

Line	ADT ⁽¹⁾	Design Life (Years)	Super Pave Mix Thickness			
			S9.5C	S9.5B	I19.0C	B25.0C
-L- (STA 21+50 to 25+76)	10,700	0.25		2.5		4.0
-L- (STA 22+50 to 28+00)						
1. ADT are based on project let year: 2026						



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.

Prepared by,

Sanad Musaffer
Designer I, Geotechnical

Maxime Metry, P.E.
Project Engineer II, Geotechnical
Registered, North Carolina 056190



Attachments:

- Provided Information: Design Data and Plan View
- 2019 NCDOT Pavement Design Manual (Select Pages)
- Calculation Summary

PROVIDED INFORMATION
DESIGN DATA
PLAN VIEW

EMAIL REQUEST FOR TEMPORARY PAVEMENT DESIGN

From: Porter Jones <wpjones@rkk.com>
Sent: Wednesday, May 6, 2026 1:28 PM
To: Scott Blevins <sblevins@rkk.com>; Gregory Goins <ggoins@rkk.com>
Cc: Erin Seals <eseals@rkk.com>; Roman Prokopovych <rprokopovych@rkk.com>
Subject: RE: R-5810 temporary pavement design

Hello Greg,

Just would like to keep you up to date. Just had some DQC comments that have resulted in some changes to the amount of temp pavement needed. We will now need temporary pavement is needed for a pipe installation from -L- Sta 21+50 to -L- Sta 25+**82** on the median side of the NB lanes and from -L- Sta 22+**26** to -L- Sta 28+**19** on the outside of the NB lanes. I have bolded the changes for clarity. I am currently working on revising the TMP to show these revised limits.

Thanks,
Porter

From: Scott Blevins <sblevins@rkk.com>
Sent: Wednesday, May 6, 2026 9:21 AM
To: Gregory Goins <ggoins@rkk.com>
Cc: Porter Jones <wpjones@rkk.com>; Erin Seals <eseals@rkk.com>; Roman Prokopovych <rprokopovych@rkk.com>
Subject: R-5810 temporary pavement design

Hey Greg,

Thanks for helping out on the temporary pavement design. Temporary pavement is needed for a pipe installation from -L- Sta 21+50 to -L- Sta 25+76 on the median side of the NB lanes and from -L- Sta 22+50 to -L- Sta 28+00 on the outside of the NB lanes. The plan view and traffic volumes are shown below. It is a short duration....< 1 month. Let us know if you need additional information.

