EEP21 Information paper

Agenda item 11.2

Task Number 3

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**Examples of design on Illumination of Structures in Korea**

Korea Association of Aids to Navigation (KAAN)

This paper provides information about the examples of the design on Illumination of Structures (LED Light Pipe) in Korea. The fabricated LED Light Pipe is a transparent acrylic round bar and easy to install. The Light Pipe is arranged in two rows of LED 78. It can be connected in series, has 4 colors (Red, Green, Yellow, White). Fig. 1 showed a picture of LED Light Pipe.

The internal structure of the Light Pipe, as shown in Figure 2, 3, has 3 types.

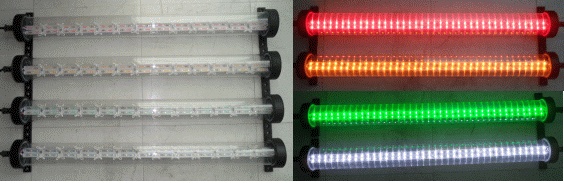


Fig. 1 LED Light pipe

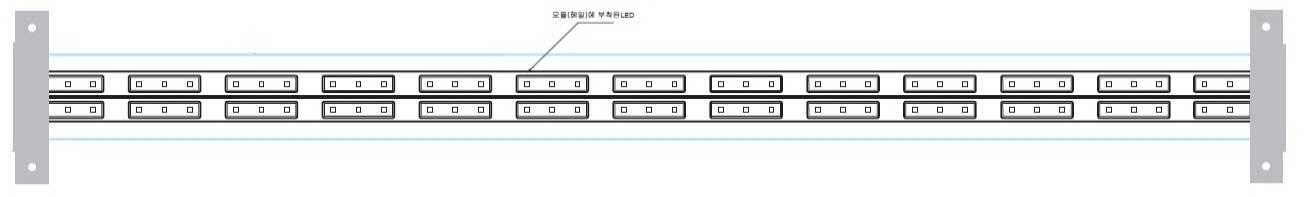


Fig. 2 Configuration of LED light pipe



Fig. 3 The internal structure of the LED light pipe

The following Table 1, 2 showed the specifications and optical characteristics of the LED light pipe. The horizontal divergence angle of the LED light pipe is defined as the range with 50% of maximum luminous intensity.

Table 1 Specifications of LED Light pipe

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | LP-G | LP-R | LP-Y | LP-W |
| color | Green | Red | Yellow | White |
| size | Φ80, 1000㎜(L) | Φ80, 1000㎜(L) | Φ80, 1000㎜(L) | Φ80, 1000㎜(L) |
| LED quantity | 78(39\*2 rows) | 78(39\*2 rows) | 78(39\*2 rows) | 78(39\*2 rows) |
| Voltage (V) | 12 | 12 | 12 | 12 |
| Current (A) | 1.21 | 1.37 | 1.29 | 1.17 |
| Power Consumption  (W) | 14.52 | 16.44 | 15.48 | 14.04 |

Table 2 Optical characteristics of the LED light pipe

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | LP-G-1 | LP-G-2 | LP-G-3 | LP-R-1 | LP-R-2 | LP-Y-1 | LP-Y-2 | LP-W-1 | LP-W-2 |
| Maximum luminous intensity  (cd) | 613 | 594 | 252 | 293 | 297 | 257 | 250 | 905 | 883 |
| Luminance  (cd/㎡) | 4,785 | 4,634 | 1,920 | 2,659 | 2691 | 2,347 | 2,484 | 7,633 | 7,172 |
| Horizontal divergence angle(°) | 60 | 51 | 100 | 60 | 51 | 59 | 52 | 61 | 52 |

Fig. 4, Fig. 5 and Fig. 6 show the light distribution curve of the Green LED light pipe with 3 types. The maximum luminous intensity of Type-1(flat plate with 60° lenses) is 613cd, the Type-2(v plate with 60° lenses) is 594cd and the Type-3(v plate) is 252cd. The horizontal divergence angle of Type-1 sample is 60°, the Type-2 is 51° and the Type-3 is 100°.

