US Army Corps of Engineers

McAlpine Lock Replacement Project

Roller Compacted Concrete Placement at McAlpine Lock

By
Larry Dalton, P.E.

US Army Corps of Engineers

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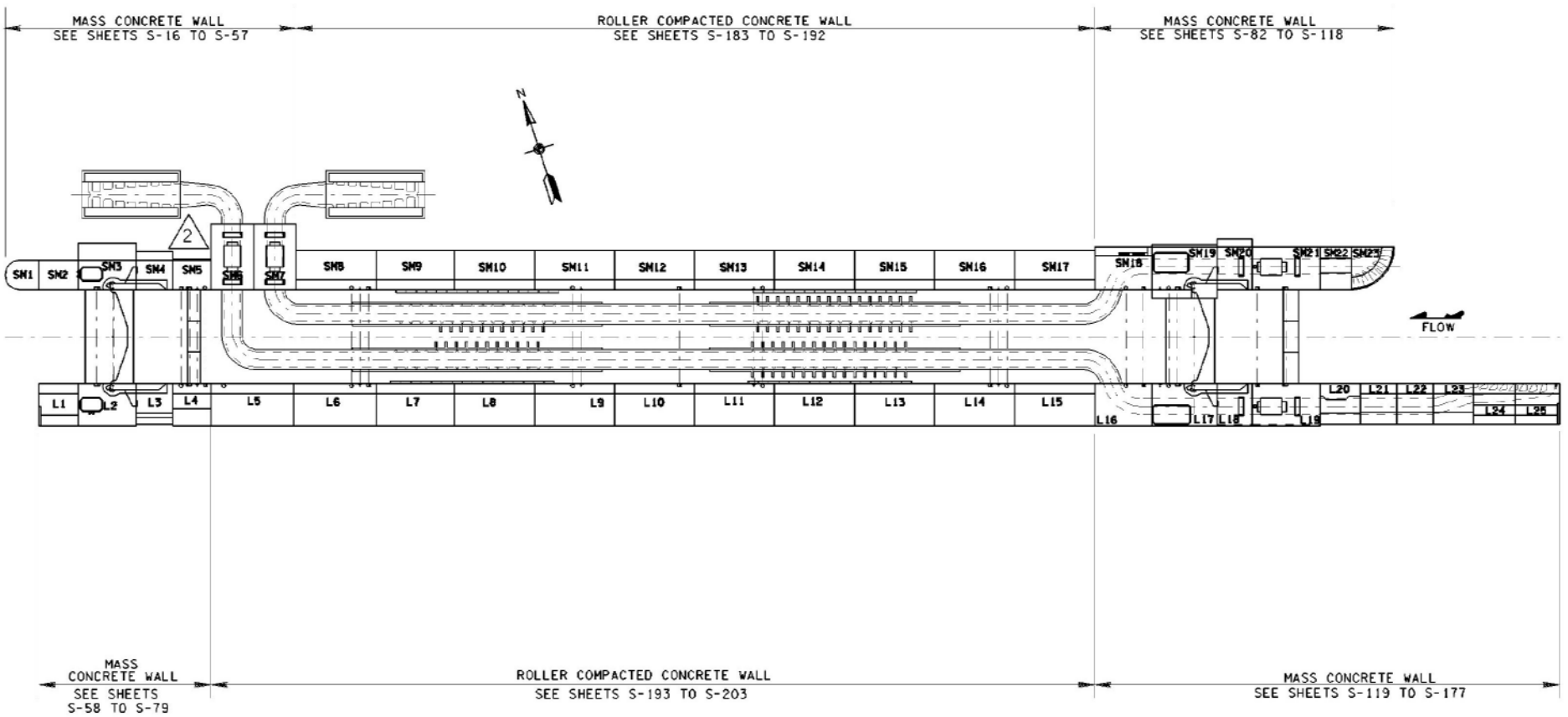
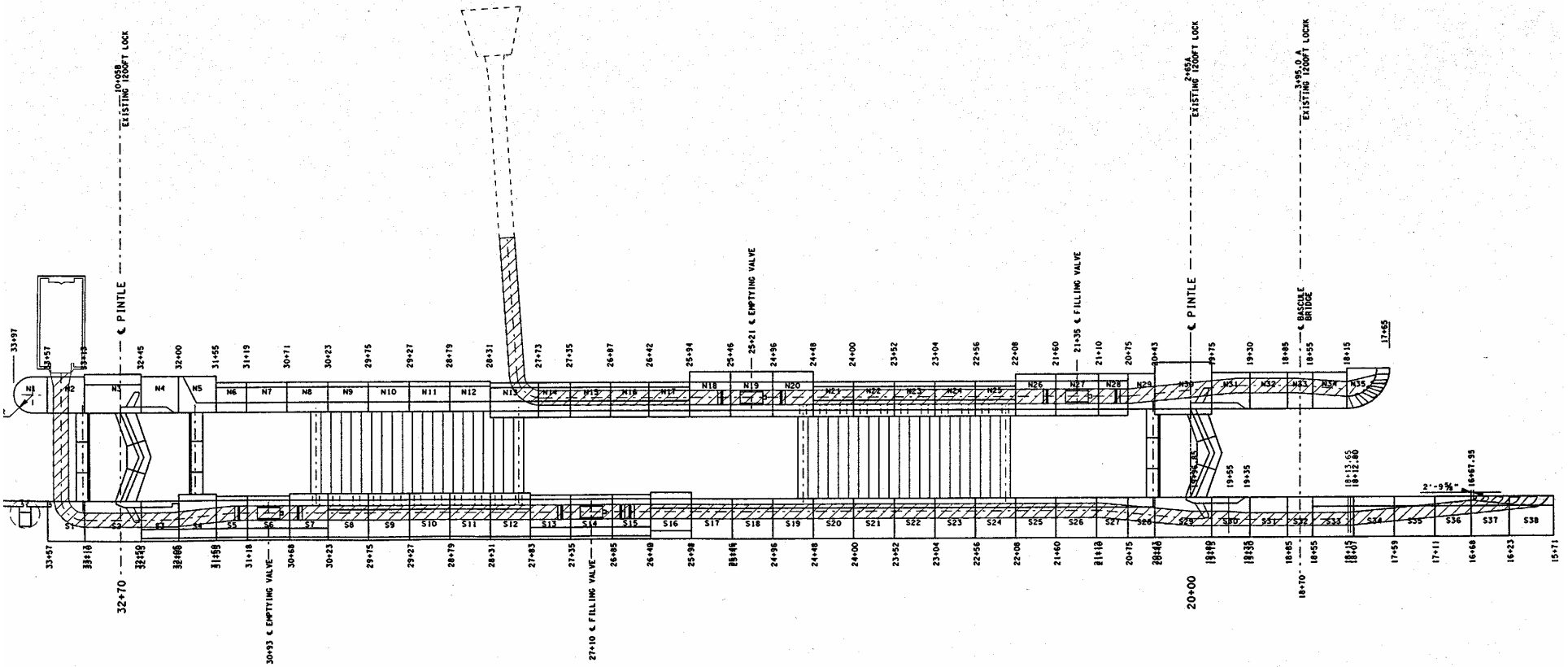
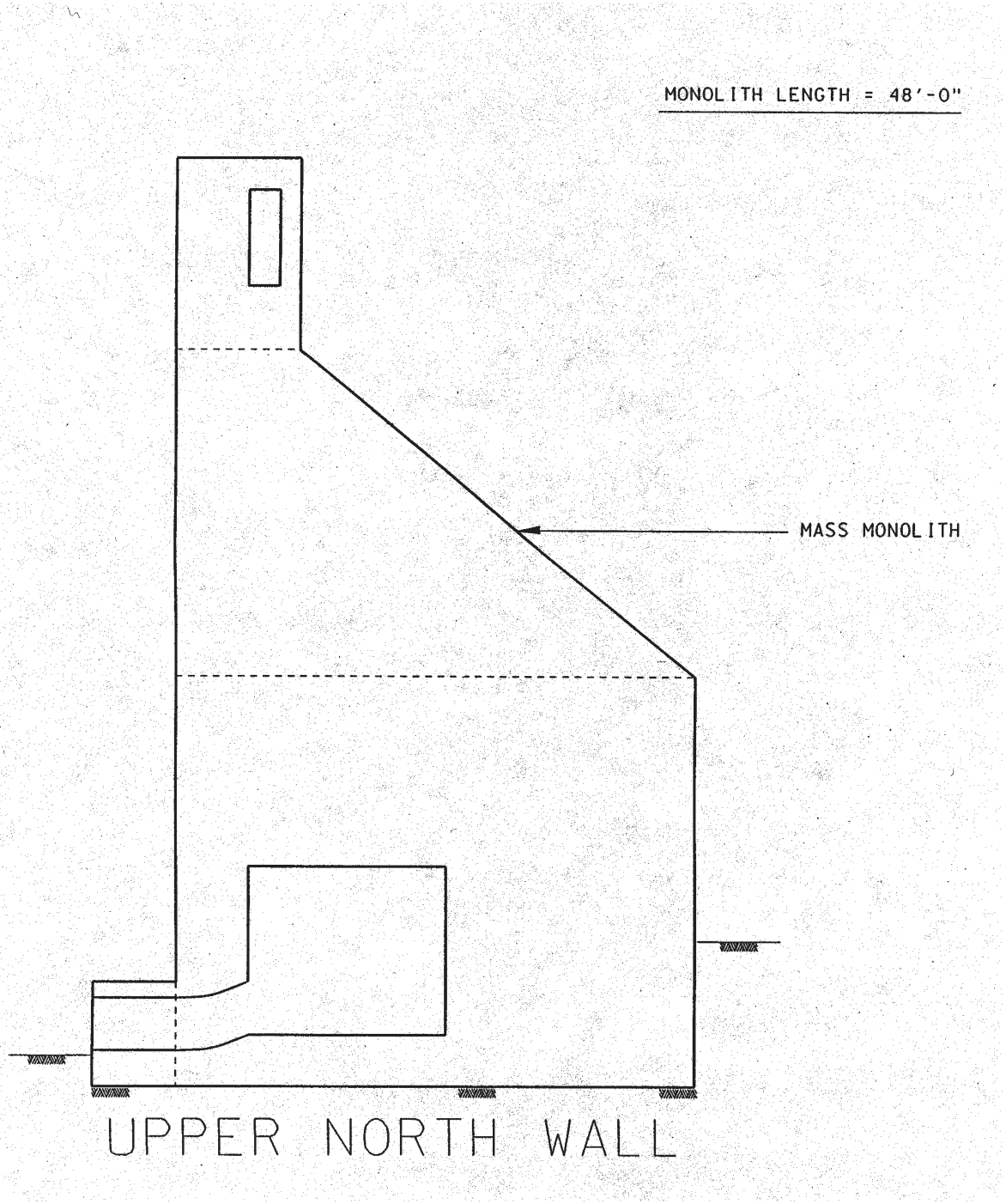
PURPOSE: Share results of the recent placement of Roller Compacted Concrete at the McAlpine Lock Replacement Project as well as Structural Lessons Learned.

