

Survey, Design, Estimation and Installation of Streetlights

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Abstract

This paper is aimed at developing a conventional procedure of survey, design, estimation and installation of streetlights at any given site. It consists of a total of four sections. In the very first section, it has been discussed in detail about the study and survey component of the project. It includes the preparation of CAD drawings and steps for its execution. In the second section, the design and estimation prospect has been discussed which turns out to be the most cumbersome out of all the activities during the project. A design software called DiaLUX has been discussed in detail. After the design section, estimation of various components and equipment has been done. Later, in the fourth section, the explanation of the entire installation process has been done. Further, it has also been mentioned about the future of the work that is kept pending.

Keywords : Preliminary survey, CAD drawing, Luminary design on DiaLUX, Illumination report, material & cost estimation of project, installation of streetlights, testing

1. INTRODUCTION

Authority of Notified Area Hazira was planning to install street lights along the roads under construction by the National Highway Authority of India (NHAI) within Hazira notified area Surat.

This paper discusses the entire process of installing the streetlights from planning to execution. The paper has been divided into mainly four sections as mentioned above.

1.1 Project objectives

The main objective of installing streetlights is to mitigate accidents due to vehicles on the road. It also provides security for people on the roads as it makes it less likely for criminal activity. Hence, since Hazira is a growing industrial hub, it is more than necessary to install streetlights through-out the main road. The objective of the internship is mentioned below:

- i. Survey of entire site, creating a survey map using actual data from site on AutoCAD & preparing an in- depth feasibility report.
- ii. Design of streetlights using DiaLUX software and creating an illumination report.
- iii. Estimation of materials and cost of the entire project.
- iv. Installation of streetlights including marking, foundation, earthing, pole installation, cable laying, section pillar installation and connections.
- v. Testing & maintenance.

2. STUDY AND SURVEY OF STREETLIGHTS

The basic plan of site and where the street lights have to be installed has been shown by the engineer at Hazira Notified Area. The widths and main roads and service roads at various points has been checked. The markings and notations of the GPS coordinates has been completed. The measurements of both the type of roads at various points in order to get an idea of the dimensions of the road has been done. The accuracy of the measurements according to industry standards has also been taken into consideration.

2.1 Creation of AutoCAD drawings

In the second round of our visit, the survey of the entire site precisely using measure-tapes and odometers has been done. An accurate representation of the site using AutoCAD has been done.

1. Satellite image of the Notified Area, Hazira site.
2. Uploading it to AutoCAD.
3. Scaling it to 1:1.
4. Cross checking the dimensions in cad file with manual dimensions taken before hand.
5. Rastering the roads, highway, bridges along with other necessary demarcation in AutoCAD.
6. Cross checking the dimensions of .cad file with Google Earth and manual dimensions to check the accuracy.

7. Adding descriptions and layers in the cad drawings for lucid understanding of dimensions and better graphical understanding.
8. Plotting the CAD drawing in pdf in 1:15000 scale.

