Submitted by the expert from Japan

Informal document GRSP-54-25
(54th GRSP, 17-20 December 2013,
agenda item 14)

Research on Chest Injury Criteria

JASIC

54th GRSP

17-20 December, 2013

Summary of Previous Report

- **FWRB tests and FEM simulation were conducted to study the different aspects of the restraint system. The results confirmed that seatbelt force limiters affect chest injury values and that the chest deflection is sensitive to the load of the force limiter whereas the acceleration is not.**
- **The simulation confirmed that the chest deflection varies with different belt paths and that the chest maximum acceleration is hardly affected by the belt path.**

Contents of the Report

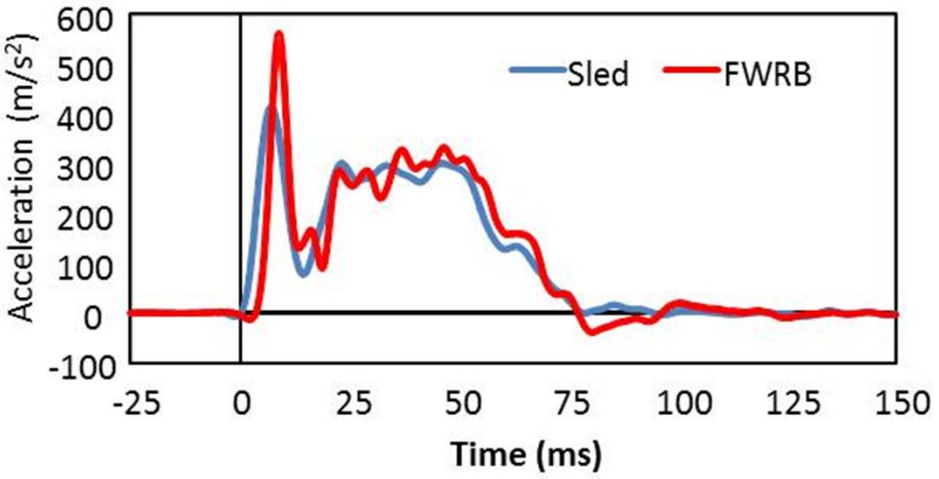
- **Vehicle sled tests to simulate FWRB tests were conducted to compare the dummy's response and chest injury measures for different seatbelt paths.**