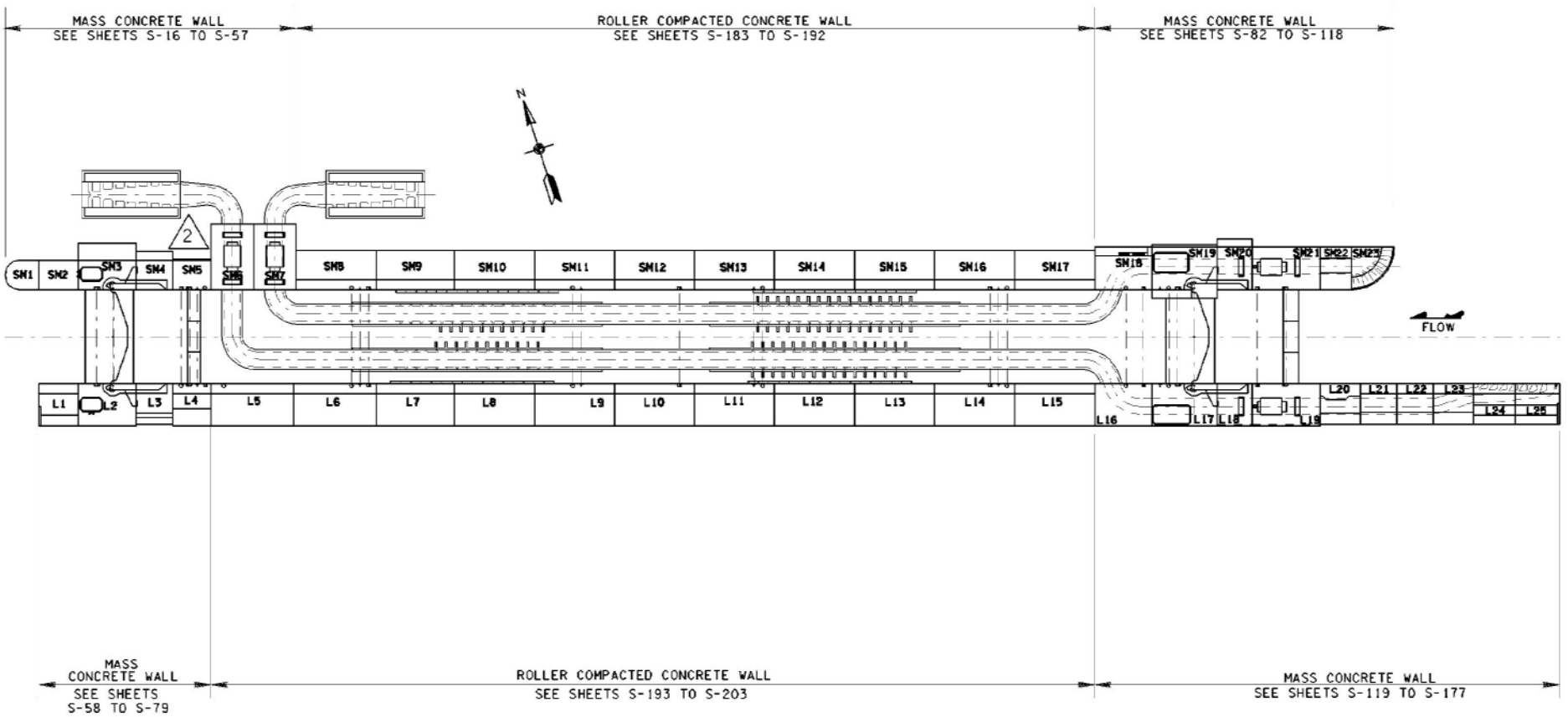


PLAN

SCALE: 1" = 100'-0"

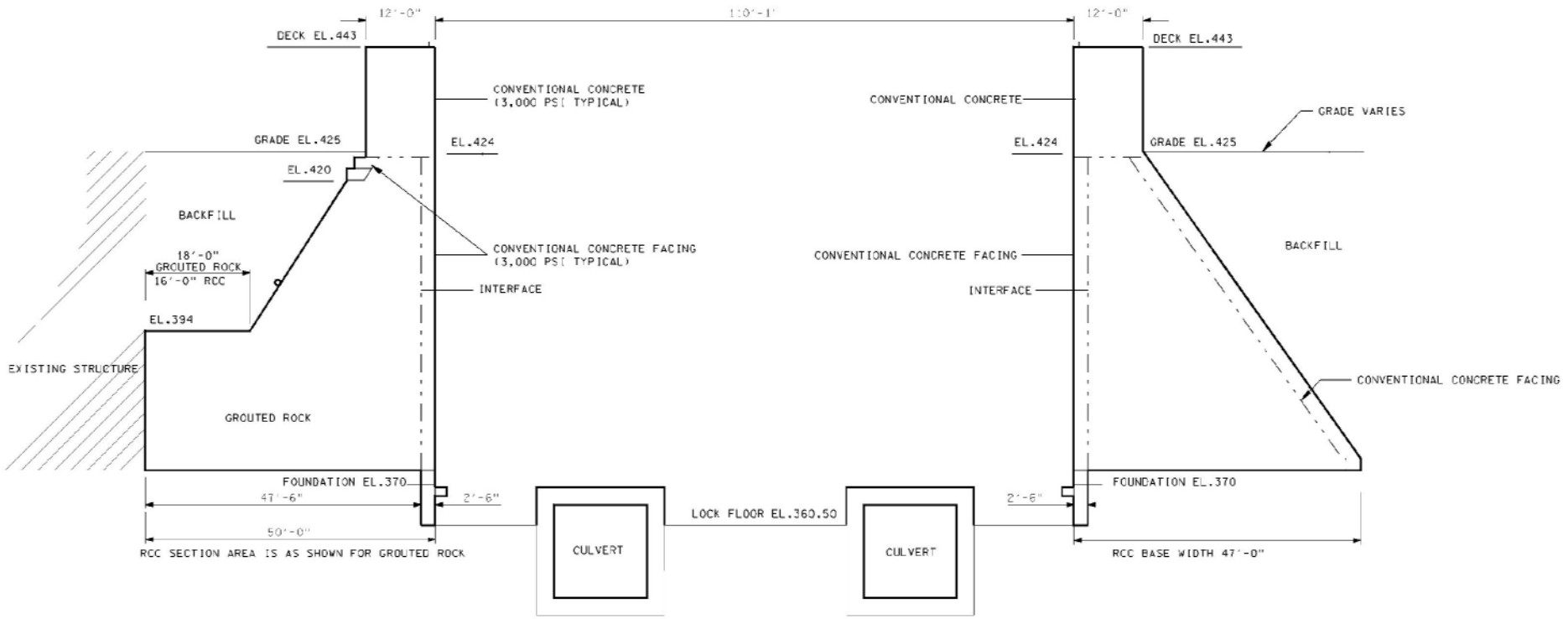

℄ PINTLE
EXISTING 1200FT LOCK
℄ EMPTYING VALVE
℄ FILLING VALVE
℄ BASCULE BRIDGE
32+70
30+93 ℄ EMPTYING VALVE
27+10 ℄ FILLING VALVE
20+00
18+70


MONOLITH LENGTH = 48'-0"
MASS MONOLITH
UPPER NORTH WALL



PLAN

SCALE: 1" = 100'-0"

