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Analysis of High Mast Street Light in Rural Area

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Abstract**: High Mast Light gives the several cost effective advantages and cost is a major issue for rural area general services. This project illustrates the theoretical basis and the analytical development of the high mast lighting poles. In the late 1960"s, studies were conducted to investigate the impact that high-mast lighting gives on traffic performance, driver visibility, and illumination costs. It was found that increasing the height of the lighting offered a noticeable advantage in that it provided drivers with increased uniformity of illumination and brightness while minimizing discomfort and disability glare. In this turn, it`s led to a reduced number of visibility related accidents. Also, lighting is a major requirement when we deal with working at the opencast mining. In opencast mining, the efficient lighting system is required while working during dark hours. In the present work, a new system of light mast tower is proposed & designed which increases the usability of the existing light mast towers. In this solution, each light mast is given a particular position to its vertical & horizontal axis which sets the light to focus in any particular area and direction to cover target area with minimum power and resource.
Keywords**: Illumination, High Mast, Visibility, Glare, Focus.

I. INTRODUCTION

High-mast lighting towers are vertical, cantilevered structures that are used to illuminate a relatively large area. Although primarily used for highway intersection lighting in rural areas, they are also utilized in other large areas such as parking lots, sporting venues, or even penitentiaries. As a result, failures of these structures are critical due to the potential for them to fall across highway lanes or other. When tall masts were installed in several cities to illuminate large areas. The first known application of high-mast lighting to highways was the Heerdter Triangle installation in Dusseldorf, Germany, in the late 1950"sItwas.followed by installations in other European countries including Holland, France, Italy, and Great Britain. With the passing of the Federal-Aid Highway Act of 1956, interest in High Mast lighting in this country was stimulated by the successful applications in Europe.RomanPage LayoutAn easy way to comply with IJRASET paper formatting requirements is to use this document as a template and simply type your text into it.



Fig 1 An Image Of Conventional Street Lighting System And Its Wasting Of Power And Resource

A. Light Mast Towers

High-mast lighting towers have several distinct features. The towers consist of a single sectioned tube connected to a flat base plate. Base plates range from 1.5-in to 4-in in thickness. The base plate is bolted to a concrete foundation that extends several feet into the ground. Illumination comes from lighting equipment located at the top of the tower. Anchor rods are used to connect the high-mast base plate to the concrete foundation. The size and number of anchor rods used to depend on the size

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and height of the high -mast tower. The anchor rods extend into the concrete foundation a considerable depth to prevent anchorage failure. Nuts are tied on both the top and bottom of the tower base plate. Levelling nuts are used underneath the base plate to both levels the tower during erection and provide uniform tightening of the base plate. The top nuts tighten enough the base plate which fixes the entire system to the concrete foundation. It is important to note that improper tightening of the nuts can introduce additional stresses in the occupied areas. High -mast lighting dates back to the 1800s pole to base plate connections. This is believed to be the culprit of many high -mast tower failures. In order to prevent loosening problem of the top nuts, double nuts are used on the upper side of the base plate.

II. METHODOLOGY

B. Modelling of A Light Mast Tower

In earlier times wherein computers were not yet developed, there has been a representation of using conventional media in designing. Ancient architects used text to abstractly describe the design process.2D drawings were later introduced and only expressed abstract visual thinking. The attempts have been continued to identify the nature of different design tools. The 3D model is created using the solid works software. Basically, the frame is modelled first and the outline provides the basic idea of a complete model. The dome shaped lights are created in 2D and then extruded by using the pan command. Once a dome is created that can be mirrored as per the requirement. Now for the modelling, the designed mechanism separate assemblies are created. The worm and worm gear is drawn and also the lead screw arrangement is created. Finally, the assembly of all the components is done and the complete 3D model is created finally. The mechanism is proposed which consist of the gearbox driven by the single phase induction motor of rpm. The gearbox consists of worm gears. Worm gear drives are used to transmit motion and power between two mutually perpendicular non-intersecting axes with a large reduction in a single step.. The linkage arrangement is basically used for the movement of lights in their vertical and horizontal direction. The lead screw with a pitch length of 10 mm is mounted on the frame which is constrained to move in the vertical direction using the Plummer block from both the ends. The motor used is a single phase induction motor of 1440 rpm and is used to rotate the lead screw. The lead screw is equipped with a nut and the nut is pivoted by the two linkages used to provide a free movement to the linkages of dome shaped lights. Similarly, the frame is arranged with the gearbox and motor assembly used to rotate the lights in particular direction.

