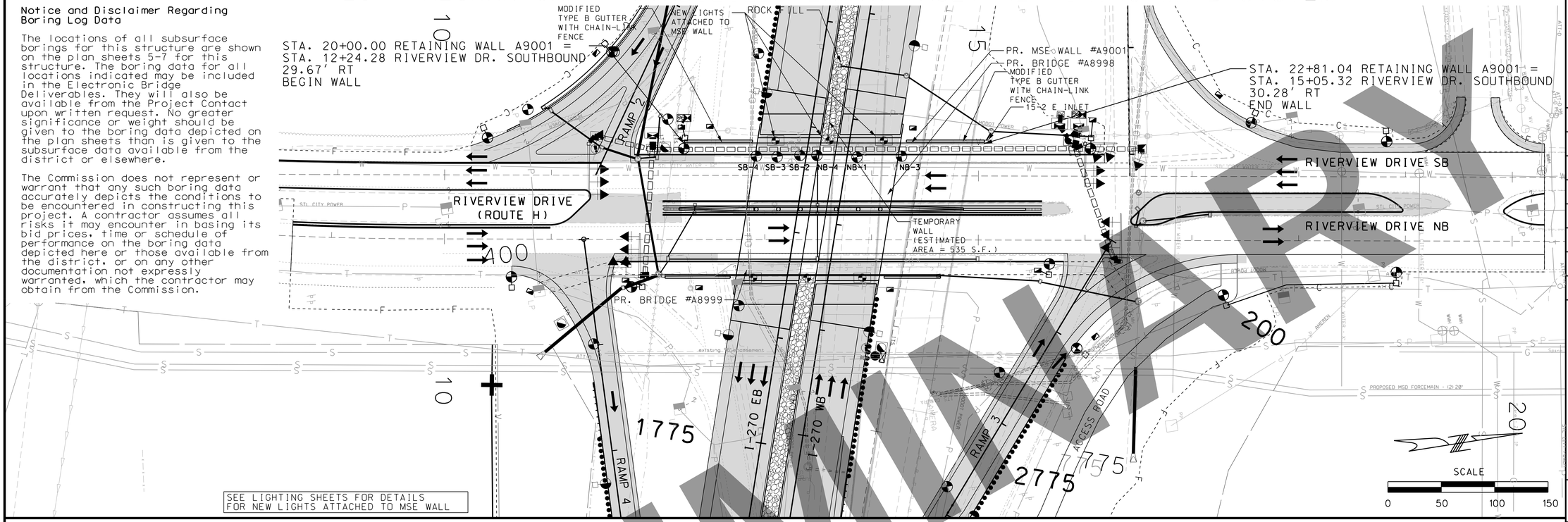
281' MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALL SYSTEM

◓ Indicates location of borings.

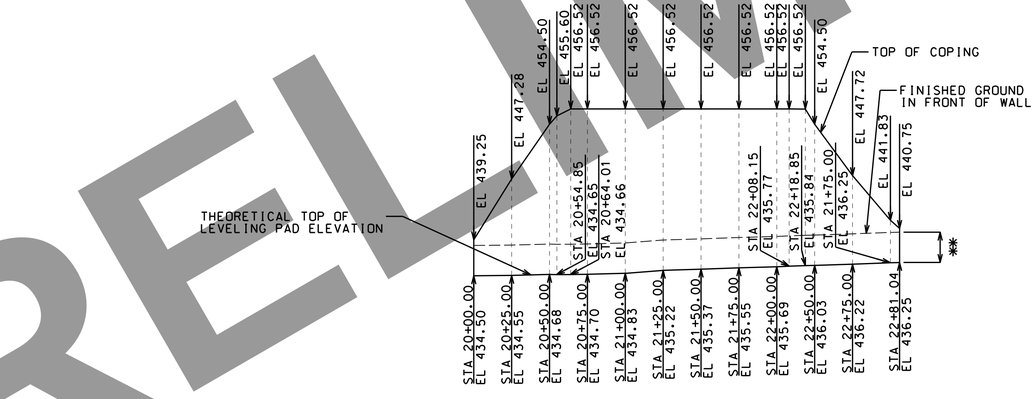
Notice and Disclaimer Regarding Boring Log Data

The locations of all subsurface borings for this structure are shown on the plan sheets 5-7 for this structure. The boring data for all locations indicated may be included in the Electronic Bridge Deliverables. They will also be available from the Project Contact upon written request. No greater significance or weight should be given to the boring data depicted on the plan sheets than is given to the subsurface data available from the district or elsewhere.

The Commission does not represent or warrant that any such boring data accurately depicts the conditions to be encountered in constructing this project. A contractor assumes all risks it may encounter in basing its bid prices, time or schedule of performance on the boring data depicted here or those available from the district, or on any other documentation not expressly warranted, which the contractor may obtain from the Commission.



SEE LIGHTING SHEETS FOR DETAILS FOR NEW LIGHTS ATTACHED TO MSE WALL



DEVELOPED ELEVATION

Note: Concrete Leveling pad not shown for clarity. *

* Wall contractor shall show the following items on the design drawings and/or on the fabricator shop drawings.

1. Leveling pad horizontal.
2. Leveling pad length and step elevations shall be based on wall manufacturer's recommendation. Top of leveling pad elevations shall not be higher than theoretical top of leveling pad elevations shown on these plans.