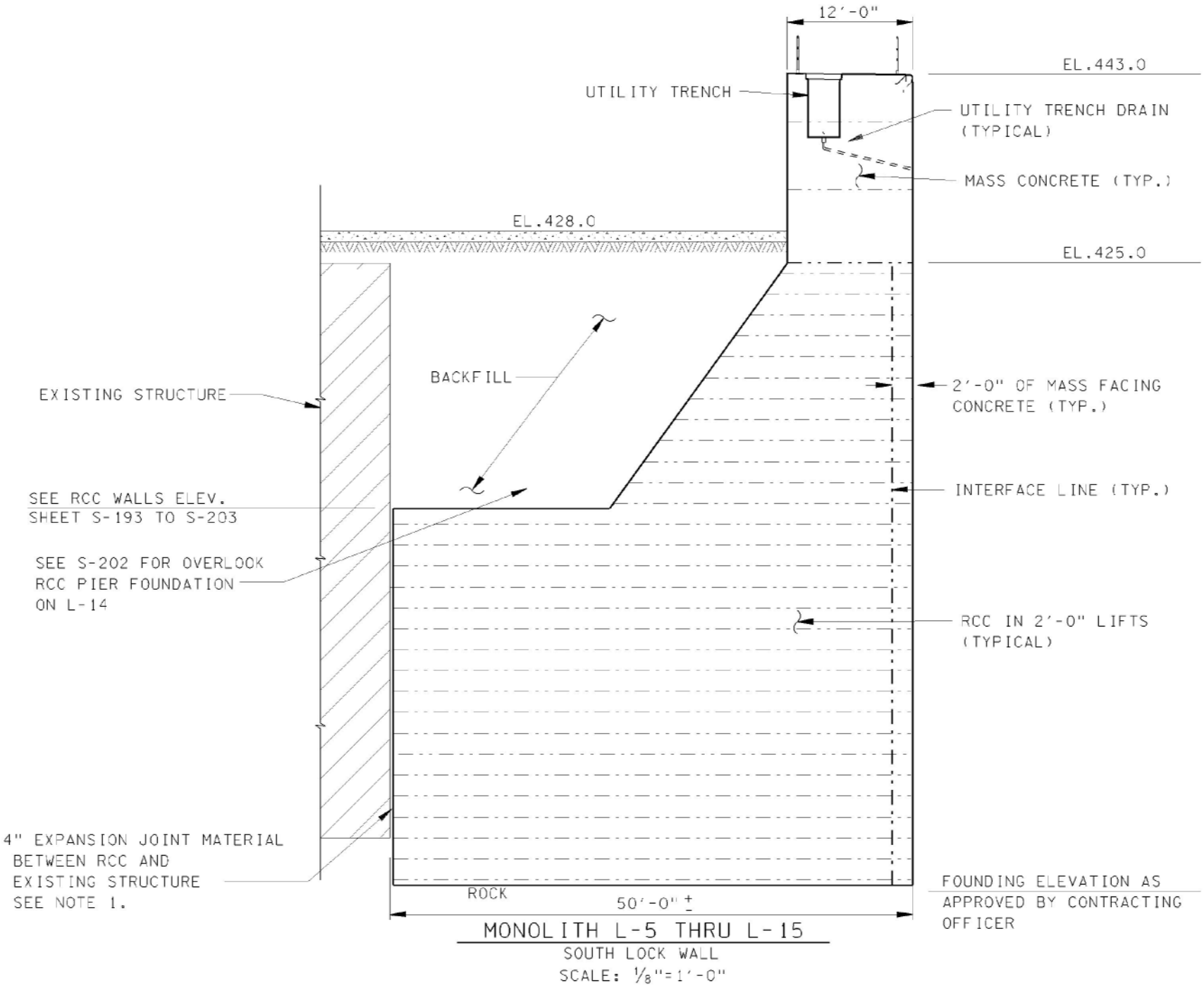


SOUTH WALL SECTION

INNOVATIVE CHAMBER WALL SECTION

SCALE: 1"= 10'

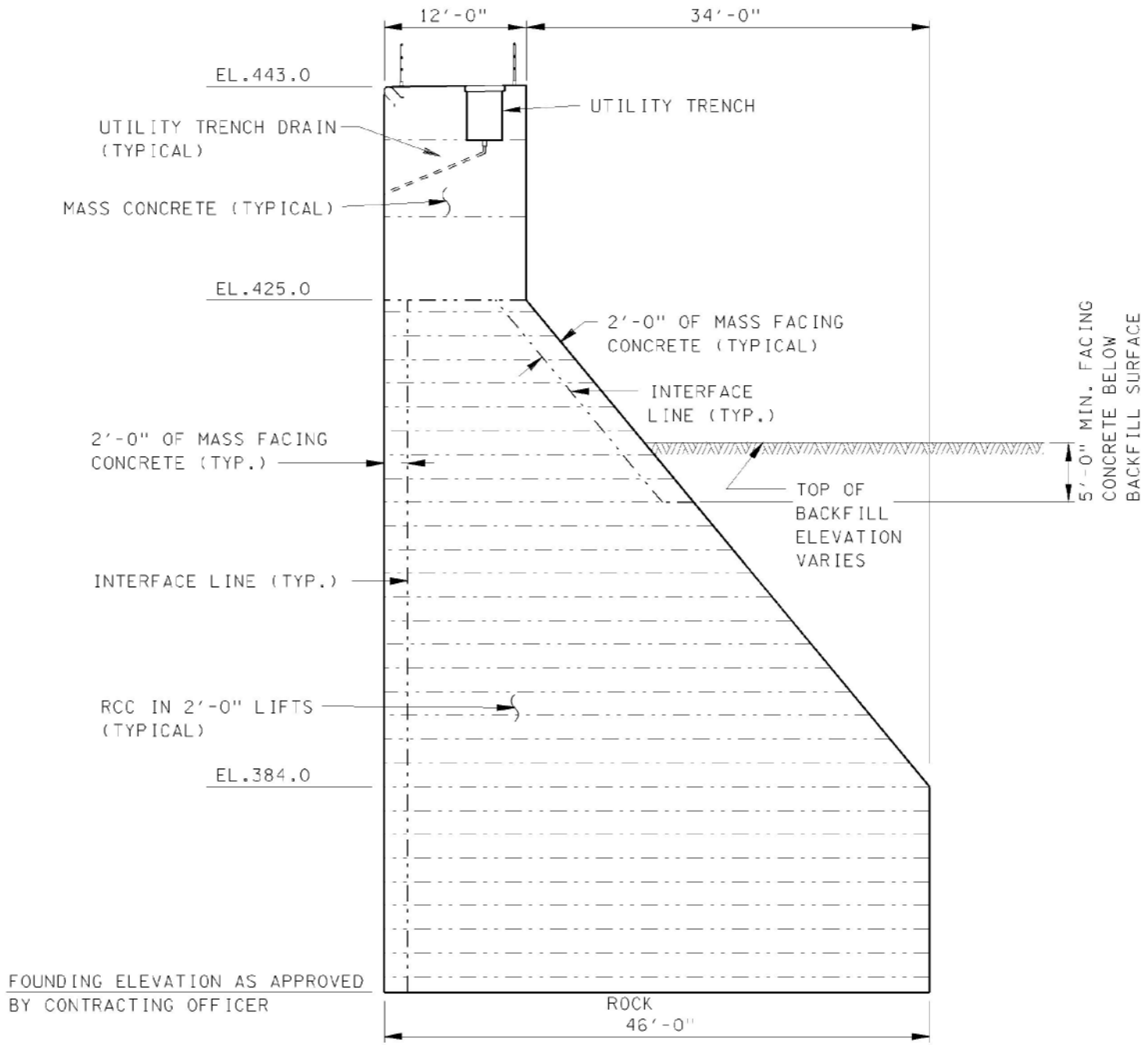
NORTH WALL SECTION



MONOLITH L-5 THRU L-15

SOUTH LOCK WALL

SCALE: 1/8"=1'-0"



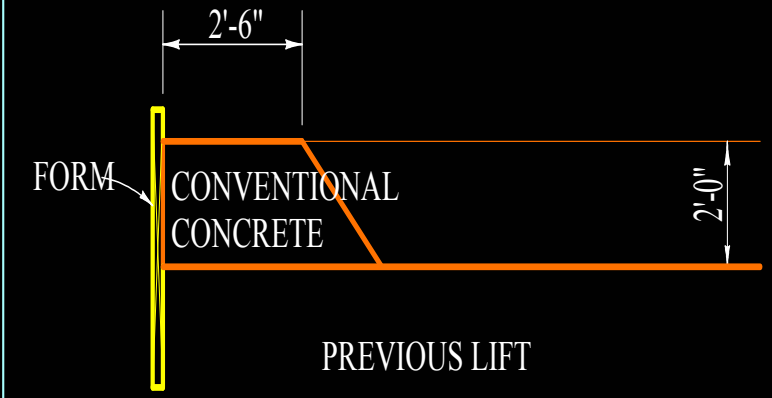
MONOLITH SM-11 THRU SM-12 AT STA.26+72.5

NORTH LOCK WALL

SCALE: 1/4"=1'-0"

