

APPLICATION NOTE #6

RETRO-REFLECTIVE EFFECT

The retro-reflective effect is the property of some materials to reflect light back to its source, within a quite narrow angle of dispersion (here: Đ), almost independently from the angle of incidence on the reflective surface, and independently of the light color (even Infra-Red).

This property is widely used on road signs, bollards, reflective tapes for cars, high visibility clothing (yellow safety jackets), and in some countries... on license plates.



When an image of a retro-reflective license plate is taken with a camera and a flash within the retro-reflection «Đ» angle, the flash reflects back on the plate and makes it overexposed and unreadable.



MULTIPLE SOLUTIONS CAN REDUCE THE RETRO-REFLECTIVE EFFECT

#1 Geometrical solution: flash and camera placement

The retro-reflective effect disappears if the camera and the flash are in an angle greater than the retro-reflection $\alpha \approx \alpha$ angle: the license plate looks exposed just as much as the rest of the car body.

As a reference, in multiple European countries, the retroreflection effect on license plates seems to be decreasing at about $\alpha = 4$ to 5°, and almost non-existent at about $\alpha = 14^{\circ}$. This implies to separate the flash and the camera by about $\alpha/2 = 7^{\circ}$ to defeat the retro-reflective effect.



#2 Geometrical solution: beam orientation

This solution necessitates a flash with a well-defined beam shape, with an intense center-beam and a less intense periphery.





Important: please note that the A/ and B/ solutions can be combined to maximize the result with minimal difficulties.

#3 Temporal solution: multiple flashes

If the flash device is able to produce multiple shots very rapidly (within approx. 10 ms), and allow a modulation in beam intensity between consecutive shots, two or more images can be captured with more or less intense light.





With an intense flash, the car will be correctly exposed, and the plate overexposed. With a less intense flash, the car will be underexposed, but the plate is correctly exposed.

With two images, the car and the plate are visible.

#4 Optical solution: Splitting Filter

Optical solutions can be found, like the «Splitting Filter».

A Splitting Filter is a very special optical filter that can be fitted on optical lenses in front of cameras. It optically splits the image in two: one main image (car well exposed), and one much underexposed «ghost» image (where the plate only is correctly exposed). These two twin images are then optically shifted and superimposed in the camera lens.

As a conclusion, only one image is taken, where the car appears correctly lit, and a duplicate licence plate is readable under the car.

No electronic is involved. No image post-processing is involved. All is optical, and in only one image capture.





Typical image without Splitting Filter. Full exposure.



Typical image with Splitting Filter. Duplicated plate with reduced exposure.