



May 14, 2026

WBS Number: 46978.1.1

TIP Number: R-5810

F.A. Number: N/A

County: Martin

Description: US 17 from North of SR 1205 (Holly Creek Blvd) to SR 1119 (Ralph Taylor Rd)

Subject: Geotechnical Report – Pavement Design – Temporary

RK&K has completed the ~~revised~~ temporary pavement design for the above referenced project.

Traffic volumes are based on information provided in the ~~Proposed Design Criteria dated 3-8-18~~.

The ~~pavement thickness design~~ is based on the provided traffic volumes, provided traffic duration for ~~1 month~~, we don't need to calculate the % growth for this. Good as is. NCDOT Pavement Design Procedures dated January 4, 2019, and using ~~the provided~~ pavement thicknesses are provided for Full Depth Asphalt pavement and are summarized in Table 1.

Table 1: Pavement Design (Full Depth Asphalt)

so it only 2 rows		ADT ⁽¹⁾	Design Life (Years)	Super Pave Mix Thickness				Notes
				S9.5C	S9.5B	I19.0C	B25.0C	
-L- (STA 21+50 to 25+76)	10,700	0.25	2.5	3	✓	4.0		
-L- (STA 22+50 to 28+00)								
1. ADT are based on project let year: 2026		Please also provide Table 1 for as on U-4700A. Based on Pave Typically temporary pavements reduce construction costs. So						

Please also provide Table 1 for ABC Design as on U-4700A. Based on Pavement Manual. Typically temporary pavements are ABC, to reduce construction waste. So let's provide both ABC & Full depth, and we will let the contractor decide what they prefer to use.

The subgrade should be prepared in accordance with NCDOT Specifications Section 500. Prevention of infiltration of water into the subgrade is essential for successful performance of the pavements.

conservative time duration/rounding to quarter-year

Scott's email says 1 month duration, which is 0.08~0.1 years. Why did we use 0.25? did Atefeh suggest this?

move this paragraph onto next page

make text spacing justified. Should extend to full width

Add another Table for the Pavement Design (Aggregate Base Course) It would be 3" Asphalt (surface), 8" ABC

We may be able to get away with using 2.5" instead of 3" for Surface Coarse (for Full Depth and ABC), but please double check this with Jamey/Atefeh before switching to 2.5".

Atefeh said 2.5 is okay

Prepared by,

Sanad Musafer
Designer I, Geotechnical

revise language. & add
what we discussed

Attachments:

Provided Information: Design Criteria and Durations
-2019 NCDOT Pavement Design Manual (Select Pages)
-Calculation Summary

you didnt include
these

Add page
breaks



Atefeh Asoudeh, P.E.
Project Manager, Geotechnical
Registered, North Carolina 043747

switch to my seal and name.
& move seal below name to
leave space for digital
signatures above names.

Maxime Metry, PE
Project Engineer II, Geotech
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Job No.: R-5810

Task: Flexible Asphalt Temporary Pavement Design

Job Name: -

By: SWM

Date: 5/14/2026

Checked By:

Date:

Flexible Asphalt Temporary Pavement Design

References:

- 1) NCDOT Pavement Design Procedure AASHTO 1993 Method, NCDOT Materials and Tests Unit - Pavement Section, January 4, 2019.
- 2) AASHTO Guide for Design of Pavement Structures 1993

Forecasted Traffic Volumes and Years

Construction Year:	2026
Design Period:	0.25 years
Level of Loading Design Period:	20 years
Initial ADT, $ADT_{Initial}$:	10,700 vpd
Initial ADT Year, $Year_{Initial}$:	2026
Future ADT, ADT_{Future} :	15,306.00 vpd
Future ADT Year, $Year_{Future}$:	2046

1 month is 0.1? Why are we using 0.25?

NCDOT Pavement Design Procedure (page 10)

NCDOT Pavement Design Procedure (page 7)

Provided by HNTB Traffic Forecasting

Provided by HNTB Traffic Forecasting

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Traffic Design Inputs

TTST Loading Factor, $TTST_F$:	0.80	Urban Other
% Multiple Unit Multiple Axle Trucks, %TTST:	1 %	
DUALS Loading Factor, $DUAL_F$:	0.25	Urban Other
% Single Unit Single Axle Trucks, %DUALS:	2 %	
Lane Distribution Factor, L_D :	1.00	1 Lane/Direction
% Direction:	50 %	
Initial Serviceability Index, P_0 :	4.20	
Terminal Serviceability Index, P_t :	2.50	
$\Delta PSI, P_0 - P_t$:	1.70	
Std Error of Traffic and Performance Prediction, S_0 :	0.45	
Reliability:	90	
Standard Normal Deviate, Z_R :	-1.282	

NCDOT Pavement

Design Procedure (page 4)

NCDOT Pavement

Design Procedure (page 4)

NCDOT Pavement Design Procedure (page 4)

NCDOT Pavement Design Procedure (page 1)

NCDOT Pavement Design Procedure (page 4)

NCDOT

Primary

What Bulk Sample?
Is this from a nother
project delete.

page 1)

ement

page 5)

Soil Design Inputs

Subgrade Soil California Bearing Ratio, CBR: 6 %

Based on Terracon PDI Bulk Samples

Traffic Percent Growth

NCDOT Pavement Design Procedure (page 3)

$$\%Growth = \left(10^{\left(\frac{\log_{10}(ADT_{Future})}{(Year_{Future} - Year_{Initial}) * 365.25} \right) * 365.25 - 365.25} \right) * 100 = 1.79 \%$$

where,

 ADT_{Future} = Future ADT Traffic Count (vpd) $Year_{Future}$ = Future ADT Year $ADT_{Initial}$ = Initial ADT Traffic Count (vpd) $Year_{Initial}$ = Initial ADT Year