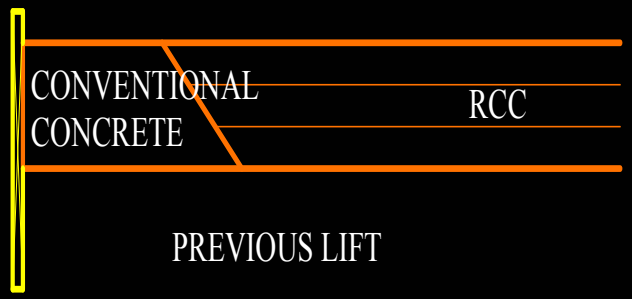
RCC PLACEMENT PROCEDURE

1



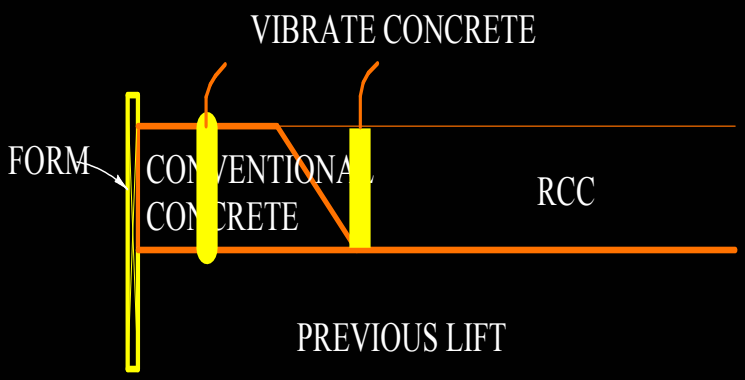
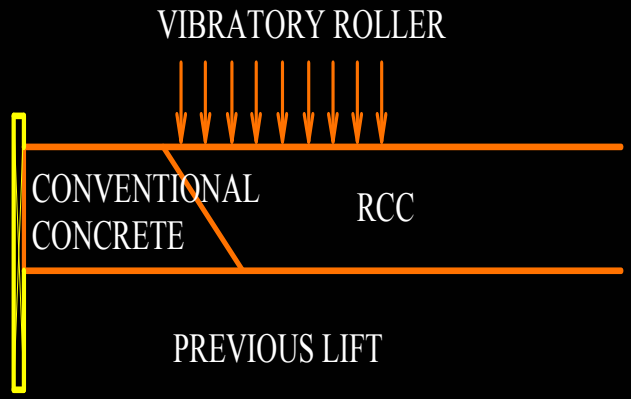
FOR EACH LIFT, CONVENTIONAL CONCRETE IS PLACED PRIOR TO ADJACENT RCC

2

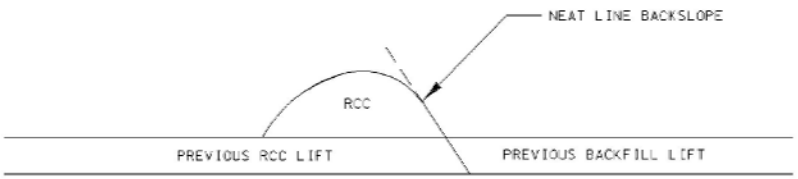
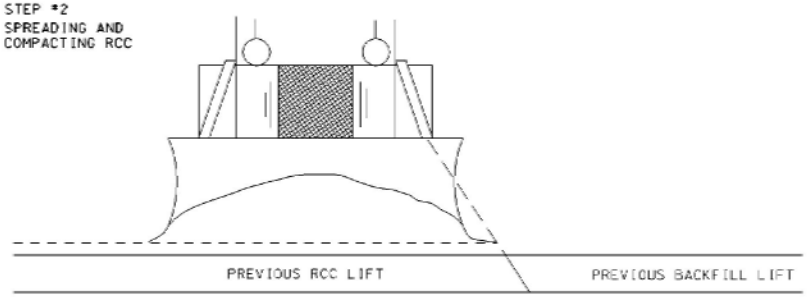
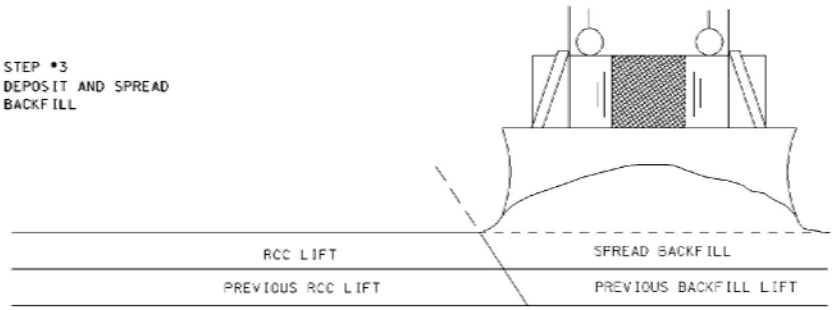
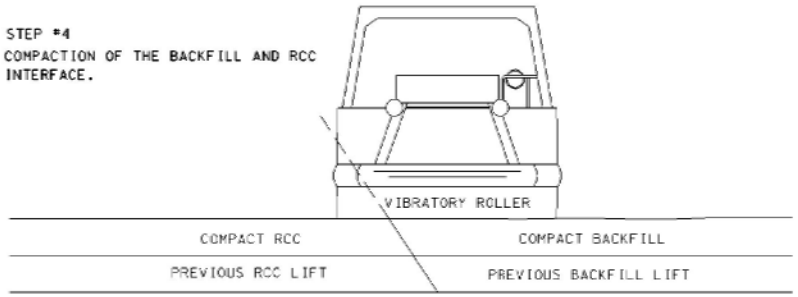


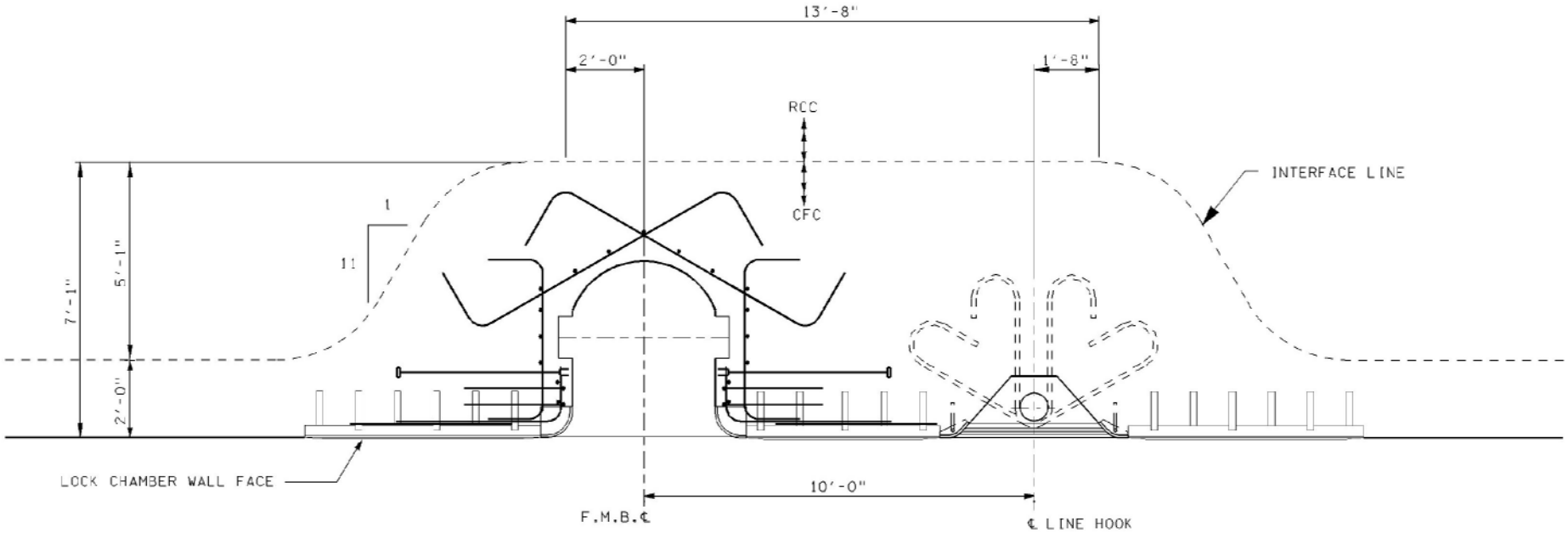
RCC IS SPREAD IN THIN LAYERS UNTIL FULL LIFT THICKNESS IS ACHIEVED.

