# Appendix

Figure A1. Sled crash pulse

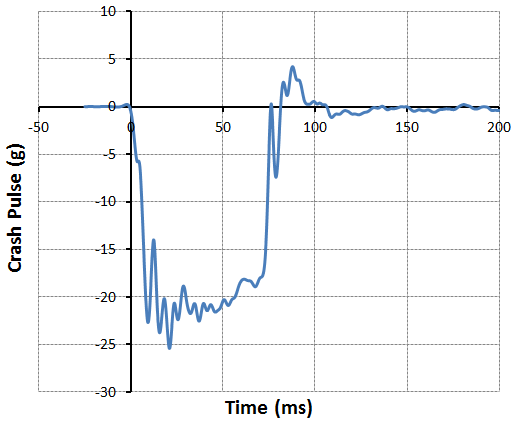


Figure A2. ATD kinematics in five sled tests

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test Condition and Injury Measure** | **WC1022** | **WC1023** | **WC1106** | **WC1107** | **WC1109** |
| ATD & Belt fit | 50M-Good | 50M-Poor | 50M-Poor | 50M-None | 5F-Poor |
| Airbag firing time | 12 ms | 12 ms | 42 ms | 42 ms | 42 ms |
| ATD kinematics at the maximal head/torsion excursions |  |  |  |  |  |

Figure A3. Comparison of occupant kinematics between sled tests and MADYMO simulations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **WC1022**  Midsize male with good belt fit | | **WC1023** Midsize male with poor belt fit | | **WC1109** Small female with poor belt fit | |
| Test | Simulation | Test | Simulation | Test | Simulation |
| 0 ms |  |  |  |  |  |  |
| 30 ms |  |  |  |  |  |  |
| 60 ms |  |  |  |  |  |  |
| 90 ms |  |  |  |  |  |  |
| 120 ms |  |  |  |  |  |  |

Table A1. Model-predicted injury measures in two parametric studies

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ATD** | **Angle (degrees)** | **Belt fit** | **Airbag** | **HIC 15** | **Nij** | **Chest D (mm)** | **Left Femur F (N)** | **Right Femur F (N)** |
| **Parametric Study #1** | 5F | 0 | Good | Yes | 124 | 0.37 | 43 | 1,892 | 1,893 |
| 5F | 0 | Poor | Yes | 133 | 0.45 | 37.2 | 3,200 | 3,057 |
| 5F | 0 | No belt | Yes | 29 | 0.26 | 37.9 | 4,225 | 4,210 |
| 5F | 0 | Good | No | 381 | 0.41 | 33.5 | 1,634 | 2,693 |
| 5F | 0 | Poor | No | 284 | 0.27 | 33.1 | 3,457 | 3,684 |
| 5F | 0 | No belt | No | 240 | **1.40** | **56.3** | 4,148 | 4,090 |
| 50M | 0 | Good | Yes | 98 | 0.18 | 36.2 | 1,043 | 762 |
| 50M | 0 | Poor | Yes | 38 | 0.19 | 42.3 | 5,538 | 5,440 |
| 50M | 0 | No belt | Yes | 38 | 0.14 | **68.2** | 5,214 | 4,742 |
| 50M | 0 | Good | No | 373 | 0.37 | 33.2 | 1,353 | 1,109 |
| 50M | 0 | Poor | No | 104 | 0.35 | 36.3 | 5,759 | 5,760 |
| 50M | 0 | No belt | No | 281 | 0.64 | **81.5** | 5,122 | 5,147 |
| **Parametric Study #2** | 5F | 15 | Good | Yes | 143 | 0.44 | 43.4 | 2,256 | 1,140 |
| 5F | 15 | Poor | Yes | 91 | 0.34 | 35.8 | 3,958 | 2,635 |
| 5F | 15 | Good | No | 421 | 0.41 | 34.4 | 1,913 | 1,618 |
| 5F | 15 | Poor | No | 205 | 0.43 | 34.7 | 4,041 | 2,894 |
| 50M | 15 | Good | Yes | 92 | 0.22 | 44.3 | 2,761 | 344 |
| 50M | 15 | Poor | Yes | 38 | 0.21 | 35.9 | 5,366 | 4,572 |
| 50M | 15 | Good | No | 305 | 0.37 | 33.7 | 3,062 | 434 |
| 50M | 15 | Poor | No | 113 | 0.45 | 28.9 | 5,220 | 4,793 |
| 5F | 30 | Good | Yes | 104 | 0.38 | 41.6 | 1,277 | 402 |
| 5F | 30 | Poor | Yes | 88 | 0.39 | 31.3 | 3,495 | 2,132 |
| 5F | 30 | Good | No | 273 | 0.64 | 35.4 | 1,164 | 582 |
| 5F | 30 | Poor | No | 111 | 0.45 | 21.0 | 3,382 | 2,331 |
| 50M | 30 | Good | Yes | 222 | 0.70 | 40.0 | 1,870 | 156 |
| 50M | 30 | Poor | Yes | **975** | 0.60 | 31.6 | 4,788 | 3,665 |
| 50M | 30 | Good | No | 205 | **1.21** | 34.2 | 2,130 | 543 |
| 50M | 30 | Poor | No | **1,336** | 0.68 | 19.6 | 4,545 | 4,094 |

Figure A4. Midsize male ATD kinematics at 100 ms in pure frontal crashes with different belt and airbag conditions

