

# GREAT DESIGNS IN STEEL

**Presentations will be available  
for download on SMDI's  
website on Wednesday, May**

**22**

# GREAT DESIGNS IN STEEL

Update on IHS side impact research

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# IIHS/HLDI

## Vehicle Research Center – Ruckersville, VA



### The Insurance Institute for Highway Safety

Founded in 1959

Independent, nonprofit, scientific, and educational organization

Mission - Reducing highway losses (deaths, injuries, and property damage)

### The Highway Loss Data Institute

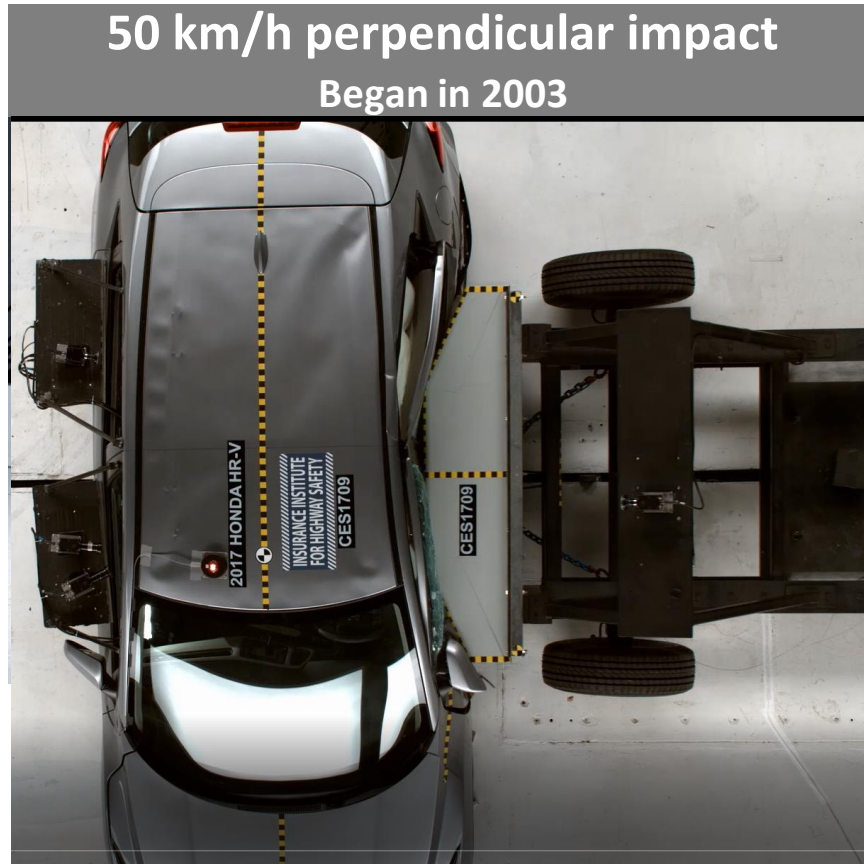
Founded in 1972

Perform scientific studies of insurance data

Publish insurance loss results



# IIHS side impact crashworthiness test



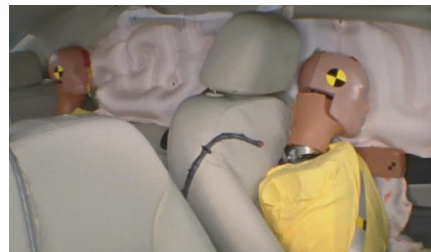
Vehicle Ratings

**G**ood

**A**cceptable

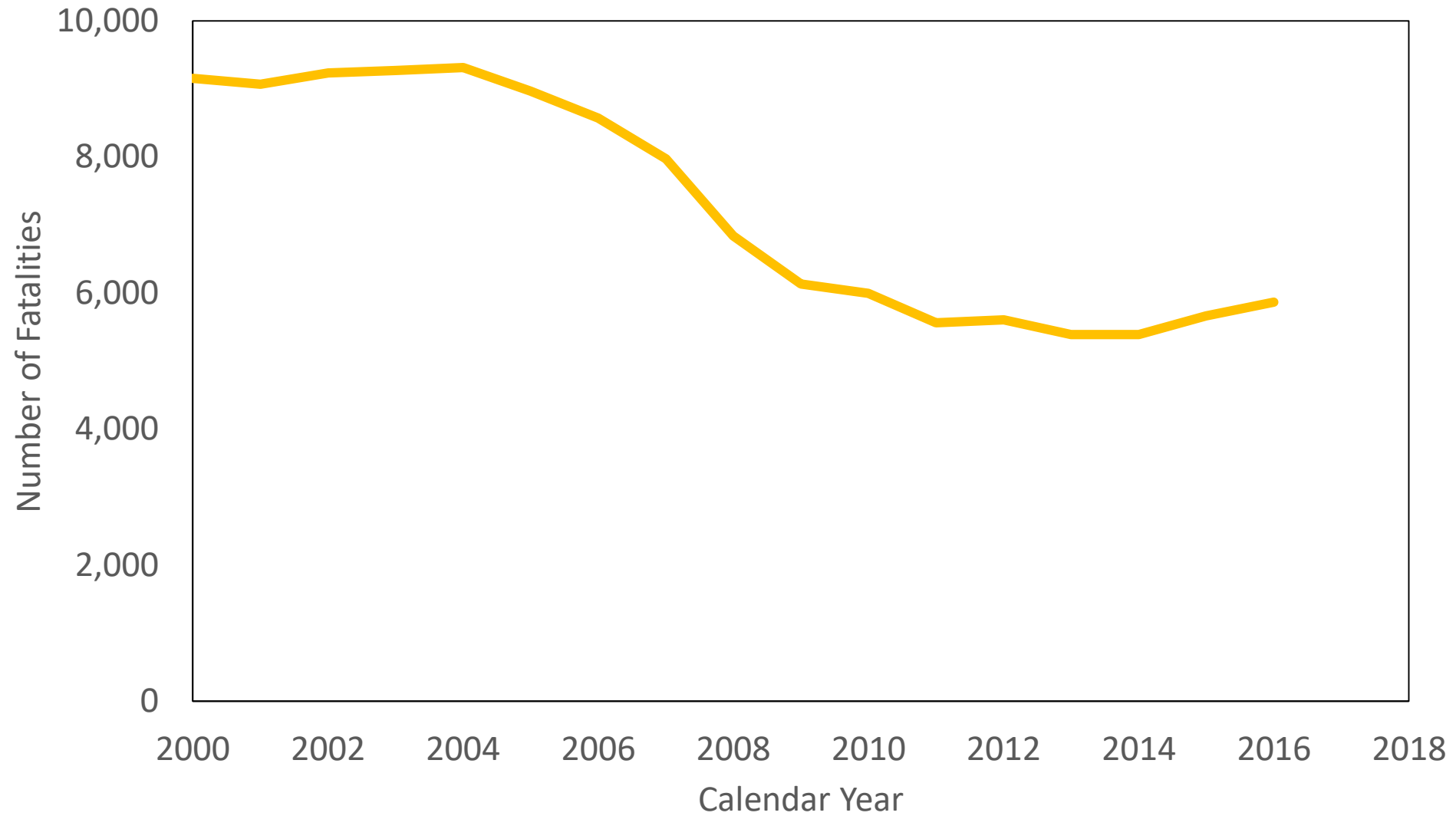
**M**arginal

**P**oor



Vehicle ratings based on dummy injury measures, restraints/dummy kinematics and structural performance

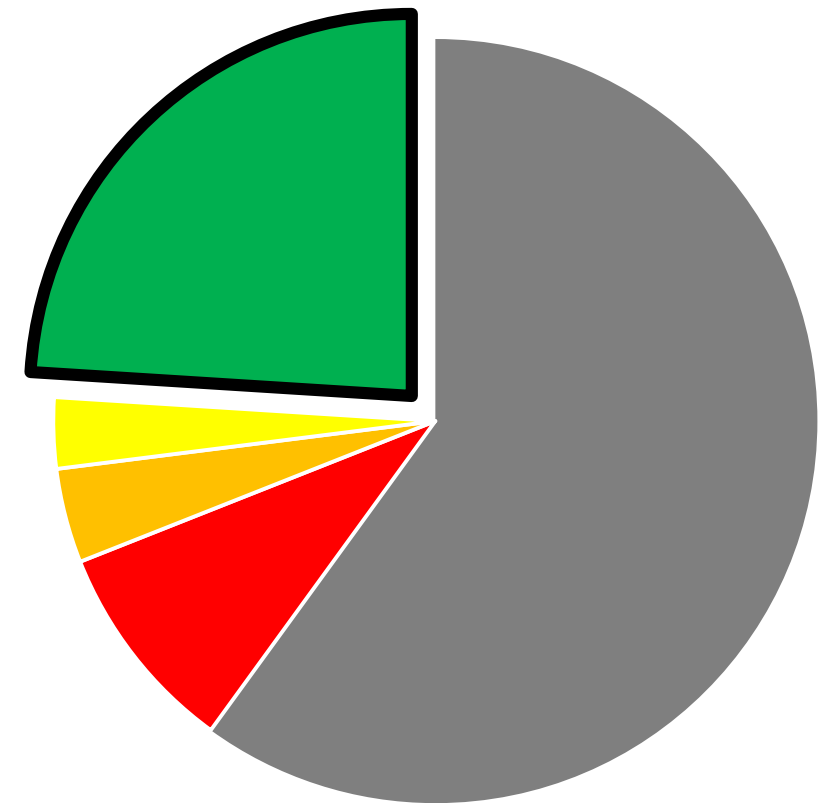
# Side crash fatalities in the United States