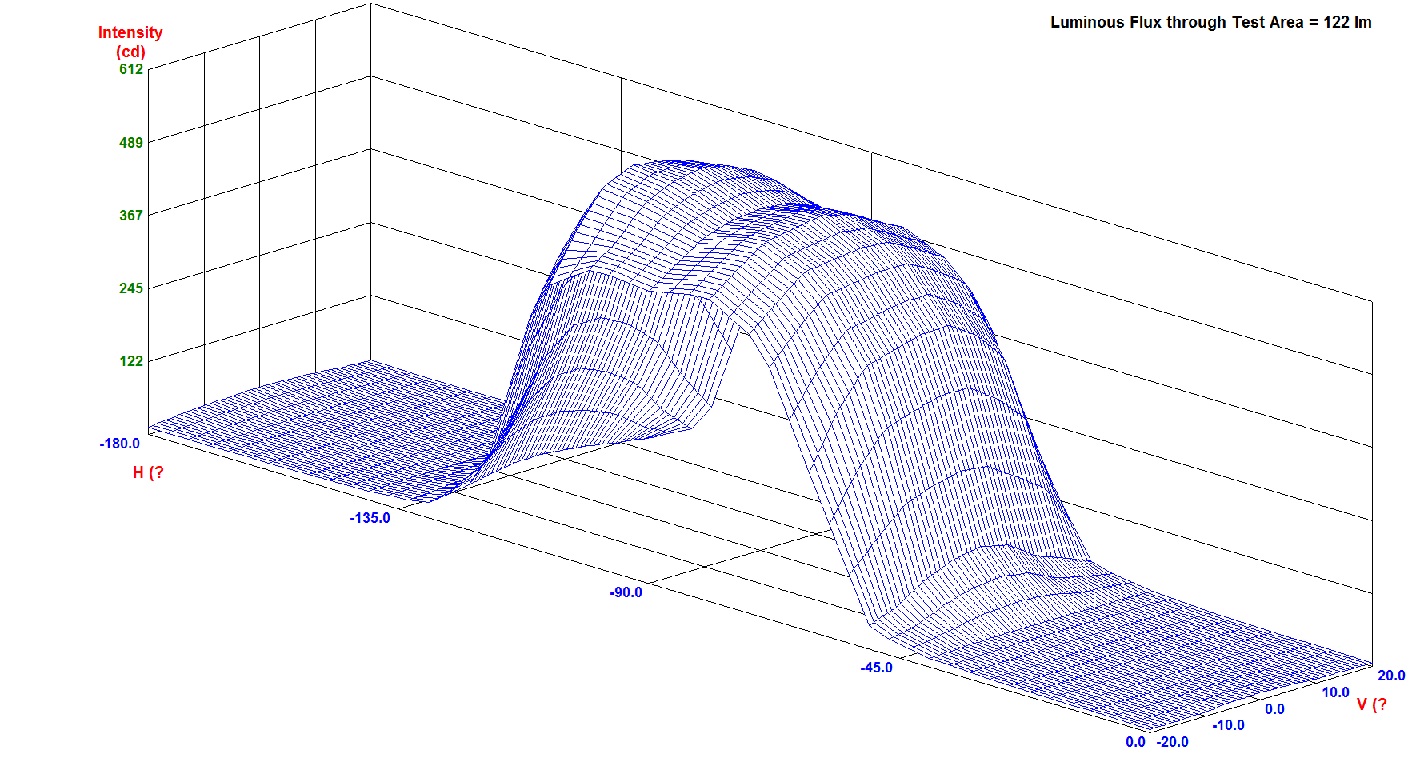


Fig. 4 The light distribution curve of the LED light pipe (Type-1, LP-G-1)

