

# **ABSTRACT**

## **Predicting the Quantity of Natural Light on the Turf Grass Field of Football Stadia**

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The quantity of natural light on the turf grass of football stadia mainly depends on the aperture area, the transmittance of roof material, the reflectance of internal surfaces, and sky conditions.

In this study, the quantities of natural light on the turf grass of a football stadium were predicted by a computer model based on Monte Carlo Method, ray-tracing technique and Perez's sky model

This thesis consists of a total of six chapters, and each chapter can be summarized as follows:

In Chapter 1, the background and purpose of the study, the scope and methodology of the study were described.

In Chapter 2, Monte Carlo method, ray-tracing technique and Perez's sky model were reviewed.

In Chapter 3, photosynthesis and the route of natural light to the turf grass field were briefly explained. Then, the calculation process of illuminance by the computer model was described.

In Chapter 4, the configurations of a football stadia and major variables in terms of the natural lighting on the turf grass field were described.

In Chapter 5, the results from computer simulations were explained.

In Chapter 6, the conclusions of the study were stated.

The results of the study can be summarized as follows:

1. The higher the peculiar transmittance rates of roofs were, the higher the level of illuminance was without regard to sky conditions.
2. The illuminance on turf grass field of football stadia was dependent on the area of apertures. However, larger area of apertures reduced the illuminance on turf grass due to the reduced area of the internal surface. Accordingly, membrane roofs with more appropriate area of apertures will show higher illuminance because of internally reflected component.
3. The methodology and the results of this study can be useful information for the designers to optimize the aperture area.