GENERAL NOTES

DESIGN DATA: THE FOLLOWING DESIGN DATA IS ASSUMED:

INTERNAL ANGLE OF FRICTION OF BACKFILL SOIL, ϕ_{bf} = 30°
TOTAL UNIT WEIGHT OF BACKFILL SOIL = 120 PCF
INTERNAL ANGLE OF FRICTION (DRAINED), FOUNDATION SOIL, ϕ_f = 28°
UNDRAINED SHEAR STRENGTH (COHESIVE), FOUNDATION SOIL, S_{uf} = 1500 PSF
UNIT WEIGHT OF CONCRETE = 150 PCF
SLOPE OF BACKFILL = 2:1 (TYPE A & B HEADWALLS)
HEIGHT OF LIVE LOAD SURCHARGE = 2 FT (TYPE C HEADWALLS)

CONCRETE CLASS QC1 - COMPRESSIVE STRENGTH 4000 PSI
(FOOTING, WINGWALL AND FORESLOPE WALL)

REINFORCING STEEL - ASTM A615, A616, OR A617
GRADE 60 MINIMUM YIELD STRENGTH
60,000 PSI (ALL REINFORCING SHALL BE EPOXY COATED)

BASED ON THE ASSUMED DESIGN DATA, THE WINGWALLS ACHIEVE FACTORED BEARING RESISTANCES THAT ARE GREATER THAN THEIR RESPECTIVE BEARING PRESSURES. IF A BACKFILL MATERIAL WITH A HIGHER INTERNAL ANGLE OF FRICTION OR A LIGHTER TOTAL UNIT WEIGHT IS USED; OR IF A FOUNDATION SOIL WITH A HIGHER DRAINED INTERNAL ANGLE OF FRICTION OR A HIGHER UNDRAINED SHEAR STRENGTH IS ENCOUNTERED; THEN THE STABILITY OF THE WINGWALLS IS SATISFACTORY.

USE TYPE A, B AND C HEADWALLS AS FOLLOWS:

USE TYPE A HEADWALLS WHEN THE CENTERLINE OF THE CULVERT IS NORMAL TO THE ROADWAY. BOTH WINGWALLS FOR TYPE A HEADWALLS ARE SKEWED AT 45° FROM THE CULVERT CENTERLINE.

USE TYPE B HEADWALLS FOR ROADWAY SKEWS OF 15, 30 OR 45 DEGREES, OR WITH NO SKEW IF SITE CONDITIONS DICTATE A STRAIGHT WINGWALL AND A WINGWALL WITH A 45 DEGREE SKEW.

USE TYPE C HEADWALLS ONLY WHERE SITE CONSTRAINTS SUCH AS RIGHT-OF-WAY OR UTILITIES PREVENT EXTENDING THE WINGWALLS TO INTERCEPT THE GRADED SLOPE. BOTH WINGWALLS FOR TYPE C HEADWALLS ARE PARALLEL TO THE ROADWAY.

CULVERT SIZE LIMITATIONS: LIMIT USE OF THIS STANDARD DRAWING TO PRECAST BOX CULVERTS WITH SPANS RANGING FROM 8 FEET TO 20 FEET (IN 2 FEET INCREMENTS ONLY), AND RISES RANGING FROM 4 FEET TO 10 FEET (IN 1 FOOT INCREMENTS). MAKE REFERENCE ON THE PLANS TO ASTM C 1433 FOR SPANS UP TO AND INCLUDING 12 FEET. FOR SPANS GREATER THAN 12 FEET AND UP TO AND INCLUDING 20 FEET, OBTAIN A BOX DESIGN FROM THE OFFICE OF STRUCTURAL ENGINEERING AND PROVIDE DETAILS IN THE PLANS. ANY CULVERT WITH A SPAN OR RISE EXCEEDING THESE LIMITS REQUIRES A SPECIAL WALL DESIGN. USE A 12" BOX THICKNESS FOR SPANS IN EXCESS OF 12 FEET.

FORESLOPE WALL HEIGHT: THE FORESLOPE WALL HEIGHT WILL BE EITHER 6" OR 1'-6" ABOVE THE TOP OF THE CULVERT.

STEM HEIGHT: CALCULATE THE STEM HEIGHT, MEASURED FROM THE TOP OF THE FOOTING TO THE TOP OF THE WALL, AS FOLLOWS:

H = BOX RISE + 2 (BOX SLAB THICKNESS) + REQUIRED FORESLOPE WALL HEIGHT

SELECT THE DESIGN HEIGHT (H) BY ROUNDING UP TO THE NEAREST VALUE SHOWN IN THE TYPE A, B OR C HEADWALL TABLES. SHOW THE "DESIGN HEIGHT" ON THE PLANS.

USE OF DESIGN DATA SHEETS:

1. CALCULATE THE REQUIRED DESIGN HEIGHT "H" PER THE "STEM HEIGHT" NOTE ON THIS SHEET.
2. SELECT HEADWALL TYPE "A", "B" OR "C" PER THE "WHEN TO USE" NOTE ON THIS SHEET.
3. FOR TYPE "A" HEADWALLS, USE THE TABLE ON SHEET 2/6. FOR TYPE "B" HEADWALLS, IDENTIFY THE SKEW ANGLE OF THE CULVERT WITH RESPECT TO THE ROADWAY "THETA ANGLE" (SEE GEOMETRIC DIAGRAM ON SHEET 3/6) AND USE THE TABLES ON SHEETS 3/6 AND 4/6. FOR TYPE "C" HEADWALLS, USE THE TABLE ON SHEET 5/6.
4. IN THE APPROPRIATE TABLE, SELECT THE REQUIRED DESIGN HEIGHT "H" FROM THE LEFTMOST COLUMN. FROM LEFT TO RIGHT FIND THE WINGWALL DIMENSIONS, FOOTING DIMENSIONS, WINGWALL REINFORCING DATA AND ESTIMATED QUANTITIES FOR YOUR DESIGN. MULTIPLY ESTIMATED QUANTITIES WITHIN THE LIMITS OF THE BOX CULVERT BY [BOX SPAN + 2x (BOX WALL THICKNESS)].
5. IN THE SECOND COLUMN, IDENTIFY THE FOOTING DESIGN NUMBER. REFER TO THE "FOOTING REINFORCING" TABLE ON SHEET 6/6 FOR THE FOOTING REINFORCING DATA.
6. IDENTIFY THE REQUIRED FORESLOPE WALL HEIGHT ABOVE THE TOP OF THE BOX CULVERT. REFER TO THE "FORESLOPE WALL QUANTITIES" TABLE ON SHEET 6/6. MULTIPLY ESTIMATED QUANTITIES BY [BOX SPAN + 2x (BOX WALL THICKNESS)].
7. FOR STANDARD HEADWALL DETAILS, SEE SHEET 6/6.
8. PROVIDE THE CULVERT & WINGWALL LAYOUT AND ELEVATION VIEWS OF THE INLET AND OUTLET ENDS ON SHEET 2 OF THE PLAN INSERTS. (THIS MAY BE ACCOMPLISHED BY COPYING AND PASTING THE APPROPRIATE DETAILS FROM THE DESIGN DATA SHEETS.)
9. USE THE ELECTRONIC SPREADSHEETS TO GENERATE REINFORCING SCHEDULES.

