San Antonio District
Pavement Design

Standard Operating Procedure
Effective Date: September 1, 2024

2024 SOP Updates

Page 7	**Added verbiage of reduced soil bore depth when PVR mitigation is not required.**
Page 7	**Updated reference of the Treatment Guidelines for Soils and Base in Pavement Structures to latest version (2019)**
Page 8	**Added unit weight of flexible base for preliminary cement or lime quantities**
Page 9	**Added note requiring coordination with District H&M team if roadway profile will be increased**
Page 10	**Modified Embankment Type C requirements and added Embankment Type C2 table**
Page 11	**Modified the borelogs bullet point to require pictures of cores**
Page 14	**Modified verbiage referencing Table 5 for the default input values for the pavement designs process**
Page 14	**Added Lane Distribution Factor table to adjust ESALs when applicable**
Page 14	**Added verbiage to request traffic projection adjustment spreadsheet when TP&P data is outdated**
Page 14	**Moved Table 5 to fall within FPS 21 Design Parameters section**
Page 15	**Removed verbiage showing cases where MTTC needs to be performed.**
Page 15	**Removed reference to memorandum about using 49% tandem axles when traffic loading is less than 3 MESALs**
Page 15	**Removed recommendation of dividing ATHWLD by 2 for detours.**
Page 20	**Added verbiage under the Widening or Turn Lanes section, requiring Value Engineering for this type of projects.**
Page 23	**Removed recommendation of dividing ATHWLD by 2 for detours for both scenarios of time usage**
Page 29	**Added verbiage under the HMA Binder Selection section**

Modified Table 4 – Updated pH reading of lime from 12.3 to 12.4

Modified Table 6 – Updated item bid codes to reflect the new 2024 Specification

Modified Table 6 – Removed fly-ash or lime fly-ash stabilized base

Modified Table 9 – Added 2024 Spec item bid codes to materials

Modified Table 9 – Updated application rates of Underseal and Bonding courses

Modified Table 9 – Added TRAIL - Emulsified Asphalt as an additional option for Bonding Course

Modified Table 9 – Removed Tack Coat item

Modified Table 9 – Added verbiage stating that Bonding Course will be placed in between HMA lifts instead of Tack Coat

Modified Table 10 – Updated item bid codes to reflect the new 2024 Specification

Modified Table 10 – Removed Crack Attenuating Mixture

Modified Table San Antonio Typical Materials and Considerations – Updated item bid codes to reflect the new 2024 Specification

Modified Table San Antonio Typical Materials and Considerations – Modified Bonding Course verbiage that will replace tack coat

Modified Table San Antonio Typical Materials and Considerations – Removed Tack Coat item

Purpose

To standardize and establish guidelines, policies and promote consistency in the pavement design process by incorporating efficient and effective materials, pavement treatments, maintenance and construction methods in the San Antonio District.

General Guidelines

As part of Plans, Specifications and Estimates (PS&E) development, a formal pavement design report is required for all District's pavement projects as set in this document and referenced / linked thereto. The general approach to pavement design should be set in a Pavement Design Concept Conference (PDCC) after the project is programmed. While many projects are programmed numerous years before the plans are completed, it is important that adequate time is allotted to ensure proper design methodology is proposed for each individual project. Prior to the PDCC (but no later than immediately after the PDCC), the Designer will request and gather all traffic, soil and pavement testing information.

The Designer will perform the pavement design analysis and prepare a preliminary pavement design report and submit it to the District Pavement Engineer (DPE). For larger scale (highly complex) projects, the pavement design may be submitted to MNT Pavement Asset Management for technical review.

After all modifications recommended in the technical process are completed, the final pavement design report will be submitted to the Area Engineer for review and concurrence and to the Director of Construction for approval. The approval of pavement design reports for projects over $20 million will require the final approval of the Director of Construction and the District Engineer.

Projects Requiring Pavement Design Concept Conference (PDCC) and Pavement Design Report (PDR):

A PDCC and PDR are required for the following projects which are greater than 500 feet long, as stated in the Department's Pavement Manual, Chapter 2, Section 9:

- New location projects (flexible and rigid)
- Reconstruction projects (flexible and rigid)
- Rehabilitation (3R) projects (flexible and rigid)
- Hydraulic cement concrete (rigid) unbonded overlays of existing rigid
- HMA overlays, thicker than 2 inches

Exceptions:

Exceptions to this guideline or special cases shall be considered by the District Pavement Engineer (DPE) and the Pavement Design Concept Conference (PDCC) committee. The pavement design for special cases will typically be based on engineering judgment, historical performance, district policy, and other Department guidelines. A design report may be required for documentation purposes. Projects that do not require a formal pavement design report (i.e. geotechnical investigation and FPS/DARWin analysis), will require a Pavement Memo to the DPE. The Pavement Memo will include the scope of work, project limits, ADT, description of existing pavement based on as-builts, any core info/pictures, project location, typical sections, Form 2088 signed and sealed for surface aggregate classification and any additional information to support the pavement analysis.

The following list provides examples of special cases that require documentation of the criteria and rationale for the strategy selected for projects greater than 500 feet long:

- Approaches on a bridge replacement
- Detours
- Pavement widening including shoulders and turn lanes
- HMA overlays of rigid pavements
- Bonded rigid overlays on rigid pavements
- Thin whitetopping of flexible pavements
- Flexible base repair and overlay projects

Contact the District Pavement Engineer for questions or specific cases.

Pavement Design Concept Conference

A Pavement Design Concept Conference (PDCC) shall be convened for all projects or when significant changes occur to the original pavement design concept. PDCC's will be held on the third (3rd) Wednesday of every month. The designer will schedule the project to be included in the monthly PDCC within two (2) months of being assigned the project. This conference is required for all projects that require a pavement design report or memo, including special cases. The DPE and Designer will coordinate to initiate and schedule the PDCC

Conference Participants *(* Indicates required attendee):*
**Designer*
**Area Engineer or Designated Representative*
**Pavement Engineer*
**Maintenance Supervisor or Designated Representative*
Lead Construction Inspector
Director of TP&D or Designated Representative
Director of Operations or Designated Representative
Director of Construction or Designated Representative

See **Appendix A** for PDCC Agenda discussion topics for consideration.

Traffic Analysis (Flexible or Rigid Pavement):

Submit TxDOT Form 2124, "Request for Traffic Data" from TP&P through the designated contact in the District Planning Office. When developing the traffic data request, in all cases request the information be developed using the following information:

- Flexible Pavement
  - SN = 3
  - Base year projections (This is the year the roadway will be put into service)
  - 20-year projections
  - 30-year projections when recommended for Perpertual Pavement or Rigid Pavement alternate
- Rigid Pavement
  - 8-inch slab thickness
  - Base year projections (This is the year the roadway will be put into service)
  - 30-year projections

Request that all traffic be developed for the frontage roads and main lanes separately, otherwise TP&P will combine these traffic totals. Provide as much information to TP&P concerning the potential truck traffic generators in the area of the project and any future development that would impact the growth of ADT and % trucks. Additional 24-hour classification counts may be needed to support the estimated traffic and can be used as a basis for estimating ESALs.

Roadways located in the Energy Sector Corridor Area (Atascosa County, McMullen County, Frio County and Southeastern half of Wilson County) will require an independent study of the traffic. This will include, but is not limited to: traffic classification counts, portable weigh-in-motion traffic load spectra, or cluster analysis from surrounding permanent weigh-in-motion station load spectra.

Pavement Evaluation, Soil Exploration and Testing:

A pavement evaluation of the existing pavement and subgrade soil conditions is required to characterize and design subbase or foundational layers of the new pavement structure as part of the pavement design process.

The Designer and District Pavement Engineer (DPE) will develop the scope of testing and evaluation for analysing the subgrade and existing pavement structure to supplement the Pavement Design Report. The following may include, but is not limited to:

- Dynamic Cone Penetration (DCP): This will determine the moduli and shear strength of the subgrade soil.
- Soil Identification (to be reported out in WinCore) for all unbound materials (base/subbase/subgrade)
  - Gradation (Tex-110-E)
  - Soil Classification (Tex-142-E)
  - Atterberg Limits (Tex 104-E, 105-E, 106-E), 107-E if applicable
  - Moisture Content (Tex-103-E)

- Sulfate Content (Tex-145-E): This will determine if calcium-based subgrade soil treatment is possible
- Organic Content (Tex-148-E):This will determine if calcium-based subgrade soil treatment is possible
- pH levels (Tex-128-E & Tex-121-E)
- Soil Treatment Design (Tex-120-E, Tex-121-E, Tex-127-E): This will determine the optimal amount of stabilizer content to optimize engineering properties, such as unconfined compressive strength, stiffness and resistance to shrink/swell, moisture damage and to determine construction parameters (density and moisture).
- Cores/Bores (thicknesses)

- Ground Penetrating Radar (GPR) – Comprehensive layer thicknesses and anomaly detection. Utilize GPR to determine bore/core locations.
- Falling Weight Deflectometer (FWD) – Stiffness for each layer
- Total Pavement Acceptance Device (TPAD) – Comprehensive layer thickness and comprehensive stiffness for each layer
- Profiler for ride quality

For testing or data collection requests from the San Antonio District Laboratory, please refer to **Appendix B**.

Soil Movement Mitigation

The Potential Vertical Rise (PVR) needs will be evaluated in the DCC and will be noted in the pavement design report if it is anticipated there will be problems. Generally, it is not feasible to perform long term repairs for problems associated with subgrade movement, therefore this type of repair will only be considered in isolated areas and on roadways meeting all of the following requirements:

- High speed facilities (Design Speed> 45mph)
- ADT > 40,000
- CRCP, perpetual pavement, or HMAC thickness > 12 inches
- Roadways located in the Eagle Ford Shale formation or pavements over subgrade soils PI >= 40

Minimum allowable PVR levels stated in Memorandum from John A. Barton, P.E. (Guidance on Potential Vertical Rise for Design) July 6, 2009 apply, unless otherwise approved by the District Pavement Engineer. The minimum PVR values for design are 1.5 inches for mainlanes and 2.0 inches for frontage roads. NOTE: The lower the PVR, the more conservative the design.

PVR values will be derived in accordance to Tex-124-E or centrifuge technology (as detailed in 5-6048). PVR values will be determined on a soil column with depth of 10 feet from top of proposed subgrade elevation. This depth may be less when sampling devices are pushed to refusal or at the depth of the ground water table.

The presence of rock, gravel or sand substrata will eliminate the necessity for drilling a large number of deep exploration holes.
When PVR is not required for a project, the depth of the proposed soil bores can be reduced to 5 feet from top of proposed subgrade elevation.

PVR mitigation: Calcium-based stabilizers will be the primary method for mitigation. If the existing subgrade contains sulfate content higher than 3000 ppm, alternative soil treatment will be implemented, in accordance with the Material and Pavement Division's Treatment Guidelines for Soils and Base in Pavement Structures, 2018.

Stabilization of Soils

Treatment will be in accordance with the Material and Pavement Division's Treatment Guidelines for Soils and Base in Pavement Structures, 2019.

Table 1 – Selecting Treatments

Layer	PI	Stabilizer Option
Base	< 12	Cement, Asphalt, or Emulsion
	> 12	Lime or Cement
Subgrade	≤ 15	Cement
	15 < PI < 30	Lime, Cement or Combination
	30+	Lime

Table 2 – Treatment Options with Sulfates

Level of Sulfates	Sulfate Concentration	Stabilizer Option
Low	<3000 ppm	No significant concern, select applicable treatment for PI
Moderate	3000ppm – 7000ppm	Treat with applicable stabilizer based on PI, specify mellowing time period*
High	>7000ppm	Do not use chemically stabilized treatment. Discuss with DPE.

*-Mellowing time will be determined in accordance with Tex-145-E, Part II. Samples will be prepared with the specified amount of lime and moisture that is 3%, 4%, and 5% above Optimum Moisture Content, then the material will be monitored until the concentration reaches 3000ppm.

Table 3 – Treatment with Organics

Level of Organics	Organic Concentration	Stabilizer Option
No Concern	≤1% Tex-148-E or ASTM D-2974	No modification needed
Concern	>1%, Tex-148-E or ASTM D-2974	If cement is selected treatment from Table 1 modify to lime-cement combination. If cement is not selected for treatment increase chemical stabilizer 1%

To determine the amount of stabilizer to approximate for estimates reference the results from tests run in accordance with Table 4.

Table 4 – Treatment Requirements

Treatment	Test	Threshold Requirements	Estimate % if Values from test cannot be obtained prior
Emulsion	Tex-226-F, Tex-117-E, Part II, Tex-117-E Retained[1]	IDT min: 50psi IDT (Moisture Conditioned) min: 30psi Moisture Conditioned UCS min: 120 psi	1% Cement with 4.5% Emulsion or 3.0% Residual
Lime (construction platform – no structural credit)	Tex-121-E, Part III	pH reading of 12.4	3.00% Minimum of 8" unless PVR identifies thicker
Lime, Lime-Cement	Tex-121-E, Part II	Minimum UCS of 50psi	6.00%
Cement	Tex-120-E, Part I	Minimum UCS of 150psi, 80% Retained Strength after Moisture Conditioning[2]	3.00%
Foam	Tex-226-F[1], Tex-226-F (MC)[1,2], Tex-117E, Part II[3]		1.0% Cement 3.0% Asphalt

1. Tex-117-E Retained is the average of three specimens subjected to 10-day capillary moisture absorption before conducting UCS
2. Submerged in water for 24 hrs. after 7 days of curing.

Note:
Use a preliminary unit weight of 2970 lb/cy (110lb/ft^3) for subgrade or 3645 lb/cy (135 lb/ft^3) for flexible base to calculate preliminary cement and lime quantities. Update unit weight once geotechnical data is available.

