Vehicle Research and Test Center

Eval of ATD

LODC

Prepared By:

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Summary Report

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Vehicle Research and Test Center

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SECTION 1
PURPOSE AND SUMMARY FOR THOR-05F

The purpose of the testing is to evaluate the durability and kinematic response of the LODC in dynamic environments. Frontal impacts were conducted on both the 213-sled buck and the Mazda CX-3 rear seat sled buck.

SUMMARY

The LODC was seating per the selected position and secured on the passenger side position of the 213 buck. The LODC was seated in multiple positions following the CW_1 procedure with and without booster and with and without tethered feet, the CW_2 position with and without booster, and finally the UMTRI full forward seating with no booster.

A LODC was secured in the right rear occupant position of the Mazda CX-3 rear seat sled buck. The LODC was seated using the CW_1 with and without booster and CW_2 with and without booster.

The LODC was instrumented with triaxial accelerometers (head, T1, T6, T12 and pelvis), angular rate sensors (head, T1, T6, T12 and pelvis), (upper/lower neck force and moment, chest displacement, lumbar force and moment, ASIS force and moment, abdomen pressure (right and left) and Femur force (left and right). During this test series the dummy was restrained with a 3-point seatbelt.

SECTION 2

Left Side 213 BUCK and Left Rear Mazda CX-3 BUCK
TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 6
ATD Type/Serial No.	LODC / 003
Restraint System	3-Point Seatbelt

CAMERA POSITIONING 213 BUCK FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
Left Side Camera	mm	416.07	-903.97	-369.65
Right Side Camera	mm	397.08	907.70	-389.89

CAMERA POSITIONING Mazda CX-3 BUCK FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
Left Side Camera	mm	358.50	-707.61	36.65
Right Side Camera	mm	356.67	714.77	47.83

DUMMY POSITIONING

LODC – CW_1 seating procedure with Turbobooster CRS

TRC Test Number: S200131-1 VRTC Test Number: FR_213SS_01

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	-0.10	-0.03	-0.03
Center of Seat Headrest - Actual	mm	-162.03	-349.61	-816.80
Top of Head - Actual	mm	100.33	-351.66	-904.08
Head CG Outboard - Actual	mm	112.62	-285.22	-806.76
Bridge of Nose - Actual	mm	197.77	-351.60	-819.33
Right Cheek - Actual	mm	193.11	-316.79	-777.92
Left Cheek - Actual	mm	196.52	-383.46	-781.24
Chin - Actual	mm	206.19	-352.80	-707.98
Neck Center - Actual	mm	120.92	-352.23	-684.10
Chest point - Actual	mm	206.93	-349.73	-572.88
Chest pot - Actual	mm	223.26	-349.51	-496.54
Shoulder Belt Upper - Actual	mm	192.70	-349.85	-605.71
Shoulder Belt Lower - Actual	mm	225.81	-350.44	-518.17
Lap Belt Upper - Actual	mm	278.77	-350.52	-396.95
Lap Belt Lower - Actual	mm	316.39	-350.62	-371.35
Base Center - Actual	mm	498.84	-351.88	-286.76
Center of Seat Frame Bottom - Actual	mm	616.99	-349.62	-108.99
Outboard Knee - Actual	mm	512.38	-229.68	-373.45
Outboard Ankle - Actual	mm	690.25	-250.59	-138.22
Right Knee top - Actual	mm	533.81	-275.05	-417.88
Left Knee top - Actual	mm	536.41	-435.66	-423.91
H-point - Actual	mm	217.77	-215.08	-308.60
Target 2 - Seat Base H-Point - Actual	mm	204.96	-138.17	-275.42
Target 3 - Seat Base Side - Actual	mm	448.77	-133.58	-240.77

DUMMY INJURY

HIC (36 ms)	214
HIC (15 ms)	119
BrIC	0.929
NIJ Max	0.915
Neck Tension Load (N)	1737.05
Neck Comp Load (N)	-12.21
Upper Neck Fx (N)	472.69
Upper Neck Fy (N)	107.93
Upper Neck Fz (N)	1737.05
Upper Neck Mx (Nm)	-10.71
Upper Neck My (Nm)	-28.74
Upper Neck Mz (Nm)	6.42
Lower Neck Fx (N)	-1369.76
Lower Neck Fy (N)	1013.19
Lower Neck Fz (N)	952.46
Lower Neck Mx (Nm)	61.04
Lower Neck My (Nm)	73.99
Lower Neck Mz (Nm)	-8.15
Chest Clip 3ms (g) T1	31.84
Chest Clip 3ms (g) T6	39.15
Chest Clip 3ms (g) T12	46.17
Chest Deflection (mm)	75.201
ASIS Left Upper Fx (N)	259.69
ASIS Left Lower Fx (N)	633.88
ASIS Sum of Left Fx (N)	893.19
ASIS Right Upper Fx (N)	83.39
ASIS Right Lower Fx (N)	508.28
ASIS Sum of Right Fx (N)	588.40
Lumbar Fx (N)	-1091.46
Lumbar Fy (N)	426.48
Lumbar Fz (N)	-918.44
Lumbar Mx (Nm)	-74.45
Lumbar My (Nm)	-44.21
Lumbar Mz (Nm)	-33.81
Abdomen Left Pressure (psi)	11.18
Abdomen Right Pressure (psi)	11.57
Abdomen Sum (psi)	22.75
Abdomen Offset (psi)	5.06/3.60
Pelvis Resultant (g)	46.42
Lap Belt Load (N)	2055.07
Shoulder Belt Load (N)	5549.68

