

AN ANALYSIS OF LIGHTING IN BUFFALO CITY (MDANTSANE)

HIGHMAST VS STREETLIGHTING

BUFFALO CITY MUNICIPALITY



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A. BACKGROUND

In 1997 the Township of Mdantsane was incorporated in Buffalo City. The electrical network was in a state of neglect. The City awarded a R63 Million two-year contract for the rehabilitation of the network including the 120 High Masts and ±4 000 streetlights. The lighting was rehabilitated to the tune of about R3 million.

After the rehabilitation, the expenditure to maintain the whole of the electrical network was monitored. Consequently it was found that 75% of the lighting budget was being spent on the 120 high mast lights. After further investigations, the following were researched.

- Installation Cost
- Maintenance Cost
- Energy Consumption Cost
- Municipality's responsibility
- Other factors affecting lighting

B. LIGHTING OPTIONS

1) Why Provide Lighting?

In analyzing our lighting policy the first question that needed to be answered is "Why does the Municipality Provide Lighting"? Some of the reasons are listed below:

- Road Safety and Better Traffic Flow
- It helps deter Crime and Vandalism
- Improves the General Appearance of Residential Areas
- Improves General Living Standards
- To Provide Security

2) What do our consumers in low-income areas want?

While it is not the Municipality's responsibility to provide security lighting, this is the main requirement in low income areas.

The Municipality needs to balance this requirement with its responsibility to provide street lighting and in so doing ensure customer satisfaction.

If the above can be done, then communities will take ownership of the street lighting thus reducing vandalism.

Parts of the community want to retain high mast lighting because, when working, they provide security lighting. Adequate security lighting can be provided with the use of street front lighting. This requires that the street front lighting be correctly designed and a luminaire fit for purposed be used. For the consumer to accept this new type of lighting they need to be informed. Pilot projects can also be used to show consumers what to expect.

The type of lighting to be used is dependant on the nature of the terrain and the income level of the residents. In a high income area where most homes have their own security lighting, but traffic is higher, mainly road lighting is required. In lower income areas where there are fewer cars and the consumers do not have security lighting, a combination is required.

3) **High Masts**

We then looked at the different types of Lighting (High mast and streetlights).

Advantages

- To the uninitiated, high mast lighting is apparently cheaper to operate and maintain.
- It provides Security Lighting.
- It is purported to be less susceptible to vandalism.

Disadvantages

- Costly when vandalized.
- Usually a combination of streets lights and high mast lights are required.
- Costly to install.
- Costly to maintain.
- Hazardous to motorists due to the glare.
- When not functioning, large areas are left in total darkness.
- Highly susceptible to damage by lightning and birds.
- Light Pollution.

4) **Light Pollution**

- Environmental issues have become a major concern worldwide.
- Light pollution has been spotlighted.
- Some countries have already adopted legislation to reduce light emissions.
- It was felt that South Africa would follow with its own legislation.
- The type of lights used on high mast systems are designed to provide security and sports field lighting.
- As these types of fittings are not shrouded, light is lost upwards causing sky glow (light pollution).

Cost of a recent incident of vandalism

- The damage to this high mast light cost R40 000, 00 to repair. All the luminaries, trailing cable, steel cable and the control panel were stolen.
- The lighting platform and door all had to be replaced due to the damage.



5) Conventional Streetlights / Post Tops

Advantages

- Enhances the appearance of the residential area.
- Cheaper than high mast lighting (on existing electrical installation).
- Conforms to SABS 098 – 1.
- Post Top luminaries provide security lighting without being obtrusive.
- Residents take ownership of their lights.



Easy to install and maintain

- Shown in the picture is a local resident who has been trained to install streetlights.
- Some municipalities have taken this training further and use local residents to change light bulbs thus creating work opportunities.
- All electrical connections are completed by electricians.

Disadvantages

- Costly to install if no existing network is available.
- Conventional street lighting provides very little security lighting to houses.

NOTE: If planned correctly electrification and street lighting can be done simultaneously, therefore making street lighting the cheaper choice.

6. SECURITY LIGHTING

As security lighting is a big issue in low income areas we looked at how to provide security lighting in the most cost effective way.

a) High Mast Lights

- High masts when working provide security lighting, but are very obtrusive and the high glare can affect drivers of vehicles.
- It has been found that because high mast lights cover a large area, they became targets for the criminal element within communities. Without the lights working they have a large area of darkness to operate in. Lights, which have been vandalised, could be inoperative for several days depending on weather conditions, damage caused by vandals, and the availability of spares required for the repairs.
- It has been found that usually a combination of high mast lighting and street lighting is required to meet street lighting standards.
- This can be due to land contours or large buildings causing shadowed areas.

b) Street Lighting (Post tops)

- This type of lighting provides very good security lighting without being obtrusive and provides street front lighting, which meets the requirements of the SABS street lighting standards.
- It has been found that the consumer, for whom the light provides security, takes responsibility for it and immediately reports any fault to the Municipality.
- Vandalism is also reduced because communities take ownership.

