement of subsequent lifts.

Ground Water

In any areas where significant cuts (2 ft or more) are made to establish final grades for building pads, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. Subsurface drains may be

required to intercept seasonal groundwater seepage. The need for these or other dewatering devices on building pads should be carefully addressed during construction. Our office could be contacted to visually inspect final pads to evaluate the need for such drains. (The seepage may happen several years after construction if the rainfall rate or drainage pattern changes around the residence).

Earthwork and Foundation Acceptance

Exposure to environment may weaken the soils at the foundation bearing level if the excavation remains open for long periods of time. Therefore, it is recommended that all foundation excavations are extended to final grade and the footings constructed as soon as possible to minimize potential damage to bearing soils. The foundation bearing level should be free of loose soil; ponded water or debris sand should be inspected and approved prior to concreting by the geotechnical engineer or his representative.

Foundation concrete should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusion during exposure or by desiccation, the unsuitable soils must be removed from the foundation excavation and replaced prior to placement of concrete.

Subgrade preparation and fill placement operations should be monitored by the soils engineer or his representative. As a guideline, at least one in-place density test should be performed for each 2500 square feet of compacted surface per lift. Any areas not meeting the required compaction should be recompacted and retested until compliance is met.

DRAINAGE AND MAINTENANCE

Final drainage is very important for the performance of the proposed structure and the pavement. Landscaping, plumbing, and downspout drainage is also very important. It is vital that all roof drainage be transported away from the building so that no water ponds around the buildings which can result in soil volume change under the buildings. Plumbing leaks should be repaired as soon as possible in order to minimize the magnitude of moisture change under the slab. Large trees and shrubs should not be planted in the immediate vicinity of the structures, since root systems can cause a substantial reduction in soil volume in the vicinity of the trees during dry periods.

Adequate drainage should be provided to reduce seasonal variations in moisture content of foundation soils. All pavement and sidewalks within 10-ft of the structures should be sloped away from the structures to prevent ponding of water around the foundations. Final grades within 10-ft of the structures should be adjusted to slope away from structures preferably at a minimum slope of 3 percent. Maintaining positive surface drainage throughout the life of the structures is essential.

In areas with pavement or sidewalks adjacent to the new structures, a positive seal must be provided and maintained between the structures and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. Post-construction movement of pavement and flatwork is not uncommon. Maximum grades practical should be used for paving and flatwork to prevent areas where water can pond. In addition, allowances in final grades should take into consideration post construction movement of flatwork particularly if such movement would be critical. Normal maintenance should include inspection of all joints in paving and sidewalks, etc. as well as re-sealing where necessary.

Several factors relate to civil and architectural design and/or maintenance, which can significantly affect future movements of the foundation and floor slab systems:

1. Where positive surface drainage cannot be achieved by sloping the ground surface adjacent to the buildings, a complete system of gutters and downspouts should carry runoff water a minimum of 10-ft from the completed structures.
2. Planters located adjacent to the structures should preferably be self contained. Sprinkler mains should be located a minimum of five feet from the building line.
3. Planter box structures placed adjacent to building should be provided with a means to assure concentrations of water are not available to the subsoils stratigraphy.
4. Large trees and shrubs should not be allowed closer to the foundations than a horizontal distance equal to roughly their mature height due to their significant moisture demand upon maturing.
5. Moisture conditions should be maintained "constant" around the edge of the slabs. Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.
6. Roof drains should discharge on pavement or be extended away from the structures. Ideally, roof drains should discharge to storm sewers by closed pipe.

Trench backfill for utilities should be properly placed and compacted as outlined in this report and in accordance with requirements of local City Standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should be prevented from becoming a conduit and allowing an access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water traveling in the trench backfill and entering beneath the structures.

The P.V.R. values estimated and stated under Design Engineering Analysis are based on provision and maintenance of positive drainage to divert water away from the structures and the

pavement areas. If the drainage is not maintained, the wetted front may move below the assumed twelve feet depth, and resulting P.V.R. will be much greater than 2 or 3 times the stated values under Vertical Movements. Utility line leaks may contribute water and cause similar movements to occur.