DUMMY POSITIONING

LODC – CW_1 seating procedure No Booster

TRC Test Number: S200203-1 VRTC Test Number: FR_213SS_03

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	-0.14	-0.08	0.20
Center of Seat Headrest - Actual	mm	-161.51	-350.04	-816.92
Top of Head - Actual	mm	145.23	-349.58	-813.97
Head CG Outboard - Actual	mm	154.69	-282.46	-717.42
Bridge of Nose - Actual	mm	240.73	-349.26	-726.68
Right Cheek - Actual	mm	234.32	-314.25	-686.01
Left Cheek - Actual	mm	237.46	-380.52	-688.62
Chin - Actual	mm	245.22	-350.31	-614.99
Neck Center - Actual	mm	159.92	-350.60	-594.09
Chest point - Actual	mm	240.96	-351.24	-481.51
Chest pot - Actual	mm	259.60	-350.32	-407.44
Shoulder Belt Upper - Actual	mm	202.20	-350.06	-550.77
Shoulder Belt Lower - Actual	mm	244.16	-350.39	-474.81
Lap Belt Upper - Actual	mm	310.09	-349.61	-301.21
Lap Belt Lower - Actual	mm	337.42	-350.18	-265.15
Center of Seat Frame Bottom - Actual	mm	617.03	-349.57	-108.81
Outboard Knee - Actual	mm	542.92	-216.26	-264.75
Outboard Ankle - Actual	mm	802.85	-223.62	-123.52
Right Knee top - Actual	mm	570.01	-258.44	-307.52
Left Knee top - Actual	mm	573.12	-441.84	-306.02
H-point - Actual	mm	251.13	-221.72	-212.69

DUMMY INJURY

HIC (36 ms)	495
HIC (15 ms)	495
BrIC	0.769
NIJ Max	1.67
Neck Tension Load (N)	3085.13
Neck Comp Load (N)	-169.74
Upper Neck Fx (N)	936.88
Upper Neck Fy (N)	110.31
Upper Neck Fz (N)	3085.13
Upper Neck Mx (Nm)	8.89
Upper Neck My (Nm)	-39.00
Upper Neck Mz (Nm)	-2.03
Lower Neck Fx (N)	-1877.67
Lower Neck Fy (N)	414.62
Lower Neck Fz (N)	1152.93
Lower Neck Mx (Nm)	-6.81
Lower Neck My (Nm)	149.93
Lower Neck Mz (Nm)	-16.51
Chest Clip 3ms (g) T1	36.56
Chest Clip 3ms (g) T6	41.77
Chest Clip 3ms (g) T12	47.33
Chest Deflection (mm)	36.833
ASIS Left Upper Fx (N)	639.73
ASIS Left Lower Fx (N)	1041.39
ASIS Sum of Left Fx (N)	1675.53
ASIS Right Upper Fx (N)	491.61
ASIS Right Lower Fx (N)	1034.85
ASIS Sum of Right Fx (N)	1523.56
Lumbar Fx (N)	872.28
Lumbar Fy (N)	-245.22
Lumbar Fz (N)	1188.31
Lumbar Mx (Nm)	25.48
Lumbar My (Nm)	47.51
Lumbar Mz (Nm)	23.78
Abdomen Left Pressure (psi)	6.98
Abdomen Right Pressure (psi)	10.74
Abdomen Sum (psi)	17.72
Abdomen Offset (psi)	7.06/4.11
Pelvis Resultant (g)	50.53
Lap Belt Load (N)	3310.44
Shoulder Belt Load (N)	4469.10

DUMMY POSITIONING

LODC – CW_2 seating procedure with Turbobooster CRS

TRC Test Number: S200204-1 VRTC Test Number: FR_213SS_05

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	-0.13	0.04	-0.21
Center of Seat Headrest - Actual	mm	-161.24	-351.35	-817.82
Top of Head - Actual	mm	84.16	-349.78	-884.71
Head CG Outboard - Actual	mm	95.00	-283.47	-786.07
Bridge of Nose - Actual	mm	180.45	-351.08	-798.09
Right Cheek - Actual	mm	175.53	-316.64	-756.65
Left Cheek - Actual	mm	178.10	-383.21	-760.63
Chin - Actual	mm	186.16	-352.88	-686.37
Neck Center - Actual	mm	101.37	-352.22	-664.93
Chest point - Actual	mm	197.66	-347.47	-556.87
Chest pot - Actual	mm	246.00	-348.97	-478.39
Shoulder Belt Upper - Actual	mm	162.90	-350.70	-622.80
Shoulder Belt Lower - Actual	mm	210.55	-350.35	-543.23
Lap Belt Upper - Actual	mm	300.88	-349.97	-404.08
Lap Belt Lower - Actual	mm	332.55	-349.73	-371.55
Base Center - Actual	mm	492.17	-352.68	-276.05
Center of Seat Frame Bottom - Actual	mm	617.05	-349.54	-108.85
Outboard Knee - Actual	mm	542.25	-223.39	-379.04
Outboard Ankle - Actual	mm	678.72	-236.90	-116.97
Right Knee top - Actual	mm	565.55	-266.71	-423.80
Left Knee top - Actual	mm	570.33	-434.88	-428.71
H-point - Actual	mm	250.53	-224.32	-310.00
Target 2 - Seat Base H-Point - Actual	mm	192.99	-159.05	-261.72
Target 3 - Seat Base Side - Actual	mm	434.15	-149.30	-234.42

DUMMY INJURY

HIC (36 ms)	487
HIC (15 ms)	290
BrIC	0.994
NIJ Max	1.43
Neck Tension Load (N)	3184.71
Neck Comp Load (N)	-80.12
Upper Neck Fx (N)	918.61
Upper Neck Fy (N)	281.70
Upper Neck Fz (N)	2448.61
Upper Neck Mx (Nm)	16.06
Upper Neck My (Nm)	-34.69
Upper Neck Mz (Nm)	3.69
Lower Neck Fx (N)	-1822.62
Lower Neck Fy (N)	843.25
Lower Neck Fz (N)	1351.03
Lower Neck Mx (Nm)	59.86
Lower Neck My (Nm)	121.43
Lower Neck Mz (Nm)	-5.51
Chest Clip 3ms (g) T1	35.96
Chest Clip 3ms (g) T6	42.17
Chest Clip 3ms (g) T12	50.7
Chest Deflection (mm)	58.108
ASIS Left Upper Fx (N)	377.13
ASIS Left Lower Fx (N)	601.34
ASIS Sum of Left Fx (N)	978.07
ASIS Right Upper Fx (N)	185.91
ASIS Right Lower Fx (N)	524.34
ASIS Sum of Right Fx (N)	710.24
Lumbar Fx (N)	-1244.66
Lumbar Fy (N)	224.47
Lumbar Fz (N)	-1028.10
Lumbar Mx (Nm)	-46.11
Lumbar My (Nm)	66.38
Lumbar Mz (Nm)	-14.23
Abdomen Left Pressure (psi)	6.92
Abdomen Right Pressure (psi)	10.69
Abdomen Sum (psi)	17.60
Abdomen Offset (psi)	5.61/3.40
Pelvis Resultant (g)	48.18
Lap Belt Load (N)	3155.67
Shoulder Belt Load (N)	5290.91

