

# Calculations Glare Rating (GR Observer)

## Details

### What is UGR?

The Unified Glare Rating (UGR) is a key metric for evaluating discomfort glare in indoor lighting environments, focusing on the direct light component. Recently, it has gained importance for obtaining WELL certification points. Under the L04 Electric Light Glare Control feature in WELL v2 of the WELL Building Standard, achieving a UGR of 16 or lower is recognized for both luminaires and spaces frequently occupied. This method of glare assessment is outlined in several CIE documents, including CIE 117-1995, CIE 190-2010, and CIE 232-2019.

When Glare Rating is specified, grids are created for each observer position that duplicate the specified horizontal illuminance grid. Each GR grid is identified by its correlated observer position, which are labeled sequentially, Obs\_1, Obs\_2, etc. In Project Manager, each GR grid is identified by its observer position and calculation points label.

For example, a horizontal grid labeled "football" with one observer position would have a Glare Rating grid associated with it called "football-Obs\_1." In Project Manager, there would be two related grids associated with football: the horizontal illuminance grid "football" and "football-Obs\_1."

The Glare Rating calculation does not take reflective or obstructive entities around or within the GR grid into account.

### Veiling Luminance Equations considering luminaires and environment

$L_{VL}$  = Veiling luminance on the eye produced by the luminaires for one point.

$i$  = the current luminaire being considered.

$n$  = total number of luminaires in the job file.

$E_{(eye), i}$  = the illuminance produced on the observer's eye in a plane perpendicular to the line of sight, produced by the  $i$ th source, in lux.

$q_i$  = the angle between the observer's line of sight and the direction of light.

$L_{VE}$  = Veiling luminance on the observer's eye produced by the environment.

$E_{hor,av}$  = Average horizontal area illuminance (ground plane).

$\rho$  = the reflectance of the area assuming diffuse reflection.

$\Omega$  = the unity solid angle in steradians.

### Nine Point Glare Assessment Scale

When glare rating was first experimented with by CIE researchers, a glare control mark GF was used that relates to the Glare Assessment scale shown below. As the GF marker increases in value, the better glare restriction that is provided by the installation. The glare assessment scale provides meaningful visual information regarding the differences in glare rating values.

Glare Control Mark GF		Glare Rating GR
1	Unbearable	90
2		80
3	Disturbing	70
4		60
5	Just Admissible	50
6		40
7	Noticeable	30
8		20
9	Unnoticeable	10

A variation of +/- 0.5 in Glare Rating is equivalent to an experimental accuracy ratio of +/- 5% in the Luminance ratio.

### Recommended Glare Rating Limits

To ensure that glare is not excessive in any normal viewing direction at any normally accessible point on the illuminated area, the maximum value of GR should always be less than the recommended value of GRmax.

### Area Lighting Applications

Type of Application		GR Max
Safety & Security	Low Risk	55
	Medium Risk	50
	High Risk	45
Movement & Safety	Pedestrians Only	55
	Slow Moving Traffic	50
	Normal Traffic	45
Work*	Very Rough	55
	Rough-Medium	50
	Fine	45