HVJ ASSOCIATES

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April 19, 2018; revised July 19; October 02, 2018; November 5, 2019

Mr. Erin Gonzales, PE, CFM
Senior Project Manager
Brown & Gay Engineers, Inc.
7000 N. Mopac, Suite 330
Austin, TX 78731

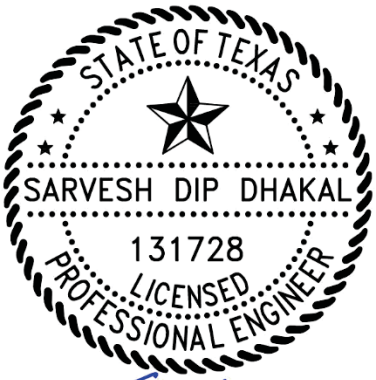
Re: Pavement Design Report
SH 281 – Super 2 PAV
Palo Pinto County, Texas
Owner: TxDOT
HVJ Project No. DG 15 17664.6.1-P

Dear Erin:

Submitted herein is the final report of our pavement design for the above referenced project. The study was performed in accordance with our proposal number DG 15 17664.6.1. It has been a pleasure to work with you on this project and we appreciate the opportunity to be of service.

Sincerely,
HVJ ASSOCIATES, INC.
Texas Firm Registration No. F-000646

Linda Barlow, PE
Pavement Engineer



11/05/2019

Sarvesh Dhakal, PE
Project Engineer

Copies submitted: (1) Electronic

The seal appearing on this document was authorized by Linda Barlow, PE 63879 and Sarvesh Dhakal, PE 131728 on November 5, 2019. This document is not to be used for bidding, construction, and permit purposes. Alteration of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.

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APPENDICES

1 General Project Information

This pavement design report is for the construction of proposed SH 281 Super 2 highway project from Jack County Line to approximately 5.5 miles North of IH 20 in Palo Pinto County near Mineral Wells, Texas. The proposed Super 2 highway consists of approximately 20 miles in length. The project scope includes non-destructive Falling Weight Deflectometer (FWD) data collection, back-calculation of layer moduli from the FWD data, determination of design subgrade strength, and pavement thickness design using TxDOT FPS-21[1] design software with recommended pavement section.

2 Site Particulars - Soil Conditions

A geotechnical investigation was conducted by HVJ North Texas[2] with 25 pavement borings to depths of approximately 15 to 20 feet. The geotechnical report was used to identify the subgrade soil for the pavement. The USDA map for the dominant soil type was also studied which is shown in Appendix C of this report, which indicates soil with medium to high plasticity index (PI).

The following table summarizes existing cross section, soil type and PI in the top 5 feet as per the geotechnical report[2]. The subgrade soil under the pavement structure on all the frontage roads were identified as low plastic clay (CL) to clayey sand (SC) with some occurrences of high plastic clay (CH).

Table 1: Summary of Boring Data / Lab Test Results for Top 5 feet of Subgrade

Bore Hole	Asphalt Thickness (in)	Base Thickness (in)	Soil (Top 5ft)	PI
B-1	8	6	CL	23
B-2	14	6	SC	-
B-3	10	12	CH	38
B-4	7	5	SANDSTONE	-
B-5	6	6	CH	51
B-6	6	6	SC	10
B-7	5.5	6	CL	9
B-8	6	6	CL	18
B-9	10	14	CL	19
B-10	5	8	CL	18
B-11	8	16	SC	-
B-12	7	6	SAND	-
B-13	9.5	14	CL	16
B-14	7.5	16	CL	9
B-15	10	14	CL	27

[1] TxDOT Flexible Pavement Design System V1.2 (FPS-21); Texas Department of Transportation, 2011
[2] Geotechnical Investigation SH 281 Super 2 Improvements, HVJ North Texas – Chelliah Consultants, Inc., Report No. DG-15-17675.6.1, November 4, 2019.

Bore Hole	Asphalt Thickness (in)	Base Thickness (in)	Soil (Top 5ft)	PI
B-16	8	16	SAND	-
B-17	12	13	CL	29
B-18	12	14	CL	12
B-19	10.5	13	CL	16
B-20	13	10	CL	14
B-21	14	10	CH	32
B-22	12	12	CL	29
B-23	4	15	CL	14
B-24	4	13	CL	8
B-25	11	13	SC	-

In addition to the soil classification and Atterburg limits, sulfate tests were also conducted for the subgrade soil. The sulfate content tests were conducted for subgrade soil at each boring location. The test results showed sulfate concentration below 100 ppm for all of the bore holes. This suggests that the subgrade soil is suitable for any traditional lime stabilization treatment without resulting in sulfate heaving.

3 Project Data – As Built Plans

The available as built construction documents were reviewed to obtain the historical information on the pavement sections. The historical as built data showed that the pavement was initially built approximately around 1923 with 5 to 10 inches of crushed stone flexible base and triple Bituminous Surface Coarse to 3 inches of Bituminous Macadam surface. Consecutive projects after that showed partial replacement of base with up to 13 inches of asphalt concrete on north of Mineral Wells. The projects south of Mineral Wells showed approximately 2 inches of asphalt concrete overlay.

The road inside the Mineral Wells city limits was reconstructed around 2002 with a total of 7 inches of asphalt concrete over 11 inches of lime or cement treated subgrade with addition of level up asphalt concrete as needed. The historical data showed the use of Dense Graded Type D asphalt as surface course in Mineral Wells city limits with Type B hot mix asphalt base.

The borehole data obtained during the geotechnical investigation by HVJ NTx showed the existing asphalt concrete thickness between 6 inches to 14 inches and the base course ranging between 6 inches to 16 inches which is consistent with the historical as built information.

4 Project Data - Design Subgrade Strength

The subgrade strength was reviewed based on Falling Weight Deflectometer testing and analyses for existing alignment as discussed below.

4.1 Subgrade Strength – Falling Weight Deflectometer Data Analyses

The non-destructive Falling Weight Deflectometer (FWD) test data was provided by TxDOT. The data consisted of test points at every 0.2 miles conducted in both northbound and southbound directions. The existing pavement material was characterized by back calculation of the FWD data.

The back calculation was carried out using Modulus 6.0[3] program and MTCP program[4] as per Section 4.3 from the TxDOT Pavement Manual[5]. The cross section for analyzing the existing pavement was obtained from the boring logs. The table below shows the back-calculated modulus values for both northbound and southbound direction. The outputs from Modulus back-calculation is presented in Appendix E of this report.

Table 2: Summary of Back-Calculation Results

Direction	Section	From	To	Borings Considered	Asphalt Thickness, in.	Base Thickness, in.	Back-Calculated Modulus, ksi		
							Asphalt	Base	Subgrade
NB	1	Jack County Line	FM 52	B22-B25	10.8	13.3	184.8	42.1	13.7
	2	FM 52	Shattles Road	B12-B21	10.1	9.0	206.6	58.6	17.1
	3	Shattles Road	5.5 miles North of I-20	B1-B11	8.0	5.9	311.1	92.3	13.4
SB	1	Jack County Line	FM 52	B22-B25	10.8	13.3	219.9	31.9	13.5
	2	FM 52	Shattles Road	B12-B21	10.1	9.0	260.7	78.0	14.1
	3	Shattles Road	5.5 miles North of I-20	B1-B11	8.0	5.9	360.9	78.7	14.6

The average modulus for the subgrade calculated from the back calculation was 14.4 ksi with the standard deviation of 1.4 ksi. The average subgrade modulus minus one standard deviation equals to 13.0 ksi which is used as the design subgrade modulus for new pavement section.

4.2 Subgrade Strength - Texas Triaxial Classification (TTC)

The FPS-21 design output is also checked based on the Modified Triaxial Method, which required the Texas Triaxial Class (TTC) for the subgrade soil needs to be established. Because no TTC tests were conducted, the TTC class was determined by selecting the soil type as clay of high plasticity from the Palo Pinto County database in FPS-21, which is 5.0.

5 **Project Data - Traffic**

The traffic data was requested from TxDOT Transportation Planning and Programming (TPP) division for the purpose of this report. The traffic analysis was obtained from TxDOT for three

[3] MODULUS 6.1.0 Flexible Pavement Backcalculation System, TxDOT
[4] Modulus Temperature Correction Program (MTCP), Texas TxDOT by Texas Transportation Institute
[5] Pavement Manual, Texas Department of Transportation, Revised January 2017.

separate locations within the project extent. The following table summarizes the traffic analysis for the 20 year design period for the three locations.

Table 2: SH 276 TPP Traffic Analysis for 20 year period

Section	From	To	2025 ADT	2045 ADT	% Truck	ATH WLD	% Tandem Axles	ESALS
1	Jack County Line	FM 52	3,400	4,600	10.6	10,800	70	1,521,000
2	FM 52	Shattles Road	5,800	7,750	9.4	11,000	60	2,286,000
3	SW 25th ST	5.5 miles North of I-20	6,100	8,100	9.4	11,000	60	2,396,000

The traffic analysis data provided by TxDOT did not include the section between Shattles Road and SW 25th St so the traffic for this section was assumed to be same as that from SW 25th St to 5.5 miles North of I-20.

6 Flexible Pavement Design Analyses

Considerations for pavement design analyses three separate traffic inputs with separate design alternatives. The existing pavement condition as well as the new pavement design was conducted for the project. The flexible pavement design was carried out and result was checked for mechanistic and Triaxial design. The designs were performed with the FPS21 program and input values were selected using TxDOT Pavement Manual. The basic design data required for FPS21 include: Basic Design Criteria; Program Controls and Constraints; Traffic Data; Environment and Subgrade; Construction and Maintenance Data; and Paving Material Information.

6.1 Basic Design Criteria

The basic design Criteria includes the analysis period, time for first overlay, reliability level, serviceability indices and others. Table 3 below shows the basic design criteria used for the design of pavement sections.

Table 3: FPS 21 - Basic Design Criteria

Parameter	Value
Length of Analysis Period	20 years
Minimum time to first overlay	8 years
Minimum time between overlays	8 years
Design Confidence Level	90%
Initial Serviceability Index	4.5
Terminal Serviceability Index	2.5
Serviceability Index after overlay	4.2
District Temperature Constant	31°F
Interest Rate	7%

6.2 Program Controls and Constraints

The TXDOT Pavement Manual dictates these inputs as follows: $99/sy maximum funds available for initial design, 99" maximum allowed thickness of initial construction, and 6" maximum depth of all overlays.

6.3 Construction and Maintenance Data

Although life cycle costs are not included in HVJ's scope of work, FPS21 has input parameters that are used for the life cycle cost considerations. The FPS21 program defaults were used for these inputs as follows: 2" minimum overlay thickness, 12 hrs/day overlay construction time, 1.98 tons/cy asphalt density, 200 tons/hr asphalt production rate, 12' lane width, $125/lane mile first year cost of routine maintenance, and $30/lane mile annual incremental increase in maintenance cost.

6.4 Design Material Properties

As per the TxDOT Pavement Manual paving material modulus and Poisson's Ratio for new construction were defined as follows. The pavement surface and base types were selected from the TxDOT Pavement Manual as well as the historical use of pavement material in the project area. The existing pavement material properties were selected from the back-calculated modulus values.

Table 5: Material Design Inputs

Material	TxDOT Spec Item	Design Modulus	Poisson's Ratio
Superpave Mixtures (Combined HMA Thickness < 4")	Item 344	650 kis	0.35
Dense Graded HMA (Combined HMA Thickness > 4")	Item 341	650 ksi	0.35
Dense Graded HMA (Combined HMA Thickness <= 4")	Item 341	500 ksi	0.35
Flexible Base	Item 247	50 ksi	0.35
Subgrade	n/a	13.0 ksi	0.40

7 Flexible Pavement Design Analyses

7.1 Existing Pavement Condition

The existing pavement condition was checked considering the back-calculated layer moduli values and cross-sections of existing pavement and traffic data. The analysis was done to estimate the remaining number of years the existing pavement section will last.

Table 6: Summary of Remaining Life

Section	From	To	Avg. Asphalt Thickness (in)	Avg. Base Thickness (in)	Estimated Life
1	Jack County Line	FM 52	10.8	13.3	>20 yrs
2	FM 52	Shattles Road	10.1	9	
3	Shattles Road	5.5 miles North of I-20	8	5.9	>20 yrs*

* Triaxial thickness requires additional 1 inch of stabilized material for 20 year life.

The existing pavement analysis showed that the existing pavement cross section can generally support the estimated traffic for the next 20 years. However, the pavement from Shattles Road to 5.5 miles North of I-20 needs an additional one inch of asphalt overlay to increase the overall cross section thickness needed to prevent shear failure in the subgrade due to occasional heavy wheel load.

7.2 New Pavement Design

The FPS21 design results were checked with the Modified Triaxial Design Procedure and the Mechanistic Design Check. The new pavement was designed considering the existing pavement thicknesses. As the new section will be placed adjacent to the existing pavement in the Super 2 lanes, it is recommended to match the existing section. This is important to prevent development of differential stresses and resulting in distresses at the interface between the newer and older sections. The resulting FPS21 design solution for a 20-year life are shown below with outputs in Appendix F.

2.0" Superpave Type C (SAC A) – TxDOT Item 344 (PG 70-28)
8.0" Dense Graded Type B – TxDOT Item 341 (PG 64-22)
12.0" Flexible Base – TxDOT Item 247

As per recommended by the Fort Worth District Standard Operating Procedure (SOP)[6], a "Surface Aggregate Selection Form 2088" was prepared for determining Surface Aggregate Classification (SAC) used for surface course of the pavement which recommended use of SAC–A . The Fort Worth SOP recommends that for a new pavement section with a medium volume traffic (3,000<ADT<10,000) to use 8" or 18" of treated subgrade depending the Potential Vertical Rise (PVR). The subgrade treatment is discussed in the following section.

8 Subgrade Treatment

Due to the presence of highly plastic clay soil at some locations, the pavement becomes susceptible to shrinkage and swelling which causes subgrade vertical heaving and non-structural pavement distresses. Potential Vertical Rise (PVR) using Tex-124 E was calculated for all the pavement borings up to 20 feet depth. The PVR is an estimation of vertical heave of the pavement surface due to variation in moisture content in subgrade. PVR values are higher for soil of higher plasticity. As per TxDOT Pavement Manual, the maximum PVR allowed for a main lane is 1.5". For this project, the pavement borings indicate PVRs ranging from 0.2" to 2.2".

One method considered to minimize the PVR is removal and replacement of the swelling clays with non-swelling select fill material. An estimation of the depth of removal and replacement with a fill of

[6] TxDOT – Fort Worth District (02) District Operating Procedure No. 03-18, Effective Date May 1, 2018

lower plasticity was calculated based on Tex-124E. The table below shows the results of PVR estimation and potential depth of removal and replacement to reduce PVR to ≤ 1.5".

Table 7: Potential Vertical Rise

Boring No.	PVR (in)	Remove/Replace Depth (ft) for PVR: 1.5 inch
B-1	1.42	0
B-2	1.45	0
B-3	2.16	4.0
B-4	0.06	0
B-5	1.21	0
B-6	0.20	0
B-7	0.75	0
B-8	1.02	0
B-9	0.98	0
B-10	1.19	0
B-11	1.16	0
B-12	0.23	0
B-13	1.03	0
B-14	0.78	0
B-15	1.49	1.0
B-16	0.01	0
B-17	0.81	0
B-18	0.88	0
B-19	1.41	0
B-20	1.30	0
B-21	0.21	0
B-22	0.95	0
B-23	1.16	0
B-24	0.05	0
B-25	0.51	0

Note: PVR was calculated with the depth range of soil up to 20 feet

As seen in the table above that the depth of removal and replacement required to reduce PVR for B-3 is 4 feet. As the PVR is only higher at one location, the removal and replacement is recommended around the location of Bore Hole B-3, generally between Borings B-2 and B-4. The select fill used for replacement is recommended to have Liquid Limit (LL) of 40, passing % sieve #40 of 50, and Plasticity Index (PI) of 20.

Another method to address both swelling soils is lime treatment. It was seen in the historical as built construction documents that a portion of the roadway located within the Mineral Wells city limits was reconstructed in 2002 with 11 inches of lime or cement treated subgrade. To both address any

locations of swelling soils and to obtain a consistent working platform, lime or cement treatment of the subgrade may be utilized.

9 Pavement Design Recommendations

The recommended pavement section is:

2.0" Superpave Type C (SAC A) – TxDOT Item 344 (PG 70-28)
8.0" Dense Graded Type B – TxDOT Item 341 (PG 64-22)
12.0" Flexible Base – TxDOT Item 247
8.0" Lime Treated Subgrade – TxDOT Item 260

10 Subgrade Preparation

Subgrade preparation for the proposed pavement construction should consist of clearing, stripping, and proof-rolling. HVJ recommends the following procedures for subgrade preparation:

1) Clear the proposed development area of existing pavement, organic material soft soils, and foreign material within the proposed improvement area to the grade required.

2) Any fill material required under the pavement section is recommended to be non-expansive select fill, which may also be used to replace locations with high sulfates. The select fill should consist of material meeting the requirements of Class A Borrow Material which shall consists of suitable granular material free from vegetation or other objectionable matter and reasonably free from lumps of earth. The borrow material should have liquid limit less than 40 and a plasticity index less than or equal to 20. Fill material that is used should be placed in loose lifts of not more than 6 inches in thickness and should be compacted to 95 percent of standard Proctor maximum dry density as determined by ASTM D698. The moisture content of the select fill should be above the optimum moisture content at the time of compaction.

3) Excavated areas should be appropriately graded and shaped to prevent ponding of water. Pumping might occur if the site becomes wet.

4) Surfaces exposed after excavation should be proof-rolled in accordance with TxDOT Specification, Item 216. If rutting develops, tire pressures should be reduced. The purpose of the proof-rolling operation is to identify any underlying zones or pockets of weak pavement/base materials.

5) Before treating the subgrade, scarify the upper 8"of exposed surface, mix with 6% lime by dry weight (based on Fort Worth district recommendation), and compact to 95 percent of standard proctor maximum dry density (ASTM D698). HVJ's lime series test results should be verified at the time of construction for subgrade soils by conducting laboratory tests on the exposed subgrade material during construction.

Appendix A – Location Map

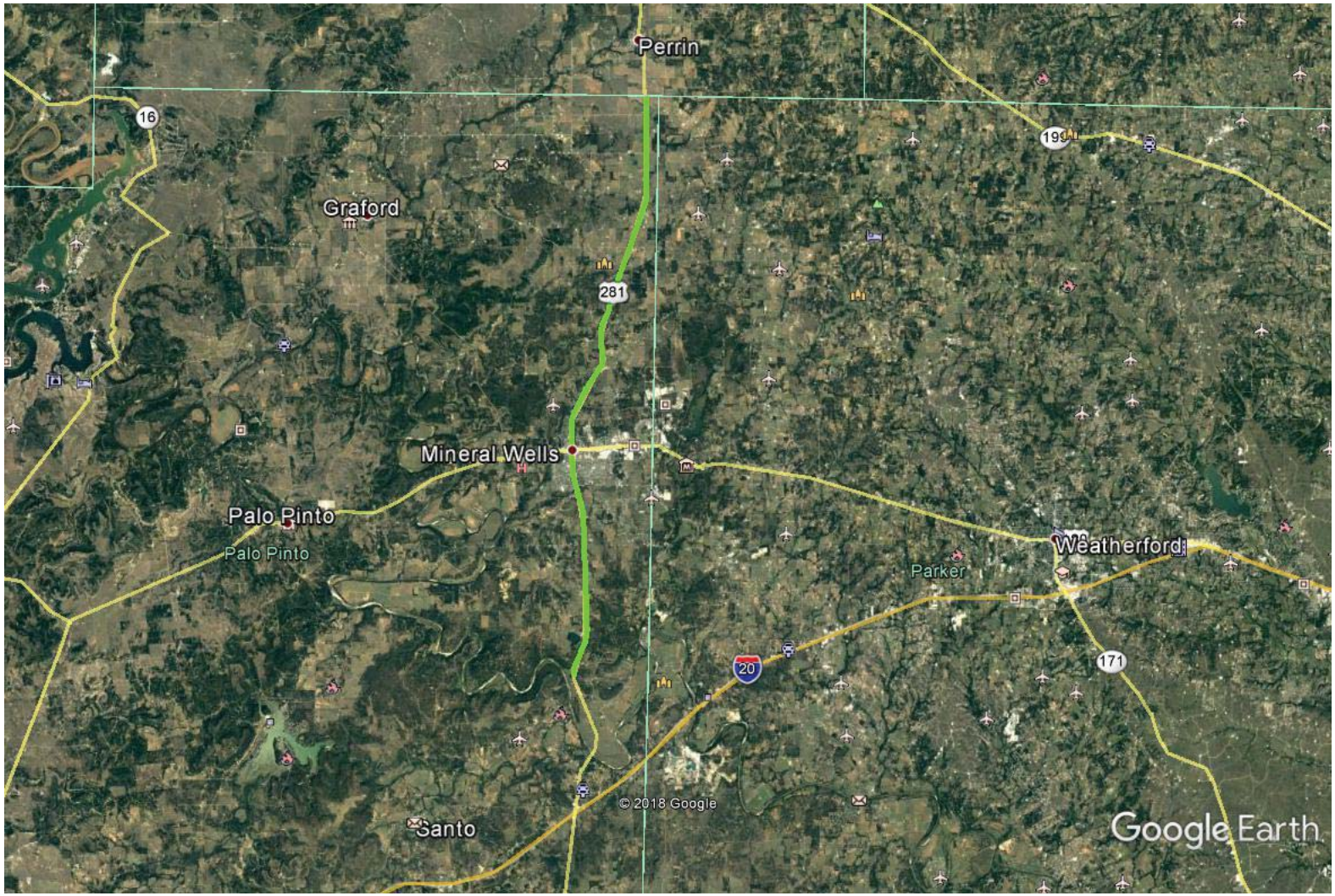

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IMAGE OBTAINED FROM GOOGLE EARTH PRO, 2018

HVJ ASSOCIATES

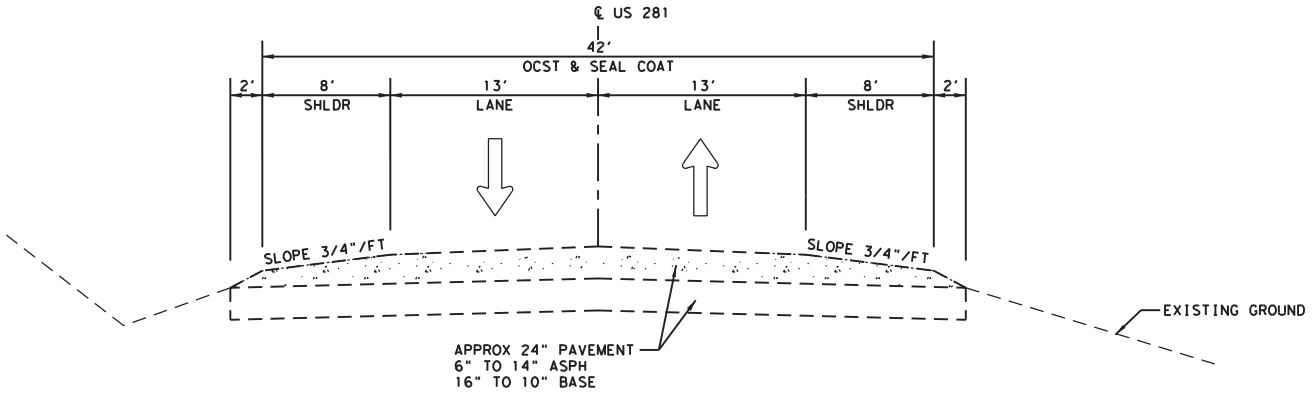
1701 DIRECTORS BLVD #910
AUSTIN, TX - 78744

DATE: 4/19/2018	APPROVED BY:	PREPARED BY:

LOCATION MAP
US 281 SUPER 2 IMPROVEMENT

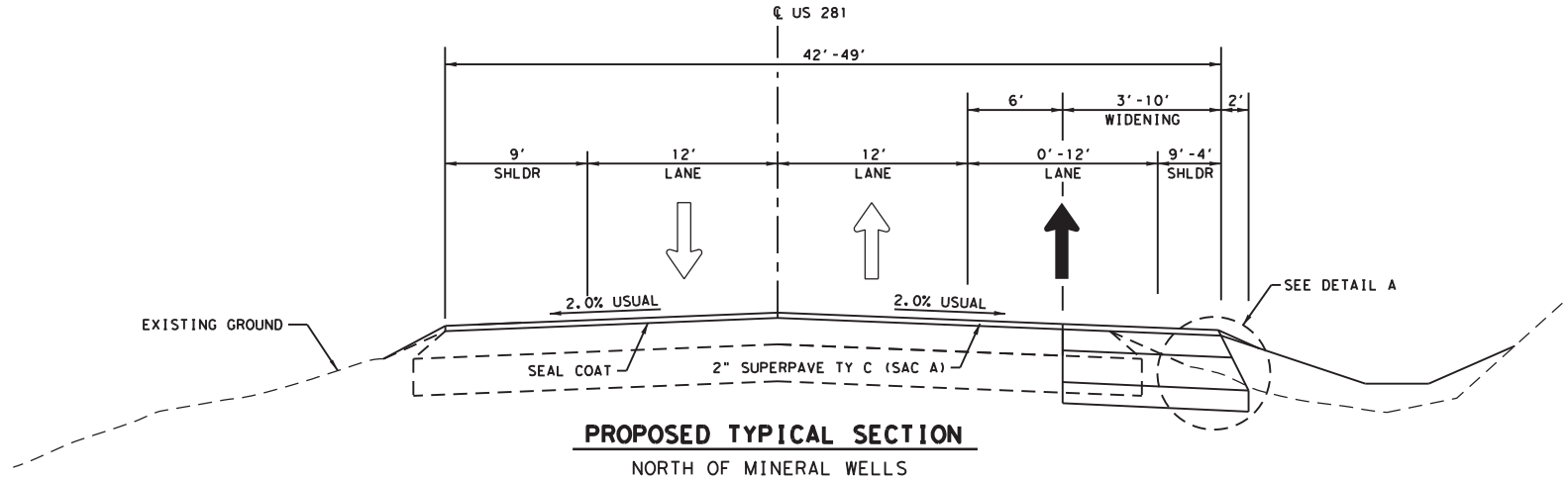
PROJECT NO.: DG-15-17664.6.1-P	DRAWING NO.: A

Appendix B – Typical Sections



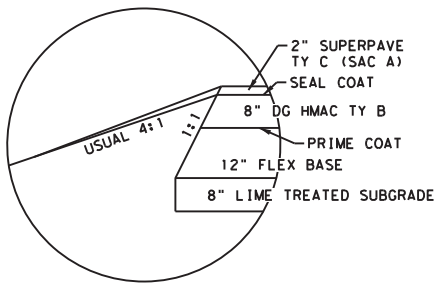
EXISTING TYPICAL SECTION

NORTH OF MINERAL WELLS

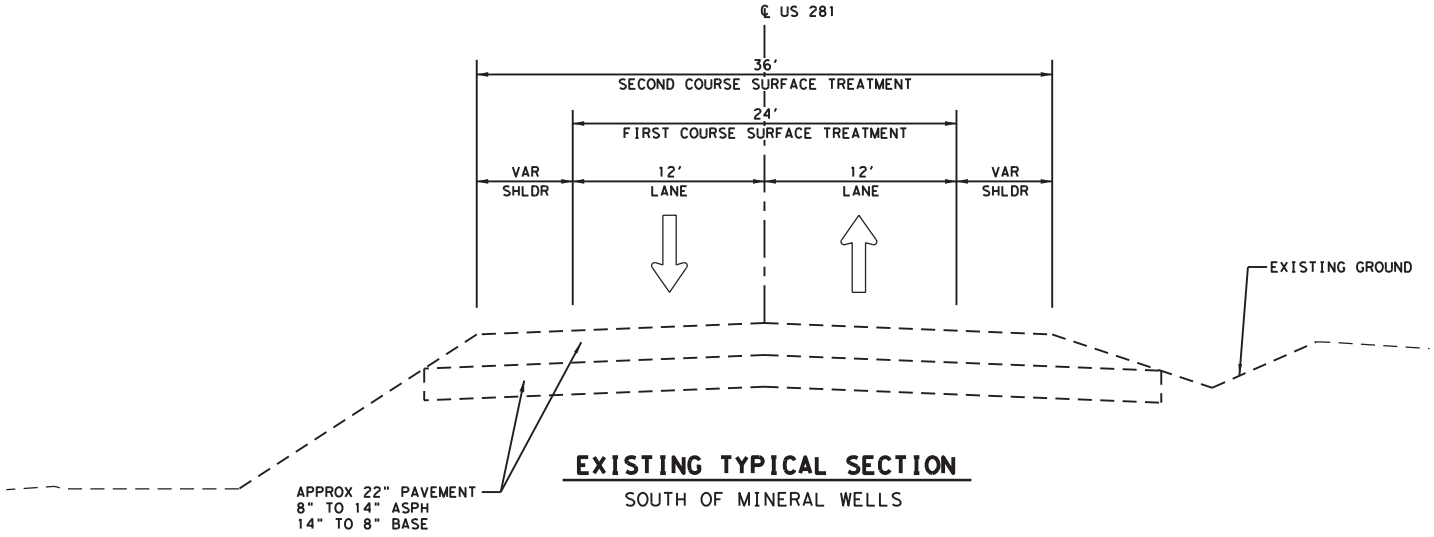


PROPOSED TYPICAL SECTION

NORTH OF MINERAL WELLS

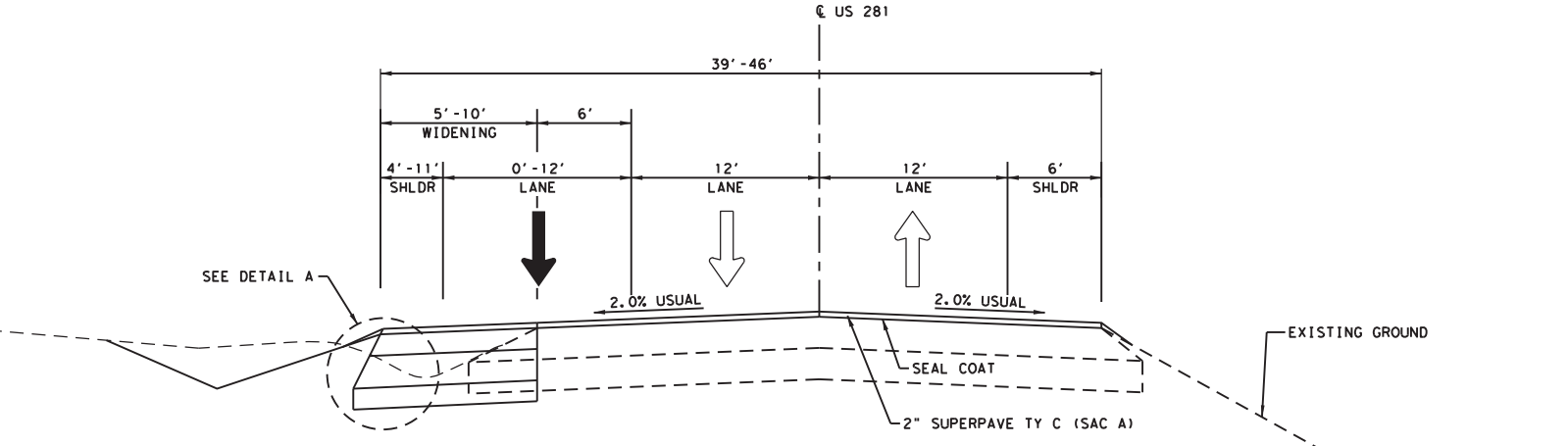


DETAIL A
N.T.S.



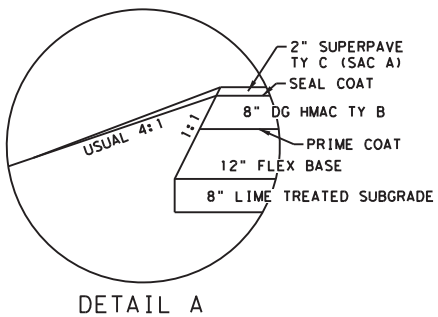
EXISTING TYPICAL SECTION

SOUTH OF MINERAL WELLS



PROPOSED TYPICAL SECTION

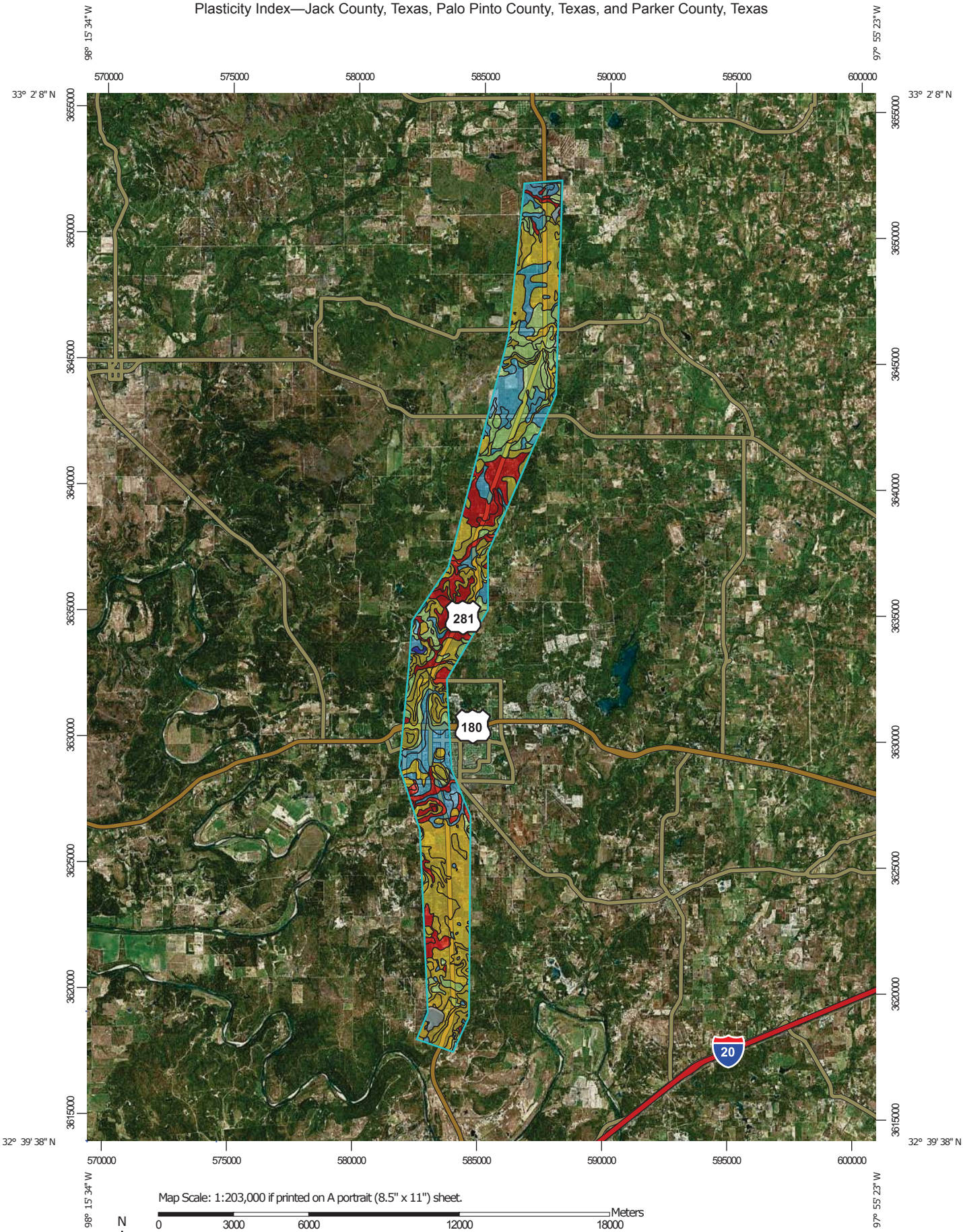
SOUTH OF MINERAL WELLS



DETAIL A

N.T.S.

Appendix C – USDA Map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97° 55' 23" W
570000
575000
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600000
33° 2' 8" N
32° 39' 38" N
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3625000
3620000
3615000
281
180
20
Map Scale: 1:203,000 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 3000 6000 12000 18000
Feet
0 5000 10000 20000 30000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

<= 9.5

> 9.5 and <= 18.5

> 18.5 and <= 25.5

> 25.5 and <= 31.2

> 31.2 and <= 36.4

Not rated or not available

Soil Rating Lines

<= 9.5

> 9.5 and <= 18.5

> 18.5 and <= 25.5

> 25.5 and <= 31.2

> 31.2 and <= 36.4

Not rated or not available

Soil Rating Points

<= 9.5

> 9.5 and <= 18.5

> 18.5 and <= 25.5

> 25.5 and <= 31.2

> 31.2 and <= 36.4

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jack County, Texas
Survey Area Data: Version 15, Nov 7, 2017

Soil Survey Area: Palo Pinto County, Texas
Survey Area Data: Version 14, Nov 7, 2017

Soil Survey Area: Parker County, Texas
Survey Area Data: Version 16, Nov 7, 2017

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Plasticity Index

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
HaA	Hassee loam, 0 to 1 percent slopes	27.6	3.5	0.0%
ThA	Thurber clay loam, 1 to 3 percent slopes	28.9	15.2	0.1%
Subtotals for Soil Survey Area			**18.7**	**0.1%**
Totals for Area of Interest			**16,389.4**	**100.0%**

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
5	Bastrop fine sandy loam, 1 to 3 percent slopes	9.3	16.8	0.1%
8	Blanket clay loam, 0 to 1 percent slopes	22.2	120.1	0.7%
9	Bonti fine sandy loam, 1 to 3 percent slopes	16.5	2,813.4	17.2%
10	Bonti fine sandy loam, 3 to 5 percent slopes	13.3	12.4	0.1%
11	Bonti-Exray complex, 1 to 8 percent slopes, extremely stony	16.1	1,670.4	10.2%
12	Bosque clay loam, 0 to 1 percent slopes, occasionally flooded	16.3	246.8	1.5%
13	Chaney loamy sand, 1 to 5 percent slopes	17.5	118.3	0.7%
17	Frio clay loam, 0 to 1 percent slopes, occasionally flooded	25.5	220.2	1.3%
18	Frio clay loam, 0 to 1 percent slopes, frequently flooded	25.5	49.8	0.3%
19	Hassee loam, 0 to 1 percent slopes	29.0	1,191.5	7.3%
20	Hensley very stony clay loam, 0 to 5 percent slopes	21.0	130.2	0.8%
21	Leeray clay, 0 to 1 percent slopes	30.6	85.7	0.5%
22	Leeray clay, 1 to 3 percent slopes	31.2	573.0	3.5%
23	Leeray clay, 3 to 5 percent slopes	36.4	26.8	0.2%

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
24	Lindy clay loam, 1 to 3 percent slopes	21.7	189.8	1.2%
25	May fine sandy loam, 0 to 1 percent slopes	13.1	49.4	0.3%
27	Minwells fine sandy loam, 1 to 3 percent slopes	22.4	891.3	5.4%
28	Minwells fine sandy loam, 3 to 5 percent slopes	22.4	28.4	0.2%
29	Minwells fine sandy loam, 2 to 5 percent slopes, eroded	23.1	13.6	0.1%
31	Owens very stony clay, 1 to 8 percent slopes	29.7	7.2	0.0%
32	Owens-Harpersville complex, 8 to 45 percent slopes, extremely bouldery	28.4	70.1	0.4%
33	Palopinto very stony clay loam, 1 to 8 percent slopes, rubbly	24.0	150.8	0.9%
35	Santo and Bunyan soils, 0 to 1 percent slopes, frequently flooded	5.0	339.5	2.1%
37	Set clay, 3 to 5 percent slopes	28.9	29.6	0.2%
38	Set-Palopinto complex, 8 to 40 percent slopes, extremely stony	25.1	95.1	0.6%
39	Shatruce gravelly sandy loam, 12 to 50 percent slopes, very rubbly	18.5	219.2	1.3%
40	Shavash stony loamy fine sand, 1 to 3 percent slopes	7.9	333.3	2.0%
41	Thurber clay loam, 0 to 1 percent slopes	28.5	735.9	4.5%
42	Thurber clay loam, 1 to 3 percent slopes	28.9	459.4	2.8%
43	Truce fine sandy loam, 1 to 3 percent slopes	23.3	278.2	1.7%
44	Truce fine sandy loam, 3 to 5 percent slopes	22.6	259.8	1.6%
45	Truce fine sandy loam, 1 to 5 percent slopes, eroded	23.6	371.9	2.3%
46	Shatruce-Bonti complex, 8 to 40 percent slopes, rubbly	18.5	1,221.5	7.5%

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
47	Vashti loamy fine sand, 1 to 5 percent slopes	9.5	1,820.4	11.1%
49	Velow clay loam, 3 to 5 percent slopes	12.5	111.5	0.7%
50	Wichita clay loam, 1 to 3 percent slopes	22.7	202.9	1.2%
51	Windthorst very fine sandy loam, 1 to 3 percent slopes	17.8	1,010.3	6.2%
W	Water		192.3	1.2%
Subtotals for Soil Survey Area			**16,356.6**	**99.8%**
Totals for Area of Interest			**16,389.4**	**100.0%**

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
BbB	Blanket clay loam, 1 to 3 percent slopes	23.9	6.9	0.0%
BfB	Bonti fine sandy loam, 1 to 3 percent slopes	16.5	0.5	0.0%
BnD	Bonti and Truce soils, 1 to 8 percent slopes	16.7	0.1	0.0%
TrB	Truce fine sandy loam, 1 to 3 percent slopes	23.3	3.2	0.0%
TrC	Truce fine sandy loam, 3 to 5 percent slopes	22.6	0.8	0.0%
W	Water		0.9	0.0%
Yb	Santo and Bunyan soils, 0 to 1 percent slopes, frequently flooded	5.0	1.6	0.0%
Subtotals for Soil Survey Area			**14.1**	**0.1%**
Totals for Area of Interest			**16,389.4**	**100.0%**

Description

Plasticity index (PI) is one of the standard Atterberg limits used to indicate the plasticity characteristics of a soil. It is defined as the numerical difference between the liquid limit and plastic limit of the soil. It is the range of water content in which a soil exhibits the characteristics of a plastic solid.

The plastic limit is the water content that corresponds to an arbitrary limit between the plastic and semisolid states of a soil. The liquid limit is the water content, on a percent by weight basis, of the soil (passing #40 sieve) at which the soil changes from a plastic to a liquid state.

Soils that have a high plasticity index have a wide range of moisture content in which the soil performs as a plastic material. Highly and moderately plastic clays have large PI values. Plasticity index is used in classifying soils in the Unified and AASHTO classification systems.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 0

Bottom Depth: 60

Units of Measure: Inches

Appendix D - Traffic Data
Transportation Planning and Programming (TP&P)

Texas Department of Transportation

MEMO

January 26, 2018

To: Loyl C. Bussell, P.E., District Engineer
Attention: John F. Cordary, P.E., Director of TPD

Through: William E. Knowles, P.E.
Traffic Analysis Section Director, TPP

From: Lee Theobald
Planner, TPP

Subject: Traffic Data
CSJ: 0249-08-042 & 0250-01-036
US 281:
From Jack County Line
To Approximately 5.5 miles North of I-20
Palo Pinto County

Attached are diagrams depicting 2025, 2045 and 2055 average daily traffic volumes and turning movements on US 281 from Jack County Line to 5.5 miles North of I-20. Also attached are tabulations showing traffic analysis for highway design for the 2025 to 2045 twenty year period and 2025 to 2055 thirty year period for the described limits of the route. Also included are tabulations showing data for use in air and noise analysis.

Due to differences in traffic volumes the project was separated into three sections.

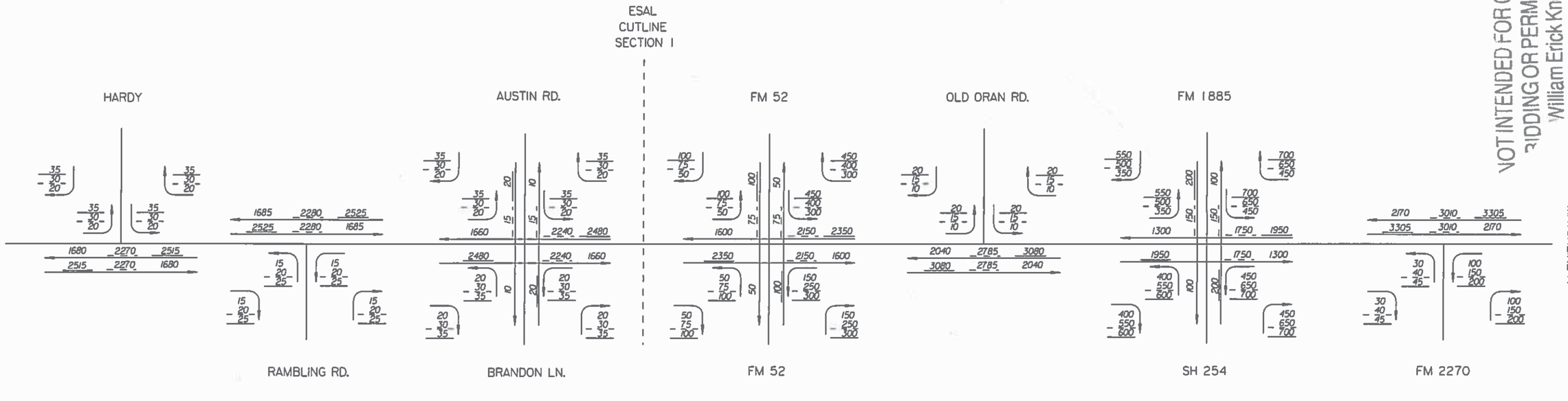
Section 1: From Jack County Line to FM 52
Section 2: From FM 52 to Shattles Road
Section 3: From SW 25th Street to 5.5 miles North of I-20

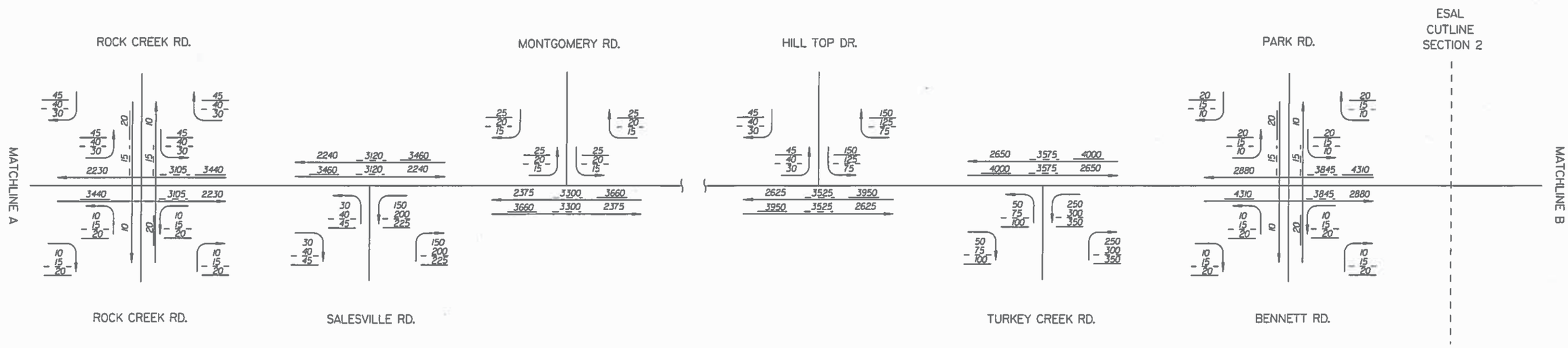
Please refer to your original request dated November 6, 2017.

If you have any questions or need additional information, please contact Lee Theobald at (512) 486-5143.

