OICA position

Magnification Factor

Minimum magnification factor

Considering that the ISO 4.2.26-4.2.27 values are issued of a scientific "translation" of the current type approved mirrors into the CMS technology thus have been considered by the ISO expert group as being acceptable as a minimum for safe driving,

Considering that the aim of this regulation enhancement is not to increase the required performances of the device for rear vision, and

Considering that designing a new car or truck cabin with CMS depending on the replaced technology is a non sense.

then OICA :
-discards ISO Annex A values as non relevant for a minimum setting
-fully supports the current values of 16.1.4.1 (see next slide)

Minimum magnification factor

16.1.4.1. Magnification factor

for class I: 0.31,
for class II (drivers side): 0,21,
for class III (drivers side): 0,29,
for class IV (drivers side): 0,037,
for class II (passengers side): 0,13,
for class III (passengers side): 0,19,
for class IV (passengers side): 0,014.

OICA position

Point Light Sources

Loss of road environment perceptibility caused by strict requirements on PSLDF.

The proposed PLSDF value only evaluate the system from one specific aspect, in which it gives priority to observe the point light source in interest as an absolutely separated two point light source.

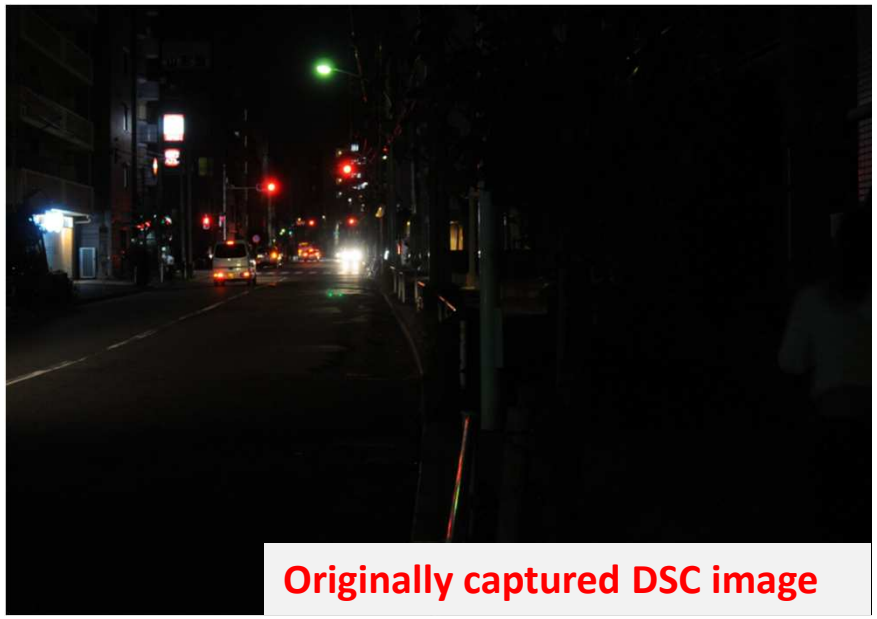
On the other hand, driver's perception and interpretation of the scene is achieved by the observation of details at the central vision and in parallel by a combination of perception of scene surrounding the object in interest, where the later has a large impact on the physiological process (perceiving – detection – **analyzing – judgment** – decision) and the loss of the later information has significant impact on decision making.

From a general safety perspective, a balanced adjustment of the CMS image is essential to fasten physiological process and not only emphasizing a specific aspect of the Point Light Source in the CMS.

Loss of road environment perceptibility caused by strict requirements on PSLDF.

The following slide shows some image examples resulting of camera adjustment to satisfy strict PLSDF requirement, which is presently proposed for adoption within UN Regulation 46 as a requirement for CMS.

If strict requirement is imposed on PLSDF value, the CMS will have to adjust the operation of the system to show images like in the example shown at upper right image**. The driver loses a large amount of safety relevant visual information which is essential in the scene interpretation and decision making, by doing so**. (example of an urban scenario in Tokyo).



