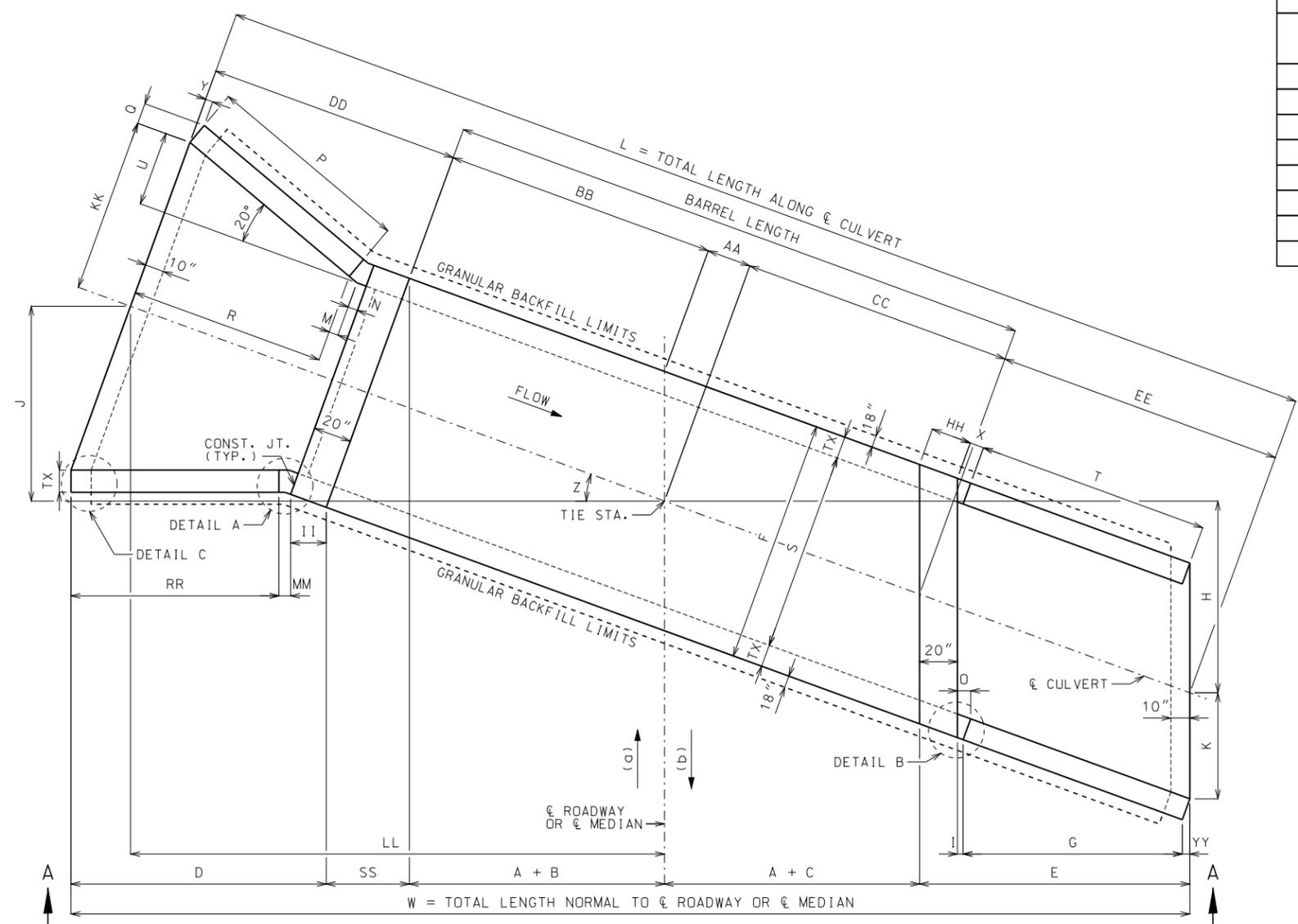


CONSTRUCTION JOINT KEY NOT SHOWN FOR CLARITY, SEE SHEET 3 OF 3 FOR DETAILS.

ELEVATION A-A

IF UNSUITABLE MATERIAL IS ENCOUNTERED, EXCAVATION OF UNSUITABLE MATERIAL AND FURNISHING AND PLACING OF GRANULAR BACKFILL SHALL BE IN ACCORDANCE WITH SECTION 206 OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION.



