Australian Government

Department of Infrastructure and Transport

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Joint Australian and Canadian Pole Side Impact Research

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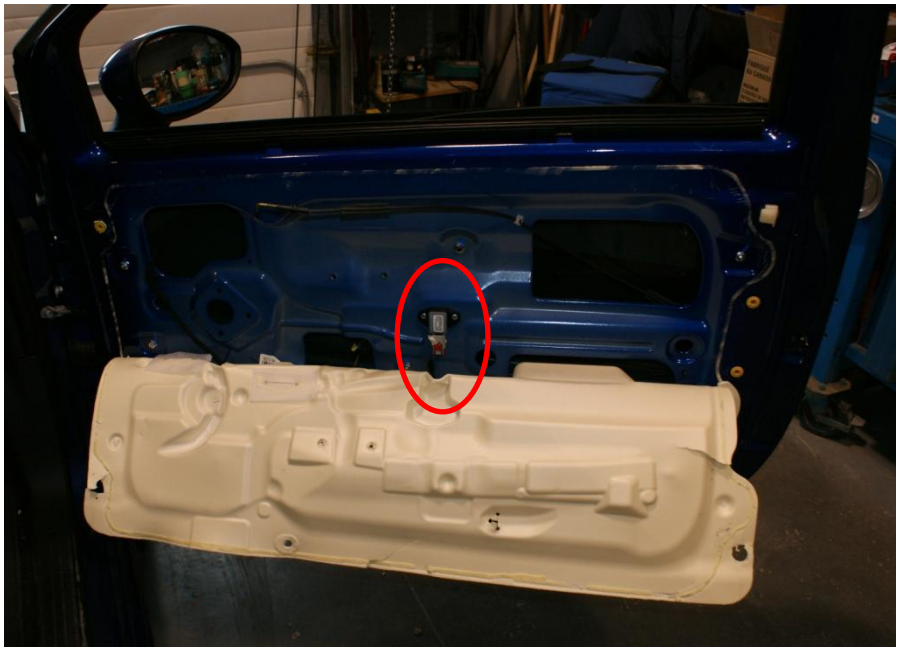
Introduction

- Presentation from Munich meeting (PSI-06-04) included results from matched 32 km/h oblique and 29 km/h perpendicular PSI tests of the Australian market and Canadian market Fiat 500s.
- Most significantly, the WorldSID 50th percentile male dummy responses indicated a significantly lower AIS 3+ thorax injury risk for the Canadian model.
- This presentation includes further results and analysis to investigate and explain the differences in the dummy thorax responses for the Australian and Canadian market vehicles.

Impact Detection

Peripheral Sensors

Australian Model



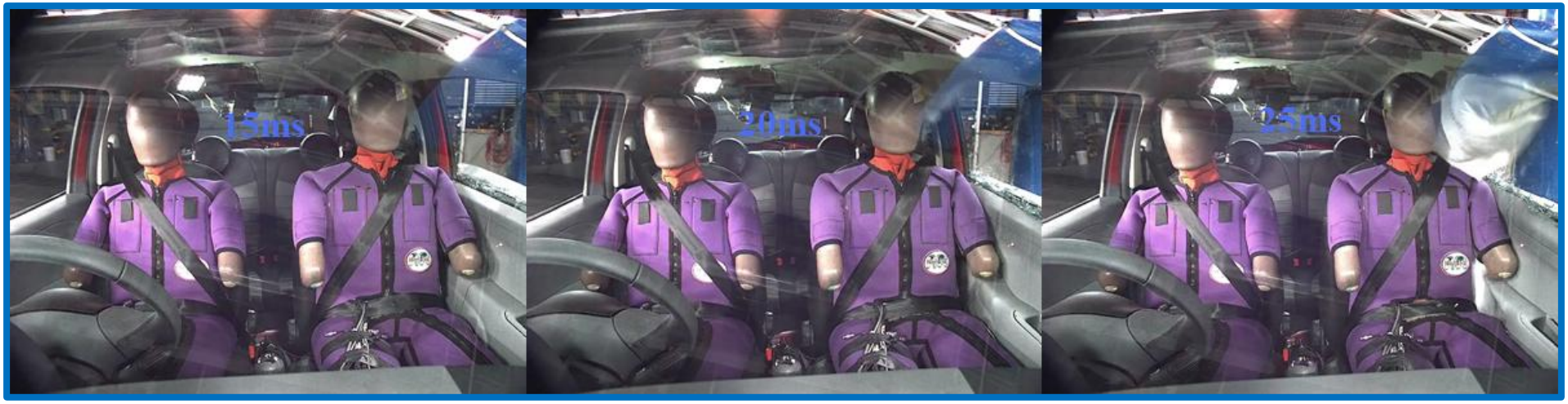
Canadian Model

- Canadian model had a side door cavity pressure sensor that Australian model did not.
- Both models had b-pillar acceleration sensors (but these were mounted in different locations).

Airbag Deployment

32 km/h Oblique Pole Test

AUS CAN



Airbag Deployment

29 km/h Perpendicular Pole Test

AUS CAN

Side Airbags

Side Curtain and Thorax Airbag Coverage (front row)

Australian Model

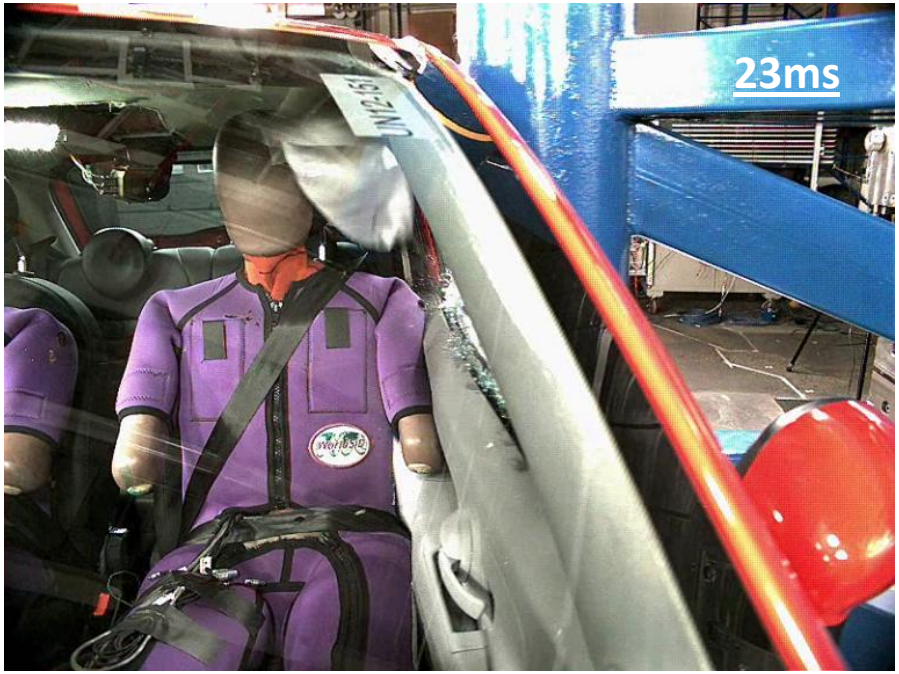
Canadian Model

- The Canadian model had a larger curtain airbag.
- The Canadian model thorax airbag was larger, more integrated with the curtain and appears to provide more coverage of the shoulder, upper arm and lower pelvis.

Side Airbags

Airbag Interaction (1)

32 km/h Oblique Pole Test



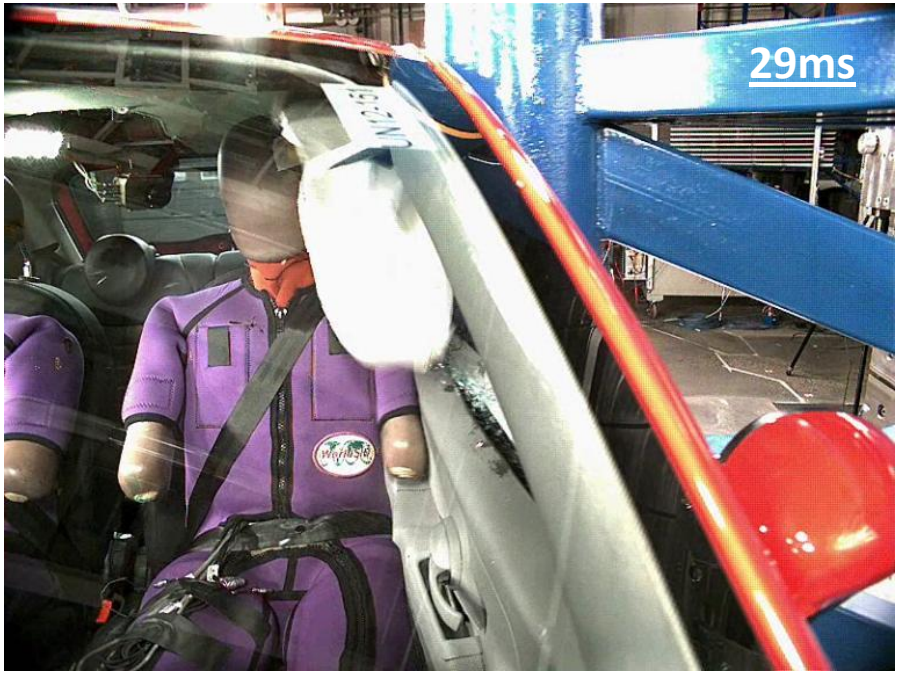
Australian Model

Canadian Model

- Frame by frame analysis of high speed video footage suggests the airbags fired approximately 7ms earlier in Canadian model.
- **NB**: the thorax airbag thickness at similar time after each airbag fired is much greater for the Canadian model (i.e. there is more lateral space across which dummy kinetic energy can be absorbed by compression of airbag).

