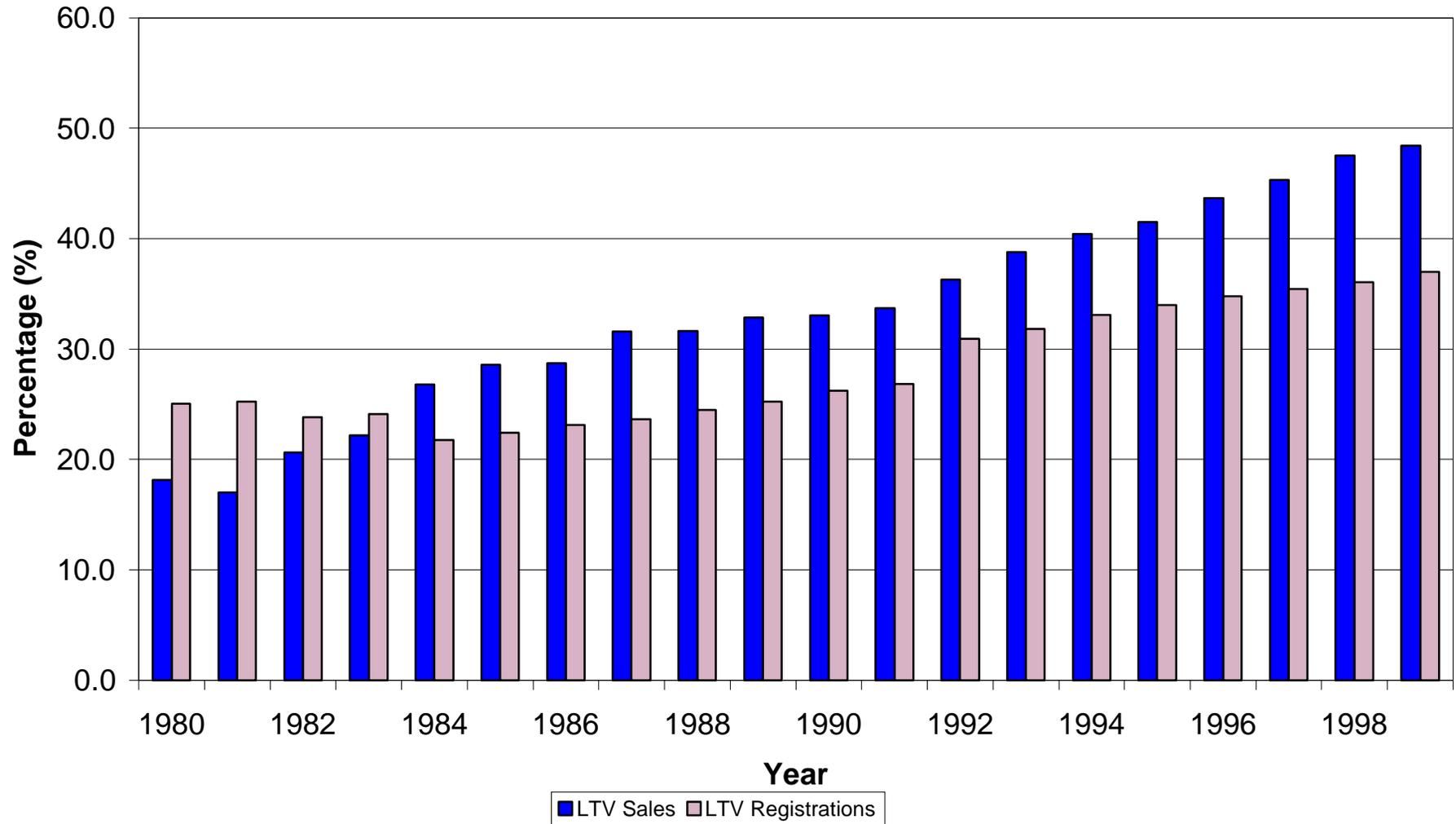


2001 SAE Government Industry Meeting

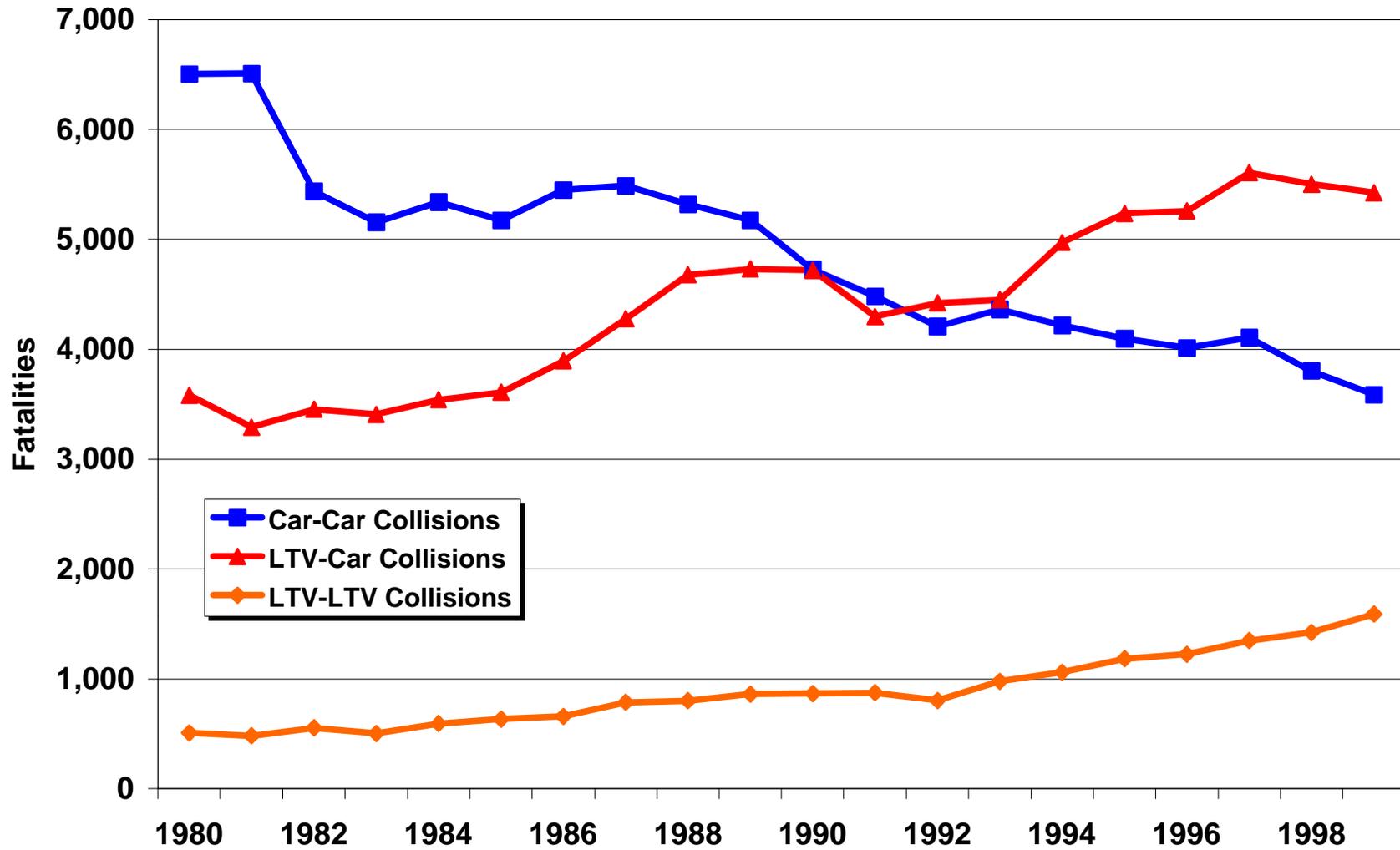
Vehicle Compatibility Research Program

National Highway Traffic Safety
Administration

U.S. Sales and Registrations of Light Trucks and Vans



Fatalities in Vehicle-to-Vehicle Collisions



Aggressivity Metric

$$\textit{Aggressivity} = \frac{\textit{Fatalities in Collision Partner}}{\textit{Number of Crashes of Subject Vehicle}}$$

