



COLLISION and INJURY DYNAMICS, Inc.

149 Sheldon Street • El Segundo, CA 90245

Phone: 310.414.0449 • FAX: 310.414.9490

www.ci-dynamics.com

May 3, 2005

To All Interested Parties:

Collision and Injury Dynamics, Inc. (CID) recently performed a series of tests on 32 full-facial coverage motorcycle helmets. These tests were done for Motorcyclist Magazine and results will be published in an upcoming issue. The staff of CID and the editors of Motorcyclist believe that the timeliness of this work relative to the Medical College of Wisconsin/Snell Memorial Foundation Workshop on Criteria for Head Injury and Helmet Standards requires that it be shared with those participants.

There were 16 different makes and models with two identical samples of each. Each helmet was impact tested in four locations, with a single impact per site. Three sites per helmet were tested for impact into a asphalt pavement anvil and the remaining site was tested against an Edge anvil. Impact drop heights were two and three meters for impact velocities of 6.3 and 7.6 m/sec. Three sites were tested at the 2m height, two on pavement and one against the edge anvil. The remaining site received a 3m impact on pavement. All tests were done on a magnesium ISO size J headform on a monorail test apparatus. Helmets were both thermoplastic and composite within the different standards and all were size medium.

The impact anvils and velocities were chosen as being realistic and common. A motorcyclist could encounter a more severe impact velocity than tested here. However, a universal truth in crash investigations is that there is never more than one severe impact at any given site on a helmet, hence the single impact tests performed in these tests.

A brief summary of the data is presented in Table 1 below. More complete data is enclosed as Appendices 1 and 2.

Table 1
Summary of Peak Acceleration and HIC by Standard

Standard (n helmets)	Avg. g (all hits)	Avg. g all 2m flat ¹	Avg. g all 3m flat	Avg. g for all 2m edge	Avg. HIC (all hits)	Avg. HIC all 2m flat	Avg. HIC all 3m flat	Avg. HIC for all 2m edge
BSI (4)	176	185	207	127	1318	1261	1684	785
DOT (6)	161	163	176	182	1166	1115	1568	866
ECE (8)	170	172	191	145	1203	1155	1437	949
SMF (14)	194	193	223	165	1550	1442	2229	1087

We trust that this information will be useful in the discussions about head injury criteria during the upcoming workshop.

Sincerely yours,



David R. Thom, MS
Collision and Injury Dynamics, Inc.

Enclosures:

