Examination of lighting equipment plans for evacuation plans in a natural disaster

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1. Introduction

In the event of a natural disaster, lighting facilities are indispensable for evacuees to recognize the direction of evacuation and to confirm the safety of walking routes when they evacuate from danger zones to safe places. While the ease of evacuation depends on factors such as light intensity, the arrangement of equipment, and the illuminated target, the methods of planning lighting equipment that can be applied to plans for these factors have not been well developed.

NILIM has conducted research and development to address this issue since FY 2020. This paper provides an overview of the method of evaluating lighting environments for examining lighting facility plans and describes the future plan.

2. Overview of the method of evaluating lighting environments for evacuation routes

Conventionally, road surface illuminance, which indicates the degree of light falling on a road surface, is often used as one of the indicators for evaluating the visibility of walking space. Road surface illuminance is found to be useful as one of the effective indicators in terms of ease of calculating light intensity over the entire evacuation route and developing designs. However, to help evacuees recognize and determine the evacuation direction, it is necessary to take into account the relationship with luminance, which is information on the brightness that reaches pedestrians' eyes directly from buildings, stairs, trees, and light sources that are in their field of vision. In this study, information on luminance distribution by image photometry was obtained using a commercially available digital camera, and a subjective evaluation of the ease of identifying surrounding spaces and the visibility of road surfaces was conducted to examine their relationship.

As an actual example of a night outdoor lighting environment evaluation, Figure 1 shows the results of subjective evaluations of different lighting conditions (bright and dark) at two different points (Point A and Point B), and Figure 2 shows the luminance distribution obtained using image photometry. As Figure 1 shows, the subjective evaluation of the ease of identifying walking space and visibility of the road surface decreased under dark lighting conditions at both Points A and B. The luminance distribution in Figure 2 shows that the subjective evaluation tends to improve as the number of sites from 1 to 10 cd/m^2 increases, indicating the usefulness of lighting environment evaluation based on luminance distribution.

3. Future plan

Lighting planning that demonstrates resilience in the event of a disaster is drawing growing interest not only in Japan but also worldwide. The future plan is to develop a method for lighting equipment planning that utilizes the knowledge gained from this research.

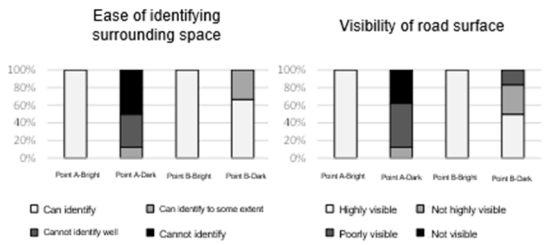

Figure 1: Results of subjective evaluation

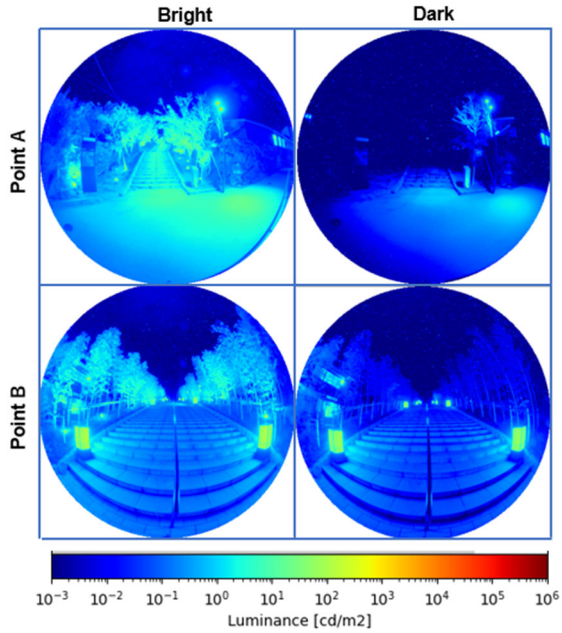

Figure 2: Results of luminance distribution measurement