

Building Environment Project

The purpose of this project is to give you experience in making a building model using the software package Integrated Environmental Systems (IES) and to use the model you have made to investigate the implications of construction and methods of ventilation upon a building's energy consumption.

The building to be investigated is a single storey group of classrooms arranged around a traditional quadrangle. On the inner face of the quadrangle there is a corridor connecting all the classrooms. A simple plan of the layout is shown below in Figure 1.

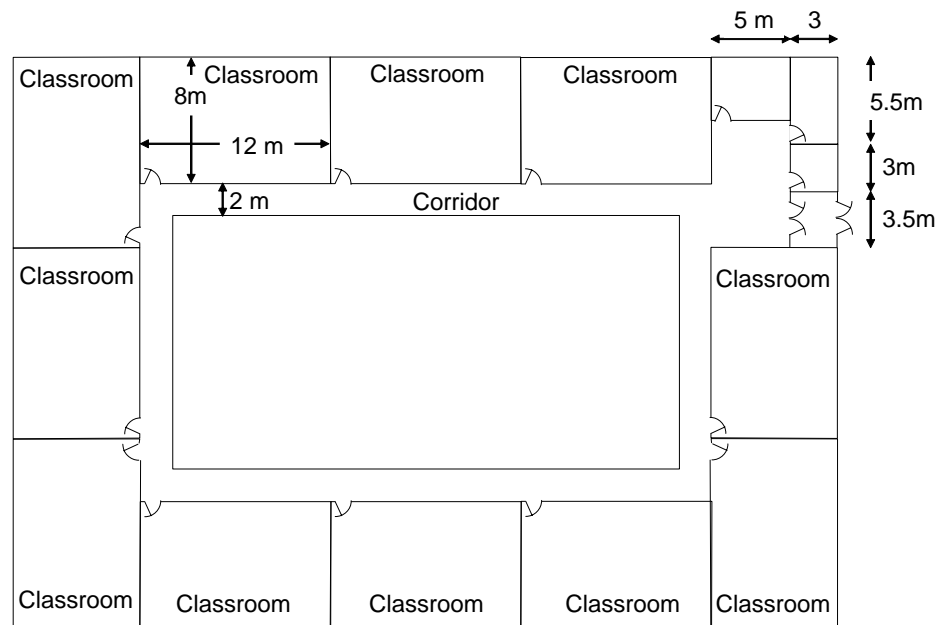


Figure 1

The floor to ceiling height in the classrooms is assumed to be 4m, and throughout the building all of the windows are a uniform size that has a lower light of 2m wide by 1.5m height and an upper light of 2m wide by 1m height.

Within each classroom, the window arrangement on the corridor side of the classrooms mirror that on the outer façade except for one window that is omitted in order to allow the construction of a door into the classroom.

The corridors have been provided with a cross section that allows for the possibility of natural ventilation and heat reclaim. The roof space above the classrooms has been arranged to have a wall common with the upper corridor space and this also facilitates the construction of ventilation and heat reclaim if required.

The ridge of the roof is 3m above the ceiling level.

A pair of connected double doors at the entrance allow for entrance and exit of the building without opening the whole corridor directly to the outside elements.

These are the fixed aspects of the building. You should decide everything else.

Tasks

- 1 To build a model of the building in IES.
- 2 To run a simulation without any cooling or heating to establish for the central north facing classroom, the central south facing classroom:
 - i the maximum summertime temperature
 - ii the minimum winter time temperature at noon

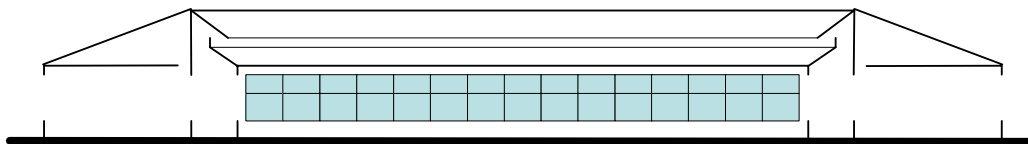
Clearly define the infiltration and use the minimum ventilation necessary during periods of occupation.
- 3 Comment upon the results.
- 4 Run a simulation through the winter months from October to March inclusive with notional heating and for the middle northern and southern classrooms determine the energy used to keep the occupants comfortable.
- 5 For the middle northern and southern classrooms model a simple mechanical hot air heating system and compare the energy use with that of the notional system.
- 6 Install heat recovery for the two rooms and comment upon the energy saved.
- 7 Construct a natural ventilation model using 'Macroflow' in order to design and control a natural ventilation system for the building. Opening and closing windows, or openings in the building in order to change the ventilation.

Make clear the basis for the ventilation control that you are using.

