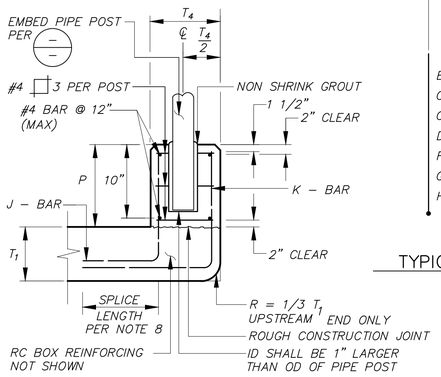
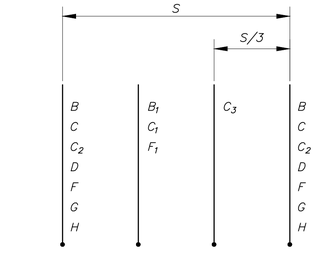




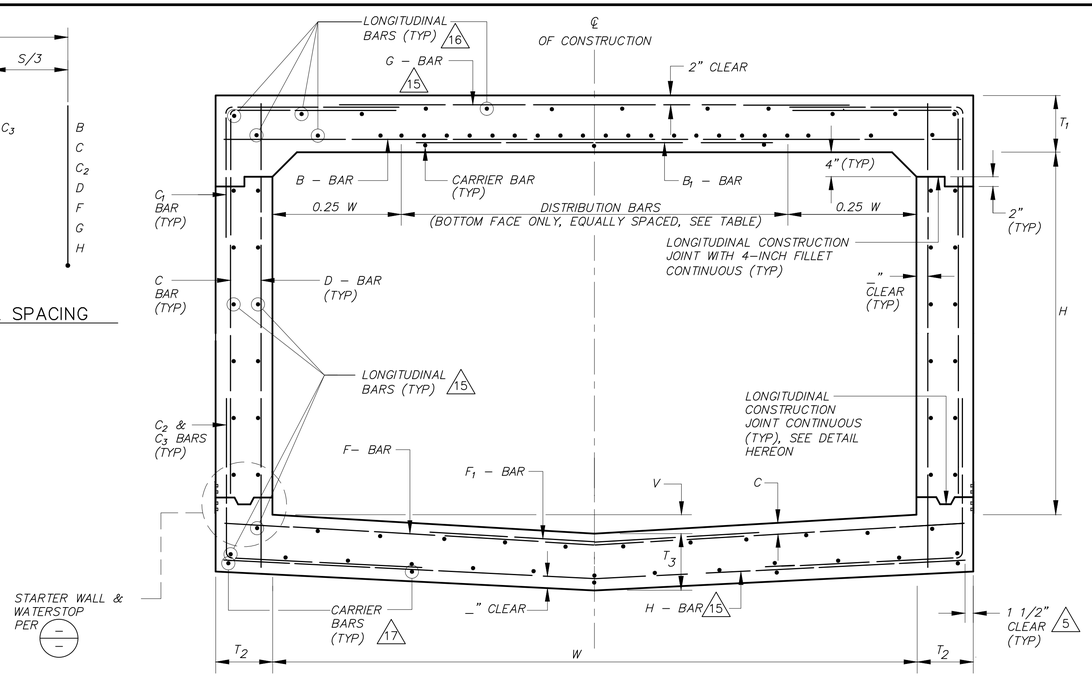
TYPICAL WALL STEEL SPACING

NOT TO SCALE

PARAPET – HEADWALL TABLE				
STATION	P	T_4	BAR NUMBER AND SPACING	
			J – BAR	K – BAR
–	–	–	–	–

PARAPET - HEADWALL DETAIL

NOT TO SCALE



TYPICAL RC BOX CULVERT DETAIL

NOT TO SCALE

DESIGN DATA

VEHICULAR LOAD

HS15–44 + IMPACT
(SPANGLER METHOD)
SEE TABLE HEREON:

DEAD LOAD

WEIGHT OF EARTH = ––– pcf
WEIGHT OF CONCRETE = 150 pcf
WEIGHT OF WATER = 62.4 pcf

SOIL

MODULUS OF SUBGRADE REACTION
K = ––– pci

LATERAL LOAD

EARTHSIDE = –– psf (EFP)
WATERSIDE = 40 psf (EFP)

ULTIMATE STRENGTH

f'_c = 4,000 ps
f_y = 60,000 psi
ϕ = 0.90 (Flexural Reduction)
ϕ = 0.85 (Shearl Reduction)
β = 0.85 (Steel/Conc Reduction)
REDUCTION FACTORS PER ACI 318, LATEST CODE

GOVERNING CODES

- USACE ECB2017–2 REVISIONS & CLARIFICATIONS OF EM 1110–2–2100 AND EM 1110–2–2502, STABILITY ANALYSIS OF CONCRETE STRUCTURES
- USACE EM 1110–2–2104, STRENGTH DESIGN FOR RC HYDRAULIC STRUCTURES
- USACE EM 1110–2–2902, "CONDUITS, CULVERTS, AND PIPES"
- USACE EM 1110–2–6053, EARTHQUAKE DESIGN AND EVALUATION OF CONCRETE HYDRAULIC STRUCTURES
- AMERICAN CONCRETE INSTITUTE (ACI 318), LATEST EDITION
- AASHTO LRFD BDS WITH CALTRANS AMENDMENTS (AASHTO LRFD), LATEST EDITION

