

A ventilative cooling system in a School Building, Imola, Italy

Original

A ventilative cooling system in a School Building, Imola, Italy / Grosso, Mario. - ELETTRONICO. - (2013).

Availability:

This version is available at: 11583/2579955 since:

Publisher:

Published

DOI:

Terms of use:

openAccess

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)









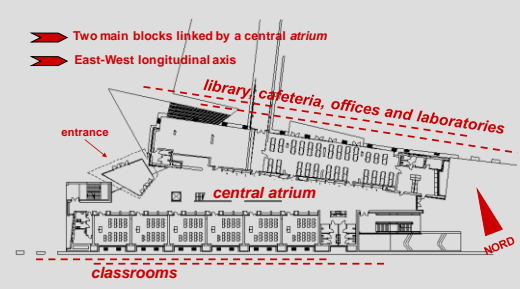

A ventilative cooling system in a School Building, Imola, Italy

Prof. Arch. Mario GROSSO,
Associate Professor of Architectural Technology
Energy-Environmental Consultant
 mario.grosso@polito.it

Brussels, March 19-20, 2013 mario.grosso@polito.it










Building layout



Two main blocks linked by a central atrium
 East-West longitudinal axis
 entrance
 library, cafeteria, offices and laboratories
 central atrium
 classrooms
 NORTH


Brussels, March 19-20, 2013 mario.grosso@polito.it

Estimate of energy needs

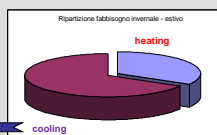
PRELIMINARY - PHASE 1
 Focussed simulations of energy strategies and comparison to a benchmark configuration
 Calculation of annual energy needs using simplified tools

Ripartizione del fabbisogno di riscaldamento



Data related to the South-West block





Ripartizione fabbisogno invernale - estivo



Data related to the South-West block for an occupation period from September to July

attention to ventilation load
 need to high-performance glazing
 priority to application of passive cooling systems

Brussels, March 19-20, 2013 mario.grosso@polito.it

Estimate of energy needs

PRELIMINARY - PHASE 2
 Evaluation of energy-saving benefit related to alternative strategies

| | | Fabbisogno di energia (diversi anni) | |
|---|--|--------------------------------------|----------------|
| | | RISCALDAMENTO | RAFFRESCAMENTO |
| <div style="display: flex; flex-direction: column; gap: 5px;"> <div style="border: 1px solid black; padding: 2px;">A</div> <div style="border: 1px solid black; padding: 2px;">B</div> <div style="border: 1px solid black; padding: 2px;">C</div> <div style="border: 1px solid black; padding: 2px;">D</div> </div> | SIMULAZIONE - A ventilazione naturale ventilazione meccanica | 13,6 | -88,7 |
| | SIMULAZIONE - B ventilazione naturale ventilazione meccanica | 13,6 | -91,9 |
| | SIMULAZIONE - C ventilazione naturale ventilazione meccanica - passivita | 21,1 | -41,4 |
| | SIMULAZIONE - D ventilazione naturale ventilazione meccanica - passivita | 21,1 | -8,8 |

SOLUTION D
to optimise yearly energy balance

TECHNOLOGICAL OPTIONS FOR INDOOR CLIMATE CONTROL SYSTEMS

Brussels, March 19-20, 2013 mario.grosso@polito.it






Architecture



South view of the School Building

Brussels, March 19-20, 2013 mario.grosso@polito.it










Architecture



North view of the School Building

Brussels, March 19-20, 2013 mario.grosso@polito.it


Ventilation system

- Hybrid system (controlled natural/mechanical system)
- Controlled natural ventilation (CNV): motorised sensor-driven openings related to IAQ and thermal comfort





Atrium:
 Winter - mechanical
 Summer - mech. + CNV

Cafeteria and discontinuous-use spaces:
 Winter - mechanical
 Summer - mechanical

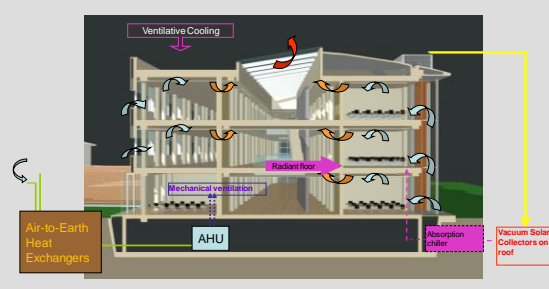
Classrooms:
 Winter - mechanical
 Summer - mech. (during occupation) + CNV







Brussels, March 19-20, 2013 mario.grosso@polito.it

Cooling systems



Brussels, March 19-20, 2013 mario.grosso@polito.it

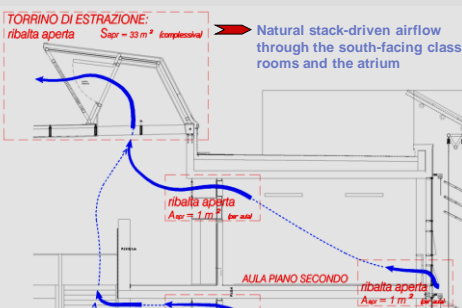





Ventilative cooling

TORRINO DI ESTRAZIONE:
 ribalta aperta $S_{ext} = 33 \text{ m}^2$ *imprescindibile* ➤ Natural stack-driven airflow through the south-facing class rooms and the atrium

ribalta aperta $A_{ext} = 1 \text{ m}^2$ *per aula*

AULA PIANO SECONDO:
 ribalta aperta $A_{ext} = 1 \text{ m}^2$ *per aula*



Brussels, March 19-20, 2013 mario.grosso@polito.it






Ventilative cooling



internal view of the atrium

vented clerestory on the atrium glazed roof

south glazed wall with hopper window openings

Brussels, March 19-20, 2013 mario.grosso@polito.it






Isolated suspended-ceiling element integrating lighting, sound adsorption, and air diffusion



Brussels, March 19-20, 2013 mario.grosso@polito.it






Isolated suspended-ceiling element integrating lighting, sound adsorption, and air diffusion: laboratory testing of air downdraft distribution



Brussels, March 19-20, 2013 mario.grosso@polito.it