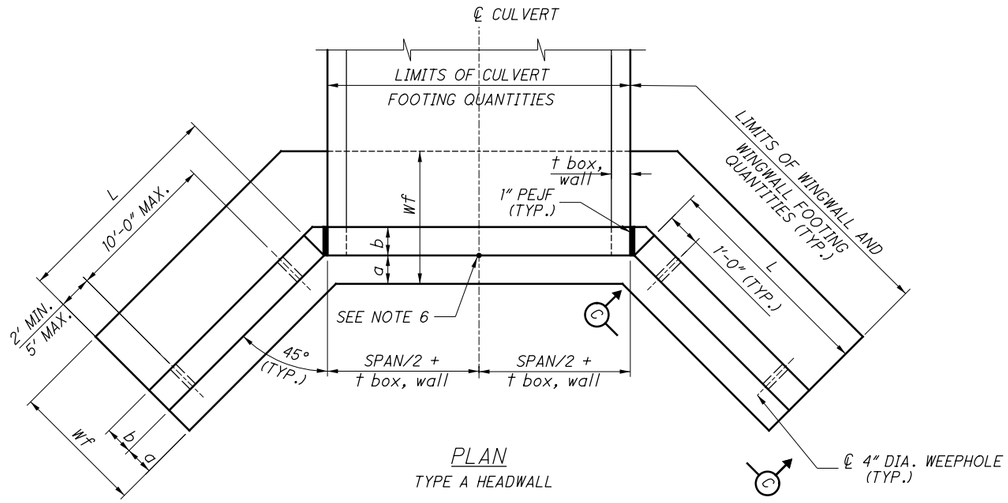
   AUTOTABLE METHOD:
   THE EXCEL WORKSHEET CELLS USE ODOT AUTOTABLE STANDARD ROW HEIGHT AND FONTS. SELECT THE REINFORCING SCHEDULE ON THE EXCEL WORKSHEET AND USE 'RANGE IMPORT' COMMAND ON AUTOTABLE TAB. SEE ADDITIONAL AUTOTABLE INFORMATION ON CADD SUPPORT WEBSITE.

   PASTE METHOD:
   PASTE THE TABLE INTO THE CAD FILE. USE THE 'PASTE SPECIAL' COMMAND IN MICROSTATION, SELECT 'PICTURE OF MICROSOFT EXCEL WORKSHEET', AND SET THE METHOD TO 'BY 2 CORNER POINTS'. SELECT THE TWO CORNERS OF THE BOX ON THE APPROPRIATE REINFORCING SHEET.
10. EDIT ALL DIMENSIONS ON THE DETAILS ACCORDING TO THE TABLES ON THE DESIGN DATA SHEETS. ON THE DETAILS SHOWING REINFORCING, USE INFORMATION PICKED FROM THE DESIGN DATA SHEETS TO COMPLETE AN UNDERSCORE (_) OR ASTERISK (*).
11. FILL IN THE ESTIMATED QUANTITIES ON SHEET 1 OF THE PLAN INSERTS.
12. ADD APPROPRIATE NOTES TO THE GENERAL NOTES SECTION ON SHEET 1 OF THE PLAN INSERTS.
13. FOR STRUCTURES OVER 12 FEET IN SPAN, INSERT THE BOX CULVERT REINFORCING DETAIL OBTAINED FROM THE OFFICE OF STRUCTURAL ENGINEERING ON ONE OF THE SHEETS.

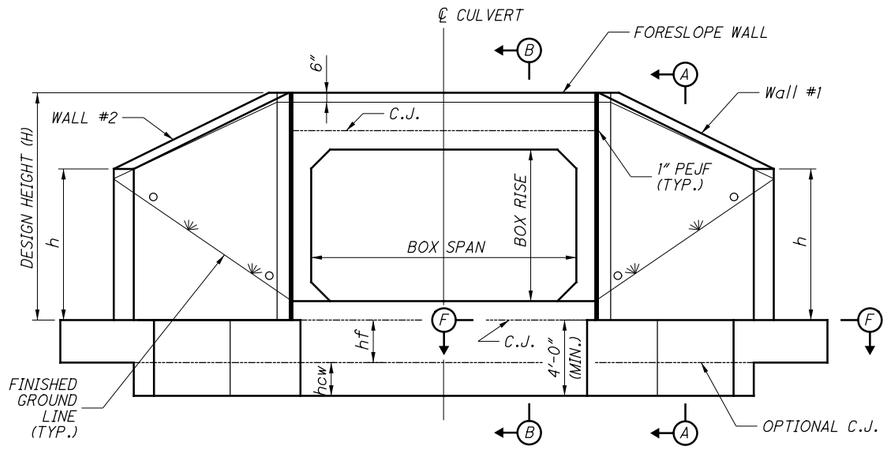
    NOTES TO DESIGNER:
    ELECTRONIC SPREADSHEETS ARE AVAILABLE TO PRODUCE REINFORCING SCHEDULES FOR THESE STANDARD HEADWALLS. MATCH THE HEADWALL TYPE A, B OR C WHEN USING THESE SHEETS.

    THE DETAILS PROVIDED SHOWING SECTIONS THROUGH THE CULVERT ENDS ARE DETAILED FOR THE INLET END. MAKE APPROPRIATE MODIFICATIONS TO SHOW THE OUTLET ENDS.

