OICA Proposal for AECS part II Vehicle Approval
# Scope for Vehicle System Approval (with approved Device)

<table>
<thead>
<tr>
<th>Scope</th>
<th>All M1 and N1 vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of triggering</strong></td>
<td>Automatic and manual</td>
</tr>
<tr>
<td><strong>Vehicle category</strong></td>
<td></td>
</tr>
<tr>
<td>M1 &lt; 2,5 t and R &lt; 700mm</td>
<td><strong>M1</strong></td>
</tr>
<tr>
<td>M1 &lt; 2,5 t and R &gt; 700mm</td>
<td><strong>M1</strong></td>
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<tr>
<td>M1 &gt; 2,5 t and R &lt; 700mm; N1 &lt; 700mm</td>
<td><strong>M1</strong></td>
</tr>
<tr>
<td>M1 &gt; 2,5 t and R &gt; 700mm; N1 &gt; 700mm</td>
<td><strong>M1</strong></td>
</tr>
<tr>
<td>Included in the scope of R94 and R95</td>
<td><strong>Included in the scope of R94 only</strong></td>
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<tr>
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<tr>
<td>Not in the scope of R94 and R95 but with trigger</td>
<td><strong>Not in the scope of R94 and R95 but without trigger</strong></td>
</tr>
<tr>
<td>Testing triggering</td>
<td>R94 and R95</td>
</tr>
<tr>
<td>Assessment after full-scale crash test</td>
<td>R94</td>
</tr>
<tr>
<td>Assessment of manual trigger</td>
<td>R95</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Demonstrate: Triggering occurred, test call can be established, subjective audio check, and successful MSD transmission</td>
<td>No assessment</td>
</tr>
</tbody>
</table>

**Additional concern:**
- How to exclude vehicles that are exempted by regional type approval regulation from the requirements of frontal- and side collision according to ECE-R 94/95 (e.g. special purpose vehicles).
- Address N1 vehicles that can meet ECE-R 95 without using a side airbag
Vehicle testing procedure (with approved Devices)

We propose 3 test procedures:

I. Full scale impact test with automatic activation
II. Full scale impact test with manual activation
III. Alternative without Full scale impact test

STEP 1.1 Verify HMI Installation

STEP 1.2 Check trigger signal generation during impact

STEP 1.3 Verify AECS Operation

STEP 2.1 Verify HMI Installation

STEP 2.2 Check trigger signal generation during impact

STEP 2.3 Move vehicle

STEP 2.4 Manual activation of AECS

STEP 2.5 Verify AECS Operation

STEP 3.1 Verify HMI installation

STEP 3.2 Generation of trigger signal (OEM info.)

STEP 3.3 Manual activation AECS

STEP 3.4 Manual activation AECS

STEP 3.5 Verify AECS Operation
I. Full scale impact test with automatic activation

**STEP 1.1**
Verify HMI Installation

**STEP 1.2**
Check trigger signal generation during impact

**STEP 1.3**
Verify AECS Operation

Verify by one of options:
1. **Actual** GNSS, MNO, PSAP
2. **Simulated** GNSS, MNO, PSAP
3. **Functional** check

VEHICLE APPROVED
I. Full scale impact test with automatic activation

STEP 1.1: Verify HMI installation

According to requirement of par. 15.1.5 - 15.1.8 (AECS control and indicator) R121

STEP 1.2: Check generation of trigger signal during frontal (ECE 94) and/or lateral (ECE 95) impacts

[UN ECE 94-02 needs to be amended as follows:
  Par. 2.36 AECS trigger signal: a signal that can be used to trigger an AECD/AECS defined in UN ECE ???.
Par. 5.2.9: If requested by the manufacturer, the technical service shall verify the availability of an AECS trigger signal generated during the test of the vehicle carried out in accordance with the method described in Annex 3. The signal specification and the method to verify the availability will be provided by the manufacturer. In case the vehicle was already approved to this Regulation this verification of the AECS trigger signal shall not require a new test according to annex 3
Annex 1, Par. ???: AECS trigger signal yes/no]

