

***Performance as Test Procedures of the
PDB and ODB Tests for the Light and
Heavy Cars***

JAPAN

March 10, 2009

4th Meeting of the Informal Group on Frontal Impact

Objective

- **To examine effects on light and heavy cars when the test conditions prescribed in ECE R94 are replaced by PDB test.**

Test Matrix

Test Vehicles	Mini-Car A (Light Car)		Mini-Car B (Light Car)			Minivan (Heavy Car)	
Test Conditions	60PDB	64ODB*	60PDB	64ODB*	56ODB (ECE R94)	60PDB	64ODB*
Test Weight (kg)	1144		1120			2110	
Dummies (DR&PA)	H3 50th%tile Male		H3 50th%tile Male			H3 50th%tile Male	

* Conducted in JNCAP

- 60PDB: PDB barrier - 60km/h - 50% overlap - 150mm ground clearance
- 64ODB: EEVC barrier - 64km/h - 40% overlap - 200mm ground clearance
- 56ODB: EEVC barrier - 56km/h - 40% overlap - 200mm ground clearance

Test Vehicles

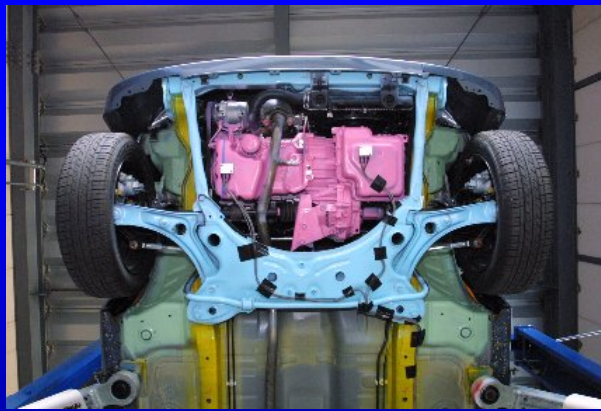
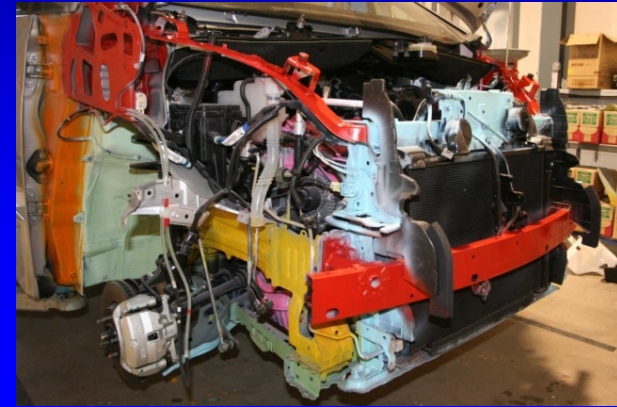
Mini-Car A



Mini-Car B



Minivan



➤ Front rail and bumper cross beam

➤ Front rail and lower cross beam (w/o bumper cross beam)

➤ Front rail, bumper cross beam, and Sub-frame

Barrier Deformation

Mini-Car A

60PDB



➤ The front plate broke wide open.

640DB (EEVC Barrier)



➤ The lower part of the honeycomb bottomed out completely.

Barrier Deformation

Mini-Car B

60PDB



64ODB (EEVC Barrier)



56ODB (EEVC Barrier)



➤ The front plate broke wide open.

➤ The lower part of the honeycomb bottomed out completely.

➤ The lower part of the honeycomb bottomed out.

Barrier Deformation

Minivan

60PDB



640DB (EEVC Barrier)



- The front plate broke wide open.
- Deformation reached the right edge of the barrier.

- The honeycomb bottomed out completely.

Vehicle Deformation

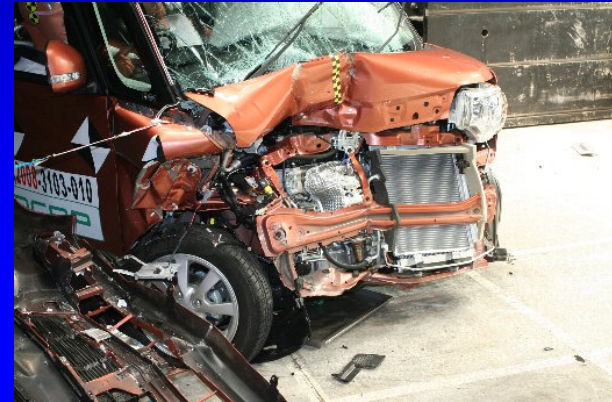
Mini-Car A

60PDB



- The front rail was rarely deformed.
- The bumper cross beam was bent significantly.

