

Analysis of Mobile Light Tower (MAST)

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Abstract— This project involves the Analysis of Mobile Light Tower Mast. The scope of the project is analyse mobile light tower mast to illuminate a relatively large area. High-mast lighting towers are used which are vertical, cantilevered structures. Especially where large areas are to be illuminated without the need for numerous lighting columns that under certain circumstances high mast lighting towers are preferred over conventional lightning. On the basis of data accumulated, design calculations and cad modeling a Finite Element Analyses performed. The project involves the detailed study and getting the information from the sources available about mobile light tower. Finite Element Modelling and Finite Element analysis of mobile light tower mast is presented to validate the mobile light tower mast. The main objective of mobile tower mast is to analyze a mobile light pole tower for mining industry and to design the truck body to carry DG set (Generator) and light pole tower.

Key words: CAD Model, MAST, IMD Stations

I. INTRODUCTION

High-mast lighting tower 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.

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 as well as 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.

This light mast tower is a very crucial element of any mine. The proposed mechanism is allowed to rotate the lights which are mounted on the tower about its vertical & horizontal direction. When the light mast rotated about horizontal axis by 90o, we can focus the light in the vertical plane. This will enable the light exactly beneath the tower. When the light mast is rotated about vertical axis by 180 degree, we can focus the light in the horizontal plane. Using this motion we can focus the light away from the tower horizontally. By setting lights using these operations, we can rotate the entire light mast assembly by 360o which will enable the light around the tower. These operations which are incorporated in the design can hold maximum of eight lights

in the any required position without any jerk & over stressed conditions in operation.

II. DATA ACCUMULATION

All design data related to the dimensions, cross sections, material of mobile light mast tower, number of lights to be installed on light mast, height of mobile light tower will be accumulated from the company and sources available. Dimension of truck body will also be accumulated to design the body on which light mast and D.G. set will be installed with the help of measuring devices, all the essential measurements will be taken to generate CAD model of Light mast tower.

4 Nos 400W Metal halide lamp (White light) to be provided for above lighting fixtures for optimum flicker free beam spread and maximum area coverage suitable for operation with 240VAC, 50Hz supply. The luminaries should work normally in 220- 240 VAC range, i.e., Voltage & Frequency range generated by DG set. The lumen output of lamps shall be 30000 lumens minimum (Lumens after 100 burning hours).

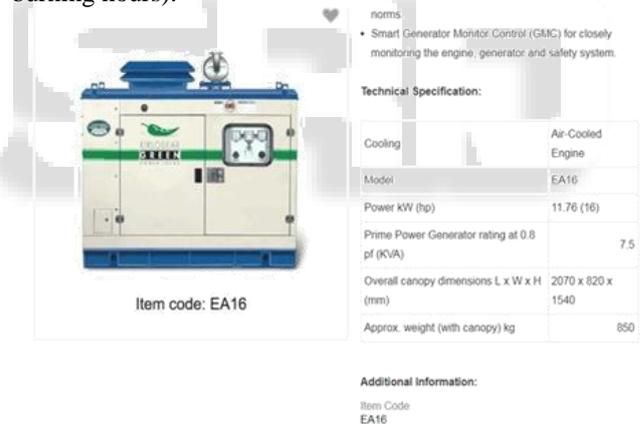


Fig.2.1: Technical Specification of Generator

IMD station	Total no. of records	Available number of years of maximum gust wind speed		Raw hourly gust statistics (Figure 1)					Up-cross peak statistics (Figure 2)		
		Count	A	B	f_{max} kmph	Wmean kmph	Westd kmph	Extrem kmph	Number of peaks	EP-mean kmph	EP-Std kmph
HASHIMARA	2882	9	125	31	13	72	1386	24	15	68	
MADRAS_HARBOUR	6177	20	150	42	13	81	3045	35	17	85	
TUTICORIN_HP	5275	15	140	51	14	94	2833	47	16	95	
MANGALORE_HP	1451	4	91	38	13	76	761	35	12	70	
AMRITSAR	11999	32	190	37	19	94	5921	31	17	82	
PALAM_A	12636	35	199	39	15	85	6792	34	14	78	
VARANASI_SAFRIG	12310	34	152	35	15	79	6457	30	14	71	
CHABUA_A	395	2	72	28	12	65	155	16	15	60	
JAIPUR_SANGANER	11697	38	181	32	15	76	6148	27	14	70	
LUCKNOW_AMAUSI	7160	18	170	39	16	87	3637	33	16	81	
BAGHOGRA_A	2921	9	102	31	13	70	1448	24	15	68	
ALLAHABAD_BAMBHAULI	863	3	131	31	14	73	452	27	13	65	
VARANASI_BABATPUR	539	2	67	25	9	52	277	21	9	49	
GAYA	2207	7	120	34	16	83	1163	29	16	76	
NEW_KANDLA	7407	22	132	47	15	91	3989	43	15	88	
AHMEDABAD	9652	29	150	35	11	69	5019	31	12	68	
BHOPAL_BAIRAGARI	7784	22	125	42	14	83	4158	38	13	78	
JAMNAGAR_A	4328	15	182	44	13	83	2209	38	16	86	
BARODA	7564	22	155	35	13	72	4052	31	13	70	
INDORE	6959	21	136	52	13	91	3704	47	15	92	
JAMSHEDPUR_PB	1395	4	118	34	18	89	730	29	16	78	
JAMSHEDPUR	1284	4	122	36	17	87	646	30	17	79	
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III. CAD MODELING