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

EQUATIONS FOR COMPUTING α , β , B AND C

α = ANGLE OF BARREL SLOPE WITH HORIZONTAL NORMAL TO ϕ ROADWAY OR ϕ MEDIAN = $\text{ARCTAN} \left(\frac{\text{UFL ELEV.} - \text{LFL ELEV.}}{W} \right)$

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

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

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

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

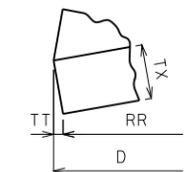
THE TERM "A(CS)" IS THE DIFFERENCE IN ELEVATION BETWEEN ϕ ROADWAY OR ϕ MEDIAN AND THE TOP OF THE FILL SLOPE NORMAL TO ϕ ROADWAY OR ϕ MEDIAN. THIS TERM SHALL BE ADJUSTED FOR UNSYMMETRICAL AND NONSTANDARD ROADWAYS.

TO ACCOUNT FOR A VARYING PROFILE GRADE THE ϕ 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.

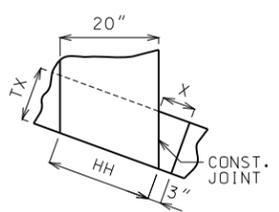
SEE ROADWAY PLANS FOR FILL SLOPES, CROSS SLOPES, ϕ ROADWAY FILL, UPPER FLOW LINE (UFL) ELEVATION AND LOWER FLOW LINE (LFL) ELEVATION.

LAYOUT DIMENSIONS

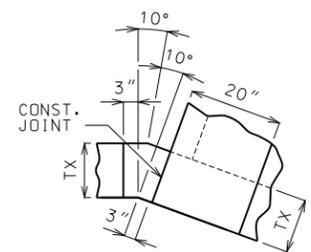
VARIABLE	DIMENSION	VARIABLE	DIMENSION	VARIABLE	DIMENSION
α	SEE EQUATIONS	M	$N(\text{COS } 20^\circ)$	BB	$(A + B)(\text{SEC } Z)$
β	SEE EQUATIONS	N	$3'' + \text{TX}(\text{TAN } 10^\circ)$	CC	$(A + C)(\text{SEC } Z)$
B	SEE EQUATIONS	O	$I + \text{YY}$	DD	$R + M + N + 20''$
C	SEE EQUATIONS	P	$2V[\text{SEC}(Z + 20^\circ)]$	EE	$E(\text{SEC } Z)$
D	$Z \geq 20^\circ: I + \text{MM} + \text{RR}$ $Z < 20^\circ: I + \text{MM} + \text{RR} + \text{TT}$	Q	$\text{TX}(\text{COS } 20^\circ)$	HH	$20''(\text{SEC } Z)$
E	$G + O + 20''$	R	$P(\text{COS } 20^\circ)$	II	$20''(\text{COS } Z)$
F	$S + 2\text{TX}$	T	$G(\text{SEC } Z)$	KK	$(S/2) + U$
G	$2V$	U	$(R + M)(\text{TAN } 20^\circ)$	LL	$(AA + BB + DD)(\text{COS } Z)$
H	$(A + C + E)(\text{TAN } Z)$	V	$\text{HT} + \text{TS} - 12''$	MM	$3''[\text{COS } Z + \text{COS}(Z - 20^\circ)]$
I	$3''(\text{COS } Z)$	W	$2A + B + C + D + E + \text{SS}$	RR	$P[\text{COS}(Z - 20^\circ)]$
J	$(AA + BB + DD)(\text{SIN } Z)$	X	$3'' + \text{TX}(\text{TAN } Z)$	SS	$F(\text{SIN } Z)$
K	$(S/2)(\text{SEC } Z)$	Y	$\text{TX}(\text{SIN } 20^\circ)$	TT	$\text{TX}[\text{SIN}(20^\circ - Z)]$
L	$AA + BB + CC + DD + EE$	Z	SKEW ANGLE	YY	$\text{TX}(\text{SIN } Z)$
		AA	$(F/2)(\text{TAN } Z)$	TOE	$\text{MAX}\{(\text{BS} + 12''), 40''\}$



DETAIL C
For Z < 20°



DETAIL B



DETAIL A

GENERAL NOTES:

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

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

DESIGN LOADS: VEHICULAR = HL-93 MINUS LANE LOAD
EARTH = 120 LB/FT^3
EQUIVALENT FLUID PRESSURE = 30 LB/FT^3 (MIN.) - 60 LB/FT^3 (MAX.)

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.

