

Can Our ATDs Sit “Comfortably” in Cars & Still Record Valid Responses

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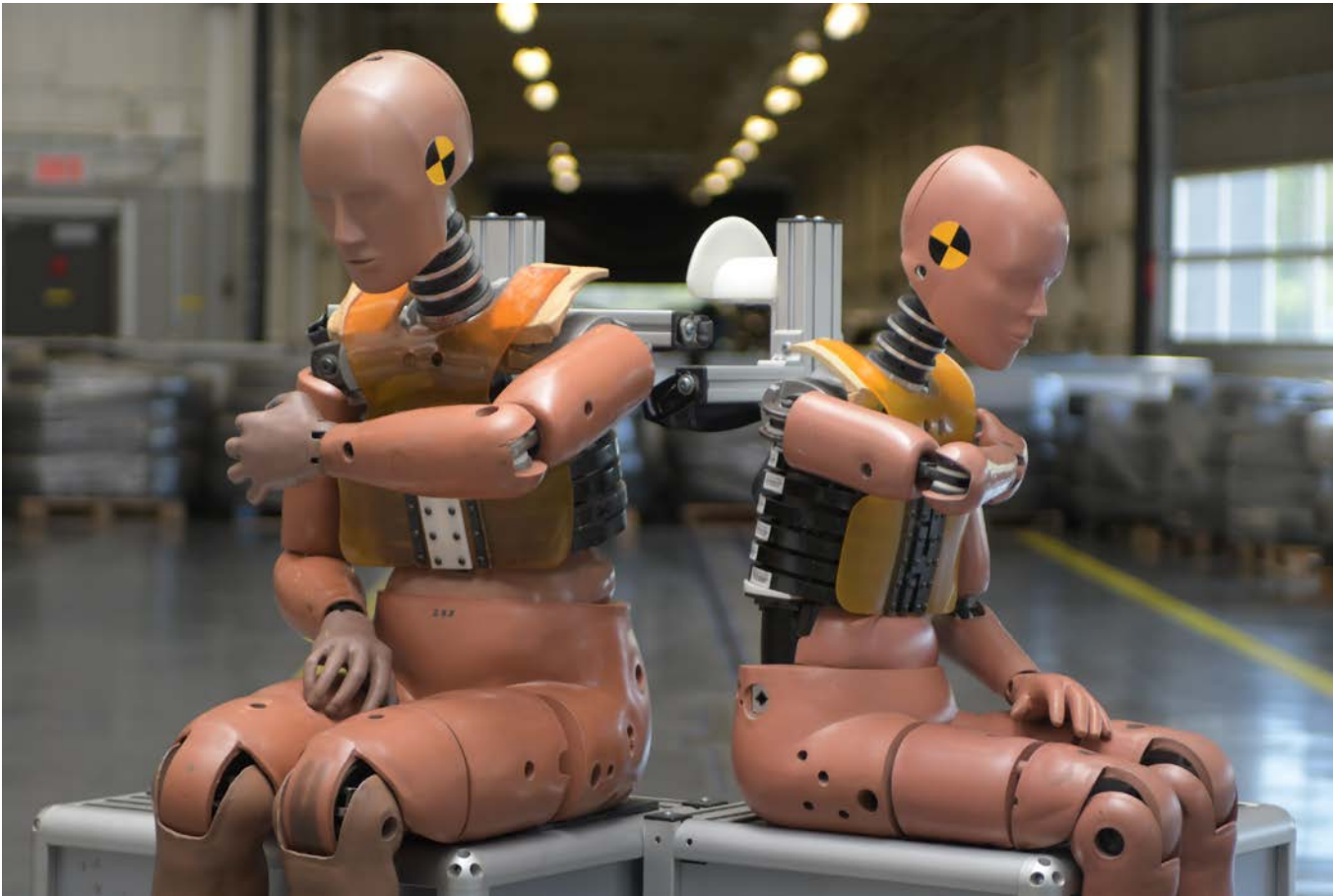