09/08/19

See Sheet 1A For Index of Sheets
See Sheet 1B For Conventional Symbols

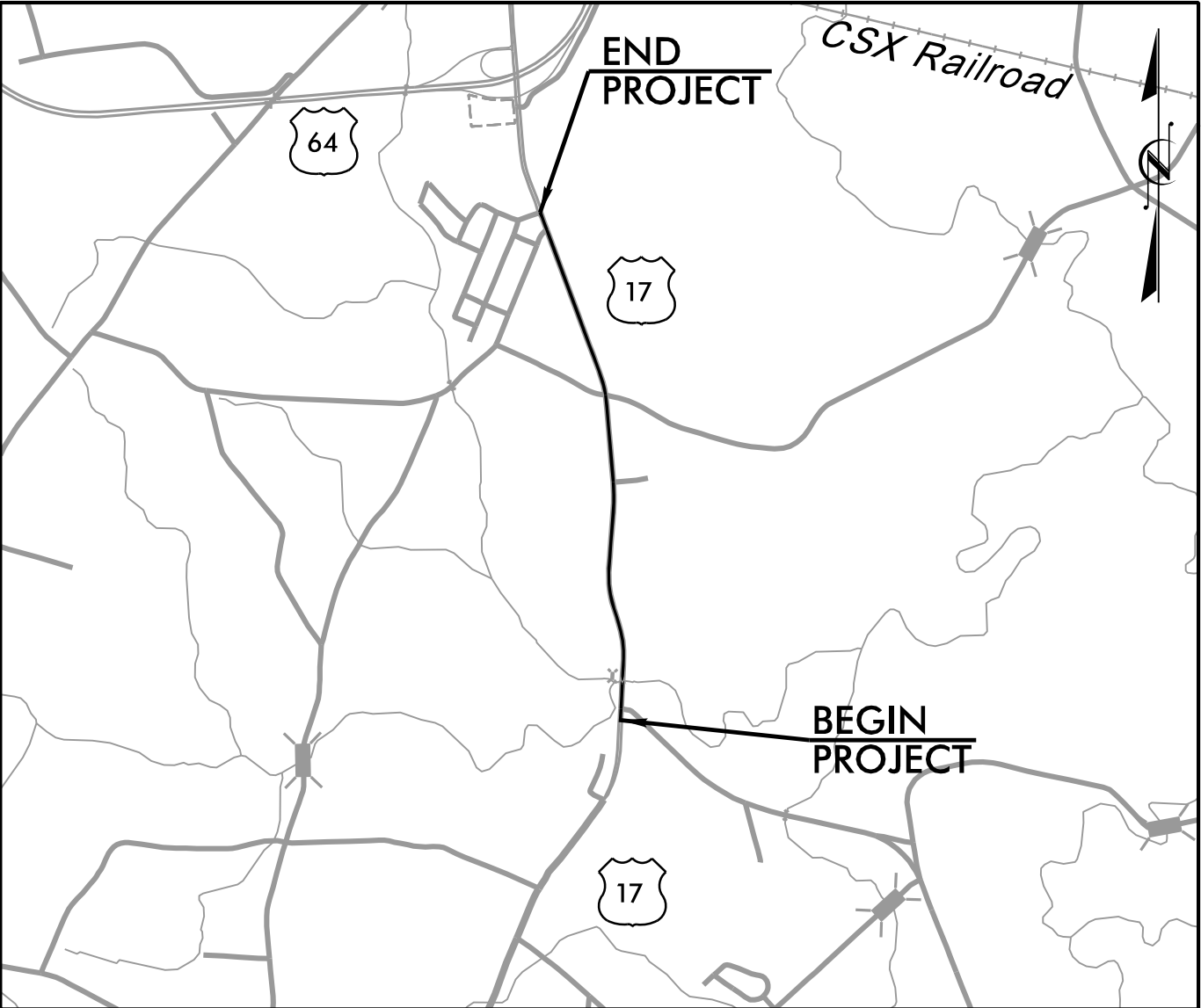
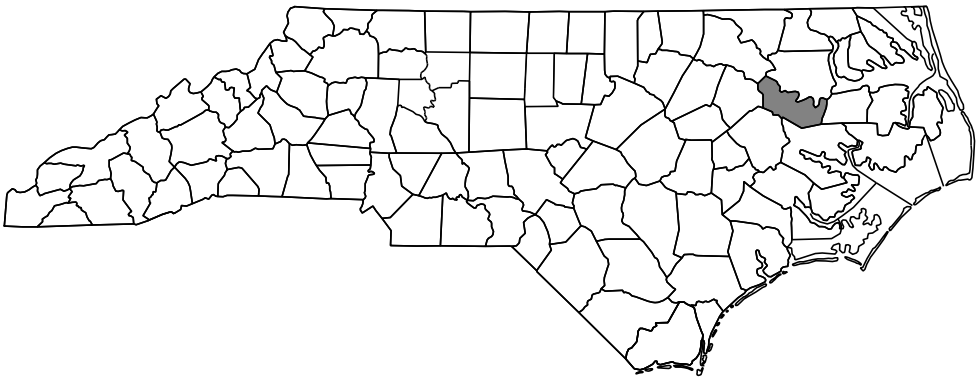
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