Airbag Interaction (2)

32 km/h Oblique Pole Test



Australian Model

Canadian Model

- 6ms later than previous slide:
  - Seat mounted side airbag not visible in Australian model
  - Seat mounted side airbag showing in Canadian model

Airbag Interaction (3)

32 km/h Oblique Pole Test

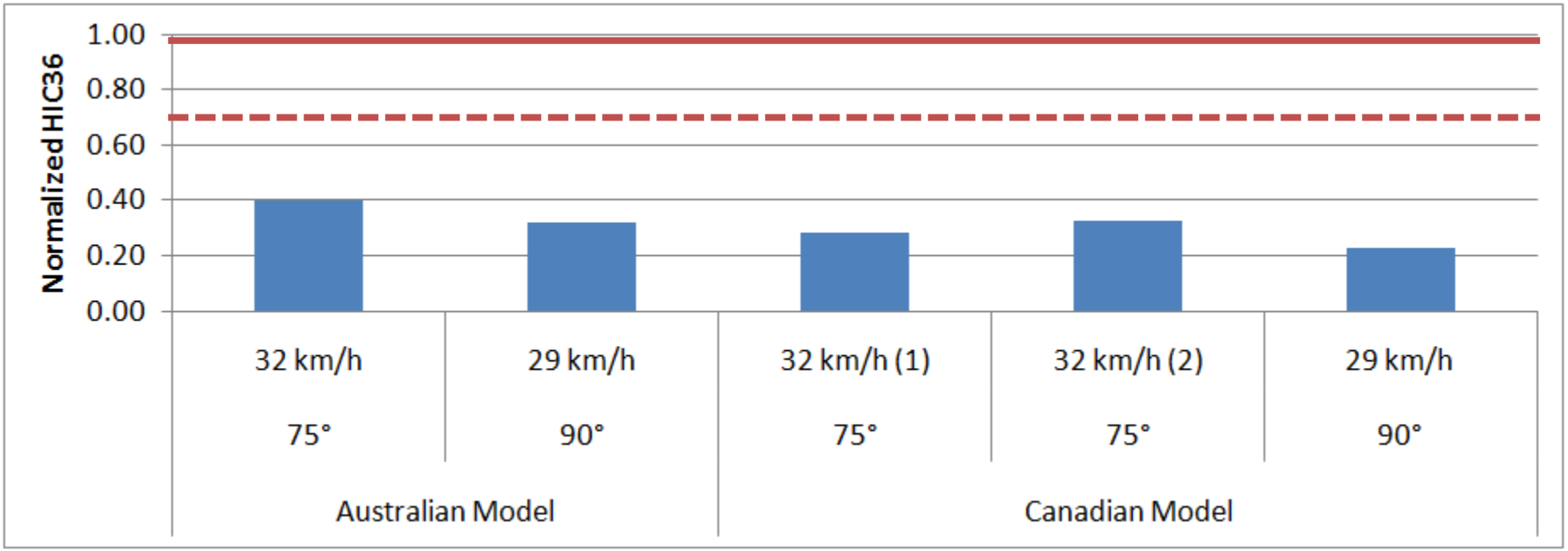
Australian Model

Canadian Model

- 6ms further on (from previous slide):
  - Seat mounted side airbag still showing in Canadian model

Head Injury Risk

HIC36 (excluding dummy occupant-to-occupant head interactions / calculated for t < 80ms)



50% AIS 3+ Head Injury Risk

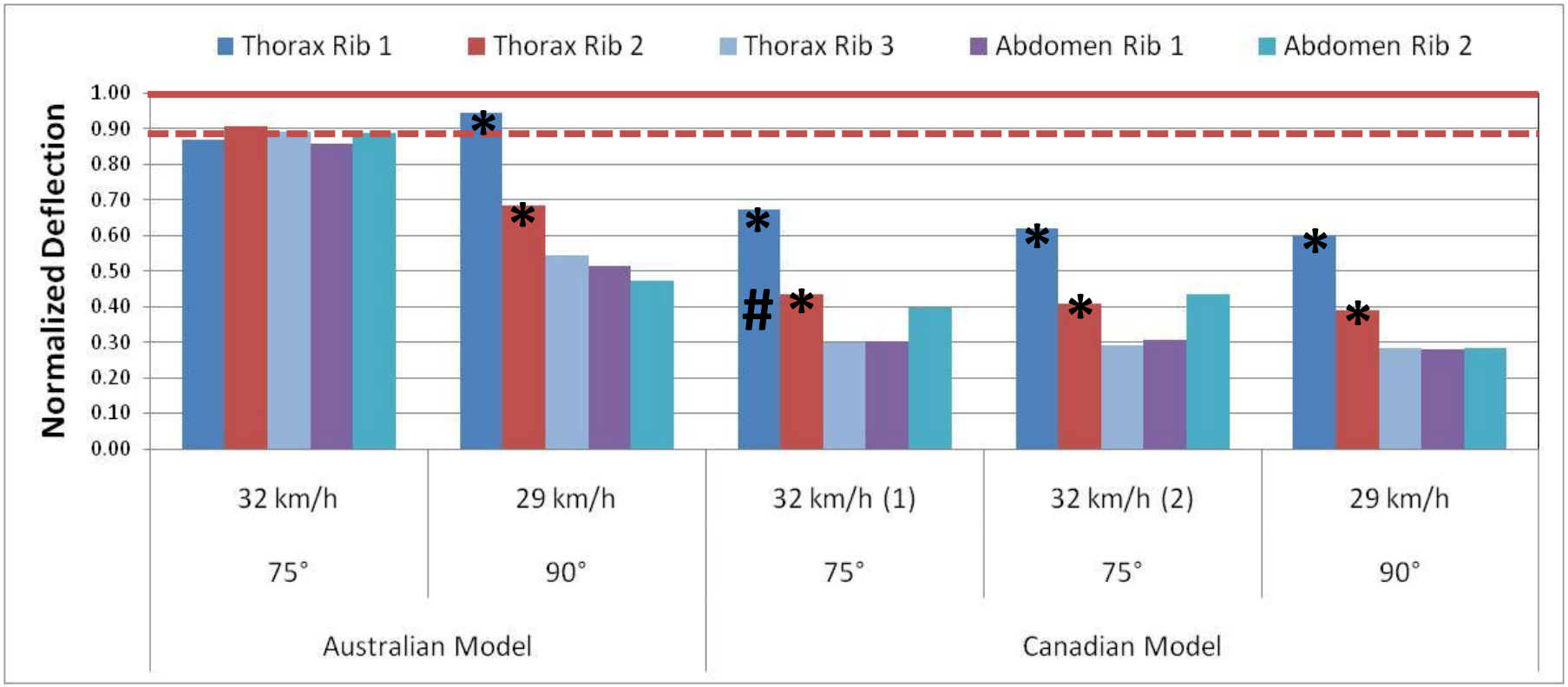
25% AIS 3+ Head Injury Risk

Head injury risk has been determined using the Prasad/Mertz AIS 3+ skull fracture probability risk function published in FMVSS 214 Final Regulatory Impact Analysis (August 2007).

Thorax Injury Risk

Maximum Theoretical IRTRACC Deflection

* Maximum prior to RibEye dropout. # Dropout after t=50ms



50% AIS 3+ Thorax Injury Risk

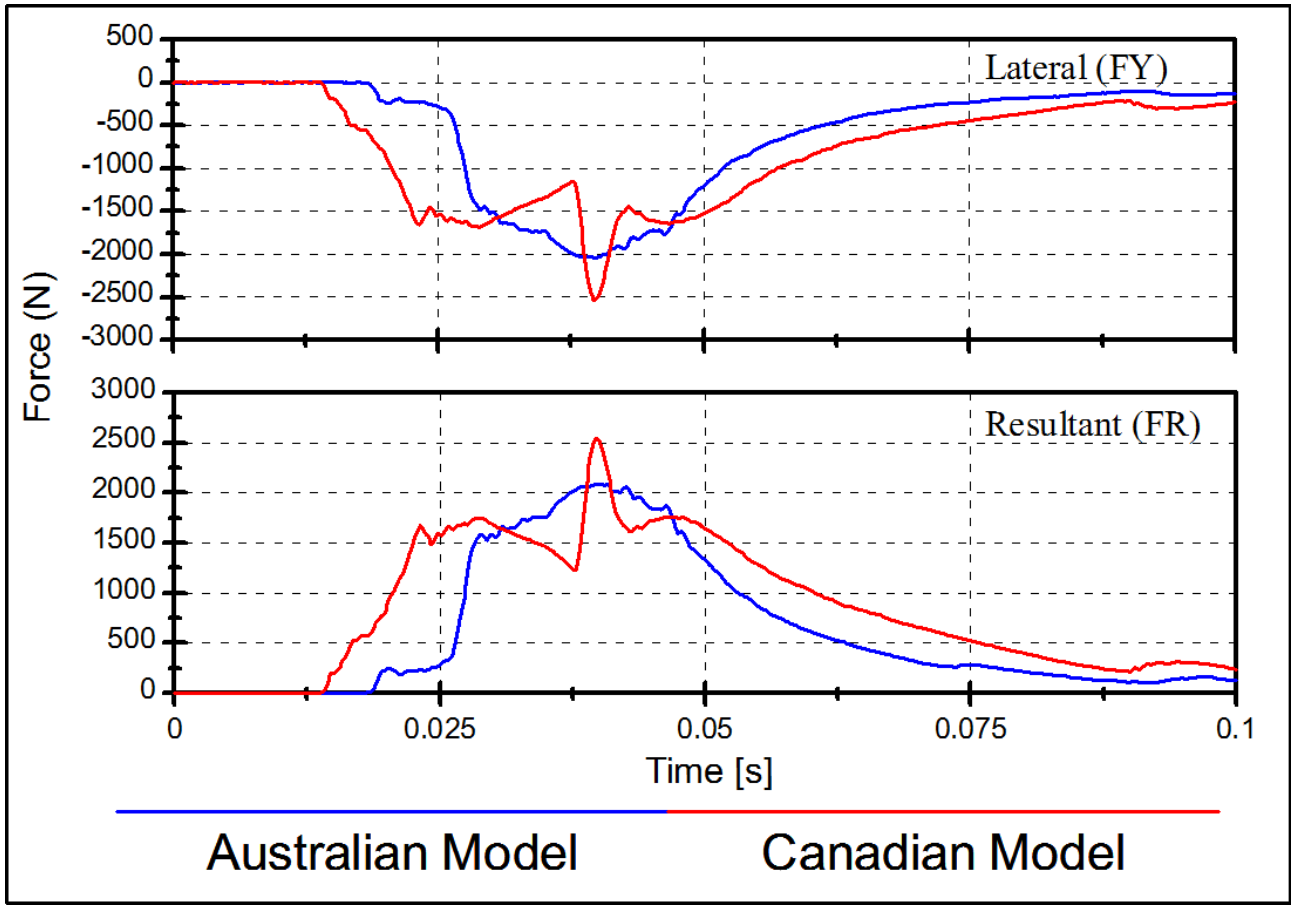
25% AIS 3+ Thorax Injury Risk

Thorax injury risk has been determined from the AIS 3+ (survival method) thorax injury risk values (adjusted to 45 year old) in CEESAR update on behalf of ISO/WG6 (WS-08-04) at London WorldSID informal group meeting.