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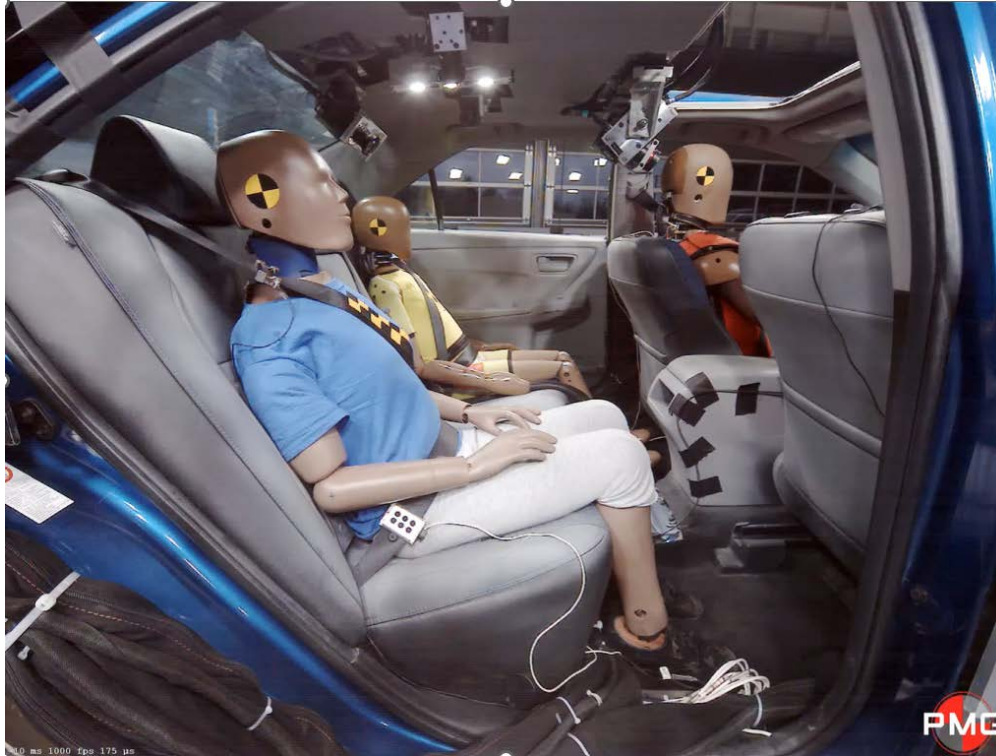
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The Stiff Family