Pavement Design Report and Documentation

A Pavement Design Report (PDR) is a formal, signed and sealed engineering document that presents all analysis, data, policies and other considerations used to design the structural aspects of a pavement. The Pavement Design Report shall consist of the following elements:

- *Cover Sheet* showing Highway Designation, District, County, CSJ, Geographical Limits and Signatures of persons involved in the preparation, review and approval. Include the statement, *"This document is released for the purpose of review, approval and design record under the authority of (Ex: Jane Doe, PE #XXXX). It is not to be used for construction, bidding or permit purposes."*
- *General Project Information*
  - Project scope
  - Limits & location particulars (Use stationing and highway designations from plans or schematic) for all pavement areas
  - Pavement objectives (widening, overlay, rehab, etc.)
- *Existing Pavement history and condition*
  - Soil conditions and subgrade Texas Triaxial Classification (TTC)
    - Soil map of the project area with a brief description of each type of soil located within the project area(s)
    - Discuss shrink/swell potential and plasticity, if applicable
  - The study of the presence of sulfate bearing compounds, organic content and any mitigation technique selected
  - Determination of PVR mitigation requirements, if applicable. Obtain and provide approval to use PVR mitigation techniques when roadway characteristics do not meet policy criteria
  - Results of Non-Destructive Testing (NDT) to characterize the existing structural condition
    - Provide details on MODULUS back calculation summary / determination. Refer to **Appendix C** for documentation example.
    - Provide a summary of the findings and recommendations based on the GPR evaluation
  - Summary of laboratory tests conducted on any materials extracted from the existing structure
  - Bore / Core results
  - Pavement Management Information System (PMIS) data
  - Maintenance considerations and concerns
  - Drainage considerations (if profile will increase coordination/approval with District H&H team is required)
- *TPP Traffic Data and any adjustments to the traffic data*
- *Pavement Design and Analysis*: Include all options designed / analysed and indicate the project specific factors used for selecting the pavement type

- Include pavement designs for each roadbed (shoulder, mainlane, ramp, intersection, widening, etc.)
- Include Alternate pavement designs, if appropriate
- Include Modified Triaxial Check and Mechanistic Design Check when applicable

- Conclusion: The PDR will conclude with a recommended pavement design, including all material selection, based on the data, analysis and procedures included in the report. If a design different from the recommended is utilized, justification will be required along with documentation explaining how the selected design is adequate.
- TY-C embankment with the below criteria must be used unless the pavement designer recommends a different one. Any embankment that differs from the below criteria must be approved by the district pavement engineer. Embankment selection must be included in the pavement report and PS&E general notes.

Item	Description	Percent Retained-Sieve				LL Max	PI Max	PI Min	Field Compact Density to
		3"	3/8"	#4	#40				
132	EMBANKMENT (FINAL) (DENS CONT)(TY C1	0	-	30-75	50-85	45	20	7	≥98% Dry Density

Item	Description	LL Max	PI Max	PI Min
132	EMBANKMENT (FINAL) (ORD COMP)(TY C2)	50	25	7

Note: The four feet underneath the pavement structure needs to be C1, anything deeper should be C2.

- Exhibits/Attachments
  - Location Map: Detailed enough to distinguish project location and incorporates topographic features. Utilize project specific design (CAD) linework overlaid on a Google image
  - Project Type Map: Designate different pavement types proposed for each roadbed (i.e, Concrete, HMA, Flex Base on mainlanes, ramps, shoulders, etc.)
  - Soils map of the project area with a brief description of each type of soil. Provide information pertaining to shrink/swell potential and plasticity
  - Existing and Proposed typical sections
  - TPP Traffic Data (with any adjustments)
  - Results of NDT to characterize the existing structural condition
  - Design input values and output
  - FPS Summary, Modified Texas Triaxial Check, Mechanistic Checks, Stress Analysis, etc. for flexible pavements
  - AASHTO (DARWin or TSLAB86) design summary for rigid pavements, or TxCRCP-ME for CRCP designs

- Form 2088, Surface Aggregate Selection Form (must be signed and sealed by PE)
- Borelogs (pictures of cores are required)
- Material Lab tests
- PMIS Data
- Life-Cycle Cost Analysis (if applicable)

Refer to **Appendix E** for the Standard Pavement Design Report format.

Pavement Design Process

The goal of all pavement designs is to develop the most cost effective and efficient method for each situation. This will take multiple factors into consideration, which includes but is not limited to: traffic, surrounding neighbourhoods and businesses, flood plains, drainage, traffic control, soil conditions and access points.

To help identify the main factors affecting the condition of a roadway, which are directly reflected in the PMIS Condition Score, it is recommended to use the PowerBI Scoping Aid Tool developed by the District Lab. This tool allows for graphing the project's limits and presenting the data in multiple scenarios. These scenarios help distinguish whether the condition scores are primarily impacted by distresses (shallow or deep), if poor ride quality is the main contributor, or all the previously mentioned. By identifying these factors, the designer can more effectively target the necessary scope of work and address the specific issues affecting the roadway. It is highly encouraged to analyse, review, and discuss this data before determining the type of work needed for each project.

This data can be requested through the SAT Pavement Data Request Form by selecting the "Other" option and specifying that a Scoping Aid Tool Analysis is desired. **Appendix F** shows an example of how the data is presented in this tool.Provide Alternate Pavement Designs to promote competitive bidding when feasible. Perform both flexible and rigid pavement designs (for high and heavy volume roads) to identify adequate performance based on price, strategic importance, and maintenance concerns. Once a flexible and rigid pavement section is determined, perform a life cycle cost analysis (LCCA) over the design life for both design sections. LCCA provides a means to select the most economical and effective pavement type for the design life of the pavement. The LCCA should include capital costs to the District, such as initial construction and future maintenance costs.

Traffic Definitions

Low Volume Roadway (≤1,000,000 ESALs and ADT <5000): These are typically rural sections that consist of flex base and a seal coat (or thin bituminous layer).

Medium Volume Roadway (1,000,000 < ESALs < 5,000,000 and / or 5,000 < ADT < 10,000): These may be roadways with low ADT and high truck traffic to high ADT and high truck traffic.

High Volume Roadway (5,000,000 < ESALs < 30,000,000 and ADT > 10,000)

Heavy Volume Roadway (> 30,000,000 ESALs): ADT is not considered for this level of ESAL.

Project Analysis and Guidelines for All Traffic Volumes

<u>Existing Pavement Analysis</u>: Evaluate the condition of the existing pavement structure to identify extent and cause of problems and selection of pavement options (rehab, overlay, reconstruction, etc.).

- Identify if existing pavement is candidate for HMA overlay only
  - May require base repair areas
  - Review applicable PMIS Data, Field Verify with Maintenance/Area Office
  - Review project specifics (flood plain, rail, curb, etc.)
  - General Direction is
    - Shallow rutting/ride (3/4” to 2”): HMA overlay or mill/inlay
    - Frictional Improvements (3/4” to 1”): HMA overlay or OCST
  - ADT >10,000
- Identify if existing pavement is candidate for structural concrete overlay only
  - May require base repair areas
  - Requires cost analysis to compare to flexible option
  - Review project specifics (flood plain, rail, curb, etc.), applicable PMIS Data, Field Verify with Maintenance/Area Office
- If roadway to be reconstructed, identify if existing pavement will be reused for base or subbase layer. If recycled, scarify, reshape, stabilize if necessary and compact.
  - Reclamation Design Options: Cement, Lime, Emulsion, Foam Stabilized Base
    - Verify a minimum of 2 inches (2”) barrier of untreated existing base material remains
    - RAP content for a recycled base/subbase should not exceed 50% when stabilizing and not more than 20% if stabilization is not used
- New Flexible Base
  - Minimum of 4” (compacted) lifts
  - When base thickness exceeds 10”, consider stabilizing and decreasing the thickness
  - Type D Flexible Base is required, unless approved by the District Engineer

- Include subgrade proof roll to ensure weak areas are corrected prior to the placement of subsequent lifts.

- Prime Coat: Prime coat should always be specified for the base/subbase that is directly underneath the HMA, as they provide an increased level of safety to prevent debonding.
  - If traffic is not anticipated to be placed on the prime coat
    - Specify a cut-in emulsion 1” deep with MS-2 or CSS-1H at a rate of 0.30 gal/sy
    - Specify MC-30 or AE-P at a rate of 0.20 gal/sy
  - If traffic is anticipated to be placed on the prime coat (more than 1 day), utilize an inverted prime
    - RC-250 (0.20 gal/sy) with Type B, Grade 5 (140 SY/CY)
    - When using RC-250 for the inverted prime, allow 48 hours before placing any additional surfacing
- Seal Coat: Area Engineer may modify the oil and aggregate requirements as project permits. Reference Table 9 for additional information.
  - Typically, only applies to Lower Volume Roadways
  - Multiple Course Surface Treatment (typically two-course):
    - When placing surface treatment directly onto base place an inverted prime, followed by a two-course surface treatment with Grade 3 below a Grade 4. The two-course surface treatment will provide a more durable surface course and ensure adequate bond to the base material / prime.
    - If the first course will anticipate direct traffic for longer periods of time (more than 2 day), utilize an AC with pre-coated rock. If the first course will not encounter direct traffic, uncoated rock with an emulsion may be specified to allow for economic benefits.
    - Three-course surface treatments are to be considered when there are long delays (such as seasonal events) in construction, or additional durability is needed.
  - Underseal
    - Use AC asphalts with pre-coated aggregate, and Emulsions with un-coated aggregate
    - See **Appendix D** for examples on when to use an Underseal layer

- Surface: HMA or Seal Coat. Refer to Table 9 and Table 10.
  - If heavy turning movements or stop and go traffic are anticipated (such as intersections or driveways), utilize HMA surface

Flexible Pavement Structural Design

Perform all flexible pavement designs in accordance to the latest version of the Department’s Pavement Manual. If the traffic and soil conditions vary, this may require segmenting the roadway and performing multiple designs. All designs must be developed in the most cost effective method while meeting all design requirements. The latest applications, materials and methods will be used to improve the design and construction process.

FPS 21 Design Parameters

- Table 5 below provides all the default input values for the San Antonio District
- Traffic data: The 20-yr 18 kip ESAL value supplied in the TP&P needs to be adjusted accordingly as per the Lane Distribution Factor table shown below. These factors may be applied when at least three lanes exist in the design direction

# Lanes in One Direction	Correction Factor Applied to 20-year ESALs
2	Use 100%
3	Use 70%
4 or more	Use 60%

- If TP&P data is outdated, obtain the traffic projection adjustment spreadsheet from the DPE.

Table 5 –FPS-21 Design Parameters

Parameter	Condition	Suggested Value
Initial SI	Surface Treatment	4.0
	Thin HMA (1.5 inches to 4 inches)	4.5
	Thick HMA (greater than 4 inches)	4.8
Final SI	< 1 M ESALs	2.0
	≥ 1 M to < 5 M ESALs	2.5
	≥ 5 M ESALs	3.0 for HMA Thickness ≥ 4” All else: 2.5
SI After Overlay	Overlay Thickness < 3” HMA	4.2
	Overlay Thickness ≥ 3” HMA	4.5
Confidence Level	All designs	C (95%)
District Temperature Constant	All	31
Swelling Potential, PVR, Swelling Rate	High PI Soils	0

Design Type

Select the appropriate design type as prescribed in the Department's Pavement Manual. When using a gap-graded or open graded surface mixture (SMA, TOM or PFC), an impermeable dense graded TY D intermediate layer must be used directly beneath these types of surface mixtures with a minimum layer thickness of 1.5 inches.

FPS 21 Material Parameters

Table 6 provides the material parameters which apply to locally available materials to the San Antonio District.

Modified Texas Triaxial Design Check

The Modified Texas Triaxial Design Check (MTTC) must be performed as specified in the Pavement Manual in Chapter 5, Section 3.

The Average Ten Heaviest Wheel Loads Daily (ATHWLD), and the percentage of tandem axles in the ATHWLD are provided in the TP&P Traffic Analysis for Highway Design report.

- For sections in the Energy Sector Corridor area (Atascosa County, McMullen County, Frio County, and South Easter half of Wilson County) utilize ATHWLD of 15,000 lbs. For these Energy Sector Corridors, discuss the percentage of tandem axles input with the District Pavement Engineer.

To reference the Texas Triaxial Class for the subgrade on the project utilize Option 2 to determine the Texas Triaxial Class (TTC) based on the plasticity index (PI) representative of the pavement location. Estimate the TTC based on the project controlling soil type. By selecting option 3, an internal database query will reveal average TTC values for predominant soil types within the project county. Select the project controlling soil type and the corresponding TTC value from the database will be placed in the TTC field

Perpetual Pavement Design

Traffic in excess of 30,000,000 ESALs will meet perpetual pavement design requirements, if standard FPS design yields greater than 10" of total HMA. Reference Chapter 5 of TxDOT's Pavement Design Manual.

- In FPS-21 it is recommended that a pavement design Type 7 be used for this type of structure since perpetual pavement typically have more than 4 unique layers (i.e. SMA over Dense Graded HMA over CAM over flexible base).
- Select a 30-year analysis period. The analysis period will not be critical, since staying reasonably below the limiting strain criteria is the ultimate goal.
- Set FPS-21 confidence level to "C" (95%). This is not tied to the limiting strain criteria, but is useful to ensure a reasonable beginning thickness.
- Use lane distribution factors when three or more lanes are planned in one direction. Adjust the 20-year cumulative ESALs if needed with the appropriate factor, then enter adjusted 20-year ESALs into FPS-21

- Select 15 years to first overlay. This will usually allow development of a sufficient structure to meet the limiting strain criteria and still ensure a reasonable reliability. The actual overlay will typically mimic needs to mitigate surface wear, oxidation, top-down cracking, etc…
- Once a pavement thickness is identified in the FPS run, click on the Mechanistic Check feature. This should show the limiting strain criteria to ensure threshold values are being met for bottom-up fatigue cracking and compressive failure of the subgrade (rutting).

Mechanistic Design Check

The Mechanistic Check will be evaluated for High Volume roadway pavement designs, perpetual pavement designs and pavements with HMA > 10 inches to ensure the new pavement structure will resist long-term rutting and fatigue cracking for the design life of the pavement. While the FPS design may yield varying levels of expected design life, the strain analysis and the Modified Triaxial Check will determine the actual thickness requirements. The following levels for the Mechanistic Check must be met:

- Tensile strain at the bottom of the composite HMA layers must be less than or equal to70 μ-strain
- Compressive strain at the top of the subgrade must be less than or equal to 200 μ-strain.
- Note the Mechanistic Check may provide a negative value for the subgrade compressive strain, consider all values to be a positive number.

Table 6 –FPS-21 Material Parameters

Material Type	2024 Specification	Design Modulus	Poisson's Ratio
Surface Treatment	Item 316	250 ksi	0.35
Limestone Rock Asphalt Pavement	Item 330	250 ksi	0.35
Hot-Mix Cold Laid ACP	Item 334	350 ksi	0.35
Dense-Graded Hot (Warm) Mix Asphalt	Item 341	Combined HMA Thickness: ≤4" use 500 ksi, 4"<T≤8" use 650 ksi, >8" use 850	0.35
Permeable Friction Course (PFC)	Item 342	300 ksi	0.35
Thin Overlay Mixtures (TOM)	Item 347	TOM-C: 650 ksi TOM-F: 500 ksi	0.35
Superpave Mixtures	Item 344	Combined HMA Thickness: ≤4.0" use 650 ksi, 4"<T≤ 6"use 750 ksi >6.0" use 850 ksi	0.35
*Thin Bonded Wearing Course	Item 348	TBWC-C: 650 ksi	0.35
Stone-Matrix Asphalt (SMA)	Item 346	Combined HMA Thickness: ≤4.0" use 650 ksi, 4"<T≤ 6"use 750 ksi >6.0" use 850 ksi	0.35
Asphalt Treatment (Base)	Item 292	400 ksi	0.35
In-Place Emulsified Asphalt Treatment (Base)	Item 290	230 ksi	0.35
In-Place Foamed Asphalt Treatment (Base)	Item 291	230 ksi	0.35
Flexible Base	Item 247	50 ksi For placement on untreated subgrade, use 3 times the modulus of the subgrade. Whichever is less.	0.35
Lime Stabilized Base	Item 260	65 ksi	0.30-0.35
Cement Stabilized Base	Item 275, 276	130 ksi	0.25-0.3
Lime Stabilized Subgrade	Item 260	3 times the modulus of the subgrade	0.3
Cement Stabilized Subgrade	Item 275	40 ksi	0.3
Emulsified Asphalt Treatment (Subgrade)	Item 314, Various Special Specifications	20 ksi	0.35
Natural Subgrade	Existing	Back-Calculated. Value should not be larger than 25 ksi.	0.35-0.45

* UTBWC will only be used when FPS21 predicts an overlay of less than 2 inches.