Appendix 1, Peak Acceleration Data Summary
Appendix 2, HIC Data Summary

¹ All flat impacts on asphalt pavement anvil

Appendix 1 Peak Acceleration

ID	Std	Location	Anvil	Velocity	Joules	Peak g	t@150g	t@200g	Avg g of two hits on both Helmets	Avg g of 4 hits	Avg g of 8 hits	Avg. g by std.	Avg g for all 2m flat Pave	Avg g for all 3m flat Pave	Avg g for Edge
MCST21	BSI	FR,LF	Pave	6.3	99.6	188	3.20	0.00	192						
MCST21	BSI	FR,RG	Pave	7.6	145.8	215	3.80	1.90	215						
MCST21	BSI	LF,RR	Pave	6.2	96.5	195	3.00	0.00	197						
MCST21	BSI	RG,RR	EDGE	6.4	103.5	132	0.00	0.00	126	183					
MCST22	BSI	FR,LF	Pave	6.4	103.5	196	3.20	0.00							
MCST22	BSI	FR,RG	Pave	7.6	145.8	215	3.90	1.70							
MCST22	BSI	LF,RR	Pave	6.2	96.5	198	3.00	0.00							
MCST22	BSI	RG,RR	EDGE	6.4	102.8	119	0.00	0.00		182	182				
MCST30	BSI	FR,LF	Pave	6.3	99.3	157	1.40	0.00	156						
MCST30	BSI	FR,RG	Pave	7.6	145.0	192	3.20	0.00	199						
MCST30	BSI	LF,RR	Pave	6.3	99.6	194	3.10	0.00	195						
MCST30	BSI	RG,RR	EDGE	6.3	99.3	126	0.00	0.00	129	167					
MCST31	BSI	FR,LF	Pave	6.3	99.6	154	0.70	0.00							
MCST31	BSI	FR,RG	Pave	7.5	139.7	205	3.20	0.80							
MCST31	BSI	LF,RR	Pave	6.2	96.2	196	3.00	0.00							
MCST31	BSI	RG,RR	EDGE	6.3	99.6	131	0.00	0.00		172	169	176	185	207	127
MCST13	DOT	FR,LF	Pave	6.4	102.8	140	0.00	0.00	149						
MCST13	DOT	FR,RG	Pave	7.6	145.8	175	3.50	0.00	176						
MCST13	DOT	LF,RR	Pave	6.2	96.2	143	0.00	0.00	154						
MCST13	DOT	RG,RR	EDGE	6.3	99.6	121	0.00	0.00	130	145					
MCST14	DOT	FR,LF	Pave	6.4	102.8	157	2.00	0.00							
MCST14	DOT	FR,RG	Pave	7.6	145.8	177	3.60	0.00							
MCST14	DOT	LF,RR	Pave	6.2	96.2	164	0.90	0.00							
MCST14	DOT	RG,RR	EDGE	6.4	102.8	138	0.00	0.00		159	152				
MCST27	DOT	FR,LF	Pave	6.2	96.2	149	0.00	0.00	152						
MCST27	DOT	FR,RG	Pave	7.6	145.8	172	3.30	0.00	173						
MCST27	DOT	LF,RR	Pave	6.3	98.4	175	2.60	0.00	175						
MCST27	DOT	RG,RR	EDGE	6.3	99.6	130	0.00	0.00	130	157					
MCST29	DOT	FR,LF	Pave	6.3	99.6	154	0.50	0.00							