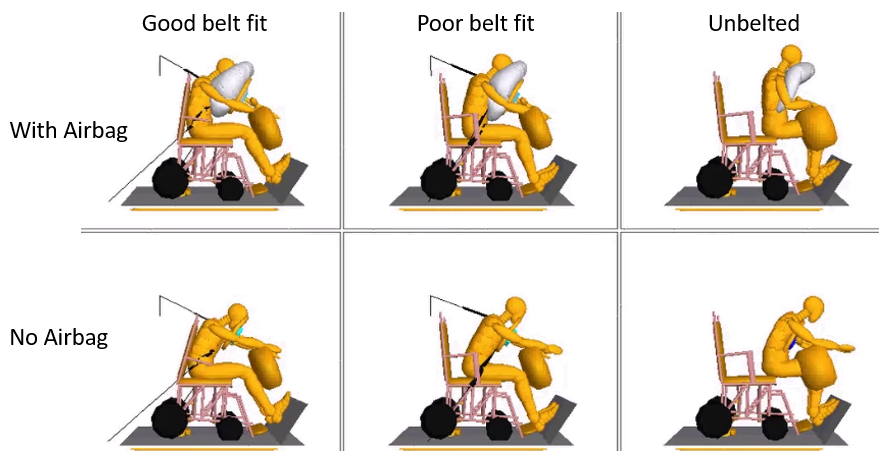


Figure A5. Small female ATD kinematics at 100 ms in pure frontal crashes with different belt and airbag conditions

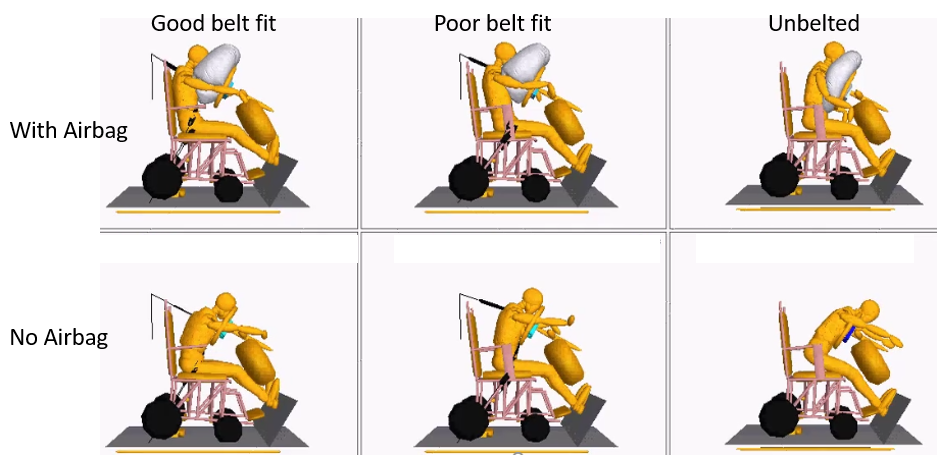


Figure A6. Midsize male ATD kinematics at 100 ms in oblique frontal crashes with different belt and airbag conditions

All oblique frontal crash simulations are with curtain airbag.

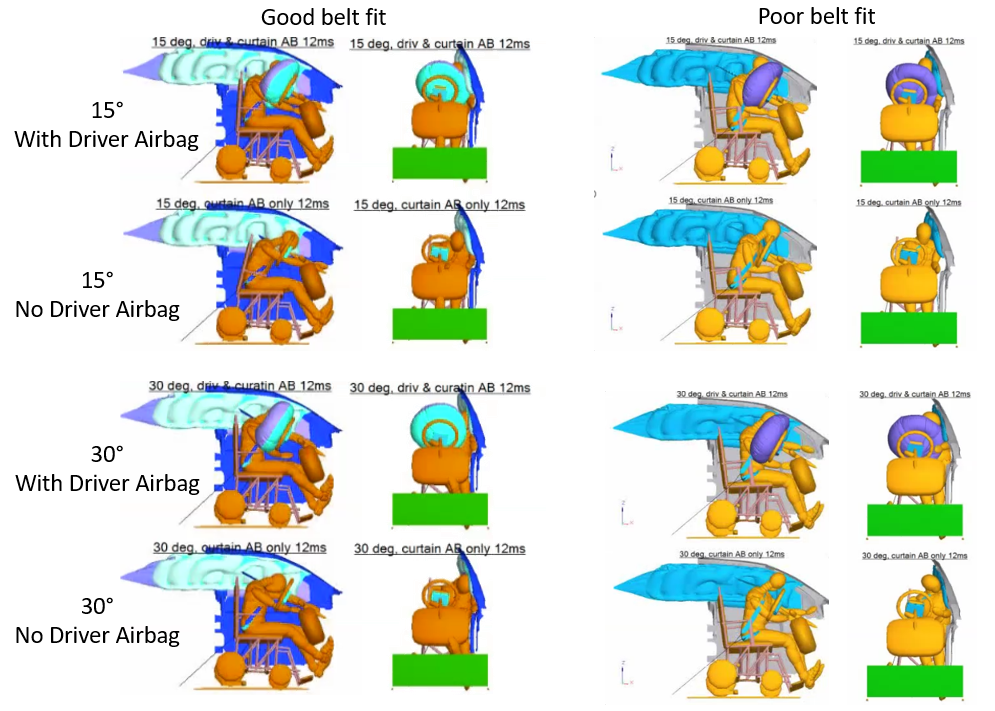


Figure A7. Small female ATD kinematics at 100 ms in oblique frontal crashes with different belt and airbag conditions

All oblique frontal crash simulations are with curtain airbag.

