



GREEN STRATEGY FOR AN INTERNATIONAL
AIRPORT IN MALAYSIA: DAYLIGHT OPTIMISATION
THROUGH SKYLIGHTS

BY

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A thesis submitted in fulfilment of the requirement for the
degree of Doctor of Philosophy in Built Environment

Kulliyyah of Architecture and Environmental Design
International Islamic University Malaysia

AUGUST 2016

ABSTRACT

The thesis focuses on an integrated design process of a large building aiming for green certification. The study particularly tracks the variability of daylight and energy simulation results as green performance goals. Indexes are used in an integrated design process and undergo refinement as the scheme moves from inception to design development, construction and then commissioning. Although simulation tools can produce large sets of data-rich results in order to guide design decisions, the process of simulations must only focus on specific key parameters. It is crucial in achieving daylight performance; a specific sky condition must be selected from the onset as there is insufficient time to test all models under all sky conditions. The study also evaluates that designing for daylighting using simulations is a different process for tropical conditions due to the need for parametric optimisation to balance the positive and negative impact of daylight and heat gain reduction - and the need to focus on specific parameters such as skylight opening size. As the early design stage represents a crucial stage of making design decisions, initial predicted results must be based on various assumptions about design, spaces and interior layout of the terminal. More accurate inputs to the simulation will be known as the design progresses. In the integrated design process, the evaluation of the reliability of simulation tools which can be done by comparing simulation outcomes with field and operational data gathered from a similar size airport terminal is crucial. It is found that the important part of the simulation process during the early design stage is the reliability of the prediction tools to envisage performance under tropical condition. Once the tool is verified, it is then used to predict design options to inform design decisions and the process is documented which prioritise strategic inputs through simulation in integrated design study. The thesis demonstrates how daylight targets and optimisation methods are integrated into the design process and to the extent of achieving energy saving in the tropics.

Keywords: Integrated design process, simulation, parametric optimisation, reliability test, airport building, skylight, tropics

خلاصة البحث

هذا البحث يسعى علي تركيز حول عملية التصميم المتكامل للمباني الكبيرة التي تهدف الي الشهادة الخضراء، التي تتبع خصوصا تغير ومحاكاة الطاقه الناتجه عن أهداف المباني الخضراء التي تستخدم في البدايه حيث سجلت المؤشرات في عملية التصميم المتكاملة تخضع لتحسين تخطيط التصميم المتطور والبناء ثم التشغيل وبالرغم في أن أدوات المحاكاة، إلا أن يمكن أن تنتج مجموعه كبيره من نتائج البيانات الغنيه من توجيه قرارات وعملية المحاكاة يجب أن تتركز علي معايير الاساسيه المحدده. لتحقيق الأهداف المتعلقة باداء ضوء النهار مما يجب تكرير حالة السماء محدود من البدايه كما أن هنالك وقت كافيا لاختيار جميع الموديلات تحت كل ظروف السماء . هذه الاطروحه تقيم أيضا تصميم ضوء النهار باستخدام المحاكاة هو عملية مختلفه عن الظروف الاستوائية لتحسين الحدودي ولتحقيق التوازن بين الآثار الإيجابية والسلبية واكتساب الحرارة وانخفاضها والحاجة الي التركيز علي معايير محدده مثل فتح حجم النوافذ السقفية. كما تمثل مرحله التصميم المبكر مرحله حاسمة ومهمه من اتخاذ قرارات التصميم والمساحات والتصميم، ويجب أن تستند النتائج الاولييه علي توقع الافتراضيات المختلفه حول التصميم والمساحات والتصميم للمحطة كما تقدم التصميم في مدخلات أكثر دقه سوف تكون معروفه وبالتالي فإن أي خطوه حاسمة في عملية التصميم المتكامل هو تقيم موثوقيه أدوات المحاكاة التي يمكن أن يتم من خلالها مقارنة نتائج المحاكاة مع المجال والبيانات التشغيليه التي تتم جميعها لمحطة المطار مماثلة الحجم، وهذه الخطوه ضروريه لعملية متكاملة. يتبين أن جزءا هاما من عملية المحاكاة خلال مرحله التصميم المبكر هو اعتماد علي أدوات التنبؤ تصور الاداء في ظل حالة الاستوائية حالما يتبع التحقق من الأداة، ثم يتم استخدام أداة التنبؤ خيارات التصميم لابلغ قرارات التصميم ويتم توثيق العملية التي أولويات المدخلات الاستراتيجيه من خلال المحاكاة في دراسته تصميم متكامل. هذه الدرسته تسعى لتوضيح كيفية الأهداف والأساليب الأمثل في ضوء النهار ودمجها في عملية التصميم ومدى تحقيق الاقتصاد واستهلاك الطاقه في المناطق المداريه.

APPROVAL PAGE

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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ACKNOWLEDGEMENTS

In the name of Allah, the Most Gracious and the Most Merciful

I would like to thank ALLAH first and foremost for the final completion of this thesis.

I would like to express my deepest appreciation to my supervisor, Assistant Prof. Dr. Puteri Shireen Jahn Kassim. It would not have been possible without the kind support and continuously conveyed a spirit of motivation, courage and guidance with regards to the overall research process, thoughts, arguments, mentoring and coaching throughout the development of this thesis. I cherish the unstoppable knowledge and explicit advice given along the journey of structuring the thesis. I am very honoured to work under her supervision and working together developing this thesis.

My sincere thanks to my co-supervisor, Dr. Zuraini Denan, for her constructive feedback, information and ideas to strengthen the arguments of this thesis.

I would like to express my heartfelt gratitude to those who have been crucial in the completion of this thesis especially my beloved parents, Tn Hj Zainal Abidin Abd Rahman and Hajjah Khadijah bt Buyong, my loving husband, Shaiful Nadzri B. Shamsudin, my lovely children, Ariff Adha b. Shaiful Nadzri, Iman Sarah bt. Shaiful Nadzri and Adil Umar b. Shaiful Nadzri, my one and only sibling Siti Norzelawati bt Zainal Abidin and family, whom I cannot find words to describe to express my appreciation for the undying love, support and encouragement through thick and thin during the process of developing this thesis.

I would like to extend my gratitude to the following authorities for their good will and support during the preliminary study:

Pusat Tenaga Malaysia

For granting the opportunity to perform the audit assessment

Malaysia Airport Berhad

For permitting the audit assessment and passenger survey assessment studies and access to drawings and confidential documents and data on both KLIA and KLIA2.

IIUM

For the study grant of the verification study

Special thanks to

En. Mustafa Kamal and En. Ahmad Firdaus,

Mr Hiroyuki Sube from Foster and Partners

Dr Srazali Aripin, for assisting me on the final structure of the thesis.

Heartfelt gratitude to this personnel for their courteousness as well as for spending their precious time and effort in making this thesis a success.

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