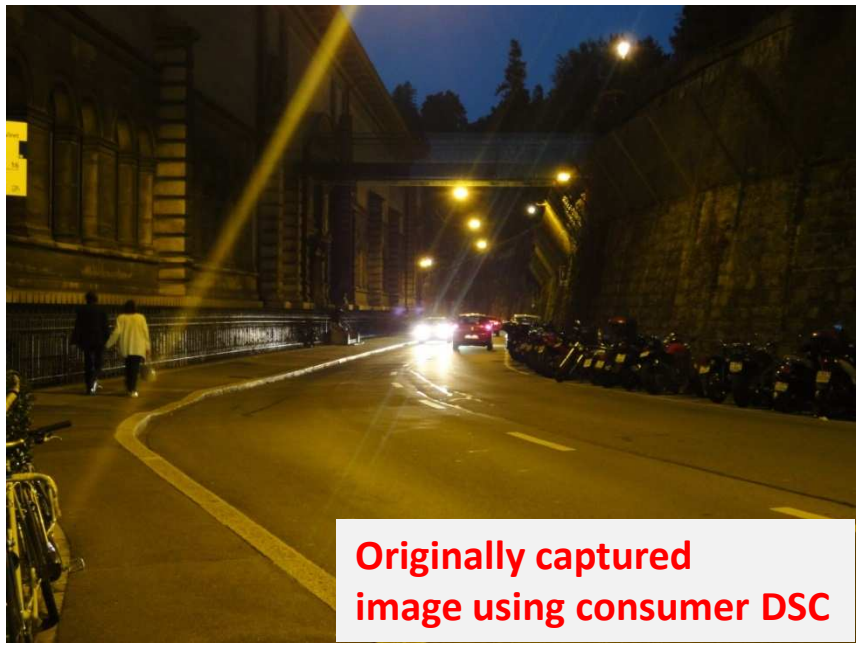
Originally captured DSC image

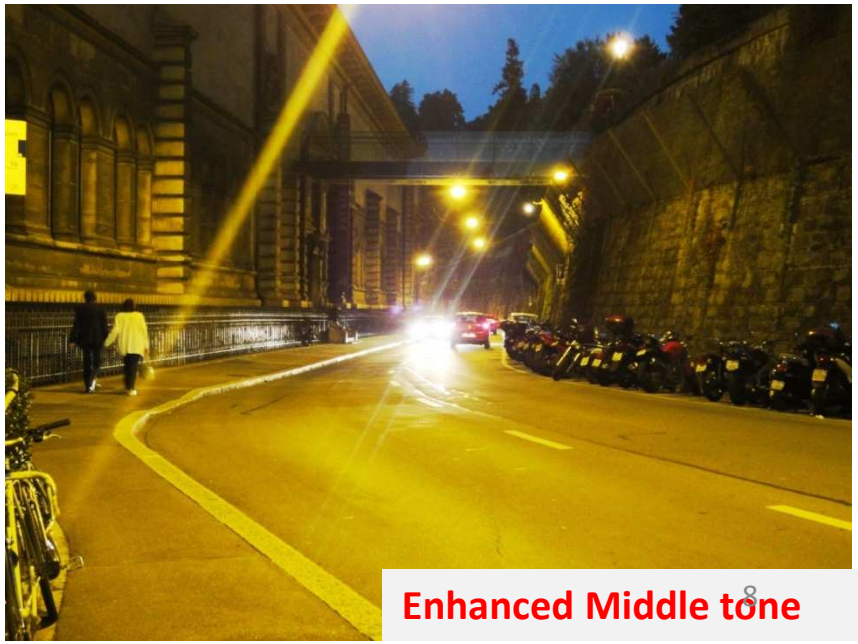
Post processed to provide higher PSLDF

Gain up image

Further gain up image

Another example of urban scenario where pedestrian get lost if adjusted to meet PLSDF high requirement.





The importance of the rear view information provided by devices for indirect vision may differ by driving scenario.

Giving emphasis only to Point Light Source reproduction may result in large loss of critical visual information depending on driving scenario, especially in urban area driving scenario or low to middle speed maneuver scenario. It would also increase detection distance.

As replacing a potential safety issue with other potential safety issues being « carved » into regulation does not seem appropriate , OICA position is to remove any requirement from the regulation about PLS and let le manufacturer be responsible for the system performance.

But if strict high requirement on Point Light Source is a must for specific driving scenario, then OICA suggests that the CMS could be adjustable and have a manual or automatic operation mode where CMS satisfies the above strict high requirement on Point Light Source:

"CMS shall be adjustable whether manually or automatically, such that an operation mode is reserved to satisfy the PLSDF≥[2,5], according to test method and condition as described in Annex 12, paragraph XX [to be created]."

With the following justification:

Some driving scenario may require high reproducibility of the point light source from an overtaking vehicle passing beam light. Similar to the operation of dimming function available in some type of optical mirrors, an operation mode should be available to driver whether manually or automatically to improve visibility and perception of the point light source of the passing beam.

In alternative, OICA could accept the following test conditions applicable for PLSDF measurement:

- PLSDF measurement for class I to III devices shall be such that the two light passing beam head lamp are separated by 1.3m and located at a distance of [150m] behind the vehicle.