OFFICE OF STRUCTURAL ENGINEERING
DESIGNED CHA REVIEWED ___
CHECKED ___
DESIGN DATA SHEET
CONCRETE HEADWALLS FOR PRECAST BOX CULVERTS
1 / 6



PLAN
TYPE A HEADWALL



ELEVATION
TYPE A HEADWALL

LEGEND

C.J.	CONSTRUCTION JOINT
℄	CENTER LINE
CLR.	CLEAR
CONC.	CONCRETE
DIA.	DIAMETER
DIM.	DIMENSION
EXTEN.	EXTENSION
E.F.	EACH FACE
F.F.	FAR FACE
MAX.	MAXIMUM
MIN.	MINIMUM
N.F.	NEAR FACE
PEJF	PREFORMED EXPANSION JOINT FILLER
QTY.	QUANTITY
REINF.	REINFORCING
SER.	SERIES
SHT.	SHEET
SPA.	SPACING
T&B	TOP AND BOTTOM
TYP.	TYPICAL

NOTES

1. FOR SECTIONS A-A, B-B AND F-F AND VIEW C-C, SEE SHEET 6/6.
2. FOR FOOTING DESIGNS, SEE SHEET 6/6.
3. FOR FORESLOPE WALL REINFORCING AND QUANTITIES, SEE SHEET 6/6.
4. POROUS BACKFILL NOT SHOWN FOR CLARITY.
5. THESE WALLS SHOULD BE USED ONLY FOR WALL CONFIGURATIONS SHOWN IN THESE STANDARDS.
6. SHOW THE STATION AND OFFSET WITH RESPECT TO THE CENTERLINE OF SURVEY ON THE PLANS.

* INCLUDES FOOTING AND CUTOFF WALL CONCRETE AND REINFORCING WITHIN THE LIMITS OF THE BOX CULVERT PER LINEAR FOOT. TO OBTAIN THE TOTAL QUANTITY, MULTIPLY THIS VALUE/FOOT BY [BOX SPAN + 2x (BOX WALL THICKNESS)].

TYPE A HEADWALL

DESIGN HEIGHT H	FOOTING DESIGN	WINGWALL LENGTH	WINGWALL HEIGHT	FOOTING DIM.		CUTOFF WALL Ht.	DIMENSIONS		WINGWALL REINFORCING (SEE SHEET 6/6)					WINGWALL CONC. QTY. (cy)	WINGWALL REINF. QTY. (lbs)	WINGWALL FOOTING CONC. QTY. (cy)	WINGWALL FOOTING REINF. QTY. (lbs)	CULVERT FOOTING CONC. QTY. (cy/ft)*	CULVERT FOOTING REINF. QTY. (lbs/ft)*
									"X" BAR	MAX. SPA. (in)	"Y" BAR	MAX. SPA. (in)	EXTEN. LENGTH						
		L	h	Wf	hf	hcw	a	b	SIZE	x	SIZE	y	c						
6'-6"	1	7'-3"	4'-0"	4'-6"	1'-6"	2'-6"	1'-2"	1'-0"	5	18.0	5	18.0	2'-5"	3.02	446	6.00	598	0.43	24.55
7'-6"	1	8'-6"	4'-6"	5'-0"	1'-6"	2'-6"	1'-6"	1'-0"	5	18.0	5	18.0	2'-5"	4.01	533	7.38	733	0.48	27.58
8'-6"	1	10'-0"	5'-0"	5'-6"	1'-6"	2'-6"	1'-11"	1'-0"	5	16.5	5	16.5	2'-5"	5.27	726	9.05	830	0.52	28.61
9'-6"	2	11'-6"	5'-6"	6'-3"	1'-6"	2'-6"	2'-3"	1'-0"	5	18.0	5	9.0	3'-10"	6.69	934	11.35	1,113	0.57	30.11
10'-6"	1	12'-9"	6'-0"	7'-0"	2'-0"	2'-0"	2'-11"	1'-3"	5	18.0	5	9.0	4'-2"	10.25	1,104	16.19	1,087	0.74	33.95
11'-6"	1	14'-3"	6'-6"	7'-6"	2'-0"	2'-0"	3'-5"	1'-3"	5	17.0	5	8.5	5'-0"	12.43	1,404	18.87	1,205	0.80	35.06
12'-6"	8	15'-9"	7'-0"	8'-9"	2'-0"	2'-0"	3'-6"	1'-3"	5	17.0	5	8.5	5'-3"	14.82	1,580	24.41	2,246	0.89	52.90
13'-6"	8	17'-0"	7'-6"	9'-6"	2'-0"	2'-0"	3'-11"	1'-3"	6	18.0	6	9.0	6'-2"	17.18	2,139	28.17	2,630	0.97	56.94

