MECHANICAL STABILIZED EARTH (MSE) RETAINING WALL STANDARDS

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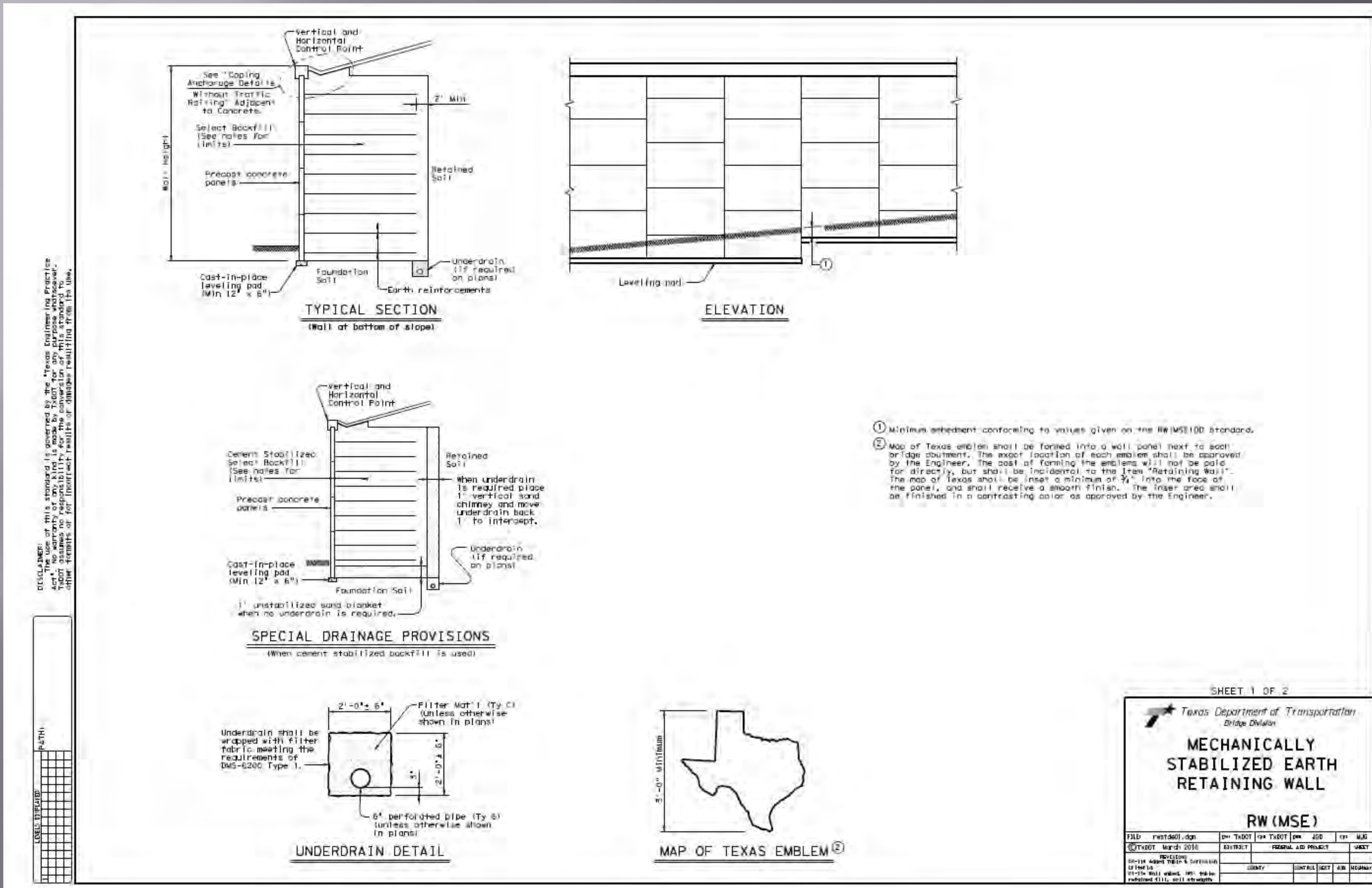
Geotechnical Branch
Bridge Division

Changes to MSE Standards

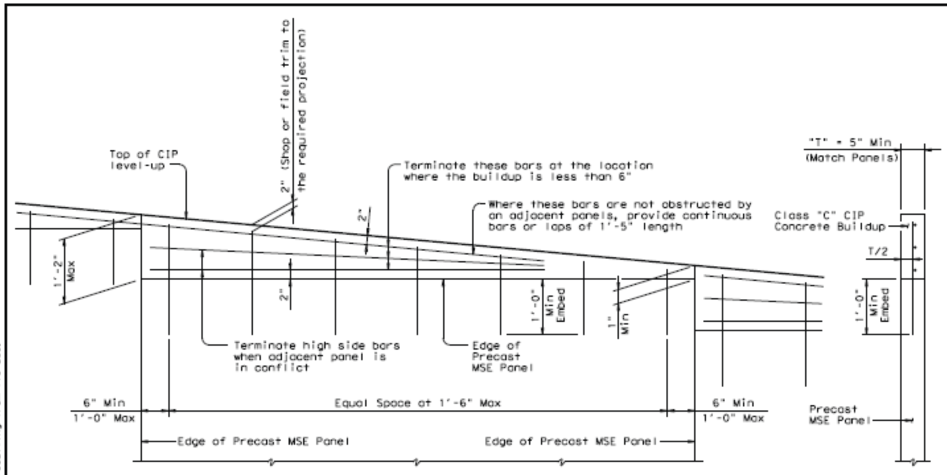
- RW(MSE) Standard has grown from 1 to 2 sheets.
- Added the RW(MSE)DD standard as an additional required sheet.

RW(MSE) 1 of 2



Vertical and Horizontal Control Point
See "Coping Anchorage Details"
Without Traffic Railing" Adjacent to Concrete
2" Min
Select Backfill (See notes for limits)
Wall Height
Retained Soil
Precast concrete panels
Cast-in-place leveling pad (Min 12" x 6")
Foundation Soil
Underdrain (if required on plans)
Earth reinforcements
TYPICAL SECTION
(Wall at bottom of slope)
Leveling pad
ELEVATION
Cement Stabilized Select Backfill (See notes for limits)
When underdrain is required place 1' vertical sand chimney and move underdrain back 1' to intercept.
1' unstabilized sand blanket when no underdrain is required.
SPECIAL DRAINAGE PROVISIONS
(When cement stabilized backfill is used)
Filter Mat'l (Ty C) (Unless otherwise shown in plans)
Underdrain shall be wrapped with filter fabric meeting the requirements of DMS-6200 Type 1.
6" perforated pipe (Ty 6) (unless otherwise shown in plans)
UNDERDRAIN DETAIL
3'-0" Minimum
MAP OF TEXAS EMBLEM (2)
(1) Minimum embedment conforming to values given on the RW(MSE)DD standard.
(2) Map of Texas emblem shall be formed into a wall panel next to each bridge abutment. The exact location of each emblem shall be approved by the Engineer. The cost of forming the emblems will not be paid for directly, but shall be incidental to the Item "Retaining Wall". The map of Texas shall be inset a minimum of 3/4" into the face of the panel, and shall receive a smooth finish. The inset area shall be finished in a contrasting color as approved by the Engineer.
SHEET 1 OF 2
Texas Department of Transportation
Bridge Division
MECHANICALLY STABILIZED EARTH RETAINING WALL
RW(MSE)

