OHIO DEPARTMENT OF TRANSPORTATION

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Retaining Wall Initiatives

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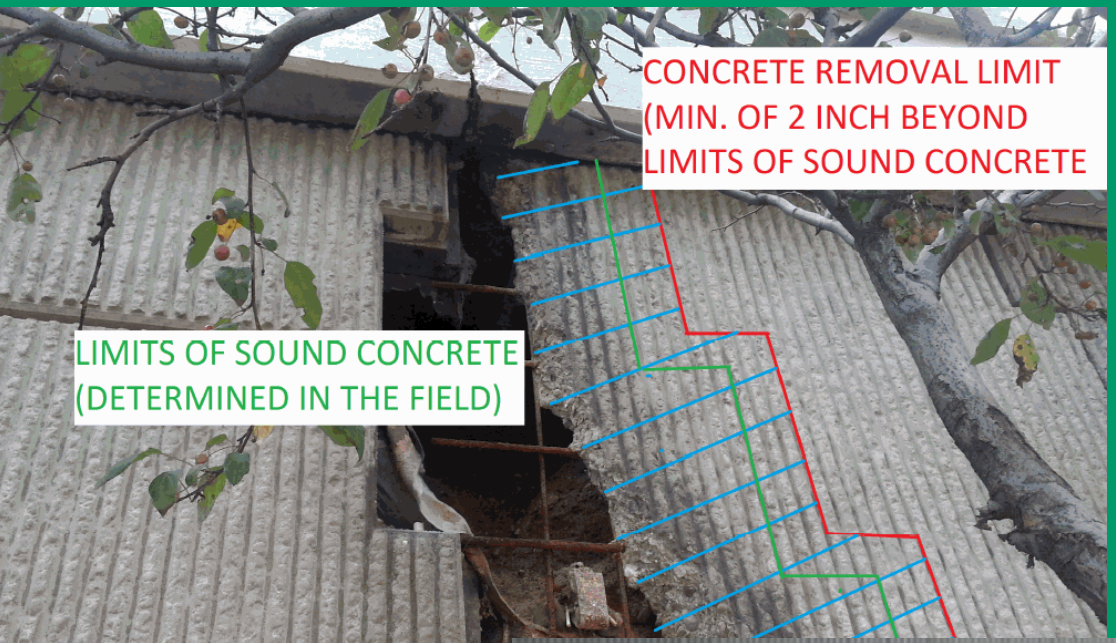
June 21, 2016 Geotechnical Consultant Workshop

Retaining Wall Initiatives

- **MSE Wall Panel Repair SD**
- **Pre-fabricated Retaining Wall Systems (PRWS) Approval Process**
  - EL Robinson Engineering, Task Order Contract, 2/2014 – 9/2015
- **Revise Headwall SDs per LRFD**
- **CIP concrete cantilever wall SDs per LRFD**
  - CHA, 1/2015 – 6/2016

MSE Wall Panel Repair

- **Investigate deterioration causes**
  - Suggest specification changes
- **Consult wall suppliers, national experts; research new/modified procedures**
  - Develop generic Standard Drawings for all potential conditions



REMOVE EXISTING CONCR

PARTIAL PANEL RE

MSE Wall Panel Repair

- **Repair Methods List**
  - Panel Repair Method 1
    - Minor cosmetic facing repair
  - Panel Repair Method 2
    - Part or full depth CIP replacement
    - New pre-cast panel with helical anchors
  - Reinforcement Repair
    - Drilled and grouted soil nails
  - Grout Fill – LSM Type 2