Sled tests

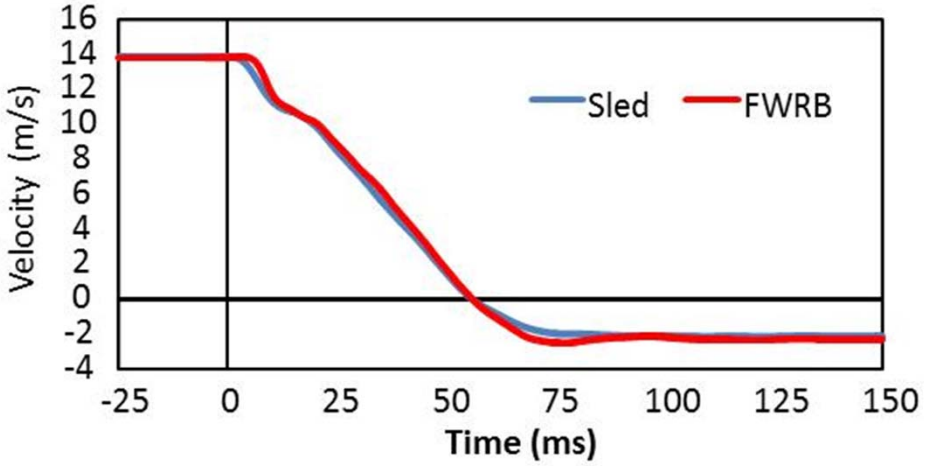
Test Condition

FWRB acceleration was simulated

Acceleration



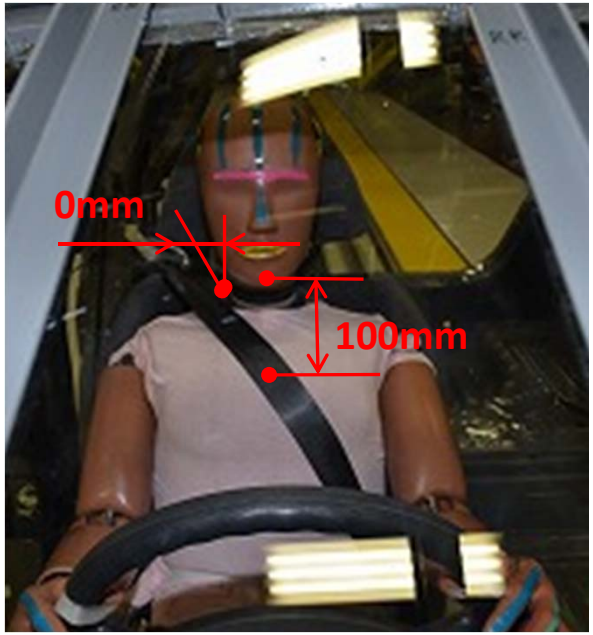
Velocity



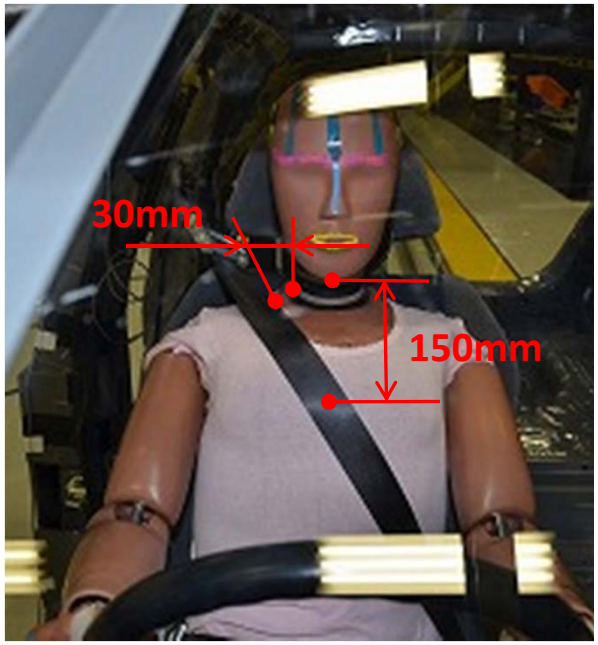
Test Matrix

Difference of seatbelt path

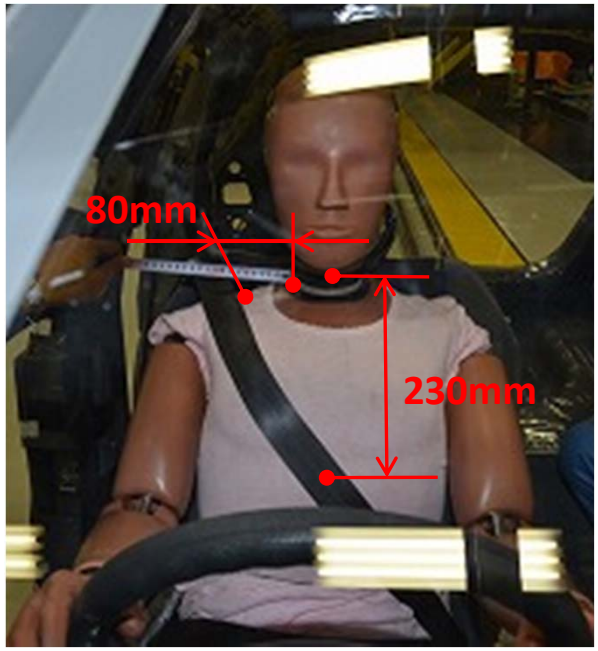
Test 1 (Upper)



Test 2 (Mid)