c) COST COMPARISON

The real aim of the exercise is always the cost. What is the cheapest way to provide lighting that meets all customer needs?

i) Installation Costs

(This cost is based on installing the lighting on an existing reticulation network)

	High Mast	Conventional / Post Top
Supply Cable	R2000	ON EXISTING
Foundations	R17100	N/A
Mast (40 m)	R52000	N/A
Crane	R11600	N/A
Labour to erect mast no electrical work	R6500	N/A
Control Panel	R6000	R2500
Light Fittings	R25000	R71500
Lighting cable	R1800	R1200
TOTAL	R122000	R75200

Note:

- The above table is based on prices as quoted on 10 May 2004 and may vary. The lighting head on the high mast is fitted with 6 (six) 1000 W HPS floodlights.
- Cost based on the installation of 55 (70 watt) hps luminaries on existing network

ii) Maintenance Costs

Shown below is a comparison of typical faults, which occur, in the street lighting network:

Task	High Mast		Post Top	
	Materials	Labour	Materials	Labour
Cable	R720	R400	R16,00	R35
Lamp	R490,34	R200	R114,70	R50
Ballast	R780,90	R350	R180,35	R200
Complete Luminaire	R2 197,27	R350	R950,00	R100

After monitoring the budget on a monthly basis it was found that on average R25 000, 00 is spent on the maintenance of the 120 high mast lights compared to R5 000, 00 for the ±4 000 streetlights on materials alone.

As can be seen from the above comparison of typical faults, the labour for the repairs to the high mast lighting is very high. This is due to the fact that the lighting platform needs to be lowered for work to be carried out.

As this task falls under the Occupation Health and Safety Act (lifting gear), it requires a competent person to be available on site at all times.

Typically it takes 25 minutes to both lower and raise the platform on the mast (i.e. 50 minutes total).

For lamp replacement on a high mast to be cost effective you need to have at least 3 lamps out. This of course reduces the effectiveness of the mast in the interim.

There is a substantial increase in costs when a fault occurs to the steel trailing cable/lighting platform, which requires the hiring of a 30 ton crane.

Such faults, which occur, can be attributed to:

- Birds nest on the lighting platform.
- Jamming of the Platform Lowering Mechanism.
- Vandalism.
- High mast lights are susceptible to lightning (lightning strikes cause damage to trailing cables).

For the use of a mobile crane to be cost effective you have to allow for at least 3 high masts to be repaired at a time. This cannot always be done, as each high mast provides lighting over a large area and therefore cannot be inoperative for an extended period of time.

As the crane must be hired for a full day the cost incurred is at least R8 000, 00. It should be noted that work on a high mast can only be carried out on calm days (light wind). Any delays caused by wind once the crane is on site increase the costs. High winds are common in the Eastern Cape.

iii) **Energy Consumption Costs**

The comparison below is based on an area covered by a 40 m high mast. It has been established that you would require between 50 and 60 (70 Watt) hps light fittings to cover the same area using conventional street lights. We have based our calculations on 55 fittings.

a) **High Mast**

$$6 \times 1000 \text{ W} = 6000 \text{ Watts}$$

Taking an average of 10 hours working per day the cost of running a high mast per year would be:

$$6 \text{ kW} \times 10 \text{ h} \times 365 \text{ days} \times \text{R}0,26/\text{kWh} = \text{R}5\,694 \text{ per annum}$$

b) **Conventional Street lights / Post Tops**

$$55 \times 70 \text{ Watts} = 3\,850 \text{ Watts}$$

Taking an average of 10 hours working per day the cost of running the conventional street lights would be:

$$3,85 \text{ kW} \times 10 \text{ h} \times 365 \text{ days} \times \text{R}0,26/\text{kWh} = \text{R}3\,653,65 \text{ per annum.}$$

The Annual Energy cost for high mast lighting is R2 040,35 higher than that of the equivalent street lighting.

There are 120 high mast installations in Mdantsane which cost R244 842,00 per annum more to run than the equivalent number of conventional street lighting luminaries.

D. CONCLUSION

High mast lighting is more expensive to install and maintain.

Security lighting can be provided without having to resort to high mast lighting. Because conventional street lighting is situated closer to consumers they take ownership, thus reducing vandalism.

Light pollution can be reduced by installing the correct type of lighting for the job on hand. (i.e. use post top fittings to provide security as this type up fitting reduces upward light, and therefore reduces sky glow but still provides adequate lighting without being obtrusive).

- After considering the above the Buffalo City Municipality have taken the following decisions:
 - i) To remove all high mast lighting installations as and when they fail.
 - ii) To install only conventional street lighting or Post Top fittings.

This of course does not mean that high mast lights do not have a place, such as security lighting of factories and for sports field lighting.