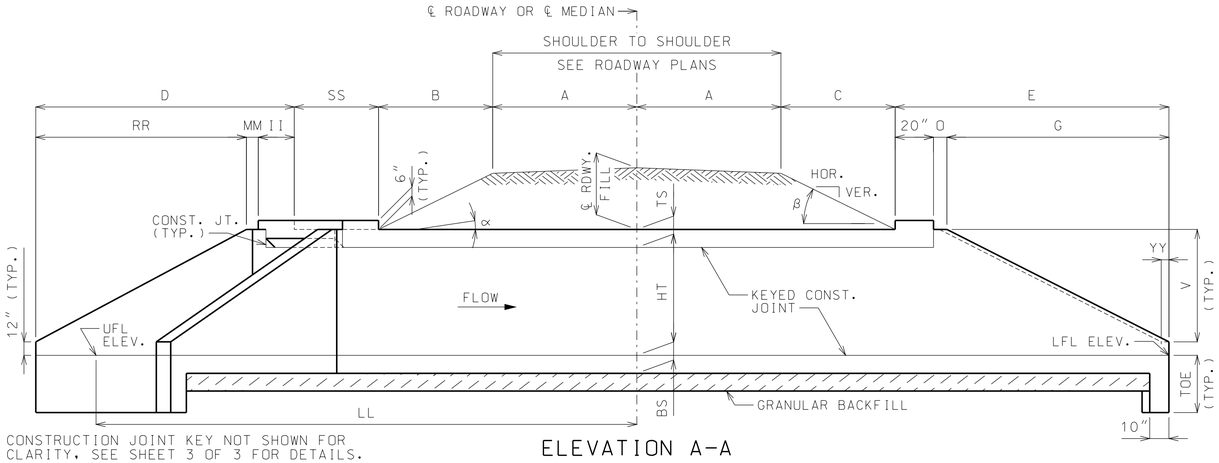
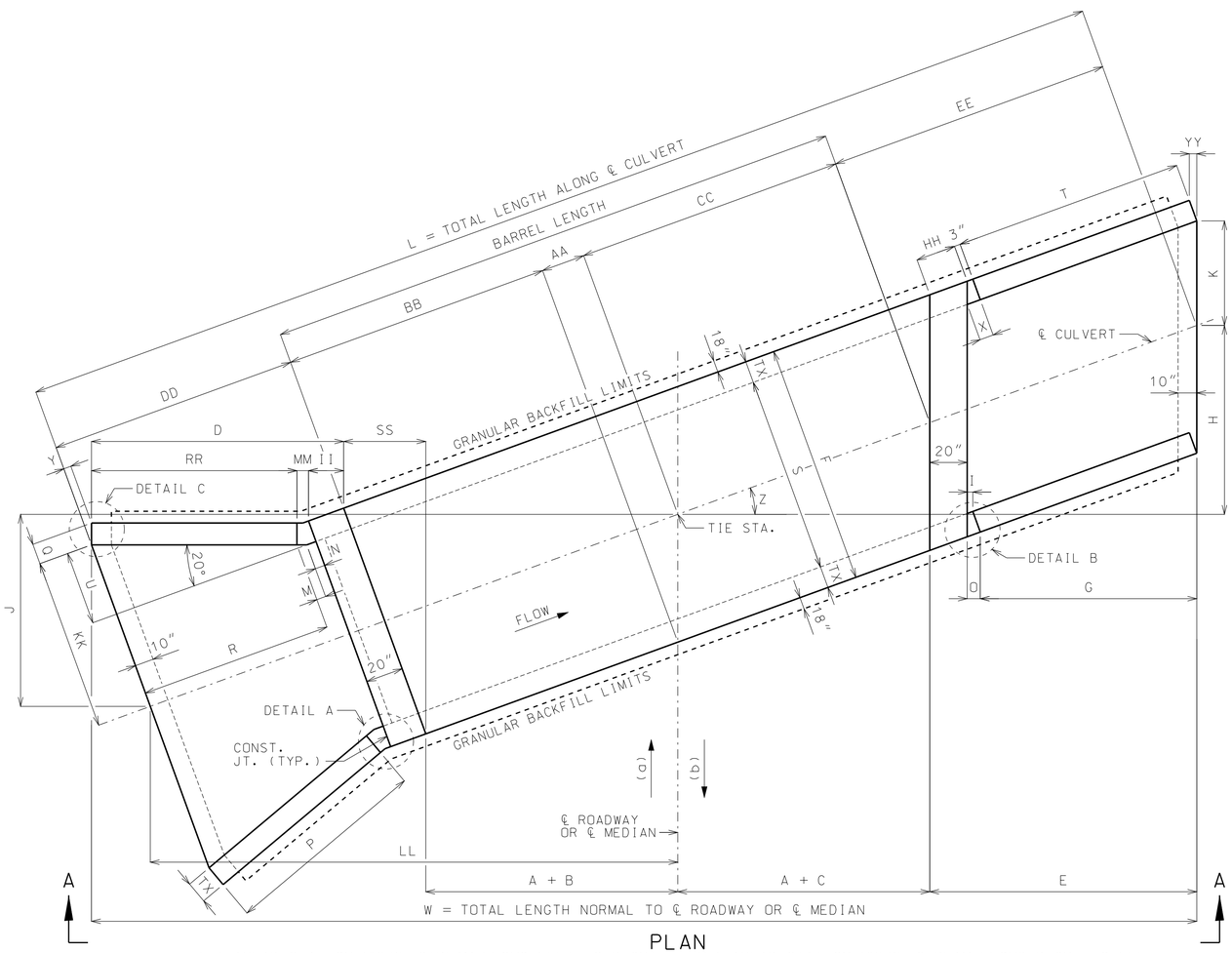