** Minimum embedment = maximum (4.0 feet, embedment based on Geotechnical Report and Global Stability requirements).

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 1 of 10

Designed: JEK
Detailed: JEK
Checked: TPL

STATE OF MISSOURI
SAURABH SHYAM MITTAL
NUMBER PE-2019010896
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 1
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
MoDOT
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
(573-751-2551)
1-888-ASK-MODOT (1-888-275-6636)

HORNER & SHIFRIN
401 S. 18TH ST., STE. 400 ST. LOUIS, MO 63103
314-431-4321 - FAX 314-431-1566
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
CERTIFICATE OF AUTHORITY: 000156
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW

I-270/RIVERVIEW
MSE WALL A9001
SHEET 1 OF 10

SEC/SUR 114 TWP 47N RGE 7E

281' MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALL SYSTEM

General Notes:

Design Specifications:

2002 AASHTO LFD (17th Ed.) Standard Specifications (Section 5, ASD Design)
Seismic Performance Category B
Acceleration Coefficient = 0.12

Design Loading:

ϕ_D = 25° and Unit weight, γ_D = 130 pcf for retained backfill material to be retained by the mechanically stabilized earth wall system.

ϕ_f = 25° for unimproved foundation ground where wall is to bear.
ϕ_f = 34° for improved foundation ground where wall is to bear.

The allowable bearing pressure for unimproved foundation ground 3.0 ksf.
The allowable bearing pressure for improved foundation ground 4.3 ksf.

The maximum applied bearing pressure for the controlling design case at the foundation level shall be shown on the shop drawings and shall be less than the allowable bearing pressure for foundation ground and provided herein. For seismic design the maximum applied bearing pressure shall be less than two times the allowable bearing pressure.

Allowable bearing pressure and limits of improved foundation ground shall not be adjusted from that as shown on the plans.

Contractor shall include ϕ_f (actual $\phi_f \geq 34°$) and the total unit weight γ_f, for the select granular backfill (reinforced backfill and wedge area backfill) for structural systems on shop drawings. Contractor shall identify source of select granular backfill material, submit proctor in accordance with AASHTO T 99 (ASTM D698) and gradation with the shop drawings. When backfill material is too coarse to develop a proctor curve the contractor shall determine the maximum dry density (relative density) in accordance with ASTM D4253 and ASTM D4254 and assume percent passing the 200 sieve for optimum water content.

Total unit weight, γ_f = (95% compaction) x (maximum dry density) x (1 + optimum water content)

Design ϕ_f = 34° for the select granular backfill (reinforced backfill) only for structural systems.

Factor of safety shall be 2.0 for overturning and 1.5 for sliding.

For seismic design the factor of safety shall be 1.5 for overturning and 1.1 for sliding.

Use default values for the pullout friction factor, F*, in accordance with AASHTO figure 5.8.5.2A. unless MoDOT has pre-approved a higher value for a specific product. For approved steel strips not shown in AASHTO figure 5.8.5.2A. use F* ≤ 2.0 at zero depth and F* ≤ Tan ϕ_f at 20 feet depth and ϕ_f design = 34°. F* values shall be shown on the shop drawings.

Design Unit Stresses:

All concrete for leveling pad and coping shall be Class B or B-1 with f'c = 4000 psi.

The minimum compressive strength of concrete for precast panel shall be 4,000 psi in accordance with Sec 1052.

Miscellaneous:

The MSE wall system shall be built vertical.

The MSE wall system shall be built in accordance with Sec 720.

The MSE wall system shall be a large block wall system.

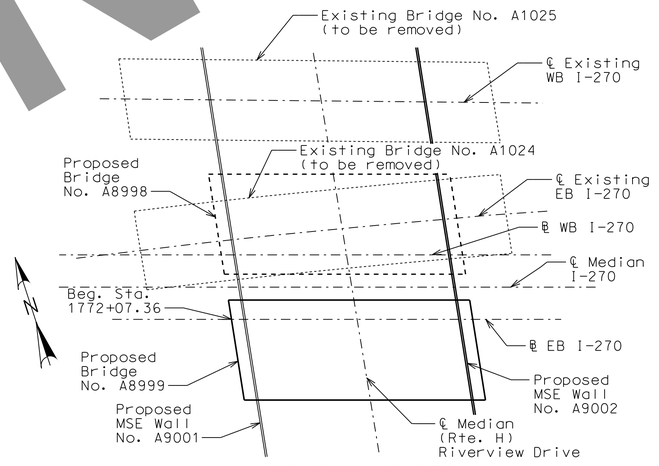
Panel and coping (or capstone) reinforcement shall be epoxy coated.

A filter cloth meeting the requirements for a Separation Geotextile material shall be placed between the select granular backfill for structural systems and the backfill being retained by the mechanically stabilized earth wall system.

Coping shall be required on this structure. When CIP coping sections extend beyond the limits of a single panel, bond breaker (roofing felt or other approved alternate) between wall panel and coping is required. Coping joints shall use 3/4-inch chamfers and shall be sealed with 3/4-inch joint filler. Coping reinforcement shall terminate 1 1/2-inch minimum from face of coping joint.

The top and bottom elevations are given for a vertical wall. If a battered small block wall system is used, the height of the wall shall be adjusted as necessary to fit the ground slope and the concrete leveling pad shall be adjusted as necessary to account for the wall batter. If a fence is built on an extended gutter, then the height of the wall shall be adjusted further.

The contractor shall be solely responsible to coordinate construction of the wall with bridge and roadway construction and ensure that the bridge and roadway construction, resulting or existing obstructions, shall not impact the construction or performance of the wall. Soil reinforcement shall be designed and placed to avoid damage by pile driving, guardrail post installation, utility and sign foundations. (See Roadway and Bridge plans.)



LOCATION SKETCH

Estimated Quantities		
Item		Total
Aesthetic Concrete Stain	LS	1
Mechanically Stabilized Earth Wall Systems	sq. foot	4819
Temporary MSE Wall	LS	1

MSE Wall Systems Data Table

Proprietary Wall Systems		Combination Wall Systems			
Manufacturer	System	Facing Unit Manufacturer	Facing Unit	Geogrid Manufacturer	Geogrid

MSE Wall Systems Data Table is to be completed by MoDOT construction personnel to record the manufacturer of the proprietary wall system or the manufacturers of the combination wall system that was used for constructing the MSE wall.

