

Road Safety Engineering Award 2010

About LED Roadway Lighting Limited

LED Roadway Lighting Limited (LRL) is the leading designer and manufacturer of LED (light-emitting diode) based street lighting fixtures. LRL is located in Nova Scotia, Canada, with research and design facilities in Halifax and a 5,100 m² ISO certified manufacturing facility in Amherst, Nova Scotia. LRL offers a complete range of LED-based street lighting fixtures, which have been implemented in over 100 installations in Canada, the United States, Europe, and the United Arab Emirate in a ten month period.

In 2006, LRL embarked on a multi-million dollar R&D program to develop the world's most energy efficient LED street light, and bring the technology to commercial viability. LRL benefited from 30+ years of experience in the technical sales and marketing of lighting products through sister company C.S.A. Enterprises Limited, as well as the electronics manufacturing expertise of sister company C-Vision Limited. C-Vision Limited has extensive experience in the high-volume electronics manufacturing of RoHS (Restriction of Hazardous Substances) compliant products and was one of the first companies in North America to obtain IPC certification for lead-free manufacturing. The end result of these efforts is the Satellite™ Series of products.

The Satellite™ Series Fixture

LRL has developed the world's highest performing roadway luminaire with unique patented optical, electronic, and thermal management systems, and an unparalleled complete 20 year design life. As a result, the Satellite™ Series offers municipalities, utilities, and commercial clients both substantial energy and maintenance cost savings. Before the Satellite™ luminaire's end of life occurs, a typical High Pressure Sodium (HPS) fixture will require re-lamping at least 4 times and may also require additional service to the ballast and photocells. This translates into substantial life cycle cost savings.

Users can expect an average energy savings of 60% with LRL's Satellite™ Series (vs. HPS), while still maintaining Illuminating Engineering Society (IES) RP-8 or Commission Internationale de L'Eclairage (CIE) recommended lighting levels. The Satellite™ Series has the highest efficacy on the market at 80 Lumens/Watt (based on independent, third-party testing). Innovative dimming features have also been incorporated into the product to allow additional savings and flexibility for end users.

LRL's proprietary combined reflector and lens optical system provides extremely efficient light distribution with maximum target lumens directed to the road surface. The reduction of light trespass results in an approximate 30%-40% improvement in target lumens over HPS and many LED competitors. LRL's Satellite™ Series is International Dark Sky Association (IDA) certified with no upward light pollution to the sky.

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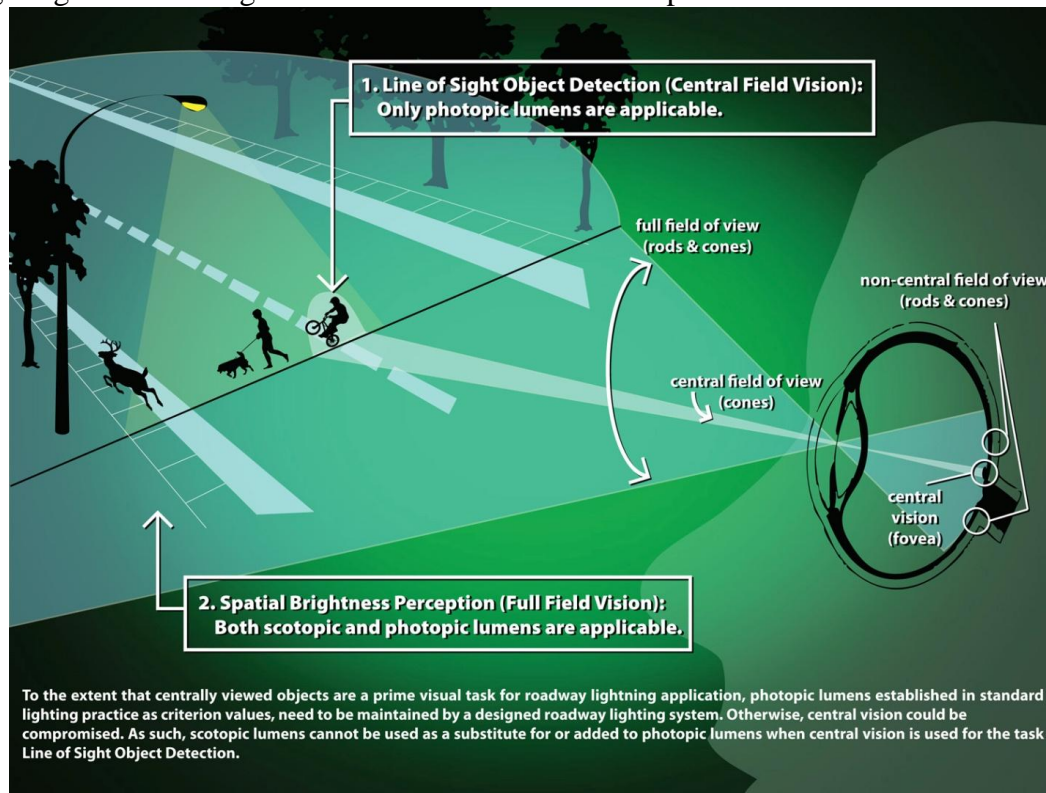
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Our model SAT-96-M fixture for example, can meet the requirements of IES RP-8 at pole spacing of up to 60 metres. Our thermal management system uses the luminaire's single piece die-cast aluminum housing itself as the means to dissipate heat. Our LED fixture thermal model design provides for cool operation, i.e. at an operating current of 280mA, our LED junction temperature is 45°C (well below the maximum LED cut-off temperature of 135°C at an ambient temperature of 20°C). This results in better fixture efficacy and lower light loss factors over 20 years.