640DB (EEVC Barrier)



- The front rail was deformed.

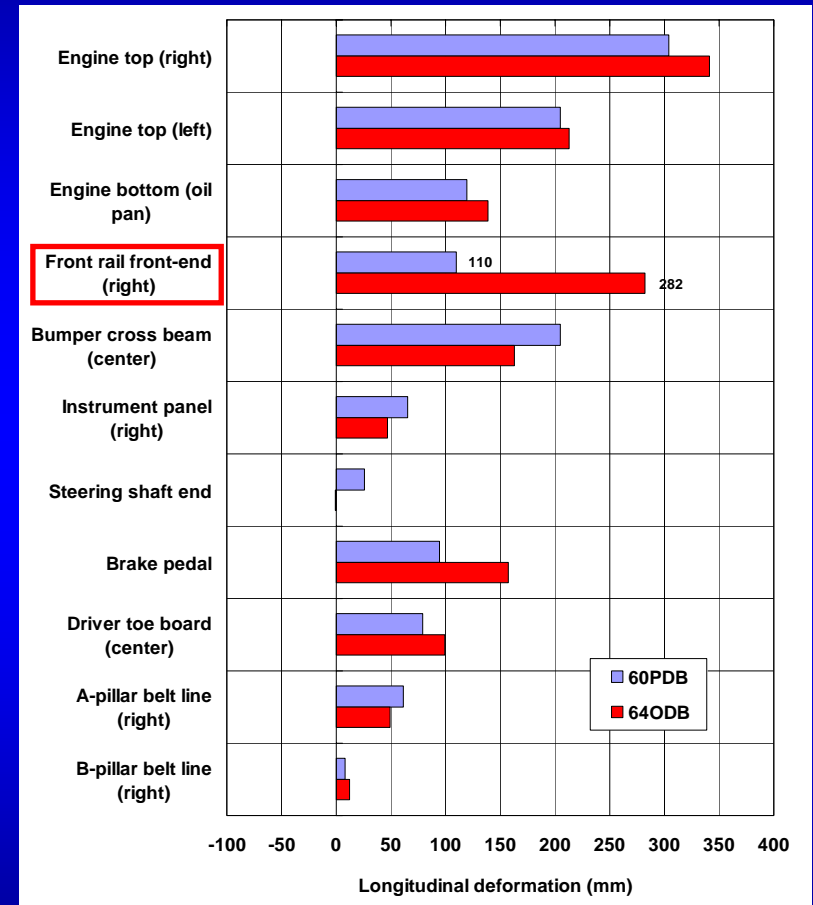
Vehicle Deformation

Mini-Car A

60PDB



64ODB
(EEVC
Barrier)



- There were big differences in the deformation of the front rail. In 60PDB, the front rail was deformed very slightly.
- The intrusion into the upper part of the cabin (instrument panel, A-pillar, etc.) tended to be large in 60PDB, while that into the lower part of the cabin (toe board, etc.) tended to be large in 64ODB.

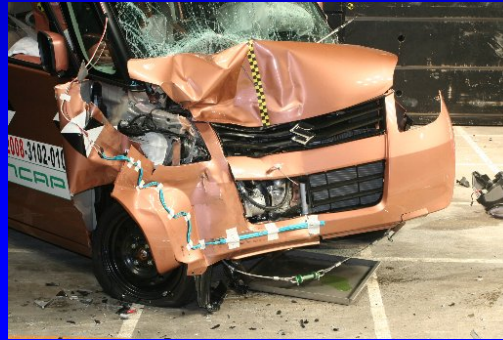
Vehicle Deformation

Mini-Car B

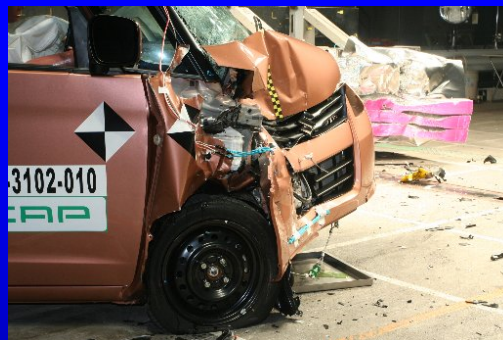
60PDB



640DB (EEVC Barrier)



560DB (EEVC Barrier)



- The front rail was rarely deformed.
- The lower cross beam was bent significantly.