MCST29	DOT	FR,RG	Pave	7.6	145.8	173	3.40	0.00							
MCST29	DOT	LF,RR	Pave	6.2	96.2	175	2.60	0.00							
MCST29	DOT	RG,RR	EDGE	6.2	96.2	129	0.00	0.00		158	157				
MCST36	DOT	FR,LF	Pave	6.4	103.5	163	1.80	0.00	163						
MCST36	DOT	FR,RG	PAVE	7.6	145.8	201	3.40	0.10	199						
MCST36	DOT	LF,RR	Pave	6.5	107.4	185	3.00	0.00	185						
MCST36	DOT	RG,RR	EDGE	6.4	103.5	149	0.00	0.00	152	175					
MCST37	DOT	FR,LF	Pave	6.4	103.5	162	1.90	0.00							
MCST37	DOT	FR,RG	PAVE	7.6	145.0	196	3.20	0.00							
MCST37	DOT	LF,RR	Pave	6.4	103.5	185	3.10	0.00							
MCST37	DOT	RG,RR	EDGE	6.4	103.5	154	1.00	0.00		174	174	161	163	176	182
MCST07	ECE	FR,LF	Pave	6.3	99.6	140	0.00	0.00	151						
MCST07	ECE	FR,RG	Pave	7.6	145.0	165	0.70	0.00	180						
MCST07	ECE	LF,RR	Pave	0.0	0.0	173	0.00	0.00	176						
MCST07	ECE	RG,RR	EDGE	6.3	99.6	135	0.00	0.00	137	153					
MCST08	ECE	FR,LF	Pave	6.3	99.6	161	1.80	0.00							
MCST08	ECE	FR,RG	Pave	7.6	145.8	194	3.30	0.00							
MCST08	ECE	LF,RR	Pave	6.3	99.6	178	2.30	0.00							
MCST08	ECE	RG,RR	EDGE	6.3	99.6	138	0.00	0.00		168	161				
MCST15	ECE	FR,LF	Pave	6.3	99.6	169	2.30	0.00	171						
MCST15	ECE	FR,RG	Pave	7.6	145.8	199	3.80	0.00	198						
MCST15	ECE	LF,RR	Pave	6.2	96.2	166	1.90	0.00	166						
MCST15	ECE	RG,RR	EDGE	6.4	102.8	166	1.50	0.00	162	175					
MCST16	ECE	FR,LF	Pave	6.3	99.6	172	2.80	0.00							
MCST16	ECE	FR,RG	Pave	7.8	151.6	197	3.70	0.00							
MCST16	ECE	LF,RR	Pave	6.3	99.6	166	1.60	0.00							
MCST16	ECE	RG,RR	EDGE	6.4	103.5	158	1.10	0.00		173	174				
MCST32	ECE	FR,LF	Pave	6.4	102.8	157	0.90	0.00	156						
MCST32	ECE	FR,RG	PAVE	7.8	152.7	204	3.70	0.40	200						
MCST32	ECE	LF,RR	Pave	6.4	103.5	190	3.00	0.00	190						
MCST32	ECE	RG,RR	EDGE	6.4	102.8	141	0.00	0.00	140	173					
MCST33	ECE	FR,LF	Pave	6.4	103.5	155	1.60	0.00							
MCST33	ECE	FR,RG	PAVE	7.8	152.7	196	3.30	0.00							
MCST33	ECE	LF,RR	Pave	6.4	103.5	190	3.00	0.00							
MCST33	ECE	RG,RR	EDGE	6.5	107.4	138	0.00	0.00		170	171				

