COLUMBIA COUNTY
BOARD OF COMMISSIONERS

DESIGN SUPPLEMENT A
PAVEMENT SYSTEM DESIGN REQUIREMENTS

Columbia County
Engineering Services Division
Road Construction Department
(706) 447-7600

Adopted July 2021

GENERAL

The Design Engineer (DE) will incorporate the pavement section in accordance with these pavement guidelines. The pavement designs presented in these guidelines shall be used unless otherwise approved by the County Engineer. Any additional pavement designs shall be performed in accordance with Georgia Department of Transportation – Pavement Design Manual, which is based on the 1972 AASHTO Guide for the Design of Pavement Structures. Pavement Designs shall be required to provide a 20-year design life. All work shall be in accordance with the Columbia County Construction Specifications – Current Edition and the Georgia Department of Transportation's Standard Specifications Construction of Transportation Systems – Current Edition, when applicable

These guidelines are applicable for all subdivision roads with a design year two-way average daily traffic (ADT) less than or equal to 10,000 vehicles per day (vpd), and/or a maximum of 250 total daily loadings. The total daily loadings shall be calculated using the assumptions and equations provided in these guidelines.

The use of these guidelines will require the following information (See Appendix 4):

a) Site Layout and any associated master plan
b) Soil Support Value for the development from a site-specific geotechnical study
c) Regional Factor = 1.6
d) Calculated Total Daily Loading (TDL)

EMBANKMENT/SUBGRADE

It is a requirement that Soil Support Values (SSV) for subgrade be provided by an independent AASHTO Accredited testing laboratory. Samples and testing will be taken in accordance with the Georgia Department of Transportation's Geotechnical Manual for cut sections and fill sections.

Fill sections will be defined as a minimum of eight (8) inches of fill material above original ground elevation. The CBR test shall be done according to ASTM D1883 and a correlation from CBR to SSV shall be according to the Soil Support Correlation Chart (included as Appendix 2). CBR Values should be determined for each soil type that is significantly different from other surrounding soils. The Project CBR Value should be selected from the lower quartile of the range of results. In General, one SSV value should be selected for the entire project, but no more than two (2) SSV values may be proposed for a site (1 for a Major Subdivision Collector and 1 for a Minor Subdivision Collector) without prior written approval by the County Engineer. The DE will base the pavement design on the subgrade SSV. SSV's shall be rounded to the lower half number increment for the basis of the pavement design.

The Owner will provide, during construction, a review of the subgrade by a qualified Geotechnical Engineer to verify design parameters. That review will be submitted to the County Engineer in writing prior to placing any base material.

The following are general soil types and their compositions.

Good subgrade soils retain a substantial amount of their load-supporting capacity when wet. Included are the clean sands, sand-gravels, and those free of detrimental amounts of plastic materials. Excellent subgrade soils are relatively unaffected by moisture or frost and contain less than 15 percent passing a No. 200 mesh sieve.

CBR: 10 - plus | SSV: 4.0 and 4.5

Fair subgrade soils are those that retain a moderate degree of firmness under adverse moisture conditions. Included are such soils as loams, silty sands, and sand gravels containing moderate amounts of clays and fine silts. When this soil becomes a cohesive material, it should have a minimum proctor density of 110 pounds per cubic foot.

CBR: 6 - 9 | SSV: 3.0 and 3.5

Poor subgrade soils are those that become quite soft and plastic when wet. Included are those soils having appreciable amount of clay and fine silt (50 percent or more) passing a No. 200 sieve. The coarse silts and sandy loams may also exhibit poor bearing properties in areas where deep-frost penetration into the subgrade is encountered for any appreciable periods of time. This also is true where the water table rises close to the surface during certain periods of the year.

CBR: 2 - 5 | SSV: 2.0 and 2.5

Very Poor subgrade soils (those with a CBR of less than 2) often perform poorly as pavement subgrades.

