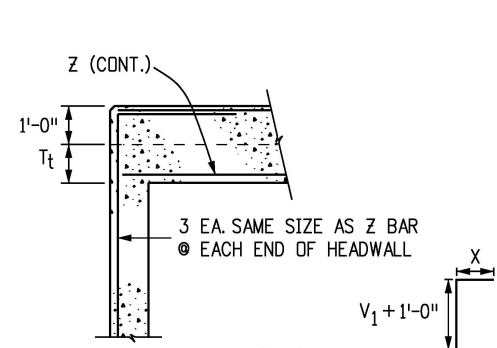
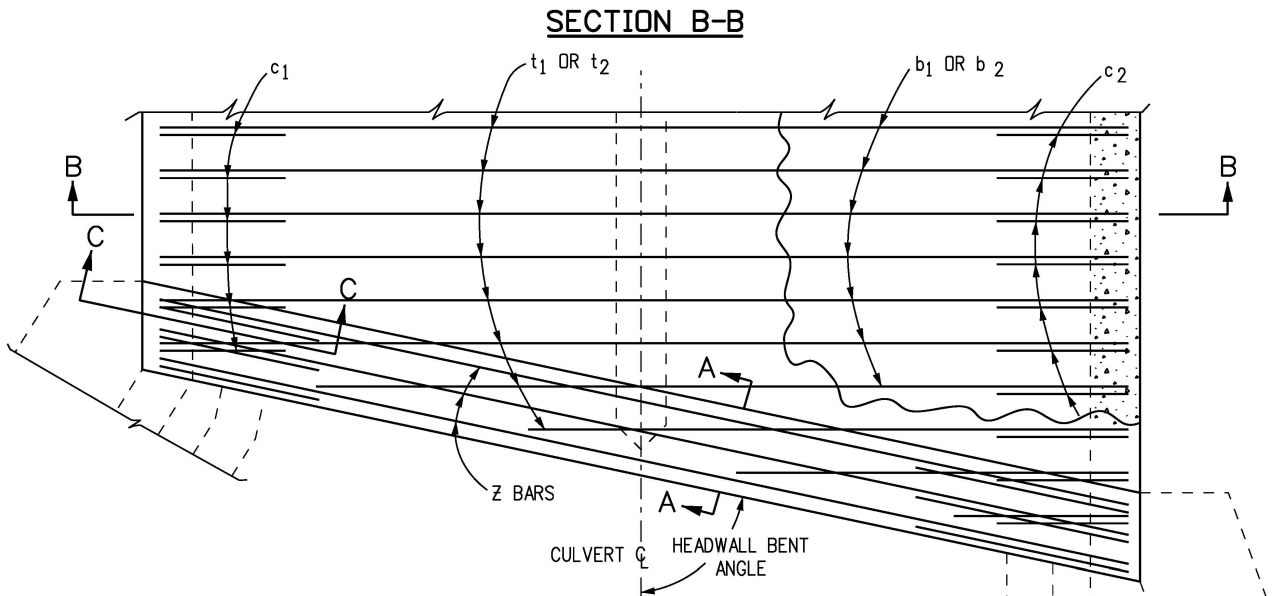
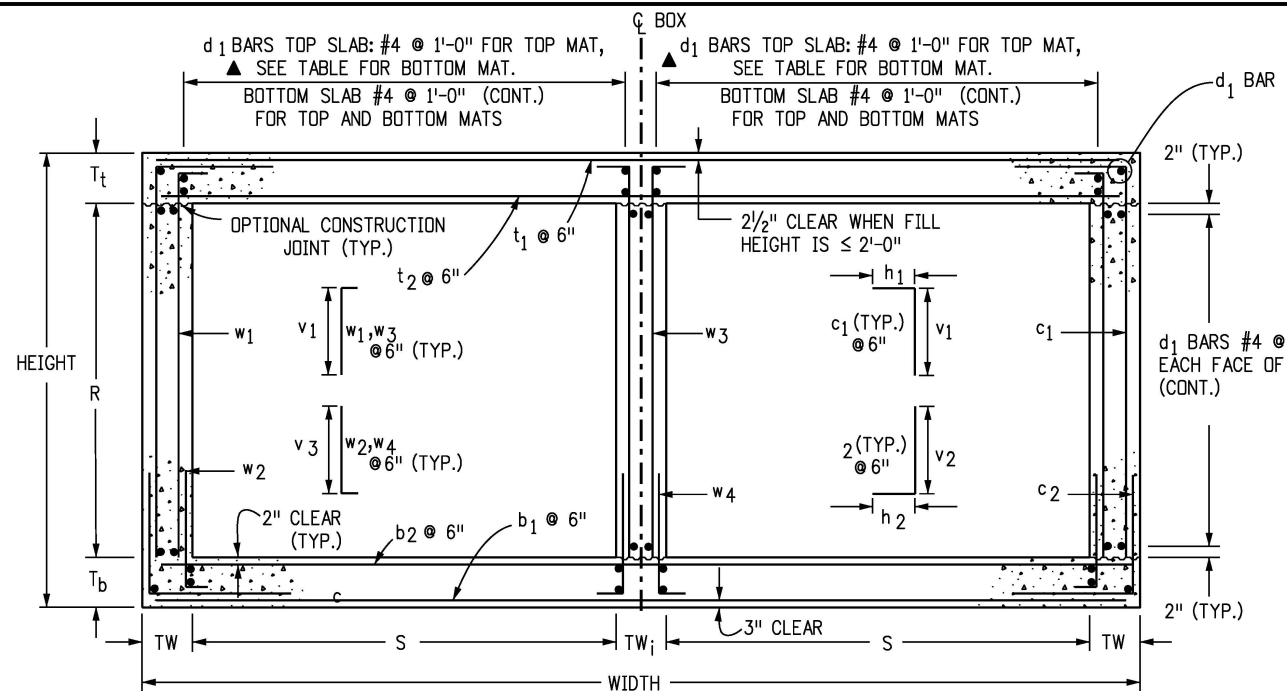
