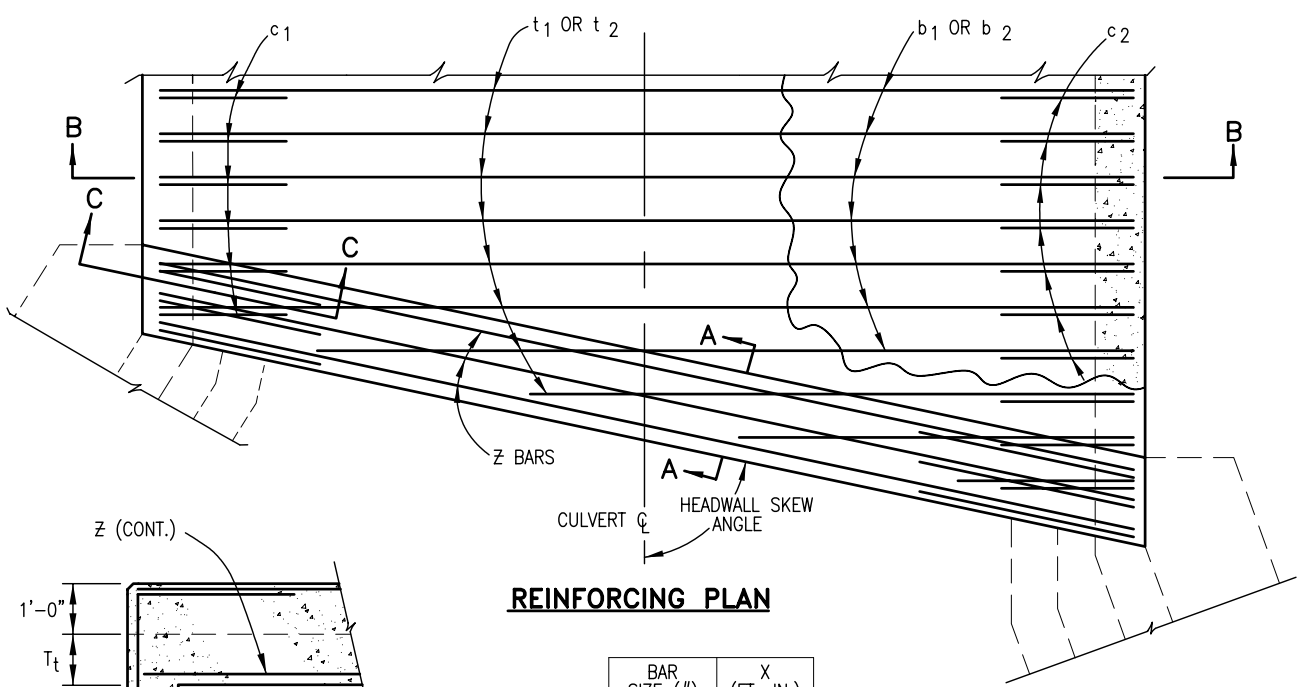


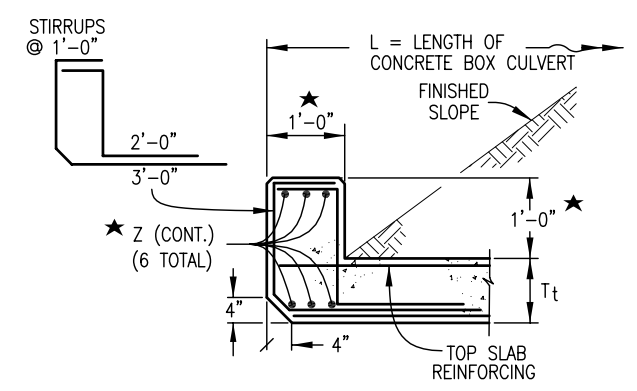
**SECTION B-B**



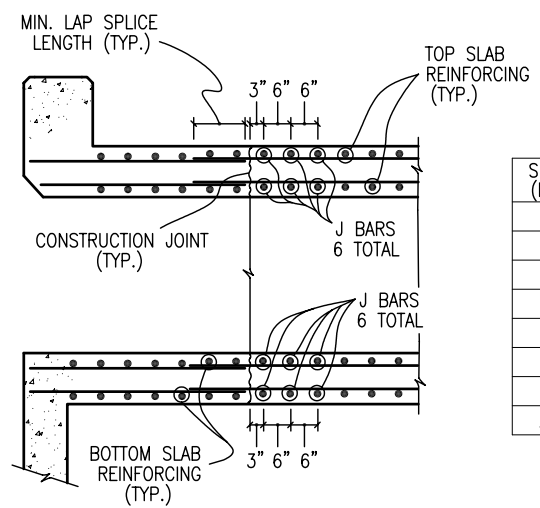
**REINFORCING PLAN**

BAR SIZE (#)	X (FT.-IN.)
4	1-9
5	2-2
6	2-7
7	3-1
8	4-0
9	5-1
10	6-5
11	7-11

**SECTION C-C HEADWALL CORNER REINFORCING DETAIL**



**SECTION A-A**



**CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION**

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS PERPENDICULAR TO THE  $\bar{C}$  OF THE BOX ONLY.

SPAN (FT.)	J BAR SIZE (#)
6	5
8	7
10	7
12	9
14	9
16	9
18	9
20	10

**GENERAL NOTES**

- ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
- ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
- CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS MAY BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
- THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
- STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
- FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
- BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH,  $f'_c$ .
- SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
- REINFORCING STEEL SHALL BE GRADE 60.
- THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-6"	1'-10"	2'-2"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-0"	1'-4"	1'-7"	1'-10"	2'-5"	3'-1"	3'-11"	4'-10"

- ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
- WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
- ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
- FILL HEIGHT IS THE DISTANCE MEASURED FROM TOP OF TOP SLAB TO TOP OF PAVEMENT.
- ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED  $\frac{3}{4}$  IN.