ATDS are designed for repeatability and durability in prescribed regulatory tests



“Proper” seating does not mean great results



ATDS will pivot about the moulded pelvis leading to extreme interactions when tested outside regulatory positions

“Proper” Seating: Is this comfortable?



Child ATDS cannot be placed in relaxed positions and remain in an upright seated position during the crash event.

How would children sit while watching a Video?



This restrictive positioning becomes quite challenging in cases where one would like to simulate typical child behaviour such as leaning towards a TV screen.

Freeze Frame



Same crash as previous slide but different view.

Children with backpacks



It is important that the ATD allow researchers to accurately demonstrate possible consequences that are associated with common behaviours. However, with these limitations it is more like to mis-represent what could actually occur in a real crash.



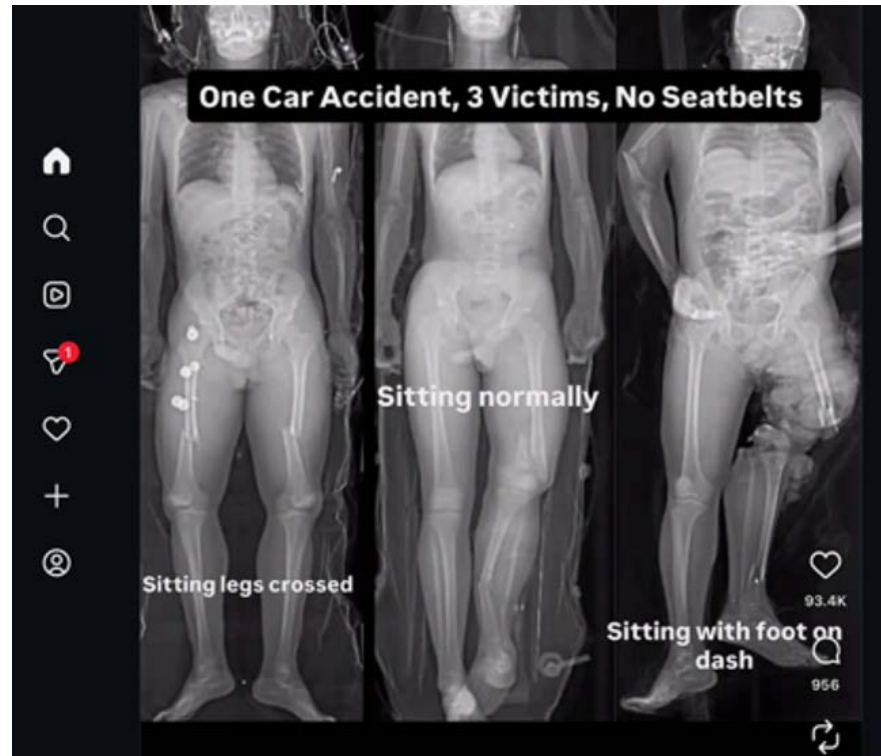


Autonomous Bus Impacted by a Passenger Car

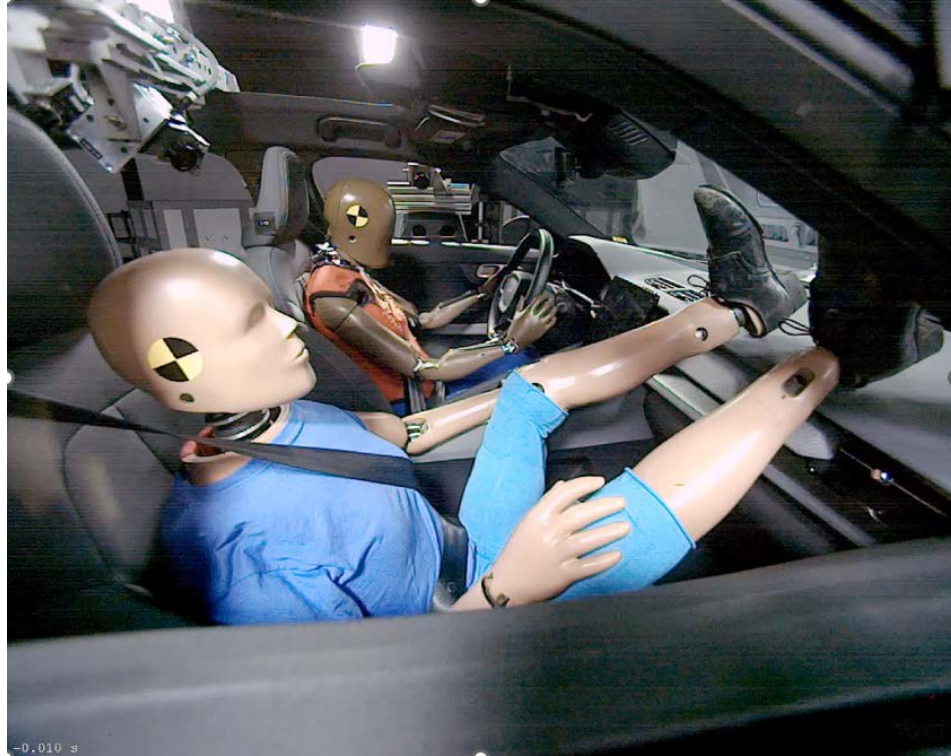


It is also difficult to predict possible injury mechanisms if the ATDs remain in an upright seated position.

Most would agree that sitting with feet up on the dashboard is not a safe position...



