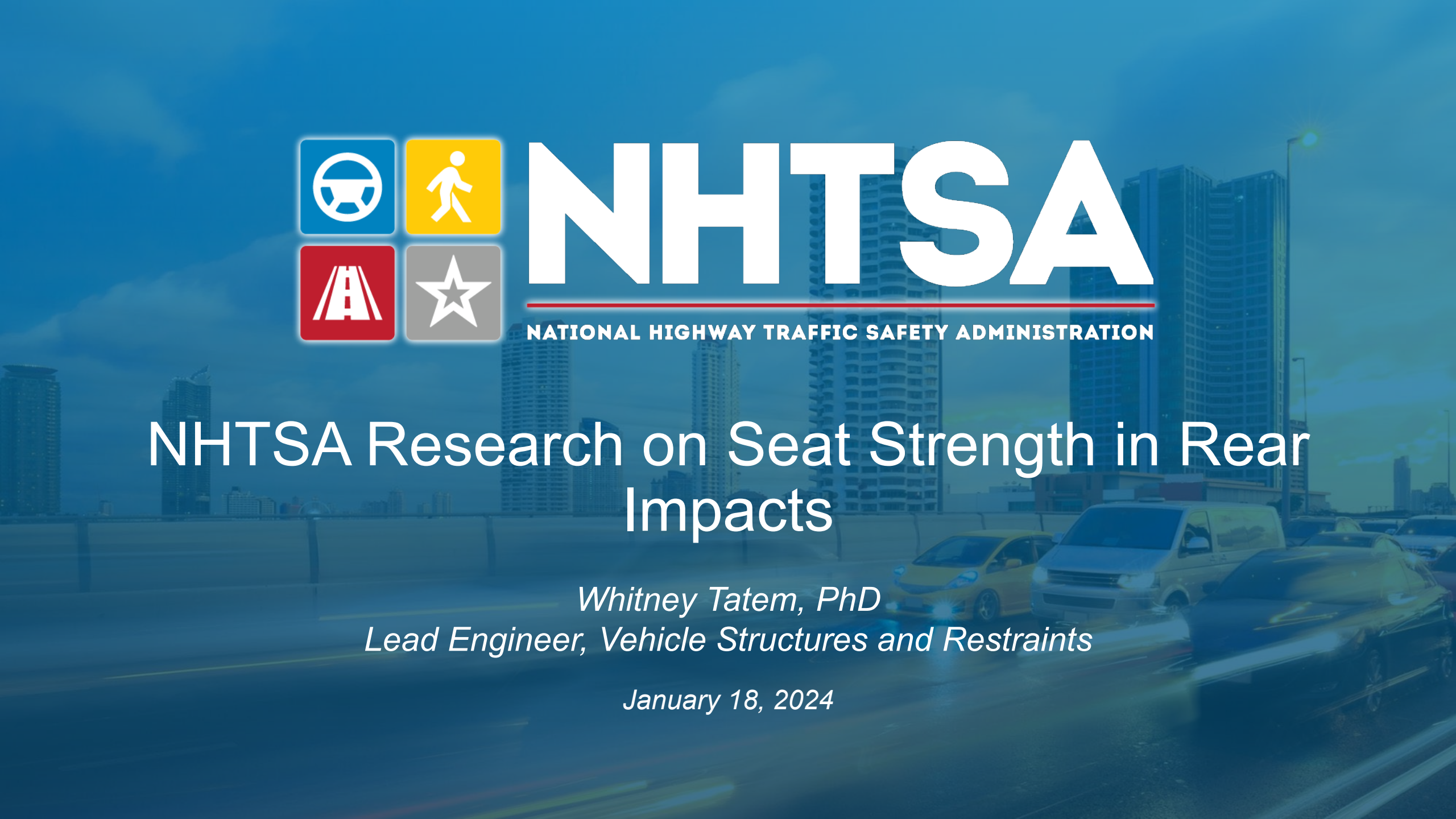

NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

NHTSA Research on Seat Strength in Rear Impacts

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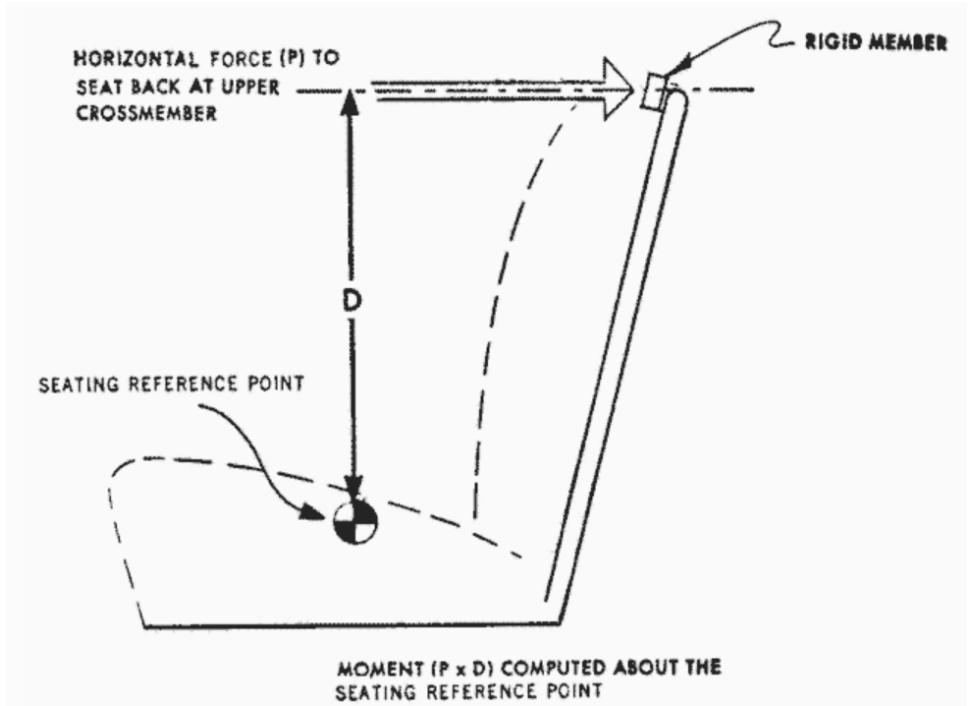
BIL Sec. 24204 – Motor Vehicle Seatback Safety Standards

- The Bipartisan Infrastructure Law (BIL) directed the Secretary of Transportation to "[n]ot later than 2 years after the date of enactment of this Act…issue an advanced notice of proposed rulemaking to update section 571.207 of title 49, Code of Federal Regulations."

- RIN 2127-AM53*, ANPRM imminent

- NHTSA expects to complete the rulemaking as soon as is practicable giving due consideration to public input throughout the rulemaking process.

* https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202310&RIN=2127-AM53



FMVSS No. 207

Establishes structural requirements for seats in passenger cars, multipurpose passenger vehicles, trucks designed to carry at least one person, and buses with a GVWR ≤ 10,000.

- Static rearward seat strength moment minimum of 3300 in-lbf or 373 N-m
- Other requirements on attachment of seat to vehicle, etc.

Modern seat strength ~2500 N-m*

Seat strength requirement currently set by FMVSS 202a at ~650 N-m

*David C. Viano, Chantal S. Parenteau, Roger Burnett & Priya Prasad (2018) Occupant responses in conventional and ABTS seats in high-speed rear sled tests, Traffic Injury Prevention, 19:1, 54-59, DOI: 10.1080/15389588.2017.1347782