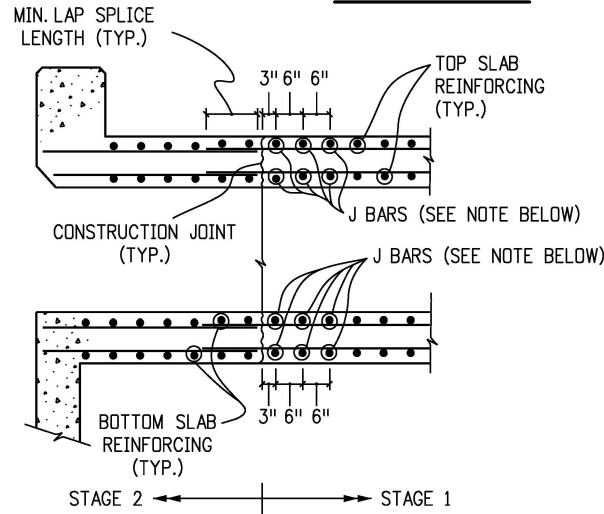
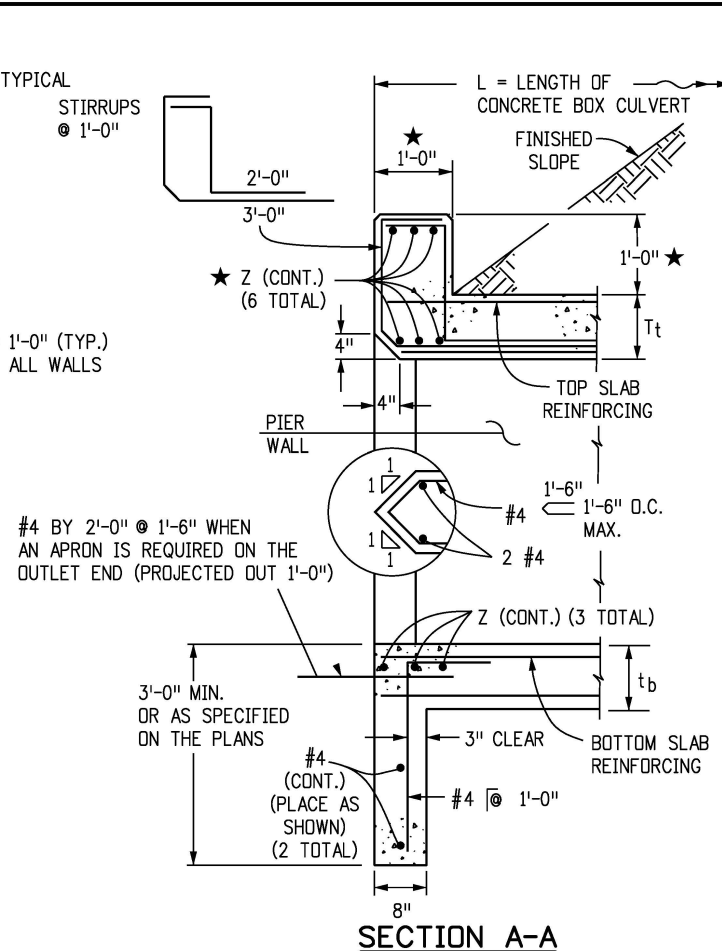