Note: Each IRTRACC deflection has been calculated from middle RibEye LED x, y and z axis channel data.

Shoulder Responses

Shoulder Force (32 km/h Oblique Impact)

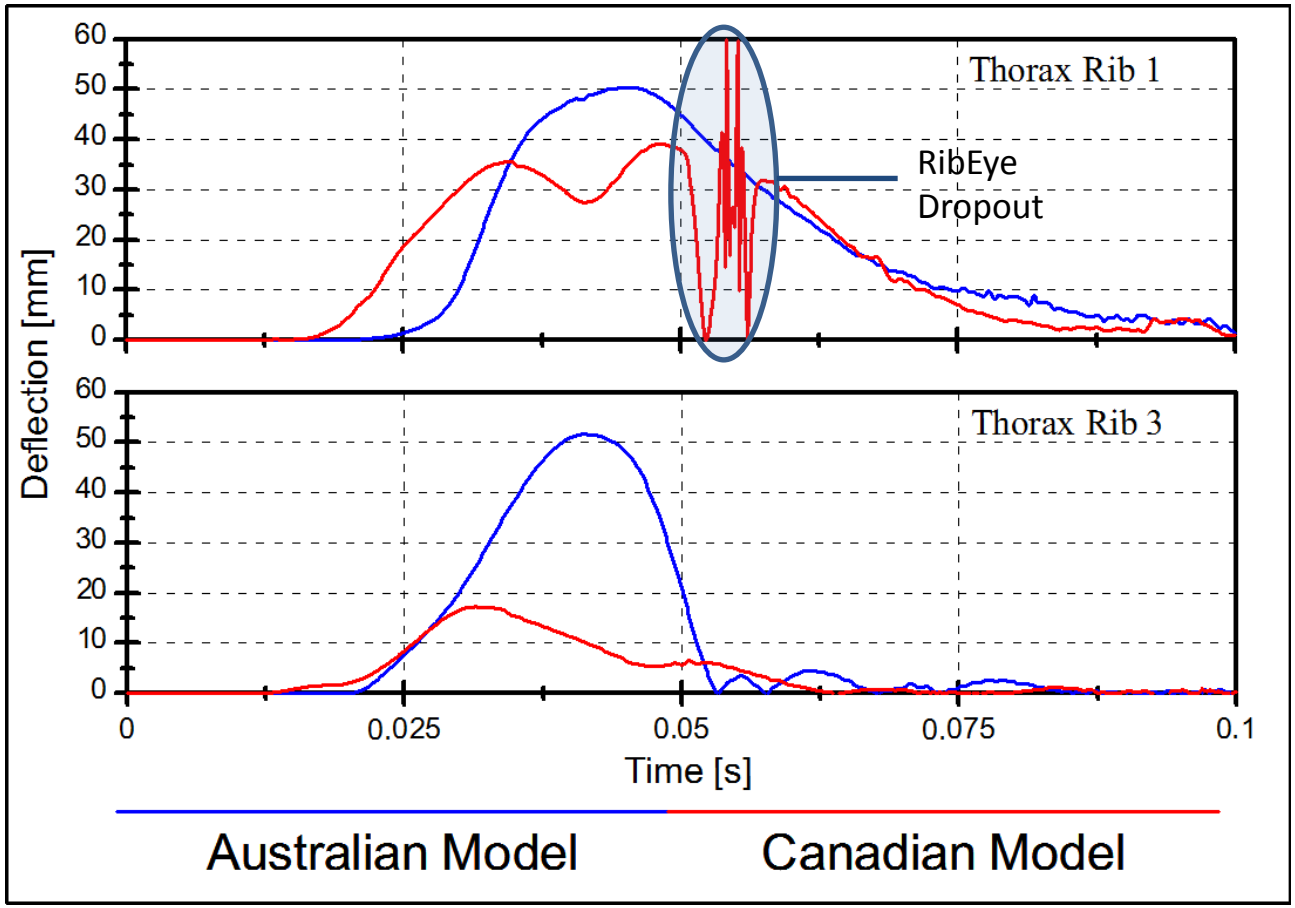


Shoulder loading is initiated earlier in Canadian Model (seat mounted airbag interaction between shoulder and door).

Peak loads are similar.

Thorax Responses

Theoretical IRTRACC Deflection (32 km/h Oblique Impact)

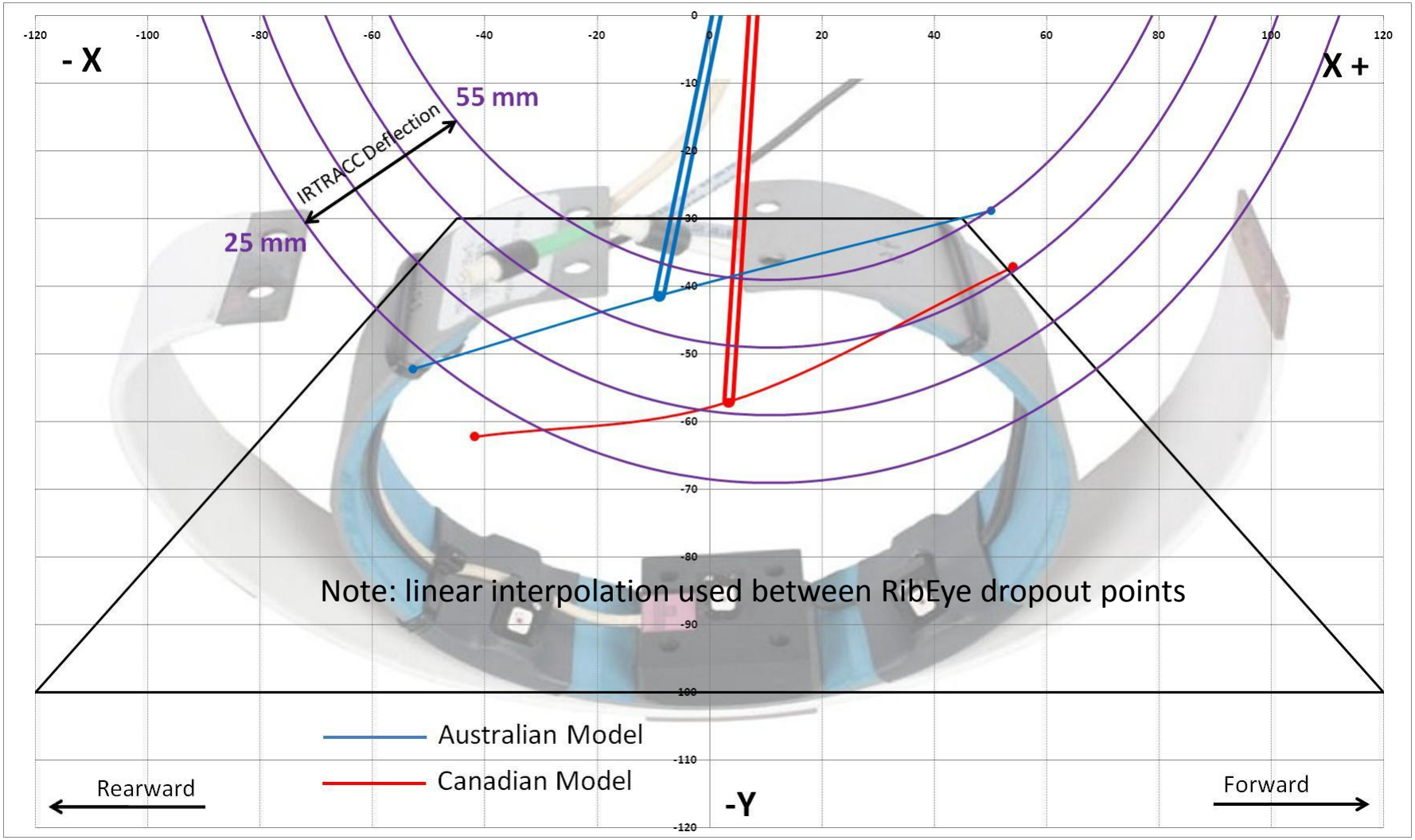


Thorax rib 1 loading is initiated earlier in Canadian Model (seat mounted airbag interaction between upper thorax and door).

Peak thorax deflections substantially lower in Canadian Model.

