

# Retaining Walls and Going Beyond the Standards



# Aesthetic Focus

- Appropriate roadway structures
- Level one (basic) designs and example
- Level two (semi-urban) designs, examples, and processes
- Level three (major urban) designs
  - Design principles and choices
  - Processes and examples
- Cost and value
- Form liner process
- Contacts

# Appropriate Roadway Structures

Determine if the project includes appropriate structures for decorative design.

- MSE walls
- Cast-in-place walls (drilled shaft, soil nail)
- Modular block walls (geometry, only)
- Bridge columns

# Levels of Aesthetic Design

Determine which level is appropriate for the project:

- Level 1 – Basic projects, rural areas
- Level 2 – Projects in semi-urban areas, moderate traffic
- Level 3 – Projects in major urban areas, high traffic

# Level 1 Design

- Standard design for most projects
- Used in low traffic areas
- Requires minimal expenditures on decorative treatments

# Level 1 Example

## Standard bridge 'I' beam structure



# Level 2 Design

- Standard design with simple decorative finishes and minimal use of color
- Good for semi-urban areas
- Options include:
  - Colored/textured concrete surfaces for retaining walls, colored textured concrete surfaces and stains for rip-rap
  - Modular block retaining walls
  - Form liners on bridge columns and retaining walls
  - Concrete brick pavers

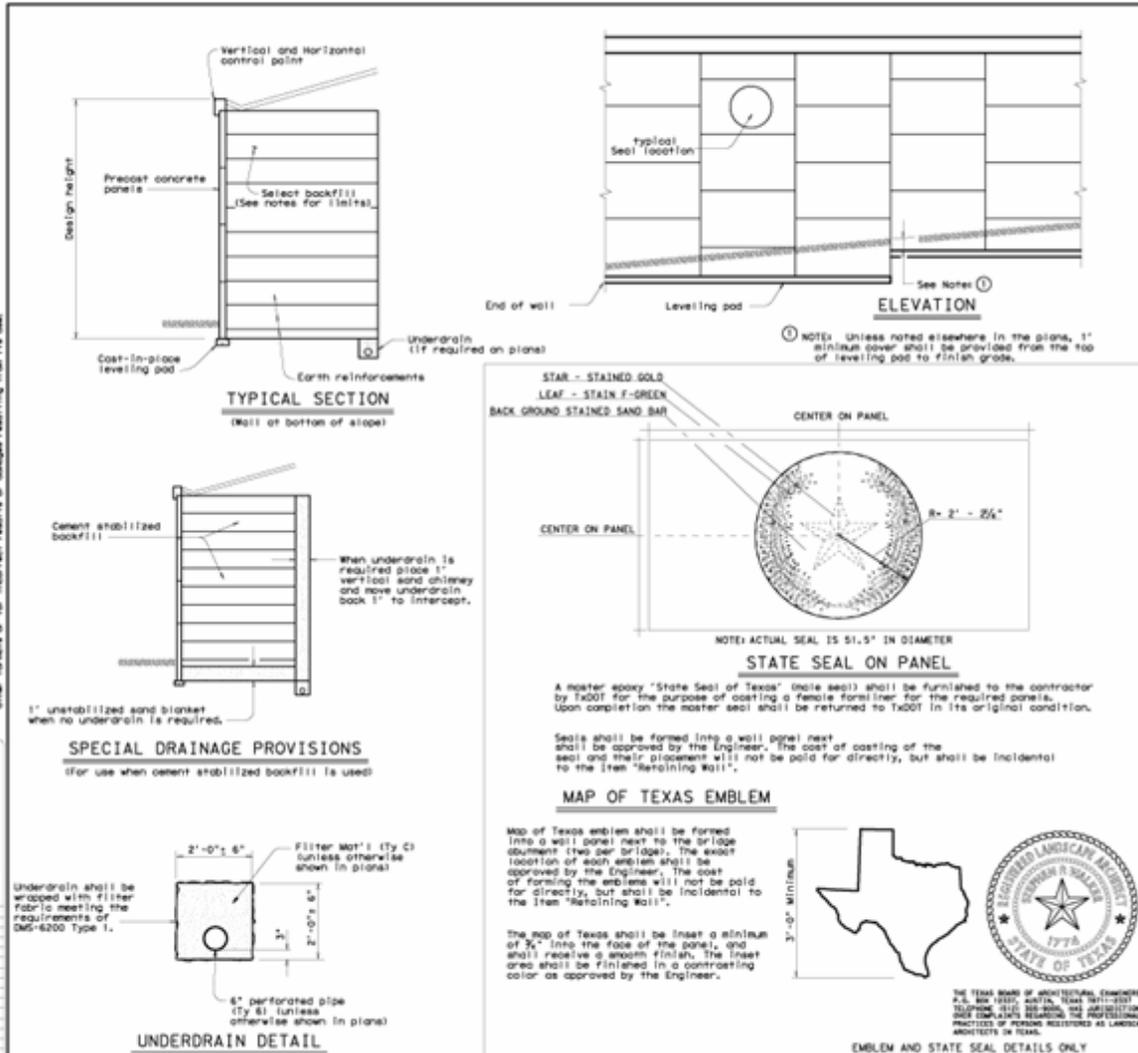
# Level 2 Example: US 83

1987: First Level 2 Design in Pharr District



# Level 2 Process

## Standard Seal and Map Detail



**DESIGN PARAMETERS:**  
Design of retaining walls shall be based on the following design parameters:  
Random Backfill unit weight = 125 pcf  
(Embankment of Existing Soils)  $\phi = 30^\circ$   $c = 0$  psf  
Select Backfill unit weight = 125 pcf  
 $\phi = 34^\circ$   $c = 0$  psf  
Cement Stabilized unit weight = 125 pcf  
Select Backfill  $\phi = 45^\circ$   $c = 0$  psf

Stress in steel and concrete shall be in accordance with current AASHTO Standard and Inlet Specifications.  
Minimum length of earth reinforcements shall be 8'-0".

**STABILITY CRITERIA:**  
Factor of safety in sliding along the base of the structure shall be greater than or equal to 1.5.  
Factor of safety in overturning shall be greater than or equal to 2.0.  
The base pressure resultant shall fall within the middle third of the retaining wall.  
The factor of safety against pullout of the earth reinforcements shall be greater than or equal to 1.5 at each level. Pullout resistance shall be determined from test data evaluated at 1/3rd strain.

