# 論 文 の 内 容 の 要 旨

論文題目　A Study on Brightness and Allowable Illuminance in Working Space
(執務空間における明るさと許容照度に関する研究)

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Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation. The greenhouse effect and an urban heat island is a metropolitan area that is significantly warmer than its surrounding rural areas due to human activities. In order to avoid these effects, global sustainability has aroused wide public concern. Sustainability is the potential for long-term maintenance of well being, which has ecological, economic, political and cultural dimensions. The easy way for sustainability is power-saving in daily life.

During the Great East Japan Earthquake in 2011, the Fukushima Daiichi nuclear disaster was an energy accident at the Fukushima I Nuclear Power Plant, initiated by the tsunami. Because of misgiving and politics factor, all nuclear power plants were already shut down for a periodic inspection now in Japan. However, shutting down all nuclear power plants was occurred power shortage. Japan government decided to require that above 500kW consumption companies or institutions should reduce 15% power in 1$^{st}$ July to 9$^{th}$ Sept. in 2011 benchmark for the same time in 2010. The other institutions or residence houses were asked reduce power consumption as more as possible. After 2011, up to now, shortage power still affects our daily life in summer.

According to reported that lighting consumes approximately 25% of the electrical energy supplied to office buildings in Japan, there is a lot of space for power-saving in lighting environment. There are so many method and research for power-saving in lighting environment, but reducing lighting consumption and lighting management are two of convenient method for power-saving in normal office building, especially after the Great East Japan Earthquake.

Therefore, this study is started the influence of reducing lighting consumption and the influence

of low task illuminance and ambient brightness. On the other hand, visual healthy is an important issue which should be concerned. VDT work has become the main working style in office, and the critical correlation of lighting environment is screen luminance. Because of above statement, this study is also discussed the influence of VDT screen luminance in low task illuminance and ambient lighting environment.

Chapter 1 presents the background related to power-saving in lighting environment. While the current lighting environment task horizontal illuminance is too high and the evaluation standard is incomplete, to the requirement of energy save, it is necessary to discuss again.

Chapter 2 is discussed the influence of visual fatigue and productivity in 200lux and 500lux task horizontal illuminance in VDT work. The result is mentioned that better working performance occurs in the lower illumination environment of 200lux in this study, which means that the contrast of luminance between the surrounding environment and the low-luminance monitors for VDT use is suggested to be smaller in order to minimize the sources of reflected luminance, thus influencing visual fatigue.

Chapter 3 is continued the result from chapter 2. To the need of power-saving, the experiment of minimum allowable horizontal illuminance in reading and VDT work is proceeded. Natural light was used as lighting resource, and horizontal task illuminance decreases with sunset. The subjects are required to reading or done VDT work through task horizontal illuminance decayed until they cannot tolerate it. Finally, the average minimum allowable task horizontal illuminance is 67lux in reading work; the average minimum allowable task horizontal illuminance is 57lux in VDT work. These results are very impressive what subjects can tolerate such low task horizontal illuminance.

Chapter 4 deals with office lighting environment survey in Japan after the Great East Japan Earthquake and normal situation in Taiwan. The almost horizontal average central task plane illuminance in 13 offices is between 400lux and 600lux in Japanese office. The result shows, although the task plane illuminance reduces, or even far below 750lux in JIS standard, workers can still work and did not feel dissatisfied.

Chapter 5 works on the minimum allowable task horizontal illuminance and vertical illuminance in eyes' position get from chapter 3. There are 5 different vertical illuminance conditions of ambient lighting environment and the subjects should adjust the minimum allowable and

appropriate task horizontal illuminance for each pattern. The result is indicated when the ambient lighting get brighter, subjects adjust the minimum allowable and appropriate task illuminance horizontal lower than when the ambient lighting get darker.

Chapter 6 is discussed the correlation of luminance uniformity of ambient space and the minimum allowable and appropriate task horizontal illuminance. Using spotlights to change uniformity of ambient space as independent variable, and asking the subjects adjust the minimum allowable and appropriate task horizontal illuminance. The experiment in this chapter is founded when the average luminance keeps identical and uniformity is good, minimum allowable and appropriate task horizontal illuminance can be adjusted lower.

The study finds that the minimum allowable and appropriate task horizontal illuminance may affected by ambient lighting environment. The brightness and uniformity is adopted to be independent variables for experiment in this study and required subjects adjusted the minimum allowable and appropriate task horizontal illuminance. According to experiemtns and survey, the minimum allowable and appropriate task horizontal illuminance in this study present that subjects can tolerate lower task horizontal illuminance and work smoothly.

Viewed generally, this study is one of concept for power-saving in lighting environment. The main methodology in this study is adjustment. Although there are another methods and measures to solve shortage power, like new lighting exploitation. The most important is that everyone should adjust our environment appropriately and get sustainability.