



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: 6/9/2026

Checked By: MM

Date: 6/9/2026

**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, $TTST_F$ :                          | 0.95   | , | Rural Other      | NCDOT Pavement                           |
| % Multiple Unit Multiple Axle Trucks, %TTST:             | 8      | % |                  | Design Procedure (page 4)                |
| DUALS Loading Factor, $DUAL_F$ :                         | 0.30   | , | Rural Other      | NCDOT Pavement                           |
| % Single Unit Single Axle Trucks, %DUALS:                | 5      | % |                  | 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)

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

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)

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

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<sub>18</sub>)**

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<sub>Total</sub> = 18 Kip Equivalent Single Axle LoadADT<sub>C</sub> = Average Annual Daily Traffic in Construction Year (vpd)L<sub>D</sub> = Lane Distribution Factor

% Direction = Percent Direction Split of Traffic in Each Direction

DUAL<sub>F</sub> = DUALs Loading Factor

% Growth = Percent Traffic Growth

N<sub>D</sub> = Design Number of Years

% DUALs = Percent Single Unit Single Axle Trucks

% TTSTs = Percent Multiple Unit Multiple Axle Trucks

N<sub>D</sub> = Design Number of Years

|                          |           |                                                        |                                          |
|--------------------------|-----------|--------------------------------------------------------|------------------------------------------|
| ESALS <sub>Total</sub> = | 40,100    | ,18 Kip Equivalent Single Axle Load (W <sub>18</sub> ) | ,0.25 year Design Period                 |
|                          | 3,848,676 | ,18 Kip Equivalent Single Axle Load (W <sub>18</sub> ) | , 20 year Level of Loading Design Period |

**Subgrade Resilient Modulus (M<sub>R</sub>)**

NCDOT Pavement Design Procedure (page 1)

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

**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<sub>Total</sub> = 18 Kip Equivalent Single Axle LoadS<sub>o</sub> = Standard Error of Traffic and Performance Prediction

SN = Structural Number of Flexible Asphalt Pavement Section

Z<sub>R</sub> = Standard Normal DeviateM<sub>R</sub> = Subgrade Resilient Modulus (psi)**REARRANGE EQUATION AND SET = 0 BY TRIAL AND ERROR CHANGING THE 'SN'**

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

$$0.000 = 0$$

Required SN = 1.979

**Required Structural Number of Flexible Asphalt Pavement**

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

where,

SN = Structural Number of Flexible Asphalt Pavement Section

a<sub>i</sub> = Structural Layer Coefficientsm<sub>i</sub> = Drainage Layer Coefficientsd<sub>i</sub> = 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<br>No. | Thickness (inches) <sup>1</sup> |                     |             |                  |            |                     |                 | Design<br>SN | Check<br>SN <sup>2</sup> |
|---------------|---------------------------------|---------------------|-------------|------------------|------------|---------------------|-----------------|--------------|--------------------------|
|               | Surface<br>Mix                  | Intermediate<br>Mix | Base<br>Mix | Granular<br>Base | CT<br>Base | Granular<br>Subbase | L/C<br>Subgrade |              |                          |
| 1             | 3.00                            |                     | 4.00        |                  |            |                     |                 | 2.520        | OK                       |
| 2             | 3.00                            |                     |             | 6.00             |            |                     |                 | 2.160        | 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 = 3,848,676, 18 Kip Equivalent Single Axle Load, 20 year Level of Loading Design Period  
 Surface Mix Design Type = S9.5C NCDOT Pavement Design Procedure (page 7)