MARTIN COUNTY

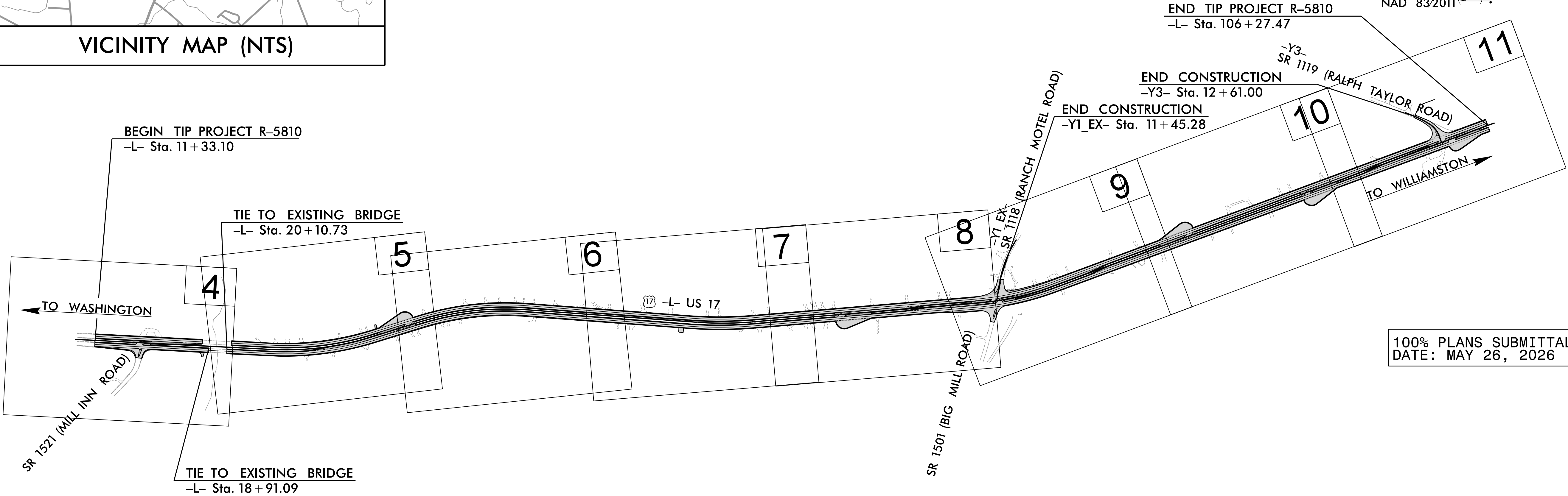
LOCATION: US 17 FROM SR 1119 (RALPH TAYLOR ROAD) TO
SR 1205 (HOLLY CREEK BOULEVARD) MANAGEMENT

TYPE OF WORK: GRADING, DRAINAGE, PAVING, AND SIGNING

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5810	1	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
46978.1.1		PE	
46978.2.1		ROW	
46978.2.2		UTIL. RELOCATION	
46978.3.1	4697801	CONST.	



VICINITY MAP (NTS)

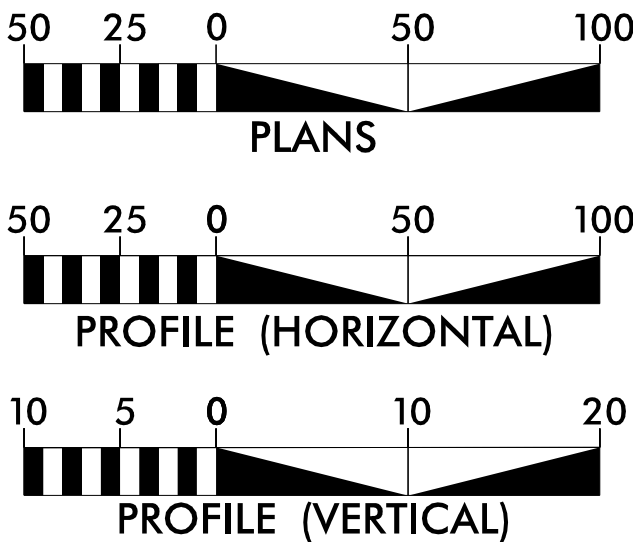


100% PLANS SUBMITTAL
DATE: MAY 26, 2026

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

NOTES:
THIS IS A PARTIALLY CONTROLLED-ACCESS PROJECT WITH ACCESS BEING LIMITED TO POINTS AS SHOWN ON THE PLANS.

