

## Appendix E

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### PAVEMENT DESIGN MEMORANDUM

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## MEMORANDUM

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Date: 06/21/2022 Project Number: 953.10.25  
To: Darren Anderson, P.E.  
From: Nick Weitzel, P.E. and Jeff Stempihar, P.E.  
Subject: Preliminary Pavement Design for East William Street Complete Street Project

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### **BACKGROUND**

This memorandum describes the existing conditions and preliminary pavement design options for the East William Complete Street Project. The project limits are from Carson Street to the I-580 interchange.

### **EXISTING PAVEMENT CONDITION**

The existing East William Street pavement is in good-to-fair condition throughout the project limits. Overall, the primary distress was longitudinal cracking along the paving joints. Between Carson Street and Roop Street, there was some raveling and weathering on the surface, and a few small base repair areas.

Between Roop Street and Saliman Drive, the pavement is in fair condition. Transverse cracks are spaced at approximately 35 to 50 feet within this segment along with some wheelpath fatigue cracking. About 5% of the pavement will need base repair and full-depth patching. The open-graded friction course (OGFC) on the pavement surface is wearing away, resulting in a rough and noisy surface. There is also raveling and weathering throughout this segment.

Between Saliman Drive to 800 feet east of Saliman Drive, where there is a pavement change, the pavement is in fair condition and similar to the pavement between Saliman Drive and Roop Street. There are longitudinal cracks forming at the paving joints and some raveling of the OGFC. Between 800 feet east of Saliman Drive and the I-580 interchange, the pavement is in much better condition, likely from work performed during the interchange construction. The limited distress observed was primarily longitudinal cracking at the paving joints.

### **PAVEMENT STRUCTURAL INVESTIGATION**

Eight cores and five soil samples were taken throughout the project limits. A summary of the cores is presented in Table 1 and a summary of the subgrade laboratory test results is presented in Table 2. The average HMA thickness varies throughout the project and ranges

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from 4 inches to 12 inches, and the lowest layer(s) in some of the cores resembles a roadmix bituminous pavement. Refer to the Geotechnical Report for additional detail and photos of the extracted HMA cores. According to the record drawings from NDOT Contract 3211, constructed in 2004, the upper layer of pavement (under the OGFC) consists of a 2-inch overlay on top of a 1-inch stress relief course. The AC below this stress relief course has signs of degradation, but based on surface distresses, the stress relief course has helped to limit reflective cracking to the 2-inch overlay.

Also of note, no aggregate base was encountered between Carson Street and Roop Street. The subgrade between Carson Street and Stewart Street is significantly weaker compared to the rest of the project limits.

**Table 1. Existing Pavement Structure**

Core/Bore Number	Location	Hot Mix Asphalt (HMA) Thickness (inch)	Granular Base Thickness (inch)
C-22-01	Between Carson St and Stewart St	6	Aggregate Base was not measured at core locations
C-22-02	Between Stewart St and Roop St	6.75	
C-22-03	Between Roop St and Saliman Rd	7.5	
C-22-04	Between Roop St and Saliman Rd	7.25	
C-22-05	Between Roop St and Saliman Rd	7	
C-22-06	Between Saliman Rd and I-580	9.25	
C-22-07	Between Saliman Rd and I-580	7.5	
C-22-08	Between Saliman Rd and I-580	8.25	
B-22-01	Between Carson St and Stewart St	8	0
B-22-02	Between Stewart St and Roop St	5.5	0
B-22-03	Between Roop St and Saliman Rd	12	4
B-22-04	Between Roop St and Saliman Rd	10	4
B-22-05	Between Saliman Rd and I-580	4	5

**Table 2. Laboratory Test Results**

Bore Number	Soil Classification	R-Value	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Fines
B-22-01	Silty, clayey sand	15	9.4	23	16	7	66.9
B-22-02	Silty, clayey sand	50	8.1	20	16	4	65.3
B-22-03	Silty, clayey sand	67	1.7	21	16	5	69.3
B-22-04	Silty, clayey sand	63	7.9	21	16	5	64.1

## TRAFFIC LOADING

NCE was provided 2019 and projected 2050 traffic counts by the City, which allowed for the computation of a yearly growth rate and the 2023 projected traffic. Traffic loading for commercial vehicles (e.g., heavy vehicles) was estimated using the commercial truck distribution from NDOT's 2009 Annual Traffic Report (Page 8, Urban Vehicle Distribution and

Average ESALs)<sup>1</sup> and taken as 4.0% trucks with 0.717 ESALs per truck from Carson Street to Saliman Drive. An ESALs per truck value of 0.988 was used from Saliman Drive to the I-580 interchange. The calculated growth rate was 0.4% between Carson Street and Roop Street, and 0.5% between Roop Street and the I-580 interchange. The 20-year design ESALs are shown in Table 3.

**Table 3. 20-year Design ESALs.**

From	To	2019 AADT	2019 AADTT	20-Year Design ESALs
Carson	Stewart	10,400	416	1,031,640
Stewart	Roop	17,000	680	1,681,482
Roop	Saliman	18,100	724	1,823,789
Saliman	Gold Dust	26,000	1,044	3,648,680

### PAVEMENT DESIGN AND REHABILITATION OPTIONS

The pavement design for this project was developed using a combination of the RTC *Flexible Pavement Design Manual* dated February 2007 and the 1993 *AASHTO Guide for Design of Pavement Structures* for flexible pavements. The pavement design options are shown in Table 4.

**Table 4. Pavement Design Options.**

From	To	Mill & Overlay	Remove/Replace Existing AC	Reconstruction
Carson	Stewart	Not Feasible	Not Feasible	6" AC on 11" AB
Stewart	Roop	Not Feasible	Not Feasible	6" AC on 6" AB
Roop	Saliman	1" Mill & 2" Overlay	---	---
Saliman	Gold Dust	1" Mill & 2" Overlay	---	---

The pavement between Roop Street and Saliman Drive has structural capacity for the projected 20-year future traffic. However, given the OGFC is wearing away, it is recommended a mill-and-overlay be performed. The stress relief course is performing as intended, and it is recommended that a 1-inch mill (plus wedge milling) be performed to remove the OGFC while leaving this stress relief course intact. A 2-inch overlay will provide a new surface while also adding an additional inch of AC that will provide additional structural capacity.

The pavement between Carson Street and Roop Street requires a significant increase in structural capacity that can only be provided through reconstruction of the roadway. Without an existing aggregate base layer, roadbed modification is also not recommended between Carson Street and Roop Street as the resulting pulverized material will have an excessive amount of fine-grained material. Additionally, possible geometric changes may

<sup>1</sup> The NDOT 2009 Annual Traffic Report is the most recent such report that includes ESAL data (<http://www.nevadadot.com/Home/ShowDocument?id=5796>).

occur between Carson Street and Roop Street; reconstruction will provide construction flexibility in these areas if grade or alignment changes do occur.

It is important to note soil borings revealed a shallow ground water table along the project limits with approximate depths of 7 – 15 feet (below pavement surface). Seasonal fluctuations in the ground water table elevation may impact pavement reconstruction.

**Limitations**

This memorandum presents preliminary pavement structural design options based on data collected by NCE and available information. The design recommendations may change as additional data becomes available and as the project design advances.