Integrated Testing and Engineering Company of San Antonio, L.P.
Geotechnical & Environmental Engineering • Construction Services • Geologic Assessment

November 29, 2023

San Antonio LD, LLC
4058 North College Avenue, Suite 300, Box 9
Fayetteville, Arkansas 72703

Attention: **Mr. David C. Frye**

Re: Subsurface Exploration and Pavement Analysis
Proposed New Streets
31.404 Acre Tract (Hidden Oasis, Unit 3)
Deer Point
San Antonio, Texas

InTEC Project No. S191460-P-A1

Ladies & Gentlemen:

Integrated Testing and Engineering Company of San Antonio (InTEC) has completed a **subsurface exploration and pavement thickness evaluation report** (InTEC Project No. S191460-P dated November 05, 2019) at the above referenced project site. As requested, concrete pavement sections for Local A type streets are presented in this addendum. All other recommendations remain the same as in the original 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 foundations explorations and materials testing-quality control phase of construction, please call us.

Sincerely,
InTEC of San Antonio

Murali Subramaniam, Ph. D., P.E.
Vice President

11/29/2023

12028 Radium • San Antonio, Texas 78216 • Office (210) 525-9033 • Fax (210) 525-9032

Table No. 1 – Summary of Recommended Options – Rigid Pavement

Street Classification	Reinforced Concrete, inches	Subgrade Thickness, inches
Local Type A (without bus traffic)	6.0	6*
Local Type A (with bus traffic)	8.0	6*

Subgrade Notes (*):

- Based on the soils encountered in the borings, we anticipate the final pavement subgrade Plasticity Index value to be 20 or less.
- If the final pavement subgrade Plasticity Index value is less than or equal to 20, then subgrade stabilization is not needed.
- Cut and fill data are not available at this time.
- However, ff the final pavement subgrade Plasticity Index value is greater than 20, then one of the following options is recommended:
    - The subgrade treatment using lime or cement. Lime or cement application rate of 6 percent lime (27 lbs per sq yard for 6-inch depth). Subgrade soils should be tested for sulfate content prior to stabilization. If the sulfate content is higher than 3000 ppm, then an alternate procedure will be needed.
    - The clayey soils may be removed and replaced with fill material with a minimum CBR value of 4.0 and a maximum Plasticity Index value of 20.

General Notes (**):

- Input parameters used in pavement section calculations are shown in Table No. 2. Please call us to provide pavement recommendations, if needed, for different input values.
- If repetitive truck or heavy truck traffic is anticipated, please contact us for revised pavement recommendations.
- Pavement section recommendations are based on a subgrade CBR value of 4.0. The pavement recommendations are not based on the shrink / swell characteristics of the underlying soils. The pavement can experience cracking and deformation due to shrinkage and swelling characteristics of the soils as described in the *Vertical Movements* section of this report. Use of geogrid will help reduce the shrink / swell related reflective cracking.
- If water is allowed to get underneath the asphalt or if moisture content of the base or subgrade changes significantly, then pavement distress will occur. Moisture penetration underneath the asphalt pavement surface may be reduced by installing a vertical moisture barrier, such as deeper curbs; curbs extending a minimum of 6 inches into subgrade.

Geogrid:

- City of San Antonio: One layer of geogrid meeting TxDOT DMS 6240 Type 2 guidelines, installed on top of compacted (moisture conditioned or treated) subgrade as per manufacturer's guidelines. Bexar County requires the use of Tensar Triax TX5 geogrid.

Fill Material:

- If fill is used to raise the grade, approved fill material should be free of deleterious material with a minimum CBR value of 4.0 and Plasticity Index values of 20 or less. Any stratum I clays (with Plasticity Index values greater than 20) should be removed prior to fill placement. The gravel size should not exceed 3 inches in diameter. The material should be placed as per applicable city or county guidelines.

Subgrade Delineation:

- At the time of construction, the final pavement subgrade should be verified by the geotechnical engineer.

Table No. 2 – Input Parameters used in Rigid Pavement Section Calculation

	Local Type A (without bus traffic)	**Local Type A** (with bus Traffic)
ESAL	ESAL= 150,000	ESAL= 1,500,000
Reliability Level	R-70	R-70
Initial and Terminal Serviceability	4.5 and 2.0	4.5 and 2.0
Standard Deviation	0.35	0.35
Service Life	30 years	30 years

Reinforced Concrete

Concrete pavement, material, and installation, should conform to Item 209 of the City of San Antonio Standard Specifications for Construction, June 2008. Minimum 28-day compressive strength value of 4,000 psi recommended.

Concrete Pavement

Concrete pavement slabs should be provided with adequate steel reinforcement. Proper finishing of concrete pavements requires the use of sawed and sealed joints which should be designed in accordance with current Portland Cement Association guidelines. Dowel bars should be used to transfer loads at transverse joints. Related civil design factors such as drainage, cross-sectional configurations, surface

elevations and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required, especially for open jointed areas which may allow surface water infiltration into the subgrade.

