IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Special Issue || Dec. 2019 || PP 15-17
International Conference on Management Practices, Innovations & Research 2019

"Design & failure analysis of solar street light pole under wind load effect "

Arti Uttam lonare1, Prof. Ritesh Banpurkar2
1 Student,Department of mechanical engineering Abha Gaikwad Patil college of Engineering, Nagpur
2 Professor, Department of mechanical engineering Abha gaikwad patil college of Engineering, Nagpur

Abstract *- Light shafts are for quite some time decreased posts and single cylinder structures utilized in expressways. Wind load is the essential plan power on this structure. In this examination, a correlation of the quality of steel and FRP light post is made when wind loads follow up on it. This work makes it conceivable to expand the investigation of a light post by fluctuating shapes with two materials. Round and hexagonal shapes are considered here. Additionally, the variety of stress and distortion of the light shaft are checked when a stiffener is set. Stress and disfigurement results are thought about..*
Key Words: *solar energy, street light, pole, composite natural fibre, static analysis.*

I. Introduction

Solar energy is the technology used to harness the sun's energy and make it useable. The technology produced less than one-tenth of one percent of global energy demand.

Many are familiar with so-called photovoltaic cells, or solar panels, found on things like spacecraft, rooftops, and handheld calculators. The cells are made of semiconductor materials like those found in computer chips. When sunlight hits the cells, it knocks electrons loose from their atoms. As the electrons flow through the cell, they generate electricity.

On a much larger scale, solar-thermal power plants employ various techniques to concentrate the sun's energy as a heat source. The heat is then used to boil water to drive a steam turbine that generates electricity in much the same fashion as coal and nuclear power plants, supplying electricity for thousands of people.

As required by their capacity and arrangement in the by and large open encompassing, wind stacking is the essential plan power on these structures. Due to lightweight slim design, the light shafts are incredibly adaptable with normal major common frequencies. The posts must be intended to limit vibration and redirection. These days fashioners pick steel and composite FRP utilized for making light posts. Steel posts are most normally utilized decreased shafts.FRP is lightweight and consumption obstruction. Strands are two kinds of common and manufactured fiber. Engineered strands are usually utilized in structures and ongoing examinations.

Figure 1: Solar Street Light Pole

Objectives
1. To perform Static Analysis of steel and FRP posts so as to get their heap versus diversion attributes.
2. Stiffeners are submitted in request to realize whether stress and disfigurement are decreased.

II. Literature Survey

A. C.W. Chien and J. J. Jang (Taiwan Ocean University): [1]:

This paper gives the contributions of high natural frequency components are obtained by Eigenvalue analysis. The method to check vortex resonance and galloping for higher-order modes is also presented. Because of turbulent winds in the atmosphere and characteristics of the irregular bluff bodies of the structures are complicated to deal with, a mathematical model, with interactive wind and structure, is still impossible at present.

This study includes four parts:
(1) a survey of geometric configurations and shape factors;
(2) along with the wind and across-wind response analysis;
(3) develops criteria for WRD; (wind resistance design);
(4) provides case application for WRD procedures.

B. Mal Thomas and Gary Noyes-Brown: [2]:

This paper describes the investigations that were undertaken and the recommended modifications that would reduce the stress concentration in the pole mast, and hence extend the pole life. The 28 light poles at the freeway interchange were all of the similar construction. figer1shows the typical luminary's arrangement at the top of the light poles, and shows a typical light pole base, with significant features being the access opening, the gusset plates, base plate anchor bolts and grout. Inspections carried out by Vic Roads identified cracking in 27 of the 28 high mast light poles at the freeway interchange. All cracking was in the light pole mast, at the tip of the gusset stiffeners. The base plates were not fully grouted; poor grouting has been known to contribute to damages of anchor bolts in other light poles and sign. Bolts need to be checked for stress due to tension and shear, however additional stress due to bending needs to also be considered if the bolts have a free length due to insufficient grout.

C. Counsell Taplin (AASHTO-2006): [3]:

In this paper, the American Association of State Highway and Transportation Officials (AASHTO) have commissioned significant research in the USA in the last five years. Culminating in the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals" (AASHTO 2006). This standard provides a tool for the design of light poles and sign gantries. This research by AASHTO has been undertaken in response to the failure of numerous light poles in the USA. For example, in Iowa in 2003, a 43-meter-high light poles collapsed (see in fig.1) prompting an extensive investigation into this type of structure.

III. Light Pole Description And Parameters

The cross-segment measurements of the posts have been chosen dependent on material accessible in the market. The all-out stature of the shaft is 19.8m with a flat a safe distance of 2m. The base of the shaft is welded to the base plate which is dashed to establishment appeared in fig .1. The light shaft has a decreasing empty roundabout segment with a base distance across of 300mm and thickness 15mm. The top distance across is 100mm and the thickness is 10mm. The size of the base plate is 400*400*20mm. The base plate is structured dependent on IS code 800: 2007. Width of the establishment is 0.5m and profundity 0.8m. The thickness of FRP is 5mm.

Table -1 Technical Specifications: High Mast Structure-12 M Pole

Height of pole - **12 meter**
No. of sections - one
Material construction - As per BS-EN10025
Base Diameter -108.91mm(**minimum) Bottom** -311.77mm(minimum)
Plate Thickness - 4mm
Cross section of **mast** - 12 side regular continuously tapered polygonal Metal protection treatment of fabricated
Mast **section** - Hot dip galvanization through single dipping process
Diameter of base plate - 520 mm (minimum)
Thickness of base plate - 25 mm
Max. **wind speed** - As per IS:875
Number of foundation bolts - 4 no. or 6 **no. (**as **per manufacturing** design)
PCD of foundation bolts - 445 mm
Type/ diameter/ length of foundation bolts - TS 600/ 25 **mm dia** / 750 mm long

IV. Methodology

The cross-segment measurements of the posts have been chosen dependent on material accessible in the market. The all-out stature of the shaft is 19.8m with a flat a safe distance of 2m. The base of the shaft is welded to the base plate which is dashed to establishment appeared in fig .1. The light shaft has a decreasing empty roundabout segment with a base distance across of 300mm and thickness 15mm. The top distance across is 100mm and the thickness is 10mm. The size of the base plate is 400*400*20mm. The base plate is structured dependent on IS code 800: 2007. Width of the establishment is 0.5m and profundity 0.8m. The thickness of FRP is 5mm.

V. Conclusions

This project has considered some of key factors associated with the design of HMS due to the effects of wind loading. Then major findings are summarized as follows. According to the results of this research, the projected area is more critical in this aspect. As for the intensity of wind excitation increases with increasing of aspect ratio (height-to-width). However, it decreases with increasing of structure damping. Consequently, the results of this research indicate that HMS is quite different from the tower structure. Furthermore, the body of the tip plays a major role in design.

References

[1]. AASHTO 2006 “Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals”
[2]. Connor 2005 “Field and Laboratory Studies on High-Mast Lighting Towers in Iowa” Robert J. Connor et al. Proc 2007 Mid-Continent Transportation Research Symposium, Ames Iowa
[3]. Davenport 1961 “The spectrum of horizontal gustiness near the ground in high winds” Quarterly Journal, Royal Meteorological Society, Vol. 87, London 1961 Fisher 1993 “Resistance of welded details under variable amplitude long-life fatigue loading” NCHRP Report 354
[4]. Fricke 2002 “Evaluation of hot spot stresses in complex welded structures” Fricke, W. Proc IIW Fatigue Seminar
[5]. Highways Agency 2007 “Design Manual for Roads and Bridges” Part BD94/07 – Design of Minor Structures