DUMMY POSITIONING

LODC – CW_2 seating procedure No Booster

TRC Test Number: S200204-2 VRTC Test Number: FR_213SS_07

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	-0.06	-0.06	0.07
Center of Seat Headrest - Actual	mm	-161.01	-350.44	-817.60
Top of Head - Actual	mm	116.83	-352.40	-792.58
Head CG Outboard - Actual	mm	128.01	-286.47	-696.64
Bridge of Nose - Actual	mm	214.74	-351.78	-708.05
Right Cheek - Actual	mm	209.48	-317.81	-667.51
Left Cheek - Actual	mm	213.24	-384.72	-668.76
Chin - Actual	mm	222.92	-352.37	-597.09
Neck Center - Actual	mm	137.42	-353.05	-574.00
Chest point - Actual	mm	242.02	-350.55	-467.04
Chest pot - Actual	mm	298.55	-351.68	-383.54
Shoulder Belt Upper - Actual	mm	141.08	-350.44	-587.36
Shoulder Belt Lower - Actual	mm	196.00	-350.51	-535.22
Lap Belt Upper - Actual	mm	325.18	-350.27	-334.26
Lap Belt Lower - Actual	mm	358.02	-350.64	-303.41
Center of Seat Frame Bottom - Actual	mm	617.14	-349.64	-108.85
Outboard Knee - Actual	mm	595.24	-222.71	-264.04
Outboard Ankle - Actual	mm	733.47	-233.45	-1.32
Right Knee top - Actual	mm	623.03	-266.51	-304.85
Left Knee top - Actual	mm	624.39	-434.17	-308.33
H-point - Actual	mm	300.27	-221.51	-225.02

DUMMY INJURY

HIC (36 ms)	432
HIC (15 ms)	342
BrIC	0.8
NIJ Max	1.11
Neck Tension Load (N)	2959.3
Neck Comp Load (N)	-176.18
Upper Neck Fx (N)	-1064.02
Upper Neck Fy (N)	144.43
Upper Neck Fz (N)	2959.30
Upper Neck Mx (Nm)	-14.35
Upper Neck My (Nm)	-43.55
Upper Neck Mz (Nm)	5.18
Lower Neck Fx (N)	-1136.86
Lower Neck Fy (N)	938.51
Lower Neck Fz (N)	1323.08
Lower Neck Mx (Nm)	24.34
Lower Neck My (Nm)	95.68
Lower Neck Mz (Nm)	-15.35
Chest Clip 3ms (g) T1	42.3
Chest Clip 3ms (g) T6	47.08
Chest Clip 3ms (g) T12	45.12
Chest Deflection (mm)	9.091
ASIS Left Upper Fx (N)	-1231.81
ASIS Left Lower Fx (N)	-835.94
ASIS Sum of Left Fx (N)	2054.40
ASIS Right Upper Fx (N)	-1100.44
ASIS Right Lower Fx (N)	-784.21
ASIS Sum of Right Fx (N)	1859.36
Lumbar Fx (N)	-1239.61
Lumbar Fy (N)	-580.56
Lumbar Fz (N)	-1437.75
Lumbar Mx (Nm)	-78.71
Lumbar My (Nm)	115.06
Lumbar Mz (Nm)	28.14
Abdomen Left Pressure (psi)	12.65
Abdomen Right Pressure (psi)	12.64
Abdomen Sum (psi)	25.29
Abdomen Offset (psi)	5.57/3.21
Pelvis Resultant (g)	45.14
Lap Belt Load (N)	2346.96
Shoulder Belt Load (N)	4392.14

DUMMY POSITIONING

LODC – UMTRI Full Forward seating procedure with Turbobooster CRS

TRC Test Number: S200205-1 VRTC Test Number: FR_213SS_09

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	-0.05	0.03	-0.07
Center of Seat Headrest - Actual	mm	-160.84	-350.87	-817.15
Top of Head - Actual	mm	87.24	-350.90	-872.16
Head CG Outboard - Actual	mm	94.16	-283.47	-774.59
Bridge of Nose - Actual	mm	180.89	-350.82	-783.04
Right Cheek - Actual	mm	173.91	-316.20	-742.18
Left Cheek - Actual	mm	177.05	-382.62	-745.13
Chin - Actual	mm	182.97	-351.97	-670.77
Neck Center - Actual	mm	97.09	-351.78	-652.24
Chest point - Actual	mm	206.07	-351.45	-542.79
Chest pot - Actual	mm	265.00	-351.24	-465.93
Shoulder Belt Upper - Actual	mm	180.62	-350.55	-585.68
Shoulder Belt Lower - Actual	mm	225.52	-350.96	-517.72
Lap Belt Upper - Actual	mm	306.43	-350.20	-408.28
Lap Belt Lower - Actual	mm	340.97	-350.02	-378.90
Base Center - Actual	mm	501.34	-352.30	-259.41
Center of Seat Frame Bottom - Actual	mm	617.14	-349.56	-108.92
Outboard Knee - Actual	mm	559.37	-223.95	-377.50
Outboard Ankle - Actual	mm	665.93	-241.59	-101.17
Right Knee top - Actual	mm	583.83	-266.44	-422.58
Left Knee top - Actual	mm	582.63	-449.30	-429.60
H-point - Actual	mm	268.99	-222.18	-314.53
Target 2 - Seat Base H-Point - Actual	mm	200.61	-143.91	-269.43
Target 3 - Seat Base Side - Actual	mm	443.33	-139.69	-235.54

