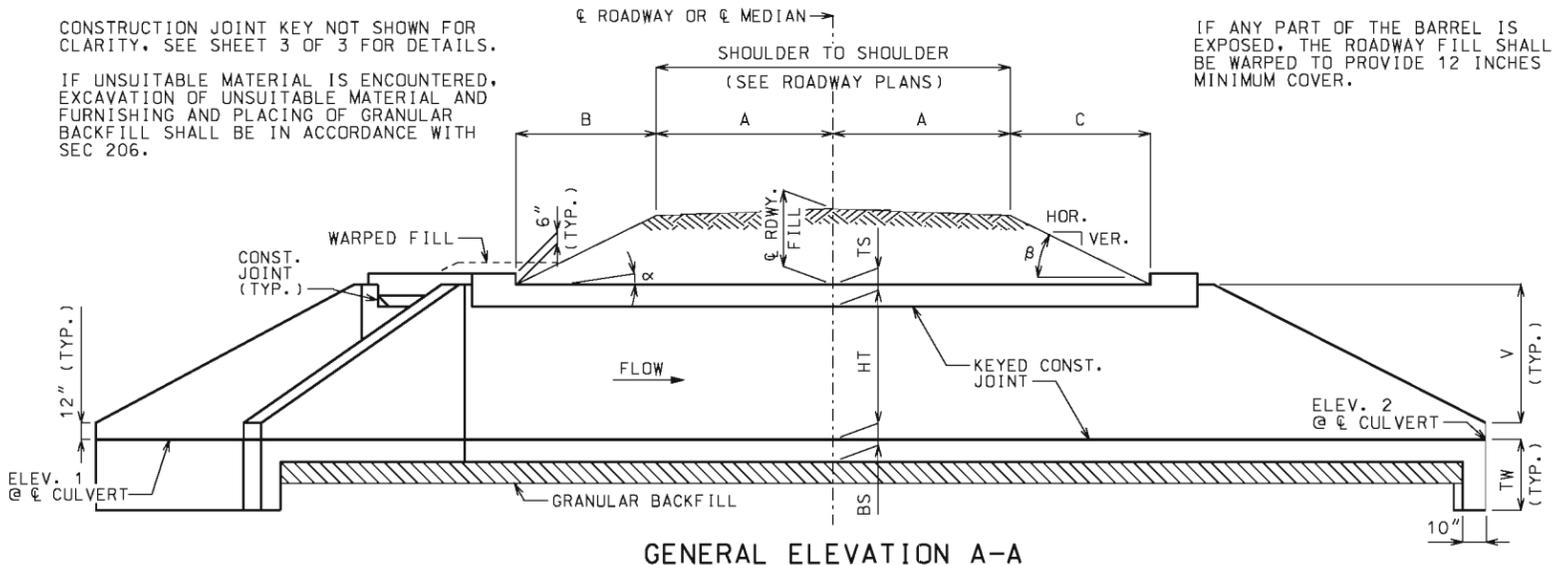


CONSTRUCTION JOINT KEY NOT SHOWN FOR CLARITY. SEE SHEET 3 OF 3 FOR DETAILS.