REINFORCING PLAN

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



CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE C 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.
- FOR 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" DOWN ALONG THE TOPS 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, 16	14, 18	20
BAR SIZE:	#4	#5	#6	#7
SPACING	0'-6"	1'-0"	1'-2"	1'-2"

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,

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.

WEARING SURFACE - 12 IN. THICK CONCRETE PAVEMENT.

DEAD LOAD - TYPE 7 BARRIER.

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

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

EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS 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 NOTES 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.

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

Computer File Information		Sheet Revisions		Colorado Department of Transportation	DOUBLE CONCRETE BOX CULVERT (CAST-IN-PLACE)	STANDARD PLAN NO. M-601-2
Creation Date: 07/31/19		Date:	Comments			
Designer Initials: JBE	(R-X)			2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868	Issued by the Project Development Branch: July 31, 2019	Standard Sheet No. 1 of 2
Last Modification Date: 07/31/19	(R-X)					
Detailer Initials: LTA	(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)					
				Project Development Branch	JBK	Project Sheet Number:

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

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL (INHES)			BAR SIZES										DIMENSIONS					QUANTITIES			RATING FACTORS					
S	R	HT.	WIDTH		T ₁	T _b	TW & TW _l	t ₁ *	t ₂	b ₁	b ₂	w ₁ *	w ₂	w ₃ *	w ₄	c ₁ *	c ₂	d ₁ *	NO.	h ₁	h ₂	v ₁	v ₂	v ₃	CONCRETE	REBAR STL	MEMBRANE	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	CY/LF	INVENTORY	OPERATING	PERMIT	VEHICLE
6	6	7-9	14-6	< 2	11	10	10	5	6	5	6	4	4	4	4	5	5	114	3-5	2-4	6-8	3-1	1-11	1.495	338	1.944	1.27	1.65	2.09	2.05	
		7-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	300		1.81	2.35	2.90	2.82	
		7-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	258		4.53	5.88	6.42	7.36	