CONSTRUCTION JOINT KEY NOT SHOWN FOR CLARITY, SEE SHEET 3 OF 3 FOR DETAILS.

## 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 ℄ ROADWAY OR ℄ MEDIAN = $\text{ARCTAN}\left(\frac{\text{UFL ELEV.} - \text{LFL ELEV.}}{W}\right)$

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

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

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

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

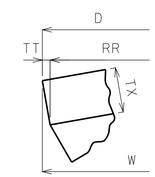
THE TERM "A(CS)" IS THE DIFFERENCE IN ELEVATION BETWEEN ℄ ROADWAY OR ℄ MEDIAN AND THE TOP OF THE FILL SLOPE NORMAL TO ℄ ROADWAY OR ℄ MEDIAN. THIS TERM SHALL BE ADJUSTED FOR UNSYMMETRICAL AND NONSTANDARD ROADWAYS.

TO ACCOUNT FOR A VARYING PROFILE GRADE THE ℄ 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.

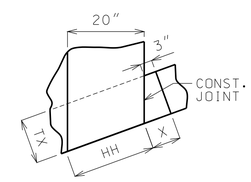
SEE ROADWAY PLANS FOR FILL SLOPES, CROSS SLOPES, ℄ ROADWAY FILL, UPPER FLOW LINE (UFL) ELEVATION AND LOWER FLOW LINE (LFL) ELEVATION.

## LAYOUT DIMENSIONS

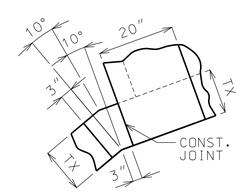
| VARIABLE | DIMENSION | VARIABLE | DIMENSION | VARIABLE | DIMENSION |
|---|---|---|---|---|---|
| α | SEE EQUATIONS | M | N(COS 20°) | BB | (A + B)(SEC Z) |
| β | SEE EQUATIONS | N | 3″ + TX(TAN 10°) | CC | (A + C)(SEC Z) |
| B | SEE EQUATIONS | O | I + YY | DD | R + M + N + 20″ |
| C | SEE EQUATIONS | P | 2V[SEC(Z + 20°)] | EE | E(SEC Z) |
| D | Z ≤ 20°: II + MM + RR | Q | TX(COS 20°) | HH | 20″(SEC Z) |
| | Z > 20°: II + MM + RR + TT | R | P(COS 20°) | II | 20″(COS Z) |
| E | G + O + 20″ | T | G(SEC Z) | KK | (S/2) + U |
| F | S + 2TX | U | (R + M)(TAN 20°) | LL | (AA + BB + DD)(COS Z) |
| G | 2V | V | HT + TS − 12″ | MM | 3″[COS Z + COS(Z − 20°)] |
| H | (A + C + E)(TAN Z) | W | 2A + B + C + D + E + SS | RR | P [COS (Z − 20°)] |
| I | 3″(COS Z) | X | 3″ + TX(TAN Z) | SS | F(SIN Z) |
| J | (AA + BB + DD)(SIN Z) | Y | TX(SIN 20°) | TT | TX[SIN(Z − 20°)] |
| K | (S/2)(SEC Z) | Z | SKEW ANGLE | YY | TX(SIN Z) |
| L | AA + BB + CC + DD + EE | AA | (F/2)(TAN Z) | TOE | MAX{(BS + 12″), 40″} |




DETAIL C
For Z > 20°




DETAIL B




DETAIL A

## GENERAL NOTES:

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

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


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

703.15D

SHEET NO. 1 OF 3

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