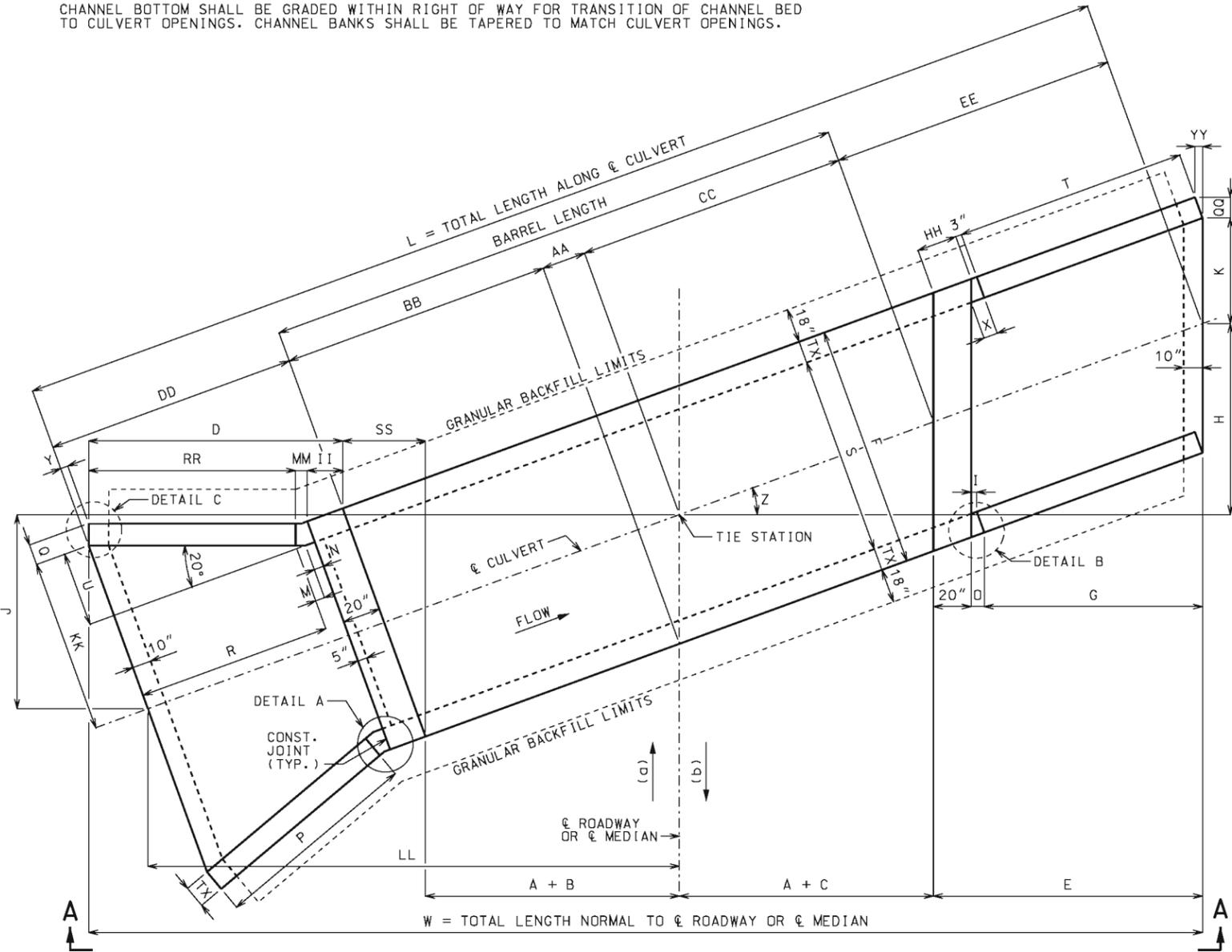
IF UNSUITABLE MATERIAL IS ENCOUNTERED, EXCAVATION OF UNSUITABLE MATERIAL AND FURNISHING AND PLACING OF GRANULAR BACKFILL SHALL BE IN ACCORDANCE WITH SEC 206.

IF ANY PART OF THE BARREL IS EXPOSED, THE ROADWAY FILL SHALL BE WARPED TO PROVIDE 12 INCHES MINIMUM COVER.



GENERAL ELEVATION A-A

CHANNEL BOTTOM SHALL BE GRADED WITHIN RIGHT OF WAY FOR TRANSITION OF CHANNEL BED TO CULVERT OPENINGS. CHANNEL BANKS SHALL BE TAPERED TO MATCH CULVERT OPENINGS.



PLAN OF LAYOUT DIMENSIONS

(a) AHEAD STATION WHERE STREAM FLOWS LEFT TO RIGHT. (b) AHEAD STATION WHERE STREAM FLOWS RIGHT TO LEFT.

EQUATIONS FOR COMPUTING  $\alpha$ ,  $\beta$ , B AND C

$\alpha$  = ANGLE OF BARREL SLOPE WITH HORIZONTAL NORMAL TO  $\phi$  ROADWAY OR  $\phi$  MEDIAN =  $\text{ARCTAN} \left( \frac{\text{ELEV. 1} - \text{ELEV. 2}}{A + C + E + LL} \right)$

$\beta$  = ANGLE OF FILL SLOPE WITH HORIZONTAL NORMAL TO  $\phi$  ROADWAY OR  $\phi$  MEDIAN =  $\text{ARCTAN} \left( \frac{\text{VER.}}{\text{HOR.}} \right)$

B = HORIZONTAL DISTANCE FROM UPSTREAM EDGE OF SHOULDER TO  $\phi$  RDWY. FILL +  $\frac{A(CS) - A(\text{TAN} \alpha)}{\text{TAN} \beta + \text{TAN} \alpha}$   
UPSTREAM HEADWALL NORMAL TO  $\phi$  ROADWAY OR  $\phi$  MEDIAN