DUMMY INJURY

HIC (36 ms)	392
HIC (15 ms)	193
BrIC	0.92
NIJ Max	0.738
Neck Tension Load (N)	2359.42
Neck Comp Load (N)	-15.72
Upper Neck Fx (N)	-751.31
Upper Neck Fy (N)	166.26
Upper Neck Fz (N)	2359.42
Upper Neck Mx (Nm)	-10.16
Upper Neck My (Nm)	-35.99
Upper Neck Mz (Nm)	4.67
Lower Neck Fx (N)	-1583.61
Lower Neck Fy (N)	702.44
Lower Neck Fz (N)	1507.19
Lower Neck Mx (Nm)	59.59
Lower Neck My (Nm)	103.64
Lower Neck Mz (Nm)	-8.34
Chest Clip 3ms (g) T1	32.78
Chest Clip 3ms (g) T6	43.53
Chest Clip 3ms (g) T12	49.58
Chest Deflection (mm)	61.229
ASIS Left Upper Fx (N)	119.59
ASIS Left Lower Fx (N)	-674.41
ASIS Sum of Left Fx (N)	1145.24
ASIS Right Upper Fx (N)	-252.78
ASIS Right Lower Fx (N)	-623.82
ASIS Sum of Right Fx (N)	876.59
Lumbar Fx (N)	1352.25
Lumbar Fy (N)	188.37
Lumbar Fz (N)	-1010.53
Lumbar Mx (Nm)	44.98
Lumbar My (Nm)	-69.20
Lumbar Mz (Nm)	-15.82
Abdomen Left Pressure (psi)	8.38
Abdomen Right Pressure (psi)	10.15
Abdomen Sum (psi)	18.52
Abdomen Offset (psi)	4.45/2.49
Pelvis Resultant (g)	47.96
Lap Belt Load (N)	2166.69
Shoulder Belt Load (N)	5439.01

DUMMY POSITIONING

LODC – UMTRI Full Forward seating procedure No Booster

TRC Test Number: S200205-2 VRTC Test Number: FR_213SS_10

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	-0.07	-0.12	-0.11
Center of Seat Headrest - Actual	mm	-159.00	-353.12	-811.26
Top of Head - Actual	mm	117.83	-349.18	-764.45
Head CG Outboard - Actual	mm	126.61	-282.08	-667.53
Bridge of Nose - Actual	mm	212.27	-350.94	-675.67
Right Cheek - Actual	mm	205.57	-315.47	-634.93
Left Cheek - Actual	mm	208.00	-382.22	-637.03
Chin - Actual	mm	214.67	-350.98	-563.52
Neck Center - Actual	mm	128.09	-350.85	-543.72
Chest point - Actual	mm	239.71	-349.67	-447.52
Chest pot - Actual	mm	320.37	-350.29	-359.86
Shoulder Belt Upper - Actual	mm	129.83	-350.12	-567.18
Shoulder Belt Lower - Actual	mm	175.41	-350.83	-521.25
Lap Belt Upper - Actual	mm	327.38	-350.14	-341.87
Lap Belt Lower - Actual	mm	362.50	-350.25	-311.55
Center of Seat Frame Bottom - Actual	mm	617.20	-349.60	-108.75
Outboard Knee - Actual	mm	618.04	-226.08	-280.45
Outboard Ankle - Actual	mm	721.75	-249.65	-3.89
Right Knee top - Actual	mm	642.67	-268.06	-325.86
Left Knee top - Actual	mm	639.67	-440.48	-330.42
H-point - Actual	mm	328.49	-222.81	-222.59

DUMMY INJURY

HIC (36 ms)	431
HIC (15 ms)	342
BrIC	0.795
NIJ Max	1.11
Neck Tension Load (N)	2821.44
Neck Comp Load (N)	-259.03
Upper Neck Fx (N)	-1101.72
Upper Neck Fy (N)	141.93
Upper Neck Fz (N)	2821.44
Upper Neck Mx (Nm)	-28.43
Upper Neck My (Nm)	-44.64
Upper Neck Mz (Nm)	-4.60
Lower Neck Fx (N)	-465.05
Lower Neck Fy (N)	597.93
Lower Neck Fz (N)	2019.44
Lower Neck Mx (Nm)	26.07
Lower Neck My (Nm)	66.58
Lower Neck Mz (Nm)	-12.42
Chest Clip 3ms (g) T1	47.64
Chest Clip 3ms (g) T6	48.11
Chest Clip 3ms (g) T12	42.57
Chest Deflection (mm)	10.257
ASIS Left Upper Fx (N)	-1113.84
ASIS Left Lower Fx (N)	-492.52
ASIS Sum of Left Fx (N)	1599.18
ASIS Right Upper Fx (N)	-1267.65
ASIS Right Lower Fx (N)	-404.54
ASIS Sum of Right Fx (N)	1637.55
Lumbar Fx (N)	3334.44
Lumbar Fy (N)	-598.82
Lumbar Fz (N)	1665.19
Lumbar Mx (Nm)	-57.81
Lumbar My (Nm)	-206.48
Lumbar Mz (Nm)	29.10
Abdomen Left Pressure (psi)	30.70
Abdomen Right Pressure (psi)	32.76
Abdomen Sum (psi)	63.45
Abdomen Offset (psi)	4.21/2.42
Pelvis Resultant (g)	51.56
Lap Belt Load (N)	2125.94
Shoulder Belt Load (N)	4133.94