Average Annual Daily Traffic in the Year of Construction

NCDOT Pavement Design Procedure (page 3)

$$ADT_C = ADT_{Initial} * \left(1 + \frac{\%Growth}{100 * 365.25} \right)^{((Year_{Construction} - Year_{Initial}) * 365.25)} = 10,700 \text{ vpd}$$

where,

 ADT_C = Average Annual Daily Traffic in Construction Year (vpd) $Year_{Construction}$ = Construction ADT Year $ADT_{Initial}$ = Initial ADT Traffic Count (vpd) $Year_{Initial}$ = Initial ADT Year

% Growth = Percent Traffic Growth

Determine Traffic ESALS (W_{18})

NCDOT Pavement Design Procedure (page 3)

$$ESALS_{Total} = \frac{((1 + \frac{\%Growth}{100 \cdot 365.25})^{(365.25 \cdot N_D)} - 1) \cdot (ADT_C \cdot \frac{\%TTST}{100} + TTST_F + ADT_C \cdot \frac{\%Duals}{100} \cdot Dual_F) \cdot \frac{\%Direction}{100} \cdot L_D}{\ln(1 + \frac{\%Growth}{100 \cdot 365.25})}$$

where,

$ESALS_{Total}$ = 18 Kip Equivalent Single Axle Load

ADT_C = Average Annual Daily Traffic in Construction Year (vpd)

L_D = Lane Distribution Factor

% Direction = Percent Direction Split of Traffic in Each Direction

$DUAL_F$ = DUALs Loading Factor

% Growth = Percent Traffic Growth

N_D = Design Number of Years

% DUALs = Percent Single Unit Single Axle Trucks

% TTSTs = Percent Multiple Unit Multiple Axle Trucks

N_D = Design Number of Years

$$ESALS_{Total} = \frac{6,365}{610,901} \cdot 18 \text{ Kip Equivalent Single Axle Load } (W_{18}) \cdot \frac{0.25 \text{ year Design Period}}{20 \text{ year Level of Loading Design Period}}$$

Subgrade Resilient Modulus (M_R)

NCDOT Pavement Design Procedure (page 1)

$$M_R = 2555 \cdot (CBR \text{ VALUE})^{0.64} = 8,045 \text{ psi}$$

Required Structural Number of Flexible Asphalt Pavement

NCDOT Pavement Design Procedure (page 1)

$$\log(W_{18}) = Z_R \cdot S_o + 9.36 \cdot \log(SN + 1) - 0.20 + \frac{\log\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN + 1)^{5.19}}} + 2.32 \cdot \log(M_R) - 8.07$$

where,

$ESALS_{Total}$ = 18 Kip Equivalent Single Axle Load

S_o = Standard Error of Traffic and Performance Prediction

SN = Structural Number of Flexible Asphalt Pavement Section

Z_R = Standard Normal Deviate

M_R = Subgrade Resilient Modulus (psi)

REARRANGE EQUATION AND SET = 0 BY TRIAL AND ERROR CHANGING THE 'SN'

$$Z_R \cdot S_o + 9.36 \cdot \log(SN + 1) - 0.20 + \frac{\log\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN + 1)^{5.19}}} + 2.32 \cdot \log(M_R) - 8.07 - \log(W_{18}) = 0$$



you did not do this right. You're suppose to use Solver or Goal Seek so that this both equals zero and that you calculate the SN. If u dont know how to do that it takes one sec, i can show you

$$0.839 = 0$$

Required SN = 2.010

Required Structural Number of Flexible Asphalt Pavement

$$SN = a_1 d_1 + a_2 d_2 m_2 + a_3 d_3 m_3 + a_4 d_4 m_4 \dots$$

where,

SN = Structural Number of Flexible Asphalt Pavement Section

a_i = Structural Layer Coefficients

m_i = Drainage Layer Coefficients

d_i = Thickness of Layers (inches)

Material Type	Design 'a'	Design 'm'
Surface Mix (S9.5B, S9.5C, S9.5D)	0.44	--
Intermediate Mix (I19.0C)	0.44	--
Base Mix (B25.0C)	0.30	--
Granular Base (ABC Stone)	0.14	1.00
Cement Treated Base (CTABC)	0.23	1.00
Granular Subbase (PADC)	0.14	1.00
Lime/Cement Stabilized Subgrade	1.00	1.00

NCDOT Pavement Design Procedure (page 6)

Atefeh said
2.5 is okay

confirm if we need 3" with Atefeh/Jamey

		Thickness (inches) ¹					Design SN	Check SN ²
Design No.	Mix	Base	Granular Base	CT Base	Granular Subbase	L/C Subgrade		
1	2.50						2.300	OK

Notes:

- 1) Check that pavement section thicknesses meet requirements of 'Minimum Depth for Pavement Designs (page 10)'
- 2) 'Design SN' must be within 0.10 of 'Required SN'

Surface Mix Design ESALS = 610,901, 18 Kip Equivalent Single Axle Load, 20 year Level of Loading Design Period
Surface Mix Design Type = S9.5B NCDOT Pavement Design Procedure (page 7)

add Design No. 2 for ABC Mix.