

SAN ANTONIO DISTRICT
PAVEMENT DESIGN REPORT
FOR
ATASCOSA COUNTY



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FM 140

CSJ 0748-05-039,ETC.

BEGIN REF MRK: 0490+1.512

END REF MRK: 0504+0.077

LIMITS: From Bluntzer Rd To SH 16

LENGTH: 12.431 MI

PREPARED BY:

Christie Lynn Hill, P.E.

Christie Lynn Hill, P.E.
Transportation Engineer

7/17/13
Date

APPROVED BY:

Brett Haggerty

Brett Haggerty, P.E.
Pavement Design Engineer

7-18-13
Date

APPROVED BY:

Gina Gallegos, P.E.

Gina Gallegos, P.E.
Director of Construction

7-18-13
Date

GENERAL PROJECT INFORMATION

This flexible pavement design is for the proposed construction of FM 140 from Bluntzer Rd to SH 16 in Atascosa County

The existing roadway consists of two 11 foot lanes with no shoulders. The proposed roadway consists of two 11' lanes and 3' shoulders. A project location map is shown as Exhibit A and typical sections are attached as Exhibit B.

PROJECT DATA

Traffic Data

The traffic analysis report for pavement design from Transportation Planning and Programming Division (TP&P) is shown as Exhibit C. The 20 year projected traffic is summarized below:

From Bluntzer Road to CR 343

2013 ADT:	700
2033 ADT:	1,000
18k ESALs:	228,000
Percent Trucks in ADT:	12.7
ATHWLD:	9,800
Percent Tandem Axles in ATHWLD:	50

From CR 343 to SH 16

2013 ADT:	800
2033 ADT:	1,200
18k ESALs:	389,000
Percent Trucks in ADT:	18.8
ATHWLD:	10,000
Percent Tandem Axles in ATHWLD:	40

Due to the increase truck traffic from the Eagle Ford Shale the ATHWLD was increased to 17,000 and the 18k ESALS were increased to 5,300,000.

Subgrade Material Properties

The *Soil Survey of Atascosa County, Texas* (March, 1977) indicates that the predominant soil type in the vicinity from Bluntzer Road to CR 343 consists of Hanis Sandy clay loam, and Webb fine sandy loam, 1 to 3 percent slopes. The predominant soil type in the vicinity from CR 343 to SH 16 is Webb fine sandy loam and Floresville fine sandy loam, 1 to 3 percent slopes. The USCS classification for Hanis is SC, CL and its AASHTO classification is A-4, A-6 and A-7. The USCS classification for Webb is SM, SM-SC and

its AASHTO classification is A-2, A-4. The USCS classification for Floresville is SM, SC, SM-SC and its AASHTO classification is A-2, A-4. The soil's average liquid limit is 25 and its average plasticity index is 7.

The Triaxial Classification of the subgrade soils, grouped by Soil Conservation Service Series, Research Report 3-05-71-035, is 4.8. A subgrade modulus of 10,800 psi was back calculated from Falling Weight Deflectometer data attached as Exhibit D.