STRUCTURAL NOTES

1. *DIMENSIONS FROM FACE OF CONCRETE TO STEEL ARE TO THE NEAREST EDGE OF BAR AND SHALL BE PER DETAIL HEREON.*
2. *CONCRETE DIMENSIONS SHALL BE MEASURED HORIZONTALLY OR VERTICALLY ON THE PROFILE, AND PARALLEL TO OR AT RIGHT ANGLES (OR RADIALLY) TO CENTERLINE OF CONDUIT ON THE PLAN UNLESS OTHERWISE SHOWN.*
3. *REINFORCEMENT DETAILS SHALL CONFORM TO THE LATEST EDITION OF THE AMERICAN CONCRETE INSTITUTE'S "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", (ACI 318).*
4. *PLACING OF REINFORCEMENT SHALL CONFORM TO THE LATEST EDITION OF THE AMERICAN CONCRETE INSTITUTE'S "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", (ACI 318).*
5. *TRANSVERSE STRAIGHT REINFORCING STEEL SHALL TERMINATE 1 ½ INCHES FROM THE CONCRETE SURFACE.*
6. *CONSTRUCTION JOINTS IN WALLS AND SLABS SHALL BE IN THE SAME PLANE. NO STAGGERING OF JOINTS WILL BE PERMITTED. TRANSVERSE CONSTRUCTION JOINTS SHALL BE NORMAL OR RADIAL TO THE CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE SHOWN.*
7. *TRANSVERSE CONSTRUCTION JOINTS SHALL NOT BE PLACED WITHIN 30 INCHES OF OPENINGS FOR MANHOLES, JUNCTION STRUCTURES, OR SIDE INLETS.*
8. *ALL LAP SPLICES SHALL CONFORM TO THE LATEST EDITION OF THE AMERICAN CONCRETE INSTITUTE'S "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE". LONGITUDINAL STEEL SHALL BE LAPPED 24 BAR DIAMETER AT SPLICES. TRANSVERSE STEEL SHALL BE LAPPED USING THE FOLLOWING TABLE:*

BAR SIZE	*#4*	*#5*	*#6*	*#7*	*#8*	*#9*	*#10*	*#11*	*#14*	*#18*
LENGTH OF LAP SPLICE	*25"*	*31"*	*37"*	*62"*	*81"*	*103"*	*130"*	*160"*	*TENSION LAP SPLICING NOT PERMITTED*	

9. *LONGITUDINAL STEEL SHALL BE CONTINUOUS AND EXTEND THROUGH ALL CONSTRUCTION JOINTS, UNLESS OTHERWISE SHOWN.*
10. *TRANSVERSE CONSTRUCTION JOINT KEYWAYS (IN BOTH SLABS AND WALLS) SHALL BE PLACED AT THE END OF EACH POUR, BUT THE SPACING THEREOF SHALL NOT EXCEED 50 FEET NOR BE LESS THAN 10 FEET, MEASURED ALONG THE CENTERLINE OF CONSTRUCTION.*
11. *TRANSVERSE BARS SHALL BE PLACED RADIALLY IN CURVED SECTIONS UNLESS SHOWN OTHERWISE ON THE DETAILS. STRAIGHT TRANSVERSE BARS IN THE TOP AND BOTTOM SLABS SHALL BE PLACED AS SHOWN ON THE TYPICAL SECTION. SPACING SHALL BE AT THE CENTERLINE OF CONSTRUCTION. STRAIGHT BARS AND 'L' SHAPED BARS IN THE WALLS SHALL BE SPACED AS SHOWN ON THE TABLE AND MEASURED BETWEEN THE VERTICAL LEGS OF THE BARS.*
12. *AT THE BEGINNING AND END OF ALL POURS, A CURTAIN OF REINFORCEMENT COMPOSED OF B, C, C_2, D, F, G, AND H BARS SHALL BE PLACED 3 INCHES FROM THE TRANSVERSE CONSTRUCTION JOINT.*
13. *D BARS MAY BE SPLICED AT THE LONGITUDINAL CONSTRUCTION JOINTS AT THE BASE OF THE WALL. THE LAP SPLICE SHALL BE IN ACCORDANCE WITH THE TABLE UNDER NOTE 8.*
14. *THE VERTICAL LENGTHS OF THE C AND C_2 BARS ARE CALCULATED BASED ON 9 1/4 INCHES HIGH STARTER WALL AND ARE LAP SPLICED TOGETHER SHOULD THIS STARTER WALL DIMENSION CHANGE, THE VERTICAL LENGTHS OF C AND C_2 BARS MUST BE REVISED ACCORDINGLY, MAINTAINING THE REQUIRED LAP SPLICE LENGTH PER THE TABLE UNDER NOTE 10. THIS ALSO APPLIES TO THE C_1 AND C_3 BARS IF THE VERTICAL LENGTH OF C_1 = C.*
15. *IF H AND/OR G BARS ARE NOT SPECIFIED, #4 TRANSVERSE BARS SHALL BE ADDED AT 36 INCH SPACING TO SUPPORT THE LONGITUDINAL BARS.*
16. *TWO LONGITUDINAL BARS SHALL BE PLACED AT EACH CORNER LOCATION ASSHOWN ON THE DETAIL. THE REMAINING LONGITUDINAL BARS SHALL BE EQUALLY SPACED BETWEEN THE CORNER BARS WITH A MAXIMUM SPACING OF 18 INCH IN EACH FACE OF THE SLABS AND WALLS, AND NEED NOT CORRESPOND TO THE NUMBER OR LOCATION SHOWN ON THE DETAIL. SEE THE TABLE FOR LONGITUDINAL BAR TOTALS.*
17. *THE NUMBER OF CARRIER BARS INDICATED IN THE TABLE SHALL BE PROVIDED AND INSTALLED TO FACILITATE PLACEMENT OF THE TRANSVERSE REINFORCING. ADDITIONAL CARRIER BARS PROVIDED AND INSTALLED FOR THE CONVENIENCE OF THE CONTRACTOR WILL BE AT HIS EXPENSE.*
18. *EXPOSED EDGES OF CONCRETE MEMBERS SHALL BE CHAMFERED 3/4" X 3/4".*
19. *DISTRIBUTION BARS SHALL BE REQUIRED IN THE BOTTOM FACE OF TOP SLAB WHEN DESIGN COVER IS LESS THAN 2 FEET. OTHERWISE, LONGITUDINAL BARS SHALL BE PLACED IN ACCORDANCE WITH NOTE 18.*

