



## ILLUMINATION SURVEY IN OPENCAST GRANITE QUARRY

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### ABSTRACT

Mine workers are obliged to have an illumination system that has been developed by trained professionals. This is done to ensure that the workers are kept safe while also allowing them to maintain a high level of productivity in their work. An exhaustive analysis of an open-pit stone mine was required in order to achieve the objectives of this investigation. During the speedy inspection of my property, an overview of the most important pathways on my land, locations close to HEMM facilities and workshops, as well as machine administrator lodges and drilling rig sites, were investigated. Additionally, these regions were observed to exist in the course of the observations. During the evaluation of the lighting, an HTC LX-101A LUX meter was used to measure the amount of light present in the room. This was done as part of the assessment. The aggregate statistics will reveal that the light standards in the mining hotspots are lower than the constraints imposed by the DGMS. [Citation needed] The light levels that were measured at HEMM were found to be enough for the principal highways, the studios, and the regions that had active drill rigs in operation.

In addition, mine lighting should be installed with the appropriate lights, fixers for level In addition to this, mine lighting should be outfitted with the proper lights and level fixers. In addition to this, the illumination in the mine should be equipped with the appropriate lights and level fixers. In addition to this, the illumination in the mine should be equipped with the appropriate lights and level fixers. It was necessary to make the recommendations that followed in order to ensure that the offices functioned fairly in order to ensure that the legislation was followed. This was a

prerequisite for ensuring that the legislation was followed. This was done in order to guarantee that the laws were adhered to in their entirety. The illumination in the cab of the L&T KOMASTU backhoe can be improved in a number of ways, one of which is by installing an incandescent lamp with a wattage of between 75 and 100 into the cabin. The laws dictate that there must be a tall pole lighting tower positioned at the facility's perimeter in order for the waste management facility to be in complete compliance with the standards. This is the only way that the facility can meet the requirements.

### I. INTRODUCTION

In a great number of countries, surface mining has been and will continue to be an important sector. This trend is not going to change any time soon. The mining industry is of critical significance to the economies of developing nations, which are strongly reliant on this sector. Minerals are extracted from the ground in an area that is no larger than a few square kilometers by employing mobile equipment that is powered by diesel and electricity. The mechanism is in constant motion, and it is going in all three directions at the same time. To increase the efficiency of the heavy earth moving equipment, large limit dumpers are usually utilised in surface mines. This is done in order to improve production. This is something that is done frequently. The night shift is the greatest time to put in place an effective education system in order to guarantee that both persons and machinery may grow in a manner that is both legal and risk-free. This can be accomplished by putting in place an education programme during the night shift. The installation of a lighting system of

a high-quality is one of the most effective ways to greatly improve mines.

In surface mines where there is little natural light, especially at night, there should be artificial illumination utilised to improve visibility. This is especially important during the day. This is of utmost significance for mines that are located underground. It not only helps workers be more productive, but it also protects their visual and sensory systems, which in turn reduces the likelihood of accidents and injuries occurring while they are on the job. Lighting is notoriously difficult to manage in surface mines due to the fact that it is continually being shifted to different locations, including highways. As a result of this dilemma, inconsequential causes do not stand a chance of benefiting from a framework that is both long-lasting and exceedingly sturdy.

To ensure that there is an adequate amount of illumination, the Department of General Maintenance and Safety (DGMS) and other administrative organizations have proposed moving lighting installations at regular intervals. When it comes to the issue of mine illumination, the gloomy environment and lacklustre reflectivity of the surface generate specific hurdles that need to be solved. It is vital that high-quality and effective educational programmes be made available during night shifts in addition to day shifts in the event that unfavorable weather patterns, such as severe hazy weather, occur. This is because it is more difficult to see during the night. This is essential in order to ensure not only the normal development of people but also of heavy earth moving machines (HEMM) and the efficient operation of hardware. When it comes to the provision of adequate illumination to guarantee a risk-free place of employment, the mining sector faces a series of issues that are unique and unmatched by any other business.

Lighting draw routes in surface mines is a significant difficulty that needs to be addressed because of the ongoing expansion of working appearances. Because of the issues that were discussed earlier, it is not possible to build a lighting structure that will last for a significant amount of time.

The Defense Geological and Mining Service (DGMS) and other government bodies responsible for the adoption of lighting standards agree that there must be frequent rotation of educational facilities. This stipulation must be adhered to at all times.

In order to satisfy the lighting criteria that have been established by a number of administrative agencies, one of which is the DGMS, it is required to have a reasonable framework for false brightening. This is because the DGMS is one of those administrative agencies.

