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Brake Assist Systems – Rationale for the proposed requirements

Presented by Ian Knowles & Iain Knight

UNECE GRRF

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Introduction

- **The pedestrian protection Directive**
  - Original proposal
  - Feasibility
  - The active safety alternative
  - Why Brake Assist?
- **Proposed Brake Assist requirements**
  - Definitions of categories
  - Requirements for category A
  - Requirements for category B & C

Pedestrian Protection and Brake Assist

- Existing Pedestrian protection Directive
- Feasibility work
- Current Proposal by Commission
- The contribution of ‘Brake Assist’

Commission Directive 2003/102/EC

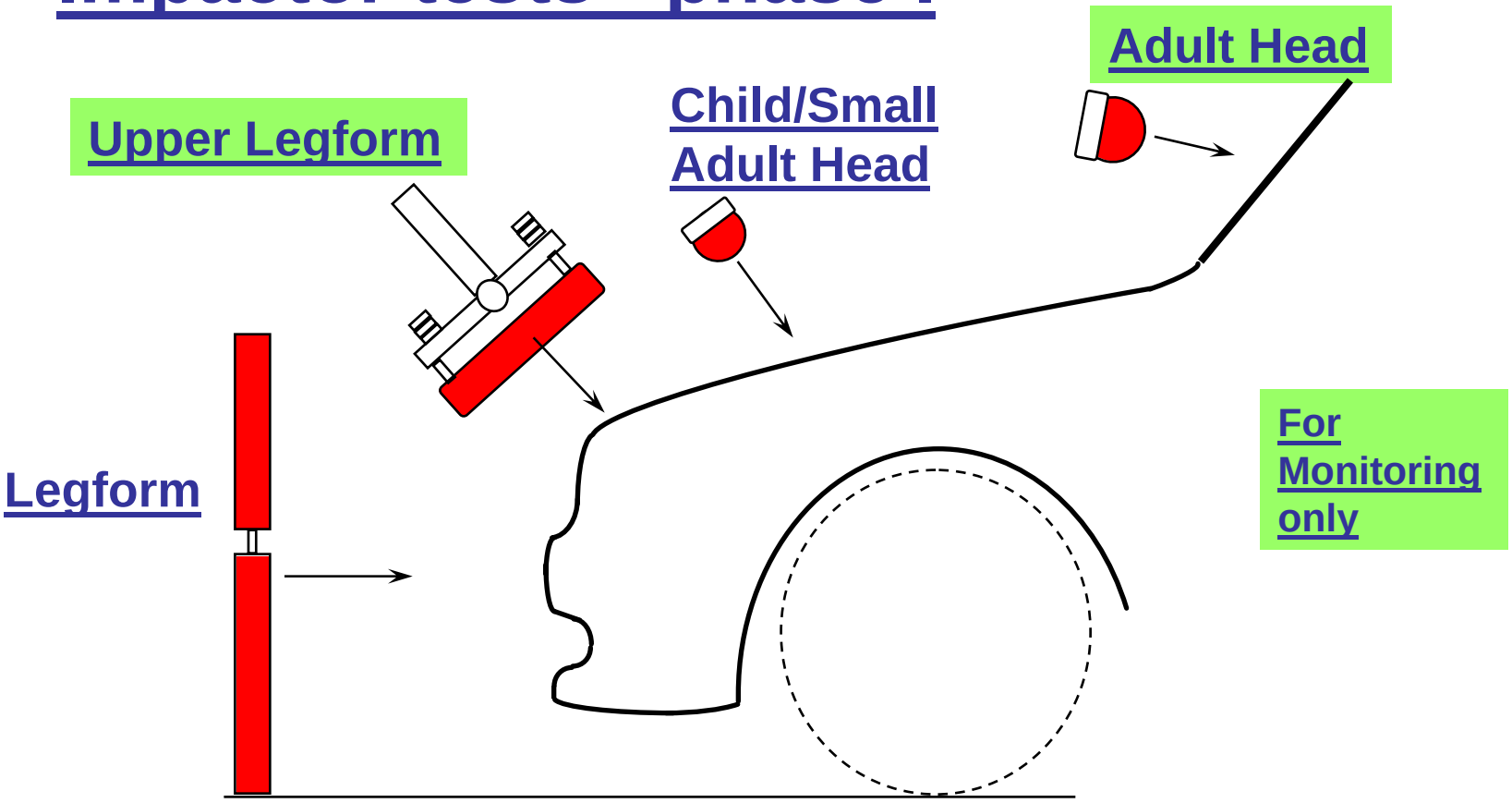
Phase I:

- all new vehicle types from 2005

- all new vehicles from 2012

- Four tests (two for monitoring)

Impactor tests - phase I



Commission Directive 2003/102/EC

Phase II (original):

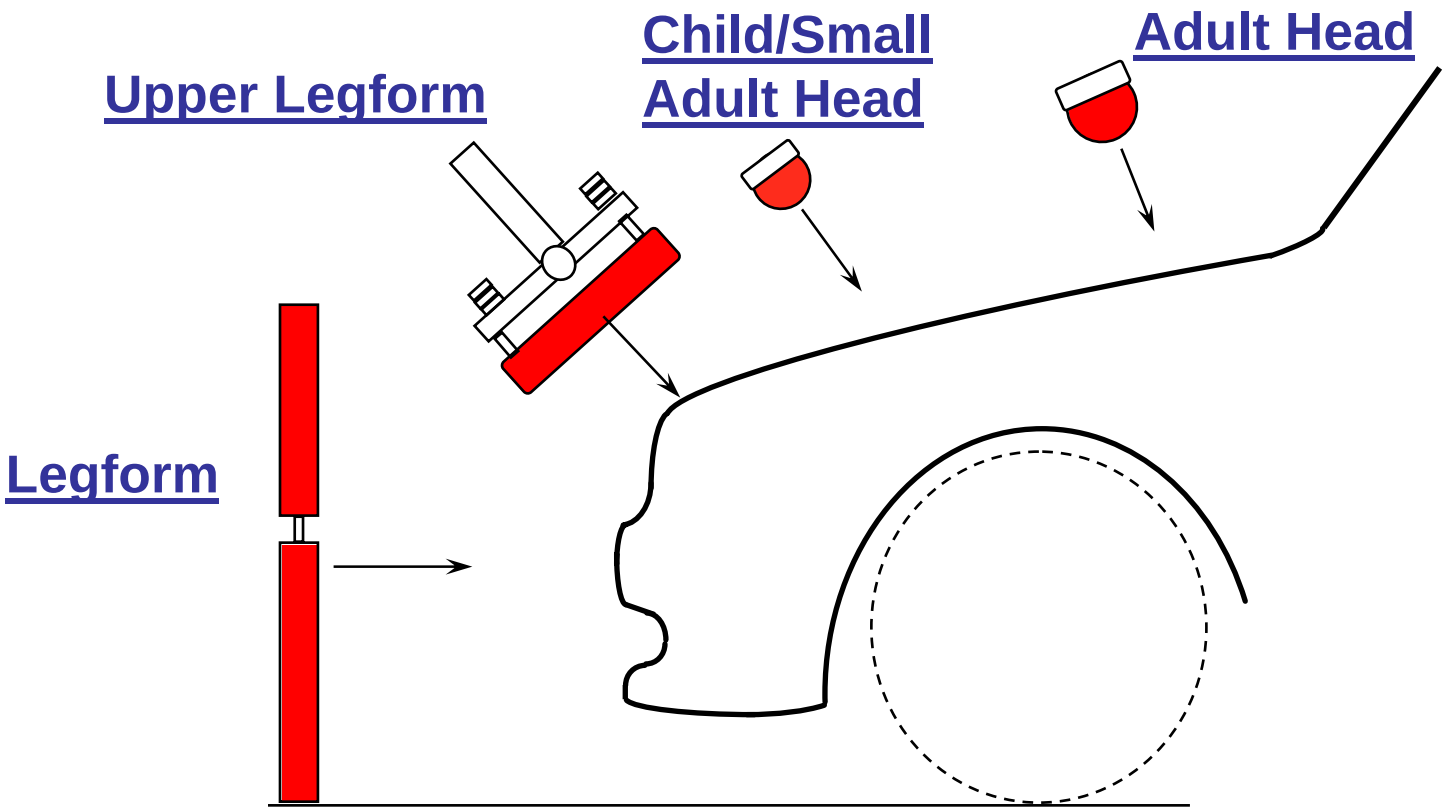
- **all new vehicle types from 2010**

- **all new vehicles from 2015**

- **Four tests**

- **subject to feasibility**

Impactor tests - phase II



Consideration of Feasibility

Directive, Article 5

"……shall carry out, by 1 July 2004, an independent feasibility assessment concerning the provisions of [Phase II] and in particular alternative measures - either passive or a combination of active and passive measures - which are at least equivalent in terms of actual effectiveness."

The 'Active Safety' Alternative

- **Active safety systems can reduce risk of collision occurring or reduce severity if collision does occur.**
- **Systems could include advanced lighting systems, collision avoidance or Brake Assist**
- **Can be used in conjunction with passive safety systems**

Why Brake Assist?

- **Technology already available**
- **Reduces vehicle speed at point of impact**
- **Allows vehicle testing to take place at lower equivalent speed (compared with original Phase II) without losing safety benefits.**