Using

1995-1999 FARS for fatality counts

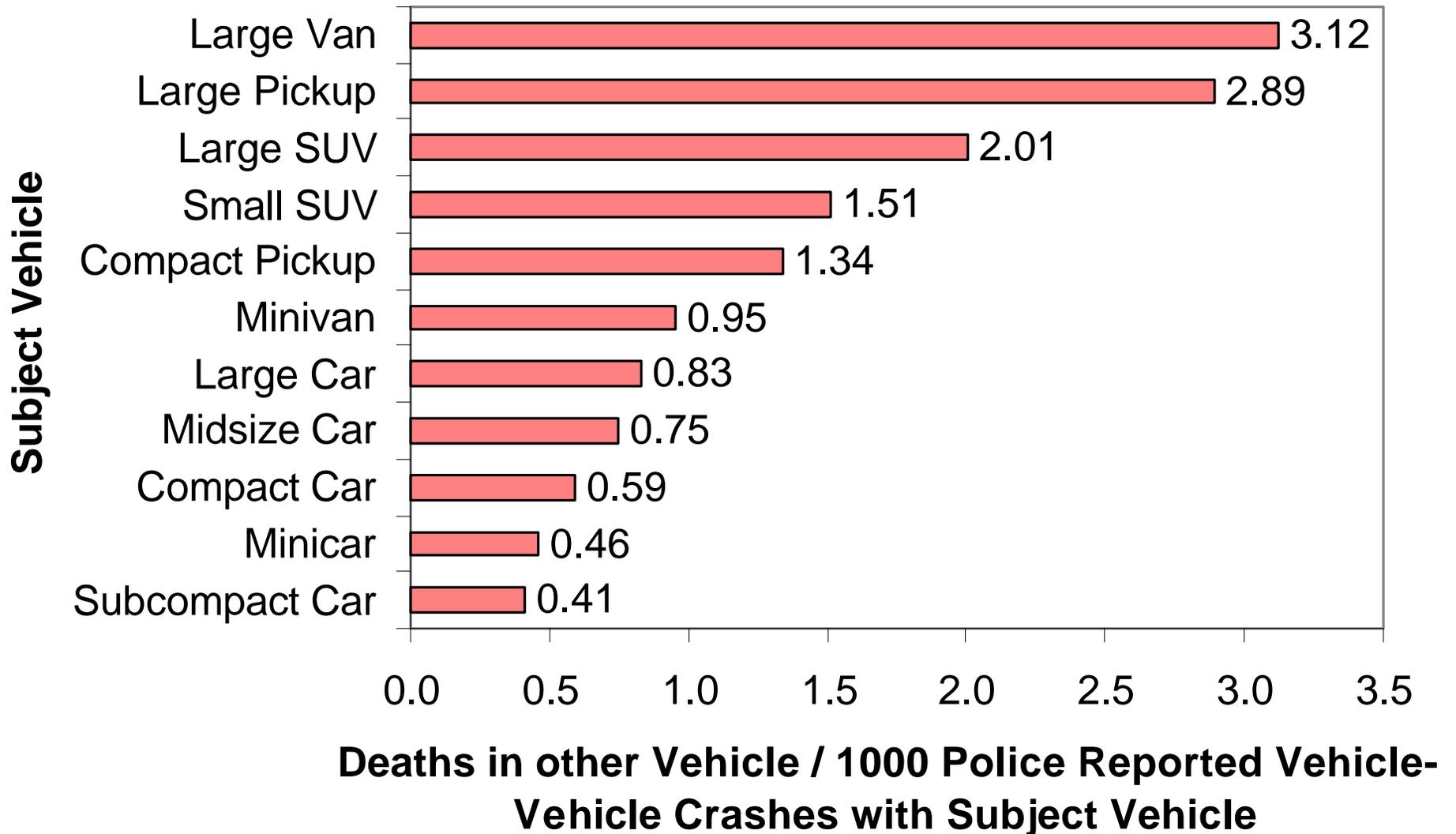
1995-1999 NASS GES number of crashes

2 vehicle crashes, both vehicles < 10,000 lbs GVW

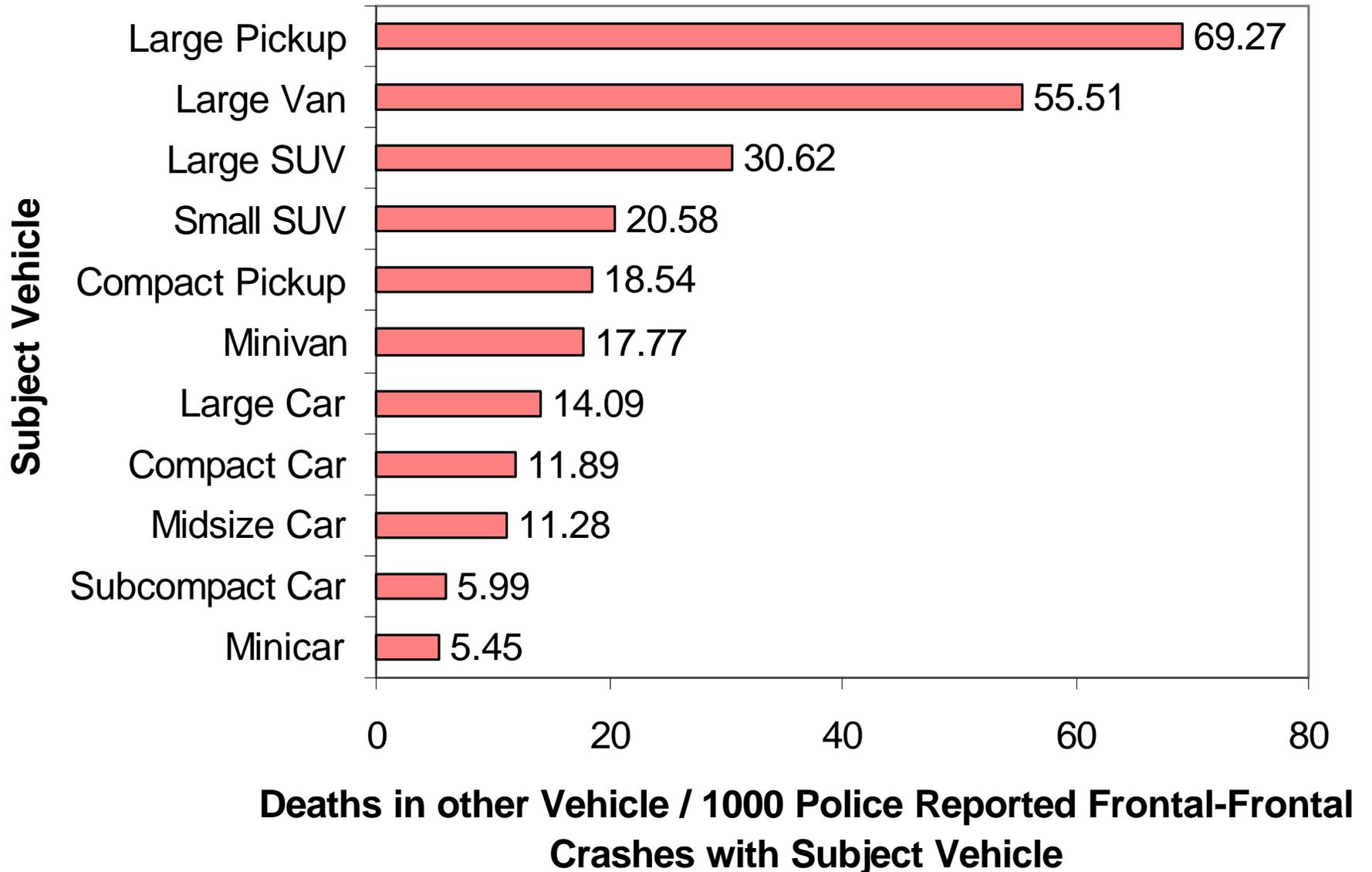
Both vehicles must be model year 1990 or newer

