AREA OF STEEL REQUIRED FOR J5 BARS IN WINGS (SQ. IN./FT.)
WALL HEIGHT VS. WALL THICKNESS

① Backfill Slope = 2:1

Wall Thickness TX (in.)	Wall Height (ft.)															
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
8	0.168	0.168	0.197	0.291	0.414	0.429	0.578	0.766	1.003							
9	0.168	0.168	0.168	0.244	0.346	0.456	0.477	0.626	0.809	1.034	1.312					
10	0.168	0.168	0.168	0.211	0.298	0.407	0.487	0.532	0.683	0.864	1.084	1.349				
11	0.168	0.168	0.168	0.185	0.261	0.357	0.475	0.520	0.592	0.746	0.929	1.147	1.405			
12		0.168	0.168	0.168	0.233	0.318	0.422	0.548	0.554	0.658	0.816	1.002	1.220	1.475		
13		0.168	0.168	0.168	0.210	0.287	0.380	0.493	0.588	0.589	0.729	0.892	1.081	1.301		
14			0.168	0.168	0.192	0.261	0.346	0.448	0.569	0.623	0.659	0.805	0.973	1.167	1.390	
15				0.168	0.176	0.240	0.317	0.411	0.521	0.652	0.658	0.734	0.886	1.059	1.258	
16					0.168	0.222	0.293	0.379	0.481	0.601	0.693	0.693	0.813	0.971	1.151	
17					0.168	0.206	0.273	0.352	0.447	0.557	0.686	0.729	0.752	0.897	1.061	1.247
18							0.255	0.329	0.417	0.520	0.639	0.764	0.764	0.834	0.985	1.156
19								0.309	0.391	0.487	0.599	0.727	0.800	0.800	0.920	1.078
20								0.291	0.368	0.459	0.563	0.684	0.821	0.836	0.863	1.011
21									0.348	0.433	0.532	0.645	0.774	0.871	0.871	0.952
22										0.411	0.504	0.611	0.733	0.870	0.907	0.970
23											0.479	0.580	0.696	0.826	0.943	0.943
24											0.456	0.552	0.662	0.786	0.925	0.979
25												0.527	0.632	0.750	0.882	1.015
26													0.604	0.717	0.843	0.984
27														0.686	0.807	0.942

AREA OF STEEL REQUIRED FOR J5 BARS IN WINGS (SQ. IN./FT.)
WALL HEIGHT VS. WALL THICKNESS

① Backfill Slope = 3:1

Wall Thickness TX (in.)	Wall Height (ft.)															
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
8	0.168	0.168	0.168	0.187	0.264	0.362	0.425	0.475	0.612							
9	0.168	0.168	0.168	0.168	0.222	0.303	0.403	0.456	0.504	0.637	0.795					
10	0.168	0.168	0.168	0.168	0.191	0.261	0.346	0.450	0.487	0.541	0.671	0.824	1.005	1.217		
11	0.168	0.168	0.168	0.168	0.168	0.229	0.304	0.394	0.501	0.520	0.583	0.713	0.864	1.039		
12		0.168	0.168	0.168	0.168	0.204	0.271	0.351	0.445	0.554	0.554	0.629	0.760	0.910		
13		0.168	0.168	0.168	0.168	0.185	0.244	0.316	0.401	0.501	0.588	0.588	0.679	0.812	0.963	
14			0.168	0.168	0.168	0.168	0.223	0.288	0.365	0.455	0.560	0.623	0.623	0.733	0.868	
15				0.168	0.168	0.168	0.204	0.264	0.335	0.417	0.513	0.623	0.658	0.669	0.791	
16					0.168	0.168	0.189	0.244	0.309	0.385	0.474	0.575	0.690	0.693	0.727	
17					0.168	0.168	0.176	0.227	0.287	0.358	0.440	0.533	0.640	0.729	0.729	0.788
18							0.168	0.212	0.269	0.334	0.411	0.498	0.597	0.709	0.764	0.764
19								0.199	0.252	0.314	0.385	0.467	0.559	0.664	0.782	0.800
20								0.188	0.237	0.295	0.362	0.439	0.526	0.625	0.735	0.836
21									0.224	0.279	0.342	0.415	0.497	0.590	0.694	0.810
22										0.265	0.325	0.393	0.471	0.558	0.657	0.766
23											0.308	0.373	0.447	0.530	0.624	0.727
24											0.294	0.356	0.426	0.505	0.594	0.692
25												0.340	0.407	0.482	0.566	0.661
26													0.389	0.461	0.542	0.632
27														0.442	0.519	0.605

NOTE:

THE WALL HEIGHT IS EQUAL TO THE BARREL HEIGHT (HT) PLUS THE TOP SLAB THICKNESS (TS). WHEN WALL HEIGHT IS IN BETWEEN OR OUTSIDE TABULATED WALL HEIGHTS, THE AREA OF STEEL REQUIRED SHOULD BE INTERPOLATED BETWEEN OR EXTRAPOLATED FROM ADJACENT AREAS OF STEEL USING THE ACTUAL WALL HEIGHT.