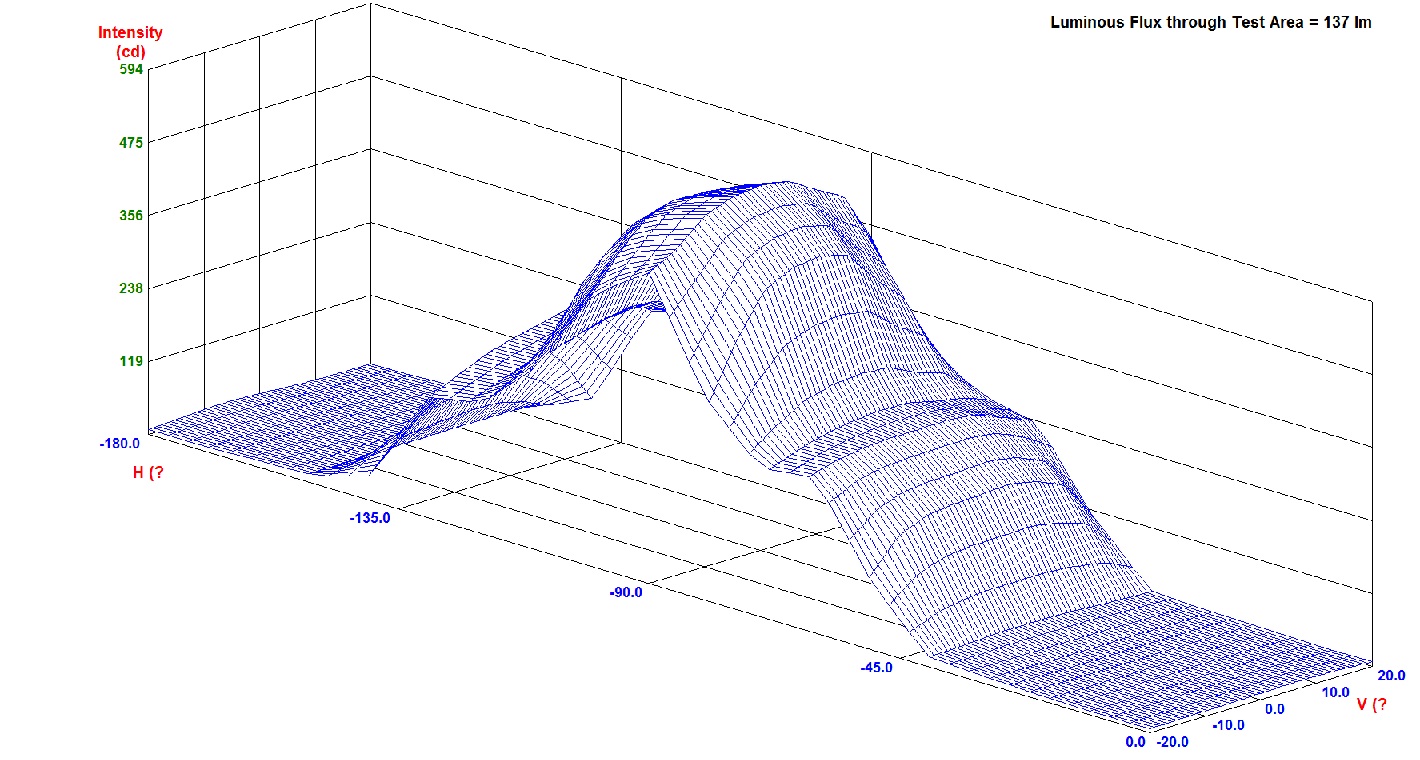


Fig. 5 The light distribution curve of the LED light pipe (Type-2, LP-G-2)