[UN ECE 95 -03 needs to be amended as follows:
  Par. 2.36 AECS trigger signal: a signal that can be used to trigger an AECD/AECS defined in UN ECE ???.
Par. 5.3.8: If requested by the manufacturer, the technical service shall verify the availability of an AECS trigger signal generated during the test of the vehicle carried out in accordance with the method described in Annex 3. The signal specification and the method to verify the availability will be provided by the manufacturer. In case the vehicle was already approved to this Regulation this verification of the AECS trigger signal shall not require a new test according to annex 3]
I. Full scale impact test with automatic activation

STEP 1.3: Verify AECS operation

Baseline is to verify the capability to
- Generate and initiate the transmission of an MSD
- Initiate a 2-way voice connection

Option 1. Use of actual GNSS signal, Mobile Network and PSAP (via a dedicated call number)

comment
- Test is close to « Real world »
- Only possible if a reliable GNSS signal and a reliable mobile network access are available at the R94/R95 impact facility
I. Full scale impact test with automatic activation

STEP 1.3: Verify AECS operation

Baseline is to verify the capability to
- Generate and initiate the transmission of an MSD
- Initiate a 2-way voice connection

Option 2. Use of simulated GNSS signal, Mobile network and PSAP

Comments:
- Not depending from external « real world » environment
- needs to be performed in a shielded or anechoic room to avoid interference with “real world” environment
- Shielded room needs to be equipped with a simulator of GNSS, MVNO and PSAP
I. Full scale impact test with automatic activation

### STEP 1.3: Verify AECS operation

Baseline is to verify the capability to:
- Generate and initiate the transmission of an MSD
- Initiate a 2-way voice connection

#### Option 3. Functional check via one out of the following four methods
(Use of simulated GNSS signal, Mobile network and PSAP)

The actual AECS operation has already been verified a Device certification level (part I). Therefore it is sufficient to verify the function of every relevant AECD component in the vehicle.

- Check of functional state of the in-vehicle system by using HMI (visual control of telltale)
- Check of functional state of the in-vehicle system by internal memory checking
- Check of functional state of the in-vehicle system by separated functional test
- Check of functional state of the in-vehicle system by functional transmission test with Wired procedure
To be used in following case:

1. If the Impact facility has no possibility to simulate Mobile or GNSS environment or has no reliable access to Mobile or GNSS environment
2. If During Test procedure a failure occurs due to an external reason e.g. failure or disruption of Mobile network or GNSS signal

II. Full scale impact test with forced activation

Verify by one of options:
1. Actual GNSS, MNO, PSAP
2. Simulated GNSS, MNO, PSAP
II. Full scale impact test with manual activation

STEP 2.1: Verify HMI installation (same as step 1.1)

STEP 2.2: Check generation of trigger signal during frontal (ECE 94) and lateral (ECE 95) impacts (same as step 1.2)

STEP 2.3: Move vehicle to an area with network or simulated network access

STEP 2.4: Manual activation

1. If the Impact facility has no possibility to simulate Mobile and GNSS environment or has no reliable access to Mobile and GNSS environment
   - Impacted vehicle will be moved to a shielded room with simulator or to an area where Mobile and GNSS environment is available

2. If During Test procedure I a failure occurs due to an external reason
   - No necessity to carry out new impact test,
   - the test procedure will continue by manual activation of AECS

STEP 2.5: Verify AECS operation (same as step 1.3, option 1 & 2)
III. Alternative without Full scale impact test

ALTERNATIVE PROCEDURE TO APPLY IN CASE OF THE FOLLOWING SITUATIONS:

1. Time gap between impact tests (ECE 94 / 95) and telematic device availability with regard to vehicle development schedule → see Annex 1

2. Technical and/or installation upgrade of telematic components during vehicle life

3. Extension of type approval for vehicle: in case of installation of already approved AECD on a vehicle type as defined in UNECE 94 and UNECE 95

4. As a choice by OEM for this alternative procedure
III. Alternative without Full scale impact test

STEP 3.1 Verify HMI installation

STEP 3.2 Generation of trigger signal (OEM information)
- Sled test pulse
- R17 pulse
- AECD is in « Safe Zone »

STEP 3.3 Manual activation

STEP 3.4 Verify AECS Operation

STEP 3.5 Verify AECS Operation

VEHICLE APPROVED
Safe Zone borders:

X: front axle  [and rear axle]

Y: between the two z-x planes crossing the outer surface of the driver’s seat and crossing the outer surface of the outermost front passenger’s seat

If components of the E-Call system are out of the above defined area, the requirements are also deemed to be fulfilled, if the manufacturer can show to the satisfaction of the technical service that the post crash functioning is given.