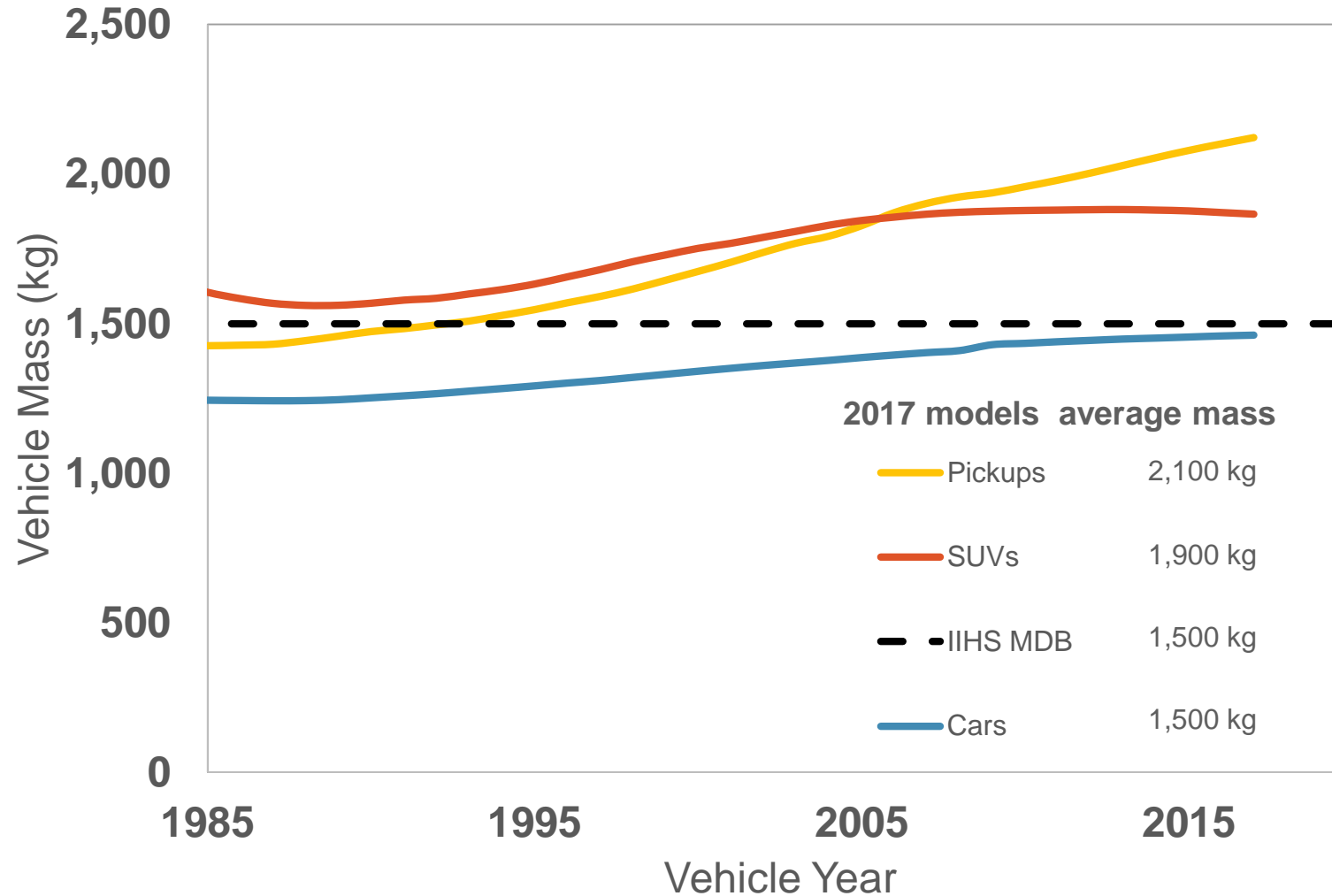
# Side impact ratings: crash tests and field data

- ▶ Fatal crash analysis - 2011
  - Fatality risk in side impact crashes 70 percent lower in 'good' rated vehicles versus 'poor'
  - Research Question: What crashes remain fatal?
- ▶ Fatal/Serious Injury case review - 2015
  - Predominantly involve more severe crashes: higher impact speed and heavier striking vehicles
- ▶ Modified crash configuration - 2017
  - Impact location similar to existing test but higher severity (impact speed or striking vehicle mass)