GRAPHIC SCALES



DESIGN DATA

ADT 2026 = 10,700
ADT 2046 = 15,306
K = 5%
D = 60%
T = 13% *
V = 60 MPH
* TTST = 8% DUAL 5%
FUNC CLASS =
PRINCIPAL ARTERIAL

PROJECT LENGTH

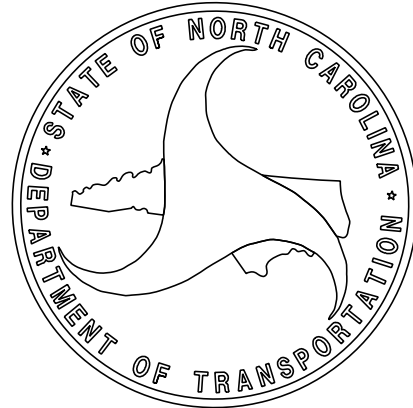
LENGTH ROADWAY TIP PROJECT R-5810..... 1.775 miles
TOTAL LENGTH OF TIP PROJECT R-5810..... 1.775 miles

PLANS PREPARED BY:
RK&K
RUMMEL, KLEPPER & KAHL, LLP
8601 SIX FORKS ROAD, FORUM 1, SUITE 700
RALEIGH, NORTH CAROLINA 27615-3960
1-888-521-4455 OR 919-878-9560
FOR NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
2024 STANDARD SPECIFICATIONS
RIGHT OF WAY DATE:
MAY 31, 2024
LETTING DATE:
OCTOBER 20, 2026
NCDOT CONTACT:

ROMAN PROKOPOVYCH, P.E.
PROJECT ENGINEER
ERIN SEALS, P.E.
PROJECT DESIGN ENGINEER
JUSTIN R. SMITH, PE.
PROJECT ENGINEER - DIVISION 1

HYDRAULICS ENGINEER

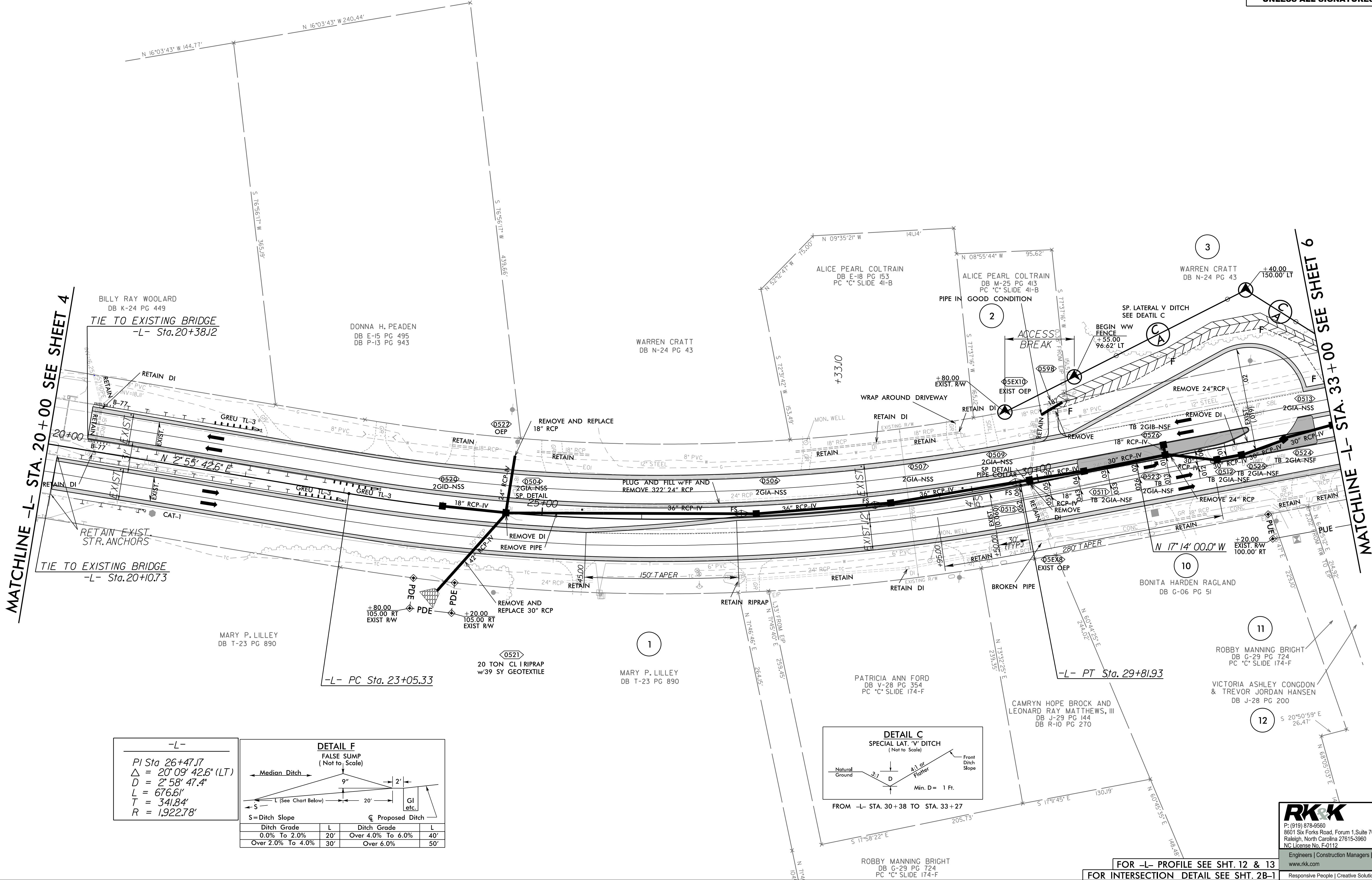
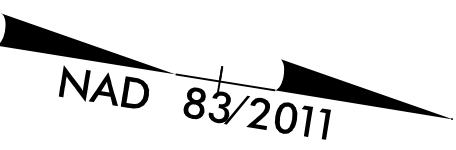
SIGNATURE: _____ P.E.
ROADWAY DESIGN
ENGINEER
SIGNATURE: _____ P.E.