Appendix 1 Peak Acceleration

MCST34	ECE	FR,LF	Pave	6.3	99.6	165	1.90	0.00	166							
MCST34	ECE	FR,RG	PAVE	7.3	134.5	186	3.40	0.00	187							
MCST34	ECE	LF,RR	Pave	6.4	102.8	208	3.20	0.80	201							
MCST34	ECE	RG,RR	EDGE	6.4	103.5	145	0.00	0.00	141	176						
MCST35	ECE	FR,LF	Pave	6.4	103.5	166	2.00	0.00								
MCST35	ECE	FR,RG	PAVE	7.8	152.7	187	3.10	0.00								
MCST35	ECE	LF,RR	Pave	6.4	103.5	194	3.00	0.00								
MCST35	ECE	RG,RR	EDGE	6.3	99.6	136	0.00	0.00			171	173	170	172	191	145
MCST03	Snell	FR,LF	Pave	6.3	99.6	192	3.20	0.00	193							
MCST03	Snell	FR,RG	Pave	7.6	145.0	245	3.90	2.90	243							
MCST03	Snell	LF,RR	Pave	6.2	96.5	202	3.00	0.20	203							
MCST03	Snell	RG,RR	EDGE	6.3	99.6	168	2.40	0.00	166	202						
MCST04	Snell	FR,LF	Pave	6.4	102.8	194	3.10	0.00								
MCST04	Snell	FR,RG	Pave	7.6	145.0	241	3.90	2.70								
MCST04	Snell	LF,RR	Pave	6.2	96.5	204	2.90	0.50								
MCST04	Snell	RG,RR	EDGE	6.3	99.6	163	2.10	0.00		201	201					
MCST05	Snell	FR,LF	Pave	6.4	103.5	203	3.30	0.30	195							
MCST05	Snell	FR,RG	Pave	7.8	151.6	225	3.90	2.70	230							
MCST05	Snell	LF,RR	Pave	6.2	96.2	230	3.30	1.60	231							
MCST05	Snell	RG,RR	EDGE	6.3	99.6	147	0.00	0.00	163	201						
MCST06	Snell	FR,LF	Pave	6.3	99.6	187	3.30	0.00								
MCST06	Snell	FR,RG	Pave	7.6	145.0	234	3.90	2.80								
MCST06	Snell	LF,RR	Pave	6.3	99.6	231	2.90	1.50								
MCST06	Snell	RG,RR	EDGE	6.3	99.6	178	1.20	0.00		208	204					
MCST09	Snell	FR,LF	Pave	6.3	99.6	186	3.30	0.00	179							
MCST09	Snell	FR,RG	Pave	7.6	145.8	201	3.80	0.30	200							
MCST09	Snell	LF,RR	Pave	6.3	99.6	181	3.30	0.00	179							
MCST09	Snell	RG,RR	EDGE	6.3	99.6	175	2.70	0.00	175	186						
MCST10	Snell	FR,LF	Pave	6.4	102.8	172	3.40	0.00								
MCST10	Snell	FR,RG	Pave	7.8	151.6	199	3.90	0.00								
MCST10	Snell	LF,RR	Pave	6.3	99.6	177	3.30	0.00								
MCST10	Snell	RG,RR	EDGE	6.4	102.8	175	2.00	0.00		181	183					