DUMMY POSITIONING

LODC – CW_1, Tethered Feet seating procedure with Turbobooster CRS

TRC Test Number: S200206-1 VRTC Test Number: FR_213SS_11

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	0.03	-0.15	-0.05
Center of Seat Headrest - Actual	mm	-158.32	-351.51	-812.00
Top of Head - Actual	mm	107.05	-349.26	-903.65
Head CG Outboard - Actual	mm	116.25	-280.46	-805.68
Bridge of Nose - Actual	mm	201.51	-347.40	-816.20
Right Cheek - Actual	mm	196.14	-312.70	-775.03
Left Cheek - Actual	mm	200.04	-379.85	-779.18
Chin - Actual	mm	207.86	-349.80	-704.88
Neck Center - Actual	mm	122.63	-350.35	-684.10
Chest point - Actual	mm	206.27	-349.93	-570.54
Chest pin tape measured - Actual	mm	224.07	-349.85	-515.63
Chest pot - Actual	mm	225.22	-349.37	-499.83
Shoulder Belt Upper - Actual	mm	194.76	-350.01	-601.52
Shoulder Belt Lower - Actual	mm	225.13	-351.17	-516.92
Lap Belt Upper - Actual	mm	269.89	-350.39	-394.01
Lap Belt Lower - Actual	mm	305.50	-350.14	-363.04
Base Center - Actual	mm	502.97	-348.78	-264.24
Center of Seat Frame Bottom - Actual	mm	617.29	-349.61	-108.71
Outboard Knee - Actual	mm	504.23	-219.71	-370.42
Outboard Ankle - Actual	mm	663.58	-233.53	-122.65
Right Knee top - Actual	mm	528.05	-262.03	-416.03
Left Knee top - Actual	mm	530.12	-432.67	-418.64
H-point - Actual	mm	214.22	-219.67	-305.82
Target 2 - Seat Base H-Point - Actual	mm	193.58	-145.93	-268.62
Target 3 - Seat Base Side - Actual	mm	437.87	-144.46	-238.46

DUMMY INJURY

HIC (36 ms)	221
HIC (15 ms)	115
BrIC	0.857
NIJ Max	0.704
Neck Tension Load (N)	1878.79
Neck Comp Load (N)	-7.39
Upper Neck Fx (N)	-601.07
Upper Neck Fy (N)	206.13
Upper Neck Fz (N)	1878.79
Upper Neck Mx (Nm)	-8.00
Upper Neck My (Nm)	-32.41
Upper Neck Mz (Nm)	5.64
Lower Neck Fx (N)	-1665.73
Lower Neck Fy (N)	1215.81
Lower Neck Fz (N)	1002.82
Lower Neck Mx (Nm)	70.68
Lower Neck My (Nm)	93.19
Lower Neck Mz (Nm)	6.44
Chest Clip 3ms (g) T1	36.91
Chest Clip 3ms (g) T6	40
Chest Clip 3ms (g) T12	48.15
Chest Deflection (mm)	60.109
ASIS Left Upper Fx (N)	-254.69
ASIS Left Lower Fx (N)	-590.99
ASIS Sum of Left Fx (N)	843.05
ASIS Right Upper Fx (N)	25.58
ASIS Right Lower Fx (N)	-386.96
ASIS Sum of Right Fx (N)	425.64
Lumbar Fx (N)	1069.61
Lumbar Fy (N)	408.99
Lumbar Fz (N)	-1158.73
Lumbar Mx (Nm)	67.30
Lumbar My (Nm)	49.32
Lumbar Mz (Nm)	-27.69
Abdomen Left Pressure (psi)	11.85
Abdomen Right Pressure (psi)	12.23
Abdomen Sum (psi)	24.08
Abdomen Offset (psi)	6.00/2.78
Pelvis Resultant (g)	48.05
Lap Belt Load (N)	2293.97
Shoulder Belt Load (N)	5714.49

DUMMY POSITIONING

LODC – UMTRI Full Forward seating procedure No Booster Taped Chest

TRC Test Number: S200206-2* VRTC Test Number: FR_213SS_12

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Measured Z Point - Actual	mm	0.02	-0.11	-0.06
Center of Seat Headrest - Actual	mm	-157.70	-352.50	-812.18
Top of Head - Actual	mm	118.32	-352.38	-768.16
Head CG Outboard - Actual	mm	126.08	-285.24	-670.41
Bridge of Nose - Actual	mm	213.82	-350.77	-679.39
Right Cheek - Actual	mm	205.99	-315.58	-638.56
Left Cheek - Actual	mm	210.78	-382.69	-640.82
Chin - Actual	mm	216.90	-351.23	-567.25
Neck Center - Actual	mm	129.81	-353.82	-548.07
Chest point - Actual	mm	245.89	-350.68	-438.88
Chest pot - Actual	mm	318.77	-349.58	-354.83
Shoulder Belt Upper - Actual	mm	131.33	-349.34	-568.62
Shoulder Belt Lower - Actual	mm	176.97	-351.78	-527.52
Lap Belt Upper - Actual	mm	327.24	-350.30	-341.52
Lap Belt Lower - Actual	mm	360.63	-350.43	-305.71
Center of Seat Frame Bottom - Actual	mm	617.12	-349.53	-108.77
Outboard Knee - Actual	mm	615.87	-219.52	-272.82
Outboard Ankle - Actual	mm	702.77	-243.29	9.52
Right Knee top - Actual	mm	642.75	-261.19	-317.65
Left Knee top - Actual	mm	638.04	-433.22	-327.71
H-point - Actual	mm	326.14	-223.37	-222.85