TIP PROJECT: R-5810

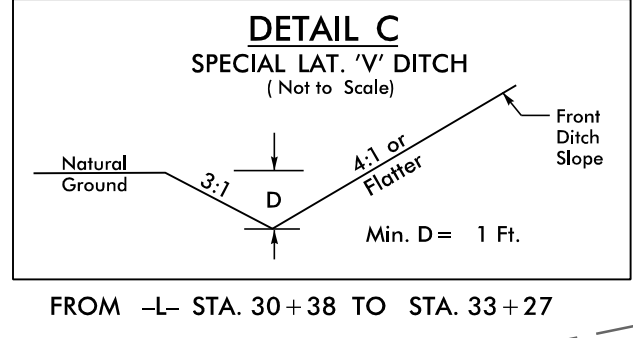
CONTRACT: C205216

PROJECT REFERENCE NO. <i>R-5810</i>		SHEET NO. <i>5</i>	
R/W SHEET NO.		HYDRAULICS ENGINEER	
ROADWAY DESIGN ENGINEER			
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION			
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED			



-L-
PI Sta 26+47.17
 $\Delta = 20^\circ 09' 42.6''$ (LT)
D = 2'58" 47.4"
L = 676.61'
T = 341.84'
R = 1,922.78'

DETAIL F FALSE SUMP (Not to Scale)			
S=Ditch Slope		Q Proposed Ditch	
Ditch Grade	L	Ditch Grade	L
0.0% To 2.0%	20'	Over 4.0% To 6.0%	40'
Over 2.0% To 4.0%	30'	Over 6.0%	50'



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2019 NCDOT PAVEMENT DESIGN MANUAL
SELECT PAGES

PAVEMENT LAYER DEPTHS

Max layer depths: Inches

S9.5X = 3.0

I19.0C = 4.0

B25.0C = no restrictions

ABC = normally limited to 12, recommended depths are typically 6*, 8, 10, and 12 inches.

*Typically Secondary Roads.

CTBC = 8 for plant mixed; for road mixed 8 with top 7 mixed.

Single lift depths: Inches

S9.5B = 1.0 to 1.5

S9.5C,D = 1.5* to 2.0

*1.0" may be used in wedging only

I19.0C = 2.5 to 4.0

B25.0C = 3.0* to 5.5

*For B25.0C placed on unstabilized subgrade, the minimum lift thickness is 4.0.

ABC = 6* to 10

*8" Preferred minimum on unstabilized subgrade for primary & greater roadways.

CTBC = 8

FDR = 12

Any deviations from these depths will be noted on the pavement design letter.

To "build" a structural number, as much of the structural number as possible will be put into the surface and intermediate layers. In other words, the depths of these two layers will be maximized.

