Sustainable Facades for Indian Tropical Climate – Case for External Movable Shading Systems

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GRIHA Sustainable Façade Conference, New Delhi
16th February, 2016

Indo-Swiss Building Energy Efficiency Project (BEEP) Activities

To promote innovative Integrated Design Charrette Approach
To promote innovative technologies like external movable shading systems
To develop design guidelines for energy-efficient multi-storey residential buildings
To strengthen the capacity of building insulation materials
To provide technical support in designing energy-efficient public buildings
To selected state PVDS in designing energy-efficient buildings
Knowledge dissemination and training
**BEEP Outputs (2012-2015)**

- **15 large buildings** – Design Support
- **Capacity building of >1000 building design professionals** – Training programmes & city-level seminars
- **MoUs with 5 Indian laboratories**
- **5 innovative indigenous designs** for external movable shading systems - National Design Competition
- Technical support to PWD’s of 2 states in developing design templates for EE public buildings
- **National Design guidelines for Energy-Efficient Housing Design**

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**Direct Solar Radiation on Glazed Surface – Use of Internal Blinds/Curtains**
Are Internal Blinds Effective in Controlling Solar Heat Gains?

Interior blinds are not effective in controlling solar heat gains. A large part of the heat comes inside the space, which is to be then removed by air-conditioning.

Solar Heat Gain Coefficient > 40%.

Two Cases to Illustrate the Impact of Direct Solar Radiation

- Commercial building, Noida
- Residential building, Indore
Case I: Commercial building at Noida

Computational Fluid Dynamics (CFD) model

Typical Office working place

Solar radiation 650W/m²

Outside = 35°C

Single glazing

Ventilation: 750 m³/h

T_air_inlet = 16°C

70 W

100 W
CFD model – Radiant Temperature

The temperature of the glazed surface exposed to direct solar radiation > 50°C

Case II: Residential Building Project
Indo-Swiss Building Energy Efficiency Project

Analysis at Flat Level to Ensure Comparable Thermal Comfort in all Flats

On a typical summer evening, the temperature of the room having glazed window on the west, is 5°C higher compared to a room having glazed window on north or south.
Simulation Results: Present Design (With Air conditioning)

Heat Balance for Summer Months (Apr-Jun)

On a typical summer day, in the room having glazed window on the west, 62% of the heat gains are from the window.

External Movable Shading

Solar Heat Gain Coefficient ~ 12%

• Cuts-off solar heat ingress and glare
• Allows day-light and views
External Window Shutters Examples

External Movable Shading (India)

Source: FACE, Ahmedabad

Indo-Swiss Building Energy Efficiency Project
External Movable Shading (Europe)

Example of external movable shading (Europe)
Example of external movable shading (Horizontal Lamella Blinds)

Case I: CFD Model: Radiant temperature after the application of External Movable Shading

- **Single glass**
- **Double low-E glass**
- **Single glass and solar protection**
- **Double low-E glass and solar protection**

Source: Swiss Problinds
Case II: Application in the Residential Building

![Diagram showing proposed shading](image)

Figure 26: Section showing proposed shading

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Case II: Impact of Shading on Inside Temperature

![Graph showing temperature difference](image)

On a typical summer evening, the temperature of the room having glazed window on the west, can be lowered by 5°C by the use of external movable shading.
National Design Competition on External Movable Shading – Jury

31 entries
5 Winners
Rs 2 million prize money

External Movable Shading Prototypes - Testing at CEPT University, Ahmedabad
Conclusions

• External movable shading systems should be an important component of the sustainable façade to reduce solar heat gains in tropical climates. In addition, these systems help in controlling glare, increased daylight utilization and natural ventilation.

• A national effort is needed, which should be focused at:
  – Developing a variety of cost-effective external movable shading systems
  – Demonstration, validation and labelling of performance
  – Promotion of local manufacturing
  – Market development

• BEEP plans to organize a national exhibition on external movable shading systems in September, 2016

THANK YOU!

For availing technical assistance for design charrettes, downloading technical materials and information on training programmes, please visit
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