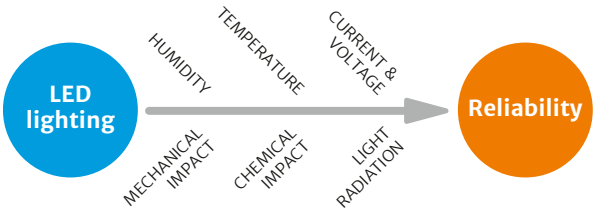
Improving the reliability of lighting systems

Lighting system reliability is the product of all of the individual reliability considerations, like LEDs, optical systems, printed circuit boards, mechanical components, thermal reliability of LED luminaire life is also a function of the power supply, operating temperatures, thermal management, materials, and electrical and material interfaces.

The most influencing factors[1]

The most important physical influencing factors on the reliability and lifetime of LED light sources include humidity, temperature, current and voltage, mechanical forces, chemicals and light radiation, which could lead to a total failure or influence the aging characteristics in the long term.



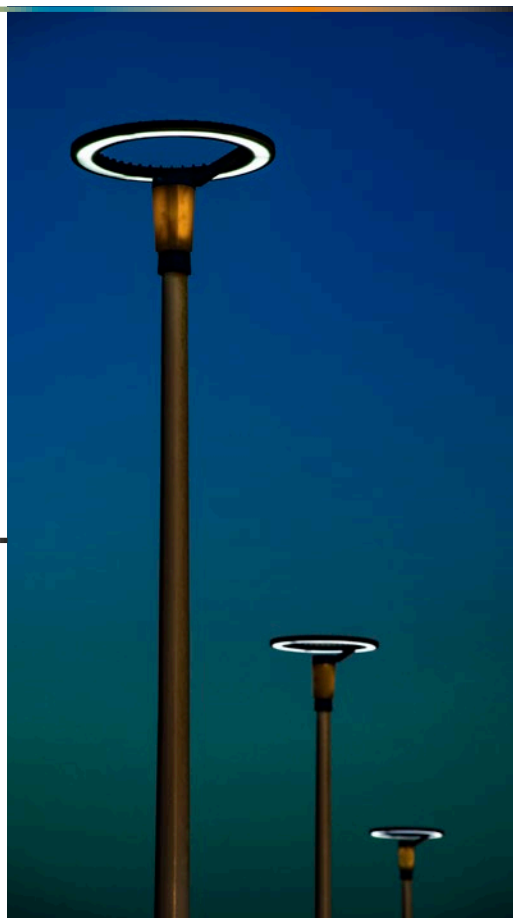


Photo: Shutterstock

Better planning of lighting systems[2]

- Plan and use high-quality LEDs from manufacturers who publish reliability data.
- Ask for luminaire warranty from manufacturer, at least comparable to traditional luminaires used for the application under consideration.
- Ask for photometric reports for luminaires, based on LM-79-08 test procedure, from an independent testing laboratory.
- Integrate remote monitoring of light points, to save on operational costs and prevent issues before they happen.
- Ensure modularity and emphasise recyclability, by enabling more efficient and longer use of components.
- Take seriously into account temperature data for the LED and information about how the measured temperature relates to expected life of the system, when operated in the luminaire in the intended application.
- Ask for test data about long-term performance of the LED luminaire.

More than 60% of lighting system failures are related to the driver.

Advantages of longer life may not be realised if the expected use cycle is less than the lifetime.

See next page for more information

Classification of failure categories[3]

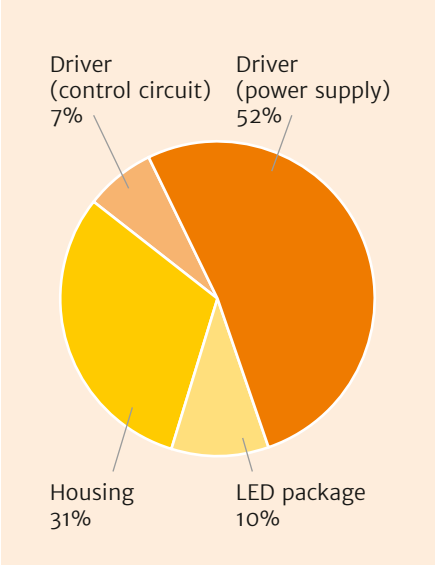
DRIVER (POWER SUPPLY) includes power supplies and contains all failures related to the power supply or its inability to perform as specified by the luminaire manufacturer.

DRIVER (CONTROL CIRCUIT) includes control board(s) or other control devices, if they are separate and unique from the power supply, including controls that monitor and/or manage the luminaire's operational state.

HOUSING INTEGRITY includes failures from loss of housing integrity, resulting in moisture ingress, debris accumulation, structural failures, etc.

LED PACKAGES includes traditional end-of-life lumen degradation, chip package failures, significant color shifts, etc.

ELECTRICAL CONTACT includes wiring and connector failures and any general connectivity issues resulting in failure or faulty functioning of the luminaire.



Main technical requirements[4]

- New LED-based light sources shall have a rated life at 25°C of:
  - L96 at 6,000 hours,
  - L70 at 50,000 hours (projected),
  - C0 at 3,000 hours or C10 at 6,000 hours,
  - C50 at 50,000 hours (projected).
- The specified control gear failure rate shall be lower than 0.2% per 1,000 h and be covered by an 8-year warranty for control gear.
- The repair or provision of relevant replacement parts of LED modules suffering abrupt failure shall be covered by a warranty for a period of 5 years (GPP core criteria) from the date of installation.
- Components must be identifiable, accessible and removable without damaging the component or the luminaire.

Requirements for tenderer[4]

- The repair or provision of relevant replacement parts of LED modules suffering abrupt failure shall be covered by a warranty for a period of 7 (GPP comprehensive criteria) years from the date of installation.
- Test data regarding the maintained lumen output of the light sources shall be provided by an International Laboratory Accreditation Cooperation-accredited laboratory that meets IES LM-80* for actual data and IES TM-21* for projected data.
- To provide a technical manual, which shall include an exploded diagram of the luminaire illustrating the parts that can be accessed and replaced. The parts covered by service agreements under the warranty must also be indicated.
- To provide the technical specifications, demonstrating that ingress protection rating criterion has been met according to IEC 60598-1 clause 9.
- To provide a declaration of compliance with the above failure rate for any control gear it intends to supply. The declaration shall be supported by relevant industry-standard testing procedures.

See also:

1 www.midstreamlighting.com

2 www.brandon-lighting.com and www.solarlighting.com

3 www.nglia.org

4 https://ec.europa.eu/environment/gpp/index_en.htm