DUMMY INJURY

HIC (36 ms)	660
HIC (15 ms)	362
BrIC	0.816
NIJ Max	1.17
Neck Tension Load (N)	2946.79
Neck Comp Load (N)	-226.17
Upper Neck Fx (N)	-1121.38
Upper Neck Fy (N)	141.18
Upper Neck Fz (N)	2946.79
Upper Neck Mx (Nm)	-26.56
Upper Neck My (Nm)	-45.93
Upper Neck Mz (Nm)	3.31
Lower Neck Fx (N)	-593.57
Lower Neck Fy (N)	667.23
Lower Neck Fz (N)	1937.84
Lower Neck Mx (Nm)	30.36
Lower Neck My (Nm)	74.09
Lower Neck Mz (Nm)	14.00
Chest Clip 3ms (g) T1	44.59
Chest Clip 3ms (g) T6	43.73
Chest Clip 3ms (g) T12	44.13
Chest Deflection (mm)	7.889
ASIS Left Upper Fx (N)	-1186.63
ASIS Left Lower Fx (N)	-529.12
ASIS Sum of Left Fx (N)	1715.74
ASIS Right Upper Fx (N)	-1347.47
ASIS Right Lower Fx (N)	-463.44
ASIS Sum of Right Fx (N)	1754.16
Lumbar Fx (N)	3242.16
Lumbar Fy (N)	-704.41
Lumbar Fz (N)	1366.06
Lumbar Mx (Nm)	-70.42
Lumbar My (Nm)	-191.16
Lumbar Mz (Nm)	27.07
Abdomen Left Pressure (psi)	30.77
Abdomen Right Pressure (psi)	32.48
Abdomen Sum (psi)	63.25
Abdomen Offset (psi)	5.30/2.76
Pelvis Resultant (g)	45.89
Lap Belt Load (N)	2279.56
Shoulder Belt Load (N)	4214.31

DUMMY POSITIONING

LODC – CW_1 seating procedure No Booster

TRC Test Number: S191211-1 VRTC Test Number: FR_RSHS_03

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Chest Pin - Actual	mm	260.79	-407.52	124.46
Rear Striker - Actual	mm	-0.42	-0.72	0.67
Top of Head - Actual	mm	122.74	-399.54	-270.55
Bridge of Nose - Actual	mm	216.84	-398.61	-181.56
Tip of Chin - Actual	mm	220.70	-400.58	-69.14
Head CG - Actual	mm	128.39	-332.92	-172.20
Neck Center - Actual	mm	124.61	-405.19	-62.23
Chest Point - Actual	mm	228.48	-406.99	54.98
Shoulder Belt up - Actual	mm	212.56	-404.46	18.91
Shoulder Belt down - Actual	mm	247.90	-404.99	91.33
Lap Belt up - Actual	mm	311.59	-405.87	210.77
Lab Belt down - Actual	mm	342.09	-404.37	247.34
H-point - Actual	mm	276.49	-278.27	313.12
Outboard Knee - Actual	mm	568.89	-278.66	268.70
Outboard Ankle - Actual	mm	721.74	-294.65	514.59
Left Knee Top - Actual	mm	600.51	-489.05	230.14
Right Knee Top - Actual	mm	596.51	-322.62	224.24

DUMMY INJURY

HIC (36 ms)	1463
HIC (15 ms)	981
BrIC	1.4
NIJ Max	2
Neck Tension Load (N)	3704.08
Neck Comp Load (N)	-540.94
Upper Neck Fx (N)	1032.68
Upper Neck Fy (N)	299.05
Upper Neck Fz (N)	3704.08
Upper Neck Mx (Nm)	-32.75
Upper Neck My (Nm)	-47.51
Upper Neck Mz (Nm)	-6.21
Lower Neck Fx (N)	-2442.67
Lower Neck Fy (N)	1900.38
Lower Neck Fz (N)	2902.75
Lower Neck Mx (Nm)	103.28
Lower Neck My (Nm)	105.90
Lower Neck Mz (Nm)	-10.58
Chest Clip 3ms (g) T1	57.15
Chest Clip 3ms (g) T6	84.53
Chest Clip 3ms (g) T12	105.93
Chest Deflection (mm)	66.06
ASIS Left Upper Fx (N)	2227.09
ASIS Left Lower Fx (N)	1552.75
ASIS Sum of Left Fx (N)	3593.96
ASIS Right Upper Fx (N)	2015.41
ASIS Right Lower Fx (N)	1463.60
ASIS Sum of Right Fx (N)	3246.65
Lumbar Fx (N)	1708.15
Lumbar Fy (N)	455.70
Lumbar Fz (N)	1809.05
Lumbar Mx (Nm)	-47.39
Lumbar My (Nm)	149.31
Lumbar Mz (Nm)	6.39
Abdomen Left Pressure (psi)	21.80
Abdomen Right Pressure (psi)	19.28
Abdomen Sum (psi)	41.08
Abdomen Offset (psi)	
Pelvis Resultant (g)	98.04
Lap Belt Load (N)	7174.93
Shoulder Belt Load (N)	7456.29

DUMMY POSITIONING

LODC – CW_1 seating procedure with Turbobooster CRS

TRC Test Number: S191216-1 VRTC Test Number: FR_RSHS_01

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Chest Pin - Actual	mm	225.23	-365.76	10.31
Rear Striker - Actual	mm	0.05	-0.32	0.43
Top of Head - Actual	mm	118.38	-360.87	-375.33
Bridge of Nose - Actual	mm	201.89	-360.41	-276.44
Tip of Chin - Actual	mm	193.35	-360.37	-165.59
Head CG - Actual	mm	116.68	-290.79	-278.06
Neck Center - Actual	mm	96.10	-363.48	-169.37
Chest Point - Actual	mm	196.67	-363.20	-35.47
Shoulder Belt up - Actual	mm	180.79	-362.40	-66.32
Shoulder Belt down - Actual	mm	217.16	-363.05	14.90
Lap Belt up - Actual	mm	273.73	-362.31	133.46
Lab Belt down - Actual	mm	315.37	-362.47	151.21
H-point - Actual	mm	224.82	-238.16	208.08
Outboard Knee - Actual	mm	515.41	-235.57	156.45
Outboard Ankle - Actual	mm	658.06	-261.60	413.78
Left Knee Top - Actual	mm	544.41	-455.32	120.28
Right Knee Top - Actual	mm	541.42	-276.56	110.09