MCST11	Snell	FR,LF	Pave	6.4	102.8	167	2.80	0.00	168							
MCST11	Snell	FR,RG	Pave	7.6	145.8	210	3.80	1.40	217							
MCST11	Snell	LF,RR	Pave	6.3	99.3	191	2.80	0.00	189							
MCST11	Snell	RG,RR	EDGE	6.3	99.6	152	0.40	0.00	152	180						
MCST12	Snell	FR,LF	Pave	6.4	102.8	168	2.60	0.00								
MCST12	Snell	FR,RG	Pave	7.6	145.8	224	3.70	2.10								
MCST12	Snell	LF,RR	Pave	6.3	99.6	186	2.70	0.00								
MCST12	Snell	RG,RR	EDGE	6.3	99.6	152	0.50	0.00		183	181					
MCST17	Snell	FR,LF	Pave	6.4	102.8	204	3.50	0.60	207							
MCST17	Snell	FR,RG	Pave	7.6	145.0	239	4.20	2.60	236							
MCST17	Snell	LF,RR	Pave	6.3	99.6	229	3.40	1.40	226							
MCST17	Snell	RG,RR	EDGE	6.3	99.6	174	1.50	0.00	176	212						
MCST18	Snell	FR,LF	Pave	6.3	99.6	209	3.30	0.80								
MCST18	Snell	FR,RG	Pave	7.8	151.6	233	4.20	2.60								
MCST18	Snell	LF,RR	Pave	6.2	96.5	223	2.70	1.20								
MCST18	Snell	RG,RR	EDGE	6.4	103.5	177	1.60	0.00		211	211					
MCST19	Snell	FR,LF	Pave	6.4	103.5	184	3.20	0.00	185							
MCST19	Snell	FR,RG	Pave	7.8	151.6	206	4.00	0.90	212							
MCST19	Snell	LF,RR	Pave	6.2	96.2	192	3.30	0.00	193							
MCST19	Snell	RG,RR	EDGE	6.3	99.6	153	0.50	0.00	158	184						
MCST20	Snell	FR,LF	Pave	6.3	99.6	185	3.30	0.00								
MCST20	Snell	FR,RG	Pave	7.6	145.8	218	4.00	2.00								
MCST20	Snell	LF,RR	Pave	6.2	96.2	193	3.30	0.00								
MCST20	Snell	RG,RR	EDGE	6.3	99.6	162	0.90	0.00		190	187					
MCST24	Snell	FR,LF	Pave	6.3	99.6	197	3.10	0.00	192							
MCST24	Snell	FR,RG	Pave	7.8	151.6	226	3.70	2.20	226							
MCST24	Snell	LF,RR	Pave	6.2	96.2	162	1.70	0.00	166							
MCST24	Snell	RG,RR	EDGE	6.3	99.6	151	0.70	0.00	167	184						
MCST25	Snell	FR,RG	Pave	6.3	99.6	186	3.10	0.00								
MCST25	Snell	FR,RG	Pave	7.8	151.6	225	3.70	2.20								
MCST25	Snell	LF,RR	Pave	6.1	93.1	170	1.90	0.00								
MCST25	Snell	RG,RR	EDGE	6.4	102.8	183	1.40	0.00		191	188	194	193	223	165	