Attachments

CC: David Fenton, P.E.,
Transportation Engineer, Fort Worth District
Design Division





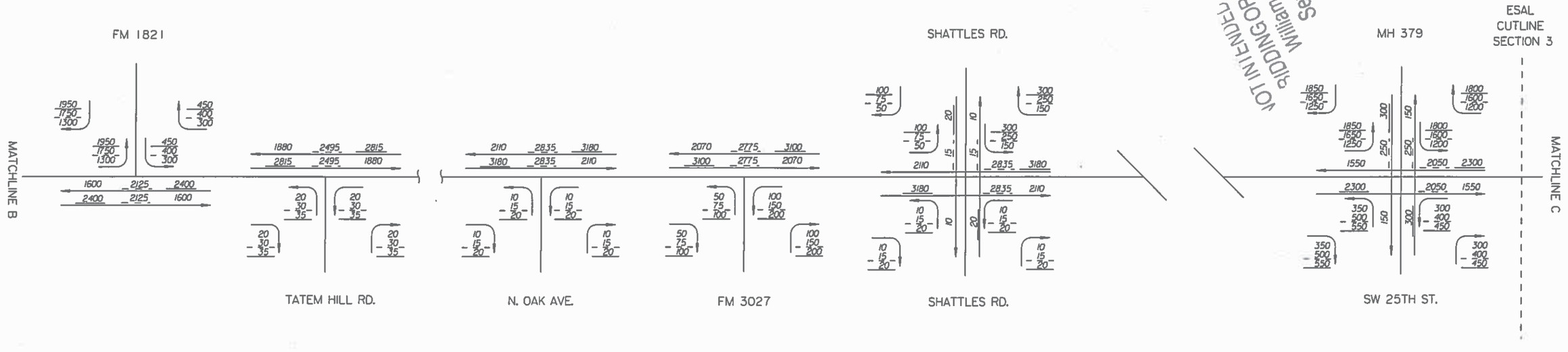
NOT INTENDED FOR CONSTRUCTION BIDDING OR PERMIT PURPOSES
William Erick Knowles, P.E.
Serial Number 84704

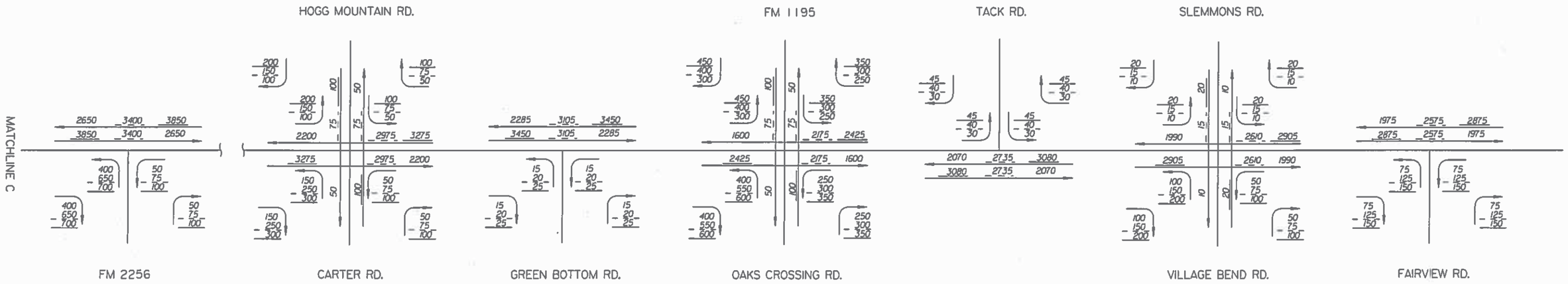
LEGEND
1000 - 2025 ADT
1000 - 2045 ADT
1000 - 2055 ADT

2025, 2045 AND 2055 ANTICIPATED AVERAGE DAILY TRAFFIC VOLUMES AND TURNING MOVEMENTS AT SPECIFIED POINTS ALONG US 281 FROM JACK COUNTY LINE TO APPROXIMATELY 5.5 MILES NORTH OF I-20

PALO PINTO COUNTY

TRANSPORTATION PLANNING AND PROGRAMMING DIVISION
JANUARY 24, 2018





LEGEND
1000 - 2025 ADT
1000 - 2045 ADT
1000 - 2055 ADT

2025, 2045 AND 2055 ANTICIPATED AVERAGE DAILY TRAFFIC VOLUMES AND TURNING MOVEMENTS AT SPECIFIED POINTS ALONG US 281 FROM JACK COUNTY LINE TO APPROXIMATELY 5.5 MILES NORTH OF I-20
PALO PINTO COUNTY

TRANSPORTATION PLANNING AND PROGRAMMING DIVISION
JANUARY 24, 2018

SHEET 2 OF 2

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN

Fort Worth District

January 26, 2018

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2045	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2025 to 2045) Flexible Pavement	S N	Rigid Pavement	SLAB
US 281 Section 1 From Jack County Line To FM 52 Palo Pinto County	3,400	4,600	53 - 47	11.9	10.6	6.4	10,800	70	1,521,000	3	2,166,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	89.4	93.6
Medium Duty	2.3	1.4
Heavy Duty	8.3	5.0

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2055	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2025 to 2055) Flexible Pavement	S N	Rigid Pavement	SLAB
US 281 Section 1 From Jack County Line To FM 52 Palo Pinto County	3,400	5,100	53 - 47	11.9	10.6	6.4	10,800	70	2,424,000	3	3,451,000	8"

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN

Fort Worth District

January 26, 2018

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2045	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2025 to 2045) Flexible Pavement	S N	Rigid Pavement	SLAB
US 281 Section 2 From FM 52 To Shattles Road Palo Pinto County	5,800	7,750	53 - 47	11.9	9.4	5.6	11,000	60	2,286,000	3	3,254,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	90.6	94.4
Medium Duty	2.0	1.2
Heavy Duty	7.4	4.4

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2055	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2025 to 2055) Flexible Pavement	S N	Rigid Pavement	SLAB
US 281 Section 2 From FM 52 To Shattles Road Palo Pinto County	5,800	8,700	53 - 47	11.9	9.4	5.6	11,000	60	3,670,000	3	5,223,000	8"

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN

Fort Worth District

January 24, 2018

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2045	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2025 to 2045) Flexible Pavement	S N	Rigid Pavement	SLAB
US 281 Section 3 From SW 25th St. To 5.5 miles North of I-20 Palo Pinto County	6,100	8,100	53 - 47	11.9	9.4	5.6	11,000	60	2,396,000	3	3,410,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	90.6	94.4
Medium Duty	2.0	1.2
Heavy Duty	7.4	4.4

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2055	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2025 to 2055) Flexible Pavement	S N	Rigid Pavement	SLAB
US 281 Section 3 From SW 25th St. To 5.5 miles North of I-20 Palo Pinto County	6,100	9,100	53 - 47	11.9	9.4	5.6	11,000	60	3,847,000	3	5,475,000	8"

Appendix E - MODULUS 6.1 and MTCP Outputs

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District:
County :
Highway/Road:

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	8.00	200,000	2,000,000	H1: v = 0.35
Base:	5.90	10,000	150,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	80.20(by DB)	5,000		H4: v = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock	
0.098	11,260	15.18	10.50	6.17	3.52	2.33	1.88	1.49	243.3	120.7	0.0	11.9	9.57	91.1	
0.500	11,162	10.99	7.34	4.25	2.37	1.26	0.89	0.69	428.9	61.2	0.0	19.4	6.34	60.6	
0.700	10,822	16.78	10.42	5.31	2.81	1.59	1.05	0.69	200.0	40.6	0.0	15.1	7.41	66.5	*
0.900	10,942	9.47	6.56	4.40	3.06	2.26	1.76	1.40	913.0	150.0	0.0	13.5	10.75	174.0	*
1.579	11,151	7.83	5.45	3.75	2.59	1.90	1.46	1.16	1304.9	150.0	0.0	16.3	10.22	164.5	*
1.895	10,811	6.34	4.77	3.42	2.51	1.91	1.50	1.08	2000.0	97.3	0.0	16.9	10.49	101.5	*
2.104	10,789	9.59	6.21	3.74	2.23	1.50	1.18	0.85	420.8	150.0	0.0	18.7	9.98	106.0	*
2.312	13,177	10.44	8.66	6.31	4.55	3.39	2.78	2.06	1752.6	150.0	0.0	9.7	6.12	269.2	*
2.501	12,367	6.41	3.30	1.72	0.96	0.53	0.38	0.29	509.7	150.0	0.0	51.0	8.70	57.0	*
3.100	11,753	9.73	6.52	4.06	2.55	1.69	1.19	0.81	537.0	150.0	0.0	18.3	7.85	105.2	*
3.300	11,162	17.23	10.92	5.61	2.87	1.39	0.85	0.57	249.4	19.8	0.0	16.2	5.59	55.0	
3.498	11,304	18.04	11.96	6.29	3.19	1.44	1.02	0.71	272.5	15.1	0.0	15.1	7.95	51.8	
3.710	11,370	18.78	10.82	6.00	3.30	1.77	1.06	0.67	200.0	39.0	0.0	14.2	4.75	63.3	*
3.898	11,052	22.73	18.15	12.20	3.63	2.56	1.94	1.33	251.4	10.0	0.0	9.5	20.05	33.6	*
4.299	11,151	24.68	17.16	8.57	4.49	2.63	1.83	1.21	200.0	16.0	0.0	9.7	9.90	66.0	*
4.904	11,227	13.85	8.67	4.93	2.89	1.97	1.48	1.31	209.3	150.0	0.0	14.9	10.52	100.0	*
5.105	11,183	21.61	13.46	6.26	3.07	1.61	1.08	0.61	200.0	12.3	0.0	14.5	9.06	54.4	*
5.708	11,074	23.52	14.14	8.24	4.86	2.86	1.83	1.26	200.0	32.8	0.0	9.4	7.74	78.4	*
5.899	11,381	17.05	9.98	4.45	2.48	1.45	0.98	0.63	200.0	31.6	0.0	18.2	11.25	70.3	*
6.099	10,899	26.98	18.28	10.32	5.64	3.40	2.29	1.69	200.0	19.1	0.0	7.6	7.48	79.3	*
6.299	10,997	17.39	11.35	6.38	3.65	2.17	1.49	1.04	200.0	69.7	0.0	12.0	6.87	78.6	*
6.498	11,183	24.71	17.21	11.86	7.41	5.24	4.19	3.17	200.0	112.1	0.0	5.5	7.49	203.1	*
6.699	11,600	12.26	9.52	6.54	4.22	2.76	1.87	1.27	564.0	144.2	0.0	10.7	3.55	105.5	
6.898	11,326	21.97	18.58	12.02	8.54	6.04	4.45	3.29	363.4	99.1	0.0	4.9	5.84	141.1	
7.111	11,381	20.63	14.71	9.49	5.74	3.62	2.54	1.91	222.0	87.6	0.0	7.8	5.28	100.9	
7.300	11,129	23.73	17.35	8.69	5.01	3.00	2.20	1.66	205.4	26.2	0.0	8.7	10.07	79.5	
7.504	10,899	29.23	22.63	15.67	9.45	6.51	4.76	3.35	200.1	65.9	0.0	4.3	5.68	155.6	*
7.686	11,852	9.90	7.89	5.76	4.06	2.92	2.15	1.67	1309.0	150.0	0.0	10.6	4.21	142.9	*
8.100	11,775	10.67	8.40	5.49	3.52	2.44	1.82	1.41	726.3	150.0	0.0	12.5	6.63	145.0	*
8.302	11,687	10.50	8.48	6.72	5.00	3.78	2.89	2.25	1769.1	150.0	0.0	7.7	3.90	165.3	*
8.506	11,654	15.59	11.46	8.32	5.79	4.19	3.10	2.35	551.9	150.0	0.0	7.4	5.92	157.1	*
9.108	11,468	11.70	9.63	7.03	3.98	2.87	2.15	1.65	1119.8	33.0	0.0	10.5	6.99	93.4	
9.500	12,805	7.17	5.97	4.54	3.20	2.27	1.65	1.13	2000.0	97.3	0.0	16.3	6.64	95.2	*
9.704	12,432	5.20	4.15	3.00	2.04	1.41	0.99	0.69	2000.0	24.4	0.0	31.8	15.77	92.7	*
9.906	12,356	7.70	6.63	5.34	3.95	2.93	2.14	1.57	2000.0	150.0	0.0	11.8	6.08	116.6	*
10.303	12,301	7.75	6.70	5.56	4.24	3.22	2.41	1.81	2000.0	132.2	0.0	11.2	9.11	126.0	*
10.499	12,082	7.89	6.74	5.58	4.21	3.10	2.26	1.66	2000.0	92.4	0.0	11.0	8.29	117.6	*
10.705	11,435	15.60	11.00	6.95	4.40	2.91	2.03	1.53	266.6	150.0	0.0	10.1	5.66	115.9	*

NB-B1-B11

10.912	11,304	12.68	9.75	7.00	4.70	3.15	2.33	1.68	630.5	150.0	0.0	9.1	4.25	125.2 *
Mean:		14.86	10.55	6.61	4.02	2.67	1.94	1.43	739.0	92.3	0.0	13.4	7.95	94.1
Std. Dev:		6.56	4.62	2.85	1.71	1.26	0.96	0.73	685.6	55.1	0.0	8.0	3.18	42.5
Var Coeff(%):		44.17	43.78	43.05	42.47	47.11	49.54	51.16	92.8	59.7	0.0	59.3	40.00	45.1

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District:
County :
Highway/Road:

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	10.10	340,000	1,040,000	H1: v = 0.35
Base:	9.00	10,000	150,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	113.62(by DB)	5,000		H4: v = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock	
0.198	12,958	11.95	9.08	6.31	4.00	2.56	1.80	1.37	576.2	17.3	0.0	17.4	3.00	98.0	
0.402	13,024	9.60	6.32	3.80	2.05	1.10	0.65	0.43	497.7	14.7	0.0	41.0	2.38	60.3	
0.607	12,772	13.14	9.73	6.69	4.16	2.54	1.61	1.10	510.6	10.4	0.0	18.5	1.56	84.7	
0.802	12,684	19.14	11.33	7.42	4.18	2.55	1.82	1.43	340.0	10.0	0.0	16.5	8.41	87.7	*
0.999	12,651	10.20	8.40	6.40	4.49	3.25	2.44	1.99	919.5	37.3	0.0	12.9	2.50	166.7	
1.201	12,772	11.31	8.37	5.83	3.60	2.29	1.59	1.37	567.2	18.9	0.0	18.9	2.93	95.5	
1.398	12,761	2.77	2.20	2.11	1.85	1.68	1.51	1.34	1040.0	97.3	0.0	60.1	43.54	300.0	*
1.601	12,695	7.98	6.42	4.81	3.37	2.47	1.92	1.53	1040.0	42.8	0.0	17.9	4.06	175.9	*
2.140	12,739	9.63	7.86	6.01	4.22	3.01	2.18	1.64	965.3	36.5	0.0	14.2	1.84	131.2	
2.335	12,410	12.87	10.63	8.25	5.76	3.93	2.67	1.94	780.7	10.0	0.0	11.6	1.31	109.7	*
2.541	12,640	8.18	6.84	4.96	3.35	2.30	1.65	1.26	1040.0	26.5	0.0	19.1	3.11	121.4	*
2.744	12,476	4.39	3.74	3.46	2.92	2.47	2.04	1.61	1040.0	150.0	0.0	22.4	22.85	122.8	*
2.949	12,586	5.09	4.64	4.02	3.20	2.51	1.97	1.59	1040.0	60.0	0.0	23.9	22.45	159.2	*
3.151	12,334	9.59	8.00	5.86	3.97	2.61	1.91	1.37	968.4	10.7	0.0	17.7	3.32	107.0	
3.354	12,377	20.08	10.37	5.91	3.15	1.69	1.03	0.76	340.0	10.0	0.0	21.3	15.62	63.4	*
3.559	12,323	6.22	5.10	4.13	3.14	2.37	1.80	1.35	1040.0	38.7	0.0	22.6	14.18	115.7	*
3.772	12,399	12.87	10.07	6.76	4.13	2.49	1.44	0.64	484.5	10.0	0.0	18.3	3.11	71.2	*
4.046	12,388	11.16	9.13	6.04	3.67	2.15	1.28	0.81	568.5	10.0	0.0	21.2	4.19	75.0	*
4.251	12,268	15.77	12.16	7.46	4.33	2.39	1.31	0.76	340.0	10.0	0.0	17.0	6.86	67.8	*
4.454	12,301	13.11	10.46	7.93	5.60	4.02	2.96	2.51	573.0	45.7	0.0	10.0	1.93	156.4	
4.659	12,246	9.67	8.12	6.22	4.33	3.08	2.27	1.74	999.4	26.2	0.0	13.4	2.60	148.7	
4.855	12,246	8.37	6.77	5.37	4.03	2.98	2.24	1.75	998.8	105.3	0.0	13.0	0.96	151.2	
5.059	12,104	10.99	9.23	7.59	5.67	4.29	3.28	2.48	921.5	71.1	0.0	8.7	1.39	145.4	
5.264	12,169	11.29	9.65	8.06	6.02	4.56	3.43	2.67	1040.0	48.5	0.0	8.3	1.25	175.6	*
5.467	12,169	10.05	8.48	6.74	4.92	3.71	2.82	2.26	1012.2	54.7	0.0	10.4	1.92	183.9	
5.671	12,213	12.87	11.09	9.05	6.79	5.22	4.21	2.73	1040.0	28.8	0.0	7.2	2.22	96.8	*
5.873	12,136	9.15	7.94	6.91	5.07	3.95	3.10	2.59	1040.0	61.9	0.0	9.8	5.07	264.7	*
6.077	12,213	9.56	7.63	5.65	3.91	2.87	2.15	1.72	728.5	67.3	0.0	14.0	2.72	160.2	
6.282	12,136	6.95	5.65	4.59	3.46	2.65	2.09	1.69	1040.0	87.9	0.0	16.2	6.43	184.1	*
6.480	12,388	6.87	5.80	4.73	3.56	2.70	2.04	1.72	1040.0	88.6	0.0	16.4	6.81	149.8	*
6.682	12,235	9.04	6.85	5.32	3.91	2.94	2.23	1.78	684.7	134.1	0.0	13.4	1.81	163.5	*
6.886	11,939	7.40	5.63	4.33	3.22	2.42	1.87	1.46	865.4	150.0	0.0	15.9	2.41	144.0	*
7.091	11,961	11.06	8.38	6.28	4.48	3.37	2.66	2.16	470.4	113.6	0.0	11.4	2.95	232.3	*
7.294	12,202	8.61	6.40	4.87	3.43	2.52	1.88	1.48	592.7	139.9	0.0	15.6	1.90	147.4	
7.491	12,027	9.45	7.31	5.51	3.77	2.67	1.91	1.43	716.5	55.1	0.0	15.0	1.79	124.4	
7.696	12,115	7.02	5.64	4.43	3.31	2.54	1.98	1.57	1040.0	120.6	0.0	16.0	3.36	158.3	*
7.899	12,202	7.75	6.05	4.57	3.26	2.28	1.61	1.15	948.4	66.3	0.0	17.8	0.83	105.6	
8.102	11,863	9.37	7.94	6.44	4.88	3.78	2.96	2.43	1040.0	61.7	0.0	10.3	2.99	231.1	*
8.281	12,202	9.78	7.31	5.34	3.87	2.94	2.28	1.84	509.7	135.3	0.0	13.5	3.03	196.8	*
Mean:		10.01	7.76	5.80	4.03	2.87	2.12	1.63	805.1	58.6	0.0	17.1	5.68	132.7	
Std. Dev:		3.44	2.17	1.46	1.02	0.82	0.69	0.57	249.4	44.8	0.0	9.1	8.15	53.3	
Var Coeff(%):		34.40	27.96	25.13	25.22	28.56	32.71	34.73	31.0	76.6	0.0	53.4	143.52	40.2	

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District:
County :
Highway/Road:

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	10.80	340,000	1,040,000	H1: v = 0.35
Base:	13.30	10,000	150,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	124.52(by DB)	5,000		H4: v = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute Dpth to ERR/Sens	Bedrock	
8.660	11,841	10.24	7.47	5.54	4.00	2.99	2.26	1.72	431.7	65.6	0.0	13.2	1.41	138.9	
8.856	12,005	8.37	6.78	4.95	3.52	2.54	1.85	1.44	824.1	31.0	0.0	17.2	1.91	127.9	
8.982	11,775	15.10	11.25	7.44	4.86	3.26	2.33	1.80	340.0	14.0	0.0	13.4	3.20	125.5	*
9.199	11,917	9.74	8.09	6.63	5.10	3.92	3.00	2.33	1040.0	31.2	0.0	10.1	0.86	156.2	*
9.397	11,939	11.41	8.41	5.73	3.80	2.58	1.87	1.54	424.8	26.1	0.0	16.5	2.55	126.5	
9.596	11,874	10.37	8.06	5.96	4.20	3.03	2.27	1.89	579.5	34.4	0.0	13.7	1.99	161.8	
9.799	11,939	9.30	7.05	5.33	3.82	2.83	2.21	1.71	556.6	63.9	0.0	13.9	2.24	150.8	
10.000	11,906	12.35	9.04	6.47	4.36	3.04	2.21	1.76	401.1	28.9	0.0	13.7	1.86	141.0	
10.201	12,016	9.46	7.61	5.83	4.11	3.03	2.35	1.84	737.7	37.3	0.0	13.6	2.70	169.7	
10.399	12,005	8.90	7.56	5.96	4.33	3.20	2.35	1.88	1040.0	20.9	0.0	13.6	1.63	140.3	*
10.606	12,016	8.47	6.69	5.26	3.93	2.94	2.25	1.79	793.0	62.5	0.0	13.4	1.12	172.6	
10.801	11,830	13.11	9.19	6.77	5.10	3.54	2.72	2.30	340.0	47.7	0.0	11.0	1.96	140.1	*
10.999	12,082	8.81	6.08	4.24	2.88	2.02	1.43	1.18	464.0	55.3	0.0	20.9	1.11	110.7	
11.199	12,016	10.26	7.86	6.07	4.37	3.17	2.28	1.73	627.5	36.7	0.0	13.3	0.76	126.8	
11.406	11,950	11.31	8.45	6.28	4.50	3.32	2.51	1.94	442.0	49.6	0.0	12.1	1.62	157.0	
11.601	12,005	6.83	5.32	4.61	3.78	3.13	2.64	2.28	1040.0	61.4	0.0	14.9	10.56	300.0	*
11.801	11,895	13.79	10.13	7.61	5.50	4.15	3.19	2.85	340.0	49.7	0.0	9.5	1.67	213.5	*
11.998	11,830	11.73	8.04	6.01	4.45	3.29	2.59	2.15	340.0	70.9	0.0	11.7	2.11	239.4	*
12.206	12,158	9.16	7.67	6.21	4.35	3.10	2.33	1.93	1040.0	13.3	0.0	15.0	2.53	171.6	*
Mean:		10.46	7.93	5.94	4.26	3.11	2.35	1.90	621.2	42.1	0.0	13.7	2.31	148.6	
Std. Dev:		2.08	1.37	0.86	0.61	0.47	0.40	0.37	267.5	18.0	0.0	2.6	2.10	31.2	
Var Coeff(%):		19.87	17.23	14.51	14.35	15.10	16.87	19.48	43.1	42.6	0.0	18.8	91.01	21.0	

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District:
County :
Highway/Road:

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	8.00	340,000	1,600,000	H1: v = 0.35
Base:	5.90	10,000	150,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	84.73(by DB)	5,000		H4: v = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock	
12.537	11,512	9.66	8.18	5.83	3.96	2.70	1.83	1.22	1230.4	103.4	0.0	11.6	2.65	97.8	
12.807	10,800	27.30	19.40	11.60	6.80	4.06	2.64	1.95	340.0	10.0	0.0	6.7	8.05	84.5	*
13.013	11,753	6.07	5.22	4.26	3.22	2.53	1.98	1.57	1600.0	150.0	0.0	16.4	16.29	156.8	*
13.213	11,611	8.91	8.00	6.69	5.13	3.90	2.94	2.12	1600.0	24.4	0.0	10.8	16.09	115.6	*
13.426	11,885	6.67	5.45	4.36	3.28	2.43	1.89	1.43	1600.0	94.6	0.0	16.6	15.22	123.6	*
13.628	11,665	11.91	9.50	7.37	5.40	3.94	2.84	2.12	1160.1	150.0	0.0	8.0	2.86	134.1	*
13.825	11,720	8.19	6.27	4.48	2.98	2.11	1.56	1.23	1328.9	150.0	0.0	15.3	5.25	142.1	*
14.013	11,698	5.21	4.72	4.06	3.19	2.56	1.96	1.63	1600.0	150.0	0.0	19.5	24.55	152.0	*
14.218	11,622	6.11	5.34	4.57	3.63	2.92	2.31	1.85	1600.0	150.0	0.0	15.3	20.09	162.9	*
14.436	11,654	16.57	11.98	7.25	4.24	2.67	1.95	1.62	340.0	59.9	0.0	11.2	6.79	95.9	*
14.629	11,633	14.28	11.47	7.01	4.08	2.57	1.86	1.54	574.0	35.2	0.0	11.8	7.43	96.0	
14.842	11,578	20.31	15.08	10.50	6.76	4.57	3.25	2.44	340.0	91.5	0.0	6.8	4.44	144.5	*
15.060	11,446	19.12	12.31	7.69	4.87	3.18	2.23	1.37	340.0	49.9	0.0	9.8	8.84	110.4	*
15.273	11,457	17.55	12.43	7.86	4.91	3.21	2.24	1.65	340.0	72.5	0.0	9.6	5.90	112.5	*
15.496	11,709	6.61	6.02	5.33	4.31	3.48	2.74	2.19	1600.0	150.0	0.0	12.4	19.88	165.9	*
15.709	11,556	9.96	7.71	5.58	3.90	2.85	2.15	1.71	1181.2	150.0	0.0	11.2	5.50	168.2	*
15.919	10,910	18.38	11.86	8.89	5.70	3.37	2.43	1.81	340.0	81.5	0.0	8.2	5.95	82.9	*
16.142	11,183	14.17	9.36	6.11	4.00	2.68	1.92	1.39	340.0	142.6	0.0	11.4	6.74	120.5	*
16.347	10,712	22.12	14.19	9.43	6.10	4.22	3.20	2.45	340.0	48.8	0.0	7.0	10.38	167.1	*
16.550	11,074	13.58	10.73	7.19	4.40	2.59	1.57	0.98	708.3	19.5	0.0	11.5	2.53	78.8	
16.754	10,822	19.92	12.38	6.78	3.73	2.02	1.20	0.80	340.0	10.0	0.0	12.9	7.15	65.1	*
16.963	10,910	20.76	14.25	7.45	3.94	2.13	1.26	0.81	340.0	10.0	0.0	11.7	8.41	65.2	*
17.154	10,866	26.10	16.28	10.04	5.32	3.09	2.26	1.67	340.0	10.0	0.0	8.3	11.34	72.9	*
17.357	11,096	18.65	11.31	7.49	3.95	1.56	0.80	0.47	340.0	10.0	0.0	14.5	9.52	48.6	*
17.554	11,414	11.24	7.94	4.89	2.96	1.88	1.22	0.85	416.4	122.4	0.0	16.0	4.46	90.6	
17.773	11,304	19.92	12.48	7.09	3.57	2.09	1.59	1.07	340.0	10.9	0.0	13.2	10.52	60.1	*
17.995	11,129	10.92	6.13	3.37	1.85	1.14	0.83	0.78	340.0	72.4	0.0	24.4	10.22	71.7	*
18.206	11,304	9.94	6.09	3.28	1.87	1.11	0.78	0.61	340.0	101.8	0.0	25.0	7.47	71.8	*
18.422	11,194	13.50	8.94	5.43	3.27	2.10	1.49	1.02	340.0	95.3	0.0	14.0	6.86	98.8	*
18.630	10,942	22.32	8.33	4.75	2.83	1.87	1.33	0.91	340.0	11.5	0.0	17.3	24.96	109.0	*
18.844	10,855	20.59	13.02	8.87	5.10	2.98	2.00	1.53	340.0	24.2	0.0	9.2	6.34	81.3	*
19.069	11,063	16.11	10.44	5.55	2.69	1.47	1.00	0.79	340.0	13.2	0.0	17.3	8.18	53.7	*
19.288	10,866	22.64	13.14	7.45	3.73	2.00	1.04	0.67	340.0	10.0	0.0	12.0	9.88	59.6	*
19.497	10,734	17.44	13.24	7.99	4.45	2.43	1.49	0.87	414.3	10.7	0.0	11.1	4.49	68.1	
19.705	11,129	9.52	6.39	3.84	2.19	1.29	0.85	0.54	445.4	106.0	0.0	21.3	4.78	72.9	
19.913	11,041	11.39	7.60	4.04	1.88	0.97	0.63	0.47	425.5	20.2	0.0	24.6	7.40	48.5	
20.112	11,085	13.57	9.03	5.68	2.90	1.13	0.83	0.62	473.7	10.0	0.0	19.8	9.52	47.1	*
20.320	10,888	14.30	9.10	5.44	2.81	1.53	1.15	0.79	340.0	34.8	0.0	16.1	7.61	63.5	*
20.528	11,151	10.17	8.08	6.22	4.46	3.24	2.37	1.76	1304.7	150.0	0.0	9.3	3.35	132.5	*
20.734	10,822	11.73	8.75	6.52	4.66	3.37	2.57	1.84	871.2	150.0	0.0	8.8	5.73	117.9	*
20.976	10,767	7.65	5.56	3.76	2.53	1.83	1.37	1.08	1138.6	150.0	0.0	16.8	8.29	146.7	*
21.185	10,997	11.17	8.61	6.42	4.43	3.04	2.21	1.67	838.9	150.0	0.0	9.7	3.59	141.4	*
21.386	11,611	6.38	5.20	4.00	2.86	2.12	1.59	1.31	1600.0	61.4	0.0	20.0	15.62	144.0	*
21.591	11,359	4.61	3.63	2.94	2.24	1.76	1.41	1.16	1600.0	97.3	0.0	28.9	25.64	179.4	*
21.886	12,838	5.26	3.52	2.44	1.69	1.20	0.88	0.61	1600.0	38.7	0.0	42.0	20.39	86.4	*
22.100	11,545	6.27	4.72	3.38	2.39	1.71	1.31	0.95	1600.0	52.6	0.0	22.1	13.29	150.7	*
22.316	11,392	7.04	5.32	3.95	2.80	2.04	1.53	1.12	1600.0	83.4	0.0	17.4	9.70	111.9	*
22.533	12,093	10.92	7.95	5.59	3.85	2.79	2.15	1.48	921.0	150.0	0.0	12.2	7.69	101.7	*
23.153	11,501	13.42	8.92	5.26	3.24	2.32	1.93	1.61	340.0	135.9	0.0	13.7	11.51	137.1	*
23.291	11,348	13.66	10.31	7.22	4.99	3.67	2.87	1.95	632.1	150.0	0.0	8.6	6.67	104.7	*

Mean:	13.40	9.24	6.06	3.80	2.49	1.79	1.32	782.9	78.7	0.0	14.6	9.72	98.6
Std. Dev:	5.88	3.52	2.05	1.24	0.88	0.68	0.53	526.2	55.5	0.0	6.6	5.89	38.4
Var Coeff(%):	43.93	38.12	33.88	32.54	35.56	38.17	40.18	67.2	70.5	0.0	44.9	60.65	38.9

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District:
County :
Highway/Road:

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	10.10	340,000	1,040,000	H1: v = 0.35
Base:	9.00	10,000	150,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	100.46(by DB)	5,000		H4: v = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute Dpth to ERR/Sens	Bedrock	
3.679	11,698	9.05	7.31	5.62	4.21	3.13	2.37	1.91	755.1	125.5	0.0	10.8	1.69	163.0	
3.838	11,852	11.46	8.65	6.16	4.25	2.89	1.95	1.41	501.6	47.0	0.0	12.8	1.10	101.0	
4.022	11,709	6.75	5.22	3.89	2.77	1.98	1.46	1.11	847.0	137.5	0.0	17.6	1.97	127.3	
4.226	11,797	9.93	6.70	4.63	3.25	2.40	1.90	1.55	347.9	150.0	0.0	14.9	4.61	224.3	*
4.431	11,950	8.04	5.90	4.16	2.95	2.13	1.61	1.24	541.9	150.0	0.0	16.8	3.22	136.3	*
4.633	11,874	9.48	6.78	4.70	3.42	2.58	1.93	1.64	422.1	150.0	0.0	14.1	3.98	142.7	*
4.838	11,764	9.07	7.26	5.64	4.29	3.34	2.77	2.13	825.9	150.0	0.0	9.8	3.51	141.3	*
5.041	11,567	9.54	6.30	4.26	2.88	2.00	1.47	1.18	340.0	120.2	0.0	17.6	3.41	133.2	*
5.245	11,468	9.88	7.20	5.31	3.70	2.65	1.95	1.48	430.7	118.3	0.0	12.9	2.15	140.5	
5.448	11,611	9.30	6.79	4.86	3.43	2.50	1.87	1.48	432.4	142.0	0.0	13.8	2.83	149.9	
5.653	11,633	10.78	7.89	5.37	3.72	2.65	1.95	1.47	386.7	90.0	0.0	13.3	3.44	134.3	
5.857	11,019	10.98	8.27	5.98	4.06	2.82	2.00	1.48	462.6	56.9	0.0	11.9	2.10	124.3	
6.054	11,337	9.12	6.55	4.89	3.52	2.60	2.01	1.56	469.7	150.0	0.0	13.0	2.78	150.8	*
6.258	11,403	11.54	8.81	6.24	4.28	3.03	2.25	1.60	435.7	66.2	0.0	11.4	3.20	114.9	
6.462	11,512	9.59	7.78	5.80	4.24	3.22	2.53	1.86	638.1	126.6	0.0	10.3	3.28	121.5	
6.659	10,866	19.65	15.50	11.41	7.82	5.48	4.00	3.21	340.0	20.2	0.0	6.1	2.49	171.7	*
6.883	10,997	16.11	13.20	10.51	7.80	5.77	4.35	3.50	467.1	54.7	0.0	5.5	1.46	206.2	
7.095	11,271	12.28	8.64	6.30	4.49	3.22	2.46	1.92	340.0	99.2	0.0	10.4	3.04	191.1	*
7.298	11,370	12.23	9.81	7.71	5.58	4.11	2.98	2.09	599.1	63.2	0.0	8.2	1.19	114.4	
7.503	11,370	7.57	5.65	4.10	2.93	2.13	1.60	1.26	608.3	150.0	0.0	16.0	2.65	146.1	*
7.708	11,446	10.65	7.67	5.75	4.15	2.87	1.94	1.30	421.7	97.7	0.0	12.1	0.60	96.2	
7.910	11,578	7.83	6.48	5.29	4.03	3.09	2.35	1.87	1040.0	146.6	0.0	10.6	1.19	164.5	*
8.121	12,640	11.19	8.62	5.42	3.11	1.71	0.98	0.64	514.8	10.0	0.0	25.2	3.21	65.2	*
8.319	12,597	10.33	8.23	5.56	3.41	2.00	1.17	0.44	662.2	10.0	0.0	22.2	2.85	74.2	*
8.527	12,257	9.57	6.80	4.50	2.87	1.89	1.32	0.91	484.7	56.5	0.0	19.6	3.04	103.6	
8.744	11,797	7.97	6.24	4.31	2.75	1.82	1.29	0.93	792.5	33.7	0.0	20.3	3.68	106.5	
8.962	11,775	10.91	8.67	6.76	4.64	1.73	1.22	0.91	557.9	10.0	0.0	18.4	13.46	45.0	*
9.151	11,928	14.37	11.68	8.07	5.19	3.30	2.27	1.66	500.8	10.0	0.0	12.0	3.56	100.4	*
9.359	11,775	14.64	10.15	8.51	5.59	3.59	2.58	1.98	351.6	54.9	0.0	9.5	3.77	110.0	
9.626	11,731	9.01	7.57	5.87	4.28	3.04	2.24	1.61	1040.0	46.0	0.0	11.5	1.76	113.7	*
9.828	11,622	11.40	9.35	6.28	3.92	2.56	1.83	1.52	601.0	12.0	0.0	15.1	4.89	108.9	
10.032	11,457	13.55	9.81	7.65	4.84	3.10	2.08	1.50	466.2	20.8	0.0	11.5	2.88	107.0	
10.241	11,633	6.67	5.30	4.39	3.34	2.54	2.02	1.53	1040.0	150.0	0.0	13.3	4.74	124.4	*
10.461	11,326	9.84	7.22	5.26	3.77	2.76	2.15	1.55	404.8	150.0	0.0	12.0	3.18	112.9	*
10.678	11,545	8.55	6.54	4.85	3.46	2.58	1.98	1.56	581.7	150.0	0.0	13.2	2.86	165.1	*
10.899	11,512	8.46	7.20	5.52	4.04	3.02	2.32	1.79	1040.0	56.3	0.0	11.6	2.81	149.2	*
11.104	11,227	16.06	12.11	8.32	4.96	3.04	1.98	1.44	347.6	10.0	0.0	11.7	3.26	91.5	*
11.314	12,049	9.59	7.02	4.12	2.42	1.58	1.12	0.92	469.6	31.3	0.0	23.5	6.32	97.3	
11.511	11,600	14.18	11.34	7.70	4.96	3.15	2.51	1.88	436.4	19.8	0.0	11.0	5.71	99.2	
11.721	11,578	14.04	11.42	7.64	4.82	3.01	2.03	1.43	461.0	10.0	0.0	12.7	3.81	93.5	*
11.926	11,600	6.82	4.61	2.70	1.54	0.91	0.61	0.40	568.9	37.7	0.0	37.7	4.52	69.4	
12.130	11,578	9.26	6.79	4.44	2.92	1.89	1.37	0.92	503.6	52.6	0.0	18.3	3.77	95.7	
12.333	11,173	22.07	18.65	11.12	7.29	4.90	3.28	2.47	340.0	10.0	0.0	6.9	8.33	105.8	*
Mean:		10.91	8.36	5.99	4.09	2.81	2.05	1.54	553.9	78.0	0.0	14.1	3.45	119.6	
Std. Dev:		3.26	2.76	1.91	1.30	0.95	0.72	0.60	203.7	54.8	0.0	5.7	2.12	41.7	
Var Coeff(%):		29.84	33.02	31.90	31.87	33.77	35.07	38.66	36.8	70.2	0.0	40.4	61.42	34.9	

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District:
County :
Highway/Road:

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	10.80	340,000	1,040,000	H1: v = 0.35
Base:	13.30	10,000	150,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	117.10(by DB)	5,000		H4: v = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute Dpth to ERR/Sens	Bedrock	
0.000	13,429	13.93	10.39	7.44	5.10	3.63	2.71	2.12	401.6	34.4	0.0	12.3	2.33	165.3	
0.209	13,013	15.83	11.04	8.30	6.03	4.22	3.13	2.31	340.0	36.5	0.0	10.1	1.62	131.5	*
0.417	13,013	12.66	11.04	8.81	6.66	5.16	4.04	3.38	922.3	22.8	0.0	8.0	1.93	256.8	
0.629	12,947	17.33	11.66	8.93	6.33	4.68	3.67	2.83	340.0	33.6	0.0	9.1	4.17	172.2	*
0.834	12,805	19.77	14.22	9.96	7.11	4.99	3.79	2.75	340.0	15.3	0.0	9.0	4.06	171.8	*
1.030	12,640	15.01	9.61	6.74	4.56	3.07	2.16	1.58	340.0	23.5	0.0	14.4	3.44	119.0	*
1.235	12,673	13.64	9.69	6.31	4.19	2.83	1.98	1.76	340.0	25.5	0.0	15.6	2.57	114.0	*
1.435	12,421	10.31	6.73	4.31	2.70	1.68	1.14	0.89	367.0	32.3	0.0	25.1	1.76	83.1	
1.647	12,443	11.54	8.96	7.02	5.13	3.85	2.96	2.14	538.8	54.6	0.0	10.2	1.63	119.1	
1.850	12,388	17.65	12.87	8.22	5.48	3.74	2.72	2.13	340.0	10.8	0.0	12.4	5.29	137.4	*
2.055	12,520	10.99	9.07	6.74	4.79	3.29	2.28	1.70	785.3	10.2	0.0	15.5	1.30	110.2	
2.259	12,695	9.49	6.83	4.93	3.41	2.35	1.66	1.20	537.6	45.8	0.0	18.1	0.84	111.7	
2.463	12,191	13.30	9.89	7.26	5.25	3.86	2.90	2.18	363.9	47.1	0.0	10.2	1.57	139.4	
2.668	12,136	14.11	9.86	6.61	4.36	3.05	2.28	1.76	340.0	24.7	0.0	13.7	3.96	159.8	*
2.871	12,290	15.79	11.01	7.13	4.83	3.44	2.61	2.00	340.0	19.3	0.0	12.6	5.49	182.8	*
3.075	12,268	9.13	7.02	4.98	3.32	2.22	1.59	1.24	671.3	22.5	0.0	19.9	2.43	112.6	
3.279	12,213	6.86	6.00	4.78	3.61	2.75	2.09	1.68	1040.0	68.2	0.0	14.3	2.65	156.0	*
3.484	12,180	12.41	8.75	6.08	4.32	3.07	2.31	1.83	340.0	47.3	0.0	13.0	2.28	162.4	*
Mean:		13.32	9.70	6.92	4.84	3.44	2.56	1.97	482.7	31.9	0.0	13.5	2.74	141.2	
Std. Dev:		3.30	2.17	1.56	1.20	0.94	0.78	0.61	224.2	15.7	0.0	4.3	1.36	34.9	
Var Coeff(%):		24.81	22.35	22.51	24.68	27.37	30.43	30.84	46.4	49.3	0.0	31.8	49.65	24.7	

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District	Forth Worth
County	Palo Pinto

	Modulus Range (ksi)			
	Thick (in)	Min	Max	Poisson
Surface	8	200	2000	0.35
Base	5.9	10	150	0.35
Subbase	0	0	0	0
Subgrade	80.2	5		0.4

																TEMPERATURE (F)				Corrected
Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
0.098	11260	15.18	10.50	6.17	3.52	2.33	1.88	1.49	243.3	120.7	0.0	11.9	9.6	91.1		35.0	43.0		14:06	52.3	100.7
0.500	11162	10.99	7.34	4.25	2.37	1.26	0.89	0.69	428.9	61.2	0.0	19.4	6.3	60.6		35.0	44.0		14:10	52.9	182.4
0.700	10822	16.78	10.42	5.31	2.81	1.59	1.05	0.69	200.0	40.6	0.0	15.1	7.4	66.5		36.0	45.0		14:11	53.5	87.3
0.900	10942	9.47	6.56	4.40	3.06	2.26	1.76	1.40	913.0	150.0	0.0	13.5	10.8	174.0		36.0	47.0		14:13	54.6	420.0
1.579	11151	7.83	5.45	3.75	2.59	1.90	1.46	1.16	1304.9	150.0	0.0	16.3	10.2	164.5		36.0	45.0		14:17	53.5	569.8
1.895	10811	6.34	4.77	3.42	2.51	1.91	1.50	1.08	2000.0	97.3	0.0	16.9	10.5	101.5		36.0	44.0		14:20	52.9	850.7
2.104	10789	9.59	6.21	3.74	2.23	1.50	1.18	0.85	420.8	150.0	0.0	18.7	10.0	106.0		35.0	46.0		14:21	54.0	188.7
2.312	13177	10.44	8.66	6.31	4.55	3.39	2.78	2.06	1752.6	150.0	0.0	9.7	6.1	269.2		33.0	44.0		14:23	52.9	745.5
2.501	12367	6.41	3.30	1.72	0.96	0.53	0.38	0.29	509.7	150.0	0.0	51.0	8.7	57.0		34.0	45.0		14:24	53.5	222.6
3.100	11753	9.73	6.52	4.06	2.55	1.69	1.19	0.81	537.0	150.0	0.0	18.3	7.9	105.2		34.0	43.0		14:29	52.3	222.3
3.300	11162	17.23	10.92	5.61	2.87	1.39	0.85	0.57	249.4	19.8	0.0	16.2	5.6	55.0		34.0	43.0		14:31	52.3	103.3
3.498	11304	18.04	11.96	6.29	3.19	1.44	1.02	0.71	272.5	15.1	0.0	15.1	8.0	51.8		34.0	42.0		14:33	51.7	109.8
3.710	11370	18.78	10.82	6.00	3.30	1.77	1.06	0.67	200.0	39.0	0.0	14.2	4.8	63.3		33.0	42.0		14:34	51.7	80.6
3.898	11052	22.73	18.15	12.20	3.63	2.56	1.94	1.33	251.4	10.0	0.0	9.5	20.1	33.6		33.0	42.0		14:36	51.7	101.3
4.299	11151	24.68	17.16	8.57	4.49	2.63	1.83	1.21	200.0	16.0	0.0	9.7	9.9	66.0		33.0	40.0		14:39	50.6	76.3
4.904	11227	13.85	8.67	4.93	2.89	1.97	1.48	1.31	209.3	150.0	0.0	14.9	10.5	100.0		33.0	41.0		14:44	51.2	82.1
5.105	11183	21.61	13.46	6.26	3.07	1.61	1.08	0.61	200.0	12.3	0.0	14.5	9.1	54.4		34.0	41.0		14:46	51.2	78.5
5.708	11074	23.52	14.14	8.24	4.86	2.86	1.83	1.26	200.0	32.8	0.0	9.4	7.7	78.4		34.0	40.0		14:50	50.6	76.3
5.899	11381	17.05	9.98	4.45	2.48	1.45	0.98	0.63	200.0	31.6	0.0	18.2	11.3	70.3		34.0	39.0		14:52	50.0	74.2
6.099	10899	26.98	18.28	10.32	5.64	3.40	2.29	1.69	200.0	19.1	0.0	7.6	7.5	79.3		34.0	40.0		14:53	50.6	76.3
6.299	10997	17.39	11.35	6.38	3.65	2.17	1.49	1.04	200.0	69.7	0.0	12.0	6.9	78.6		34.0	41.0		14:54	51.2	78.4
6.498	11183	24.71	17.21	11.86	7.41	5.24	4.19	3.17	200.0	112.1	0.0	5.5	7.5	203.1		34.0	41.0		14:56	51.2	78.4
6.699	11600	12.26	9.52	6.54	4.22	2.76	1.87	1.27	564.0	144.2	0.0	10.7	3.6	105.5		34.0	41.0		14:58	51.2	221.1
6.898	11326	21.97	18.58	12.02	8.54	6.04	4.45	3.29	363.4	99.1	0.0	4.9	5.8	141.1		35.0	41.0		14:59	51.2	142.5
7.111	11381	20.63	14.71	9.49	5.74	3.62	2.54	1.91	222.0	87.6	0.0	7.8	5.3	100.9		36.0	41.0		15:00	51.2	87.0
7.300	11129	23.73	17.35	8.69	5.01	3.00	2.20	1.66	205.4	26.2	0.0	8.7	10.1	79.5		35.0	40.0		15:03	50.6	78.4
7.504	10899	29.23	22.63	15.67	9.45	6.51	4.76	3.35	200.1	65.9	0.0	4.3	5.7	155.6		36.0	42.0		15:05	51.7	80.7
7.686	11852	9.90	7.89	5.76	4.06	2.92	2.15	1.67	1309.0	150.0	0.0	10.6	4.2	142.9		36.0	43.0		15:06	52.3	542.0
8.100	11775	10.67	8.40	5.49	3.52	2.44	1.82	1.41	726.3	150.0	0.0	12.5	6.6	145.0		37.0	43.0		15:09	52.3	300.7
8.302	11687	10.50	8.48	6.72	5.00	3.78	2.89	2.25	1769.1	150.0	0.0	7.7	3.9	165.3		37.0	43.0		15:11	52.3	732.4
8.506	11654	15.59	11.46	8.32	5.79	4.19	3.10	2.35	551.9	150.0	0.0	7.4	5.9	157.1		37.0	44.0		15:14	52.9	234.7
9.108	11468	11.70	9.63	7.03	3.98	2.87	2.15	1.65	1119.8	33.0	0.0	10.5	7.0	93.4		35.0	45.0		15:20	53.5	489.0
9.500	12805	7.17	5.97	4.54	3.20	2.27	1.65	1.13	2000.0	97.3	0.0	16.3	6.6	95.2		35.0	43.0		15:24	52.3	828.0
9.704	12432	5.20	4.15	3.00	2.04	1.41	0.99	0.69	2000.0	24.4	0.0	31.8	15.8	92.7		36.0	44.0		15:26	52.9	850.7
9.906	12356	7.70	6.63	5.34	3.95	2.93	2.14	1.57	2000.0	150.0	0.0	11.8	6.1	116.6		36.0	44.0		15:27	52.9	850.7
10.303	12301	7.75	6.70	5.56	4.24	3.22	2.41	1.81	2000.0	132.2	0.0	11.2	9.1	126.0		37.0	43.0		15:30	52.3	828.0
10.499	12082	7.89	6.74	5.58	4.21	3.10	2.26	1.66	2000.0	92.4	0.0	11.0	8.3	117.6		36.0	45.0		15:32	53.5	873.3