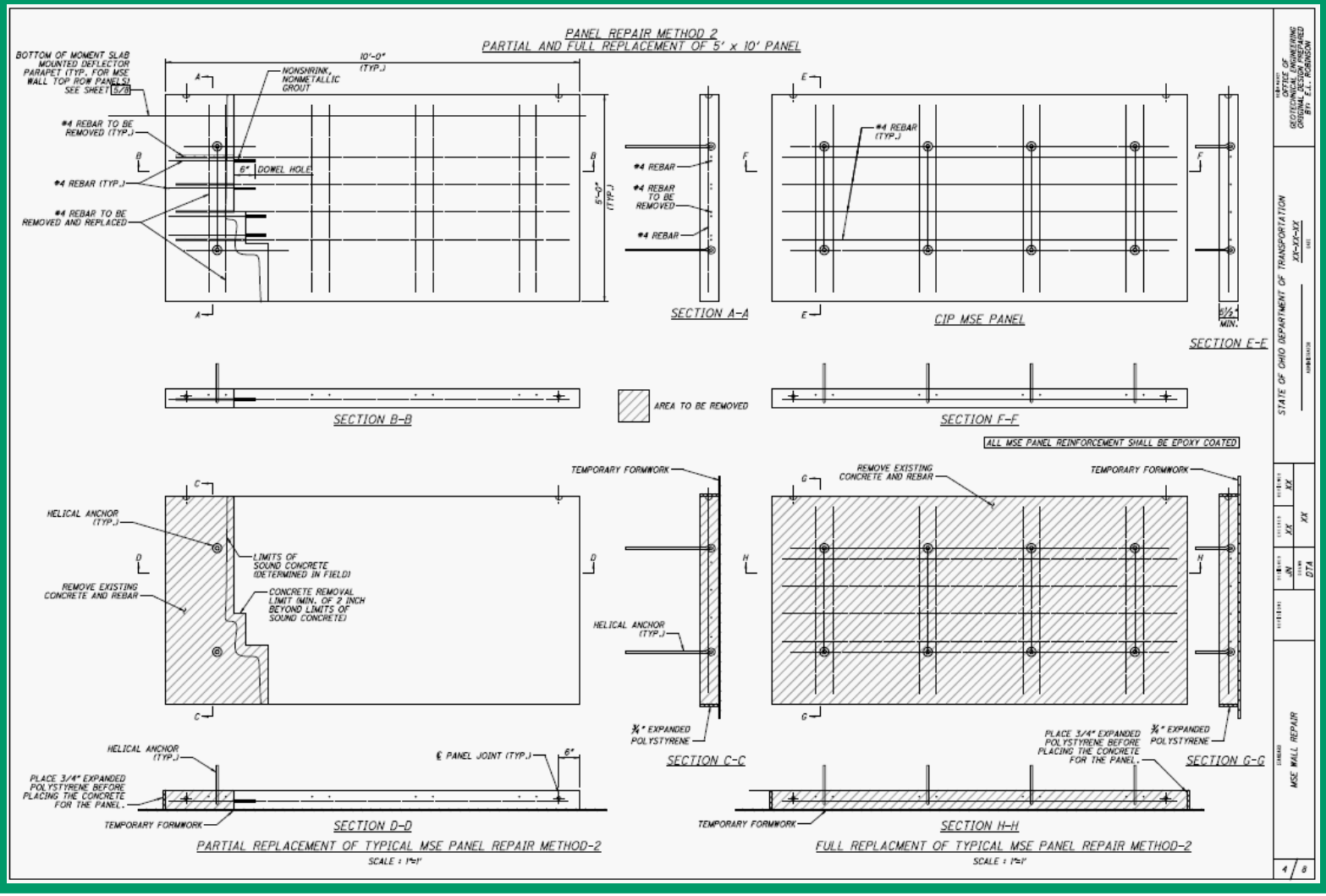
MSE Wall Panel Repair

- **Damage Types and Repair Methods**
  - Type 1 (most extensive – all three conditions)
    - Panel Repair Method 2
    - Reinforcement repair where not functional
    - Grout Fill
  - Type 2 (local panel damage, partial loss of fill)
    - Panel Repair Method 1 or 2
    - Grout Fill

MSE Wall Panel Repair

- **Damage Types and Repair Methods**
  - Type 3 (panel displacement, partial loss of fill)
    - Panel Repair Method 1 or 2 to close joints
    - Grout Fill
  - Type 4 (least extensive – panel damage only)
    - Panel Repair Method 1

MSE Wall Panel Repair



MSE Wall Panel Repair

QUESTIONS?

Pre-fabricated Retaining Wall Systems (PRWS) Approval Process

- **Submit**
- **Approve**
- **Include on ODOT Approved Products List (APL)**
  - Established 4/1/2016
  - Prior approval status will expire 12/31/2016

PRWS Approval Process

- **Including (but not limited to):**
  - Precast Gravity, Semi-Gravity, and Bin & Crib Wall Systems
  - Gravity Modular Block and Large Block Retaining Wall Systems
  - Mechanically Stabilized Earth (MSE) Wall Systems

PRWS Approval Process

- **Currently**
  - Limited to MSE Walls (2004 BDM), listed in SS840
  - HITEC Evaluation Required
    - Expensive
    - Time-consuming
    - Defunct?
  - Pre-LRFD, based on 2004 BDM and 2002 AASHTO
  - No Time Renewal Requirement

PRWS Approval Process

- **Submit**
  - Letter of Intent (ODOT review in 4 weeks)
    - Review Engineer Pre-qualification Requirements
  - Detailed information
    - Retaining Wall System Evaluation Report
      - Prepared by Review Engineer
      - Sample long-hand calculations for specified cases
      - ID unique features
      - Highlight exceptions to AASHTO LRFD Specs
      - Shop Drawings
      - Etc.