Early Feasibility Studies:

Commission study(2004):

- feasibility changes only, providing 79% effectiveness

- using Brake Assist provides up to 85% effectiveness

Industry studies(2004): (ACEA & JAMA)

- feasibility changes required

- using Brake Assist provides up to 133% effectiveness

Commission Addendum study(2005):

- use of Brake Assist can provide up to 116% effectiveness

Final Feasibility Study(2006):

Estimations of Casualties saved

		Existing Phase II in Directive		Commission Proposal	
		Fatal	Serious	Fatal	Serious
no BAS	**Nos.**	**626**	**32,246**	366	24,060
	%	**100**	**100**	58	75
BAS fitted	**Nos.**	n.a.	n.a.	**1,128**	**46,550**
	%	n.a.	n.a.	**180**	**144**

New Proposal on Phase II:

Provides for:

- **improved feasibility in testing**
- **the use of ‘Brake Assist’**
- **a wider vehicle scope**
- **resultant increase in level of protection**

New Commission Proposal:

Brake Assist Systems:

- **Early application of requirement.**

- **Provide appropriate means to verify the existence of Brake Assist in the vehicle.**

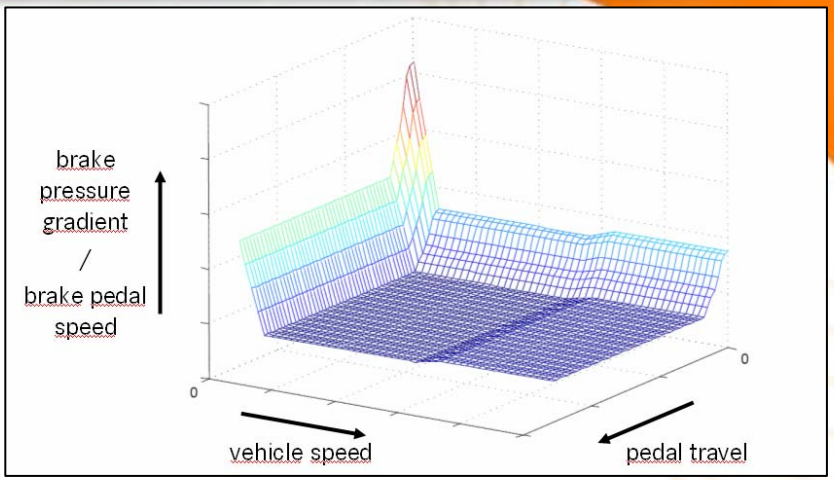
- **Adapt UNECE Regulation 13H to introduce necessary certification procedure (GRRF 2008/2.)**