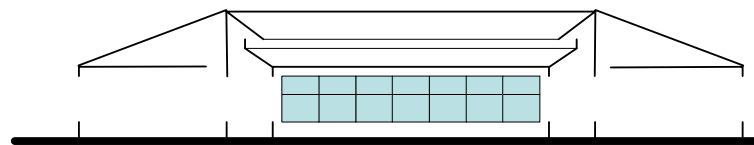
Compare the maximum summertime temperatures for the central southern and northern classrooms with the maximum temperatures experienced when only the minimum ventilation was used – part 2.
- 8 Modelling only the middle south facing classroom, install some form of solar shading that restricts the maximum summertime temperature to 28° C.
- 9 For the southern middle classroom, determine the energy used during one week of the Summer period and one week of the Winter period.
- 10 Record and summarise the results of these simulations. Then discuss the results and reach appropriate conclusions.

The submission will be a CD disc of your model, results files and report. It must be ensured that this model will run on the Department's computers. The report should also be printed, brief and illustrated where this can aid understanding. An index of computer files should be included.

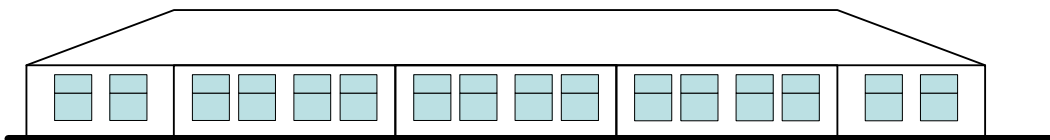
Text should be double spaced and the report should NOT be encased in a plastic folder. The submission will be to the Departmental office between 2-00pm and 4-00pm on Friday 1st June.



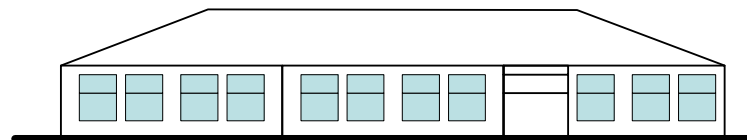
SECTION AA



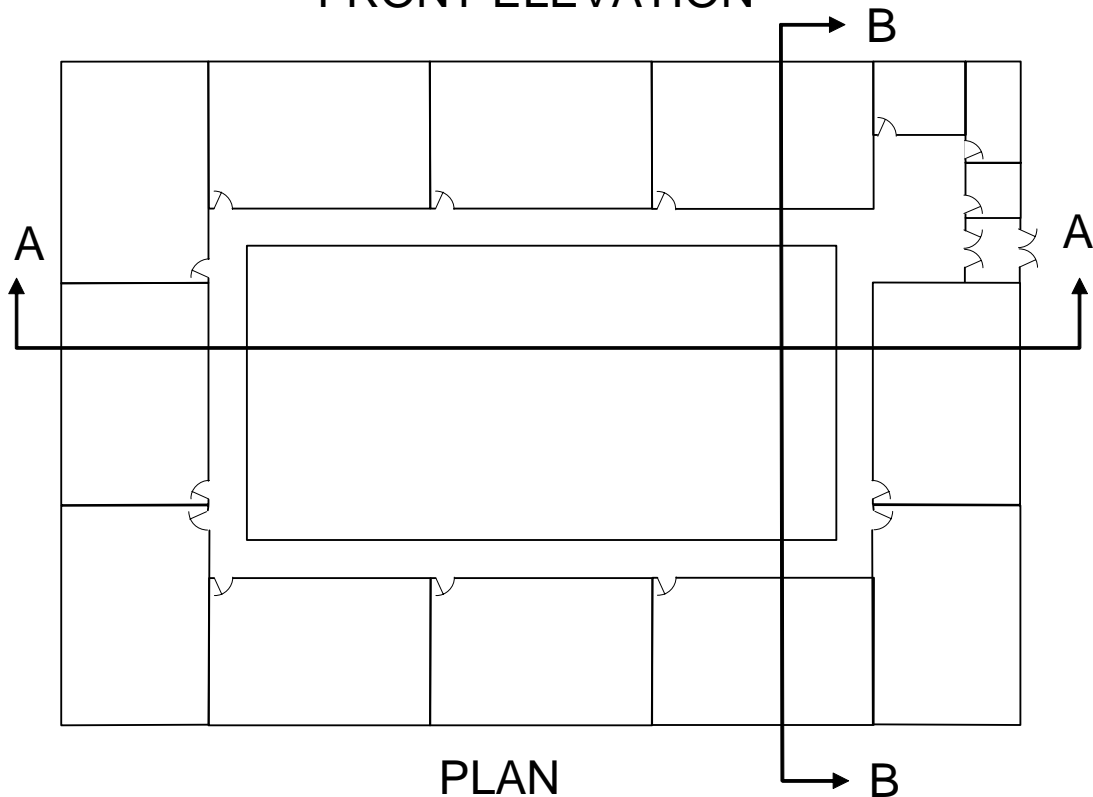
SECTION BB



FRONT ELEVATION



SIDE ELEVATION



PLAN

General Arrangement