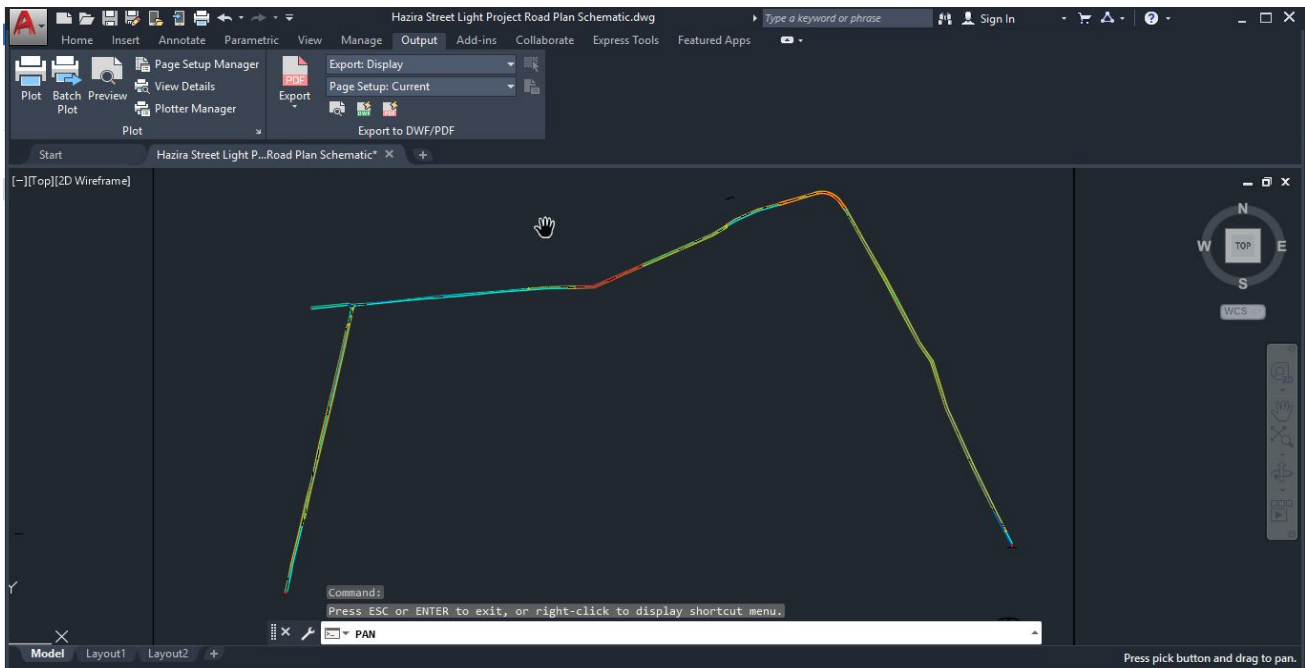


Figure 1 AutoCAD screenshot

3. DESIGN AND ESTIMATION OF STREETLIGHTS

3.1 Using DiaLUX

DiaLUX is a 3D graphics software developed and distributed by DIAL GmbH in Ludenscheid for lighting planning indoors and outdoors. Numerous manufacturers of lamps and luminaires offer plug-ins for their products that make the radiation characteristics available in DiaLUX. It can be used to plan, calculate and visualize light for indoor and outdoor areas, from entire buildings and individual rooms to parking spaces or street lighting. Also, here are a few steps that can help understand the entire process of designing a little better.

- Firstly, using the lucid software options, a road and the side lawn is created using actual dimensions from the measurement of the actual road at site. The meridian is also added as per the dimensions. This has to be done separately for different kinds of roads.
- Then, additional .uld or .ies files have to be downloaded. These are the file extensions for luminaries that the DiaLUX software can use. These files are either available online or should be provided by the OEM. These files contain the exact characteristics of a particular luminary.
- Now since characteristics of each luminary is available, the parameters like the pole height, boom angle, length of arm, et cetera can be changed.
- However, in order to design a streetlight properly, a set of criteria that have to be fulfilled. For example, in this case, a minimum lux parameter of 40 lux has been set. This will ensure that the design will only be considered successful when the variable parameters are such that they fulfil the required criteria.
- A detailed report in the form of a pdf can be achieved once satisfying results are obtained.

3.2 DiaLUX design report

If this software is given the right inputs, the output is fairly simple and doesn't require an expert to understand it. For the output, almost all the information we require is achieved– ranging from pole height and arm length to boom angle and the distance between two consecutive poles. It also provides a gradient map with which the possibility of dark spots can be mitigated. The screenshots of the two separate reports for main roads and service roads are attached here.