Justification : Expected entire time of merging decision shall be less than the time a vehicle is at the acceleration/merge lane. OICA statistical data revised so far does not show any justification to require more than 4 sec even for elderly driver.

1.3m is a typical distance between two head lamps.

OICA position

Grey Scale Rendering

OICA alternative proposal

The devices for indirect vision shall be capable to represent enough tonal steps to secure a smooth tonal image of the field of vision on the monitor. The CMS monitor shall be able to represent at least 12 distinguishable steps of a grey scale chart on the monitor display.

OICA alternative proposal

Justification:

The grey scale rendering is introduced as test to verify that enough tonal steps are secured for displaying the field of vision through the CMS.

It is a common practice to improve the perceptivity of the content of image by controlling the input and output response, adjusting the contrast of the image to the viewer, and thus fastening the physiological process of perception.

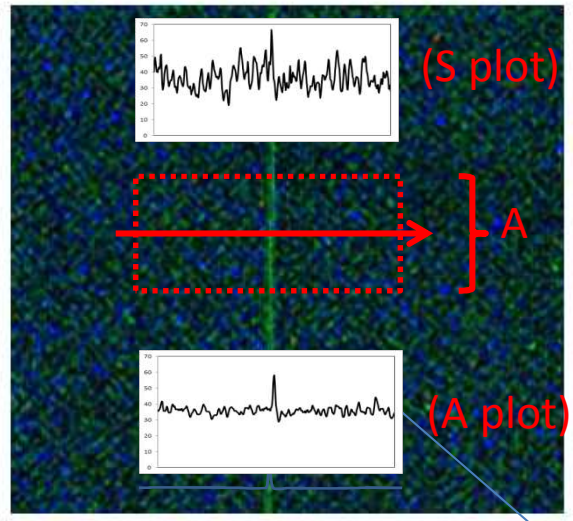
On the other hand, an excess of contrast enhancement resulting in loss of minimum tonal representation to the output image may deteriorate this physiological process of perception.

It is therefore necessary to limit contrast to keep a minimum tonal step on the displayed image.

OICA position

Color Noise

Color Noise: Line noise *(column, row noise)*



Fixed color noise of this type occurs mainly as result malfunctioning of the sensor reset, read out, vertical line amplification circuit.

This type of fault is largely depended on the sensor semiconductor fabrication matureness and test in quality control limits a failure sample from outgoing the production.

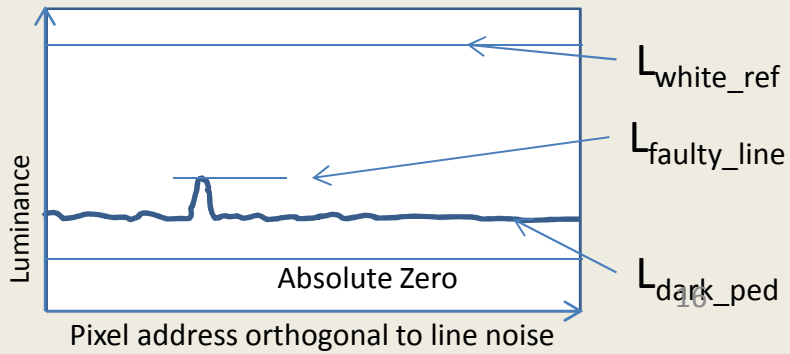
Therefore, a typical CMS type approval sample may rarely exhibit disturbing level fixed line noise failure, because samples are generally tested and screened at least at component stage.

TEST METHOD:

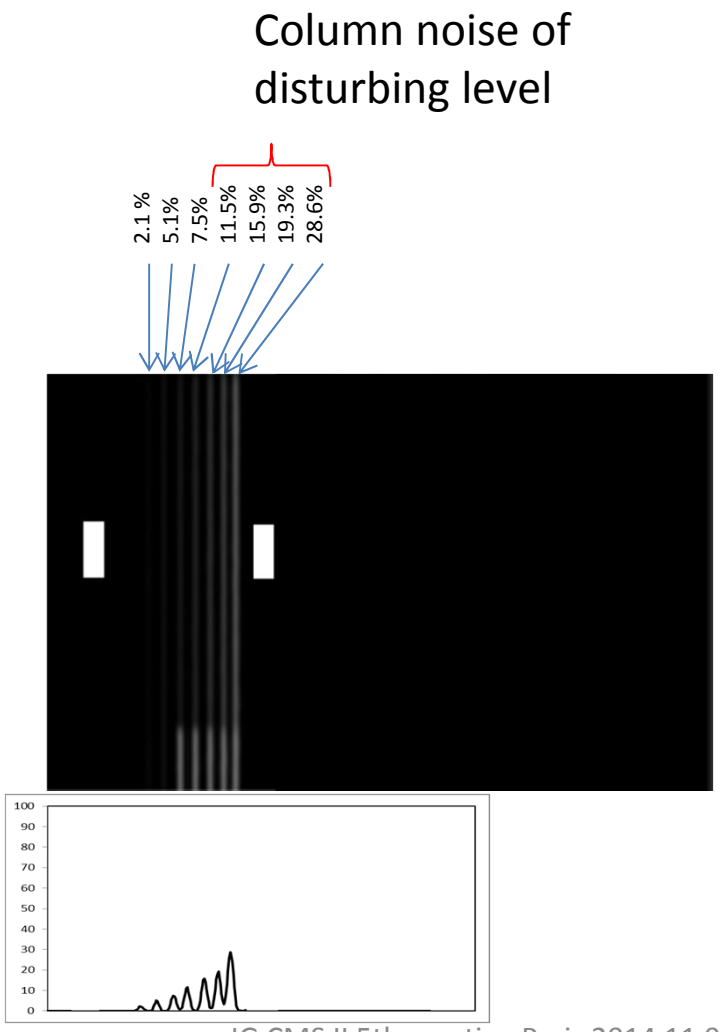
1. Obtain the white signal level of the CMS using a grey scale chart with contrast ratio of at least 1:20 and measure the white patch signal level or equivalent to determine the L_{white_ref}.
2. With camera at dark condition, find the brightest line observed on the CMS monitor, if any.
3. Using a reference camera, capture a local image of the brightest line found on the displayed image taken with the monitor at dark, and camera under a environment of no illumination, at dark.
4. For vertical line noise measurement, obtain the signal luminance level plot towards the orthogonal orientation. As a single line plot (S plot) may exhibit disturbing pixel noise apart the lien noise in interest,
5. it is necessary to remove these noisy single pixel random signal and obtain a smooth plot curve to evaluate the line noise signal level.
6. Using an image analyses software, obtain plots of at least 20 row of the CMS image signal luminance level towards the orthogonal orientation of the line noise (see A) and average the plots to obtain a smooth curve (A plot).
7. Read the average luminance level dark scene from the plot and this will be used as the pedestal dark luminance level: L_{dark_ped}
8. Read the faulty noise line signal luminance level: L_{faulty_line}
9. Calculate the noise signal level in reference to the white signal level L_{white_ref}.
10. Compare whether the faulty line is under the perceptual level 7%.

$$|L_{faulty\_line} - L_{dark\_ped}| / (L_{white\_ref} - L_{dark\_ped}) =< 7\ \%$$

Justification for measuring luminance for the evaluation of color column/row noise..
Apart some specific sensor, image sensor in general uses a mosaic array of colored pixel .
It is the irregular response of luminance to electronic signal of specific column or row that causes an unbalance in the color processing, resulting in some color deviation, and followed by luminance deviation.



Artificially generated image to see the impression of what a vertical bright line would look like. Actual image on a working CMS may look difference due to further random noise and Dark pedestal level.



Color Noise: Random noise

TUV proposal:

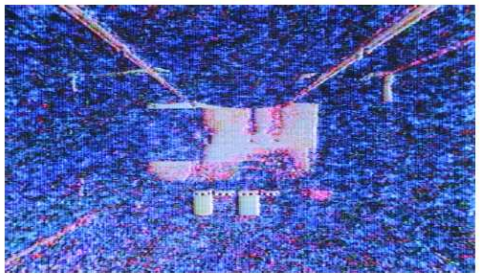
Why is limitation of color noise important?

Color noise produces wrong information and is distracting. Therefore limitation of color noise is a safety aspect.

NOTE:
The aim is not minimizing the color noise that maybe is introduced by image enhancement technologies. The aim is to limit color noise that leads to wrong information and is distracting.

Should:

Is:



Where to limit the occurrence of color noise?

There is no literature showing a clear relation of the threshold of perception of image content versus the noise occurrence. It is largely known that content perception and interpretation are still highly maintained under noise occurrence and the content interpretation dependent on the grain size and occurrence pattern of such noise.

A large scale study shall be performed in advance to introducing such a specific threshold requirement to justify the specific threshold if such is to be introduced as a requirement.

Color Noise: OICA position

As line noise is a typical quality control topic there should be no particular type approval test in the regulation.

OICA position is to keep color noise as a designated recommendation as it is proposed under ISO 16505:
“Annoying color noise should be avoided under night condition.”.