



# **STUDENT MODELLING COMPETITION**

**Building Simulation 2009**

**Briefing Document**

**M. J. Cook  
S.J.Rees  
J. A. Wright**

Version 1.0

# Student Modelling Competition

## Building Simulation 2009

### Briefing Document

#### 1. Background

As part of the Building Simulation conference 2009 ([www.bs2009.org.uk](http://www.bs2009.org.uk)) IBPSA are running a student modelling competition. The aim is to facilitate wider participation in the conference and to provide a competitive forum for student members of the building simulation community. It is expected that several tutors of relevant courses in universities around the world will use this as part of their teaching material.

This document contains all the information relating to the competition. Entries will be judged *prior* to the conference with an award being made at the conference in Glasgow in July 2009.

#### 2. Tasks

The aim of the exercise is to use computer simulation to model the control of a **hybrid ventilation system**. The building for analysis is a 3-storey, open-plan, office building located in the centre of Glasgow (Scotland) with stack-assisted cross ventilation. A section and typical floor layout are given in the appendix. Glazing sizes are shown on the elevation in the appendix. Opening areas for natural ventilation should be sized to deliver the amount of ventilation necessary for cooling and fresh air. As a guideline, you could try free areas in the range 1-2.5% of the floor area being served. It is intended that outside air will be provided from the central lightwell and stale air will flow out of the building through stacks around the perimeter. Of the three floors, the top floor (level 3) is characterised by high occupancy density and the lowest floor (level 1) is characterised by high heat gains due to computing equipment.

You should aim to provide natural ventilation to as much of the building as possible for as much of the time as possible, whilst maintaining acceptable thermal and indoor air quality conditions.

Entrants will be expected to demonstrate an innovative control strategy for switching between natural and mechanical ventilation in such a way as to minimise energy consumption whilst maintaining comfortable conditions. Entrants are free to propose their own heating, cooling and mechanical ventilation systems, but must provide details of these in their report.

All entrants must use a validated code.

### 3. Other Information

#### 3.1 Building Constructions

See table A-1.

Assume there is no solar shading, external or internal.

#### 3.1 Heat gains

See table A-2.

#### 3.2 Occupied period

00<sup>00</sup> – 06<sup>59</sup> (0%)

07<sup>00</sup> – 08<sup>59</sup> (20%)

09<sup>00</sup> – 11<sup>59</sup> (80%)

12<sup>00</sup> – 13<sup>59</sup> (50%)

14<sup>00</sup> – 16<sup>59</sup> (80%)

17<sup>00</sup> – 18<sup>59</sup> (30%)

19<sup>00</sup> – 23<sup>59</sup> (0%)

#### 3.3 Environmental conditions and Climate Data

Dry resultant temperature of 28C (82F) not to be exceeded for more 1% of the occupied period. Adequate ventilation to be provided during all occupied periods (please state the criteria you adopted). Use weather data for **Oban**, which can be found on the EnergyPlus web site.

### 4. Deliverables

One report containing the following sections:

Title page (including author name(s), affiliations, and contact details)

Executive summary

Contents

Nomenclature

Introduction

Modelling methods employed

Modelling Assumptions

Results

Conclusions

References (if required)

Appendices (if required)

### 5. Key Dates

March 1<sup>st</sup> 2009: entrants to notify Malcolm Cook (see section 8) of their intention to submit an entry

June 1<sup>st</sup> 2009: deadline for completed entries

July 1<sup>st</sup> 2009 winners announced

July 27<sup>th</sup> – 30<sup>th</sup> 2009: BS2009 conference in Glasgow

### 6. Judging Criteria

- The key factors influencing the judges' decision will be *accurate* and *intelligent* use of building simulation.
- Secondary, but also important, will be energy performance of the resulting control system.
- Comfort criteria *must* be met.
- It is anticipated that two awards will be made: one for individual entrants and a second for group entrants.
- Please note that the decision of the judges is final and no negotiation will be entered into.

### **7. Important Note**

**Winners will be notified on July 1<sup>st</sup> and will be expected to produce a poster for display at BS2009.**

### **8. Queries**

If you require any further information, please contact one of the following people. Please use email and try to make your question as concise as possible.

Malcolm Cook (IBPSA-England)  
[malcolm.cook@lboro.ac.uk](mailto:malcolm.cook@lboro.ac.uk)

