

# **Technical Requirements of UN-R 139 Brake Assist Systems**

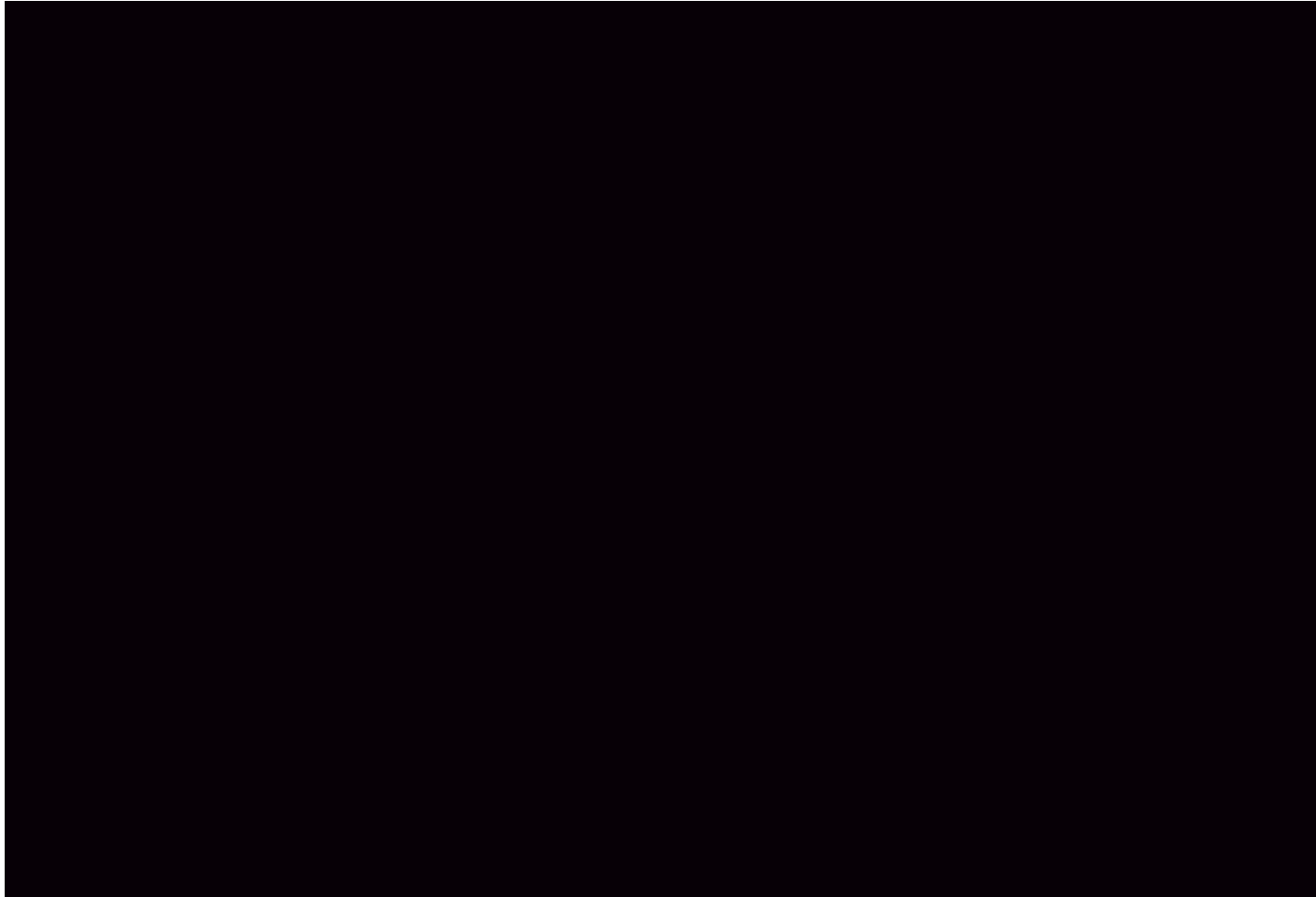
The 56<sup>th</sup> Asia Expert Meeting in Malaysia

Date: July 16<sup>th</sup> – 17<sup>th</sup> , 2019



**JAPAN AUTOMOBILE STANDARDS INTERNATIONALIZATION CENTER**

# 1. What is BAS?



2.6.

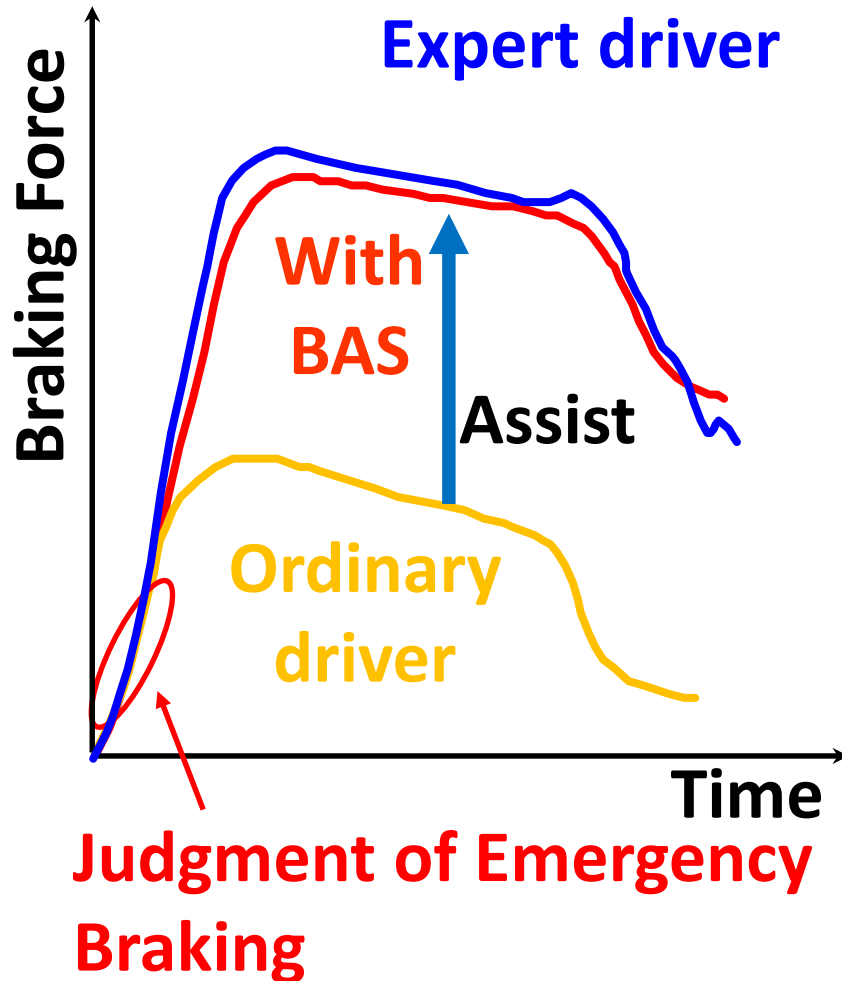
**"*Brake Assist System (BAS)*" means a function of the braking system that deduces an emergency braking event from a characteristic of the driver's brake demand and, under such conditions:**