Designed: JEK
Detailed: JEK
Checked: TPL

Note: This drawing is not to scale. Follow dimensions.

RETAINING WALL UNDER END BENT NO. 1
AT BRIDGE A8998 AND BRIDGE A8999

ROUTE EB I-270 FROM LILAC AVENUE TO MISSOURI STATE LINE
ABOUT 1.0 MILES EAST OF LILAC AVENUE
STATION 12+24.28 ALONG ℄ SB ROUTE H

SAURABH SHYAM MITTAL
NUMBER PE-2019010896
STATE OF MISSOURI
PROFESSIONAL ENGINEER

DATE PREPARED
3/16/2022

ROUTE	STATE
I-270	MO
DISTRICT	SHEET NO.
BR	2

COUNTY
ST. LOUIS CITY

JOB NO.
J6I3020C

CONTRACT ID.

PROJECT NO.

BRIDGE NO.
A9001

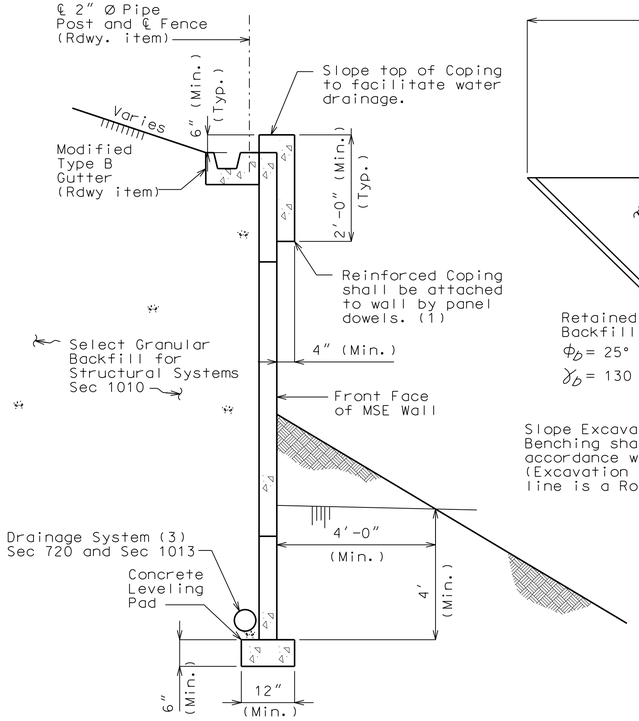
DATE	DESCRIPTION

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

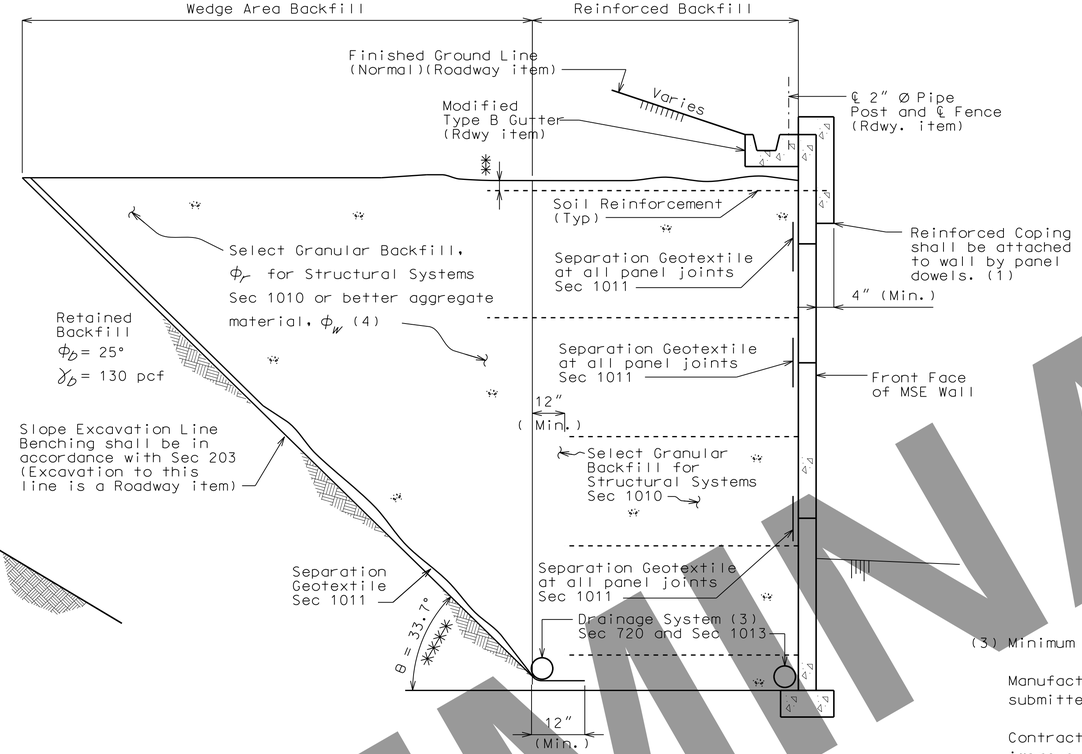
HORNER SHIFRIN
401 S. 18TH ST., STE. 400 ST. LOUIS, MO 63103
314-531-4321 - FAX 314-531-0866
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
CURRENT LICENSURE: MISSOURI
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW

I-270/RIVERVIEW
MSE WALL A9001
SHEET 2 OF 10



TYPICAL SECTION THRU
LARGE BLOCK WALL



TYPICAL SECTION THRU
LARGE BLOCK WALL SHOWING FILTER CLOTH

General Notes Cont.:

Minimum 18" wide Geotextile strips shall be centered at vertical and horizontal joints of panel. Geotextile material shall be adhered to back face of panel using an adhesive compound supplied by the manufacturer. All edges of each fabric strip shall provide a positive seal. A minimum 18" overlap shall be provided between spliced filter fabric.