For normal mixes this total depth is 5-5.5 in, and for heavy duty designs the total depth is 6 in. 7 in. of surface and intermediate depth is typically required on interstate designs.

For curb and gutter and expressway gutter sections, the total surface and intermediate depth will be increased to 7 in. to match curb depth. For shoulder berm gutter sections, the total surface and intermediate depth will be set to match gutter depth.

Two lifts of surface mix is standard for almost all designs. 1.25" or 1.5" of S9.5B and 1.5" of S9.5C/S9.5D are the typical lift depths. An asphalt base, ABC base, or CTBC base is required on all flexible pavement designs. Normally 8 in of ABC is used as the starting depth for aggregate base.

Prime Coat is required to be used where surface mixes is placed directly on top of ABC.

MINIMUM DEPTHS FOR PAVEMENT DESIGNS

Minimum Structure Depths that are Recommended for NCDOT Designs				
	Interstate & Freeways	Primary and Secondary >20,000ADT	Primary <20,000ADT	Secondary <20,000ADT
Full Depth Asphalt	11.0" Asphalt	9.5" Asphalt	7.0" Asphalt	6.5" Asphalt
ABC	7.0" Asphalt and 8" ABC	5.5" Asphalt and 8.0" ABC	3.0" Asphalt and 8.0" ABC	2.5" Asphalt and 6.0" ABC
CTBC	7.0" Asphalt and 8.0" CTBC	5.5" Asphalt and 8.0" CTBC	3.0" Asphalt and 8.0" CTBC	2.5" Asphalt and 8.0" CTBC
Concrete	9.0" Concrete 3.0" of PADC 1.25" of S9.5B**	8.0" Concrete 3.0" of PADC 1.25" of S9.5B**	7.0" Concrete 3.0" of PADC 1.25" of S9.5B**	5.0-6.0" Concrete* and 4.0" ABC

*5.0" is the minimum on residential subdivision streets only.

*5.5" is the minimum on collector roadways.

*6.0" is the minimum on Poor to Fair subgrade type (A-4 to A-7)

** For pavements with <2000 average daily trucks 6" ABC can be used rather than the PADC and S9.5B

PAVEMENT DESIGNS FOR DETOURS

Pavement designs for detours and other temporary pavements will usually be constructed of aggregate base course (ABC) and minimal asphalt depths to reduce construction waste. ABC recovered from detour structures will be re-used in the project or stockpiled to be used by Division Maintenance Forces. Typical design periods are from 6 months to 2 years as provided by Project Design Engineer. Pavement designs prepared for design periods of less than 6 months should be carefully reviewed since required structural numbers may be unreasonably low. For any detour that is expected to carry truck traffic, the minimum asphalt layer shall be 2 inches. Surface mix is required to be the top layer is any flexible design including detours and temporary pavements.

Note: The selection of loading level for SuperPave mixes will be based on the theoretical 20 year accumulation of ESAL's even when the design life used for the pavement structure is for a short duration, with the exception of D mix types, which will be replaced with a C mix.

THIN-DEPTH PAVED SHOULDER DESIGN

For paved shoulders that will not be constructed with full depth of travel lane pavement thickness (see Roadway Design Paved Shoulder Policy), 2 % of the design lane traffic loads will be used for design.

BRIDGE REPLACEMENT PAVEMENT DESIGNS

Due to the small amount of roadway work involved in most of these projects, final pavement designs for bridge replacement projects are typically made without a soils investigation or review committee input. On bridge replacement projects with roadway work less than 1,200 ft in length, a full depth asphalt design is normally recommended. For lengths in excess of 1,200 ft, an aggregate base course (ABC) will be provided if feasible. All of these designs are to be based on a 20 or 30 year design period, based on ADT. If there is an exception, the reason(s) for the exception should be documented on the final pavement design issued to the Roadway Design or Design Services Project Engineer. Overlay designs on existing pavement should consist of one to two lifts of surface and based on the condition of the existing roadway. Recommended bridge replacement pavement designs are listed on next page, as low volume designs.

RECOMMENED LOW VOUME PAVEMENT DESIGNS

This table is an easy method to determine designs typically used for low volume pavements, based on required SN (Page 1). Minimum pavement depths based on road types (page 10) still are required, regardless of this table.

****CHECK DESIGN MEETS MINIMUM DEPTHS FOR PAVEMENT DESIGNS (PAGE 10)****

Without Curb and Gutter Designs:

(Determine if load level is B, C, or D by using the 20 year ESALS - Page 7)

Table A-1 Recommended Pavement Design - (Full Depth)				
Required Structural Number	Surface	Inter.	Base	Structural Number Provided
B LEVEL DESIGNS (Use when 20 year ESALS are <0.3 Million)				
<2.37	2.5" S9.5B		4.0" B25.0C	2.30
2.38 - 2.52	2.5" S9.5B		4.5" B25.0C	2.45
2.53 - 2.67	2.5" S9.5B		5.0" B25.0C	2.60
2.68 - 2.82	2.5" S9.5B		5.5" B25.0C	2.75
2.83 - 3.47	2.5" S9.5B	2.5" I19.0C	4.0" B25.0C	3.40
B, C, & D LEVEL DESIGNS (Use when 20 year ESALS are >0.3 Million)				
<2.59	3.0" S9.5X		4.5" B25.0C	2.52
2.60 - 2.74	3.0" S9.5X		4.5" B25.0C	2.67
2.75 - 2.89	3.0" S9.5X		5.0" B25.0C	2.82
2.90 - 3.04	3.0" S9.5X		5.5" B25.0C	2.97
3.05 - 3.69	3.0" S9.5X	2.5" I19.0C	4.0" B25.0C	3.62
3.70 - 3.84	3.0" S9.5X	2.5" I19.0C	4.5" B25.0C	3.77
3.85 - 3.99	3.0" S9.5X	2.5" I19.0C	5.0" B25.0C	3.92
4.00 - 4.14	3.0" S9.5X	2.5" I19.0C	5.5" B25.0C	4.07

(Determine if load level is B, C, or D by using the 20 year ESALS - Page 7)

Table A-2 Recommended Pavement Design (ABC)				
Required Structural Number	Surface	Inter.	Base	Structural Number Provided
B LEVEL DESIGNS (Use when 20 year ESALS are <0.3 Million)				
<2.01	2.5" S9.5B *		6" ABC	1.94
2.02 - 2.29	2.5" S9.5B*		8" ABC	2.22
2.30 - 2.57	2.5" S9.5B*		10" ABC	2.50
2.58 - 3.11	2.5" S9.5B	2.5" I19.0C	6" ABC	3.04
3.12 - 3.39	2.5" S9.5B	2.5" I19.0C	8" ABC	3.32
3.40 - 3.67	2.5" S9.5B	2.5" I19.0C	10" ABC	3.60
B, C, & D LEVEL DESIGNS (Use when 20 year ESALS are >0.3 Million)				
<2.23	3.0" S9.5X		6" ABC	2.16
2.24 - 2.51	3.0" S9.5X		8" ABC	2.44
2.52 - 2.79	3.0" S9.5X		10" ABC	2.72
2.80 - 3.33	3.0" S9.5X	2.5" I19.0C	6" ABC	3.26
3.34 - 3.61	3.0" S9.5X	2.5" I19.0C	8" ABC	3.54
3.62 - 3.89	3.0" S9.5X	2.5" I19.0C	10" ABC	3.82

* Prime coat required

Curb and Gutter Designs:

(Determine if load level is B, C, or D by using the 20 year ESALS - Page 7)

Table B-1 Recommended Pavement Design - (Full Depth)				
Required Structural Number	Surface	Inter.	Base	Structural Number Provided
<4.35	3.0" S9.5X	4.0" I19.0C	4.0" B25.0C	4.28
4.36 - 4.50	3.0" S9.5X	4.0" I19.0C	4.5" B25.0C	4.43

(Determine if load level is B, C, or D by using the 20 year ESALS - Page 7)

Table B-2 Recommended Pavement Design (ABC)				
Required Structural Number	Surface	Inter.	Base	Structural Number Provided
<3.99	3.0" S9.5X	4.0" I19.0C	6" ABC	3.92
4.00 - 4.27	3.0" S9.5X	4.0" I19.0C	8" ABC	4.20
4.28 - 4.55	3.0" S9.5X	4.0" I19.0C	10" ABC	4.48

CALCULATION SUMMARY



Job No.: R-5810

Task: Flexible Asphalt Temporary Pavement Design

Job Name: US 17 from North of SR 1205 to SR 1119

By: SWM

Date: 6/1/2026

Checked By: MM

Date: 5/26/2026

**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	NCDOT Pavement Design Procedure (page 10)
Level of Loading Design Period:	20	years	NCDOT Pavement Design Procedure (page 7)
Initial ADT, $ADT_{Initial}$:	10,700	vpd	Provided by HNTB Traffic Forecasting
Initial ADT Year, $Year_{Initial}$:	2026		Provided by HNTB Traffic Forecasting
Future ADT, ADT_{Future} :	15,306	vpd	Provided by HNTB Traffic Forecasting
Future ADT Year, $Year_{Future}$:	2046		Provided by HNTB Traffic Forecasting

Traffic Design Inputs

TTST Loading Factor, $TTST_F$:	0.80	,	Urban Other	NCDOT Pavement
% Multiple Unit Multiple Axle Trucks, %TTST:	1	%		Design Procedure (page 4)
DUALS Loading Factor, $DUAL_F$:	0.25	,	Urban Other	NCDOT Pavement
% Single Unit Single Axle Trucks, %DUALS:	2	%		Design Procedure (page 4)
Lane Distribution Factor, L_D :	0.90	,	2 Lane/Direction	
% Direction:	50	%		NCDOT Pavement Design Procedure (page 4)
Initial Serviceability Index, P_0 :	4.20			NCDOT Pavement Design Procedure (page 1)
Terminal Serviceability Index, P_t :	2.50			NCDOT Pavement Design Procedure (page 4)
$\Delta PSI, P_0 - P_t$:	1.70			
Std Error of Traffic and Performance Prediction, S_0 :	0.45			NCDOT Pavement Design Procedure (page 1)
Reliability:	90	,	Primary	NCDOT Pavement
Standard Normal Deviate, Z_R :	-1.282			Design Procedure (page 5)

Soil Design Inputs

Subgrade Soil California Bearing Ratio, CBR: 6 %

Traffic Percent Growth

NCDOT Pavement Design Procedure (page 3)

$$\%Growth = (10^{\frac{\log_{10}(\frac{ADT_{Future}}{ADT_{Initial}})}{(Year_{Future} - Year_{Initial}) * 365.25}} - 1) * 365.25 = 1.79 \%$$

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)

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

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)

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

where,

ESALS_{Total} = 18 Kip Equivalent Single Axle Load

% Growth = Percent Traffic Growth

ADT_C = Average Annual Daily Traffic in Construction Year (vpd)N_D = Design Number of YearsL_D = Lane Distribution Factor

% DUALs = Percent Single Unit Single Axle Trucks

% Direction = Percent Direction Split of Traffic in Each Direction

% TTSTs = Percent Multiple Unit Multiple Axle Trucks

DUAL_F = DUALs Loading FactorN_D = Design Number of Years

$$ESALS_{Total} = \frac{5,729}{549,811} \cdot 18 \text{ Kip Equivalent Single Axle Load } (W_{18}) \quad \frac{0.25 \text{ year Design Period}}{20 \text{ year Level of Loading Design Period}}$$

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 LoadZ_R = Standard Normal DeviateS_o = Standard Error of Traffic and Performance PredictionM_R = Subgrade Resilient Modulus (psi)

SN = Structural Number of Flexible Asphalt Pavement Section

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

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

$$0.000 = 0$$

$$\text{Required SN} = 1.401$$

Required Structural Number of Flexible Asphalt Pavement

$$SN = a_1 d_1 + a_2 d_2 m_2 + a_3 d_3 m_3 + a_i d_i m_i \dots\dots$$

where,

SN = Structural Number of Flexible Asphalt Pavement Section

m_i = Drainage Layer Coefficientsa_i = Structural Layer Coefficientsd_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)

Design No.	Thickness (inches) ¹							Design SN	Check SN ²
	Surface Mix	Intermediate Mix	Base Mix	Granular Base	CT Base	Granular Subbase	L/C Subgrade		
1	2.50		4.00					2.300	OK
2	2.50			6.00				1.940	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 = 549,811, 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)