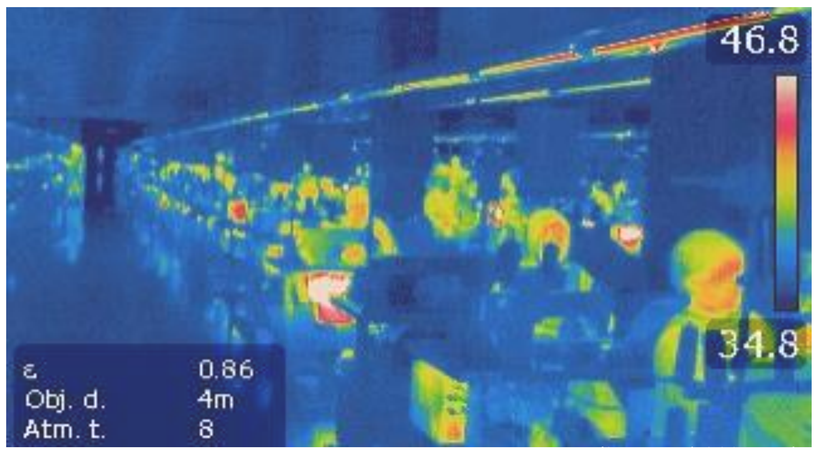
Improving Workspace Environment

Through Changing Design Strategies in Clothing Factories

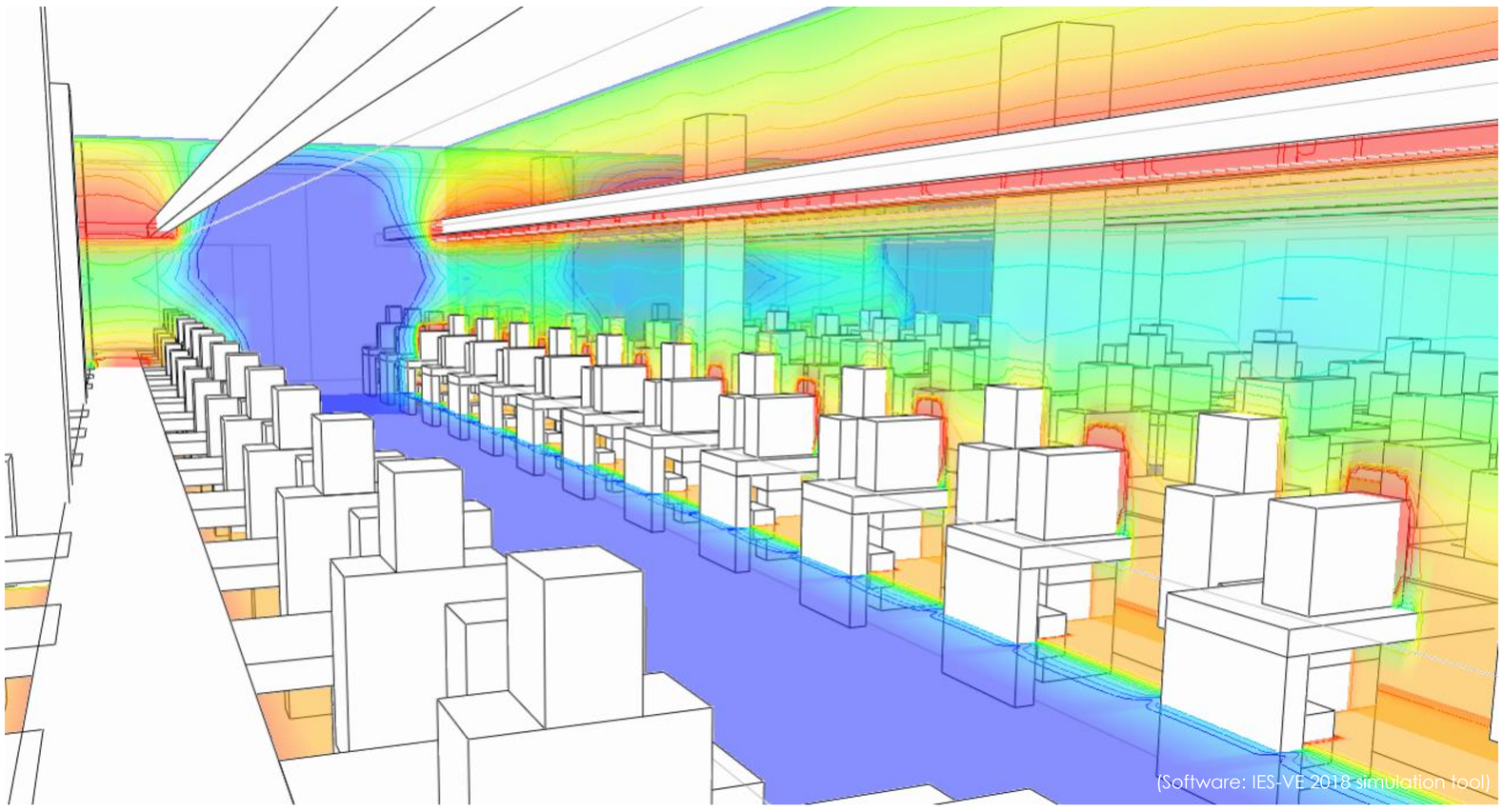
Mohataz Hossain, PhD, The University of Nottingham | Robin Wilson, PhD, The University of Nottingham | Benson Lau, RIBA, MPhil, The University of Westminster | Brian Ford, RIBA, Natural Cooling Ltd