RW(MSE) 2 of 2



ELEVATION

SECTION

LEVEL UP DETAIL⑤

Provide Grade 60 (#4) Reinforcement

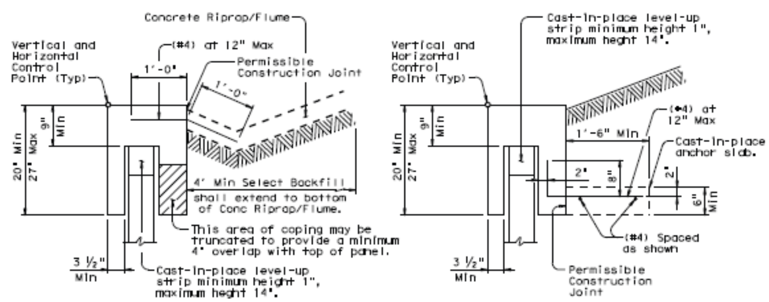
③ Precast coping shall be anchored to prevent rotation or displacement. Use these details to develop custom anchorage for precast copings. Details shall include coping reinforcement. Concrete flume (if required) shall be paid for separately from Item 423.

④ Soil design parameter must be based on long term soil strength. Design parameters must be listed on the RW(MSE)DD standard.

⑤ Cast vertical bars into the top of panels. At contractor's option vertical bars may be embedded 4" with a Type III Clac C epoxy anchorage system. Follow manufacturer's directions for installing the epoxied vertical bars.

⑥

SELECT BACKFILL UNIT WEIGHT			
Type A, B & D	Unit Weight	Inernal Stability	External Stability
	105 PCF	Pullout	Sliding, Overturning, Eccentricity
	125 PCF	Rupture	Bearing



ADJACENT TO CONCRETE
(Excluding Concrete Pavement)

ADJACENT TO SOIL

COPING ANCHORAGE DETAILS WITHOUT TRAFFIC RAILING③

DESIGN PARAMETERS:

Design of retaining walls shall be based on the following design parameters unless stated elsewhere in the plans:

Retained Soil	Unit Weight = 125 pcf Ø = ④ C = 0 psf
Foundation Soil	Ø = ④ C = 0 psf
Select Backfill	Unit Weight = See Table ⑥ Ø = 34 C = 0 psf
Cement Stabilized Select Backfill	Unit Weight = 125 pcf Ø = 45 C = 0 psf

Stress in steel and concrete shall be in accordance with current AASHTO Standard and Interim Specifications.
The minimum length of earth reinforcements are as shown on the RW(MSE)DD standard.

STABILITY CRITERIA:

Stability criteria applies to both dry and drawdown analysis.
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 ¾ inch strain.

CORROSION CRITERIA:

The earth reinforcement elements shall be designed to have a minimum design life of 75 years, using current AASHTO corrosion rates.
Stress calculations (rupture) shall be done on the calculated earth reinforcement section remaining after 75 years. Pullout calculations may be based on non-corroded section.

PRECAST COPINGS:

Wall supplier is to maximize lengths of precast coping. Precast coping is to be provided in 10' minimum lengths (typical). To optimize coping lengths at radiuses, end of runs or other wall geometric conditions favorable to shorter coping sections, shorter lengths may be used pending approval by the Engineer. This applies only to coping without railing.

JOINT SEALER:

The joints between coping segments must be sealed in accordance with the DMS-6310 "Joint Sealant's and Fillers", joint sealing material, Class 4. The joint must be sealed 3" below and 6" above the adjoining pavement surface, or as directed by the Engineer. The purpose of the joint sealing is to contain surface drainage and prevent infiltration into the retaining wall backfill.

GENERAL NOTES:

Section and elevation shown is for informational purposes only. Specific geometry is to be determined based on wall layouts 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 a minimum 2' beyond the end of the earth reinforcements. The select backfill shall extend vertically from the top of the leveling pad 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 pad.
Minimum wire size for earth reinforcements shall be W7.0. 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.
A maximum of four wire mesh configurations (wire sizes) will be allowed on a project. Each mesh configuration shall have a unique transverse bar spacing, differing from other configurations by a minimum of 3". Earth reinforcement lengths shall be stepped in increments no finer than 12".
Standard precast concrete panels shall have a maximum height of 6', and a maximum surface area of 50 sq ft. Top and bottom panels may exceed these limitations as necessary to achieve required wall grades. Maximum height of any panel shall be 7'-6". 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 joint configuration shall be such that 1) the filter fabric and/or pad materials are not exposed at the wall face and 2) the design opening is between ⅜" and ¾".
A one-piece corner panel shall be provided for wall angle changes of greater than 30 degrees. Butting of chamfered panels will be allowed for angle changes of 30 degrees or less.
Concrete coping shall be provided along the top of wall, at the vertical steps at bridge backwalls, and at 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 DMS-6310 "Joint Sealants and Fillers", using Class 4 joint sealant.
When obstructions (inlets, drilled shafts, piling, etc.) prevent placement of soil reinforcements in their normal locations, provide details and calculations that establish support for the affected panels. Furnish the same earth reinforcement coverage as that required in the absence of the obstruction. For skewed (rotated) earth reinforcements no adjustment in length is needed for skew angles between 1 and 10 degrees. For skew angles greater than 10 degrees adjust the length of earth reinforcement to provide a cosine length of the reinforcement equivalent to the stated design length for the section of wall. Provide calculations that justify any alterations made to the soil reinforcements or modifications to their normal placement. Do not use panels without any soil reinforcements connected to them unless they are connected with galvanized hardware to adjacent panels which do have supporting Soil reinforcements attached to them and as approved by the Engineer.
Reinforced concrete must be Class "C", Precast concrete Class "H", Unreinforced concrete Class "A".
All reinforcing steel must be Grade 60.
Coping and anchor slabs are considered subsidiary to the Item "Retaining Wall".
These details are to be used in conjunction with the retaining wall layout, standard RW(MSE)DD and other applicable standards.

