DRIVER RESEARCH INSTITUTE

# USE OF A CONTRAST GRADIENT PANEL

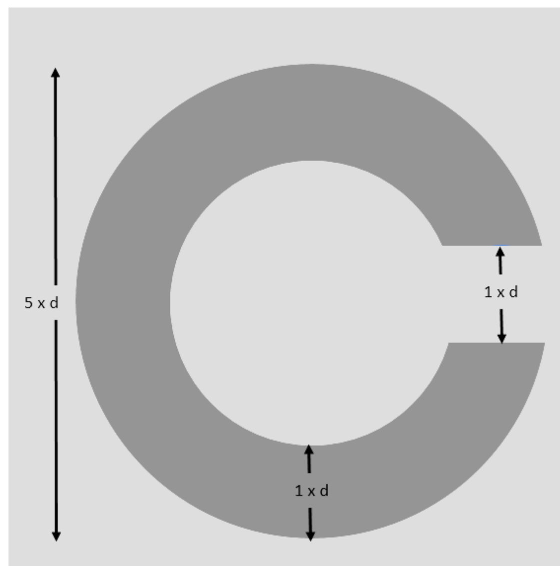
## FOR DOCUMENTING NIGHTTIME SCENES

There are several ways to create fair and accurate photographs of nighttime crash scenes. The method explained below is a rather simple but objective method to assure that the photograph is both fair and accurate.

When taking photographs of a crash site at night, the photographer must be able to testify that the resulting photograph is “fair and accurate”. When at the site of the crash, the investigator might take a photograph and compare that to what he or she can see. There are two primary concerns. First, documenting the site. The observer should make note of what can be seen and what cannot be seen, and how various shades of color appear at various distances. Secondly, once the photograph is taken, the output might display the photograph very differently than the LED display at the back of the camera. For instance, some computer displays are brighter or darker, and the same can be said of printed photographs. The goal is to produce that photograph that is fair and accurate when displayed.

Many times, months or years pass between when the photograph is taken and when it is displayed. An objective methodology must include 1. Document of the site, 2. Observe the effects of a target in the area, and 3. Be able to calibrate the output.

## USING A CONTRAST PANEL




The contrast gradient utilizes a series of ten Landolt Cs. A Landolt C, also referred to as a broken ring has been used as a symbol for eye testing in Europe and Japan. These Cs as they are referred to are broken rings and are placed so the ring opening, or break is facing up, down, left or right. The Landolt C was first developed as a method of static eye testing by Edmund Landolt, an ophthalmologist.

The observer is asked to identify where the break in the C appears. The standard size of each C is designed to have its width and gap be one-fifth the size of the character. As shown below, when the C is 5 units tall, the gap and width should be 1 unit wide.

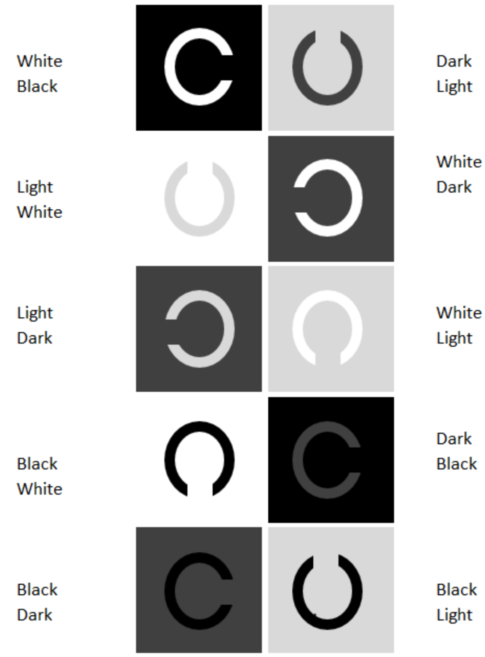
In the contrast, gradient panel, each C is 8.5 inches tall, 1.7 inches wide, and has a gap (break) of 1.7 inches. This size was selected to account for the distances associated with the recognition of white targets (the farthest distance). Pedestrians along the right side of the road have been recognized from an average distance of approximately 325 feet in on-road studies at night. Pedestrians along the left side of the lane and pedestrians wearing darker shades have been recognized as shorter distances.

An observer with 20/20 vision should be able to identify the direction of the break in the C from a distance of 57.1 feet for each 1 inch height of the letter. Consequently, an observer with corrected vision of 20/20 (6/6) in good lighting should be able to discern the direction of each C from a distance of approximately 485 feet.

The most common normal vision is 20/20 (or 6/6) which means that an observer can read the letter from 20 feet (6 m) that a normal observer with perfect or corrected vision can read from 20 feet (6 m). An observer with 20/40 vision means that the observer can read a letter from 20 feet (6 m) that the normal observer can read from 40 feet (12 m).

On unlit roads, many of the letters might not be discernible. Earlier there was a discussion related to the size of the character. Yet other variables that influence the ability to discern the character include contrast and lighting. The contrast gradient panel is set up so that there are an equal number of darker letters on lighter backgrounds, and lighter colored letters on darker backgrounds.

