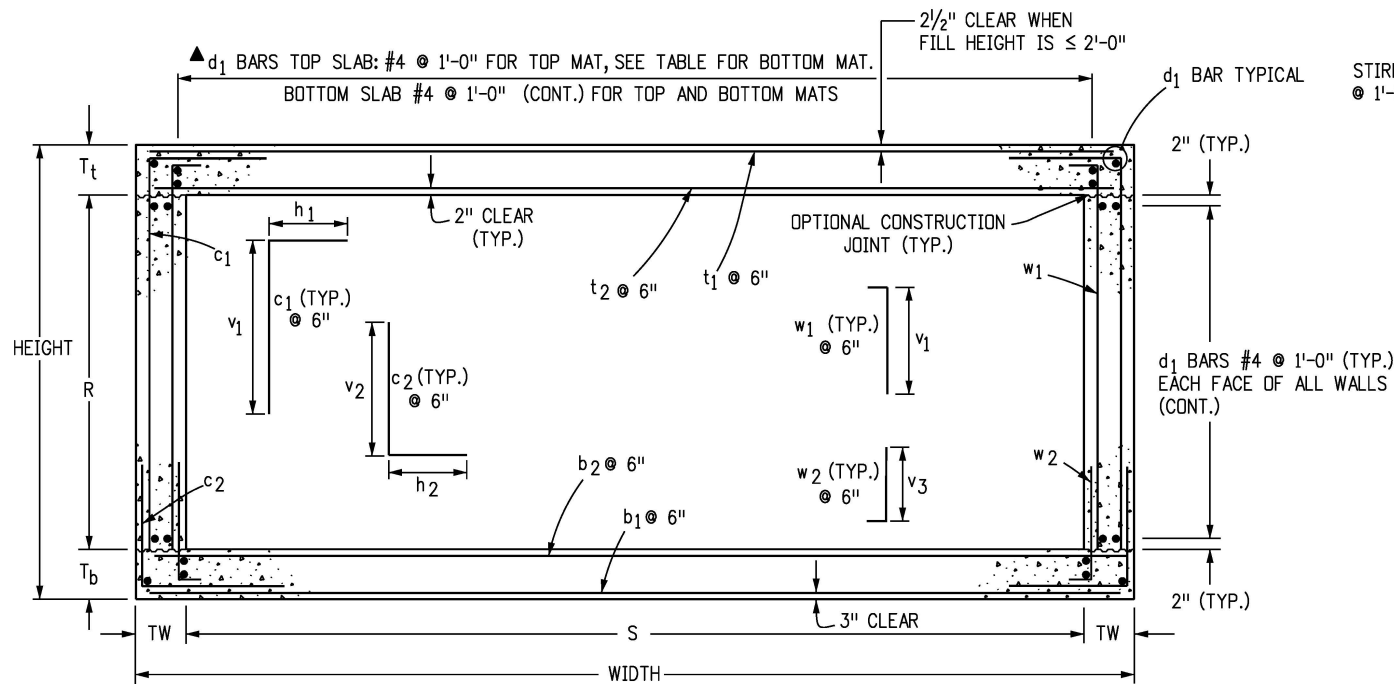
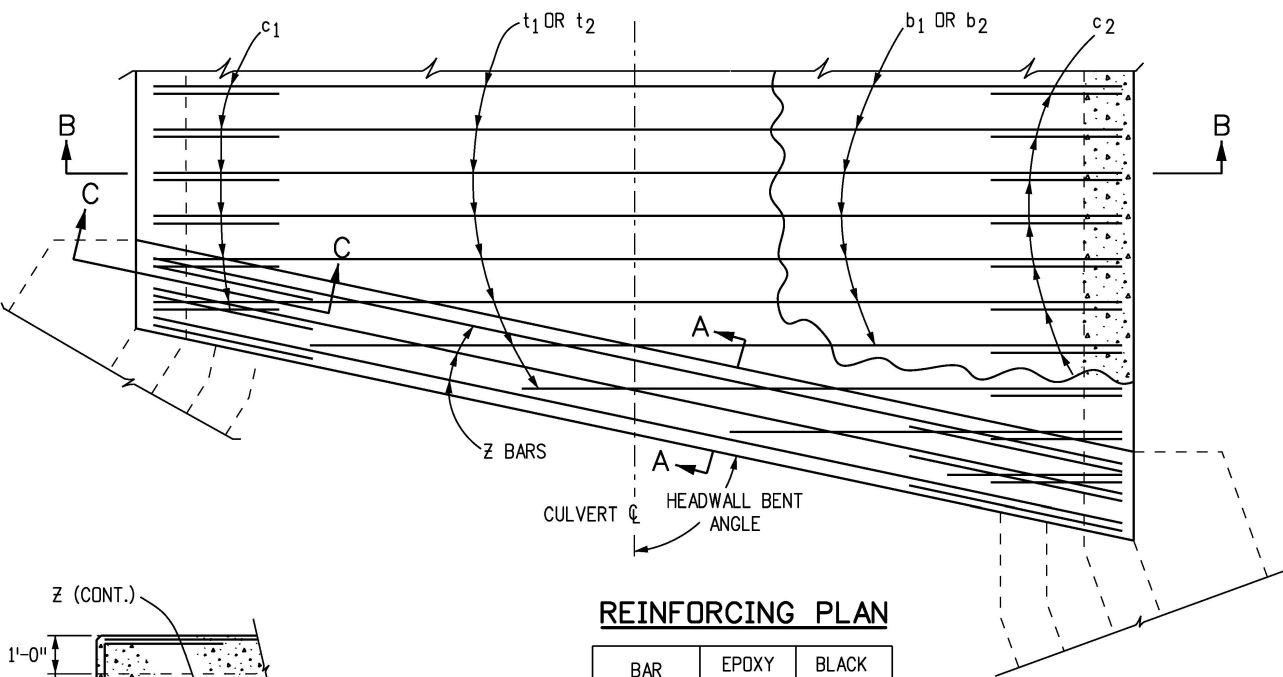