RCC PLACEMENT PROCEDURE

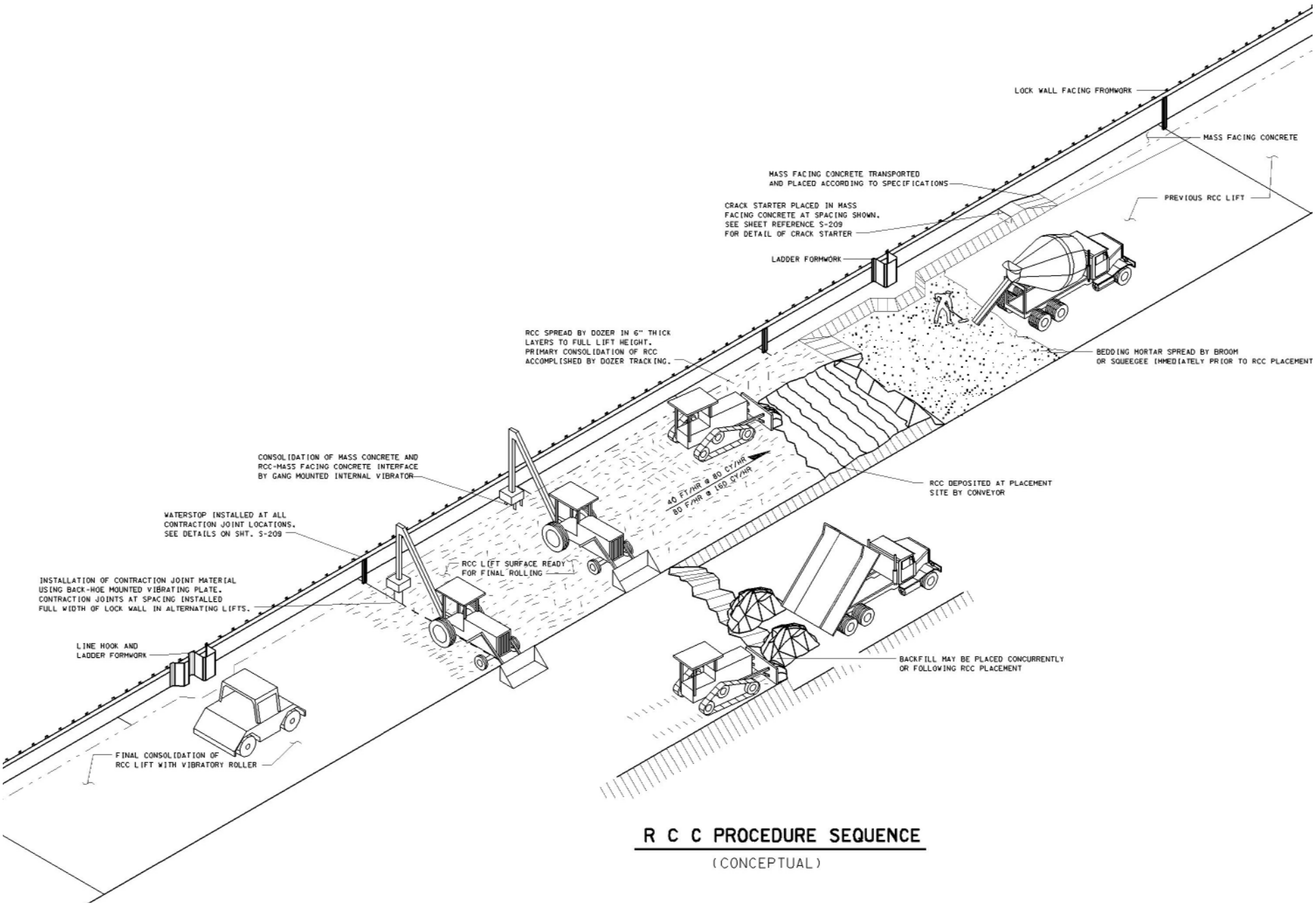
3		INTERFACE BETWEEN RCC AND CONVENTIONAL CONRETE IS THOROUGHLY VIBRATED
4		CONSOLIDATE RCC WITH VIBRATORY ROLLER AS CLOSE TO CONVENTIONAL CONCRETE AS POSSIBLE

PLACEMENT PROCEDURE AT INTERFACE BETWEEN RCC AND BACKFILL FOR CONCURRENT PLACEMENT

①	STEP *1 DEPOSIT RCC BY CONVEYOR  	RCC IS DEPOSITED, SPREAD AND CONSOLIDATED WITHIN THE SPECIFIED NEAT LINE.
②	STEP *2 SPREADING AND COMPACTING RCC  	RCC IS SPREAD IN 6" THICK LAYERS UNTIL FULL LIFT THICKNESS IS ACHIEVED.
③	STEP *3 DEPOSIT AND SPREAD BACKFILL  	BACKFILL IS SPREAD IN LAYERS MATCHING THE RCC LIFT.
④	STEP *4 COMPACTION OF THE BACKFILL AND RCC INTERFACE.  	VIBRATORY ROLLER IS USED TO COMPACT THE RCC AND BACKFILL AT THE INTERFACE.

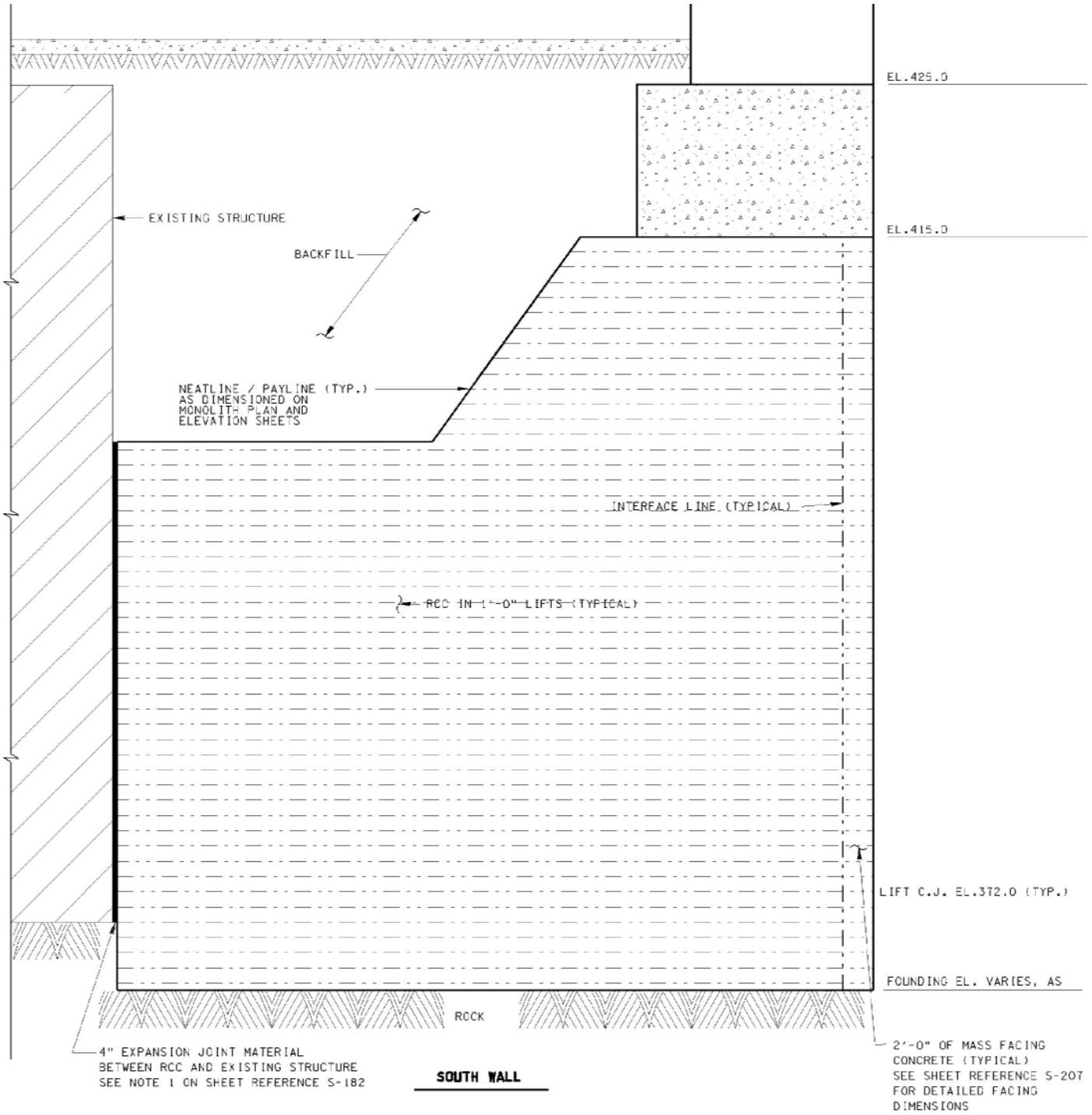


TYPICAL FLOATING MOORING BITT & LINE HOOK PLAN



R C C PROCEDURE SEQUENCE

(CONCEPTUAL)


EL.425.0
EXISTING STRUCTURE
EL.415.0
BACKFILL
NEATLINE / PAYLINE (TYP.)
AS DIMENSIONED ON
MONOLITH PLAN AND
ELEVATION SHEETS
INTERFACE LINE (TYPICAL)
RCC IN 1'-0" LIFTS (TYPICAL)
LIFT C.J. EL.372.0 (TYP.)
FOUNDING EL. VARIES, AS
ROCK
4" EXPANSION JOINT MATERIAL
BETWEEN RCC AND EXISTING STRUCTURE
SEE NOTE 1 ON SHEET REFERENCE S-182
2'-0" OF MASS FACING
CONCRETE (TYPICAL)
SEE SHEET REFERENCE S-207
FOR DETAILED FACING
DIMENSIONS