* For full depth HMA, use half of the corresponding "T" design modulus for the first lift.

*Underseal shouldn't be included as a layer in the FPS21 design.

Rigid Pavement Structural Design

Perform all rigid pavement designs in accordance to the latest version of the Department's Pavement Manual. If the traffic and soil conditions vary, this will require segmenting the roadway and performing multiple designs. All designs must be developed in the most cost effective method while meeting all design requirements. The latest applications, materials and methods will be used to improve the design and construction process.

Concrete Thickness Design

- For new rigid pavement designs, utilize the latest approved design methods, TxCRCP-ME for CRCP, and AASHTO DARWin 3.1 for JCP.
- Minimum concrete thickness will be 7", maximum concrete thickness will be 13". Thicknesses outside of this range will need District Engineer approval.
- The latest version of the following TxDOT pavement-related standards should be included in the pavement design report where applicable.
  - CRCP (1) – Continuously Reinforced Concrete Pavement, One-Layer Steel Bar Placement – applies to CRCP that is from 7 to 13 in. thick.
  - CRCP (2) – Continuously Reinforced Concrete Pavement, Two-Layer Steel Bar Placement – applies to CRCP that is from 14 to 15 in. thick.
- Subgrade – Construct or stabilize the existing subgrade so that it provides a stable working platform for the concrete pavement structure. When there are potential problems associated with stabilization, other options may be considered.
- Base –The following base layer combinations for concrete slab support are allowed:
  - 4 inches of HMA, Type B PG 64-22 (with QC/QA) should be used as the District standard, with subgrade stabilization as needed.
  - 1.5 inches minimum of HMA bond breaker (Ty D or TY F level up, PG64-22 (non QC/QA) over 6 inches of a cement treated base (Item 276 (Cement Treatment (Plant-Mixed), Class L) may be allowed with justification and documentation as determined by the DPE

Table 7 – DARWin Material Parameters

Parameter	Input	Comment
28 – Day Concrete Modulus of Rupture (MOR), psi	620 psi	All CRCP and JCP
Effective Modulus of Subgrade Reaction (k), pci	300 pci	Subbase = 4” HMA or 6” CTB + 1.5” HMA
	300	All designs
Reliability, %	90%	≤ 5 M ESALs
	95%	> 5 M ESALs
Load Transfer Coefficient, (J)	2.9	JCP with tied concrete shoulder
28 – Day Concrete Elastic Modulus, psi	5,000,000	All CRCP and JCP
Serviceability Indices	Initial: 4.5	All CRCP and JCP
	Terminal: 2.5	
	Difference: 2.0	
Overall Standard Deviation	0.39	All CRCP and JCP
Drainage Coefficient (DC)	DC = -0.005 * Annual Rainfall (inches) + 1.2	All CRCP and JCP; Typically range for San Antonio District is 1.01 – 1.05; Default Value is 1.02
Design Life	30 Years	

Table 8 – TxCRCP-ME Material Parameters

Parameter	Input	Comment
Design Life (year)	30	A performance period other than 30 yr. may be utilized with justification
Number of Punchouts per Mile	10	
28-day Modulus of Rapture (Mr), psi	570	Only for CRCP designs
Modulus of Base Layer (ksi)	400	a) Base = 4” HMA
	500	b) Base = 6” CTB + 1.5" HMA

Widening or Turn Lanes

Before proceeding to design a widened section greater than 500 feet, the condition of the existing travel lanes must be considered before building new adjacent pavement. If the existing travel lanes are in poor condition and require extensive repair and level-up, cost analyses have shown it is as economical to reconstruct and widen the full width pavement when looking at a life cycle cost. The initial construction may be approximately 20% higher, but the future reduction in maintenance cost benefit will exceed this expense in initial construction costs.

Use of dissimilar cross sections between the widened area and the existing area should not be performed, as it often results in lateral subsurface drainage restrictions ("bath tub" effect). While not feasible to never allow, the new section should never have an impermeable layer that is more than 2" below the existing (see Figure 2).

If the existing travel lane condition is in good structural condition for the projected 20-year service life or there are budgetary constraints preventing full width reconstruction and widening, then the pavement design process for widening falls into two categories.

Value engineering is recommended for this projects, for which Area Office, designers, consultant and DPE need to be in the meeting.

Safety Widening (≤ 3 feet)

Historically, full depth HMA sections have been utilized to construct narrow pavement width, as it is difficult to construct unbound layers or flexible base in these narrow areas. Full depth HMA is acceptable as long as the following criteria and constraints are adhered to:

- Determine the existing section of the adjacent pavement structure.
- For non-trafficked safety widening (such as shoulder widening), a pavement design is not required. Match the existing section. Consider future use of roadway to ensure existing shoulder will not be a future trafficked lane.
- Do not design a HMA thickness thicker than the total thickness of the adjacent pavement structure. The goal is to daylight the bottom of the base course of the adjacent pavement to maintain positive drainage.
- Include a "stair-step" approach at the widening joints to minimize longitudinal joint cracks or failures. This should be shown on the typical sections. Refer to **Appendix D** for examples.
- Mill, notch and tie into the adjacent pavement to place the construction joint in between the wheel paths. This will prevent longitudinal cracking along the construction joint and water infiltration into the pavement. It will also promote proper load transfer across this joint.
- Overlay or seal coat the full width of the final pavement structure. When overlaying, utilize an underseal course prior to overlaying to assure all construction joints and pre-existing cracks are sealed.

Additional Pavement (> 3 feet)

Perform the following steps when designing a notch widened section for additional pavement width:

1. Determine the existing section of the adjacent pavement structure. When constructing additional pavement (whether a shoulder and/or additional travel lanes), utilize the existing pavement material when possible.
2. Determine if the existing pavement section is structurally sufficient by performing an FPS 21 design. Falling Weight Deflectometer (FWD) should be used to evaluate the adequacy of any existing structure.
3. If the existing section is structurally sufficient for the projected 20-year traffic, then match the adjacent pavement section, if economical. For thicker existing pavements, optimize the widened section by reducing the section or use strong materials and still meet all FPS 21 requirements for 20-year traffic.
4. If the existing section is not structurally sufficient for projected 20-year traffic and the subgrade soil is expansive (PI > 25), the following can be done to improve structural capacity:
   a. Reclaim a portion of the existing pavement and construct a cement stabilized subbase (CSS) with this road-mix to the final subgrade width. (Minimum CSS of 6”)
   b. Microcrack CSS according to specifications in Item 275.
   c. When the subgrade has a plasticity index (PI) greater than 25, place geogrid (TY II) reinforcement on top of the cement stabilized road-mix subbase.
   d. Construct a flexible pavement on top of this reinforced or stabilized subbase using a combination of HMA and flexible base.
5. If the existing section is not structurally sufficient for projected 20-year traffic and the subgrade soil is non-expansive (PI ≤ 25), the following can be done to improve structural capacity:
   a. Reclaim a portion of the existing pavement and construct a cement stabilized subbase (CSS) with this road-mix to the final subgrade width. (Minimum CSS of 6”)
   b. Microcrack CSS according to specifications in Item 275.
   c. Construct a flexible pavement on top of this reinforced or stabilized subbase using a combination of HMA and flexible base.
6. Mill, notch and tie into the adjacent pavement where the construction joint is between the wheel paths. This will prevent longitudinal cracking along the construction joint and water infiltration of into pavement. It will also promote proper load transfer across this joint.
7. Overlay or seal coat the full width of the final pavement structure. When overlaying, utilize an underseal course prior to overlaying to assure all construction joints and pre-existing cracks are sealed.
   Include a “stair-step” approach at the widening joints to minimize longitudinal joint cracks or failures. This should be shown on the typical sections. Refer to **Appendix D** for examples.

Figure 1 – Unbound Base Section

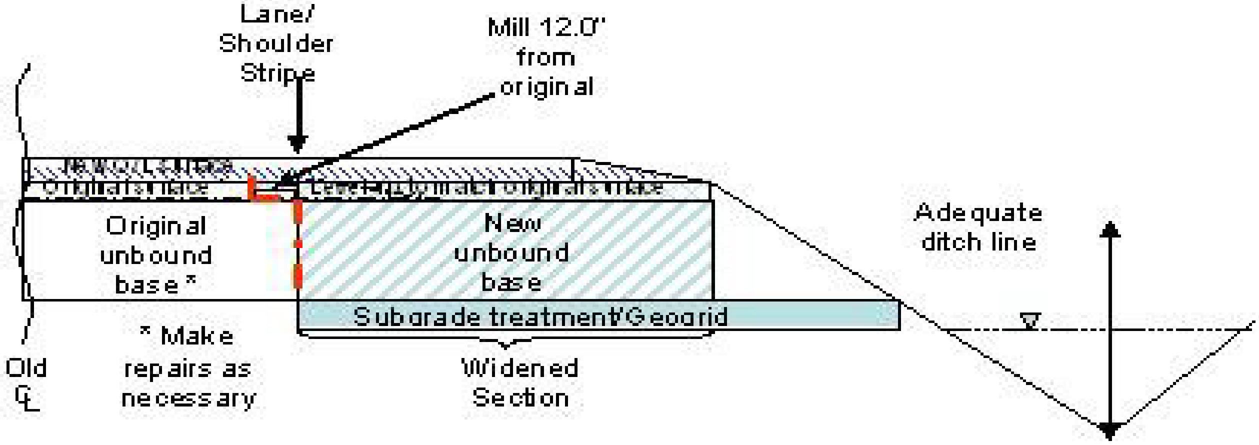
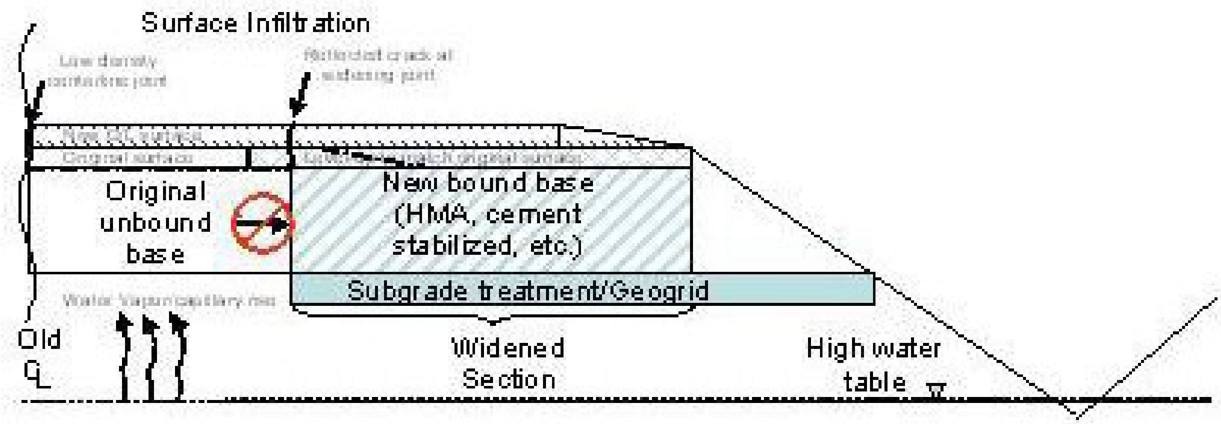


Figure 2 – In-pavement Moisture Accumulation



8. Widening longitudinal joints should not be on the proposed wheelpath, use table below to determine how much of existing pavement structure needs to be saw cut to avoid the proposed wheelpath locations.

Typical Wheel Path Locations

Lane width ft.	cl	ft	WP ft	ft	WP ft	ft	edge line
9		0	3	2	3	1	
10		1	3	2	3	1	
11		1.33	3	2	3	1.66	
12		1.66	3	2.7	3	1.7	
13		2.3	3	2.7	3	2	

Special Cases

Detours

- FPS design is required for all detours.
- Utilize 20-year traffic information and typical serviceability inputs from the main travel lanes
- For detours expected for use less than 2 years
  - Set “Length of analysis period” (T1) to 2 years and “Time to first overlay” (T2) to 2 years. Verify overlay at T2 does not exceed 2 inches.
  - Perform Modified Triaxial Check
    - Set the tandem axle multiplier to less than 50%
- For detours expected for more than 2 years
  - Set “Length of analysis period” (T1) to expected detour usage plus one year (Minimum 4 years) “Time to first overlay” (T2) to half of the required usage time (Minimum 2 years).
  - Perform Modified Triaxial Check
    - Set the tandem axle multiplier to less than 50%

Shoulders

- Obtain pavement forensic data (GPR, FWD, bores) on existing shoulders that will be utilized for detours during construction
- Use above “Detour” guidance for FPS design analysis
- Include a Remaining Life Analysis to verify pavement design

Ramps

- FPS design is required. Use the frontage road traffic if ramp traffic data is not available, with the pavement starting at the back of the gore. If the designer identifies additional traffic is being placed on the ramp, traffic adjustments may be allowed.

Intersections – Depending on traffic, turning movements, and time to open the following options may be utilized:

- If rutting and shoving in asphalt pavement continue to cause problems, then a more rigid surface option may be selected. Be aware that this will typically call for a minimum of 8” of concrete or 4” of concrete and 4” of HMA.

- If Trucks per Day per Lane is less than 1,000 Thin Whitetopping may be selected. Design in accordance with TxDOT's current Pavement Design Manual Standards for Whitetopping.
- Rigid pavement options, using High Early Strength (HES) concrete may be utilized for early opening to traffic.
- Otherwise use stiff surface mixes for heavier traffic (do not use surface treatments or open graded mixes in these areas).

Bridge Decks – When the decision is made to utilize an asphaltic protection system for a Bridge Deck, the preferred option is to utilize a one course surface treatment and a SMA or SP overlay (other impermeable HMA mixtures may be substituted). The overlay and one course surface treatment will ensure adequate bond and seal of the deck. Use of a PFC, TBPFC, or other permeable materials is not considered appropriate for this application because of future corrosion of header joints. In lieu of utilizing a one course surface treatment, special consideration may be allowed to utilize a spray applied underseal membrane, upon approval of the DCC and District Bridge Engineer.

Change Orders

Changes to the approved pavement design will require a signed and sealed revised pavement design report.

Item 585

8/11/04 TxDOT - Construction Division Flexible Pavements Branch

This document is provided for information only and is not to be used for bidding or contract purposes.