Foundation depth, width, reinforces, for conventional light standards. If high-mast lighting is used, foundations typically require specialized designs and soil surveys are performed to ensure adequate support. Check with the Geotechnical Section for additional guidance. Lighting design depends on the illumination method relies on the amount of lighting flux reaching the pavement and the uniformity of the light on the pavement surface. The steps in the design process are as follows:

1) Estimation of the foot-candle value to be lighted
2) Selecting the type of light source.
3) Selecting light source size and mounting height.
4) Selecting luminaire type.
5) Determining luminaire spacing and location.
6) Checking for design adequacy.

C. Placement

It provides the Department's criteria for the roadway. Street Light poles standards a major factor in highway lighting process is the selection of the luminaire and the mounting height. Higher mounting heights usually reduce the number of light standards required and enhance illumination uniformity. The Standard Specifications, the electrical drawings and the latest edition of the Standard Specifications for Structural Support for Highway Signs, Luminaires and Traffic Signals provide the Department's criteria for light.

D. Luminaires

The luminaire (pronounced loom-in-air) is the complete lighting unit (or fixture), including the light source, reflector(s), lens, and housing. The common types of luminaires and their uses are describing here.

E. Conventional Luminaires

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Conventional roadway luminaires consist of aluminium housings with glass lenses and polished aluminium reflectors. They are commonly called "cobra heads." These conventional units are usually mounted no higher than 50 feet. Typical sizes and mounting heights are:

1) 400-watt HPS at 45 to55 foot MH
2) 250-watt HPS at 30 to 40 foot MH (mounting height)
3) 150-watt HPS at 20 to 30 lower mounting heights are necessary (such as the airports).

Mounting of Luminaires "House side mounting" refers to the placement of luminaires between the curb and right-of-way line. "Median mounting" refers to placement on open medians or medians with the concrete traffic barrier.

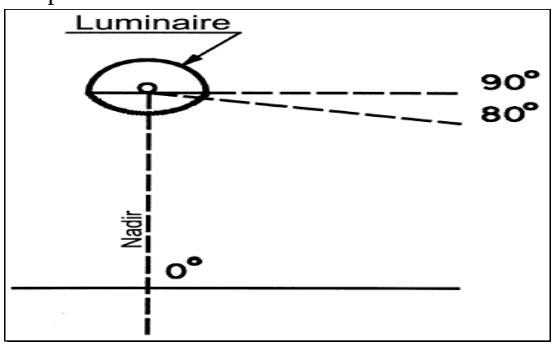


Fig 2 The candlepower of luminaires designated as full-cutoff, cutoff, and semi cutoff is limited at angles of 90 and 80 degrees from the nadir

F. Cutoff

Roadway luminaires, the point on the ground directly below the light source is called the "nadir." Reduction of the luminous intensity (candlepower) in the upper portion of the light beam above nadir is required to control glare or reduce the amount of light falling off the right-of-way. Luminaires that feature this type of control are called "full-cutoff," "cutoff," and "semi-cutoff." The candlepower of luminaires designated as full- cutoff, cutoff, and semi-cutoff is limited at angles at 90 and 80 degrees from the nadir (see Figure 2). The following table shows the requirements for full-cutoff, cutoff, semi-cutoff, and no cutoff type luminaires

TABLE I. CANDLEPOWER CUTOFF REQUIREMENTS FOR DIFFERENT LUMINAIRE TYPES

Luminaire Type	Percent of Total Candlepower at 90° from Nadir (Horizontal)	Percent of Total Candlepower at 80° from Nadir
Full-cutoff	0%	≤10%
Cutoff	≤2.5%	≤10%
Semi cutoff	≤5%	≤20%
No cutoff	No limitation in either zone.	