SOUTH WALL


TEREX


ERE
HOLT


310E


DEERE

DEERE


DEERE
L-13

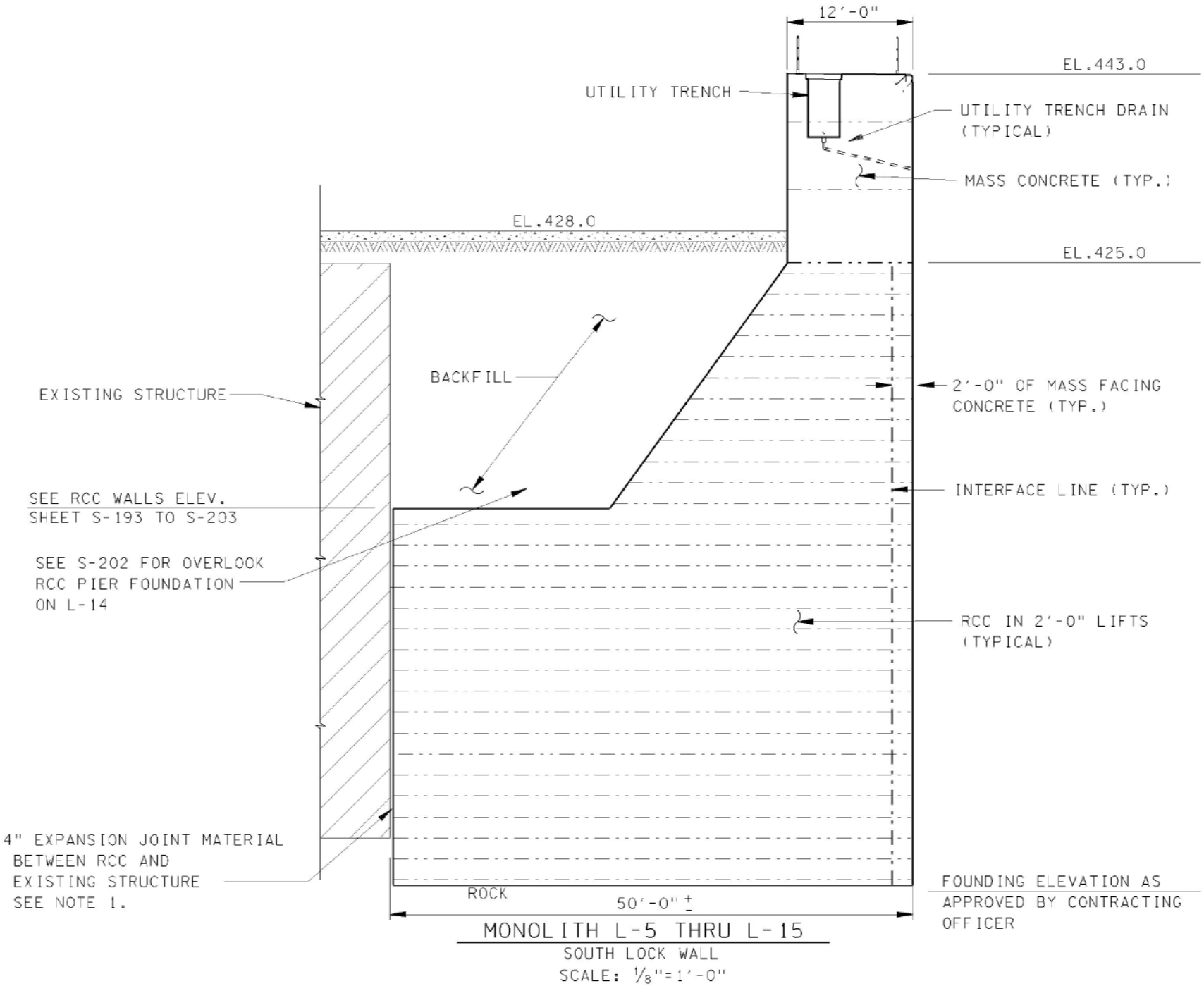

E-13
E-12


CLYDE
CAT
DEERE


CLYDE
CAT
RENTS


CAT
WAYNE
RENTS

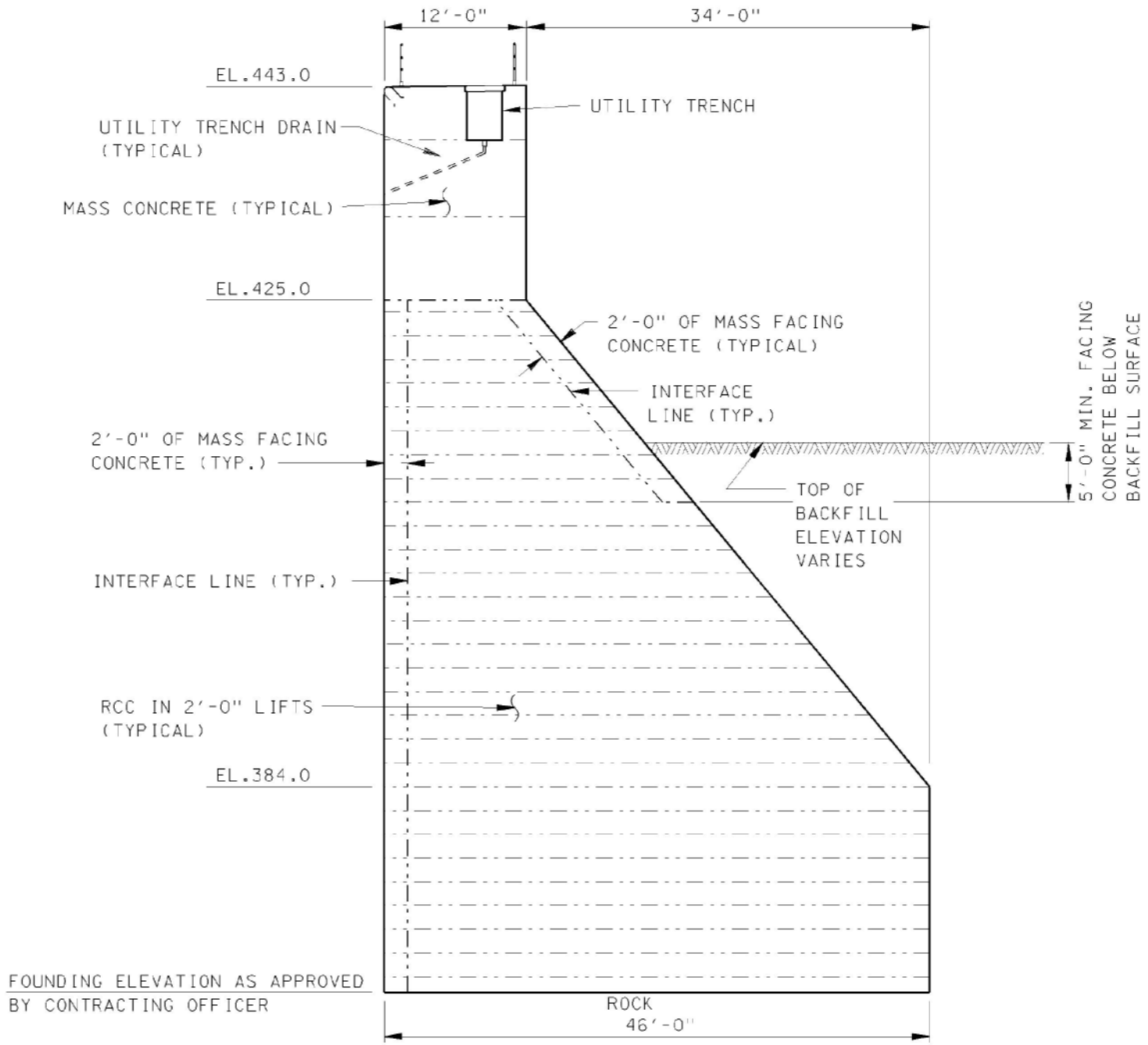

CLYDE



MONOLITH L-5 THRU L-15

SOUTH LOCK WALL

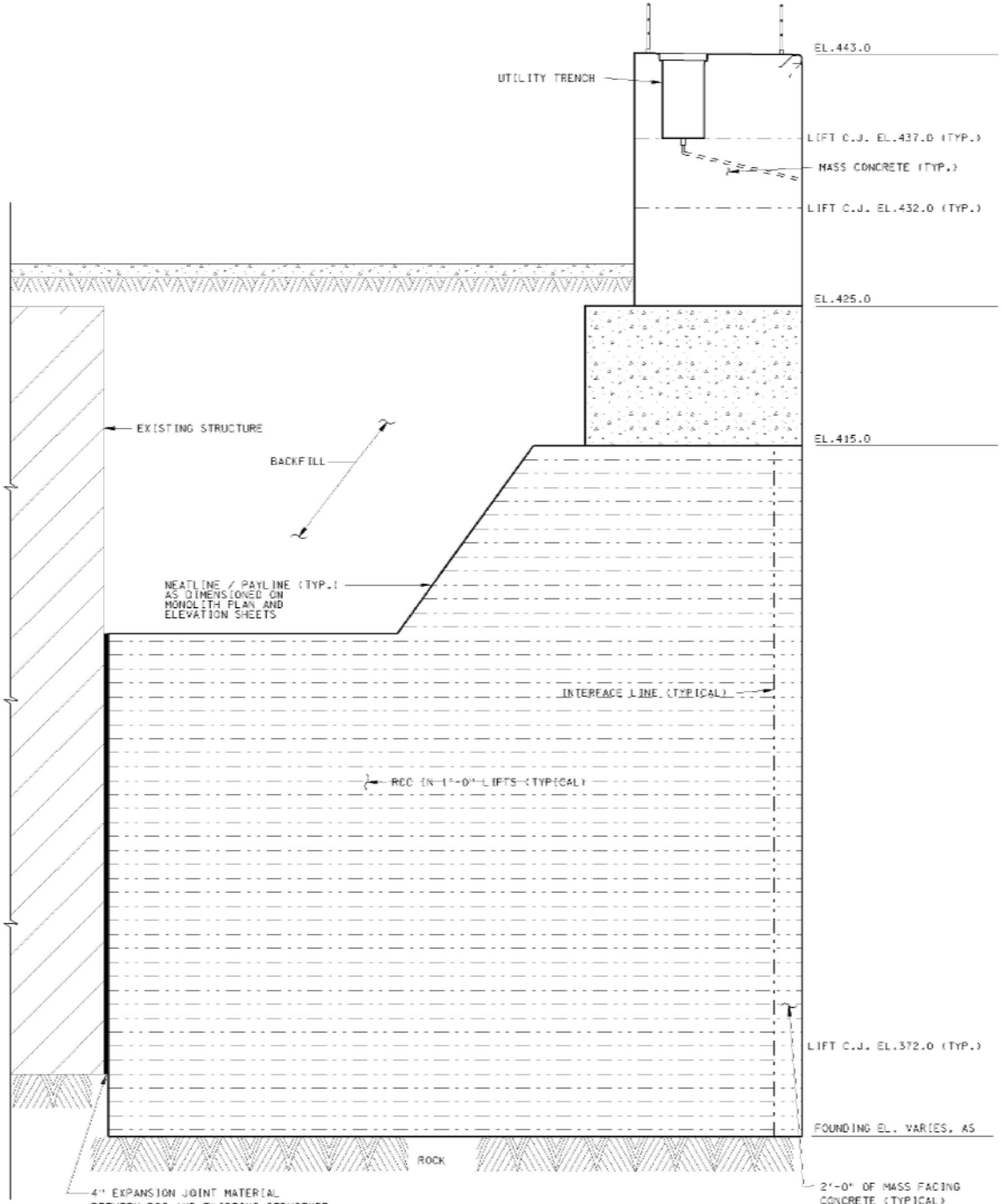
SCALE: 1/8"=1'-0"



