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

E.A. Palaniappan, Ph.D., P.E.
Murali Subramaniam, Ph.D., P.E.
Kausi Subramaniam, B.S.

March 11, 2020

Lucca Rabel, LLC

24607 Fairway Springs
San Antonio, Texas 78260

Attention: **Mr. Paul Kuo**

Email: pkuo@hkredevelopment.com

Re: Subsurface Exploration and Pavement Analysis
Proposed New Streets
Rabel Subdivision, Phases 1 & 2 and Rabel Road Improvements
San Antonio, Texas

InTEC Project No. S201049-P

Ladies & Gentlemen:

Integrated Testing and Engineering Company of San Antonio (InTEC) has been authorized to complete the pavement report for the above referenced unit. InTEC will be completing the proposed borings and present a completed report.

The pavement recommendations presented in this report are based on the available soils information from prior soils study at this site, geologic map, soils map, and tests performed on samples obtained from this site. California Bearing Ratio and Lime series tests were completed on samples obtained from the above referenced unit.

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, L.P.

03/11/2020

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

Table No. 1 – Summary of Recommended Options
Minimum Flexible Pavement Recommendations – CBR = 4.0**

	Asphaltic Concrete			Aggregate Base	Geogrid	Subgrade	Structural Number
Classification	**Type D, inches**	**Type C, inches**	**Type B, inches**	**inches**		**inches**	
Local Type A	2.00	-	-	10.00	No	*	2.28
(no bus traffic)	2.00	-	-	8.00	Yes	*	2.24
	2.00	-	6.00	-	No	*	2.92
Local Type A	3.00	-	-	13.50	No	*	3.21
(with bus traffic)	3.00	-	-	11.50	Yes	*	3.27
	3.00	-	6.00	-	No	*	3.36
Local Type B	3.00	-	-	19.00	No	*	3.98
	3.00	-	-	16.00	Yes	*	4.04
	3.00	-	8.00	-	No	*	4.04
Collector	3.00	-	-	21.50	No	*	4.33
	3.00	-	-	18.00	Yes	*	4.38
	3.00	-	9.00	-	No	*	4.38
Arterial	2.00	3.00	-	18.50	No	*	4.79
	2.00	2.00		15.00	Yes	*	4.75
	2.00	2.00	9.00	-	No	*	4.82

Subgrade Notes (*):

- Cut and fill data are not available at this time.
- Sand, Clayey Sand, and Sandy Clay soils are anticipated.
- We anticipate the final pavement subgrade Plasticity Index value to be less than or equal to 20.
- If the pavement subgrade Plasticity Index values are greater than 20, then:
  - The subgrade should be treated to a depth of 6 inches using 5 percent lime or cement content.
  - The subgrade soils should be tested for soil sulfate content prior to treatment. If the soil sulfate content is over 3000 ppm, an alternate procedure will be needed.
    - Lime application rate of **25 lbs per sq yard for 6-inch depth** of treatment is recommended.
    - Cement may also be used to treat the subgrade in lieu of lime. Please call InTEC to determine the cement application rate.

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.
- 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:

- One layer of geogrid, Tensar Triax TX5, installed on top of compacted (moisture conditioned or treated) subgrade as per manufacturer's guidelines

Fill Material:

- Fill used to raise the grade - approved fill material should have a minimum CBR value of 4.0 and a maximum Plasticity Index value of 20. 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.

Subgrade verification:

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

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

	Local Type A Street (no bus traffic)	Local Type A Street (with bus traffic)	Local B	Collector	Secondary Arterial
ESAL	100,000	1,000,000	2,000,000	2,000,000	3,000,000
Reliability Level	R-70	R-70	R-90	R-90	R-95
Initial and Terminal Serviceability	4.2 & 2.5	4.2 & 2.5	4.2 & 2.5	4.2 & 2.5	4.2 & 2.5
Standard Deviation	0.45	0.45	0.45	0.45	0.45
Service Life	20 years	20 years	20 years	20 years	20 years
If heavy truck traffic is anticipated, please contact InTEC with anticipated traffic data for revised recommendations.					

Table No. 3 – Summary of Pavement Materials

Pavement Section	Material	Stabilization or Treatment	Thickness
Subgrade	Sand, Clayey Sand, Sandy Clay	Compacted subgrade	As recommended in pavement options (6 or 8 inches)
Base	TxDOT Item 247 A1-2	-	As recommended in pavement options (maximum of 6 inches per lift)
Asphalt	Type B, C, D	-	As recommended in pavement options
Geogrid	Tensar Triax TX5	One layer	As per manufacturer's recommendations

See report for more details

Table No. 4 – Applicable procedures and minimum density and moisture percentages

All applicable City of San Antonio Standard Specifications for Construction, June 2008, should be followed. Some of the relevant procedures are shown below.

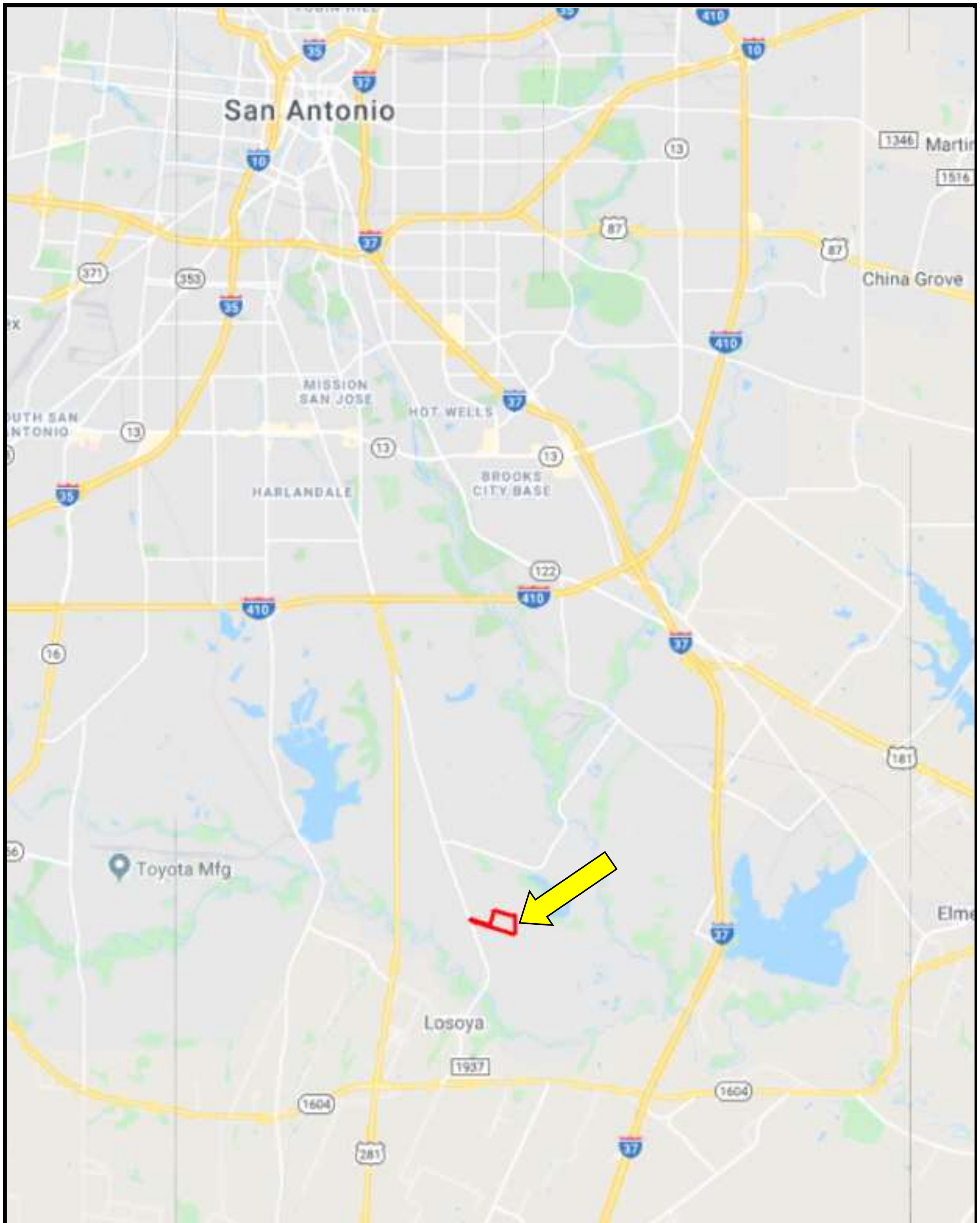
Pavement Material	Procedure *	Density and Moisture Control
Subgrade fill (maximum 6 inch thick lifts)	Item 107	As per construction specifications
Treated Subgrade – if needed (6 inch thick lift)	Item 108- lime	As per construction specifications
Aggregate Base TxDOT Item 247 A1-2 (maximum 6 inch thick lift)	Item 200	As per construction specifications
Asphalt HMAC Type B, C, D	Item 205, 206	As per construction specifications
Geogrid	Manufacturer's Guidelines	-