Table No. 3 – Concrete Pavement Reinforcement

Reinforcement:	#3 reinforcing steel bars (grade 60) at 18 inches on center each way (at 12 inches on center each way for 8 inch thick concrete and 10 inches on center each way for 10 inch thick concrete)
Contraction joint spacing:	12 feet each way for 6 inch thick concrete 15 feet each way for 8 inch thick concrete 20 feet each way for 10 inch thick concrete The saw cuts should be planned based on features such as inlets, manholes, valves, etc. The saw cuts are recommended to be made the same day (before the concrete starts to set)
Contraction joint depth:	At least one-fourth (¼) of pavement thickness
Contraction joint width:	One-fourth (¼) inch or as required by joint sealant manufacturer
Expansion joint:	Expansion joints are not recommended; may be placed at end of concrete pours
Isolation joint:	Features such as concrete inlet structures, man-holes, and valve covers should be isolated using isolation joints.

Subgrade Preparation

It is important that any existing pavement and organic and compressible soils are removed and the exposed subgrade is properly prepared prior to pavement installation. The subgrade should be prepared as described in the applicable city guidelines. Base course material, if recommended, should be placed immediately upon completion of the subgrade compaction operation to prevent drying of the soils due to exposure.

The finish grade elevation of the subgrade should be such that water drains downward freely towards a drainage area. At the drainage area, 3x5 rock may be provided at the subgrade level and the collected water at the drainage area should be taken out (such as into the existing concrete drainage channel). If any voids in the subgrade should be filled, they should be filled in with the same subgrade material and compacted in lifts.

The approved fill material should be placed in 8 inch loose lifts (6 inches compacted) and compacted as recommended in the Site Preparation section of the Construction Guidelines presented in this report. If the

fill depth exceeds 4 feet, the potential subgrade settlement should be considered. Please contact InTEC with the cut and fill information to evaluate the effect of proposed cut and fill on the recommendations and to provide fill material and compaction recommendations.

Perimeter Drainage

It is important that proper perimeter drainage be provided so that infiltration of surface water from compacted areas surrounding the pavement is minimized, or if this is not possible, curbs should extend through the base and into the subgrade. A crack sealant compatible to both asphalt and concrete should be installed at the concrete-asphalt interfaces.

Wherever there are drastic grade changes in the pavement area (such as from 3 to 4 percent grade to 1 to 2 percent grade) 3 x 5 inch gravel subgrade with a subsurface drain system (such as Akwadrain® on the sides of the pavement) and outlet should be considered. This aspect will provide for a better drainage system in this area. Please contact InTEC for drainage recommendations.

Concrete Section Calculations

Subsurface Exploration and Pavement Analysis Addendum: Concrete Pavement Sections 31.404 Acre Tract (Hidden Oasis, Unit 3) Deer Point San Antonio, Texas		
	InTEC Project Number: **S191460-P-A1**	Date: 11/29/2023

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Pavement Design/Evaluation

Concrete Thickness	5.01	**inches**	**Load Transfer Coefficient**	2.90	
Total Rigid ESALs	150,000		**Modulus of Subgrade Reaction**	250	**psi/in.**
Reliability	70.00	**percent**	**Drainage Coefficient**	1.00	
Overall Standard Deviation	0.35		**Initial Serviceability**	4.50	
Flexural Strength	400	**psi**	**Terminal Serviceability**	2.00	
Modulus of Elasticity	4,000,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	0.0
Unadjusted Modulus of Subgrade Reaction	0
Depth to Rigid Foundation	0.00
Loss of Support Value (0,1,2,3)	0.0

Modulus of Subgrade Reaction	250	**psi/in.**

Subsurface Exploration and Pavement Analysis
Addendum: Concrete Pavement Sections
31.404 Acre Tract (Hidden Oasis, Unit 3)
Deer Point
San Antonio, Texas

Local A—No Bus Traffic

InTEC Project Number:
S191460-P-A1

Date:
11/29/2023

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Pavement Design/Evaluation

Concrete Thickness	7.80	**inches**	**Load Transfer Coefficient**	2.90	
Total Rigid ESALs	1,500,000		**Modulus of Subgrade Reaction**	250	**psi/in.**
Reliability	70.00	**percent**	**Drainage Coefficient**	1.00	
Overall Standard Deviation	0.35		**Initial Serviceability**	4.50	
Flexural Strength	400	**psi**	**Terminal Serviceability**	2.00	
Modulus of Elasticity	4,000,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	0.0
Unadjusted Modulus of Subgrade Reaction	0
Depth to Rigid Foundation	0.00
Loss of Support Value (0,1,2,3)	0.0

Modulus of Subgrade Reaction	250	**psi/in.**

Subsurface Exploration and Pavement Analysis Addendum: Concrete Pavement Sections 31.404 Acre Tract (Hidden Oasis, Unit 3) Deer Point San Antonio, Texas	**Local A—with Bus Traffic**	
	InTEC Project Number: **S191460-P-A1**	Date: 11/29/2023

Appendix

Subsurface Exploration and Pavement Analysis Addendum: Concrete Pavement Sections 31.404 Acre Tract (Hidden Oasis, Unit 3) Deer Point San Antonio, Texas		
	InTEC Project Number: **S191460-P-A1**	Date: 11/29/2023

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org