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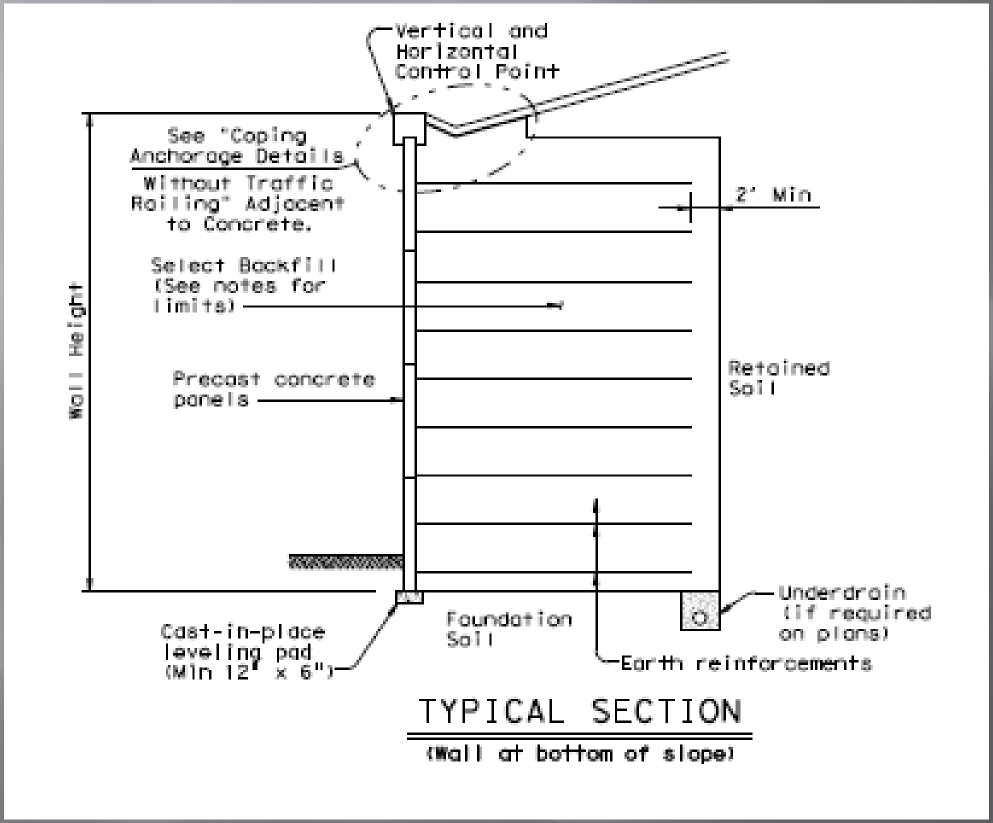
Texas Department of Transportation
Bridge Division

MECHANICALLY STABILIZED EARTH RETAINING WALL

RW(MSE)

FILE: rwstde01.dgn	DN: TxDOT	CK: TxDOT	DW: JSD	CK: MJS
©TxDOT March 2010	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS 04-11: Added Table & Corrosion Criteria. 01-13: Wall embed, (MS) table, retained fill, soil strength.	COUNTY	CONTROL	SECT	JOB	HIGHWAY

Wall Typical Section

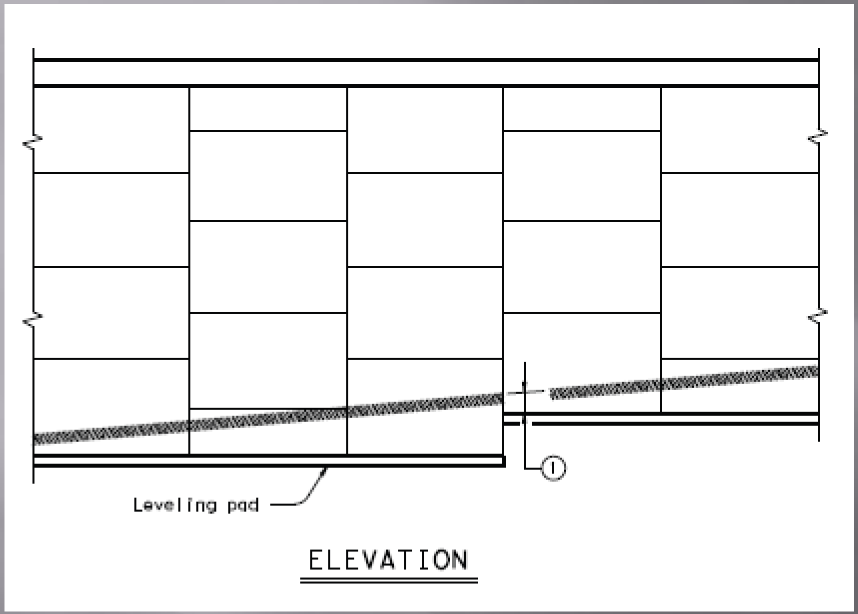


- Section now identifies foundation and retained soil
- The select fill zone extends a minimum of 2′ beyond the earth reinforcement.

Select Fill/Retained Fill

Select Fill/Retained Fill

Wall Embedment



Minimum embedment requirement has been modified. Additional guidance for determining minimum required embedment can be found on the RW(MSE)DD standard.

(1) Minimum embedment conforming to values given on the RW(MSE)DD standard.

1) Minimum embedment conforming to the values given on the RW(MSE)DD standard.

Wall Embedment

Wall Embedment

MSE Design Parameters

DESIGN PARAMETERS:
Design of retaining walls shall be based on the following design parameters unless stated elsewhere in the plans:

Retained Soil	Unit Weight = 125 pcf Ø = 4 C = 0 psf
Foundation Soil	Ø = 4 C = 0 psf
Select Backfill	Unit Weight = See Table 6 Ø = 34 C = 0 psf
Cement Stabilized Select Backfill	Unit Weight = 125 pcf Ø = 45 C = 0 psf

4 Soil design parameter must be based on long term soil strength. Design parameters must be listed on the RW(MSE)DD standard.