Aluminized soil reinforcement shall have edges coated with coating material per manufacturer.

Soil reinforcement shall be spaced to avoid roadway drop inlet behind wall.

Upper two layers of soil reinforcement shall be extended 3 feet beyond the lower layers.

The splay angle should be less than 15° and tensile capacity of splayed reinforcement shall be reduced by the cosine of the splay angle. Soil reinforcement shall clear the obstruction by at least 3 inches.

No reinforcement shall be left unconnected to the wall face or arbitrarily cut/bent in the field to avoid the obstruction.

Where interference between the vertical obstruction and the soil reinforcement is unavoidable, the design of the wall near the obstruction may be modified using one of the alternatives in FHWA-NHI-10-24, Section 5.4.2. Show detail layout on the drawings. For wall designs with horizontal obstructions in reinforced soil mass, see FHWA-NHI-10-024, Section 5.4.3.

Excavation quantities and pay items are given on the roadway plans. Excavation quantities are based on a soil reinforcement length of 0.75 x Height of the Wall in ft. The soil reinforcement length may vary based upon the wall design selected by the contractor. Plan excavation quantities will be paid regardless of any actual quantities removed based on the soil reinforcement length and design selected.

Contractor to overexcavate 5 feet below bottom of wall where wall exceeds 10 feet height.

(1) Inverted U-shape reinforced capstone may be used in lieu of coping. Panel dowels for level-up concrete shall be required, and provided by manufacturer. The dowels shall be field trimmed to clear the capstone by a minimum of 1 1/2 inches and a maximum of 2 1/2 inches.

(2) Topmost layer of reinforcement shall be fully covered with select granular backfill for structural systems, as approved by the wall manufacturer, before placement of the Separation Geotextile.

Material Properties Used in Design				
Reinf. Fill/Select Granular Backfill		Active Force Computations		Foundation
$\phi°$	γ (pcf)	$\phi°$	γ (pcf)	$\phi°$

Note: MSE Wall designer shall include table on shop drawings and provide values used in the design computations. Effects of cohesion shall be ignored unless approved by the engineer.

(3) Minimum 6" diameter perforated PVC or PE pipe.

Manufacturer shall show drain details on design plans to be submitted as shown on MoDOT MSE wall plans and/or roadway plans.

Contractor shall modify the drain details as shown if it will improve flow as may be the case for stepped leveling pad, and for an uneven ground line (approval of the engineer required).

(4) Select granular backfill shall extend a minimum of 12" beyond the end of all soil reinforcement. Where the angle, θ, between the retained backfill excavation/fill line and the horizontal is less than 90°, the wedge area backfill between θ and 90° shall be filled with select granular backfill for structural systems meeting the requirements of Section 1010.

- For $(45° + \phi_D/3) < \theta \leq 90°$, properties for retained backfill shall be used for active force computations.

- For $\theta \leq (45° + \phi_D/3)$, contractor shall have the option to use select granular backfill, ϕ_r, or better aggregate material, ϕ_w for active force computations in the wedge area backfill. For active force computations, the angle of internal friction for wedge area backfill material, ϕ_r or ϕ_w, shall be limited to 34° unless determined otherwise in accordance with Section 1010. If ϕ_r or $\phi_w > 34°$ is desired for wedge area backfill then test report shall be submitted with shop drawings. ϕ_r or ϕ_w shall not be greater than 40° for computations. Final configuration of this option shall be sent to Geotechnical Section for a new overall global stability analysis. Design ϕ_w shall be shown on the shop drawings if used.

The slope excavation line shall be benched and separation geotextile shall be placed between the retained backfill and either select granular backfill or better aggregate material, and between the select granular backfill and better aggregate material.

Show range of acceptable theta (θ) angle on shop drawings which must be consistent with design computations and proposed construction of wall. Show active force computation properties on shop drawings and in design computations. Coordination between wall designer (manufacturer) and contractor is required before shop drawing submittal.

DETAILS FOR MSE WALL

Designed:JEK
Detailed:JEK
Checked: TPL

Note: This drawing is not to scale. Follow dimensions.

STATE OF MISSOURI
SAURABH SHYAM MITTAL
NUMBER PE-2019010896
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 3
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)
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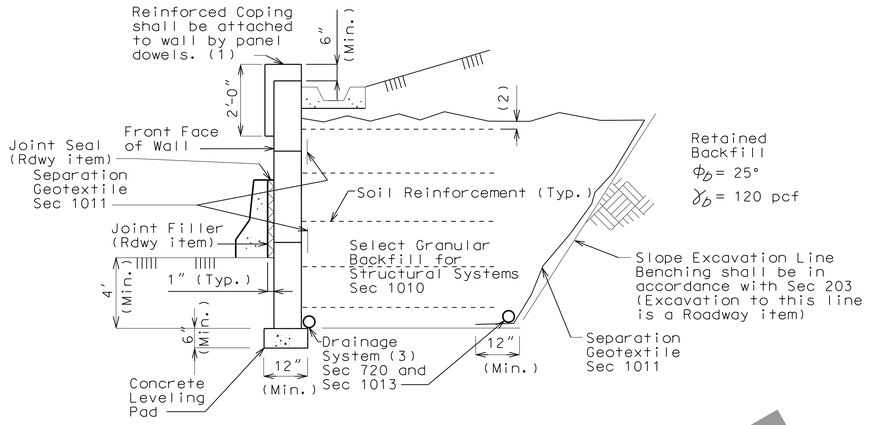
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
AUTHORIZATION #: E-2001017000
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW
MSE WALL A9001
SHEET 3 OF 10



TYPICAL SECTION THRU LARGE BLOCK WALL

Note: For additional information, see "TYPICAL SECTION THRU LARGE BLOCK WALL SHOWING FILTER CLOTH".

