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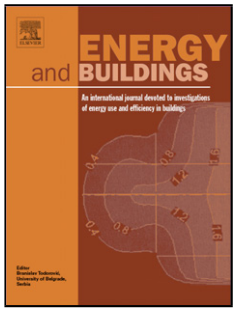

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AN INTEGRATIVE APPROACH for INDOOR ENVIRONMENT QUALITY ASSESSMENT of LARGE GLAZED AIR-CONDITIONED AIRPORT TERMINAL in the TROPICS

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Abstract
The indoor environment quality in large glazed space such as airport terminals affects its users in many ways. The indoor environment quality assessment of such a building was typically conducted objective measurement using measurement and subjective assessment using questionnaire survey. However, limited resources and measurement period imply that would be incomplete and cannot provide accurate results. Computer modelling is thus an additional tool in the integrative approach for indoor environment quality assessment and analysis to improve its comfort and energy performance.

Field measurement on the objective variables defined the environment quality and energy consumption, as well as questionnaire survey on the subjective judgment defined the indoor comfort. While the computer modelling was assessed across the air temperature, indoor glazed roof surface temperatures, mean radiant temperatures, operative temperatures and illuminance, to examine the building energy performance across the annual cooling load in 2010.

The inner surface temperature over glazed roof were recorded as 56^{o}C due to high level solar penetration, even when the indoor air temperatures over the floor level remain stable within the standard comfort zone. This rose the mean radiant temperature and was considered as main cause for indoor discomfort revealed by the survey. The survey found the employees to be slightly uncomfortable and dissatisfied, particularly in summer. The total energy consumption in 2010 was very high compared against the energy benchmarking. This study confirms that the large proportion of glazed roof is the cause for both overheating and thermal discomfort even with excessive use of the cooling system. In addition, recommendation was made to improve the thermal comfort condition in the large glazed air-conditioned terminal.

Keywords: Large glazed space, airport terminal, questionnaire, field measurement, thermal comfort, dynamic thermal model, lighting model and lighting quality.

1. INTRODUCTION

Airport terminals provide passengers with access from ground transportation to board aircrafts, as well as processing disembark from their aircrafts. These buildings are characterized by large open spaces and high ceilings. Often, for brightness and openness, glazed panels are used extensively for the construction of transparent roofs and walls in most of these buildings, regardless of cultural and climate context [1]. Thermal environment in such spaces are poor due to solar penetration and high radiant temperature [2]. Glazed buildings are notoriously uncomfortable regardless of a huge, complicated, high running cost and maintenance cooling system, especially in hot-humid climates [3]. This is thus indicated that the high probability of thermal discomfort in these glazed buildings.

Recent research and practices show that a quality and comfortable interior space of a proper design is closely associated with work efficiency and productivity of the occupants inside the building. The indoor environment consists of many elements which influence building users [4]. There is an increasing concern over the quality of buildings' indoor environments study, particularly in hot climates where air-conditioning is essential [5].

In order to assess such buildings, an integrate approach assessment would be explored due to the dynamic interaction of subsystems in buildings such as building geometry, indoor environment and occupants needs [6]. The indoor environment assessment can be applied with various levels of input information to support the type of evaluation and level of detail needed to meet the aim of an individual study. A standard method is to use objective measurement to investigate the existing conditions and overall indoor physical variables, and subjective assessment using a questionnaire-base survey to obtain occupants' feedbacks on their personal response to the indoor environment [7]. As the energy use for cooling in a

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