

State of the Art for AEBS in Japan

1. History of AEBS in Japan

2001 Design Principles for ASV Systems

2003 Technical Guideline for AEBS

2003 First Release of AEBS in Passenger Cars

2005 Revision of Technical Guideline for AEBS

2006 First Release of AEBS in Large Trucks

2007 – Discussion on the Technical Regulation of AEBS for Large Truck

2. AEBS Demonstration



3. Large Trucks with AEBS - 1

ISUZU



Oct. 2007 ~

NISSAN
DIESEL



Oct. 2007 ~

HINO



Feb. 2006 ~

3. Large Trucks with AEBS - 2

- Total Trucks sold with AEBS: 3,000
(100,000 Passenger Cars)
- Truck types and Classes : Rigid Trucks of GVW 20t ~ 25t
Tractors for semi-trailers
- Suspension Types: Rear Air Suspension
Full Air Suspension
Leaf Suspension
- Object Detection: Millimeter Wave Radar
- Objects: Stationary / Moving
Moving

4. AEBS Functions - 1

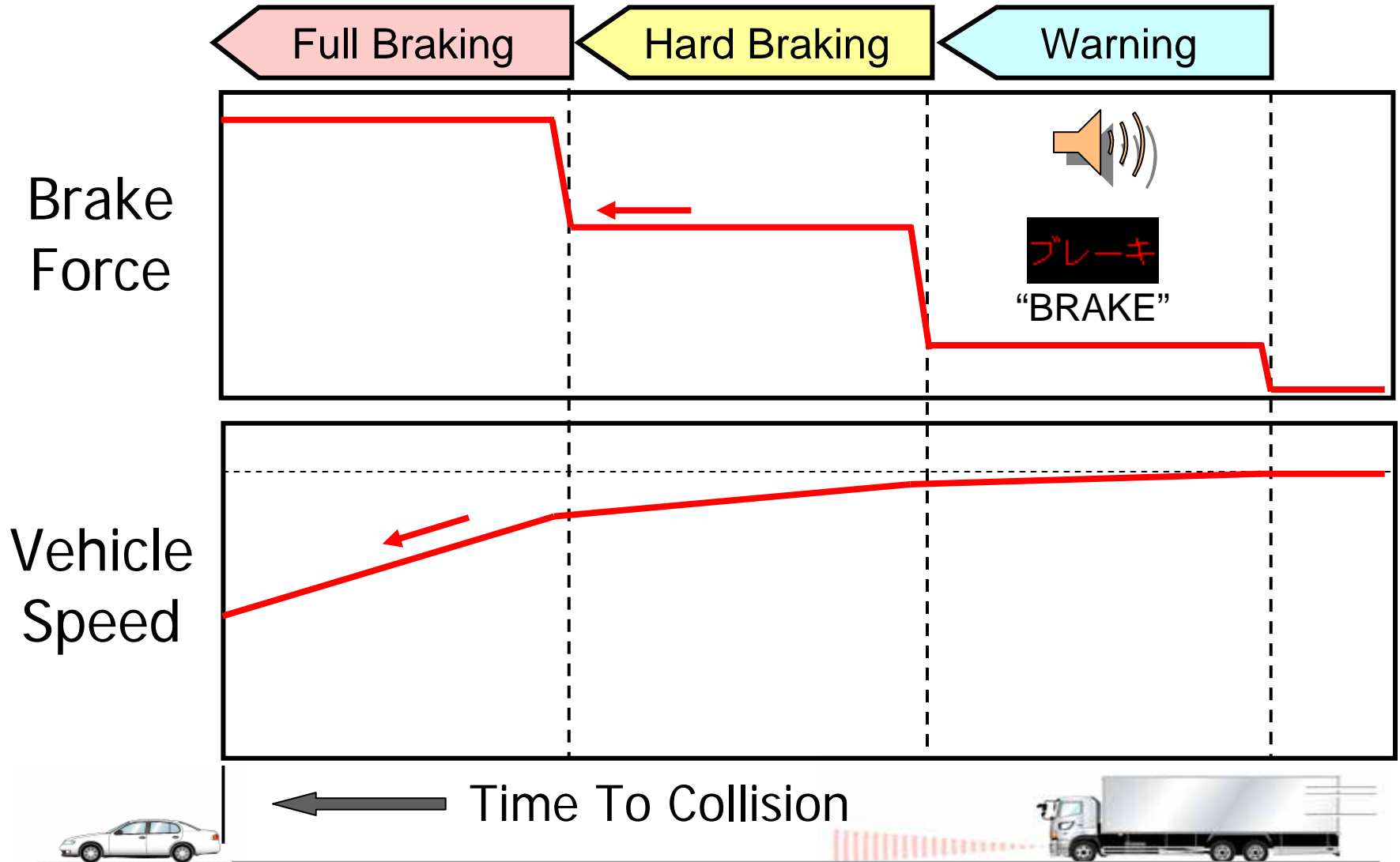
✓ Current systems are based on the revised version of Technical Guideline for AEBS 2005.