A linear static analysis of Mobile light tower mast is performed with the following boundary conditions. Constraints is applied on Platform base which is fixed with Truck chassis and the Wind pressure and DG set load of 61.25N and 9810 N is applied on structure respectively

IV. FINITE ELEMENT ANALYSIS

A. Assembly:

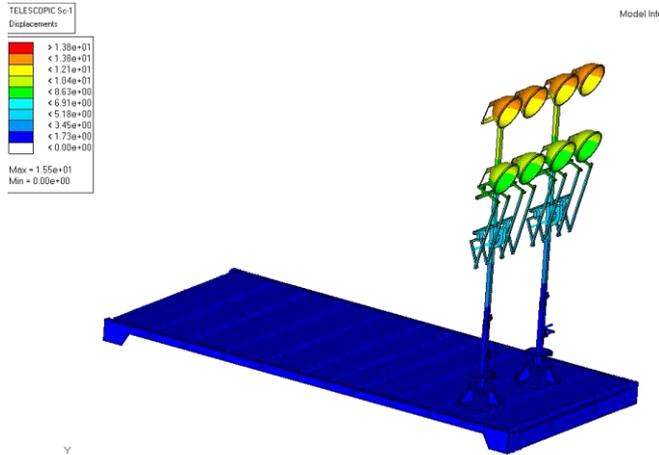


Fig 4.1: Maximum Displacement = 15.5 mm

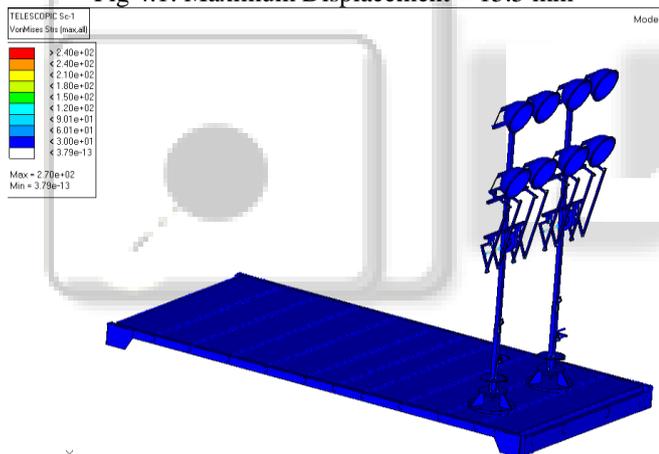


Fig 4.2: Maximum Stress = 270 MPa

B. Tower

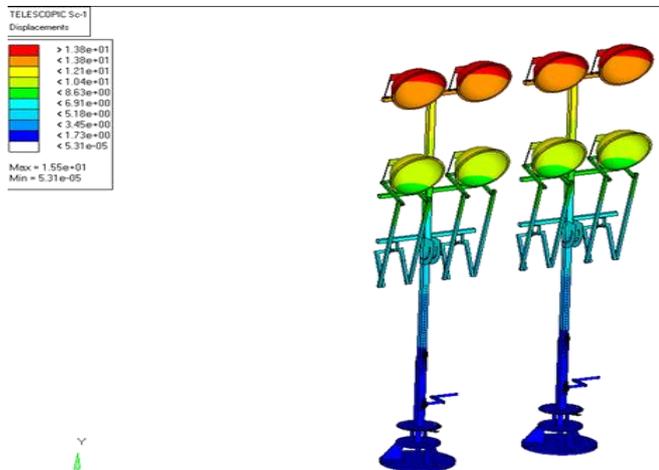


Fig 4.3: Maximum Displacement = 15.5 mm

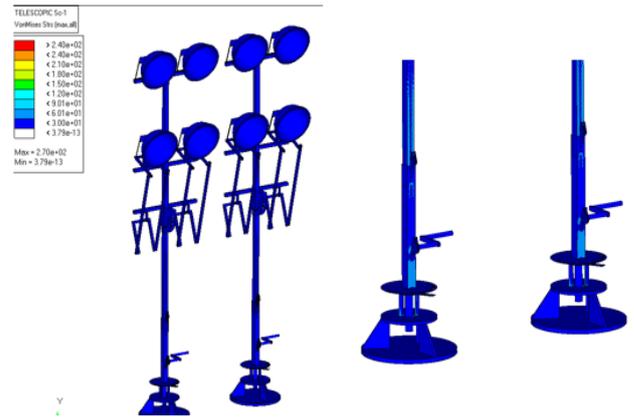


Fig 4.4: Maximum Stress = 270MPa

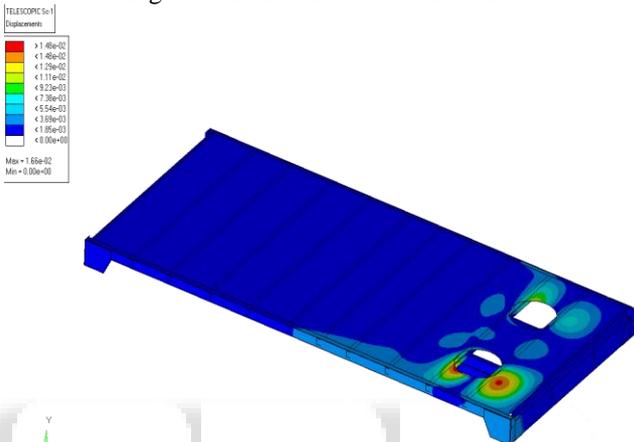


Fig 4.5: Maximum Displacement = 0.016 mm

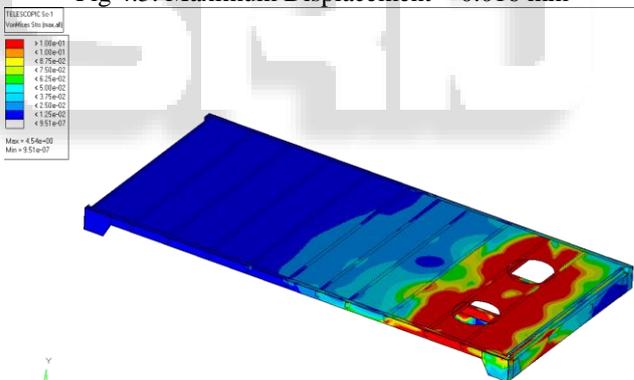


Fig 4.6: Maximum Stress = 4.54 MPa

V. RESULT DISCUSSION

As per the requirements we have analysed a Mobile Light Tower Mast by using Finite element analysis techniques. A Linear static analysis is carried out to validate the design for maximum loading conditions. From the linear static analysis it is observed that Max. Displacements is 15.6 mm observed in the light tower mast assembly at maximum wind gust condition. Max. Stress is 270 MPa observed in the light tower mast assembly at maximum wind gust condition. In the frame which supports light tower masts and DG set loads, maximum displacement 0.016mm and Maximum stress 4.54 MPa obtained.

The Maximum Displacements and stress obtained in the Tower is 15.6mm and 270 MPa respectively. The maximum displacement and stress obtained in the base is 0.016mm and 4.54MPa respectively.

VI. CONCLUSION

The main objective of mobile tower mast is to analyze a mobile light pole tower for mining industry and to design the truck body to carry DG set (Generator) and light pole tower. The need for light towers significantly increases during the months when days are shorter. These portable light towers enable workers to complete their tasks even after sun sets. Aside from providing needed visibility, light towers also reduce safety risks of workers being injured and prevent major accidents which can sometimes end badly. Finite Element Modelling of CAD model is carried out in HYPERMESH and Finite Element Analysis of CAD model of mobile light tower mast is carried out in Nastran software and achieved more light and comfort ability as it is easy to move from one place to another.

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