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## Street Lights Smart Solutions for Energy-Efficient Lighting

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COVERSTORY

# Street Lights

## Smart Solutions for Energy-Efficient Lighting in India

Neha Tripathi

**S**TREET lights rarely catch our attention — unless they are flickering or not working. We seldom turn our gaze towards the street lights lighting our path ahead. But if you have ever looked at the street lights in the villages, towns and cities across the length and breadth of the country you cannot help wondering at the mindboggling variety of street light designs as you move from region to region.

One often finds traditional lantern-style designs in rural areas, while in urban areas, the designs are modern and sleek. The street lights in rural areas of India are often made of metal or bamboo and are designed to look like lanterns. One of the most striking examples of street light designs in India is in the city of Jaipur. Known as the 'Pink City', Jaipur is famous for its beautifully designed buildings, with intricately and ornately designed street lights complementing the architecture.

Another city that stands out for its street light designs is Bengaluru. The street lights here are modern and sleek, and many of them use LED technology. The city has also installed



solar-powered street lights in some areas, which not only saves electricity but also helps to reduce carbon emissions.

Often, while modernising the infrastructure of a city or town, street light designs play a crucial part. They are not only essential for public safety but also for beautifying the surroundings. Without us realising, there is a lot of science and technology that goes into street lights. Let's explore the various aspects of street light design in India, including the types of street lights, their placement, and the factors that influence their design.

#### **Types of Street lights**

Street lights play a vital role in maintaining the safety and security of public spaces in India. In recent years, advancements in technology and urban planning have led to significant improvements in the design of street lights.



## History of Street Lights in India

Bangalore city, often referred to as the 'garden city of India' for its lush greenery and pleasant weather, has transformed over the years to become India's Silicon Valley. The city has also undergone tremendous changes in terms of its infrastructure, with the first street light being installed in 1905 in the Chickpet area, which at that time was a bustling market area. It was a kerosene lamp, which was manually lit every evening by the lamp lighter. This was the only source of illumination for the people commuting and working in the area.

However, with time, Bangalore started to grow, and the need for proper street lighting increased. As a result, in 1937, the Bangalore City Corporation decided to install electric street lights. The new street lights were installed in the central business districts and by 1940, more than 3,000 street lights were installed across the city. In the 1970s and 1980s, as Bangalore became the hub of India's IT industry, there was a significant increase in the population of the city. With a rise in population came the need for more advanced infrastructure. The street lighting system was upgraded once again, this time with the introduction of high-pressure sodium lamps.

In 2011, the Bangalore City Corporation initiated a project to replace the older street lights with energy-efficient LED lights. The new LED lights save electricity and have a longer lifespan than the previous lighting systems. Today, Bangalore's street light infrastructure has come a long way from the kerosene lamps of 1905. The city is now dotted with modern and energy-efficient street lights, which provide illumination to the city's streets and footpaths. The street lights are now controlled by a centralised computer system, making them more efficient in their usage of electricity.

In India, there are several types of street lights that are commonly used. These include:

1. **High-Pressure Sodium (HPS) Lamps:** These lamps emit a warm, yellowish light and are commonly used on arterial roads, highways and expressways.
2. **Light Emitting Diode (LED) Lamps:** LED lamps are energy-efficient and have a longer lifespan than High-Pressure Sodium lamps. They are used in residential areas, parks, and pedestrian walkways.
3. **Metal Halide Lamps:** These lamps emit a bright white light and are used in commercial areas and stadiums.

### Placement of Street lights

The placement of street lights is crucial to ensure sufficient lighting for public safety. In India, street lights are placed based on various factors such as:

1. **Traffic volumes:** Street lights are installed at regular intervals on arterials and highways to ensure better visibility for drivers.

- A busy road will need bright and wide-ranging lights to ensure the highest visibility for cars on the road.
- Residential areas or small streets may require warm light that is not too bright to avoid disturbing residents.
- Lights in parks or gardens may have a softer and more elegant design that blends well with the surrounding area.