**(a) Assists the driver to deliver the maximum achievable braking rate; or**

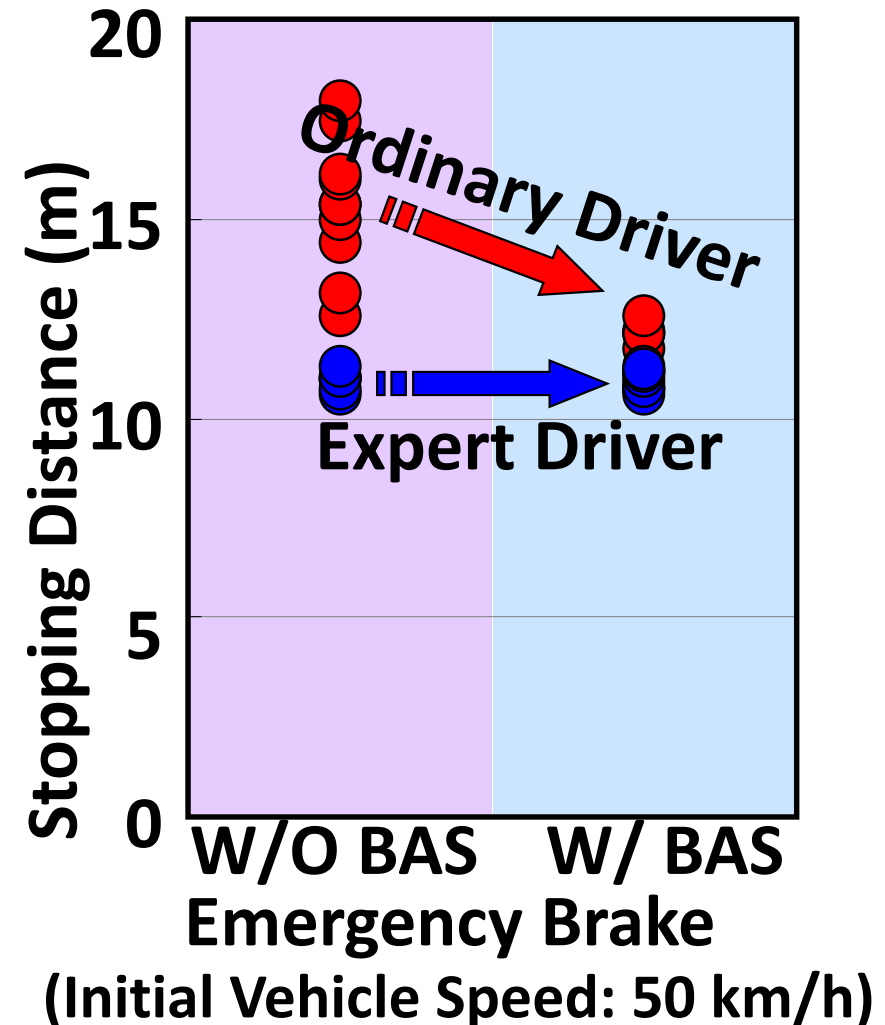
**(b) Is sufficient to cause full cycling of the Anti-lock Braking System.**