2016 Fatal Side Crashes (FARS)



# MDB mass underrepresents current SUVs and pickups



# Research testing: Comparison of IIHS barrier, SUV and Pickup impacts at higher mass and higher speed

1900 kg, 60 km/h

IIHS Barrier



Ford F-150



Honda Pilot





# Vehicles for evaluation

All 'good' performers, represent high-to-low range of 'good' evaluation

**Very strong Good rated structure**

Toyota Camry



**Borderline Good-Acceptable structure**

Honda Accord



Volkswagen Atlas



Infiniti QX50



# Ford F-150 into Toyota Camry



# Vehicle rotation differences

Vehicles vs. MDB

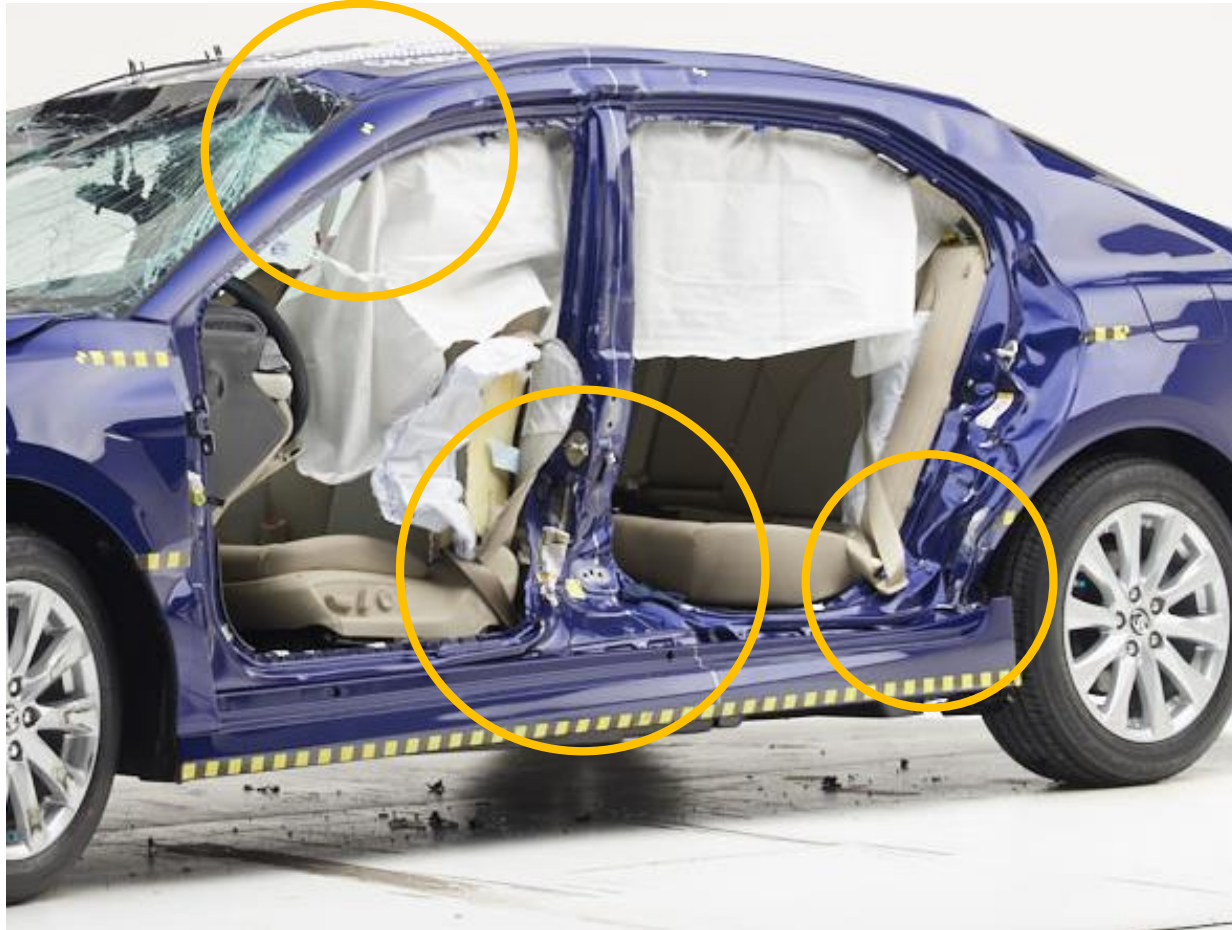


# Issues observed with MDB in higher speed tests



# 2018 Toyota Camry

Structure: MDB and F-150 differences



1,900 kg MDB into Camry at 60 km/h



2,257 kg F-150 into Camry at 60 km/h

# 2018 Toyota Camry

Structure: MDB and F-150 differences



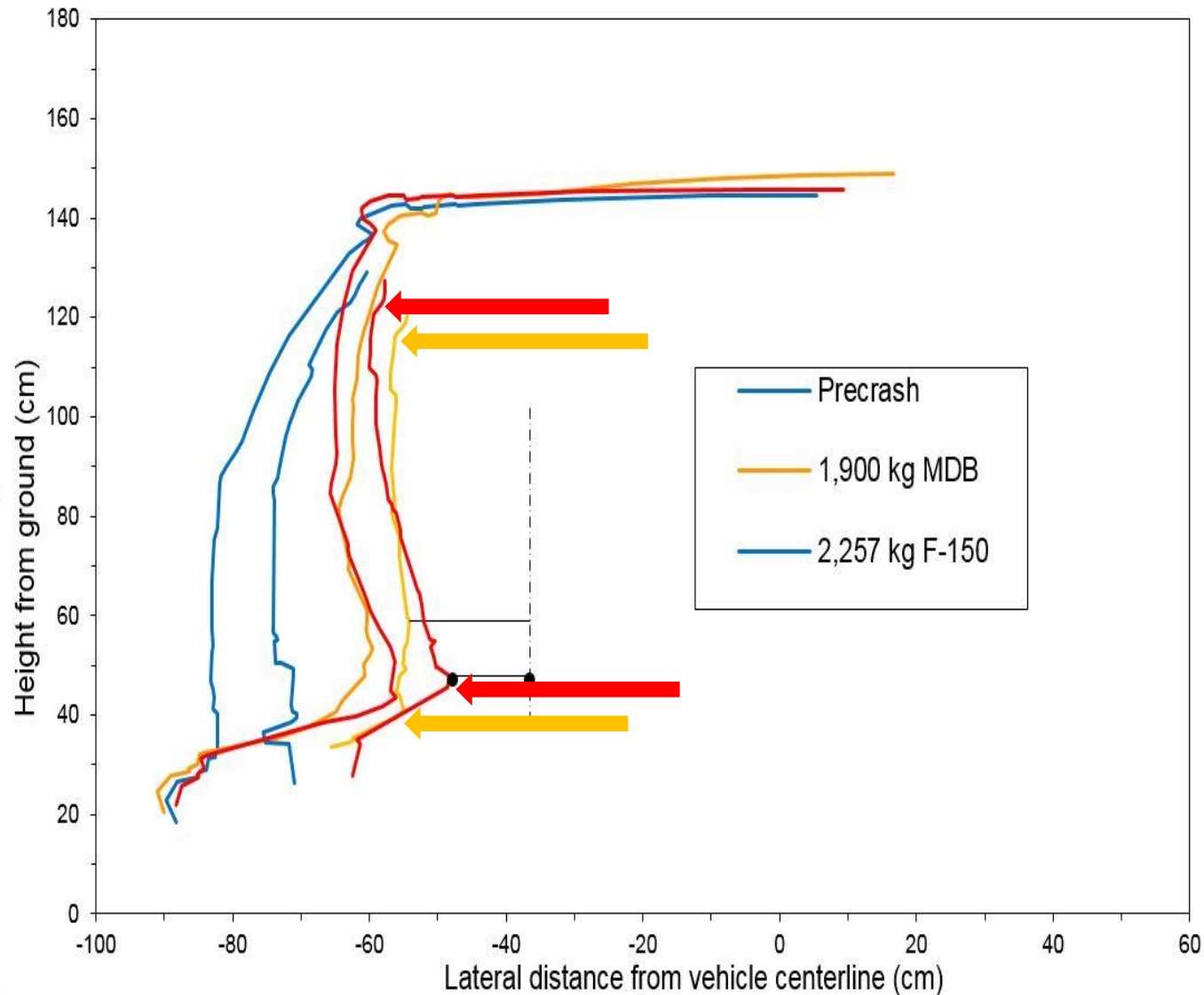
Barrier crushes and backing plate loads wheel arch