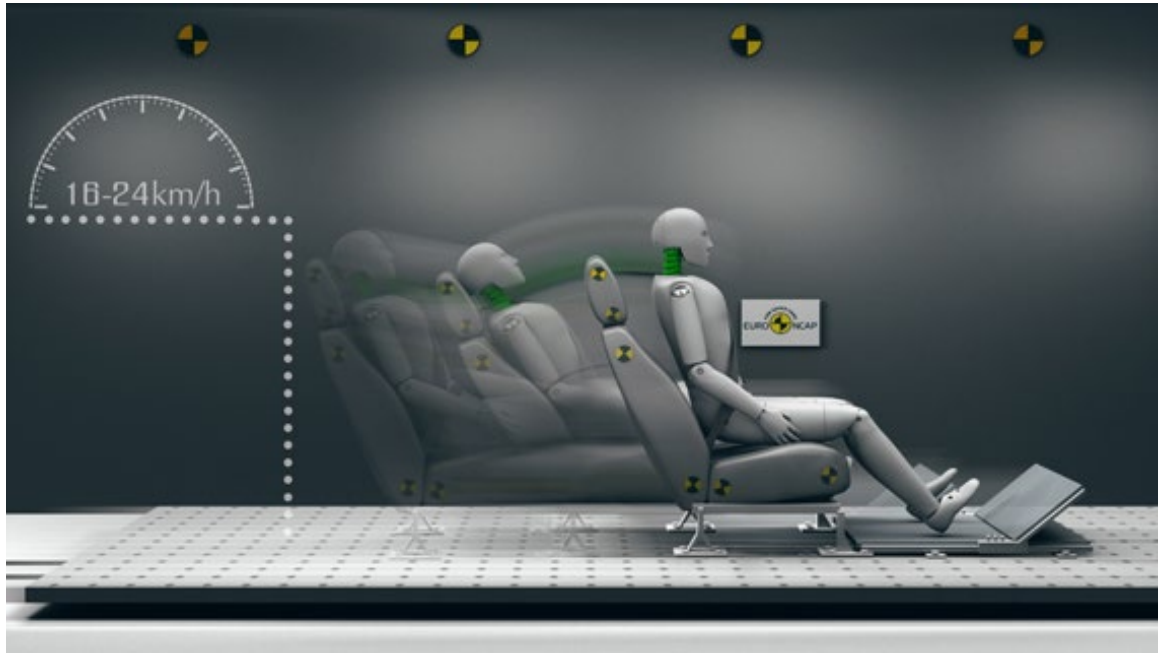
Research Areas

- Field Data Assessment
  - Define the current rear impact safety issue.
- Market Research
  - Better understand current seat construction and technologies.
- PMHS and ATD Testing
  - Explore occupant/ATD kinematics and injuries over a range of impact speeds.
- Injury Criteria Development
  - Critical for dynamic test procedures.
- Computational Modeling
  - Continue to improve advanced modeling resources and exercise in parametric studies.
- Cost Benefit Assessment

Field Data Assessment: Euro NCAP Dynamic Whiplash Test

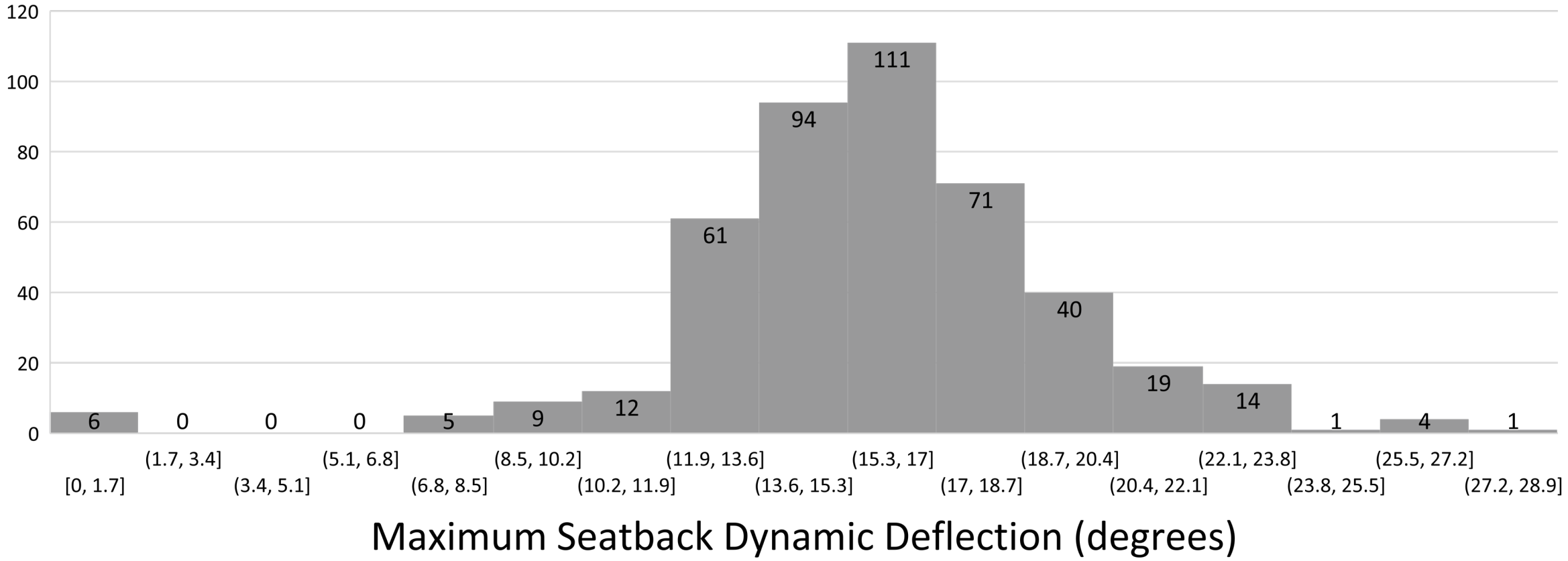
- Readily available measurement of maximum seatback deflection in a controlled lab environment