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

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

CONCRETE SINGLE BOX CULVERT

SKEW: LEFT ADVANCE
WINGS: FLARED

LAYOUT

DATE EFFECTIVE: 04/01/2011
DATE PREPARED: 9/8/2011

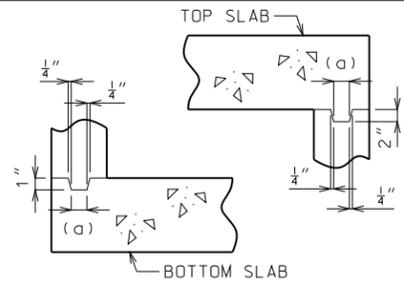
703.13H

SHEET NO. 1 OF 3

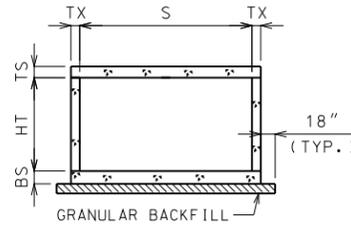
STATE OF MISSOURI
DENNIS W. HECKMAN
NUMBER PE-27141
PROFESSIONAL ENGINEER

THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

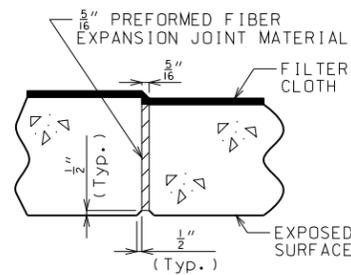
IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.



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



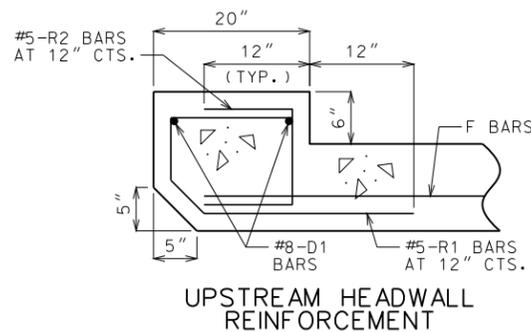
GRANULAR BACKFILL LIMITS AND MEMBER DIMENSIONS



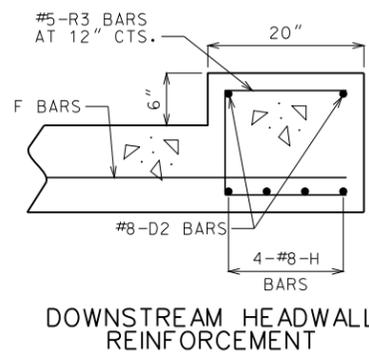
TRANSVERSE JOINT THRU BARREL

PREFORMED FIBER EXPANSION JOINT MATERIAL SHALL BE SECURELY STITCHED TO ONE FACE OF THE CONCRETE WITH NO. 10 GAGE COPPER WIRE OR NO. 12 GAGE SOFT DRAWN GALVANIZED STEEL WIRE.

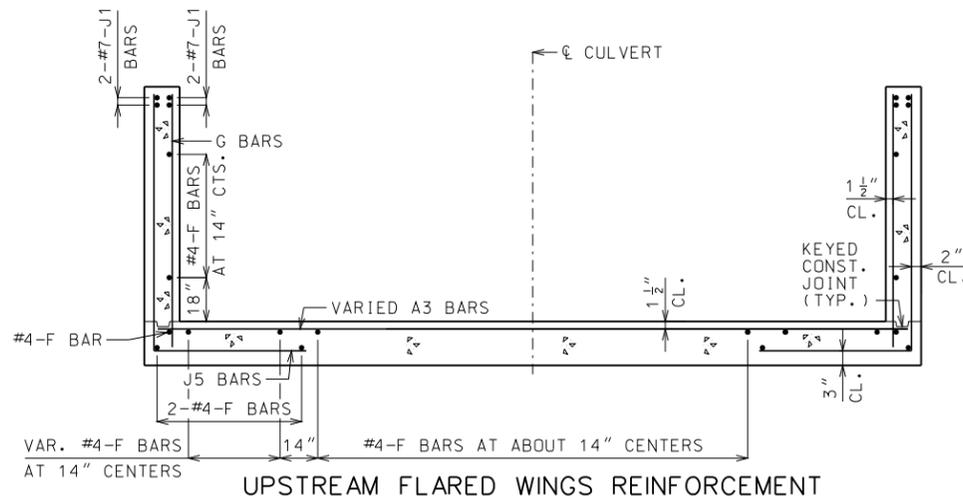
FILTER CLOTH 3 FEET IN WIDTH AND DOUBLE THICKNESS SHALL BE CENTERED ON TRANSVERSE JOINTS IN TOP SLAB AND SIDEWALLS WITH EDGES SEALED WITH MASTIC OR TWO SIDED TAPE. FILTER CLOTH SHALL BE A SUBSURFACE DRAINAGE GEOTEXTILE IN ACCORDANCE WITH SECTION 1011 OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION.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