Garment Factories in Bangladesh

The indoor workspaces of the multi-storey ready-made garment factories are usually overheated due to the high amount of **internal heat gain** and **lack of uniform ventilation**. As a result, workers who labour 10-12 hours per day suffer from **thermal discomfort** and **health issues**. It also hampers their **productivity**. As a continuation of a previous paper[1], this poster presents **two design approaches** improving the workspaces.

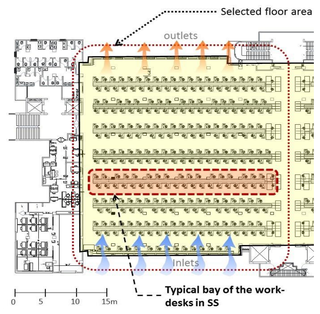


1. HOSSAIN, M. M., LAU, B., WILSON, R. & FORD, B. 2017. Effect of Changing Window Type and Ventilation Strategy on Indoor Thermal Environment of Existing Garment Factories in Bangladesh, Architectural science review, 60(4), 299-315.



Changing Functional Layout

Existing Functional Layout

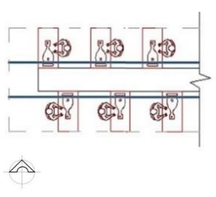


Overhead florescent lights

Typical work desk (sewing section)

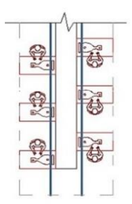
The overall workspace (sewing section) have low average airspeed

Proposed Change of layout



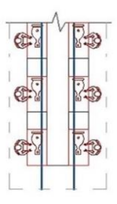
Existing layout

- Workstations facing towards **east/west** side
- Workers get airflows from their **left/right** hand side



Layout Option 1

- Workstations facing towards **north/south** side
- Workers get airflows from their **front/back**



Layout Option 2

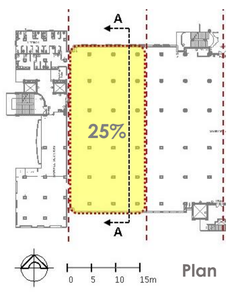
- Workstations facing towards **east/west** side
- Workers get airflows from their **left/right** hand side

Adding Ventilation Shaft

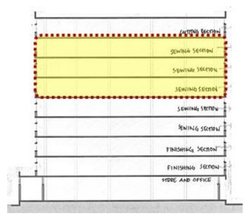
Selected Floor Area

Existing Floor plates without shaft

- Existing 25% of the floor plate **without shaft** was considered.
- A shaft needs to be proposed to naturally ventilate **three adjacent floor plates** (SS)



Plan

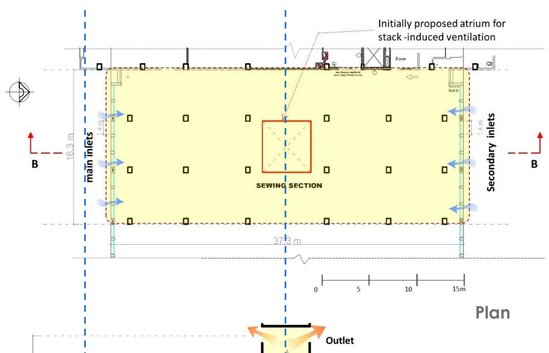


Section AA

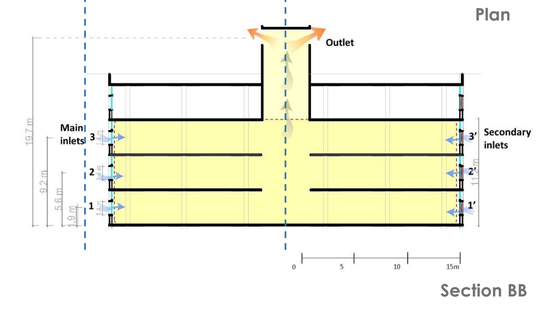
Proposed ventilation shaft and its outlets