		7-8	14-6	12.8 TO 20	10	10	10	4	4	4	4	4	4	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.451	258		◆	◆	◆	◆	
		9-9	14-6	< 2	11	10	10	5	6	5	6	4	4	4	4	5	5	126	3-5	2-4	8-8	3-1	1-11	1.681	365	1.944	1.28	1.66	2.10	2.05	
		9-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.613	327		1.82	2.36	2.85	2.77	
	8	9-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.613	285		4.66	6.04	6.82	5.08	
		9-8	14-6	12.8 TO 20	10	10	10	4	5	5	5	4	4	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.636	317		◆	◆	◆	◆	
		11-9	14-6	< 2	11	10	10	5	6	5	6	4	4	4	4	5	5	138	3-5	2-4	10-8	3-1	1-11	1.866	392	1.944	1.28	1.67	1.00	2.06	
		11-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	4	4	5	5	126	2-6	2-4	10-8	3-1	1-11	1.799	354		1.83	2.38	1.00	2.78	
		11-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	4	4	5	5	126	2-6	2-4	10-8	3-1	1-11	1.799	312		2.22	2.88	2.79	1.96	
		11-8.5	14-10.5	12.8 TO 20	10	10.5	11.5	4	5	4	5	4	4	4	4	5	5	126	2-6	2-4	10-8	3-2	2-0	2.006	336		◆	◆	◆	◆	
8	6	7-10.5	18-6	< 2	12.5	10	10	5	6	5	6	4	4	4	4	5	5	134	3-5	2-4	6-10	3-1	1-11	1.840	394	2.389	1.20	1.56	1.76	1.65	
		7-8	18-6	2 TO 10	10	10	10	5	5	5	5	4	4	4	4	5	5	118	2-6	2-4	6-8	3-1	1-11	1.698	344		1.47	1.90	2.19	2.15	
		7-10	18-6	10 TO 15	10	12	10	5	4	5	5	4	4	4	4	5	5	118	2-6	2-4	6-8	3-3	2-1	1.812	332		2.89	3.74	4.00	4.38	
		7-11	18-9	15 TO 16.8	10.5	12.5	11	5	4	5	5	4	4	4	4	5	5	118	2-6	2-5	6-8	3-4	2-2	1.942	335		3.37	4.37	4.60	4.86	
		7-11	18-9	16.8 TO 20	10.5	12.5	11	5	4	5	5	4	4	4	4	5	5	118	2-6	2-4	6-8	3-4	2-2	1.942	335		◆	◆	◆	◆	
		9-10.5	18-6	< 2	12.5	10	10	5	6	5	6	4	4	4	4	5	5	146	3-5	2-4	8-10	3-1	1-11	2.025	421	2.389	1.21	1.57	1.71	1.61	
	8	9-8	18-6	2 TO 10	10	10	10	5	5	5	5	4	4	4	4	5	5	130	2-6	2-4	8-8	3-1	1-11	1.883	371		1.46	1.89	2.18	2.13	
		9-10	18-6	10 TO 15	10	12	10	5	4	5	5	4	4	4	4	5	5	130	2-6	2-4	8-8	3-3	2-1	1.997	359		2.96	3.83	4.10	4.37	
		9-11	18-9	15 TO 16.8	10.5	12.5	11	5	4	5	5	4	4	4	4	5	5	130	2-6	2-5	8-8	3-4	2-2	2.146	362		3.44	4.46	4.70	4.96	
		9-11	18-9	16.8 TO 20	10.5	12.5	11	5	4	5	5	4	4	4	4	5	5	130	2-6	2-5	8-8	3-4	2-2	2.146	362		◆	◆	◆	◆	
		10	8-0.5	22-6	< 2	13.5	11	10	5	6	5	6	4	4	4	4	5	5	134	3-5	2-4	6-11	3-2	2-0	2.257	444	2.833	1.15	1.49	1.65	1.49