PRWS Approval Process

- **ODOT Technical Review**
  - 16 weeks
  - Approved; Conditions of Approval (if any)
  - Rejected; Reasons for Rejection

PRWS Approval Process

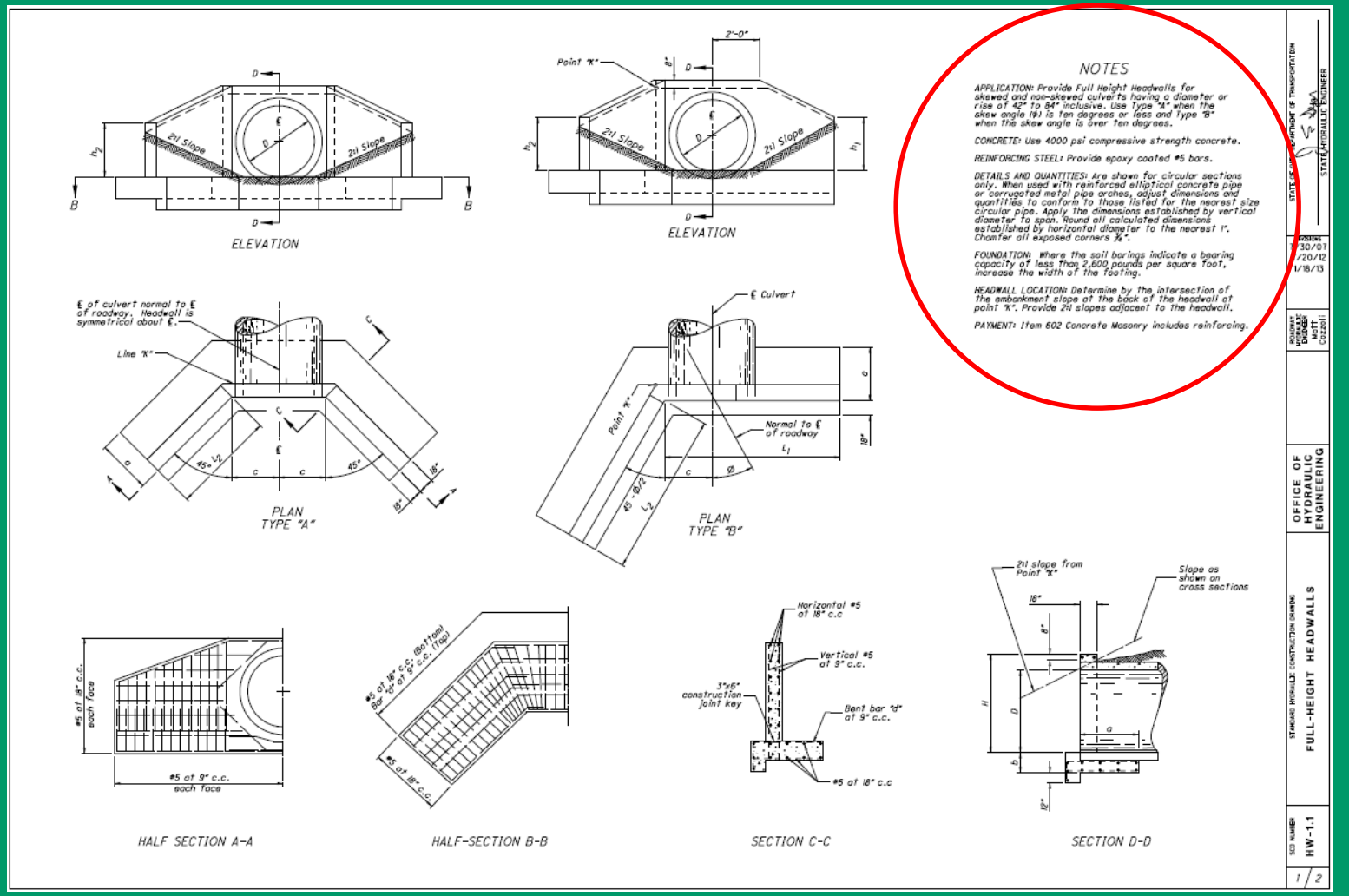
- http://www.dot.state.oh.us/Divisions/ConstructionMgt/Materials/Pages/default.aspx

QUESTIONS?

