

Informal document No. **GRRF-61-28**
(61st GRRF, 5-9 February 2007
agenda item 7.4.)

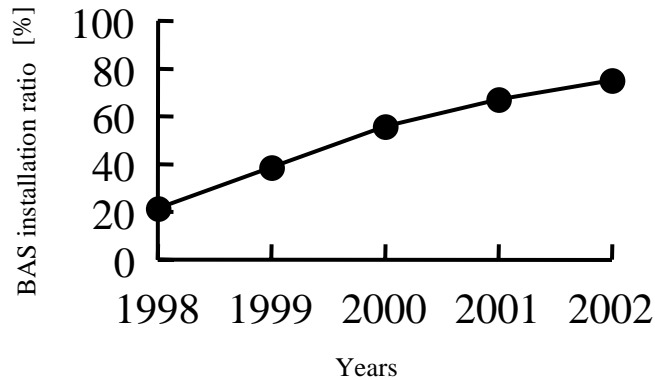
Investigation on the Activation Timing and Additional Deceleration of Brake Assist Systems (BAS)

Background

Weak drivers who cannot get sufficient pedal force in the emergency condition.

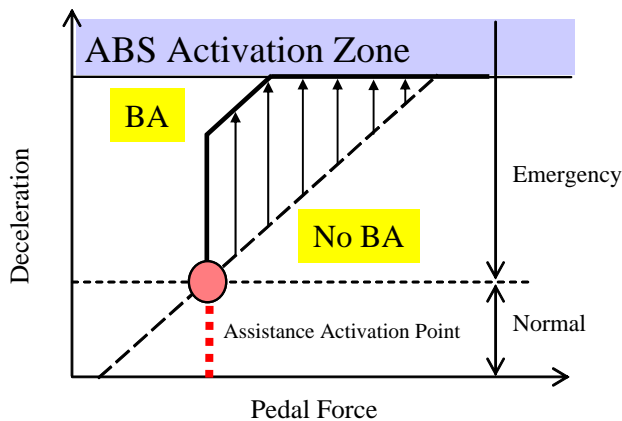


Brake Assist Systems (BAS) enable automobiles to automatically increase braking power during emergency braking.

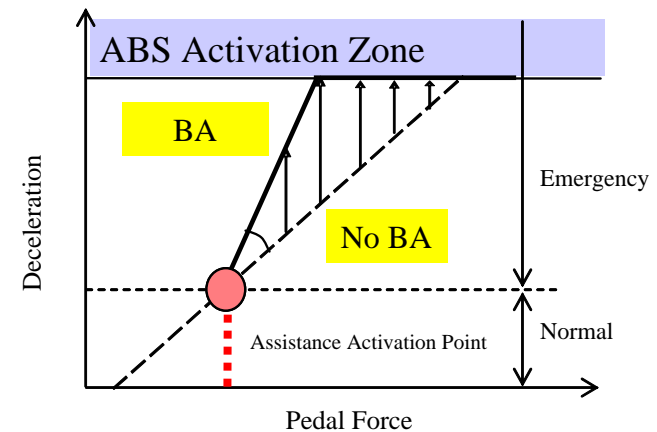


BAS production was begun in Japan in 1997, and in 5 years 75% of all automobiles sold were equipped with the system.

Pedal Speed Detection Type BAS



Pedal Force Detection Type BAS



Objectives

BAS Performance Requirements

- Effective BAS must fulfill 2 performance requirements.
 - (1) Ability for BAS to be activated when the driver suddenly applies the brakes in an emergency
(Ease of operation of BAS)
 - (2) Ability to provide assistance (Early application of ABS full-cycling)
(Improvement of braking performance)

Study Objectives

- (1) Obtain an understanding of drivers' emergency braking characteristics
- (2) Measure the frequency of BAS activation during normal braking

- **Driver Acceptance**

BAS activates only during emergency braking, and not during normal braking so as not to cause the driver discomfort.

Improvement of Safety

For example, there is the possibility of a driver suffering from a rear-end collision from cars behind it if the BAS activates during normal braking.

Testing Methods

(1) Study of driver characteristics during emergency braking tests

What are the driver's brake pedal speed and force as well as the brake pedal stroke during emergency braking?

(2) BAS evaluation via a driving simulator

What is the frequency of BAS activation during normal braking if the BAS activation timing and degree of additional assistance are changed?

Item	Test Topic	Test Method
Driver Characteristics	Compatibility of BAS activation conditions with drivers' emergency braking characteristics	Emergency braking tests on test courses
BAS Evaluation	Frequency of BAS activation during normal braking	Braking tests on driving simulator (DS)

(1) Study of driver characteristics during emergency braking tests



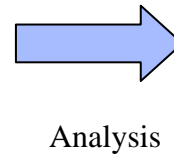
(a) Dummy automobile jumps out from the front left