- The front rail was deformed.
- The front rail was deformed.

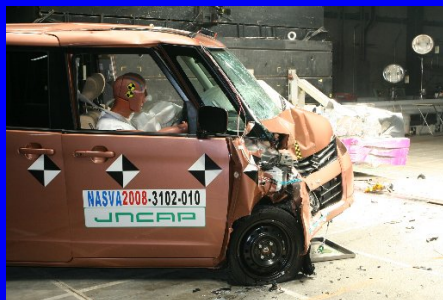
Vehicle Deformation

Mini-Car B

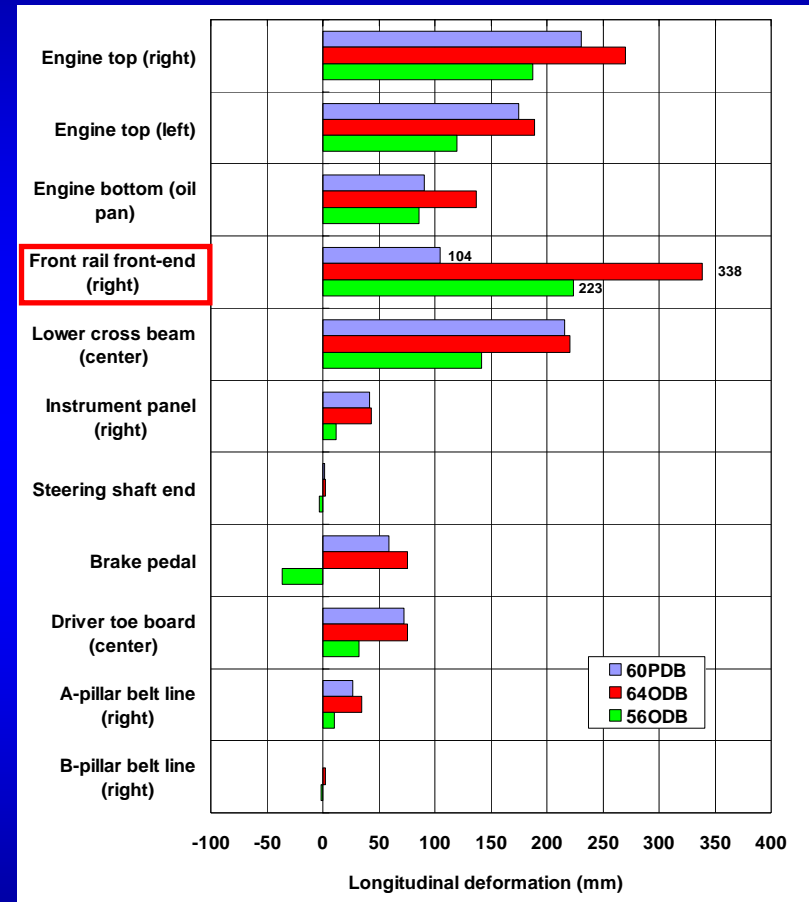
60PDB



64ODB
(EEVC
Barrier)



56ODB
(EEVC
Barrier)



- Overall, vehicle deformation in 64ODB tended to be large.
- 60PDB showed the smallest deformation of the front rail.

Vehicle Deformation

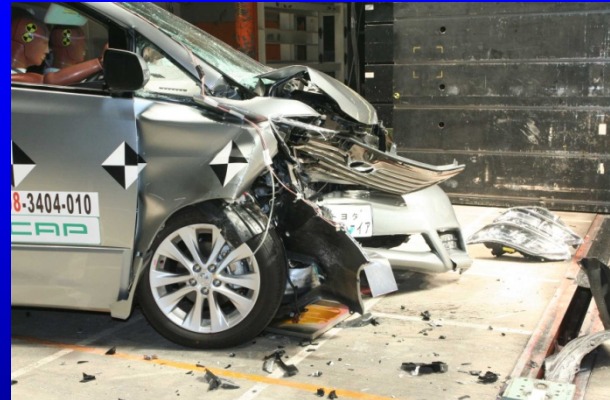
Minivan

60PDB



- The front rail was slightly deformed; only its end was deformed downward.
- The sub-frame was bent significantly.

