Summary of the BioRID-II Test Program

PDB Test Series 2006 – 2010

GTR 7 – BioRID-II TEG

Federal Ministry of Transportation

Berlin, September 21, 2010
Objectives

• Analysis of the repeatability and reproducibility (R&R)
  – Focus on dummy
  – Seat and pulse also analysed

• Investigation of potential causes of the variances
  – Friction based (cables, head contact switch, neck bolts, jacket)
  – Stiffness based (pelvis)
Test Programme

- Dummies
  - 8 BioRID-II
- Crash pulses
  - Low (trapezoid, \(dv=16\) km/h)
  - Medium (triangular, \(dv=16\) km/h)
  - High (trapezoid, \(dv=24\) km/h)
- Seat
  - Standard vehicle seat
  - Hard bucket seat (race car seat)
- Laboratory
  - 2 test institutes
- Certification test

\(\rightarrow\) 200+ dummy data sets
Results – R&R-Study 2009
Hard bucket seat, low severity pulse, 8 dummies
Results – Upper Neck Fx
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

cv = 13.9%
Results – Upper Neck Fx
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

Mean Curve

1-Sigma Corridor

Hard bucket seat

low severity pulse

8 dummies

cv= 13.9%
Results – Upper Neck Fz

Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

\[ \text{cv} = 9.1\% \]
Results – Upper Neck Fz
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

cv = 9.1%
Results – Upper Neck My
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

\[ \text{cv} = 33.9\% \]

During head contact: \[ \text{cv} = 46.7\% \]
Results – Upper Neck My

Hard bucket seat, low severity pulse, 8 dummies

Mean Curve, 1-Sigma Corridor,

cv = 33.9%

During head contact: cv = 46.7%
Results – Lower Neck Fx

Hard bucket seat, low severity pulse, 8 dummies

Mean Curve, 1-Sigma Corridor,

cv = 10.8%

Test series 2: 8 BioRID-II, 96 data sets
Results – Lower Neck Fz
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

cv = 33.1%
During head contact: cv = 55.3%
Results – Lower Neck My
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

CV = 11.1%
Results – T1 ax
Hard bucket seat, low severity pulse, 8 dummies

Test series 2: 8 BioRID-II, 96 data sets

Mean Curve, 1-Sigma Corridor,

cv= 8.9%
Repeatability
Hard bucket seat, low severity pulse, 8 dummies

Not acceptable

BioRID-IIg

NIC
Upper Neck Fx
Lower Neck Fz

Nkm
Upper Neck Fz
Lower Neck My

Head-ax
Upper Neck My
T8-ax

T1-ax
Lower Neck Fz
Pelvis-ax
Reproducibility

Hard bucket seat, low severity pulse, 8 dummies

Not acceptable

- NIC
- Nkm
- Head-ax
- T1-ax
- Upper Neck Fx
- Upper Neck Fz
- Upper Neck My
- Lower Neck Fx
- Lower Neck Fz
- Lower Neck My
- T8-ax
- Pelvis-ax
Results & Conclusion

• Overall Test Accuracy
  – **Accelerations**
    single measurements: \( cv = 5 \ldots 10 \% \)
    NIC: \( cv > 10 \% \)
  – **Forces & Moments**
    \( cv = 10 \ldots 35 \% \)
  – **Kinematics**
    dynamic backset: \( cv < 10 \% \)
Results & Conclusion

• Investigation of potential causes of the variances
  – Friction based (cables, head contact switch, neck bolts)
    ➔ Minor influence on R&R
  – Stiffness based (pelvis)
    ➔ No influence on R&R