**CORROSION CRITERIA:**  
The earth reinforcement elements shall be designed to have a corrosion resistance + durability to ensure a minimum design life of 75 years. Maximum loss per side due to corrosion shall be computed by assuming a uniform loss model based on the following:  
Fine corrosion rate (first 2 years) - 15  $\mu\text{m/yr}$   
Fine corrosion rate (subsequent years) - 12  $\mu\text{m/yr}$   
Carbon steel corrosion rate - 12  $\mu\text{m/yr}$   
All stress and pullout calculations shall be done on the calculated earth reinforcement section remaining after 75 years.

**GENERAL NOTES:**  
Section and elevation shown is for informational purposes only. Specific geometry is to be determined based on wall layout and other plan information.  
The select backfill specified for use within the mechanically stabilized earth volume shall extend horizontally from the back of the panels to the end of the earth reinforcements. The select backfill shall extend vertically from the top of the leveling pod or 4' below the lowest earth reinforcement, whichever is lower, to the top of panels.  
The uppermost earth reinforcements shall be no more than 3.0' below the top of wall.  
The lowest level of earth reinforcements shall be no more than 2.0' above the top of the leveling pod.  
Minimum wire size for earth reinforcements shall be #7.0. If different longitudinal and cross wires are used in an earth reinforcement mesh, the smaller wire shall have at least 50% of the cross sectional area of the larger wire.  
Standard precast concrete panels shall have a maximum height of 6', and a maximum surface area of 50 sq ft. Minimum panel thickness shall be 5". Panels shall be arranged to provide offset horizontal joints.  
An open joint shall be provided around the perimeter of the concrete panels. The vertical joint opening shall be between 1/4" and 3/8". The joint configuration shall be such that the filter fabric or pod materials are not exposed at the wall face.  
A one-piece corner panel shall be provided for wall angle changes of greater than 30 degrees or less.  
Concrete coping shall be provided along the top of wall, or the vertical knees or bridge bents, and of other vertical steps along the top of wall. The joints between all coping segments shall be sealed to prevent infiltration of water into the retaining wall backfill. Sealing shall be in accordance with the Item "Joint Sealants and Fillers", using Class 4 Joint Sealant.

Texas Department of Transportation  
Bridge Division

**RETAINING WALL  
STATE SEAL AND MAP  
DETAIL SHEET**

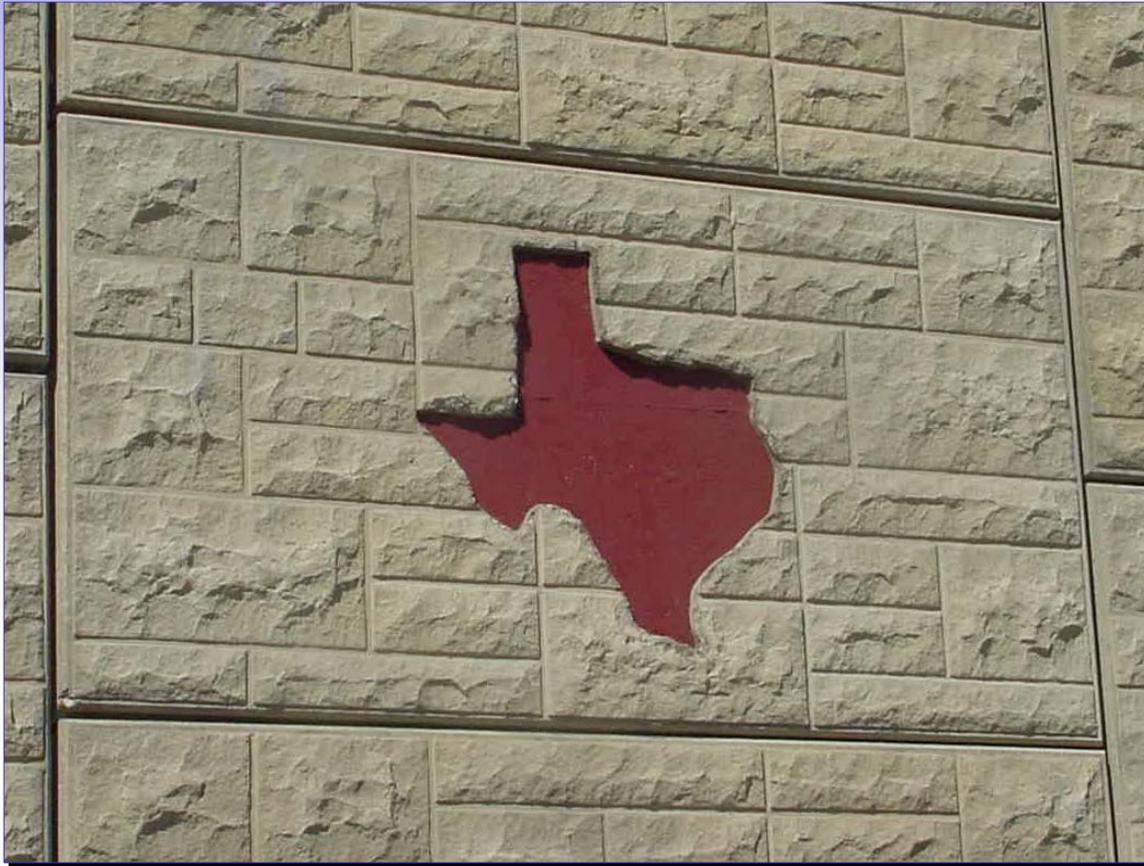
**BR (MSE) QD**

DATE	DATE	DATE	DATE	DATE	DATE
DESIGNED	CHECKED	APPROVED	DESIGNED	CHECKED	APPROVED
DATE	DATE	DATE	DATE	DATE	DATE

THIS SHEET AND THE USE OF THIS SHEET IS GOVERNED BY THE "Texas Engineering Practice Act" and the "Professional Engineers Act" of the State of Texas. No warranty or representation is made by TxDOT for any design or other information on this sheet. The user assumes all responsibility for the proper use of this sheet.