Proposed requirements for BAS

- **TRL research objectives:**
  - Prepare a finalised technical proposal for inclusion in R13H
  - Based on a technical proposal from ACEA as modified by the EC

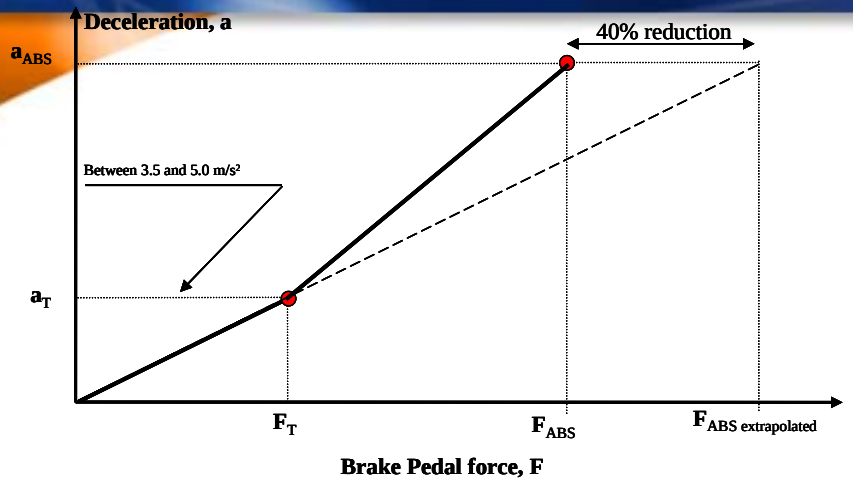
Categories of BAS

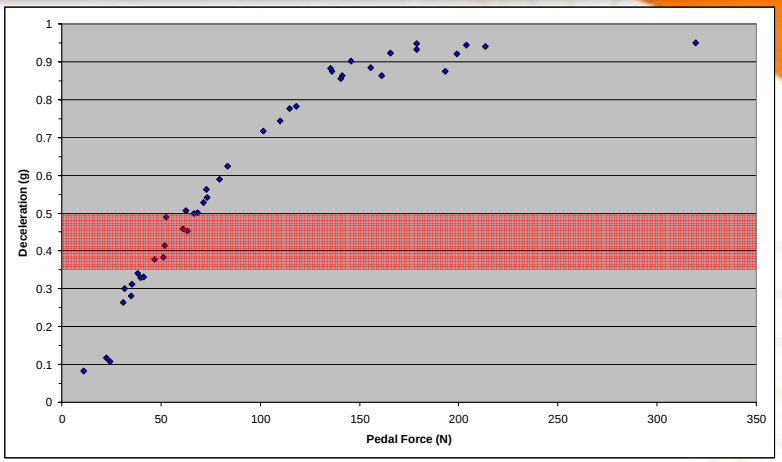
- **Requested information from industry**
  - Type of BAS fitted to their vehicles
  - Activation criteria and thresholds
- **Original ACEA proposal defined two BAS categories:**
  - Pedal force sensitive
  - Pedal speed sensitive
- **Replies from four manufacturers concerning 14 different BAS revealed three distinct types**