NOTE: In some cases the cutoff distribution may meet the requirements of the semi cutoff, and the semi cutoff may meet the requirements of the no cutoff.

G. Light Distribution Patterns

The Illumination Engineering Society (IES) writes many of the industry standard specifications for fixtures. The IES has designated several standard types based on their light distribution patterns. Figure 3 shows plan views of light distribution patterns for the basic types of conventional luminaires.

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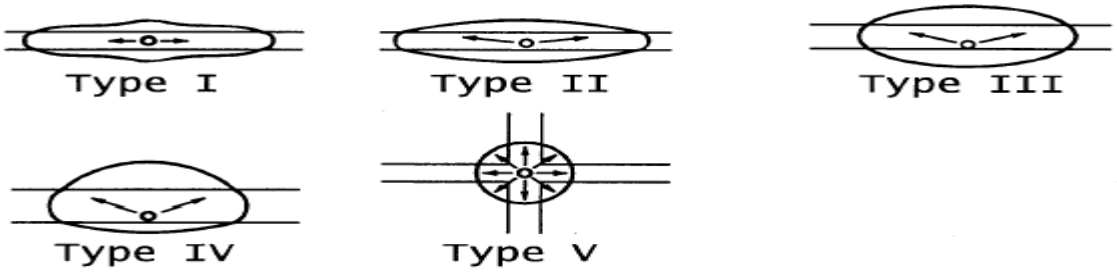


Fig 2 Plan views of light distribution patterns for basic types of conventional luminaires

H. Underpass Luminaires

Underpasses may require a special 150-watt HPS cobra head or induction fluorescent luminaires mounted on caps or special brackets. Where structures are higher than 25 feet above the roadway, the 250-watt luminaire may be used.

I. High Mast Lighting

High mast lighting units are mounted at heights of 100 feet or more and use high-pressure sodium light sources. The following table shows the three types of high mast lighting, their photometric characteristics, and their typical light sources.

J. Computational Methodology

A study manufacturing of different high mast poles with its specification, environmental conditions for placement, economy, commissioning was being carried out and found taper circular hollow section to be optimum. The material is selected as mild steel due to its properties as exhibited in the graph. By this developing procedure of finding diameters of high mast pole and foundation bolts by considering the circular section of the pole has being done and analyses are carried out in solid works (Cosmos Xpress) by fixing the base section and applying the compressive load on the top section of the pole. By which we obtain various stress, strain and deformation relations shown. High mast lighting system used to provide unified illumination for large intersections of the target area, especially for highways located in rural areas.

III. RESULT AND DISCUSSION

So we have concluded that by using High Mast Solar Street Light the Large amount of capital can be saved and on with saved cost more light can be installed. If we use solar energy system with being provided independently as it produces power from itself operating Producing clean source of energy saving fossil fuel and which is not harmful to the environment.

A. Lighting Fixture

TABLE I. HM POWER REQUIREMENT

Name	Specifications
LED Light Power	80 W
Lamp Count	5
Cost	31000 Rs

B. Pole

TABLE II. HM POLE REQUIRED SPECIFICATION

Name	Specifications
Height of Pole	18 mtrs
Material	G.I. Pole
Base dia. and top dia.	Top- 160mm, Bottom- 370 m
Diameter of base plate	540 mm
Thickness of base plate	28mm
Cost	26000 Rs

Fig. 1 Example of an unacceptable low-resolution image

III. CONCLUSIONS

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We have to increase the use of HML tower in tribes to reduce the cost of power consumption and installation. The proposed mechanism is allowed to select right spot and height of the tower to install HML in a target area that helps us to plan and estimate the .cost of deployment of HML towers. This can prevent a wrong and unnecessary installation of HML that will save the huge amount of money. Also, we can use the solar panel on top of every HML than we can get additional cut saving on the power consumption. When we think about HML life than its design already proved the long life and stays undamaged against heavy wind impact comparable with normal street lamp pole. So there are many advantages comes when we adopt HLM as journal lighting system to enlightening the public livings area.

