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# DETERMINATION OF PERFORMANCE EVALUATION & DEVELOPMENT DIRECTION OF A TRIAL PRODUCT FOR A LOW LIGHTING

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## ABSTRACT

A traditional light pole-type road lighting is mostly installed on the roadside to provide the driver with the visibility at night or in inclement weather, but current light pole type road lighting which is designed to irradiate the light to road surface from a high level using a light source restricts the visibility of the driver because of the constraints in design. Recently, a line lighting system which was developed by supplementing the shortcomings of the existing light pole type has been emerged as the alternative. However since no evaluation method for a line lighting system is available, the method used for the light pole type is inevitably adopted. This study is intended to identify the road illumination grade using the trial product under development so as to determine the development policy in future.

***Keywords***: *Low-lighting System, Road Lighting, Road Lighting Calculations*

## I. INTRODUCTION

Road lighting is used as almost an only means to secure the driver's visibility at night or in inclement weather condition. A light pole type that irradiates the light to road surface from a high level has been globally used for road lighting. But a light pole type results in light loss, leaked light, excessive energy consumption and light pollution because of the technical and design limit due to the difference in elevation between the light source and road surface. A line lighting which significantly has improved the problems with a light pole type by adjusting the installation level to driver's eye-level has been introduced. Then despite of many advantages, it still has difficulties in breaking into the market due to unfavorable economic feasibility, which remains to be solved. Besides, a line lighting has no performance valuation method which is globally verified and thus the method used for a light pole type is inevitably adopted. This study thus is intended to identify the road illumination grade using the trial product under development, thereby determining the development policy in future.

## II. OPTICAL MESUREMENT

### 2.1 Setting Of Trial Product

As seen in Figure 1, 10 trial products were placed longitudinally so as to irradiate the light to the shoulder and the road and the measurement was conducted at 2m and 3m interval, respectively.

**Figure**

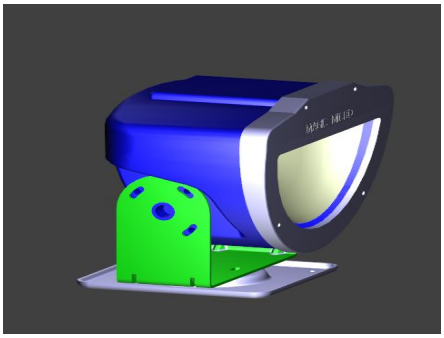

*Figure 1.Trial Product*

Figure2 shows the trial products installed

**Figure**

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*Figure 2.Trial products installed*

### 2.2 Instrument

Technoteam's portable luminance meter, lmk mobile advanced('lmk') was used to measure the luminance.lm is the instrument designed to measure the lighting at urban environment including road and tunnel as well as the efficiency of various color rendering and lighting device.

**Figure**

*Figure 3. LMK Mobile Advanced(http://www.is-soft.co.kr)*

### 2.3 Calculation Of Photometric Quantity And Evaluation Of Road Lighting Grade

Calculation domain was determined as follows, referring to the recommendation for Road lighting calculation domain, CIE 140-200 as Figure 4

**Figure**

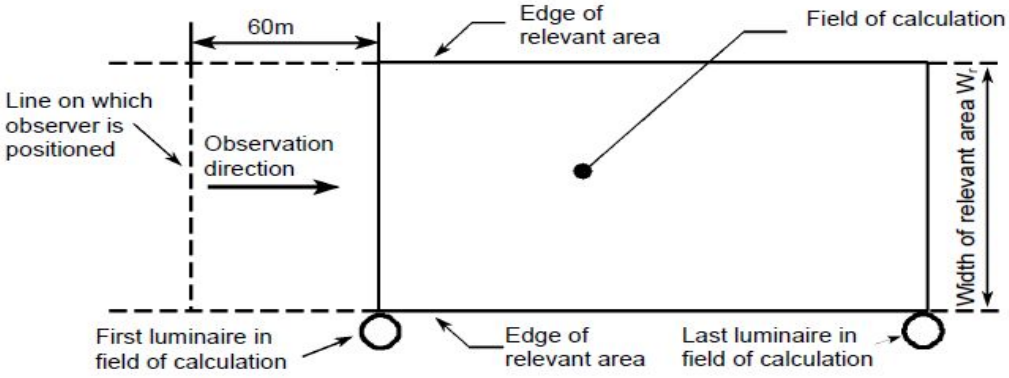


*Figure 4. Field of calculation for carriageway luminance (CIE 140-200)*

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- Calculation domain is a typical road area and the first lighting device was set 60m ahead of the observer.
- The observer is located at the center of the driving lane laterally
- height of the instrument was1.5m

Road lighting glade, according to CIE 115:2000, is determined by average road surface luminance (), overall uniformity () and longitudinal uniformity ()

Average road surface luminance () and overall uniformity () are calculated for whole road from the observer's position while longitudinal uniformity () is calculated for each center line. Utilization value of ,and is the lowest value in each case.