In order to reduce the likelihood of accidents brought on by the increasing use of automation, there will be a requirement for new lighting standards. These regulations will be necessary to meet. An effective lighting system in the workplace offers several advantages, including improved visual performance, reduced levels of fatigue, a drop in the number of mistakes and errors made, and an overall reduction in the number of errors made. Workers are driven to put in more hours at the workplace and produce new ideas for the company as a result of this incentive, which was provided by the corporation.

## II. OBJECTIVES OF THE PROJECT

- 1) To conduct illumination survey in working areas of an opencast quarry.
- 2) To compare illumination survey results with DGMS standards.

## III. MINE LOCATION AND DESCRIPTION

Pearl Mineral and Mines Private Limited is spread over a degree of Acres 17.92 (7.252 hectares) in Sy.No.55/6B, R.L. Puram Village, Chimakurthy Mandal, Prakasam District, and Andhra Pradesh. It is one of the reputed firms in Ongole. The working limit of the quarry would be around 1500 (M<sup>3</sup>) each month.



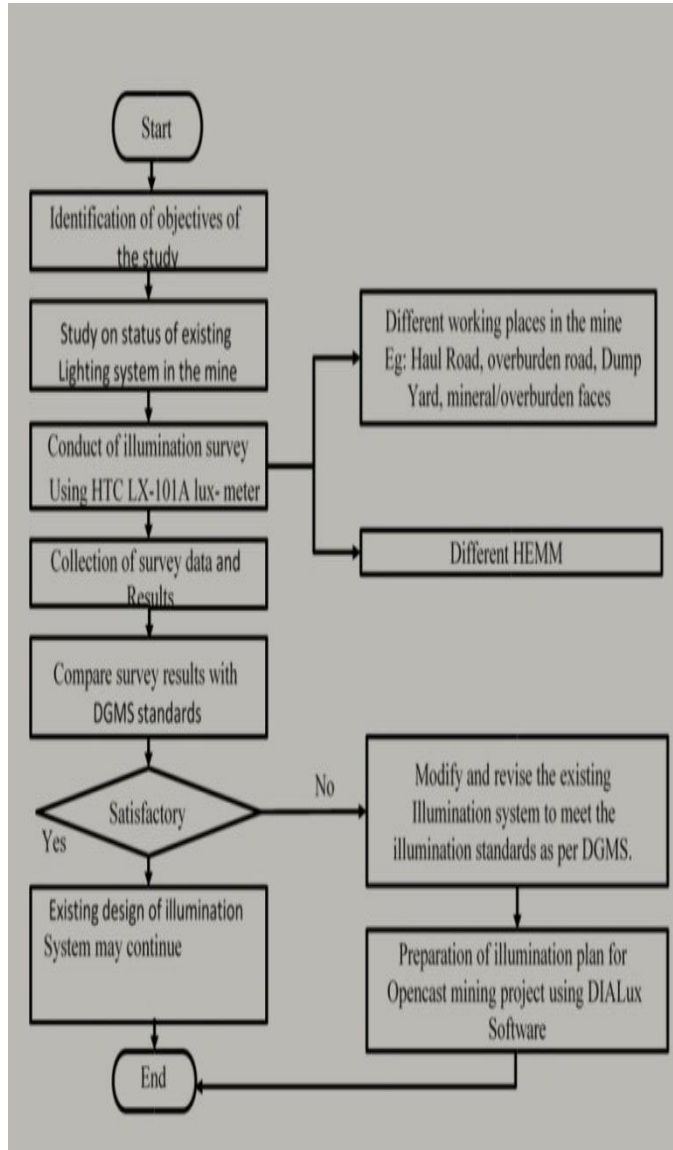
Fig 1: Location of Pearl Granite Quarry

In the worldwide Market, each shade of Granite Slabs are having elective items/colours. Though for Black Galaxy material, there is no substitute in the whole World. It has innate glitterness like Bronzite pieces dressed in Black, subsequently called Galaxy. Having overall interest for this item, Chinese used to get greater amount. Consequently the market request expanded and the present existing units are not in that frame of mind to take care of the interest of these Chinese Units. Other than development material, completed chunks are predominantly utilized for kitchen stages in numerous European and worldwide nations. Particularly for landmarks, they utilize the dark material wherein the Black Galaxy is the most Premium material in this fragment.

Stone has become one of the most famous items among building materials. It has been utilized from millennia in both inside and outside applications. Rock layered stone is utilized in development of structures, spans, clearing, landmarks and numerous other inside projects. The business has been an unexpected spray in rock's use as ledges for example kitchen, washroom, and gathering counters. There is monstrous interest for stone ledges in the U.K, Middle East, North America and different nations in Far East and Europe. Today in India rock is utilized generally in homegrown development area, landmarks development market, friendliness industry, trade market, and collectibles. The Granite material turned out to be notable in light of mechanical headways, complex quarrying methods and diminished cost of mining and development in utilization as material in the enrichment area.

