LED Street Lighting- Current and Future Trends, South African Standards and Case Studies

By Daniel KASPER
The 3 Phases to LED transformation

1. Technology has reached ‘good enough’ phase
   - Small to medium projects, trial installations
   - The first LED light sources are placed in existing luminaires

2. Technology is superior, cost decrease, penetration, mass adoption
   - Payback times decrease, volumes grow fast
   - Consolidation around certain light sources, implementation of standards

3. New solutions, new features are added
   - New form factors, new lighting vehicles, new channels
   - Digitalisation and Intelligence
Who can I trust…who is there to support me in future

Newest trends

Are the guarantee conditions covering me sufficiently

Misleading claims
Newest trends
LED Luminous Efficiency compared to other light sources

- 2018: 200 lm/W
- 2013: 160 lm/W
**BEKA LEDlume midi**

- **<45/50W**
- **HID Equivalent: >42/70W**
- **<150W**
- **<250W**
- **<400W**

**Residential streets, Pedestrian streets, paths, cyclepaths**

**Mixed traffic, commercial streets in urban areas**

**STREETS**

**PEDESTRIAN AREAS**

**Motorways, Highways, Express ways, Ringroads**

**ROADS**

**Motorized traffic, Roads in urban areas**

**Rural roads**

**BEKA LEDlume maxi**

**BEKA LEDlume mini**

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**Cool White Price ($/klm)**

- **LED optic 5068 – Urban Road**
- **LED optic 5091 – Residential Street Wide**
- **LED optic 5094 – Urban Performance**

- **Optic LensFlex2® “Narrow road” 5068**
- **Optic LensFlex2® “Residential street” 5093**

- **For S classification according to CIE 115**
- **For M4 classification according to CIE 115**

- **LED optic 5098 – Narrow Road**
- **LED optic 5102 – Major Road**
- **LED optic 5103 – Major Road Wide**

- **Optic LensFlex2® “Urban road” 5068**
- **Optic LensFlex2® “Motorway” 5092**

- **For M5 classification according to CIE 115**
- **For M5 classification according to CIE 115**

- **LED optic 5102 – Major Road**
- **LED optic 5103 – Major Road Wide**

- **Optic LensFlex2® “Medium area” 5120**
- **Optic LensFlex2® “Large area” 5121**
Who can I trust…

Misleading claims
National and international LED standards

- **Safety standard:**
  - IEC 60598-2-3
  - SABS 60598-2-3

- **EMC standards:**
  - IEC 55015,
  - IEC 55022-F
  - IEC 61000-4-5

- **IEC standard:**
  - IEC 62722-2-1 (revised version for SANS)
  - IEC 62717 (modules)

- **IES standard:**
  - IES LM80-08 (LED lumen maintenance)
  - IES LM79-08 (LED luminaire maintenance)
  - IES TM21-11 (LED lumen maintenance projection)

- **ARP 035:**
  - Approved recommended practice
Performance scope

- Photometric measurement and reporting
- Lumen maintenance and endurance test
IES LM 80-08
Projection data

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Temperature (solder-point)</strong></td>
<td><strong>T_s = 55 °C</strong></td>
<td><strong>T_s = 85 °C</strong></td>
<td><strong>T_s = 118 °C</strong></td>
</tr>
<tr>
<td><strong>α</strong></td>
<td>2.495E-06</td>
<td>2.617E-06</td>
<td>2.621E-06</td>
</tr>
<tr>
<td><strong>Projected L70</strong></td>
<td>140,238 hours</td>
<td>126,784 hours</td>
<td>127,483 hours</td>
</tr>
<tr>
<td><strong>Reported L70</strong></td>
<td>102,000 hours</td>
<td>102,000 hours</td>
<td>102,000 hours</td>
</tr>
</tbody>
</table>
Endurance Test - Temperature cycling test:

Endurance Test – Supply switching test:

Endurance Test – Accelerated operation life test:
STANDARDS SOUTH AFRICA

Recommended practice

Guidelines for the installation and maintenance of street lighting

This document does not have the status of a South African National Standard.
<table>
<thead>
<tr>
<th>Item 1</th>
<th>Item 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of luminaire and lamp type</strong></td>
<td><strong>Unit</strong></td>
</tr>
<tr>
<td>250W HPS/E</td>
<td>LEDlume 60/145W - 5102</td>
</tr>
</tbody>
</table>

**Design criteria**

| Lighting category | A2 | A2 |
| Arrangement | Single sided left |
| Lanes per carriageway | 2 |
| Width of each lane | m | 3.7 |
| Mounting height | m | 10 |
| Overhang of left-hand side | m | 0 |

**Maintenance factor:**

- for IP 6: 0.83*0.90
- for IP 5: 0.76*0.90

| Traffic volume for road without median vehicles per hour per lane | 300 |
| Luminance | cd/m² | 1 |
| Overall uniformity | U₀ | 0.4 |
| Longitudinal uniformity | Uₗ | 0.6 |
| Threshold increment | % | 20 |

**Design results**

| System Wattage, per luminaire | W | 278 | 145 |
| Lamp lumen | lm | 27000 | 15100 |
| Angle of tilt | degrees | 15 | 0 |
| Pole spacing | m | 42 | 44 |
| Luminance | cd/m² | 1.01 | 1.04 |
# Price schedule, based on the following given costs:

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<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>3</td>
<td>Number of years to be considered for evaluation</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Electricity Cost per kWh, averaged over the projected period</td>
<td>R</td>
<td>1.3</td>
</tr>
<tr>
<td>5</td>
<td>Cost of installed pole, inclusive internal wiring</td>
<td>R</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>Unit price of luminaire, inclusive of light source</td>
<td>R</td>
<td>1347</td>
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<tr>
<td>7</td>
<td>Scheme price as per formula A</td>
<td>R</td>
<td>103 500</td>
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<tr>
<td>8</td>
<td>Power consumption per km [1]/[2]</td>
<td>kW</td>
<td>6.619</td>
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<tr>
<td>9</td>
<td>Annual Energy Cost per km, as per formula B</td>
<td>R</td>
<td>34 419</td>
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</tbody>
</table>

Cost of Ownership for the evaluation period: \([7]+[3]*[9]\)

R 206 757 208 705

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**Design results**

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<td>Lamp lumen</td>
<td>lm</td>
</tr>
<tr>
<td></td>
<td>Angle of tilt</td>
<td>degrees</td>
</tr>
<tr>
<td>2</td>
<td>Pole spacing</td>
<td>m</td>
</tr>
<tr>
<td>25</td>
<td>Luminance</td>
<td>cd/m²</td>
</tr>
</tbody>
</table>

**Overall uniformity**

- **Group A New**
- **Group B New**
- **Group A Existing**
- **Group B Existing**
Who can I trust...who is there to support me in future

Are the guarantee conditions covering me sufficiently
LEDlume projects installed

People involved LED product manufacturing ≈750
Thank you for your attention!