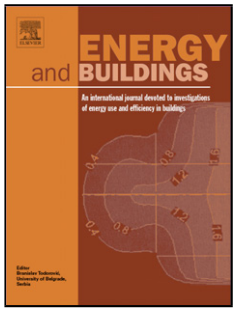

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Author: Adam O'Donovan Paul D. O'sullivan Michael D. Murphy

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A field study of thermal comfort performance for a slotted louvre ventilation system in a low energy retrofit

Adam O' Donovan, Paul D O'Sullivan, Michael D Murphy

Department of Process, Energy and Transport, Cork Institute of Technology, Rossa Avenue, Bishopstown, Cork, Ireland

Abstract

In this study, the effectiveness of a retrofitted natural ventilation system in a low energy building was evaluated, both subjectively and objectively, in response to an overheating scenario during shoulder seasons. Four ventilation configurations were evaluated including one control (no ventilation) configuration. Standardised questionnaires were used to evaluate the levels of subjective comfort based on ASHRAE guidelines and ISO 10551. Both subjective and objective evaluations were compared with three thermal comfort standards. Objectively, the strength of relationships between both individual parameters and indices were investigated and the errors between the actual and predicted mean thermal sensation reported. The results indicated that the use of smaller openings provided a better mean thermal sensation than the use of a larger opening in response to an overheating scenario. Smaller louvre openings were found to achieve a sufficient level of subjective comfort in 30 minutes given a daily mean external temperature of 12°C. This study found that standards varied in accuracy with ASHRAE 55 performing the best in predicting three out of four of the configurations accurately. The most accurate thermal comfort model used was seen to be the effective temperature model with a mean absolute percentage error of 82%.

Keywords: retrofit, overheating, natural ventilation, slot louvres, thermal comfort

Nomenclature

Abbreviations		*Subscripts*	
PMV	predicted mean vote	g	globe
MTSV	mean of thermal sensation votes	r	mean radiant
PPD	predicted percentage of dissatisfied (%)	a	air
PD	percentage of dissatisfied (%)	o	operative
ET	effective temperature (°C)	cl	clothing
SET	standard effective temperature (°C)	c	convective
HVAC	heating, ventilation, and air-conditioning	s	stratification
IEQ	indoor environmental quality	rm	exponentially weighted running mean
MAPE	mean absolute percentage error	pma(out)	prevailing mean outside
RH	relative humidity (%)	ext	external
POF	percentage of opened to floor area ratio (%)	per	perception
H	height	pref	preference
A	area	f	Fanger
		oramp	operative temperature ramp
Symbols		net	net opening
t	temperature (°C)	ope	opening
ε	emissivity		
D	diameter (m)		
f	surface area factor		
M	metabolic rate (met, W/m2)		
I	thermal resistance (clo, m2K/W)		