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’

Phase I:

- all new vehicle types from 2005
- all new vehicles from 2012
- Four tests (two for monitoring)
Impactor tests - phase I

Upper Legform

Child/Small Adult Head

Adult Head

Legform

For Monitoring only

Phase II (original):

- all new vehicle types from 2010

- all new vehicles from 2015

- Four tests

- subject to feasibility
Impactor tests - phase II

Upper Legform

Child/Small Adult Head

Adult Head

Legform
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

<table>
<thead>
<tr>
<th></th>
<th>Existing Phase II in Directive</th>
<th>Commission Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatal</td>
<td>Serious</td>
</tr>
<tr>
<td>no BAS Nos.</td>
<td>626</td>
<td>32,246</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>BAS fitted Nos.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>%</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
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</table>
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**

<table>
<thead>
<tr>
<th>Activation criteria</th>
<th>Action</th>
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<tbody>
<tr>
<td>Pedal force</td>
<td>Increased pedal force: deceleration ratio</td>
</tr>
<tr>
<td>Pedal speed</td>
<td>Boost to maximum (ABS)</td>
</tr>
<tr>
<td>Multiple criteria (e.g. pedal force, pedal speed &amp; vehicle speed)</td>
<td>Boost to maximum (ABS)</td>
</tr>
</tbody>
</table>
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

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## Simulator results

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

<table>
<thead>
<tr>
<th>System</th>
<th>Time to max deceleration (s)</th>
<th>Max deceleration (m/s/s)</th>
<th>Initial Speed (km/h)</th>
<th>Distance to impact at point of braking (m)</th>
<th>Estimated collision speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No BAS</td>
<td>0.93</td>
<td>9.60</td>
<td>100</td>
<td>48</td>
<td>32</td>
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<tr>
<td>Category A BAS</td>
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<td>9.58</td>
<td>100</td>
<td>48</td>
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<tr>
<td>Category B BAS</td>
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<td>9.63</td>
<td>100</td>
<td>48</td>
<td>0</td>
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<tr>
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<td>50</td>
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<td>50</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Category B BAS</td>
<td>0.60</td>
<td>9.63</td>
<td>50</td>
<td>14</td>
<td>0</td>
</tr>
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