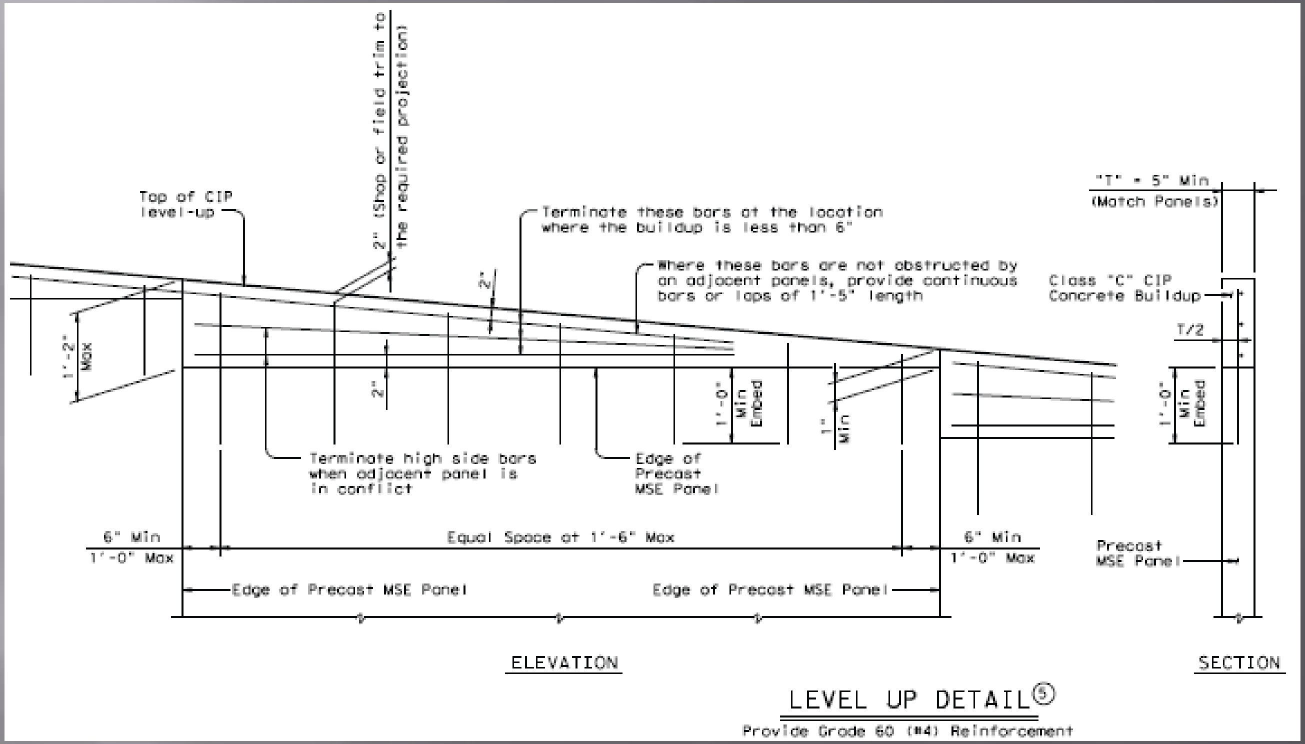
5 Cast vertical bars into the top of panels. At contractor's option vertical bars may be embedded 4" with a Type III Clac C epoxy anchorage system. Follow manufacturer's directions for installing the epoxied vertical bars.

6

SELECT BACKFILL UNIT WEIGHT			
	Unit Weight	Inernal Stability	External Stability
Type A, B & D	105 PCF	Pullout	Sliding, Overturning, Eccentricity
	125 PCF	Rupture	Bearing

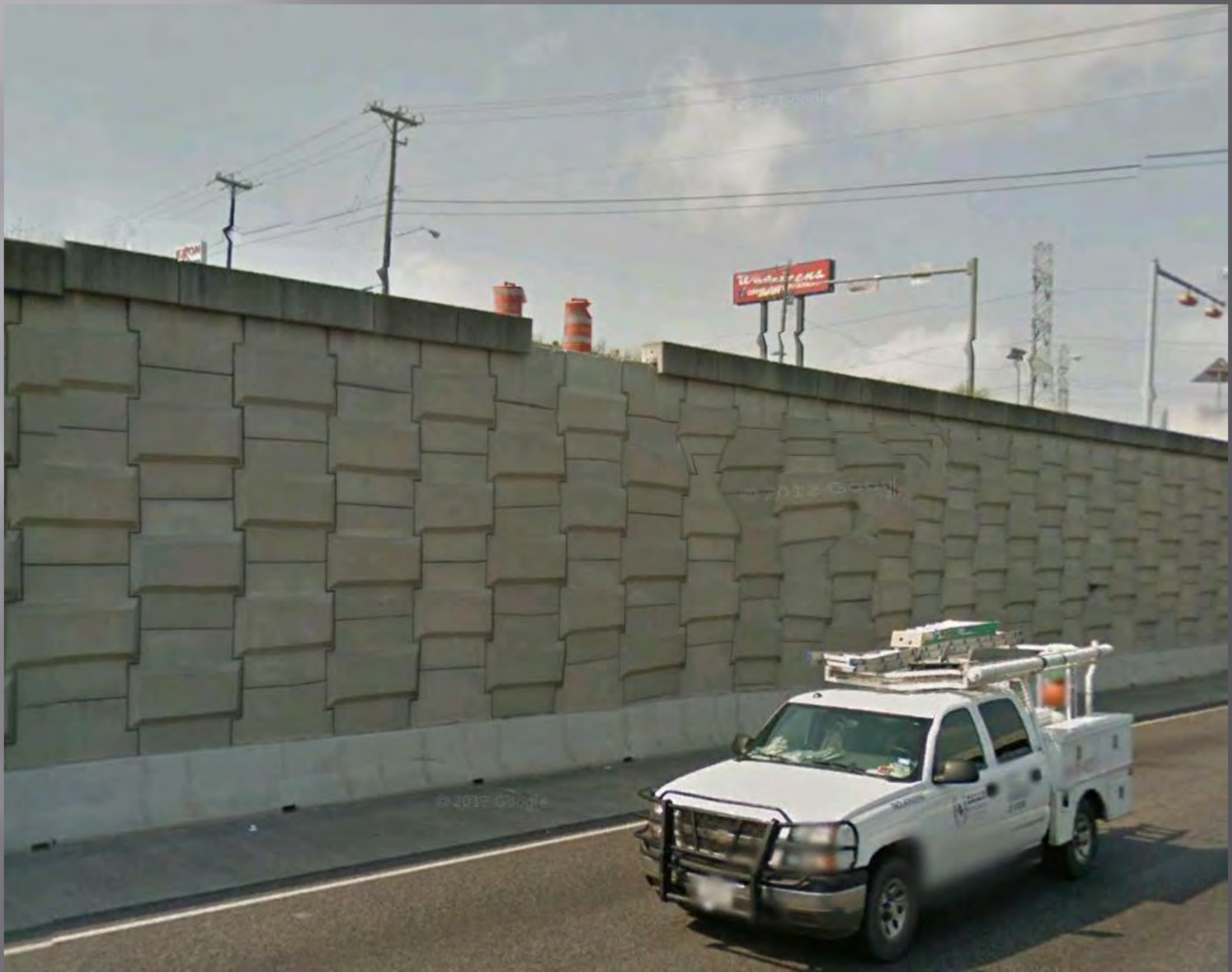
Values for friction angles of the foundation and retained soil have been removed from the standard and are now to be populated on the RW(MSE)DD standard.

Top Panel Level-Up



Level up detail for top panels.