Pavement Design Data

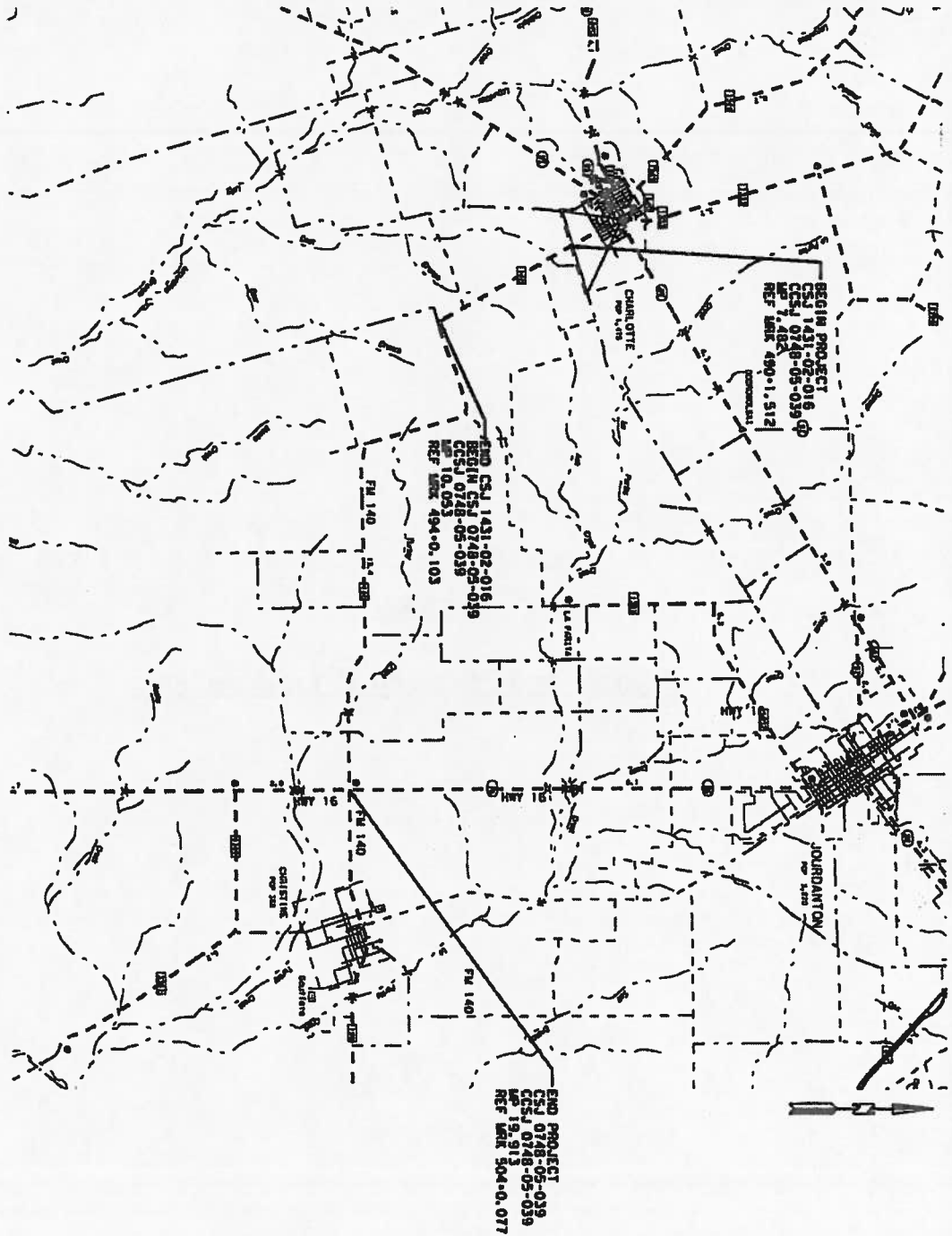
The pavement structure was designed using the FPS19 program and the design input values were selected using TxDOT guidelines. The TTI Modulus Analysis Summary Report is shown in Exhibit D. All design data is included in Exhibit E which is the FPS19 input and output. The selected FPS19 design was then checked with the Modified Triaxial Design Procedure and did not pass the Modified Triaxial Check. The design data for the Modified Triaxial Design is shown as Exhibit F. The Pavement Design was based on a 5 year design.

CONCLUSIONS

The pavement design from Bluntzer Rd to SH 16 will be as follows:

2-2" HMA (TY C)
6" REWORK BASE MATL (TY B)(6")(DENS CONT)
CEMENT TREAT (EXST MTL)(6") (for Base)
6" CEMENT TREAT (SUBGRADE)(6")

Exhibit A
Project Location Map



NOT TO SCALE

DATE	04/15/2013	SHEET	1	OF	1
BY	05/01/13	PROJECT	FM 140	MAP	
SCALE		STATE	MISSISSIPPI		

Mississippi Department of Transportation

FM 140
 LOCATION
 MAP

CHRISTINE TOWN HILL, V.T.