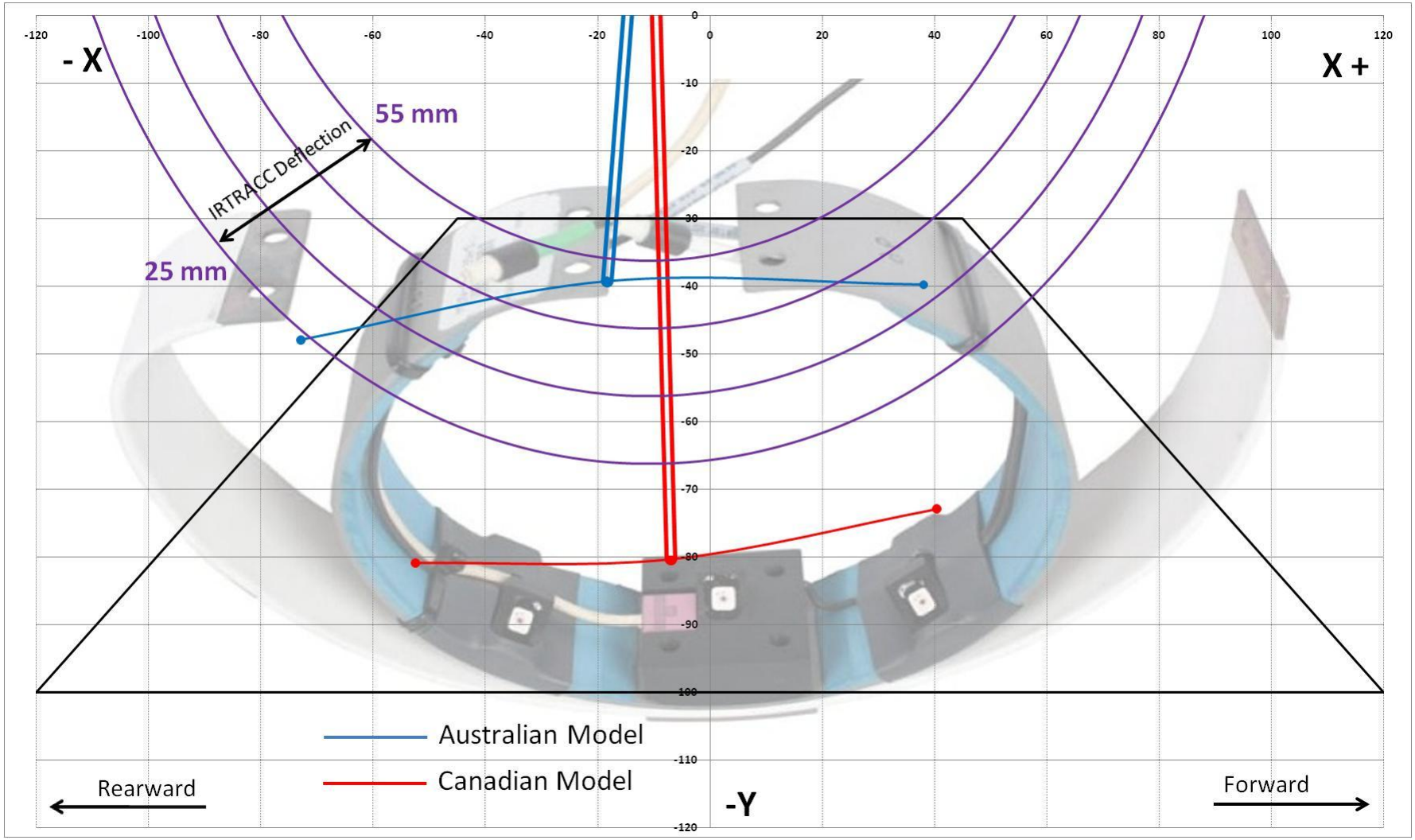
Thorax Responses

X-Y Response (0-100ms): Thorax Rib 1 (32 km/h Oblique Impact)



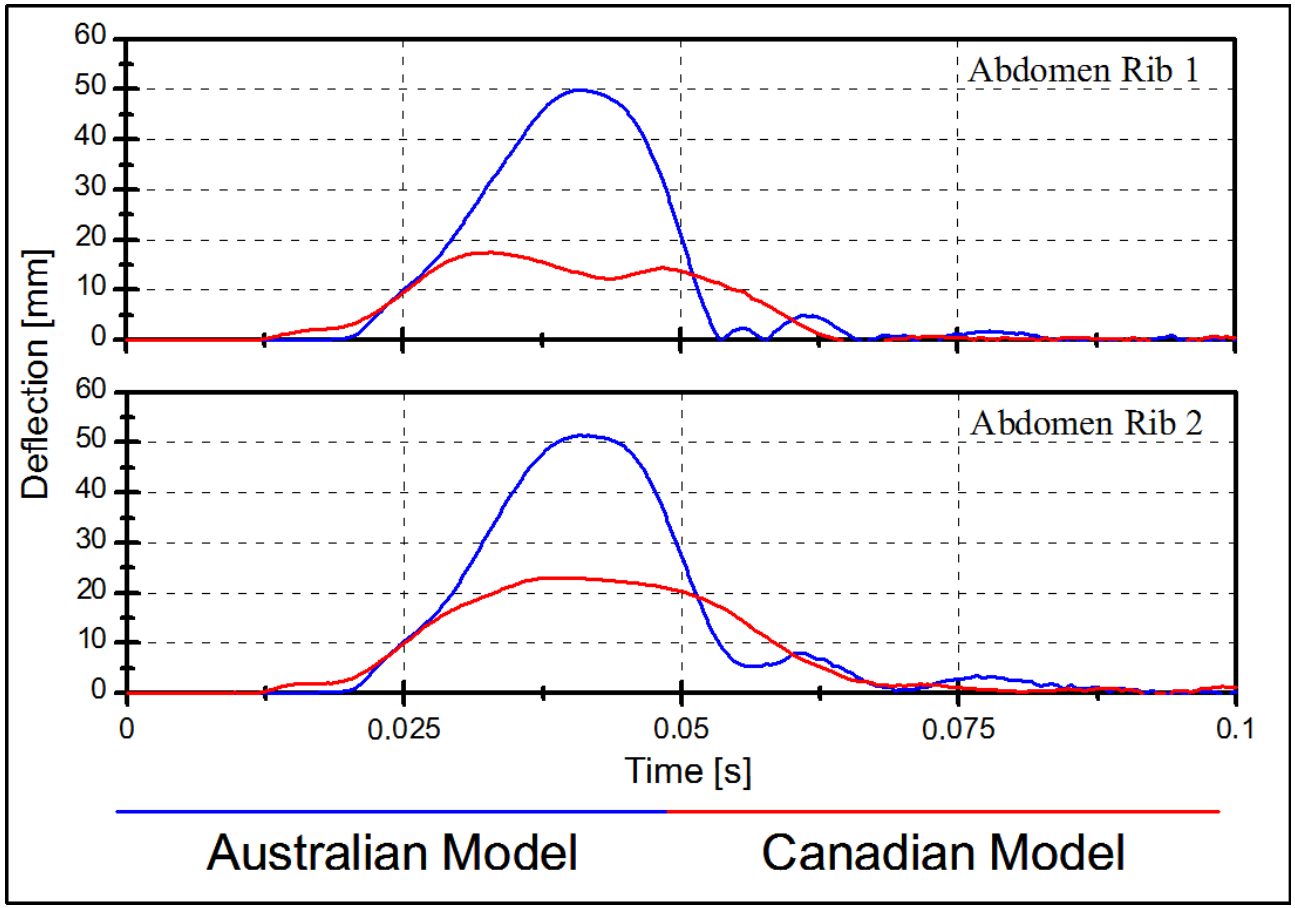
Thorax Responses

X-Y Response (0-100ms): Thorax Rib 3 (32 km/h Oblique Impact)



Abdomen Responses

Theoretical IRTRACC Deflection (32 km/h Oblique Impact)

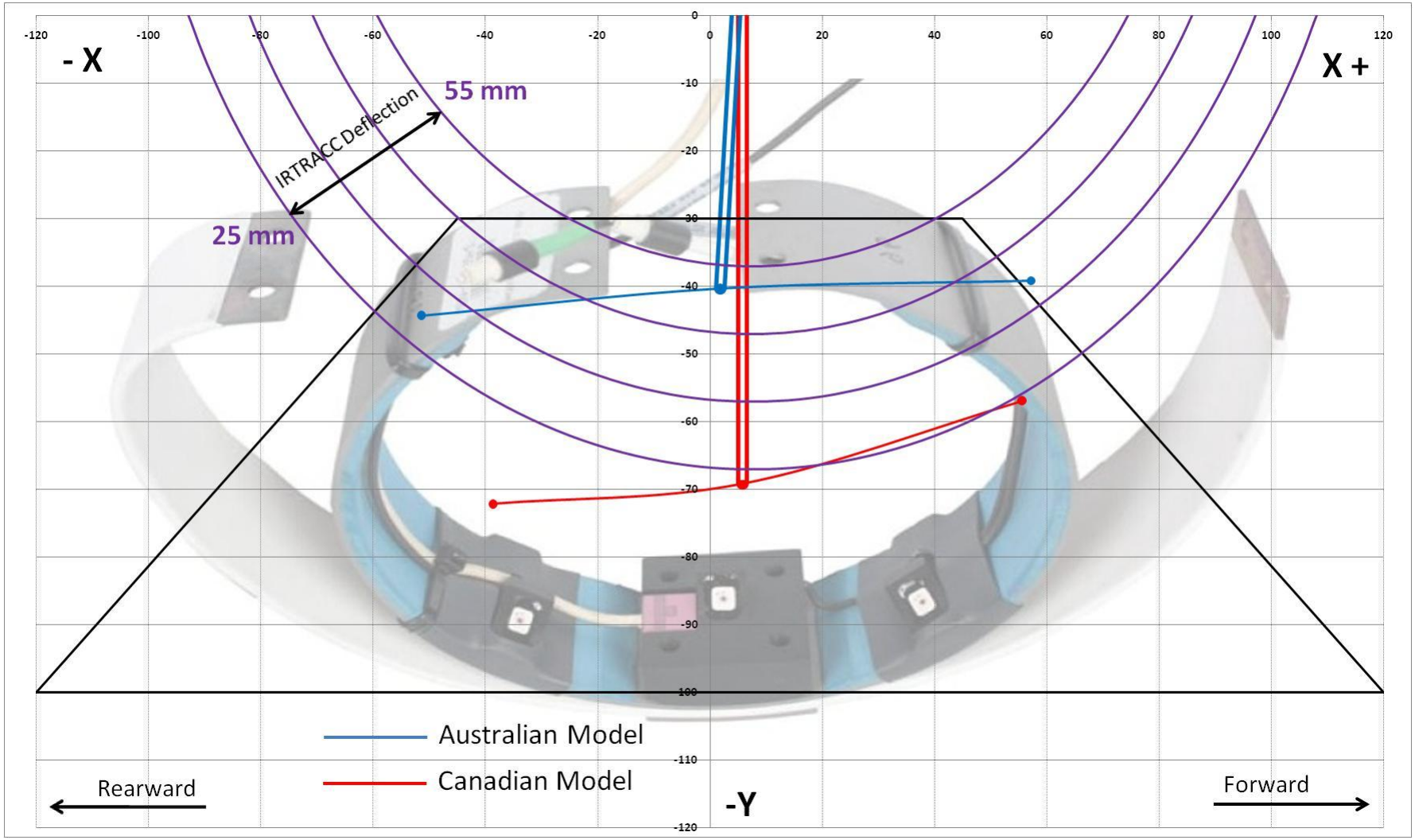


Peak abdominal rib deflections substantially lower in Canadian Model.