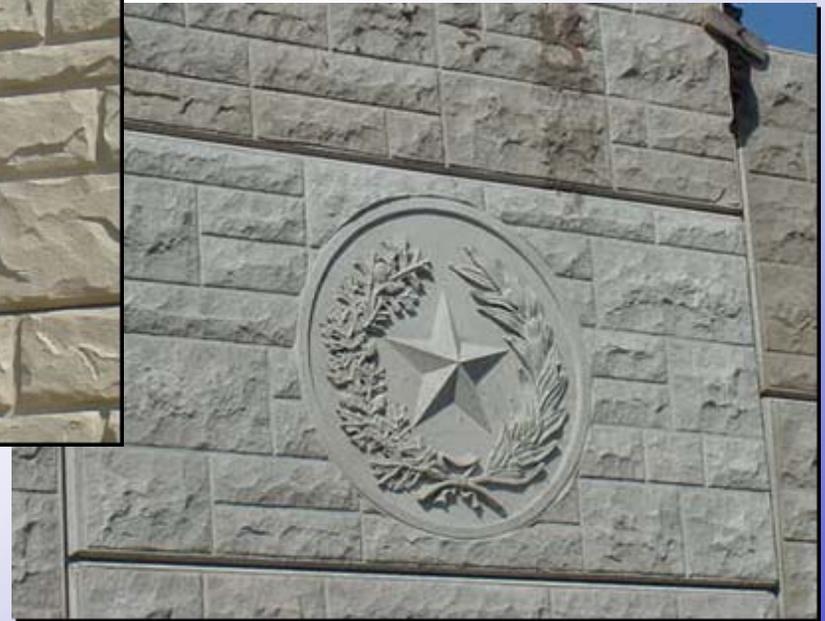
# Level 2 Process

Map on MSE Panel



# Level 2 Process

Seal on MSE Panel



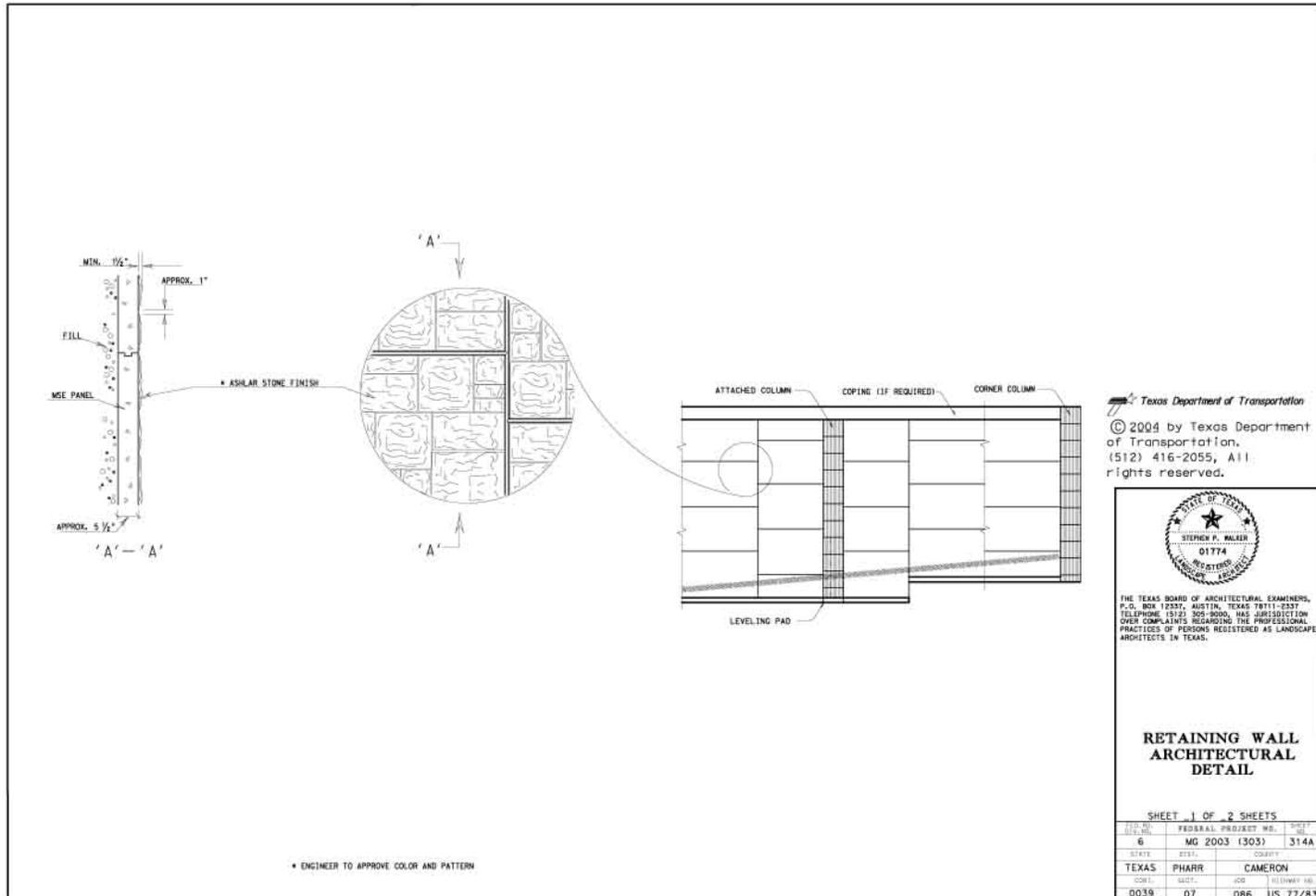
# Level 2 Process

Ashlar Stone Texture on MSE Panel



# Level 2 Process

## Ashlar Stone Texture on MSE Detail



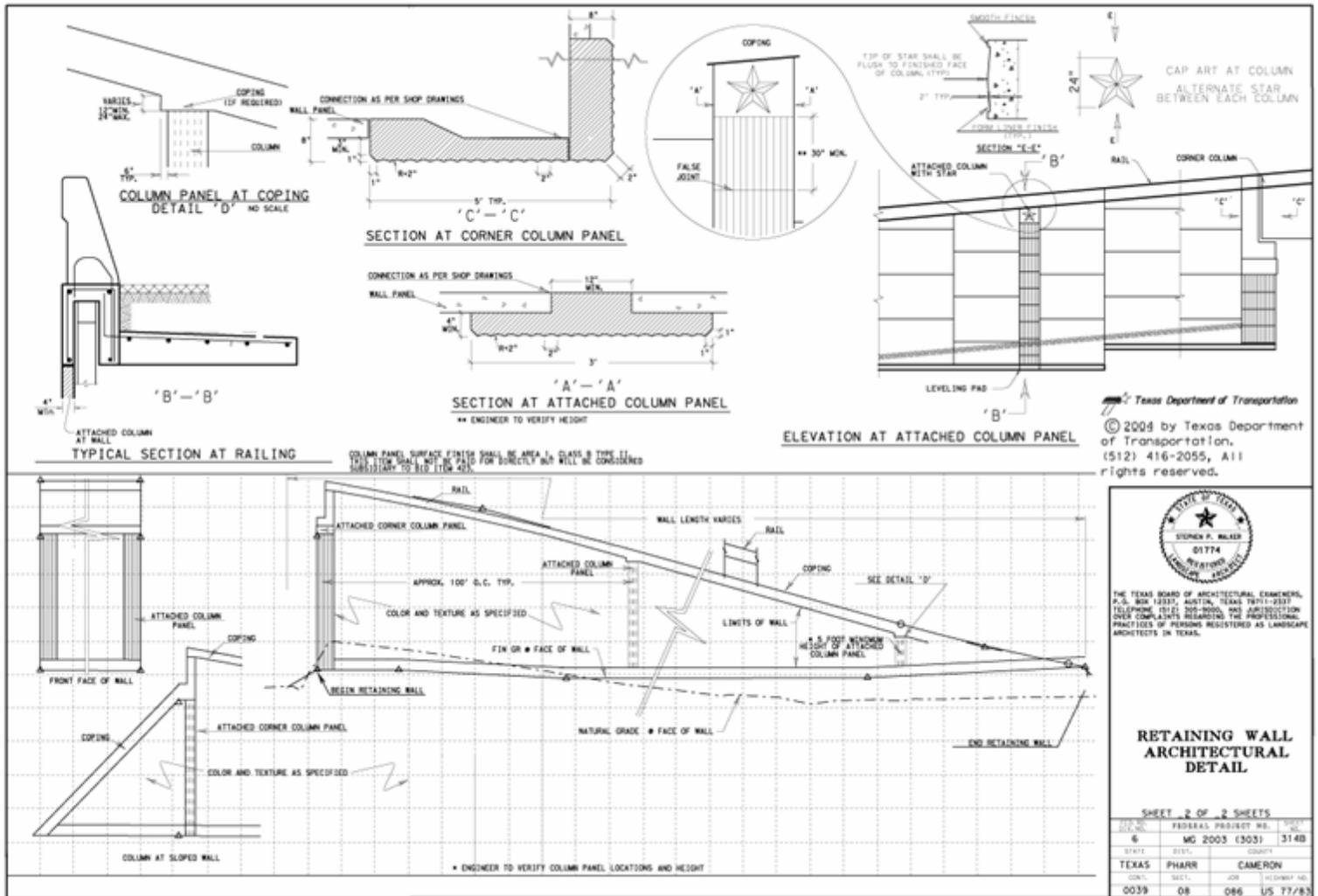
# Level 2 Process

## Form Liners



# Level 2 Process

## Attached Column Detail Sheet



# Level 2 Process

## Form Liner Flat Work



# Level 2 Process

Attached Column Form for Form Liner Cap Detail