Coping Stability



Panel Level-Up

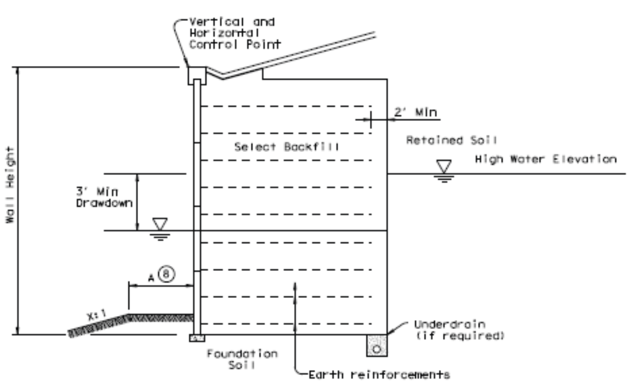
Notes Revision

- Provided clarification on the controlling factors of safety for both dry and drawdown analysis
- Design service life is to be calculated using AASHTO corrosion rates.
- Added note of clarification for panel joints.
- Added note requiring wall supplier to address obstructions and provide calculations and details in the shop drawings.
- Expanded concrete requirements for unreinforced, reinforced and precast concrete.

RW(MSE)DD

WALL SUMMARY

MSE Retaining Wall	Begin Station ①	End Station ①	Retained Soil Frictin Angle ②	Foundation Soil Friction Angle ②	Ground Improvement ③	Min Earth Reinforcement Length ④	Min Wall Embedment ⑦	Underdrain Required ⑤	Drawdown Analysis ⑥	Bench Width ⑧



TYPICAL SECTION

(RAPID DRAWDOWN CONDITION)

① Indicate limits for which the stated soil design requirements/assumptions are applicable.

② Retained and Foundation friction angle listed should be based on local experience or measured/correlated long term strength values.

③ Indicate if ground improvement is required or not required. If shown as required, refer to Ground Improvement Detail(s) for additional information.

④ Indicate on table minimum length and length ratio required. The minimum default length of earth reinforcements shall be either 8'-0" or 70% of the wall height, whichever is greater. Wall height and design wall height may differ depending on project geometry and loading conditions. Note: Wall height at bridge abutments is equal to the distance between the top of leveling pad and finished grade at the bridge abutment backwall.

⑤ Indicate if underdrain is required or not required.

⑥ Indicate if rapid drawdown analysis is required.

⑦ Guidance to wall designer of record for determination of minimum wall embedment: Unless noted elsewhere in the plans, the minimum embedment provided from the top of leveling pad to finish grade shall be 1' for level ground where there is no potential for erosion or future excavation or 2' for sloping ground (4.0H:1.0V or steeper) or where there is potential for removal of soil in front of the wall.

⑧ Horizontal Bench width at base of wall varies. Use the following criteria to establish base width.
A = 2.0' Min for X > 4. or
A = 4.0' Min for X ≤ 4.
Applicable to both drawdown and dry condition.

SPECIAL NOTES:
This sheet is to be filled out by the wall designer of record at time of plan preparation to provide soil strength parameters for the design of the specified walls.
The completed sheet shall be signed, sealed, and dated by a licensed Professional Engineer.

Texas Department of Transportation
Bridge Division

MECHANICALLY STABILIZED EARTH RETAINING WALL DESIGN DATA

RW(MSE)DD

FILE: rwstde16.dgn	DN: TxDOT	CK: MJG	DW: JTR	CK: MJG
© TxDOT January 2013	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS				
	COUNTY	CONTROL	SECT	JOB	HIGHWAY

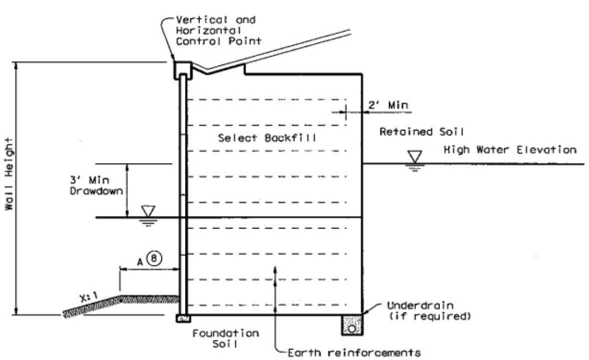
PATH:

LEVELS DISPLAYED

RW(MSE)DD-Example

WALL SUMMARY

MSE Retaining Wall	Begin Station ①	End Station ①	Retained Soil Frictin Angle ②	Foundation Soil Friction Angle ②	Ground Improvement ③	Min Earth Reinforcement Length ④	Min Wall Embedment ⑦	Underdrain Required ⑤	Drawdown Analysis ⑥	Bench Width ⑧
RETAINING WALL 1	835+00.00	838+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	2.0' to 1.0'	YES	N/A	3.0'
RETAINING WALL 1	838+00.00	843+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 1	843+00.00	845+00.00	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 1	845+00.00	847+32.20	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	1.0' to 2.0'	YES	N/A	3.0'
RETAINING WALL 2	834+00.00	837+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	2.0' to 1.0'	YES	N/A	3.0'
RETAINING WALL 2	837+00.00	846+50.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 2	846+50.00	848+12.35	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0' to 2.0'	YES	N/A	3.0'
RETAINING WALL 3	849+25.38	854+00.00	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 3	854+00.00	858+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 3	858+00.00	860+99.71	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0+ to 2.0'	YES	N/A	3.0'
RETAINING WALL 4	850+05.53	851+84.27	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 4	851+84.27	859+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 4	859+00.00	861+07.21	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0+ to 2.0'	YES	N/A	3.0'
RETAINING WALL 5	966+94.00	971+23.49	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 5	971+23.49	976+08.10	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 5	976+08.10	977+13.20	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0' to 2.0'	YES	N/A	3.0'
RETAINING WALL 6	967+00.00	968+00.00	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 6	968+00.00	976+43.38	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 6	976+43.38	978+31.08	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	1.0+ to 2.0'	YES	N/A	3.0'
RETAINING WALL 7	978+86.69	980+58.08	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 7	980+58.08	986+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 7	986+00.00	989+00.00	30 deg.	30 deg.	SEE NOTE	8' OR 70% OF H	1.0+ to 2.0'	YES	N/A	3.0'
RETAINING WALL 8	980+04.57	981+67.77	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	2.0+ to 1.0'	YES	N/A	3.0'
RETAINING WALL 8	981+67.77	987+00.00	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	1.0'	YES	N/A	3.0'
RETAINING WALL 8	987+00.00	990+06.00	30 deg.	27 deg.	SEE NOTE	10' OR 80% OF H	1.0+ to 2.0'	YES	N/A	3.0'



TYPICAL SECTION
(RAPID DRAWDOWN CONDITION)

① Indicate limits for which the stated soil design requirements/assumptions are applicable.

