September 7, 2022

Mr. Dean L. Carlson, P.E.
Carlson Consulting Engineers, Inc.
7068 Ledgestone Commons
Bartlett, TN 38133

ECS Project No. 58:1524

Reference: Addendum Letter
Capstone Apartments
NE Grand Boulevard & NE Grand Circle
Oklahoma City, Oklahoma

Dear Mr. Carlson:

ECS Southwest (ECS) provided the subsurface exploration and geotechnical engineering analyses for the referenced project in a report dated August 29, 2022. Since that report has been issued, site specific traffic data has been provided. This letter contains pavement recommendations based on the traffic data provided that will replace and supplement section **4.7 Pavements**. These additional recommendations should be attached to, and considered part of, our original report. All other recommendations provided in the original report remain valid.

4.7 PAVEMENTS

For the design and construction of exterior pavements, the subgrade should be prepared in accordance with the recommendations in the Site Construction Recommendations section of this report.

Design Traffic Loading: We understand that the pavement design criteria, daily design traffic loads, and ESAL factors are as follows:

- Design life: 20 years
- Initial Serviceability: 4.2
- Terminal serviceability: 2.0
- Reliability: 85%
- Standard Deviation:
  - 0.45 for flexible pavements
  - 0.35 for rigid pavements
- Passenger Vehicle Parking: up to 4 passenger vehicle passes per day
- Drive Areas:
  - Up to 300 passenger vehicle passes per day
  - Up to 2 trash truck and 1 box truck passes per week
- Maximum 20 Year Design Life ESALs: 17,500

Subgrade Characteristics: Based on the results of our borings, it appears that the majority of pavement subgrades will consist of existing moderate plasticity soils. Based on our experience with similar soils, a design CBR value of 3 is recommended for this project. The subgrade should be prepared in accordance with the recommendations in the Site Construction Recommendations section of this report.

Minimum Material Thicknesses: Pavements for the project are expected to consist of automobile only parking areas and drive areas within the apartment complex only. Based on the information provided, experience with similar projects, and typical practices in this region, we recommend the following minimum pavement section that can be used throughout the project, with exception of front loading trash dumpster areas. Please note that this section is considered a minimum required thickness and does not represent a pavement design.

MINIMUM PAVEMENT SECTIONS(1)		
MATERIAL	**FLEXIBLE PAVEMENT**	**RIGID PAVEMENT(2)**
Portland Cement Concrete	-	5 in.
Asphaltic Concrete Surface Course	1 ½ in.	-
Asphaltic Concrete Binder Course(3)	2 in.	-
Stabilized Subgrades(4,5)	8 in.	8 in.

Notes:

(1) Assumes that traffic loads will not exceed those presented in this report and proper pavement maintenance will be performed.
(2) Minimum thickness for rigid pavement per the AASHTO 1993 Method.
(3) ODOT Type A aggregate base material may be substituted for the asphalt binder using a substitute ratio of three inches of aggregate base for each inch of asphalt binder.
(4) Based on experience with similar soils, we estimate 4 percent lime, 12 percent Cement Kiln Dust (CKD), or 14 percent Fly Ash will be required to stabilize the near surface soils at this site. The final amount and type of stabilizing agent should be determined at the time of construction based on the type(s) of material(s) at final grade.
(5) In lieu of stabilized subgrades, 6 inches of ODOT Type A aggregate base material may be used.

ECS should be allowed to review these recommendations and make appropriate revisions based upon the formulation of the final traffic design criteria for the project. It is important to note that the design sections do not account for construction traffic loading. It should also be noted that these design recommendations may not satisfy the local jurisdictional traffic guidelines. Any roadways/entrance drives constructed within public right of way, for public use, and/or to be dedicated to the local or state jurisdiction for repair and maintenance must be designed in accordance with those jurisdictional requirements.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of an 8 inch thick Portland Cement Concrete (PCC) pavement section. Appropriate jointing should also be incorporated into the design of the PCC pavement.

Pavements should be specified, constructed and tested to meet the ODOT Standard Specifications for Highway Construction and the following requirements:

1. Reinforcing steel may consist of #3 reinforcing steel bars placed at 18 inches on center each way.

2. Hot Mix Asphaltic Concrete: In accordance with Oklahoma Department of Transportation (ODOT) Standard Specifications.

3. Portland Cement Concrete: Minimum compressive strength of 3,500 psi (28 Days). Concrete should be designed with 3 to 6 percent entrained air.

4. Crushed Limestone Base Material: ODOT Type A Aggregate Base. The material should be compacted to a minimum 95 percent of Standard Proctor maximum dry density (ASTM D 698) and within three percentage points of the material's optimum moisture.

If there are any questions with regard to the information and recommendations contained in this letter, or if we can be of further assistance to you during design and construction, please do not hesitate to contact us.

Respectfully,

ECS Southwest, LLP

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