▲ WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT., THE SPACING OF THE  $d_1$  BARS IN THE BOTTOM OF THE TOP SLAB SHALL BE 6 IN. OR LESS. USE THE FOLLOWING EQUATION TO CALCULATE THE ADDITIONAL REINFORCING QUANTITY. WHERE S IS IN FEET:

$$\text{ADDED REINFORCING, LBS./LIN FT.} = \left( \frac{S}{0.5} - \frac{S}{1.5} \right) \times 0.668 = 0.891 S$$

DESIGN DATA: 16TH EDITION OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES

SERVICE LOAD DESIGN METHOD

UNIT STRESSES:  $f_s = 24,000$  psi.,  $f_y = 60,000$  psi.,  $f_c = 1,800$  psi.,  $f'_c = 4,500$  psi.,  $n = 8$

LOADING DATA:

LIVE LOAD = AASHTO, HS 20-44 AND ALTERNATE MILITARY LOADING  
 DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.  
 DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.  
 FUTURE HMA OVERLAY = 48 LBS./SQ. FT. BASED ON 4 IN. THICKNESS  
 LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 16):

- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY ADDITIONAL STIRRUP LENGTH WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT OF GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

**Computer File Information**

Creation Date: 07/04/06	Initials: SJR
Last Modification Date: 07/04/06	Initials: LTA
Full Path: www.dot.state.co.us/DesignSupport/	
Drawing File Name: 601010102.dwg	
CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

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 Project Development Branch SRJ/LTA

**SINGLE CONCRETE BOX CULVERT**  
 Issued By: Project Development Branch on July 04, 2006

**STANDARD PLAN NO.**  
 M-601-1  
 Sheet No. 1 of 2

**SINGLE CONCRETE BOX CULVERT DIMENSIONS & QUANTITIES (EXCLUDING HEADWALLS & TOEWALLS)**

BOX SIZE		FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES						d <sub>1</sub> NO.	DIMENSIONS					QUANTITIES		
S	R		HT.	WIDTH	T <sub>t</sub>	T <sub>b</sub>	TW	t <sub>1</sub> * & b <sub>1</sub>	t <sub>2</sub>	b <sub>2</sub>	w <sub>1</sub> * & w <sub>2</sub>		c <sub>1</sub> *	c <sub>2</sub>	h <sub>1</sub>	h <sub>2</sub>	v <sub>1</sub>	v <sub>2</sub>	v <sub>3</sub>	CONCRETE
FT.	FT.	FT.-IN.	FT.-IN.	FT.-FT.	T <sub>t</sub>	T <sub>b</sub>	TW	#	#	#	#	#	#	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	CU.YDS./LIN.FT.	LBS./LIN.FT.
6	7	8-5	7-8	0 TO 10	8	9	10	4	5	5	4	4	4	2-7	2-11	7-6	2-3	2-3	0.834	153
		8-7	7-8	>10 TO 15	8.5	10.5	10	4	5	5	4	4	4	2-7	3-1	7-6	2-4	2-4	0.882	154
		8-10	7-8	>15 TO 20	10	12.0	10	4	5	5	4	4	4	2-7	3-3	7-9	2-6	2-6	0.953	156

**HEADWALL AND TOEWALL QUANTITIES**

HEADWALL SKEW ANGLE	90° TO 75 °			74° TO 60 °			59° TO 45 °		
	SPAN - S	Z	STIRRUPS	Z	STIRRUPS	Z	STIRRUPS	Z	STIRRUPS
	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.
6	4	4	22.1	4	4	21.9	4	4	21.3
8	4	4	22.5	4	4	22.3	5	4	28.0
10	5	4	28.2	5	4	27.9	7	4	43.2
12	5	4	27.6	6	4	34.5	8	5	56.4
14	6	4	34.0	7	4	41.9	10	5	81.5
16	6	4	32.3	8	5	53.3	*	*	*
18	7	4	39.0	9	5	62.6	*	*	*
20	7	4	38.6	11	6	96.9	*	*	*

CONCRETE QUANTITY = 0.085 CU.YDS./LIN.FT.

**NOTES**

- QUANTITIES ARE PER LINEAR FOOT (OF HEADWALL) FOR ONE HEADWALL AND TOEWALL AND INCLUDE ALL HEADWALL AND TOEWALL REINFORCING STEEL. QUANTITY INCLUDED WAS CALCULATED PER 1 FT. STRIP. SKEW ANGLE MAY VARY. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.
- \* 2. A SKEWED HEADWALL IS NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.
- FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.
- WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT.-0 IN., ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (\*), AND THE d<sub>1</sub> IN THE BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.
- REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.
- WHEN AN R (RISE) OF LESS THAN 6 FT. IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT. RISE (IF AVAILABLE ON THE TABLE).
- ▲ 7. THE SIZE OF d<sub>1</sub> BARS IS #4. THE NUMBER OF BARS REQUIRED IS LISTED.

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 Last Modification Date: 07/04/06 Initials: LTA  
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 Drawing File Name: 601010202.dwg  
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**SINGLE CONCRETE BOX CULVERT**

Issued By: Project Development Branch on July 04, 2006

**STANDARD PLAN NO.**

**M-601-1**

**Sheet No. 2 of 2**