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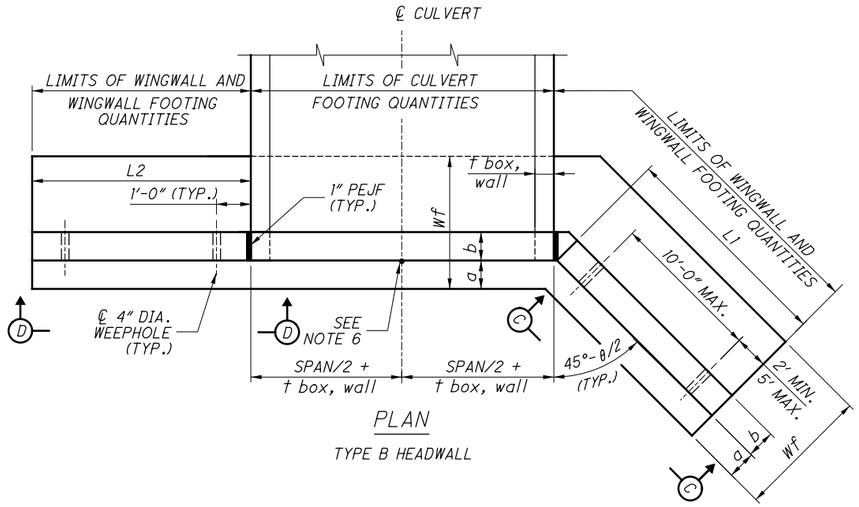
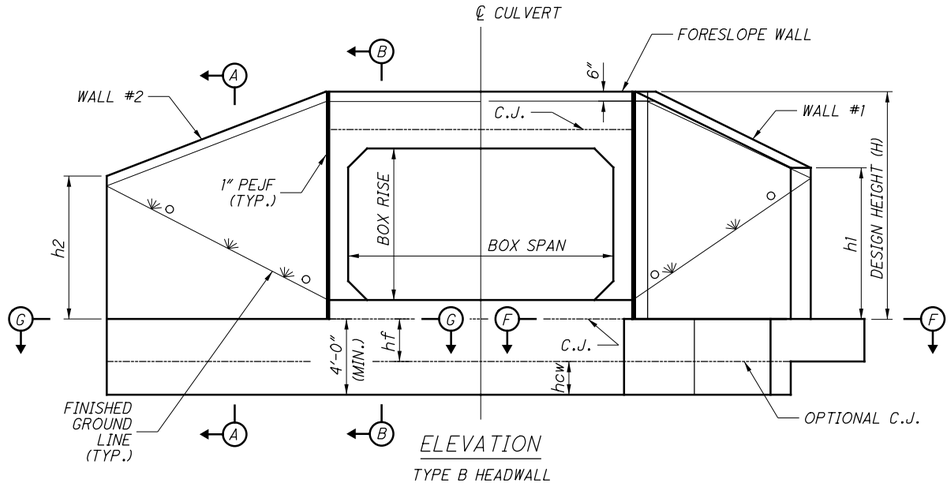
CHECKED ---
DESIGN DATA SHEET
CONCRETE HEADWALLS FOR PRECAST BOX CULVERTS
2 / 6



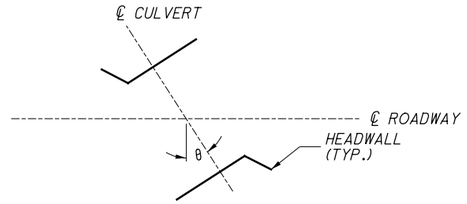
PLAN

TYPE B HEADWALL



ELEVATION

TYPE B HEADWALL



GEOMETRIC DIAGRAM

NOTES

1. FOR SECTIONS A-A, B-B AND F-F AND VIEW C-C, SEE SHEET 6/6.
2. FOR FOOTING DESIGNS, SEE SHEET 6/6.
3. FOR FORESLOPE WALL REINFORCING AND QUANTITIES, SEE SHEET 6/6.
4. POROUS BACKFILL NOT SHOWN FOR CLARITY.
5. THESE WALLS SHOULD BE USED ONLY FOR WALL CONFIGURATIONS SHOWN IN THESE STANDARDS.
6. SHOW THE STATION AND OFFSET WITH RESPECT TO THE CENTERLINE OF SURVEY ON THE PLANS.

* INCLUDES FOOTING AND CUTOFF WALL CONCRETE AND REINFORCING WITHIN THE LIMITS OF THE BOX CULVERT PER LINEAR FOOT. TO OBTAIN THE TOTAL QUANTITY, MULTIPLY THIS VALUE/FOOT BY [BOX SPAN + 2x (BOX WALL THICKNESS)].

TYPE B HEADWALL

FOR ALL VALUES OF "θ"												θ = 0° **										θ = 15° **									
DESIGN HEIGHT H	FOOTING DESIGN	FOOTING DIM.		CUTOFF WALL Ht.	DIMENSIONS		WINGWALL REINFORCING (SEE SHEET 6/6)					WINGWALL LENGTHS		WINGWALL HEIGHTS		WINGWALL CONC. QTY. (cy)	WINGWALL REINF. QTY. (lbs)	WINGWALL FOOTING CONC. QTY. (cy)	WINGWALL FOOTING REINF. QTY. (lbs)	CULVERT FOOTING CONC. QTY. (cy/ft)*	CULVERT FOOTING REINF. QTY. (lbs/ft)*	WINGWALL LENGTHS		WINGWALL HEIGHTS		WINGWALL CONC. QTY. (cy)	WINGWALL REINF. QTY. (lbs)	WINGWALL FOOTING CONC. QTY. (cy)	WINGWALL FOOTING REINF. QTY. (lbs)	CULVERT FOOTING CONC. QTY. (cy/ft)*	CULVERT FOOTING REINF. QTY. (lbs/ft)*
							"X" BAR	MAX. SPA.(in)	"Y" BAR	MAX. SPA.(in)	EXTEN. LENGTH																				
		Wf	hf	hcw	a	b	SIZE	x	SIZE	y	c	L1	L2	h1	h2							L1	L2	h1	h2						
6'-6"	1	4'-9"	1'-6"	2'-6"	1'-8"	1'-0"	5	18.0	5	18.0	2'-5"	7'-1"	10'-0"	4'-0"	6'-6"	3.89	512	6.94	552	0.47	25.31	8'-3"	6'-4"	4'-0"	4'-9"	3.05	422	5.94	493	0.47	25.31
7'-6"	1	5'-6"	1'-6"	2'-6"	2'-1"	1'-0"	5	15.0	5	15.0	2'-5"	8'-6"	12'-0"	4'-6"	7'-6"	5.34	667	9.13	684	0.53	28.77	9'-11"	7'-11"	4'-6"	5'-6"	4.05	582	7.95	631	0.53	28.77
8'-6"	2	6'-3"	1'-6"	2'-6"	2'-6"	1'-0"	5	18.0	5	9.0	2'-10"	9'-11"	14'-0"	5'-0"	8'-6"	7.02	921	11.62	1,028	0.58	30.40	11'-6"	9'-6"	5'-0"	6'-3"	5.63	783	10.20	935	0.58	30.40
9'-6"	3	7'-0"	1'-6"	2'-6"	2'-11"	1'-0"	5	18.0	5	9.0	3'-2"	11'-4"	16'-0"	5'-6"	9'-6"	8.93	1,118	14.39	1,373	0.64	36.79	13'-2"	11'-1"	5'-6"	7'-0"	7.22	960	12.76	1,240	0.64	36.79
10'-6"	3	8'-0"	2'-0"	2'-0"	3'-9"	1'-3"	5	14.5	5	7.25	3'-7"	12'-9"	18'-0"	6'-0"	10'-6"	13.88	1,464	21.52	1,677	0.85	41.10	14'-10"	12'-8"	6'-0"	7'-9"	11.32	1,245	19.23	1,517	0.85	41.10
11'-6"	7	9'-0"	2'-0"	2'-0"	4'-1"	1'-3"	5	14.5	5	7.25	3'-9"	14'-2"	20'-0"	6'-6"	11'-6"	16.83	1,787	26.54	2,144	0.93	50.56	16'-6"	14'-3"	6'-6"	8'-9"	13.89	1,535	23.91	1,947	0.93	50.56
12'-6"	9	10'-0"	2'-0"	2'-0"	4'-6"	1'-3"	6	16.0	6	8.0	4'-9"	15'-7"	22'-0"	7'-0"	12'-6"	20.07	2,321	32.04	3,030	1.03	67.81	18'-1"	15'-10"	7'-0"	9'-6"	16.59	2,020	28.96	2,722	1.03	67.81
13'-6"	10	11'-3"	2'-0"	2'-0"	4'-10"	1'-3"	6	12.5	6	6.25	4'-11"	17'-0"	24'-0"	7'-6"	13'-6"	23.59	2,928	38.97	4,023	1.13	84.51	19'-9"	17'-6"	7'-6"	10'-3"	19.61	2,587	35.52	3,669	1.13	84.51

