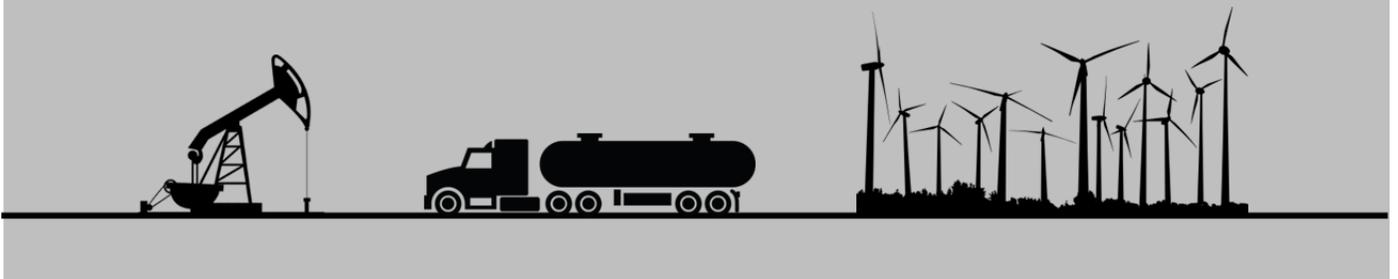


Rehabilitation Recommendations for FM 97 in Gonzales County

Technical Memorandum TM-14-04



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INTRODUCTION

Roadways in the Eagle Ford Shale energy sector development area of Texas experienced severe distress during the early and mid-2010s. One of these roadways was SH 97 in Gonzales County and located in the Yoakum District of the Texas Department of Transportation (TxDOT). The Yoakum District asked the Texas A&M Transportation Institute to perform an investigation and to recommend repair strategies for the section of SH 97 from US 80 to US 183 in Gonzales County.

This investigation was performed in cooperation with TxDOT's Maintenance Division and Yoakum District and Area Offices. The pavement investigation and analysis included gathering historical information on the project, collection and analysis of ground-penetrating radar (GPR) and falling weight deflectometer (FWD) data, and pavement borings. The Yoakum District performed the pavement boring and was also instrumental in helping document the pavement history and providing traffic control during field data collection.

Based on historic, GPR, and FWD data, the project was divided into four subsections as described at the end. Individual recommendations are provided for each of these four sections.

RECOMMENDATIONS

Table 1 provides a summary of recommendations for pavement repair of SH 97. Structural sections are recommended. Table 1 also prioritizes each of the four identified pavement sections along the project length. The data collected and analyzed from SH 97 indicates the following:

- The pavement section with a treated subbase (8 in. of lime stabilized material), flexible base (4 in.), and a surface treatment has good performance over a 14-year period.
- The in-situ moduli (measured from FWD backcalculations) for the flexible base and the lime treated subbase are 123 and 191 ksi, respectively.
- Based on the performance of the section with flexible base placed over a stabilized subgrade, the sections currently experiencing failures should utilize a repair with flexible base placed over a stabilized layer.
- In FPS, when a flexible base is over a treated base, the assigned flexible base value should be increased. The data from SH 97 suggest a value of 100 ksi is reasonable for the flexible base when placed over treated subbase.
- The key to successful performance with this pavement structure is ensuring that a) a permanently stabilized subbase layer designed and constructed, and b) an effective seal exists over the flexible base.

Table 1. Recommendations for SH 97, Gonzales County, US 80 to US 183.

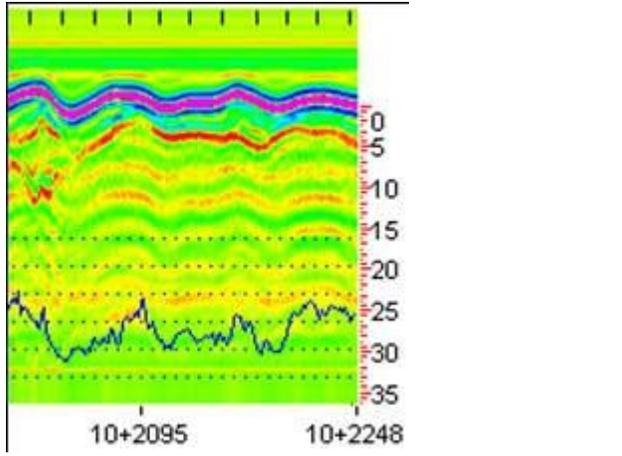
| Begin | End | Typical Existing | Recommended Strategy | Length | Priority |
|--------------------------|--------------------------|--|---|---------------|-----------------|
| US 80 | TRM 590.167 (Bebe) | Surface treatment, 4" flex base over 8" lime stabilized base about 14 years old. | Confirm existing structure meets FPS with current traffic projections. Perform shoulder widening. Apply surface treatment or overlay. | 9.39 mi | 3 |
| TRM 590.167 (Bebe) | TRM 596.680 (Cost) | Surface treatment, 6" treated base over 7" flexible base. Some localized roughness and surface patching. | Flexible base overlay with surface treatment or overlay. | 6.51 mi | 2 |
| TRM 596.680 (Cost) | TRM 601.270 | 2 to 5" HMA with 9 to 12" flexible base. Many failures with deep ruts and cracking. | Full-depth recycling with flexible base overlay. | 4.59 mi | 1 |
| TRM 601.270 | US 183 | Bridge structures; 6 to 8" HMA with 12" gravel base. Good condition. | Continue preventive maintenance. | 1.56 mi | 4 |

