

APPENDIX

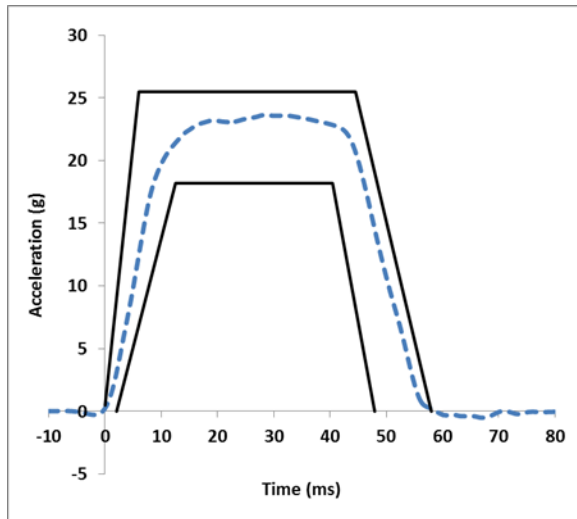


Figure A1. Sample sled pulse scaled to 35 km/h delta-v and upper and lower boundaries for proposed FMVSS 213 side impact pulse.

Table A1. BrIC and maximum angular velocities and times

Test Number	Angle	Tether	BrIC	X Ang. Vel. [Max -] (rad/s)	Time (ms)	X Ang. Vel. [Max +] (rad/s)	Time (ms)	Y Ang. Vel. [Max -] (rad/s)	Time (ms)	Y Ang. Vel. [Max +] (rad/s)	Time (ms)	Z Ang. Vel. [Max -] (rad/s)	Time (ms)	Z Ang. Vel. [Max +] (rad/s)	Time (ms)
201	60/30	Yes	1.27	-50.6	72	19.9	105	-40.9	64	20.5	95	-17.2	148	30.3	97
202	60/30	Yes	1.37	-53.2	72	21.7	106	-44.9	64	19.1	93	-18.5	149	33.0	89
206	80/10	Yes	1.25	-65.8	76	19.8	103	-30.4	70	3.3	200	-22.9	71	16.5	90
207	80/10	Yes	1.45	-57.0	74	17.3	111	-38.7	69	8.1	96	-23.6	70	40.4	93
203	60/30	No	1.35	-55.1	81	28.4	95	-44.8	68	21.5	118	-25.7	136	30.5	86
204	60/30	No	1.45	-55.4	77	14.3	98	-42.4	67	8.3	87	-5.7	143	39.4	86
205	60/30	No	1.33	-52.2	81	26.1	96	-45.9	70	16.8	116	-22.2	137	30.3	87
208	80/10	No	1.37	-78.3	76	15.3	98	-31.8	73	4.9	188	-18.0	74	12.2	98
209	80/10	No	1.42	-82.3	76	15.2	113	-30.2	73	5.2	200	-18.5	74	12.2	97

Table A2. Maximum neck forces and moments and times

Test	Angle	Tether	Neck Tension (kN)	Time (ms)	Upper Neck Mx (Nm)	Time (ms)	Upper Neck My (Nm)	Time (ms)
201	60/30	Yes	2.6	75	25.6	81	-20.5	125
202	60/30	Yes	3	75	23.8	82	-19.7	124
206	80/10	Yes	2.1	77	40.6	84	-14.4	64
207	80/10	Yes	1.9	77	35.1	80	-18.5	63
203	60/30	No	2.6	82	17.4	84	-16.7	61
204	60/30	No	2.6	80	23.4	85	-16.6	60
205	60/30	No	2.7	80	15.6	83	-17.6	62
208	80/10	No	1.9	77	18.6	78	-18.5	63
209	80/10	No	2.1	77	22.1	78	-15.7	81

Table A3. Maximum shoulder deflection, chest deflection, pelvis resultant acceleration, pubic symphysis force and times.

Test	Angle	Tether	Left Shldr Comp. (mm)	Time (ms)	Chest Lateral Deflect. (mm)	Time (ms)	T1 Accel. (g)	Time (ms)	Thoracic Result. Accel (g)	Time (ms)	Pubic Symphysis Force (N)	time (ms)	Pelvis Result. Accel. (g)	Time (ms)
201	60/30	Yes	8	62	3	72	47.5	63	50.4	63	98.0	51	45.5	54
202	60/30	Yes	10	64	3	75	51.9	63	55.4	63	71.1	50	49.6	55
206	80/10	Yes	9	60	1	47	54.8	62	60.3	62	199.7	53	47.3	62
207	80/10	Yes	8	61	6	69	53.7	63	54.5	63	211.3	67	51.8	62
203	60/30	No	11	67	8	77	49.5	69	47.9	56	43.1	48	55.1	57
204	60/30	No	10	59	7	76	46.2	65	47.6	64	62.4	49	50.0	57
205	60/30	No	11	69	7	102	46.1	67	50.3	57	53.2	48	54.1	58
208	80/10	No	13	63	4	63	81.7	66	77.9	66	342.3	53	54.2	53
209	80/10	No	10	61	4	199	69.9	67	65.6	67	208.2	65	56.5	60

