OPTIMUM PRE-COOLING GUIDELINES: APPLICABLE TO COMMERCIAL BUILDINGS IN SRI LANKA

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Degree of Master of Science

Department of Mechanical Engineering

University of Moratuwa

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree Master of Science in Building Services Engineering

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DECLARATION

"I declare that this is my own work and this thesis/dissertation[2] does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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NAPSK Narangoda Date

The above candidate has carried out research for the Master's thesis/ dissertation under my supervision.

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ABSTRACT

HVAC plants in buildings are generally started earlier than the building operation start time. That is to absorb the stored thermal energy in the building and reach the set indoor thermal condition by the time which the building operation is started. Cooling energy required during this period is called **Pre-cooling energy** and the early plant running time is called **Pre- cooling time** of the building. Thermal energy in buildings depends on pre-defined factors and predicted factors. Pre-defined factors include building envelope, envelope materials, type of HVAC system installed, Building interior, lighting, other internal heat gain factors, building operation pattern etc. Predicted factors include climatic condition in the region throughout the year. Due to the fact that pre-cooling time is determined by both pre-defined and predicted factors, a thermal modeling study is more appropriate and recommended to assess the "pre-cooling demand and time" of buildings. The focus on this research study is to prepare an optimum "pre-cooling guidelines" for commercial buildings in Sri Lanka taking climatic variations also into account. World Trade center, Colombo, the largest commercial building in Sri Lanka was modeled in e-QUEST and results were analyzed with Colombo climatic data throughout the year to study the pre-cooling requirements (demand & time) and hence to derive a set of general pre-cooling guidelines applicable to any commercial building in Colombo.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
CIBSE	Charted Institution of Building Services Engineers
a	Absorption coefficient
b	Periodic conduction transfer function
c	Specific heat
K	Transfer function
q	Heat flux
Q	Thermal load
u	Periodic radiation transfer function
X	Periodic transfer function
α	Surface heat transfer coefficient
t	Temperature
AC	Air Conditioning
HVAC	Heating, Ventilation a& Air Conditioning
TR	Refrigerant Tons