

## Author's Accepted Manuscript

DAYLIGHTING 'ENERGY AND COMFORT'  
PERFORMANCE IN OFFICE BUILDINGS:  
SENSITIVITY ANALYSIS, METAMODEL  
AND PARETO FRONT

Louis-Gabriel Maltais, Louis Gosselin



PII: S2352-7102(17)30102-X  
DOI: <https://doi.org/10.1016/j.job.2017.09.012>  
Reference: JOBE332

To appear in: *Journal of Building Engineering*

Received date: 24 February 2017  
Revised date: 23 September 2017  
Accepted date: 26 September 2017

Cite this article as: Louis-Gabriel Maltais and Louis Gosselin, DAYLIGHTING 'ENERGY AND COMFORT' PERFORMANCE IN OFFICE BUILDINGS: SENSITIVITY ANALYSIS, METAMODEL AND PARETO FRONT, *Journal of Building Engineering*, <https://doi.org/10.1016/j.job.2017.09.012>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# DAYLIGHTING ‘ENERGY AND COMFORT’ PERFORMANCE IN OFFICE BUILDINGS: SENSITIVITY ANALYSIS, METAMODEL AND PARETO FRONT

Louis-Gabriel Maltais, Louis Gosselin\*

Department of Mechanical Engineering, Université Laval, Quebec City, Quebec, Canada

## Abstract

Daylighting performance is an integral feature of sustainable building design. In this paper, two performance criteria were defined, namely an annual glaring index (AGI) and an annual energy requirement for lighting (AEL). Based on 1900 daylight simulations of an office building located in Montreal (Canada), a sensitivity analysis was performed to identify the most influential building design variables among a list of 15. Two sensitivity analysis techniques were employed. Window-to-wall ratios and the overhang dimension were among the most influential parameters for both AEL and AGI, whereas building orientation and aspect ratio, as well as visible transmittance, were found to have a relatively weak influence. A Pareto front demonstrating the optimal tradeoffs between AEL and AGI was approximated from the simulation sample. Finally, a metamodel is developed to calculate rapidly the daylight performance indices for a given set of the 15 design variables.

*Keywords:* daylight; energy consumption; glare; metamodel; sensitivity analysis; building design

## Nomenclature

AEL	annual energy for artificial lighting, (klm-h)/m <sup>2</sup>
AGI	annual glaring index
b <sub>xi</sub>	linear regression coefficient for each design variable
B <sub>k</sub>	window still position for each façade, % of ‘available’ façade height
CV	coefficient of variation, %

---

\* Corresponding Author: Louis.Gosselin@gmc.ulaval.ca; Tel.: +1-418-656-7829; Fax: +1-418-656-5343.

Download English Version:

<https://daneshyari.com/en/article/4923042>

Download Persian Version:

<https://daneshyari.com/article/4923042>

[Daneshyari.com](https://daneshyari.com)