Abdominal rib loadings occur over similar time duration.

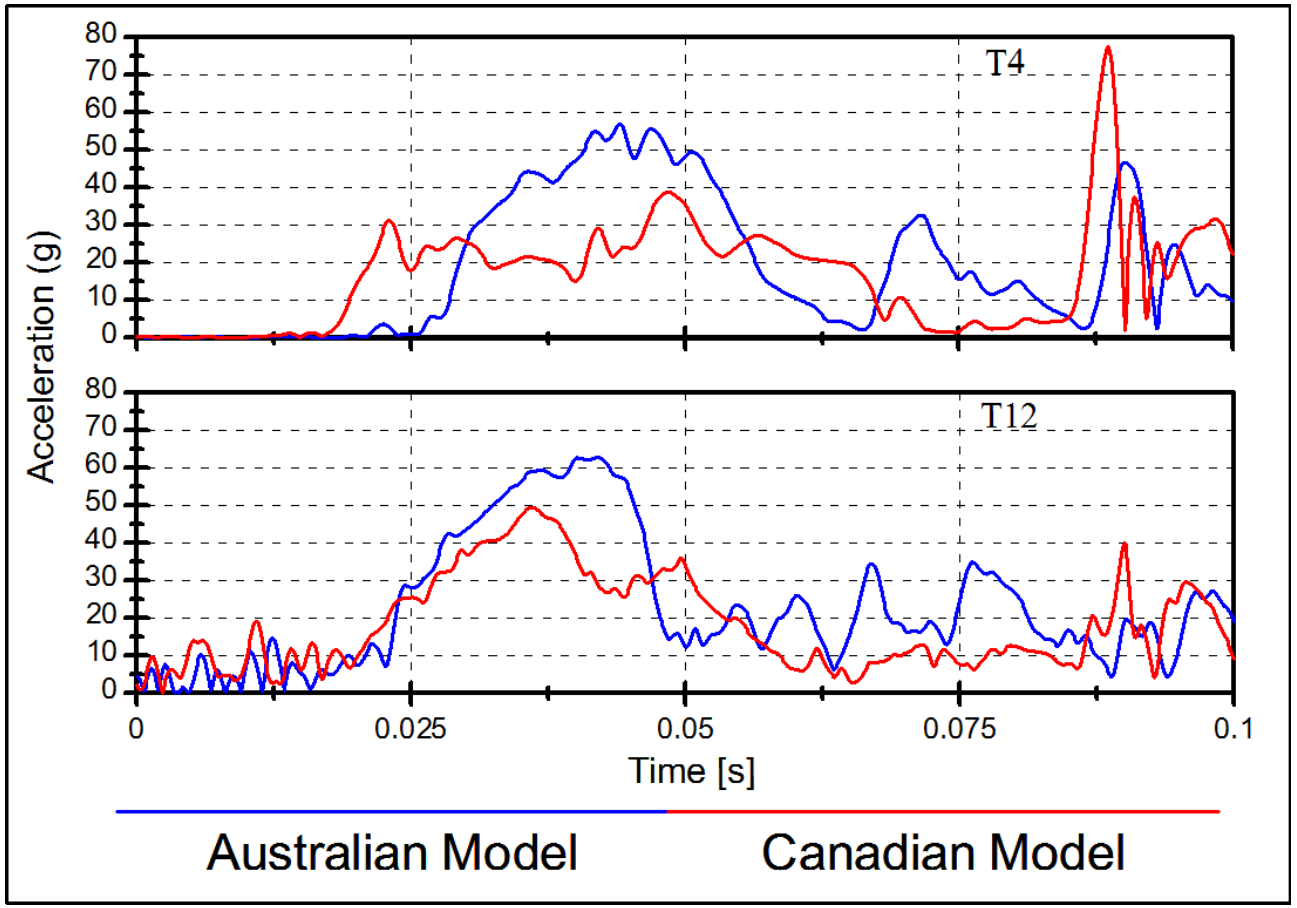
Abdomen Responses

X-Y Response (0-100ms): Abdominal Rib 2(32 km/h Oblique Impact)



T. Spine Responses

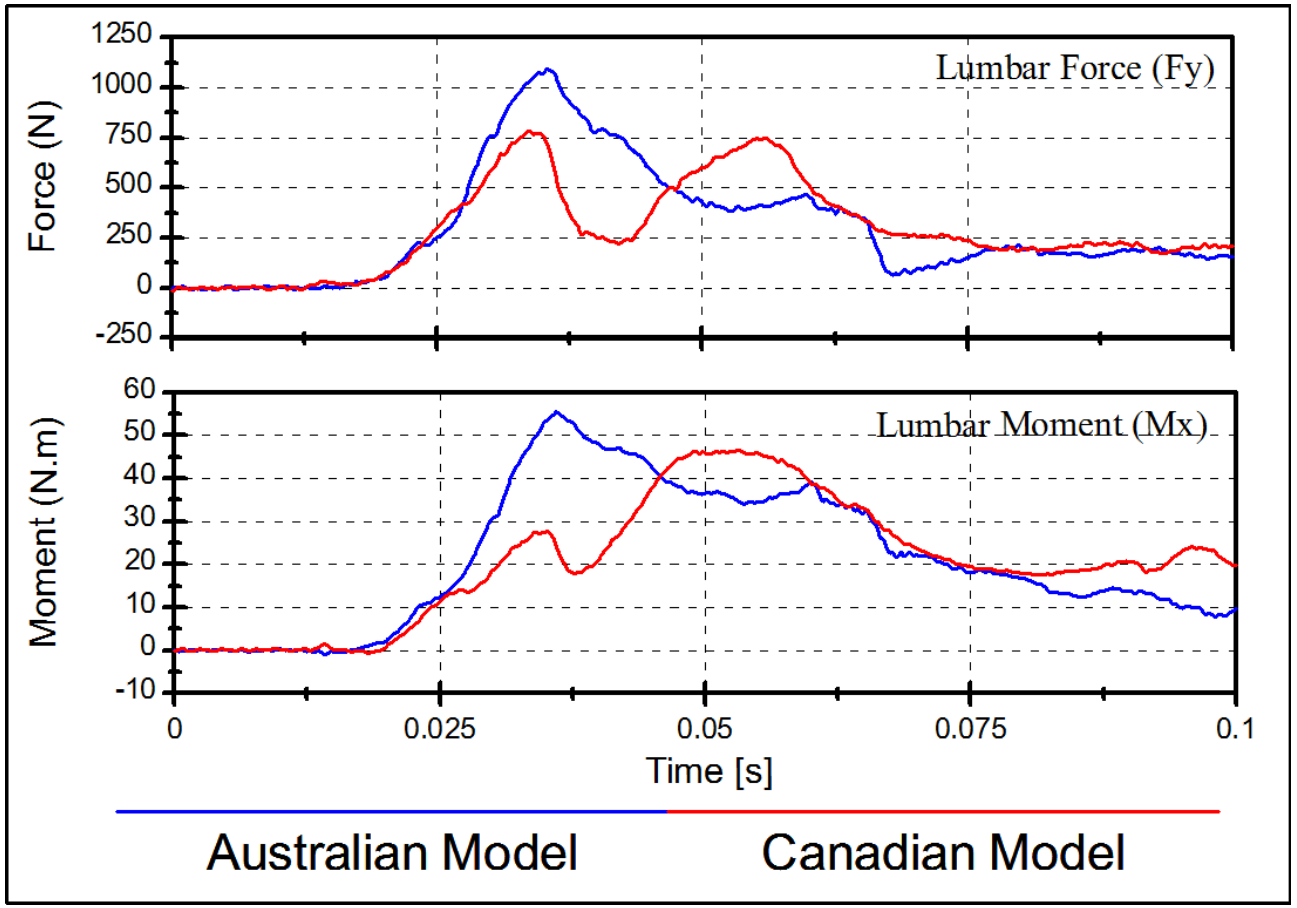
Resultant Spine Accelerations (32 km/h Oblique Impact)



T4 acceleration initiated earlier in Canadian Model (seat mounted airbag interaction between upper thorax and door).