**IV. METHODOLOGY AND FIELD OBSERVATIONS**

The following flow chart shows the design methodology for the present project



**Fig 2: Flow chart for Illumination Design Methodology for the Project**

**Table 1: DGMS Standards of Illumination in Opencast Mines**  
(Abbreviations-V: Vertical, H: Horizontal)

Sl.No.	Place/Area to be illuminated	Minimum standards of illumination to be provided (in lux)
1	Work place of heavy machinery	15H,25V (So as to cover depth and height through which the machine operates.)
2	Drilling operations	
	(a)Area where drilling rig works	25V (So as to illuminate full height of the drilling rig.)
	(b) area where drill holes exists	15H
3	Places where manual work is done	15H,25V
4	Places where loading, unloading, or transfer loading of dumpers, trucks or train is carried on (including OB Dump and coal stack yard)	15H,15V
5	Operators cabins of machines	50H
6	Haul roads for trucks and dumpers	10H
7	Roadways and footpaths from bench to bench	10H
8	Permanent path for use of persons employed	10H
9	First aid stations	50H
10	Workshops	100H,50V
11	Pumping station	40H
12	Electrical sub station	100H,50V
13	Parking yard	50H
14	General working areas has determined by manager in writing	10H

**Table 2: Illumination Study of Excavator-1**

<b>Make</b>	VOLVO Construction Limited	
<b>Model</b>	EC380DI	
<b>Number of lights</b>	Front-5, Rear-1	
<b>Cabin light(lux)</b>	52.1	
<b>Distance(m)</b>	<b>Horizontal Illuminance in lux</b>	<b>Vertical Illuminance (at a height of 2m) in lux</b>
5	17.3	89.7
10	12.4	28.1

**Table 3: Illumination Study of Excavator-2**

<b>Make</b>	L&T Construction Equipment Limited	
<b>Model</b>	KOMATSU	
<b>Number of lights</b>	Front-3, Rear-1	
<b>Cabin light(lux)</b>	24.5	
<b>Distance(m)</b>	<b>Horizontal Illuminance in lux</b>	<b>Vertical Illuminance (at a height of 2m) in lux</b>
1	7.4	310.7
2	16.8	94.2
3	9.3	44.7

**Table 4: Illumination Study of Dumper**

Make	CATERPILLAR	
Number of lights	Front-4, Rear-1	
Cabin light(lux)	51.4	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 2m) in lux
1	10.5	150.6
2	10.7	110.2
3	19.2	65.9

**Table 5: Illumination Study of Trimmer**

Make	CATERPILLAR
Number of lights	Front-3, Rear-1
Cabin light(lux)	40.5
Horizontal Illuminance in lux	232
Vertical Illuminance (at a height of 80cm) in lux	47.2

**Table 6: Illumination Study of Ranger**

Make	CATERPILLAR	
Number of lights	Front-5, Rear-2	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 1.3m) in lux
1	6.2	700.4
2	10.4	218.5

**Table 7: Illumination Study of Mobile Light at Wire Saw at Level-4**

Type of light	INCANDESCENT LAMP	
Number of lights	2	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 1.6m) in lux
1	90.7	800.9
2	50.1	234.3

**Table 8: Illumination Study of Mobile Light at Wire Saw at Level-8**

Type of light	INCANDESCENT LAMP	
Number of lights	2	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 1.6m) in lux
1	114.7	860.1
2	69.3	285.3

**Table 9: Illumination Study at Workshop**

Type of light	LED	
Number of lights	2	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 1.5m) in lux
2	26.8	35.1
4	94.5	80.3
6	60.4	53.2
8	30.8	24.6

**Table 10: Illumination Study of V Loader -Front Side**

Number of lights	7	
Cabin light(lux)	57.4	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 2m) in lux
5	12.3	116.4
10	23.5	84.4
15	17.2	20.8

**Table 11: Illumination Study of V Loader-Rear Side**

Number of lights	8	
Cabin light(lux)	57.4	
Distance(m)	Horizontal Illuminance in lux	Vertical Illuminance (at a height of 2m) in lux
5	12.4	152.1
10	13.5	45.3

**Table 12: Haul Road (at the entrance of the mine)****Illumination Survey Data of Pearl Granite Quarry**

Serial No	Distance (m)	Horizontal Illuminance in lux		
		Left Edge of The Road	Middle of The Road	Right Edge of the Road
1	0	9.7	7.4	5.7
2	2	12.3	9.5	7.6
3	4	15.4	10.2	9.4
4	6	18.7	11.2	10.3
5	8	20.1	14.3	11.6
6	10	19.4	14.6	9.1
7	12	17.3	11.2	7.5
8	14	10.1	8.7	5.3