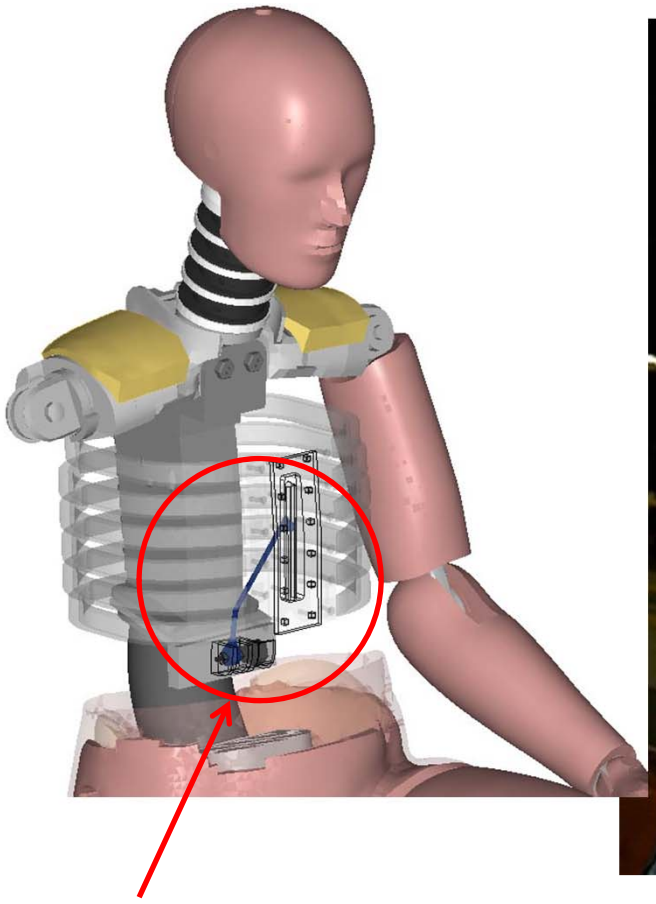


Test 3 (Lower)

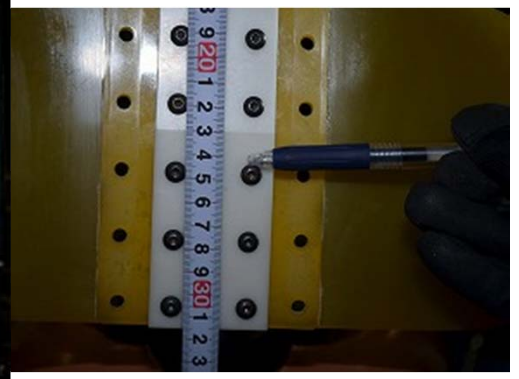


- The same condition as the FWRB test is represented in Test 2.
- Seatbelt path of Test 1 was upper than that of Test 2.
- Seatbelt path of Test 3 was lower than that of Test 2, and went over the position of the potentiometer.

