

TxDOT – Corpus Christi District Standard Operating Procedure

Subject: Pavement Design Process

Approval Authority: District Engineer Effective Date: September 1, 2009

Review Authority: Director of Construction Revision: 1

Department Policy & Procedure Manuals & Document References:

- Pavement Design Guide
- Memorandums from:
 - Quality Assurance Program for Asphalt Binders
 - John A. Barton, P.E., Guidelines for Alternate Pavement Designs (Design-Bid-Build Process), dated October 22, 2008
 - Thomas Bohuslav, P.E., Item 247, Grade 5 and Base Selection Guidance, dated February 11, 2009
 - John A. Barton, P.E., Cost Control Ideas Update, dated February 12, 2009
 - John A. Barton, P.E., Guidance on Potential Vertical Rise (PVR) for design, dated July 6, 2009
 - John A. Barton, P.E., Flexible Pavement Design Guidance, dated August 10, 2009
 - John A. Barton, P.E., Use of Grade 1 Flex Base, dated August 25, 2009
 - David B. Casteel, P.E., Policy for Alternate Pavement Design for new Construction and Total Reconstruction
- Surface Aggregate Selection Form (WWARP) (Form 2088)
- Pavement Design Concept Conference Agenda
- Corpus Christi District's Pavement Design Strategy

Purpose:

Formalize the pavement design process for Corpus Christi District's engineers and design personnel.

General Guidelines

Pavement Design Responsibilities

A formal pavement design report or memorandum is required as part of the PS&E package for all Districts' pavement projects as set in this document. The approach to the pavement design will be reviewed/determined in a Pavement Design Concept

Conference (PDCC) after the project is programmed. The District Pavement Engineer (DPE) or Designer (with guidance from the DPE) will prepare the initial pavement design report or memorandum as stated in the section titled Pavement Design Documentation prior to the PDCC.

After the PDCC, the DPE will submit the proposed pavement design to the Director of Construction, Director of Maintenance, Director of Transportation Planning and Development, and the respective Area Engineer for review and comment. The DPE will review/research all comments with subject matter experts, and incorporate revisions where appropriate. After all comments have been addressed, the DPE will forward a copy of the proposed pavement design to each functional area Director and respective Area Engineer for concurrence. Concurrence with the proposed pavement will be documented by signature on the typical section sheet, which will be included in the pavement design report. Once concurrence is documented, the DPE will forward a signed and sealed copy of the pavement design to the District Engineer, through the Director of Construction for final approval.

Pavement Design Concept Conference

The Pavement Design Concept Conference can be held in conjunction with the Project Scoping Meeting or Design Concept Conference for the rehabilitation, reconstruction, or new construction pavement projects. The District Pavement Engineer shall present the initial pavement design report and provide any additional information to assist in the selection of the final pavement design.

Conference Participants - depending on the size and/or sensitivity of the project, all or some of the following will participate in the conference:

- Geometric Design Engineer and Design Project Engineer
- Area Engineer (AE may include the following)
 - Maintenance Supervisor
 - Lead Construction Project Engineer or Inspector
- District Pavement Engineer
- Director of TP&D, or the designated representative
- Director of Maintenance, or the designated representative
- Director of Construction, or the designated representative
- District Engineer

Discussion of pavement design should include:

Existing Conditions:

- Existing pavement history including typical section, existing materials, maintenance and distress scores
- Cores of existing pavement structure
- Performance of similar pavements in the area

Design:

- Traffic data (analysis of TP&P data considering traffic volumes, ESALs, ATHWLD, local traffic generators)
- Type of Facility and cross-sectional elements/geometry (urban or rural, roadway classification, 2R, 3R or 4R design criteria)
- Consideration of rehab strategies (i.e. spot work, addressing only distressed lanes, minimize work on shoulders, less expensive materials, staged construction, stabilization of existing materials, overlay versus rehab, surface treatments versus overlay, etc)
- Alternate Pavement Design Strategy guidance
- Computer run using one of the approved formal pavement design procedures (FPS19W, AASHTO, or Modified Texas Triaxial)
- Constructability considerations including traffic control, construction sequencing, lateral support, drainage, etc
- Future roadway expansion

Materials:

- Soils/materials characteristics
- Material considerations (ACP including Asphalt Binder Grade, Aggregate and Asphalt grades for two-course surface treatments, Flexible Base selection (Type A Grade 5 unless otherwise approved), Stabilization of Subgrade or Flexible Base, Recycling or Conservation of materials, alternate materials, availability, local materials etc)

Performance:

- Climate/weather
- Review of adjacent sections
- Selection of input parameters for formal pavement design procedures and take in consideration managing risks and optimizing design
- Examine and consider proven pavement structures in lieu of supporting more formal strategies as the basis for design
- Local preference

Pavement Design Documentation

The pavement design report or memorandum shall be in accordance with the *Pavement Design Guide*. The original will be maintained in the DPE's office with a copy in the District and Design project files and a copy scanned to CST-M&P.