② Retained and Foundation friction angle listed should be based on local experience or measured/correlated long term strength values.

③ Indicate if ground improvement is required or not required. If shown as required, refer to Ground Improvement Detail(s) for additional information.

④ Indicate on table minimum length and length ratio required. The minimum default length of earth reinforcements shall be either 8'-0" or 70% of the wall height, whichever is greater. Wall height and design wall height may differ depending on project geometry and loading conditions. Note: Wall height at bridge abutments is equal to the distance between the top of leveling pad and finished grade at the bridge abutment backwall.

⑤ Indicate if underdrain is required or not required.

⑥ Indicate if rapid drawdown analysis is required.

⑦ Guidance to wall designer of record for determination of minimum wall embedment: Unless noted elsewhere in the plans, the minimum embedment provided from the top of leveling pad to finish grade shall be 1' for level ground where there is no potential for erosion or future excavation or 2' for sloping ground (4.0H:1.0V or steeper) or where there is potential for removal of soil in front of the wall.

⑧ Horizontal Bench width at base of wall varies. Use the following criteria to establish base width.
$A = 2.0'$ Min for $X > 4.$ or
$A = 4.0'$ Min for $X \leq 4.$
Applicable to both drawdown and dry condition.

③ NOTE: Perform proof rolling on retaining wall foundation area to identify any loose, soft or unsuitable materials in accordance with Item 216. Material not meeting a maximum rut depth of 1 in per pass of pneumatic tired roller should continue to be rolled or removed and replaced with suitable material.

Texas Department of Transportation
Bridge Division

MECHANICALLY STABILIZED EARTH RETAINING WALL DESIGN DATA

RW(MSE)DD

FILE: rwstde16.dgn	DN: TxDOT	CK: MJG	DW: JTR			CK: MJG	
© TxDOT January 2013	DISTRICT	FEDERAL AID PROJECT				SHEET	
REVISIONS	CORP						
	COUNTY		CONTROL	SECT	JOB	HIGHWAY	
	NUECES		0102	02	096	US 77	

Wall and Station Designation

MSE Retaining Wall	Begin Station 1	End Station 1

Retaining wall designation and station limits. These fields identify the wall and wall limit to which all other information provide on the specific row in the table are applicable.

Design Parameters

Retained Soil Frictin Angle 2	Foundation Soil Friction Angle 2

- These fields identify the applicable long term drained friction angle of the retained and foundation soil.
- Historic default used = 30 degrees.
- The friction angles listed should be based on local experience or measured/correlated strength values.
- Values used should also be used by the designer to evaluate the overall wall stability.
- **Remember all soils are not created equal**!

P.I. Strength Correlation

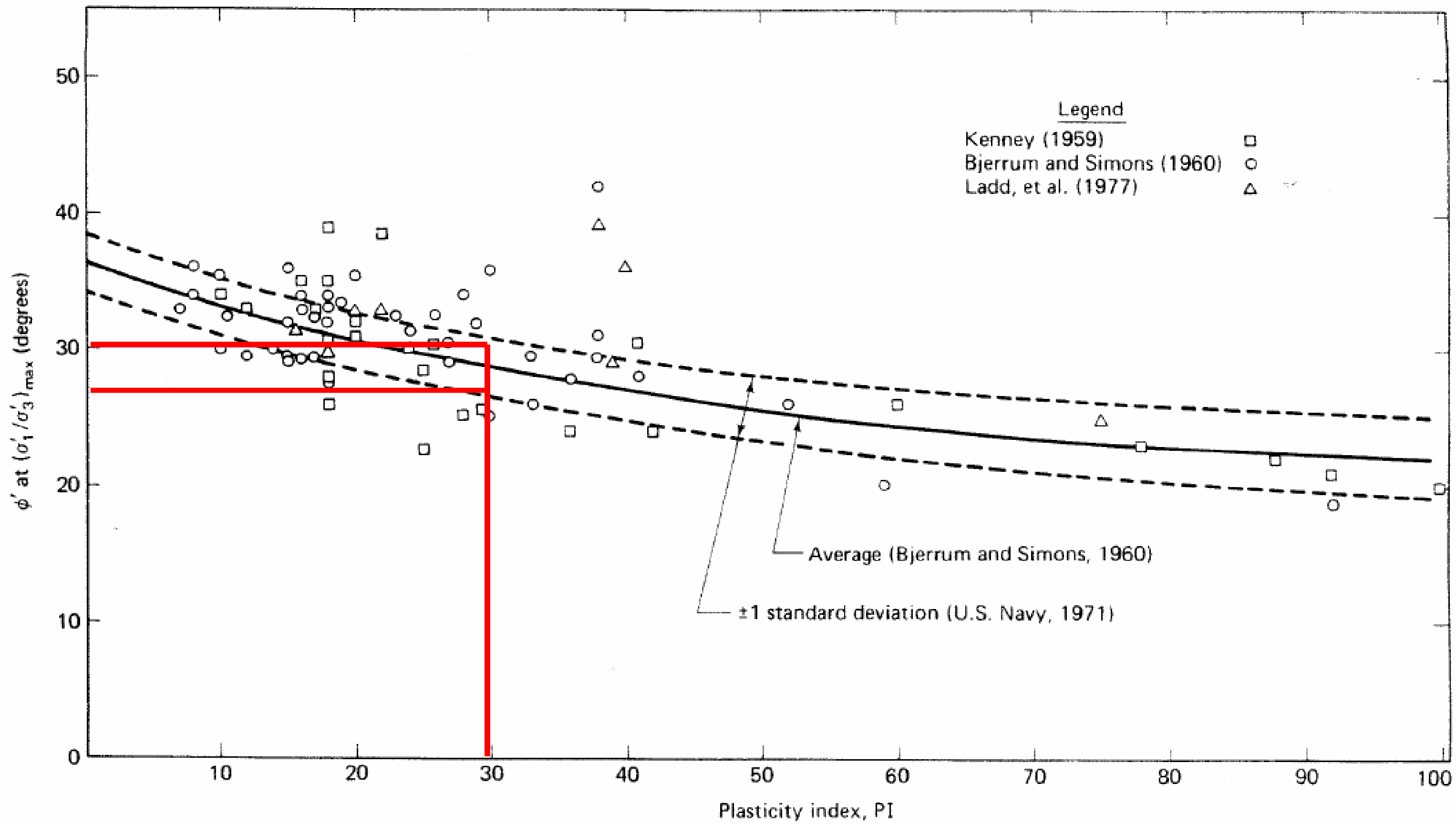


Fig. 11.27 Empirical correlation between ϕ' and PI from triaxial compression tests on normally consolidated undisturbed clays (after U.S. Navy, 1971, and Ladd, et al., 1977).