- Seats and head restraints are tested on a sled using the BioRID



Seatback Deflections Vary in a Controlled Test Environment

Euro NCAP Dynamic Whiplash Assessment Data, Vehicle Model Years 2009-2023



Ongoing Research: Field Data Assessment

CIREN, CISS, SCI (e.g., EWRs)

- Observe:
  - If and how seats deform in real-world rear impacts
  - If newer model year vehicles appear to have ‘better’ seat construction
- Define the incidence of:
  - Occupant injuries in rear impacts
  - Seat deformation (and extent)
  - Rear passenger row intrusion from:
    - A deformed front row seat
    - Rear vehicle crush

Market Research: Seat Teardown Survey at VRTC

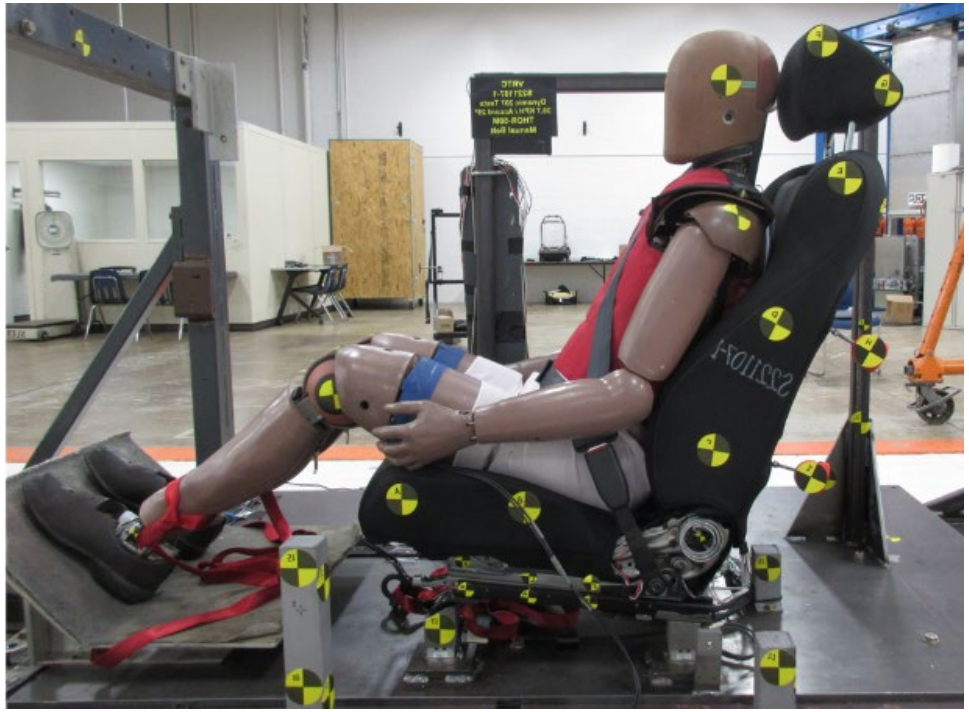
Completed physical teardowns of vehicle seats to:

- Determine seat areas that typically fail in rear impacts.
- Compare failure mechanisms/damage from diverse test modes.
- Assess the state of seats currently in the market including design trends such as:
  - Seatback frame types
  - Seat pan frame types
  - Pivot mechanisms
  - Etc.

Test Modes

207 Research Sled Tests

- ~ 15 G pulse
- BioRID or THOR-50M



FMVSS 301R Crash Tests

- ~ 15 G pulse
- Un-instrumented HIII-50M

Summary of Failure Mechanisms/Damage

All tested seats:

- Showed deformation to the seat pan
  - Often twisted about the x-axis and collapsed downward onto the seat rail assembly
- Were permanently more reclined about the y-axis
  - Often twisted about the z-axis as well

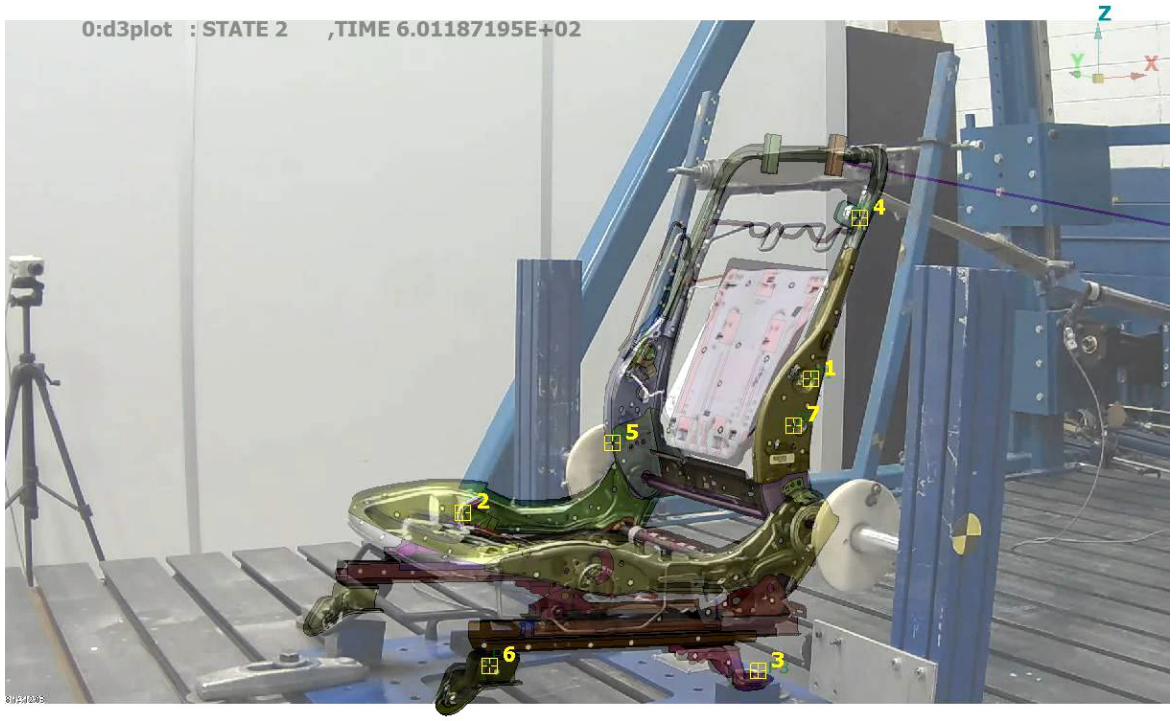
Majority of tested seats:

- Exhibited damage to the seatback pivot mechanism

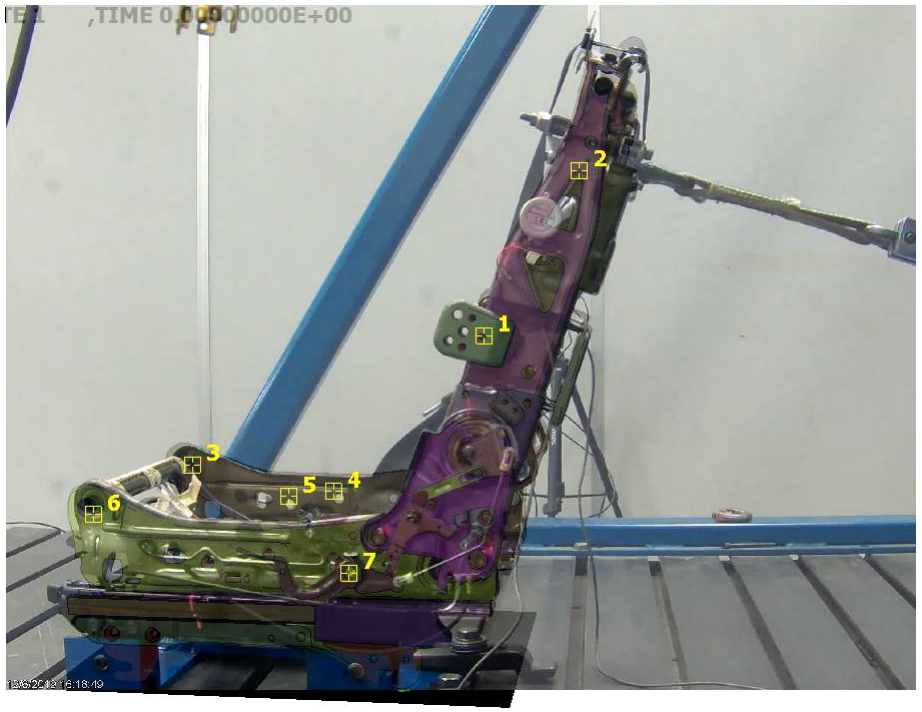
Ongoing Research: ATD and PMHS Sled Testing

- Exploratory high speed rear impact sled testing
  - 36 km/h Delta V
  - THOR-50M and BioRID-II ATD
  - 3 seat models tested thus far
  - Rearward rotation, ranging from 20° to 40°
- Matched pair PMHS testing
  - Looking at injuries
  - Generating biomechanical data

Computational Modeling: Existing Vehicle Seat FE Models



2014 Honda Accord



2019 Honda Odyssey

Ongoing Research: FE Modeling of Vehicle Seating

Task Order awarded to UVA, 3-year project

- Model and validate 3 new vehicle seats via sled tests
- Expected outcomes:
  - Define characteristics of an ‘optimal’ vehicle seat
  - Define tests methods to assess vehicle seat optimization for occupant protection
  - Define test requirements (i.e., ATD metrics, maximum seatback deformation limits, etc.)

Ongoing Research: Cost Analysis of Seatbacks and Head Restraints of the Front Seat of Light Vehicles

- Conduct a full teardown of 6 front vehicle seats (seat selections TBD)
- Consider diverse seat frame constructions (e.g., stamped vs. tubular steel)
- Catalogue seat features:
  - Bucket seats
  - Power adjustable seats
  - Heated seats
  - Ventilated seats
  - Massaging seats
  - Adjustable head restraint
  - In-seat audio system
- Catalogue seat materials:
  - Cloth
  - Synthetic leather
  - Real leather

Summary

- BIL requires that NHTSA issue an ANPRM to update FMVSS 207.

- Research is underway to investigate test approaches to improve seat designs to mitigate injuries in rear impacts.

  - Field data assessment of CIREN, CISS, SCIs, etc.

  - Ongoing market research such as seat teardown studies.

  - Ongoing ATD and PMHS sled testing in varying severities of rear impacts.

  - Additional computational modeling resources are being developed (3 new seat models expected).

NHTSA

Thank you!

Questions?

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