** SEE "GEOMETRIC DIAGRAM"

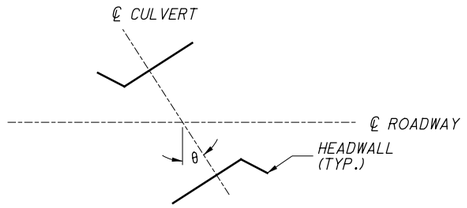
OFFICE OF STRUCTURAL ENGINEERING

DESIGNED CHA | CHECKED —— | REVIEWED ——

DESIGN DATA SHEET

CONCRETE HEADWALLS FOR PRECAST BOX CULVERTS

3 / 6



GEOMETRIC DIAGRAM

LEGEND:

C.J.	CONSTRUCTION JOINT
℄	CENTER LINE
CLR.	CLEAR
CONC.	CONCRETE
DIA.	DIAMETER
DIM.	DIMENSION
EXTEN.	EXTENSION
E.F.	EACH FACE
F.F.	FAR FACE
MAX.	MAXIMUM
MIN.	MINIMUM
N.F.	NEAR FACE
PEJF	PREFORMED EXPANSION JOINT FILLER
QTY.	QUANTITY
REINF.	REINFORCING
SER.	SERIES
SHT.	SHEET
SPA.	SPACING
T&B	TOP AND BOTTOM
TYP.	TYPICAL

NOTES

1. FOR NOTES, SEE SHEET 3/6.

TYPE B HEADWALL

FOR ALL VALUES OF θ												θ = 30° **										θ = 45° **									
DESIGN HEIGHT H	FOOTING DESIGN	FOOTING DIM.		CUTOFF WALL Ht.	DIMENSIONS		WINGWALL REINFORCING (SEE SHEET 6/6)					WINGWALL LENGTHS		WINGWALL HEIGHTS		WINGWALL CONC. QTY. (cy)	WINGWALL REINF. QTY. (lbs)	WINGWALL FOOTING CONC. QTY. (cy)	WINGWALL FOOTING REINF. QTY. (lbs)	CULVERT FOOTING CONC. QTY. (cy/ft)*	CULVERT FOOTING REINF. QTY. (lbs/ft)*	WINGWALL LENGTHS		WINGWALL HEIGHTS		WINGWALL CONC. QTY. (cy)	WINGWALL REINF. QTY. (lbs)	WINGWALL FOOTING CONC. QTY. (cy)	WINGWALL FOOTING REINF. QTY. (lbs)	CULVERT FOOTING CONC. QTY. (cy/ft)*	CULVERT FOOTING REINF. QTY. (lbS/ft)*
							"X" BAR	MAX. SPA.(in)	"Y" BAR	MAX. SPA.(in)	EXTEN. LENGTH																				
		Wf	hf	hcw	a	b	SIZE	x	SIZE	y	c	L1	L2	h1	h2							L1	L2	h1	h2						
6′-6″	1	4′-9″	1′-6″	2′-6″	1′-8″	1′-0″	5	18.0	5	18.0	2′-5″	10′-0″	4′-0″	4′-0″	3′-6″	2.83	407	5.71	468	0.47	25.31	13′-1″	4′-0″	4′-0″	2′-9″	3.40	469	6.97	535	0.47	25.31
7′-6″	1	5′-6″	1′-6″	2′-6″	2′-1″	1′-0″	5	15.0	5	15.0	2′-5″	12′-0″	5′-4″	4′-6″	4′-3″	3.99	531	7.74	625	0.53	28.77	15′-9″	4′-0″	4′-6″	3′-6″	4.51	590	8.82	676	0.53	28.77
8′-6″	2	6′-3″	1′-6″	2′-6″	2′-6″	1′-0″	5	18.0	5	9.0	2′-10″	14′-0″	6′-8″	5′-0″	5′-0″	5.35	772	10.05	922	0.58	30.40	18′-4″	4′-11″	5′-0″	4′-0″	5.94	825	11.32	982	0.58	30.40
9′-6″	3	7′-0″	1′-6″	2′-6″	2′-11″	1′-0″	5	18.0	5	9.0	3′-2″	16′-0″	8′-0″	5′-6″	5′-6″	6.87	917	12.64	1,229	0.64	36.79	20′-11″	6′-1″	5′-6″	4′-6″	7.63	983	14.26	1,337	0.64	36.79
10′-6″	3	8′-0″	2′-0″	2′-0″	3′-9″	1′-3″	5	14.5	5	7.25	3′-7″	18′-0″	9′-4″	6′-0″	6′-3″	10.85	1,189	19.13	1,487	0.85	41.10	23′-7″	7′-3″	6′-0″	5′-3″	12.06	1,325	21.66	1,628	0.85	41.10
11′-6″	7	9′-0″	2′-0″	2′-0″	4′-1″	1′-3″	5	14.5	5	7.25	3′-9″	20′-0″	10′-8″	6′-6″	7′-0″	13.29	1,483	23.89	1,908	0.93	50.56	26′-2″	8′-5″	6′-6″	5′-9″	14.71	1,622	27.05	2,116	0.93	50.56
12′-6″	9	10′-0″	2′-0″	2′-0″	4′-6″	1′-3″	6	16.0	6	8.0	4′-9″	22′-0″	12′-0″	7′-0″	7′-6″	15.91	1,957	29.11	2,683	1.03	67.81	28′-9″	9′-7″	7′-0″	6′-3″	17.63	2,157	32.96	2,995	1.03	67.81
13′-6″	10	11′-3″	2′-0″	2′-0″	4′-10″	1′-3″	6	12.5	6	6.25	4′-11″	24′-0″	13′-4″	7′-6″	8′-3″	18.84	2,520	35.74	3,674	1.13	84.51	31′-5″	10′-9″	7′-6″	6′-9″	20.84	2,772	40.55	4,064	1.13	84.51