640DB (EEVC Barrier)



- The front rail was deformed.

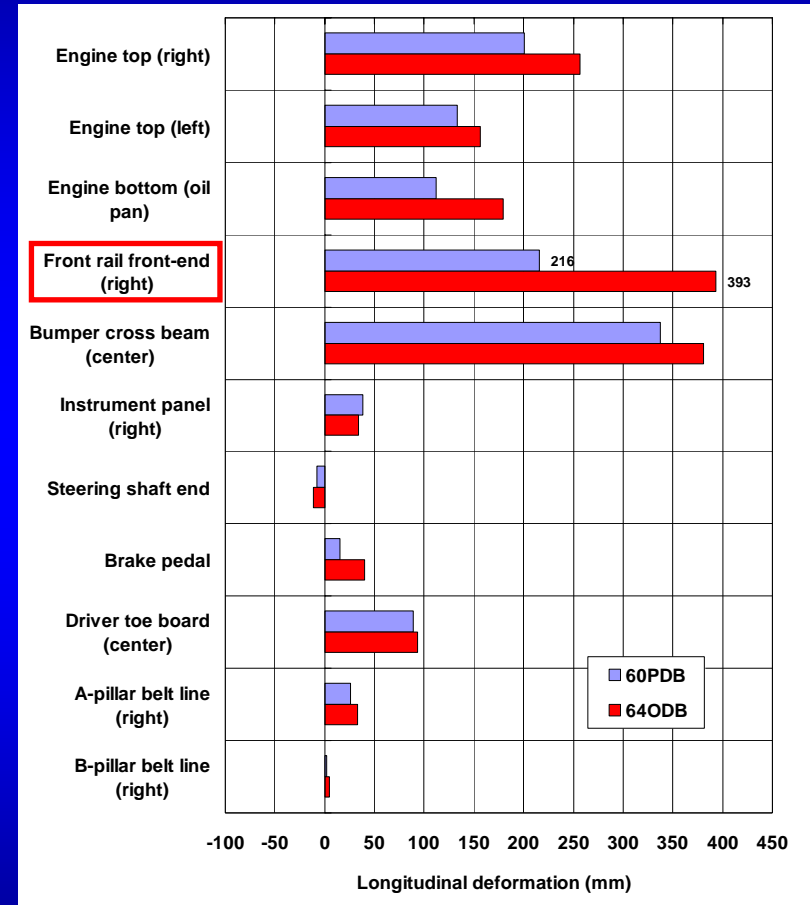
Vehicle Deformation

Minivan

60PDB



64ODB
(EEVC
Barrier)

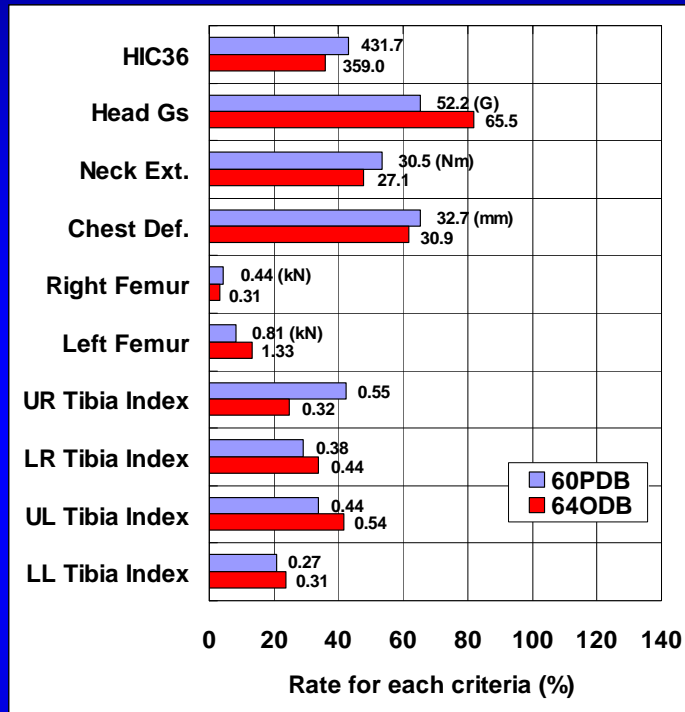


- Large difference in the deformation of the front rail: Smaller in 60PDB.
- Overall, vehicle deformation tended to be small in 60PDB.