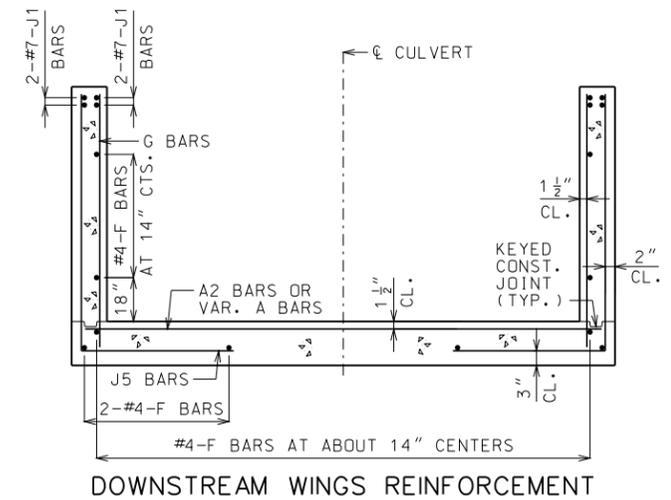
UPSTREAM HEADWALL REINFORCEMENT



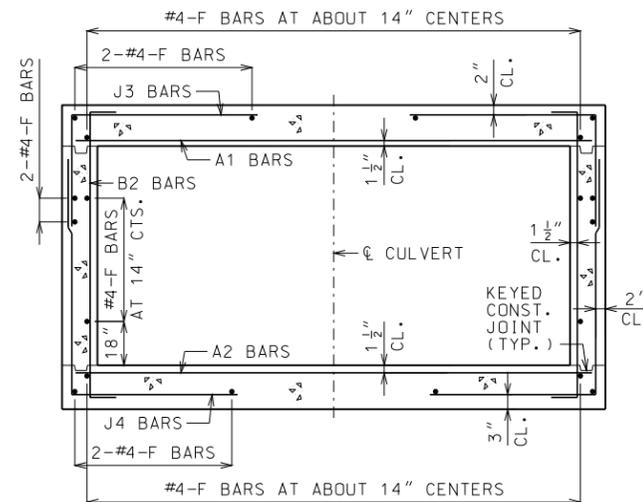
DOWNSTREAM HEADWALL REINFORCEMENT



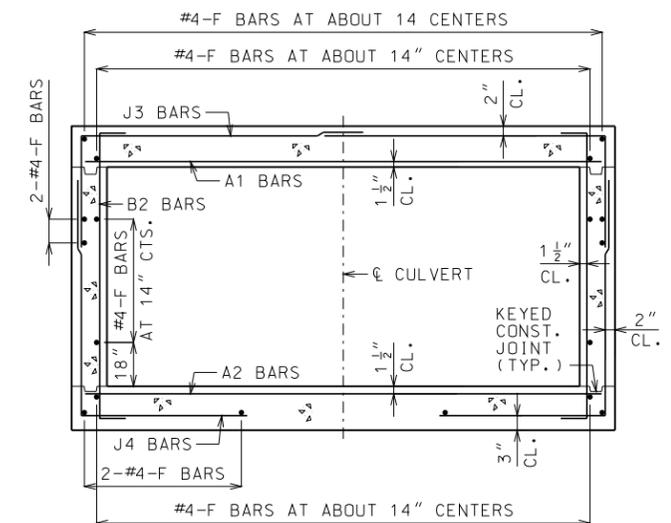
UPSTREAM FLARED WINGS REINFORCEMENT



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".

	MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION	
	105 WEST CAPITOL JEFFERSON CITY, MO 65102 1-888-ASK-MODOT (1-888-275-6636)	
	CONCRETE SINGLE BOX CULVERT SKEW: LEFT ADVANCE WINGS: FLARED	
	SECTIONS	
DATE EFFECTIVE: 04/01/2011 DATE PREPARED: 9/8/2011	703.13H	SHEET NO. 3 OF 3

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