# Level 2 Process

Attached Column Segment Form for Form Liner



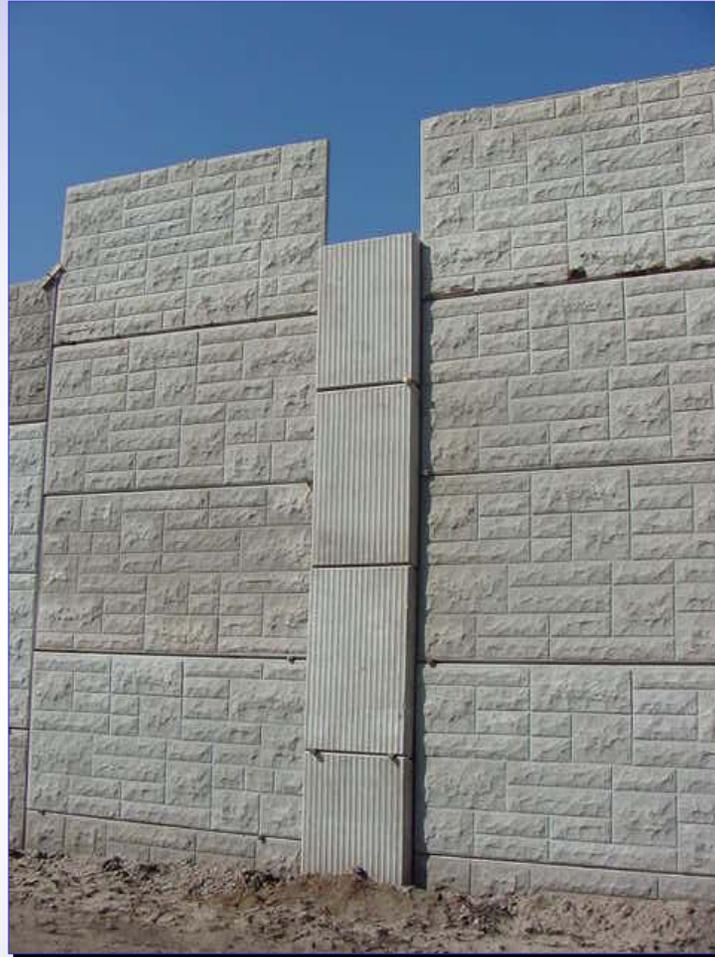
# Level 2 Process

Column Segments Stacked after Fabrication



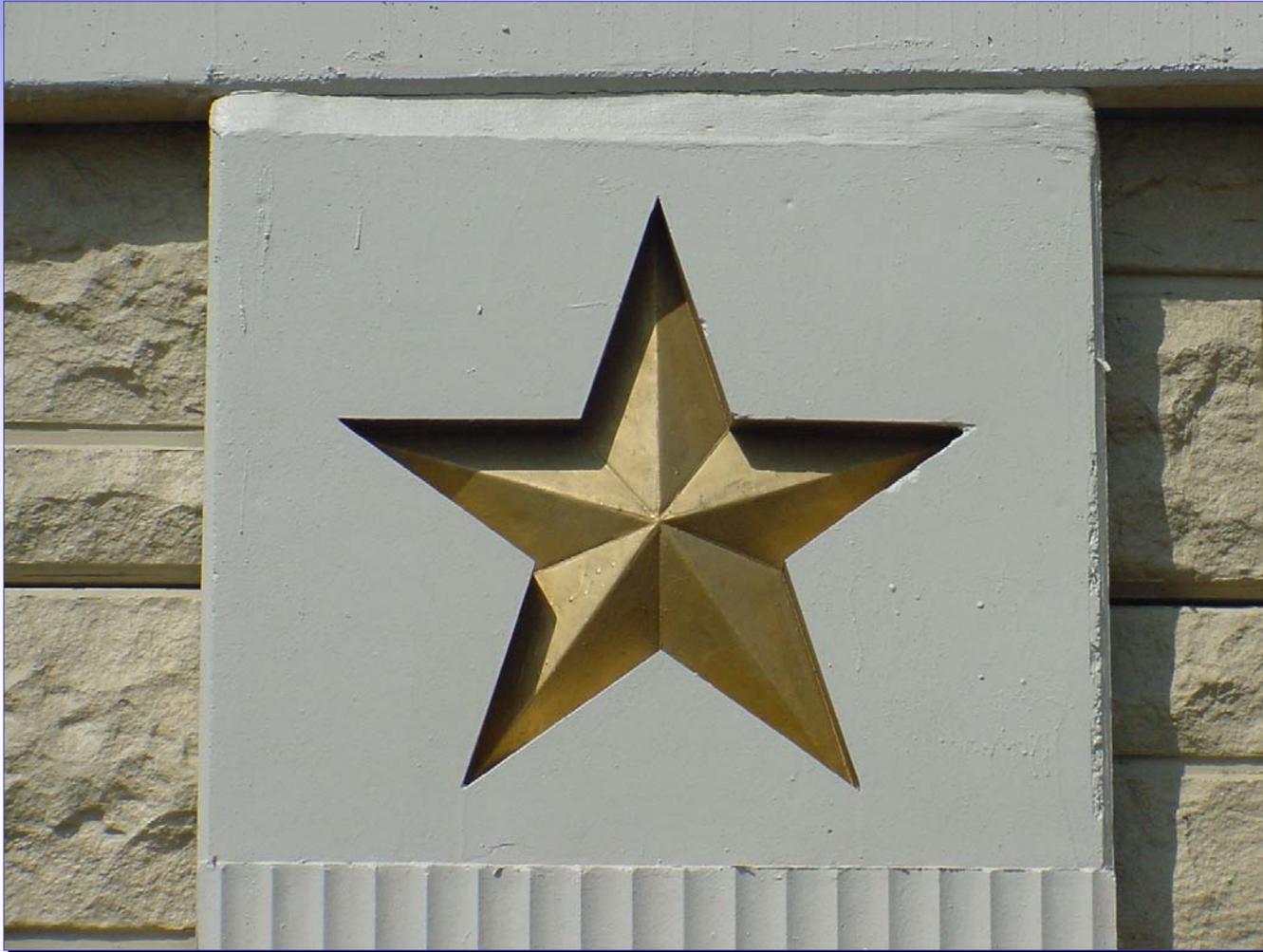
# Level 2 Process

Column in Construction, with Ashlar Stone Panels



# Level 2 Process

## Attached Column Cap Detail



# Level 2 Process

Column Cap Detail & form liners (IH 35 Austin)



# Level 3 Design

- Standard design packet with decorative finishes PLUS high profile designs.
- Murals, extensive form liner and color applications to most concrete surfaces.
- Major urban and high traffic areas, only.
- Principles: stylization, depth, color, scale.
- Rules for success: community ties (context-sensitive design), economy, focus.

# Design Principles

## Stylization



Line



Outline



Inline



Positive



Negative



Multi-level



Stylized  
Sculpture



Realistic  
Sculpture

# Design Principles

Stylization: Multi-Level Form (US 181, Portland)



# Design Principles

Stylization: Multi-Level Form (IH 20, Odessa District)



