



GE Evolve™

Next Generation Roadway Luminaires & Control Solutions

*Re-imagining roadways for the **future***

current
powered by GE



Street-smart *from the start*

Over a century ago, GE created the first streetlights, and we've been mastering the technology behind roadway fixtures ever since. More than one hundred years and thousands of miles of street lighting later, our passion for innovation still burns bright.



In 1962, GE scientist Dr. Nick Holonyak Jr. invented the first visible LED, leading the way to the next generation of lighting solutions. Today, we have applied our expertise in outdoor fixture and LED systems design to bring you our next generation **GE Evolve™ LED Roadway & High Mast Luminaire** fixtures.

Building on a reputation for excellence that dates back to Edison's first electric light bulb, GE brings a depth of expertise that's unsurpassed in the industry. From day one, we've been here, ready to work with you to provide a solution that helps save energy while bringing greater aesthetics and overall cost savings to city streets and roadways.

*And you can count on **GE** to be there
as we continue to lead the **lighting revolution**.*



Differentiating factors

We've applied the science of light and our expertise in roadway fixtures to integrate application efficiency and reliability into every Evolve ERL & ERHM fixtures. The foundation of our exceptional, high-performance LED roadway lighting solution revolves around GE's custom designs.



optical
design

Unique reflective optic design

- Non-pixelated light distribution to minimize distracting glare
- Optimized to meet IESNA RP-8 recommended practices for luminance, illuminance and small target visibility design
- Excellent light control aims the light directly where you need it
- Low light trespass and zero up-light
- High optical efficiency and utilization of light
- Lower power consumption required for the target roadway space



electrical
design

One manufacturer of complete system

- Reliable GE Lightech™ LED Driver powers the GE Evolve™ LED fixture
- Entire system, including driver, fixture and controls are made, tested and warranted by the same manufacturer to ensure long-term system reliability

Standard surge protection against multiple strikes

- Surge protection against multiple strikes comes standard, with optional high-capacity protection available



mechanical
design

Removable power door assembly

- Makes electrical components easily accessible for replacement or repairs
- Tool-less or single-tool entry and quick connects

Dust & dirt mitigation

- Flat tempered glass lens and IP65 rated enclosed cavity minimize effects of dirt to provide consistent light distribution over the life of the product



reliability &
performance

Extensive testing of the LED, subsystem and complete system

- Conforms to the most stringent regulatory and performance requirements including UL, Design Lights Consortium (DLC) and International Dark-Sky Association (IDA)
- Provides applicable supporting performance documentations such as including TM-21, LM-79 and LM-80 reporting methods
- Rather than rely solely on test data from LED suppliers, we extensively test the complete system to validate performance



controls
capability

Available with wireless network control capability

- GE LightGrid™ Outdoor Wireless Control System allows remote monitoring, utility-grade energy metering and GPS mapping of streetlights
- Adaptive controls ready, without any additional internal electrical components required



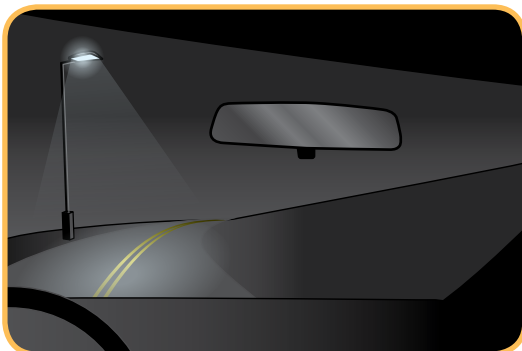
Optical design

Aiming to please

GE uses an advanced reflective optic design that meets RP-8 recommended practices for luminance, illuminance and small target visibility. This unique design ensures that Evolve ERL fixtures will deliver light control with significantly less waste than the other optical technologies used by many of our competitors.