Position of the Potentiometer



Potentiometer

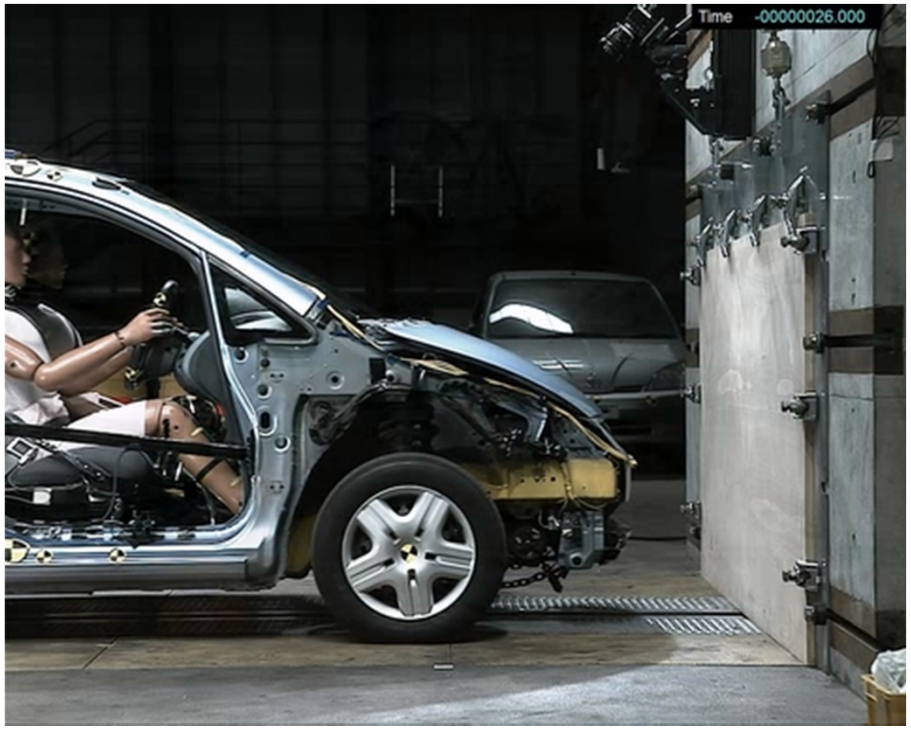


- The initial position of the potentiometer is 240mm away from the chin.

Comparison of Sled and FWRB

Video

FWRB



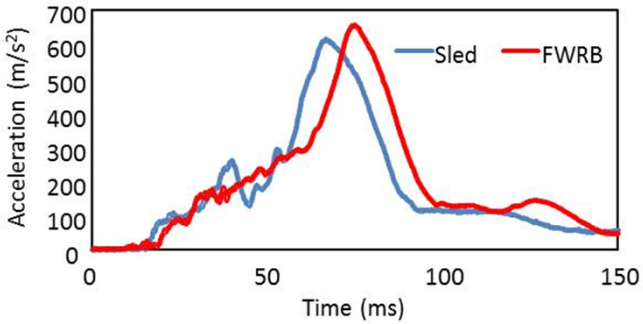
Sled

Comparison of Sled and FWRB

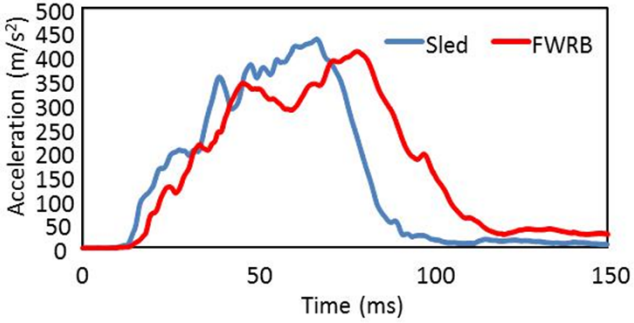
Dummy injury measures

Injury Criteria	Unit	Sled	FWRB
HIC 36		466	491
Head Maximum Acceleration (3ms)	G	61.5	65.2
Chest Deflection	mm	38.4	33.1
Chest Maximum Acceleration (3ms)	G	43.3	41.1