Design Parameters

Correlations exist that utilize the index properties of soils to estimate the drained friction angle and can be found in many geotechnical engineering references. As a general rule of thumb the following recommendations can be used to establish appropriate soils strengths.

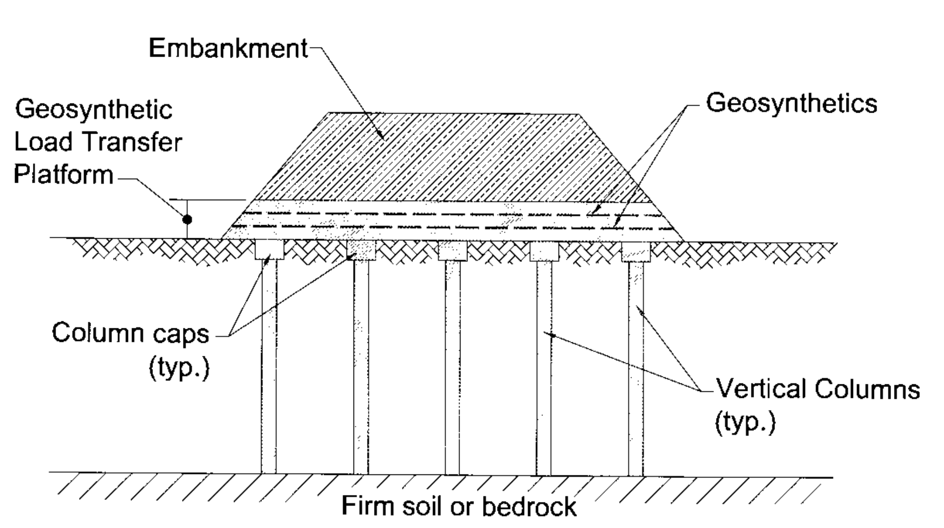
Design Friction Angle	
Material Type	Friction Angle
Rock	30 degrees*
Sand/Gravel	30 degrees*
Lean Clay; PI<20	30 degrees
Lean Clay; 20<PI<30	27<phi<30
Fat Clay; 30<PI<45	25<phi<27

*Designer may elect to use higher values based laboratory test data or local experience.

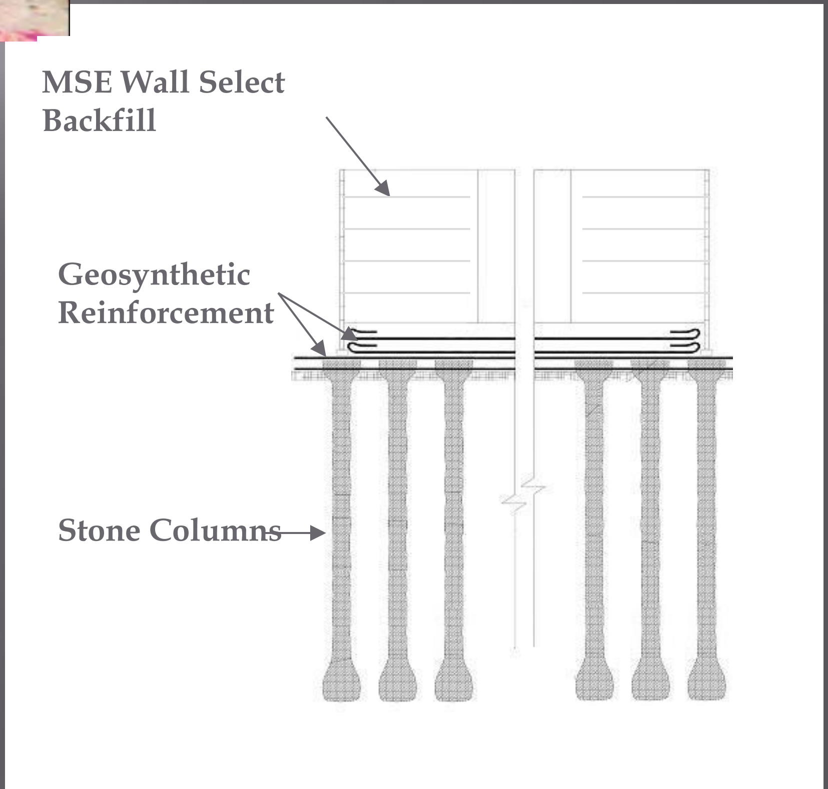
Ground Improvement

4) Ground Improvement – this field is to identify if ground improvement is required for a given wall or given section of wall. For sites with weak foundation soils it is sometimes more economical to provide a ground (foundation) improvement plan to allow the safe use of MSE walls rather than change out the wall type. Ground improvement plans can vary from the simple remove and recompact or replace material to the complex, i.e, the use of geopiers, stone columns or geogrid reinforced pads. The friction angle of the foundation soil should reflect the frictional properties of the material used for the ground improvement.