Note:

Holes shall be 5/8" round and extended 4" into the third layer of blocks, recessed 2" deep by 1 1/2" round.

Rods or reinforcing bars shall be secured by an approved resin anchor system in accordance with Sec 1039.

Recess hole shall be backfilled with non-shrink cement grout.

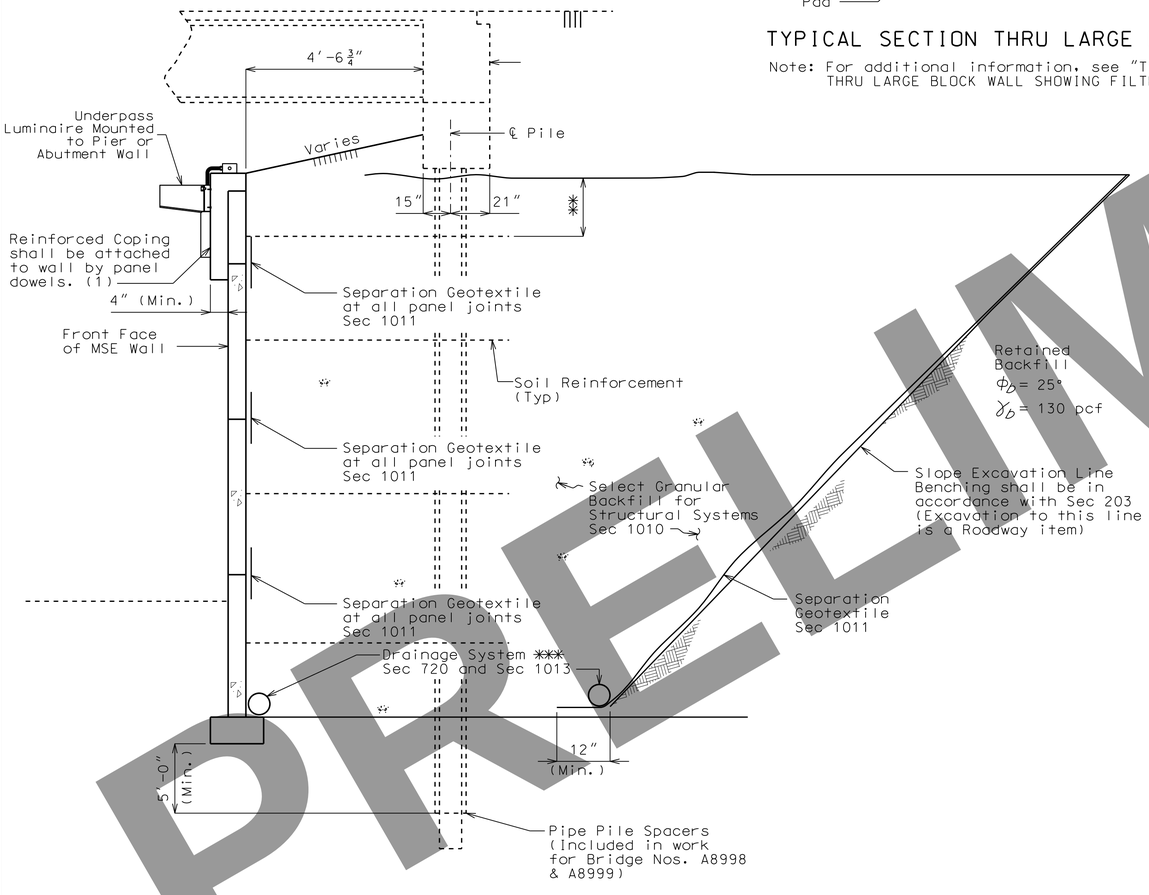
(1) Inverted U-shape reinforced capstone may be used in lieu of coping. Panel dowels for level-up concrete shall be required, and provided by manufacturer. The dowels shall be field trimmed to clear the capstone by a minimum of 1 1/2 inches and a maximum of 2 1/2 inches.

(2) Topmost layer of reinforcement shall be fully covered with select granular backfill for structural systems, as approved by the wall manufacturer, before placement of the Separation Geotextile.

(3) Minimum 6" diameter perforated PVC or PE pipe.

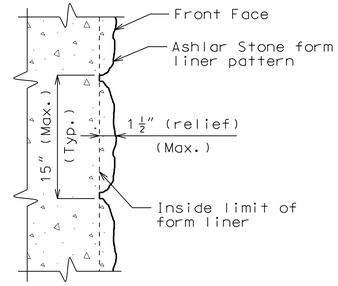
Manufacturer shall show drain details on design plans to be submitted as shown on MoDOT MSE wall plans and/or roadway plans.

Contractor shall modify the drain details as shown if it will improve flow as may be the case for stepped leveling pad, and for an uneven ground line (approval of the engineer required).



TYPICAL SECTION THRU LARGE BLOCK WALL UNDER BRIDGE

Note: For additional information, see "TYPICAL SECTION THRU LARGE BLOCK WALL SHOWING FILTER CLOTH".



FORM LINER DETAIL (Large Block Wall)

Notes:

The cost of form liners for MSE wall systems, complete in place, will be considered completely covered by the contract unit price for Mechanically Stabilized Earth Wall System.

Form liner shall be constructed in accordance with Special Provisions.