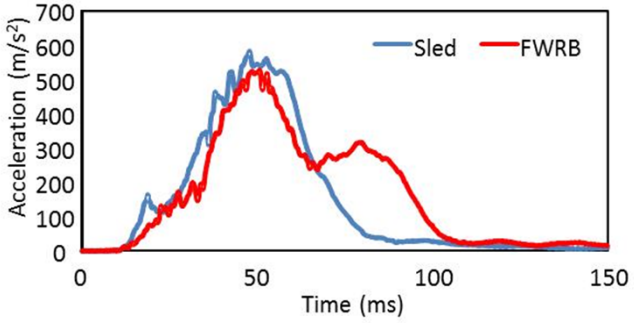
Head acceleration



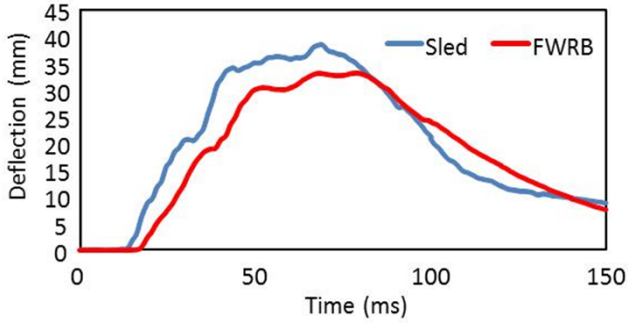
Chest acceleration



Pelvis acceleration



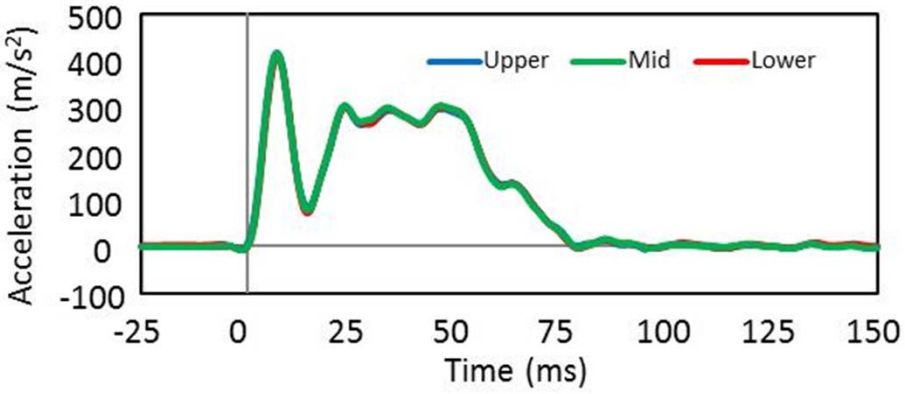
Chest deflection



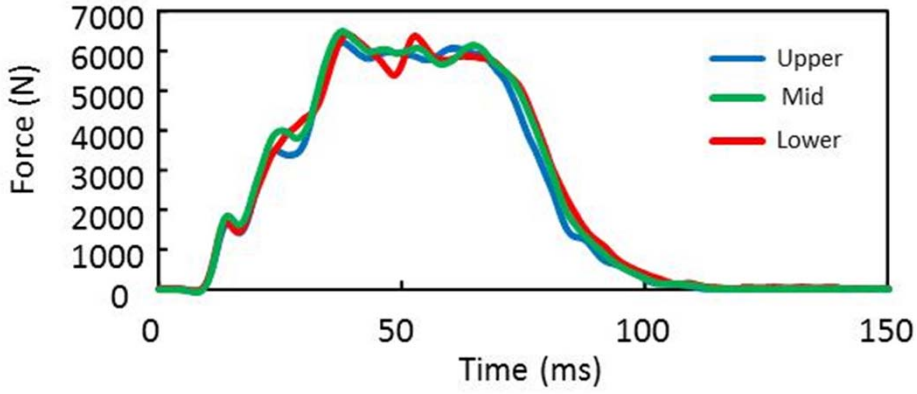
- The dummy responses were comparable in both tests.