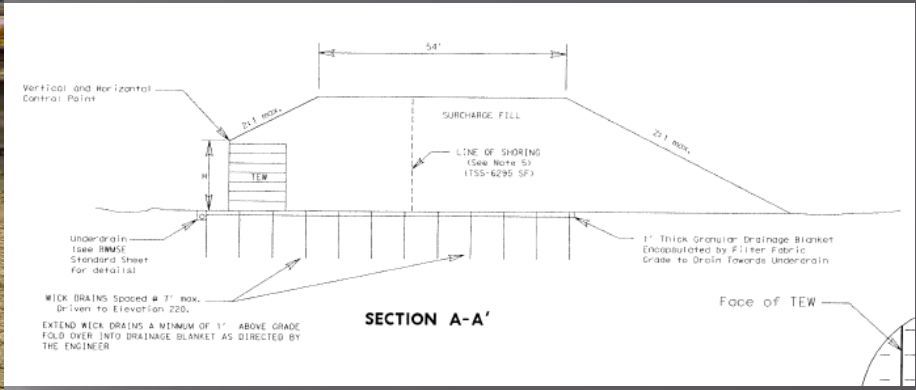
Pile Supported Embankment

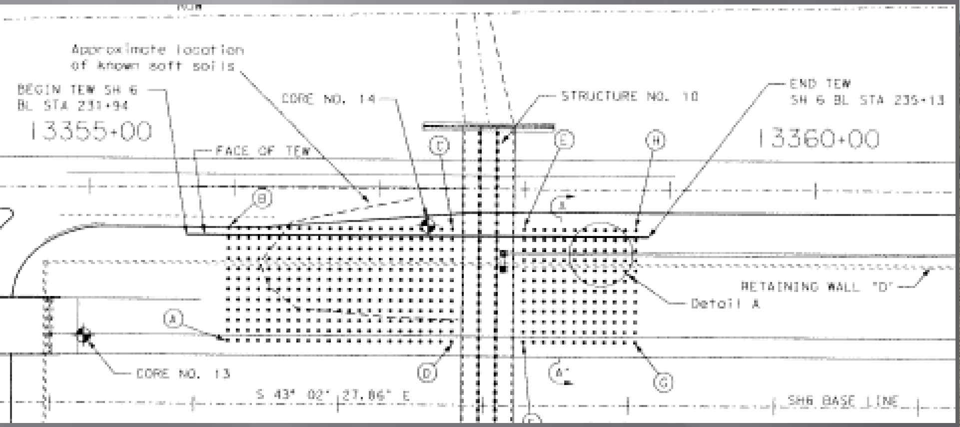


Stone Columns/Geopiers



Remove and Replace/Wick Drains

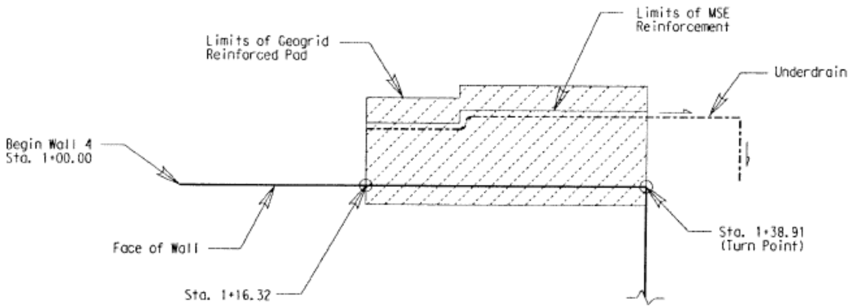




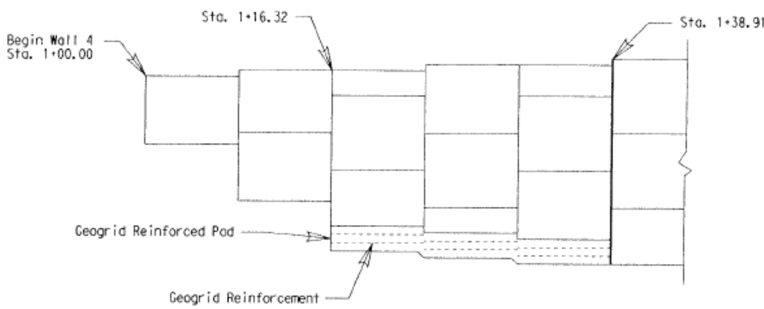
Remove and Replace – Reinforced Pad

ESTIMATED QUANTITIES

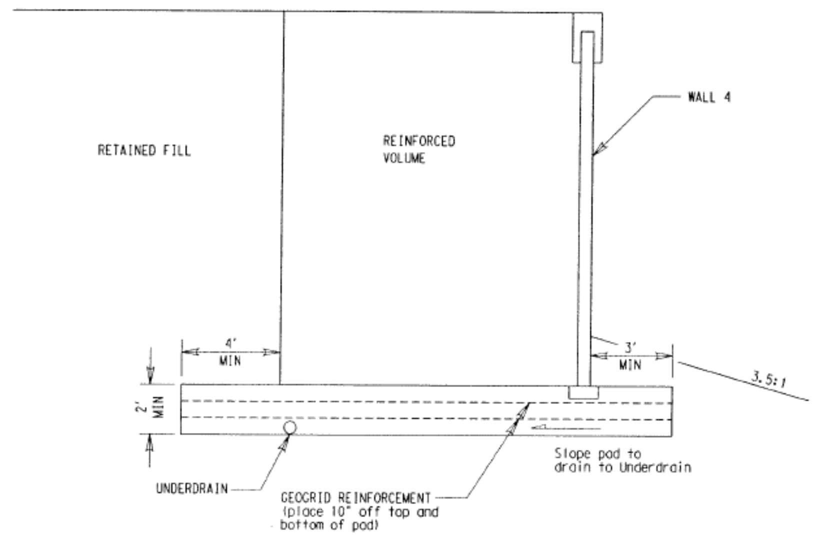
DESCRIPTIONS		QUANTITIES
SELECT FILL (Stabilized Pad)	CY	29
GEOGRID	SY	43



PARTIAL PLAN - WALL 4



PARTIAL ELEVATION - WALL 4



STABILIZED PAD TYPICAL SECTION

(Wall 4 Sta. 1+16.32 to Sta. 1+38.91)

GENERAL NOTES

Stabilized Pad to be constructed under Wall 4 between Sta 1+16.32 to Sta. 1+38.91. Pad to be composed of select fill used for reinforced volume of the MSE wall and reinforced with two levels of geogrid reinforcement. Geogrid to be Mirafi - Miragrid 3XT or equivalent and have a minimum LTDS of 1300 lbs/ft.

Geogrid to be placed 10" off the top and bottom of stabilized pad.

Underdrain pipe to be place to drain section of MSE wall treated with stabilized pad.

Run underdrain at back of strap of retaining wall from Sta. 1+00 to (1+38.91)+15'. The underdrain is then to run down slope for 10' min.

REV.	C.O. #	DESCRIPTIONS	DATE
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TEXAS DEPARTMENT OF TRANSPORTATION

WALL 4 STABILIZED PAD

Reinforcement Ratio

Minimum Earth Reinforcement Length – this field is to list the minimum length and wall design height to length ratio required for the wall design. The wall supplier will utilize this information to properly size the reinforced volume to satisfy project requirements. The default minimum reinforcement length is set at 8' or 70% of the design wall height, whichever is greater. If the default values satisfy stability requirements then 8' or 70% would be entered in the table. If the designer of record determines the need for a longer minimum such as 10' or 80% of the wall height this value would be entered on the table.

Embedment, Underdrain

Min Wall Embedment 7	Underdrain Required 5

Minimum Wall Embedment Required – this field allows the wall designer of record to indicate the required minimum wall embedment below finished grade. The previous requirement was 1.0' regardless of the ground condition in front of the proposed wall. This requirement has been changed to address the ground slope condition in front of the proposed wall. Guidelines for the minimum embedment of the wall from top of leveling pad to finished grade are 1' for level ground where there is no potential for erosion or future excavation; 2' for sloping ground (4H:1V or steeper) or where there is potential for removal of soil in front of the wall.

Underdrain Required – this field allows the wall designer of record to indicate if an underdrain is required for the wall.

Draw Down and Bench Width

Drawdown Analysis 6	Bench Width 8

Rapid Drawdown – this field allows the wall designer of record to indicate if a rapid draw down analysis is required for the wall.
Bench Width – this field allows the wall designer of record to identify the minimum bench width requirement for the proposed wall. For walls on slopes, the bench width will vary depending on the steepness of the slope. Guidelines for minimum bench widths are: 2' for slopes flatter than a 4H:1V and 4' for slopes that are 4H:1V or steeper.

Draw Down Typical