LIMITATIONS

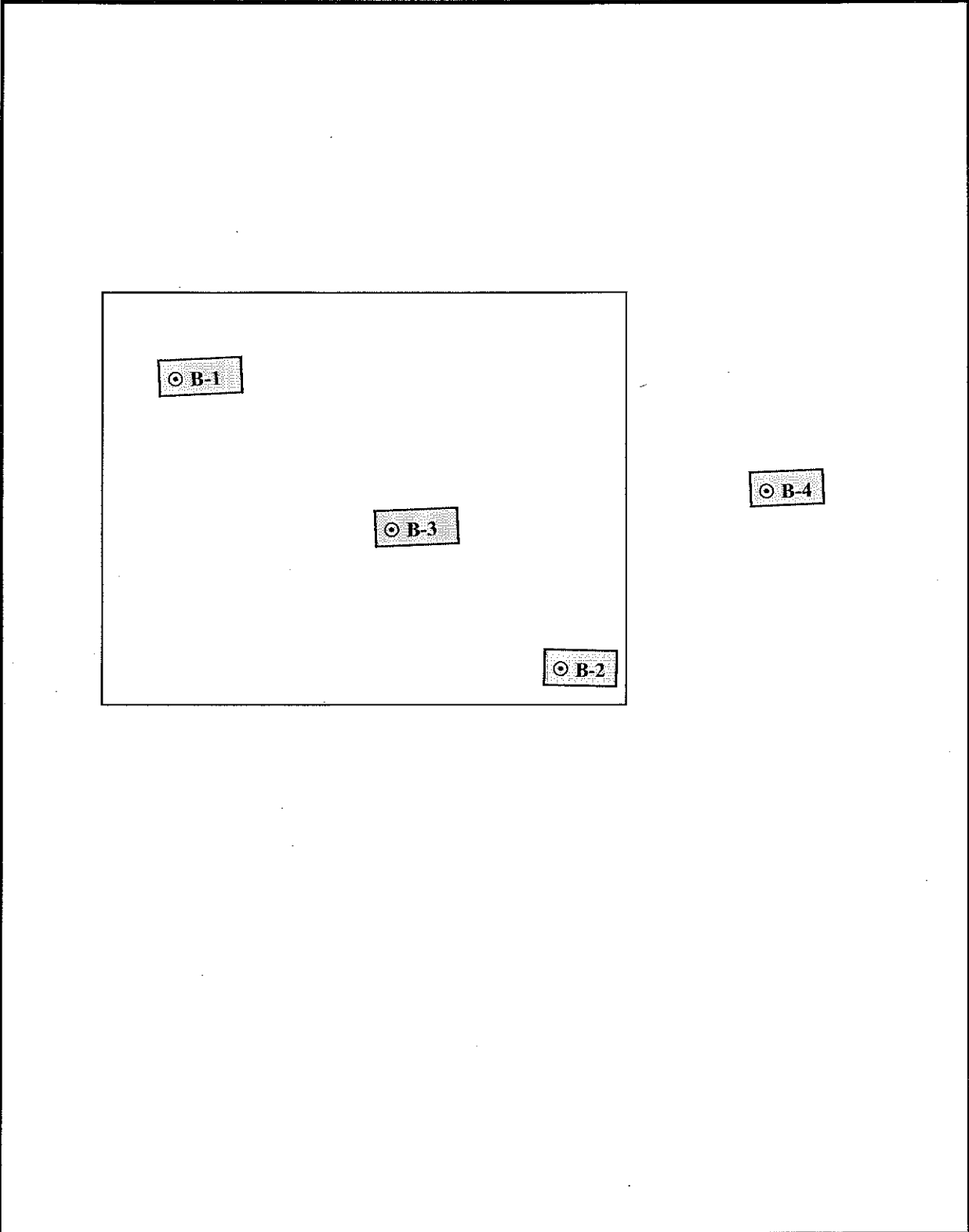
The exploration and analysis of the subsurface conditions reported herein are considered sufficient to form a reasonable basis for the foundation design. The recommendations submitted are based upon the available soil information and design details furnished by Dr. Byron Brown, Pastor.

Final plans for the proposed residence should be reviewed by the geotechnical engineer so that he may determine if changes in the foundation recommendations are required. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the attention of the geotechnical engineer.

The geotechnical engineer declares that the findings, recommendations, specifications or professional advise contained herein, have been made after being prepared in accordance with generally accepted professional engineering practice, in the fields of geotechnical engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

This report has been prepared for the exclusive use of First Baptist Church and their design team for the specific application to the proposed First Baptist Church on Hwy 434 in LaCombe, Louisiana. This report should not be used by others or at any other location.

Illustration Section



Boring Location Plan First Baptist Church On Highway 434 LaCombe, LA	Approximate Boring Locations—Drillers's Sketch	
	InTEC Project Number: L101119	Date: 08/14/2010

LOG OF BORING NO. B-2



PROJECT: First Baptist Church on Hwy 434

DATE: 07-30-2010

LOCATION: LaCombe, Louisiana

PROJECT NO.: L101119

SUBSURFACE PROFILE				UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX	Water Content %
DEPTH	SYMBOL	SAMPLES	SOIL DESCRIPTION <i>Surf. Elev.</i>							
5	SS		Medium Dense Brown Silty Sand - with Some Clay	99		11	0.93	28	17	20
	ST		Stiff Tan to Reddish Tan Sandy Clay to Clayey Sand							
5	ST					16		37	21	40
	SS		Medium Dense Light Tan to Reddish Tan Silty Sand - with a Trace of Clay			25				60
10	SS					31		22	09	80
15	SS									
20	SS					29				
25										
30										
35										
40										
45										
50										

Completion Depth 20'