For projects not requiring a pavement design report, the Designer shall submit a memorandum to the DPE to document the criteria and rationale for the pavement design selected. The original will be maintained in the DPE's office with a copy in the District and Design project files.

Modified Triaxial Check (MTC)

The triaxial check is required for pavement design, but thickening a pavement structure in response to the check is not a requirement. Percentage of trucks, the Average of the Ten Heaviest Wheel Loads Daily (ATHWLD), and the percentage of tandem axles in the ATHWLD are provided in the Transportation Planning and Programming Division (TPP) *Traffic Analysis for Highway Design* report. Use a 1.0 factor for ATHWLD with the exception that a 1.3 may be used when tandems are 50% or greater for traffic loading greater than 5 M ESALs. Where heavy industry truck traffic, aggregate pits, concrete plants, etc., is prevalent, special design considerations may have to be made.

For the following, the pavement design must meet the MTC:

- New Location/construction or complete reconstruction
- Upgrading to a 4 lane divided facility
- Upgrading to a curb and gutter section

Perform an MTC on all other projects requiring a pavement design report. Review the results and determine if MTC thickness is needed based on engineering judgment in consultation with appropriate District Staff.

Potential Vertical Rise (PVR)

The Corpus Christi District historically has chosen not to replace in-situ swelling materials with soils with less swell potential, and therefore does not consider PVR. Replacing in-situ material would not be cost effective in the Corpus Christi District because the majority of the underlying soils have an average plastic index of 50 and above. In addition, a good portion of the soils in the Corpus Christi District have high organic contents. Therefore, a common pavement design practice is to "modify" existing swelling soils with lime or cement and place a Geogrid membrane over this material. When this is performed, the modulus value used for this material is obtained from Modulus 6 using the raw data from FWD testing performed on the existing pavement. This material is not given "structural credit" in the pavement design due to the presence of organics in the in-situ material.

Design Strategies

The following is a table of typical pavement design strategies for low, medium, and high volume roadways. The intent of the table is not to be all-inclusive. The values shown are common outputs, which theoretically should result from the input data recommended in the **CORPUS CHRISTI DISTRICT'S PAVEMENT DESIGN STRATEGY** guidance document. After a pavement design alternative has been developed, this design strategy table can be cross-referenced to determine if there is a fatal flaw.

ADT: ≤ 3,000

ADT: 3,000 – 10,000

ADT: ≥ 10,000

LOW VOLUME ROADWAY			MEDIUM VOLUME ROADWAY			HIGH VOLUME ROADWAY	
			RURAL		URBAN	RURAL	URBAN
	2 CRSE	2" HMAC	2 CRSE	HMAC (2"-4")	*HMAC (4"-6" min.)	HMAC (4"-6" min.) or alt. **CRCP	*HMAC (4"-6" min.) or alt. **CRCP
2 CRSE	NEW FLEXBASE (4"-10")	UNDERSEAL	NEW FLEXBASE (4"-10")	UNDERSEAL	UNDERSEAL	UNDERSEAL	UNDERSEAL
TREATED EXISTING FLEXBASE (6"-10")	% CEMENT TRT SALV.	***NEW and/or Existing Treated FLEXBASE (8"-15")	% CEMENT TRT SALV.	***NEW and/or Existing Treated FLEXBASE (8"-15")	***NEW and/or Existing Treated FLEXBASE (8"-15")	***NEW and/or Existing Treated FLEXBASE (8"-15")	***NEW and/or Existing Treated FLEXBASE (8"-15")
	SUBGRADE	SUBGRADE	SUBGRADE	SUBGRADE	SUBGRADE	SUBGRADE	SUBGRADE

*Note: Limit only one structural overlay to urban curb and gutter roadways.

** Note: Continuously Reinforced Concrete Pavement (CRCP) can be an alternate pavement design to increase competition

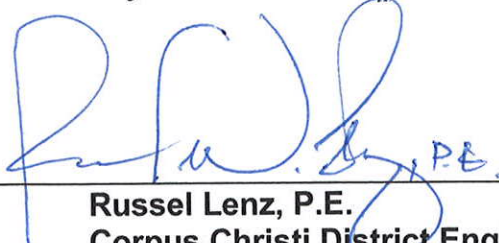
*** Note: 4' minimum of new base material

Wet Weather Accident Reduction Program (WWARP)

The District predominantly uses Surface Aggregate Classification (SAC) "B" materials. The Design Engineer will need to determine if SAC "A" requirements are needed. To meet the frictional demands of the surface course and ensure compliance with the Wet Weather Accident Reduction Program, the Design Engineer will prepare and sign the "Aggregate Selection Form".

These procedures will remain in effect until revised or rescinded. As a minimum, this SOP will be reviewed annually and updated if necessary by September 1st. Submit recommendations to modify or clarify this document in writing to the Review Authority.

January 20, 2010
Approval Date


Russel Lenz, P.E.
Corpus Christi District Engineer

Standard Operating Procedure