Also of note is that the gradient panel shows shades of gray. Drivers get very little color information when lighting is less than 3 lux (0.3 fc), therefore, drivers are frequently attempting to identify shades of gray.




## PROCEDURE

It is recommended that the gradient panel be placed along the roadside near the impact location. When taking photographs of the site, note the distance from impact for each photograph. Record camera settings (f-stop, shutter speed and ISO). For an unlit road, start with an ISO of the highest capable for that camera. The maximum ISO (also known as “film speed” or sensor sensitivity to light), is usually 3200 or 6400 for many digital cameras. Many photography enthusiasts might argue that such a high ISO (sensitivity) will yield grainier photographs. Recall that the purpose of these photographs is not for pleasing the observer but instead for documenting evidence, specifically the lighting and contrasts in a fair and accurate way. The higher the ISO, the faster you can set your shutter speed. The higher ISO is much more forgiving of what comes next.

Obtain a vehicle with similar headlights. A similar headlight includes the headlight of a vehicle from a similar model year and within one bulb type. For instance, if the crash vehicle was a 2006 model with 9006 headlight bulbs, a 2003 through 2009 vehicle with 9003, 9004, H7, or H11 headlights have had statistically similar headlight outputs. Make sure the vehicle is running at all times. When the vehicle engine is off, voltage to the headlights decreases, and so does the headlight output. When the vehicle is a bus that kneels, or a vehicle with swivel headlights, the vehicle should be kept in DRIVE, or in gear with the foot on the brake and the parking brake engaged. Headlights do not swivel when the car is in PARK. The vibration from a running vehicle can be overcome by higher ISO, hence, the necessity for the greatest ISO.

On an unlit road, start with a F-stop near 4.5 and a shutter speed of $1/8^{th}$ of a second. If the resulting photograph is too bright, increase the shutter speed or the F-stop. The choice of increased shutter speed or F-stop depends upon your demands. When there are numerous street lights in the area, increasing the shutter speed reduces the blooming effect from street lights. When taking a photograph of a small object from more than 200 feet (60 m) away, the depth of field might become more imperative which means that F-stop should be increased. Take photographs after each increase in the F-stop and/or shutter speeds until you find a photograph that is too dark. Then return to the combination of F-stop and shutter speed that resulted in the photograph that shows the contrast gradient the best when compared to what you see.

If the first photograph is too dark, decrease the F-stop to 4.0 and decrease the shutter speed to $1/6^{th}$, or $1/4^{th}$ of a second. When the shutter speed is so slow, vibrations, and blooming from street lights become more pronounced. However, there is usually very little light in the area when the camera settings are set so low. When the lighting in the area allows for a shutter speed greater than $1/20^{th}$ of a second, and the resulting photos are still bright, you can increase the F-Stop. A greater F-stop allows for more depth of field. A greater depth of field is desirable at greater distances.

For those of you who do not have the luxury of stopping on a road to take a photograph, photographs from a moving vehicle might be necessary. If so, ISO must be maximized as well as the shutter speed. Increased shutter speeds decrease blurring. Therefore, try to use a shutter speed of $1/30^{th}$ of a second and ISO of 6400, or 3200. Then modify the F-stop accordingly, with lower F-stop to get a brighter shot, and greater F-stops for darker shots and more depth of field.

## RECORDINGS

Record what is seen on the contrast gradient at each photograph distance. Note which of the ten Cs can be fully discerned and record the direction the C was facing. Then record which Cs could be discerned as characters, but with an unknown opening direction. Lastly, record the squares that stood out from the background. For instance, when at 200 feet (60 m), you might be able to recognize the direction of 2 Cs, and you might be able to recognize that there are two other Cs, but you cannot discern the direction of the opening. Two of the square shades might be able to be discerned, but the other contrast being unidentifiable (blended with the background). Therefore, for this example you would record which of the ten contrasts Cs were identified, which were seen but not identified, and which squares were detected. Repeat this for multiple locations (distances from impact) where photographs were taken.

Also, consider recording what can be seen when looking directly at the contrast panel and when looking to one side or the other of the panel. Few drivers will be lucky enough to be looking directly at a target when it is first discernible when looking directly at it. These indirect glance recordings might be more like what the driver faced.

## OUTPUT

When printing the photograph, or displaying the photograph, use these notes to assist in replicating the desired output. As an example, if you saw 6 squares, 4 characters, and could identify the direction of two C characters, then that is what should be seen in the subsequent photograph or graphical display.

Make sure the resulting display shows the target at the proper perspective. For example, suppose you are taking a photograph of a pedestrian who is 5 feet tall from a distance of 200 feet. If showing that pedestrian in a photograph viewed from 20 inches, the pedestrian should be displayed at the same perspective, or 0.5 inches tall. Displaying the target at a larger size will make the target appear to be more conspicuous. Displaying the target at a smaller size makes the target less conspicuous.

When exemplar clothing is not available, the various contrasts can be utilized for a comparison. A person wearing light colors might be similar to a white or light gray square on the contrast gradient, while a pedestrian wearing dark clothing might appear more like the dark gray or black squares.