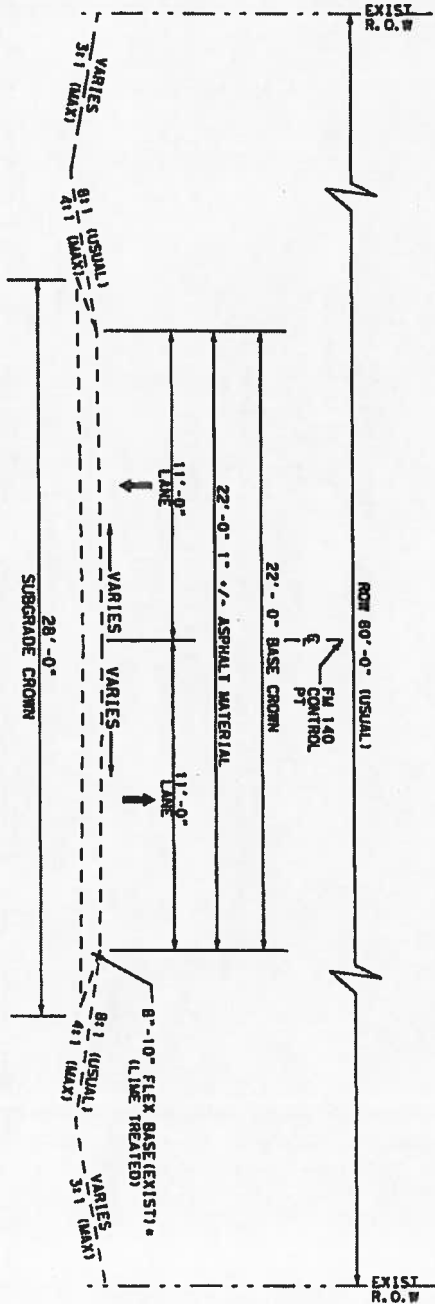


Exhibit B

Existing and Proposed Typical Sections

AREAS OF DIFFERENT MATERIALS MAY BE ENCOUNTERED

FM 140
 EXISTING TYPICAL SECTION



NOT TO SCALE

Sheet No.	1 of 2
Project No.	130640-05-07874-140
Scale	AS SHOWN
Drawn By	JG
Checked By	
Approved By	



FM 140
 EXISTING
 TYPICAL SECTION

CHRISTIE ENGINEERING, P.C.



Exhibit C

TP&P Traffic Analysis for Highway Design

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN

San Antonio District

November 2, 2012

Description of Location	Average Daily Traffic		Dir Dist %	K Factor	Base Year		ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2013 to 2033)		SLAB	
	2013	2033			ADT	DHV			Flexible Pavement	Rigid Pavement		
	<p align="center">NOT INTENDED FOR CONSTRUCTION BIDDING OR PERMIT PURPOSES William Erick Knowles, P.E. Serial Number 84704</p>											
FM 140 From Bluntzer Road To County Road 343 Alascaosa County	700	1,000	51 - 49	13.5	12.7	9.5	9,800	50	228,000	3	258,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year	
	% of ADT	% of DHV
Light Duty	87.3	90.5
Medium Duty	9.6	7.2
Heavy Duty	3.1	2.3

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN

October 18, 2012

San Antonio District	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2013 to 2033)											
	Base Year				ATHWLD	Percent Tandem Axles in ATHWLD	Flexible Pavement		Rigid Pavement		SLAB	
	Average Daily Traffic		Dir Dist %	K Factor			Percent Trucks ADT	DHV	S	N		
Description of Location	2013	2033										
<p>FM 140</p> <p>From CR 343 To SH 16</p> <p>Atascosa County</p>	800	1,200	66 - 34	11.6	18.8	14.1	10,000	40	389,000	3	440,000	8"

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

Data for Use in Air & Noise Analysis	Base Year	
	% of ADT	% of DHV
Vehicle Class		
Light Duty	81.2	85.9
Medium Duty	13.9	10.4
Heavy Duty	4.9	3.7

Exhibit D

Falling Weight Deflectometer Data

Exhibit E

FPS Input and Output Data



Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

FP S21-1.3

FLEXIBLE PAVEMENT SYSTEM

Release:6-1-2012

PAVEMENT DESIGN TYPE # 7 -- USER DEFINED PAVEMENT

PROB	DIST.	COUNTY	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
1	San Antonio	ATASCOSA	0748	05	039	FM140	7/17/2013	1