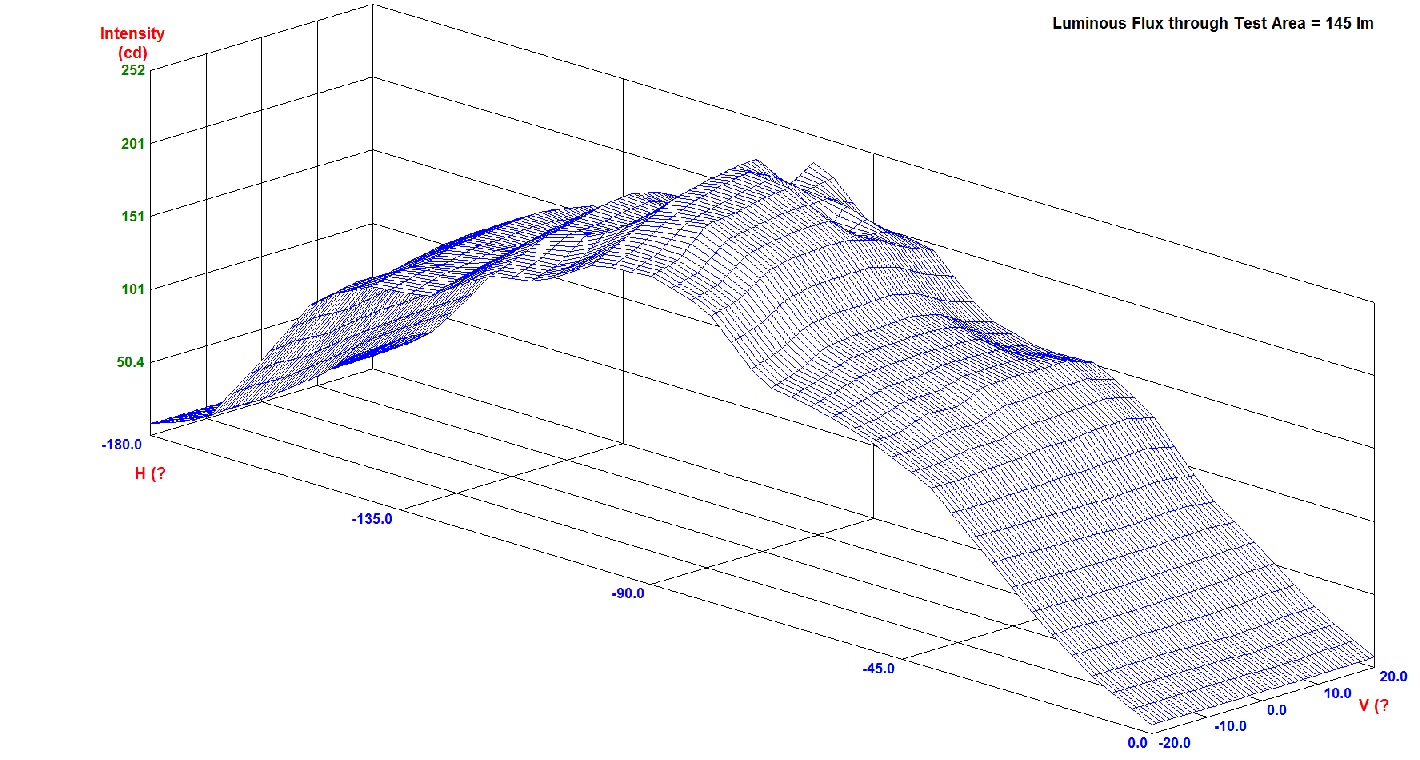


Fig. 6 The light distribution curve of the LED light pipe (Type-3, LP-G-3)

In the field experiments, we evaluated the conspicuity on the original lantern and LED Light pipe. The field experiment was conducted in ‘Yeosugu Hang lighthouse’ in Yeosu-city (Korea). We observed a distance of 790m from the lighthouse. Three Light pipes fixed on the mounting plate were installed as a serial in the vertical direction (LP-G-1 (upper), LP-G-2 (middle), and LP-G-3 (lower)). The original lantern has the light pipe with intervals of 1.5m. The light characteristic was set equal to F1 G 4s (original lantern). From the experimental results, it was confirmed that the fabricated LED Light Pipe is clearly distinguished.