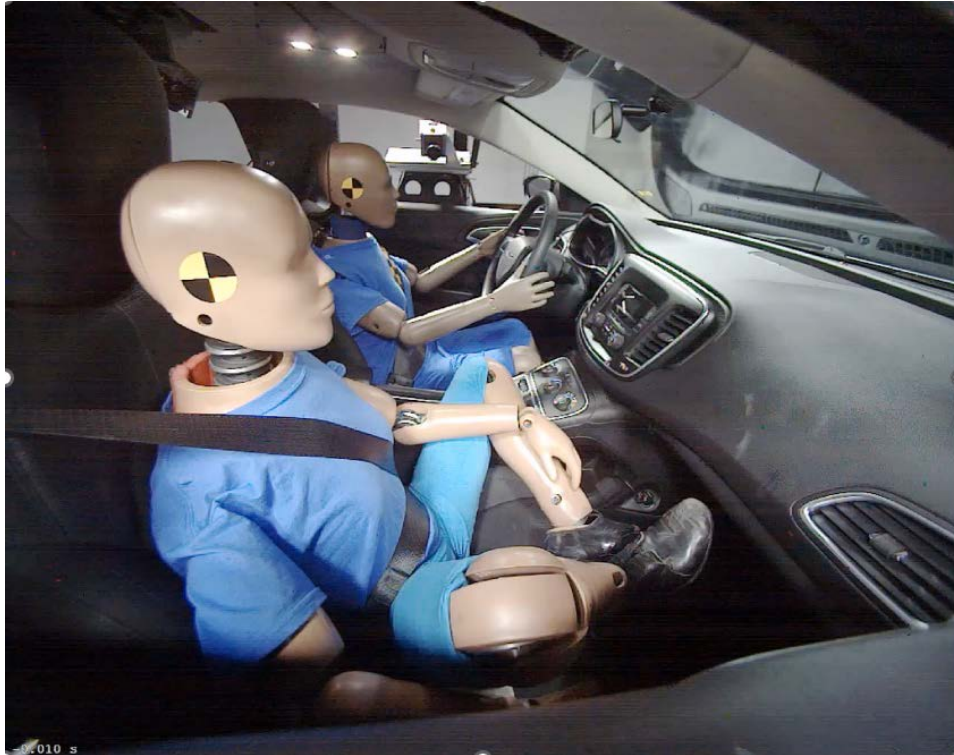
But the ATD does not suggest that this is a problem



It is extremely difficult to position the ATD in this position because the hips do not flex, even when all joints are loosened.

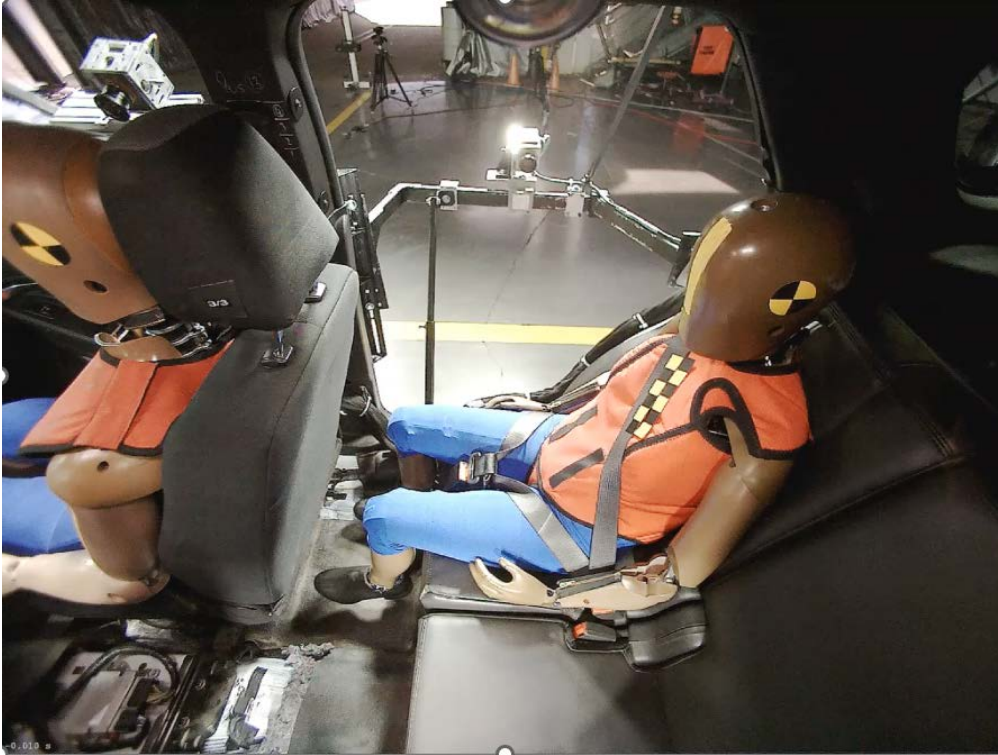


Same test, different view



This too is a position that is difficult to simulate and while the belt penetrates into the abdomen, there are few metrics to indicate that this is a problem

Evaluating after market products



The ATD limitations become quite serious when the ATDs are used to evaluate after market products since the ATD can give misleading results.