(*) City of San Antonio Standard Specifications for Construction, June 2008

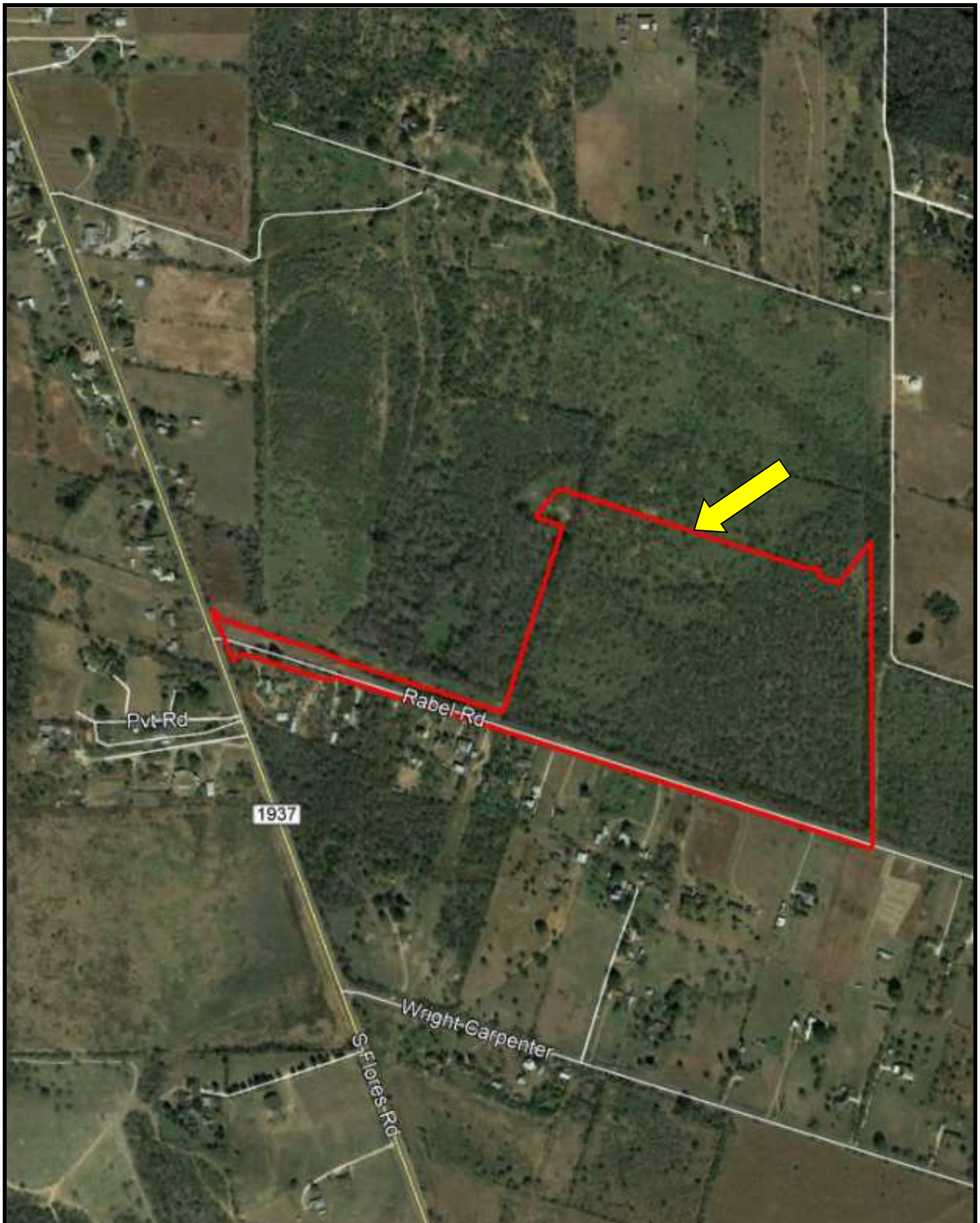
Illustration Section

Description	Plate No.
Vicinity Map	Plate 1A
Aerial Map	Plate 1B
Topographic Map	Plate 1C
Geologic Map	Plate 1D
Soil Map	Plate 1E
Approximate Boring Locations	Plate 1F
Boring Logs	Plates 2—13
Keys to Classifications and Symbols	Plate 14
Calculations	Plates 15—31
Information on Geotechnical Report	Appendix

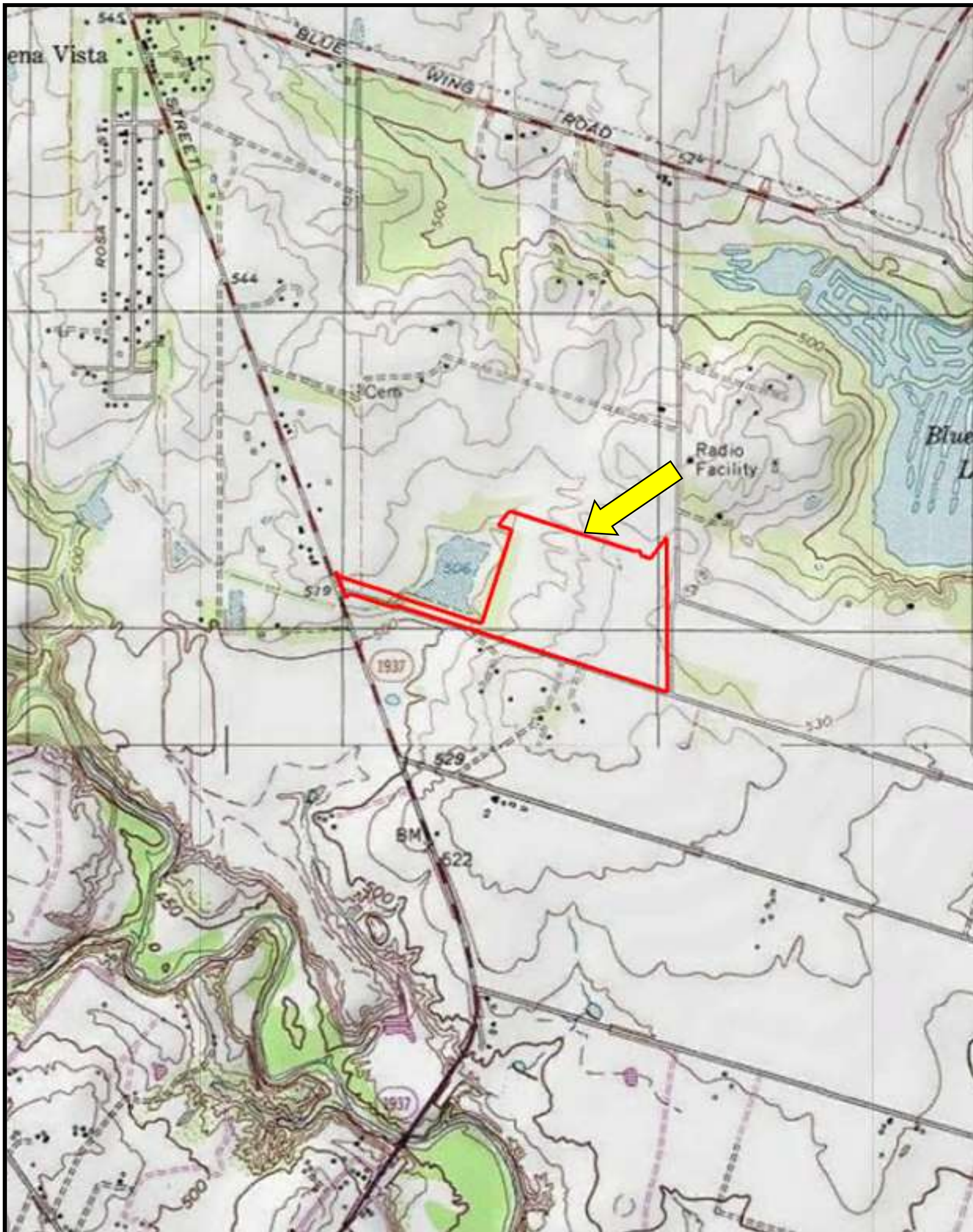
Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	InTEC Project Number: **S201049-P**	Date: 02/06/2020