Count only driver fatalities between 25 and 55 years old

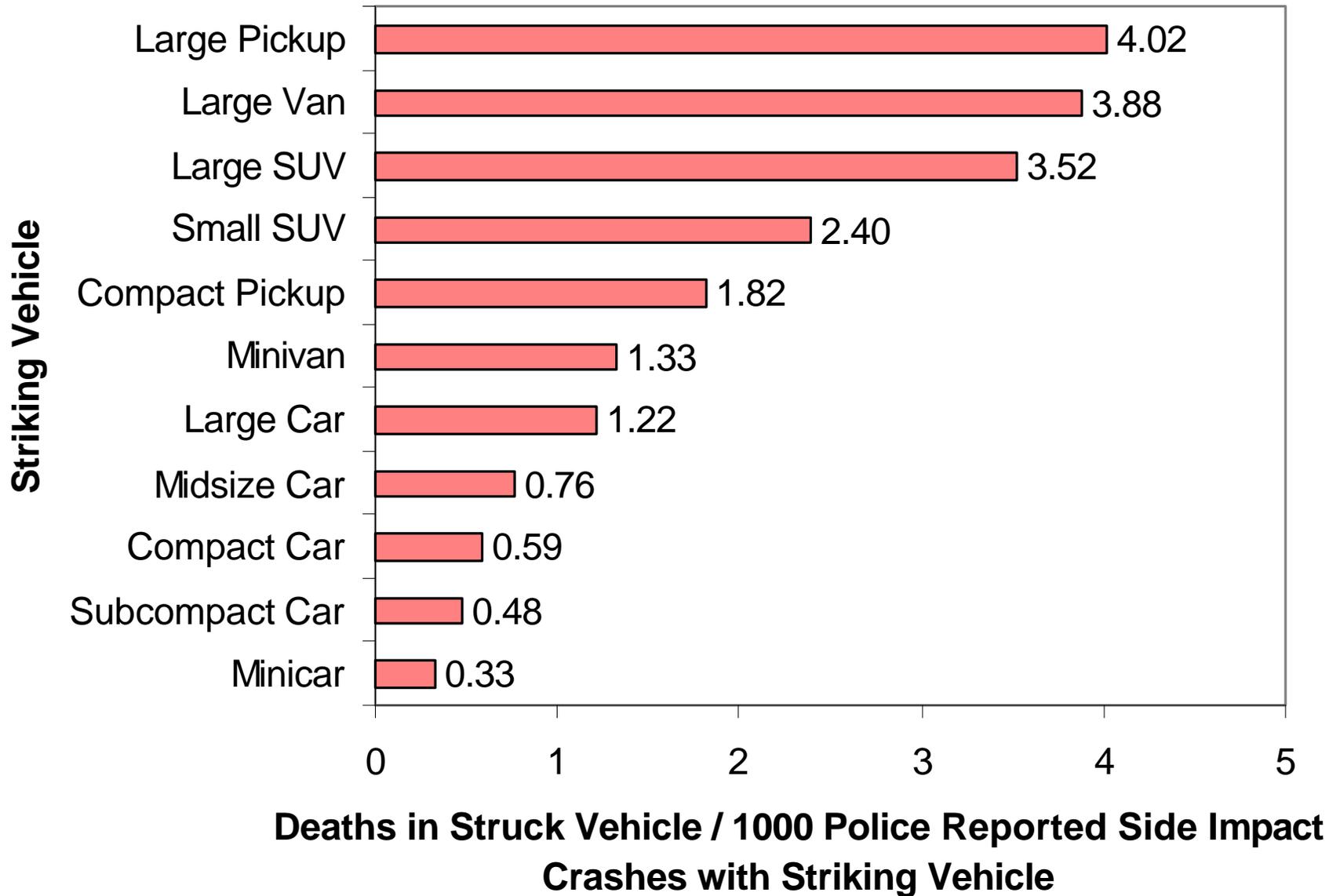
Aggressivity Metric – All Crashes



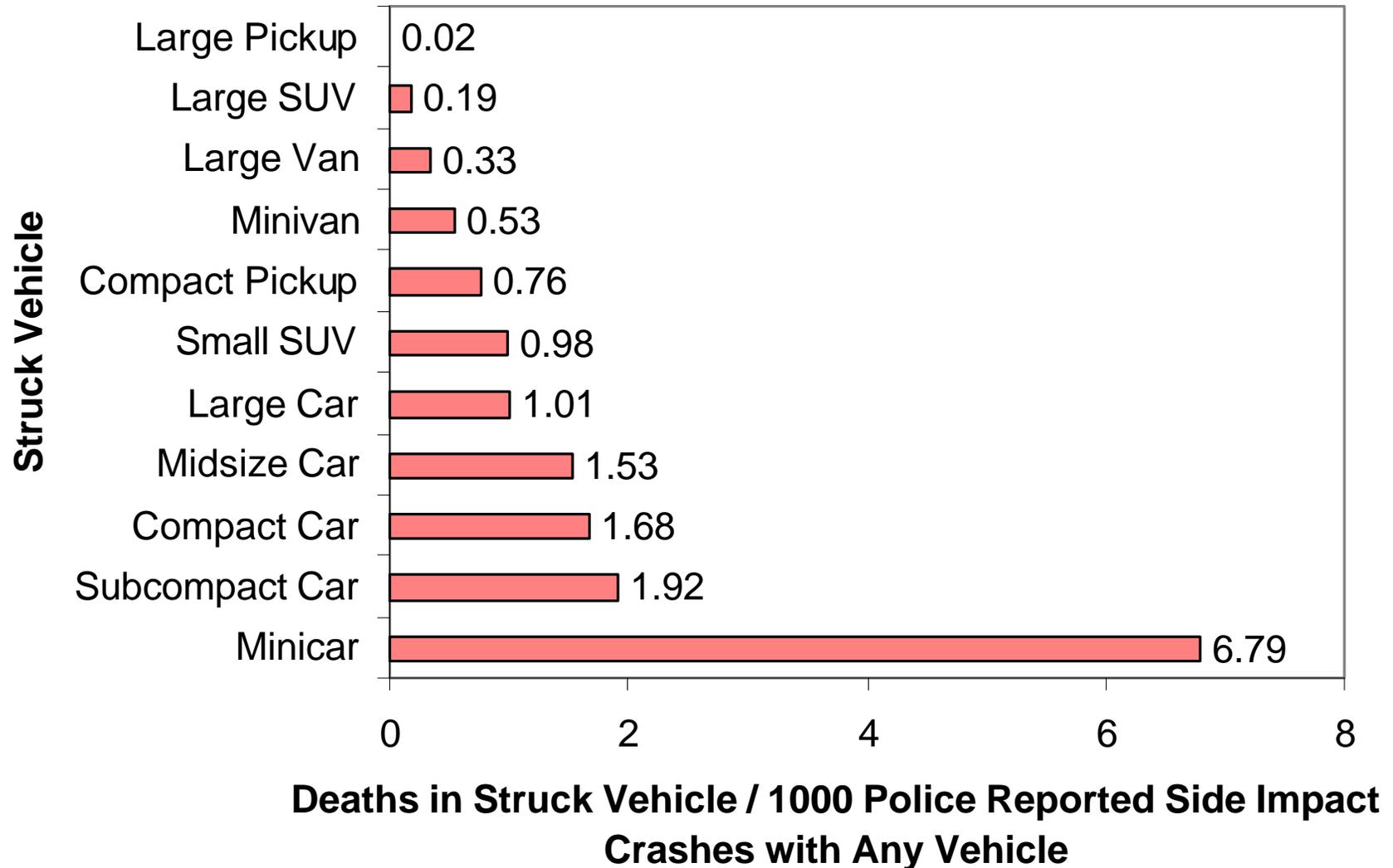
Frontal-Frontal crashes



Frontal-Side crashes



Vulnerability Metric, Frontal-Side crashes



Development of Test Methods to Evaluate Compatibility

- Goals:
 - Evaluate occupant protection in a crash with average or most likely crash partner
 - Self protection
 - Evaluate other vehicle crash severity with average or most likely crash partner
 - Partner protection

Loadcell MDB Testing

- LCMDB can be designed to represent the crash partner vehicle
 - Height, width, stiffness, depth of crush to be determined based on fleet survey data
 - Delta V of test vehicle will depend upon its weight
- Loadcells intended to measure distribution of force during crash
 - Aggressivity estimates may be derived from data
- Baseline research was presented as 2001 SAE Congress, 2001-01-1167

Research Goals

- Use Frontal-Frontal to evaluate feasibility
 - Collinear, 35 mph each vehicle
 - Full frontal engagement
 - 1996 Plymouth Neon, 1997 Dodge Caravan
 - Baseline 214 MDB face
- Compare LCMDB-to-vehicle and vehicle-to-vehicle responses
 - MDB weight was adjusted to simulate collision partner

Summary of previous Test Results

- Bumper element on LCMDB face diffused the measured force distribution
 - Distribution of force was not measured
- Insufficient energy absorption, 214 face bottomed out early in the test
 - LCMDB crashes were more ‘severe’ than vehicle-to-vehicle crashes
- Significant energy transfer occurred outside the loadcell face

Extended Test Matrix

Test	Vehicle 1	Vehicle 2
3362	LCMDB 56.2 kmph, 2051 kg	1996 Plymouth Neon 55.9 kmph, 1382 kg
3413	LCMDB 56.2 kmph, 1377 kg	1997 Dodge Caravan 56.8 kmph, 2138 kg
3414	1997 Dodge Caravan 56.5 kmph, 2060 kg	1996 Plymouth Neon 55.9 kmph, 1378 kg
3608	LCMDB Bumper Removed 58.0 kmph, 2050 kg	1996 Plymouth Neon 57.1 kmph, 1382 kg
3609	LCMDB Bumper Removed 56.2 kmph, 1377 kg	1997 Dodge Caravan 56.8 kmph, 2139 kg