Sled Test Results

Sled acceleration



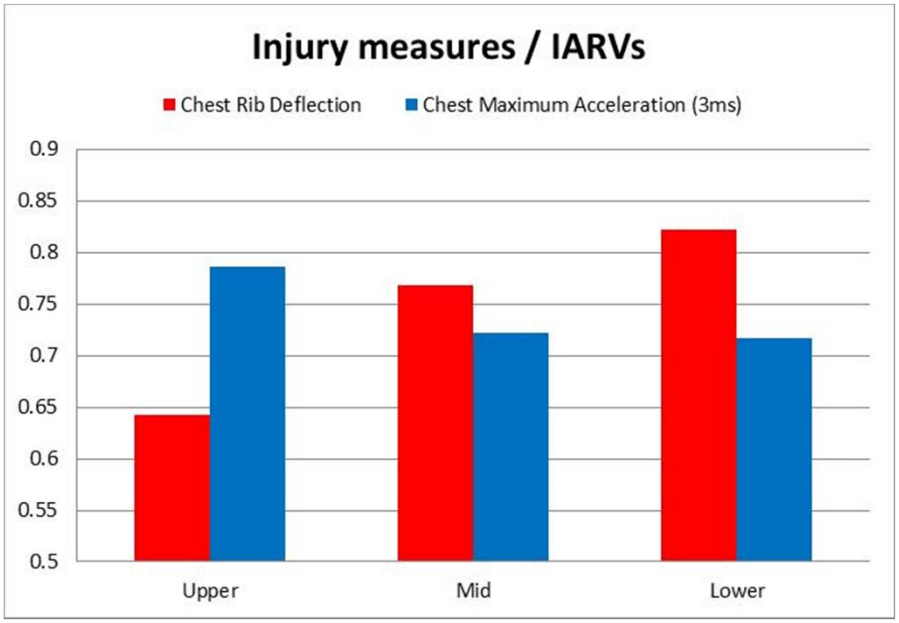
Shoulder belt tension force

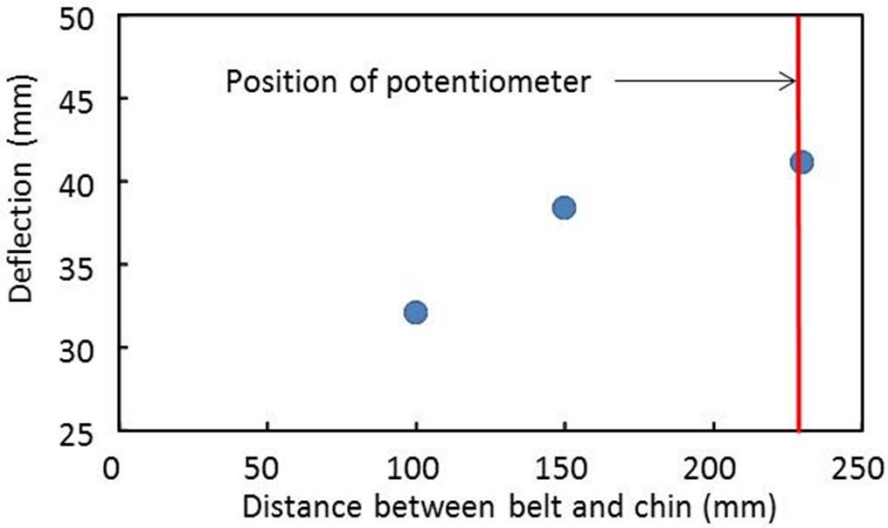


- Sled accelerations and shoulder belt tension forces were almost the same in all the sled tests.

Maximum Injury Measures

Injury Criteria	Unit	Upper	Mid	Lower
HIC 36		583	466	512
Head Maximum Acceleration (3ms)	G	71.8	61.5	63.2
Chest Deflection	mm	32.1	38.4	41.1
Chest Maximum Acceleration (3ms)	G	47.2	43.3	43.0