The following is a list of form liner manufacturers and types which may be used. Depth of relief for all form liner pattern's shall vary up to 1 1/2". The height of any single 'stone' shall be 15" maximum.

- Scott System, Inc.: Form liner pattern #167 "Ashlar Stone"
- Fitzgerald Formliners: Form liner pattern #16986 "Ashlar Stone"
- Greenstreak: Form liner pattern #330 "Ashlar Stone"
- Spec Formliners: Form liner pattern #1515 "Ashlar Stone"
- Customrock: Form liner pattern #12020 "Tollway Ashlar"
- An approved equal

Designed: JEK
Detailed: JEK
Checked: TPL

DETAILS FOR MSE WALL

Note: This drawing is not to scale. Follow dimensions.

STATE OF MISSOURI
SAURABH SHYAM MITTAL
NUMBER PE-2019010896
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 4
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
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DISCIPLINE: PROFESSIONAL ENGINEERING
CERTIFICATE OF AUTHORITY: 000156
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001 SHEET 4 OF 10

BORING NUMBER NB-1

PAGE 1 OF 1

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri
DATE STARTED 3/23/20 **COMPLETED** 3/23/20
GROUND ELEVATION 438.8 ft **HOLE SIZE** inches
DRILLING CONTRACTOR Bulldog, CME75LC, Efficiency: 94%
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING 8.00 ft / Elev 430.80 ft
LOGGED BY B.Fisher **CHECKED BY** J. Schaeffer
AT END OF DRILLING --- not measured
NOTES
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0	Concrete (10.0") 438										
	FILL: Light brown to light grey, lean CLAY, with silt and organic material, trace sand and gravel										
	- pushed 1000 psi, no recovery - 3.0" of wood at 3.5 ft	ST 1	0								
5		SS 1	50	8-6-6 (12)	2.5		11				
	- pushed 1000 psi, no recovery - 3.0" sand seam at 8.5 ft - 3.0" of wood at 9.0 ft	ST 2	0								
10		SS 2	94	4-6-8 (14)	2.5		21				
	427.3 Dark grey, lean CLAY (CL)										
	- undrained shear strength at 13.0 ft = 1.71 TSF	ST 3	83		3.5	106	21				
15	422.8 Blue-grey to brown, fat CLAY (CH)										
	419.8	SS 4	78	5-4-8 (12)	3.5		14				
20	SHALE: Brown to grey, highly weathered										
	417.3 Refusal at 21.5 feet. Bottom of borehole at 21.5 feet.										

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 12/17/20 11:22 - G:\PROJECT FILES\2020\MG20007 I-270 RIVERVIEW DRIVE INTERCHANGE\FIELD DATA\I270 AT RIVERVIEW DRIVE INTERCHANGE GINT.GPJ

BORING DATA

Note: For locations of borings, see Sheet No. 1.

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 5 of 10

Designed: JAA
Detailed: JAA
Checked: JEK

STATE OF MISSOURI
SAURABH SHYAM MITTAL
NUMBER PE-2019010896
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 5
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HORNER SHIFRIN
401 S. 18TH ST., STE. 400 ST. LOUIS, MO 63103
314-631-4321 - FAX 314-631-6986
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
CERTIFICATE OF AUTHORITY: 000556
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001 SHEET 5 OF 10

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BORING NUMBER NB-3

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri
DATE STARTED 2/28/20 **COMPLETED** 2/28/20
GROUND ELEVATION 439.1 ft **HOLE SIZE** inches
DRILLING CONTRACTOR Bulldog, CME550X, Efficiency: 95%
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger, NQ Rock Core
AT TIME OF DRILLING --- not encountered
LOGGED BY B.Fisher **CHECKED BY** J. Schaeffer
AT END OF DRILLING --- not measured
NOTES 3.0 ft west of design due to location of marked utilities
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0	Concrete (10.0") 438.3										
	Crushed limestone (2.0") 438.1										
	Brown, lean CLAY (CL), trace sand										
5		SS 1	72	4-5-6 (11)	2.0		22				
	- undrained shear strength at 8.0 ft = 1.40 TSF	ST 2	67		3.75	106	21				
10	426.1										
	Blue-grey, lean to fat CLAY (CL-CH)	SS 3	89	3-3-4 (7)	2.5		24				
15	421.1										
	SHALE: Blue-grey to brown, clayey, trace limestone fragments	SS 4	83	2-4-10 (14)	2.0		16				
20	416.1										
	LIMESTONE: Grey to blue-grey, slightly to moderately weathered, moderately hard to hard, banded to thin bedded, finely-crystalline	SS 5	100	50/2"			3				
25		RC 1	91 (27)								
		RC 2	100 (83)								
	411.6										
	SHALE: Grey, soft to moderately hard, calcareous	RC 3	0 (0)								

(Continued Next Page)

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
30	SHALE: Grey, soft to moderately hard, calcareous *(continued)*										
	- rock core qu at 30.7 ft = 5,060 psi - thick clay seams from 28.5-33.5 ft	RC 4	100 (75)								
35		RC 5	100 (100)		1.213						
	400.6										
	Refusal at 23.5 feet. Bottom of borehole at 38.5 feet.										

BORING DATA

Note: For locations of borings, see Sheet No. 1.