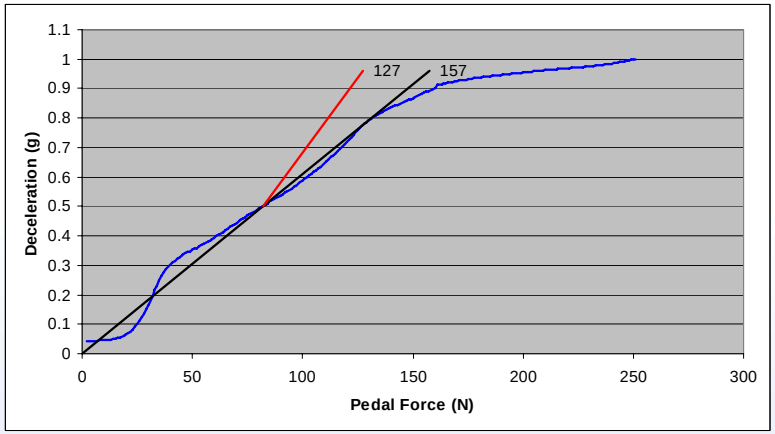


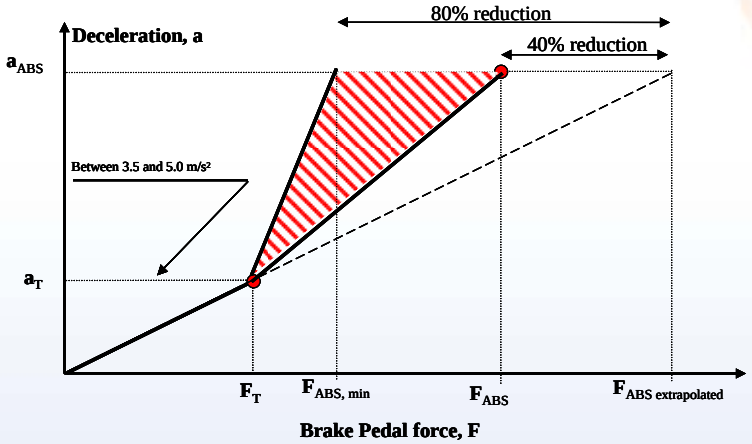
Activation criteria	Action
Pedal force	Increased pedal force : deceleration ratio
Pedal speed	Boost to maximum (ABS)
Multiple criteria (e.g pedal force, pedal speed & vehicle speed)	Boost to maximum (ABS)

Evaluation of proposed test for force sensitive BAS





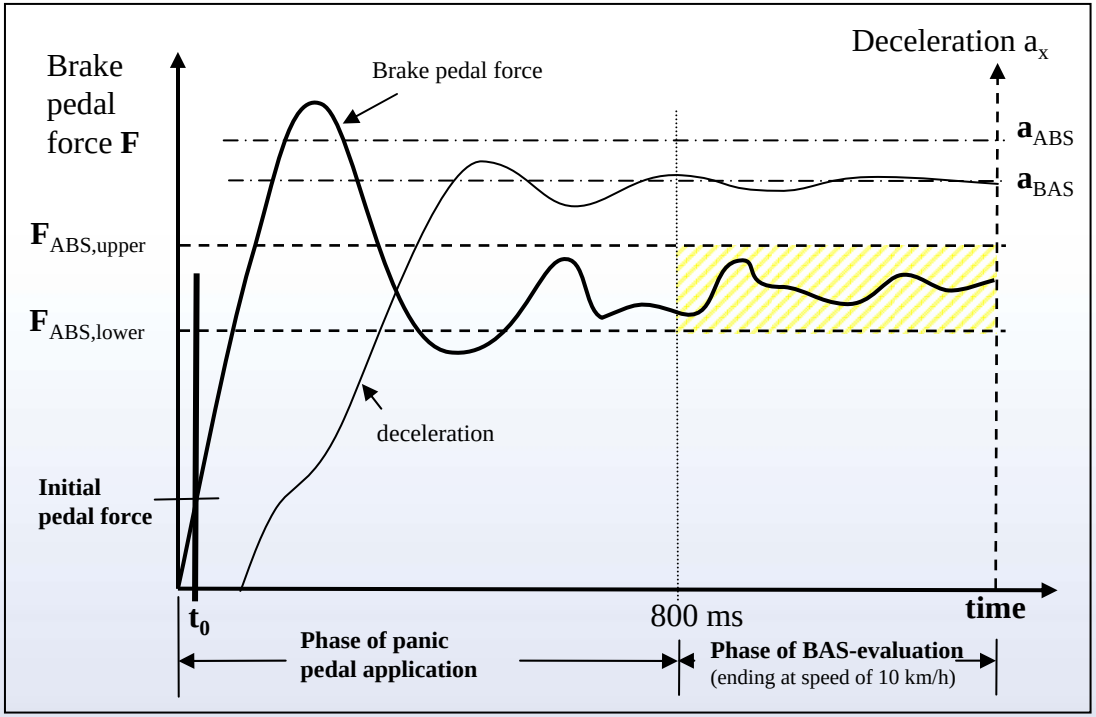




- ACEA method successfully “failed” car with no BAS
- Proposed upper limit to maintain graduated braking
- Both Activation and Action are controlled