# Design Principles

Stylization: Sculptured Application



# Design Principles

Depth



# Design Principles

Color: US 281 in Hidalgo County



# Design Principles

Color: SH 100 & US 77/83



# Design Principles

Color: SH 1015/SH 1016 in Pharr District



# Design Principles

Scale: US 281 in Edinburg, Texas



# Design Principles

Scale: Combinations with Typical Form Liners



# Design Principles

Scale: Waco District



Sign Bridge column

# Design Principles

Scale: SH 100 & US 77/83



# Rules for Success

## Context-Sensitive Design



# Rules for Success

Context: Nature –SH 358/SH 286, Corpus Christi



# Rules for Success

Context: History –US 77/83, Brownsville



# Rules for Success

Context: History–US 77/83, Brownsville



# Rules for Success

Economy: Repetition



# Rules for Success

Economy: Repetition—SH 358/SH 286, Corpus Christi



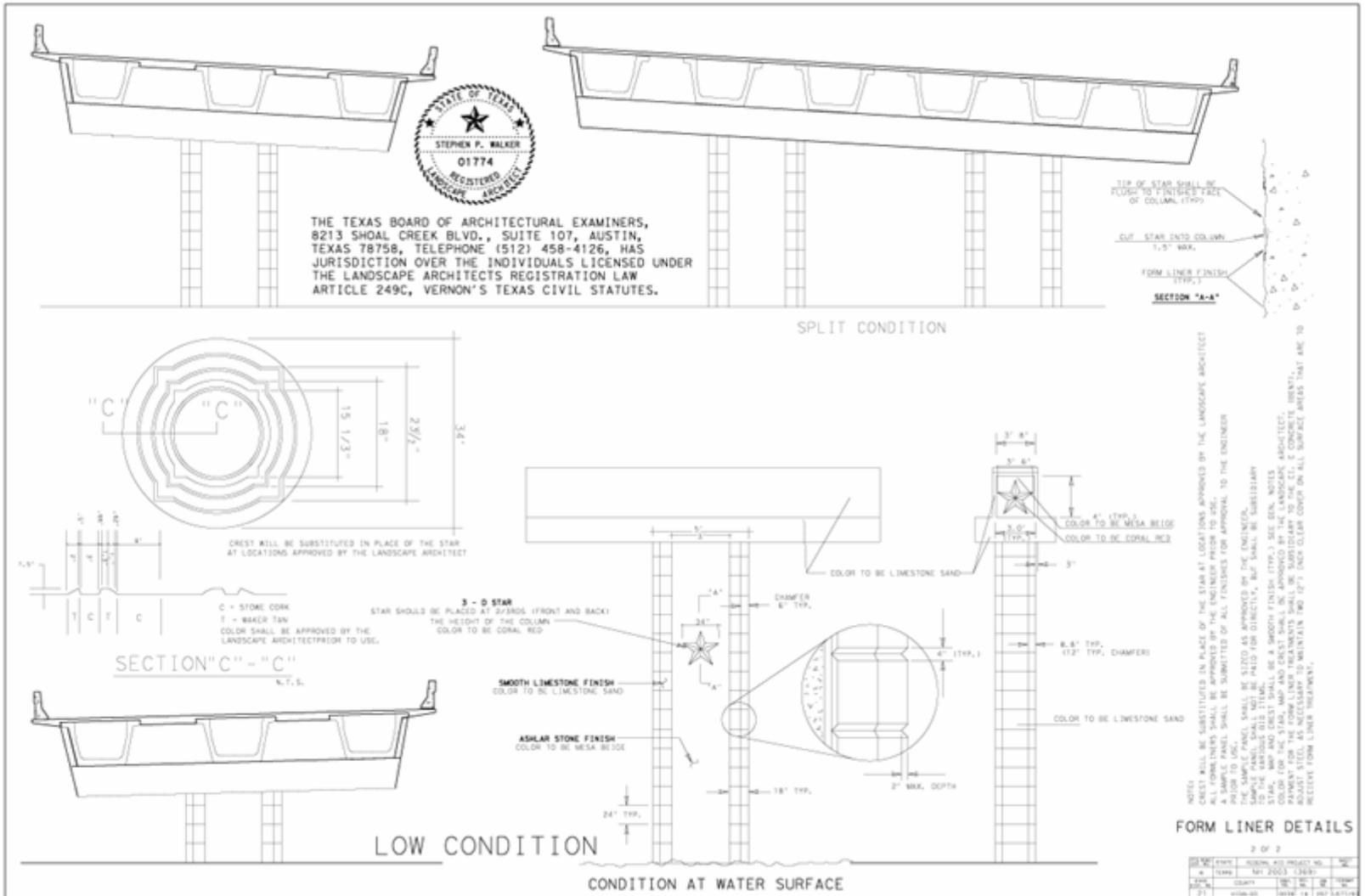
# Rules for Success

Economy: Repetition—US 77/83, Brownsville



# Rules for Success

## Form Liner Detail Sheet for US 77/83



# Rules for Success

Economy (Repetition) and  
Focus w/Column as a Focal Point



# Form Liner Process

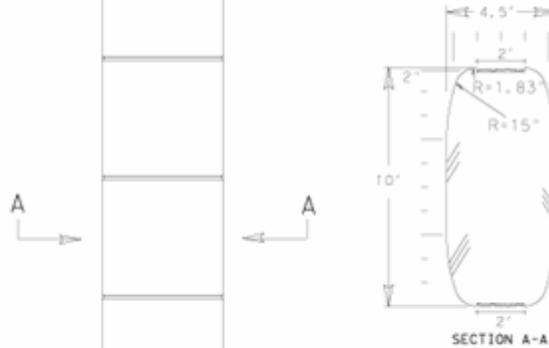
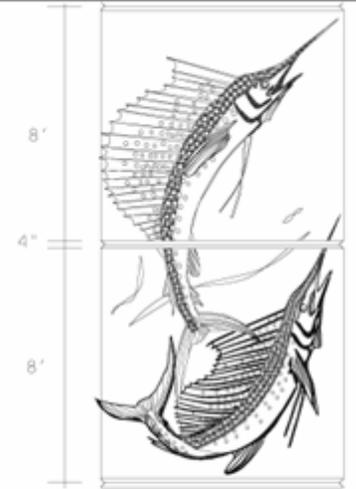
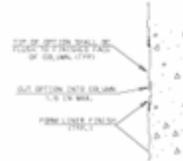
## Column Form Liner Detail



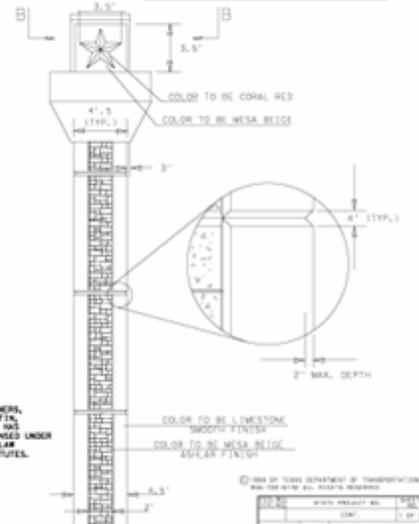
# Form Liner Process

## Column Form Liner Detail Sheet

NOTE:  
 CAP OPTIONS WILL BE SUBSTITUTED IN PLACE OF THE STAR AT LOCATIONS APPROVED BY THE LANDSCAPE ARCHITECT  
 ALL FORMLINERS SHALL BE APPROVED BY THE ENGINEER PRIOR TO USE.  
 A SAMPLE PANEL SHALL BE SUBMITTED OF ALL FINISHES FOR APPROVAL TO THE ENGINEER PRIOR TO USE.  
 THE SAMPLE PANEL SHALL BE SIZED AS APPROVED BY THE ENGINEER.  
 SAMPLE PANEL SHALL NOT BE PAID FOR DIRECTLY, BUT SHALL BE SUBSIDIARY TO THE VARIOUS BID ITEMS.  
 MAP, STAR, SHELL ETC. SHALL BE A SMOOTH FINISH (TYP.) SEE GEN. NOTES  
 COLOR FOR THE STAR, MAP AND CRIST SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT.  
 PAYMENT FOR THE FORM LINER TREATMENTS SHALL BE SUBSIDIARY TO THE C.I. C CONCRETE (BENT).  
 ADJUST STEEL AS NECESSARY TO MAINTAIN TWO (2") INCH CLEAR COVER ON ALL SURFACE AREAS THAT ARE TO RECEIVE FORM LINER TREATMENT.



THE TEXAS BOARD OF ARCHITECTURAL EXAMINERS,  
 8013 SHILOH CREEK BLVD., SUITE 100, AUSTIN,  
 TEXAS 78718, TELEPHONE (512) 488-4100, HAS  
 JURISDICTION OVER THE INDIVIDUALS LICENSED UNDER  
 THE LANDSCAPE ARCHITECTS REGISTRATION LAW  
 ARTICLE 2490C, VERNON'S TEXAS CIVIL STATUTES.