- Audible and visual warnings together with slight braking are given to urge the driver to take avoiding maneuver.
- Braking control is given with the timing described in the guideline to reduce the collision speed.
- Both stationary and moving objects are detected.
- Speed Reduction of 5 – 25km/h is achieved;
depending on the conditions and systems.

4. AEBS Functions - 2

- Drivers can cancel the activation of the system with an off switch.
- System activation may be interrupted by driver maneuver; depending on the systems, e.g. steering maneuver .

4. AEBS Functions - 3



5. Radar Technology - 1



FM-CW; Frequency-Modulated Continuous Wave

Radar Modulation	FM - CW
Frequency	76 – 77GHz
Size (without bracket)	H86 x W128 x D45 mm
Horizontal Direction Measurement	Electronic Scanning 5 ch. MUSIC
Detection Distance (@ 0deg.)	5 – 150 m min.
View Angle	Horizontal; ± 10 deg. Vertical; ± 2 deg.
Interface	CAN

5. Radar Technology - 2



Radar Modulation	FM - CW
Frequency	76 – 77GHz
Size	H76 x W95 x D67 mm
Detection Distance	2 - 120 m
View Angle	Horizontal; ± 8 deg. Vertical; ± 1.9 deg.
Weight	0.5kg
Interface	CAN

5. Radar Technology - 3



FSK; Frequency Shift Keying

Radar Modulation	FSK
Frequency	76 – 77GHz
Size (without bkt.)	H75 x W103 x D45 mm
Detection Distance	1 – 120 m
View Angle	Horizontal; ± 8 deg. Vertical; ± 2 deg.
Weight	0.5kg
Interface	CAN

6. Feed Back from the Market

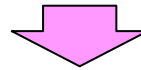
- Systems are mostly accepted by customers.
- Some complaints for false warnings have been heard; e.g.
 - when entering a curve on suburban road and Metropolitan Expressway with excessive speed

7. Estimation of Damage Mitigation - 1

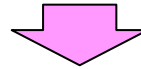
How to estimate?

• Data of rear-end collisions of large trucks in 2001 – 2003 were used.

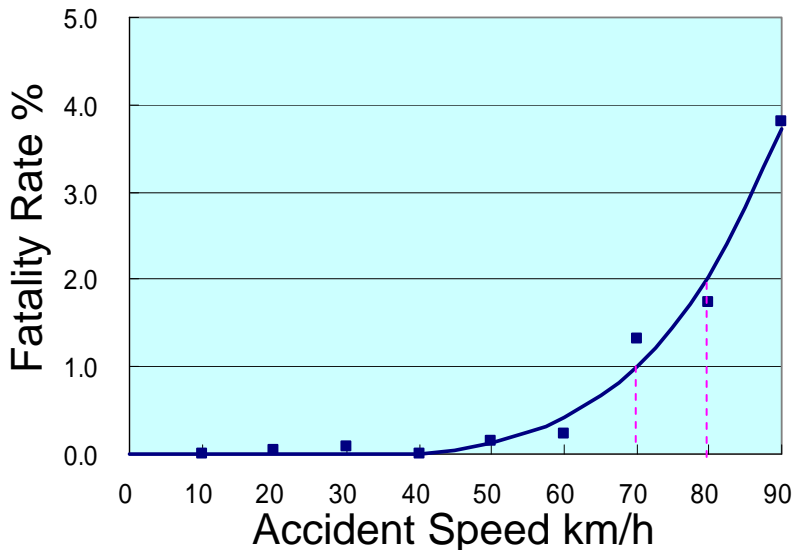
1. Count the number of fatal and all rear-end collision accidents in each accident speed range



2. Calculate the fatality rate against the accident speed



3. Suppose the accident speed has decreased evenly by AEBS, And calculate the estimated number of fatal accidents with AEBS