TRAFFIC ANALYSIS

Traffic Analysis for calculating the TDL will be based on a 20-year design life from the end of the construction period and should include traffic from the entire master plan buildout. Traffic data for the basis of the pavement design will be in accordance with the trip generation criteria below. Exceptions may be granted by County Engineer to utilize a traffic study only in specific circumstances and will be considered on a case-by-case basis:

Vehicle Type	Number of Vehicles	Number of Trips per Day	Growth Rate
Passenger Cars	3 per Lot	2 trips per Lane	2%
Single-Unit Trucks (S.U.)			
Bus	3	2 trips per Lane	2%
2-Axle	3	1 trip per Lane	2%
3-Axle	1	1 trip per Lane	2%
Multi-Unit Trucks (M.U.)	2 per Lot	4 trips over 20-year design period	N/A

Traffic Analysis Equations:

- Design ADT = (Passenger Cars + S.U. Trucks + M.U. Trucks) – average of initial year and final year
- 24-Hour Truck % = (S.U. Trucks + M.U. Trucks) / (Design ADT)
- S.U. Truck % = (S.U. Trucks) / Design ADT
- M.U. Truck % = (M.U. Trucks) / Design ADT
- LDF = 1.0
- S.U. ESAL Factor = 0.40
- M.U. ESAL Factor = 1.50
- Design ADTT = (Design ADT) * (24-Hour Truck %)
- 18-Kip ESAL Factor = (S.U. Truck %) / (24-Hour Truck %) * 0.40 + (M.U. Truck %) / (24-Hour Truck %) * 1.50
- Design TDL: (Design ADTT) * (LDF) * (18-Kip ESAL Factor)

If Construction Traffic will be run on any portion of the pavement section, the following shall be used to compute a Construction TDL and will be added to the Design TDL for selection of pavement design:

Vehicle Type	Number of Vehicles	Number of Trips per Day (Annualized over 5 years)
Passenger Cars	3 per Lot	2 trips per Lane
Single-Unit Trucks (S.U.)	3 per Lot	4 trips per Lane
Multi-Unit Trucks (M.U.)	15 per Lot	1 trip (total per construction period)

Traffic Analysis Equations:

- Construction ADT = (Passenger Cars + S.U. Trucks + M.U. Trucks) / 5 years / 365 days
- 24-Hour Truck % = (S.U. Trucks + M.U. Trucks) / (Design ADT)
- S.U. Truck % = (S.U. Trucks) / Design ADT
- M.U. Truck % = (M.U. Trucks) / Design ADT
- LDF = 1.0
- S.U. ESAL Factor = 0.40
- M.U. ESAL Factor = 1.50

- Construction ADTT = (Construction ADT) * (24-Hour Truck %)
- 18-Kip ESAL Factor = (S.U. Truck %) / (24-Hour Truck %) * 0.40 + (M.U. Truck %) / (24-Hour Truck %) * 1.50
- Construction TDL = (Construction Year ADTT) * (LDF) * (18-Kip ESAL Factor)
- Construction TDL Conversion = Construction TDL/4
- Total TDL = (Design TDL) + (Construction TDL Conversion)

PAVEMENT REQUIREMENTS

a) Pavement Selection Requirements: The criteria described in the preceding sections will be utilized to generate the information needed for pavement selection. The County uses a Regional Factor of 1.6, which has been incorporated into the pavement sections within this design supplement.
   1. From Table 1 (included in Appendix 1), the recommended pavement section is obtained given the SSV and calculated TDL.
   2. Table 2 (included in Appendix 1) indicates the Pavement Section of an asphaltic concrete pavement thickness required to satisfy the TDL. The hyphenated number indicates the required graded aggregate base (GAB) thickness, in inches. Please note the minimum pavement section allowed, regardless of traffic or soil conditions is A-6. This includes 3.25 inches of asphaltic concrete on top of 6 inches of Graded Aggregate Base.
   3. Alternately, to improve the performance of the sub-grade, these soils can be stabilized with Portland cement. The amount of cement to use, and the application procedure depends on the soil classification and should be established to achieve a 300 psi unconfined compressive strength in a sample test. The amount and procedure should not produce an unconfined compressive strength of greater than 450 psi to avoid the sub-base behaving as a rigid pavement, as this may negatively affect the performance of the asphalt pavement layers. The percent of cement and application procedure should be determined through appropriate laboratory testing and shall be based on a minimum mixing depth of 8 inches. Other stabilization methods require approval by the County Engineer and will be made on a case-by-case basis.
   4. Example - The recommended section for a road with a SSV: 2.5, and calculated TDL: 19.7 is Pavement Section B-12 or A-8 whereas the letter represents the required Pavement Code Section (Table 2) and the number represents the depth in inches of GAB. In this case, the A-8 Pavement Section would also require 8" of Portland cement stabilized sub-grade.