Appendix 2 Head Injury Criteria (HIC)

ID	Std	Location	Anvil	Velocity	Joules	Peak g	HIC	Avg.HIC. 4 hits	Avg. HIC. 8 hits	Avg. HIC by Std.	Avg HIC for 2m flat pave	Avg HIC for 3m flat pave	Avg HIC for Edge
MCST21	BSI	FR,LF	Pave	6.3	99.6	188	1459						
MCST21	BSI	FR,RG	Pave	7.6	145.8	215	2046						
MCST21	BSI	LF,RR	Pave	6.2	96.5	195	1394						
MCST21	BSI	RG,RR	EDGE	6.4	103.5	132	828	1432					
MCST22	BSI	FR,LF	Pave	6.4	103.5	196	1550						
MCST22	BSI	FR,RG	Pave	7.6	145.8	215	2103						
MCST22	BSI	LF,RR	Pave	6.2	96.5	198	1439						
MCST22	BSI	RG,RR	EDGE	6.4	102.8	119	768	1465	1448				
MCST30	BSI	FR,LF	Pave	6.3	99.3	157	999						
MCST30	BSI	FR,RG	Pave	7.6	145.0	192	1547						
MCST30	BSI	LF,RR	Pave	6.3	99.6	194	1395						
MCST30	BSI	RG,RR	EDGE	6.3	99.3	126	751	1173					
MCST31	BSI	FR,LF	Pave	6.3	99.6	154	913						
MCST31	BSI	FR,RG	Pave	7.5	139.7	205	1675						
MCST31	BSI	LF,RR	Pave	6.2	96.2	196	1422						
MCST31	BSI	RG,RR	EDGE	6.3	99.6	131	794	1201	1187	1318	1261	1684	785
MCST13	DOT	FR,LF	Pave	6.4	102.8	140	1018						
MCST13	DOT	FR,RG	Pave	7.6	145.8	175	1581						
MCST13	DOT	LF,RR	Pave	6.2	96.2	143	929						
MCST13	DOT	RG,RR	EDGE	6.3	99.6	121	776	1076					
MCST14	DOT	FR,LF	Pave	6.4	102.8	157	1242						
MCST14	DOT	FR,RG	Pave	7.6	145.8	177	1700						
MCST14	DOT	LF,RR	Pave	6.2	96.2	164	990						
MCST14	DOT	RG,RR	EDGE	6.4	102.8	138	963	1224	1150				
MCST27	DOT	FR,LF	Pave	6.2	96.2	149	858						
MCST27	DOT	FR,RG	Pave	7.6	145.8	172	1453						
MCST27	DOT	LF,RR	Pave	6.3	98.4	175	1264						
MCST27	DOT	RG,RR	EDGE	6.3	99.6	130	715	1073					
MCST29	DOT	FR,LF	Pave	6.3	99.6	154	935						
MCST29	DOT	FR,RG	Pave	7.6	145.8	173	1500						
MCST29	DOT	LF,RR	Pave	6.2	96.2	175	1255						
MCST29	DOT	RG,RR	EDGE	6.2	96.2	129	753	1111	1092				
MCST36	DOT	FR,LF	Pave	6.4	103.5	163	1042						
MCST36	DOT	FR,RG	PAVE	7.6	145.8	201	1588						
MCST36	DOT	LF,RR	Pave	6.5	107.4	185	1386						
MCST36	DOT	RG,RR	EDGE	6.4	103.5	149	968	1246					
MCST37	DOT	FR,LF	Pave	6.4	103.5	162	1028						
MCST37	DOT	FR,RG	PAVE	7.6	145.0	196	1588						
MCST37	DOT	LF,RR	Pave	6.4	103.5	185	1431						
MCST37	DOT	RG,RR	EDGE	6.4	103.5	154	1022	1267	1257	1166	1115	1568	866
MCST07	ECE	FR,LF	Pave	6.3	99.6	140	875						
MCST07	ECE	FR,RG	Pave	7.6	145.0	165	1134						
MCST07	ECE	LF,RR	Pave	0.0	0.0	173	MD						
MCST07	ECE	RG,RR	EDGE	6.3	99.6	135	766	925					
MCST08	ECE	FR,LF	Pave	6.3	99.6	161	1092						
MCST08	ECE	FR,RG	Pave	7.6	145.8	194	1590						
MCST08	ECE	LF,RR	Pave	6.3	99.6	178	1215						
MCST08	ECE	RG,RR	EDGE	6.3	99.6	138	788	1171	1066				
MCST15	ECE	FR,LF	Pave	6.3	99.6	169	1143						
MCST15	ECE	FR,RG	Pave	7.6	145.8	199	1831						
MCST15	ECE	LF,RR	Pave	6.2	96.2	166	1063						
MCST15	ECE	RG,RR	EDGE	6.4	102.8	166	1057	1274					
MCST16	ECE	FR,LF	Pave	6.3	99.6	172	1223						
MCST16	ECE	FR,RG	Pave	7.8	151.6	197	1752						
MCST16	ECE	LF,RR	Pave	6.3	99.6	166	1020						
MCST16	ECE	RG,RR	EDGE	6.4	103.5	158	994	1247	1260				
MCST32	ECE	FR,LF	Pave	6.4	102.8	157	1020						
MCST32	ECE	FR,RG	PAVE	7.8	152.7	204	1749						
MCST32	ECE	LF,RR	Pave	6.4	103.5	190	1294						
MCST32	ECE	RG,RR	EDGE	6.4	102.8	141	878	1235					
MCST33	ECE	FR,LF	Pave	6.4	103.5	155	1048						
MCST33	ECE	FR,RG	PAVE	7.8	152.7	196	1676						
MCST33	ECE	LF,RR	Pave	6.4	103.5	190	1312						
MCST33	ECE	RG,RR	EDGE	6.5	107.4	138	808	1211	1223				