This could be for example:
- Relevant components are in non-deformed areas
- Relevant functions are redundant
- Devices are mounted on/in windows (e.g. windshield, rear window, …)
- … (others, tbd.)
Safe Zone boarders:

**Justification**
-The concept of “Safe Zone boarders” describes protection zones within the vehicle's bodywork structure where deformation is unlikely according to real-world data.
-In addition, mechanical requirements (deceleration test according to ECE-R 17, Annex 9) for AECS components ensure shock-proof protection in case of an accident.

**Procedure**
-A study [1] was conducted by analyzing the damages of approx. 9000 vehicles involved in severe real-world accidents, using the German In-Depth Accident Study (GIDAS) database.
-For each vehicle, the deformations in the lower vehicle level were plotted in a standardized 2-D grid.
-By consolidating the resulting deformation matrix with the accident frequency and severity, the probability of the deformation of each vehicle cell in any crash type can be evaluated accordingly in a deformation probability matrix.
-To reflect the relevance of deformation in particular regions, a cumulative frequency matrix can be calculated.
-The deformation characteristic of the car fleet changes over time depending on the improved crash structure in newer car models.
-Therefore, the 5th percentile of the cars registered 2000 and later is calculated and the result is shown in the image below:

-According to this matrix, the following Safe Zone boarders are defined:

X: front axle [and rear axle]
Y: between the two z-x planes crossing the outer surface of the driver’s seat and crossing the outer surface of the outermost front passenger’s seat.

Analysis of Fuel Cell Vehicles Equipped with Compressed Hydrogen Storage Systems from a Road Accident Safety Perspective

Joerg Bakker
Daimler

Christian Sachs
Adam Opel AG - General Motors Company

Dietmar Otte
Medical Univ Hannover

Rainer Justen
Daimler

Lars Hannawald
VUFO GmbH

Flavio Friesen
Adam Opel AG - General Motors Company
III. Alternative without Full scale impact test

STEP 3.1: Verify HMI installation (same as step 1.1)

STEP 3.2: Generation of trigger signal

Generation of Triggering Signal
- The manufacturer shall demonstrate the generation of the triggering signal to the technical service in line with ECE 94 and ECE 95 provisions

STEP 3.3: Sled test with pulse of ECE R17 Annex 9

Verification that the AECD is installed in such a way as to be protected from the consequences of a collision to the front or side of the vehicle (Safe Zone)

STEP 3.4: Manual activation (same as step 2.3)

STEP 3.5: Verify AECS operation (same as step 1.3)
Back-up
Scope for Vehicle **System** Approval (with approved Device)

M1 with a GWM < 2,5 t and a R point height of < 700 mm

N1 with a R point height of < 700 mm

Other vehicles of category M1 and N1 if fitted with a trigger system detecting at least one impact according to UNECE Regulation 94 or 95

Vehicles of other categories on request of the manufacturer
## Scope for Vehicle **System** Approval (with approved Device)

<table>
<thead>
<tr>
<th>Conditions from R 94</th>
<th>GVM &lt; 2,5t</th>
<th>GVM &gt; 2,5t</th>
</tr>
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<tbody>
<tr>
<td><strong>Cond</strong></td>
<td>R &lt; 700 mm</td>
<td>In scope of R 94 &amp; R 95</td>
</tr>
<tr>
<td><strong>R &gt; 700 mm</strong></td>
<td>In scope of R 94 only</td>
<td>Not in the scope of R 94 &amp; not in the scope of R 95</td>
</tr>
</tbody>
</table>

**Green colour:** Show compliance in the R 94 and R 95 test

**Yellow colour:** Show compliance in R 95 test only

**Blue colour:** Show compliance in R 94 test only

**Red colour:** OEM shall provide documentation showing that an ecall will be established

For all: sled test with [75 g] has to be done with the eCall system