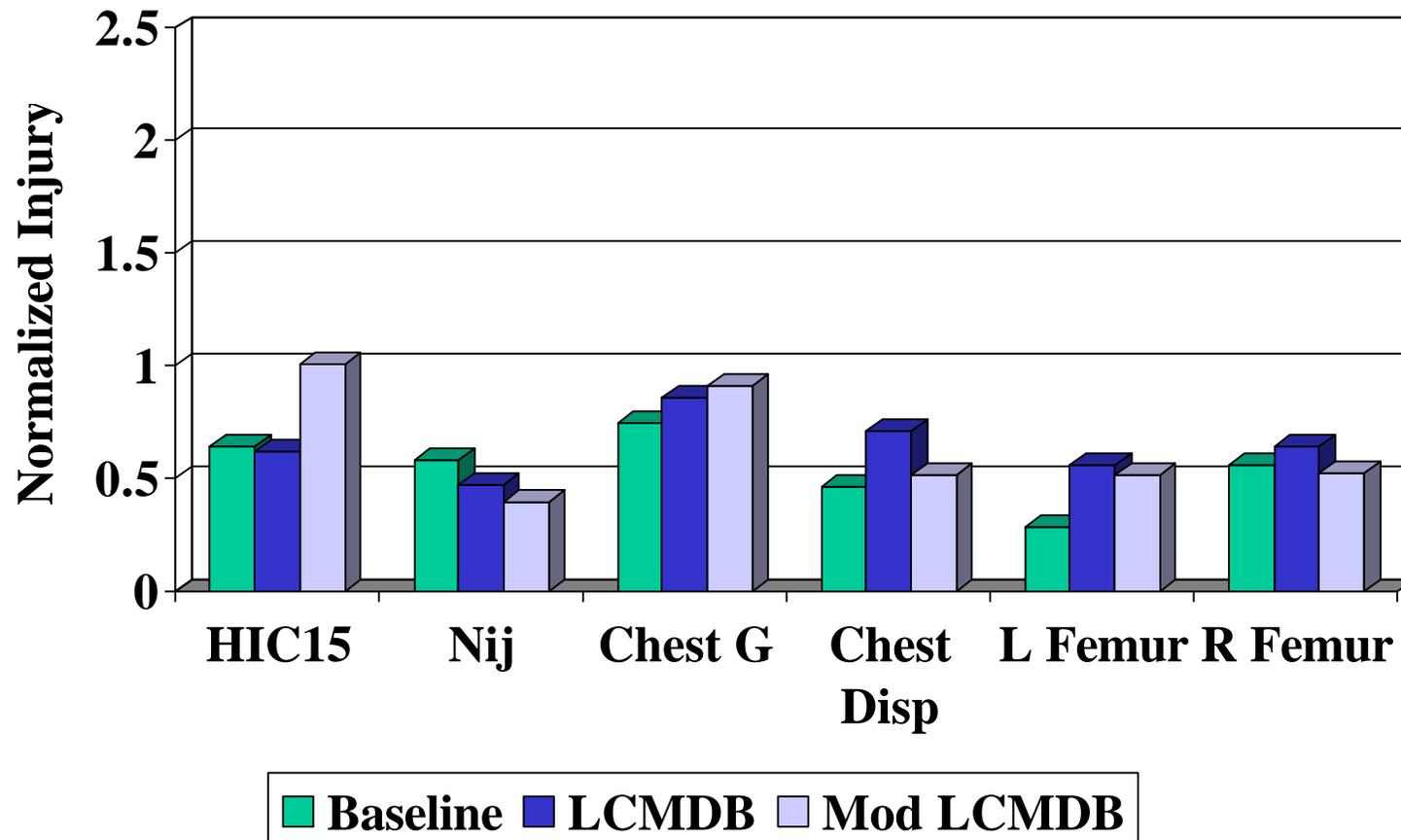
Modified LCMDB



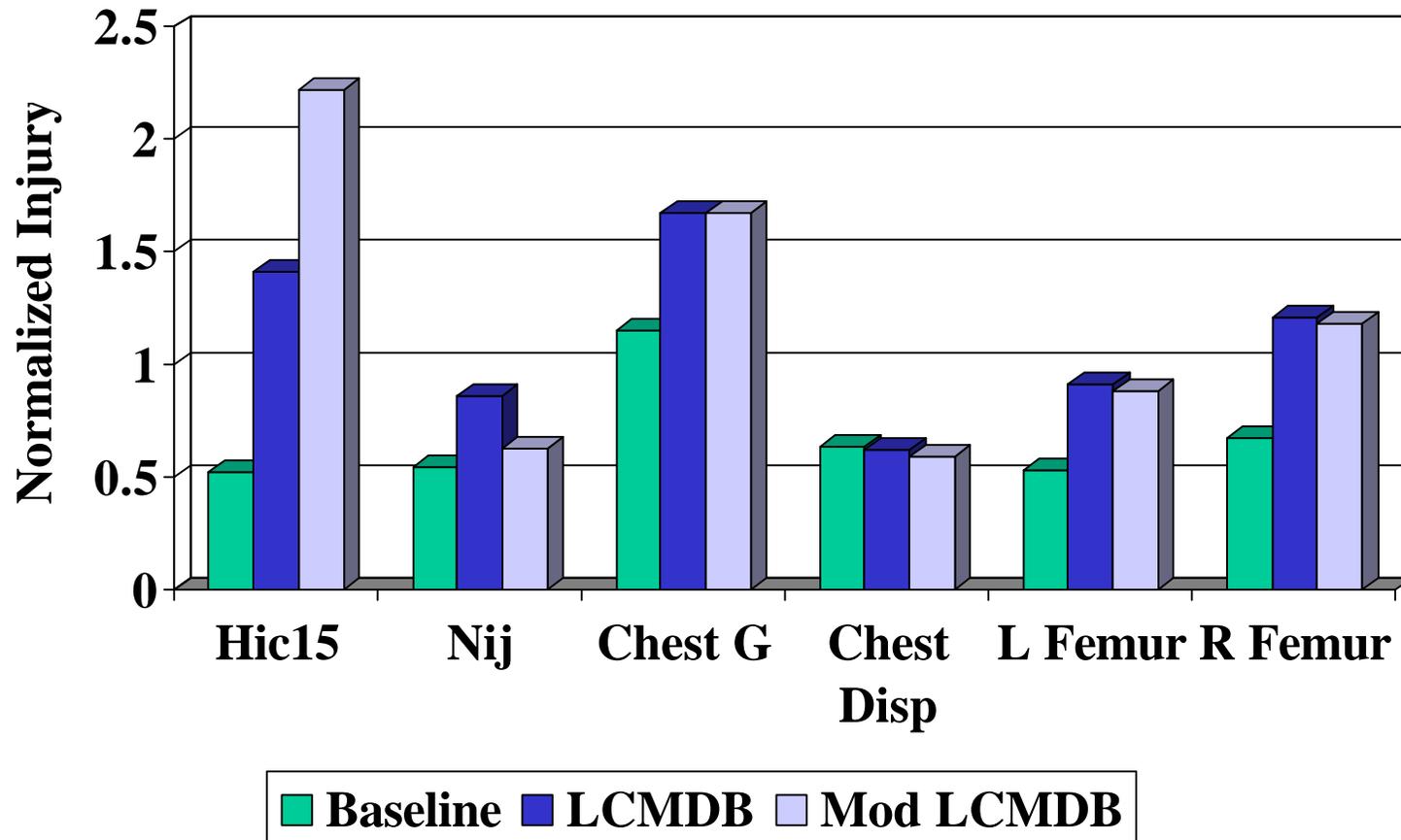
Occupant Injury

- Belted 50th male driver
- Belted 5th female passenger
- LCMDB tests without bumper produced higher HIC15 measurements
 - All injuries higher than baseline test
 - Other injuries were comparable between baseline and modified LCMDB

Caravan Driver Injury