C = HORIZONTAL DISTANCE FROM DOWNSTREAM EDGE OF SHOULDER TO  $\phi$  RDWY. FILL +  $\frac{A(CS) + A(\text{TAN} \alpha)}{\text{TAN} \beta - \text{TAN} \alpha}$   
DOWNSTREAM HEADWALL NORMAL TO  $\phi$  ROADWAY OR  $\phi$  MEDIAN

CS = CROSS SLOPE OF EACH PART OF ROADWAY INCLUDING CROWN, LANES AND SHOULDERS. CS IS POSITIVE IF RISING AND NEGATIVE IF FALLING AWAY FROM  $\phi$  ROADWAY OR  $\phi$  MEDIAN.

THE TERM "A(CS)" IS THE DIFFERENCE IN ELEVATION BETWEEN  $\phi$  ROADWAY OR  $\phi$  MEDIAN AND THE TOP OF THE FILL SLOPE NORMAL TO  $\phi$  ROADWAY OR  $\phi$  MEDIAN. THIS TERM SHALL BE ADJUSTED FOR UNSYMMETRICAL AND NONSTANDARD ROADWAYS.

TO ACCOUNT FOR A VARYING PROFILE GRADE THE  $\phi$  ROADWAY FILL SHALL BE BASED ON STATIONS THAT CORRESPOND TO THE CORNERS OF THE INSIDE FACE OF THE HEADWALLS THAT PRODUCE MAXIMUM VALUES FOR B AND C.

SEE ROADWAY PLANS FOR SLOPES,  $\phi$  ROADWAY FILL AND ELEVATIONS 1 AND 2. ELEVATIONS 1 AND 2 CORRESPOND TO UPPER AND LOWER FLOW LINE ELEVATIONS AND MAY BE BELOW THE NATURAL STREAM BOTTOM DUE TO ENVIRONMENTAL REQUIREMENTS.

LAYOUT DIMENSIONS

VARIABLE	DIMENSION	VARIABLE	DIMENSION	VARIABLE	DIMENSION
$\alpha$	SEE EQUATIONS	N	$3" + \text{TX}(\text{TAN } 10^\circ)$	CC	$(A + C)(\text{SEC } Z)$
$\beta$	SEE EQUATIONS	O	$I + \text{YY}$	DD	$R + M + N + 20"$
B	SEE EQUATIONS	P	$2\text{V}[\text{SEC}(Z + 20^\circ)]$	EE	$E(\text{SEC } Z)$
C	SEE EQUATIONS	Q	$\text{TX}(\text{COS } 20^\circ)$	HH	$20"(\text{SEC } Z)$
D	$Z \geq 20^\circ$ :	II	$\text{P}(\text{COS } 20^\circ)$	II	$20"(\text{COS } Z)$
	$Z < 20^\circ$ :	TT	$\text{G}(\text{SEC } Z)$	KK	$\text{S}/2 + \text{U}$
E	$\text{G} + \text{O} + 20"$	U	$(R + M)(\text{TAN } 20^\circ)$	LL	$(AA + BB + DD)(\text{COS } Z)$
F	$\text{S} + 2\text{TX}$	V	$\text{HT} + \text{TS} - 12"$	MM	$3"[\text{COS } Z + \text{COS}(Z - 20^\circ)]$
G	$2\text{V}$	W	$2A + B + C + D + E + \text{SS}$	QQ	$\text{TX}(\text{COS } Z)$
H	$(A + C + E)(\text{TAN } Z)$	X	$3" + \text{TX}(\text{TAN } Z)$	RR	$\text{P}[\text{COS}(Z - 20^\circ)]$
I	$3"(\text{COS } Z)$	Y	$\text{TX}(\text{SIN } 20^\circ)$	SS	$\text{F}(\text{SIN } Z)$
J	$(AA + BB + DD)(\text{SIN } Z)$	Z	SKEW ANGLE	TT	$\text{TX}[\text{SIN}(20^\circ - Z)]$
K	$\text{S}(\text{SEC } Z)/2$	AA	$\text{F}(\text{TAN } Z)/2$	YY	$\text{TX}(\text{SIN } Z)$
L	$AA + BB + CC + DD + EE$	BB	$(A + B)(\text{SEC } Z)$	TW	$\text{MAX}\{3'-4" \text{ OR } (\text{BS} + 12")\}$
M	$\text{N}(\text{COS } 20^\circ)$				