** SEE "GEOMETRIC DIAGRAM" ON SHEET 3/6

OFFICE OF STRUCTURAL ENGINEERING

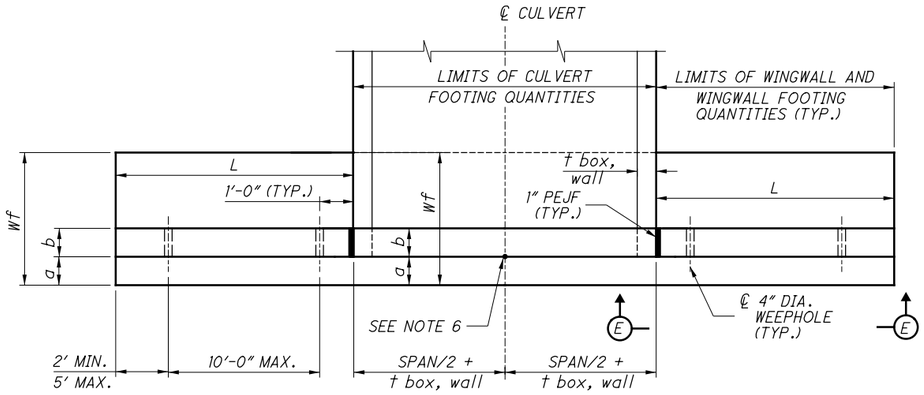
DESIGNED CHA REVIEWED ___

CHECKED ___

DESIGN DATA SHEET

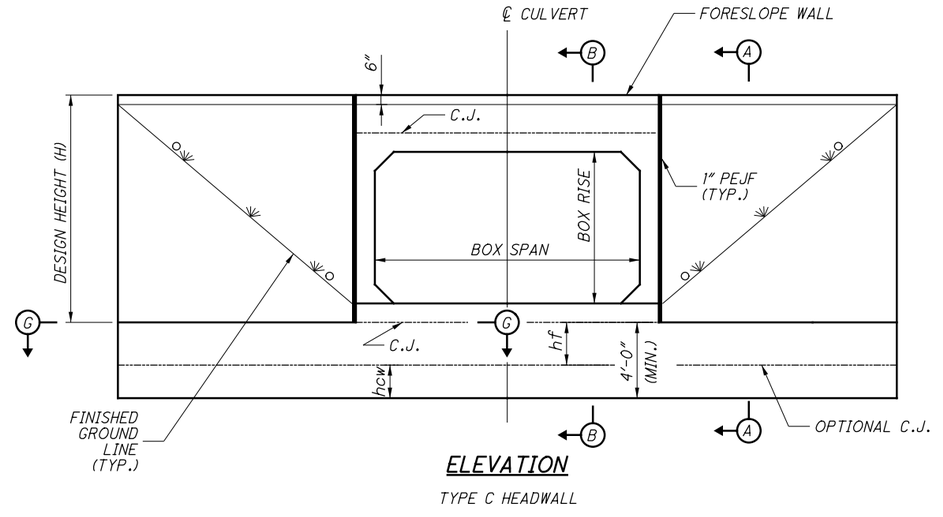
CONCRETE HEADWALLS FOR PRECAST BOX CULVERTS

4 / 6



PLAN

TYPE C HEADWALL



ELEVATION

TYPE C HEADWALL

LEGEND:

C.J.	CONSTRUCTION JOINT	PEJF	PREFORMED EXPANSION JOINT FILLER
℄	CENTER LINE	QTY.	QUANTITY
CLR.	CLEAR	REINF.	REINFORCING
CONC.	CONCRETE	SER.	SERIES
DIA.	DIAMETER	SHT.	SHEET
DIM.	DIMENSION	SPA.	SPACING
EXTEN.	EXTENSION	T&B	TOP AND BOTTOM
E.F.	EACH FACE	TYP.	TYPICAL
F.F.	FAR FACE		
MAX.	MAXIMUM		
MIN.	MINIMUM		
N.F.	NEAR FACE		

NOTES

1. FOR SECTIONS A-A, B-B AND F-F AND VIEW C-C, SEE SHEET 6/6.
2. FOR FOOTING DESIGNS, SEE SHEET 6/6.
3. FOR FORESLOPE WALL REINFORCING AND QUANTITIES, SEE SHEET 6/6.
4. POROUS BACKFILL NOT SHOWN FOR CLARITY.
5. THESE WALLS SHOULD BE USED ONLY FOR WALL CONFIGURATIONS SHOWN IN THESE STANDARDS.
6. SHOW THE STATION AND OFFSET WITH RESPECT TO THE CENTERLINE OF SURVEY ON THE PLANS.

* INCLUDES FOOTING AND CUTOFF WALL CONCRETE AND REINFORCING WITHIN THE LIMITS OF THE BOX CULVERT PER LINEAR FOOT. TO OBTAIN THE TOTAL QUANTITY, MULTIPLY THIS VALUE/FOOT BY [BOX SPAN + 2x (BOX WALL THICKNESS)].

