June 10, 2025

HDC HWY 211, LLC
100 NE Loop 410, Suite 1080
San Antonio, Texas 78216

Attention: **Mr. L. Michael Cox**

Re: Subsurface Exploration and Pavement Analysis
Proposed New Streets
Briggs Ranch East, Phase 1, Unit 2 Collector
San Antonio, Texas

InTEC Project No. S251074-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. S251074 dated March 28, 2025) at the above referenced project site. As requested, Arterial pavement sections 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 or answer any questions, please call us.

Sincerely,
InTEC of San Antonio

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

STATE OF TEXAS
MURALI SUBRAMANIAM
102417
LICENSED
PROFESSIONAL ENGINEER
InTEC of SAN ANTONIO
F-7623

06/26/2025

Table No. 1 – Minimum Flexible Pavement Recommendations – CBR = 2.0 **

Street Classification	Asphaltic Concrete			Aggregate Base, Inches	Geogrid	Stabilized Subgrade, Inches	Structural Number
	Type D, inches	Type C, inches	Type B, inches				
Arterial	2.00	3.00	-	22.50	No	Stabilized 8"	5.99
	2.00	3.00	-	18.50	Yes	Stabilized 8"	5.98
	-	4.00	6.00	11.00	No	Stabilized 8"	5.94
	2.00	2.00	10.50	-	No	Stabilized 8"	5.97
	-	4.00	10.50	-	No	Stabilized 8"	5.97

Design Notes:

- The results of our laboratory testing and engineering evaluation indicate that the underlying shallow clays are **moderately plastic to highly plastic in character.** Potential vertical movement on the order of **2 ½ to 5 inches** is estimated at existing grade elevation.
- Cut and fill information is not available at this time. Anticipated potential vertical movements and recommended pavement sections should be re-evaluated after cut and fill information is made available. Final Subgrade Plasticity Index values greater than 20 are anticipated.
- Pavement section recommendations are based on the design CBR value of 2.0 and the input parameters. 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.
- As requested, Arterial type street recommendations are presented.
- Input parameters 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.

Subgrade Notes:

- Based on the thickness of the clays encountered in the borings, we anticipate the final pavement subgrade Plasticity Index value to be greater than 20 or less than or equal to 20.
- Cut and fill information is not available at this time. Fill used to raise the grade:
  - approved fill material free should have a minimum CBR value of 2.0 and a maximum Plasticity Index value of 50. Lime application rates should be re-evaluated and tested for sulfate content prior to use of the fill material.
  - The fill material should be approved by the geotechnical engineer, free of deleterious material, and the gravel size should not exceed 3 inches in size. The material should be placed and compacted as per applicable city / county guidelines.
  - The subgrade, prior to placement of fill, should be proof rolled to identify weak areas. Any identified weak areas should be recompacted.

- If the final pavement subgrade is within Stratum II, calcareous clay or marl (plasticity index values less than equal to 20), then subgrade stabilization is not needed. The final pavement subgrade plasticity index value should be tested at the time of construction.
- Recommend stabilizing 8 inches of subgrade soils.
  - The subgrade soils should be tested for soil sulfate content prior to stabilization. If the soil sulfate content is higher than 3000 ppm an alternate / modified procedure will be needed.
  - Lime or cement may be used to stabilize the subgrade.
    - An application rate of 7 percent lime is recommended. Application rate of cement, if needed, should be determined at the time of construction.
    - Lime application rate of **42.0 lbs per sq yard for 8-inch depth** of stabilization is recommended.
    - Stabilization should meet Bexar County stabilization guidelines (such as Unconfined compressive strength value of 160 psi for lime application).
    - Cement application rate, if needed, should be determined at the time of construction.
- **If final pavement subgrade consists of marl and the subgrade Plasticity Index values are less than or equal to 20, subgrade stabilization is not needed.**

<u>General Notes:</u>

- Significant pavement distress has been observed during construction phase with the combination of construction traffic and irrigation water / rain water getting underneath the asphalt.
- If water is allowed to get underneath the asphalt or if moisture content of the base or subgrade soil changes significantly, then pavement distress will occur.
  - Minimizing moisture penetration underneath the asphalt will lower the chances of pavement distress.
  - Significant pavement distress, more often caused by water getting underneath the asphalt, is noted during home construction.
  - Aggregate base extending beyond the back of the curb increases the likelihood of water getting underneath the asphalt. Moisture penetration may be reduced by using a deeper curb, such as curb extending a minimum of 6 inches into subgrade or compacted clays backfilled against the curbs.
  - In addition, water should not be allowed to get underneath the pavement section at the time of home construction.

