# I. COVERAGE CRITERIA:

Main outcome of EG2 Technical Requirement group was to identify objective coverage criteria (OCC) for evaluation of compliant content to the new Field of Vision Assistant (FVA) regulation.

## 1. FVA CONTENT IN AREA 1 AND AREA 2 HAS TO FULFIL THE FOLLOWING REQUIREMENTS:

- The HMI design can consist of pixels with reduced brightness (= semi-transparent) and such with higher brightness (= potentially covering).

⇨ OCC_1: For calculation of coverage, pixels with a brightness above 70% of the maximum brightness value for a particular outside brightness situation are considered as potentially covering and count into the coverage calculation.

Note: introduced as definition in the FVA regulation, considering 'on' and finally 'opaque' pixels.

## 2. AREA 1 (ADAPT JAMA BASIC FIGURE CRITERION):

- To calculate a potential coverage, a basic reference figure, inspired of a child size of 2,6° height x 0,8°width, as derived from JAMA guideline (V4, GRSG-IWG-FVA-05-06), is compared against the FVA content (i.e. compared against the HMI design documented in the development phase).
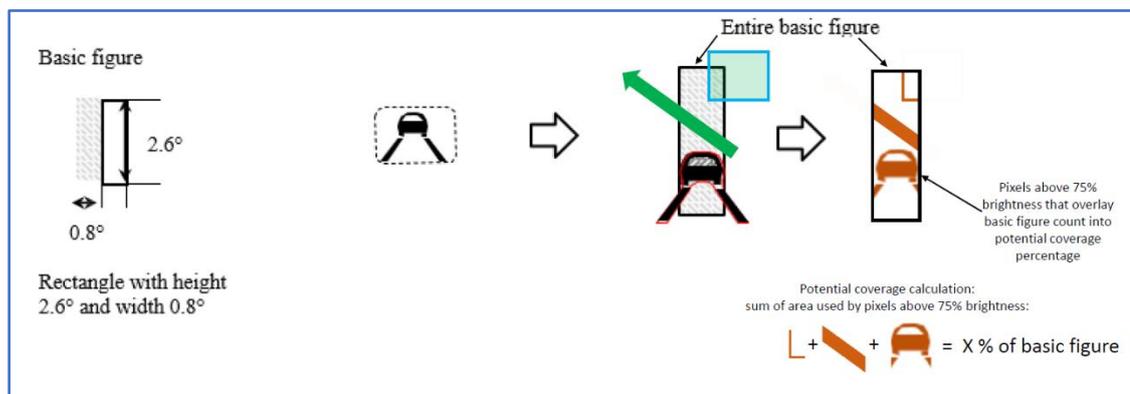


⇨ OCC_2: For opaque-pixels brighter than 70% of the allowed brightness in a given situation, the maximum area covering a basic figure as defined above must not exceed 50% of that basic figure.

Note: opaque pixels related to the external brightness, as introduced in OCC_1

For FVA systems displaying in area 1, a functional safety concept shall be implemented:

- Maximum opaque-pixel ratio: 50% of the available FVA display area (where pixels brighter than 70% shall be rated as an opaque-pixel) shall be acceptable limitation.

⇨ OCC_3a: An opaque-pixel-ratio above 50% of the available FVA display area shall be rated as electrically detectable failure and thus the system shall enter the safe state defined in the risk assessment (e.g. according to ISO26262).

⇨ OCC_3b: An automatic brightness adjustment for the FVA must be implemented that is depending on the outside brightness (preferably using vehicle forward brightness as a reference)

## 3. AREA 2 (ADAPT S AREA CRITERION):

For area 2, which is outside area 1 in the transparent field of view, the approach of R125.02 is adapted (emphasizing: only for area 2, as area 1 already needs to fulfil the strict JAMA figure criterion as described above):

- 0,2 x area S according to R125.02 is calculated 0,0472m² @ 1,5m and transferred to a distance-independent value (unit: square degrees), that can be applied for different virtual image distances. This is necessary to effectively cover different FVA systems that typically range between 2-20m.

  The squared unit of the limit value has the effect that a virtual image cannot only partly cover an Area S as it was possible in R125.02, but the horizontal/vertical aspect ratio of the limit value can vary and thus adapt to different aspect ratios of FVA systems, making it a much more strict criterion. Additionally, the height upwards is limited by the lower border of area 1 by definition, making it impossible that content approved only for area 2 could extend upwards into area 1.

- The unit is square degrees (horizontal x vertical field of view = degrees²).

⇨ OCC_4: Coverage calculation value shall not exceed 66°²

## II. JUSTIFICATIONS:

This document is the final update of first issued IWG-FVA-12-09. It stands as the 3rd revision: IWG-FVA-15-06 being the 2nd, IWG-FVA-14_05 the 1st.

