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**□** ARM **X** ENG **□** PAP **□** Input

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Agenda item 3.1

Workplan Task Number / Technical Domain 2 x.x.x /\_\_\_\_\_\_\_

Working Group WG1

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Establishment of Optical Performance Guideline for Bridge Lantern to Improve Visibility

In October 2020, an accident occurred at Wonsan-Anmyeon Bridge in Tae-an, South Korea where a fishing boat operating at dawn struck a pier. The accident has occurred at night time because operator didn't recognize bridge lantern. In Korea, marine bridge crash accidents have occurred continuously, and over the past 10 years, 26 cases of marine bridge crash accidents have been reported.

In order to prevent the same accidents, revision of the guideline for the function and specifications of AtoN is being pursued and the focus is on bridge safety management. In January 2021, the guideline for the functions and specifications of AtoN were revised and announced. In addition to the previously defined bridge marks, pier foundation lights and pier boundary lights have been added.

In addition, in the first half of 2021, safety inspections were carried out for bridge lantern of the Korean maritime bridge marks improvement plan. According to the survey, a total of 192 bridges in Korea were investigated. There are 60 bridges installed in large-scale fishing ports and 132 bridges installed in small-scale fishing ports. As a result of the safety inspection, a total of 83 points were noted, of which 68 were directly or indirectly related to the visibility of bridge lantern.

The visibility of bridge lantern is the most important factor in preventing accidents, and visibility may deteriorate due to the influence of backlights such as landscape lights and coastal lights. Therefore, in order to increase the visibility of bridge lantern, optimizing the luminous intensity according to distance and divergence angle, etc. would be considerated. For this reason, it is necessary to clarify the installation guideline for bridge lantern, such as restrictions on backlight, installation location, luminous intensity, and etc.

Since the installation guideline for bridge lantern are not clear, we have selected a few bridges with a lot of traffic and study on the installation guideline for bridge lantern considering optical performance through field surveys and data analysis in progress.

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| Figure 1  *Fresnel lens type* | Figure 2  *Reflector type* | Figure 3  *Individual lens type* | Figure 4  *Lens module type* |

In order to prepare the optimal vertical divergence angle guideline, 4 domestic companies evaluated the visibility efficiency before and after changing the divergence angle of bridge lantern. As a result of the measurement, when the divergence angle of the existing bridge lantern was lowered by 9, the visibility was improved by an average of 38 times. The effect of improving visibility by lowering the vertical divergence angle of bridge lantern and the like is shown to be large at the distance that ships mainly recognize bridges and navigation(within about 1 NM from the bridge).

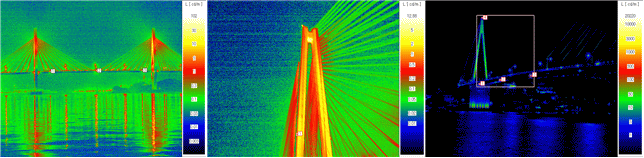


Figure 5 *Measurement of effective luminous intensity of Wonsan Anm-yeon Bridge, Hwayang-Jobal Bridge and Dolsan Bridge*

In order to select an appropriate luminous intensity guideline for bridge lantern, backlight measurement was conducted in the real sea area. The backlight measurement compared the background luminance(landscape lighting) with the bridge lantern currently installed on the bridge, and through comparative measurement, we tried to find a reference value that satisfies the prerequisite that the minimum luminous intensity bridge lantern should be higher than that of the backlight. Measurements were carried out at Wonsan-Anmyeon bridge, Hwayang-Jobal bridge, dolsan bridge. As a result of the measurement, the fixed light intensity can be calculated as 108 cd(based on 5 NM LED flashing bridge lantern).

In addition, we identified the operating status and problems of bridge lantern in marine bridge, and collected opinions from ship users passing near the bridge. As a result of the field survey, it was found that there was no difficulty in navigation as the bridge marks installed in large-scale fishing ports were well installed and operated with bridge lantern, bridge daymarks, pier foundation lights and pier boundary lights. On the other hand, in the case of bridge marks installed in small-scale fishing ports, bridge lantern and bridge daymarks are well installed and operated, but there is a high risk of collision with bridges at night because there are many places where pier foundation lights and pier boundary lights are not installed.

In the future, we plan to expand the field of investigation on the current status of bridges in Korea to reinforce the evidence of vertical divergence guideline and effective luminance guideline for bridge lantern.

There is information on installation and operation of bridge lantern in the recommendation and guideline, but there is no information about improving visibility, so request for revision of guideline.