COMMENTS ABOUT THIS PROBLEM

BASIC DESIGN CRITERIA

LENGTH OF THE ANALYSIS PERIOD (YEARS)	20.0
MINIMUM TIME TO FIRST OVERLAY (YEARS)	5.0
MINIMUM TIME BETWEEN OVERLAYS (YEARS)	5.0
DESIGN CONFIDENCE LEVEL (95.0%)	C
SERVICEABILITY INDEX OF THE INITIAL STRUCTURE	4.5
FINAL SERVICEABILITY INDEX P2	2.5
SERVICEABILITY INDEX P1 AFTER AN OVERLAY	4.0
DISTRICT TEMPERATURE CONSTANT	31.0
SUBGRADE ELASTIC MODULUS by COUNTY (ksi)	10.80
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)	69.0
ACCUMULATED MAX DEPTH OF ALL OVERLAYS (INCHES) (EXCLUDING LEVEL-UP)	6.0

TRAFFIC DATA

ADT AT BEGINNING OF ANALYSIS PERIOD (VEHICLES/DAY)	700.
ADT AT END OF TWENTY YEARS (VEHICLES/DAY)	1000.
ONE-DIRECTION 20YEAR 18 kip ESAL (millions)	5.300
AVERAGE APPROACH SPEED TO THE OVERLAY ZONE (MPH)	65.0
AVERAGE SPEED THROUGH OVERLAY ZONE (OVERLAY DIRECTION) (MPH)	40.0
AVERAGE SPEED THROUGH OVERLAY ZONE (NON-OVERLAY DIRECTION) (MPH)	40.0
PROPORTION OF ADT ARRIVING EACH HOUR OF CONSTRUCTION (PERCENT)	6.0
PERCENT TRUCKS IN ADT	12.7



Texas Department of Transportation

TEXAS DEPARTMENT OF TRANSPORTATION

FP S21-1.3

FLEXIBLE PAVEMENT SYSTEM

Release:6-1-2012

PAVEMENT DESIGN TYPE # 7 -- USER DEFINED PAVEMENT

PROB	DIST.-15	COUNTY- 7	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
1	San Antonio	ATASCOSA	0748	05	039	FM140	7/17/2013	2

INPUT DATA CONTINUED

CONSTRUCTION AND MAINTENANCE DATA

MINIMUM OVERLAY THICKNESS (INCHES)	1.5
OVERLAY CONSTRUCTION TIME (HOURS/DAY)	12.0
ASPHALTIC CONCRETE COMPACTED DENSITY (TONS/C.Y.)	1.90
ASPHALTIC CONCRETE PRODUCTION RATE (TONS/HOUR)	200.0
WIDTH OF EACH LANE (FEET)	11.0
FIRST YEAR COST OF ROUTINE MAINTENANCE (DOLLARS/LANE-MILE)	0.00
ANNUAL INCREMENTAL INCREASE IN MAINTENANCE COST (DOLLARS/LANE-MILE)	0.00

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	B DENSE-GRADED HMA	T115.00	500000.	0.35	4.00	4.00	30.00
2	M FLEXIBLE BASE	37.00	130000.	0.25	6.00	6.00	75.00
3	P CEMENT STABILIZED	45.00	35000.	0.30	6.00	6.00	70.00
4	T SUBGRADE	2.00	10800.	0.40	172.20	172.20	90.00



TEXAS DEPARTMENT OF TRANSPORTATION

FPS21-1.3

FLEXIBLE PAVEMENT SYSTEM

Release:6-1-2012

PAVEMENT DESIGN TYPE # 7 -- USER DEFINED PAVEMENT

PROB	DIST.	COUNTY	CONT.	SECT.	JOB	HIGHWAY	DATE	PAGE
1	San Antonio	ATASCOSA	0748	05	039	FM140	7/17/2013	3

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

1

MATERIAL ARRANGEMENT	BMP
INIT. CONST. COST	26.44
OVERLAY CONST. COST	3.04
USER COST	0.00
ROUTINE MAINT. COST	0.00
SALVAGE VALUE	-3.91

TOTAL COST 25.57

NUMBER OF LAYERS 3

LAYER DEPTH (INCHES)	
D(1)	4.00
D(2)	6.00
D(3)	6.00

NO. OF PERF. PERIODS 2

PERF. TIME (YEARS)	
T(1)	11.
T(2)	21.