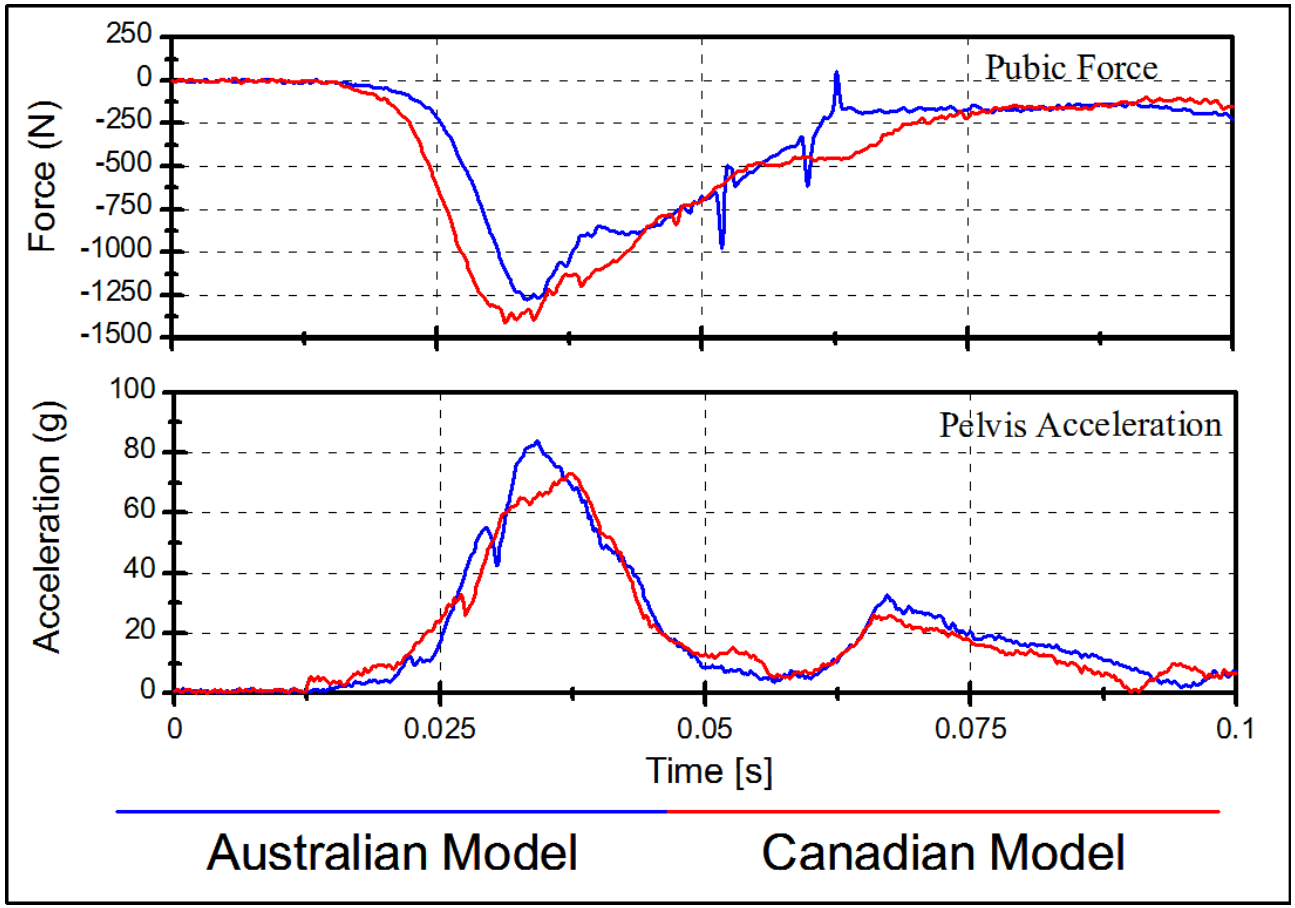
L. Spine Responses

Lumbar Force (Fy) / Lumbar Moment (Mx) (32 km/h Oblique Impact)



Pelvis Responses

Pubic Force / Pelvis Acceleration (32 km/h Oblique Impact)

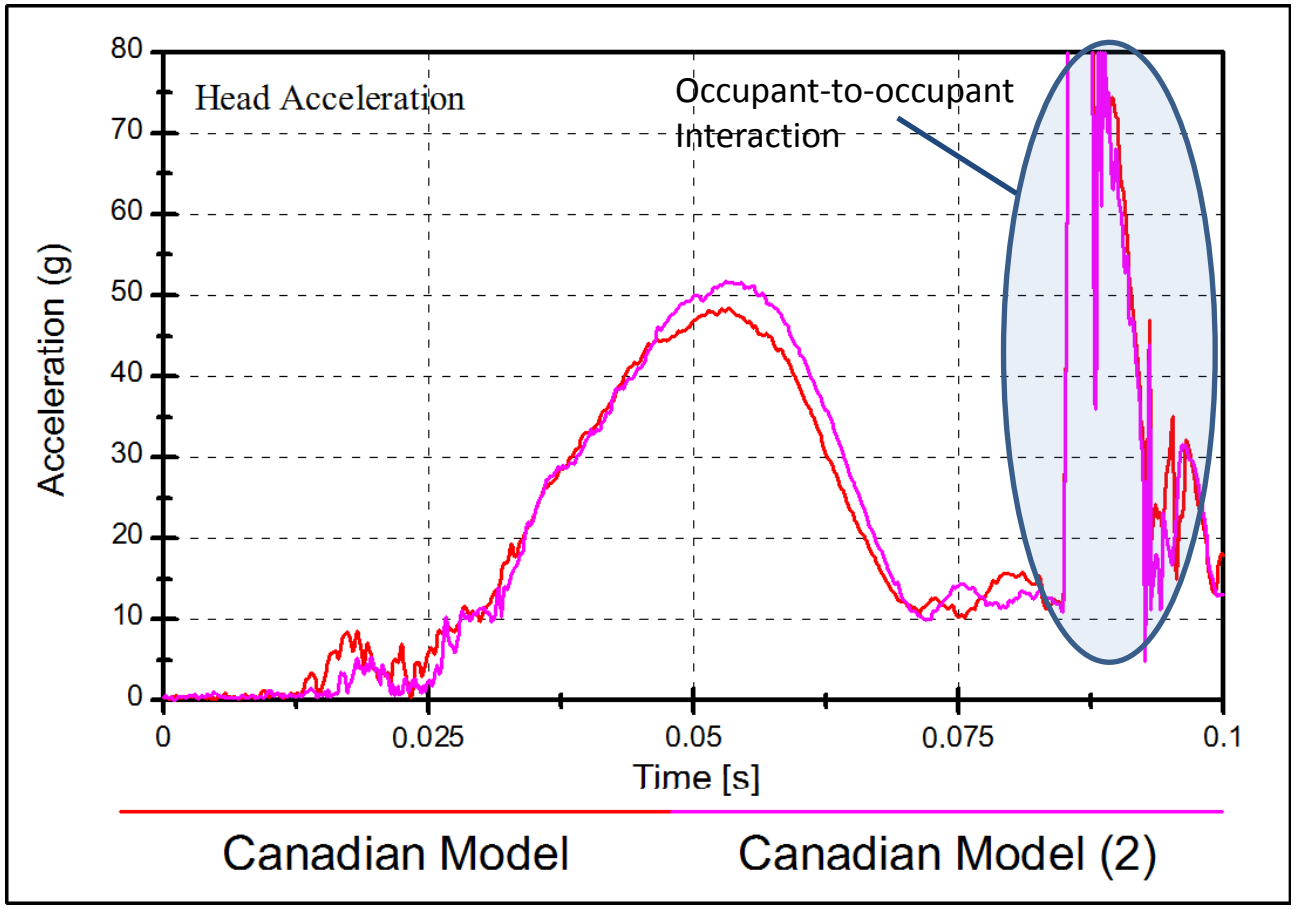


Summary

- A peripheral pressure and acceleration sensor were used in the Canadian market vehicle.
- The side airbags fired/deployed earlier in the Canadian market vehicle (airbag fire time < 10ms).
- Most likely explanations for improved thorax responses produced by Canadian model:
  - Seat mounted airbag is fired early enough to deploy between the upper arm / shoulder and door, resulting in earlier loading of the shoulder and upper thorax.
  - The Canadian market seat mounted side airbag has absorbed more of the WorldSID kinetic impact energy, reducing the energy required to be absorbed by deflection of the dummy thorax and abdomen ribs.

Repeatability

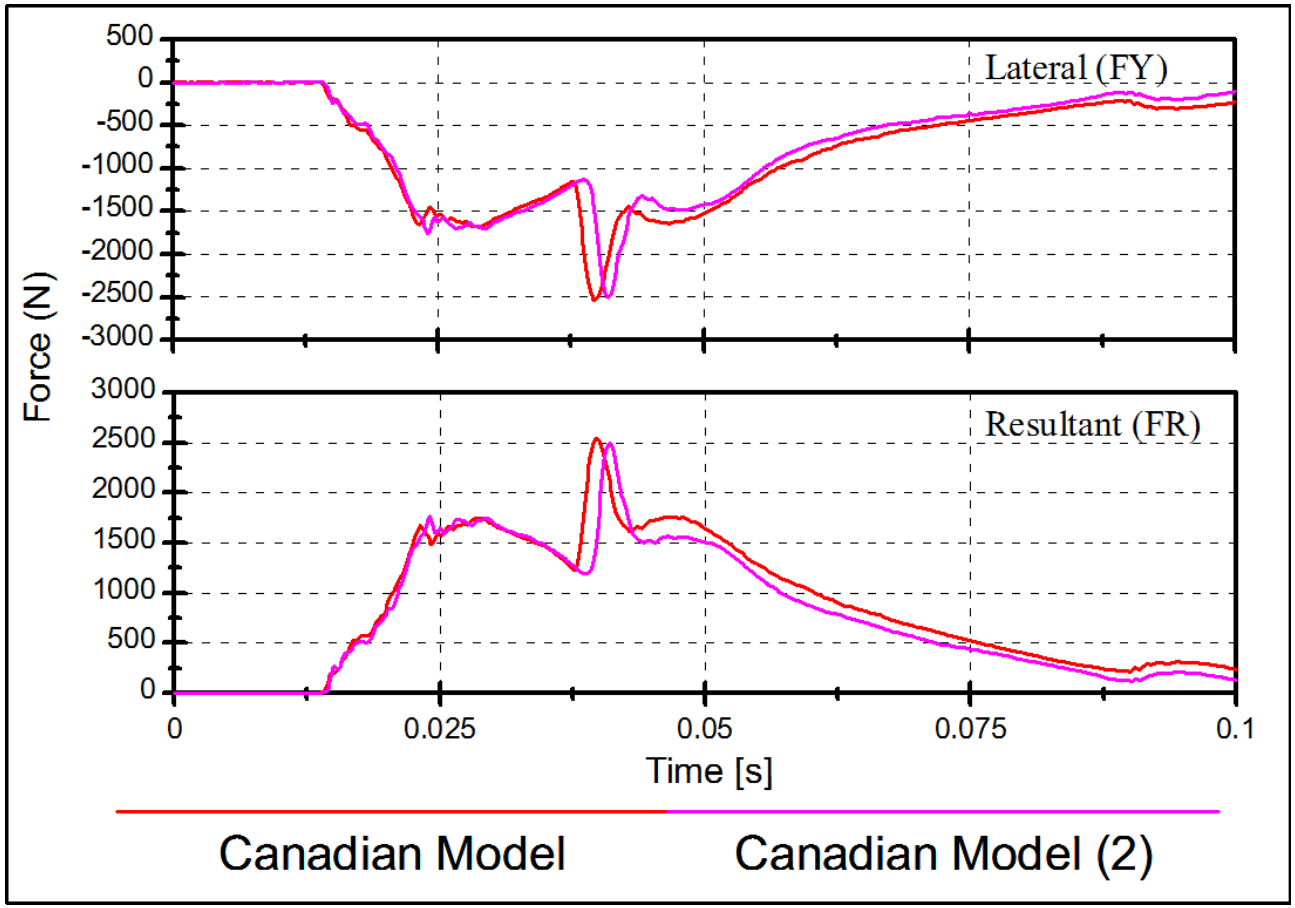
Head Acceleration (32 km/h Oblique Impact)



Results repeatable.