# 1. What is BAS?

## ▪ Example (Category B)



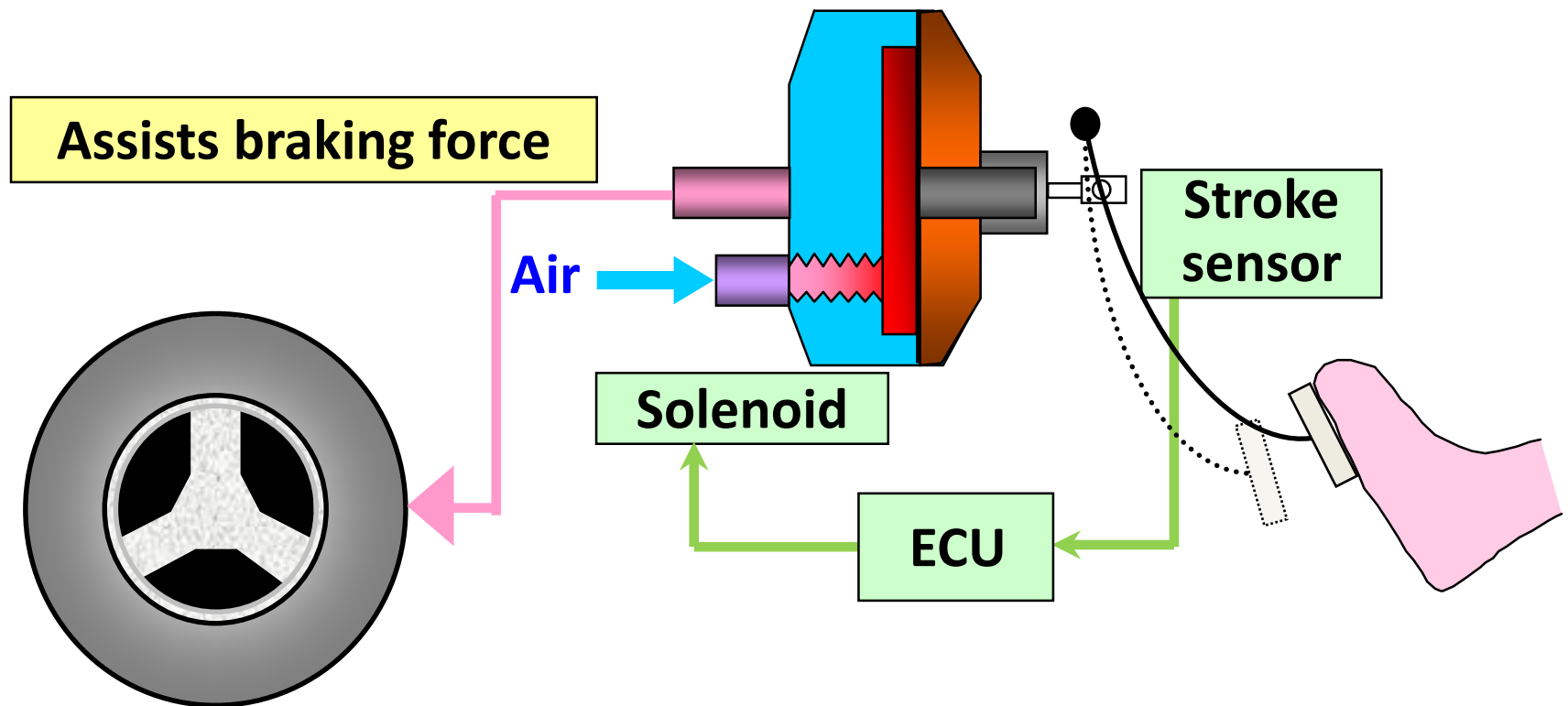
## Effectiveness of BAS



# 1. What is BAS?

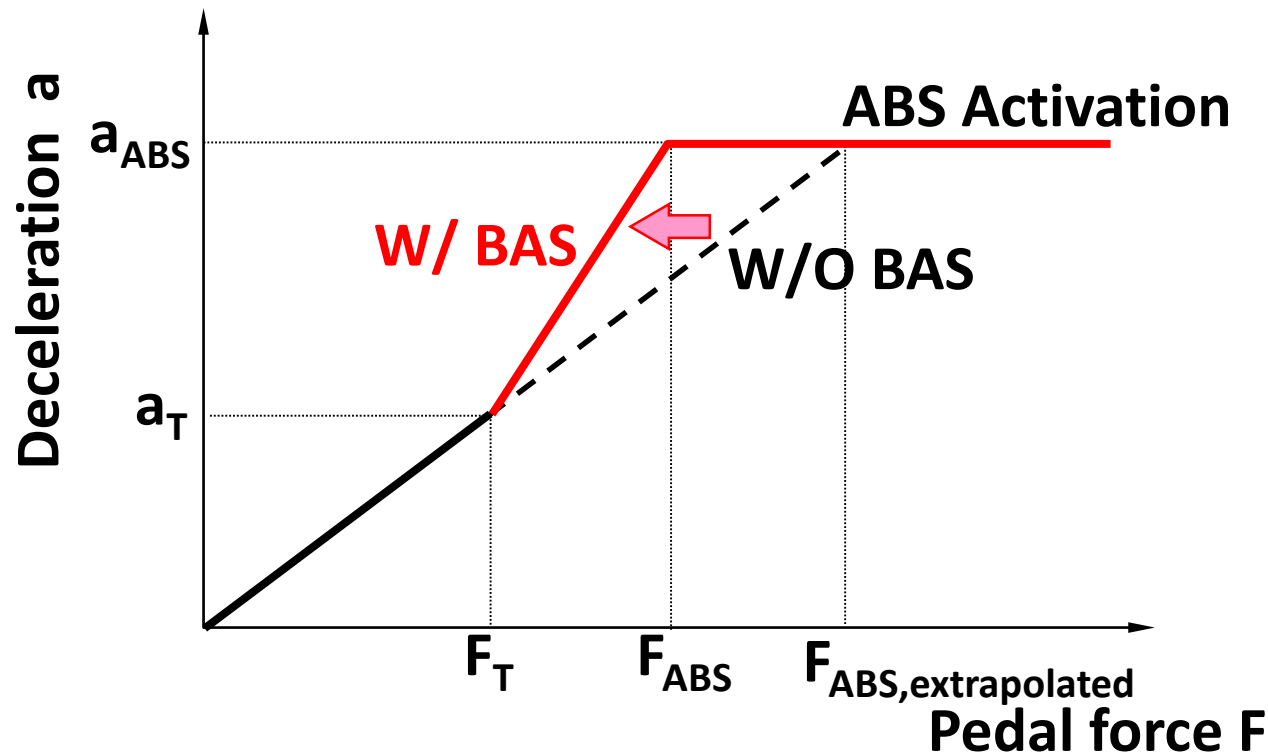
Assist the ordinary driver to attain the braking force same as the expert driver by increasing braking force when detecting an emergency braking.

- Example (Category B)



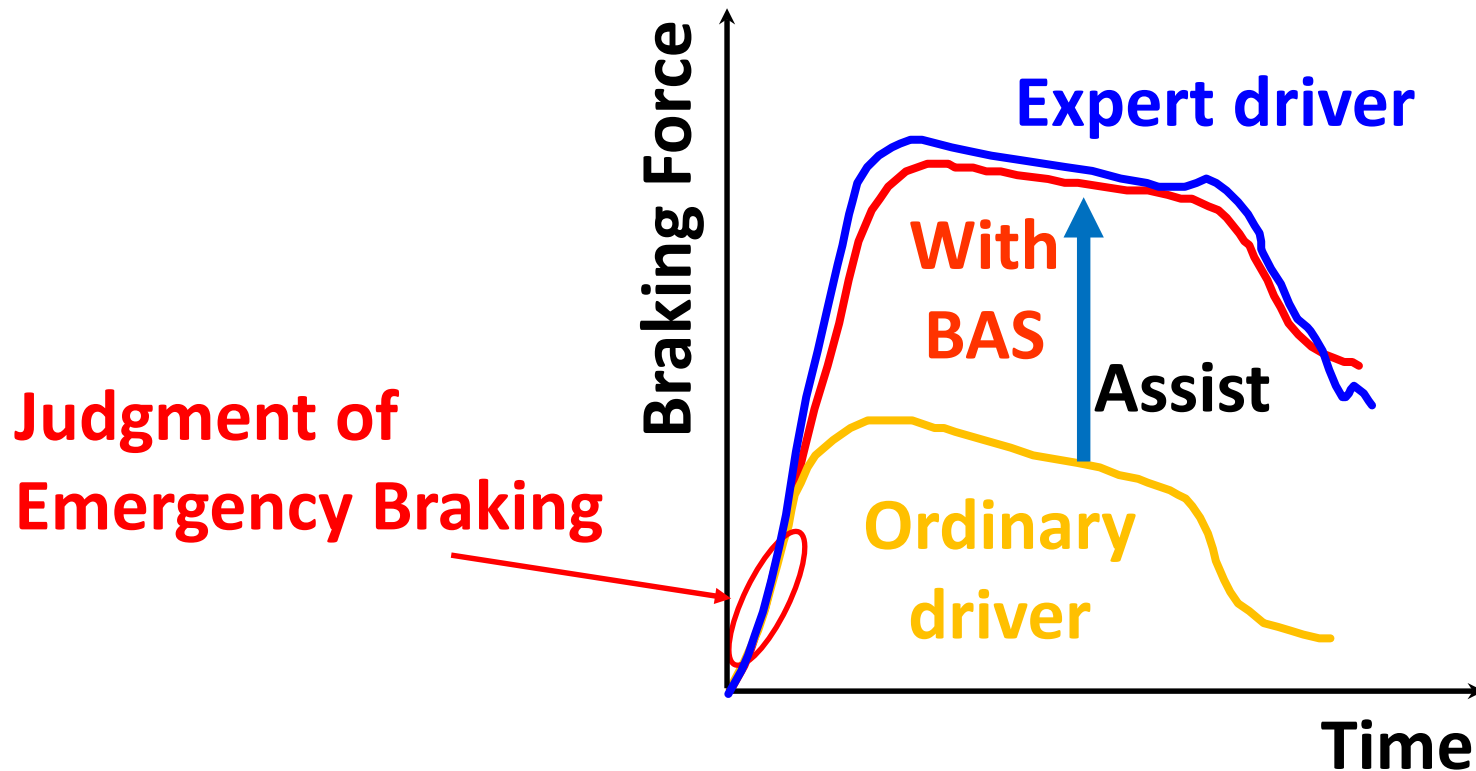
### 2.6.1.

*"Category A Brake Assist System"* means a system which detects an emergency braking condition based **primarily on the brake pedal force** applied by the driver;



2.6.2.

"*Category B Brake Assist System*" means a system which detects an emergency braking condition based **primarily on the brake pedal speed** applied by the driver;



#### 6.1.

**General performance characteristics for category "A" BAS systems**

**When an emergency condition has been sensed by a relative high pedal force, the additional **pedal force to cause full cycling of the ABS shall be reduced** compared to the pedal force required without the BAS system in operation.**

**Compliance with this requirement is demonstrated if the provisions of paragraphs 8.1. to 8.3. of this Regulation are met.**

