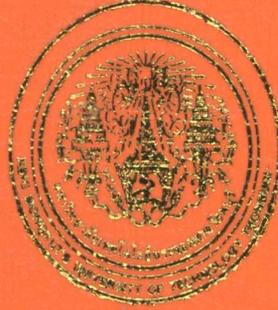


ห้องสมุดงานวิจัย สำนักงานคณะกรรมการการวิจัยแห่งชาติ



E46296



PASSIVELY INTEGRATED DESIGN STRATEGIES IN THERMAL COMFORT  
OF INDUSTRIAL BUILDINGS IN TROPICAL CLIMATE

MR. PRASITCHAI PROMLIPHONKUL

A THESIS SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR  
THE DEGREE OF MASTER OF ARCHITECTURE (DESIGN AND PLANNING)  
SCHOOL OF ARCHITECTURE AND DESIGN  
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI

2011

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of Industrial Buildings in Tropical Climate

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A Thesis Submitted in Partial Fulfillment of the Requirements  
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### Abstract

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The thesis is composed of two main portions in organization: the data acquisition of existing comfort conditions including energy use of industrial buildings in Thailand and the significant design strategies in terms of energy saving integrating with innovation for the present industrial buildings in Thailand. The state of research is conducted on tropical climate of Thailand weather condition applying to the industrial buildings that are mainly naturally ventilated. The thermal comfort factors are focused on temperature, air velocity, daylighting, lighting illumination, and noise level. The relationship between temperature, humidity and air velocity of thermal comfort factors which mostly affect to the occupants is considered with various conditions. The results of simulation to explore the most appropriate building performances respected to opening wall, roof monitor and roof insulation regarding the thermal comfort were investigated including comparison in the experiments between conventional case and integrated cases. The parameters of the experiment are composed of natural ventilation, heat gain reduction, noise reduction, and daylight. In addition, the reduction of energy use and thermal comfort value such as Mean Radiant Temperature (MRT) and Predicted Mean Vote (PMV) would be expressed that the thermal comfort of integrated design model had been improved to achieve human comfort according to Thai standard or Thai regulation. It is the hope that the results will be considered in the integrated design strategies and the guideline for energy-efficient industrial building design in tropical climate in spite of improving comfort conditions and building desirable environments in sustainable industrial buildings particularly in Thailand.

**Keywords:** Energy Efficiency/ Industrial Buildings/ Passive Design/ Thermal Comfort/ Tropical Climate

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## LIST OF SYMBOLS

$A$	Area of smaller opening ( $m^2$ )
$A_i$	Area of Inlet Opening ( $m^2$ )
$AV_{in}$	Air Velocity of Inlet (m/s)
$AV_{out}$	Air Velocity of Outlet (m/s)
$C_d$	Discharge Coefficient
$g$	Gravity Acceleration ( $m/s^2$ )
$H$	Height (m)
$I_{am}$	Illuminance of Ambient Light (Lx)
$I_{ta}$	Illuminance of Task Light (Lx)
$K$	Coefficient of Effectiveness
NL	Noise Level (dB)
$Q_{stack}$	Volume of Ventilation Rate ( $m^3/s$ ) for Stack Ventilation
$Q_{wind}$	Volume of Airflow ( $m^3/h$ )
RH	Relative Humidity (%)
SHGC	Solar Heat Gain Coefficient
$T_{e/r}$	Temperature of Exterior Roof Surface ( $^{\circ}C$ )
$T_i$	Average Temperature of Indoor Air (K)
$T_{in}$	Temperature of Inside the Building ( $^{\circ}C$ )
$T_{i/r}$	Temperature of Interior Roof Surface ( $^{\circ}C$ )
$T_o$	Average Temperature of Outdoor Air (K)
$T_{out}$	Temperature of Outside the Building ( $^{\circ}C$ )
$T_r$	Mean Radian Temperature ( $^{\circ}C$ )
$V$	Outdoor Wind Speed (m/h)
$X$	Distance (m)
$\theta_o$	Angle of Outer Louver ( $^{\circ}$ )
$\theta_i$	Angle of Inner Louver ( $^{\circ}$ )

## LIST OF ABBREVIATIONS

ACH	Air Change per Hour
CMH	Cubic Meter per Hour
dB	Decibel
fpm	Feet per minute
h	Hour
kg	Kilogram
kg/m <sup>3</sup>	Kilogram per Cubic Meter
kg/s	Kilogram per Second
ktoe	Kilo Ton Oil Equivalent
kW	Kilo Watt
kWh	Kilo Watt Hour
L/s	Liter per Second
Lx	Lux
m	Meter
m <sup>2</sup>	Square Meter
m <sup>3</sup>	Cubic Meter
MJ/m <sup>2</sup> -day	Mega Joule per Square Meter and per Day
m/s	Meter per Second
m/s <sup>2</sup>	Meter per Second Square
m <sup>3</sup> /s	Cubic Meter per Second
rpm	Round per Meter
W	Watt
W/m <sup>2</sup>	Watt per Square Meter