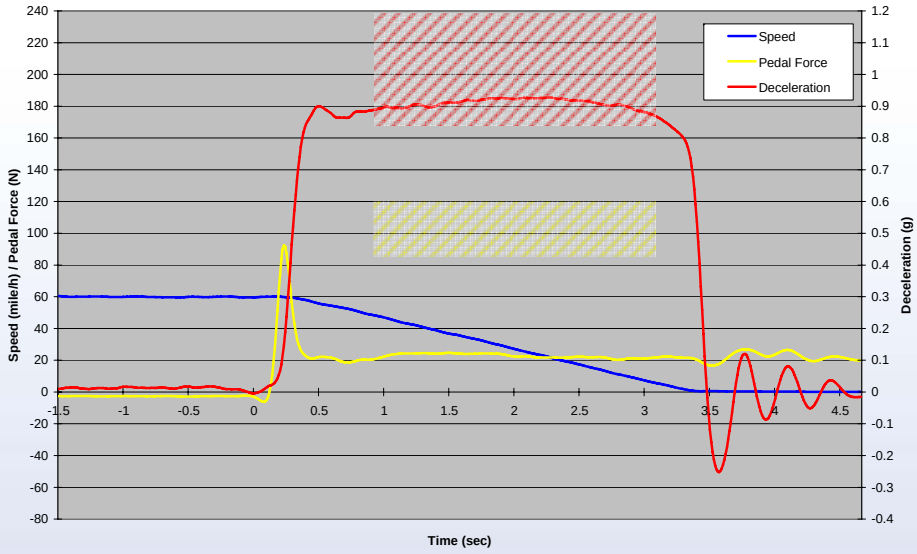
Evaluation of proposed test for speed sensitive BAS

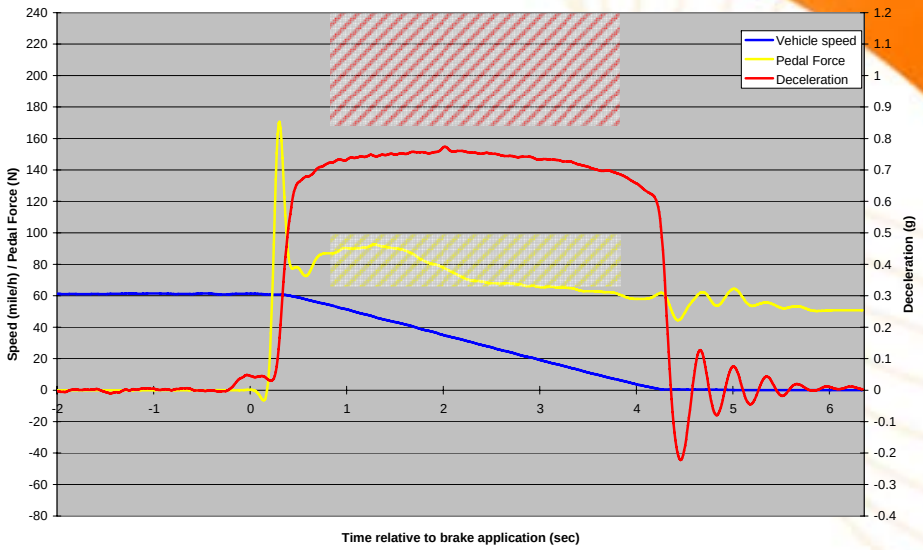
- **ACEA original proposal**
  - Pedal to be applied according to manufacturer's instruction
    - Activation not controlled by the test
  - ABS braking to be maintained despite drop in pedal force when activation criteria are met
    - Assistance action is controlled by the test