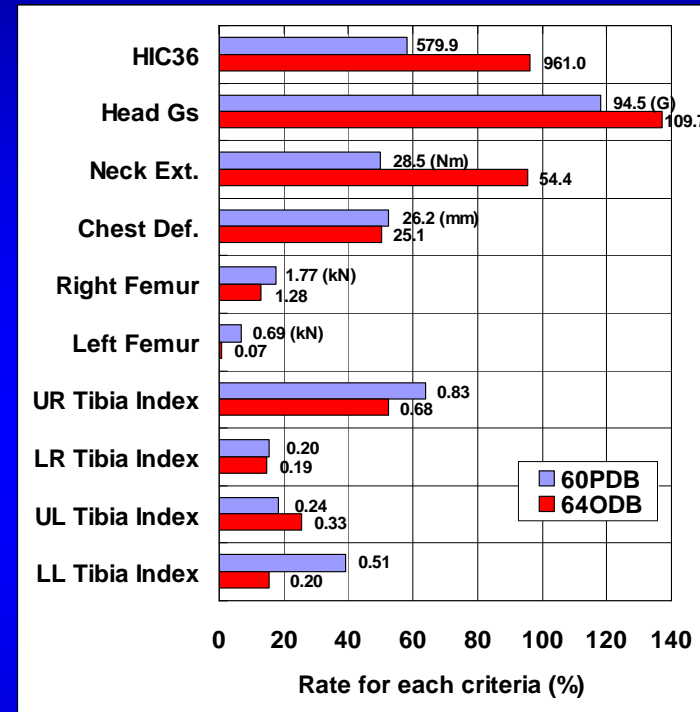
Dummy Injury Criteria

Mini-Car A

Driver



Passenger



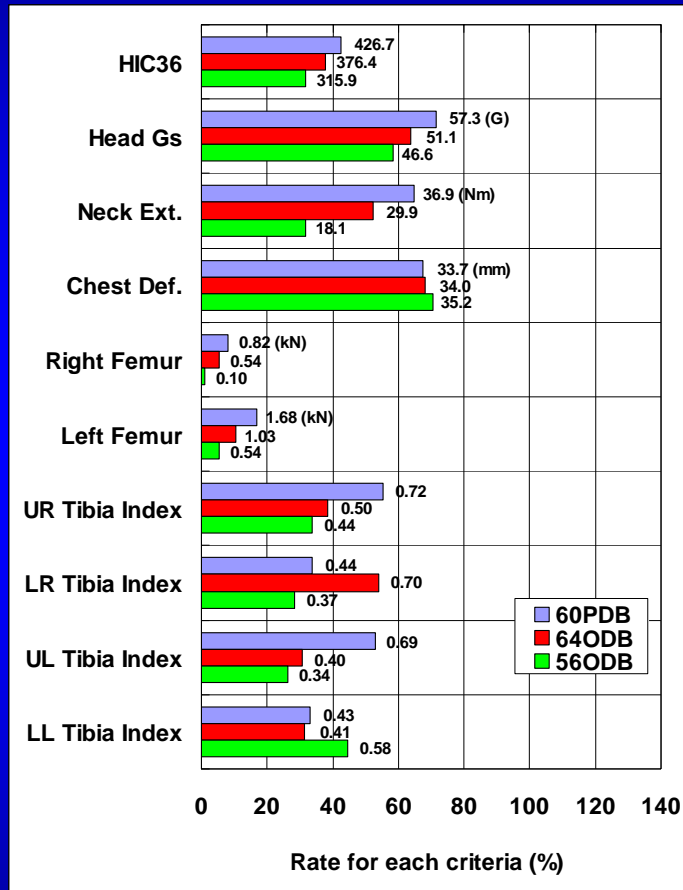
- 60PDB showed a slightly higher HIC, while 64ODB showed a slightly higher Head Gs.
- No significant difference was observed between the two tests for Neck, Chest, and Legs. The criteria were sufficiently met for all injury indices.