Appendix 2 Head Injury Criteria (HIC)

MCST34	ECE	FR,LF	Pave	6.3	99.6	165	1015								
MCST34	ECE	FR,RG	PAVE	7.3	134.5	186	1603								
MCST34	ECE	LF,RR	Pave	6.4	102.8	208	1529								
MCST34	ECE	RG,RR	EDGE	6.4	103.5	145	876	1256							
MCST35	ECE	FR,LF	Pave	6.4	103.5	166	1094								
MCST35	ECE	FR,RG	PAVE	7.8	152.7	187	1597								
MCST35	ECE	LF,RR	Pave	6.4	103.5	194	1382								
MCST35	ECE	RG,RR	EDGE	6.3	99.6	136	874	1237	1246	1203	1155	1437	949		
MCST03	Snell	FR,LF	Pave	6.3	99.6	192	1493								
MCST03	Snell	FR,RG	Pave	7.6	145.0	245	2546								
MCST03	Snell	LF,RR	Pave	6.2	96.5	202	1487								
MCST03	Snell	RG,RR	EDGE	6.3	99.6	168	1225	1688							
MCST04	Snell	FR,LF	Pave	6.4	102.8	194	1522								
MCST04	Snell	FR,RG	Pave	7.6	145.0	241	2424								
MCST04	Snell	LF,RR	Pave	6.2	96.5	204	1494								
MCST04	Snell	RG,RR	EDGE	6.3	99.6	163	1171	1653	1670						
MCST05	Snell	FR,LF	Pave	6.4	103.5	203	1563								
MCST05	Snell	FR,RG	Pave	7.8	151.6	225	2377								
MCST05	Snell	LF,RR	Pave	6.2	96.2	230	1796								
MCST05	Snell	RG,RR	EDGE	6.3	99.6	147	1012	1687							
MCST06	Snell	FR,LF	Pave	6.3	99.6	187	1392								
MCST06	Snell	FR,RG	Pave	7.6	145.0	234	2438								
MCST06	Snell	LF,RR	Pave	6.3	99.6	231	1642								
MCST06	Snell	RG,RR	EDGE	6.3	99.6	178	1134	1652	1669						
MCST09	Snell	FR,LF	Pave	6.3	99.6	186	1488								
MCST09	Snell	FR,RG	Pave	7.6	145.8	201	1936								
MCST09	Snell	LF,RR	Pave	6.3	99.6	181	1413								
MCST09	Snell	RG,RR	EDGE	6.3	99.6	175	1193	1508							
MCST10	Snell	FR,LF	Pave	6.4	102.8	172	1342								
MCST10	Snell	FR,RG	Pave	7.8	151.6	199	1963								
MCST10	Snell	LF,RR	Pave	6.3	99.6	177	1448								
MCST10	Snell	RG,RR	EDGE	6.4	102.8	175	1155	1477	1492						
MCST11	Snell	FR,LF	Pave	6.4	102.8	167	1177								
MCST11	Snell	FR,RG	Pave	7.6	145.8	210	1990								
MCST11	Snell	LF,RR	Pave	6.3	99.3	191	1367								
MCST11	Snell	RG,RR	EDGE	6.3	99.6	152	856	1348							
MCST12	Snell	FR,LF	Pave	6.4	102.8	168	1150								
MCST12	Snell	FR,RG	Pave	7.6	145.8	224	2104								
MCST12	Snell	LF,RR	Pave	6.3	99.6	186	1255								
MCST12	Snell	RG,RR	EDGE	6.3	99.6	152	872	1345	1346						
MCST17	Snell	FR,LF	Pave	6.4	102.8	204	1620								
MCST17	Snell	FR,RG	Pave	7.6	145.0	239	2462								
MCST17	Snell	LF,RR	Pave	6.3	99.6	229	1732								
MCST17	Snell	RG,RR	EDGE	6.3	99.6	174	1136	1738							
MCST18	Snell	FR,LF	Pave	6.3	99.6	209	1530								
MCST18	Snell	FR,RG	Pave	7.8	151.6	233	2369								
MCST18	Snell	LF,RR	Pave	6.2	96.5	223	1641								
MCST18	Snell	RG,RR	EDGE	6.4	103.5	177	1178	1680	1709						
MCST19	Snell	FR,LF	Pave	6.4	103.5	184	1438								
MCST19	Snell	FR,RG	Pave	7.8	151.6	206	2014								
MCST19	Snell	LF,RR	Pave	6.2	96.2	192	1486								
MCST19	Snell	RG,RR	EDGE	6.3	99.6	153	1050	1497							
MCST20	Snell	FR,LF	Pave	6.3	99.6	185	1540								
MCST20	Snell	FR,RG	Pave	7.6	145.8	218	2239								
MCST20	Snell	LF,RR	Pave	6.2	96.2	193	1555								
MCST20	Snell	RG,RR	EDGE	6.3	99.6	162	1125	1615	1556						
MCST24	Snell	FR,LF	Pave	6.3	99.6	197	1456								
MCST24	Snell	FR,RG	Pave	7.8	151.6	226	2163								
MCST24	Snell	LF,RR	Pave	6.2	96.2	162	988								
MCST24	Snell	RG,RR	EDGE	6.3	99.6	151	1012	1405							
MCST25	Snell	FR,RG	Pave	6.3	99.6	186	1383								
MCST25	Snell	FR,RG	Pave	7.8	151.6	225	2185								
MCST25	Snell	LF,RR	Pave	6.1	93.1	170	969								
MCST25	Snell	RG,RR	EDGE	6.4	102.8	183	1103	1410	1407	1550	1442	2229	1087		