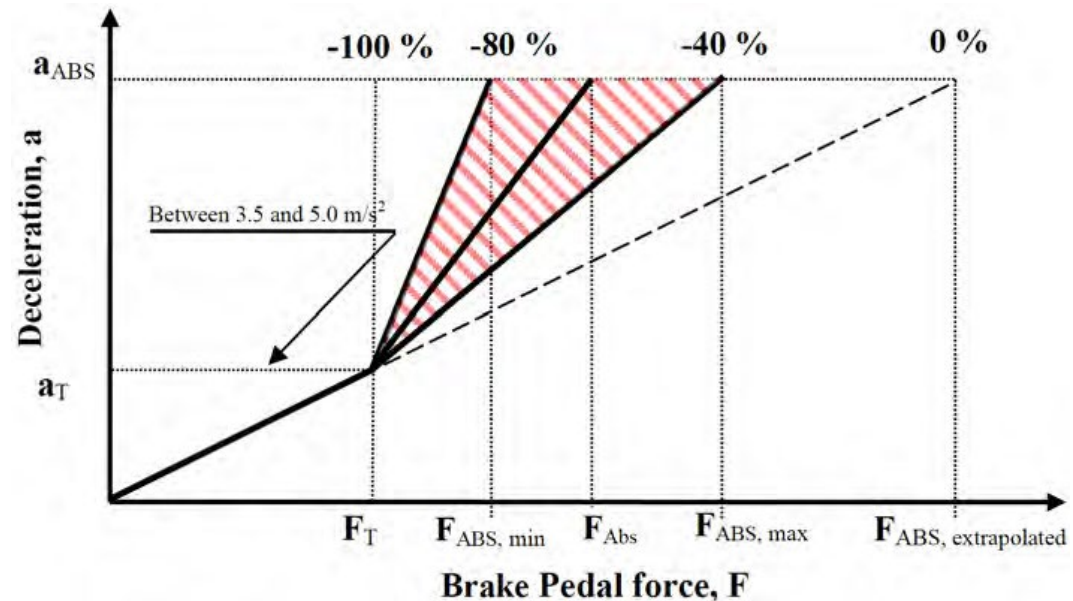


#### 8.2.1.

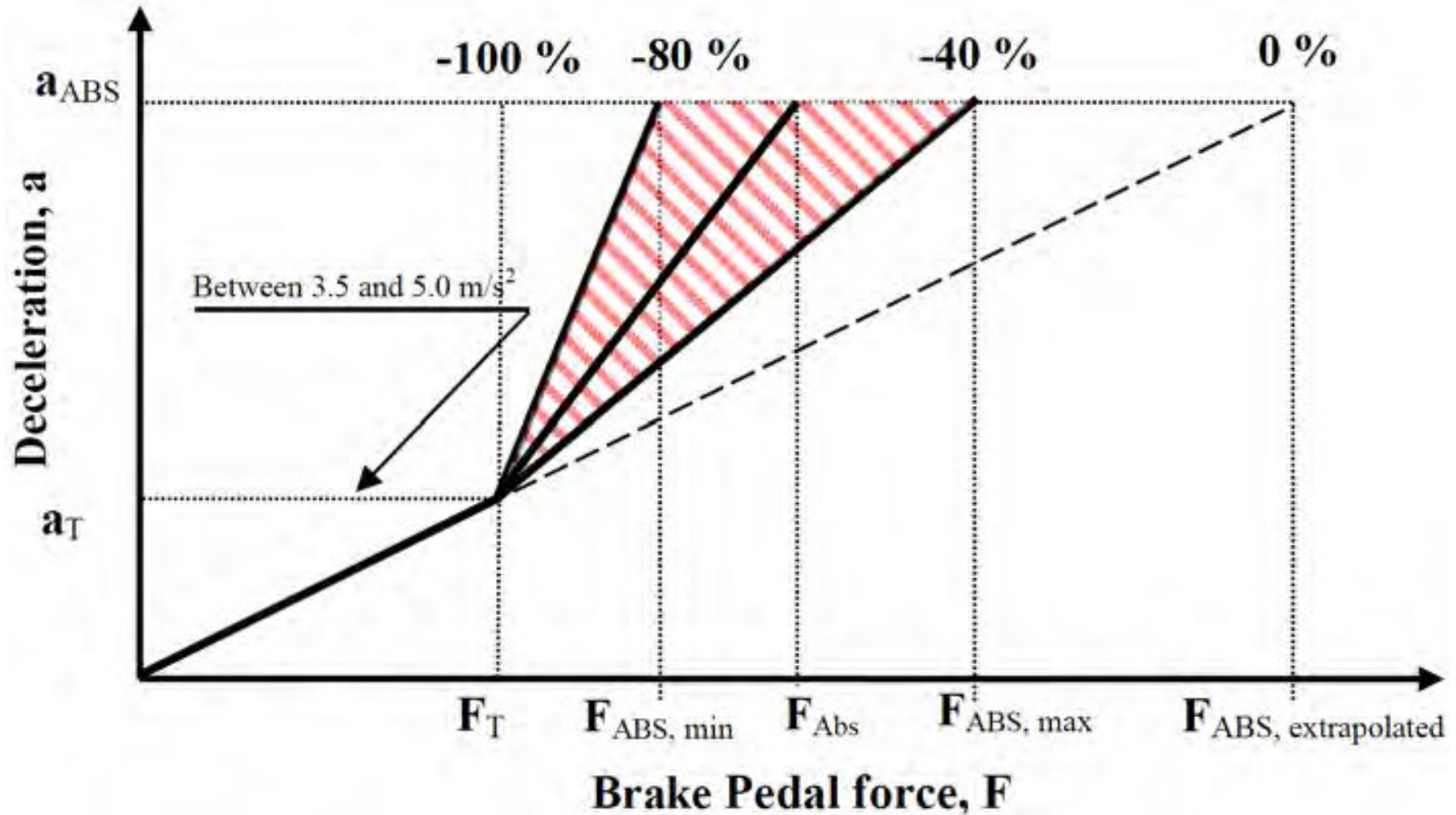
Once an emergency braking condition has been detected, systems sensitive to pedal force shall show a significant increase in the ratio of:

(a) Brake line pressure to brake pedal force, where permitted by paragraph 8.2.5.; or

(b) Vehicle deceleration to brake pedal force.