- 64ODB showed higher levels for Head and Neck.
- No significant difference was observed between the two tests for Chest and Legs.
- The Head Gs criterion was exceeded in both tests.

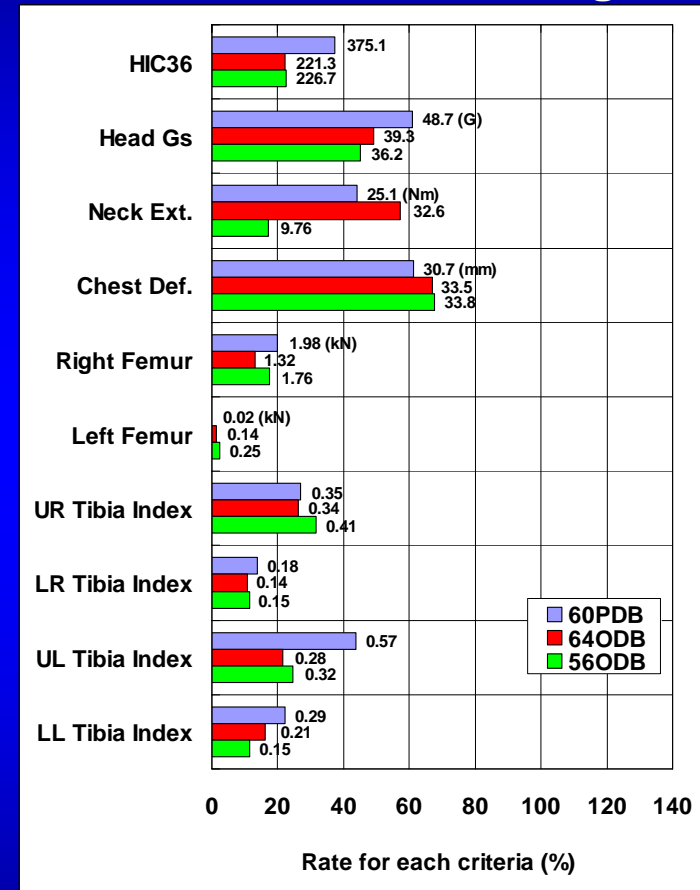
Dummy Injury Criteria

Mini-Car B

Driver



Passenger



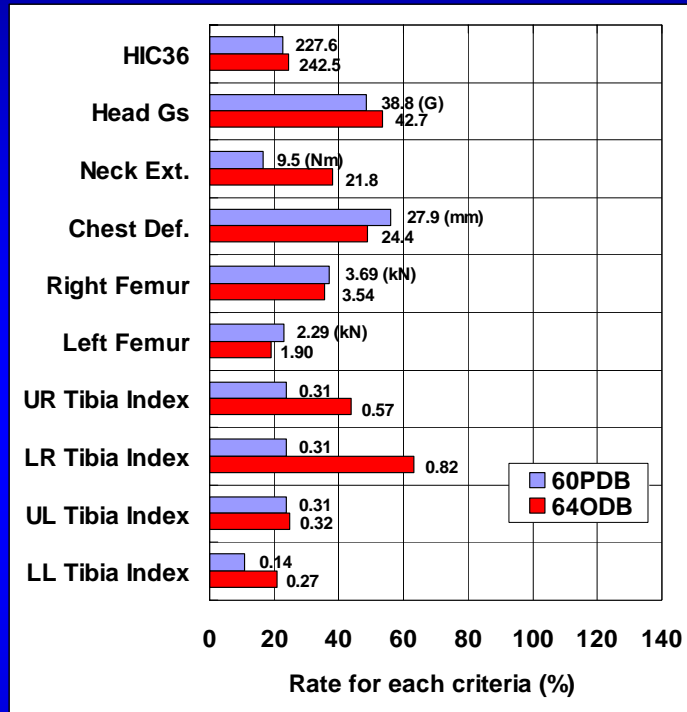
- The Head and Neck levels became lower in the order of 60PDB, 64ODB, and 56ODB.
- No significant difference was observed between 60PDB and 64ODB for Chest and Legs. The criteria were sufficiently met for all injury indices.

- 60PDB showed the highest level for Head.
- No significant difference was observed between the three tests for Chest and Legs. The criteria were sufficiently met for all injury indices.