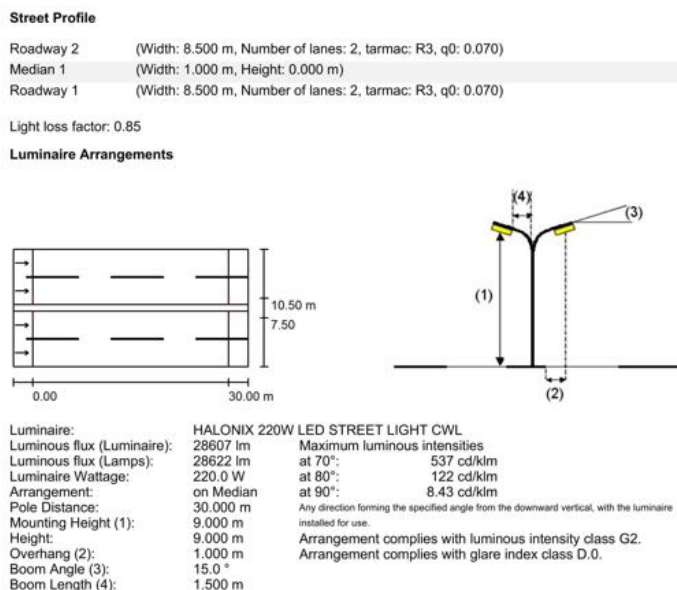


Figure 2 DiaLUX design report for the Main Roads

3.3 Project cost estimation (BOQ & BOM)

Primarily, the BOQ is created using prices of equipment and services of previous projects and experience. Using these prices, an approximate costing of the entire project can be achieved.

The prices of poles, arms, luminaries, junction boxes, cables, flexible wires, service lines, section pillars, DWC pipes, excavation charges, foundations, foundation bolts, earthing of various types and other equipment that are necessary are included.

4. INSTALLATION OF STREETLIGHTS

These are the parameters that are taken into consideration.

I. **Foundation for poles:** The foundations are done as per foundation drawings.

II. **Earthing:** It is done as per the procedures approved by GIDC a) For poles b) For Section pillars

III. **Arm Installation:** Consecutively, arms are also installed as per the design.

IV. **Luminary fixtures:** The light fixtures must be LEDs with these properties.

PF more than 0.95,

THD (Total harmonic distortion) < 10 %,

CCT (Correlated color temperature) 5000 K to 5700K,

Uniformity ratio >0.45,

LED driver efficiency > 85 %.