Evaluating after market products



Different view of the same test.

Evaluating child safety products



It is important to understand the limitations of our tools.

Interactions of Rear-Facing Child Restraints in Frontal Crash Tests

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INTRODUCTION

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- Every CRS sold in Canada must comply to the applicable standards set out in CMVSS 213 — Child Restraint Systems. The standard (CMVSS) is largely harmonized with the Federal Motor Vehicle Safety Standard (FMVSS) for CRSs in the United States.
- The CMVSS 213 currently includes an additional requirement limiting the allowable rebound of RFCRSs.
- In both regulations, head protection is evaluated using an acceleration-based criterion.
- Head excursion is monitored, but there is no test fixture to evaluate responses arising from interaction with a front seatback.



OBJECTIVES

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- a) investigate the kinematics of the child ATDs in a general sample of RFCRSs that were installed in passenger cars subjected to frontal impacts;
- b) investigate the effect of anti rebound (AR) features on the kinematics of the rear-facing child ATDs; and
- c) investigate the effect of the load leg on the kinematics of the rear-facing child ATD.

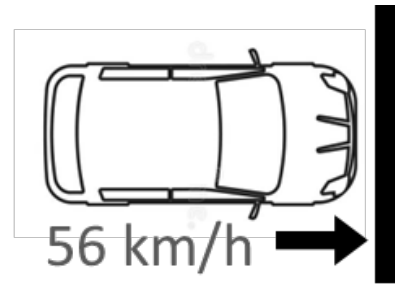


METHODS

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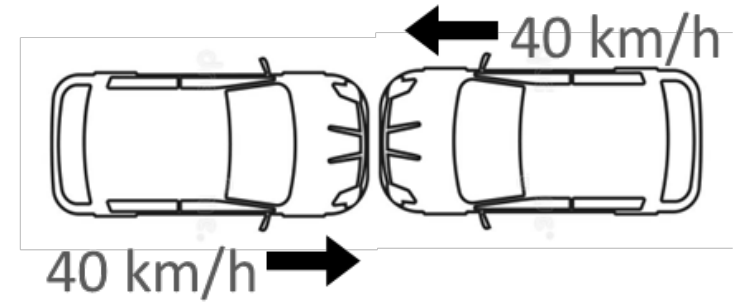
Frontal barrier (FFRB)

A

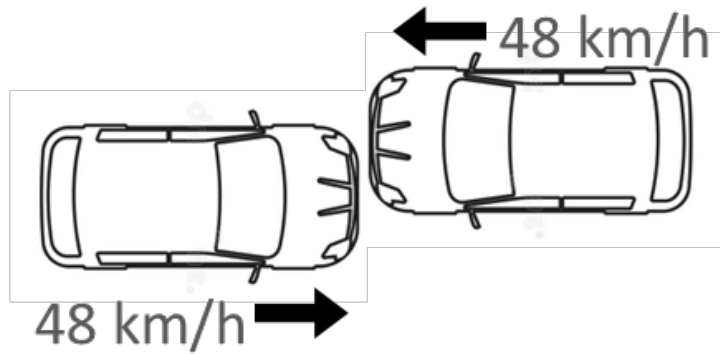


Car-to-car 100%

B

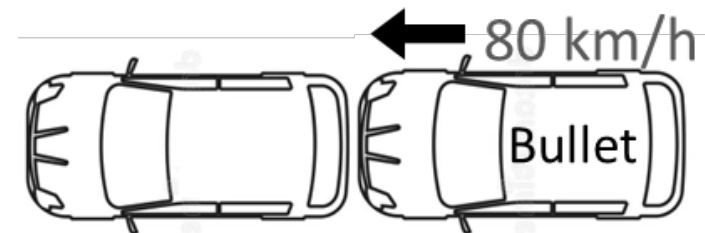


C



Car-to-car 40%

D



Car-to-car bullet

a) General sample

- derived from previously conducted frontal crash tests that included rear facing CRSs installed in second-row vehicle seats.
- **70 tests** conducted with 13 CRS brands and three sizes of ATDs: CRABI- 12 M, 18M and Q1.5 the Q3 (legs flexed) and Hybrid III 3YO.