DUMMY INJURY

HIC (36 ms)	955
HIC (15 ms)	654
BrIC	1.5
NIJ Max	1.5
Neck Tension Load (N)	2569.03
Neck Comp Load (N)	-504.51
Upper Neck Fx (N)	747.18
Upper Neck Fy (N)	228.43
Upper Neck Fz (N)	2569.03
Upper Neck Mx (Nm)	-36.72
Upper Neck My (Nm)	10.20
Upper Neck Mz (Nm)	9.39
Lower Neck Fx (N)	-1487.92
Lower Neck Fy (N)	2145.10
Lower Neck Fz (N)	1953.54
Lower Neck Mx (Nm)	114.89
Lower Neck My (Nm)	60.66
Lower Neck Mz (Nm)	-18.84
Chest Clip 3ms (g) T1	47.31
Chest Clip 3ms (g) T6	63.16
Chest Clip 3ms (g) T12	82.43
Chest Deflection (mm)	64.88
ASIS Left Upper Fx (N)	867.60
ASIS Left Lower Fx (N)	2226.52
ASIS Sum of Left Fx (N)	3083.83
ASIS Right Upper Fx (N)	522.00
ASIS Right Lower Fx (N)	1464.60
ASIS Sum of Right Fx (N)	1984.62
Lumbar Fx (N)	-2325.62
Lumbar Fy (N)	581.39
Lumbar Fz (N)	-1648.86
Lumbar Mx (Nm)	-126.92
Lumbar My (Nm)	-113.31
Lumbar Mz (Nm)	-34.95
Abdomen Left Pressure (psi)	19.97
Abdomen Right Pressure (psi)	12.44
Abdomen Sum (psi)	32.41
Abdomen Offset (psi)	
Pelvis Resultant (g)	82.09
Lap Belt Load (N)	7092.23
Shoulder Belt Load (N)	8692.32

DUMMY POSITIONING

LODC – CW_1 seating procedure with Turbobooster CRS

TRC Test Number: S191217-1 VRTC Test Number: FR_RSHS_05

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Chest Pin - Actual	mm	227.32	-361.96	34.77
Rear Striker - Actual	mm	-0.05	-0.07	0.16
Top of Head - Actual	mm	85.22	-360.45	-374.53
Bridge of Nose - Actual	mm	178.08	-362.87	-283.78
Tip of Chin - Actual	mm	179.81	-366.16	-172.60
Head CG - Actual	mm	92.31	-293.78	-275.71
Neck Center - Actual	mm	83.31	-365.50	-166.95
Chest Point - Actual	mm	188.96	-361.36	-41.34
Shoulder Belt up - Actual	mm	180.71	-361.92	-65.28
Shoulder Belt down - Actual	mm	218.01	-362.02	6.87
Lap Belt up - Actual	mm	283.74	-362.31	122.66
Lab Belt down - Actual	mm	322.17	-363.29	146.65
H-point - Actual	mm	230.94	-240.03	204.19
Outboard Knee - Actual	mm	522.37	-239.64	157.12
Outboard Ankle - Actual	mm	659.86	-270.80	417.11
Left Knee Top - Actual	mm	545.99	-453.87	104.49
Right Knee Top - Actual	mm	548.11	-279.97	110.19
Right Side Camera - Actual	mm	356.86	713.02	48.30
CRS Point 2 - Actual	mm	218.30	-170.92	232.46
CRS Point 3 - Actual	mm	457.26	-171.95	283.53
CRS Center - Actual	mm	513.34	-359.46	243.35

DUMMY INJURY

HIC (36 ms)	926
HIC (15 ms)	610
BrIC	1.3
NIJ Max	1.4
Neck Tension Load (N)	2697.29
Neck Comp Load (N)	-184.74
Upper Neck Fx (N)	738.92
Upper Neck Fy (N)	172.86
Upper Neck Fz (N)	2697.29
Upper Neck Mx (Nm)	-31.93
Upper Neck My (Nm)	-41.55
Upper Neck Mz (Nm)	-8.81
Lower Neck Fx (N)	-1415.02
Lower Neck Fy (N)	2074.55
Lower Neck Fz (N)	1953.29
Lower Neck Mx (Nm)	114.38
Lower Neck My (Nm)	70.95
Lower Neck Mz (Nm)	-14.46
Chest Clip 3ms (g) T1	46.77
Chest Clip 3ms (g) T6	79.01
Chest Clip 3ms (g) T12	77.78
Chest Deflection (mm)	85.55
ASIS Left Upper Fx (N)	788.62
ASIS Left Lower Fx (N)	2188.99
ASIS Sum of Left Fx (N)	2977.22
ASIS Right Upper Fx (N)	517.66
ASIS Right Lower Fx (N)	1723.69
ASIS Sum of Right Fx (N)	2240.93
Lumbar Fx (N)	-1975.52
Lumbar Fy (N)	667.29
Lumbar Fz (N)	1180.47
Lumbar Mx (Nm)	-130.73
Lumbar My (Nm)	-105.67
Lumbar Mz (Nm)	-43.48
Abdomen Left Pressure (psi)	21.59
Abdomen Right Pressure (psi)	17.67
Abdomen Sum (psi)	39.26
Abdomen Offset (psi)	8.32/6.99
Pelvis Resultant (g)	86.75
Lap Belt Load (N)	8064.11
Shoulder Belt Load (N)	4023.03

DUMMY POSITIONING

LODC – CW_1 seating procedure No Booster

TRC Test Number: S200123-1 VRTC Test Number: FR_RSHS_07

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Chest Pin - Actual	mm	280.37	-397.77	128.80
Rear Striker - Actual	mm	0.17	-0.09	0.38
Top of Head - Actual	mm	118.05	-396.72	-281.20
Bridge of Nose - Actual	mm	214.07	-394.58	-193.31
Tip of Chin - Actual	mm	219.40	-396.48	-82.58
Head CG - Actual	mm	124.72	-329.63	-183.48
Neck Center - Actual	mm	134.50	-398.30	-60.05
Chest Point - Actual	mm	232.80	-398.65	50.46
Shoulder Belt up - Actual	mm	202.77	-395.17	-11.62
Shoulder Belt down - Actual	mm	239.35	-395.24	60.14
Lap Belt up - Actual	mm	332.60	-395.94	198.27
Lab Belt down - Actual	mm	362.68	-395.43	233.11
H-point - Actual	mm	279.25	-265.06	299.48
Outboard Knee - Actual	mm	575.76	-265.66	265.21
Outboard Ankle - Actual	mm	749.93	-267.53	504.63
Left Knee Top - Actual	mm	609.91	-484.41	223.85
Right Knee Top - Actual	mm	605.31	-311.63	226.54