Road light grade is determined depending on ,, as Table 1.

**Tables**

*Table 1. Lighting classes for motorized traffic, based on road surface luminance(CIE 115:2000)*

| Lighting class | Road surface | | | | Threshold increment | Surround ratio |
|---|---|---|---|---|---|---|
| | Dry | | | wet | | |
| | in | | | | in % | |
| M1 | 2.0 | 0.40 | 0.70 | 0.15 | 10 | 0.5 |
| M2 | 1.5 | 0.40 | 0.70 | 0.15 | 10 | 0.5 |
| M3 | 1.0 | 0.40 | 0.60 | 0.15 | 15 | 0.5 |
| M4 | 0.75 | 0.40 | 0.60 | 0.15 | 15 | 0.5 |
| M5 | 0.50 | 0.35 | 0.40 | 0.15 | 15 | 0.5 |
| M6 | 0.30 | 0.35 | 0.40 | 0.15 | 20 | .05 |

## III. OUTCOME OF THE MEASUREMENT

Calculation method aforementioned is appropriate to existing light pole type and when it comes to a line lighting, no specific method is available now and thus when applying CIE140-2000, analysis is impossible because of difficulties in determining the measurement domain due to the interval of 2~3m. Thus calculation domain was adjusted to 10m to be able to conduct the analysis.

**Figure**

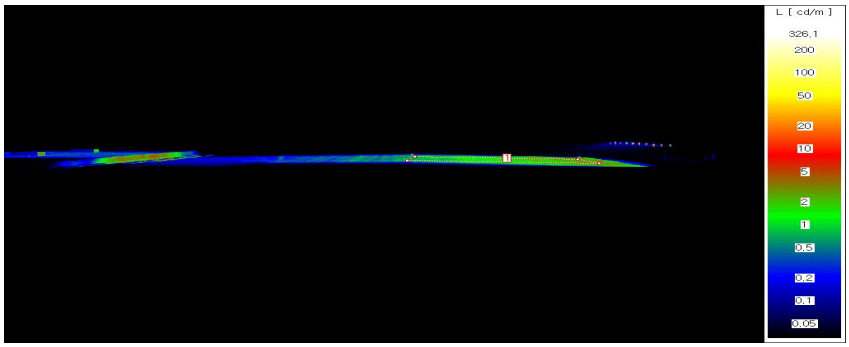


*Figure 5. Setting of calculation area*

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Consequently, according to the lowest value of average road surface luminance (), overall uniformity () and longitudinal uniformity (), M3 when the interval was 2m and M5 when the interval was 3m.

**Tables**

*Table 2. Outcome of measurement*

| when installation interval is 2m | | | | | |
|---|---|---|---|---|---|
| Object | 1st lane | whole | 2nd lane | whole | Lighting class |
| Location | center line of the 1st lane | center line of the 1st lane | center line of the 2nd lane | center line of the 2nd lane | |
| | | 1.660 | | 1.656 | M2 |
| | | 0.431 | | 0.433 | M1 |
| | 0.667 | | 0.600 | | M3 |

| when installation interval is 3m | | | | | |
|---|---|---|---|---|---|
| Object | 1st lane | whole | 2nd lane | whole | Lighting class |
| Location | center line of the 1st lane | center line of the 1st lane | center line of the 2nd lane | center line of the 2nd lane | |
| | | 1.014 | | 1.082 | M3 |
| | | 0.430 | | 0.449 | M1 |
| | 0.645 | | 0.500 | | M5 |

## IV. RESULT & DISCUSSION

According to the analysis of optical measurement of a low lighting trial product, road lighting grade was M3 at 2m interval and M5 at 3m interval due to longitudinal uniformity. When it comes to overall uniformity, it satisfied M1 requirement at both conditions and for average road surface luminance, it satisfied the conditions of M2 at 2m interval and M3 at 3m interval. Should the longitudinal uniformity be upward adjusted, development of the product with a higher road lighting grade is expected.

## V. ACKNOWLEDGEMENTS

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