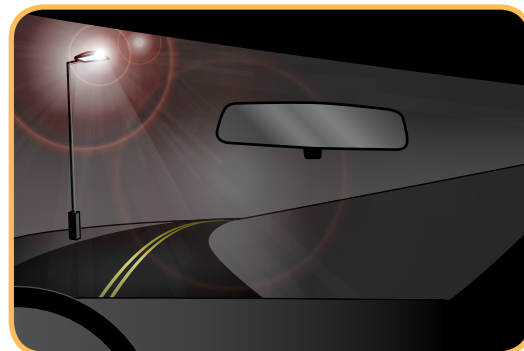
Evolve ERL fixtures have improved ratings for backlight, up-light and glare (BUG ratings) to direct more light on the road and not in neighboring properties or in the eyes of nighttime drivers, meeting tight local ordinances and International Dark-Sky (IDA) requirements.

GE



Our unique reflective technology allows us to focus light where it's needed – on the road – with less glare.

COMPETITION



The refractive technology design used by other manufacturers typically results in more wasted light trespass and glare for drivers.

Minimizing glare

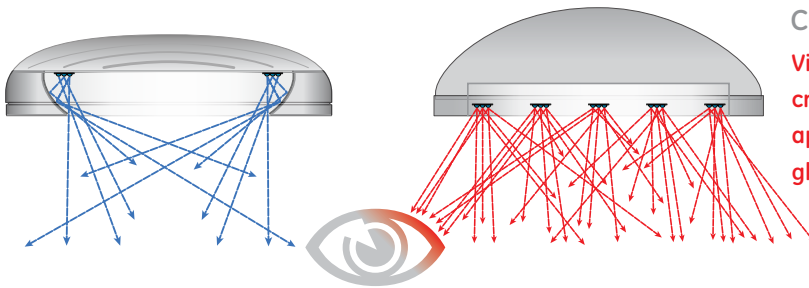
GE's innovative reflective design only puts light where it is needed and minimizes direct view of the light source with a non-pixelated appearance.

GE design recesses the LED array within the optic (or reflector) to limit visibility of the LEDs from the drivers' field of view, minimizing glare. Many competing optical designs use LED arrays with individual optics, making the entire array visible to the driver, resulting in a pixelated appearance with higher levels of glare and increased light trespass.



GE

Minimized visibility to LED light source, creating non-pixelated appearance to driver's field of view

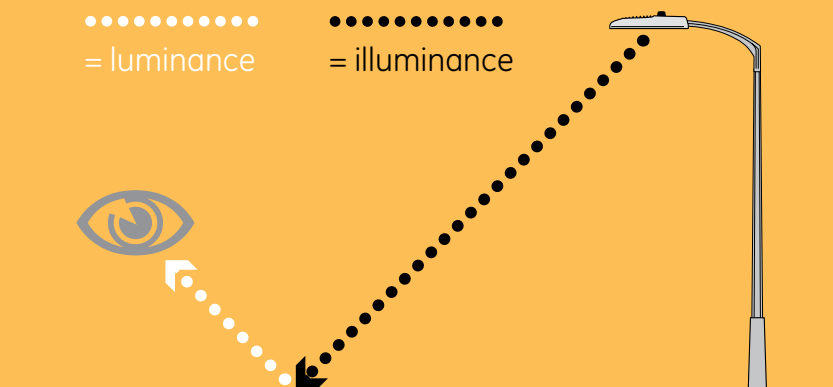


COMPETITION

Visibility to every LED, creating a pixelated appearance and increased glare to driver's field of view

Why is luminance an important focus of GE's optical reflector design?

GE optical design provides outstanding overall visibility while driving, offering reflector optics that were designed with the driver in mind. This design only puts necessary light at and above 45° angles, reducing glare to the driver. GE provides consistent luminance uniformity in the driver's center field of view, while many competing products have greater variation. GE also ensures reduced glare at the critical angles, improving small target visibility which allows drivers to detect objects faster while driving. The uniformity of light in the driver's field of view improves the retina image. Designing for the driver's field of view with consistent retina light levels provides excellent overall visibility while driving.