Headwall/Wingwall/CIP Wall

- Revise Standard Construction Drawing (SCD) HW-1.1
- Revise plan insert sheets for concrete headwalls for precast box culverts
- Verify SCD HW-2.1 and HW-2.2 and revise as necessary

Headwall/Wingwall/CIP Wall



Headwall/Wingwall/CIP Wall

NOTES

APPLICATION: Provide Full Height Headwalls for skewed and non-skewed culverts having a diameter or rise of 42" to 84" inclusive. Use Type "A" when the skew angle (ϕ) is ten degrees or less and Type "B" when the skew angle is over ten degrees.

CONCRETE: Use 4000 psi compressive strength concrete.

REINFORCING STEEL: Provide epoxy coated #5 bars.

DETAILS AND QUANTITIES: Are shown for circular sections only. When used with reinforced elliptical concrete pipe or corrugated metal pipe arches, adjust dimensions and quantities to conform to those listed for the nearest size circular pipe. Apply the dimensions established by vertical diameter to span. Round all calculated dimensions established by horizontal diameter to the nearest 1". Chamfer all exposed corners ¾".

FOUNDATION: Where the soil borings indicate a bearing capacity of less than 2,600 pounds per square foot, increase the width of the footing.

HEADWALL LOCATION: Determine by the intersection of the embankment slope at the back of the headwall at point "K". Provide 2:1 slopes adjacent to the headwall.

PAYMENT: Item 602 Concrete Masonry includes reinforcing.

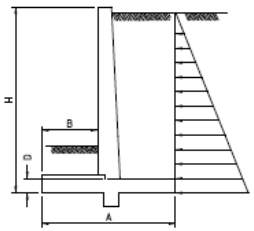
Headwall/Wingwall/CIP Wall

- **Perform an independent check of a new SCD Cast-in-place Reinforced Concrete Cantilever Retaining Wall and revise as necessary**

Headwall/Wingwall/CIP Wall

CASE I (3.5 KSF MAX FACTORED APPLIED BEARING PRESSURE)

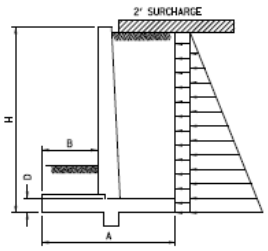
WALL DIMENSIONS					REINFORCING STEEL BAR DESIGNATION																												QUANTITIES	
					J				K				L	M	N						Q	R				S					U	CONC.	STEEL
H	A	B	D	SK (1)	SIZE	NO	SPA	LGTH	SIZE	NO	SPA	LGTH	NO	NO	SIZE	NO	SPA	LGTH	DIM a	LGTH	SIZE	NO	SPA	LGTH	SIZE	NO	SPA	LGTH	LGTH	CU. FT.	LBS.
5'-0"	3'-0"	0'-8"	1'-0"		5	21	1'-6"	2'-8"	5	21	1'-6"	2'-8"	6	8	5	21	1'-6"	5'-5"	4'-8"	3'-6"									3'-6"	10	34
6'-6"	4'-0"	1'-0"	1'-0"		5	21	1'-6"	3'-8"	5	21	1'-6"	3'-8"	8	10	5	21	1'-6"	6'-11"	6'-2"	3'-6"									5'-0"	13	43
8'-0"	4'-6"	1'-3"	1'-3"		5	21	1'-6"	4'-2"	5	21	1'-6"	4'-2"	8	12	5	21	1'-6"	8'-5"	7'-8"	3'-9"									6'-3"	17	50
10'-0"	5'-6"	1'-6"	1'-3"		5	21	1'-6"	5'-2"	5	21	1'-6"	5'-2"	10	14	5	21	1'-6"	4'-7"	3'-8"	3'-9"	5	21	1'-6"	8'-6"					8'-3"	21	63
11'-6"	6'-0"	1'-6"	1'-3"		5	21	1'-6"	5'-8"	5	21	1'-6"	5'-8"	10	16	5	21	1'-6"	4'-7"	3'-8"	3'-9"	5	21	1'-6"	10'-0"					9'-9"	24	70
13'-0"	6'-6"	2'-0"	1'-6"		5	21	1'-6"	6'-2"	5	21	1'-6"	6'-2"	12	18	6	21	1'-6"	5'-5"	4'-4"	4'-0"	5	21	1'-6"	11'-3"					11'-0"	28	81
15'-0"	7'-6"	2'-0"	1'-6"		5	21	1'-6"	7'-2"	5	21	1'-6"	7'-2"	12	20	6	27	1'-2"	5'-5"	4'-6"	4'-0"	5	27	1'-2"	13'-3"					13'-0"	32	90
16'-8"	8'-6"	2'-6"	1'-6"		5	27	1'-2"	8'-2"	5	27	1'-2"	8'-2"	14	22	6	31	1'-0"	5'-5"	4'-4"	4'-0"	5	21	1'-0"	14'-9"					14'-6"	35	94
18'-0"	9'-0"	2'-6"	2'-0"		5	31	1'-0"	8'-8"	5	31	1'-0"	8'-8"	22	24	8	31	1'-0"	8'-3"	6'-8"	4'-6"	5	31	1'-0"	15'-9"					15'-6"	42	127
20'-0"	10'-6"	3'-0"	2'-0"		5	31	1'-0"	10'-2"	5	31	1'-0"	10'-2"	26	26	8	41	9"	8'-3"	6'-8"	4'-6"	6	41	9"	9'-0"	5	21	1'-6"	12'-0"	17'-6"	48	148
21'-8"	12'-0"	3'-0"	2'-0"		5	31	1'-0"	11'-8"	5	31	1'-0"	11'-8"	28	28	8	41	9"	8'-3"	6'-8"	4'-6"	6	41	9"	10'-6"	5	21	1'-6"	12'-0"	19'-0"	55	159
23'-0"	14'-0"	3'-6"	2'-6"		5	31	1'-0"	13'-8"	5	31	1'-0"	13'-8"	32	30	8	41	9"	8'-9"	7'-3"	5'-0"	6	41	9"	10'-6"	5	21	1'-6"	13'-0"	20'-0"	68	174
25'-0"	16'-0"	5'-9"	2'-6"		6	41	9"	15'-8"	6	41	9"	15'-8"	34	32	8	46	8"	10'-3"	9'-2"	5'-0"	6	46	8"	11'-0"	6	23	1'-4"	15'-8"	22'-0"	78	213