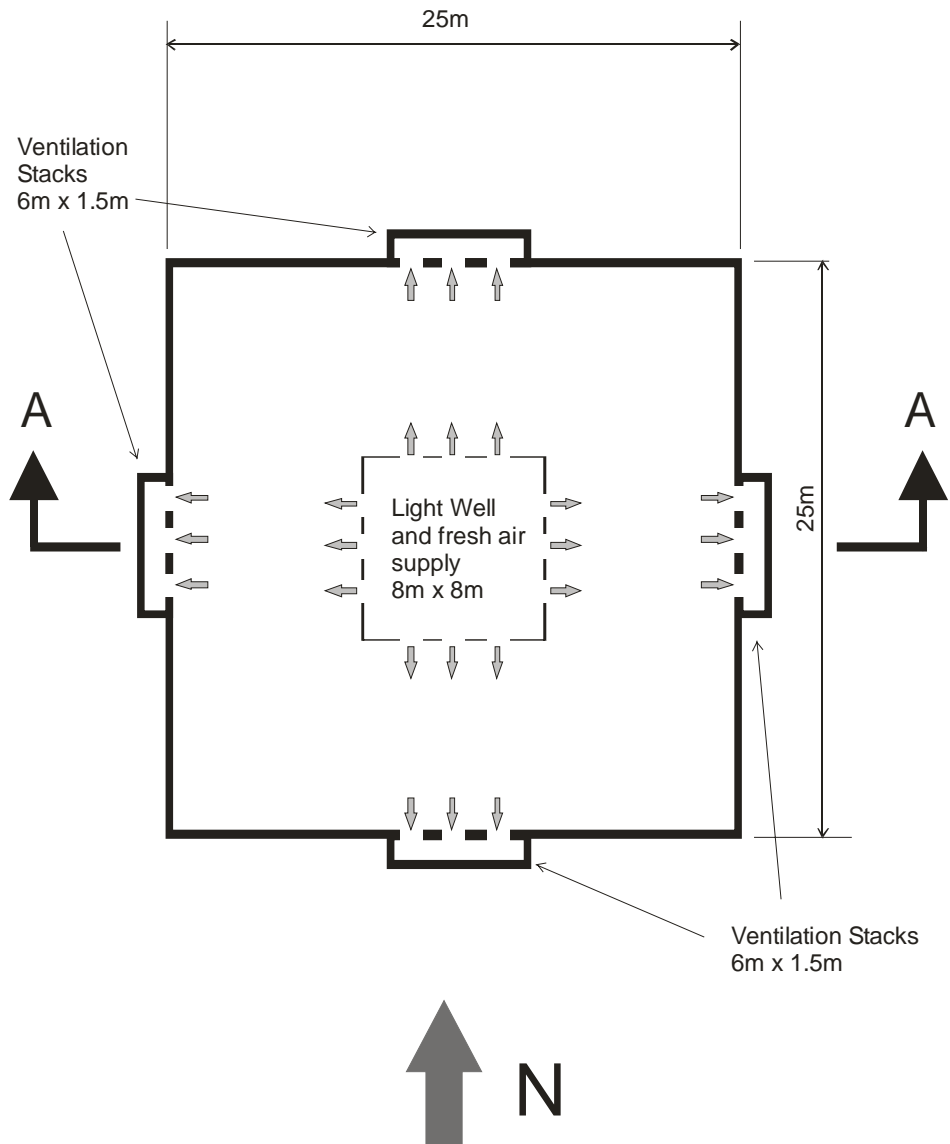
Simon Rees (IBPSA-England)  
[sjrees@dmu.ac.uk](mailto:sjrees@dmu.ac.uk)

Jonathan Wright (IBPSA-England)  
[j.a.wright@lboro.ac.uk](mailto:j.a.wright@lboro.ac.uk)