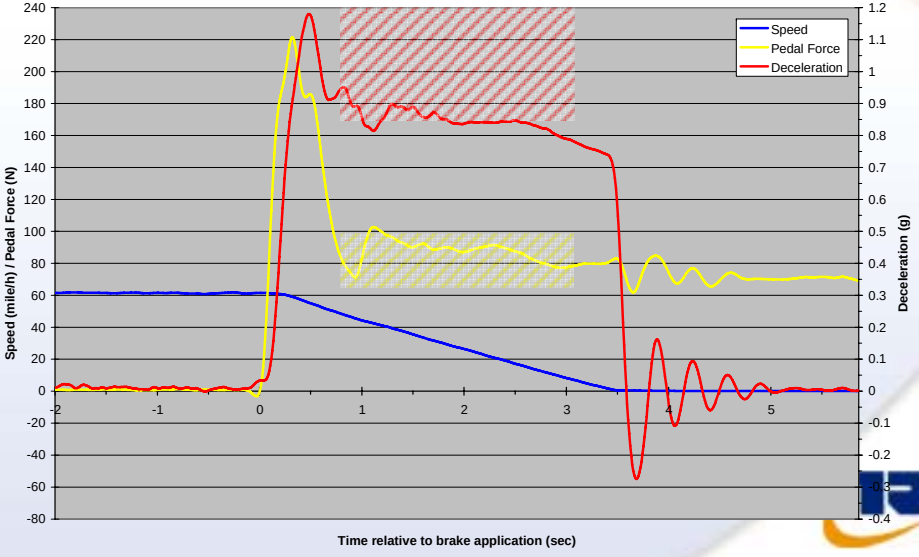


Results from different BAS

- **Requirements not met when activation criteria not met**
- **One system failed to meet proposed requirements**
  - Proposal will increase the amount of assistance for some vehicles
- **One system comfortably exceeded requirement**
- **Requirements can be applied to multi-criteria systems**





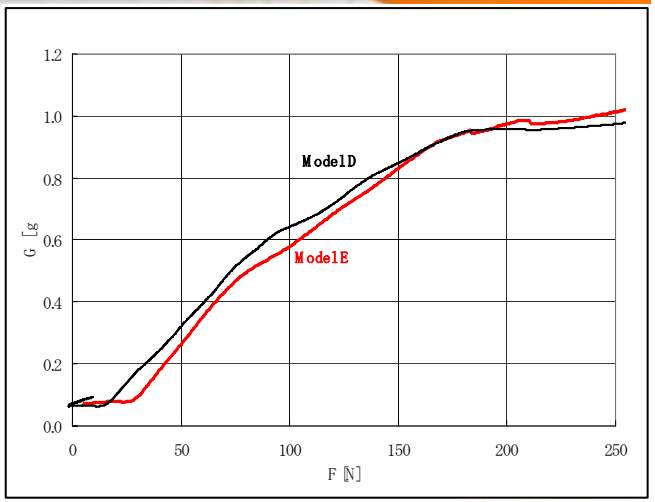


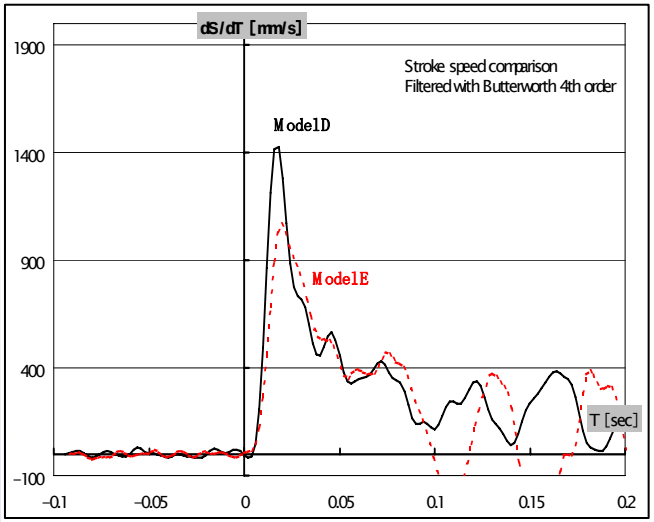
Evaluation of proposed test for speed sensitive BAS