2. **Pedestrian traffic:** In areas with high pedestrian traffic, street lights are installed at lower heights to provide better illumination on footpaths.
3. **Environmental factors:** In areas with high wind speeds, street lights are installed closer to the ground to prevent damage.

### Designing Street Lights

Several design factors influence the design of street lights in India, including:

1. **Power supply:** The power supply for street lights in India is typically 230V AC, 50Hz.
2. **Light intensity:** The intensity of light provided by street lights varies depending on the location and purpose of the lighting.
3. **Mounting height:** The mounting height of street lights varies based on the location and type of streetlight used.

Lights are typically designed by professional engineers or lighting designers who have expertise in electrical engineering and lighting technology. These professionals work with local government agencies and contractors to determine the appropriate lighting requirements for a given location, taking into account factors such as traffic flow, safety, and aesthetics. The design process may also involve consideration of energy efficiency and sustainability in order to reduce the environmental impact of the street lights. Additionally, manufacturers may also have in-house engineering teams who design and develop street lights for production.

Mr Anil Kumar Choudhary, Head Operations (Lighting) at Energy Efficiency Services Limited (EESL), Ministry of

Power, Government of India, explains that, “For installation of new lights everything is decided by EESL. Overall standard design requirements for the lights is given by EESL along with the specifications and lux level on the ground. But the lights and fixtures are manufactured by the selected manufacturing companies. Our specifications are way ahead than what is prevailing in the market because try to bring in better products than what is available.”

Street light design in India has evolved significantly over the years, with a focus on safety and energy efficiency. In India, street lights have come a long way and have undergone a significant transformation in the past couple of decades. The country has been proactive in adopting advanced lighting technologies and has made considerable advancements in the design of street lights.

Designing of street lights takes into account a variety of factors, including the location of the street, the cost-effectiveness of the solution and the environmental impact. Street lights are designed to enhance visibility at night, reduce accidents, and provide for a safe and well-lit environment.

One of the most significant advancements in street light design in India is the introduction of LED lighting technology. LEDs are highly energy-efficient and cost-effective when compared to conventional lighting. The use of LED lights in street lights has resulted in a significant reduction in

The design of a street lighting system must be appropriate for the site and should provide the level of illumination (lux) and uniformity of light specified in the Indian Standard (BIS, 1981).

energy consumption and has helped in minimizing the carbon footprint. This has made LED lighting a popular option for public lighting systems throughout India.

Moreover, the Indian government has been working to make streetlights more environmentally friendly. Solar-powered street lights are being installed in various regions across the country. These street lights work using solar panels that collect energy during the day, store it in batteries and use it to power the LED lights at night. This technology reduces the dependency of street lights on electricity and lowers the carbon footprint of the country.

Furthermore, the design of street lights is also focused on durability and low maintenance. The lights are housed in sturdy, weather-resistant enclosures that protect them from the elements and prevent damage due to vandalism or accidents. Additionally, the components used in the lights are of high quality and require little maintenance, reducing the need for frequent repairs and replacements.

### Street Light Parameters

For choosing the right type of street light, several factors need to be considered. Some of these factors include height, distance, bulb, angle, and design. An optimal balance of these factors is crucial for road safety and maintaining the overall illumination of the city. It is essential to choose street lights that provide visibility while not causing light pollution, and ones that are aesthetically pleasing.

- 1. Height:** The first factor to consider is the height of the street light. A street light that is too short would not provide enough illumination and risk accidents at nighttime. On the other hand, a street light that is too tall could be expensive to install and maintain. Therefore, a height that is optimal for the street and its immediate surroundings is selected to ensure sufficient lighting coverage while also avoiding interfering with any tall buildings or trees nearby.
- 2. Distance:** The distance between each street light is also a critical factor to consider. The distance should be appropriate as too much space between them will leave dark spots, thereby reducing visibility for drivers and pedestrians. Conversely, too little space can mean that the streetlights become overbearing, resulting in light pollution, which may disrupt the natural habitat of birds and animals.
- 3. Intensity:** The type of bulb used in street lights is also an essential factor. Today there are many bulbs that can be used, like halogen, LED, fluorescent, and high-intensity discharge lamps. Each bulb has its own lighting capacity and energy efficiency. Some may be more suitable for