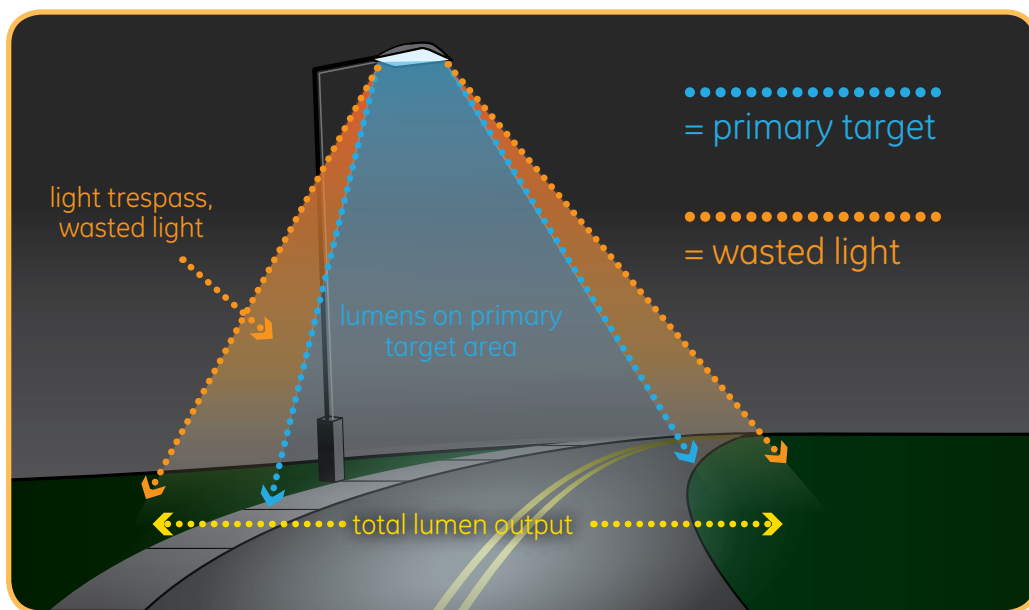




Optical design

Light on target: coefficient of utilization

By putting energy toward the task of lighting the roadway and not the surrounding area, Evolve ERL fixtures put light where it is intended and provide more efficient utilization of light. This is known as coefficient of utilization or (CU), and is a key characteristic of any fixture when determining its ability to light the intended area. A higher CU means less wasted light which, in turn, means lower energy consumption. This will reduce costs over the life of the fixture.



Efficiency in action

- Lumens per Watt (LPW) = Total Lumen Output/Total Watts
- Coefficient of Utilization (CU) = Lumens on Primary Target Area/Total Lumen Output
- Higher the Coefficient of Utilization (CU) = Less Wasted Light



Electrical design

Dependable drivers

Reliable GE Lightech drivers power Evolve ERL roadway fixtures. You can rest assured that the entire system, including driver, fixture and controls, is made, tested and warranted by the same manufacturer to ensure long term system reliability.

Surge protection

LED fixtures require robust surge protection devices to protect valuable components from voltage spikes and surge events over their operating life. Many surge protection devices are only rated for a single event. GE knows that a product's ability to survive repetitive events is key to maintenance-free operation.

GE's standard transient voltage surge suppression (TVSS) exceeds the U.S. DOE Municipalities Solid State Lighting Consortium (MSSLC) specification for surge protection devices. Evolve LED roadway fixtures come standard with a surge protection device verified to provide protection against at least 120 combination wave events of 6kV/3kA per IEEE/ANSI C62.41.2-2002. An optional high-capacity protection device that can survive up to 5,000 6kV/3kA events or 120 10kV/5kA (UL 1449) events is also available.

Surge hit tolerance comparison

RATINGS OF MOST COMPETITOR OFFERINGS	NUMBER OF STRIKES PROTECTED AGAINST
	1-30
GE STANDARD OFFERING (6kV/3kA)	120

FOR SITUATIONS REQUIRING PROTECTION AGAINST
MORE POWERFUL STRIKES

GE OPTIONAL HIGH-CAPACITY OFFERING	5,000 6kV/5kA
	120 10kV/5kA



Mechanical design

Flexibility in design

GE offers a range of roadway lighting solutions to meet a wide variety of key customer requirements:

- Complete scalable lumen range
- Wide range of photometric selections
- Optimized wattage choices with drive current options
- Lumens per watt
- Luminaire feature content
- Surge suppression options

Fixtures that stand the test of time

Advanced engineering at its best, Evolve ERL & ERHM balances the technical needs of a sophisticated LED system with the functional demands of an outdoor fixture facing the year-round hazards of Mother Nature. The Evolve ERL & ERHM has a broad operating temperature range of -40°C to $+50^{\circ}\text{C}$, going above and beyond most standard fixture ratings to withstand potential extreme conditions.