b) Pavement Extension Requirements**:**
   1. If the development will consist of extending the roadway of an existing subdivision or adding a new road to an existing subdivision road, the DE will be required to confirm the pavement section of the existing subdivision road is acceptable.
      - The DE will be required to acquire pavement section cores every 500-ft along the existing road alignment to confirm the existing pavement section(s).
      - Based on the results of the pavement cores, the DE will be required to prepare a report detailing the existing pavement's structural sufficiency to accept the proposed additional traffic loadings OR a remediation plan detailing proposed improvements to the existing pavement(s) to support the proposed additional traffic loadings.
      - The DE will be required to meet with the County Engineer to review said report.
   2. The structural sufficiency of the existing pavement, or any remediation measures thereto, must be reviewed by and approved by the County Engineer.

c) Pavement Section Buildout Requirements: Contractor shall not be allowed to place construction traffic on a reduced pavement section. If the contractor wishes to run construction traffic after any asphalt pavement has been constructed, then the entire pavement section shall be constructed before placing construction traffic on the road.

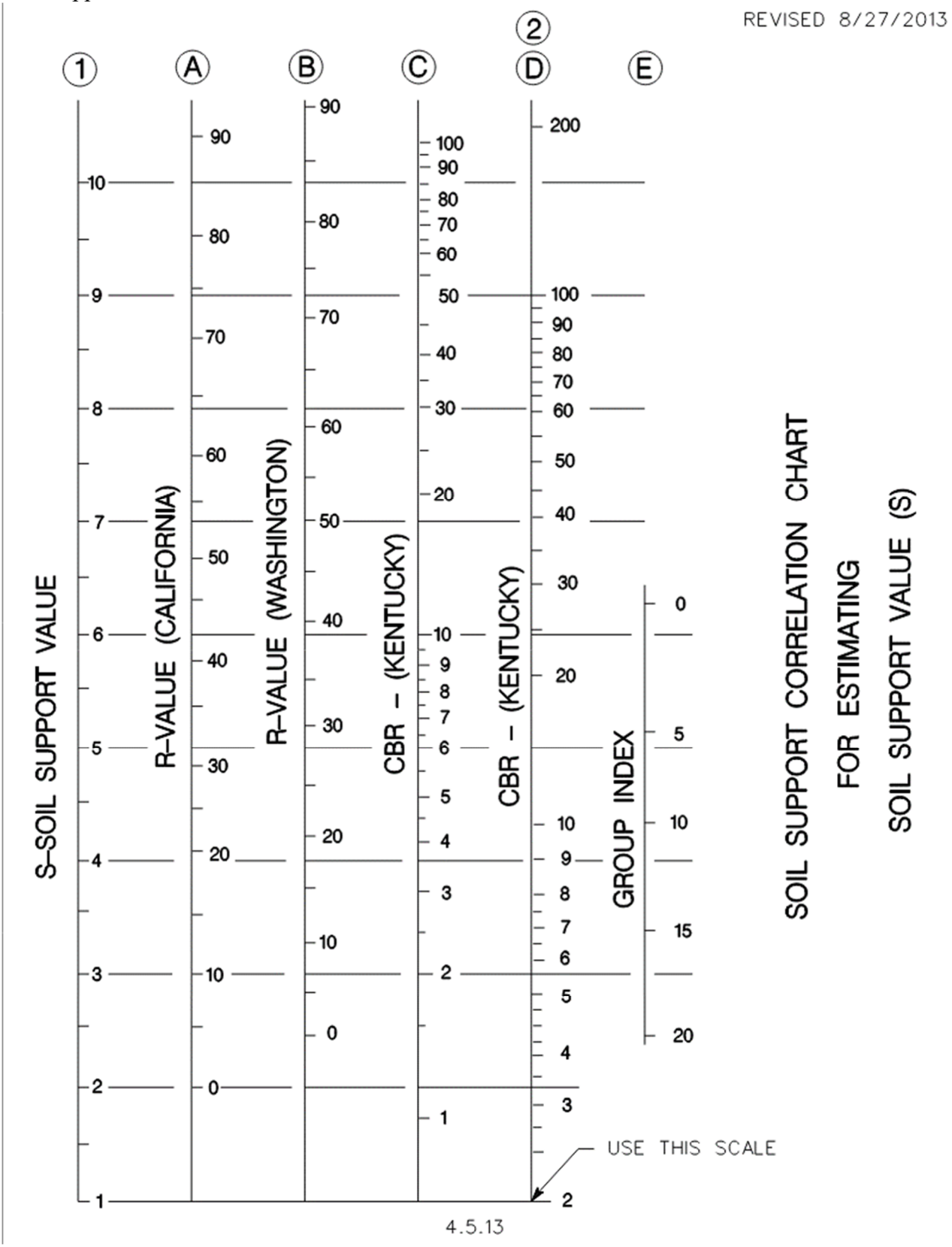
Appendix 1:
Guidelines for Pavement Selection
Table 1: Project Pavement Selection Sections