Neon Driver Injury



Loadcell Measurements

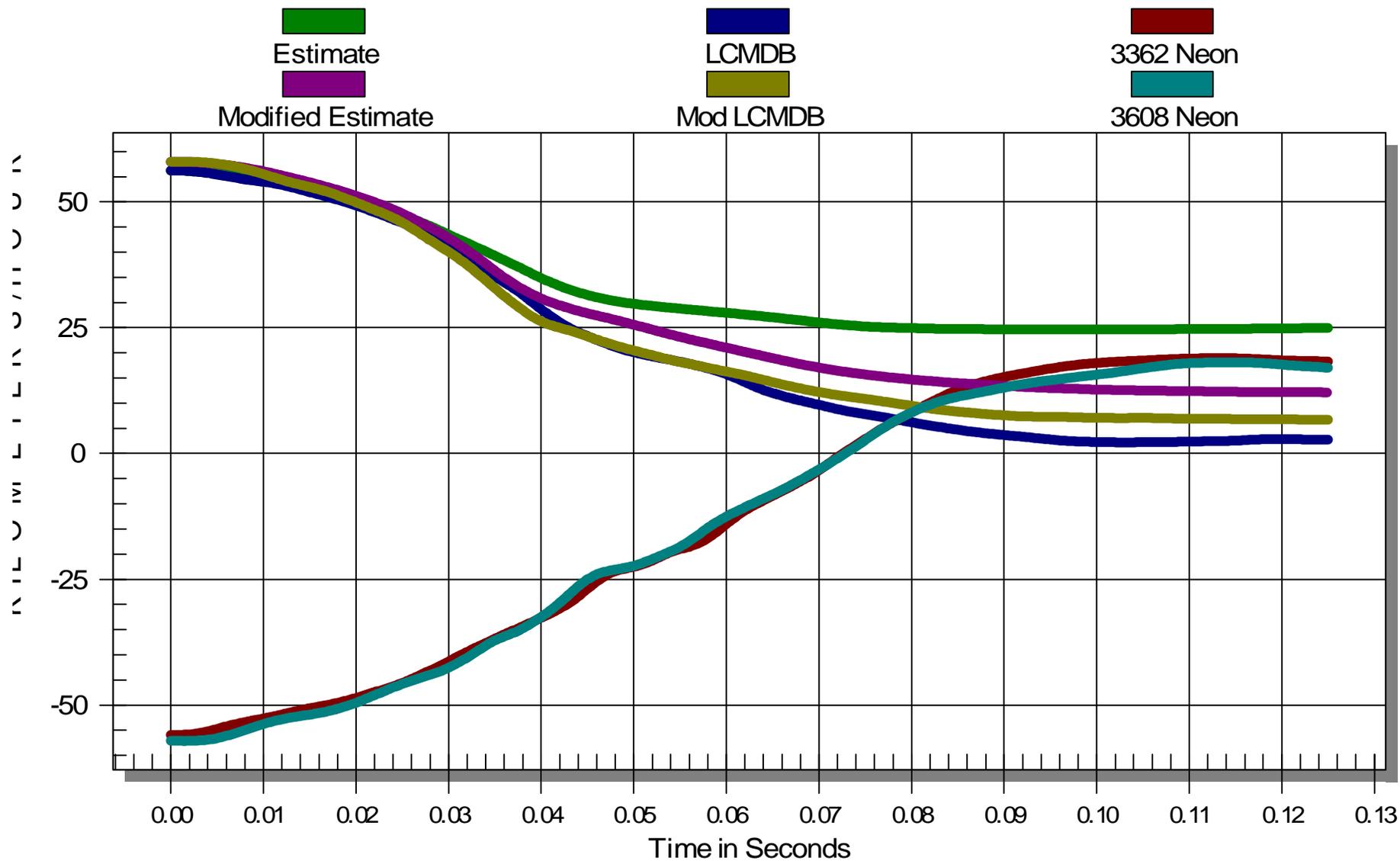
- Neon Loadcell measurements improved without the MDB bumper
 - Reduced bending of the honeycomb face for the Neon test
- Caravan measurements matched overall force, but changed distribution
- Existing MDB has insufficient energy absorption for this test configuration