## Smart Solutions by EESL

1. Solar-powered street lights with automatic dimming sensors
2. Street lights with decorative designs inspired by local culture and heritage
3. Smart street lights with remote monitoring and control systems
4. Street lights with built-in cameras for improved public safety
5. Energy-efficient LED street lights with customizable colour temperatures
6. Street lights with motion sensors to conserve energy
7. Street lights that double as charging stations for electric vehicles
8. Street lights with integrated air quality monitors
9. Street lights with modular designs for easy maintenance and repair
10. Street lights with adjustable heights for different road types and traffic densities
11. Street lights with programmable light patterns for festivals and events
12. Street lights with built-in sound systems for public announcements and emergency alerts

certain locations or situations, while others might be too harsh or bright.

4. **Angle:** Another crucial factor is the angle of the street light. An incorrect angle can affect the amount of light distributed, making some areas too dark or too bright, resulting in glare that can be harmful to drivers. Therefore, choosing the correct angle is crucial for proper lighting distribution.
5. **Design:** Finally, the design of the street light is also an essential factor to consider. The design should be in line with the overall aesthetics of the city or town. It is important that the street light meets the requirements of functionality and style.

Mr Utkarsh Singh, Assistant Manager (Technical) from Energy Efficiency Services Limited (EESL), helps us understand the guidelines and parameters to be considered during installation of street lights on public streets and roads.

1. On a single side arrangement, where all luminaires are on one side of the road, the height of the street lighting pole is directly related to the width of the area to be illuminated. Meaning, the width of the area to be illuminated by the lighting fixture is roughly equal to the height of the lighting pole.



2. The spacing/pole span (i.e. distance between two successive poles) and the space-height ratio is generally between 2.5 to 3. This helps in preserving longitudinal uniformity of road surface luminance, which is the ratio of minimum luminance to maximum luminance. Also, shorter street light poles are installed at closer intervals to meet the above criteria and avoid formation of dark spots between two poles.
3. Depending on the mounting height of the street light/luminaire, it is advisable to keep the angle of tilt between 15 to 30 degrees. This range of angles allows for optimal illumination while reducing the chances of a discomforting glare on drivers.

He explains that in the case of LEDs, they emit light at a 120-degree angle when no optical material is used. However, an optical material can be placed on the LED package, which can shift the light beam angles to 30, 60 or 90 degrees. So, the beam angle also plays an important role in preventing formation of dark spots on roads between two successive poles.

The most common reasons for inefficient street lighting systems in municipalities are:

- Selection of inefficient luminaires
- Poor design and installation
- Poor power quality
- Poor operation and maintenance practices

### National Lighting Code (NLC)

The National Lighting Code (NLC) is a document that sets out the minimum standards for lighting design, installation and maintenance in India. The code was developed by the Bureau of Indian Standards (BIS) in collaboration with the Indian Society of Lighting Engineers (ISLE).

The NLC provides guidelines to ensure that lighting is provided in a manner that is safe, effective and energy-efficient. The code covers indoor and outdoor lighting systems, including street lighting, lighting in parks and public spaces, and lighting in commercial and residential buildings.

One of the key objectives of the code is to ensure that lighting is energy-efficient, which helps to reduce energy consumption and greenhouse gas emissions. The code recommends the use of energy-efficient lighting technologies such as LED (Light-Emitting Diode) and CFL (Compact

Fluorescent Lamp) bulbs, which are more energy-efficient than traditional incandescent bulbs.

The NLC also provides guidelines for the illumination levels required for different types of spaces. For example, it specifies that the illumination levels in commercial and industrial spaces should be higher than those in residential buildings. The code also provides guidelines for the placement and spacing of light fixtures, which helps to ensure that lighting is evenly distributed throughout the space.

In addition, the NLC includes guidelines for the maintenance of lighting systems. Regular maintenance is important to ensure that lighting systems are working effectively and efficiently. The code recommends that lighting systems be inspected and maintained on a regular basis to prevent failures and to ensure that they are operating at peak efficiency.