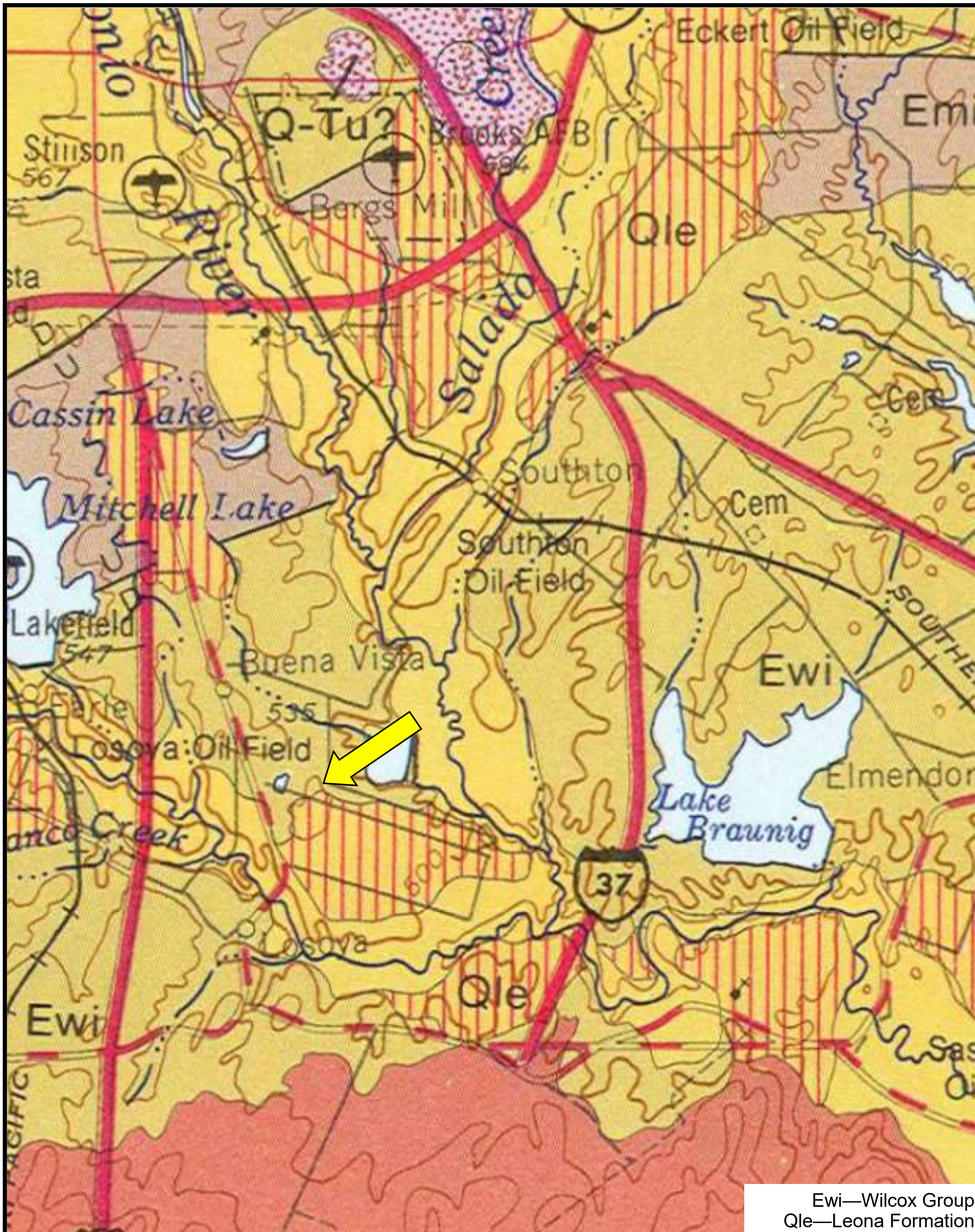
Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Vicinity Map**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020



Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Aerial Map—Approximate Location**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020



Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Topographic Map—Approximate Location**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020

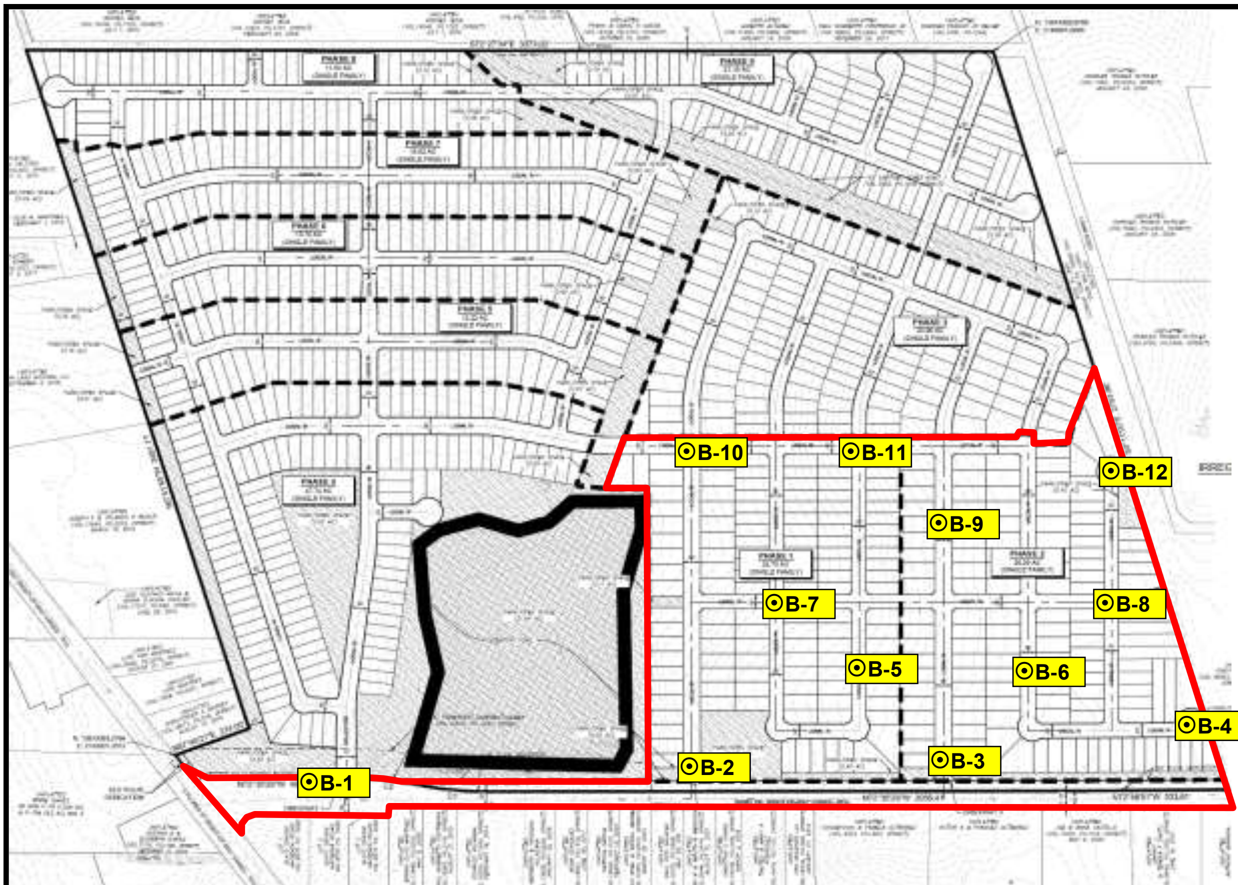


Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Geologic Map—Approximate Location**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020

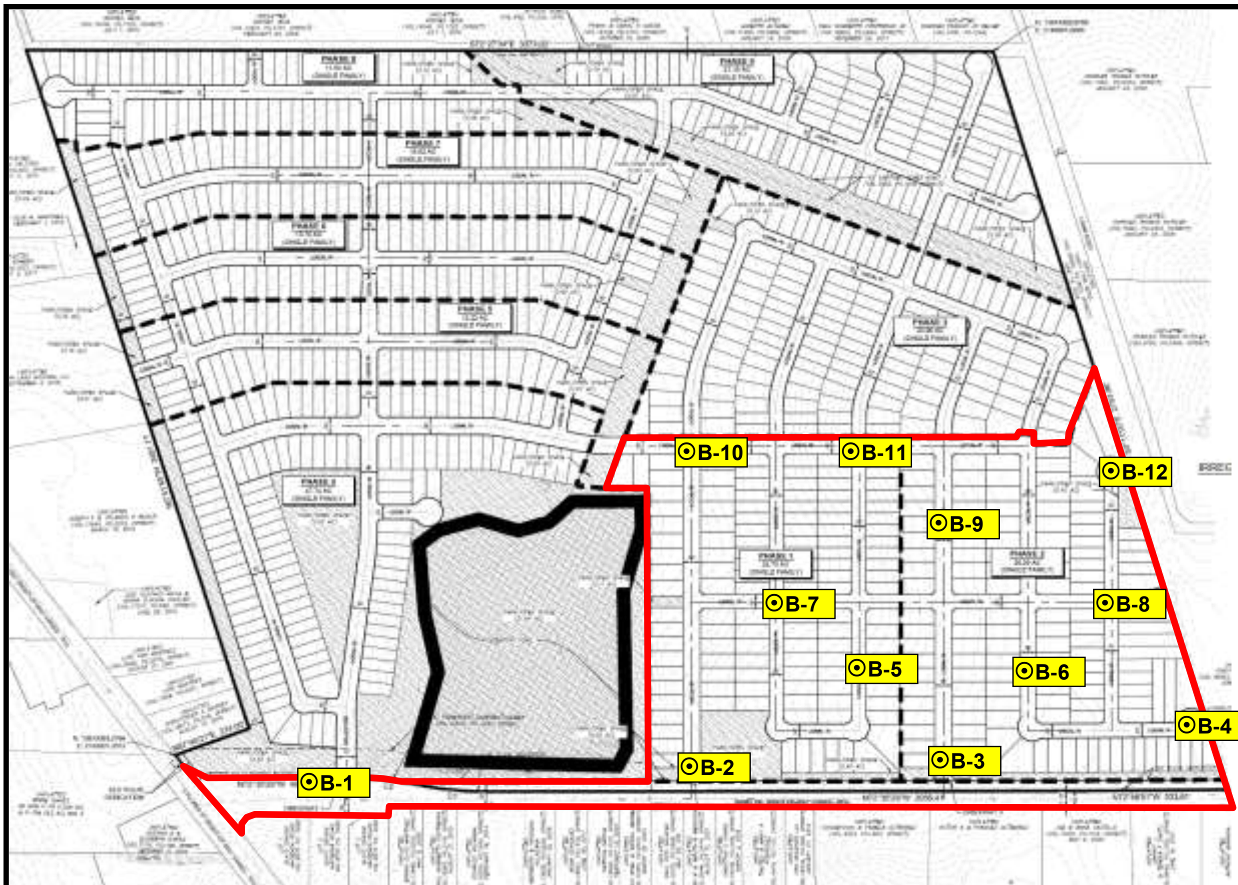
Bexar County, Texas

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Pct Fragments: >10 inches	Pct Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
			In				L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H
CfB—Miguel fine sandy loam, 1 to 3 percent slopes														
Miguel	95	C	0-11	Fine sandy loam	SC, SC-SM, SM	A-4, A-2-4	0- 0- 0	0- 0- 0	94-97-100	93-97-100	81-90- 98	32-39- 45	16-21 -26	3-7 -10
			11-33	Sandy clay, clay	CH, CL, SC	A-7-6, A-6	0- 0- 0	0- 0- 0	94-97-100	93-97-100	74-80- 91	44-53- 62	40-45 -51	20-22-30
			33-43	Sandy clay loam, sandy clay	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	60-98-100	88-98-100	83-92-100	50-57- 71	33-38 -50	10-20-28
			43-60	Sandy clay loam, sandy clay	CL, SC	A-6	0- 0- 0	0- 0- 0	90-96-100	88-96-100	81-92-100	43-53- 68	26-29 -40	11-15-23
HkB—Wilco loamy fine sand, 0 to 3 percent slopes														
Wilco	100	C	0-16	Loamy fine sand	SC-SM, SM	A-2-4	0- 0- 0	0- 1- 2	95-98-100	95-98-100	80-90-100	13-22- 30	0-13 -25	NP-4 -7
			16-33	Sandy clay loam, sandy clay, clay, clay loam	CH, CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 2	95-98-100	95-98-100	80-90-100	48-57- 65	36-47 -55	18-25-31
			33-40	Sandy clay loam, sandy clay	CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 2	95-98-100	95-98-100	80-90-100	26-40- 60	28-44 -48	17-21-27
			40-60	Fine sandy loam, sandy clay loam	CL, SC	A-2-6, A-2-7, A-6	0- 0- 0	0- 1- 2	90-95-100	90-95-100	80-90-100	30-45- 60	28-37 -45	11-16-25
HkC—Wilco loamy fine sand, 3 to 5 percent slopes														
Wilco	100	C	0-16	Loamy fine sand	SC-SM, SM	A-2-4	0- 0- 0	0- 1- 2	95-98-100	95-98-100	80-90-100	13-22- 30	0-13 -25	NP-4 -7
			16-33	Sandy clay loam, sandy clay, clay, clay loam	CH, CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 2	95-98-100	95-98-100	80-90-100	48-57- 65	36-47 -55	18-25-31
			33-40	Sandy clay loam, sandy clay	CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 2	95-98-100	95-98-100	80-90-100	26-40- 60	28-44 -48	17-21-27
			40-60	Fine sandy loam, sandy clay loam	CL, SC	A-2-6, A-2-7, A-6	0- 0- 0	0- 1- 2	90-95-100	90-95-100	80-90-100	30-45- 60	28-37 -45	11-16-25
HtA—Branyon clay, 0 to 1 percent slopes														
Branyon	85	D	0-12	Clay	CH	A-7-6	0- 0- 0	0- 0- 0	94-98-100	78-92-100	73-88-100	64-79- 92	39-62 -88	25-39-62
			12-72	Silty clay, clay	CH	A-7-6	0- 0- 0	0- 0- 0	95-96-100	78-92-100	89-90-100	62-82- 94	59-69 -74	39-43-47
			72-80	Clay, clay loam, silty clay loam, silty clay	CL, CH	A-7-6, A-6	0- 0- 0	0- 0- 0	98-98-100	78-82-100	68-81-100	60-85- 97	40-60 -64	23-34-47
KaC—Atco loam, 3 to 5 percent slopes														
Atco	100	B	0-15	Loam	CL, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	95-98-100	95-98-100	95-98-100	65-75- 85	22-26 -30	7-10-13
			15-60	Loam, sandy clay loam, clay loam	CL, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	96-98-100	95-98-100	88-93-100	60-68- 75	22-26 -30	7-10-13
VcA—Sunev clay loam, 0 to 1 percent slopes														
Sunev	100	B	0-16	Clay loam	CH, CL	A-6, A-7-6	0- 0- 0	0- 0- 0	80-88-100	80-92-100	80-90-100	55-68- 85	30-41 -51	12-22-32
			16-36	Loam, clay loam, silty clay loam	CL	A-4, A-6	0- 0- 0	0- 0- 0	85-93-100	80-92-100	70-85-100	51-68- 85	28-34 -40	8-14-20
			36-62	Loam, clay loam, silty clay loam	CL	A-4, A-6, A-7-6	0- 0- 0	0- 0- 0	89-95-100	70-82-100	65-83-100	51-61- 70	25-34 -42	8-13-22
WkB—Floresville fine sandy loam, 1 to 3 percent slopes														
Floresville	95	C	0-10	Fine sandy loam	CL, SC-SM, SC	A-6, A-4, A-2-4	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	82-90- 98	34-41- 51	20-26 -33	4-8 -13
			10-30	Clay, sandy clay	CH, CL	A-6, A-7-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	78-88- 98	55-64- 73	38-52 -60	24-30-36
			30-44	Sandy clay, sandy clay loam	CH, CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	78-84- 97	49-56- 66	34-38 -51	13-25-32
			44-80	Sandy clay loam, clay loam, fine sandy loam	CL, SC	A-4, A-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	71-84- 93	40-52- 57	27-35 -40	9-19-23
WkC—Floresville fine sandy loam, 3 to 5 percent slopes														
Floresville	95	C	0-10	Fine sandy loam	CL, SC-SM, SC	A-6, A-4, A-2-4	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	82-90- 98	34-41- 51	20-26 -33	4-8 -13
			10-30	Clay, sandy clay	CH, CL	A-6, A-7-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	78-88- 98	55-64- 73	38-52 -60	24-30-36
			30-44	Sandy clay, sandy clay loam	CH, CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	78-84- 97	49-56- 66	34-38 -51	13-25-32
			44-80	Sandy clay loam, clay loam, fine sandy loam	CL, SC	A-6, A-4	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	71-84- 93	40-52- 57	27-35 -40	9-19-23
WmC2—Floresville fine sandy loam, 1 to 5 percent slopes, eroded														
Floresville, eroded	95	C	0-6	Fine sandy loam	CL, SC-SM, SC	A-6, A-4, A-2-4	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	82-90- 98	34-41- 51	20-26 -33	4-8 -13
			6-30	Clay, sandy clay	CH, CL	A-6, A-7-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	78-88- 98	55-64- 73	38-52 -60	24-30-36
			30-44	Sandy clay, sandy clay loam	CH, CL, SC	A-6, A-7-6	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	78-84- 97	49-56- 66	34-38 -51	13-25-32
			44-80	Sandy clay loam, clay loam, fine sandy loam	CL, SC	A-6, A-4	0- 0- 0	0- 1- 1	95-97- 99	94-97- 99	71-84- 93	40-52- 57	27-35 -40	9-19-23

Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Soil Map—Approximate Location**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020



Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Approximate Boring Locations**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020



Samples near B-1 were used run California Bearing Ratio and Lime Series Tests

Boring logs will be presented after all the borings are completed.

Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Logs**	
	InTEC Project Number: **S201049-P**	Date: 02/06/2020

Calculations

CBR = 4.0

Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar.

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 70	Initial Serviceability	= 4.2
Standard Normal Deviate	= -.524	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

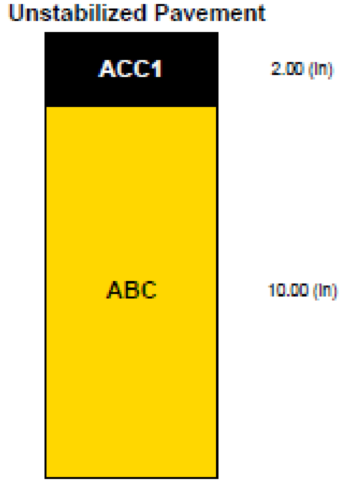
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ABC	Aggregate Base Course	20	0.140	1.0

Stabilized Section Material Properties

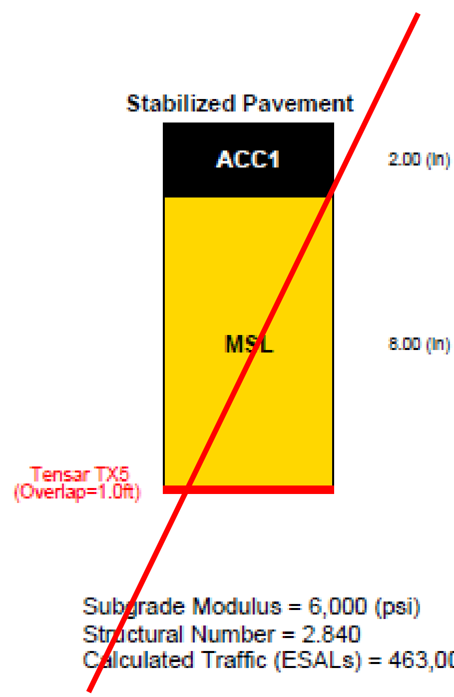
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
MSL	Mechanically Stabilized Base Cour	20	0.245	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 2.280
Calculated Traffic (ESALs) = 113,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 2.840
Calculated Traffic (ESALs) = 463,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local A with NO Bus Traffic**
InTEC Project Number: **S201049-P**	Date: 03/08/2020

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Tensar

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 70	Initial Serviceability	= 4.2
Standard Normal Deviate	= -.524	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

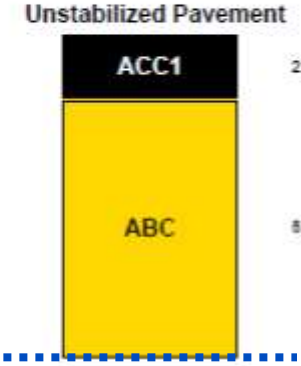
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ABC	Aggregate Base Course	20	0.170	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0

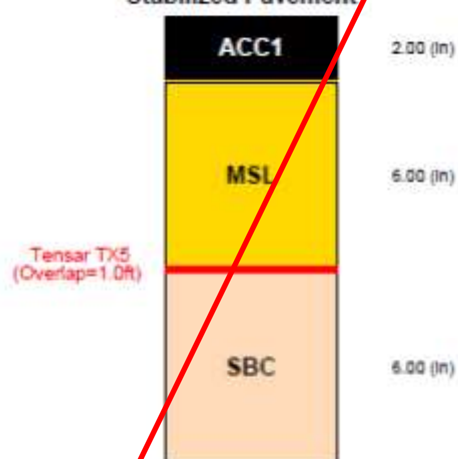
Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 2.240
Calculated Traffic (ESALs) = 102,000

Geogrid option calculated with adjusted structural coefficient value

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 2.910
Calculated Traffic (ESALs) = 543,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local A with NO Bus Traffic**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

SpectraPave™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 70	Initial Serviceability	= 4.2
Standard Normal Deviate	= -.524	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

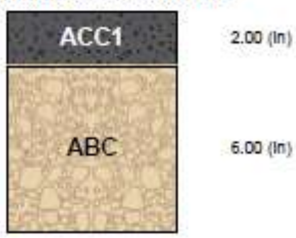
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.440	N/A
ABC	Aggregate Base Course	20.00	0.340	1.0

Stabilized Section Material Properties

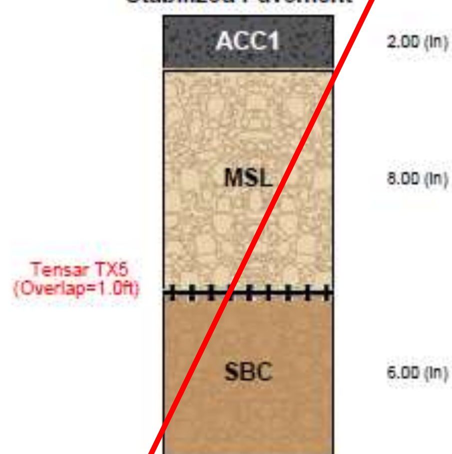
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.420	N/A
MSL	Mechanically Stabilized Base Course	20.00	0.238	1.0
SBC	Subbase Course	16.00	0.080	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 2.920
Calculated Traffic (ESALs) = 555,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.224
Calculated Traffic (ESALs) = 1,069,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local A with NO Bus Traffic**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 70	Initial Serviceability	= 4.2
Standard Normal Deviate	= -.524	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

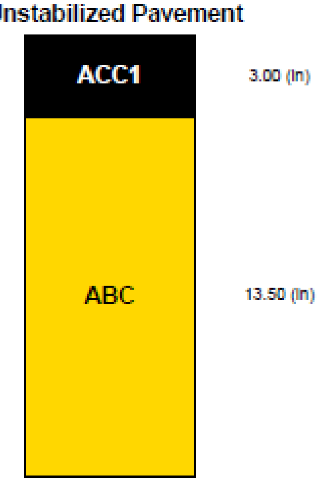
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ABC	Aggregate Base Course	20	0.140	1.0

Stabilized Section Material Properties

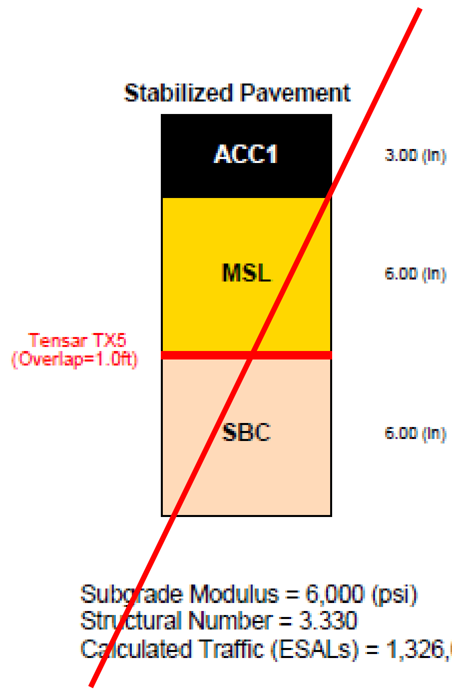
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.210
Calculated Traffic (ESALs) = 1,038,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.330
Calculated Traffic (ESALs) = 1,326,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local A with Bus Traffic**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 70	Initial Serviceability	= 4.2
Standard Normal Deviate	= -.524	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

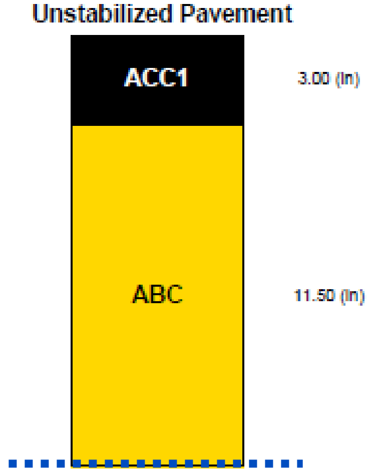
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ABC	Aggregate Base Course	20	0.170	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0

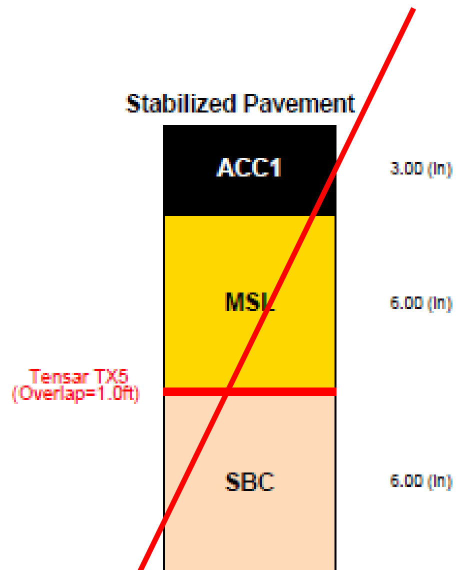
Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.275
Calculated Traffic (ESALs) = 1,186,000

Geogrid option calculated with adjusted structural coefficient value

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.330
Calculated Traffic (ESALs) = 1,326,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local A with Bus Traffic**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar.

SpectraPave™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 70	Initial Serviceability	= 4.2
Standard Normal Deviate	= -.524	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

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
ABC	Aggregate Base Course	20.00	0.340	1.0

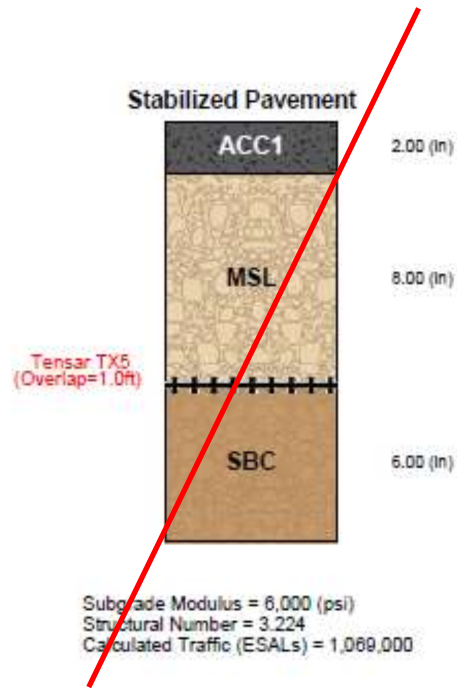
Stabilized Section Material Properties

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 = 6,000 (psi)
Structural Number = 3.360
Calculated Traffic (ESALs) = 1,409,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.224
Calculated Traffic (ESALs) = 1,069,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local A with Bus Traffic**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 90	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.282	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

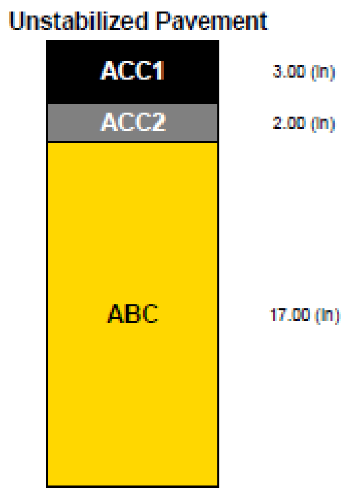
D50 <= 27mm (Base course)

Unstabilized Section Material Properties

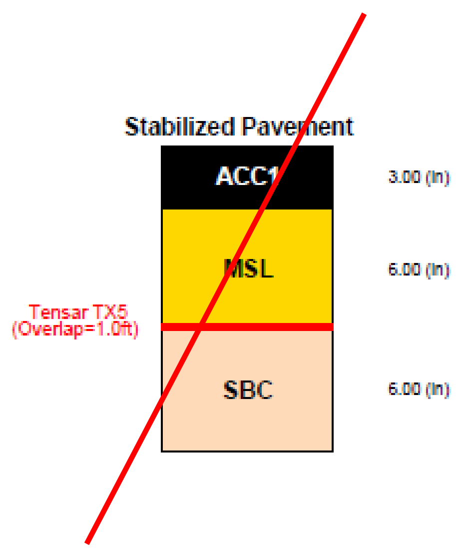
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ACC2	Dense-graded Asphalt Course	70	0.140	N/A
ABC	Aggregate Base Course	20	0.140	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.980
Calculated Traffic (ESALs) = 2,044,000



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.330
Calculated Traffic (ESALs) = 605,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local B**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 90	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.282	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

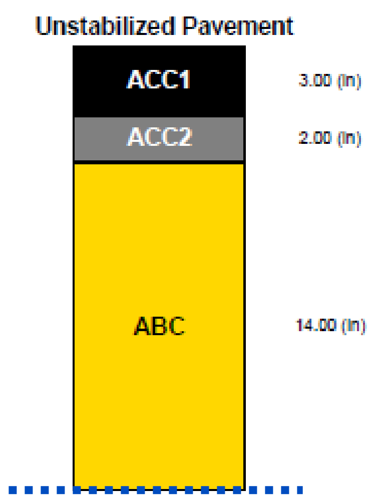
D50 <= 27mm (Base course)

Unstabilized Section Material Properties

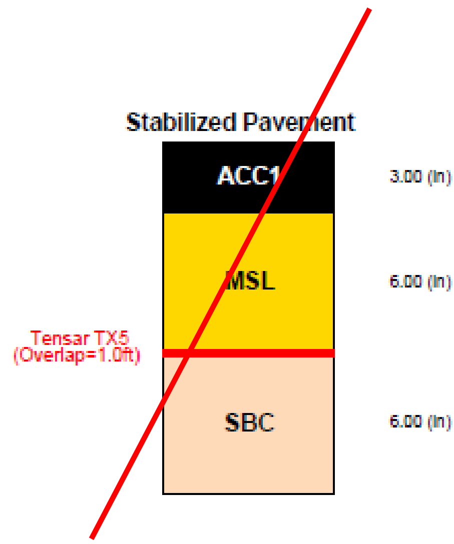
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ACC2	Dense-graded Asphalt Course	70	0.170	N/A
ABC	Aggregate Base Course	20	0.170	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.040
Calculated Traffic (ESALs) = 2,270,000



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.330
Calculated Traffic (ESALs) = 605,000

Geogrid option calculated with adjusted structural coefficient value

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local B**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar.

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 90	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.282	Terminal Serviceability	= 2.0
Standard Deviation	= 0.45	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

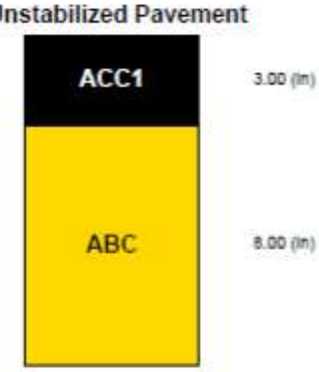
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ABC	Aggregate Base Course	20	0.340	1.0

Stabilized Section Material Properties

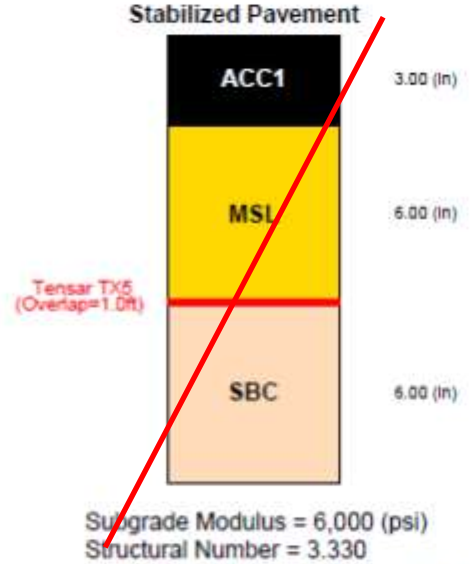
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.040
Calculated Traffic (ESALs) = 2,270,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.330
Calculated Traffic (ESALs) = 605,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Local B**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar.

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 90	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.282	Terminal Serviceability	= 2.5
Standard Deviation	= 0.45	Change in Serviceability	= 1.7

Aggregate fill shall conform to following requirement:

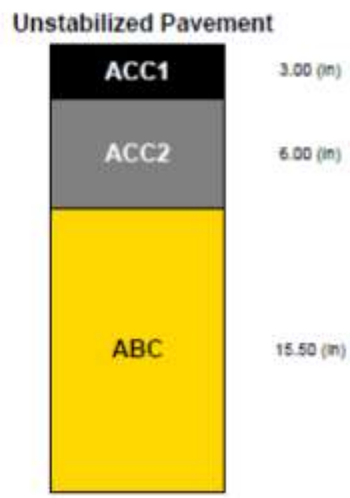
D50 <= 27mm (Base course)

Unstabilized Section Material Properties

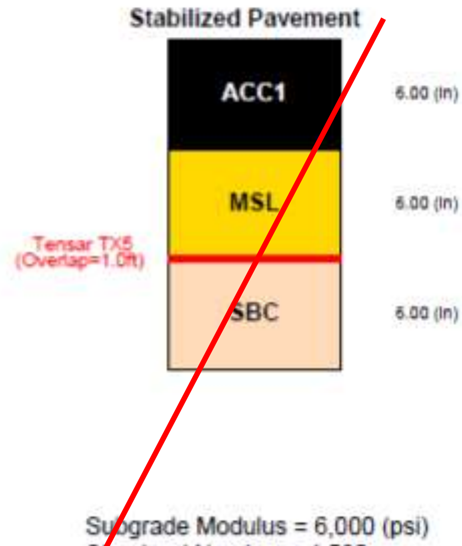
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ACC2	Dense-graded Asphalt Course	70	0.140	N/A
ABC	Aggregate Base Course	20	0.140	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.330
Calculated Traffic (ESALs) = 2,384,000



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.590
Calculated Traffic (ESALs) = 3,511,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Collector**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar.

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 90	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.282	Terminal Serviceability	= 2.5
Standard Deviation	= 0.45	Change in Serviceability	= 1.7

Aggregate fill shall conform to following requirement:

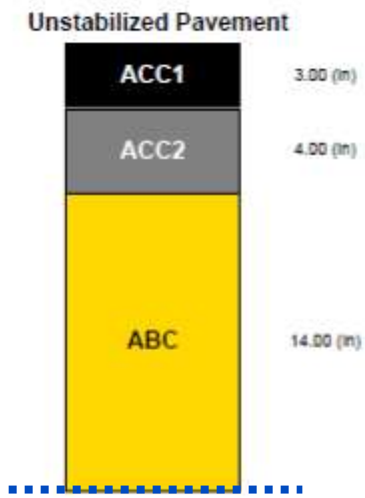
D50 <= 27mm (Base course)

Unstabilized Section Material Properties

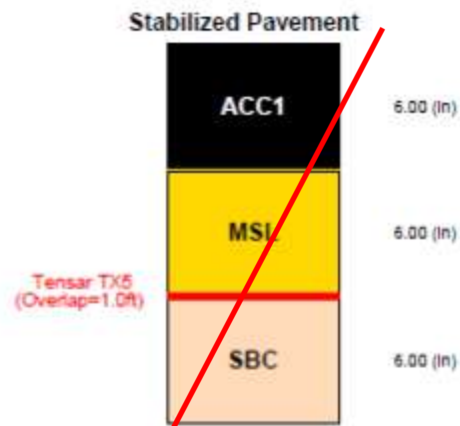
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ACC2	Dense-graded Asphalt Course	70	0.170	N/A
ABC	Aggregate Base Course	20	0.170	1.0

Stabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.380
Calculated Traffic (ESALs) = 2,571,000



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.590
Calculated Traffic (ESALs) = 3,511,000

Geogrid option calculated with adjusted structural coefficient value

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Collector**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Tensar.

SpectraPave4 PRO™
Pavement Optimization Design Analysis

Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 90	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.282	Terminal Serviceability	= 2.5
Standard Deviation	= 0.45	Change in Serviceability	= 1.7

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

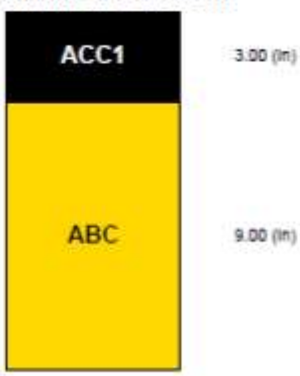
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.440	N/A
ABC	Aggregate Base Course	20	0.340	1.0

Stabilized Section Material Properties

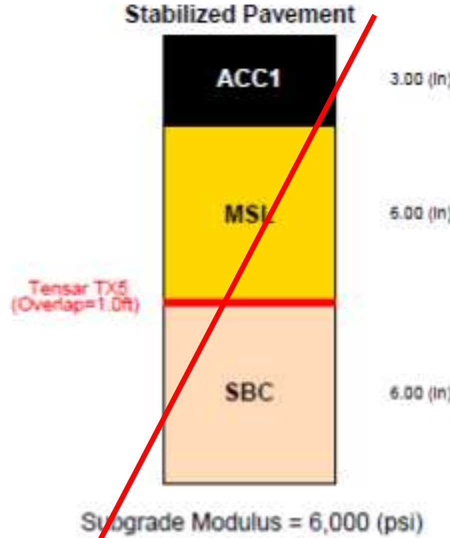
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
MSL	Mechanically Stabilized Base Cour	20	0.265	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.380
Calculated Traffic (ESALs) = 2,571,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.330
Calculated Traffic (ESALs) = 461,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Collector**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

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)

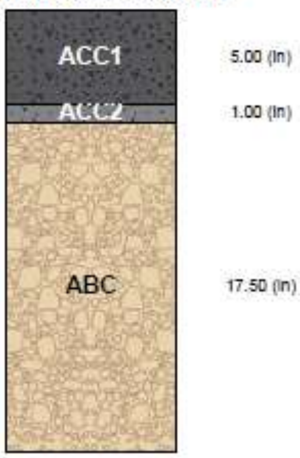
Unstabilized Section Material Properties

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

Stabilized Section Material Properties

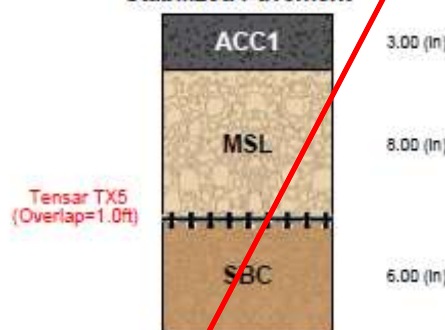
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.420	N/A
MSL	Mechanically Stabilized Base Course	20.00	0.238	1.0
SBC	Subbase Course	16.00	0.080	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.790
Calculated Traffic (ESALs) = 3,219,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.644
Calculated Traffic (ESALs) = 548,000

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 Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Arterial**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

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)

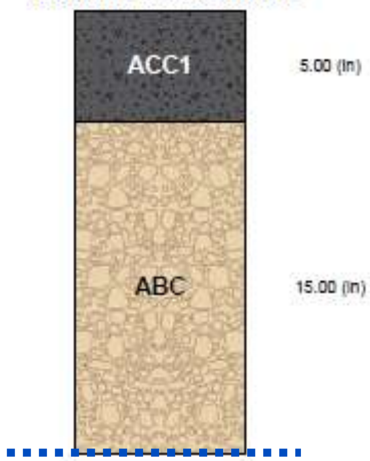
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.440	N/A
ABC	Aggregate Base Course	20.00	0.170	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

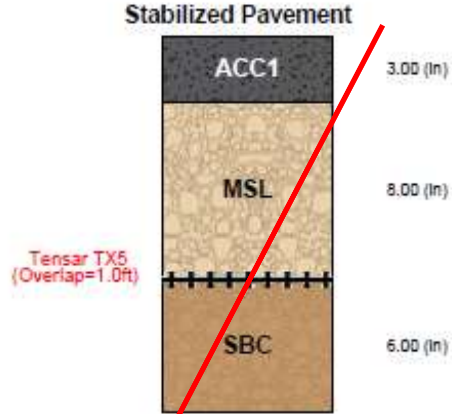
Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.750
Calculated Traffic (ESALs) = 3,040,000

Geogrid option calculated with adjusted structural coefficient value

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.644
Calculated Traffic (ESALs) = 548,000

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.

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)

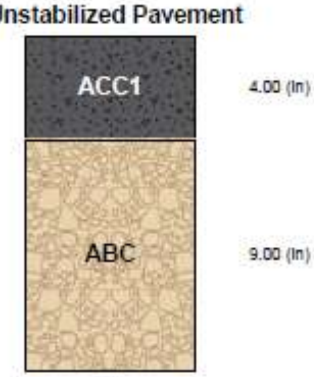
Unstabilized Section Material Properties

Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.440	N/A
ABC	Aggregate Base Course	20.00	0.340	1.0

Stabilized Section Material Properties

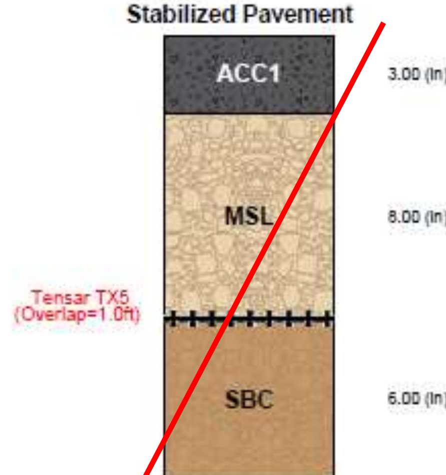
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70.00	0.420	N/A
MSL	Mechanically Stabilized Base Course	20.00	0.238	1.0
SBC	Subbase Course	16.00	0.080	1.0

Unstabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 4.820
Calculated Traffic (ESALs) = 3,360,000

Stabilized Pavement



Subgrade Modulus = 6,000 (psi)
Structural Number = 3.644
Calculated Traffic (ESALs) = 548,000

LIMITATIONS OF THE REPORT

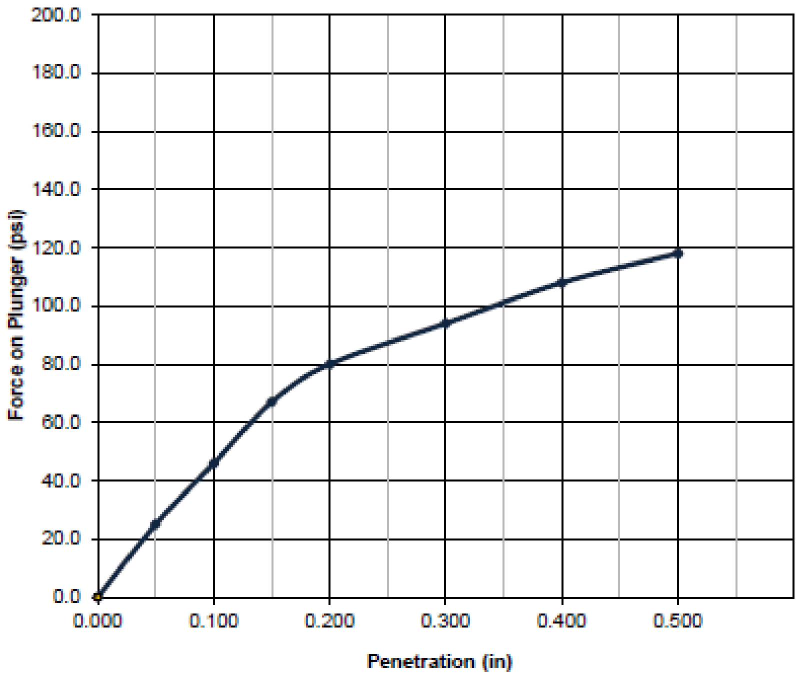
The designs, illustrations, information and other content included in this report are necessarily general and conceptual in nature, and do not constitute engineering advice or any design intended for actual construction. Specific design recommendations can be provided as the project develops.

Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**Arterial**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

InTEC of San Antonio

ASTM D-1883 California Bearing Ratio Test Report

Load Penetration Curve



CBR Results					
Results	A	B	C	D	Average
0.1 in Pen.	4.6				
0.2 in Pen.	5.3				
Moisture (%)	10.80				
Density (pcf)	112.10				
Final Moisture (%)	14.50				
Final Density (pcf)	105.10				

Project Information			
Project Number	S201049-P	Sample Location	
Project Name	Rable Phases 1 and 2	Specimen A	near B-1
Date	3/8/2020	Specimen B	
Client		Specimen C	
		Specimen D	
Job Ref.		Liquid Limit:	32.0
Sample Num.		Plastic Limit:	16.0
Remarks	Brown Clayey Sand		

Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	**CBR Test Results**	
	InTEC Project Number: **S201049-P**	Date: 03/08/2020

Appendix

Subsurface Exploration and Pavement Analysis Proposed New Streets Rabel Subdivision, Phases 1 & 2 San Antonio, Texas	InTEC Project Number: **S201049-P**	Date: 03/08/2020

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, clients can benefit from a lowered exposure to the subsurface problems 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 below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs 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. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project 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.*

This Report May Not Be Reliable

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

- for a different client;
- for a different project;
- 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, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been 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 your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

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

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment 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 from project start to project finish, so the individual can provide 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 judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed 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 full-time 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 on hand quickly 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 observation.

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 informational 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, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. 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. 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 relate any 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 yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

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, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled 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