The surface is protected by corrosion-resistant polyester powder paint applied at a minimum thickness of 2.0 mil to accommodate the long life of the fixture.





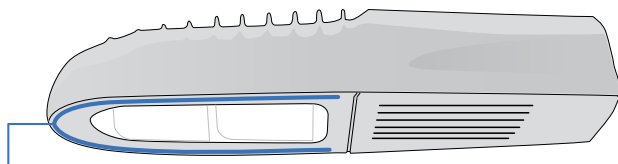
Sometimes, flat is better

Those crevices, pockets and ridges in competitor outdoor luminaires can become the perfect places for dirt and grime to collect—potentially reducing overall LED light output and impairing the intended pattern of light distribution. This problem is called Luminaire Dirt Depreciation (LDD) and it can reduce the performance of your outdoor LED lighting.

The Evolve fixture houses the LEDs and reflectors in a dirt- and dust-free cavity with an IP65/IP66-rated optical enclosure and a tempered glass lens to minimize the effects of dirt. This design approach provides consistent brightness and light distribution over the life of the product.

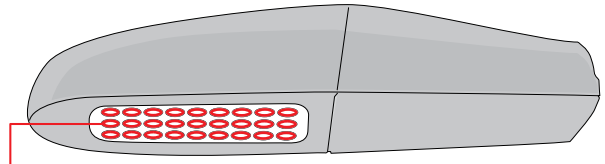


GE



Flat, tempered glass lens protects the LED optical enclosure. Lens surface is smooth and flat which is less prone to dirt accumulation.

COMPETITION



Designs that have exposed refractive optics have more crevices (or surfaces, edges, pockets) prone to dirt accumulation that could adversely affect the beam distribution pattern.

A recent Illuminating Engineering Society report* on LDD stated:

“LED luminaires with flat glass optics were less susceptible to average dirt depreciation than luminaires with exposed inner optics...With exposed optics, especially the individually molded acrylic, the surface of the optic is much more complex, has significantly more leeward edges, and significantly more surface area. These features will cause much more turbulence over the exposed optics, enabling dirt to accumulate on each individual optic and likely leading to more dirt sticking.”

*Source: Illuminating Engineering Society, RES-1-16 Measure and Report Luminaire Dirt Depreciation (LDD) in LED Luminaires for Street and Roadway Lighting Applications; page 71, Gibbons, Palmer, Meyer, Terry



Reliability & performance

Tried and true

Impressive long-life technology makes LED systems a long-term investment. Lasting significantly longer than traditional lighting sources, LED systems offer tremendous energy and maintenance savings that easily justify their higher upfront cost. But not all LED systems perform equally over their years of operation.

Inferior quality products can prematurely fail or degrade in light output far below initial claims — which results in failure to provide the value originally promised. At GE, our product life ratings recognize acceptable light levels for any given application to ensure you won't be left in the dark.



Rather than rely solely on test data from LED suppliers, we extensively test the complete system, using both in-house and independent labs around the world to validate performance. GE has accumulated more than 1 million unit hours of testing and more than 16,000 hours of testing at +60°C ambient, going beyond the industry's standard level of testing to ensure our fixtures can live up to our claims.

At GE, we know our fixtures can stand the test of time because we've designed them that way. It is this diligent approach to quality assurance that has earned GE a reputation as one of the most respected names in the industry.





Control capability

You're in control

While some might be satisfied with winning awards and industry recognition, we've never stopped to rest on those laurels. Instead, our team went the extra mile to bring you a whole new level of flexibility, efficiency and control.