NB - B1 to B11

Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
10.705	11435	15.60	11.00	6.95	4.40	2.91	2.03	1.53	266.6	150.0	0.0	10.1	5.7	115.9		35.0	44.0		15:35	52.9	113.4
10.912	11304	12.68	9.75	7.00	4.70	3.15	2.33	1.68	630.5	150.0	0.0	9.1	4.3	125.2		35.0	45.0		15:37	53.5	275.3
Average :		14.86	10.55	6.61	4.02	2.67	1.94	1.43	739.0	92.3	0.0	13.4	7.9	107.8		34.92	42.79	#DIV/0!		52.2	311.11
Std. Dev. :		6.56	4.62	2.85	1.71	1.26	0.96	0.73	685.6	55.1	0.0	8.0	3.2	47.5		1.22	1.91	#DIV/0!		1.10	292.58
Var Coeff.:		44.17	43.78	43.05	42.47	47.11	49.54	51.16	92.8	59.7	#DIV/0!	59.3	40.0	44.0		3.50	4.46	#DIV/0!		2.10	94.04

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District	Fort Worth
County	Palo Pinto

	Modulus Range (ksi)			
	Thick (in)	Min	Max	Poisson
Surface	10.1	340	1040	0.35
Base	9	10	150	0.35
Subbase	0	0	0	0
Subgrade	113.62	5		0.4

															TEMPERATURE (F)				Corrected
Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
0.198	12958	11.95	9.08	6.31	4.00	2.56	1.80	1.37	576.2	17.3	0.0	17.4	3.0	98.0		23.0	29.0		9:02	41.8	137.9
0.402	13024	9.60	6.32	3.80	2.05	1.10	0.65	0.43	497.7	14.7	0.0	41.0	2.4	60.3		23.0	27.0		9:04	40.7	111.8
0.607	12772	13.14	9.73	6.69	4.16	2.54	1.61	1.10	510.6	10.4	0.0	18.5	1.6	84.7		23.0	26.0		9:05	40.2	111.1
0.802	12684	19.14	11.33	7.42	4.18	2.55	1.82	1.43	340.0	10.0	0.0	16.5	8.4	87.7		23.0	30.0		9:07	42.3	83.9
0.999	12651	10.20	8.40	6.40	4.49	3.25	2.44	1.99	919.5	37.3	0.0	12.9	2.5	166.7		24.0	29.0		9:09	41.8	220.0
1.201	12772	11.31	8.37	5.83	3.60	2.29	1.59	1.37	567.2	18.9	0.0	18.9	2.9	95.5		23.0	30.0		9:11	42.3	140.0
1.398	12761	2.77	2.20	2.11	1.85	1.68	1.51	1.34	1040.0	97.3	0.0	60.1	43.5	300.0		23.0	30.0		9:12	42.3	256.7
1.601	12695	7.98	6.42	4.81	3.37	2.47	1.92	1.53	1040.0	42.8	0.0	17.9	4.1	175.9		23.0	30.0		9:14	42.3	256.7
2.140	12739	9.63	7.86	6.01	4.22	3.01	2.18	1.64	965.3	36.5	0.0	14.2	1.8	131.2		24.0	28.0		9:17	41.3	223.9
2.335	12410	12.87	10.63	8.25	5.76	3.93	2.67	1.94	780.7	10.0	0.0	11.6	1.3	109.7		25.0	28.0		9:18	41.3	181.1
2.541	12640	8.18	6.84	4.96	3.35	2.30	1.65	1.26	1040.0	26.5	0.0	19.1	3.1	121.4		25.0	28.0		9:20	41.3	241.2
2.744	12476	4.39	3.74	3.46	2.92	2.47	2.04	1.61	1040.0	150.0	0.0	22.4	22.9	122.8		25.0	28.0		9:21	41.3	241.2
2.949	12586	5.09	4.64	4.02	3.20	2.51	1.97	1.59	1040.0	60.0	0.0	23.9	22.5	159.2		25.0	30.0		9:23	42.3	256.7
3.151	12334	9.59	8.00	5.86	3.97	2.61	1.91	1.37	968.4	10.7	0.0	17.7	3.3	107.0		25.0	31.0		9:26	42.9	246.4
3.354	12377	20.08	10.37	5.91	3.15	1.69	1.03	0.76	340.0	10.0	0.0	21.3	15.6	63.4		25.0	32.0		9:27	43.4	89.1
3.559	12323	6.22	5.10	4.13	3.14	2.37	1.80	1.35	1040.0	38.7	0.0	22.6	14.2	115.7		26.0	34.0		9:28	44.5	289.4
3.772	12399	12.87	10.07	6.76	4.13	2.49	1.44	0.64	484.5	10.0	0.0	18.3	3.1	71.2		25.0	30.0		9:29	42.3	119.6
4.046	12388	11.16	9.13	6.04	3.67	2.15	1.28	0.81	568.5	10.0	0.0	21.2	4.2	75.0		26.0	31.0		9:31	42.9	144.6
4.251	12268	15.77	12.16	7.46	4.33	2.39	1.31	0.76	340.0	10.0	0.0	17.0	6.9	67.8		26.0	32.0		9:32	43.4	89.1
4.454	12301	13.11	10.46	7.93	5.60	4.02	2.96	2.51	573.0	45.7	0.0	10.0	1.9	156.4		25.0	32.0		9:34	43.4	150.2
4.659	12246	9.67	8.12	6.22	4.33	3.08	2.27	1.74	999.4	26.2	0.0	13.4	2.6	148.7		25.0	33.0		9:36	43.9	270.1
4.855	12246	8.37	6.77	5.37	4.03	2.98	2.24	1.75	998.8	105.3	0.0	13.0	1.0	151.2		25.0	32.0		9:37	43.4	261.9
5.059	12104	10.99	9.23	7.59	5.67	4.29	3.28	2.48	921.5	71.1	0.0	8.7	1.4	145.4		25.0	29.0		9:39	41.8	220.5
5.264	12169	11.29	9.65	8.06	6.02	4.56	3.43	2.67	1040.0	48.5	0.0	8.3	1.3	175.6		25.0	30.0		9:40	42.3	256.7
5.467	12169	10.05	8.48	6.74	4.92	3.71	2.82	2.26	1012.2	54.7	0.0	10.4	1.9	183.9		26.0	32.0		9:42	43.4	265.4
5.671	12213	12.87	11.09	9.05	6.79	5.22	4.21	2.73	1040.0	28.8	0.0	7.2	2.2	96.8		26.0	30.0		9:44	42.3	256.7
5.873	12136	9.15	7.94	6.91	5.07	3.95	3.10	2.59	1040.0	61.9	0.0	9.8	5.1	264.7		25.0	32.0		9:46	43.4	272.7
6.077	12213	9.56	7.63	5.65	3.91	2.87	2.15	1.72	728.5	67.3	0.0	14.0	2.7	160.2		25.0	34.0		9:47	44.5	202.7
6.282	12136	6.95	5.65	4.59	3.46	2.65	2.09	1.69	1040.0	87.9	0.0	16.2	6.4	184.1		25.0	34.0		9:48	44.5	289.4
6.480	12388	6.87	5.80	4.73	3.56	2.70	2.04	1.72	1040.0	88.6	0.0	16.4	6.8	149.8		25.0	36.0		9:50	45.5	306.6
6.682	12235	9.04	6.85	5.32	3.91	2.94	2.23	1.78	684.7	134.1	0.0	13.4	1.8	163.5		25.0	34.0		9:51	44.5	190.5
6.886	11939	7.40	5.63	4.33	3.22	2.42	1.87	1.46	865.4	150.0	0.0	15.9	2.4	144.0		25.0	33.0		9:53	43.9	233.9
7.091	11961	11.06	8.38	6.28	4.48	3.37	2.66	2.16	470.4	113.6	0.0	11.4	3.0	232.3		25.0	33.0		9:54	43.9	127.1
7.294	12202	8.61	6.40	4.87	3.43	2.52	1.88	1.48	592.7	139.9	0.0	15.6	1.9	147.4		26.0	33.0		9:55	43.9	160.2
7.491	12027	9.45	7.31	5.51	3.77	2.67	1.91	1.43	716.5	55.1	0.0	15.0	1.8	124.4		26.0	33.0		9:57	43.9	193.6
7.696	12115	7.02	5.64	4.43	3.31	2.54	1.98	1.57	1040.0	120.6	0.0	16.0	3.4	158.3		26.0	33.0		9:59	43.9	281.0
7.899	12202	7.75	6.05	4.57	3.26	2.28	1.61	1.15	948.4	66.3	0.0	17.8	0.8	105.6		26.0	34.0		10:00	44.5	263.9

NB - B12 to B21

Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
8.102	11863	9.37	7.94	6.44	4.88	3.78	2.96	2.43	1040.0	61.7	0.0	10.3	3.0	231.1		26.0	31.0		10:02	42.9	264.6
8.281	12202	9.78	7.31	5.34	3.87	2.94	2.28	1.84	509.7	135.3	0.0	13.5	3.0	196.8		26.0	36.0		10:03	45.5	150.3
Average :		10.01	7.76	5.80	4.03	2.87	2.12	1.63	805.1	58.6	0.0	17.1	5.7	141.9		24.87	31.21	#DIV/0!		43.0	206.63
Std. Dev. :		3.44	2.17	1.46	1.02	0.82	0.69	0.57	249.4	44.8	0.0	9.1	8.2	54.5		1.03	2.41	#DIV/0!		1.28	66.10
Var Coeff.:		34.40	27.96	25.13	25.22	28.56	32.71	34.73	31.0	76.6	#DIV/0!	53.3	143.5	38.4		4.14	7.72	#DIV/0!		2.98	31.99

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District	Fort Worth
County	Palo Pinto

	Modulus Range (ksi)			
	Thick (in)	Min	Max	Poisson
Surface	10.8	340	1040	0.35
Base	13.3	10	150	0.35
Subbase	0	0	0	0
Subgrade	124.52	5		0.4

															TEMPERATURE (F)					Corrected
Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
8.660	11841	10.24	7.47	5.54	4.00	2.99	2.26	1.72	431.7	65.6	0.0	13.2	1.4	138.9		26.0	37.0		10:06	46.2	132.0
8.856	12005	8.37	6.78	4.95	3.52	2.54	1.85	1.44	824.1	31.0	0.0	17.2	1.9	127.9		27.0	35.0		10:08	45.2	238.4
8.982	11775	15.10	11.25	7.44	4.86	3.26	2.33	1.80	340.0	14.0	0.0	13.4	3.2	125.5		26.0	29.0		10:09	42.1	82.6
9.199	11917	9.74	8.09	6.63	5.10	3.92	3.00	2.33	1040.0	31.2	0.0	10.1	0.9	156.2		27.0	36.0		10:11	45.7	309.4
9.397	11939	11.41	8.41	5.73	3.80	2.58	1.87	1.54	424.8	26.1	0.0	16.5	2.6	126.5		27.0	35.0		10:12	45.2	122.9
9.596	11874	10.37	8.06	5.96	4.20	3.03	2.27	1.89	579.5	34.4	0.0	13.7	2.0	161.8		27.0	35.0		10:14	45.2	167.6
9.799	11939	9.30	7.05	5.33	3.82	2.83	2.21	1.71	556.6	63.9	0.0	13.9	2.2	150.8		26.0	35.0		10:15	45.2	161.0
10.000	11906	12.35	9.04	6.47	4.36	3.04	2.21	1.76	401.1	28.9	0.0	13.7	1.9	141.0		27.0	38.0		10:16	46.7	126.0
10.201	12016	9.46	7.61	5.83	4.11	3.03	2.35	1.84	737.7	37.3	0.0	13.6	2.7	169.7		27.0	36.0		10:18	45.7	219.5
10.399	12005	8.90	7.56	5.96	4.33	3.20	2.35	1.88	1040.0	20.9	0.0	13.6	1.6	140.3		27.0	36.0		10:19	45.7	309.4
10.606	12016	8.47	6.69	5.26	3.93	2.94	2.25	1.79	793.0	62.5	0.0	13.4	1.1	172.6		27.0	36.0		10:21	45.7	235.9
10.801	11830	13.11	9.19	6.77	5.10	3.54	2.72	2.30	340.0	47.7	0.0	11.0	2.0	140.1		28.0	36.0		10:23	45.7	101.1
10.999	12082	8.81	6.08	4.24	2.88	2.02	1.43	1.18	464.0	55.3	0.0	20.9	1.1	110.7		28.0	35.0		10:24	45.2	134.2
11.199	12016	10.26	7.86	6.07	4.37	3.17	2.28	1.73	627.5	36.7	0.0	13.3	0.8	126.8		28.0	36.0		10:25	45.7	186.7
11.406	11950	11.31	8.45	6.28	4.50	3.32	2.51	1.94	442.0	49.6	0.0	12.1	1.6	157.0		28.0	37.0		10:27	46.2	135.1
11.601	12005	6.83	5.32	4.61	3.78	3.13	2.64	2.28	1040.0	61.4	0.0	14.9	10.6	300.0		29.0	36.0		10:28	45.7	309.4
11.801	11895	13.79	10.13	7.61	5.50	4.15	3.19	2.85	340.0	49.7	0.0	9.5	1.7	213.5		29.0	37.0		10:29	46.2	103.9
11.998	11830	11.73	8.04	6.01	4.45	3.29	2.59	2.15	340.0	70.9	0.0	11.7	2.1	239.4		29.0	39.0		10:31	47.2	109.7
12.206	12158	9.16	7.67	6.21	4.35	3.10	2.33	1.93	1040.0	13.3	0.0	15.0	2.5	171.6		29.0	38.0		10:32	46.7	326.7
Average :		10.46	7.93	5.94	4.26	3.11	2.35	1.90	621.2	42.1	0.0	13.7	2.3	161.6		27.47	35.89	#DIV/0!		45.6	184.82
Std. Dev. :		2.08	1.37	0.86	0.61	0.47	0.40	0.37	267.5	18.0	0.0	2.6	2.1	45.8		1.02	2.02	#DIV/0!		1.05	81.31
Var Coeff.:		19.87	17.23	14.51	14.35	15.10	16.87	19.48	43.1	42.7	#DIV/0!	18.8	91.0	28.3		3.71	5.64	#DIV/0!		2.30	44.00

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District	Fort Worth
County	Palo Pinto

	Modulus Range (ksi)			
	Thick (in)	Min	Max	Poisson
Surface	8	340	1600	0.35
Base	5.9	10	150	0.35
Subbase	0	0	0	0
Subgrade	84.73	5		0.4

															TEMPERATURE (F)				Corrected
Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
12.537	11512	9.66	8.18	5.83	3.96	2.70	1.83	1.22	1230.4	103.4	0.0	11.6	2.7	97.8		35.0	48.0		12:32	55.2	580.8
12.807	10800	27.30	19.40	11.60	6.80	4.06	2.64	1.95	340.0	10.0	0.0	6.7	8.1	84.5		36.0	48.0		12:34	55.2	160.5
13.013	11753	6.07	5.22	4.26	3.22	2.53	1.98	1.57	1600.0	150.0	0.0	16.4	16.3	156.8		36.0	47.0		12:36	54.6	736.0
13.213	11611	8.91	8.00	6.69	5.13	3.90	2.94	2.12	1600.0	24.4	0.0	10.8	16.1	115.6		36.0	48.0		12:37	55.2	755.3
13.426	11885	6.67	5.45	4.36	3.28	2.43	1.89	1.43	1600.0	94.6	0.0	16.6	15.2	123.6		36.0	48.0		12:39	55.2	755.3
13.628	11665	11.91	9.50	7.37	5.40	3.94	2.84	2.12	1160.1	150.0	0.0	8.0	2.9	134.1		36.0	47.0		12:40	54.6	533.6
13.825	11720	8.19	6.27	4.48	2.98	2.11	1.56	1.23	1328.9	150.0	0.0	15.3	5.3	142.1		36.0	47.0		12:43	54.6	611.3
14.013	11698	5.21	4.72	4.06	3.19	2.56	1.96	1.63	1600.0	150.0	0.0	19.5	24.6	152.0		35.0	46.0		12:45	54.0	717.3
14.218	11622	6.11	5.34	4.57	3.63	2.92	2.31	1.85	1600.0	150.0	0.0	15.3	20.1	162.9		35.0	47.0		12:46	54.6	736.0
14.436	11654	16.57	11.98	7.25	4.24	2.67	1.95	1.62	340.0	59.9	0.0	11.2	6.8	95.9		36.0	48.0		12:49	55.2	160.5
14.629	11633	14.28	11.47	7.01	4.08	2.57	1.86	1.54	574.0	35.2	0.0	11.8	7.4	96.0		36.0	48.0		12:51	55.2	270.9
14.842	11578	20.31	15.08	10.50	6.76	4.57	3.25	2.44	340.0	91.5	0.0	6.8	4.4	144.5		35.0	47.0		12:54	54.6	156.4
15.060	11446	19.12	12.31	7.69	4.87	3.18	2.23	1.37	340.0	49.9	0.0	9.8	8.8	110.4		36.0	48.0		12:56	55.2	160.5
15.273	11457	17.55	12.43	7.86	4.91	3.21	2.24	1.65	340.0	72.5	0.0	9.6	5.9	112.5		35.0	48.0		12:59	55.2	160.5
15.496	11709	6.61	6.02	5.33	4.31	3.48	2.74	2.19	1600.0	150.0	0.0	12.4	19.9	165.9		36.0	47.0		13:01	54.6	736.0
15.709	11556	9.96	7.71	5.58	3.90	2.85	2.15	1.71	1181.2	150.0	0.0	11.2	5.5	168.2		36.0	47.0		13:02	54.6	543.3
15.919	10910	18.38	11.86	8.89	5.70	3.37	2.43	1.81	340.0	81.5	0.0	8.2	6.0	82.9		36.0	46.0		13:04	54.0	152.4
16.142	11183	14.17	9.36	6.11	4.00	2.68	1.92	1.39	340.0	142.6	0.0	11.4	6.7	120.5		36.0	46.0		13:05	54.0	152.4
16.347	10712	22.12	14.19	9.43	6.10	4.22	3.20	2.45	340.0	48.8	0.0	7.0	10.4	167.1		36.0	45.0		13:06	53.5	148.5
16.550	11074	13.58	10.73	7.19	4.40	2.59	1.57	0.98	708.3	19.5	0.0	11.5	2.5	78.8		35.0	47.0		13:08	54.6	325.8
16.754	10822	19.92	12.38	6.78	3.73	2.02	1.20	0.80	340.0	10.0	0.0	12.9	7.2	65.1		35.0	46.0		13:09	54.0	152.4
16.963	10910	20.76	14.25	7.45	3.94	2.13	1.26	0.81	340.0	10.0	0.0	11.7	8.4	65.2		35.0	46.0		13:12	54.0	152.4
17.154	10866	26.10	16.28	10.04	5.32	3.09	2.26	1.67	340.0	10.0	0.0	8.3	11.3	72.9		35.0	46.0		13:12	54.0	152.4
17.357	11096	18.65	11.31	7.49	3.95	1.56	0.80	0.47	340.0	10.0	0.0	14.5	9.5	48.6		35.0	45.0		13:14	53.5	148.5
17.554	11414	11.24	7.94	4.89	2.96	1.88	1.22	0.85	416.4	122.4	0.0	16.0	4.5	90.6		34.0	45.0		13:16	53.5	181.8
17.773	11304	19.92	12.48	7.09	3.57	2.09	1.59	1.07	340.0	10.9	0.0	13.2	10.5	60.1		35.0	48.0		13:18	55.2	160.5
17.995	11129	10.92	6.13	3.37	1.85	1.14	0.83	0.78	340.0	72.4	0.0	24.4	10.2	71.7		36.0	46.0		13:19	54.0	152.4
18.206	11304	9.94	6.09	3.28	1.87	1.11	0.78	0.61	340.0	101.8	0.0	25.0	7.5	71.8		36.0	46.0		13:21	54.0	152.4
18.422	11194	13.50	8.94	5.43	3.27	2.10	1.49	1.02	340.0	95.3	0.0	14.0	6.9	98.8		36.0	48.0		13:23	55.2	160.5
18.630	10942	22.32	8.33	4.75	2.83	1.87	1.33	0.91	340.0	11.5	0.0	17.3	25.0	109.0		36.0	46.0		13:24	54.0	152.4
18.844	10855	20.59	13.02	8.87	5.10	2.98	2.00	1.53	340.0	24.2	0.0	9.2	6.3	81.3		36.0	46.0		13:26	54.0	152.4
19.069	11063	16.11	10.44	5.55	2.69	1.47	1.00	0.79	340.0	13.2	0.0	17.3	8.2	53.7		35.0	45.0		13:27	53.5	148.5
19.288	10866	22.64	13.14	7.45	3.73	2.00	1.04	0.67	340.0	10.0	0.0	12.0	9.9	59.6		35.0	46.0		13:29	54.0	152.4
19.497	10734	17.44	13.24	7.99	4.45	2.43	1.49	0.87	414.3	10.7	0.0	11.1	4.5	68.1		35.0	46.0		13:30	54.0	185.7
19.705	11129	9.52	6.39	3.84	2.19	1.29	0.85	0.54	445.4	106.0	0.0	21.3	4.8	72.9		35.0	47.0		13:32	54.6	204.9
19.913	11041	11.39	7.60	4.04	1.88	0.97	0.63	0.47	425.5	20.2	0.0	24.6	7.4	48.5		36.0	46.0		13:33	54.0	190.8
20.112	11085	13.57	9.03	5.68	2.90	1.13	0.83	0.62	473.7	10.0	0.0	19.8	9.5	47.1		36.0	46.0		13:35	54.0	212.4

SB - B1 to B11

Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
20.320	10888	14.30	9.10	5.44	2.81	1.53	1.15	0.79	340.0	34.8	0.0	16.1	7.6	63.5		35.0	45.0		13:36	53.5	148.5
20.528	11151	10.17	8.08	6.22	4.46	3.24	2.37	1.76	1304.7	150.0	0.0	9.3	3.4	132.5		35.0	49.0		13:38	55.8	631.5
20.734	10822	11.73	8.75	6.52	4.66	3.37	2.57	1.84	871.2	150.0	0.0	8.8	5.7	117.9		35.0	46.0		13:39	54.0	390.6
20.976	10767	7.65	5.56	3.76	2.53	1.83	1.37	1.08	1138.6	150.0	0.0	16.8	8.3	146.7		35.0	46.0		13:40	54.0	510.5
21.185	10997	11.17	8.61	6.42	4.43	3.04	2.21	1.67	838.9	150.0	0.0	9.7	3.6	141.4		35.0	49.0		13:42	55.8	406.1
21.386	11611	6.38	5.20	4.00	2.86	2.12	1.59	1.31	1600.0	61.4	0.0	20.0	15.6	144.0		35.0	48.0		13:43	55.2	755.3
21.591	11359	4.61	3.63	2.94	2.24	1.76	1.41	1.16	1600.0	97.3	0.0	28.9	25.6	179.4		36.0	48.0		13:45	55.2	755.3
21.886	12838	5.26	3.52	2.44	1.69	1.20	0.88	0.61	1600.0	38.7	0.0	42.0	20.4	86.4		35.0	48.0		13:49	55.2	755.3
22.100	11545	6.27	4.72	3.38	2.39	1.71	1.31	0.95	1600.0	52.6	0.0	22.1	13.3	150.7		36.0	48.0		13:51	55.2	755.3
22.316	11392	7.04	5.32	3.95	2.80	2.04	1.53	1.12	1600.0	83.4	0.0	17.4	9.7	111.9		36.0	47.0		13:52	54.6	736.0
22.533	12093	10.92	7.95	5.59	3.85	2.79	2.15	1.48	921.0	150.0	0.0	12.2	7.7	101.7		36.0	47.0		13:55	54.6	423.6
23.153	11501	13.42	8.92	5.26	3.24	2.32	1.93	1.61	340.0	135.9	0.0	13.7	11.5	137.1		36.0	44.0		13:57	52.9	144.6
23.291	11348	13.66	10.31	7.22	4.99	3.67	2.87	1.95	632.1	150.0	0.0	8.6	6.7	104.7		35.0	44.0		13:59	52.9	268.9
Average :		13.40	9.24	6.06	3.80	2.49	1.79	1.32	782.9	78.7	0.0	14.6	9.7	106.3		35.50	46.72	#DIV/0!		54.4	360.95
Std. Dev. :		5.88	3.52	2.05	1.24	0.88	0.68	0.53	526.2	55.5	0.0	6.6	5.9	37.4		0.54	1.21	#DIV/0!		0.70	247.45
Var Coeff.:		43.93	38.12	33.88	32.54	35.56	38.17	40.18	67.2	70.5	#DIV/0!	44.9	60.6	35.2		1.53	2.60	#DIV/0!		1.28	68.56