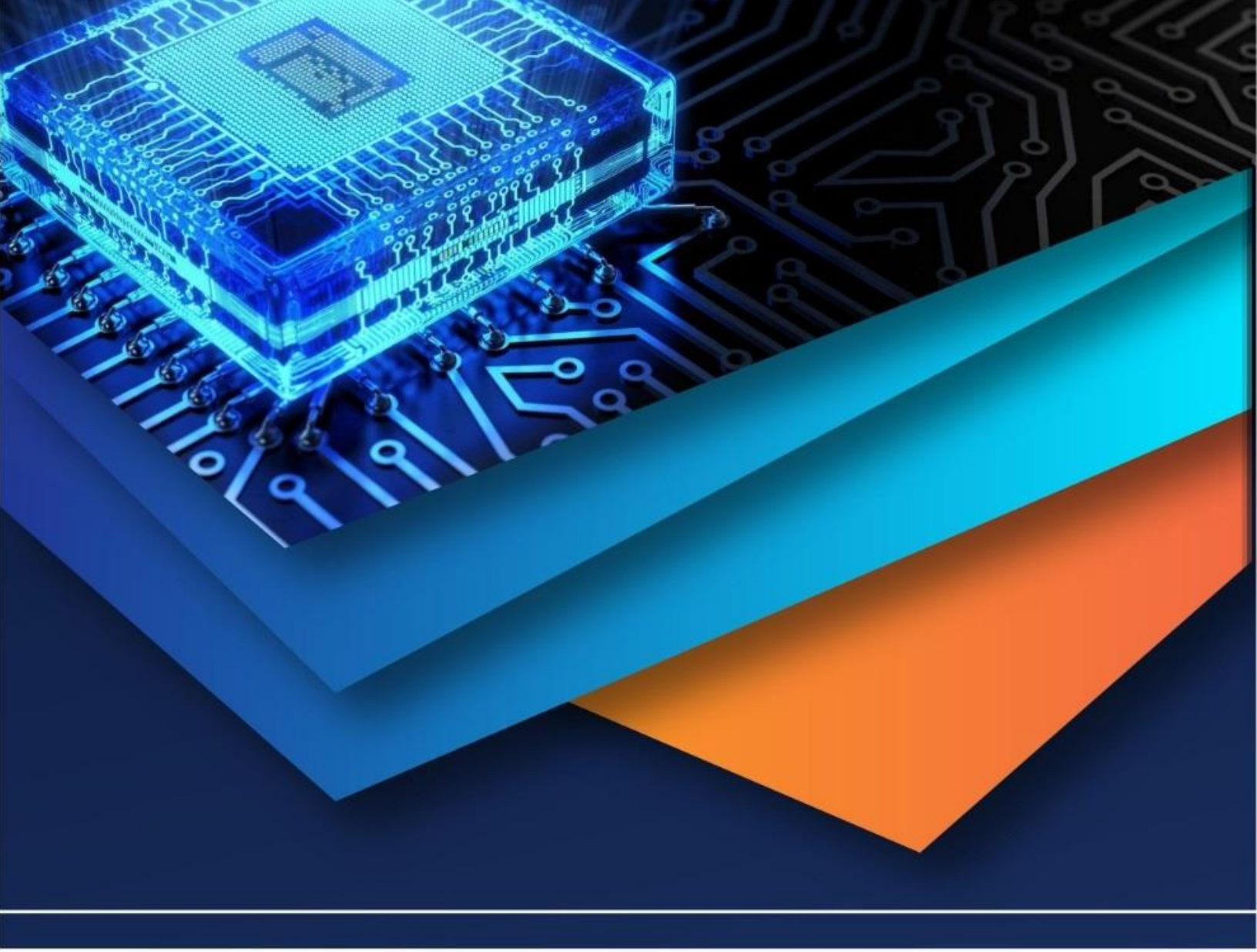
IV. ACKNOWLEDGMENT

Cost comparisons between high mast installation and conventional lighting systems installation vary differently depending on the application where the lighting system is being installed. But the High-Mast lighting installation frequently less expensive to install than conventional lighting systems. Also, High-Mast has reduced the complexity of plan and easy to fit and the smaller number of equipment's, wiring and poles required. Another interchange of the situation of the installation, conventional lighting usually starts from a smaller initial cost.

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