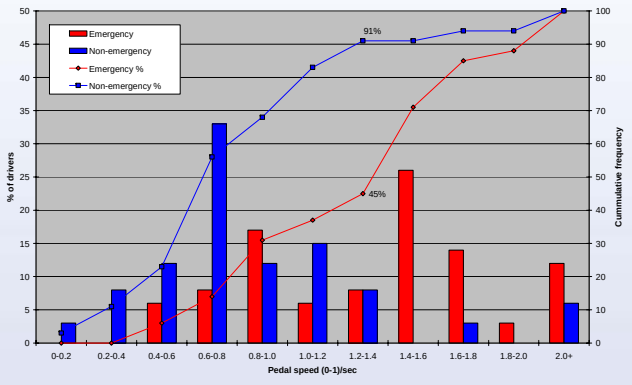
- ACEA proposal is an effective test of the presence of BAS and adequately defines the extent of assistance action that is provided
- The same test method can be applied to detect the presence and control the assistance of systems based on pedal speed activation and systems that base activation on multiple criteria
- However, the test does not control the conditions in which the BAS will activate

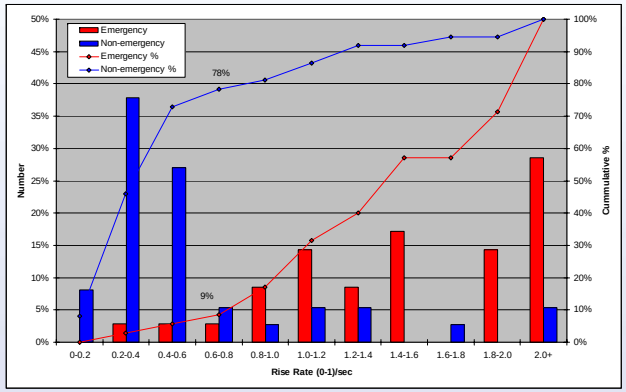
Control of activation criteria for speed sensitive and multi-criteria BAS

- **Ideally, activation criteria should also be controlled but:**
  - Pedal stiffness/travel (pedal “feel”) varied considerably
  - Drivers apply the brakes differently, according to “feel”
    - Long travel, low stiffness = faster application
    - Short travel, high stiffness = slower application
    - Range for systems from 4 manufacturers ~ 90 – 600mm/s
  - Universal limit values for pedal speed would either:
    - Be so wide ranging as to be meaningless
    - Require pedal “feel” to be standardised – very difficult
    - Result in some vehicles with ineffective BAS
  - Vehicle speed criteria controllable with additional lower speed test(s) but accuracy & repeatability reduced. Results indicated pedal speed was dominant input









Control of activation criteria for speed sensitive and multi-criteria BAS

- **In the absence of direct control of activation criteria, collection of relevant information has been proposed to enable monitoring of trends and new developments, and future effectiveness research**
- **Information requested on:**
  - System category,
  - Evidence of research to demonstrate appropriate activation
  - Activation criteria
  - Limit values and relationships between different variables

Conclusions

- **Proposed requirements based mainly on the ACEA proposal with minor modifications/format changes.**
- **3 Categories of BAS defined, pedal force (A), pedal speed (B), multiple (C), but same test applied for B & C**
- **For category A, both activation and assistance action are controlled.**
- **For category B and C only assistance action is controlled**
  - No simple objective test could be found for activation
  - Information requirements proposed to monitor developments

End of Presentation

Presented by Ian Knowles & Iain Knight

Email: iknight@trl.co.uk

Simulator results

- **Theoretical assessment of collision speeds based on mean performance of typical drivers in a simulator**

System	Time to max deceleration (s)	Max deceleration (m/s/s)	Initial Speed (km/h)	Distance to impact at point of braking (m)	Estimated collision speed (km/h)
No BAS	0.93	9.60	100	48	32
Category A BAS	0.63	9.58	100	48	13
Category B BAS	0.60	9.63	100	48	0
No BAS	0.93	9.60	50	14	21
Category A BAS	0.63	9.58	50	14	8
Category B BAS	0.60	9.63	50	14	0