CASE I

CASE II (3.5ksf FACTORED TOTAL BEARING PRESSURE)

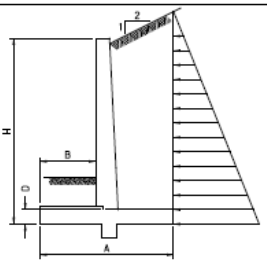
WALL DIMENSIONS					REINFORCING STEEL BAR DESIGNATION																												QUANTITIES	
					J				K				L	M	N						Q	R				S					U	CONC.	STEEL
H	A	B	D	SK (1)	SIZE	NO	SPA	LGTH	SIZE	NO	SPA	LGTH	NO	NO	SIZE	NO	SPA	LGTH	DIM a	LGTH	SIZE	NO	SPA	LGTH	SIZE	NO	SPA	LGTH	LGTH	CU. FT.	LBS.
5'-0"	3'-6"	1'-0"	1'-0"		5	21	1'-6"	3'-2"	5	21	1'-6"	3'-2"	8	8	5	21	1'-6"	5'-5"	4'-8"	3'-6"									3'-6"	10	37
6'-6"	4'-0"	1'-0"	1'-0"		5	21	1'-6"	3'-8"	5	21	1'-6"	3'-8"	8	10	5	21	1'-6"	6'-11"	6'-2"	3'-6"									5'-0"	13	43
8'-0"	5'-6"	1'-6"	1'-3"		5	21	1'-6"	5'-2"	5	21	1'-6"	5'-2"	10	12	5	21	1'-6"	8'-5"	7'-8"	3'-9"									6'-3"	18	54
10'-0"	6'-0"	1'-6"	1'-3"		5	21	1'-6"	5'-8"	5	21	1'-6"	5'-8"	10	14	5	21	1'-6"	4'-7"	3'-11"	3'-9"	5	21	1'-6"	8'-6"					8'-3"	21	64
11'-8"	6'-6"	2'-0"	1'-3"		5	21	1'-6"	6'-2"	5	21	1'-6"	6'-2"	12	16	6	21	1'-6"	5'-2"	4'-4"	3'-9"	5	21	1'-6"	10'-0"					9'-9"	24	76
13'-0"	7'-0"	2'-0"	1'-6"		6	21	1'-6"	6'-8"	6	21	1'-6"	6'-8"	12	18	6	27	1'-2"	5'-5"	4'-7"	4'-0"	5	27	1'-2"	11'-3"					11'-0"	29	89
15'-0"	7'-6"	2'-0"	1'-6"		6	21	1'-6"	7'-2"	6	21	1'-6"	7'-2"	12	20	6	41	9"	5'-5"	4'-7"	4'-0"	5	41	9"	13'-3"					13'-0"	32	96
16'-8"	8'-6"	2'-6"	1'-6"		6	27	1'-2"	8'-2"	6	27	1'-2"	8'-2"	14	22	8	31	1'-0"	7'-9"	6'-8"	4'-0"	5	31	1'-0"	14'-9"					14'-6"	35	120
18'-0"	9'-6"	2'-6"	2'-0"		5	31	1'-0"	9'-2"	5	31	1'-0"	9'-2"	22	24	8	31	1'-0"	8'-3"	7'-2"	4'-6"	6	31	1'-0"	15'-9"					15'-6"	43	135
20'-0"	12'-0"	3'-0"	2'-0"		5	31	1'-0"	11'-8"	6	31	1'-0"	11'-8"	26	26	8	41	9"	8'-3"	7'-2"	4'-6"	6	41	9"	10'-0"	5	21	1'-6"	11'-0"	17'-6"	52	157
21'-6"	14'-0"	4'-0"	2'-0"		6	31	1'-0"	13'-8"	6	31	1'-0"	13'-8"	30	28	8	41	8"	8'-6"	7'-5"	4'-6"	6	46	8"	11'-3"	5	46	1'-4"	11'-3"	19'-0"	59	189