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 6 of 10

Designed: JAA
Detailed: JAA
Checked: JEK

SAURABH SHYAM MITTAL — NUMBER PE-2019010896 — STATE OF MISSOURI — PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 6
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
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105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HORNER SHIFRIN
401 S. 18TH ST., STE. 400 ST. LOUIS, MO 63103
314-431-4321 - FAX 314-431-8986
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
CERTIFICATE OF AUTHORITY NUMBER: 000156
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001
SHEET 6 OF 10

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 12/17/20 11:22 - G:\PROJECT FILES\2020\MG20007 I-270 RIVERVIEW DRIVE INTERCHANGE\FIELD DATA\I270 AT RIVERVIEW DRIVE INTERCHANGE GINT.GPJ

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BORING NUMBER NB-4

PAGE 1 OF 2

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri
DATE STARTED 3/2/20 **COMPLETED** 3/2/20
GROUND ELEVATION 438.4 ft **HOLE SIZE** inches
DRILLING CONTRACTOR Bulldog, CME550X, Efficiency: 95%
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger, NQ Rock Core
AT TIME OF DRILLING 8.00 ft / Elev 430.40 ft
LOGGED BY B.Fisher **CHECKED BY** J. Schaeffer
AT END OF DRILLING --- not measured
NOTES 5.0 ft west of design due to location of marked utilities
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Concrete (10.0") 437.57										
		FILL: Brown lean CLAY and GRAVEL										
		434.57										
		POSSIBLE FILL: Tan, clayey SAND (SC)	SS 1	67	3-7-8 (15)			7				
5												
		429.4										
		Light brown, sandy SILT (ML), trace clay	SS 2	67	4-4-4 (8)	1.5		19				
10		427.4										
		Grey, clayey SILT (ML)										
		- 3.0" rocky seam at 13.8 ft	SS 3	78	7-7-8 (15)	>4.5		21				
15		421.4										
		Brown to grey, lean CLAY (CL)	SS 4	100	2-3-5 (8)	2.0		23				
20		414.7										
		SHALE: Brown, grey, purple, and blue-grey, weathered, clayey	SS 5	89	11-12-15 (27)			15				
25		410.4										

(Continued Next Page)

BORING NUMBER NB-4

PAGE 2 OF 2

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (ROD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
30		SHALE: Bluegrey, soft, calcareous - vertical fracture from 28.6-28.8 ft - 6.0" limestone layer at 28.8 ft	SS 6	100	50/1"			8				
		- 3.0" near vertical fracture at 30.5 ft	RC 1	97 (89)								
		- rock core qu at 32.3 ft = 2,540 psi - core loss from 32.7-32.9 ft										
35		- 5.5" weathered clayey shale seam at 34.5 ft	RC 2	100 (92)								
		- very soft from 38.0-38.3 ft										
40			RC 3	100 (98)								
		- 4.0" weathered clay seam at 42.5 ft 395.4										

Refusal at 28.0 feet.
Bottom of borehole at 43.0 feet.

BORING DATA

Note: For locations of borings, see Sheet No. 1.

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 7 of 10

Designed: JAA
Detailed: JAA
Checked: JEK

SAURABH SHYAM MITTAL
NUMBER PE-2019010896
STATE OF MISSOURI
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 7
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HORNER SHIFRIN
401 S. 18TH ST., STE. 400 ST. LOUIS, MO 63103
314-531-4321 - FAX 314-531-6866
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
CERTIFICATE OF AUTHORITY: 000165
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001
SHEET 7 OF 10

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 12/17/20 11:22 - G:\PROJECT FILES\2020\MG20007 I-270 RIVERVIEW DRIVE INTERCHANGE\FIELD DATA\I270 AT RIVERVIEW DRIVE INTERCHANGE GINT.GPJ

BORING NUMBER SB-2

PAGE 1 OF 1

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri
DATE STARTED 3/2/20 **COMPLETED** 3/2/20
GROUND ELEVATION 438.3 ft **HOLE SIZE** inches
DRILLING CONTRACTOR Bulldog, CME550X, Efficiency: 95%
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING 7.00 ft / Elev 431.30 ft
LOGGED BY B.Fisher **CHECKED BY** J. Schaeffer
AT END OF DRILLING --- not measured
NOTES 5.0 ft west of design due to location of marked utilities
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Concrete (10.0") 437.47										
		POSSIBLE FILL: Grey to brown, lean CLAY (CL), with sand, trace gravel										
		434.3										
		POSSIBLE FILL: Tan, clayey SAND (SC)	SS 1	61	3-2-5 (7)	0.25		10				
5		- approx. 12.0" layer of lean clay at 6.0 ft	ST 2	100			111	17				
			SS 3	100	4-6-7 (13)			22				
10		427.3										
		Tan to grey, lean CLAY (CL), with sand										
			SS 4	100	1-3-3 (6)	2.0		19				
15												
		- blue-grey, more plastic below 18.0 ft	SS 5	100	2-3-5 (8)	1.5		25				
20												
		416.3										
		SHALE: Blue-grey to brown, weathered	SS 6	100	5-14-17 (31)	>4.5		15				
25												
		411.3	SS 7		50/0"							
		Refusal at 27.0 feet. Bottom of borehole at 27.0 feet.										

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BORING DATA

Note: For locations of borings, see Sheet No. 1.

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 8 of 10

Designed: JAA
Detailed: JAA
Checked: JEK

STATE OF MISSOURI
SAURABH SHYAM MITTAL
NUMBER PE-2019010896
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 8
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HORNER SHIFRIN
401 S. 18TH ST., STE. 400 ST. LOUIS, MO 63103
314-531-4321 - FAX 314-531-6966
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
LICENSE/CERTIFICATE #: 2005018656
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001 SHEET 8 OF 10