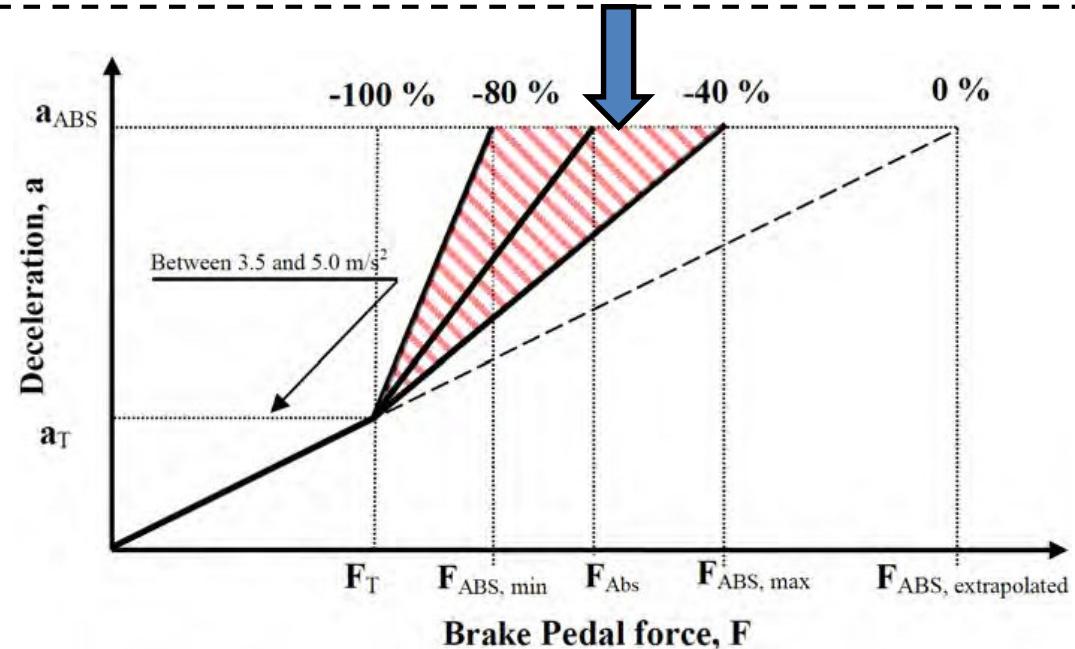


### 3. Functional requirements Category A



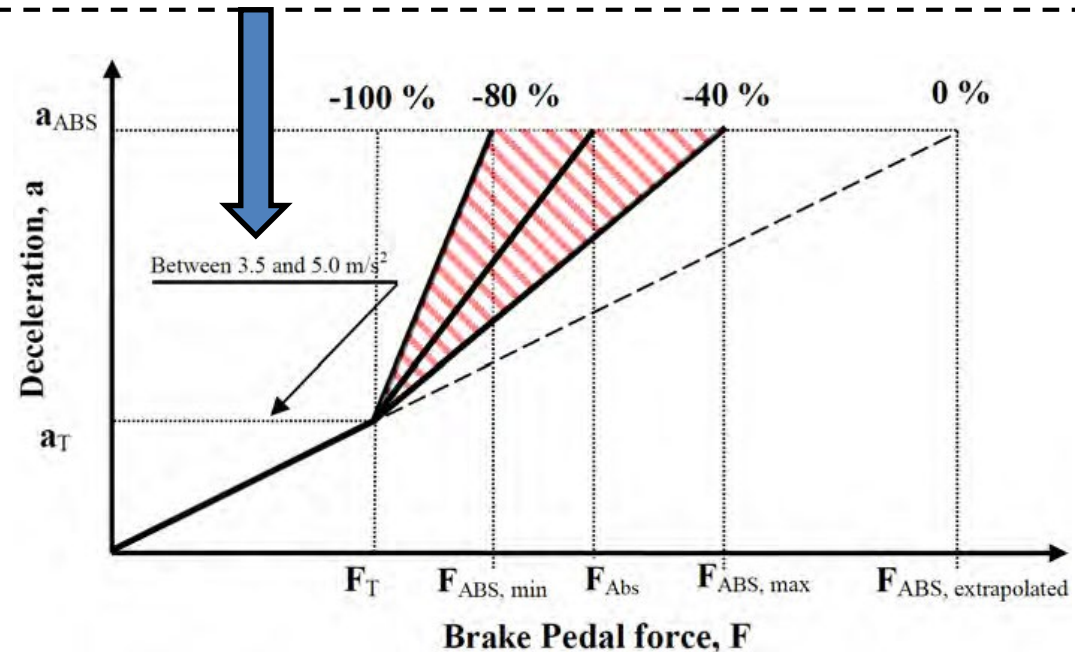
## 8.2.2.

The performance requirements for a category "A" BAS are met if a specific brake application characteristic can be defined that exhibits **a decrease of between 40 per cent and 80 per cent** in required brake pedal force for  $(F_{ABS} - F_T)$  compared to  $(F_{ABS,extrapolated} - F_T)$ .



#### 8.2.3.

$F_T$  and  $a_T$  are threshold force and threshold deceleration as shown in Figure 1. The values of  $F_T$  and  $a_T$  shall be supplied to the Technical Service at the time of submission of the type-approval application. The value of  $a_T$  shall be **between 3.5 m/s<sup>2</sup> and 5.0 m/s<sup>2</sup>**.



#### 8.2.5.

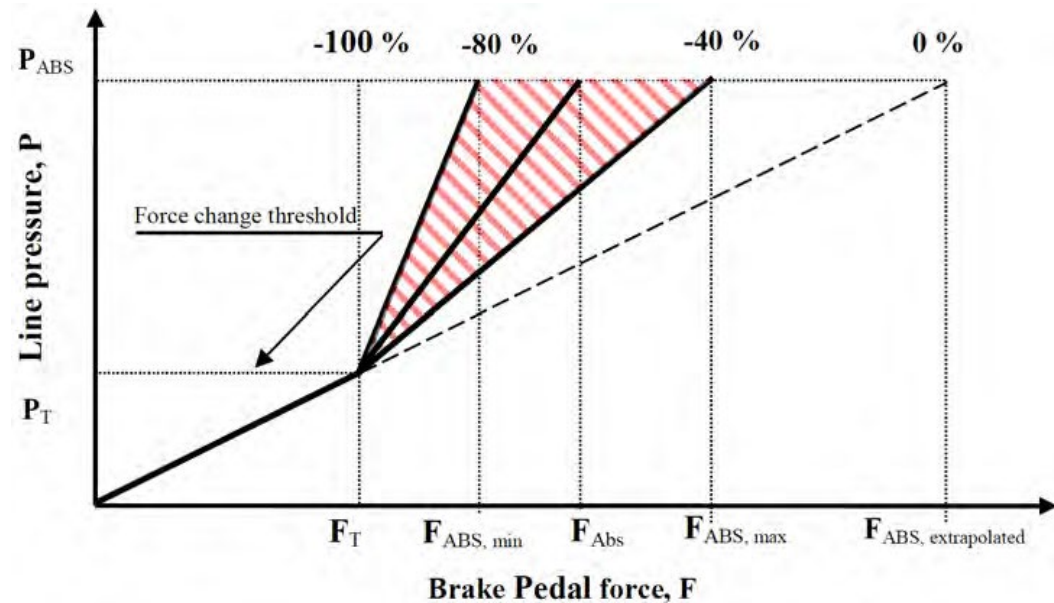
As an alternative, which can be selected by the manufacturer, in the case of vehicles of **category N1**, or **M1 derived from those N1 vehicles**, with a gross vehicle mass **GVM > 2,500 kg**, the pedal force figures for  $F_T$ ,  $F_{ABS,min}$ ,  $F_{ABS,max}$  and  $F_{ABS,extrapolated}$  **may be derived from the brake line pressure response characteristic instead of the vehicle deceleration characteristic.** This shall be measured as the brake pedal force is increasing.

#### 8.2.1.

Once an emergency braking condition has been detected, systems sensitive to pedal force shall show a significant increase in the ratio of:

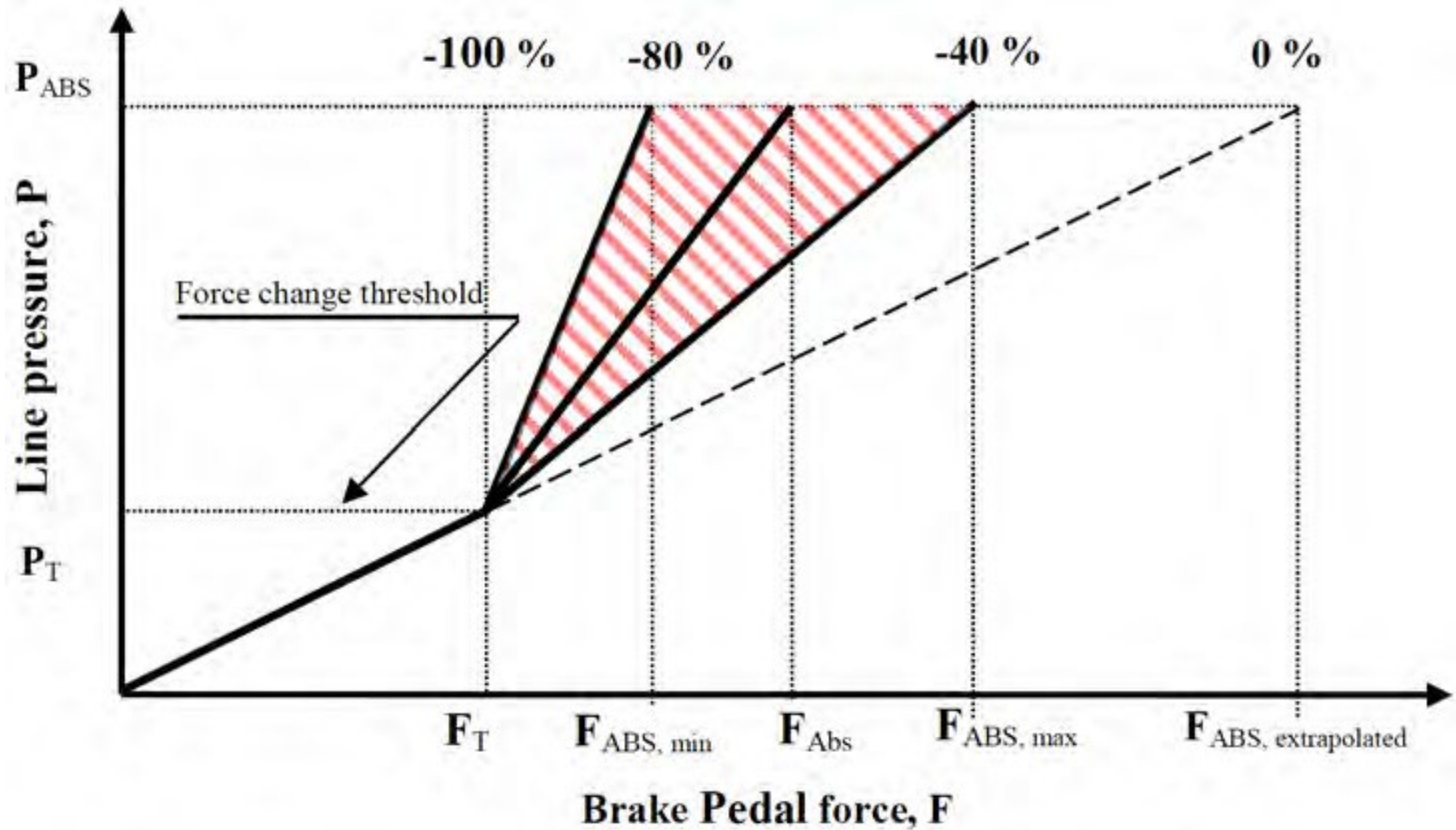
(a) Brake line pressure to brake pedal force, where permitted by paragraph 8.2.5.; or

(b) Vehicle deceleration to brake pedal force.



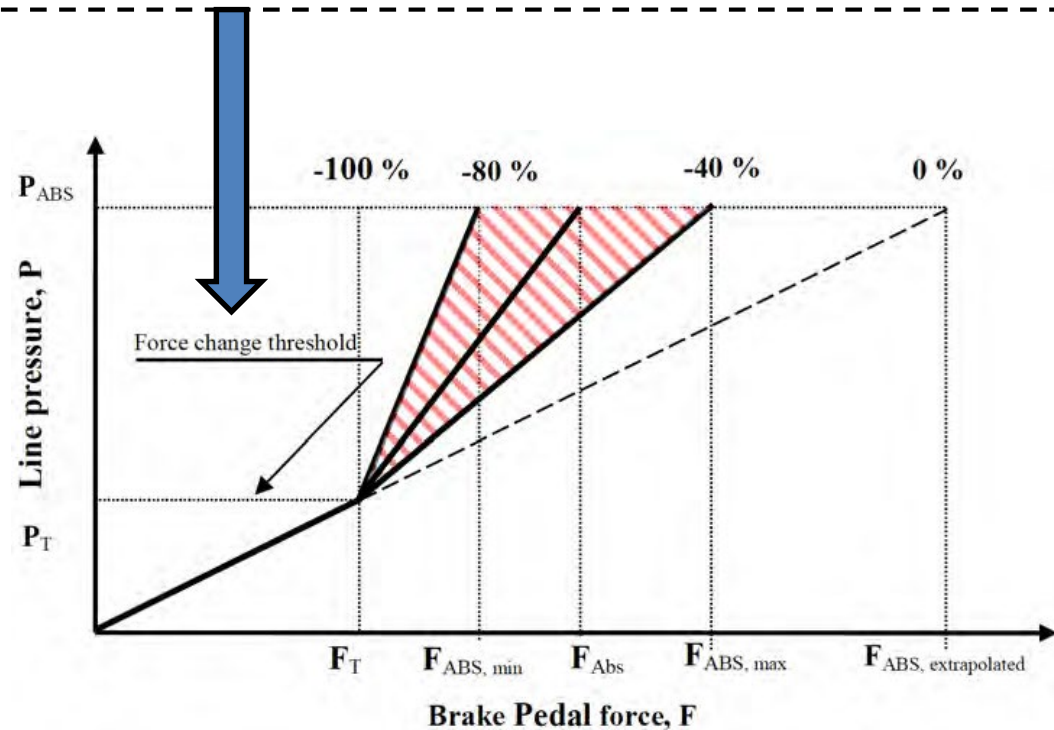


### 3. Functional requirements Category A



#### 8.2.5.2.

The threshold pressure  $P_T$  shall be stated by the manufacturer and correspond to a deceleration in the range of **2.5 - 4.5 m/s<sup>2</sup>**.