IF AREA OF STEEL IN THE WALL OF THE CULVERT (J4 BARS) IS GREATER THAN THAT INDICATED IN THE TABLE, USE THE SAME SIZE AND SPACING FOR THE J5 BARS IN THE WINGS. HOWEVER, IF THE AREA OF STEEL PROVIDED BY MATCHING SIZE AND SPACING OF THE J4 BARS IS INSUFFICIENT, INCREASE THE SIZE OF THE J5 BARS (#8 MAX.) AND/OR DECREASE THE SPACING OF THE J5 BARS (6" MIN.). USE SMALLEST BAR SIZE POSSIBLE BASED ON MINIMUM SPACING.

MINIMUM STEEL TO BE USED IN THE WINGS FOR J5 BARS IS #4 BARS AT 14" CENTERS (AREA OF STEEL = 0.1683 SQ. IN./FT.)

① SEE STANDARD PLAN 703.37C, SHEET 2 OF 2 FOR BACKFILL SLOPE TO BE USED BASED ON SKEW.

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 BOX CULVERT

EXTERIOR WING REINFORCEMENT

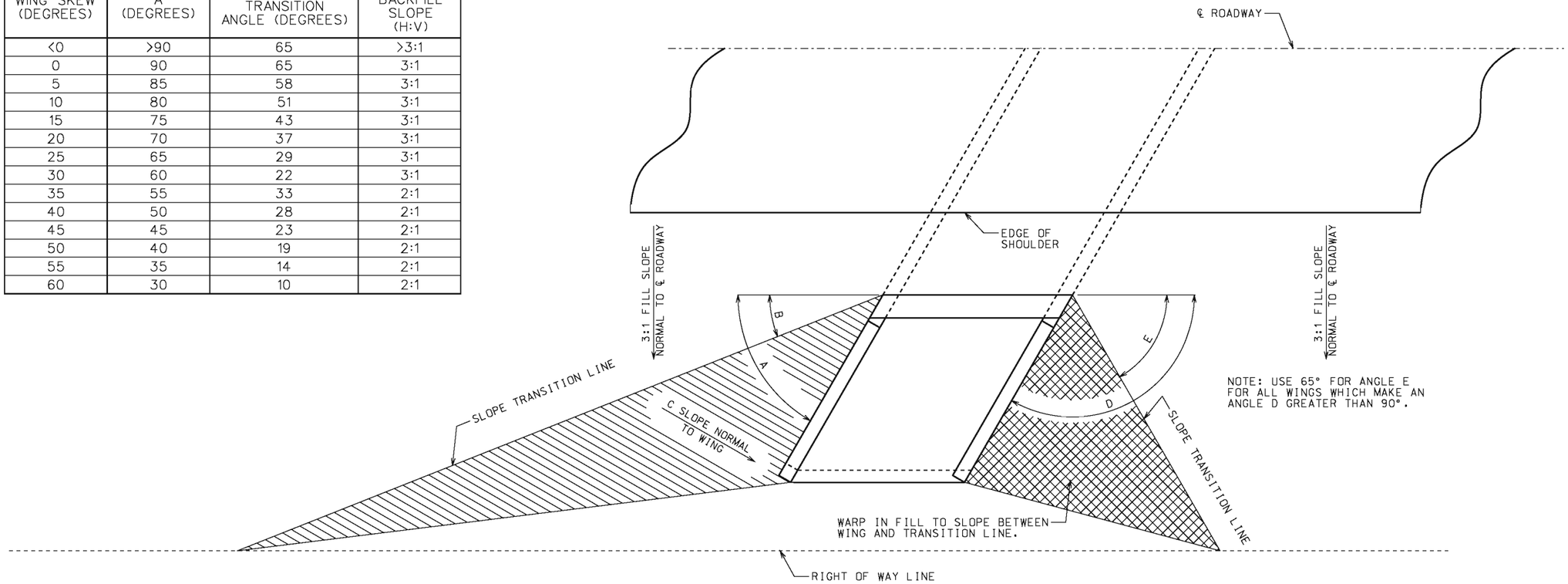
DATE EFFECTIVE: 04/01/2011
DATE PREPARED: 4/18/2011

703.37C

SHEET NO. 1 OF 2

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

WING BACKFILL TABLE			
WING SKEW (DEGREES)	A (DEGREES)	B TRANSITION ANGLE (DEGREES)	C BACKFILL SLOPE (H:V)
<0	>90	65	>3:1
0	90	65	3:1
5	85	58	3:1
10	80	51	3:1
15	75	43	3:1
20	70	37	3:1
25	65	29	3:1
30	60	22	3:1
35	55	33	2:1
40	50	28	2:1
45	45	23	2:1
50	40	19	2:1
55	35	14	2:1
60	30	10	2:1



PLAN OF WINGS AND SLOPE TRANSITION LINES

NOTE: BACKFILL TRANSITION ANGLE AND BACKFILL SLOPE SHALL APPLY TO ALL BOX CULVERTS REGARDLESS OF TYPE – SINGLE, DOUBLE, OR TRIPLE.

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

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CONCRETE BOX CULVERT

EXTERIOR WING BACKFILL SLOPE TRANSITION

DATE EFFECTIVE: 04/01/2011
DATE PREPARED: 4/18/2011

703.37C

SHEET NO. 2 OF 2