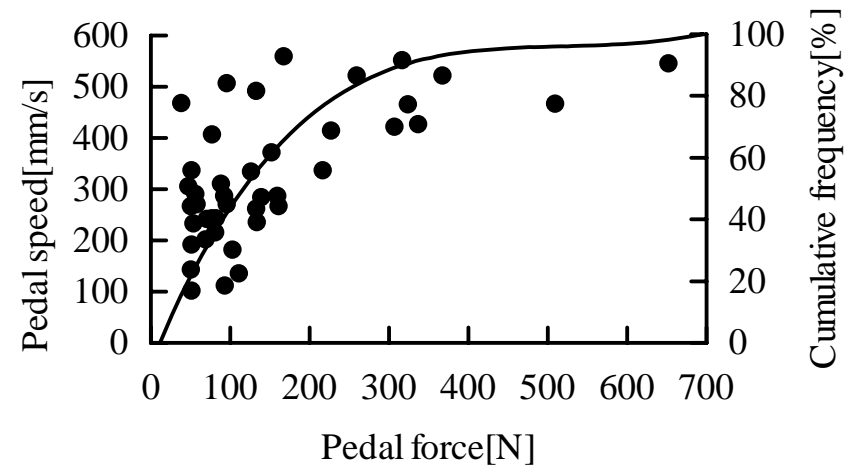
(b) Driver notices the dummy automobile



(c) Driver suddenly activates the brakes



Analysis



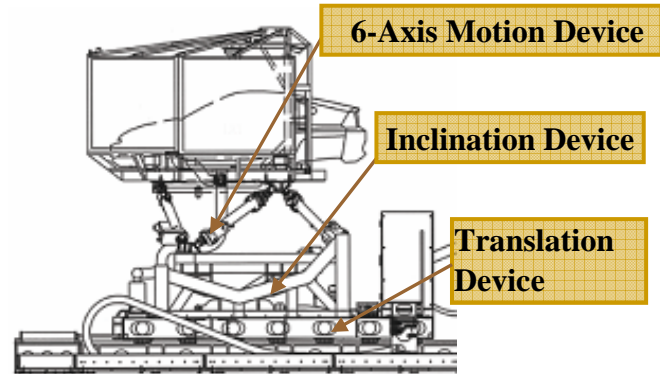
Measured Items

Brake pedal force and speed, brake pedal stroke, longitudinal acceleration

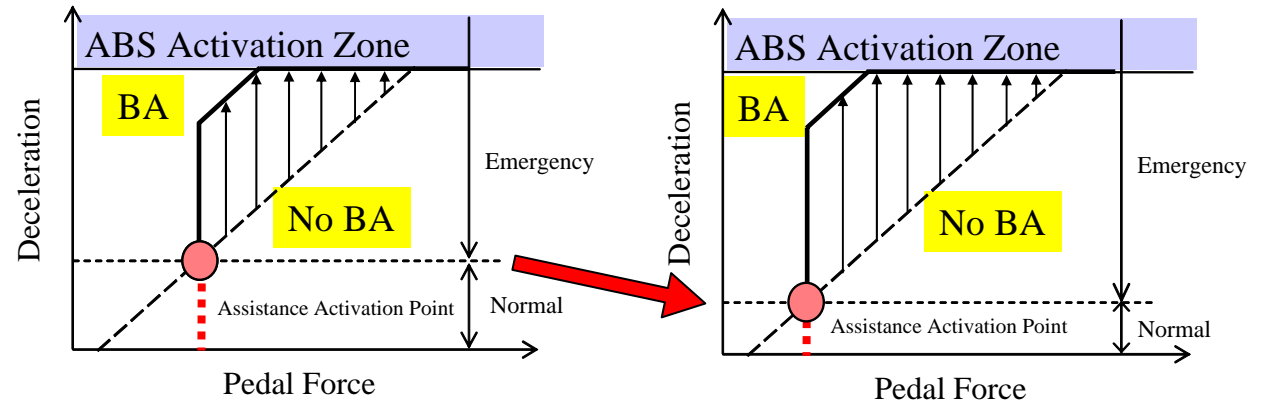
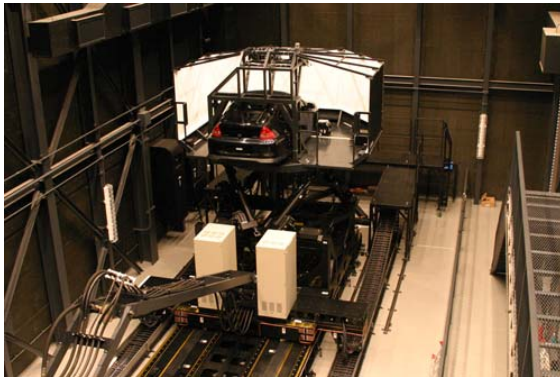


Data for studying the BAS activation timing

(2) BAS evaluation via a driving simulator



- **Horizontal Direction**
Maximum Acceleration:
6.0m/s² (short period)
5.0m/s² (continuous)
Maximum Jerk: **10.0m/s³**
- **Vertical Direction**
Maximum Acceleration : **3.0m/s²**
- Response Frequency: **5Hz**
- Translation Device Stroke: **8m**



Easy modification of BAS activation thresholds

- Frequency of BAS activation ratios during normal braking
- Subjective evaluations of driver acceptance of BAS

Summary

- In 2002, 75% of all cars sold in Japan were equipped with BAS. However, the effects and the side effect of the BAS triggering during normal braking, are still unknown.

- **This study aims to examine what effects and side effects the BAS activation timing and degree of assistance have on drivers.**

- Testing Methods
 - 1) Examined the compatibility of BAS activation conditions with drivers' emergency braking characteristics through **the study of driver characteristics in emergency braking test.**
 - 2) Examined the effects and side effects of BAS activation timing and degree of assistance on drivers through **BAS evaluations via a driving simulator.**

- The above studies began in December of last year, and we plan to compile the study results by the next GRRF session.