Fender and bumper bend before crushing arch

# 2018 Toyota Camry

## Structure: MDB and F-150 differences



- ▶ CE test – 22.0 cm from seat C/L
- ▶ MDB – 17.6 cm from seat C/L
  - Acceptable driver HIC
  - Acceptable driver and rear passenger average torso deflection
  - Good lower body (pelvis & legs)
- ▶ F-150 – 11.3 cm from seat C/L
  - Good upper body (chest & head)
  - Marginal driver femur force
  - Poor driver femur moment

# 2018 Volkswagen Atlas

Structure: MDB and F-150 differences



1,900 kg MDB into Atlas at 60 km/h



2,257 kg F-150 into Atlas at 60 km/h



# 2018 Volkswagen Atlas

Structure: MDB and F-150 differences



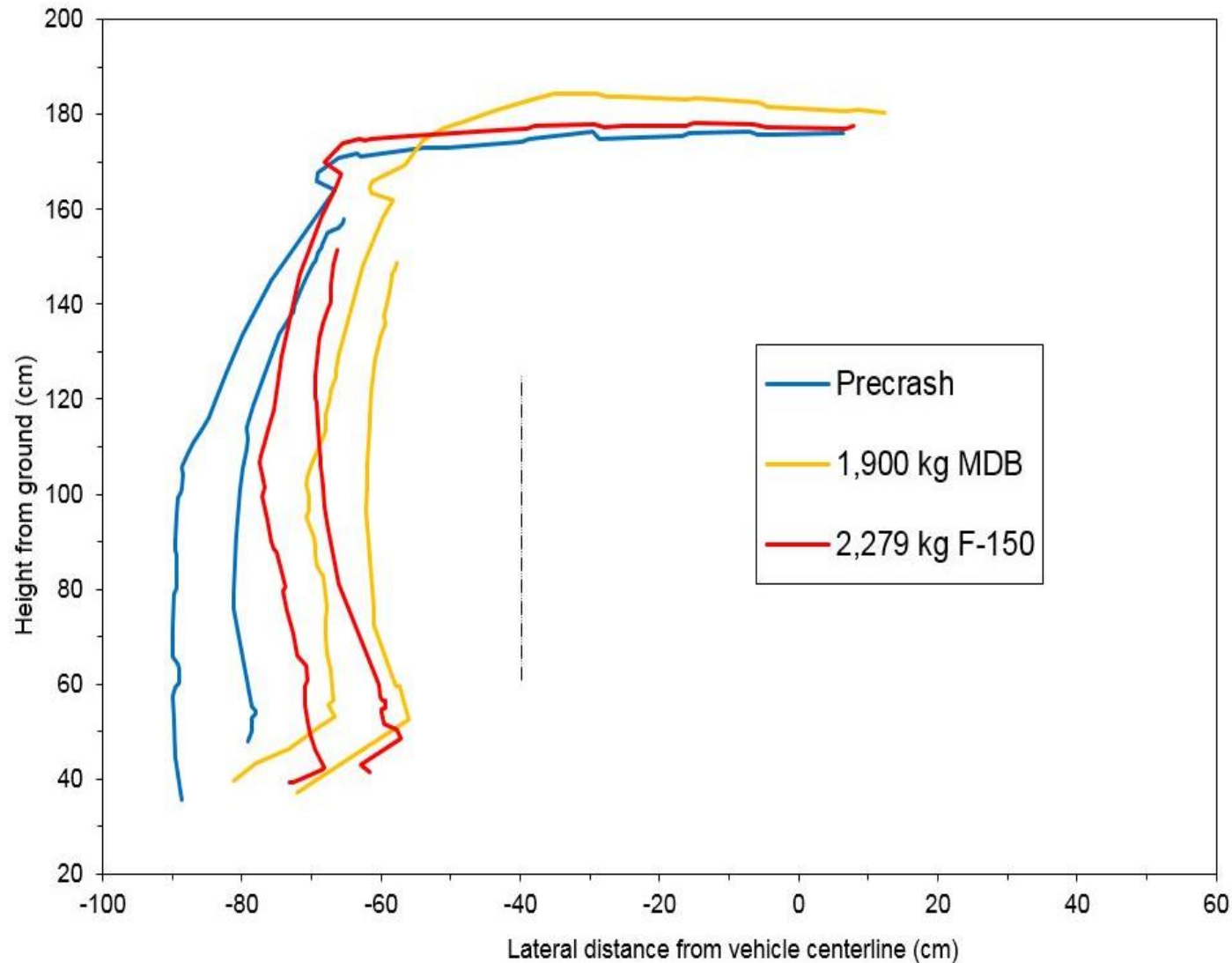
Outer edge of barrier crushes, then loads a-pillar, bucking roof and windshield