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District	Forth Worth
County	Palo Pinto

	Modulus Range (ksi)			
	Thick (in)	Min	Max	Poisson
Surface	10.1	340	1040	0.35
Base	9	10	150	0.35
Subbase	0	0	0	0
Subgrade	100.46	5		0.4

																TEMPERATURE (F)				Corrected
Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
3.679	11698	9.05	7.31	5.62	4.21	3.13	2.37	1.91	755.1	125.5	0.0	10.8	1.7	163.0		36.0	47.0		11:19	55.2	356.1
3.838	11852	11.46	8.65	6.16	4.25	2.89	1.95	1.41	501.6	47.0	0.0	12.8	1.1	101.0		36.0	45.0		11:21	54.1	225.5
4.022	11709	6.75	5.22	3.89	2.77	1.98	1.46	1.11	847.0	137.5	0.0	17.6	2.0	127.3		36.0	46.0		11:22	54.6	390.1
4.226	11797	9.93	6.70	4.63	3.25	2.40	1.90	1.55	347.9	150.0	0.0	14.9	4.6	224.3		37.0	47.0		11:23	55.2	164.1
4.431	11950	8.04	5.90	4.16	2.95	2.13	1.61	1.24	541.9	150.0	0.0	16.8	3.2	136.3		36.0	46.0		11:27	54.6	249.6
4.633	11874	9.48	6.78	4.70	3.42	2.58	1.93	1.64	422.1	150.0	0.0	14.1	4.0	142.7		36.0	46.0		11:29	54.6	194.4
4.838	11764	9.07	7.26	5.64	4.29	3.34	2.77	2.13	825.9	150.0	0.0	9.8	3.5	141.3		36.0	45.0		11:30	54.1	371.3
5.041	11567	9.54	6.30	4.26	2.88	2.00	1.47	1.18	340.0	120.2	0.0	17.6	3.4	133.2		36.0	46.0		11:32	54.6	156.6
5.245	11468	9.88	7.20	5.31	3.70	2.65	1.95	1.48	430.7	118.3	0.0	12.9	2.2	140.5		35.0	45.0		11:34	54.1	193.6
5.448	11611	9.30	6.79	4.86	3.43	2.50	1.87	1.48	432.4	142.0	0.0	13.8	2.8	149.9		35.0	44.0		11:35	53.6	189.8
5.653	11633	10.78	7.89	5.37	3.72	2.65	1.95	1.47	386.7	90.0	0.0	13.3	3.4	134.3		35.0	45.0		11:37	54.1	173.8
5.857	11019	10.98	8.27	5.98	4.06	2.82	2.00	1.48	462.6	56.9	0.0	11.9	2.1	124.3		35.0	46.0		11:38	54.6	213.1
6.054	11337	9.12	6.55	4.89	3.52	2.60	2.01	1.56	469.7	150.0	0.0	13.0	2.8	150.8		35.0	45.0		11:39	54.1	211.2
6.258	11403	11.54	8.81	6.24	4.28	3.03	2.25	1.60	435.7	66.2	0.0	11.4	3.2	114.9		35.0	45.0		11:41	54.1	195.9
6.462	11512	9.59	7.78	5.80	4.24	3.22	2.53	1.86	638.1	126.6	0.0	10.3	3.3	121.5		35.0	44.0		11:42	53.6	280.0
6.659	10866	19.65	15.50	11.41	7.82	5.48	4.00	3.21	340.0	20.2	0.0	6.1	2.5	171.7		36.0	46.0		11:44	54.6	156.6
6.883	10997	16.11	13.20	10.51	7.80	5.77	4.35	3.50	467.1	54.7	0.0	5.5	1.5	206.2		36.0	46.0		11:45	54.6	215.1
7.095	11271	12.28	8.64	6.30	4.49	3.22	2.46	1.92	340.0	99.2	0.0	10.4	3.0	191.1		36.0	45.0		11:47	54.1	152.8
7.298	11370	12.23	9.81	7.71	5.58	4.11	2.98	2.09	599.1	63.2	0.0	8.2	1.2	114.4		36.0	46.0		11:49	54.6	275.8
7.503	11370	7.57	5.65	4.10	2.93	2.13	1.60	1.26	608.3	150.0	0.0	16.0	2.7	146.1		37.0	46.0		11:50	54.6	280.1
7.708	11446	10.65	7.67	5.75	4.15	2.87	1.94	1.30	421.7	97.7	0.0	12.1	0.6	96.2		37.0	48.0		11:51	55.7	203.6
7.910	11578	7.83	6.48	5.29	4.03	3.09	2.35	1.87	1040.0	146.6	0.0	10.6	1.2	164.5		36.0	47.0		11:52	55.2	490.5
8.121	12640	11.19	8.62	5.42	3.11	1.71	0.98	0.64	514.8	10.0	0.0	25.2	3.2	65.2		36.0	48.0		11:57	55.7	248.5
8.319	12597	10.33	8.23	5.56	3.41	2.00	1.17	0.44	662.2	10.0	0.0	22.2	2.9	74.2		37.0	48.0		11:59	55.7	319.7
8.527	12257	9.57	6.80	4.50	2.87	1.89	1.32	0.91	484.7	56.5	0.0	19.6	3.0	103.6		37.0	47.0		12:01	55.2	228.6
8.744	11797	7.97	6.24	4.31	2.75	1.82	1.29	0.93	792.5	33.7	0.0	20.3	3.7	106.5		37.0	48.0		12:03	55.7	382.6
8.962	11775	10.91	8.67	6.76	4.64	1.73	1.22	0.91	557.9	10.0	0.0	18.4	13.5	45.0		37.0	48.0		12:05	55.7	269.3
9.151	11928	14.37	11.68	8.07	5.19	3.30	2.27	1.66	500.8	10.0	0.0	12.0	3.6	100.4		37.0	48.0		12:07	55.7	241.8
9.359	11775	14.64	10.15	8.51	5.59	3.59	2.58	1.98	351.6	54.9	0.0	9.5	3.8	110.0		37.0	48.0		12:09	55.7	169.7
9.626	11731	9.01	7.57	5.87	4.28	3.04	2.24	1.61	1040.0	46.0	0.0	11.5	1.8	113.7		37.0	48.0		12:11	55.7	502.1
9.828	11622	11.40	9.35	6.28	3.92	2.56	1.83	1.52	601.0	12.0	0.0	15.1	4.9	108.9		37.0	47.0		12:12	55.2	283.4
10.032	11457	13.55	9.81	7.65	4.84	3.10	2.08	1.50	466.2	20.8	0.0	11.5	2.9	107.0		36.0	48.0		12:14	55.7	225.1
10.241	11633	6.67	5.30	4.39	3.34	2.54	2.02	1.53	1040.0	150.0	0.0	13.3	4.7	124.4		37.0	48.0		12:15	55.7	502.1
10.461	11326	9.84	7.22	5.26	3.77	2.76	2.15	1.55	404.8	150.0	0.0	12.0	3.2	112.9		37.0	48.0		12:17	55.7	195.4
10.678	11545	8.55	6.54	4.85	3.46	2.58	1.98	1.56	581.7	150.0	0.0	13.2	2.9	165.1		36.0	49.0		12:18	56.2	287.4
10.899	11512	8.46	7.20	5.52	4.04	3.02	2.32	1.79	1040.0	56.3	0.0	11.6	2.8	149.2		36.0	48.0		12:20	55.7	502.1
11.104	11227	16.06	12.11	8.32	4.96	3.04	1.98	1.44	347.6	10.0	0.0	11.7	3.3	91.5		36.0	49.0		12:22	56.2	171.7

SB - B12 to B21

Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
11.314	12049	9.59	7.02	4.12	2.42	1.58	1.12	0.92	469.6	31.3	0.0	23.5	6.3	97.3		36.0	49.0		12:23	56.2	232.0
11.511	11600	14.18	11.34	7.70	4.96	3.15	2.51	1.88	436.4	19.8	0.0	11.0	5.7	99.2		36.0	48.0		12:24	55.7	210.7
11.721	11578	14.04	11.42	7.64	4.82	3.01	2.03	1.43	461.0	10.0	0.0	12.7	3.8	93.5		36.0	49.0		12:26	56.2	227.8
11.926	11600	6.82	4.61	2.70	1.54	0.91	0.61	0.40	568.9	37.7	0.0	37.7	4.5	69.4		36.0	47.0		12:27	55.2	268.3
12.130	11578	9.26	6.79	4.44	2.92	1.89	1.37	0.92	503.6	52.6	0.0	18.3	3.8	95.7		36.0	47.0		12:29	55.2	237.5
12.333	11173	22.07	18.65	11.12	7.29	4.90	3.28	2.47	340.0	10.0	0.0	6.9	8.3	105.8		35.0	48.0		12:31	55.7	164.1
Average :		10.91	8.36	5.99	4.09	2.81	2.05	1.54	553.9	78.0	0.0	14.1	3.4	124.0		36.12	46.84	#DIV/0!		55.1	260.69
Std. Dev. :		3.26	2.76	1.91	1.30	0.95	0.72	0.60	203.7	54.8	0.0	5.7	2.1	36.4		0.70	1.41	#DIV/0!		0.75	98.04
Var Coeff.:		29.84	33.02	31.90	31.87	33.77	35.07	38.66	36.8	70.2	#DIV/0!	40.3	61.4	29.3		1.93	3.02	#DIV/0!		1.37	37.61

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.1)

District	Fort Worth
County	Palo Pinto

	Modulus Range (ksi)			
	Thick (in)	Min	Max	Poisson
Surface	10.8	340	1040	0.35
Base	13.3	10	150	0.35
Subbase	0	0	0	0
Subgrade	117.1	5		0.4

															TEMPERATURE (F)					Corrected
Station	Load	R1	R2	R3	R4	R5	R6	R7	E(ac)	E(bs)	E(sb)	E(sg)	Err/Sen	DB(in)	Limit	Air	Surface	Paveme	Test tim	Predicte	Modulus
0.000	13429	13.93	10.39	7.44	5.10	3.63	2.71	2.12	401.6	34.4	0.0	12.3	2.3	165.3		36.0	46.0		10:52	54.8	186.4
0.209	13013	15.83	11.04	8.30	6.03	4.22	3.13	2.31	340.0	36.5	0.0	10.1	1.6	131.5		36.0	45.0		10:54	54.3	154.2
0.417	13013	12.66	11.04	8.81	6.66	5.16	4.04	3.38	922.3	22.8	0.0	8.0	1.9	256.8		36.0	45.0		10:55	54.3	418.2
0.629	12947	17.33	11.66	8.93	6.33	4.68	3.67	2.83	340.0	33.6	0.0	9.1	4.2	172.2		37.0	45.0		10:56	54.3	154.2
0.834	12805	19.77	14.22	9.96	7.11	4.99	3.79	2.75	340.0	15.3	0.0	9.0	4.1	171.8		37.0	45.0		10:58	54.3	154.2
1.030	12640	15.01	9.61	6.74	4.56	3.07	2.16	1.58	340.0	23.5	0.0	14.4	3.4	119.0		37.0	44.0		10:59	53.8	150.6
1.235	12673	13.64	9.69	6.31	4.19	2.83	1.98	1.76	340.0	25.5	0.0	15.6	2.6	114.0		37.0	45.0		11:00	54.3	154.2
1.435	12421	10.31	6.73	4.31	2.70	1.68	1.14	0.89	367.0	32.3	0.0	25.1	1.8	83.1		37.0	46.0		11:02	54.8	170.3
1.647	12443	11.54	8.96	7.02	5.13	3.85	2.96	2.14	538.8	54.6	0.0	10.2	1.6	119.1		37.0	45.0		11:04	54.3	244.3
1.850	12388	17.65	12.87	8.22	5.48	3.74	2.72	2.13	340.0	10.8	0.0	12.4	5.3	137.4		37.0	46.0		11:06	54.8	157.8
2.055	12520	10.99	9.07	6.74	4.79	3.29	2.28	1.70	785.3	10.2	0.0	15.5	1.3	110.2		37.0	44.0		11:07	53.8	347.8
2.259	12695	9.49	6.83	4.93	3.41	2.35	1.66	1.20	537.6	45.8	0.0	18.1	0.8	111.7		36.0	45.0		11:09	54.3	243.8
2.463	12191	13.30	9.89	7.26	5.25	3.86	2.90	2.18	363.9	47.1	0.0	10.2	1.6	139.4		36.0	45.0		11:10	54.3	165.0
2.668	12136	14.11	9.86	6.61	4.36	3.05	2.28	1.76	340.0	24.7	0.0	13.7	4.0	159.8		36.0	45.0		11:12	54.3	154.2
2.871	12290	15.79	11.01	7.13	4.83	3.44	2.61	2.00	340.0	19.3	0.0	12.6	5.5	182.8		36.0	47.0		11:14	55.3	161.5
3.075	12268	9.13	7.02	4.98	3.32	2.22	1.59	1.24	671.3	22.5	0.0	19.9	2.4	112.6		37.0	46.0		11:15	54.8	311.6
3.279	12213	6.86	6.00	4.78	3.61	2.75	2.09	1.68	1040.0	68.2	0.0	14.3	2.7	156.0		37.0	45.0		11:17	54.3	471.6
3.484	12180	12.41	8.75	6.08	4.32	3.07	2.31	1.83	340.0	47.3	0.0	13.0	2.3	162.4		36.0	46.0		11:18	54.8	157.8
Average :		13.32	9.70	6.92	4.84	3.44	2.56	1.97	482.7	31.9	0.0	13.5	2.7	144.7		36.56	45.28	#DIV/0!		54.4	219.87
Std. Dev. :		3.30	2.17	1.56	1.20	0.94	0.78	0.61	224.2	15.7	0.0	4.3	1.4	39.3		0.51	0.75	#DIV/0!		0.39	100.80
Var Coeff.:		24.81	22.35	22.51	24.68	27.37	30.43	30.84	46.5	49.3	#DIV/0!	31.7	49.7	27.1		1.40	1.66	#DIV/0!		0.72	45.84

Appendix F - FPS 21 Run,
and Triaxial and Mechanistic Design Check

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

Existing Roadway
Jack County Line to FM 52

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	13.70
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	3400.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	4600.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	1.521
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	10.6

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	CODE	MATERIALS NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	184800.	0.35	10.80	10.80	30.00
2	B	FLEXIBLE BASE	37.00	42100.	0.35	13.30	13.30	75.00
3	C	SUBGRADE(200)	2.00	13700.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

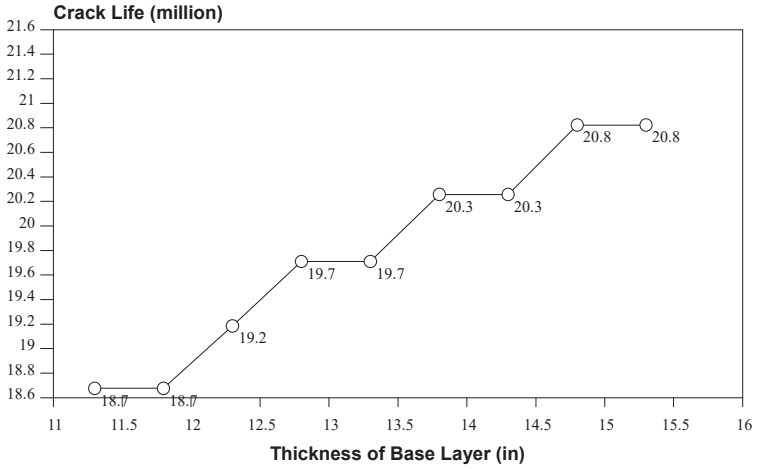
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	48.17
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-5.32
TOTAL COST	43.40
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.80
D(2)	13.30
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.80	184.80	0.35	ASPH CONC PVMT
Base	13.30	42.10	0.35	FLEXIBLE BASE
Subgrade	200.00	13.70	0.40	SUBGRADE(200)



Fatigue Crack Model:

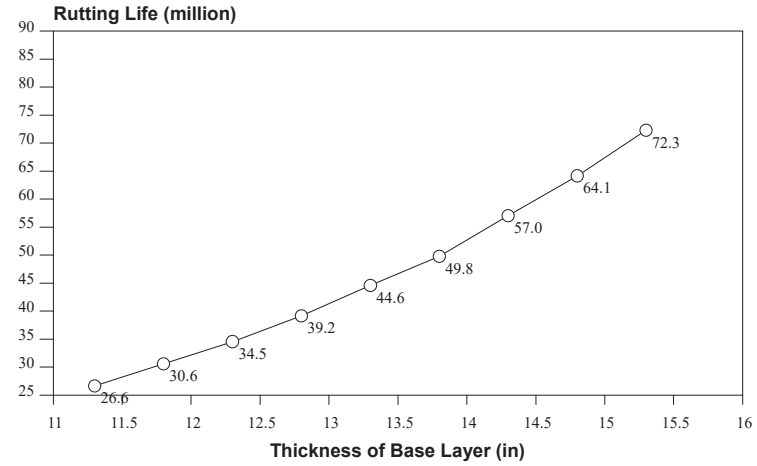
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 3.58 (million)

Crack Life: 19.71 (million) ε_τ = 121.00 (με)

Rut Life: 44.57 (million) ε_v = -205.00 (με)

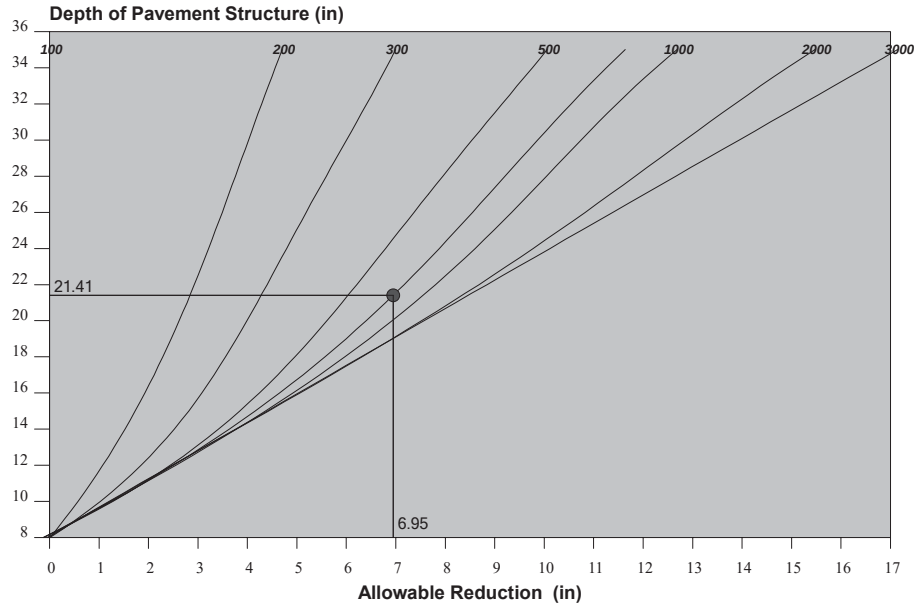
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:1.52millions.
Also the start ADT:3400.0 and ending ADT:4600.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 1 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.80	184.80	0.35	ASPH CONC PVMT
FLEXIBLE BASE	13.30	42.10	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	13.70	0.40	SUBGRADE(200)
Bed Rock		1370.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	10800.0 (lb)
Percentage of TandemAxles	70.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14040.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.4 (in)
The FPS Design Thickness	24.1 (in)
Allowable Thickness Reduction	6.9 (in)
Modified Triaxial Thickness	14.5 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 1 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

New Pavement
Jack County Line to FM 52

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	13.00
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	3400.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	4600.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	1.521
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	10.6

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	650000.	0.35	10.00	10.00	30.00
2	B	FLEXIBLE BASE	37.00	50000.	0.35	12.00	15.00	75.00
3	C	SUBGRADE(200)	2.00	13000.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

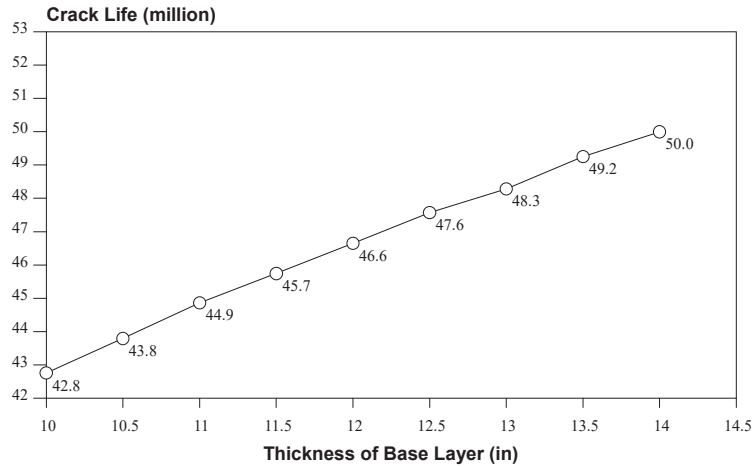
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	44.28
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-4.87
TOTAL COST	39.97
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.00
D(2)	12.00
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 7

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.00	650.00	0.35	ASPH CONC PVMT
Base	12.00	50.00	0.35	FLEXIBLE BASE
Subgrade	200.00	13.00	0.40	SUBGRADE(200)



Fatigue Crack Model:

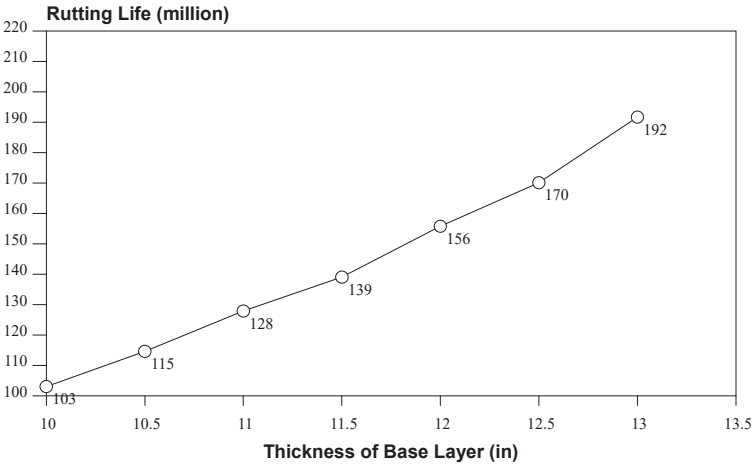
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 3.58 (million)

Crack Life: 46.65 (million) ε_τ = 67.20 (με)

Rut Life: 155.81 (million) ε_v = -155.00 (με)