### 3. Functional requirements Category A

#### 8.2.5.2.

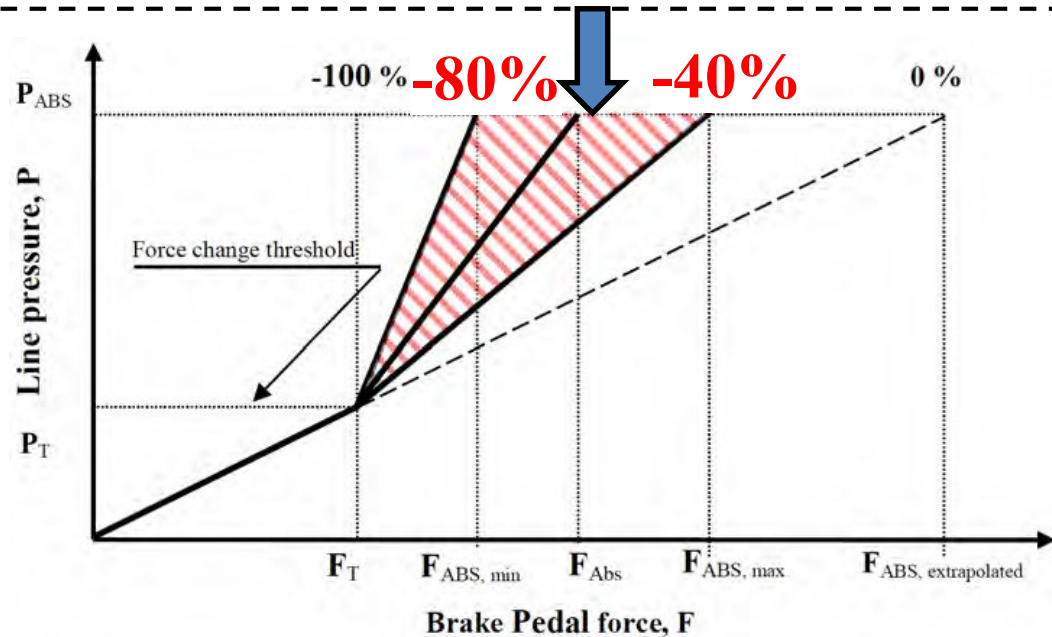
#### Data evaluation

The presence of a category "A" BAS is proven if

$$F_{ABS,min} < F_{ABS} < F_{ABS,max}$$

where:  $F_{ABS,max} - F_T \leq (F_{ABS,extrapolated} - F_T) \cdot 0.6$

and  $F_{ABS,min} - F_T \geq (F_{ABS,extrapolated} - F_T) \cdot 0.2$



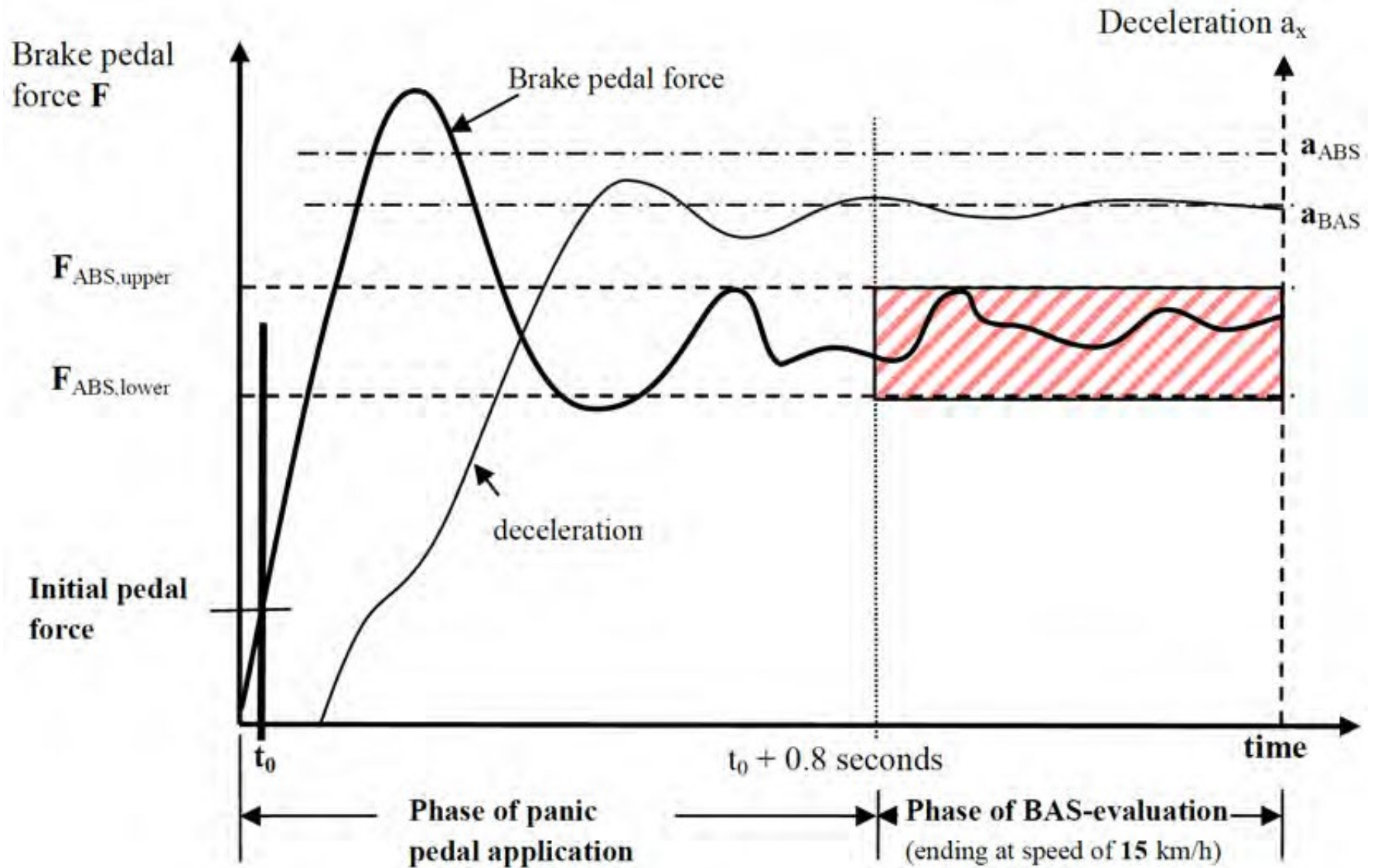
#### 6.2.

**General performance characteristics for category "B" BAS systems**

**When an emergency condition has been sensed, at least **by a very fast application of the pedal**, the BAS system shall raise the pressure **to deliver the maximum achievable braking rate or cause full cycling of the ABS.****

**Compliance with this requirement is demonstrated if the provisions of paragraphs 9.1. to 9.3. of this Regulation are met.**

### 3. Functional requirements Category B



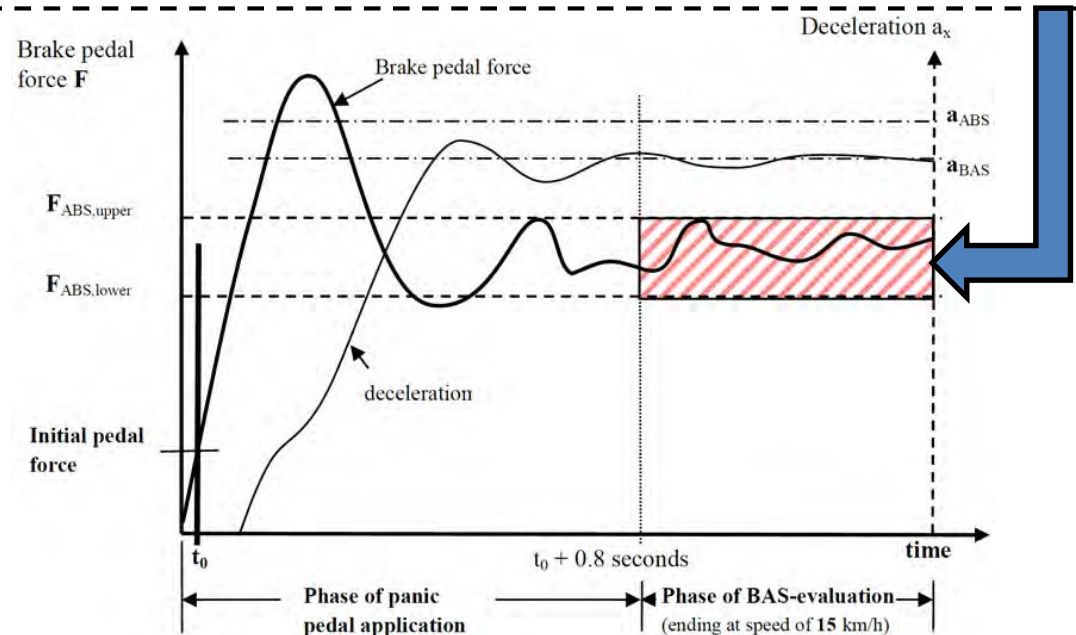
### 3. Functional requirements Category B

**Extract from 9.2.**

**After  $t = t_0 + 0.8$  s and until the vehicle has slowed down to a speed of 15 km/h, the brake pedal force shall be maintained in a corridor between  $F_{ABS, upper}$  and  $F_{ABS, lower}$ ,**