MONOLITH SM-11 THRU SM-12 AT STA.26+72.5

NORTH LOCK WALL

SCALE: 1/4"=1'-0"

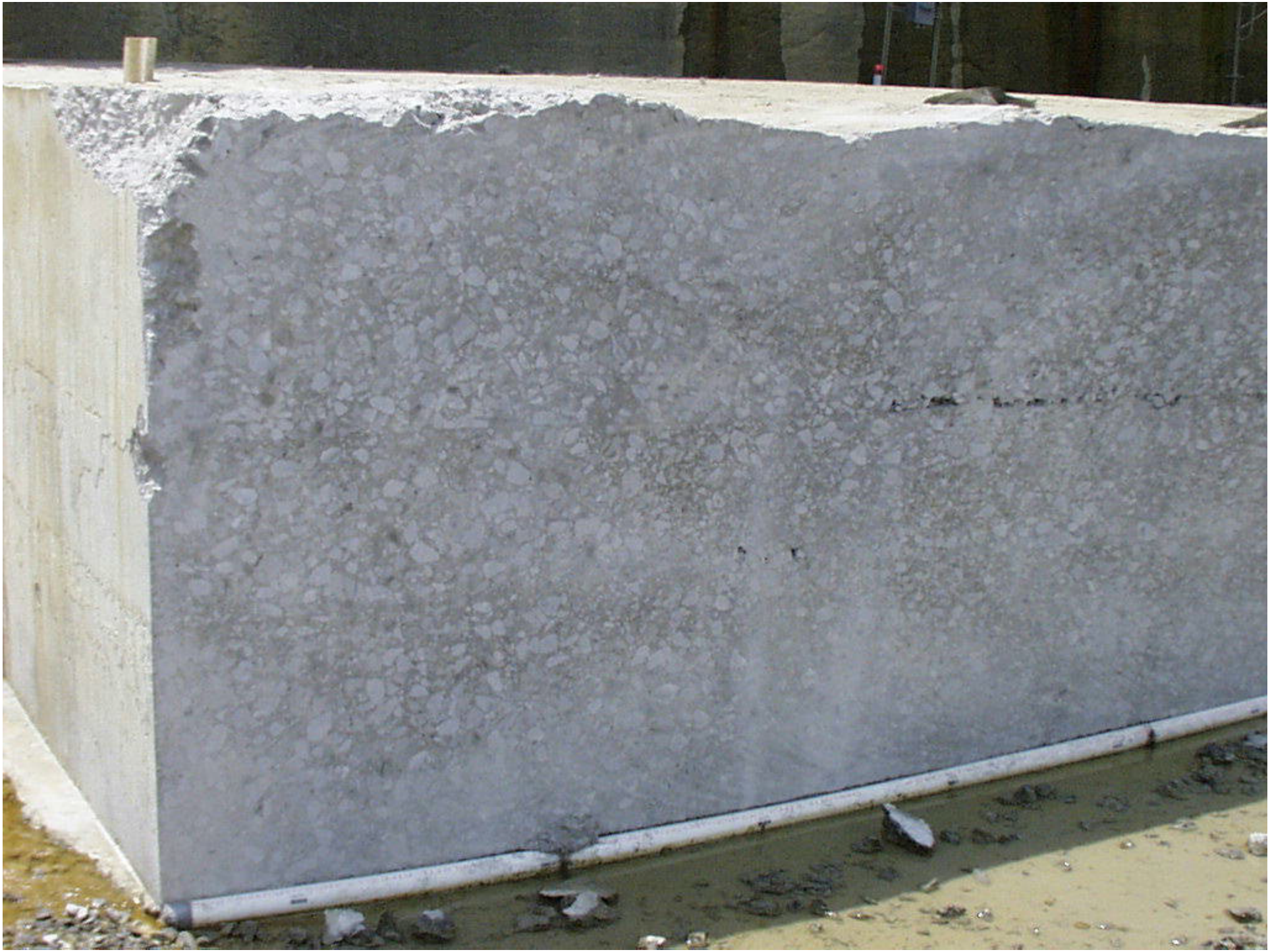

EL.443.0
UTILITY TRENCH
LIFT C.J. EL.437.0 (TYP.)
MASS CONCRETE (TYP.)
LIFT C.J. EL.432.0 (TYP.)
EL.425.0
EXISTING STRUCTURE
BACKFILL
EL.415.0
NEATLINE / PAYLINE (TYP.) AS DIMENSIONED ON MONOLITH PLAN AND ELEVATION SHEETS
INTERFACE LINE (TYPICAL)
RCC (N 1'-0" LIFTS (TYPICAL)
LIFT C.J. EL.372.0 (TYP.)
FOUNDING EL. VARIES, AS
ROCK
4" EXPANSION JOINT MATERIAL BETWEEN RCC AND EXISTING STRUCTURE SEE NOTE 1 ON SHEET REFERENCE S-182
2'-0" OF MASS FACING CONCRETE (TYPICAL) SEE SHEET REFERENCE S-207 FOR DETAILED FACING DIMENSIONS

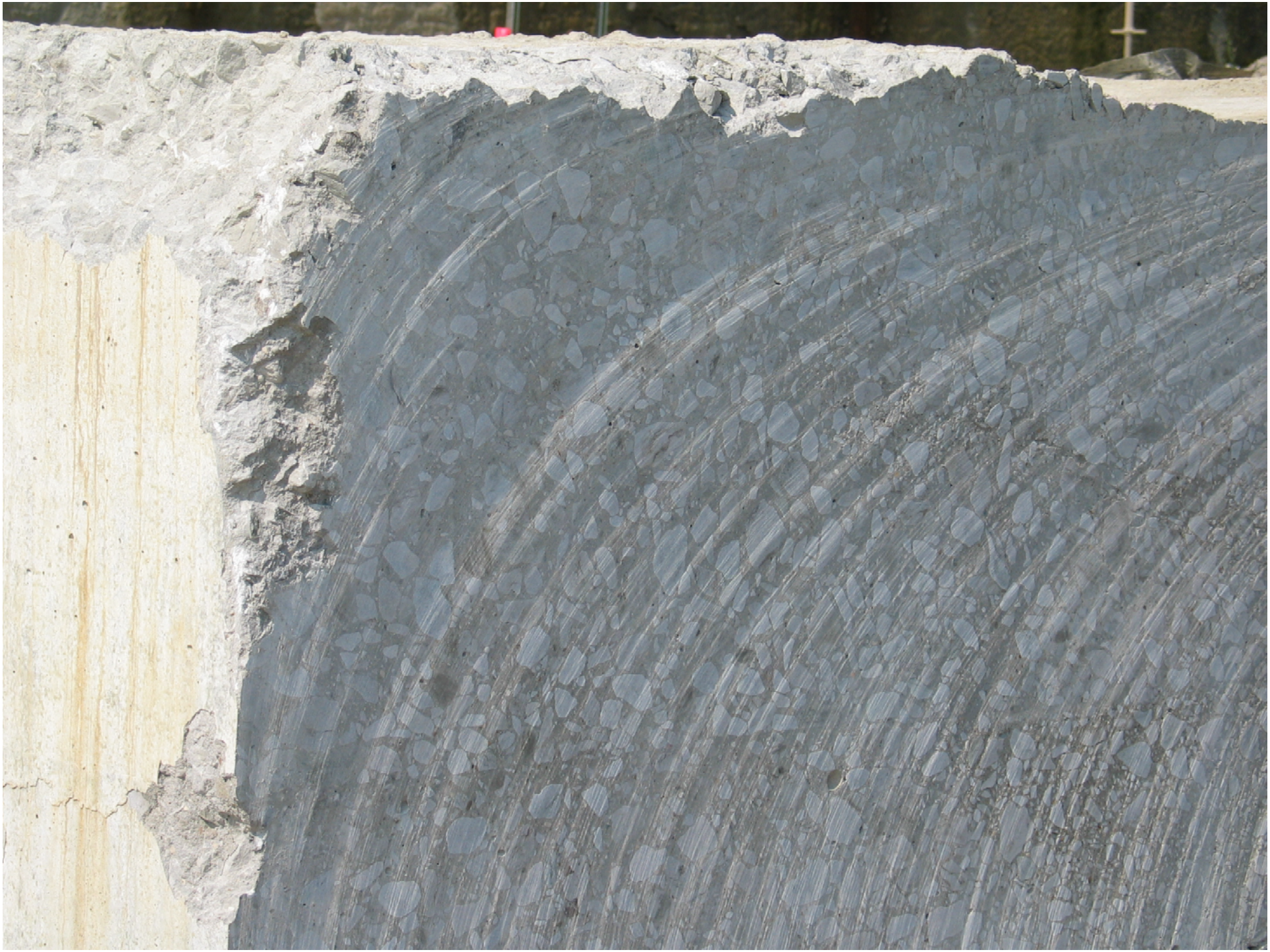
SOUTH WALL


TEREX
TEREX


6/24
6/23
6/22


6/24
6/23
6/22





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ROLLER COMPACTED CONCRETE

- MATERIAL PROPERTIES -

ITEM	Assumed For Design	Actual QA Test Results
Unit Weight	150 pcf	154 pcf
Compressive Strength	2000 psi	3300 psi
Phi	45 degrees	??
Cohesion	25 psi	??

