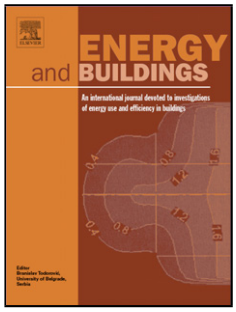

Title: A Study of Thermal Destratification for Large Warehouse Energy Savings

Authors: Liangzhu Leon Wang, Weigang Li

PII: S0378-7788(17)30744-2
DOI: http://dx.doi.org/doi:10.1016/j.enbuild.2017.07.070
Reference: ENB 7810

To appear in: *ENB*

Received date: 2-3-2017
Revised date: 20-7-2017
Accepted date: 25-7-2017

Please cite this article as: Liangzhu Leon Wang, Weigang Li, A Study of Thermal Destratification for Large Warehouse Energy Savings, Energy and Buildingshttp://dx.doi.org/10.1016/j.enbuild.2017.07.070

A Study of Thermal Destratification for Large Warehouse Energy Savings

Liangzhu (Leon) Wang and Weigang Li

Centre for Zero Energy Building Studies, Department of Building, Civil and Environmental Engineering, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, Quebec, Canada, H3G1M8

Corresponding Author:

Liangzhu (Leon) Wang, Ph.D., P.Eng., Associate Professor Centre for Zero Energy Building Studies, Department of Building, Civil and Environmental Engineering, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, Quebec, Canada, H3G1M8.

leon.wang@concordia.ca ; lzwang@gmail.com

1-514-848-2424 ext. 5766

Highlights

- Field measurements of thermal stratification in two large industrial warehouses were conducted
- Multiple Reference Frame model was validated for modeling ceiling rotating fan for thermal destratification
- Pressure Jump model was applied to modeling axial bucket fan for thermal destratification
- A dimensionless non-uniformity coefficient of temperature was used for evaluating destratification performance
- Different thermal destratification strategies were compared for the energy savings of the warehouses

Abstract

Thermal stratification in large warehouses is a common phenomenon in winter, especially for cold climates. Buoyancy-driven warm air tends to move upwards towards ceilings creating vertical temperature gradients with upper higher temperatures, and consequently leading to excessive heat losses through roofs. These warehouses therefore require thermal destratification through certain air mixing strategies, the selection of which often relies on engineering rules of thumb and experiences but can be better determined through combined experimental and numerical approaches. This paper investigated different thermal destratification methods in two industrial warehouses based on field measurements and CFD simulations with the focus on the quantification of thermal stratification, and the suitable methods modeling air mixing devices, e.g. ceiling rotating fans and bucket fans. The numerical models were first validated by field measurements and then