Soil Support Value (SSV)	Regional Factor	Total Daily Loadings	Pavement Section	Pavement Section w/ Cement Stabilized Sub-Grade
4.5	1.6	< 16	A-6	A-6
		17 to 28	A-8	A-6
		29 to 65	A-10	A-6
		66 to 127	B-10	A-8
		128 to 249	C-8	B-6
4.0	1.6	< 9	A-6	A-6
		10 to 16	A-8	A-6
		17 to 28	A-10	A-6
		29 to 65	B-10	A-6
		66 to 127	B-12	A-8
		128 to 249	C-10	B-8
3.5	1.6	< 5	A-6	A-6
		6 to 9	A-8	A-6
		10 to 16	B-6	A-6
		17 to 28	B-8	A-6
		29 to 65	B-12	A-8
		66 to 127	C-8	B-8
		128 to 249	C-10	B-10
3.0	1.6	< 9	A-8	A-6
		10 to 16	A-10	A-6
		17 to 28	A-12	A-6
		29 to 65	B-12	B-6
		66 to 127	C-10	B-8
		128 to 249	C-12	C-6
2.5	1.6	< 5	A-8	A-6
		6 to 9	A-10	A-6
		10 to 16	A-12	A-6
		17 to 28	B-12	A-8
		29 to 65	C-8	B-8
		66 to 127	C-12	B-10
		128 to 249	D-12	C-8
2.0	1.6	< 5	A-10	A-6
		6 to 9	B-8	A-6
		10 to 16	B-10	A-8
		17 to 28	B-12	B-6
		29 to 65	C-10	C-6
		66 to 127	D-10	C-8
		128 to 249	E-8	D-8

Table 2: Pavement Section Codes for Asphaltic Concrete Pavement Thicknesses

Pavement Section Code	Total Asphaltic Concrete Thickness (inches)	9.5 mm SP Type II* (In.)	19mm SP (In.)	25mm SP (In.)
A	**3.25**	1.25	2	0
B	**4.25**	1.25	3	0
C	**6.25**	1.25	2	3
D	**7.25**	1.25	2	4
E	**9.25**	1.25	2	6