Fender and hood of F-150 crush, instead of loading a-pillar, reducing roof buckle

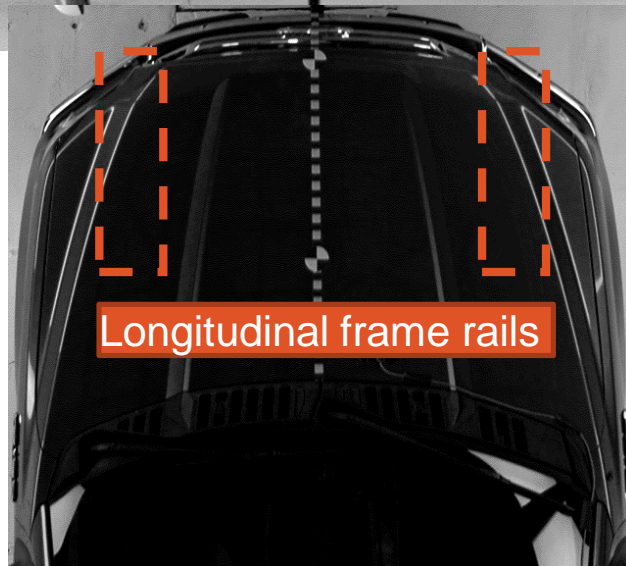
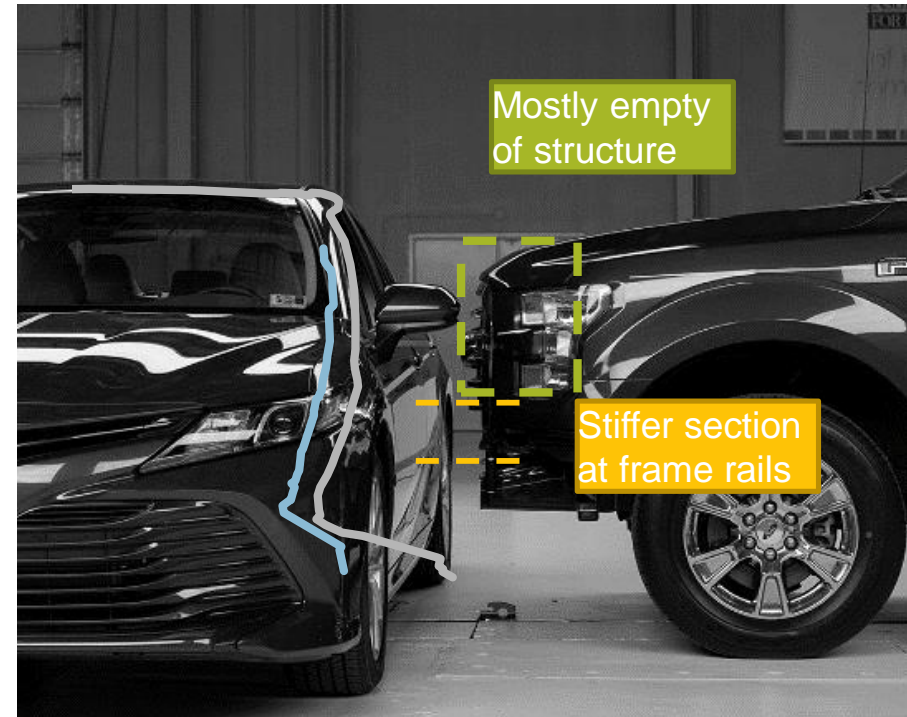
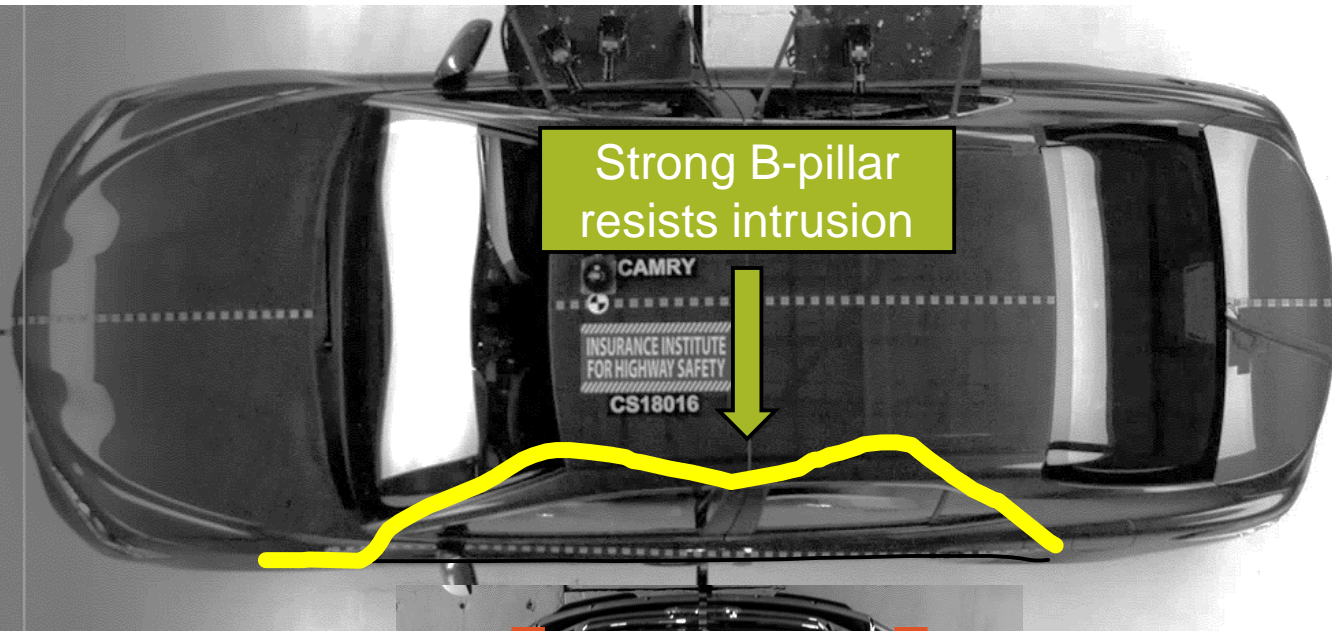
# 2018 Volkswagen Atlas