Neon / LCMDB

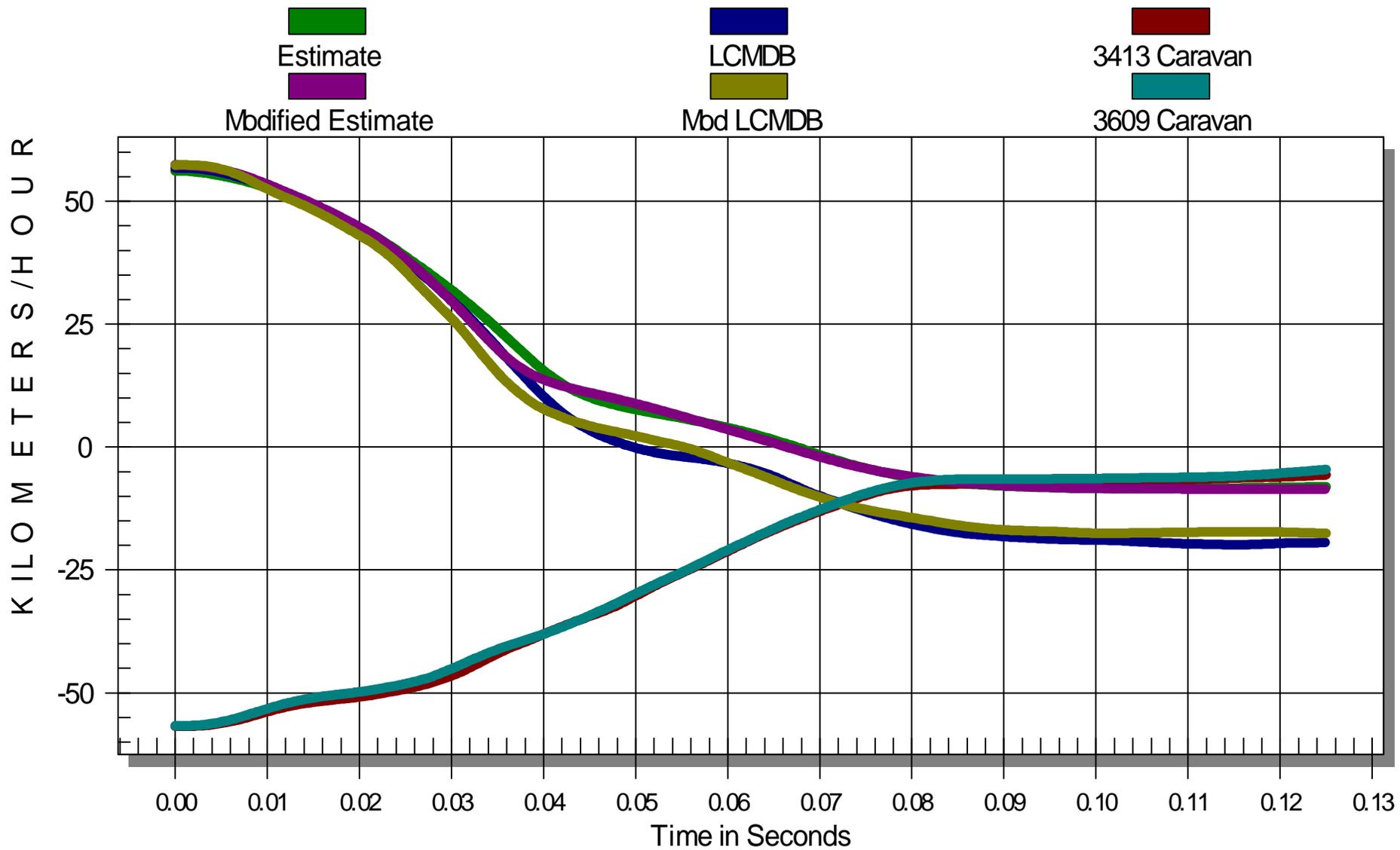


Neon / Modified LCMDB



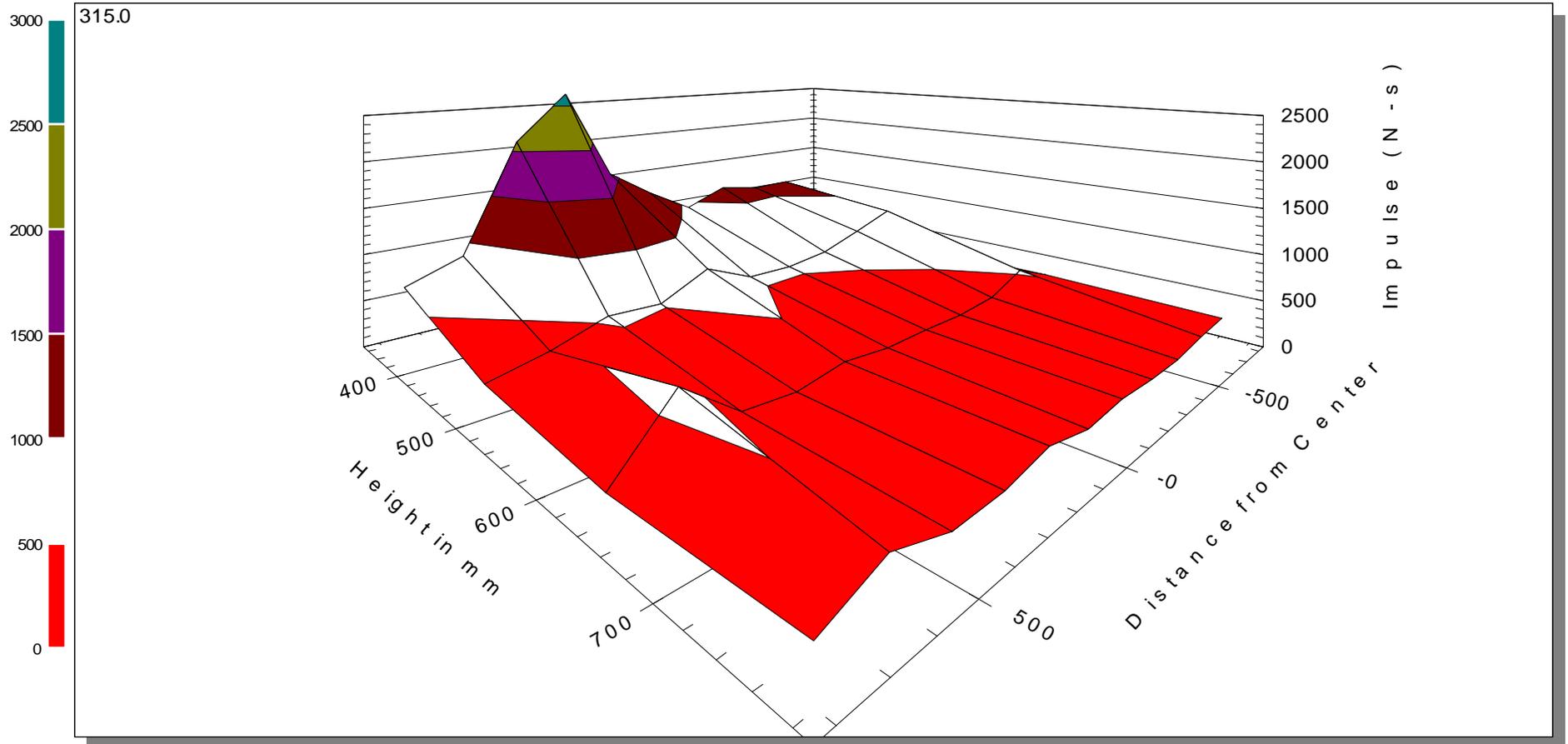


$$Estimate = \frac{TotalForce}{MassMdb}$$



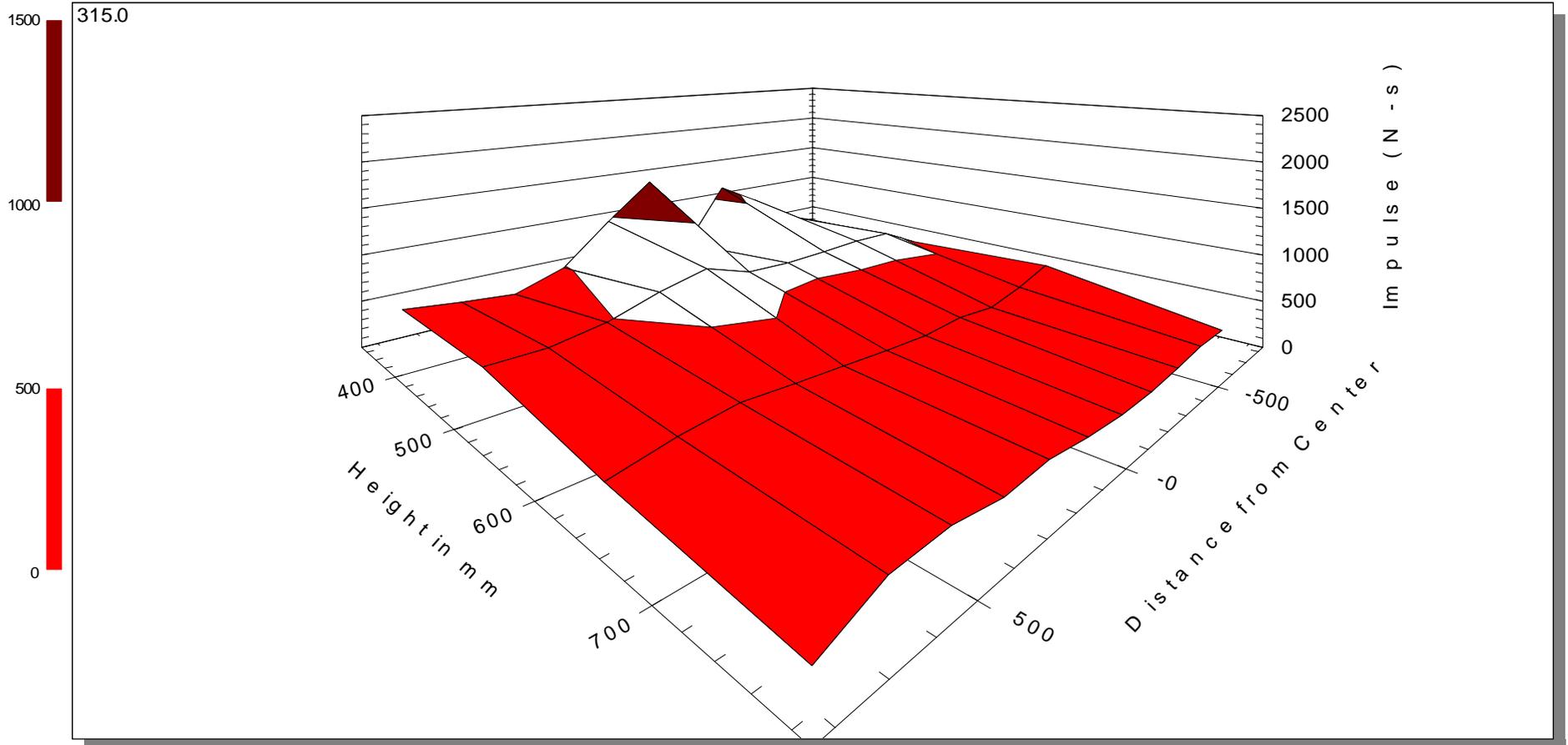
Neon / Modified LCMDB

Test 3608, Neon / Mod LCMDB



Neon / LCMDB

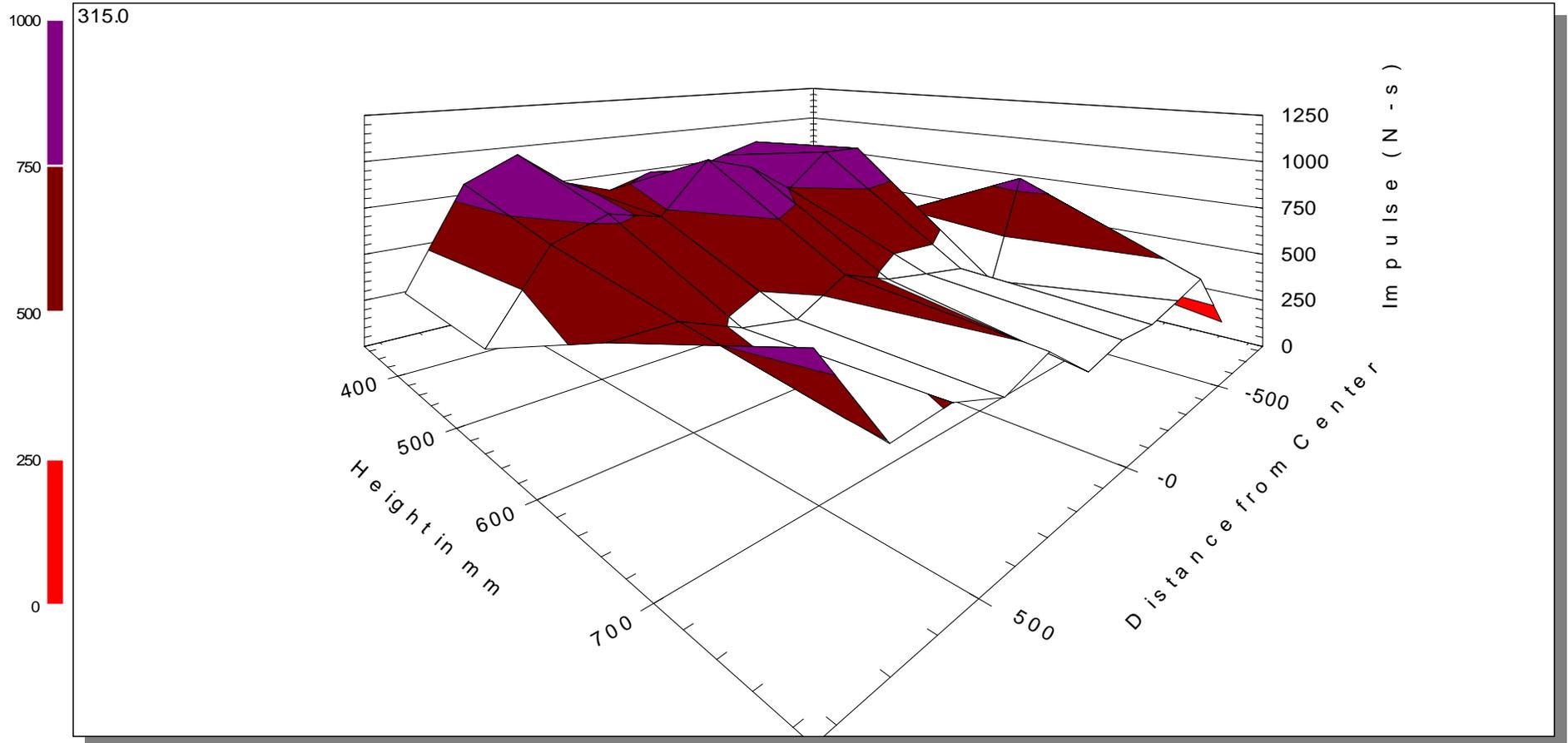
Test 3362