Ground Water Observed 6-ft

Date: 07-30-2010

S.S. by P.P.- Shear Strength in TSF
by Hand Penetrometer

S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample

L.L.- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

Plate: 3

LOG OF BORING NO. B-3



PROJECT: First Baptist Church on Hwy 434

DATE: 07-30-2010

LOCATION: LaCombe, Louisiana

PROJECT NO: L101119

SUBSURFACE PROFILE				UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX	Water Content %
DEPTH	SYMBOL	SAMPLES	SOIL DESCRIPTION Surf. Elev.							
0			Medium Dense Brown Silty Sand	99	0.8	13	1.11	37	23	
1		SS								
2		ST	Stiff to Very Stiff Tan to Reddish Tan Sandy Clay							
3		ST	- with Some Tan Sand							
4		SS								
5		SS	Medium Dense Light Tan to Reddish Tan Silty Sand							
9		SS	- with a Trace of Clay	29	29	17	06			
14		SS		29						
15		SS		32						
20										
25										
30										
35										
40										
45										
50										

Completion Depth 15'

Ground Water Observed 9-ft

Date: 07-30-2010

S.S. by P.P.- Shear Strength in TSF
by Hand Penetrometer

S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample

L.L- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

LOG OF BORING NO. B-4



PROJECT: First Baptist Church on Hwy 434

DATE: 07-30-2010

LOCATION: LaCombe, Louisiana

PROJECT NO: L101119

SUBSURFACE PROFILE				UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX	Water Content %			
DEPTH	SYMBOL	SAMPLES	SOIL DESCRIPTION Surf. Elev.							20	40	60	80
0													
0-1		SS	Medium Dense Brown Silty Sand - with Some Clay			14							
1-2		ST	Stiff to Very Stiff Tan to Reddish Tan Sandy Clay to Clayey Sand	98	0.9		0.63	35	22				
2-3		ST											
3-4													
4-5													
5-6													
6-7													
7-8													
8-9													
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44-45													
45-46													
46-47													
47-48													
48-49													
49-50													

Completion Depth 6'

Ground Water Observed No

Date: 07-30-2010

S.S. by P.P.- Shear Strength in TSF
by Hand Penetrometer

S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample










L.L- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

KEY TO CLASSIFICATIONS AND SYMBOLS

Soil Fractions

<u>Component</u>	<u>Size Range</u>
Boulders	Greater than 12"
Cobbles	3" - 12"
Gravel	3" - #4 (4.76mm)
Coarse	3" - 3/8"
Fine	3/8" - #4
Sand	#4 - #200 (0.075mm)
Coarse	#4 - #10 (2.00mm)
Medium	#10 - #40 (0.425mm)
Fine	#40 - #200 (0.075mm)
Silt and Clay	Less than #200

Soil or Rock Types
(Shown in symbols column)
(Predominate Soil Types Shown Heavy)

		
Silt	Clay	Marl
		
Shale	Sand	Sandy Gravel
		
Limestone	Sandy Clay	Gravel

TERMS DESCRIBING SOIL CONSISTENCY

<u>Description</u> (Cohesive Soils)	<u>Unconfined</u> <u>Compression</u> <u>TSF</u>	<u>Blows/Ft.</u> <u>Std. Penetration</u> <u>Test</u>	<u>Description</u> (Cohesionless Soils)	<u>Blows/Ft.</u> <u>Std. Penetration</u> <u>Tests</u>
Very Soft	0.25	<2	Very Loose	0-4
Soft	0.25 - 0.50	2-4	Loose	4-10
Firm	0.50 - 1.00	4-8	Medium Dense	10-30
Stiff	1.00 - 2.00	8-15	Dense	30-50
Very Stiff	2.00 - 4.00	15-30	Very Dense	50
Hard	>4.00	>30		

SOIL STRUCTURE

Calcareous	Containing deposits of calcium carbonate; generally nodular.
Slickenside	Having inclined planes of weakness that are slick and glossy in appearance.
Laminated	Composed of thin layers of varying color and texture.
Fissured	Containing shrinkage cracks frequently filled with fine sand or silt. Usually more or less vertical.
Interbedded	Composed of alternate layers of different soil types.
Jointed	Consisting of hair cracks that fall apart as soon as the confining pressure is removed.
Varved	Consisting of alternate thin layers of sand, silt or clay formed by variations in sedimentations during the various seasons of the year, of often exhibiting contrasting colors when partially dried. Each layer is generally less than 1/2" in thickness.
Stratified	Composed of, or arranged in layers (usually 1 inch or more)
Well-graded	Having a wide range of grain sizes and substantial amount of all intermediate particle sizes.
Poorly or Gap-graded	Having a range of sizes with some intermediate sizes missing.
Uniformly-graded	Predominantly of one grain size.

First Baptist Church
On Highway 434
LaCombe, LA

InTEC Project Number:
L101119

Date:
08/14/2010