b) Paired Comparison of CRS Rebound With and Without AR Features

- In each vehicle, a pair of CRSs, identical except that only one was used with the AR feature, were installed in adjacent rear outboard seats.
- The **14 pairs** included rear-to-forward facing convertible CRS and infant seat;

c) Paired Comparisons of RFCRSs Installed With and Without a Load Leg

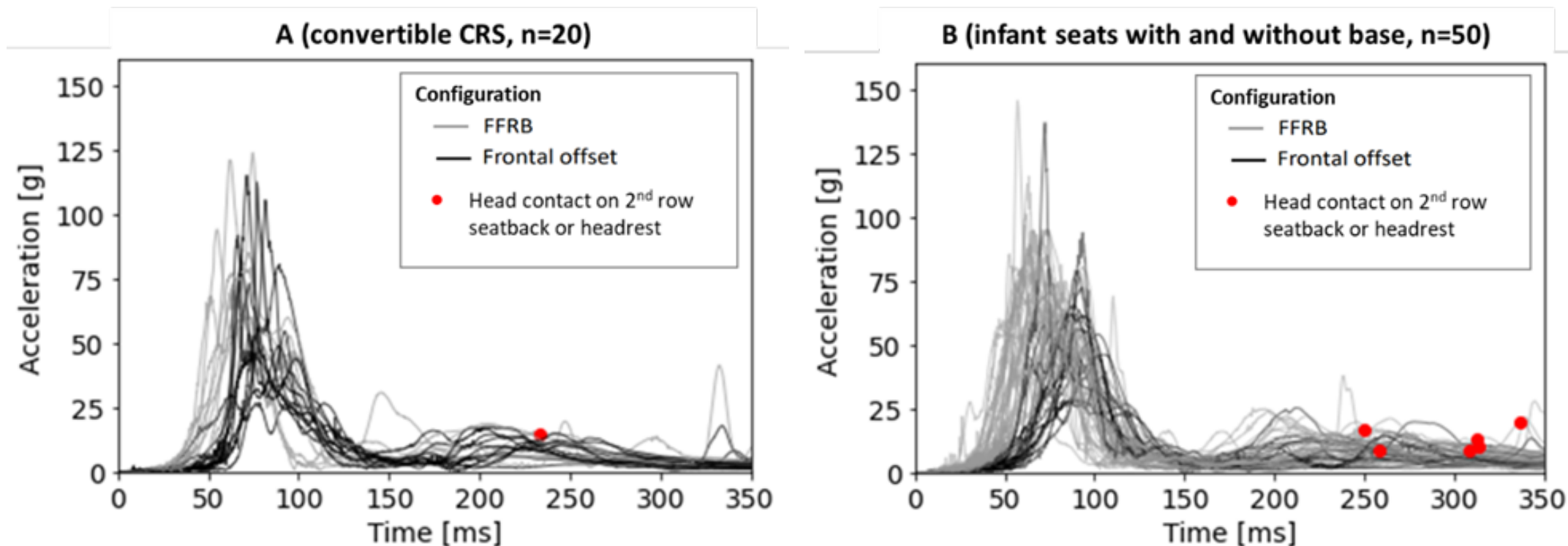
- pair of CRSs of the same model was installed in the two rear outboard seating positions of the vehicle.
- **5 pairs** of RFCRSs installed in 5 vehicles undergoing 56 km/h FFRB impacts .