Presence of the LCMDB bumper substantially shifted the load distribution

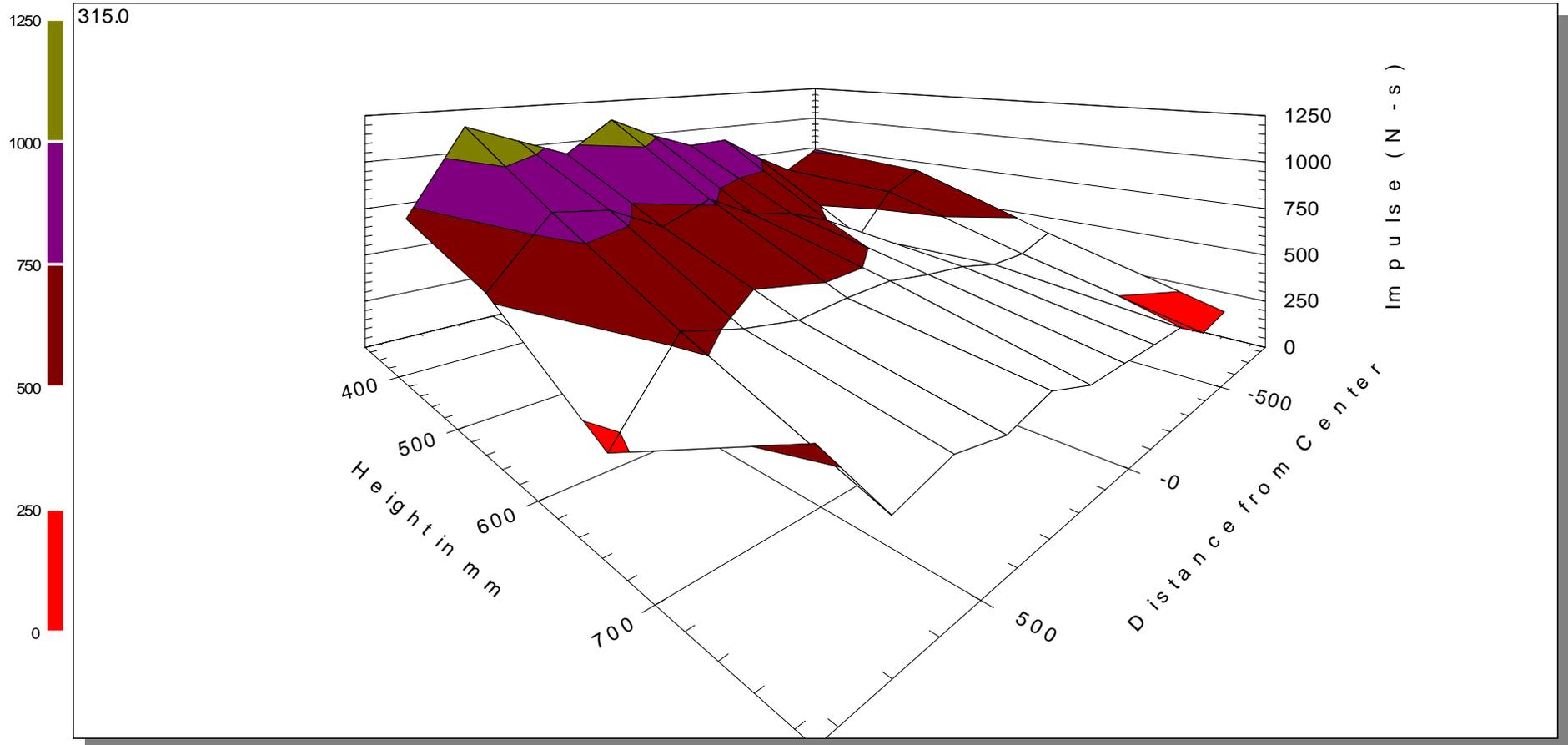
Caravan / Modified LCMDB

Test 3609



Caravan / LCMDB

Test 3413



Even for the Caravan tests, the LCMDB bumper substantially changed the load distribution

Conclusions

- Compatibility continues to be a concern for US fleetwide safety
- MDB crash tests can reasonably replicate vehicle to vehicle crashes
- Load distribution is sensitive to the design of the MDB face
 - Still need to establish the relationship, if possible, between load distribution and compatibility
 - Work in progress to reevaluate MDB design to represent average or most likely collision partner