GENERAL NOTES:

DESIGN SPECIFICATIONS: 2010 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND 2010 INTERIM REVISIONS

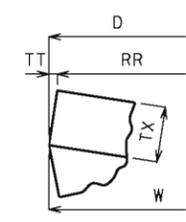
DESIGN LOADING: VEHICULAR = HL-93 MINUS LANE LOAD, EARTH = 120 LB/CF EQUIVALENT FLUID PRESSURE = 30 LB/CF (MIN.), 60 LB/CF (MAX.)

DESIGN UNIT STRESSES: CLASS B-1 CONCRETE (BOX CULVERT)  $f'c = 4,000$  PSI REINFORCING STEEL (GRADE 60)  $f_y = 60,000$  PSI

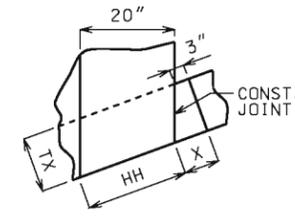
MISCELLANEOUS: FOR REINFORCEMENT DETAILS, SEE SHEET 2 OF 3. FOR SECTION DETAILS, SEE SHEET 3 OF 3. FOR MEMBER THICKNESS, SEE 703.17.

DRAWING NOT TO SCALE. FOLLOW DIMENSIONS. DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

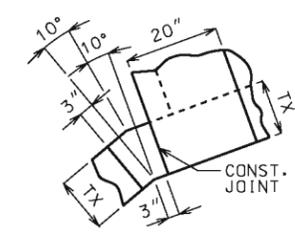
WHEN ALTERNATE PRECAST CONCRETE BOX CULVERT SECTIONS ARE USED, THE MINIMUM DISTANCE FROM INSIDE FACE OF HEADWALLS TO PRECAST SECTIONS MEASURED ALONG THE SHORTEST WALL SHALL BE 3 FEET. REINFORCEMENT AND DIMENSIONS FOR WINGS AND HEADWALLS SHALL BE IN ACCORDANCE WITH MISSOURI STANDARD PLANS.



DETAIL C For Z < 20°



DETAIL B



DETAIL A

**MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION**

105 WEST CAPITOL  
JEFFERSON CITY, MO 65102  
1-888-ASK-MODOT (1-888-275-6636)

STATE OF MISSOURI  
DENNIS W. HECKMAN  
NUMBER PE-27141  
PROFESSIONAL ENGINEER

THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

**CONCRETE SINGLE BOX CULVERT**

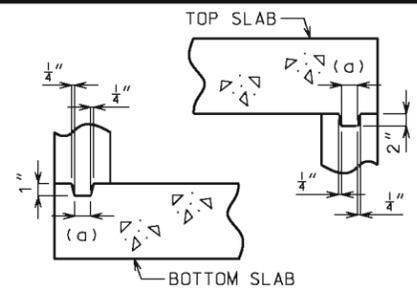
SKEW: RIGHT ADVANCE  
WINGS: FLARED

LAYOUT

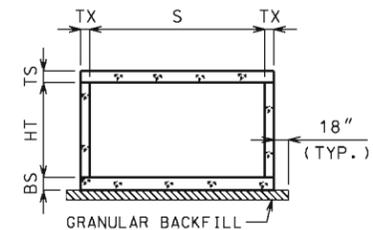
DATE EFFECTIVE: 07/01/2015	703.15E	SHEET NO. 1 OF 3
DATE PREPARED: 6/4/2015		

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

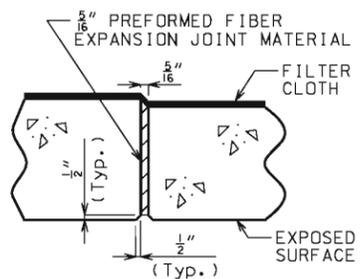




**KEYED CONSTRUCTION JOINT**  
 (d) APPROXIMATELY ONE-THIRD OF WALL THICKNESS



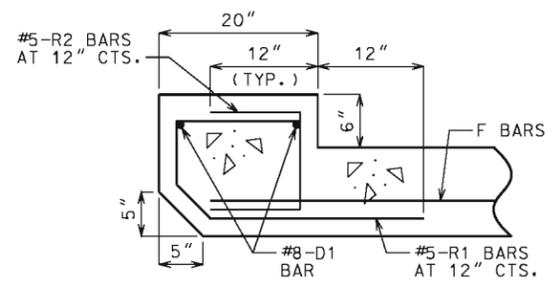
**GRANULAR BACKFILL LIMITS AND MEMBER DIMENSIONS**