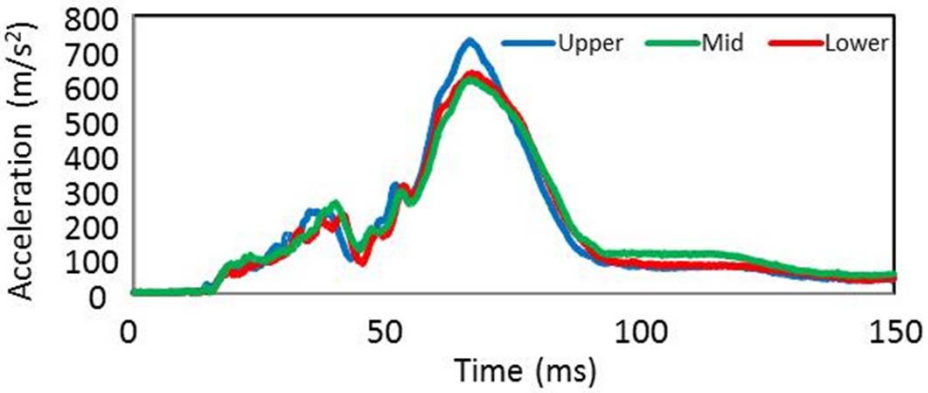




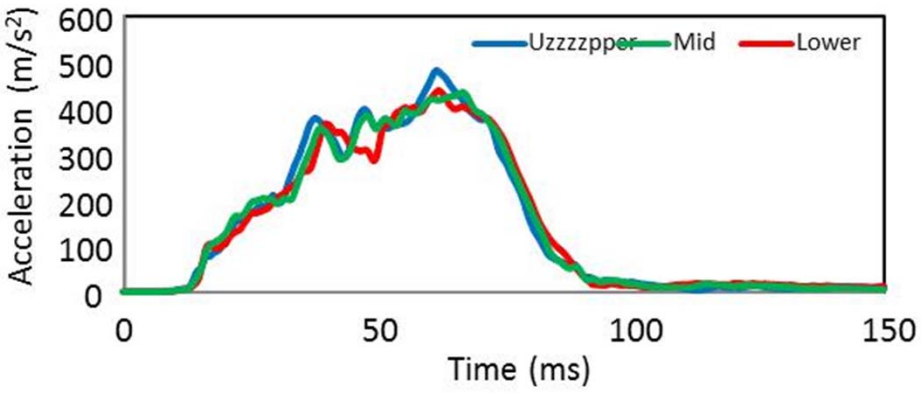
- The chest deflection was very sensitive to the seatbelt path.