RC BOX CONDUIT TABLE

SECTION NUMBER			1	2	3	4	5	6
LIVE LOAD (24+IMPACT %) KIPS			28.8	(DISTRIBUTED ON THE MIDDLE & REAR AXLE)				
DESIGN COVER			–					
WIDTH (DESIGN SPAN)		W	–					
HEIGHT		H	–					
THICKNESS (INCHES)	TOP SLAB	T_1	–					
	SIDE WALL	T_2	–					
	BOTTOM SLAB	T_3	–					
INVERT DROP		V	–					
STEEL CLEARANCE INVERT		C	–					
B BARS	BAR NO. & SPACING		–					
	LENGTH		–					
B_1 BARS	BAR NO. & SPACING		–					
	LENGTH		–					
C BARS	BAR NO. & SPACING		–					
	HORIZONTAL LENGTH		–					
	VERTICAL LENGTH		–					
C_1 BARS	BAR NO. & SPACING		–					
	HORIZONTAL LENGTH		–					
	VERTICAL LENGTH		–					
C_2 BARS	BAR NO. & SPACING		–					
	HORIZONTAL LENGTH		–					
	VERTICAL LENGTH		–					
C_3 BARS	BAR NO. & SPACING		–					
	HORIZONTAL LENGTH		–					
	VERTICAL LENGTH		–					
D BARS	BAR NO. & SPACING		–					
	LENGTH		–					
F BARS	BAR NO. & SPACING		–					
	LENGTH		–					
F_1 BARS	BAR NO. & SPACING		–					
	LENGTH		–					
G BARS	BAR NO. & SPACING		–					
	LENGTH		–					
H BARS	BAR NO. & SPACING		–					
	LENGTH		–					
DISTRIBUTION BARS	BAR NO.		–					
	NUMBER OF BARS		–					
NUMBER OF #4 LONGITUDINAL BARS		TOP SLAB	–					
		BOTTOM SLAB	–					
		SIDE WALLS	–					
TOTAL #4 LONGITUDINAL BARS			–					
#4 CARRIER BARS		TOP	–					
		BOTTOM	–					
CONCRETE QUANTITY: CY./LINEAR FT.			–					
STEEL QUANTITY: LBS./LINEAR FT.			–					

RC BOX CONDUIT LOCATION

RC BOX SECTION NUMBER	STATION		BARS TO BE ADJUSTED	
	FROM	TO	VERTICAL LEG	HORIZONTAL LEG
1	–	–	–	–

PLOT DATE: 9/15/21

SAVE DATE: 9/2/21 117246 K:\RESOURCES\STANDARDS_PROCEDURES\AUTOCAD\0_STANDARD DRAWINGS\DRAWING INDEX\2019_STANDARD_DETAILS_ UPDATE\STRUCTURAL\DWG\RC BOX CONDUIT STRUCTURAL DETAILS.DWG

	REVISION	DESCRIPTION	APP.	DATE
D				
C				
B				
A				
△				

DESIGNED –
DRAWN –
CHECKED –

WATERSHED PROJECT MANAGER DATE
WATERSHED DEPUTY DIRECTOR DATE
WATERSHED DIRECTOR DATE

VENTURA COUNTY
PUBLIC WORKS AGENCY
WATERSHED PROTECTION

SPEC. NO. –
PROJ. NO. –

PROJECT NAME

RC BOX CONDUIT STRUCTURAL DETAILS

SHEET – OF –
DRAWING SET NO. WPD–?–???