Guidance Document for:

Item 585

Ride Quality for Pavement Surfaces

General. This guidance document is provided to assist TxDOT engineers in specifying the appropriate ride quality requirements. These guidelines should not be viewed as Department Policy nor should they be used in lieu of engineering judgment. The 2004 version of Item 585 contains a number significant changes compared to previous ride quality specifications. Item 585 should be reviewed carefully before consulting this guidance document.

Select the Pay Adjustment Schedule for Surface Test Type B (inertial profiler) based on what is achievable using engineering judgement. Select the appropriate "Pay Adjustment Schedule" using the following guidelines. For further assistance, please contact the Construction Division.

1. Item 585 includes provisions for Surface Test Type B with Pay Adjustment Schedule 3 as the default. **General notes or display on typical sections are required to change the Pay Adjustment Schedule** or

use Surface Test Type A. It is strongly advised that the designer show on the plans which pay schedule they wish to use rather than rely on the default conditions listed above. You must use a general note if you want to use surface Test Type B on **Service Roads and Ramps or Short Projects (less the 2,500 ft.).** In addition, any areas that you wish to designate as **Leave-out Sections** (such as driveways, intersections, etc), must be shown on the plans. These "Leave-out Sections" will be evaluated with Surface Test Type "A" rather than Surface Test Type "B".

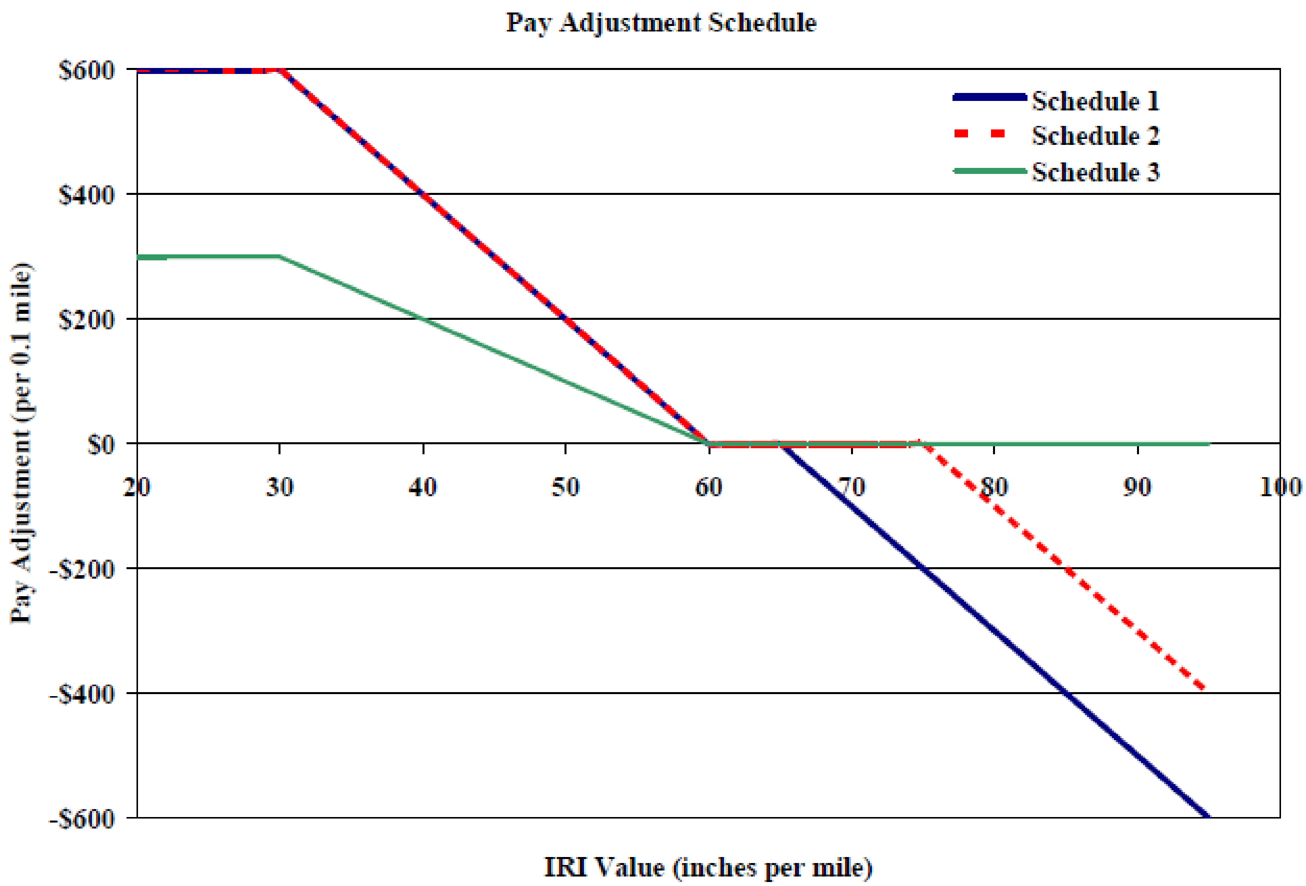
2. Use engineering judgment and the guidelines in Table 1 to determine the appropriate "Pay Adjustment Schedule" (1, 2, or 3) to be used for the project. When making this selection, take into account the **existing condition (roughness) of the pavement, previous experiences on similar projects, the ability of a contractor to improve the existing ride with the number of smoothness opportunities specified, and the need for higher ride quality**. Note that Table 1 does not cover all possible construction scenarios.
3. As a general rule, the roughness (IRI value) can be reduced approximately 50% with each lift of hot mix; however, there is a point of diminishing returns once the IRI values get below 60. Typically, an IRI value less than 60 is considered excellent and an IRI greater than 95 requires corrective action. Note that the most recent international roughness index (IRI) values are stored in the Department's Pavement Management Information System (PMIS) database. It is recommended that these values be obtained early in the decision making process.
4. The pay adjustment schedules listed in Item 585 are shown graphically in Figure 1.
5. Smoothness opportunity definition: A smoothness opportunity is defined as a continuous level-up regardless of the thickness, a specified lift of 1.0 inches or more of asphaltic concrete pavement, in place recycling, and grading for base courses. Spot level-ups, milling operations, and seal coats, will not be considered as a smoothness opportunity. Mill and fill operations that require matching the existing pavement are not considered to be a smoothness opportunity.
6. Please note that diamond grinding is the default method (on both flexible and rigid pavements) for removing localized roughness (bumps and dips). There are several exceptions to the requirement for diamond grinding. These exceptions are spelled out in detail in Item 585.
7. In some cases where only a single lift of hot mix is specified, it may be advantageous to diamond grind some of the larger bumps and dips prior to the hot mix overlay. In such cases, diamond grinding should be set up as a separate bid item and the roadway should be profiled in advance to identify the existing bumps. Note that diamond grinding is an effective method of removing bumps yet somewhat less effective at removing dips.
8. On projects that have 3 or more lifts of hot mix, the designer should consider adding a plan note requiring that the contractor (at his own expense) be required to profile the pavement and diamond grind areas of localized roughness prior to placing the final lift of hot mix.

Table 1: Guidance for Selecting Pay Adjustments Schedule

<table>
<tr><th colspan="4">Project Description</th><th>Recommended Pay Adjustment Schedule</th></tr>
<tr><td rowspan="3">New Construction or Major Rehabilitation (IH , US, Multilane divided highways)</td><td rowspan="2">Rigid Pavements</td><td colspan="2">CRCP</td><td>2</td></tr>
<tr><td colspan="2">JCP</td><td>3</td></tr>
<tr><td colspan="3">Flexible Pavements with a total HMA thickness > 1.5”</td><td>1</td></tr>
<tr><td rowspan="7">Overlays or Minor Rehabilitation</td><td colspan="3">Rigid Pavements
(bonded and unbonded concrete overlay)</td><td>3</td></tr>
<tr><td colspan="3">Flexible Pavements with total HMA thickness < 1.5” such as an overlay with a Permeable Friction Course (PFC). Note that in some cases Surface Test Type “A” may be more appropriate for this application.</td><td>3*</td></tr>
<tr><td rowspan="5">Flexible Pavements Total HMA thickness > 1.5”</td><td colspan="2">All roads with posted speed < 45MPH</td><td>3*</td></tr>
<tr><td rowspan="2">When there are 2 or more smoothness opportunities</td><td>All highway classifications other than 2-lane undivided</td><td>1*</td></tr>
<tr><td>2-lane undivided highways</td><td>2*</td></tr>
<tr><td rowspan="2">When there is only 1 smoothness opportunity</td><td>All highway classifications other than 2-lane undivided</td><td>2*</td></tr>
<tr><td>2-lane undivided highways</td><td>3*</td></tr>
</table>

* It may be appropriate to increase or decrease this number depending on the ride quality of the existing pavement. For example: if the ride quality of the existing pavement is poor (IRI > 170), it may be appropriate to increase this number if applicable. Conversely, it may be appropriate to decrease this number if applicable and if the ride quality of the existing pavement is good (IRI< 95).

Figure 1: Graphical Illustration of Pay Adjustment Schedules



Surface Aggregate Classification (SAC) Selection

Subsurface aggregate will not be given a SAC unless approved by the DPE. For all surface HMA layers, select the SAC in accordance with the San Antonio Surface Aggregate Selection Policy, Ricardo Castaneda February 21, 2012. HMA selection will begin with Form 2088, the DPE, DCC Committee or Area Engineer may modify selected material as needed.

MEMORANDUM

Texas Department of Transportation

TO: Area Engineers — February 21, 2012

FROM: Ricardo Castañeda, P.E.
Gina Gallegos, P.E.

SUBJECT: San Antonio Surface Aggregate Selection Policy

This Memorandum supersedes previous guidance issued on March 24, 2004. The San Antonio District has an abundance of high quality aggregates that can be used in hot mix and concrete. Our district sends large quantities of these aggregates to less fortunate districts. Our largest volume of quality aggregates are Class B aggregates. We need to continue taking advantage of this great supply of high quality Class B aggregate, however recent roadways have shown early signs of polishing on high volume roadways. With this in mind the following is the new San Antonio District Policy for the selection of surface aggregates:

- Use the surface Aggregate Selection Form as a starting point.
- Use Class A aggregate on the following roadways:
  - ALL Interstate highway mainlanes in Bexar County
  - US, SH's in Bexar County with an ADT > 30,000
  - Interstate highway mainlanes outside Bexar County with an ADT > 30,000
- All other roadways not covered above shall default to Class B aggregate if there ends up being a choice between Class A or B aggregates after using the selection form.
- The selection of aggregate types that are more restrictive then Class A aggregates, such as aggregates with an LA abrasion loss value of 15 or less, must be approved in advance by the Director of Construction.

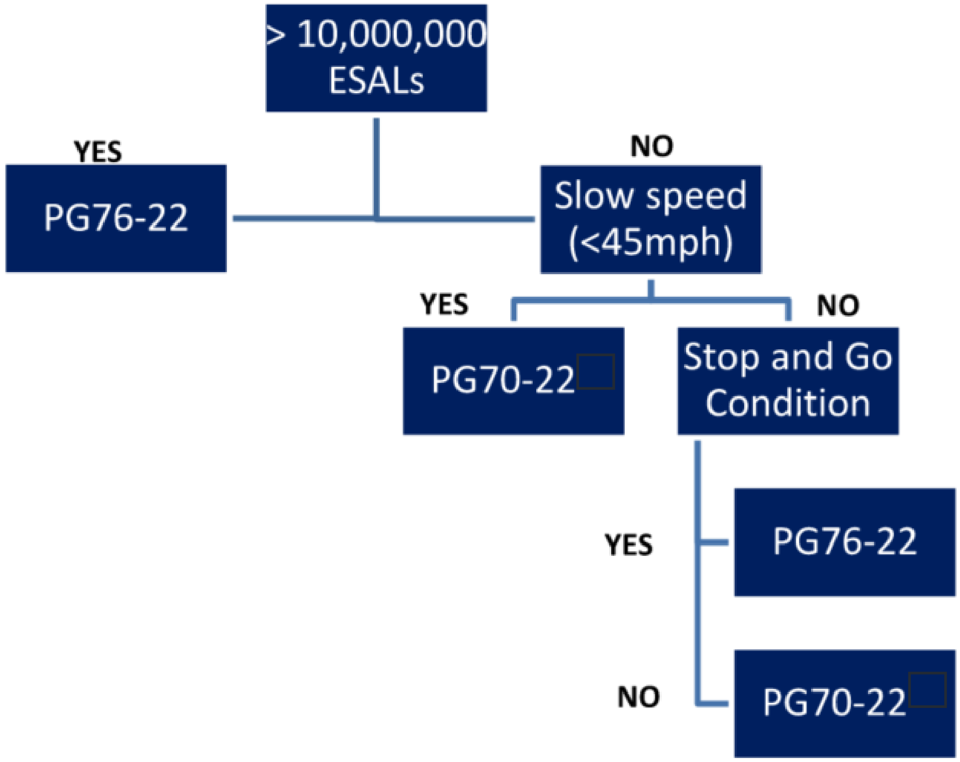
If you should have any questions concerning this policy please give contact us.

Gina Gallegos, P.E. — Ricardo Castañeda, P.E.

cc: Marion G. Medina, P.E.
Julia Brown, P.E.
Clay Smith, P.E.
Gregg Granato, P.E.
Dan Stacks, P.E.
John Bohuslav, P.E.
Ken Davenport, P.E.
Patrick Downey, P.E.

HMA Binder Selection

The Performance Grade (PG) of the HMA surface layer will be determined based on the flow chart shown below.



All HMA layers below 2 inches of the surface shall use PG64-22 unless otherwise approved by the District Pavement Engineer.