Dummy Accelerations

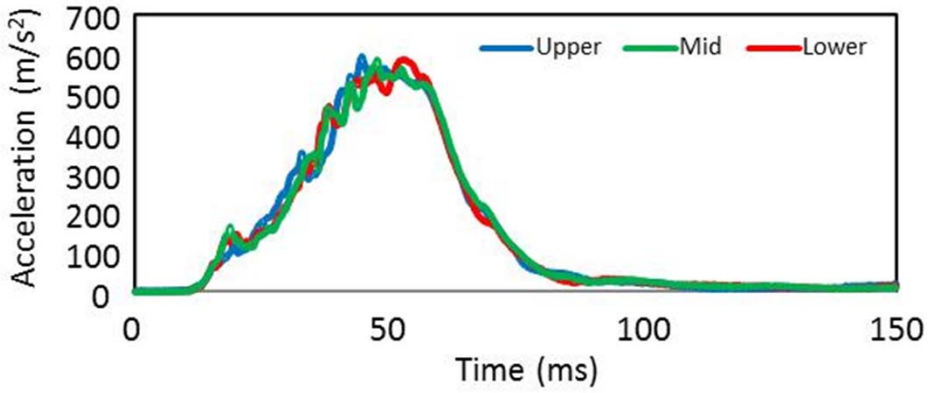
Head resultant acceleration



Chest resultant acceleration

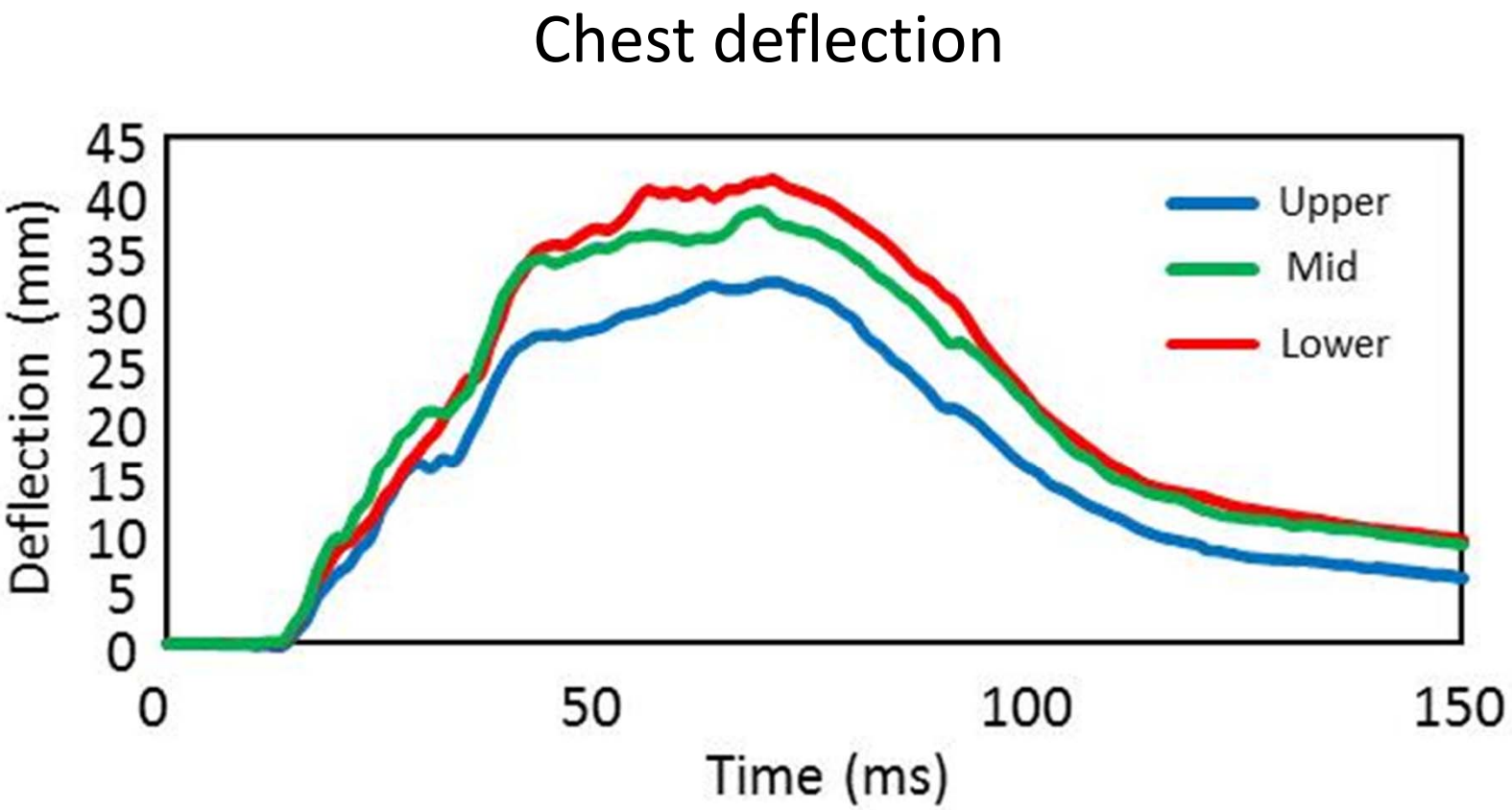


Pelvis resultant acceleration



- The curves of accelerations were similar in all the tests.

Chest Deflection



- The chest deflection was influenced by the seatbelt path.

Summary

- **In this test series, the chest deflection was influenced by the seatbelt path.**
- **The dummy accelerations were not affected by the seatbelt path.**
- **Therefore, Japan proposes the definition of the seatbelt path in the UN/ECE R94 regulation.**

Summary

- **Japan is scheduled to propose how to define the seatbelt path at the next informal working group.**
- **J-NCAP specifies the seatbelt path for AF05 seated in the rear seat.**

* **3.1.9.2 Fastening of Seatbelt**

After placing the dummies in the seats of the test vehicle, the seatbelts shall be fastened so that the routing position thereof is the design standard position (in the case of the AF05 dummy, this means the center of the belt lies normally between the breasts). The slack of the seatbelt shall be taken in sufficiently. If the seatbelt is equipped with a device for eliminating the feeling of oppression when the wearer fastens the seatbelt, the design standard slack shall be provided at the webbing for the shoulder.