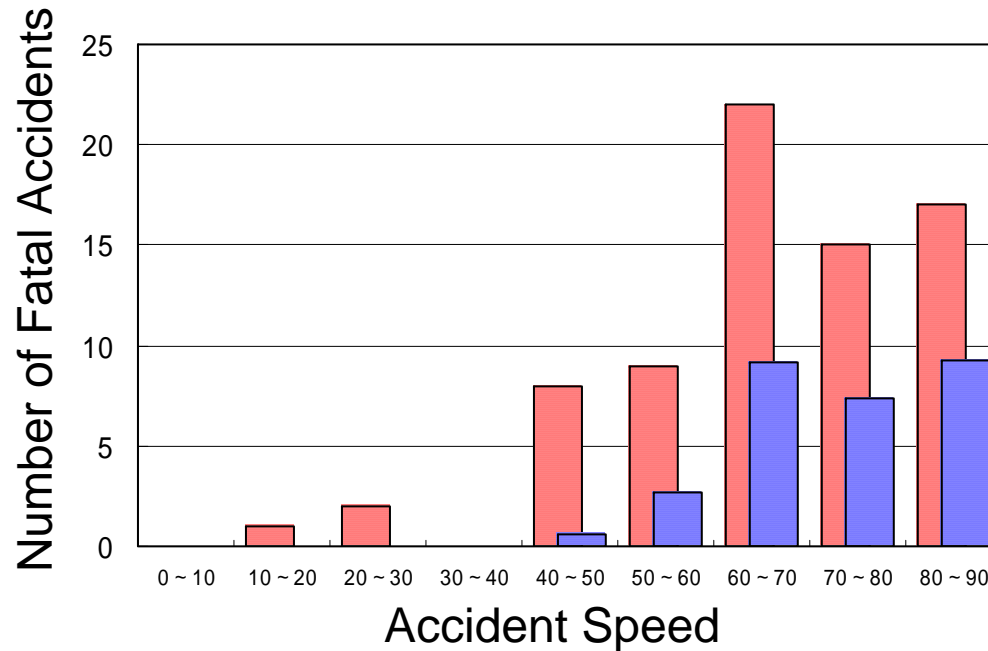
Fatality Rate Curve

If AEBS reduced the accident speed from 80km/h to 70km/h, the fatality rate would become one half.

7. Estimation of Damage Mitigation - 2

Result

✓ Reduction of 10km/h in accident speed may decrease 61% of fatal accidents.



Number of Fatal Accidents

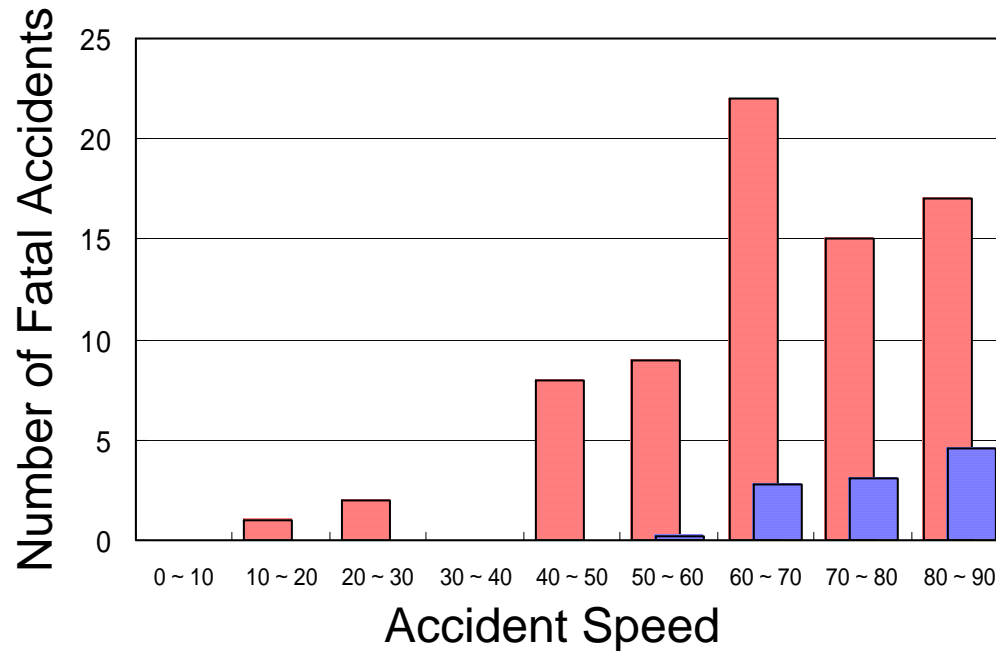


Estimated Number of Fatal Accidents with AEBS

7. Estimation of Damage Mitigation - 3

Result

✓ Reduction of 20km/h in accident speed may decrease 86% of fatal accidents.



Number of Fatal Accidents



Estimated Number of Fatal Accidents with AEBS

8. New technology

- AEBS with a Driver Monitor - *Passenger car: Feb. 2008 ~*
Large truck: May 2009 ~

- Driver monitor camera detects the direction of the face and openness of the eyelid of the driver.
- In a case, unsafe driver's condition detected, warnings of AEBS are given with earlier timing.

**Driver Monitor Camera
With Infrared LED**