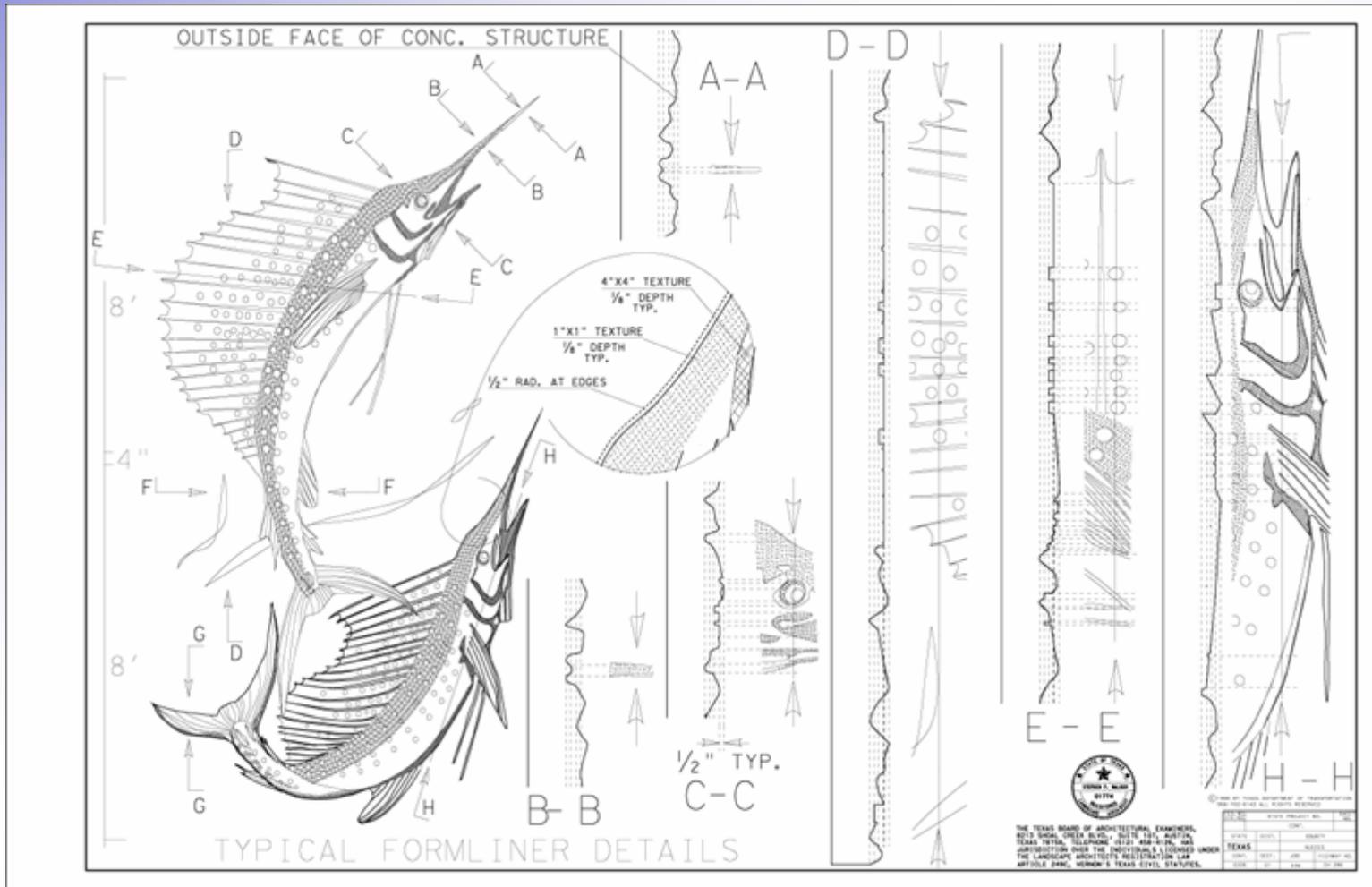


© 2008 BY TEXAS DEPARTMENT OF TRANSPORTATION  
 WITH THE WESA BLEND DESIGN REVISION

STATE	COUNTY	PROJECT NO.	SHEET NO.
TEXAS	NEEDS		
DATE	REV.	DATE	BY

# Form Liner Process

## Typical Section for Form Liner



# Form Liner Process

## Form Liner Fabrication



# Form Liner Process

## Column Form Liner



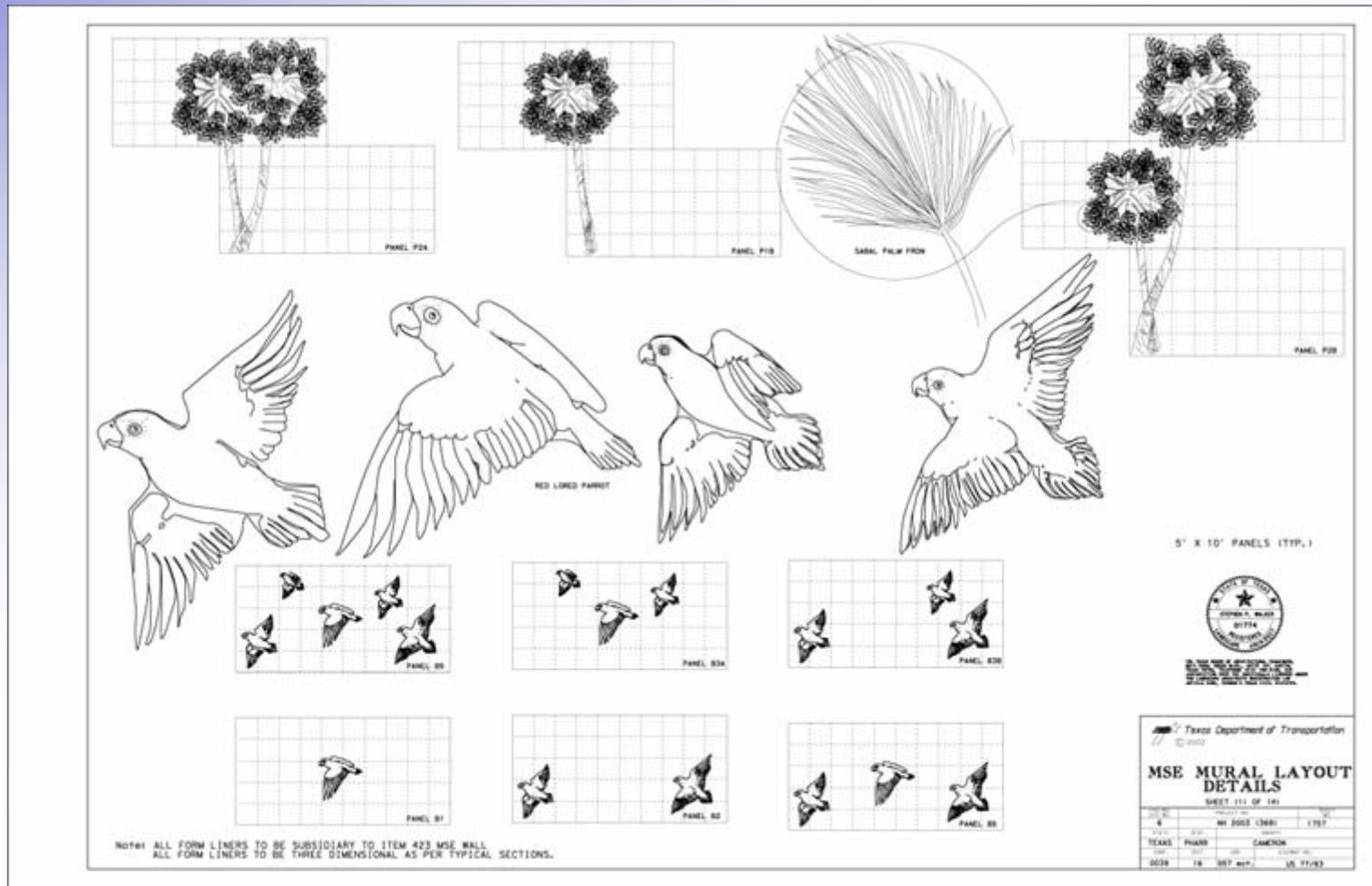
# Form Liner Process

Form Liners and MSE 3-D Art



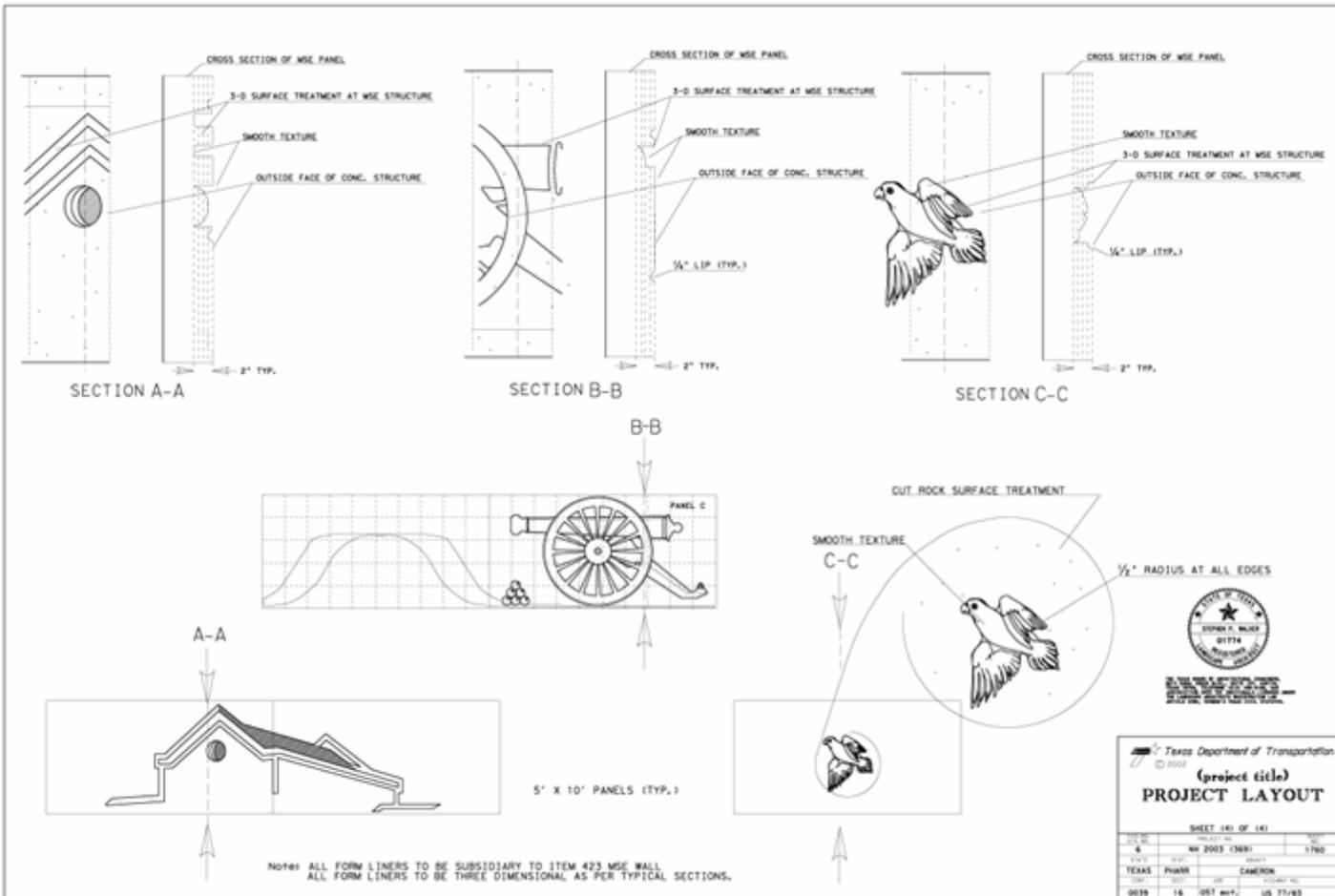
# Form Liner Process

## Sample Detail of Art Work in PS&E



# Form Liner Process

## Typical Section and 3-D Control



# Form Liner Process

Form Liners for MSE Panels



# Cost and Value

- Cost over normal treatments in percentages:

  - Form liners for MSE, cast in place etc. = 1%–5% of total cost.

  - Form liners for column treatments = 1%–5% of total cost.

- Value: Not quantified. Additional pleasure for traveling public and additional sense of geographic, cultural, and community.

# Closing comments

- Due to the advancements in construction techniques, TxDOT is able to offer more to the public than the standard construction elements by the addition of decorative finishes.
- This allows TxDOT, local public agencies and the private sector to become more associated with roadway development. Also provides an opportunity of additional cost of the use of aesthetic treatments to be shared with outside interests and improve the quality of life in our communities.

# For More Info...

- **Bridge Division, Design Section**  
Dean W. Vanlanduyt, P.E. 512-416-2178
- **Design Division, Landscape Section**  
Barrie Cogburn, 512-416-3086
- **District Landscape Architects**  
<http://crossroads/org/des/le/index.asp>