

PWDAS-47**LIGHTING PATTERN EFFECT ON SPACE BRIGHTNESS EVALUATED
BY MEASURING BORDER LUMINANCE OF COLOR
APPEARANCE MODE**

Hideki Yamaguchi, Hiroyuki Shinoda, Wataru Iwai and Shigeko Kitamura

Ritsumeikan University, Kusatsu, Japan

It is very important for architectural design to assess space brightness quantitatively. To design a lighting environment, horizontal illuminance is generally used as the brightness of a room. But it is reported that a subjective brightness does not always match the horizontal illuminance. For example, the room furnished with high reflectance surface is perceived brighter than the room furnished with low reflectance surface, even though the horizontal illuminance is the same. Moreover, it is difficult to evaluate the brightness of a room which is illuminated ununiformly by plural lamps. To evaluate space brightness which is immeasurable by horizontal illuminance, we proposed a new measurement method using a border luminance of color appearance mode. The color appearance modes are divided into three categories according to its appearance; object color mode, unnatural object color mode, and light source color mode. We can define the 'border luminance' for an object's surface as the transition luminance between object color mode and unnatural object color mode. Our previous study showed that the brightness of a room which is illuminated uniformly was proportional to the 0.5th power of the border luminance. In this paper, we investigated the influence that the difference of a luminaire type and layout gave space brightness by measuring the border luminance. To clarify that influence more, we conducted the experiment with two rooms; one is furnished with high reflectance surfaces and the other is low reflectance surfaces.

The experiment was conducted with two rooms 2.4m wide by 3.9m long and 2.4m high. One is reference room, the other is test room. The reference room was furnished with white wall and light-gray floor. It was illuminated by circular fluorescent lamp placed on the center of the ceiling. On the other hand, interior decoration of the test room was arranged in two ways; one is the same as the reference room (H), the other is furnished with dark-gray wall and black floor (L). Lighting patterns of the test room were 18 conditions with combination of luminaires and light distribution. Subject was asked to adjust the luminance of the test patch placed at center of the room to the border luminance. Subject was also asked to evaluate the brightness of the test room with method of magnitude estimation. Six subjects participated in the experiment.

Even though the test room was illuminated by same lamp, perceived brightness of the test room obtained by magnitude estimation method was high if the observer could see high luminance part of luminaire. Moreover, perceived brightness of the test room was significantly different because of the interior decorations. It was found that the perceived brightness was proportional to the 0.4th power of the border luminance regardless of the lighting pattern and interior decoration. Other index of space brightness such as horizontal illuminance, however, did not always correspond to the brightness evaluated by subject. Our results showed that space brightness can be evaluated quantitatively by border luminance even if the room illuminated ununiformly by plural lamps.



This research was a part of the activity of research investigation committee of the Illuminating Engineering Institute of Japan. Although other evaluation methods were also examined in the committee, in this paper, only the measurement by using the border luminance was reported.