TYPE C HEADWALL

DESIGN HEIGHT H	FOOTING DESIGN	WINGWALL LENGTH	FOOTING DIM.		CUTOFF WALL Ht.	DIMENSIONS		WINGWALL REINFORCING (SEE SHEET 6/6)					WINGWALL CONC. QTY. (cy)	WINGWALL REINF. QTY. (lbs)	WINGWALL FOOTING CONC. QTY. (cy)	WINGWALL FOOTING REINF. QTY. (lbs)	CULVERT FOOTING CONC. QTY. (cy/ft)*	CULVERT FOOTING REINF. QTY. (lbs/ft)*
								"X" BAR	MAX. SPA. (in)	"Y" BAR	MAX. SPA. (in)	EXTEN. LENGTH						
		L	Wf	hf	hcw	a	b	SIZE	x	SIZE	y	c						
6'-6"	1	10'-0"	5'-3"	1'-6"	2'-6"	1'-5"	1'-0"	5	17.5	5	17.5	2'-5"	4.82	528	8.62	587	0.49	27.84
7'-6"	1	12'-0"	5'-9"	1'-6"	2'-6"	2'-0"	1'-0"	5	12.0	5	12.0	2'-5"	6.67	749	11.00	695	0.55	29.04
8'-6"	1	14'-0"	6'-3"	1'-6"	2'-6"	2'-7"	1'-0"	5	17.5	5	8.75	3'-6"	8.82	1,012	13.62	823	0.59	30.15
9'-6"	3	16'-0"	7'-0"	1'-6"	2'-6"	2'-11"	1'-0"	5	17.5	5	8.75	3'-8"	11.26	1,261	16.89	1,448	0.64	36.68
10'-6"	3	18'-0"	8'-0"	2'-0"	2'-0"	3'-8"	1'-3"	5	18.0	5	9.0	3'-11"	17.50	1,485	25.34	1,803	0.85	40.93
11'-6"	7	20'-0"	9'-0"	2'-0"	2'-0"	3'-10"	1'-3"	6	18.0	6	9.0	4'-6"	21.30	2,201	31.12	2,250	0.92	46.94
12'-6"	9	22'-0"	9'-9"	2'-0"	2'-0"	4'-3"	1'-3"	6	16.0	6	8.0	5'-2"	25.47	2,775	36.67	3,378	1.00	66.64
13'-6"	9	24'-0"	10'-6"	2'-0"	2'-0"	4'-8"	1'-3"	6	13.0	6	6.5	5'-4"	30.0	3,454	42.67	3,789	1.06	69.56

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DESIGN DATA SHEET

CONCRETE HEADWALLS FOR PRECAST BOX CULVERTS

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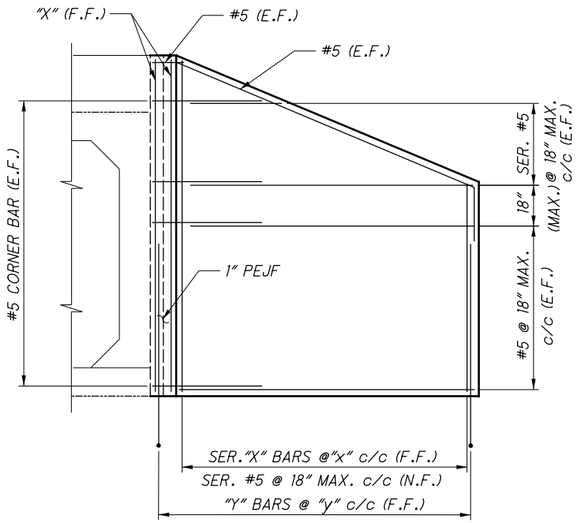
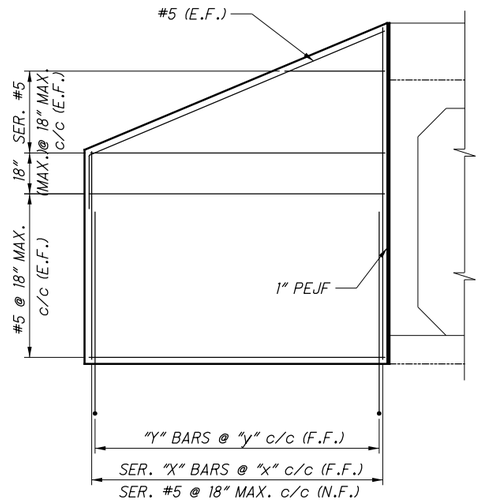


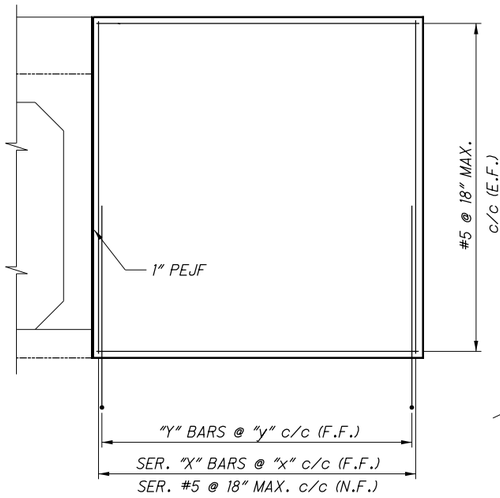
VIEW C-C

TYPE A (TYP.) OR TYPE B (WINGWALL #1)