IWG-FVA EG2 Technical Requirement group worked along FVA meetings and had dedicated meetings for consolidation. Main inputs were initiated at IWG-FVA #10 at the Lelystad meeting (NL) in June 2023 for field investigations one various vehicles, including geometry rules (e.g. definition and position of the separation line between area 1 and 2), not detailed in that document.
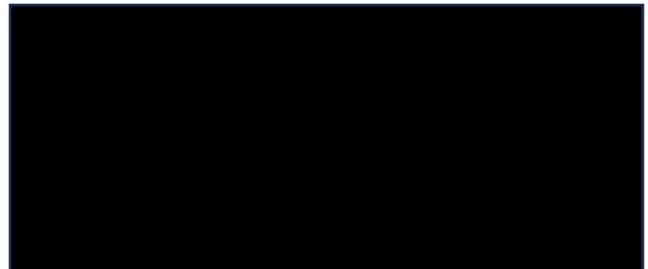
- The intention of the coverage criterion is to prevent content shown by the FVA to be so large or so bright that road users or other objects could be overseen by the driver.

- Due to varying outside brightness and the resulting need for adaptive FVA brightness setting, the coverage calculation shall be based on the HMI design of an FVA system: based on systems that adapt the FVA brightness according to the outside brightness and driver's set up, a relative brightness shall be considered. This ensures that dark FVA system settings at night as well as brighter settings at daytime are covered by the regulation. Absolute values cannot cover the variety of brightness conditions.

## 1. AREA 1

- OCC_1: decision was taken at FVA-17 to set the relative brightness to 70% for a secure position.

  Initial [70]% of area coverage and [75]% of relative brightness were proposed as outcome of IWG-FVA #10 workshop, placing a figure of a child in the size of the basic figure onto the road and determine the limit values of size and brightness (same rational as JAMA guideline).

- OCC_2: no decision at EG2-03.

Driving tests were conducted, and it was concluded that a safe driving was possible in all situations. Furthermore, it showed that a 35% JAMA figure coverage would not allow to display useful and intended HMI content like lane departure warning or road speed signs without compromising readability, for a final relevant coverage criterion of 75%. However, decision was not reached between 35 and 70% threshold (NL&FR for 35% secure position ; JP open to 70% compromise ; DE neutral, open to further work).
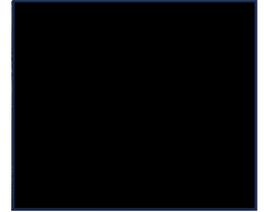
FVA#18, April 5, 2024 introduced further JAMA consideration (35% being considered without R_FVA additional requirements). JP-NL-FR remaining on their positions. FR standing on the safe side, without experience on such system.. still ok for 50% (to be improved with experience/amendment). JP challenging OCC_3a to be reduced. DE supporting safe approach, 50%, for a final decision to remove preceding brackets.

- OCC_3a: "An opaque-pixel-ratio above 50% shall be rated as electrically detectable failure and thus the system shall enter the safe state defined in the risk assessment (e.g. according to ISO26262)."

This requirement proposal was finally not included as such in the regulation, but as an effective performance criterion. This ensures that besides the JAMA coverage criterion for symbols also an accumulation of information is prevented; this aims at system errors but also at multiple dynamic objects being displayed in augmented reality FVA systems, e.g. 100 pedestrians crossing a road, preventing that each one is highlighted, filling out more than 50% of the available FVA display area.

- OCC_3b: "An automatic brightness adjustment for the FVA must be implemented that is depending on the outside brightness (preferably using vehicle forward brightness as a reference)."

State of the art (already applied in systems on the market).

## 2. AREA 2, OCC_4

- It was clarified by JAMA that the basic figure criterion is not intended for area 2, but only for area 1.

- Due to the lack of an "area S" and a 20% criterion that was previously used in R125.02 there is the need of a definition for area 2 that is also applicable for heavy duty vehicles (M2N2, M3N3) and that can work for different virtual image distances as seen in FVA systems.

- The keep-free-area (area 1, with special requirements) already ensures that the most important area is much more strictly regulated than R125.02 which has virtually "no" restriction on amount of content above area S.

**Reminders:**

a. Area 2 is intended to be used to display mostly "static" information.
b. Area 2 is also allowed to be additionally used for "dynamic"/augmented content that can add up to the "static" content, so _further limitation could render FVA systems useless_ that use augmented reality features for highlighting or navigation purposes.
c. At the biggening of the FVA discussion, a possible area 2 above area 1 was considered. The upper area 2 was discarded for a potential later regulation evolution.