Table A4. Belt webbing max load magnitude, timing, and head impact

Test	Angle	Tether	Tether Belt Force (N)	Time (ms)	LATCH Belt Force (N)	Time (ms)	Head Impact
201	60/30	Yes	1220	68	3635	59	N
202	60/30	Yes	1321	66	3600	59	N
206	80/10	Yes	922	53	3382	61	Y
207	80/10	Yes	1032	81	3740	62	Y
203	60/30	No	-	-	4147	62	Y
204	60/30	No	-	-	4248	61	Y
205	60/30	No	-	-	4109	62	Y
208	80/10	No	-	-	4005	60	Y
209	80/10	No	-	-	4301	62	Y

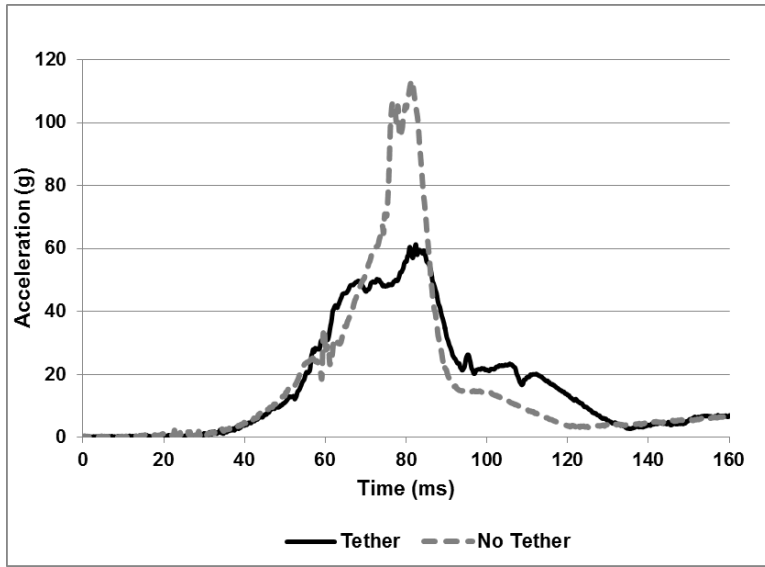


Figure A2. - Sample plots of head resultant acceleration verses time with and without tether

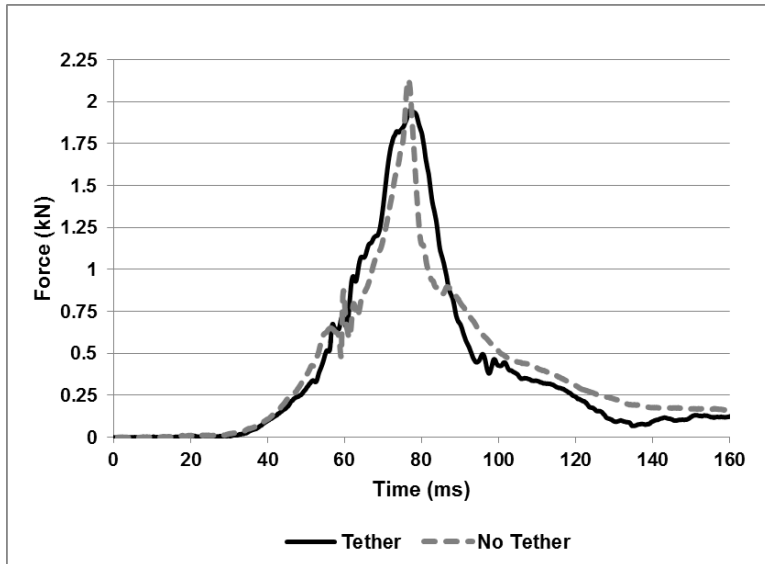


Figure A3. - Sample plots of neck tension verses time with and without tether



Figure A4. High speed video frames at t0, 40ms, 60 ms, max excursion (82 ms), 100 ms, and 120ms for the CRS tested utilizing the tether.



Figure A5. High speed video frames at 0ms, 40ms, 60 ms, max excursion (79 ms), 100 ms, and 120ms for the CRS tested not utilizing the tether, note additional tipping and lateral excursion of CRS compared to Figure A4.