Dummy Injury Criteria

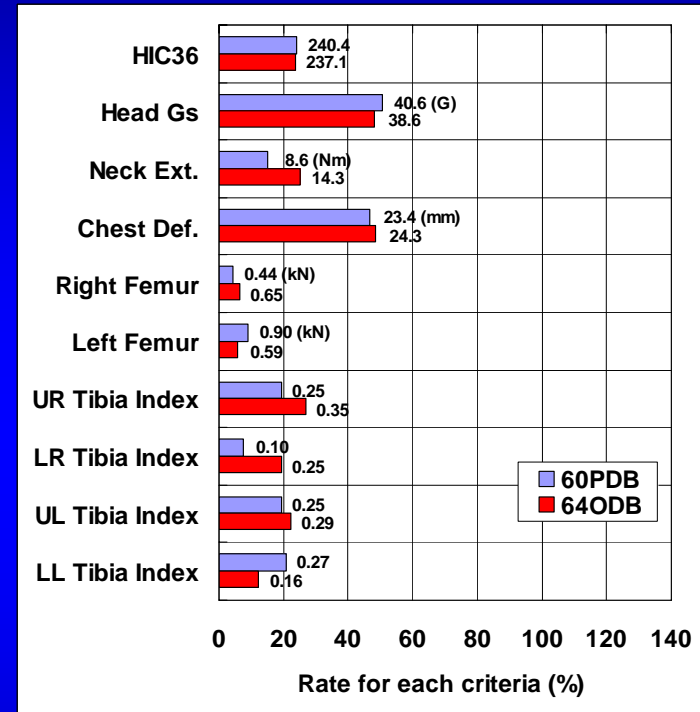
Minivan

Driver



➤ Overall, injury levels tended to be lower in 60PDB, though no significant difference was observed. The criteria were sufficiently met for all injury indices.