Repeatability

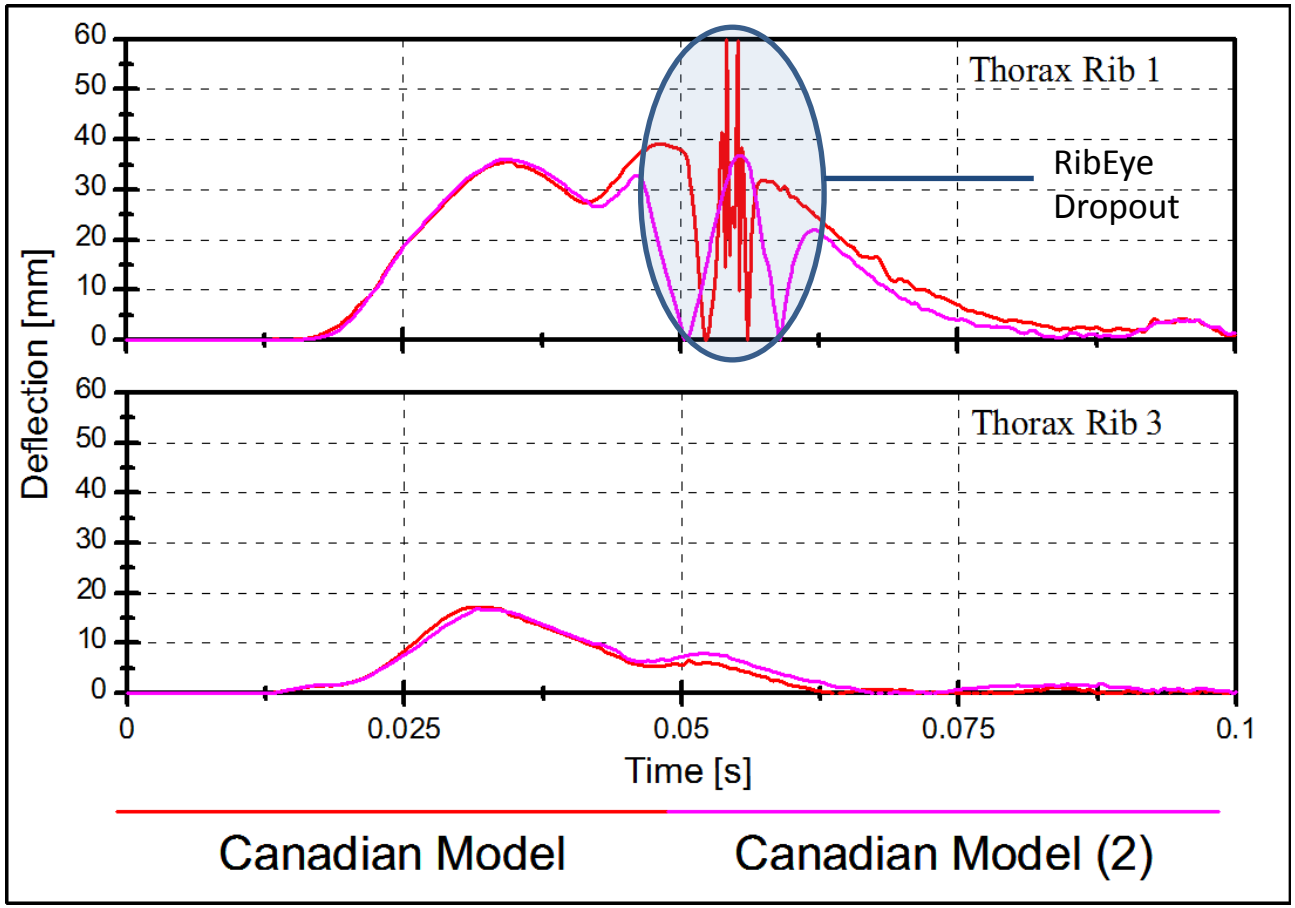
Shoulder Force (32 km/h Oblique Impact)



Results highly repeatable.

Repeatability

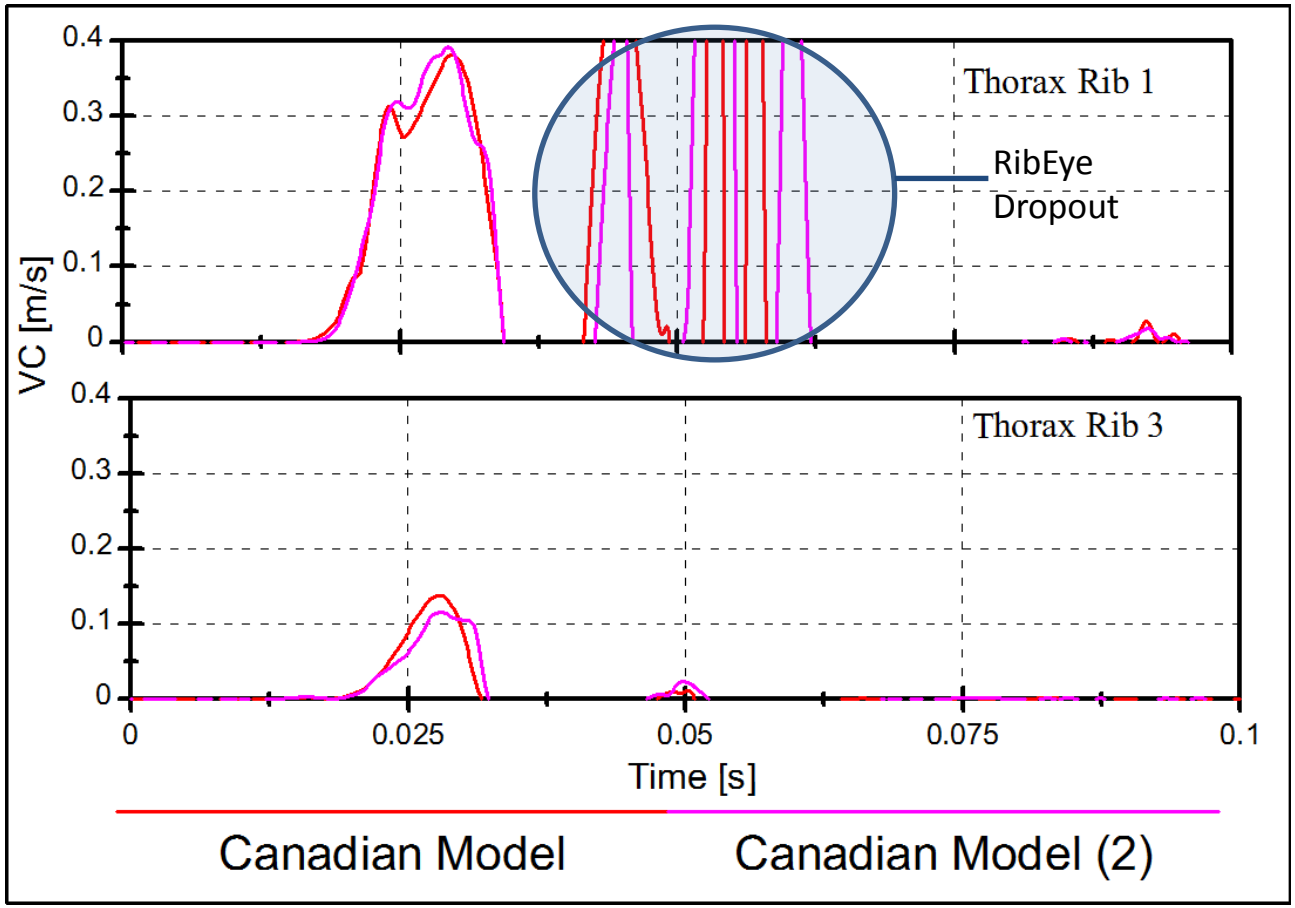
Theoretical IRTRACC Deflection (32 km/h Oblique Impact)



Results highly repeatable.