Evolve ERL & ERHM fixtures are available with both wireless and non wireless stand alone control capability. The control module connection is made externally through an optional dimming control receptacle, making Evolve fixtures adaptive control ready.

Compatible for use with control options ranging from a simple shorting cap to a standard PE photocell control or sophisticated **GE LightGrid Outdoor Wireless Control System**, this solution allows for easy upgrading to other control solutions down the road, without any additional internal electrical components required.



STANDARD
SHORTING CAP



STANDARD PE
PHOTO CONTROL



GE LIGHTGRID
OUTDOOR WIRELESS
CONTROL SYSTEM



ANSI dimming receptacle will accept any standard PE or GE LightGrid Outdoor Wireless Control System.



Intelligent design

LightGrid™ Outdoor Wireless Control System The Right Light at the Right Time

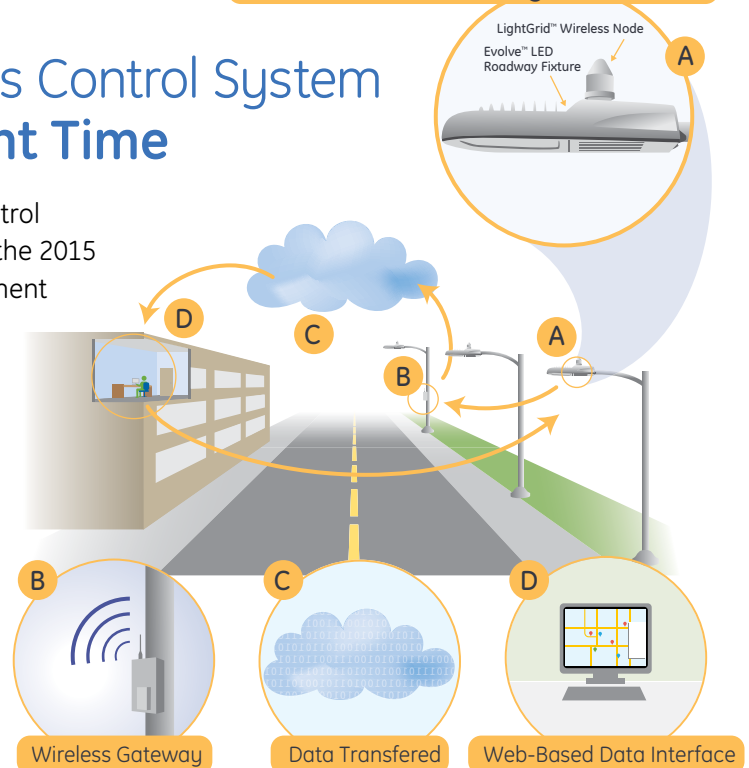
LightGrid™ is a groundbreaking outdoor wireless control system for street and roadway lights. Honored with the 2015 Gold Edison Award for Outstanding Energy Management and Conservation, the unique technology inside this system allows for remote operation and monitoring of all fixtures through a Web-enabled central management system.

Designed with municipalities and transportation departments in mind, LightGrid offers many features, including:

- Accurate, utility-grade energy metering per pole you pay for what is used
- GPS chip embedded into node always know the exact location of controllers and fixtures; node automatically connects to the network and acquires location in just minutes, reducing commissioning time.
- One-piece control no special electronics necessary in the fixture; node simply connects to external socket, so it can be added easily at any time
- Operates with programmed schedules in case of network outage

Together with award-winning Evolve™ LED roadway lighting fixtures, LightGrid will deliver the energy efficiency, reliability and flexibility needed to optimize street and roadway lighting.

It all starts with the LightGrid node.



Let there be light. How much is up to you.

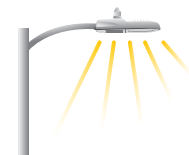
Control more with GE's LightGrid right from where you sit, and control costs every step of the way.