Fig. 7 The location of the field experiment



Fig. 8 Photograph of the original lantern (AtoN) and installing LED Light Pipe

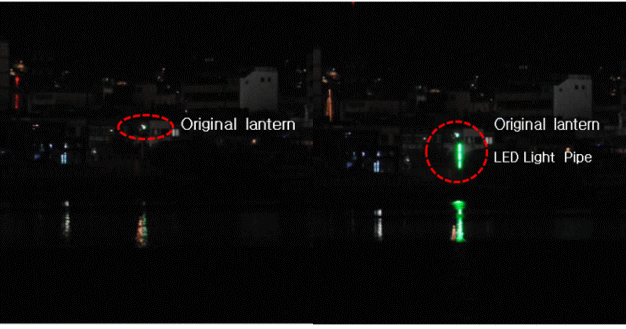


Fig. 9 Comparison of conspicuity on the original lantern and LED light pipe

The method of installing the LED light pipe in place of the conventional LED floodlight (breakwater lighthouse installed in Jeju Island) is proposed. Table 3 shows the optical characteristics to compare LED Floodlight with LED light pipe.

The pictures installed LED floodlights are shown in Figure 10. The configuration diagram of the LED light pipe arranged intervals of 30° in a breakwater house is shown in Figure 11, Figure 12. It is for the ship to enter the harbor. The arrangement of LED light pipe, depending on the installation environment, can be variously changed.

Table 3 Comparison of the LED light pipe (2lines) and existing LED Floodlight

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **unit** | **LED Floodlight** | **LED light pipe** |
| Voltage | V | DC 15V | **DC 12V** |
| Power Consumption (1set) | W | 36 | **16.5** |
| Number of LED (1set) | EA | 12 | **78** |
| Size | ㎜ | 360x100x55㎜ | **1,000x80x80㎜** |
| Total Number of the Light | set | 30 | **6** |
| Total Power Consumption | W | 1,080 | **99** |
| Viewing angle | o | 360 | **120** |
| Installation type | - | Radial arrangement  (Round) | 2 lines at intervals of 30° |



Fig. 10 Pictures of breakwater lighthouse installed LED floodlight (Seogwipooehang in Jeju)

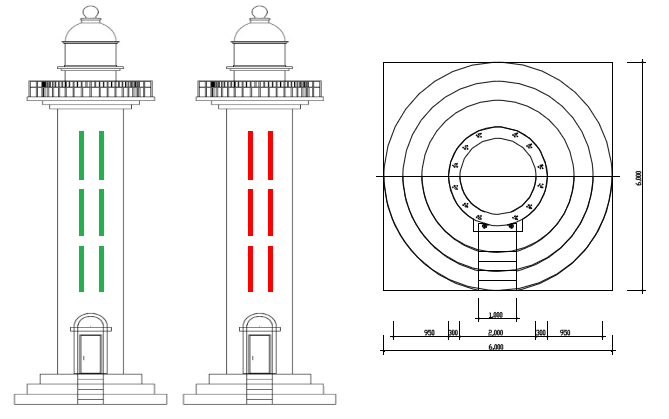


Fig. 11 Design of the LED light pipe on the breakwater lighthouse (2 lines)

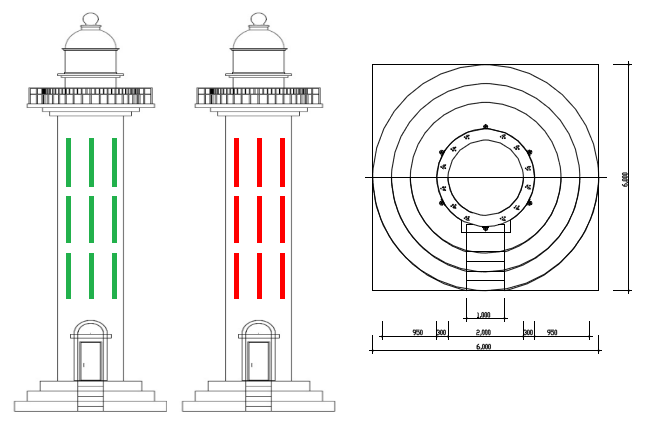


Fig. 12 Design of the LED light pipe on the breakwater lighthouse (6 lines)

**Future Tasks**

The field experiment is required for the different colors of the Light Pipe. The optical characteristics (including luminous intensity, luminance, visible range, et.al) on Illumination of Structures should be continually considered.