			8-1.5	22-6	2 TO 5	13	12.5	10	5	6	5	6	4	4	4	4	5	5	134	2-6	2-4	6-11	3-4	2-2	2.326	434		1.52	1.98	1.82	1.84
8-2	22-6		5 TO 10	13	13	10	5	4	6	6	4	4	4	4	5	5	134	2-6	2-4	6-11	3-5	2-2	2.361	417		1.77	2.29	2.65	3.77		
8-2.5	22-9		10 TO 15	13	13.5	11	6	5	6	6	5	5	5	5	5	5	134	2-6	2-5	6-11	3-5	2-7	2.472	495		3.57	4.63	4.62	5.05		
8-5.5	23-0		15 TO 20	14	15.5	12	6	5	6	6	5	5	5	5	5	5	134	2-6	2-6	7-0	3-7	2-9	2.761	501		3.36	4.36	4.38	4.52		
10-1	22-6		< 2	14	11	10	5	6	5	6	4	4	4	4	5	5	146	3-5	2-5	8-11	3-2	2-0	2.477	472	2.833	1.22	1.58	1.60	1.44		
10	8	10-1.5	22-6	2 TO 5	13	12.5	10	5	6	5	6	4	4	4	5	5	146	2-6	2-4	8-11	3-4	2-2	2.512	461		1.52	1.97	1.79	1.79		
		10-3	22-6	5 TO 10	13	14	10	5	4	5	6	4	4	4	5	5	146	2-6	2-4	8-11	3-5	2-3	2.616	425		1.74	2.25	2.61	3.53		
		10-3	22-9	10 TO 15	13	14	11	6	5	6	5	5	5	5	5	5	146	2-6	2-5	8-11	3-5	2-7	2.711	508		3.95	5.12	5.26	5.69		
		10-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	6	6	6	5	5	146	2-6	2-6	9-0	3-7	2-9	2.983	588		3.46	4.48	4.51	4.64		
		12-2	22-6	< 2	14	12	10	5	6	5	6	4	4	4	4	5	5	158	3-5	2-5	10-11	3-3	2-1	2.731	499	2.833	1.24	1.60	1.79	1.61	
		12-2	22-6	2 TO 5	13	13	10	5	6	5	6	4	4	4	4	5	5	158	2-6	2-4	10-11	3-4	2-2	2.731	488		1.64	2.12	1.89	1.88	
	10	12-3	22-6	5 TO 10	13	14	10	5	4	5	6	4	4	4	4	5	5	158	2-6	2-4	10-11	3-5	2-3	2.801	452		1.72	2.23	2.58	2.74	
		12-5.5	22-9	10 TO 15	14	15.5	11	5	6	6	4	5	5	5	5	5	5	158	2-6	2-5	11-0	3-7	2-9	3.090	527		2.42	3.14	3.18	2.25	
		12-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	5	5	5	5	5	5	158	2-6	2-5	11-0	3-7	2-9	3.205	567		2.11	2.73	2.64	1.86	
		6	8-3.5	26-6	< 2	14.5	13	10	5	6	5	6	4	4	4	4	5	5	150	3-5	2-5	7-0	3-4	2-2	2.805	500	3.278	1.16	1.51	1.51	1.59
			8-5	26-6	2 TO 5	14	15	10	5	6	6	6	4	4	4	4	5	5	150	2-6	2-4	7-0	3-6	2-4	2.927	512		1.22	1.59	1.43	1.54
			8-5.5	26-6	5 TO 10	14	15.5	10	6	5	6	6	4	4	4	4	5	5	150	2-6	2-4	7-0	3-6	2-5	2.968	488		2.10	2.72	3.13	3.89
8-6.5	26-9		10 TO 15	15	15.5	11	6	6	7	6	5	5	5	5	5	5	150	3-3	2-5	7-1	3-7	2-9	3.129	610		1.86	2.42	2.36	2.53		
10-4	26-6		< 2	14.5	13.5	10	5	6	5	6	4	4	4	4	5	5	162	3-5	2-5	9-0	3-5	2-3	3.031	528	3.278	1.16	1.51	1.56	1.59		
10-5.5	26-6		2 TO 5	14	15.5	10	5	6	5	6	4	4	4	4	5	5	162	2-6	2-4	9-0	3-7	2-5	3.154</								