MIDSTREAM

The Practical Application of Refraction Lenses

Large Area Lighting, especially Airport Apron Lighting, requires specific technology and know-how to deliver desired results.

The optic system of choice will play a big part in the suitability of a Luminaire for this application.

Some of the key problems are addressed in this document:

Glare:

Glare is a bone fide concern.
Highly concentrating optics, with symmetrical light emission, can cause glare problems for pilots taxiing to Stands as a result of high cd/Klm intensity in the peak. Lamps with this somewhat outdated optical systems may show satisfactory GR ratings on a lighting simulation (due to a flaw in the calculation formula which was created for standard discharge lamps) but the actual results will differ when installed in an airport environment. The luminaire will need to be tilted to the desired angle of emission in order to make itself asymmetric and thereby generate peaks of emission in every direction and result in a high level of glare from multiple angles.

Refraction optics can create very asymmetric emissions on the C0-180 plane whilst still being diffusive on the C90-270 plane. This allows much reduced tilting and less intense cd/Klm peaks along the photometric, resulting in a more comfortable light.

Uniformity:

Highly concentrating optics illuminate areas with a technique known as “Multispot”.

This technique consists of illumination by creating a pattern of lighting spots across the target area. This technique was often implemented in street lighting in the early years of LED technology, and has since been abandoned as refraction lenses became more readily available in the market. Some companies are still employing Multispot technique in the large area lighting due to the challenge of developing highly asymmetric refraction lenses.

Multispot technique is dangerous is live apron applications - in the case of failure of a single lamp, a part of the apron will remain dark.

Refraction optics use a technique known as “Multilayer” which allows the light to spread over a large surface, resulting in a much higher uniformity, and a safer environment in case of failure of a single unit.

Efficiency:

The most efficient system today utilizes Refraction lenses.

Refraction lenses allow for easy arrangement in an IP rated matrix therefore not requiring a glass screen. The optical efficiency of a lens matrix can vary from 89 to 96% depending on the photometric.

TIR (total internal reflection) lenses can have good efficiency in redirecting light (75-85% depending on the angle) but are difficult to arrange in arrays, so they are usually installed singularly and have to be protected by a glass screen that will absorb up to a further 7-8% of the light emission.

Cone reflector have the advantage of being the cheapest options but have a poor efficiency and a fast light depreciation. They also require a glass screen. They are slowly being abandoned for outdoor luminaires.

Conclusion

LEDs are directional sources of light rather than omni-directional from traditional sources of light. For LEDs with reflectors, much of the light at the centre of the beam passes out of the system without even touching the reflector. This reduces the scope of modulating the beam of light and is a very visible source of glare. Lenses help guide virtually every ray of light emitted by the LED.

Highly concentrating optics (TIR Lenses or Cone reflectors) are not suitable for Large Area Lighting applications such as Apron lighting.