## Structure: MDB and F-150 differences



- ▶ CE – 32.0 cm from seat C/L
- ▶ MDB – 21.2 cm from seat C/L
  - Acceptable HIC
  - Acceptable driver average torso deflection
  - Marginal passenger peak torso deflection
  - Good lower body (pelvis & legs)
- ▶ F-150 – 26.5 cm from seat C/L
  - Good head and legs
  - Marginal passenger torso deflection
  - Acceptable driver and passenger pelvis (poor passenger acetabulum)

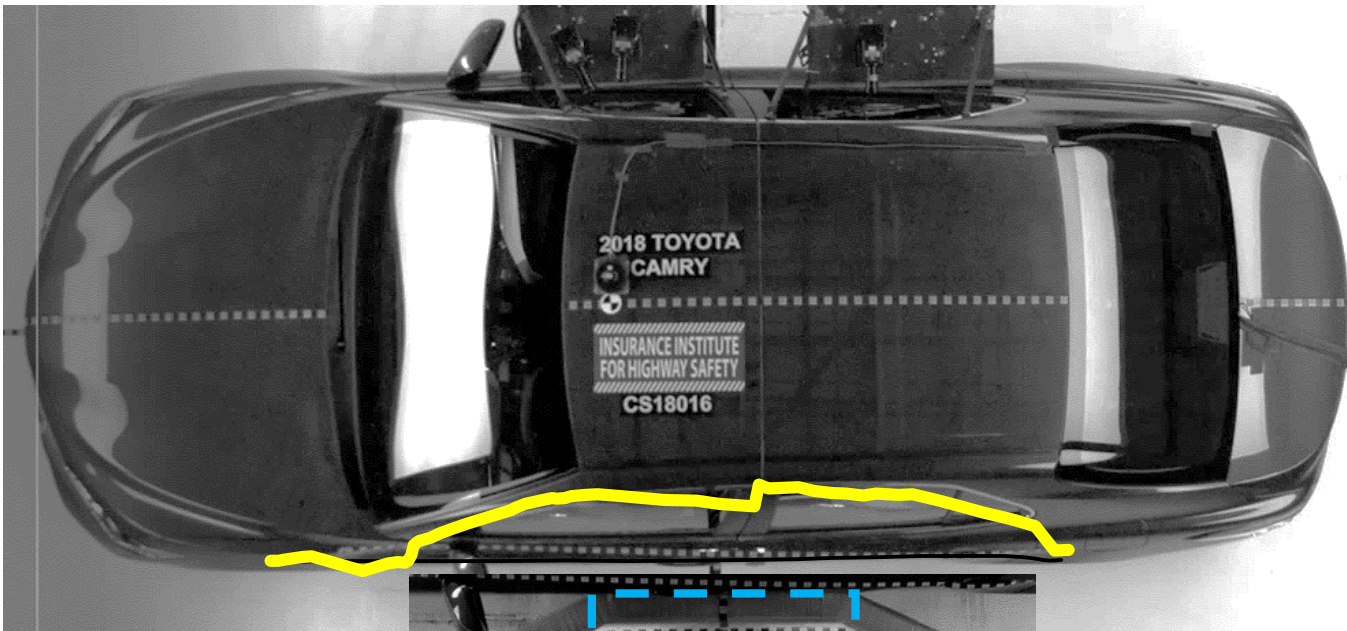
# Vehicle deformation when struck by pickup/SUV