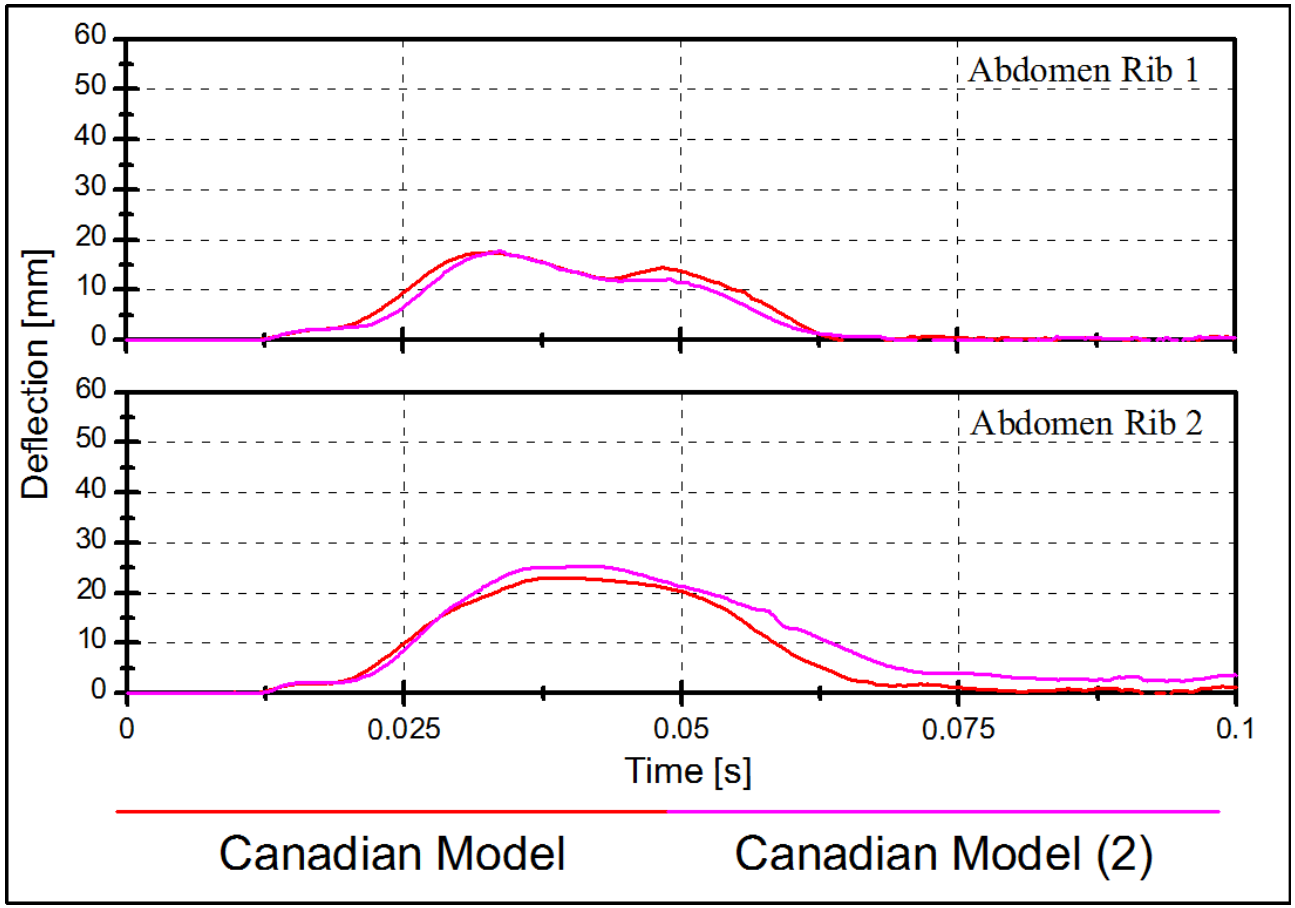
Repeatability

Theoretical VC (32 km/h Oblique Impact)



Repeatability

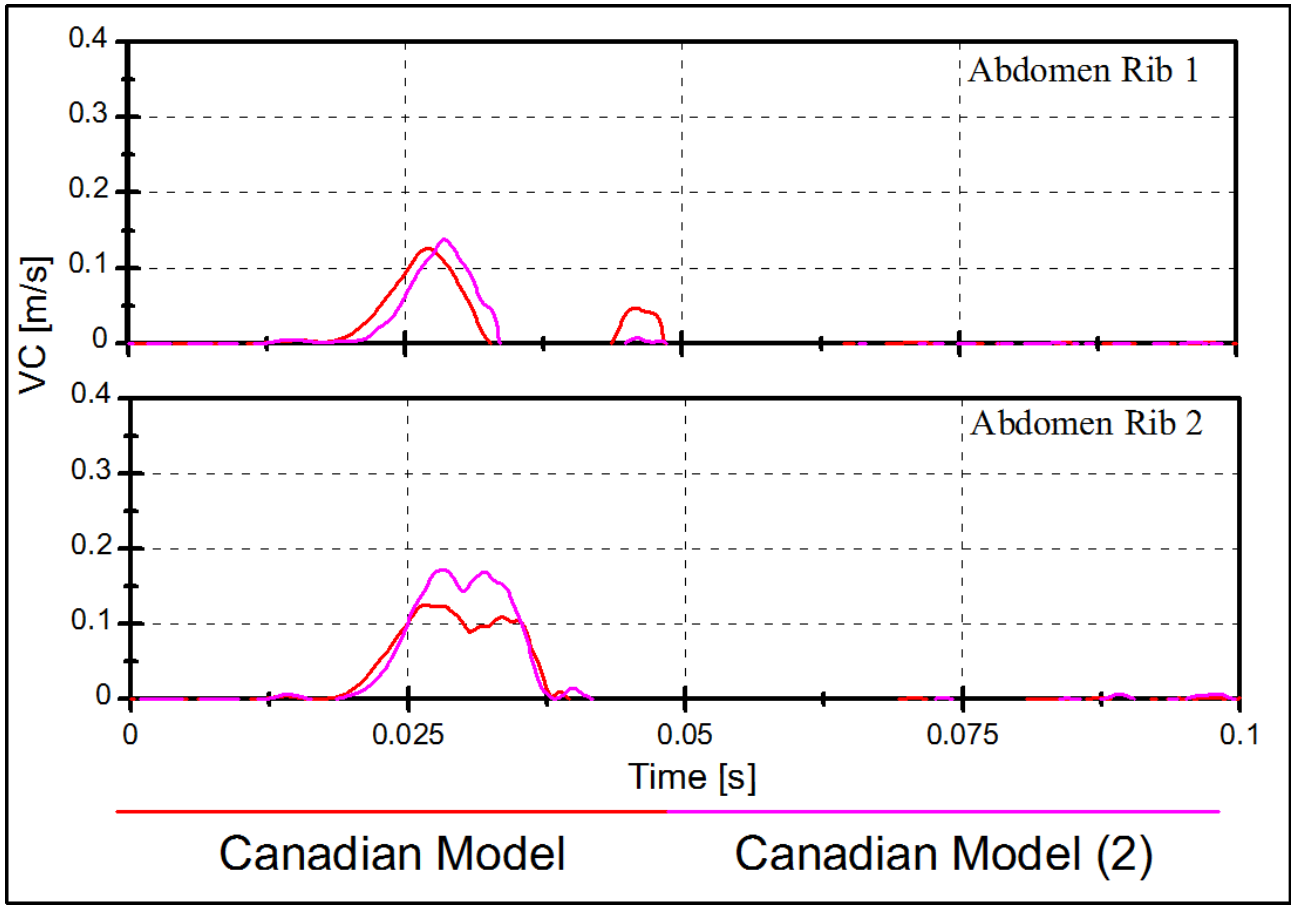
Theoretical IRTRACC Deflection (32 km/h Oblique Impact)



Results highly repeatable.

Repeatability

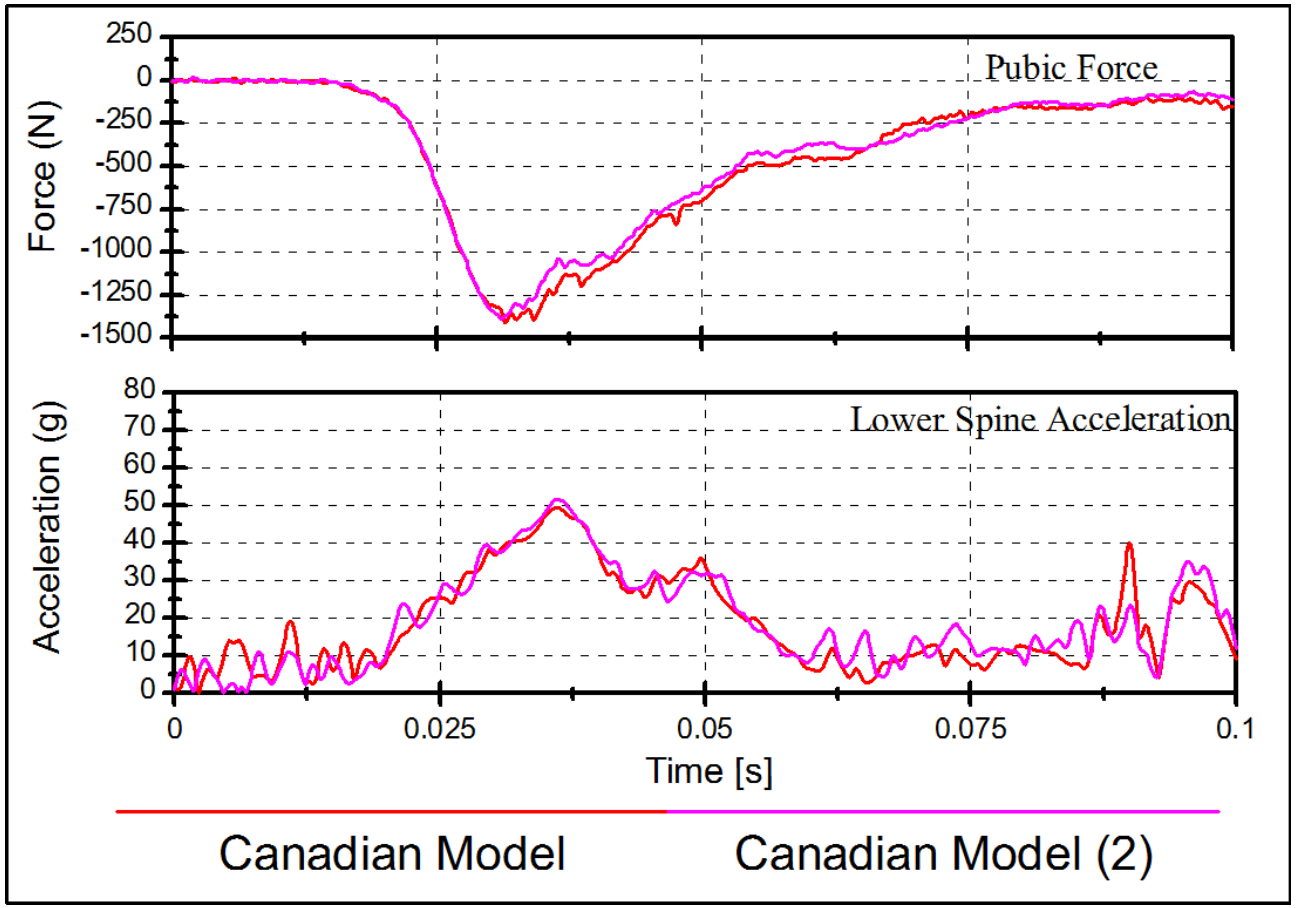
Theoretical VC (32 km/h Oblique Impact)



Results not as repeatable as deflection.

Repeatability

Pelvis and Lower Spine (32 km/h Oblique Impact)



Results highly repeatable.

Summary

- WorldSID 50th percentile adult male responses from repeated 32 km/h oblique pole side impact tests of a Canadian market Fiat 500 were highly repeatable.

Thank you