V. **DWC Pipe and cable laying:** Cable laying is done consecutively.

VI. **Section pillars & connections:** Section pillars are installed according to schematic diagrams.

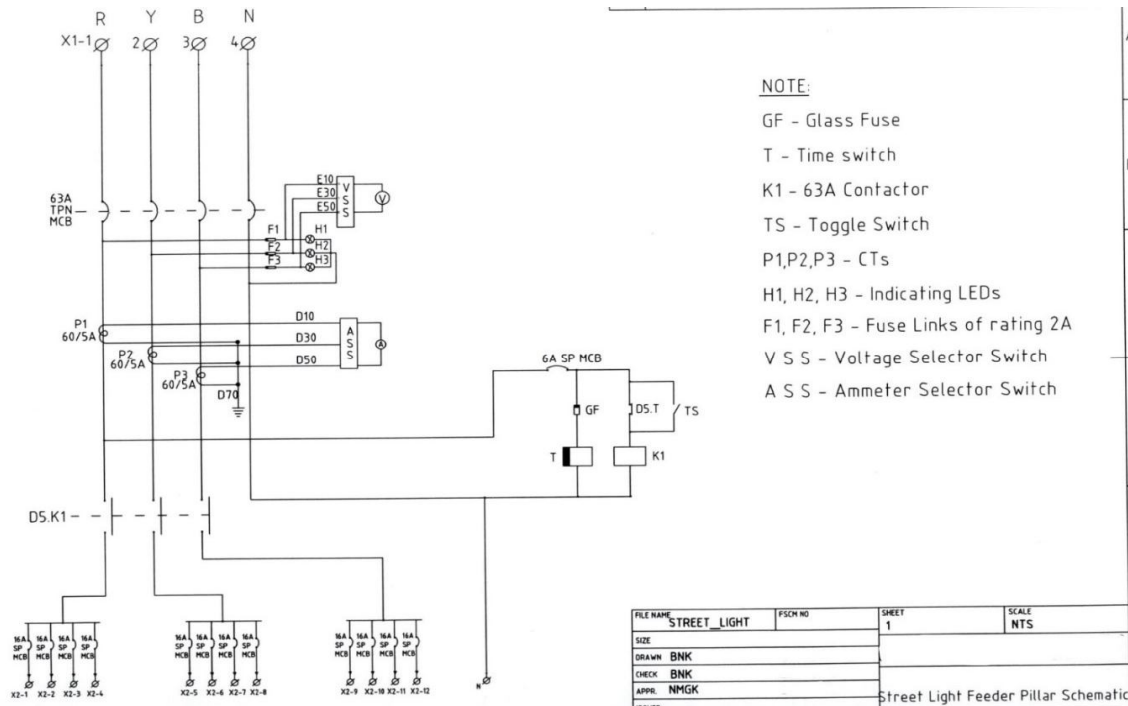


Figure 3 Section pillar schematic diagram of connections

5. TESTING AND MAINTENANCE

5.1 Testing:

On field testing of the street lights is done by the 9 Point / 30 Point method. The average lux level of a street light assembly is measured using this method.

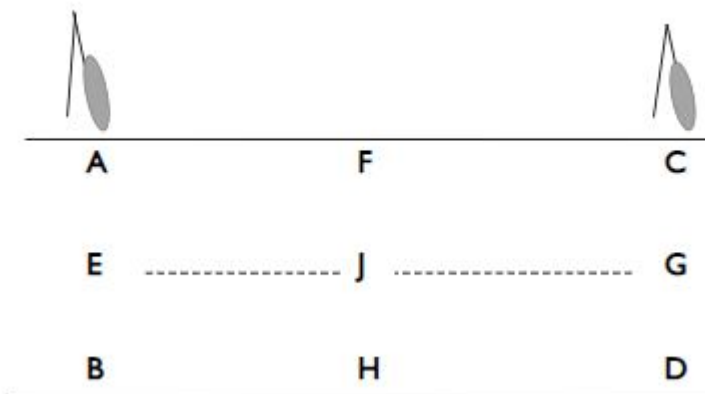


Figure 4 Point method of testing streetlights

9 points are marked on the road in between two consecutive street lights. 3 points A, E and B are marked under one street light at equal distance. Points C, G and D are marked under the other street light at equal distance. Points F, J and H are marked exactly midway. A lux meter is used to measure the lux at each point. In the field, both the methods – 9 point & 30 point are used extensively. If the distances between the two poles is large, it is better to take more input points in order to get the average lux levels at each point. It also increases the accuracy of the output marginally.

5.2 Maintenance: It is done at regular intervals according to standards mentioned by the authority.

6. CONCLUSION

- Created an in-detail feasibility study report after surveying the site and meeting up with officials. Gathered all the data required for further activities, design and estimation and compiled it in a lucid report format.

- After the approval of the feasibility, designed the streetlights keeping all the parameters in mind, using various software with the help of my guides and using other information on the internet. This design is approved by the clients.
- Having the complete design in my hands, a complete BOQ (bill of quantity) for the equipment and services has been created.
- Later, the explanation of the complete installation parameters with keeping each equipment in mind is done.
- In the end, a clarification upon the future scope of work which will include the testing and maintenance of these streetlights has been done.

7. REFERENCES

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AUTHORS

Aziz Malik is pursuing a Bachelor's degree in Electrical Engineering at Indus University, Ahmedabad. He did his internship at Legion Energy Pvt. Ltd. where he was appointed the task of handling a streetlight installation project at GIDC Notified Area, Hazira from December 2019 to May 2020. This paper documents the activities of that Project in a detailed manner.

Honey Sharma an assistant professor in the Electrical Department at Indus University, Ahmedabad since 2014. Her area of specialization and research domain is Power Electronics, Electrical Machines and Electrical Drives. She did her M.Tech in Electrical Engineering from Nirma University.