RESULTS

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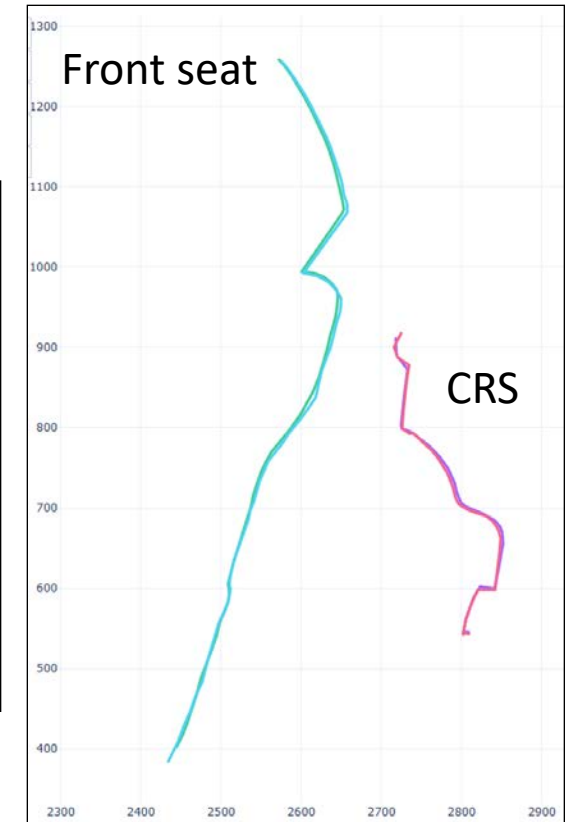
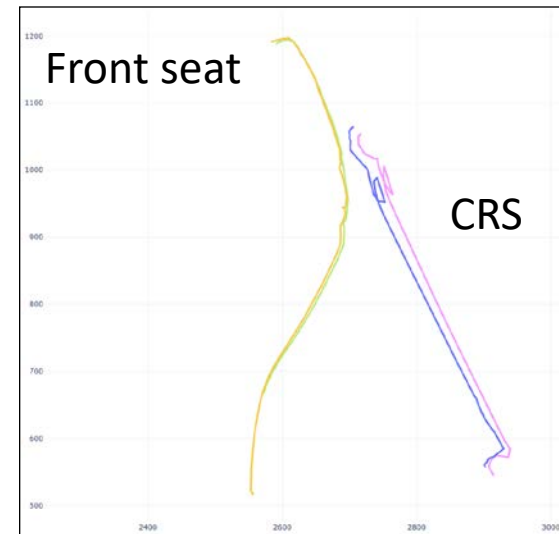
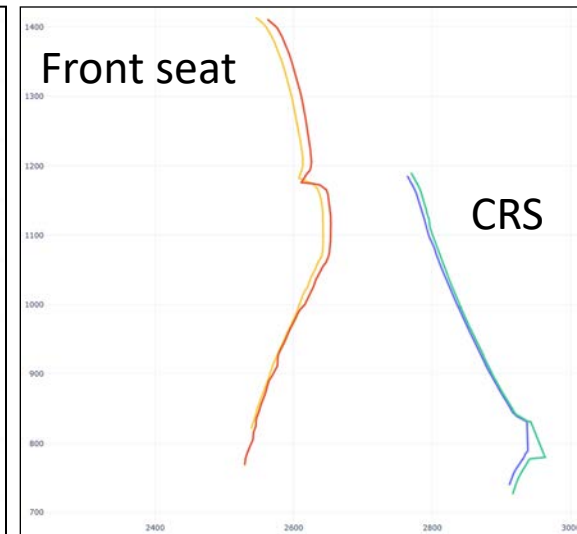
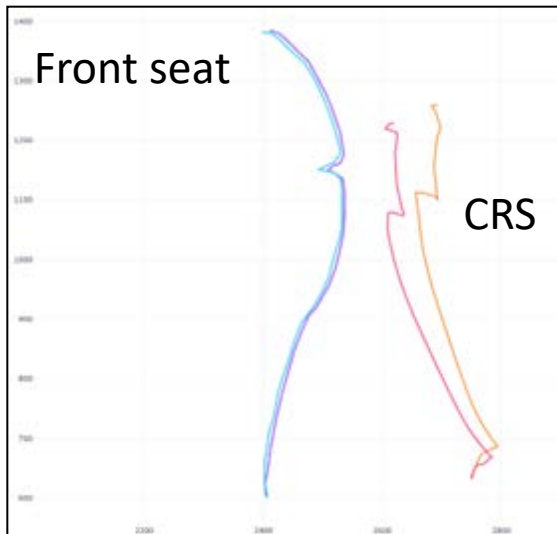
a) General sample