Control Metering



Control Maintenance



Control Output



The **LightGrid™** system is made up of three basic components:

LightGrid nodes

- Built-in GPS device lets you know the exact location of each fixture, which provides confirmation of installation, as well as making for more efficient maintenance
- Automatically connects to the network, reducing commissioning time
- Utility-grade metering means you pay for actual energy use, with measurement accuracy of up to $\pm 0.5\%$
- One-piece control ensures no special electronics are needed, as node connects to external socket

LightGrid gateways

Each LightGrid wireless gateway can control a mesh network made up of 500+ nodes. Protected by an IP66 enclosure, they're designed for reliable operation, even in the harshest environments.

- Automated GPS detection
- 500m line-of-sight range
- Output: Standard TCP-IP interface
- Input: 120-277VAC

LightGrid server

With LightGrid, lighting data for every fixture is accessible through a Web-based interface that can be hosted remotely. Protected by a high level of security encryption, our central management server offers secure login for all users.

Armed with actionable information, municipalities and transportation departments can implement smarter energy-saving strategies through more precise on/off and dimming schedules, particularly during a middle-of-the-night operation in low-traffic areas. Other features include the ability to:

- Update easily with "over-the-air" firmware upgrades
- Send automated fault email notifications when something happens to a fixture
- Display GPS coordinates in the Google Maps format
- Present real-time lighting information with a single click
- Access scheduling, customized reporting, grouping and user access level management
- Dim manually with detailed information



GE Evolve™

LED Roadway Luminaire

ERL Series — with **Next Generation Optics**



The **Evolve™** LED Roadway Luminaire is optimized for customers requiring a LED solution for local, collector and major roadways. GE's unique reflective optics are designed to optimize application efficiency and minimize glare. The modern design incorporates the heat sink directly into the unit for heat transfer to prolong LED life. This reliable unit has a 100,000 hour design life, significantly reducing maintenance needs and expense over the life of the fixture. This efficient solution lowers energy consumption compared to traditional HID fixture for additional operating cost savings.

Features:

- Lumen output ranging from 1,900 to 30,000lm
- Photometric Options: Type II Narrow, Type II Wide, Type III, Type IV
- Evolve™ light engine consisting of reflective technology designed to optimize application efficiency and minimize glare
- 70 CRI at 3000K and 4000K typical
- -40° to 50°C UL Ambient Typical
- Coastal Finish Available
- International Dark-Sky Association (IDA) compliant

Applications:

- Local Roadways
- Collector Roadways
- Major Roadway/Streets



Previous Generation Optics vs. Next Generation Optics



GE Evolve™

LED Roadway High Mast Luminaire ERHM Series



The **Evolve™** LED High Mast is optimized for customers requiring a LED solution for expressway, freeway interchanges and other large area applications. GE's unique reflective optics are designed to optimize application efficiency and minimize glare. This reliable unit has a 100,000-hour design life, significantly reducing maintenance needs and expense over the life of the fixture. The ERHM luminaire is an efficient solution lowering energy consumption as compared to traditional HID fixtures providing additional operating cost savings.

Features:

- Lumen output ranging from 28,800 to 58,300 lm
- Photometric Options: Type II Narrow, Type II Wide, Type III, Type IV
- 70 CRI at 3000K and 4000K typical
- Field rotatable optics
- -40° to 50°C UL Ambient Typical
- Coastal Finish Available
- Designed & Assembled in USA

Applications:

- Airport Lighting,
- Expressway and Freeway Interchanges
- Port Facilities
- Trailer/Container Yard and Rail Yard Operations





Total solution



The GE Advantage™

- 1 Discovery & Design**
Before we illuminate, we listen. By understanding your goals and the makeup of your existing infrastructure, we can optimize a design that will meet codes, legislation and your objectives.
- 2 Innovative Systems**
Our unique reflective technology and broad product portfolio mean the best possible lighting solutions.
- 3 Seamless Distribution**
Our recently re-imagined manufacturing facility and local support networks ensure products are available and on time.
- 4 Integration Services**
Whether it's new construction or an update of existing infrastructure, our network of partners provide turnkey installation solutions.
- 5 ROI Optimization**
We'll help you see financial benefits – as soon as the first month – through energy savings, utility rebate capture programs and financing options.



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