Table 9 – Seal Coat Table

Traffic (ADT)	Placement Weather*	Asphalt / Oil / Emulsion	Oil Rate (gal/sy)	Aggregate	Aggregate Rate (sy/cy)	Comment
≤ 750 Low Volume Roadways	Cold (50F<Temp<70F)	CRS-2 or Inverted Prime (See Notes)	0.48	Grade 3 Final Surface: Type B, SAC-B[1] 1st Course: Type B	105	Use Grade 3 if addressing flushing lanes or planning to cover with 2CST or re-seal within 2 years
			0.42	Grade 4 Final Surface: Type B, SAC-B[1] 1st Course: Type B	120	Use Grade 4 for longer durability, quieter surface and surface of 2CST
	Hot / Warm (Temp>70F)	AC: AC-15P, AC-10-2TR Emulsion: CRS-2P, CHFRS-2P	AC: 0.34 Emulsion: 0.48	Grade 3 Final Surface: Type PB, SAC-B[1] 1st Course: Type PB	105	Use Grade 3 if addressing flushing lanes or planning to cover with 2CST or reseal within 2 years
			AC: 0.30 Emulsion: 0.42	Grade 4 Final Surface: Type PB, SAC-B[1] 1st Course: Type PB	120	Use Grade 4 for longer durability, quieter surface and surface of 2CST
750 < ADT ≤ 2000 Moderate Volume Roadways	Cold (50F<Temp<70F)	CRS-2 or Inverted Prime (See Notes)	0.48	Grade 3 Final Surface: Type D, SAC-B[1] 1st Course: Type B	105	Use Grade 3 if addressing flushing lanes or planning to cover with 2CST or reseal within 2 years
			0.42	Grade 4 Final Surface: Type D, SAC-B[1] 1st Course: Type B	120	Use Grade 4 for longer durability, quieter surface and surface of 2CST
	Hot / Warm (Temp>70F)	AC-15P, AC-20-5TR, AC-20XP	0.34	Grade 3 Final Surface: Type PD, SAC-B[1] 1st Course: Type PB	105	Use Grade 3 if addressing flushing lanes or planning to cover with 2CST or reseal within 2 years
			0.30	Grade 4 Final Surface: Type PD, SAC-B[1] 1st Course: Type PB	120	Use Grade 4 for longer durability, quieter surface and surface of 2CST
> 2000 Heavy Volume Roadways	Cold (50F<Temp<70F)	CRS-2 or Inverted Prime (See Notes)	0.48	Grade 3 Final Surface: Type D, SAC-B[1] 1st Course: Type B	105	Use Grade 3 if addressing flushing lanes or planning to cover with 2CST or reseal within 2 years
			0.42	Grade 4 Final Surface: Type D, SAC-B[1] 1st Course: Type B	120	Use Grade 4 for longer durability, quieter surface and surface of 2CST

	Hot / Warm (Temp>70F)	A-R Type II, A-R Type III, AC-15P, AC-20-5TR, AC-15P, AC-20XP	AR: 0.50	Grade 3 Final Surface: Type PD, SAC-B[1]	105	Use Grade 3 with AR for longer durability. AR is also option for sealing existing cracks that are less than ¼" wide, structural integrity should be intact.
			AC: 0.30	Grade 4 Final Surface: Type PD, SAC-B[1]	120	Use Grade 4 for quieter surface or to address aggregate from spraying on vehicles
Underseal (SS 3006)	Cold (50F<Temp<70F)	CRS-2, CHFRS-2P	0.35	Grade 4 Type B	120	Use Underseal course prior placing a new surface lift of HMA over existing pavement if: -Notch and widen projects -Existing surface cracks deeper than 1" or wider than ¼". Milled surfaces with visible cracking. -PFC and SMA overlays Underseal may be waived if 4" below the surface with approval from DPE.
	Hot / Warm (Temp>70F)	AC-15P, AC-20-5TR, AC-20XP, AC-10-2TR	0.27	Grade 4 Type PB		
	Spray Applied Underseal Membrane		0.30	N/A	N/A	
	TRAIL – Hot Asphalt		0.17	N/A	N/A	
Inverted Prime (Item 316)	Temp>50F	RC-250	0.20	Grade 5 Type B	140	Allow 48 hours before placing any additional surfacing to allow volatiles to evaporate.
Bonding Course (SS 3007)	TRAIL – Emulsified Asphalt		0.12	N/A	N/A	Use bonding course in between HMA lifts and/or before placing surface HMA layer if below HMA layer is new or existing without cracks.
	TRAIL – Hot Asphalt		0.12	N/A	N/A	
	Spray Applied Underseal Membrane		0.15	N/A	N/A	
Prime Coat (Item 310)	Hot / Warm (Temp>70F)	MC-30, AE-P	0.20	N/A	N/A	MC-30 or AE-P is the preferred application. If Emulsion is environmentally preferred, cut in the CSS-1H or MS-2 to a depth of 1 inch (Item 314).
	Cold (50F<Temp<70F)	CSS-1H, MS-2	0.30	N/A	N/A	

1 – Only the final riding surface may be specified as SAC-B. Refer to Form 2088 for SAC Classification

*Note: Cold temperature binders should typically not be specified in the plans. Most construction activities will plan to be constructed in warmer applications. However, when specifying a multi-course surface treatment, it will assist contractor to have an emulsion option for the first/second course to speed construction, but final course will be AC. If AC and Emulsion options are both provided, use emulsion rate for Estimate determination.

2 – If constructing a seal coat directly on flexible base, an inverted prime with Grade 5 TY B aggregate must be used prior to the planned OCST, TCST, etc.

3 – Bonding Course to be used instead of tack coat in between HMA lifts to provide better bonding material and minimize the use of multiple item bid codes during the development of plan sets.

Table 10 – Hot Mix Asphalt Surface Table

Surface Mixture	Lift Thickness	ADT	% Truck	ESALs (20 Year)	Speed	Estimating Rate	Pavement & Traffic Considerations
Item 316, Seal Coat	—	< 10,000	< 10%	≤ 1.0 Million	> 40 mph	Refer to Seal Coat Table (Table 9)	• Pavement must be structurally sound • Ideal for 2R FM roadways or low volume / truck traffic US or SH roadways • Optimal for roadways with steep grades and horizontal curves • May require level-up course prior to placement in order to obtain good drainage and ride quality • Do not use on Urban sections with turning or stopping motions, such as intersections, short radius exit ramps, turnouts, etc. as seal coats are not resistant to high shearing force • Do not use on roadways with curb and gutter • Do not use on roadways with heavy truck traffic
Item 350, Microsurfacing	—	—	—	—	All Speeds	25 lb/sy	• Used best when Chip Seal is NOT the best choice for the location, provided there is non-distressed HMA on the riding surface • To address rutting in the wheel paths • To correct ride due to aggregate loss from a previous seal coat, minor rutting or rough patching. • When an existing surface that is "flushed" of "bleeding". Don't add additional "free" asphalt to a "flushing" surface • Needs approval from District Pavement Engineer
Item 341, Dense-Graded (DG) Mixture	1.5" – 2.0"	≥ 8,000	< 10%	> 1.0 Million	≤ 40 mph	*115 lb/sy per inch	• Use on low speed highways • Can be used as a temporary surface course for phased construction • Do not use in areas with rapid deceleration or stopping motions
Item 342, Permeable Friction Course (PFC)	1.0" – 1.5" General rule of thumb: 0.5" per lane	≥ 25,000; <75,000	< 10%	≥ 4 million; < 30 million	≥50 mph	95 lbs/sy per inch Asphalt: 6.0% Aggregate: 94.0%	• Reduces Wet Weather Accidents • Underseal or spray paver underseal membrane is required underneath all PFC's • Optimal for roadways with steep grades, horizontal curves or limited site distance • Requires good cross slope for adequate positive drainage; may require level-up course prior to placement of PFC • Do not use on Urban sections with turning and stopping motions, roadway with curb and gutter or mill & inlay operations • PFC freezes faster than other mixtures and can cause deterioration • Although PFC can improve the quality of storm water runoff and reduce noise levels, it is not recommended to meet TCEQ requirements, as these properties may not be sustainable over the life of the surface course. • Do not place where a significant amount of hand work is necessary • Do not place directly on base or subgrade; requires at least a level up
Item 344, Superpave	1.25" - 2.5"	≥ 8,000; < 75,000	≥ 7%	> 1 million; < 30 million	All Speeds	*115 lb/sy per inch	• More gap-graded than Dense Graded mixtures, but not as widely gap-graded as SMA. Promotes stone on stone contact • Has more asphalt than DG mixtures makes it more crack resistant • Viable for all roadway classifications meeting the minimum traffic criteria • May require level-up course prior to placement in order to obtain good drainage and ride quality

Item 346, Stone Matrix Asphalt (SMA)	1.25" - 2.25"	≥ 75,000	≥ 10%	≥ 30 million	≥50 mph	*115 lb/sy per inch	• Primarily used as a surface mix for heavy volume and truck traffic roadways, such as Interstates • Often used as the intermediate layer when PFC is used as the surface layer • Ideal for roadways with both high-speed and stop and go traffic and heavy trucks • Difficult to compact and construct during cold weather
Item 347, Thin Overlay Mixtures (TOM) (Reference Table 11)	0.75" – 1.25"	≥ 8,000; < 75,000	≥ 7%	> 1 Million; < 30 Million	All Speeds	115 lbs/sy per inch Asphalt: 6.5% Aggregate: 93.5%	• Viable for all roadway classifications meeting the minimum traffic criteria • Requires good cross slope for adequate positive drainage • May require level-up course prior to placement in order to obtain good drainage and ride quality • Perform edge milling and / or micromilling in urban sections with curb and gutter • Use in combination with PFC in areas with turning motions combined with braking such as intersections, short radius exit ramps, turnouts, etc. • Designed with higher asphalt contents to provide increased resistance to cracking and uses durable aggregate to provide increased skid resistance • Utilize a trackless track instead of underseal to assist with better ride quality • Difficult to compact and construct during cold weather. • Pavement must be structurally sound
Item 348, Ultra Thin Bonded Hot Mix Wearing Course (Reference Table 11)	0.5" – 0.75"	≥ 8,000; < 5,000	≥ 7%	> 1 Million; < 30 Million	≥45 mph	115 lbs/sy per inch Asphalt: 5.0% Aggregate: 95.0%	• Produces a thin lift of gap-graded HMA with the application of a polymer modified emulsion membrane prior to the placement of the mix • Does not require an underseal • Utilized on roadways with posted speed limits of 45 mph and above • Designed with higher asphalt contents to provide increased resistance to cracking and uses durable aggregate to provide increased skid resistance • Due to thinness, should not be considered to address deep rutting or significant increase to structural capacity • Thinner lifts allow for lower yield and cheaper overall cost to dense graded mix options
Item 358, Hot In Place Recycling (HIR)	2.0"	≥ 8,000; < 75,000	≥ 7%	> 1 million; < 30 million	All Speeds	Rejuvenator: 0.25 gal/sy per inch	• Used to correct asphalt pavement surface distresses (cracking, roughness, lack of skid) • Requires a surface layer on top; verify flood plain elevation requirements • Must have at least 2" of HMA or concrete below the HIR layer for HIR train support • No more than 1 Seal Coat can be present in the HIR limits • No Grid can exist in the HIR layers • No Tire Rubber Asphalt can exist in the HIR layers • Must have at least 100,000 SY available for HIR process • Utilize GPR and borings to ensure moisture is not entrapped

***When thicknesses are less than 2.0", utilize 120 lb/sy-in to account for variable grade changes and anticipated overruns.**

Table 11 – Thin Surface Mixture Guidance

Criteria	When NOT to use Thin Surface Mix	Ok to use Thin Surface Mix
Visual Distress	• Rutting > 0.5” • Cracks wider than 3/8” • Areas of extensive, deep (>4”) patching (>20%) • More than 15% by area of the section has moderate to severe alligator cracking • Layer debonding • Existing surface has high air voids (i.e. PFC, CMHB, etc.) • Areas of severe bleeding / flushing (must be milled first) • More than 2 failures per mile	• Rutting ≤ 0.5” • Top-down cracking • Block Cracking • Less than 15% moderate fatigue cracking (with spot repair prior) • Longitudinal cracking in wheel path, shallow rutting • Overlay notch and widen sections • Ravelling • Highly Oxidized • Polishing (low skid)
Structural Condition	• FPS21 analysis predicts that an overlay of more than 2” is required • FWD deflection (d1) is greater than 25 mils	• FPS21 predicts an overlay of less than 2” • FWD deflection (d1) is less than 25 mils • Structural Condition Index (SCI) less than 0.7 (Reference TxDOT Research Project 0-4332)

Table 12 – HMA Surface Alternate Selection Table

Alternate No.	Mixture 1	Mixture 2	Mixture 3	Mixture 4	Mixture 5
1	PFC-76 with Underseal	PFC-AR with Underseal	TBWC-C, SAC-A	HIR	Underseal Grade 5 (150 sy/cy)
2	TBPFC-PG	TBPFC-AR	TOM-C, SAC-A (with Trackless Tack)	SP- D	Spray Applied Polymer Modified Emulsion Membrane

The standard PFC contains PG76-22 and fibers and can be used as an alternate to PFC-AR. PFC-AR is generally more expensive than the standard PFC, but PFC-AR is recommended when overlaying an existing concrete pavement, when a high degree of noise reduction is desired and when placed as an overlay on a pavement that has a high amount of cracking. PG76-22 has better permeability.

Flexible Base & Base Stabilization

Material Type Selection

Type A and Type D materials are considered high-quality base and are often used in combination with Grade 1-2, which has the most stringent material requirements. Type D allows the use of Type A or crushed concrete. This option provides an alternative where crushed concrete may be used if economically feasible. As a District Policy, specify Type D flexible base on all projects.

Material Grade Selection

Grade 1–2 base is intended for use with pavements providing low confinement or low lateral support, and for pavements experiencing moderate to high traffic. Low confinement typically exists in the following situations:

- Pavements with thin surfacing. Seal coat or thin hot-mix asphalt (HMA) placed directly on the base may be too thin and not provide adequate confinement to the base.
- Pavements with little or no shoulders. In this situation, the lack of shoulder provides no lateral support and the base may become unstable as vertical loads are applied. The base must rely on its own cohesion and stability.

Grade 1–2 is the only grade of base to include a requirement for an unconfined compressive strength from laboratory testing, unless it is specified on the plans or general notes for a Grade 4. The unconfined compressive strength provides an indication of how well the base material will perform when placed within a pavement structure with minimal or no confinement.

Grade 3 base material is generally *not recommended for base courses in pavement structures*. This grade of material is primarily used for subbase courses or maintenance uses, such as backfilling pavement edges, rehabilitation, or shoulder work.

Grade 4 (properties shown on the plans) presents the flexibility to customize a base specification to address unique pavement and material design situations, such as but not limited to the following:

- A designated special grade to be used by other items of work.
- Local materials.
- Experimental sections.
- Recycled materials.

Grade 5 base is a modification of a Grade 1–2 base and has most of its characteristics, except for the unconfined compressive strength requirement. Grade 5 base material allows the use of a harder aggregate with a lower fines content. Fines may be less cohesive than those found in Grade 1–2. Since the Grade 5 base has the potential to have non-cohesive fines but has strengths equivalent to a Grade 1—2 base when confined, a 3 psi lateral confinement is used for Grade 5 base requirements. The material that meets this specification may have difficulty providing its own stability; therefore, Grade 5 is recommended for situations where stability is provided by the pavement structure and roadway features, such as shoulders, thick surface course, or other material placed over the base. Unless Grade 5 base is used as a subbase under an appropriate base and with appropriate thickness, it is not recommended for high-traffic roadways with thin surfaces or for roadways with no shoulders.

Table 13 – Flexible Base Selection Table

Shoulder Width	HMA Surface Thickness	Traffic (Design ESALs)*	Base Grade
< 3 ft	Surface Treatment	< 500,000	1–2
		≥ 500,000	1–2
	HMA < 3 inches	All Traffic Levels	1–2
	HMA ≥ 3 inches	< 500,000	1–2 or 5
		> 500,000	1–2 or 5
> 3 ft	Surface Treatment	< 500,000	1–2 or 5
		> 500,000 and ≤ 3,000,000	1–2 or 5
		≥ 3,000,000	1–2
	HMA < 3 inches	< 500,000	1–2
		> 500,000	1–2
	HMA ≥ 3 inches	< 500,000	1–2 or 5
		> 500,000	1–2 or 5

* Percentage of heavy vehicles or trucks in addition to design ESALs should be taken into consideration.