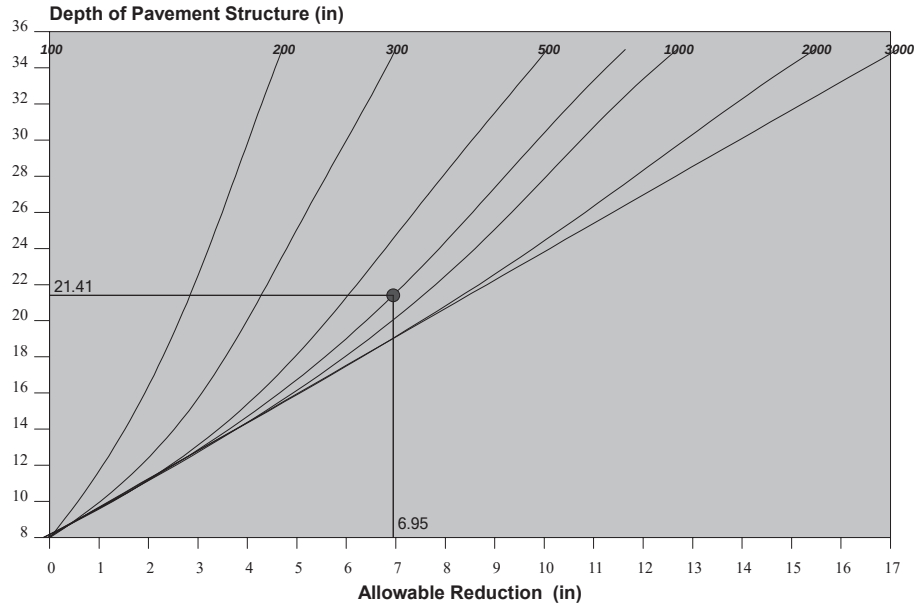
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:1.52millions.
Also the start ADT:3400.0 and ending ADT:4600.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 1 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.00	650.00	0.35	ASPH CONC PVMT
FLEXIBLE BASE	12.00	50.00	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	13.00	0.40	SUBGRADE(200)
Bed Rock		1300.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	10800.0 (lb)
Percentage of TandemAxles	70.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14040.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.4 (in)
The FPS Design Thickness	22.0 (in)
Allowable Thickness Reduction	6.9 (in)
Modified Triaxial Thickness	14.5 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 1 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

Existing Roadway
Jack County Line to FM 52

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	13.50
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	3400.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	4600.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	1.521
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	10.6

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	219900.	0.35	10.80	10.80	30.00
2	B	FLEXIBLE BASE	37.00	31900.	0.35	13.30	13.30	75.00
3	C	SUBGRADE(200)	2.00	13500.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

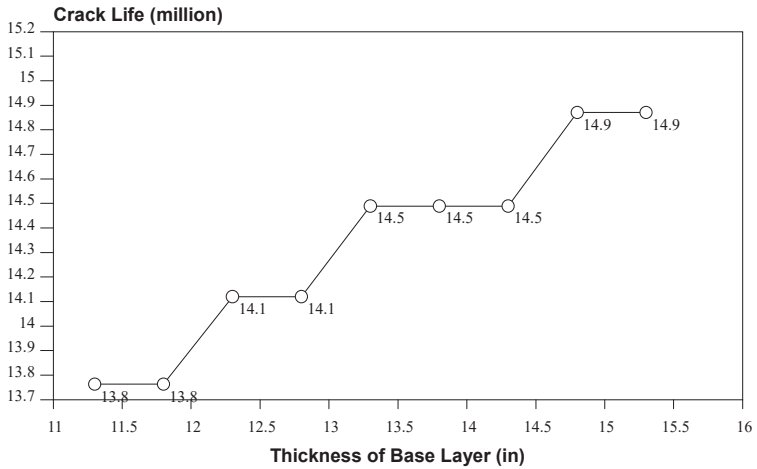
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**1**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	48.17
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-5.32
TOTAL COST	43.40
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.80
D(2)	13.30
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.80	219.90	0.35	ASPH CONC PVMT
Base	13.30	31.90	0.35	FLEXIBLE BASE
Subgrade	200.00	13.50	0.40	SUBGRADE(200)



Fatigue Crack Model:

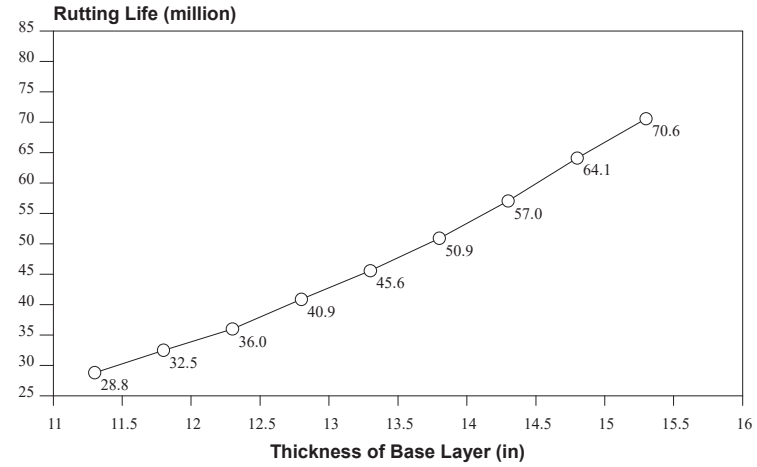
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 3.58 (million)

Crack Life: 14.49 (million) ε_τ = 127.00 (με)

Rut Life: 45.55 (million) ε_v = -204.00 (με)

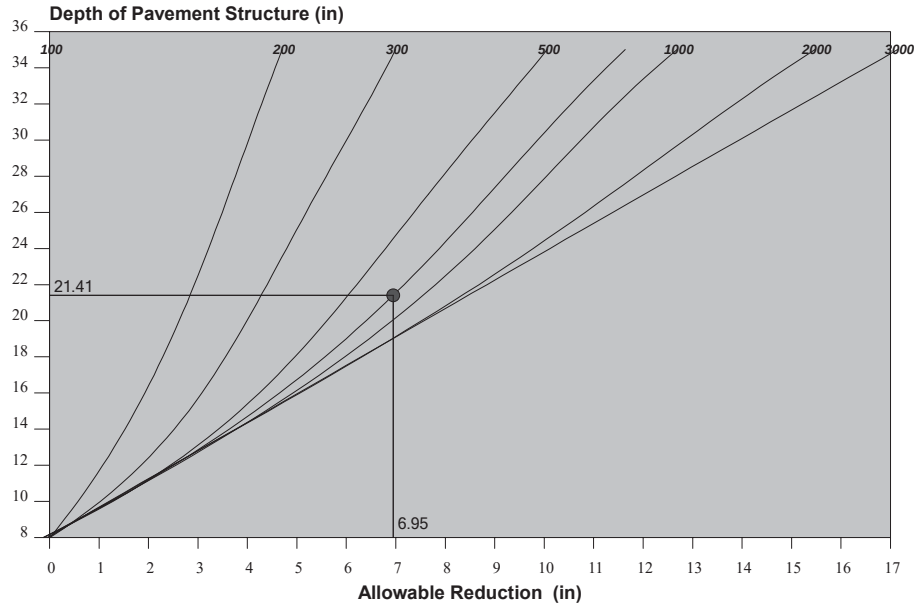
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:1.52millions.
Also the start ADT:3400.0 and ending ADT:4600.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 1 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.80	219.90	0.35	ASPH CONC PVMT
FLEXIBLE BASE	13.30	31.90	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	13.50	0.40	SUBGRADE(200)
Bed Rock		1350.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	10800.0 (lb)
Percentage of TandemAxles	70.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14040.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.4 (in)
The FPS Design Thickness	24.1 (in)
Allowable Thickness Reduction	6.9 (in)
Modified Triaxial Thickness	14.5 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 1 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

Existing Roadway
FM 52 to Shattles Road

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	17.10
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	5800.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	7750.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	2.300
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	9.4

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	206600.	0.35	10.10	10.10	30.00
2	B	FLEXIBLE BASE	37.00	58600.	0.35	9.00	9.00	75.00
3	C	SUBGRADE(200)	2.00	17100.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

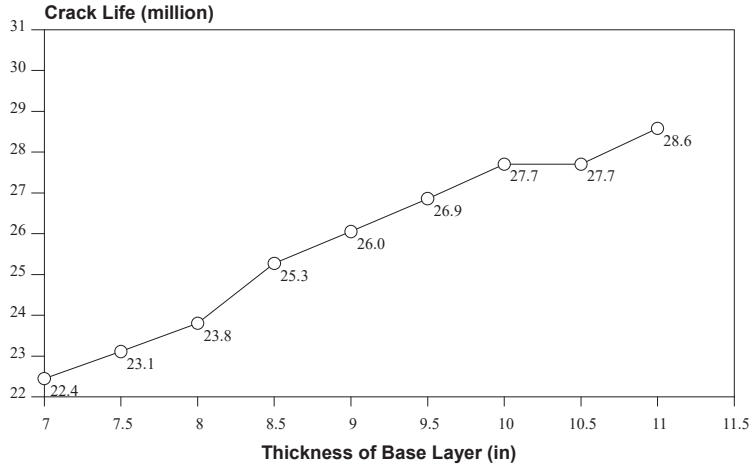
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	41.51
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-4.29
TOTAL COST	37.77
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.10
D(2)	9.00
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.10	206.60	0.35	ASPH CONC PVMT
Base	9.00	58.60	0.35	FLEXIBLE BASE
Subgrade	200.00	17.10	0.40	SUBGRADE(200)



Fatigue Crack Model:

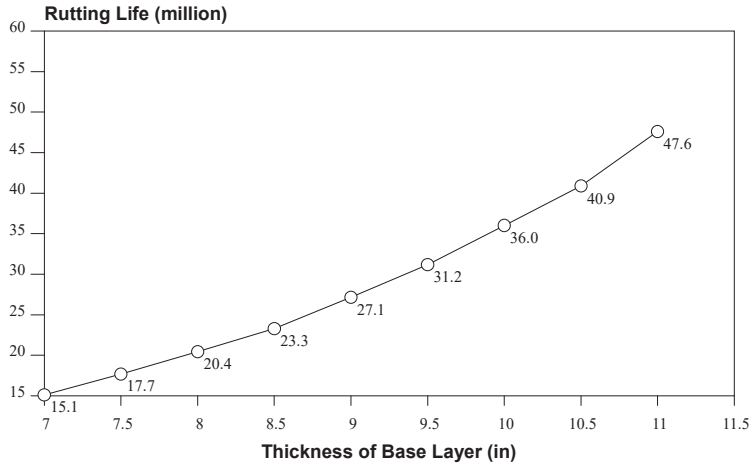
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 5.37 (million)

Crack Life: 26.05 (million) ε_τ = 108.00 (με)

Rut Life: 27.15 (million) ε_v = -229.00 (με)

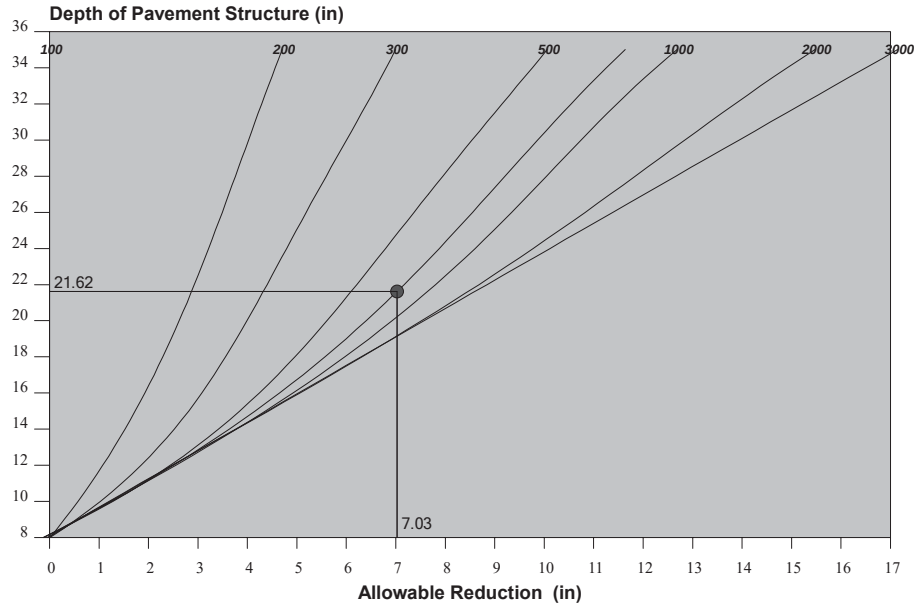
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.30millions.
Also the start ADT:5800.0 and ending ADT:7750.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 2 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.10	206.60	0.35	ASPH CONC PVMT
FLEXIBLE BASE	9.00	58.60	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	17.10	0.40	SUBGRADE(200)
Bed Rock		1710.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	11000.0 (lb)
Percentage of TandemAxles	60.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14300.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.6 (in)
The FPS Design Thickness	19.1 (in)
Allowable Thickness Reduction	7.0 (in)
Modified Triaxial Thickness	14.6 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 2 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**SH 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

New Pavement
FM 52 to Shattles Road

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	13.00
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	5800.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	7750.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	2.300
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	9.4

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**SH 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	650000.	0.35	10.00	10.00	30.00
2	B	FLEXIBLE BASE	37.00	50000.	0.35	12.00	15.00	75.00
3	C	SUBGRADE(200)	2.00	13000.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

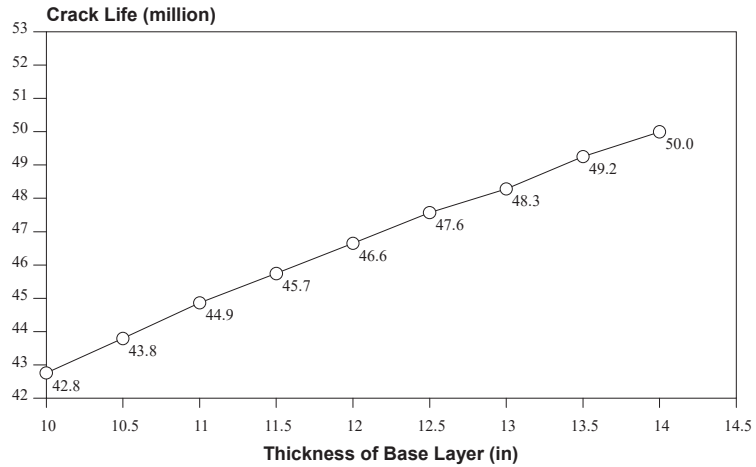
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**SH 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	44.28
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-4.87
TOTAL COST	39.97
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.00
D(2)	12.00
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 7

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.00	650.00	0.35	ASPH CONC PVMT
Base	12.00	50.00	0.35	FLEXIBLE BASE
Subgrade	200.00	13.00	0.40	SUBGRADE(200)



Fatigue Crack Model:

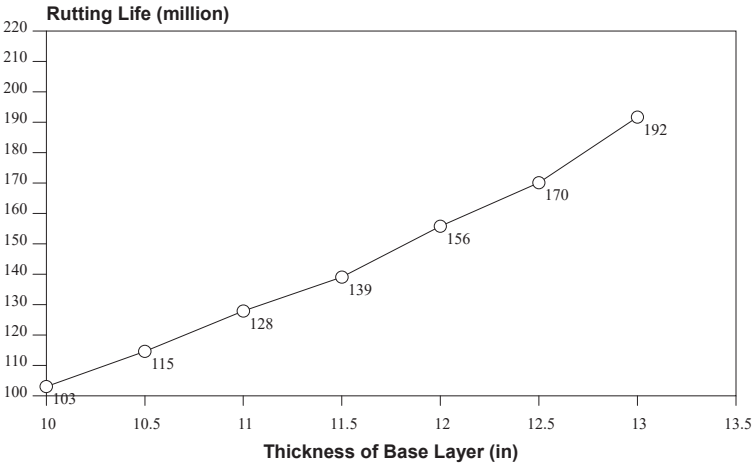
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 5.37 (million)

Crack Life: 46.65 (million) ε_τ = 67.20 (με)

Rut Life: 155.81 (million) ε_v = -155.00 (με)

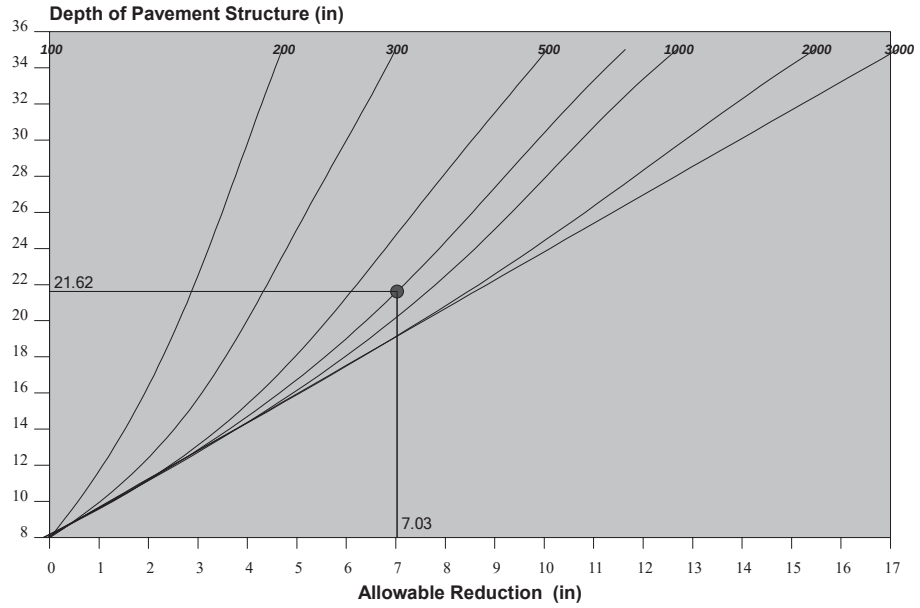
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.30millions.
Also the start ADT:5800.0 and ending ADT:7750.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	SH 281	Problem	00
C-S-J	1 - 2 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.00	650.00	0.35	ASPH CONC PVMT
FLEXIBLE BASE	12.00	50.00	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	13.00	0.40	SUBGRADE(200)
Bed Rock		1300.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	11000.0 (lb)
Percentage of TandemAxles	60.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14300.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.6 (in)
The FPS Design Thickness	22.0 (in)
Allowable Thickness Reduction	7.0 (in)
Modified Triaxial Thickness	14.6 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	SH 281	Problem	00
C-S-J	1 - 2 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

Existing Roadway
FM 52 to Shattles Road

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	14.10
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	5800.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	7750.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	2.300
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	9.4

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	260700.	0.35	10.10	10.10	30.00
2	B	FLEXIBLE BASE	37.00	78000.	0.35	9.00	9.00	75.00
3	C	SUBGRADE(200)	2.00	14100.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

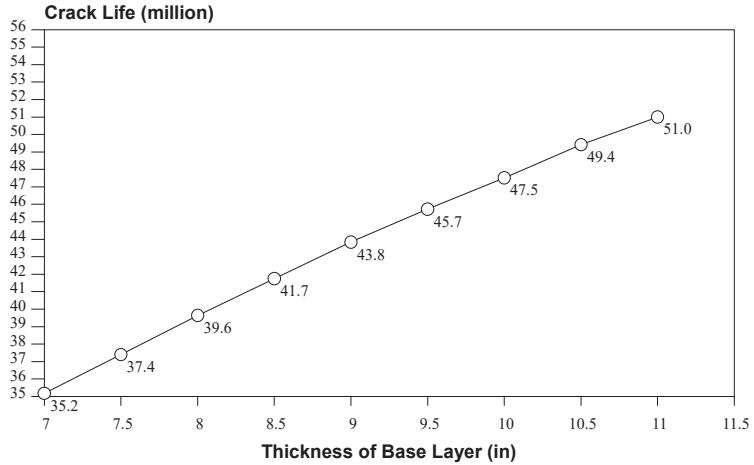
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**2**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	41.51
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-4.29
TOTAL COST	37.77
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.10
D(2)	9.00
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.10	260.70	0.35	ASPH CONC PVMT
Base	9.00	78.00	0.35	FLEXIBLE BASE
Subgrade	200.00	14.10	0.40	SUBGRADE(200)



Fatigue Crack Model:

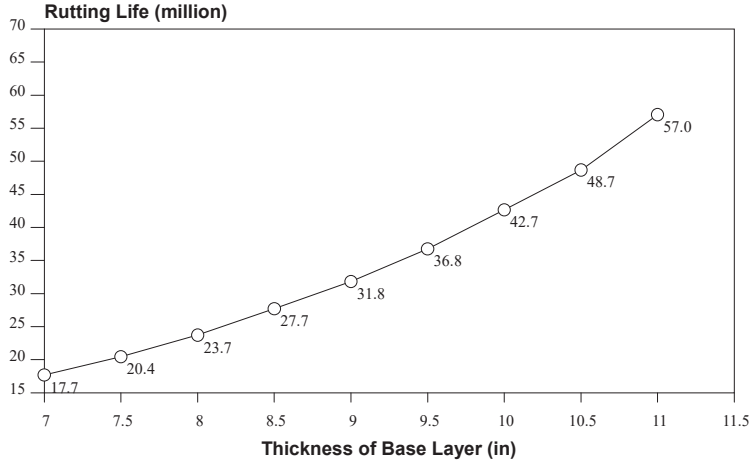
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 5.37 (million)

Crack Life: 43.84 (million) ε_τ = 86.80 (με)

Rut Life: 31.83 (million) ε_v = -221.00 (με)

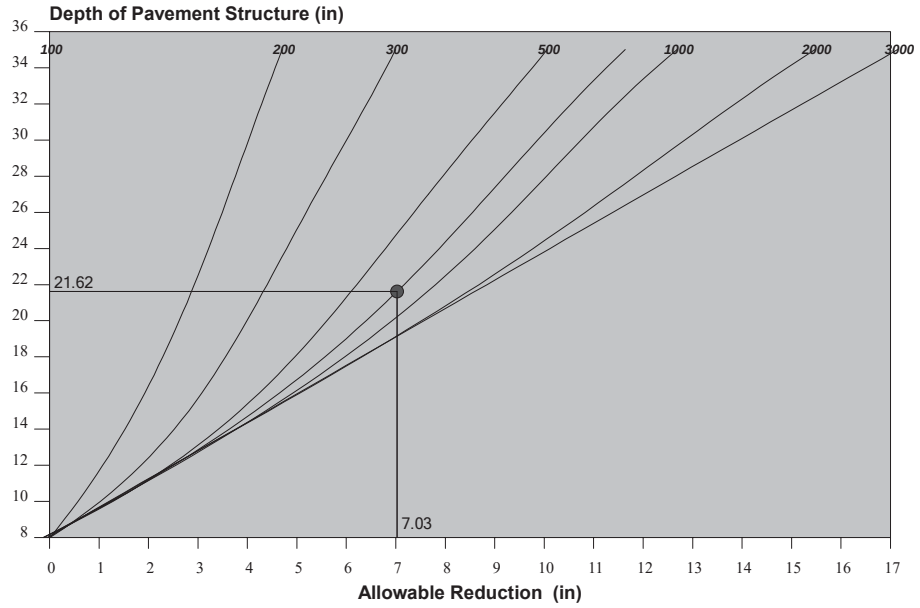
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.30millions.
Also the start ADT:5800.0 and ending ADT:7750.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 2 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.10	260.70	0.35	ASPH CONC PVMT
FLEXIBLE BASE	9.00	78.00	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	14.10	0.40	SUBGRADE(200)
Bed Rock		1410.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	11000.0 (lb)
Percentage of TandemAxles	60.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14300.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.6 (in)
The FPS Design Thickness	19.1 (in)
Allowable Thickness Reduction	7.0 (in)
Modified Triaxial Thickness	14.6 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 2 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

Existing Roadway
Shattles Road to S 25th St

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	13.40
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	6100.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	8100.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	2.400
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	9.4

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	311100.	0.35	8.00	8.00	30.00
2	B	FLEXIBLE BASE	37.00	92300.	0.35	5.90	5.90	75.00
3	C	SUBGRADE(200)	2.00	13400.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