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BORING NUMBER SB-3

PAGE 1 OF 2

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri
DATE STARTED 3/3/20 **COMPLETED** 3/3/20
GROUND ELEVATION 438.3 ft **HOLE SIZE** inches
DRILLING CONTRACTOR Bulldog, CME550X, Efficiency: 95%
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger, NQ Rock Core
AT TIME OF DRILLING 7.00 ft / Elev 431.30 ft
LOGGED BY B.Fisher **CHECKED BY** J. Schaeffer
AT END OF DRILLING --- not measured
NOTES 5.0 ft west of design due to location of marked utilities
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Concrete (10.0") 437.5										
		Brown-orange to grey, lean CLAY (CL), trace sand										
5			SS 1	100	3-5-5 (10)	2.5		17				
		▽										
		- possible sand layer below 8.0 ft	ST 2	0								
10		- no recovery at ST-2, classifications from cuttings										
		427.3										
		Grey, fat CLAY (CH), trace sand and gravel										
15			SS 3	89	3-2-3 (5)	1.75		22				
		- undrained shear strength at 15.0 ft = 0.60 TSF	ST 4	100		0.75	102	24				
20		- with sand below 18.5 ft	SS 5	83	2-2-4 (6)	1.0		18				
25			SS 6	56	2-2-5 (7)	1.0		10				
		409.8										

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BORING NUMBER SB-3

PAGE 2 OF 2

Millennia Professional Services

CLIENT Horner & Shifrin, Inc.
PROJECT NAME Interstate 270 at Riverview Drive Improvements
PROJECT NUMBER MG20007
PROJECT LOCATION St. Louis, Missouri

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
30		LIMESTONE: Grey, moderately hard, thin bedded, coarsely-crystalline, moderately weathered 408.5	SS 7	100	50/1"			10				
		SHALE: Grey, soft to moderately hard, calcareous 407.3	RC 1	100 (87)								
		SHALY LIMESTONE: Grey, moderately hard, finely-crystalline, thin to medium bedded, moderately weathered 405.8										
35		SHALE: Grey, soft to moderately hard	RC 2	100 (77)								
		- soft below 35.0 ft - rock core qu at 35.5 ft = 5,090 psi										
		400.3	RC 3	100 (100)								
40		LIMESTONE: Grey, argillaceous, moderately hard, thin to thick bedded, very finely-crystalline, slightly weathered - with shale inclusions from 38.0-38.5 ft										
			RC 4	93 (82)								
		394.8										

Refusal at 28.5 feet.
Bottom of borehole at 43.5 feet.

BORING DATA

Note: For locations of borings, see Sheet No. 1.

Note: This drawing is not to scale. Follow dimensions.

Designed: JAA
Detailed: JAA
Checked: JEK

Sheet No. 9 of 10

SAURABH SHYAM MITTAL
NUMBER PE-2019010896
STATE OF MISSOURI
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022
ROUTE I-270 | STATE MO
DISTRICT BR | SHEET NO. 9
COUNTY ST. LOUIS CITY
JOB NO. J6I3020C
CONTRACT ID.
PROJECT NO.
BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HORNER SHIFRIN
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DISCIPLINE: PROFESSIONAL ENGINEERING
CERTIFICATE OF AUTHORITY: 000158
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001 SHEET 9 OF 10

BORING NUMBER SB-4

PAGE 1 OF 1

Millennia Professional Services

CLIENT Horner & Shifrin, Inc. **PROJECT NAME** Interstate 270 at Riverview Drive Improvements

PROJECT NUMBER MG20007 **PROJECT LOCATION** St. Louis, Missouri

DATE STARTED 3/3/20 **COMPLETED** 3/3/20 **GROUND ELEVATION** 438.1 ft **HOLE SIZE** inches

DRILLING CONTRACTOR Bulldog, CME550X, Efficiency: 95% **GROUND WATER LEVELS:**

DRILLING METHOD Hollow Stem Auger **AT TIME OF DRILLING** 9.00 ft / Elev 429.10 ft

LOGGED BY B.Fisher **CHECKED BY** J. Schaeffer **AT END OF DRILLING** --- not measured

NOTES 2.0 ft north and 5.0 ft west of design due to location of marked utilities **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Concrete (10.0") 437.3										
		Orange-brown to grey, lean to fat CLAY (CL-CH), with sand, trace gravel										
			SS 1	94	3-3-6 (9)	2.5		14	49	18	31	
5		432.1										
		Grey, lean CLAY (CL), trace sand lenses										
		428.6	SS 2	89	2-2-4 (6)	1.0		17				
10		Tan SAND (SC) with silt and clay										
		427.1										
		Grey, lean CLAY (CL), trace sand and gravel										
		- undrained shear strength at 13.0 ft = 0.76 TSF	ST 3	83		1.5	110	20				
15		- with gravel below 14.0 ft										
			SS 4	100	1-2-2 (4)	1.25		23				
20												
			SS 5	78	4-3-3 (6)	2.0		25				
25		- 2.0" fragmented rock layer at 23.8 ft										
		410.6	SS 6	100	50/0"							
		Refusal at 27.5 feet. Bottom of borehole at 27.5 feet.										

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BORING DATA

Note: For locations of borings, see Sheet No. 1.

Note: This drawing is not to scale. Follow dimensions.

Sheet No. 10 of 10

Designed: JAA
Detailed: JAA
Checked: JEK

STATE OF MISSOURI
SAURABH SHYAM MITTAL
NUMBER PE-2019010896
PROFESSIONAL ENGINEER

DATE PREPARED 3/16/2022

ROUTE I-270 | STATE MO

DISTRICT BR | SHEET NO. 10

COUNTY ST. LOUIS CITY

JOB NO. J6I3020C

CONTRACT ID.

PROJECT NO.

BRIDGE NO. A9001

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HORNER SHIFRIN
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314-531-4321 - FAX 314-531-6986
WWW.HORNERSHIFRIN.COM
DISCIPLINE: PROFESSIONAL ENGINEERING
LICENSE: STATE OF MISSOURI, NUMBER 2005018556
EXPIRATION DATE: DECEMBER 31, 2022

I-270 AND RIVERVIEW
I-270/RIVERVIEW MSE WALL A9001 SHEET 10 OF 10

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