SECTION B-B

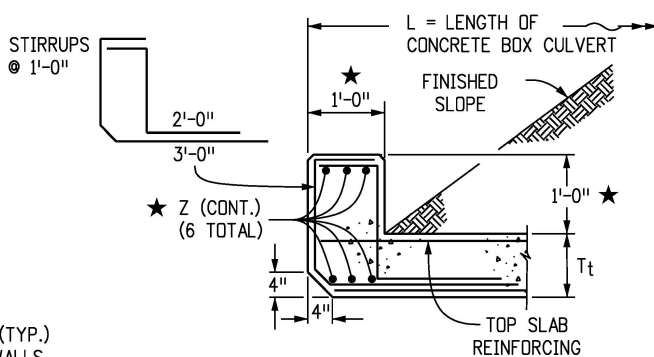
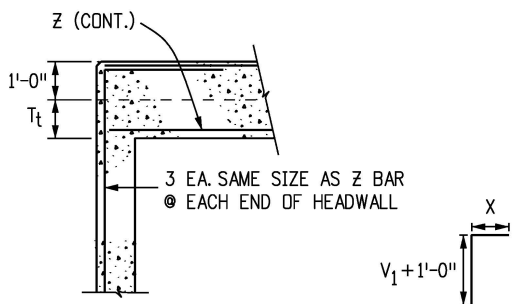


REINFORCING PLAN

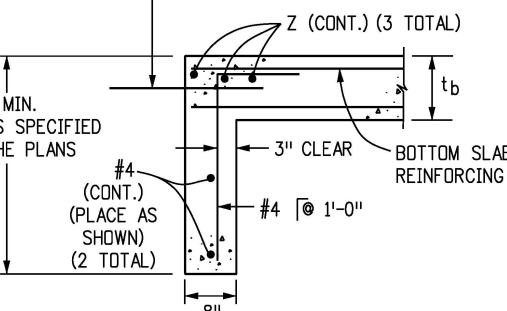
BAR SIZE (#)	EPOXY X (FT.-IN.)	BLACK X (FT.-IN.)
4	2-4	1-11
5	2-10	2-4
6	3-5	2-10
7	4-1	3-3
8	5-3	4-3
9	6-8	5-5