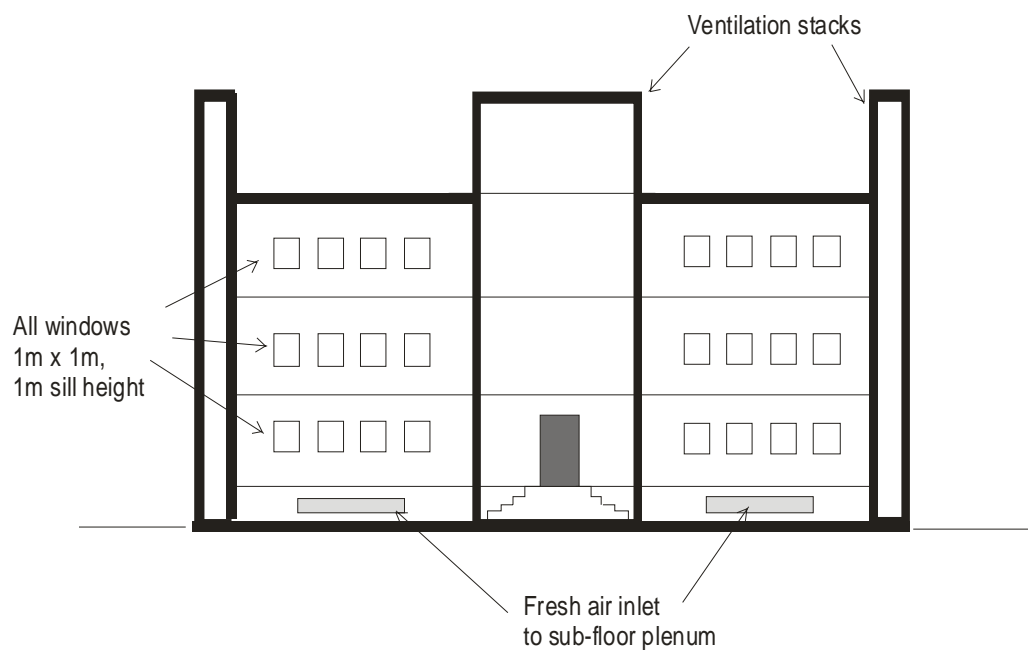
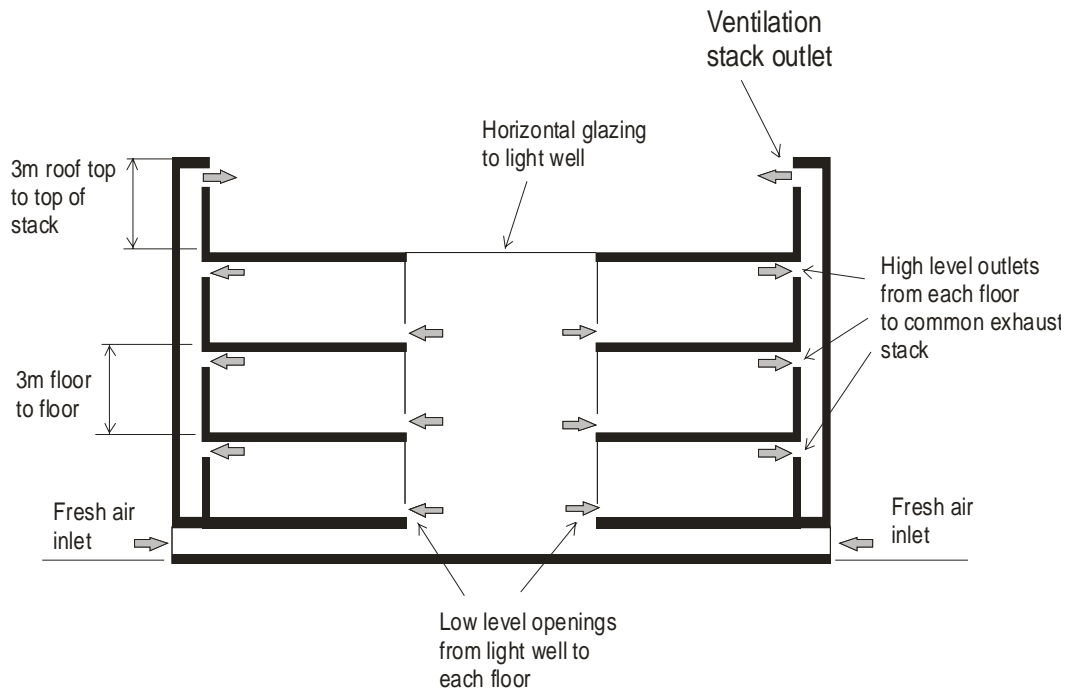
All questions and responses will be posted to the competition section on the BS09 website so please look here first to check that your query has not already been answered. Thank you.

# Appendix

Floor plan



Section



**Table A-1 Building Constructions**

<b>Construction Type</b>	<b>Construction Detail (outside to inside)</b>
External Glazing	6mm Clear float 16mm Argon Cavity 6.4mm Clear float
Internal Glazing	10mm Toughened 50mm Air Cavity 6mm Laminated
Roof	100mm Aggregate 160mm Styrofoam 150mm Concrete
Internal wall	140mm concrete
Outer Wall	102mm Brickwork 200mm Rockwool 140mm Concrete block
Ground Floor	1000mm London clay 1200mm Void 155mm Concrete 100mm Insulation 75mm Screed
Intermediate Floor	75mm Screed 25mm Rockwool 150mm Cast concrete

**Table A-2 Heat Gains**

Level	GAINS			Period of Gain
	Occupants	Equipment	Lighting	
1	100 Adults @ 90W each			See occupied period
		100 Computers @ 110W		Occupied period
		5 Laser Printer @ 130W		Occupied period
		2 Overhead Projector @ 300W		09 <sup>00</sup> – 12 <sup>59</sup> And 15 <sup>00</sup> - 15 <sup>59</sup>
		Vending at 2kW		Continuous
			Fluorescent @ 10W/m <sup>2</sup>	07 <sup>00</sup> – 18 <sup>59</sup>
2	50 Adults @ 90W each			See occupied period
		15 Computers @ 110W		Occupied period
		1 Laser Printer @ 130W		Occupied period
		Vending at 500W		Continuous
			Fluorescent @ 10W/m <sup>2</sup>	07 <sup>00</sup> – 18 <sup>59</sup>
3	150 Adults @ 90W each			See occupied period
		3 Computers @ 110W		Occupied period
		1 Laser Printer @ 130W		Occupied period
		Vending at 500W		Continuous
			Fluorescent @ 10W/m <sup>2</sup>	07 <sup>00</sup> – 18 <sup>59</sup>