The NLC is an important document that helps to ensure that lighting systems in India are safe, effective and energy-efficient. Implementation of the code can help to reduce energy consumption, lower greenhouse gas emissions, and improve the safety and comfort of those who use the spaces where the lighting systems are installed.

Since lighting is an integral part of any building, whether residential or commercial, the National Lighting Code (NLC) also provides guidelines for the installation and use of lighting systems in buildings to ensure safety, energy efficiency, and maximum performance.

The NLC requires proper installation of lighting systems to ensure safety and correct functioning of the equipment. It emphasises installation of all wiring and fixtures by a licensed electrician in accordance with the Electrical Safety Code. The installation must be done in such a way that it does not create a hazard to building occupants, nor does it cause any damage to the building structure.

The code also requires that wiring and fixtures be installed in such a way that they are accessible for maintenance and repair. The wiring must be routed in a way that it does not interfere with other building systems or create a fire hazard. All wiring must be properly grounded, and light fixtures must be secured in place to prevent them from falling.

The NLC also sets guidelines for the placement of light fixtures to ensure optimal lighting performance. For example, it recommends that lighting fixtures be placed at a height that allows for even distribution of light and reduces glare. The code also recommends the use of energy-efficient lighting sources. It sets minimum requirements for the efficacy of various types of lamps and the maximum power usage of lighting fixtures.

Does exterior lighting in buildings, malls and stadiums also follow the National Lighting Code? Ms Priti Bhatnagar, Head-Electro Technical Division, Bureau of Indian Standards (BIS) says, "There is no regulation to follow the National Lighting Code. It is not mandatory to follow this code. We are now revising the document to come up with a comprehensive code. Efforts will also be made to popularise the code and make people aware of the document so that it can become a part of the regulation."

### Wattage of Street Light

The required wattage of a street light depends on various factors such as the street size, traffic density, and the level of

illumination required. Generally, street lights in India range from 40 watts to 250 watts. However, it is recommended that LED lights be used as they consume less energy and have a longer lifespan. The wattage for LED street lights can range from 20 watts to 150 watts. The appropriate wattage of a streetlight is determined by a qualified electrical engineer or lighting designer.

The traditional street lighting system that we have been using for long has become outdated and inefficient. Fortunately, with advancements in technology, we now have a more efficient and cost-effective solution smart and energy-efficient LED street lights.

In 2015, India launched the Street Lighting National Program (SLNP) to replace conventional street lights with smart and energy efficient LED street lights across the country. So, what makes LED street lights different from conventional street lights that we have been using for decades? Here are some observations of experts along with Ms Neha Agarwal, Scientist 'C' at Bureau of Indian Standards:

**1. Energy Efficiency:** One of the most significant differences between conventional street lights and LED street lights is their energy efficiency. LED street lights consume less electricity than their traditional counterparts. As per reports, LEDs can save around 50% to 70% of energy compared to the conventional street light systems. This not only reduces the carbon footprint but also helps to reduce the energy bills for local governments.

**2. Longevity:** Conventional street lights have a short lifespan and require frequent maintenance, which can be a time-consuming and costly affair. LED street lights have a much longer lifespan, with some models rated to operate up to 100,000 hours while requiring minimal maintenance. This leads to a lower replacement frequency, reducing the overall cost of ownership.

**3. Smart technology:** LED street lights integrated with smart technology sensors can detect the presence of vehicles, pedestrians and adjust their light output automatically. This helps to conserve energy by only illuminating the area when it's needed. Smart LED street lights can work with various control systems such as software applications, wireless connectivity and can be monitored by a central control unit. They also have the capability to adjust the light output in real-time, and track and report failures remotely, eliminating the need for manual inspection.

**4. Environmental sustainability:** Conventional street lights pose a threat to the environment, as they contain harmful chemicals such as mercury, which can cause pollution when not disposed of correctly. LED street lights, on the other hand, are environment-friendly and contain no toxic chemicals, and can be recycled easily.

A safe, livable, and sustainable environment is a crucial aspect while developing public infrastructure. In India, as experts continue to innovate, we can expect to see more smart and eco-friendly street light designs in the future.

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