**Table 13: Ramp (connecting level 7 and level 8)****Illumination Survey Data of Pearl Granite Quarry**

Serial No	Distance (m)	Horizontal Illuminance in lux		
		Left Edge of The Road	Middle of The Road	Right Edge of the Road
1	0	0.7	3.2	9.5
2	2	1.9	3.6	9.2
3	4	2.8	3.9	9.1
4	6	3.1	3.5	9.4

**Table 14: Illumination Survey Data near Sump at Level-8**

PLACE	Horizontal Illuminance in lux
start	29.1
end	4.7

**V. CONCLUSIONS**

- The average lux level on Haul Road was 11.53 lux, which is within the range that the DGMS recommends for safe driving, which is (0.5 to 3.0) lux.
- With an average lux level of 4.99, the suggested lux level range for Ramp by DGMS is between 0.5 and 3.0.
- One machine, the L&T KOMATSU backhoe, was an exception to this rule. Its cabin illumination was determined to be just 24 lumens brighter than the threshold that was advised by DGMS, which was set at 50.

**VI. RECOMMENDATIONS**

- The cabin of the L&T KOMATSU earthmover has the capability of being fitted with an incandescent lamp that ranges from 40–60 W.
- To comply with the regulations regarding safety, a high-mast lighting tower must be installed around the perimeter of the landfill.

**VII. ACKNOWLEDGMENT**

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**VIII. REFERENCES**

1. N.Lakshmipathy, Ch.S.N.Murthy, and M. Aruna (2014): Problems Encountered in the Types of Lighting Systems Generally Used in Surface Mining Projects (<http://www.theijes.com/papers/v3-i9/Version-1/10391061072.pdf>)
2. Lighting in underground mines - ILO content manager (<https://www.iloencyclopaedia.org/part-xi36283/mining-and-quarrying/item/605-lighting-in-underground-mines>)
3. The Role of Illumination in Reducing Risk to Health and Safety in South African Gold and Platinum Mines. (<http://researchspace.csir.co.za/dspace/bitstream/handle/10204/1855/GAP804.pdf;jsessionid=8A37830C8ECAD5C4E7062C2118065548?sequence=1>)
4. Standards of illumination in opencast metalliferous mines (DGMS Circular No. o3 of 2017) ([http://dgms.gov.in/writereaddata/UploadFile/Cir\\_02\\_Legis\\_2\\_017.pdf](http://dgms.gov.in/writereaddata/UploadFile/Cir_02_Legis_2_017.pdf))
5. Satyajeet Parida- 2015: Design of illumination for an opencast manganese mine. (<http://ethesis.nitrkl.ac.in/7949/>)
6. Chowdhury, Olive (2014) DESIGN OF ILLUMINATION SYSTEM FOR AN OPENCAST COAL MINING PROJECT–A CASE STUDY. MTech thesis. (<http://ethesis.nitrkl.ac.in/view/divisions/sch=5Fmin/>)
7. Light measurement hand book- Alex Ryer (<http://apps.usd.edu/coglab/schieber/pdf/handbook.pdf>)
8. N. Lakshmipathy, Ch.S.N. Murthy and M. Aruna (2014) - Design of illumination system by using MATLAB
9. Mine Illumination: A Historical and Technological Perspective (John J. Sammarco, Ph.D. NIOSH, Pittsburgh, PA 15236 USA Jacob L. Carr NIOSH, Pittsburgh, PA 15236 USA.
10. Mine Illumination –Pranjal Sao (<https://www.slideshare.net/Pranjal1996/mineillumination>)
11. Taylor, A. E. Illumination Fundamentals. New York (USA), Lighting Research Center, Rensselaer Polytechnic Institute, (2000). (<https://www.lrc.rpi.edu/resources/publications/pdf/illuminationfund.pdf>)
12. <<http://pearlmines.in/>>
13. The Indian Electricity Rules ,1956 (<http://www.derc.gov.in/ActsPolicies/ActsPolicesfiles/ier1956.pdf>)
14. Rea, M. S. The IESNA Lighting Handbook: Reference & Application. New York (USA), Illuminating Engineering Society of North America, (2000).
15. < <https://www.amazon.in/HTC-Instrument-LX-Luxmeter-Up/dp/B013YPMMGM>>
16. < <http://www.slideshare.net/hrishihrx/luminance-and-illumination>>
17. Anil Valia. (2014-15) “Designing with light.” International lighting academy.
18. Boast, B. W. (1942). “Illuminating Engineering.” McGraw-Hill Book Co. Inc, New York.