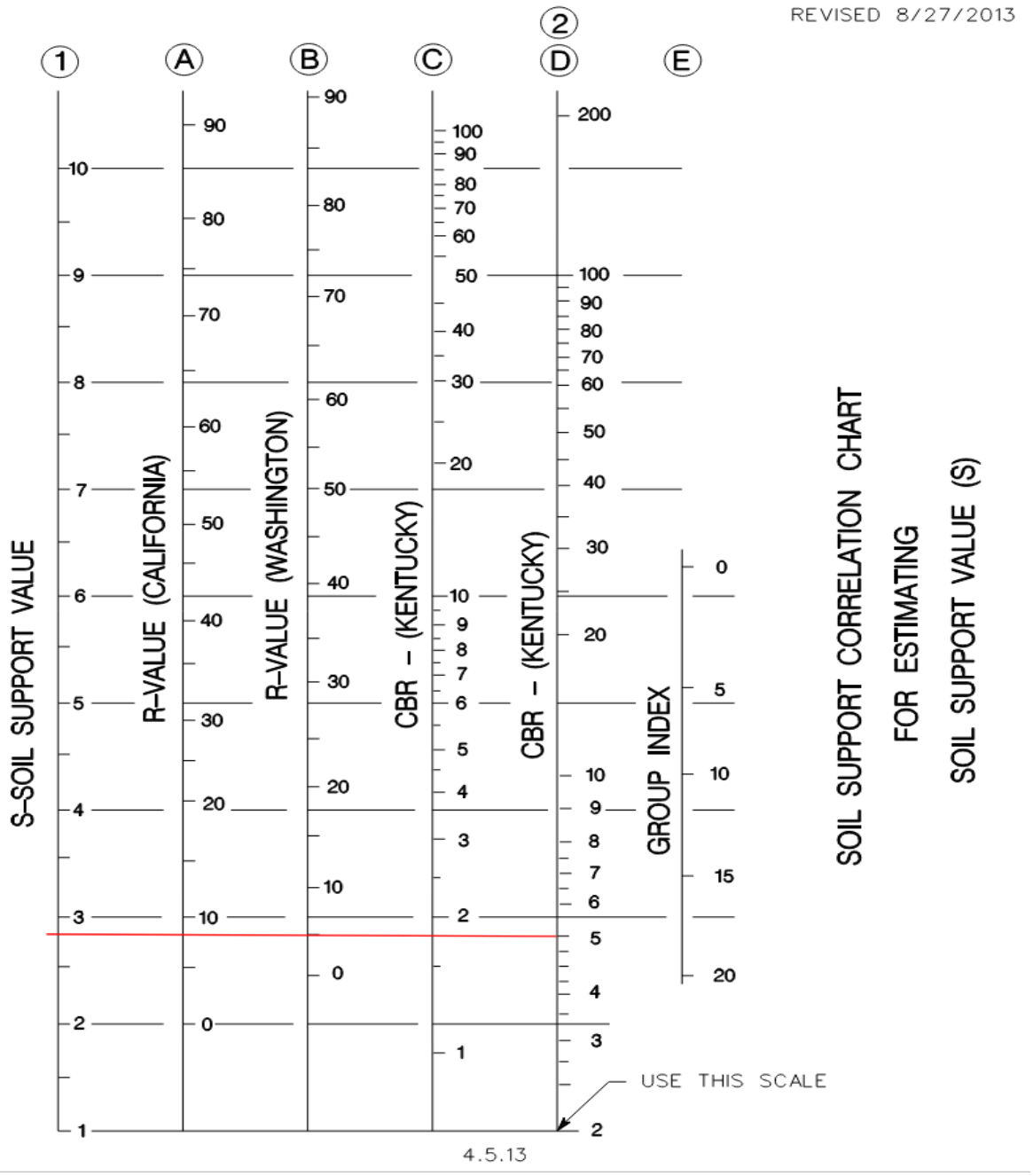
Appendix 2:
Soil Support Correlation Chart



Appendix 3:
Pavement Design Selection Example

Given:

Lot Size: 60 Units
Regional Factor: 1.6
C.B.R: 5
Construction Traffic will utilize pavement during construction



Compute SSV: CBR 5 -> SSV 2.8 => **USE SSV 2.5**

Traffic Analysis and TDL Computation:

Design Traffic						
LOT SIZE:	**60**					
Vehicle Type	**Number of Vehicles**	**Number of Trips per Day**	**Growth Rate**	**Initial ADT**	**Final ADT**	**Design ADT**
Passenger Cars	3 per Lot	2 trips per Lane	2%	360	535	447
Single-Unit Trucks (S.U.)						
Bus	3	2 trips per Lane	2%	6	9	7
2-Axle	3	1 trip per Lane	2%	3	4	4
3-Axle	1	1 trip per Lane	2%	1	1	1
Multi-Unit Trucks (M.U.)	2 per Lot	4 trips over 20-year design period	N/A	0.1	0.1	0.1
		TOTAL ADT		**370**	**550**	**460**