SECTION C-C

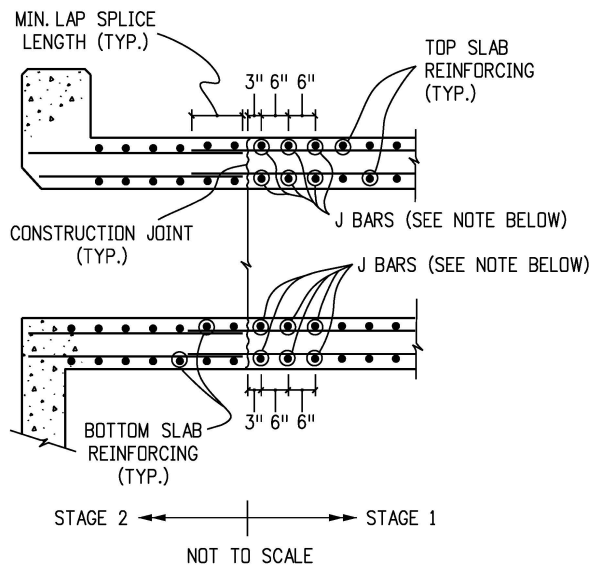
HEADWALL CORNER REINFORCING DETAIL



#4 BY 2'-0" @ 1'-6" WHEN AN APRON IS REQUIRED ON THE OUTLET END (PROJECTED OUT 1'-0")



SECTION A-A



CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ϕ OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

GENERAL NOTES

- ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
- ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
- ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL 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.
- 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'-7"	2'-5"	2'-10"	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'-1"	1'-4"	1'-7"	1'-11"	2'-6"	3'-1"	3'-11"	4'-10"

THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.

- 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.
- THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
- ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED $\frac{3}{4}$ ".
- FOR FILL HEIGHTS LESS THAN 2 FT. A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18 INCHES DOWN FROM THE TOP OF THE EXTERIOR WALLS.
- FOR FILL HEIGHTS LESS THAN 2 FT, THE d_1 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	6	8	10	12, 14, 16, 18, 20
BAR SIZE:	#5	#6	#6	#5
SPACING	1'-0"	1'-0"	0'-6"	0'-6"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

RATING DATA: 2ND EDITION, 2011, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION

$f_y = 60,000$ psi.,

$f'_c = 4,500$ psi.,

LOADING DATA:

LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK, AND NRL

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.

THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.

WEARING SURFACE - 12 INCHES THICK CONCRETE PAVEMENT.

DEAD LOAD - TYPE 7 BARRIER.

EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDDT DRAINAGE MANUAL.

EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE DESIGN BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.

LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

- ★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19, AND THE INFORMATION BELOW):

- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY SPECIAL DESIGN FOR STIRRUPS 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 19.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
- 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.

18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBE
Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

(R-X)
(R-X)
(R-X)
(R-X)

Sheet Revisions

Date:	Comments

Colorado Department of Transportation

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Denver, CO 80204
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Project Development Branch

JBK

SINGLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.

M-601-1

Standard Sheet No. 1 of 2

Project Sheet Number:

SINGLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

BOX SIZE		FILL HEIGHT ALLOWED			SLAB & WALL THICKNESS (INCHES)			BAR SIZES						d1▲	DIMENSIONS					QUANTITIES			RATING FACTORS					
S	R	HT.	WIDTH		Tt	Tb	TW	t1*	b1	t2	b2	w1*	w2	c1*	c2	NO.	h1	h2	v1	v2	v3	CONCRETE	REBAR STL	WATERPROOFING	HL-93	HL-93	COLORADO	NRL
FT	FT	FT-IN	FT-IN		FT-FT			#	#	#	#	#	#	#	#		FT-IN	FT-IN	FT-IN	FT-IN	FT-IN	CY/LF	LBS/LF	SY/LF	INVENTORY	OPERATING	PERMIT	VEHICLE
6	7	8-8	7-8	< 2	10	10	10	4	6	6	4	5	5	64	3-5	4-4	7-7	3-1	1-11	0.905	215	1.185	1.23	1.59	2.03	2.09		
		8-4.5	7-8	2 TO 8	8.5	8	10	4	5	5	4	5	5	64	3-10	4-4	7-6	2-11	1-9	0.823	199		1.67	2.17	2.51	2.58		
		8-5	7-8	8 TO 15	8.5	8.5	10	4	5	5	4	5	5	64	3-8	2-4	7-6	3-0	1-9	0.834	190		◆	◆	◆	◆		
		8-5	7-8	15 TO 20	8.5	8.5	10	4	5	5	4	5	5	64	3-8	2-4	7-6	3-0	1-9	0.834	190		◆	◆	◆	◆		
8	6	7-9	9-8	< 2	11	10	10	4	7	7	4	5	5	68	4-9	2-4	6-8	3-1	1-11	0.997	251	1.407	1.10	1.43	1.65	1.63		
		7-6	9-8	2 TO 8	8.5	9.5	10	4	6	6	4	5	5	66	4-8	2-4	6-6	3-1	1-10	0.907	220		1.59	2.07	2.39	2.46		
		7-6	9-8	8 TO 15	8.5	9.5	10	4	6	6	4	5	5	66	3-7	2-4	6-6	3-1	1-10	0.907	216		◆	◆	◆	◆		
		7-6	9-8	15 TO 20	8.5	9.5	10	4	6	6	4	5	5	66	3-7	2-4	6-6	3-1	1-10	0.907	216		◆	◆	◆	◆		
	8	9-9.5	9-8	< 2	11.5	10	10	4	7	7	4	5	5	76	5-8	5-4	8-9	3-1	1-11	1.135	287	1.407	1.07	1.38	1.60	1.58		
		9-7	9-8	2 TO 8	9	10	10	4	6	6	4	5	5	74	4-8	2-4	8-7	3-1	1-11	1.061	240		1.61	2.09	2.54	2.57		
		9-7	9-8	8 TO 15	9	10	10	4	6	6	4	5	5	74	3-7	2-4	8-7	3-1	1-11	1.061	235		◆	◆	◆	◆		
		9-7	9-8	15 TO 20	9	10	10	4	6	6	4	5	5	74	3-7	2-4	8-7	3-1	1-11	1.061	235		◆	◆	◆	◆		
	10	11-10	9-8	< 2	11.5	10.5	10	4	7	7	4	5	5	84	3-5	2-4	10-9	3-2	2-0	1.274	285	1.407	1.12	1.46	1.69	1.66		
		11-7	9-8	2 TO 8	9	10	10	4	6	6	4	5	5	82	5-6	2-4	10-7	3-1	1-11	1.184	262		1.61	2.09	2.52	2.56		
		11-7	9-8	8 TO 15	9	10	10	4	6	6	4	5	5	82	4-6	2-4	10-7	3-1	1-11	1.184	258		◆	◆	◆	◆		
		11-9	9-11	15 TO 20	10	11	11.5	4	6	6	4	6	6	85	4-7	2-5	10-8	3-1	1-11	1.353	302		◆	◆	◆	◆		
10	6	7-11.5	11-8	< 2	12.5	11	10	4	8	8	4	5	5	87	5-8	2-7	6-10	3-2	2-0	1.217	321	1.630	1.05	1.36	1.49	1.48		
		7-7	11-8	2 TO 10	9	10	10	4	6	6	4	5	5	72	5-5	2-7	6-7	3-1	1-11	1.055	246		1.25	1.62	1.88	1.84		
		7-8	11-8	10 TO 15	10	10	10	4	6	6	4	5	5	72	4-2	2-7	6-8	3-1	1-11	1.091	242		◆	◆	◆	◆		
		8-1	11-10	15 TO 20	13	12	11	4	6	6	4	5	5	75	4-7	2-9	6-11	3-3	2-1	1.320	251		◆	◆	◆	◆		
	8	9-11.5	11-8	< 2	12.5	11	10	4	9	9	4	5	5	95	5-8	2-7	8-10	3-2	2-0	1.340	383	1.630	1.02	1.32	1.44	1.43		
		9-7.5	11-8	2 TO 10	9.5	10	10	4	6	6	4	5	5	80	5-5	2-7	8-7	3-1	1-11	1.196	265		1.21	1.57	1.82	1.78		
		9-8	11-8	10 TO 15	10	10	10	4	6	6	4	5	5	80	4-3	2-7	8-8	3-1	1-11	1.214	261		◆	◆	◆	◆		
		10-0	12-0	15 TO 20	12	12	12	4	6	6	4	5	5	83	4-7	2-10	8-10	3-3	2-1	1.481	271		◆	◆	◆	◆		