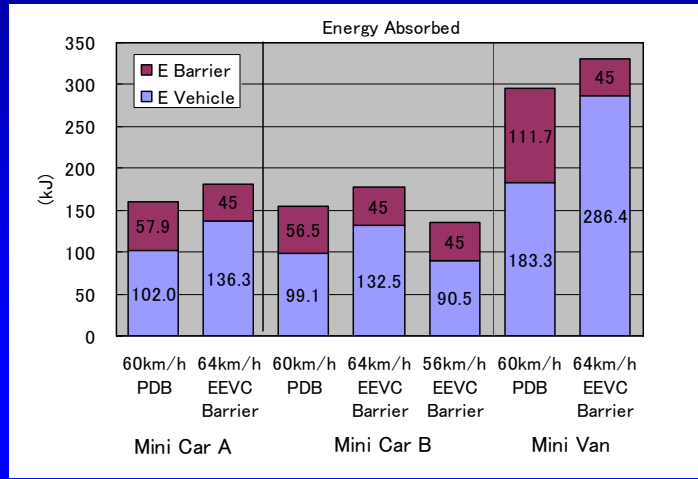
Passenger



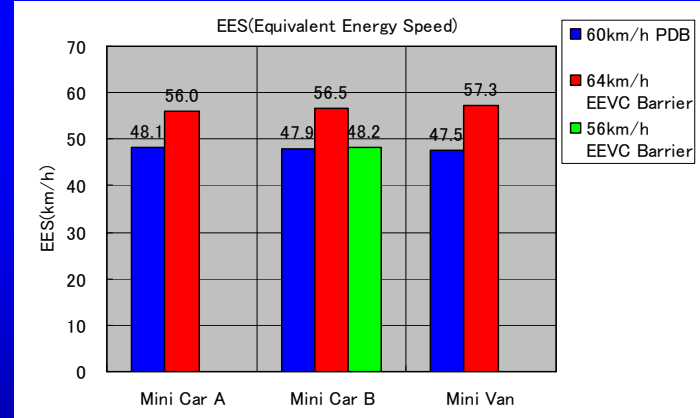
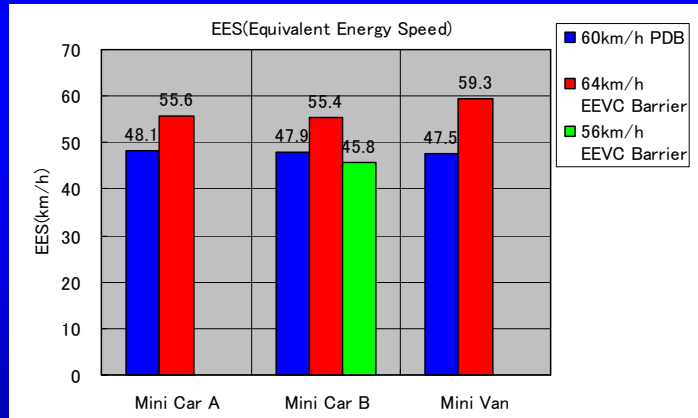
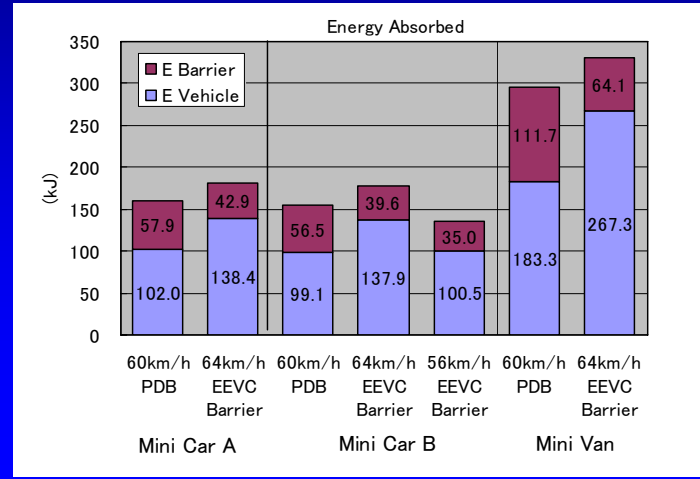
➤ No significant difference was observed between the two tests for any injury index. The criteria were sufficiently met for all injury indices.

Vehicle Severity (EES)

Suppose the deformation energy of EEVC Barrier is 45kJ (UTAC Proposal) :



The deformation energy of EEVC Barrier was actually measured.



- 64ODB showed the highest EES.
- The EES in 60PDB was around the same level for Mini-Cars (light cars) and Minivan (heavy car).
- The EES in 64ODB was higher for Minivan than Mini-Cars. However, when the EEVC Barrier deformation energy was actually measured, the EES difference between Minivan and Mini-Cars was not as large as when it was calculated using the constant value of 45 kJ.

Summary

- The bottom-out of the EEVC barrier was observed with the mini-car even under the 56ODB conditions (the current ECE R94).
- No bottom-out of the PDB was observed, even in the crash with Minivan (heavy car, 2,110 kg). However, the front rail of Mini-Cars and Minivan stuck into the PDB, deforming its front block significantly (causing its front plate to break wide open).
- Significant differences were seen in the deformation of the front rail between PDB and ODB. Deformation in 60PDB was extremely smaller than that in 56 and 64 ODB.
- Overall, the vehicle deformation of Mini-Cars tended to be larger in 64ODB than in 60PDB (in Mini-Car A, the intrusion into the upper part of the cabin [instrument panel, etc.] tended to be large in 60PDB, while that into the lower part of the cabin [toe board, etc.] tended to be large in 64ODB).
- Overall, the vehicle deformation of Minivan tended to be larger in 64ODB than in 60PDB.

Summary

- **Dummy injury criteria:** In Mini-Cars, no significant difference was observed between 60PDB and 64ODB for Chest and Legs (in Mini-Car B, the Head injury level tended to be higher in 60PDB than 64ODB and 56ODB). The criteria were sufficiently met for all injury indices, except Head Gs of the passenger dummy in Mini-Car B.
- In Minivan, overall, injury levels for the driver dummy tended to be lower in 60PDB than 64ODB, though no significant difference was observed. As for the passenger dummy, no significant difference was observed between the two tests for any injury index. In both tests, the criteria were sufficiently met for all injury indices of both dummies.
- The EES in 60PDB was around the same level for Mini-Cars and Minivan.
- The EES in 64ODB was higher for Minivan than Mini-Cars. However, when the EEVC Barrier deformation energy was actually measured, the EES difference between Minivan and Mini-Cars was not as large as when it was calculated using the constant value of 45 kJ.
- ◆ **The result of C2C test (Mini-Car B to Light Passenger Car) is scheduled to be presented at the 5th informal meeting.**