Localized deformation vertically at height of pickup's frame rails

"M" shaped loading pattern along vehicle side

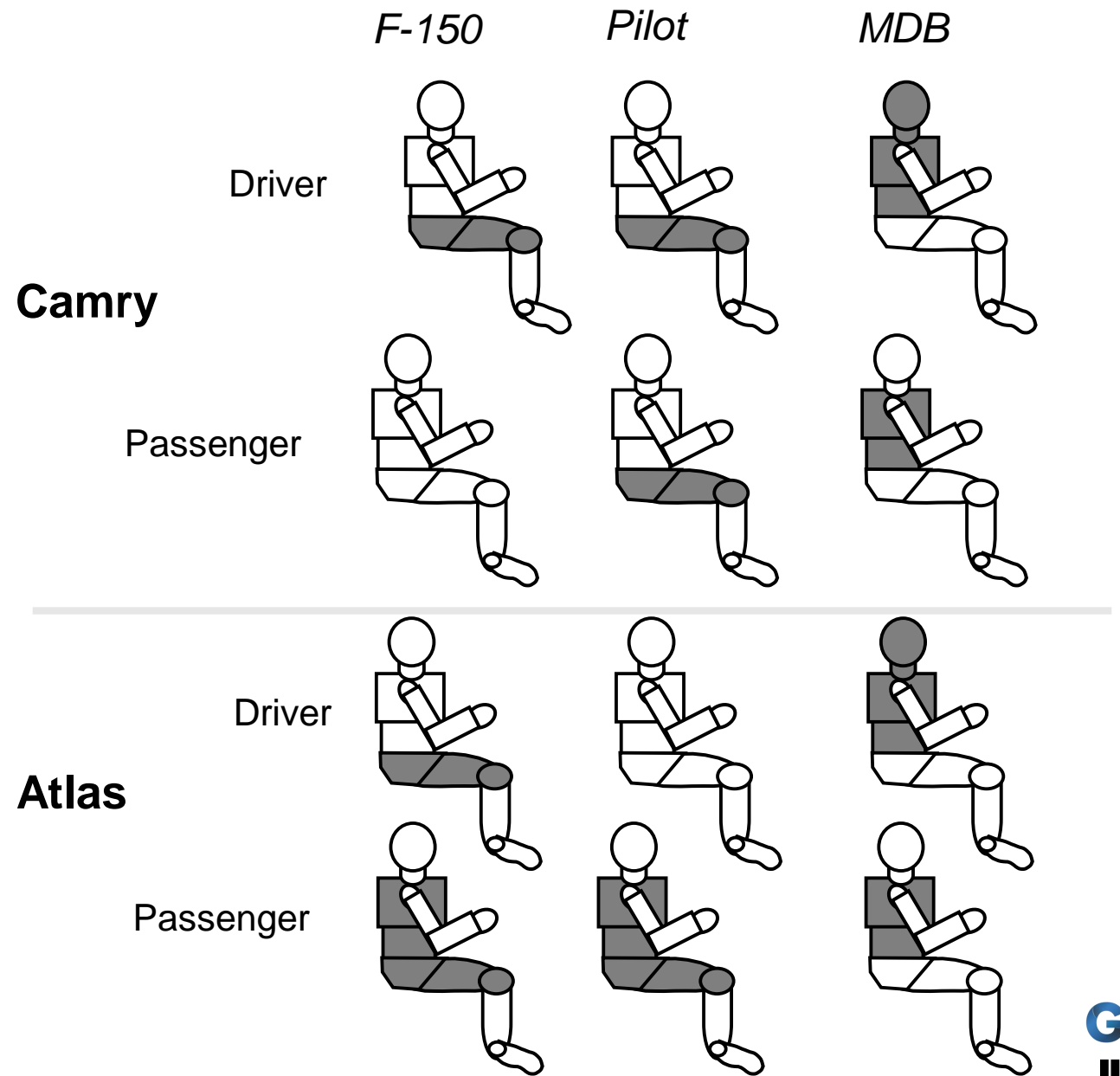
# Vehicle deformation when struck by MDB



Uniform loading front to back  
Uniform loading top to bottom

# Dummy injury measures

- ▶ Body regions with injury risks exceeding IARVs – MDB vs vehicles
  - More pelvis and leg interaction
  - Less upper body interaction



# Good performing vehicles produced a range of performance

1,900 kg MDB - 60 km/h

Very strong Good rated structure in ratings test

structural performance

**G**

structural performance

**G**



Camry



Atlas

Borderline Good-Acceptable structure in ratings test

structural performance

**A**

structural performance

**M**



Accord



QX50

# Next Steps

MDB redesign



Barrier designed to capture stiffer and softer regions of vehicle front ends?

# Summary

- ▶ Higher speed test with a heavier MDB could encourage structural and restraint system design changes
- ▶ Modification of the IIHS MDB may be necessary to make it more representative of SUV or Pickup striking vehicles
  - Different vehicle kinematics
  - Differences in structural deformation produced different injury patterns
    - MDB indicated high risk of head and chest injuries
    - SUV/Pickups indicated high risk of pelvic injuries
- ▶ Side crashworthiness can be improved with more stringent evaluation criteria



**Thank You!**

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