	10	12-0	11-8	< 2	12.5	11.5	10	4	9	9	4	5	5	103	6-7	6-5	10-10	3-3	2-1	1.481	423	1.630	1.07	1.39	1.51	1.50		
		11-7.5	11-8	2 TO 10	9.5	10	10	4	6	6	4	5	5	88	5-5	2-7	10-7	3-1	1-11	1.319	285		1.16	1.51	1.74	1.71		
		11-9	11-10	10 TO 15	10	11	11	4	6	6	4	5	5	91	4-4	2-8	10-8	3-2	1-11	1.446	285		◆	◆	◆	◆		
		12-0.5	12-0	15 TO 20	12	12.5	12	4	6	6	5	5	5	91	4-7	2-10	10-10	3-4	2-6	1.648	315		◆	◆	◆	◆		
12	6	8-1.5	13-8	< 2	13.5	12	10	4	9	9	4	6	6	97	5-5	3-0	6-11	3-7	2-1	1.446	433	1.852	1.03	1.33	1.42	1.39		
		7-7.5	13-8	2 TO 8	9.5	10	10	4	7	7	4	6	6	78	6-4	3-0	6-7	3-5	1-11	1.193	339		1.27	1.65	1.89	1.84		
		7-9	13-8	8 TO 12	9.5	11.5	10	4	7	7	4	6	6	78	5-1	3-0	6-7	3-7	2-0	1.256	333		2.28	2.95	3.25	3.54		
		8-0.5	13-10	12 TO 16	12	12.5	11	4	7	7	4	6	6	81	5-0	3-1	6-10	3-7	2-0	1.453	339		◆	◆	◆	◆		
	8	8-0.5	14-0	16 TO 20	12	12.5	12	5	7	7	5	6	6	81	5-2	3-2	6-10	3-8	2-6	1.503	361	1.852	1.00	1.29	1.37	1.35		
		10-1.5	13-8	< 2	13.5	12	10	4	9	9	4	6	6	105	6-6	3-0	8-11	3-7	2-1	1.569	462		1.21	1.57	1.77	1.73		
		9-8	13-8	2 TO 8	9.5	10.5	10	4	7	7	4	6	6	86	5-1	3-0	8-7	3-6	1-11	1.337	355		2.32	3.01	3.31	3.60		
		9-9.5	13-8	8 TO 12	10	11.5	10	4	7	7	4	6	6	86	5-5	3-0	8-8	3-7	2-0	1.401	358		◆	◆	◆	◆		
	10	9-9.5	13-10	12 TO 16	10	11.5	11	4	7	7	4	6	6	89	5-0	3-1	8-8	3-7	2-0	1.461	360		◆	◆	◆	◆		
		10-0.5	14-0	16 TO 20	12	12.5	12	5	7	7	4	6	6	89	5-1	3-1	8-10	3-7	2-1	1.651	385		◆	◆	◆	◆		
		12-2	13-8	< 2	13.5	12.5	10	4	9	9	4	6	6	113	7-10	6-3	10-11	3-8	2-2	1.714	513	1.852	1.04	1.35	1.43	1.41		
		11-8	13-8	2 TO 8	9.5	10.5	10	4	7	7	4	6	6	94	6-4	3-0	10-7	3-6	1-11	1.461	385		1.15	1.50	1.69	1.65		
		11-9.5	13-8	8 TO 12	10	11.5	10	4	7	7	4	6	6	94	5-1	3-0	10-8	3-7	2-0	1.524	379		2.08	2.70	2.97	2.16		
		11-9.5	13-10	12 TO 16	10	11.5	11	5	7	7	4	7	7	97	5-1	3-2	10-8	4-0	2-0	1.597	456		◆	◆	◆	◆		
		12-1	14-0	16 TO 20	12.5	12.5	12	5	7	7	4	7	7	97	5-2	3-3	10-10	4-0	2-1	1.821	462		◆	◆	◆	◆		
		8-3.5	15-8	< 2	14	13.5	10	4	9	9	4	6	6	107	5-10	3-5	6-11	3-9	2-0	1.700	479	2.074	1.10	1.43	1.48	1.41		
14	6	7-8	15-8	2 TO 6	9.5	10.5	10	4	8	8	4	7	7	84	7-3	3-5	6-7	3-11	1-11	1.337	460		1.13	1.47	1.65	1.59		
		7-8.5	15-8	6 TO 8	9.5	11	10	4	8	8	4	7	7	84	5-9	3-5	6-7	3-11	2-0	1.362	448		1.67	2.16	2.50	3.01		
		7-10.5	15-8	8 TO 10	10.5	12	10	4	8	8	4	7	7	84	5-9	3-5	6-8	4-0	2-1	1.458	450		2.66	3.45	3.89	4.43		
		7-11.5	15-8	10 TO 12	11	12.5	10	4	8	8	4	7	7	84	5-9	3-5	6-9	4-1	2-1	1.507	452		2.65	3.44	3.79	4.11		
	8	8-1.5	15-8	12 TO 14	12	13.5	10	4	8	8	4	7	7	84	5-9	3-5	6-10	4-2	2-2	1.603	453		3.13	4.05	4.38	4.89		
		8-1.5	15-10	14 TO 18	12	13.5	11	5	8	8	5	7	7	87	5-9	3-6	6-10	4-2	2-7	1.654	500		◆	◆	◆	◆		
		10-4	15-8	< 2	14	14	10	4	9	9	4	6	6	115	5-10	3-6												