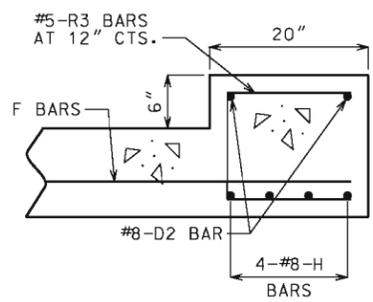
**TRANSVERSE JOINT THRU BARREL**

PREFORMED FIBER EXPANSION JOINT MATERIAL IN ACCORDANCE WITH SEC 1057 SHALL BE SECURELY STITCHED TO ONE FACE OF THE CONCRETE WITH 10 GAGE COPPER WIRE OR 12 GAGE SOFT DRAWN GALVANIZED STEEL WIRE.

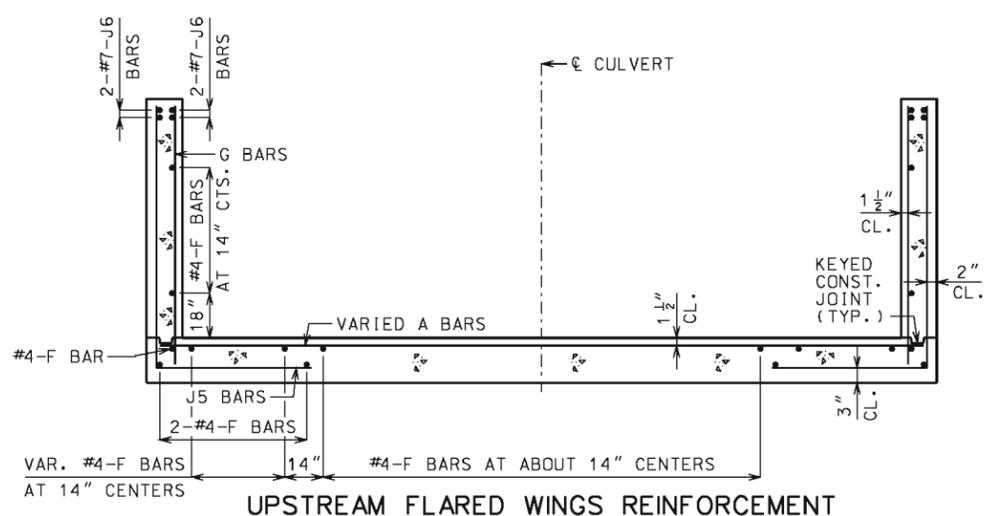
FILTER CLOTH 3 FEET IN WIDTH AND DOUBLE THICKNESS SHALL BE CENTERED ON TRANSVERSE JOINTS IN TOP SLAB AND SIDEWALLS WITH EDGES SEALED WITH MASTIC OR TWO SIDED TAPE. FILTER CLOTH SHALL BE A SUBSURFACE DRAINAGE GEOTEXTILE IN ACCORDANCE WITH SEC 1011. COST OF FURNISHING AND INSTALLING FILTER CLOTH WILL BE CONSIDERED COMPLETELY COVERED BY THE CONTRACT UNIT PRICE FOR OTHER ITEMS.