Interaction between the head of the ATD or the shell of the CRS and the front seat occurred in more than 80% of tests



SEATBACK & CRS SHELL PROFILES



RESULTS

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a) General sample



RESULTS

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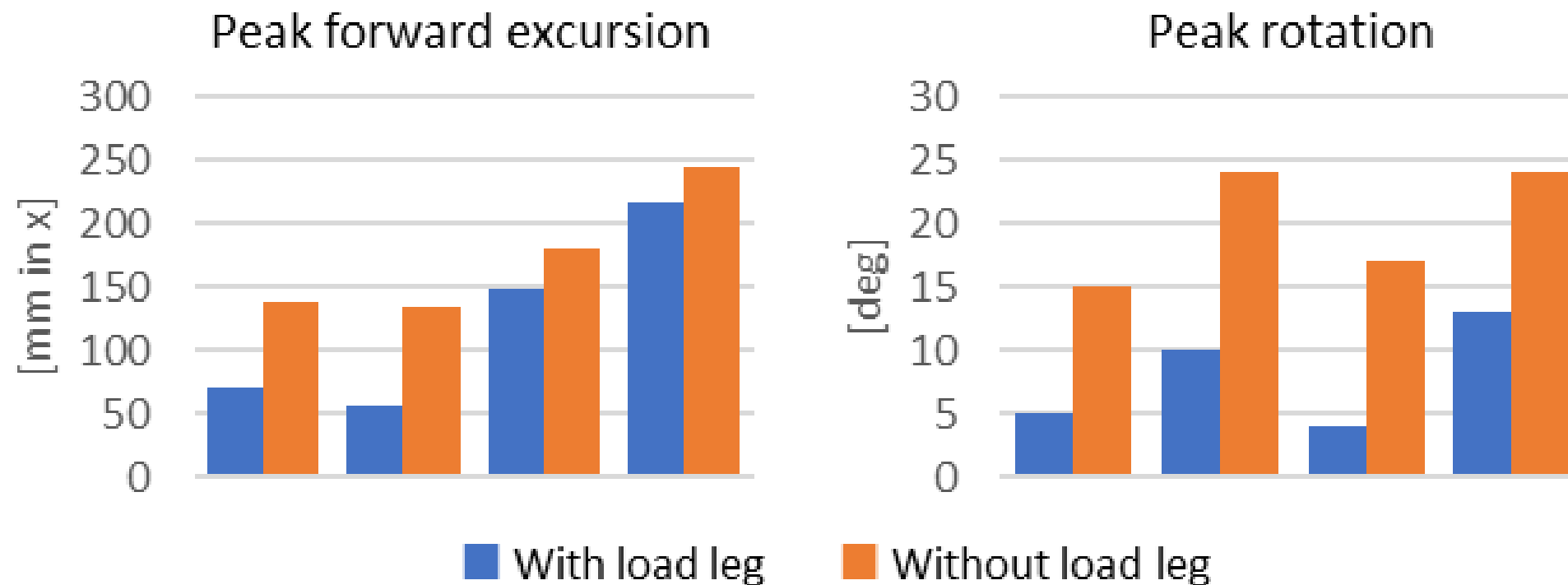
c) Paired Comparisons of RFCRSs Installed With and Without a Load Leg



RESULTS

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c) Paired Comparisons of RFCRSs Installed With and Without a Load Leg



Excursion reduced by up to 72 mm
NO instance of head contact with load leg



Summary

a) General sample (previously conducted crash tests)

- Interaction between the head of the ATD or the shell of the CRS and the front seat occurred in more than 80% of tests, kinematics are influenced by a combination of factors:
 - Respective profiles of the seatback and CRS
 - Interior surface of the CRS
 - Seat cushion characteristics

b) AR Features

- No practical significance on head kinematics during rebound

c) Load Legs

- Reduced forward excursion, forward rotation and occurrence of CRS contact
- No head contact observed