CASE II

CASE III (3.5KSF FACTORED TOTAL BEARING PRESSURE)

WALL DIMENSIONS					REINFORCING STEEL BAR DESIGNATION																												QUANTITIES	
					J				K				L	M	N						Q	R				S					U	CONC.	STEEL
H	A	B	D	SK (1)	SIZE	NO	SPA	LGTH	SIZE	NO	SPA	LGTH	NO	NO	SIZE	NO	SPA	LGTH	DIM a	LGTH	SIZE	NO	SPA	LGTH	SIZE	NO	SPA	LGTH	LGTH	CU. FT.	LBS.
5'-0"	3'-0"	0'-8"	1'-0"		5	21	1'-6"	2'-8"	5	21	1'-6"	2'-8"	8	8	5	21	1'-6"	5'-5"	4'-8"	3'-6"									3'-6"	10	36
6'-6"	4'-3"	1'-0"	1'-0"		5	21	1'-6"	3'-11"	5	21	1'-6"	3'-11"	8	10	5	21	1'-6"	6'-11"	6'-2"	3'-6"									5'-0"	13	44
8'-0"	4'-9"	1'-3"	1'-3"	1'-0"	5	21	1'-6"	4'-5"	5	21	1'-6"	4'-5"	10	12	5	21	1'-6"	8'-5"	7'-8"	3'-9"									6'-3"	17	52
10'-0"	5'-6"	1'-6"	1'-3"	1'-0"	5	21	1'-6"	5'-2"	5	21	1'-6"	5'-2"	12	14	6	21	1'-6"	5'-2"	4'-4"	3'-9"	5	21	1'-6"	8'-6"					8'-3"	21	68
11'-8"	7'-6"	2'-0"	1'-3"	1'-0"	5	21	1'-6"	7'-2"	6	21	1'-6"	7'-2"	12	16	6	34	11"	5'-2"	4'-4"	3'-9"	5	14	11"	10'-0"					9'-9"	26	81
13'-0"	8'-0"	2'-0"	1'-6"	1'-6"	5	37	10"	7'-8"	6	37	10"	7'-8"	14	18	6	46	8"	5'-5"	4'-7"	4'-0"	5	46	8"	11'-3"					11'-0"	30	89
15'-0"	10'-6"	3'-0"	1'-6"	2'-0"	5	31	1'-0"	10'-2"	6	31	1'-0"	10'-2"	16	20	8	37	10"	7'-9"	6'-8"	4'-0"	6	37	10"	13'-3"					13'-0"	37	124



CASE III

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
ADMINISTRATOR
DATE
REVISIONS
DESIGNED CHECKED
DRAWN REVISED
OFFICE OF STRUCTURAL ENGINEERING
STANDARD BRIDGE DRAWING
SID NUMBER

Headwall/Wingwall/CIP Wall

QUESTIONS?