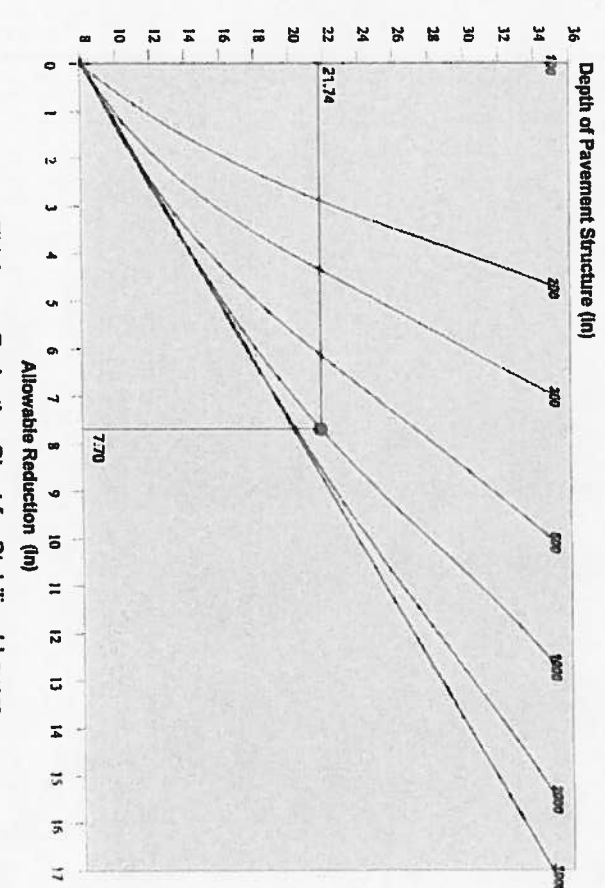
OVERLAY POLICY (INCH) (INCLUDING LEVEL-UP)	
O(1)	2.0

THE TOTAL NUMBER OF FEASIBLE DESIGNS CONSIDERED WAS 1

Exhibit F

Modified Triaxial Design Procedure

Thickness (Inches)	Modulus (ksi)	Poisson's Ratio	Material Name
4.00	500.00	0.35	DENSE GRADLED HMA Thin
6.00	110.00	0.35	FLEXIBLE BASE
6.00	35.00	0.30	CEMENT STABILIZED BASE
172.20	10.00	0.40	SUBGRADE
	1080.00	0.15	Bed Rock



INPUT PARAMETERS:

The Heaviest Wheel Loads Daily (ATHWLD) 17000.0 (lb)
 Percentage of Tandem Axles 49.0 (%)
 Modified Cohesionmeter Value 1000.0
 Design Wheel Load 17000.0 (lb)
 Subgrade Texas Triaxial Class Number (TTC) 4.80
 User Input TTC based on historical TEX-117-E

RESULT:

Triaxial Thickness Required 21.7 (in)
 The FPS Design Thickness 16.0 (in)
 Allowable Thickness Reduction 7.7 (in)
 Modified Triaxial Thickness 14.0 (in)

TRIAXIAL CHECK CONCLUSION:

The Design OK !

FPS 21 Triaxial Design Check Output (FPS21-1.3Release:6-1-2012)			
Highway	FM140	Problem	1
C-S-J	0748-05-039	Date	7/17/2013
District	San Antonio	County	ATASCOSA

Design Type: User Defined Pavement Design

Exhibit G

Surface Aggregate Selection Form



Surface Aggregate Selection Form

CSJ: 0748 - 05 - 039
 Highway: FM 140
 Limits: From Bluntzer Road To SH 16
 County: Atascosa
 District: San Antonio
 Designer's Name: Christie Lynn Hill, P.E.

Date: 01/24/13

Selection Guidelines for Bituminous Surface Aggregate Classification (SAC)

Demand for Friction	Low (1)	Moderate (2)	High (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			
*Available Friction	Low (2)	Moderate (5)	High (8)
Cross Slope (%)	<2	2 - 3	3 - 4
Surface Design Life (years)	>10	>5 ≤10	≤5
Macro Texture of proposed surface	Fine (Such as: HMA Type 'D' and 'F')	Medium (Such as: HMA 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			
Does total available friction equal or exceed total frictional demand?			

DESIGNER'S RATING

1	2	3
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16		
2	5	8
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
23		
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

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

Comments:

Given an Overall Frictional Demand of Moderate I chose an Aggregate Classification of "B". I base this decision on the high volume of Trucks and the Moderate horizontal curves and speed.



Christie Lynn Hill, P.E. 1/24/13