<u>Geogrid:</u>

- <u>One layer of geogrid, Tensar Triax 130 or better (Bexar County), installed on top of compacted (stabilized) subgrade as per manufacturer’s guidelines.</u>

<u>Aggregate Base:</u>

- TxDOT Item 247 A1-2 aggregate base is recommended. The lift thickness and the compaction should follow all applicable city / county guidelines.

<u>Asphalt:</u>

- The asphalt material and installation should follow all applicable city / county guidelines.

Subgrade Verification:

- At the time of construction, the final pavement subgrade should be observed / verified by a representative of InTEC.

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

	Arterial
ESAL	3,000,000
Reliability Level	R-95
Initial and Terminal Serviceability	4.2 and 2.5
Standard Deviation	0.45
Service Life	20 years

Calculations

CBR = 2.0

Subsurface Exploration and Pavement Analysis Proposed New Streets Briggs Ranch East, Phase 1, Unit 2 Collector San Antonio, Texas	InTEC Project Number: **S251074-A1**	Date: 06/10/2025

Tensar

SpectraPave™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 95	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.645	Terminal Serviceability	= 2.5
Standard Deviation	= 0.45	Change in Serviceability	= 1.7

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

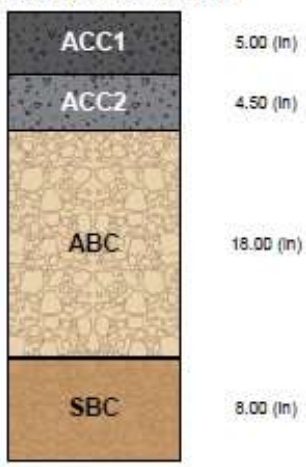
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.440	N/A
ACC2	Dense-graded Asphalt Course	70.00	0.140	N/A
ABC	Aggregate Base Course	20.00	0.140	1.0
SBC	Subbase Course	16.00	0.080	1.0

Stabilized Section Material Properties

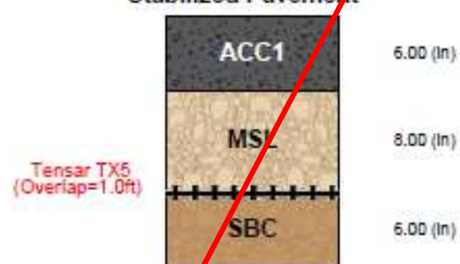
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.420	N/A
MSL	Mechanically Stabilized Base Course	20.00	0.238	1.0
SBC	Subbase Course	16.00	0.080	1.0

Unstabilized Pavement



Subgrade Modulus = 3,000 (psi)
Structural Number = 5.990
Calculated Traffic (ESALs) = 3,235,000

Stabilized Pavement



Subgrade Modulus = 3,000 (psi)
Structural Number = 4.904
Calculated Traffic (ESALs) = 758,000

LIMITATIONS OF THE REPORT

The designs, illustrations, information and other content included in this report are necessarily general and conceptual in nature, and do not constitute engineering advice or any design intended for actual construction. Specific design recommendations can be provided as the project develops.

Subsurface Exploration and Pavement Analysis Proposed New Streets Briggs Ranch East, Phase 1, Unit 2 Collector San Antonio, Texas	**Arterial**	
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Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.440	N/A
ACC2	Dense-graded Asphalt Course	70.00	0.170	N/A
ABC	Aggregate Base Course	20.00	0.170	1.0
SBC	Subbase Course	16.00	0.080	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.420	N/A
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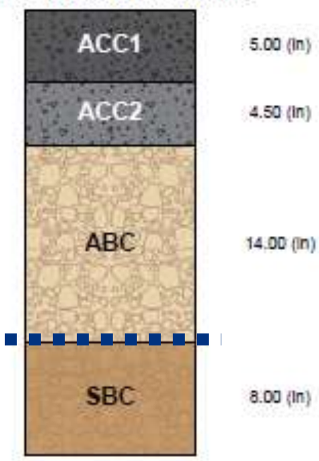
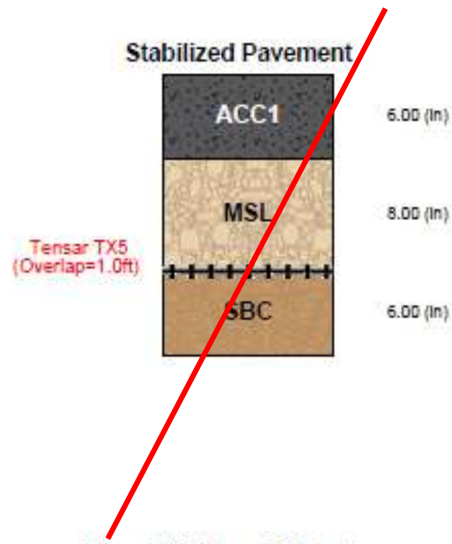
Unstabilized Pavement