Floor plates with a central shaft

- Size of the ventilation **shaft** and **outlets** were determined by **optivent tool**.
- **Existing windows** were considered as **inlets**.
- **Simulations** were proposed where each 25% floor plate contains **a shaft** and scenarios were base on the **functional layout**.
- The aim was to **raise the air speed** for thermal comfort.



Plan



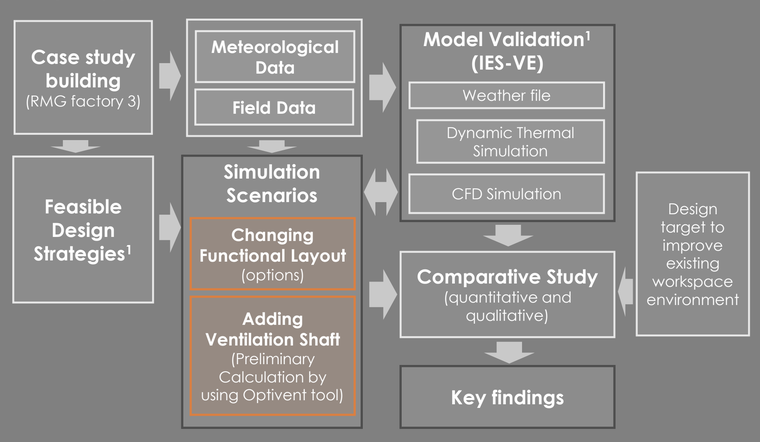
Section BB

Optivent Results

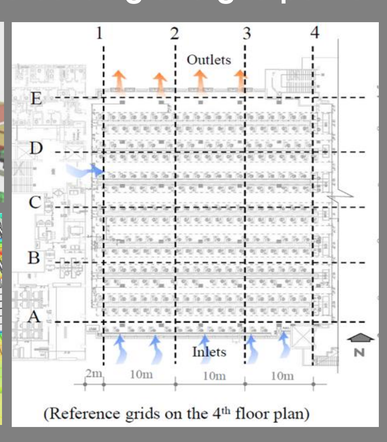
The results gained from the Optivent revealed that during the cool-dry, hot-dry and warm-humid seasons, average natural **air speed (resultant value of horizontal and vertical direction)** of **0.25, 0.15** and **0.1 m/s** can be maintained within the selected volume of the building. Outlet size was determined by using Oprivent..

Research Methods: Modelling, Validation and Simulation Scenarios

Methods



Validated IES model of the building and grid points



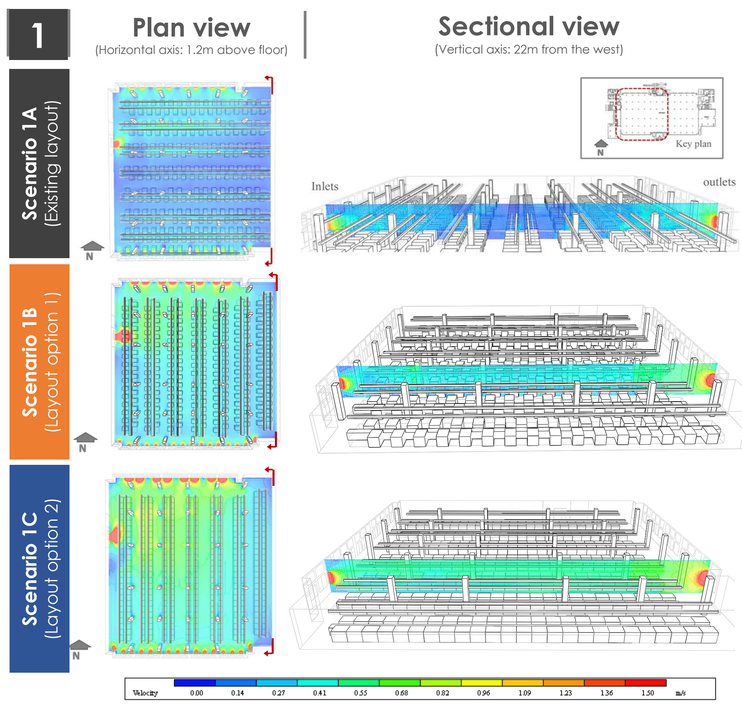
(Reference grids on the 4th floor plan)