DESIGN ADT =	(370 + 550)/2 =	460
24-Hour Truck % =	(7 + 4 + 1 +0.1)/460 =	2.72%
S.U. Truck % =	(7+4+1)/460 =	2.70%
M.U. Truck % =	(0.1)/460 =	0.01%
LDF =		1.0
S.U. ESAL Factor =		0.4
M.U. ESAL Factor =		1.5
Design ADTT =	(460) * (2.72%)	12.5
18-Kip ESAL Factor =	(2.7%/2.72%)*0.4 + (.01%/2.72%)*1.5	0.41
Design TDL =	(12.5) * (1.0) * (0.41)	**5.1**

Construction Traffic			
LOT SIZE:	**60**		
Vehicle Type	**Number of Vehicles**	**Number of Trips per Day**	**Design ADT**
Passenger Cars	3 per Lot	2 trips per Lane	72
Single-Unit Trucks (S.U.)	3 per Lot	4 trips per Lane	144
Multi-Unit Trucks (M.U.)	15 per Lot	Total Construction period	0.5
		TOTAL ADT	**216**

Construction ADT =	(360 + 720 + 0.5) =	216
24-Hour Truck % =	(720+0.5)/1080 =	66.74%
S.U. Truck % =	(720)/1080 =	66.51%
M.U. Truck % =	(0.1)/1080 =	0.23%
LDF =		1.0
S.U. ESAL Factor =		0.4
M.U. ESAL Factor =		1.5
Construction ADTT =	(216) * (66.74%) =	144.5
18-Kip ESAL Factor =	(66.51%/66.74%)*0.4 + (.23%/66.74%)*1.5 =	0.40
Construction TDL =	(144.5) * (1.0) * (0.40) =	**58.3**
Construction TDL Conversion =	58.3/4 =	**14.6**
TOTAL TDL =	**(5.1) + (14.6) =**	**19.7**

SSV: 2.5
TOTAL TDL: 19.7
From Table 1 – Appendix 1:
Pavement Section B-12, or;
Pavement Section A-8 (with cement stabilized subgrade)

Appendix 4:
Pavement Design Deliverable Checklist

PAVEMENT DESIGN PACKAGE SUBMITTAL CHECKLIST
COLUMBIA COUNTY, GA

Project Name: _____

Address/Location: _____

Property Owner: _____

Design Engineering Firm: _____

Design Engineer: _____

Geotechnical Testing Firm/Independent Lab: _____

_____

Package Submittal Date: _____

Pavement Design Package shall be one combined PDF, in the order listed below:

1. Completed Pavement Design Package Submittal Checklist
2. Project Summary, which includes:
    a. Project Description
    b. Selected Pavement Section(s)
    c. Proposed Pavement Typical Section(s)
    d. Other Design Factors
3. Site Layout (Master Plan, if applicable) with Street Names/Lot Layout
4. Pavement Design Analysis* shall include at a minimum (see Appendix 3 Example):
    a. Units proposed, Regional Factor, CBR value, and Construction Traffic Usage
    b. Soil Support Correlation Chart (Appendix 2) with CBR to SSV correlation redline
    c. Traffic Analysis and TDL Computation
5. Lab Results* shall include at a minimum:
    a. CBR laboratory testing results
    b. Cement stabilized soil mix design laboratory testing results (if applicable)
6. Complete Subsurface Geotechnical Investigation Report*

*Requires the seal and signature of a Registered GA Licensed Professional Engineer

NOTE: Should the Applicant wish to perform the required geotechnical activities for the pavement design during the construction phase of the project instead of with plan approval, Columbia County will grant conditional approval of the plans as it pertains to the pavement design provided the following criteria are met:

1. A **C-8 Pavement Section** or a **B-8 Pavement Section with Cement Stabilized Sub-Grade** detail is shown on the plans watermarked with "**NOT FOR CONSTRUCTION**."
2. The following note is added directly below the abovementioned pavement section detail in the plans:
    a. "As of the approval of these plans by Columbia County, this pavement section is NOT approved for construction. A pavement section, meeting the requirements set forth in the **Design Supplement A, Columbia County Pavement System Design Requirements,** is required to be submitted to and approved by Columbia County prior to the mixing of cement or placement of any base material."
3. By utilizing this option, the Applicant affirms that they understand the final pavement section(s) approved by Columbia County is subject to change and any and all risk and delays for the project involved with utilizing this option lies solely on the Applicant.