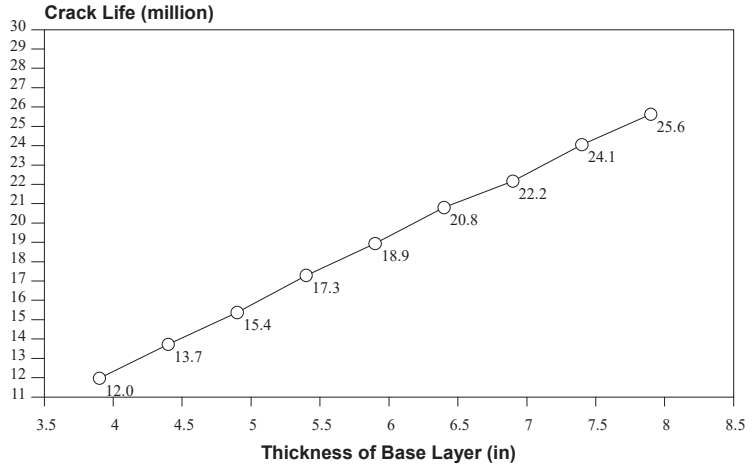
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	31.62
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-3.16
TOTAL COST	29.02
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	8.00
D(2)	5.90
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	8.00	311.10	0.35	ASPH CONC PVMT
Base	5.90	92.30	0.35	FLEXIBLE BASE
Subgrade	200.00	13.40	0.40	SUBGRADE(200)



Fatigue Crack Model:

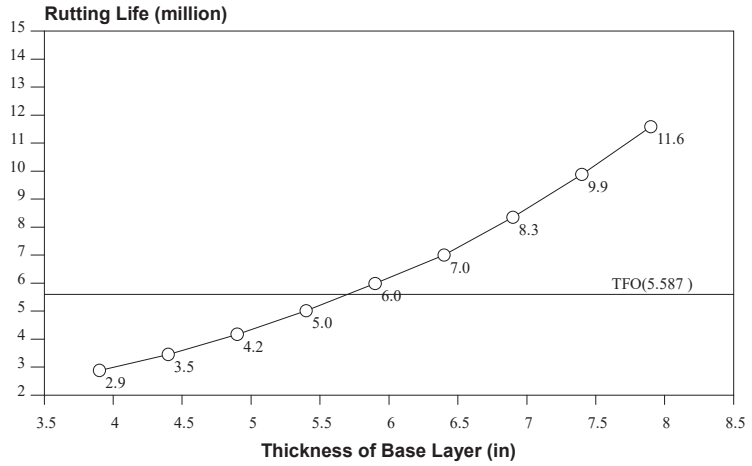
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 5.59 (million)

Crack Life: 18.94 (million) ε_τ = 107.00 (με)

Rut Life: 5.99 (million) ε_v = -321.00 (με)

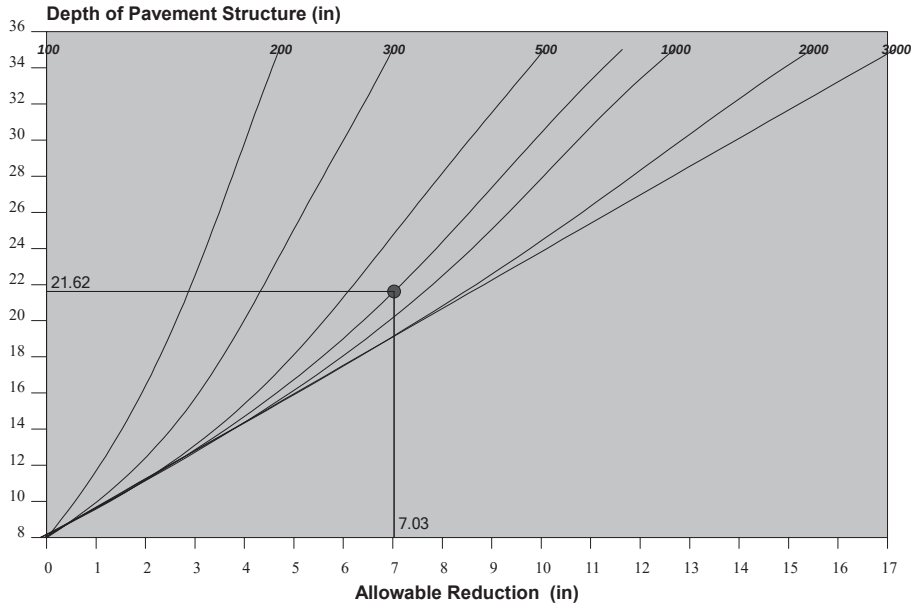
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.40millions.
Also the start ADT:6100.0 and ending ADT:8100.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 3 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	8.00	311.10	0.35	ASPH CONC PVMT
FLEXIBLE BASE	5.90	92.30	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	13.40	0.40	SUBGRADE(200)
Bed Rock		1340.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	11000.0 (lb)
Percentage of TandemAxles	60.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14300.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.6 (in)
The FPS Design Thickness	13.9 (in)
Allowable Thickness Reduction	7.0 (in)
Modified Triaxial Thickness	14.6 (in)

TRIAXIAL CHECK CONCLUSION:

The Design Fails !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 3 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

New Pavement
Shattles Road to S 25th St

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	13.00
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	6100.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	8100.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	2.400
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	9.4

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	650000.	0.35	10.00	10.00	30.00
2	B	FLEXIBLE BASE	37.00	50000.	0.35	12.00	15.00	75.00
3	C	SUBGRADE(200)	2.00	13000.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**3**

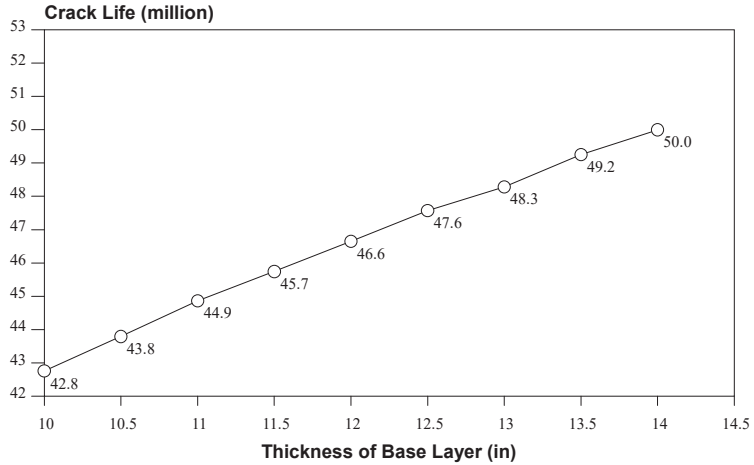
C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	44.28
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-4.87
TOTAL COST	39.97
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	10.00
D(2)	12.00
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 7

Section 3 - New

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	10.00	650.00	0.35	ASPH CONC PVMT
Base	12.00	50.00	0.35	FLEXIBLE BASE
Subgrade	200.00	13.00	0.40	SUBGRADE(200)



Fatigue Crack Model:

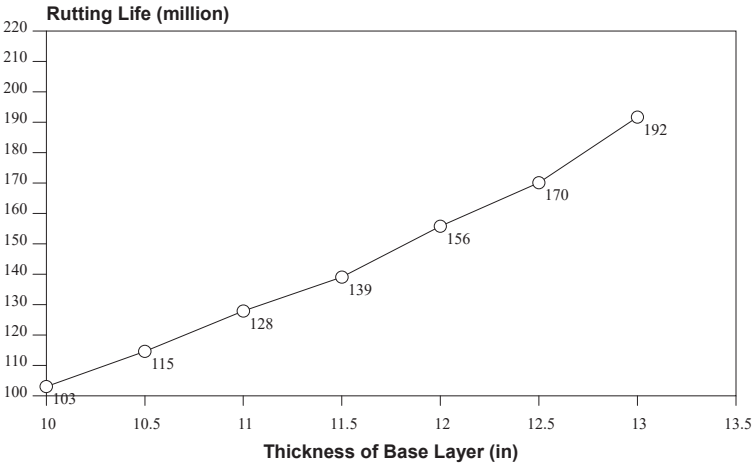
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 5.59 (million)

Crack Life: 46.65 (million) ε_τ = 67.20 (με)

Rut Life: 155.81 (million) ε_v = -155.00 (με)

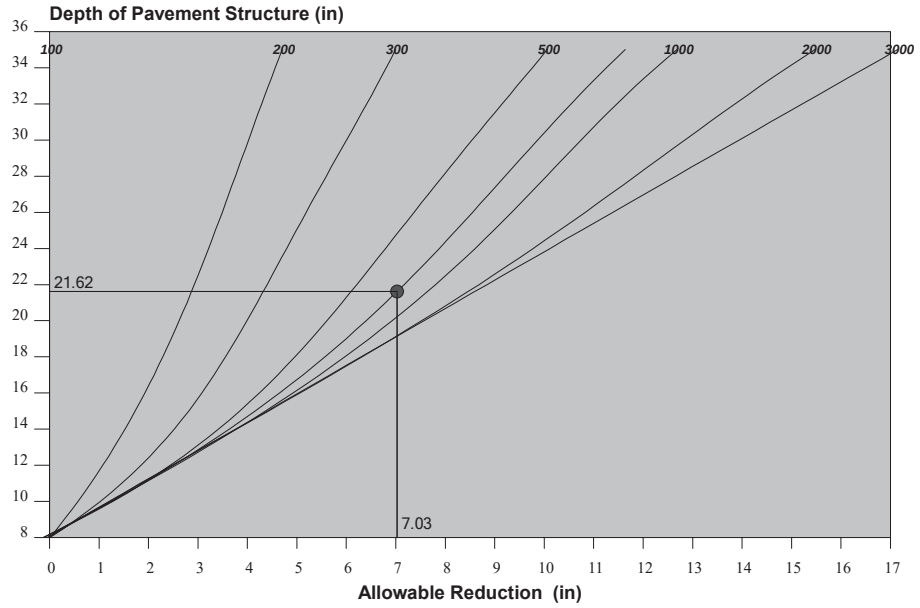
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.40millions.
Also the start ADT:6100.0 and ending ADT:8100.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 3 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	10.00	650.00	0.35	ASPH CONC PVMT
FLEXIBLE BASE	12.00	50.00	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	13.00	0.40	SUBGRADE(200)
Bed Rock		1300.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	11000.0 (lb)
Percentage of TandemAxles	60.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14300.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.6 (in)
The FPS Design Thickness	22.0 (in)
Allowable Thickness Reduction	7.0 (in)
Modified Triaxial Thickness	14.6 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 3 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

TEXAS DEPARTMENT OF TRANSPORTATION

F P S21-1.2 *FLEXIBLE PAVEMENT SYSTEM* *Release:10-12-2011*

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**1**

COMMENTS ABOUT THIS PROBLEM

Existing Roadway
Shattles Road to S 25th St

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	8.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	8.0
DESIGN CONFIDENCE LEVEL (90.0%)	B
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.2
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	14.60
INTEREST RATE OR TIME VALUE OF MONEY (PERCENT)	7.0

PROGRAM CONTROLS AND CONSTRAINTS

NUMBER OF SUMMARY OUTPUT PAGES DESIRED (8 DESIGNS/PAGE)	3
MAX FUNDS AVAILABLE PER SQ.YD. FOR INITIAL DESIGN (DOLLARS)	99.00
MAXIMUM ALLOWED THICKNESS OF INITIAL CONSTRUCTION (INCHES)	99.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	6100.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	8100.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	2.400
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE(MPH)	60.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION)(MPH)	45.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	45.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	9.4

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**2**

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	2.0
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.98
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	12.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	125.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	30.00

DETOUR DESIGN FOR OVERLAYS

TRAFFIC MODEL USED DURING OVERLAYING	2
TOTAL NUMBER OF LANES OF THE FACILITY	2
NUMBER OF OPEN LANES IN RESTRICTED ZONE (OVERLAY DIRECTION)	0
NUMBER OF OPEN LANES IN RESTRICTED ZONE (NON-OVERLAY DIRECTION)	1
DISTANCE TRAFFIC IS SLOWED (OVERLAY DIRECTION) (MILES)	0.60
DISTANCE TRAFFIC IS SLOWED (NON-OVERLAY DIRECTION) (MILES)	0.60
DETOUR DISTANCE AROUND THE OVERLAY ZONE (MILES)	0.00

PAVING MATERIALS INFORMATION

LAYER	MATERIALS CODE	NAME	COST PER CY	E MODULUS	POISSON RATIO	MIN. DEPTH	MAX. DEPTH	SALVAGE PCT.
1	A	ASPH CONC PVMT	115.00	360900.	0.35	8.00	8.00	30.00
2	B	FLEXIBLE BASE	37.00	78700.	0.35	5.90	5.90	75.00
3	C	SUBGRADE(200)	2.00	14600.	0.40	200.00	200.00	90.00

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

NOTE -- THE CALCULATED BASE VALUE WAS OVER-WRITTEN BY THE USER FOR PAVEMENT DESIGN TYPE #1

PAVEMENT DESIGN TYPE # 2 -- ACP + FLEX BASE OVER SUBGRADE

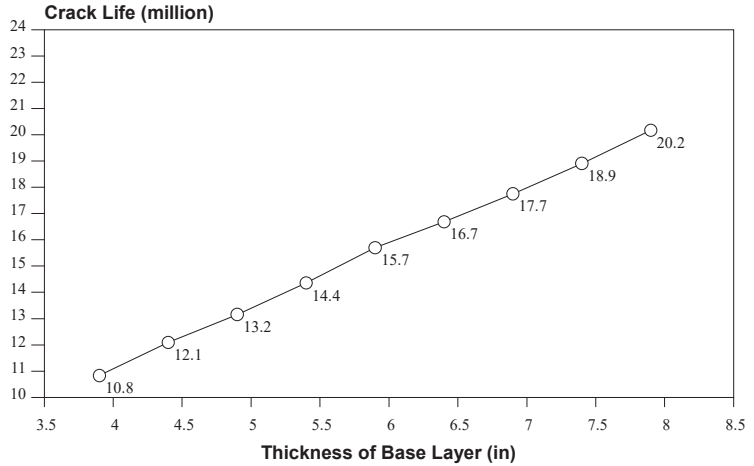
PROB	DIST.- 2	COUNTY-182	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
00	**Fort Worth**	**PALO PINTO**	**1**	**3**	**HVJ**	**US 281**	**7/10/2018**	**3**

C. LEVEL B SUMMARY OF THE BEST DESIGN STRATEGIES
IN ORDER OF INCREASING TOTAL COST
1

MATERIAL ARRANGEMENT	AB
INIT. CONST. COST	31.62
OVERLAY CONST. COST	0.00
USER COST	0.00
ROUTINE MAINT. COST	0.55
SALVAGE VALUE	-3.16
TOTAL COST	29.02
NUMBER OF LAYERS	2
LAYER DEPTH (INCHES)	
D(1)	8.00
D(2)	5.90
NO.OF PERF.PERIODS	1
PERF. TIME (YEARS)	
T(1)	40.
OVERLAY POLICY(INCH) (INCLUDING LEVEL-UP)	

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
AC	8.00	360.90	0.35	ASPH CONC PVMT
Base	5.90	78.70	0.35	FLEXIBLE BASE
Subgrade	200.00	14.60	0.40	SUBGRADE(200)



Fatigue Crack Model:

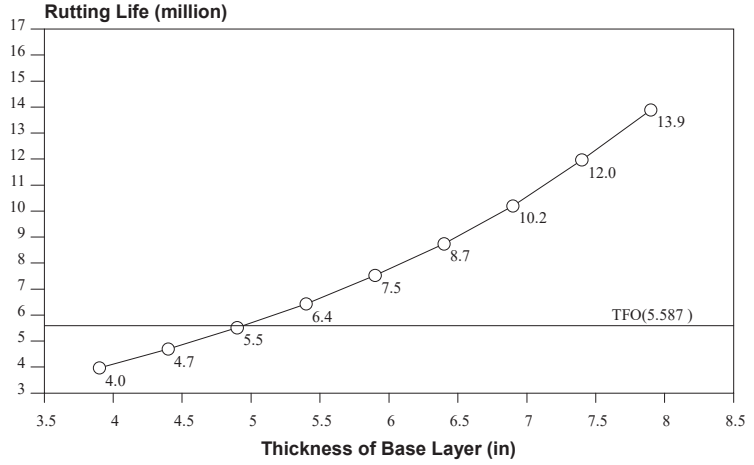
$$N_f = f_1 (\varepsilon_t)^{-f_2} (E_1)^{-f_3}$$

f_1 =7.96E-02
f_2 = 3.291
f_3 = .854

Rutting Model:

$$N_d = f_4 (\varepsilon_v)^{-f_5}$$

f_4 =1.37E-09
f_5 = 4.477



TFO(Traffic to 1st Overlay): 5.59 (million)

Crack Life: 15.69 (million) ε_τ = 109.00 (με)

Rut Life: 7.53 (million) ε_v = -305.00 (με)

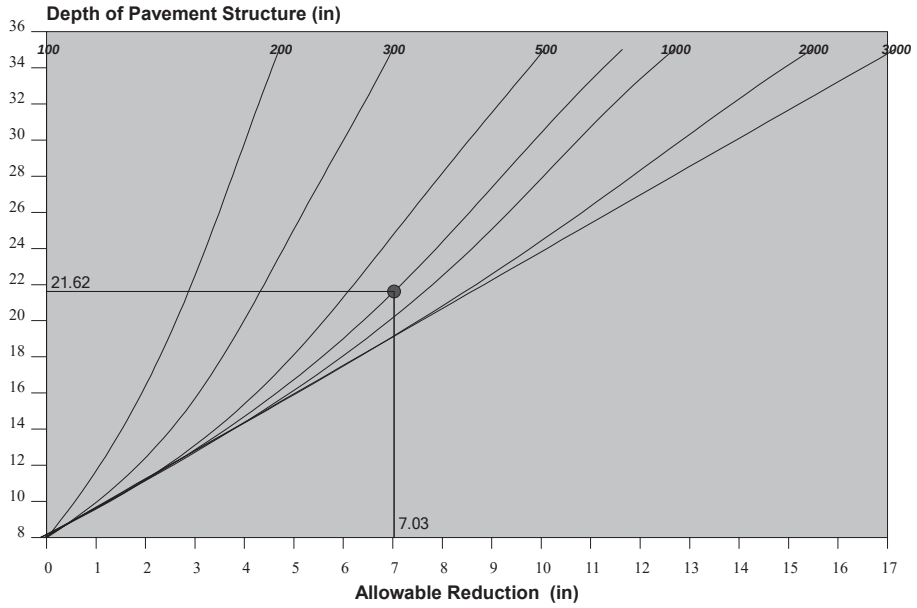
Traffic to 1st Overlay is calculated by analysis period: 20years and 18 kips:2.40millions.
Also the start ADT:6100.0 and ending ADT:8100.0

Mechanistic Check Conclusion:

The design is OK !

FPS 21 Mechanistic Design Check Output (FPS21-1.2Release:10-12-2011)			
Highway	US 281	Problem	00
C-S-J	1 - 3 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

	Thickness (inches)	Modulus (ksi)	Poisson's Ratio	Material Name
ASPH CONC PVMT	8.00	360.90	0.35	ASPH CONC PVMT
FLEXIBLE BASE	5.90	78.70	0.35	FLEXIBLE BASE
SUBGRADE(200)	200.00	14.60	0.40	SUBGRADE(200)
Bed Rock		1460.00	0.15	Bed Rock



Thickness Reduction Chart for Stabilized Layers

INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD)	11000.0 (lb)
Percentage of TandemAxles	60.0 (%)
Modified Cohesionmeter Value	800.0
Design Wheel Load	14300.0 (lb)
Subgrade Texas Triaxial Class Number (TTC)	5.00

TTC is based on Texas County Soil Database for (PALO PINTO)
For soils type : clay of high plasticity, fat clay(CH)

RESULT:

Triaxial Thickness Required	21.6 (in)
The FPS Design Thickness	13.9 (in)
Allowable Thickness Reduction	7.0 (in)
Modified Triaxial Thickness	14.6 (in)

TRIAXIAL CHECK CONCLUSION:

The Design Fails !

FPS 21 Triaxial Design Check Output		**(FPS21-1.2Release:10-12-2011)**	
Highway	US 281	Problem	00
C-S-J	1 - 3 - HVJ	Date	7/10/2018
District	Fort Worth	County	PALO PINTO
Design Type:Asphalt concrete + Flexible Base over Subgrade			

Appendix G – FORM 2088
Surface Aggregate Selection Form

Surface Aggregate Selection Form

Form 2088
(Rev. 05/12)
Page 1 of 1

CSJ: 0249 - 08 - 036 **Date:** 04/19/18

Highway: SH 281

Limits: Jack County Line to FM 52

County: Jack County Line

District: Fort Worth

Designer's Name: Linda Barlow

Selection Guidelines for Bituminous Surface Aggregate Classification (SAC)

Demand for Friction	Low (1)	Moderate (2)	High (3)	DESIGNER'S RATING 1	2	3
Rain Fall (inches/year)	≤20	>20 ≤40	>40	☐	☒	☐
Traffic (ADT)	≤5000	>5000 ≤15,000	>15,000	☒	☐	☐
Speed (mph)	≤35	>35 ≤60	>60	☐	☐	☒
Trucks (%)	≤8	>8 ≤15	>15	☐	☒	☐
Vertical Grade (%)	≤2	>2 ≤5	>5	☐	☒	☐
Horizontal Curve (°)	≤3	>3 ≤7	>7	☒	☐	☐
Driveways (per mile)	≤5	>5 ≤10	>10	☐	☐	☒
Intersecting Roadways (ADT)	≤500	>500 ≤750	>750	☐	☐	☒
Wet Surface Crashes (%)	≤5	>5 <15	≥15	☐	☒	☐
Summary of Total Frictional Demand				19		
***Available Friction**	**Low (2)**	**Moderate (5)**	**High (8)**	**2**	**5**	**8**
Cross Slope (%)	<2	2 - 3	3 - 4	☐	☒	☐
Surface Design Life (years)	>10	>5 ≤10	≤5	☒	☐	☐
Macro Texture of proposed surface	Fine (Such as: HMAC Type 'D' and 'F')	Medium (Such as: HMAC Type 'C', CMHB, SuperPave, Microsurface)	Coarse (Such as: PFC, SMA, Seal Coat, NovaChip)	☐	☒	☐
Aggregate MicroTexture	SAC C	SAC B	SAC A	☐	☐	☒
Summary of Total Friction Available				20		
Does total available friction equal or exceed total frictional demand?				☒ Yes ☐ No		

*Parameters set by the designer that affect pavement friction.
Total friction available should always exceed total frictional demand.

Comments:

Surface Aggregate Selection Form

Form 2088
(Rev. 05/12)
Page 1 of 1

CSJ: 0249 - 08 - 049 **Date:** 04/19/18

Highway: SH 281

Limits: FM 52 to 5.5 mile N of I-20

County: Jack County Line

District: Fort Worth

Designer's Name: Linda Barlow

Selection Guidelines for Bituminous Surface Aggregate Classification (SAC)

Demand for Friction	Low (1)	Moderate (2)	High (3)	DESIGNER'S RATING 1	2	3
Rain Fall (inches/year)	≤20	>20 ≤40	>40	☐	☒	☐
Traffic (ADT)	≤5000	>5000 ≤15,000	>15,000	☐	☒	☐
Speed (mph)	≤35	>35 ≤60	>60	☐	☐	☒
Trucks (%)	≤8	>8 ≤15	>15	☐	☒	☐
Vertical Grade (%)	≤2	>2 ≤5	>5	☐	☒	☐
Horizontal Curve (°)	≤3	>3 ≤7	>7	☒	☐	☐
Driveways (per mile)	≤5	>5 ≤10	>10	☐	☐	☒
Intersecting Roadways (ADT)	≤500	>500 ≤750	>750	☐	☐	☒
Wet Surface Crashes (%)	≤5	>5 <15	≥15	☐	☒	☐
Summary of Total Frictional Demand				20		
***Available Friction**	**Low (2)**	**Moderate (5)**	**High (8)**	**2**	**5**	**8**
Cross Slope (%)	<2	2 - 3	3 - 4	☐	☒	☐
Surface Design Life (years)	>10	>5 ≤10	≤5	☒	☐	☐
Macro Texture of proposed surface	Fine (Such as: HMAC Type 'D' and 'F')	Medium (Such as: HMAC Type 'C', CMHB, SuperPave, Microsurface)	Coarse (Such as: PFC, SMA, Seal Coat, NovaChip)	☐	☒	☐
Aggregate MicroTexture	SAC C	SAC B	SAC A	☐	☐	☒
Summary of Total Friction Available				20		
Does total available friction equal or exceed total frictional demand?				☒ Yes ☐ No		

*Parameters set by the designer that affect pavement friction.
Total friction available should always exceed total frictional demand.

Comments: