BURGE ENGINEERING & ASSOCIATES
Geotechnical Engineering • Environmental • Testing

November 7, 2024

Mr. Eduardo Arroyo
Ira Lee Road Development, LLC
26811 Bluewater Way
San Antonio, Texas 78260

RE: Addendum I – Rigid Pavement Recommendations
New Subdivision
592 Ira Lee Road
San Antonio, Texas
BEA Project No. 12-24-0519

Dear Mr. Arroyo:

Burge Engineering & Associates (BEA) is pleased to provide this Addendum to our *Pavement Design (Study),* BEA Project No. 12-24-0519, dated October 30, 2024. This Addendum provides the design team with a rigid pavement design option for a *Local Type A Street with Bus Traffic*. Unless specifically addressed in this Addendum letter, no changes to our recommendations made in our original *Study* are implied.

It is our understanding that the design team is requesting a concrete pavement option for the city street and for the private driveways. It is our understanding that the new street will be designed as a *Local Type A without Bus Traffic.* Depending on what the subgrade conditions exist following rough grading operations will determine if lime-stabilization is required as noted below. As such, we are providing a concrete pavement option with and without lime-stabilization depending on the subgrade conditions encountered following rough grading operations. We designed the streets using the design criteria parameters in accordance with *City of San Antonio Unified Development Code.* Our pavement analysis was generally based on the design procedure developed by AASHTO's *Guide for Design of Pavement Structures*, 1993. Based on the site location and proposed use, we utilized an effective pavement life of 20 years.

A design CBR (California Bearing Ratio) value of four (4) percent was estimated for the Stratum I Clay. If Stratum I Clayey Gravel is encountered for the subgrade alignment for the private driveways or the city street following rough grading operations, then an estimated CBR value of six (6) percent may be used for that portion of the subgrade. **If Clayey Gravel is the remaining subgrade following rough grading operations, then lime-stabilization would not be required. As such, BEA should determine which portions of the private drives and city street subgrade is to be designed using the CBR value of 4 percent and 6 percent following rough grading operations.**

The following design parameters and criteria were considered in our analyses:

- Modulus of Subgrade Reaction: 100 pci - Stratum I Clay; 150 pci - Stratum I Clayey Gravel
- Resilient Modulus: 6,000 psi for Stratum I Clay; 9,000 psi for Stratum I Clayey Gravel
- Reliability: 70 percent for flexible pavement; 90 percent for rigid pavement
- Overall Standard Deviation: 0.45 for flexible pavement; 0.35 for rigid pavement
- Initial Serviceability: 4.2 for flexible pavement; 4.5 for rigid pavement
- Terminal Serviceability: 2.0
- Drainage Coefficient: 1.01
- Load Transfer Coefficient: 3.2
- Concrete Modulus of Rupture: 630 psi (approx. 4,000 psi compressive strength)
- Modulus of Elasticity: 4,000,000 psi

Local Type "A" Residential Street without Bus Traffic and Private Driveways
The pavement section detailed in this report assumes the pavements are maintained on a regular basis. The sections in the following table will exceed a minimum of 150,000 ESAL's required for a rigid pavement design:

	Subgrade – (Clay)	**Subgrade – (Clayey Gravel)**
Pavement Material	**Thickness, (in)**	**Thickness, (in)**
Reinforced Concrete	6	6
Crushed Limestone Base Material	Note 1	Note 1
Lime-Stabilized Subgrade[2]	6	---
Compacted Subgrade[2]	---	6

Note 1.) Crushed limestone base is not required as a structural layer, but may be used as a leveling course.
2.) Following rough grading operations, BEA shall determine which portions of the city street subgrade is Stratum I Clay and which portion is Stratum I Clayey Gravel, so the contractor knows which pavement section to place.

Specifications were provided for the pavement materials in our *Study*. Below is the specifications for reinforced concrete to be used to construct the proposed pavement areas:

Reinforced Concrete – Concrete should be designed to exhibit a flexural strength (third point loading) of at least 630 psi at 28 days (this is a compressive strength of about 4,000 psi). The flexural strength (M_r) may be approximated by the following formula from ACI 330R-08: $M_r=10\ (f_c')^{1/2}$, where f_c' is the average 28 day compressive strength of the concrete test cylinders. Furthermore, this approximation is based on concrete with rough-textured, angular-shaped aggregate. The actual relationship between flexural and compressive strength for the proposed mix should be evaluated in the laboratory.

The following recommendations are provided for reinforcement and jointing.

Type of Joint	Joint Spacing	Joint Depth	Joint Width[2]
Contraction (Control)	15 feet each way	One-fourth (¼) of slab thickness	One-eighth (⅛) to one-fourth (¼) inch
Construction	At location of contraction joints	Full depth of pavement thickness	One-eighth (⅛) to one-fourth (¼) inch
Isolation	As required to isolate from structures	Full depth of pavement thickness	Three-fourths (¾) to one (1) inch
Expansion[1]	60 feet each way	Full depth of pavement thickness	Three-fourths (¾) to one (1) inch

Notes: 1.) Serious consideration should be given to the total elimination of expansion joints. In this region, drying shrinkage of concrete typically significantly exceeds anticipated expansion due to thermal affects. As a result, the need for expansion joints is eliminated. Construction of an unnecessary joint may be also become a maintenance problem.

2.) All joint widths should be as noted above or as required by the joint sealant manufacturer.

Distributed Steel: No. 3 reinforcing steel bars at a maximum spacing of 18 inches on center each way, Grade 60

All construction joints shall have dowels, and dowel information varies with pavement thickness. The applicable dowel information for this project is provided below:

Pavement Thickness:	6 inches
Dowels	¾-inch diameter
Dowel Spacing	12 inches on center
Dowel Length	14 inches long
Dowel Embedment	6 inches minimum

We appreciate the opportunity to continue our service to you during the design phase of this project. If you have any questions regarding the information contained in this letter or if we can be of further assistance to you, please feel free to contact us.

Respectfully submitted,
BURGE ENGINEERING & ASSOCIATES
Texas Registered Engineering Firm F-7740
Geotechnical Engineering Services

Robert W. Burge, Jr., P.E.
Principal

11/7/24

STATE OF TEXAS
ROBERT WILLIAM BURGE, JR.
86874
LICENSED
PROFESSIONAL ENGINEER

Distribution: Addressee (Email)