DUMMY INJURY

HIC (36 ms)	1229
HIC (15 ms)	774
BrIC	1.16
NIJ Max	2.06
Neck Tension Load (N)	3604.1
Neck Comp Load (N)	-372.80
Upper Neck Fx (N)	1159.87
Upper Neck Fy (N)	458.58
Upper Neck Fz (N)	3604.10
Upper Neck Mx (Nm)	-33.73
Upper Neck My (Nm)	-48.57
Upper Neck Mz (Nm)	6.94
Lower Neck Fx (N)	-2445.58
Lower Neck Fy (N)	1944.11
Lower Neck Fz (N)	2339.12
Lower Neck Mx (Nm)	114.40
Lower Neck My (Nm)	131.69
Lower Neck Mz (Nm)	-9.55
Chest Clip 3ms (g) T1	53.46
Chest Clip 3ms (g) T6	83.42
Chest Clip 3ms (g) T12	91.14
Chest Deflection (mm)	81.18
ASIS Left Upper Fx (N)	1639.72
ASIS Left Lower Fx (N)	2132.88
ASIS Sum of Left Fx (N)	3681.42
ASIS Right Upper Fx (N)	1455.24
ASIS Right Lower Fx (N)	1968.38
ASIS Sum of Right Fx (N)	3411.79
Lumbar Fx (N)	1613.35
Lumbar Fy (N)	474.43
Lumbar Fz (N)	1689.82
Lumbar Mx (Nm)	-47.44
Lumbar My (Nm)	118.95
Lumbar Mz (Nm)	-32.88
Abdomen Left Pressure (psi)	11.84
Abdomen Right Pressure (psi)	13.24
Abdomen Sum (psi)	25.08
Abdomen Offset (psi)	4.13/1.57
Pelvis Resultant (g)	180.77
Lap Belt Load (N)	7330.34
Shoulder Belt Load (N)	3792.07

DUMMY POSITIONING

LODC – CW_2 seating procedure with Turbobooster CRS

TRC Test Number: S200127-1 VRTC Test Number: FR_RSHS_09

DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Chest Pin - Actual	mm	258.07	-365.78	39.72
Rear Striker - Actual	mm	-0.15	0.18	0.33
Top of Head - Actual	mm	54.12	-363.66	-367.20
Bridge of Nose - Actual	mm	156.38	-366.12	-288.25
Tip of Chin - Actual	mm	170.27	-367.60	-177.50
Head CG - Actual	mm	72.66	-296.41	-270.74
Neck Center - Actual	mm	87.32	-365.65	-147.89
Chest Point - Actual	mm	192.65	-365.57	-46.72
Shoulder Belt up - Actual	mm	172.70	-365.72	-79.33
Shoulder Belt down - Actual	mm	218.95	-365.28	-6.16
Lap Belt up - Actual	mm	311.92	-365.31	109.64
Lab Belt down - Actual	mm	339.76	-366.69	145.66
H-point - Actual	mm	255.17	-233.70	197.14
Outboard Knee - Actual	mm	548.88	-238.35	143.59
Outboard Ankle - Actual	mm	655.43	-240.13	419.44
Left Knee Top - Actual	mm	574.64	-445.79	97.18
Right Knee Top - Actual	mm	575.11	-283.78	101.41
Right Side Camera - Actual	mm	357.03	713.48	48.56
CRS Point 2 - Actual	mm	219.27	-160.17	229.33
CRS Point 3 - Actual	mm	461.95	-161.84	276.31
CRS Center - Actual	mm	515.03	-359.50	247.13

DUMMY INJURY

HIC (36 ms)	919
HIC (15 ms)	533
BrIC	1.37
NIJ Max	1.46
Neck Tension Load (N)	2567.18
Neck Comp Load (N)	-270.85
Upper Neck Fx (N)	743.23
Upper Neck Fy (N)	232.58
Upper Neck Fz (N)	2567.18
Upper Neck Mx (Nm)	-33.92
Upper Neck My (Nm)	-46.81
Upper Neck Mz (Nm)	9.73
Lower Neck Fx (N)	-1417.78
Lower Neck Fy (N)	2152.92
Lower Neck Fz (N)	1964.22
Lower Neck Mx (Nm)	119.04
Lower Neck My (Nm)	69.68
Lower Neck Mz (Nm)	-14.99
Chest Clip 3ms (g) T1	46.39
Chest Clip 3ms (g) T6	54.59
Chest Clip 3ms (g) T12	68.74
Chest Deflection (mm)	83.107
ASIS Left Upper Fx (N)	749.93
ASIS Left Lower Fx (N)	2093.57
ASIS Sum of Left Fx (N)	2820.75
ASIS Right Upper Fx (N)	443.13
ASIS Right Lower Fx (N)	1541.18
ASIS Sum of Right Fx (N)	1982.94
Lumbar Fx (N)	-1977.19
Lumbar Fy (N)	692.43
Lumbar Fz (N)	-923.90
Lumbar Mx (Nm)	-128.83
Lumbar My (Nm)	-89.92
Lumbar Mz (Nm)	-46.50
Abdomen Left Pressure (psi)	12.10
Abdomen Right Pressure (psi)	10.81
Abdomen Sum (psi)	22.90
Abdomen Offset (psi)	5.49/3.02
Pelvis Resultant (g)	2107.279
Lap Belt Load (N)	6460.68
Shoulder Belt Load (N)	4624.01