**where  $F_{ABS, upper}$  is  $0.7 F_{ABS}$  and  $F_{ABS, lower}$  is  $0.5 F_{ABS}$ .**

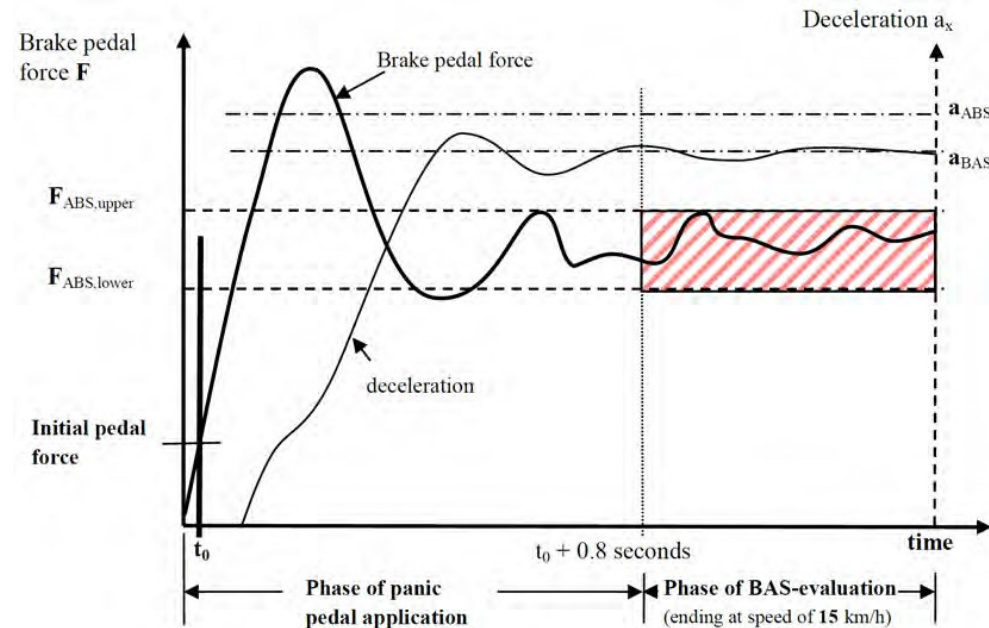
**The requirements are also considered to be met if, after  $t = t_0 + 0.8$  s, the pedal force falls below  $F_{ABS, lower}$  provided the requirement of paragraph 9.3. is fulfilled.**



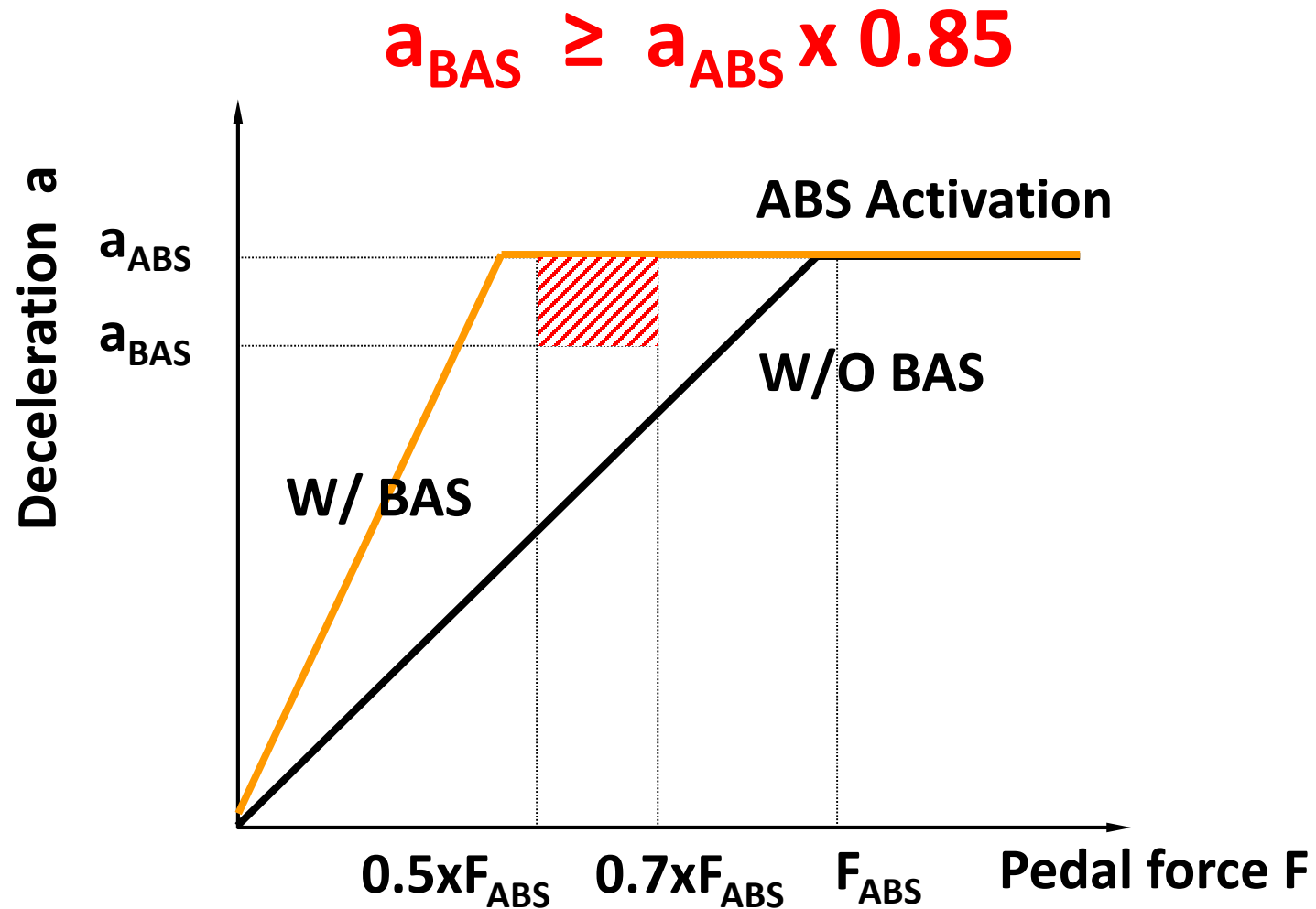
#### 9.3.

#### Data evaluation

The presence of BAS 'B' is demonstrated if a mean deceleration ( $a_{BAS}$ ) of at least  $0.85 \cdot a_{ABS}$  is maintained from the time when  $t = t_0 + 0.8$  s to the time when the vehicle speed has been reduced to 15 km/h.



### 3. Functional requirements Category B



### Extract from 5.1.

vehicles equipped with a brake assist system shall also be **equipped with ABS** in accordance with technical requirements of Regulation 13-H.

### 5.2.

The BAS shall be so designed, constructed and fitted as to enable the vehicle in normal use, **despite the vibration** to which it may be subjected, **to comply with the provisions of this Regulation.**

### 5.3.

In particular, the BAS shall be so designed, constructed and fitted as to be able **to resist the corroding and ageing** phenomena to which it is exposed.

**Extract from 5.4.**

**The effectiveness of the BAS shall not be adversely affected by magnetic or electrical fields.**

**Extract from 5.5.**

**The assessment of the safety aspects of BAS shall be included in the overall safety assessment of the braking system as specified in Regulation No. 13-H requirements associated with complex electronic control systems.**



Thank you!