Product development of a complete suite of wireless, and power line carrier control systems, and renewable energy powered systems with solar and wind powered models are underway.

The Road Safety Initiative: Photopic Lumens

LED Roadway Lighting has always had a high level of safety standards. When creating the Satellite™ series of LED fixtures, LRL researched to find out how to build a better street light. They wanted to make a brighter, more energy efficient light that provided the proper lumens to necessary for Central Field Vision, where the Vulnerable Road Users (as defined by CCMTA's Standing Committee on Road Safety Research and Policies) would be. By creating street lights that provides the proper levels of photopic lumens, LED Roadway Lighting Ltd is making the streets safer for drivers and pedestrians.



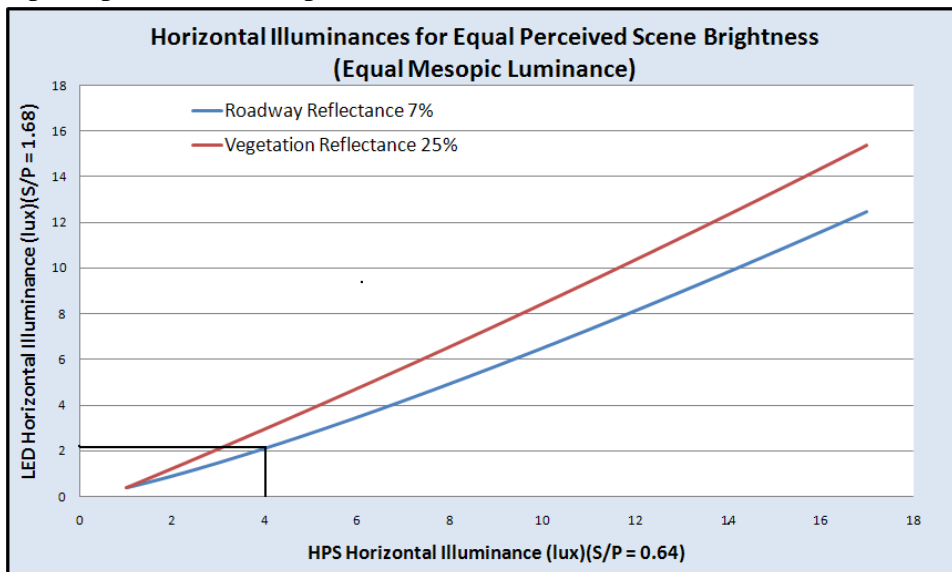
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In the human eye, there are photoreceptors referred to as rods and cones. At light levels that are typical at night where streets are illuminated by street lights, both the rods and cones are active in producing images that are processed and perceived. However, for street lighting, where the principle visual task is to recognize an object on the street, the visual receptor that is key to on-axis vision and object recognition is the cone in the fovea (as seen in the figure on Page 2). The fovea, which is located in the central part of the rear of the eye is responsible for perceiving objects in the direct line of sight (~2 degree solid angle). The fovea contains **only** cone receptors. Cone receptors respond primarily to photopic lumens, meaning that visual perception of objects in direct line of sight is critically linked to photopic lumen output from street lights.

For white light LED based street lights, which contains significantly higher amounts of scotopic lumens than a technology, standard HPS light, there is an opportunity to reduce the overall input electrical energy and still provide equivalent brightness. This must be done with prudence since direct line of sight visibility will be reduced. This kind of overall reduction in light level, based on brightness perception, does not apply to street lighting where a reduction in photopic lumen output reduces the ability of a driver to see objects on the roadway, such as Vulnerable Road Users, when travelling at normal driving speed.