Subgrade Modulus = 3,000 (psi)
Structural Number = 5.985
Calculated Traffic (ESALs) = 3,215,000

Stabilized Pavement



Subgrade Modulus = 3,000 (psi)
Structural Number = 4.904
Calculated Traffic (ESALs) = 758,000

Geogrid option calculated with modified structural coefficient value of 0.17

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Subsurface Exploration and Pavement Analysis Proposed New Streets Briggs Ranch East, Phase 1, Unit 2 Collector San Antonio, Texas	**Arterial**	
	InTEC Project Number: **S251074-A1**	Date: 06/10/2025

Asphalt Pavement
Design Analysis

Tensar
A Division of CMC

Design		Reference	
Project		Location	
Customer		Designer	Murali Subramaniam
Company	InTEC	Date	July 1, 2025

Method of analysis

The calculation method used to create this Tensar software output is the design method for flexible pavements given in the AASHTO Guide for Design of Pavement Structures 1993. The enhancement of performance due to the inclusion of Tensar geogrids in the stabilised layer is derived empirically from full scale pavement tests and trafficking trials carried out by independent authorities.

Results

Stabilized
3,194,300 ESALs

Unstabilized
3,056,000 ESALs

Total HMA thickness should be within the same range on both pavement sections for accurate comparison: 2-3 in | 3-6 in | 6-14 in

	Thickness	Coeff.	SN
HMA layer 1	5 in	0.440	2.200
Aggregate base (NX750)	18 in	0.210	3.780
Structural number (SN)			5.980

	Thickness	Coeff.	SN
HMA layer 1	4 in	0.440	1.760
HMA layer 3	6 in	0.340	2.040
Aggregate base	10.75 in	0.140	1.505
Subbase	8 in	0.080	0.640
Structural number (SN)			5.945

Parameters

Project Information

Target ESALs	Subgrade resilient modulus	Reliability	Standard deviation	Serviceability	
				Initial	Terminal
3,000,000	3,000 psi	95%	0.45	4.2	2.5

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D50 <= 27mm (Base course)

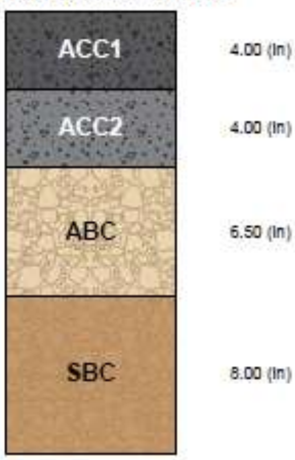
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.440	N/A
ACC2	Dense-graded Asphalt Course	70.00	0.340	N/A
ABC	Aggregate Base Course	20.00	0.340	1.0
SBC	Subbase Course	16.00	0.080	1.0

Stabilized Section Material Properties

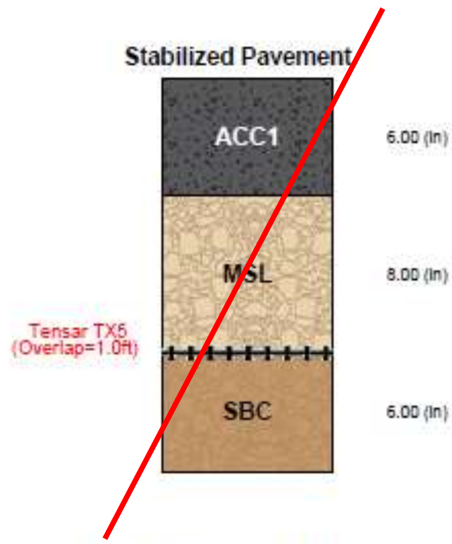
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.420	N/A
MSL	Mechanically Stabilized Base Course	20.00	0.238	1.0
SBC	Subbase Course	16.00	0.080	1.0

Unstabilized Pavement



Subgrade Modulus = 3,000 (psi)
Structural Number = 5.970
Calculated Traffic (ESALs) = 3,154,000

Stabilized Pavement



Subgrade Modulus = 3,000 (psi)
Structural Number = 4.904
Calculated Traffic (ESALs) = 758,000

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Subsurface Exploration and Pavement Analysis Proposed New Streets Briggs Ranch East, Phase 1, Unit 2 Collector San Antonio, Texas	**Arterial**	
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Appendix

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 <u>not</u> 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 <u>Not</u> 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 <u>not</u> 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 <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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