San Antonio Typical Materials and Considerations

Description	2024 Bid Item
Flexible Base	TY D GR 1-2 or 5
Lime - Utilize this bid item to provide an option for the type of Lime to be used. There are two bid items that need to be included for Lime Stabilization work. This item is only for the Lime payment itself.	0260-7001, LIME (COM OR QK)(SLURRY) OR QK(DRY)
Prime Coat – Utilize this bid item to provide an option for the type of Prime Coat to be used	0310-7013, PRIME COAT (MC-30 OR AE-P)
Asphalt – To be used when specifying a Seal Coat Underseal.	0316-6419, ASPH (AC-15P, AC-20-5TR, AC-20XP)
Dense-Graded Hot-Mix Asphalt (Small Quantity) – If your project has less than 5,000 total production tons, use this Item	Item 341 (EXEMPT)
Dense-Graded Hot-Mix Asphalt – This item shall only be used for pavement sub-layers. Do not specify SS 3076 for Surface unless approved by the DPE.	Item 341
Superpave Mixtures – This is the default material to be used for Surface paving unless approved by the DPE.	Item 344
Superpave Mixtures – If utilizing PG 70-22, must include General Note as stated in SOP	Item 344
Underseal Course – This item should be used when widening or milling distressed HMA prior to surface mix.	SS3006
Bonding Course – This item should be used for full width reconstruction or new pavement areas prior to surface mix. Additionally, this item should be used in between every HMA lift.	SS3007

Duration / Update

This Standard Operating Procedure will remain in effect until revised or rescinded. Recommendations to modify or clarify this document should be submitted in writing to the Review Authority. This SOP must be updated when Department guidelines, specifications or special provisions referred to in this document are modified. As a minimum, this SOP will be updated annually on September 1.

DocuSigned by:
Charles Benavidez
3BB8A8580ACF41C...

Charles Benavidez, PE
San Antonio District Engineer

2/28/2025

Approval Date

Appendix A
Pavement Design Concept Conference (PDCC) Agenda

Texas Department of Transportation

PAVEMENT DESIGN CONCEPT CONFERENCE AGENDA

CSJ	
HIGHWAY	
LIMITS	
COUNTY	
LENGTH	
SCOPE	
PRELIMINARY CONSTRUCTION ESTIMATE	
READY TO LET DATE	

1. Type of facility
2. Design Criteria (2R, 3R, 4R)
3. Traffic Data (TPP data considering traffic volumes, ESALS, ATHWLD, local traffic generators)
4. Soils / Subgrade characteristics (utilize nomenclature in soils_series.xls)
5. Existing Pavement History (Include location map, typical sections, date(s) of construction, materials, maintenance and existing distresses / motivation for construction)
6. Pavement Management (PMIS, Skid, Ride, 4 Yr PMP)
7. What is the Pay Adjustment Schedule of the project?

8. Pavement Forensics (cores/bores, FWD, GPR, DCP)

9. Material considerations (HMA types, seal coat binder selection, flex base, treatment / stabilization, recycling or conservation of materials, alternates, availability, local materials, cure times, multiple pavement designs)

10. Constructability considerations (traffic control, construction phasing, detours, project location/limits)

11. Is this an overlay project, or mill and inlay? Will the proposed pavement structure increase the existing roadway profile? If yes, review and approval of District H&H team is needed.

12. Computer Analysis using approved pavement design software (FPS 21, DarWin 3.1, TxCRCP-ME)

13. Maintenance History & Concerns

14. Is this roadway on a load zone?

15. Is this roadway in the Energy Sector? (If yes, a minimum of 15,000 lbs needs to be used for ATHWLD when doing the Triaxial Check)

16. Is there any projects under construction or planned within your project limits or adjacent to your project?

Appendix B
Pavement Data Collection Requests

Diana Rogerio

From:	Diana Rogerio
Sent:	Wednesday, February 28, 2018 3:26 PM
To:	Gregg Granato; Lizette Colbert; Eric Hernandez; Malcolm Gonzalez; Linda Cox; Clayton Ripps; Eddie Reyes; Will Lockett; Jessica Castiglione; Mike Coward; Henry Fojtik
Cc:	Ryan Desjean; Darrell Jones; Daniel Hinojosa; Mark Andrews
Subject:	Pavement Data Collection Requests
Attachments:	Pavement Data Request Form.pdf; Roadbed.pdf

All,
First of all, I apologize for the long email, but think that this information will help all of us on future projects. Please share this with anyone who you think will benefit from this info.

In order to assist you more efficiently with pavement data collection and analysis, our pavement team has put together some items that we'd like your assistance with so that we can provide you with accurate information when we receive your request(s). Please see below for information related to the SAT Pavement Data Request Form. The most updated form can be found in Sharepoint with these links:

Links:
Pavement SharePoint Link: SharePoint
Direct Link to PDR Form: Pavement Data Request Form

Falling Weight Deflectometer (FWD) & Ground Penetrating Radar (GPR)
The default location(s) on where this data is collected is indicated on the SAT Pavement Data Request Form. The default locations are: A) For a 2 lane roadway, the outside lane in one direction is collected. B) For a 4 lane roadway, the outside lane in each direction is collected.

If you want something other than the default location collected, please ensure you specifically request where you want the data collected in the Comments box. Please be as specific in your location request as possible, such as which lane you want, shoulder or wheel path.

Please provide a Google .kmz file identifying the Begin and End locations.

If you are not going to need for me to provide the backcalculated modulus, please indicate this in the comments.

Core(s) and Bore(s)
To ensure we are providing you with accurate pavement data as well as for you to have an understanding of what to expect in your deliverable, please see the descriptions below for Cores and Bores.

Core(s): If you request core(s), you will only receive the existing Surface Pavement Thickness. Please indicate in the Comments Box if cores are needed to be collected for a distress analysis.

Bore(s): If you request bore(s), as a default, you will receive the Pavement Layer and Thickness, Soil Classification, PI, Organics, Sulfates, pH and Gradations. If you need additional testing, you must specify in the Comments Box. We only have the ability to bore to a depth of approximately 2.5 feet (maximum).

For core and/or bore requests, please provide a .kmz file identifying exactly where you want the core and / or bore taken. We will use the Latitude and Longitude of those locations (from the .kmz) to get as close to the requested location as possible. Please label your cores/bores by number in the .kmz file to differentiate each location. If requesting cores/bores in both directions, please be clear in your labeling. I recommend using the attached *Roadbed.pdf* document for your labeling, as it will be easier to correlate to the FWD that you receive. For example, if you want multiple cores on Lane K1, please label K1-1, K1-2, etc. If you need assistance with choosing the locations you can contact me directly.

Existing Pavement Layer Depths

Please review as-built or other existing information to provide your best estimate at the Existing Pavement Layer Depths, rather than leaving the fields blank. You may use the Comment Box to indicate where the information came from.

Timeframe & Logistics

When preparing the SAT Pavement Data Request Form, please accurately indicate when you need the data collected by. Our team schedules the work in the order it is received. If we truly know when you need the data, we can schedule the work more accurately to get you what you need in a more efficient manner.

As part of the scheduling process, we have to ensure we clear utilities and coordinate proper Traffic Control with the maintenance sections, who do not work on Fridays. Please understand that these items factor into our scheduling and turnaround times.

In order to ensure the safety of our personnel, we would like to request that you utilize a Geotechnical consultant for Core and / or Bore requests on high volume roads. The consultants are equipped with more manpower and resources to handle these hazardous locations. We can still collect the FWD and GPR, since they are mobile operations. If you are requesting DCP operations, please call in advance to coordinate, as this operation is location specific. We can discuss the details, prior to submitting a formal request. If you have any questions on whether or not we can handle a location, please feel free to contact me to discuss.

If you have any questions at all regarding any of this information, please give me a call to discuss.

Thanks,
Diana

SAT Pavement Data Request

Rev. 06/2023

SAT LAB / PAV.
Emilio Ramos, P.E. Lab Engineer
Alejandro Miramontes, P.E. Pavement Engineer

CLICK HERE TO SUBMIT FORM

(Today's Date)
Request Date : ____

Project Information

CSJ: ____

Ready to Let : ____

Highway: ____

Let Date : ____

County: ____

Limits: (Nearest Mile Marker, Landmark, or Intersection)

Point of Contact: ____

Begin: ____

Phone #: ____

End: ____

Due By : ____

Length (Miles): ____

Job Type:
- ○ Construction
- ○ Routine Maintenance Contract (RMC) :

RMC Charge Number (Example: 15-XX-XXXX-XX-XX Func XXX) ____

Existing Pavement Layer Depths

Surface Depth (in) & Type: ____

Base Depth (in) and Type : ____

Subgrade (in) : ____

Pavement Data Request

NON-DESTRUCTIVE TESTING

(Please Mark BEGINING / END Limits on KMZ file.)

Default:
- 2 Lane Roadway - 1 outside lane - One direction will be collected.
- 4 Lane Roadway - 1 outside lane - Each direction will be collected.
- Right Wheel Path.

- ○ FWD - **Raw Data Only**
- ○ FWD - **Remaining Life**
- ○ FWD - **Modulus Back Calculation**
- ○ **GPR** - Pavement Layer
- ○ **IRI** - International Roughness Index (Profile)
- ○ **Other:** ____

DESTRUCTIVE TESTING

(Please Mark EACH Location on KMZ file.)

○ **BORES** ____ *Total Needed*

Default: Full Pavement Structure Depth. (Top layer HMA + Mid. layer Base + Bot. Layer Sub.) Max. size 36in. x 8" dia. Depth.
Default Soil Testing: PI, Organics, Sulfates, pH, Gradations, and Soil Layer Classification.
Please specify if testing is needed.

○ **CORES** ____

Default: Core is HMA Top layer only. HMA Core size 2" - 14" long x 6"dia.

COMMENTS

(Must Provide A .kmz File For All Requests.)

(Reference Marker + Displacement)

Begin RM: ____ End RM: ____

Collection Begin / End Notes:

____

(Lane, Shldr.,Wheel Path, & Direction)

Collection Specifics: ○**NB** ○**SB** ○**WB** ○**EB**

____

Other Sampling & Testing:

____

Appendix C
MODULUS Backcalculation Example

Back Calculation Example

HWY:	SH16	**LANE:**	L1
CJS:	0291-10-110		

NEW AVERAGE			
SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)
149.5	77.1		12.5

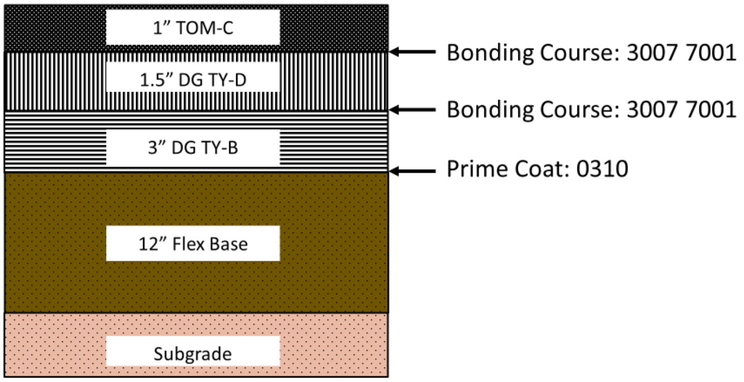
THRESHOLD VALUES				
LAYER:	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)
MAX:	232.8	133.9	0	23.5
MIN:	100.4	41.3	0	6.7

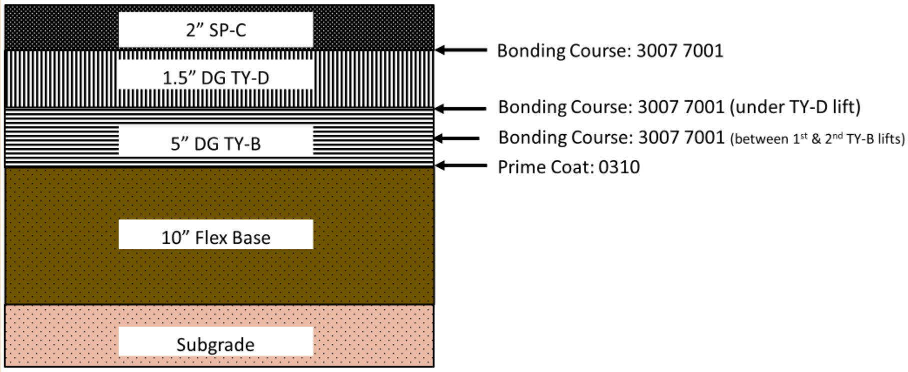
Load Station	Measured Deflection (mils): (lbs)	R1	R2	Calculatec Moduli R3	R4	values R5	(ksi): R6	Absolute R7	Dpth SURF(E1)	to BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Bedrock	Outliers SURF	Outliers BASE	Outliers SUBB	Outliers SUBG
0	8,193	7.37	3.69	2	1.84	1.43	1.09	0.84	300	150	0	15.1	23.56	101.6 *	Outlier	Outlier		15.1
82	7,678	15.48	9.53	5	3.03	1.66	1.06	0.7	141.3	53.4	0	7.6	7.21	66.5	141.3	53.4		7.6
160	7,864	11.91	7.01	4	2.13	1.11	0.7	0.48	173.8	68	0	11.1	7.11	62.3	173.8	68		11.1
240	7,941	9.96	5.3	3	1.78	1.13	0.83	0.59	148.8	136.2	0	13.6	13.5	78.9 *	148.8	Outlier		13.6
321	7,601	14.86	7.31	3	1.5	0.83	0.46	0.37	104.5	38.7	0	14.4	13.03	55.6	104.5	Outlier		14.4
404	7,777	17.67	9.2	4	1.83	0.84	0.54	0.39	110.3	25.1	0	12.3	10.42	53.2	110.3	Outlier		12.3
483	7,656	13.8	6.46	3	1.49	0.89	0.63	0.47	90.3	63.6	0	14.8	16.21	63.8	Outlier	63.6		14.8
561	7,864	14.21	7.39	3	1.86	1.07	0.72	0.56	108.7	60.2	0	12.3	12.8	66.4	108.7	60.2		12.3
640	7,777	13.41	6.85	3	1.57	0.85	0.56	0.41	120.3	51.2	0	14.2	11.97	58.3	120.3	51.2		14.2
724	7,755	14.13	7.48	4	1.65	0.72	0.42	0.27	145.8	32.5	0	14	8.16	54.3	145.8	Outlier		14
820	7,864	15.24	8.28	4	1.99	1.02	0.65	0.49	127.1	40.5	0	11.4	9.12	58.2	127.1	Outlier		11.4
880	7,634	18.93	9.91	5	2.32	1.3	0.84	0.65	85.4	36.4	0	9.5	12.62	62.2	Outlier	Outlier		9.5
960	7,842	17.74	10.23	5	2.3	1.07	0.63	0.48	136.6	24	0	10.2	8.9	56.6	136.6	Outlier		10.2
1040	7,809	12.69	7.01	4	2.39	1.49	0.91	0.7	126.3	97.9	0	9.8	9.66	76.2 *	126.3	97.9		9.8
1120	8,313	9.3	4.64	3	1.86	1.16	0.81	0.57	199.6	140.8	0	14.1	13.25	76.9 *	199.6	Outlier		14.1
1293	7,919	8.2	3.76	2	0.96	0.6	0.46	0.42	139.6	150	0	24	16.71	65.6 *	139.6	Outlier		Outlier
1383	7,996	7.65	3.68	2	1.17	0.81	0.64	0.52	196.5	150	0	21	18.39	101 *	196.5	Outlier		21
1462	7,864	9.86	5.59	3	1.57	0.97	0.74	0.6	173.1	101.6	0	14	12.8	68.1	173.1	101.6		14
1541	8,007	7.78	3.62	2	0.99	0.61	0.45	0.35	158.5	150	0	25	17.04	77.1 *	158.5	Outlier		Outlier
1623	8,094	6.02	2.19	1	0.6	0.53	0.46	0.4	186.8	150	0	45	28.4	62.2 *	186.8	Outlier		Outlier
1705	7,908	6.99	3.05	2	1.03	0.72	0.56	0.45	204.3	150	0	25.6	20.76	104.4 *	204.3	Outlier		Outlier
1781	7,809	8.93	5.28	3	2.3	1.66	1.27	0.95	300	108.7	0	10.9	15.86	106.3 *	Outlier	108.7		10.9
1861	7,755	6.29	3.23	2	0.96	0.62	0.5	0.4	300	62.7	0	29.8	25.89	71.8 *	Outlier	62.7		Outlier
1943	7,777	8.05	4.6	3	1.76	1.16	0.83	0.67	285.1	132	0	13.2	13.06	87.3 *	Outlier	132		13.2
2040	7,579	18.61	12.12	7	4.63	3.15	2.57	2.04	149.9	50	0	5	12.19	115.9 *	149.9	50		Outlier
2190	7,886	13.82	8.74	5	3.24	2.24	1.78	1.48	242.3	52.9	0	8.1	14.8	123.1 *	Outlier	52.9		8.1
2262	7,908	11.97	5.65	3	2.28	1.74	1.4	1.19	138.9	111.4	0	11.1	21.96	300 *	138.9	111.4		11.1
2311	7,711	20.09	10.82	5	3.42	2.34	1.83	1.45	71.1	66.2	0	6.6	16.54	111.7 *	Outlier	66.2		Outlier
	Mean:	12.18	6.52	3.34	1.94	1.2	0.87	0.67	166.6	87.6	0	15.1	14.71	72.4				
Std.	Dev:	4.21	2.64	1.39	0.86	0.6	0.5	0.41	66.2	46.3	0	8.4	5.48	20.2				
Var	Coeff(%):	34.54	40.44	41.61	44.2	49.95	57.65	60.35	39.7	52.9	0	55.3	37.24	27.8				