SUMMARY OF COLLECTED INFORMATION

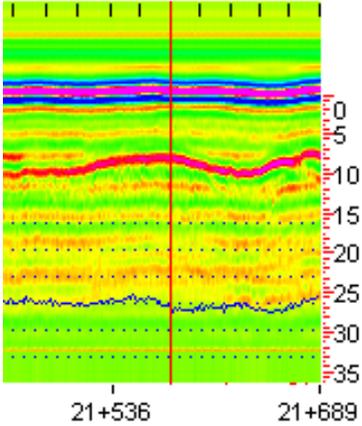
The remainder of this memorandum presents a summary of each of the four sections on SH 97. Supporting information follows the section summaries. This supporting information includes:

- The layer moduli backcalculated from the FWD data.
- Pavement boring results from the Yoakum District.
- Soils maps from the Natural Resource Conservation Service showing the soil ratings for:
 - Roads and streets.
 - Plasticity index.
 - Gypsum.
 - Organic matter.

| | | |
|--|-------------------------|--|
| SH 97 Section 1 | County: Gonzales | US 80 to TRM 590.167 |
| Pavement Structure: Base: 4 in. flexible base over 8 in. LTB Total HMA: none (surface treatment) | | Last Treatment: ~2000 Type: 4 in. flexible base overlay |
| Current Condition: | | |
|  | | |
| Distress: The pavement structure is in good condition. Edge failures exist due to lack of shoulder. | | |
| Cause of Problem: The lack of shoulders is causing the edge failures to occur. The photo above shows the District is performing repairs in problem locations. The pavement has good structure, where FWD backcalculations show the base modulus to be 123 ksi and the lime-stabilized base 191 ksi. The subgrade modulus from the FWD is 16 ksi. | | |
| Recommended Rehabilitation Approach: Confirm the existing structure meets FPS requirements with current traffic projections. Perform shoulder widening and then apply a surface treatment or overlay. Options for this shoulder widening include undercut and add flexible base, undercut and stabilize the existing soil and then add flexible base, or match the existing section of flexible base over a stabilized base. The soils maps suggest the native subgrade in this section is free of gypsum, low in organic content, and generally low plasticity. Soil samples should be collected and tested to confirm the soil properties, and then alternative shoulder designs checked with FPS for meeting triaxial thickness requirements. | | |
| Priority: 3 | | |

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|--|--|--|
| SH 97 Section 2 | County: Gonzales | TRM 590.167 – 596.680 |
| Pavement Structure: Base: 6 in. LTB over 7 in. flexible base Total HMA: none (surface treatments) | | Last Treatment: 1970s? Type: reconstruction of base and surfacing |
| Current Condition: | | |
|  |  | |
| Distress: Some localized roughness and surface patching. | | |
| Cause of Problem: Based on plans and information gathered from District staff, this section has probably exceeded its original design life. The FWD shows reasonable lime-treated base and flexible base modulus values of 170 and 41 ksi, respectively. The subgrade modulus averaged 13 ksi. | | |
| Recommended Rehabilitation Approach: Given the excellent performance of section 1, apply a flexible base overlay with surface treatment or overlay. Constructing the flexible base overlay on top of the lime stabilized layer will enable the District to realize a higher modulus value from locally sourced aggregates. FWD results on similar sections suggest 100 ksi can be used in FPS for the flexible base layer over the stabilized layer. Widened shoulders already exist in this section, so no shoulder widening is needed. | | |
| Priority: 2 | | |

| | | |
|--|-------------------------|--|
| SH 97 Section 3 | County: Gonzales | TRM 596.680 – 601.270 |
| Pavement Structure: Base: Flexible ~ 9 to 12 in. Total HMA: 2 to 5 in. | | Last Treatment: unknown Type: |
| Current Condition: | | |
|  | | |
| Distress: Many failures exist with deep ruts and alligator cracking. Substantial maintenance activity exists. This section exhibits the worst distress on SH 97. | | |
| Cause of Problem: This section has also likely exceeded its original design life. The soils maps suggest the native subgrade in this section is relatively poor for roads and streets due to shrink-swell and low strength. The pavement structure could thus be thin for this subgrade and the pavement structure does not have a stabilized base or subbase layer. The FWD shows the gravel base modulus averaging 24 ksi, with a subgrade modulus of 10 ksi. | | |
| Recommended Rehabilitation Approach: Perform full depth recycling (FDR) with a flexible base overlay and new final surfacing. Lime or cement should be considered for the stabilizing agent used in FDR. Use lab results of roadway material samples to determine the best suited stabilizer: <ul style="list-style-type: none"> • Measure plasticity index. • Based on PI, select cement or lime as the most likely candidate stabilizer. • Perform laboratory tests using Tex 120-E or 121-E as appropriate to determine the required stabilizer content. • Alternatively, the Texas A&M Transportation Institute has developed mix design methodology using the Texas Gyrotory Compactor, where multiple potential mixture designs can be screened with a small quantity of roadway material. Once the potential mixture designs are screened, the most promising design can be verified with 6×8 in. sample molds. | | |
| Priority: 1 | | |

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|---|-----------------|--|
| SH 97 Section 4 | County Gonzales | TRM 601.270 – US 183 |
| Pavement Structure: Base: 12 in. flexible Total HMA: 6 to 8 in. | | Last Treatment: Unknown Type: |
| Current Condition: <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Distress: Good condition.</p> | | |
| Cause of Problem: No problems were observed in this section. The section is structurally sound and substantially thicker than other sections of SH 97. | | |
| Recommended Rehabilitation Approach: This section contains several bridge structures and has thick asphalt cover. Continue preventive maintenance program. | | |
| Priority: 4 | | |