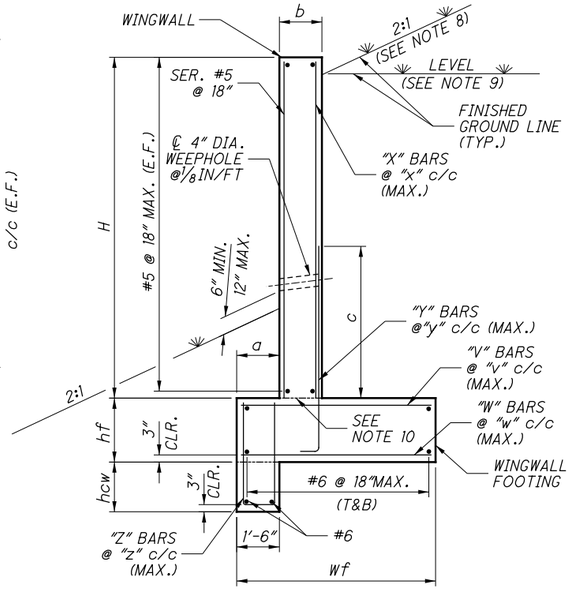
VIEW D-D

TYPE B WINGWALL #2



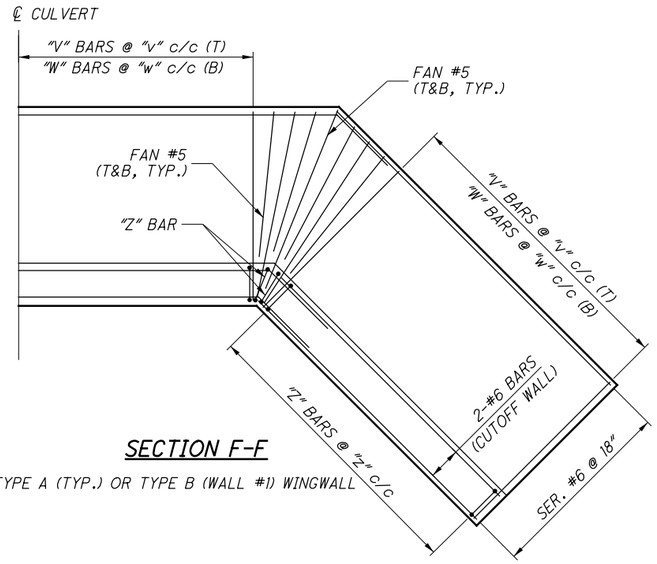
VIEW E-E

TYPE C WINGWALL



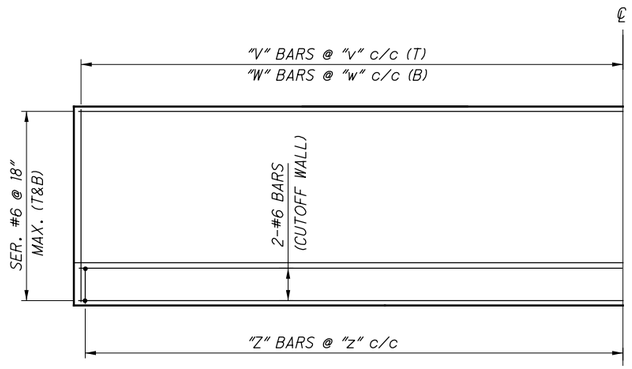
SECTION A-A

(POROUS BACKFILL NOT SHOWN FOR CLARITY)



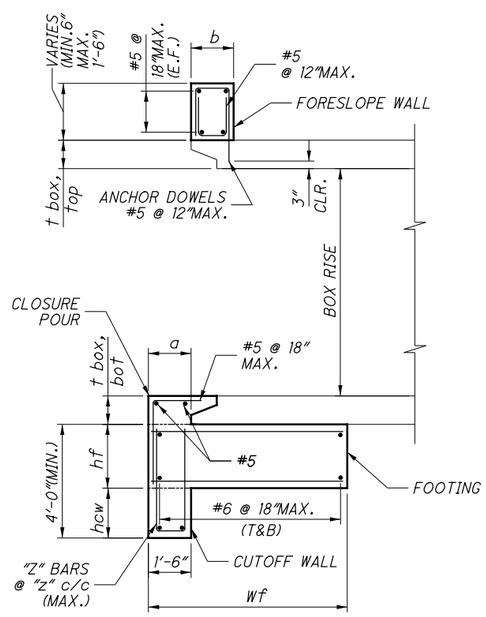
SECTION F-F

TYPE A (TYP.) OR TYPE B (WALL #1) WINGWALL



SECTION G-G

TYPE B (WALL #2) OR TYPE C WINGWALL (TYP.)



SECTION B-B

(CULVERT INLET BEVEL SHOWN)

FOOTING REINFORCING

FOOTING DESIGN	"V" BAR SIZE	MAX. SPA. (in) v	"W", "Z" BARS SIZE	MAX. SPA. (in) w, z
1	5	18	5	18
2	5	15	5	18
3	5	12	5	15
4	5	18	5	12
5	5	15	5	9
6	6	18	6	18
7	6	15	6	15
8	6	9	6	18
9	6	9	6	12
10	7	12	7	12

FORESLOPE WALL QUANTITIES

WIDTH b >	HEIGHT OF FORESLOPE WALL (ft)	FORESLOPE WALL REINF. QTY. (lbs/ft)*	FORESLOPE WALL CONC. QTY. (cy/ft)*
1'-0"	6"	6.70	0.02
	1'-6"	10.87	0.06
1'-3"	6"	7.22	0.03
	1'-6"	11.39	0.07

* INCLUDES FORESLOPE WALL CONCRETE AND REINFORCING WITHIN THE LIMITS OF THE BOX CULVERT PER LINEAR FOOT. TO OBTAIN THE TOTAL QUANTITY, MULTIPLY THIS VALUE/FOOT BY [BOX SPAN + 2x (BOX WALL THICKNESS)].

NOTES

1. FOR THE GENERAL NOTES SEE SHEET 1/6.
2. FOR THE LOCATIONS OF SECTIONS A-A AND B-B, SEE SHEETS 2/6, 3/6 AND 5/6.
3. FOR THE LOCATIONS OF VIEW C-C AND SECTION F-F, SEE SHEETS 2/6 AND 3/6.
4. FOR THE LOCATION OF VIEW D-D SEE SHEET 3/6.
5. FOR THE LOCATION OF VIEW E-E, SEE SHEET 5/6.
6. FOR THE LOCATION OF SECTION G-G, SEE SHEETS 3/6 AND 5/6.
7. FOR SIZE AND SPACING OF "X" AND "Y" BARS SEE SHEETS 2/6 TO 5/6.
8. 2:1 BACKSLOPE, NORMAL TO CULVERT, IS FOR TYPE A WINGWALLS AND TYPE B WINGWALLS.
9. LEVEL SURFACE WITH 2 FOOT LIVE LOAD SURCHARGE IS FOR TYPE C WINGWALLS.
10. THE INTERFACE BETWEEN THE TOP OF FOOTING AND BASE OF WINGWALL STEM IS INTENTIONALLY ROUGHENED TO A FULL AMPLITUDE OF APPROXIMATELY 1/4" BY MEANS OF A SERRATED TROWEL.
11. WALL THICKNESS († box, wall) FOR PRECAST BOX CULVERT IS AS FOLLOWS:
    SPAN = 8'-0" WALL THICKNESS = 8"
    SPAN = 10'-0" WALL THICKNESS = 10"
    SPAN ≥ 12'-0" WALL THICKNESS = 12"

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DESIGN DATA SHEET
CONCRETE HEADWALLS FOR PRECAST BOX CULVERTS
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