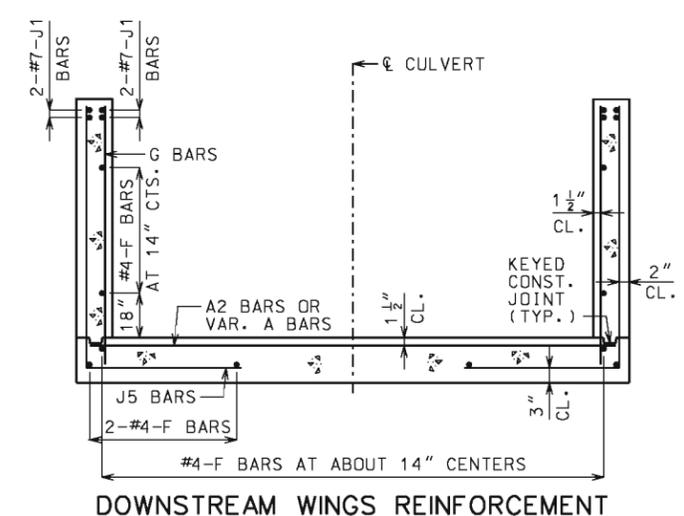
**UPSTREAM HEADWALL REINFORCEMENT**



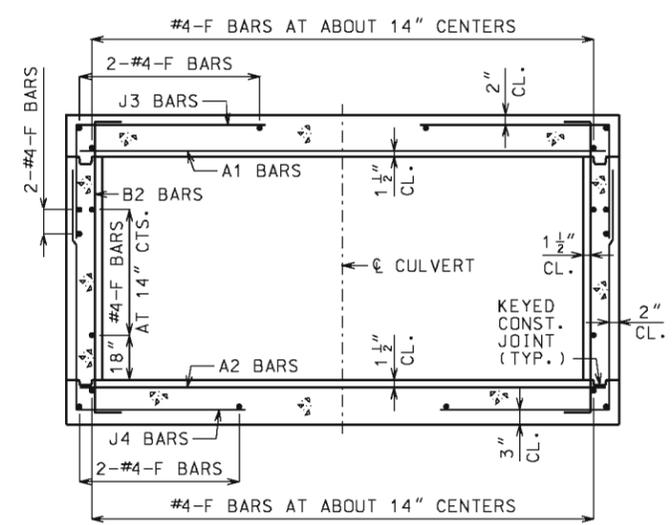
**DOWNSTREAM HEADWALL REINFORCEMENT**



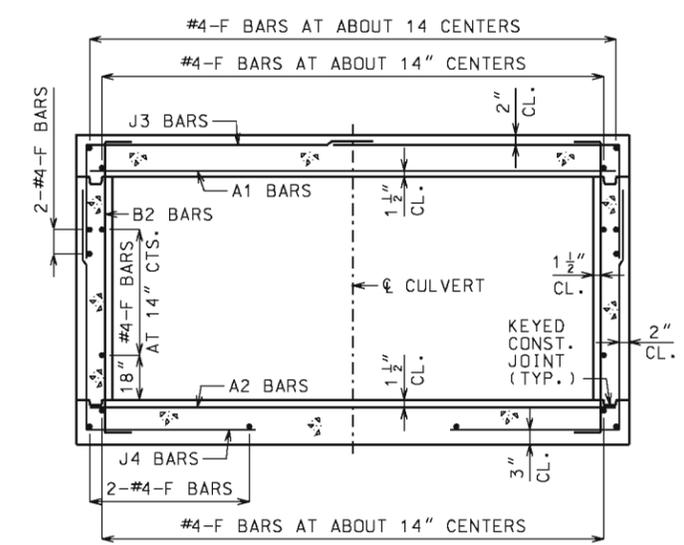
**UPSTREAM FLARED WINGS REINFORCEMENT**



**DOWNSTREAM WINGS REINFORCEMENT**



**BARREL REINFORCEMENT FOR DESIGN FILLS OVER 2'-0"**



**BARREL REINFORCEMENT FOR DESIGN FILLS 2'-0" OR LESS**

**GENERAL NOTES:**

FOR MEMBER THICKNESS AND FOR BAR SIZES, SPACING AND DIMENSIONS OF ALL REINFORCEMENT EXCEPT J5 BARS, SEE 703.17. FOR J5 BARS, SEE 703.37.

BARREL AND WINGS SECTIONS ARE SYMMETRICAL ABOUT AND NORMAL TO CULVERT. HEADWALL SECTIONS ARE NORMAL TO LONG DIRECTION OF HEADWALL.

DRAWING NOT TO SCALE. FOLLOW DIMENSIONS.

MINIMUM CLEARANCE TO REINFORCING STEEL SHALL BE 1 1/2".

	<b>MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION</b> 105 WEST CAPITOL JEFFERSON CITY, MO 65102 1-888-ASK-MODOT (1-888-275-6636)	
	<b>CONCRETE SINGLE BOX CULVERT</b> SKEW: RIGHT ADVANCE WINGS: FLARED	
	<b>SECTIONS</b>	
DATE EFFECTIVE: 07/01/2015 DATE PREPARED: 5/13/2015	<b>703.15E</b>	SHEET NO. <b>3 OF 3</b>

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.