1	Simulation Scenarios	Changing functional layout
Results	Scenario 1A (existing scenario)	Existing layout
	Scenario 1B	Proposed layout option 1
	Scenario 1C	Proposed layout option 2

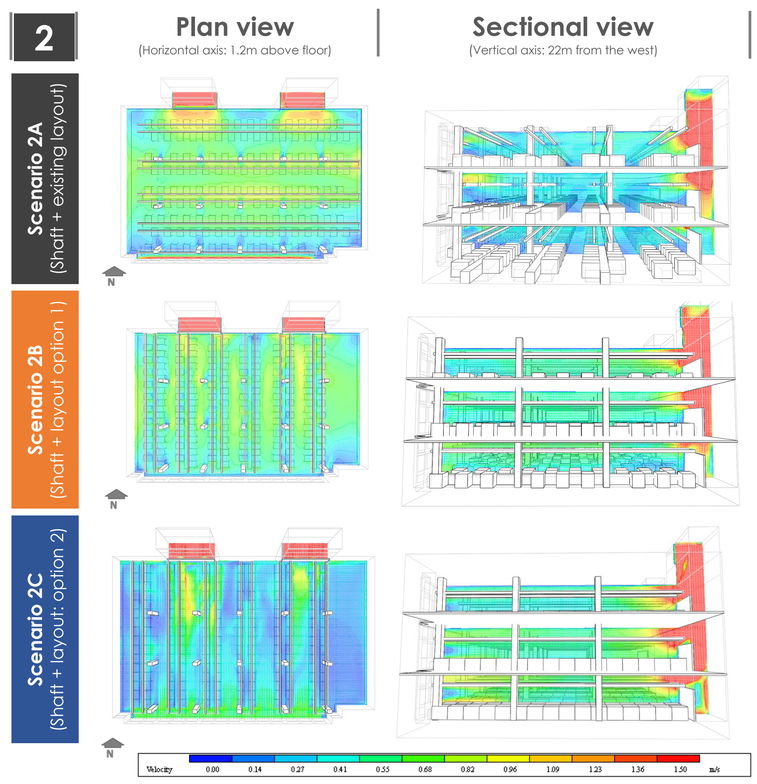
2	Simulation Scenarios	Added shaft for stack induced ventilation + changing functional layout
Results	Scenario 2A	Shaft + existing layout
	Scenario 2B	Shaft + proposed layout option 1
	Scenario 2C	Shaft + proposed layout option 2

Simulation Results

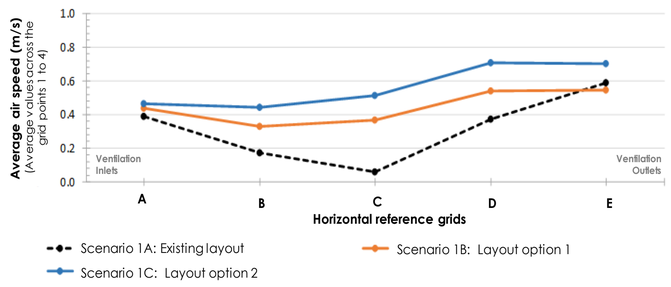
Rise of air speed in scenarios 1B and 1C by changing layout

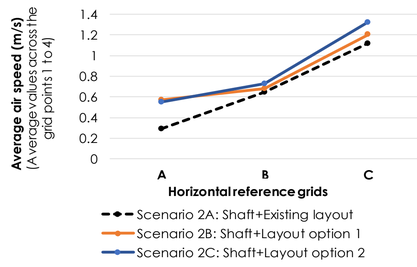


Rise of air speed in scenarios 2B and 2C by adding shaft + changing layout



Improvements





Both existing and proposed layout with passive stack induced ventilation can **improve the air circulation in horizontal direction** which can be used to for building cooling during night utilising the thermal mass.

Key Findings

- **Improvement of thermal environment of existing workspaces of garment factories can be made through changing functional layout and adding passive ventilation shafts.**
- **These approaches can increase the air circulation across the floor space providing additional air speed of 0.45 m/s towards the horizontal direction which may increase thermal comfort, in particular, during the warm-humid season.**

CIBSE Technical Symposium | Sheffield, UK | 25-26 April 2019