To achieve equivalent scene brightness, the table below (on Page 4) shows the Lux levels in photopic lumens from both LED and HPS lighting fixtures. At a required light level of about 2 lux, the LED light only needs to emit 50% of the photopic lumens compared to an HPS fixture.



Horizontal illuminance equivalence for LED light (S/P=1.68) and HPS light (S/P=0.64)

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A reduction in photopic light levels below standard lighting specifications, on the basis that scotopic lumens can be added to photopic lumens, ignores the fact that only photopic lumens are involved with direct line of sight object recognition, where primarily cone receptors in the fovea are activated. For good lighting practice applied to street, roadway, and highway lighting applications, it is essential not to deviate from the IES (Illuminating Engineering Society) RP-8- 00 specifications [11] or CIE (International Commission on Illumination) 115-2005 specifications [4] that define photopic light levels. These specifications are based on the determination of the minimum amount of photopic lumens required for safety and security in Direct Object Recognition applications, such as a Vulnerable Road User, for example a pedestrian crossing a roadway.

To the extent that centrally viewed objects are a prime visual task for roadway lighting applications, photopic lumens established in standard lighting practices as criterion values need to be maintained by a designed roadway lighting system. Otherwise, central vision could be comprised. As such, scotopic lumens cannot be used as a substitute for or added to photopic lumens when central vision is used for the task Line of Sight Object Detection.

The Innovation in the Initiative

LRL has a designed a revolutionary, patent pending lens optics and reflection system. The patent pending reflection system allows us to efficiently focus the LED light into the lens optics in a way that no other LED street light manufacturer has been able to accomplish. Once this light is focused into the lens optics system, our unique optics design allows us to distribute light in a pattern that meets international light level requirements, RP-8 (North America) and CIE (Europe), as well as distribution patterns that have not been achieved by any other company trying to produce an energy-efficient LED street light. We have been advised by the senior executive team of the largest LED supplier in the world, Nichia (of Japan), that we have by far the most sophisticated street lighting design and highest performance fixture in the world. We have also received the same feedback from senior management of Toronto Hydro.

Applicability to Transportation

Following CCMTA's Road Safety Vision 2010 Sub Target of Vulnerable Road Users and decreasing the number of fatal or serious injuries by 30%. A Vulnerable Road User is defined as a pedestrian, including any device operated by a pedestrian, recreational vehicles, when operated on a highway, cyclists, motorcyclists and the operator of any two-wheeled or three-wheeled vehicles. The Vulnerable Road Users are in the direct line of sight of the driver. By creating an LED Street light with the necessary photopic lumens the drivers are able to better see the Vulnerable Road Users, making the streets safer for all.

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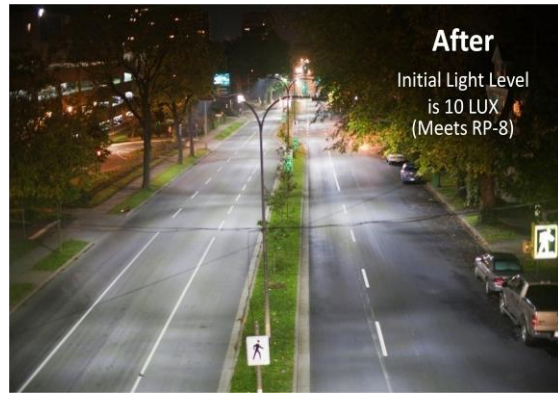
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Testimonial

"I've been a bus operator for twenty years, and believe LED roadway lights, from LED Roadway Lighting have a more consistent, and natural looking light when compared to traditional street lighting.

I spoke with at least twelve bus operators, who also believed the light was more consistent and a more natural looking light. The feedback was all positive with operators referring to light as having no glare, along with no dark spots. Several mentioned it was easier to see pedestrians. When they were told of the energy savings, they were very impressed, and believe the city should install more of them."

Ken Hatcher - Metro Transit Bus Operator (Halifax, NS)



As people are becoming more aware of their impact on the environment, they are trying to use less energy, more environmentally friendly products and their negative environmental footprint. LRL's Satellite™ Series fixtures are substantially more energy efficient than current technology. They are much more environmentally friendly because they are free of lead and mercury, and are fully recyclable.

A complete Canadian conversion to LRL's fixtures would create over 8,500 jobs in manufacturing, supply chain and installation. With a 20 year design life, there is little to no maintenance involved, resulting in fewer disruptions on the street. Fewer re-lampings means less dark spots on the road, creating a safer environment for all road users. Less maintenance costs lead to savings and a faster return on investment. This is a product that is excellent for Canada, and the transportation industry, in regards of road safety, the environment, and cost savings.