Appendix D
Underseal Examples and Longitudinal Joint “Stair-step” approach for Widenings

New Construction

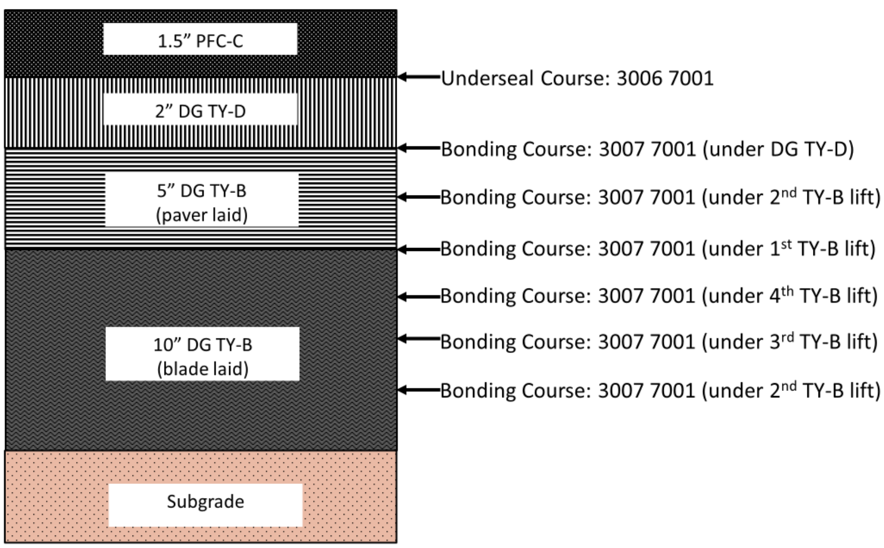
- Do not place bonding course on top of flexible base. Prime is sufficient.
- Do not use prime, or bonding/seal course on top of treated or non-treated subgrade.
- Use bonding course between each HMA lift, D-GR Type B mix may have multiple lifts.





New Construction (All-HMA Section)

- Use Underseal Course underneath all PFC layers, except when the District Pavement Engineer (DPE) approves something different.
- Do not use prime, or bonding/seal course on top of treated or non-treated subgrade.
- Use Bonding Course between each HMA lift, D-GR Type B mix may have multiple lifts.



Overlay (including Mill & Overlay)

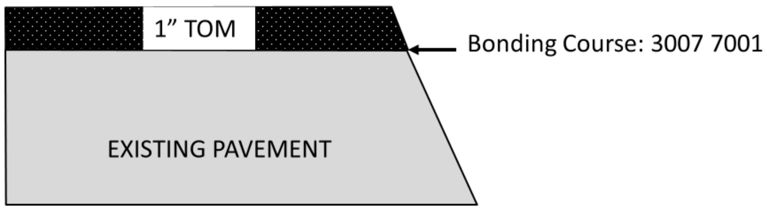
SEAL COAT

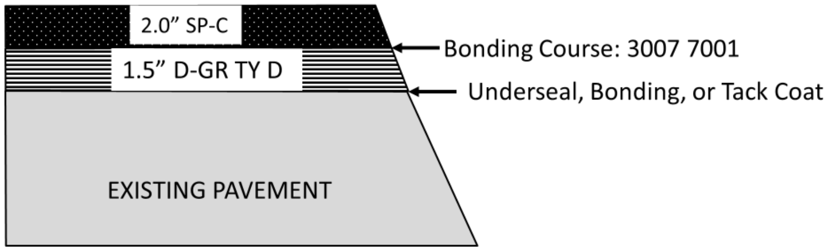
- No underseal/bonding course or tack coat is needed.

HMA OVERLAY (<2.0")

- Apply a bonding course prior to placing the overlay to the existing structure.
- Bonding course is the default option.
- An underseal course is required due to the following conditions:
  - Notch and widen projects (next slide)
  - Existing Surface with cracks deeper than 1" or wider than ¼"
  - Milled surfaces with visible cracking
  - PFC overlay

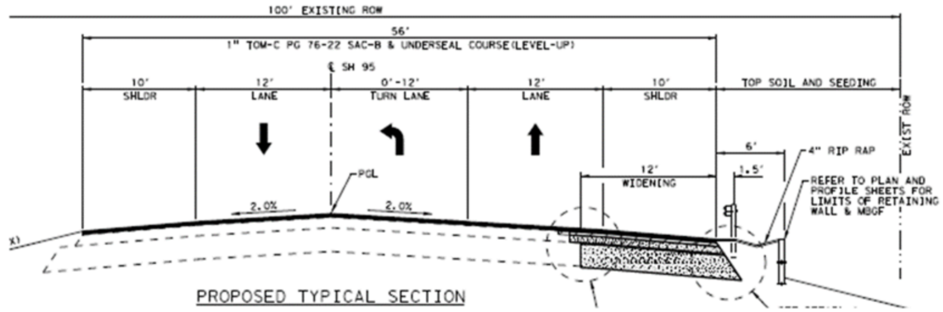
STRUCTURAL HMA OVERLAY (>2.0")

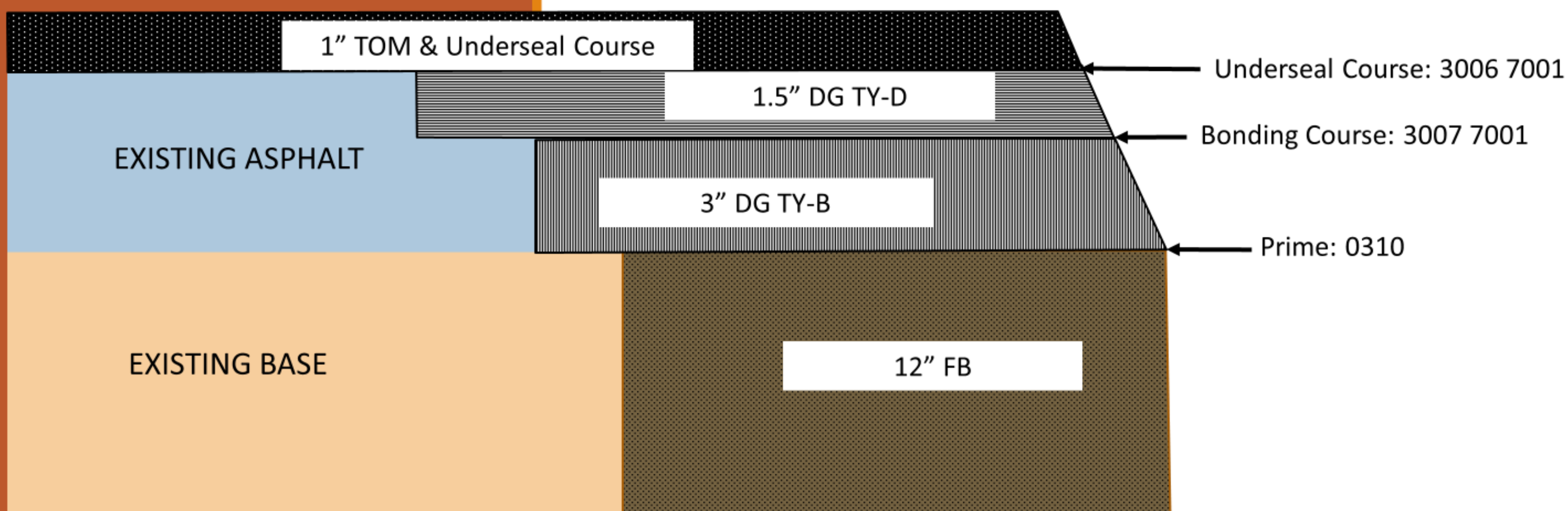




Widening & Overlay

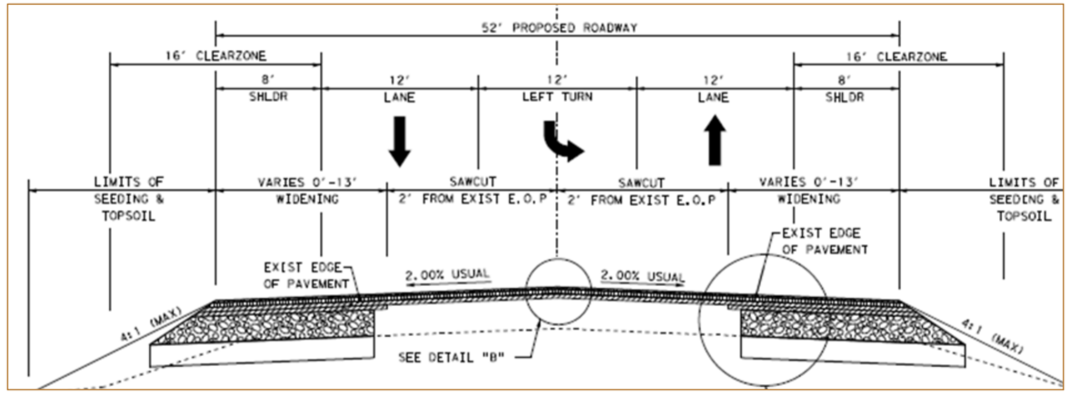
- Use Underseal Course to seal the old surface and construction joint.
- Place the Underseal Course over the entire roadbed, including the widen section.
- Use stair-step approach on typical sections.

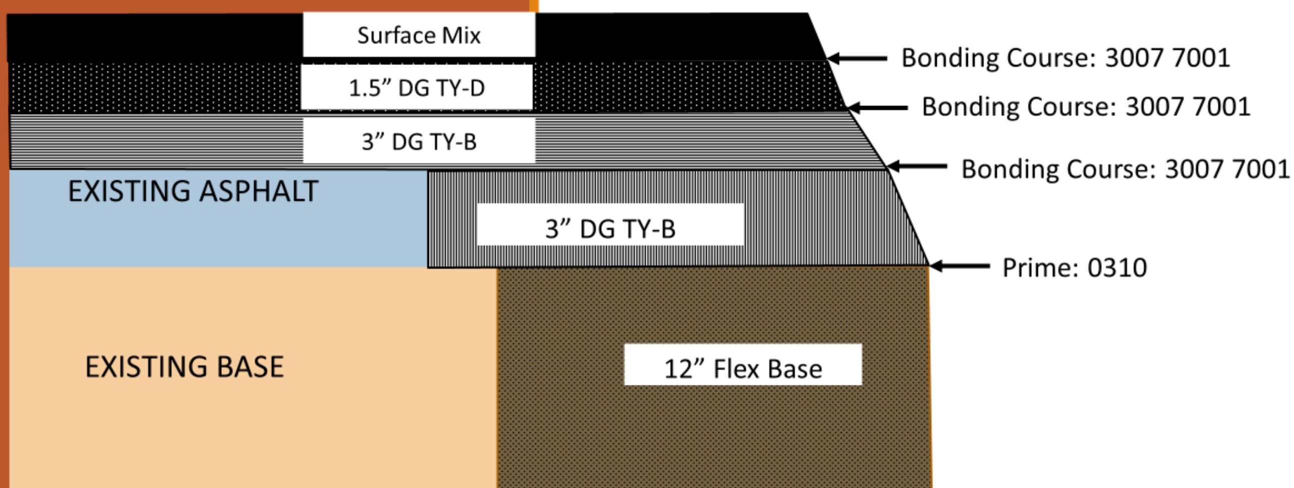




Structural Overlay & Widening

- Always notch when widening
- Underseal course may not be necessary when placing multiple HMA layers over the entire roadbed. The DPE will decide if bonding course is sufficient.





Appendix E
Standard Pavement Design Report Format

CSJ: XXXX-XX-XXX
Highway Name –
Pavement Design Report

County

Limits From: XXXX

To: XXXX

Project Description:

Project Length: XX Miles

Prepared By: ______________________________ ____________

Engineer’s Name Date

Pavement Engineer - Firm Name

Recommended
For Approval By: ______________________________ ____________

Engineer’s Name (License No.) Date

San Antonio District Pavement Engineer

Reviewed By: ______________________________ ____________

Engineer’s Name Date

Area Engineer

Approved By: ______________________________ ____________

Engineer’s Name Date

San Antonio District Director of Construction

Approved By: ______________________________ ____________

Engineer’s Name Date

San Antonio District Engineer (For Projects Over $20 million)

This document is released for the purpose of interim review and is not intended for bidding, construction, or permitting purposes.