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ROLLER COMPACTED CONCRETE

- DESIGN CRITERIA -

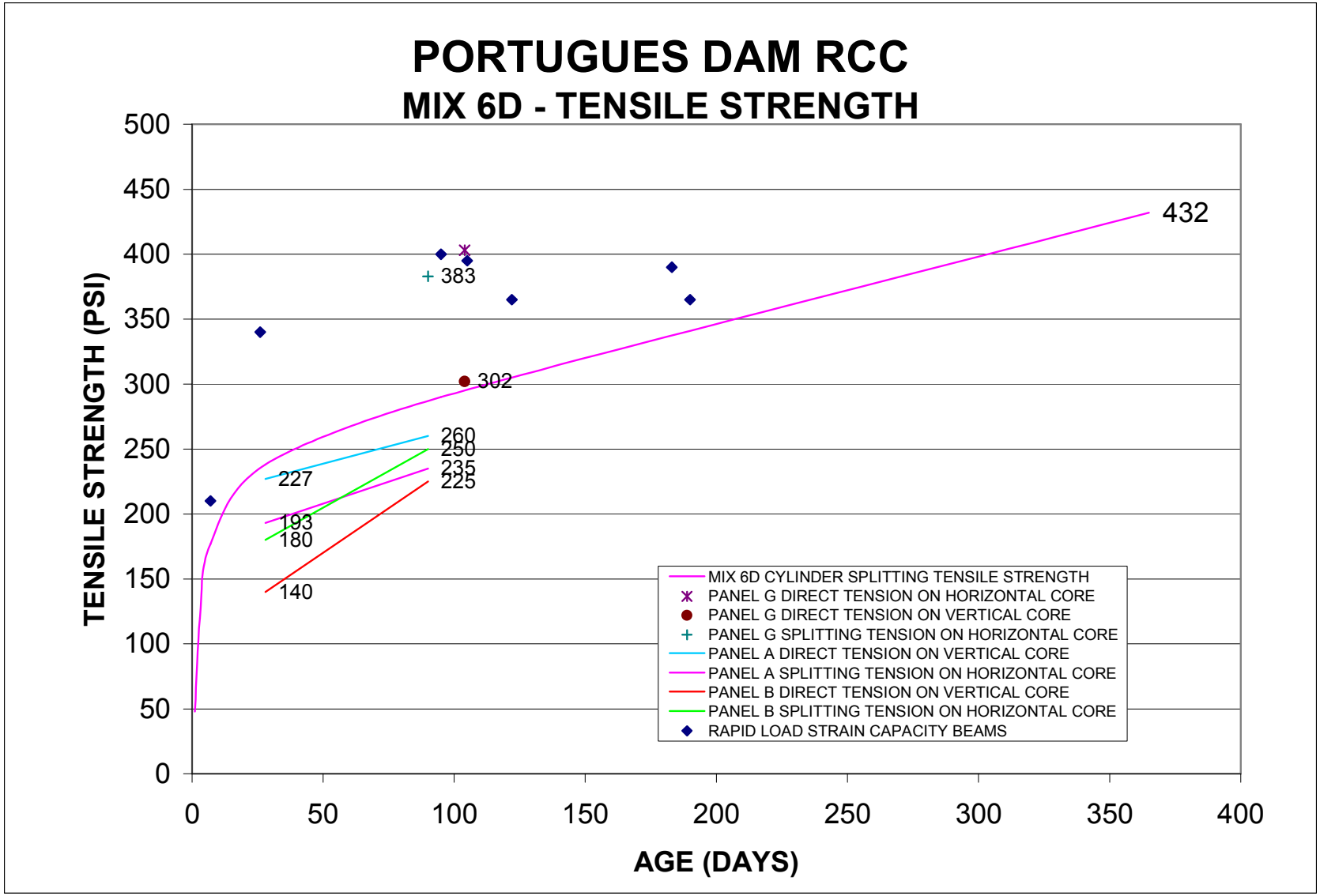
CRACKED PLANE (Full Uplift Assumed)

CHECKS
Location of Resultant for Overturning Stability
Factor of Safety Against Sliding
Compression Stresses Against Allowables

UNCRACKED PLANE (Reduced and Zero Uplift Assumed)

CHECKS
Factor of Safety Against Sliding
Compression and Tension Stresses Against Allowables
Allowable Tension Stress 25% of Table 4-1
(Design Value = 59.5 psi vs. 332 psi w/ 100% & QA values)
Allowable Compressive Stress 100% of Table 4-1
(Design Value = 1800 psi vs. 2970 psi w/ Actual QA values)

Bond Strength



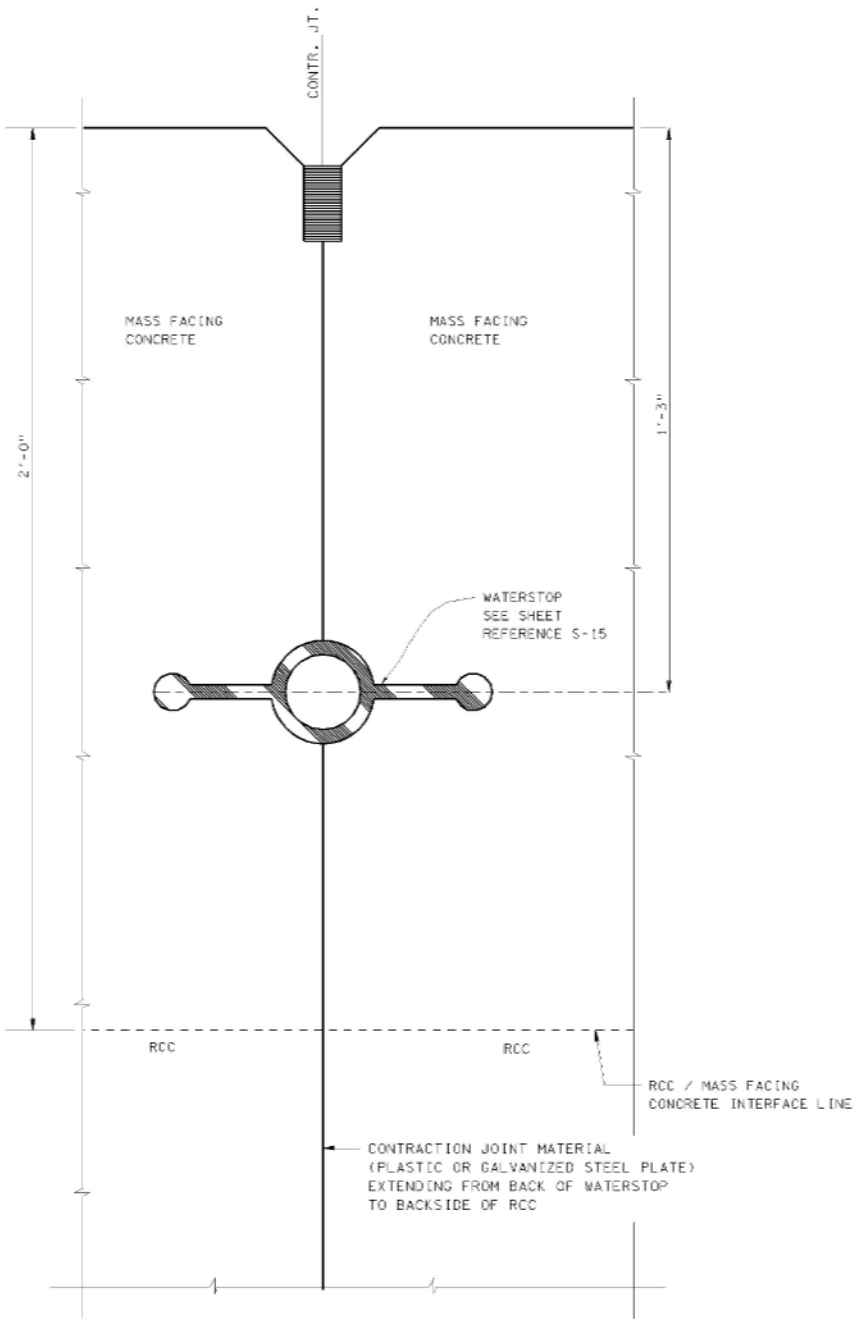
Larry L. Dalton, PE
Louisville District, USACE
(502) 315-6279
Larry.L.Dalton@LRL02.usace.army.mil

US Army Corps of Engineers

PRELIMINARY

- MIX PROPORTIONS -

Material	Mixture No. 2 63mm NMSA RCC Natural Sand Fine Aggregate 35% Class F Fly Ash Mass, S.S.D. (lb)	Mixture No. 5 63mm NMSA RCC Limestone Fine Aggregate 35% Class F Fly Ash Mass, S.S.D. (lb)
Cement	130	156
Fly Ash	54	64
Fly Ash for Fines	104	0
Limestone Fines	0	1317
Natural Sand	1252	0
63 to 19.0 mm	1463	1400
19.0 to 4.75 mm	979	934
Water	168	221
WRA	12.0 fl oz	14.4 fl oz
Vebe (average)	15 sec	16 sec



CONTRACTION JOINT DETAIL