Location Map

Maps should be detailed enough to distinguish urban or rural project locations and the presence of water features such as lakes, streams, etc.

Summary of Proposed Design (starting with top of pavement)

From STA 0+00 to STA 50+00 (or other limits)		
Item	Material Description	Thickness (in)
3077	SP-D PG76-22 SAC A	2
3076	D-GR HMA TY-D PG70-22	2
3085	TRAIL, Spray Applied Membrane, or OCST See Construction Section of Report for Rates	N/A
3076	D-GR HMA TY-B P 64-22	4
310	Prime Coat (MC-30 or AE-P)	N/A
247	Flexible Base Ty-D GR 1-2 or 5	8
	Time to First Overlay (years)	20
	Total Life (years)	22

From STA 50+00 to STA 100+00 (or other limits)		
Item	Material Description	Thickness (in)
316	ASPH (AC-15P, AC-20-5TR, OR AC-20XP) 0.3 GAL/SY	N/A
316	AGGR (TY-PD GR-4, SAC-B) 120 SY/CY	N/A
3076	D-GR HMA TY-B PG64-22	3
3076	Tack Coat	N/A
3076	D-GR HMA TY-B PG64-22	3
260	Lime-Treated Subgrade	N/A
	Time to First Overlay (years)	20
	Total Life (years)	22

Pavement Design Summary

- Provide short summary of decision making/ considerations on chosen pavement design and material selection.

TABLE OF CONTENTS

A. PROJECT LAYOUT MAP AND PROPOSED PAVEMENT DESIGN (see pg. 5 for example)

B. INTRODUCTION – PROJECT SCOPE

C. PAVEMENT DESIGN DATA, ANALYSES, AND RECOMMENDATIONS

1. Review of As-Built Drawings
2. Subsurface Soil and Groundwater Conditions, and Existing Pavement Structure
   - Geologic Overview
   - Field Exploration
   - Existing Pavement Structure
   - Laboratory Testing (see pg. 6 for list of pre-approved tests)
   - Groundwater Conditions
   - FWD Observations
   - GPR Observations
3. Subgrade Properties – Texas Triaxial Class and Subgrade Modulus
4. Traffic Data
5. Flexible Pavement Design: FPS-21 Methods
   - Flexible Pavement Design Parameters
   - Proposed Flexible Pavement Sections
   - Mechanistic and Modified Triaxial Design Checks
6. Rigid Pavement Design: TxCRCP-ME Methods
   - Rigid Pavement Design: TxCRCP-ME Methods
   - Proposed Rigid Pavement Sections
7. Detours
   - Inside Main Lane Shoulders with Detour Usage
   - Outside Main Lane Shoulders for Detour Usage
8. Potential Vertical Rise (PVR)
   - PVR Mitigation

D. PAVEMENT CONSTRUCTION – Talk about any potential constructability items. Below are some items that can be talked about.

- Site Preparation – Proof Roll?
- Embankment Select Fill – What type?
- Lime-Treated Subgrade – What lime percent is recommended? What density should be used for calculating lime quantity based on your testing?
- Geogrid – What type?
- Flexible Base – What type?
- Underseal – What rates?
- Site Drainage

E. MAINTENANCE CONSIDERATIONS

F. CONCLUSIONS

G. ATTACHMENTS

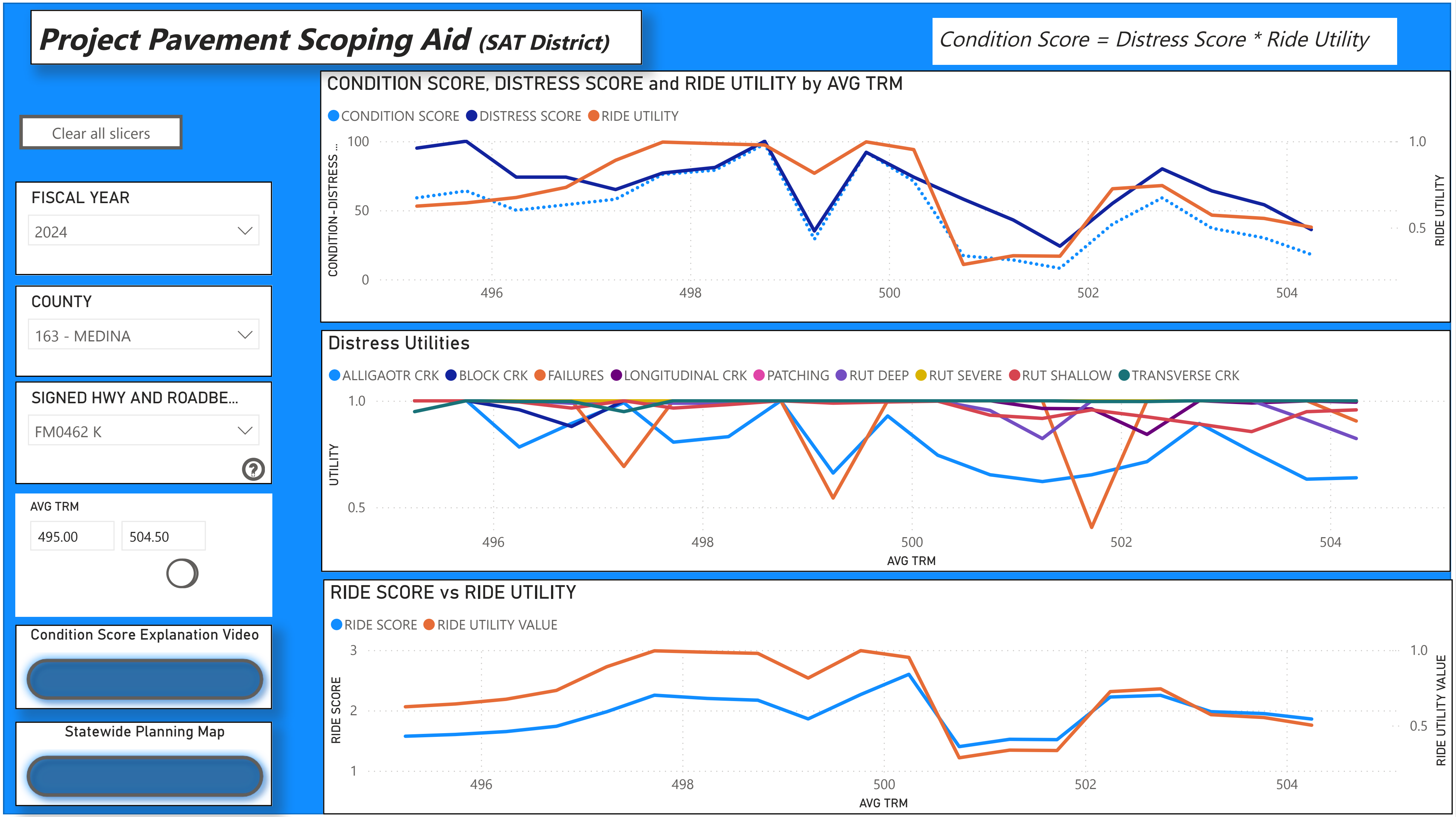
1. Vicinity Map
2. USGS Maps
   - PI and Soil Classification
   - Sulfate Map
   - Organic Matter
   - Groundwater Table
3. Overall Pavement Boring Location Plan
4. Bore Log and Lab Testing
5. Bore/Core Photographs
6. Modulus Study
   - Back-calculation
   - Segmentation Analysis
   - Remaining Life Analysis
7. PaveCheck snips (if needed)
8. Traffic Data
9. FPS Printouts
10. TxCRCP-ME
11. PVR Sheets
12. Form 2088 (Signed and Sealed)

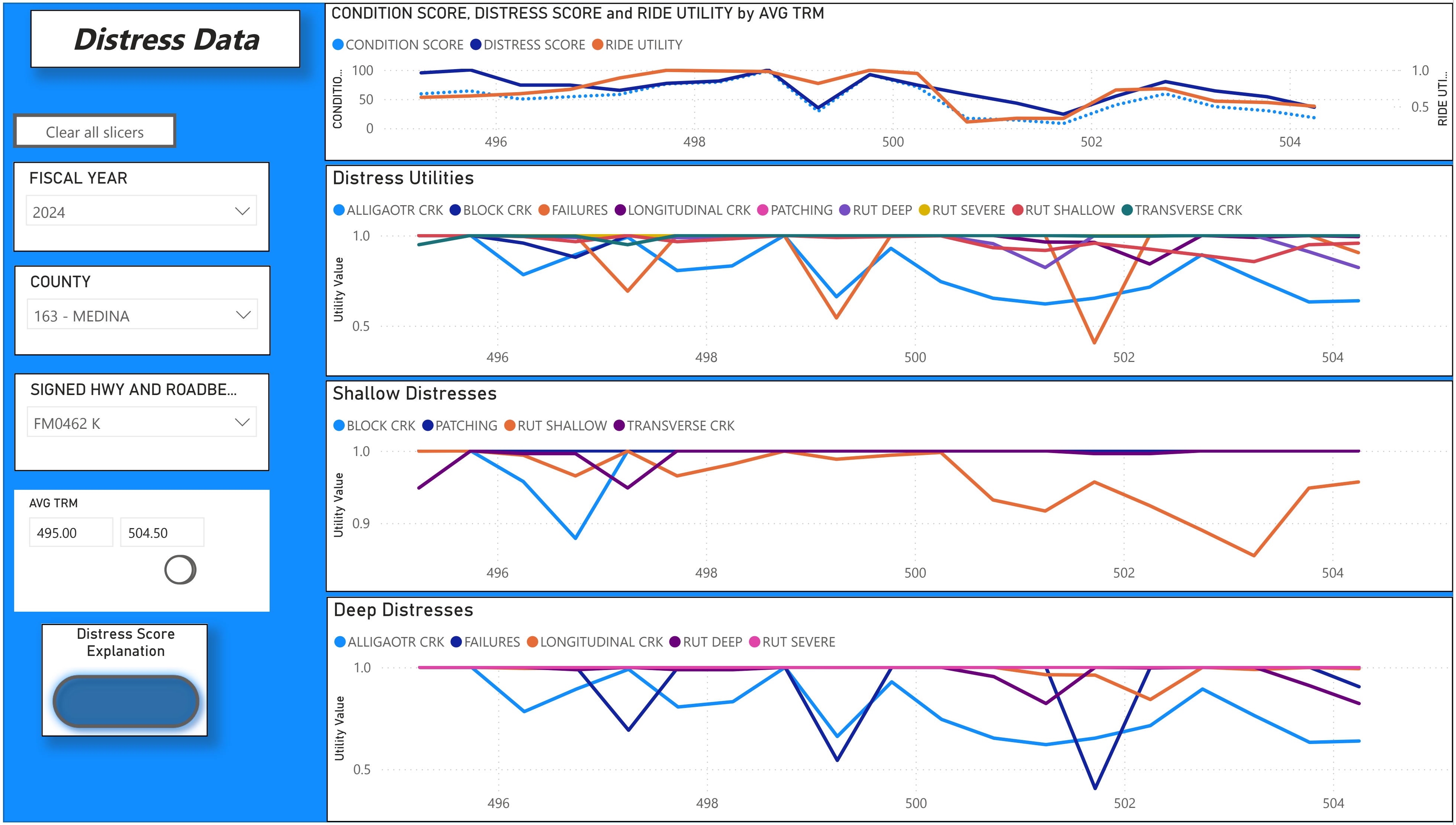
PAVEMENT PRE-APPROVED TESTING

- Dynamic Cone Penetration (DCP)
- Soil Identification
- Gradation (Tex-110-E)
- Soil Classification (Tex-142-E)
- Atterberg Limits (Tex-104-E, 105-E, 106-E), 107-E if applicable
- Moisture Content (Tex-103-E)
- Sulfate Content (Tex-145-E)
- Organic Content (Tex-148-E)
- pH levels (Tex-128-E & Tex-121-E)
- Soil Treatment Design (Tex-120-E, Tex-121-E, Tex-127-E)
- Core/Bores
- Ground Penetrating Radar (GPR)
- Falling Weight Deflectometer (FWD)
- Profiler for ride quality

Submit boring and testing plan to the District Pavement Engineer for approval prior to starting bore/core operations. If a different test is needed, you must request approval from the District Pavement Engineer.

Appendix F
PowerBI Scoping Aid Tool Example


Project Pavement Scoping Aid (SAT District)
Condition Score = Distress Score * Ride Utility
Clear all slicers
FISCAL YEAR
2024
COUNTY
163 - MEDINA
SIGNED HWY AND ROADBE...
FM0462 K
AVG TRM
495.00
504.50
Condition Score Explanation Video
Statewide Planning Map
CONDITION SCORE, DISTRESS SCORE and RIDE UTILITY by AVG TRM
CONDITION SCORE
DISTRESS SCORE
RIDE UTILITY
CONDITION-DISTRESS ...
RIDE UTILITY
100
50
0
1.0
0.5
496
498
500
502
504
Distress Utilities
ALLIGAOTR CRK
BLOCK CRK
FAILURES
LONGITUDINAL CRK
PATCHING
RUT DEEP
RUT SEVERE
RUT SHALLOW
TRANSVERSE CRK
UTILITY
1.0
0.5
496
498
500
502
504
AVG TRM
RIDE SCORE vs RIDE UTILITY
RIDE SCORE
RIDE UTILITY VALUE
RIDE SCORE
RIDE UTILITY VALUE
3
2
1
1.0
0.5
496
498
500
502
504
AVG TRM


Distress Data
Clear all slicers
FISCAL YEAR
2024
COUNTY
163 - MEDINA
SIGNED HWY AND ROADBE...
FM0462 K
AVG TRM
495.00
504.50
Distress Score Explanation
CONDITION SCORE, DISTRESS SCORE and RIDE UTILITY by AVG TRM
CONDITION SCORE DISTRESS SCORE RIDE UTILITY
CONDITIO...
RIDE UTI...
100
50
0
1.0
0.5
496 498 500 502 504
Distress Utilities
ALLIGAOTR CRK BLOCK CRK FAILURES LONGITUDINAL CRK PATCHING RUT DEEP RUT SEVERE RUT SHALLOW TRANSVERSE CRK
Utility Value
1.0
0.5
496 498 500 502 504
Shallow Distresses
BLOCK CRK PATCHING RUT SHALLOW TRANSVERSE CRK
Utility Value
1.0
0.9
496 498 500 502 504
Deep Distresses
ALLIGAOTR CRK FAILURES LONGITUDINAL CRK RUT DEEP RUT SEVERE
Utility Value
1.0
0.5
496 498 500 502 504

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