INDO-SWISS BUILDING ENERGY EFFICIENCY PROJECT

BEEP
BUILDING ENERGY EFFICIENCY PROJECT

RAJKOT MUNICIPAL CORPORATION

CASE STUDY ON "GREEN" AFFORDABLE HOUSING: SMART GHAR III, RAJKOT

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OVERVIEW

The Indo-Swiss Building Energy Efficiency Project (BEEP) provides technical assistance to builders and developers in designing energy efficient buildings. The technical assistance is provided by conducting a design "charrette" (a 3-4 day integrated design workshop) in the early design phase of the project.

Smart GHAR III (Green Homes at Affordable Rate) is an affordable housing project in Rajkot under the Pradhan Mantri Awas Yojana (PMAY) Untenable Slum Redevelopment. The project is being executed by the Rajkot Municipal Corporation (RMC). The charrette for this project was held in September 2016.

PROJECT DETAILS:

- Site area: 17,593 m^2
- Built-up area: 57,408 m^2
- Number of dwelling units (DU): 1176 (All 1 BHK)
- Built-up area per DU: 33.6 m^2
- Carpet area per DU: 28 m^2
- 11 residential towers
- Number of floors: Stilt + 7

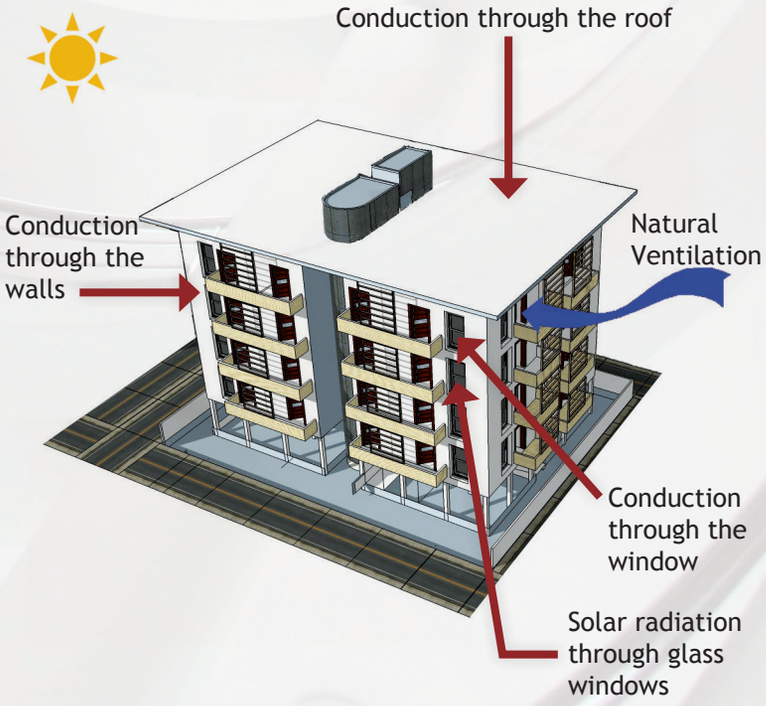
Image showing the charrette in progress

ACHIEVING THERMAL COMFORT IN THE RAJKOT CLIMATE

Rajkot falls in the composite climate zone with peak summer daytime temperature reaching 41°C - 43°C. However the diurnal temperature variation is high. Rajkot also has good wind speed which can be utilised to achieve better thermal comfort at night.

Initial analysis before the charrette showed that inside peak temperature on a typical summer day can reach 38°C. Given the climate of Rajkot, the objectives of the charrette were:

- Reduce heat gains through the building envelope i.e. windows, walls and roof
- Utilise and improve potential of natural ventilation for better cooling.



ENERGY EFFICIENCY MEASURES IMPLEMENTED IN SMART GHAR III:

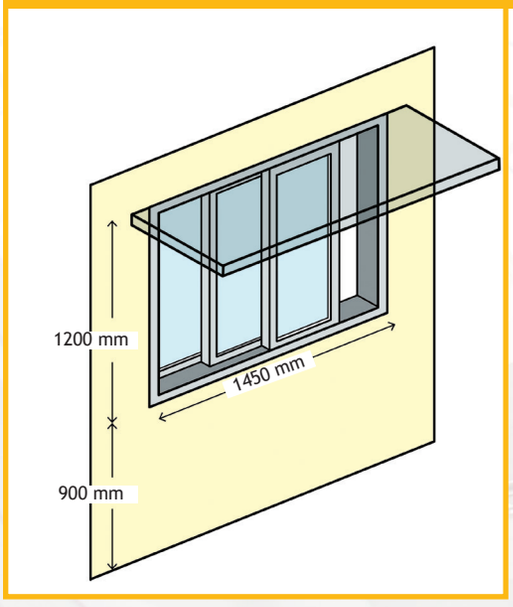
Reducing heat gains through walls and roof

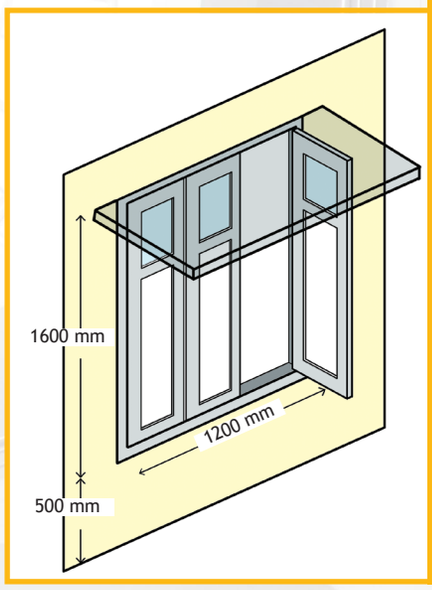
The walls are constructed of 230 mm AAC blocks[1], which has a U-value of 0.8 W/m^2.K. This is lower than the U-value of 230 mm burnt clay brick wall (U-value 2 W/m^2.K), thus allowing less conduction heat gains through the wall. Walls on the southern side are cavity walls, constructed of 230 mm AAC blocks on both sides of an air cavity of 50 mm (U-value 0.3 W/m^2.K).

The roof will have external insulation (40 mm polyurethane foam) which reduces the U-value of the roof from 2.7 W/m^2.K to 0.56 W/m^2.K. The roof will also have high-reflective china mosaic finish[1].

Reducing heat gains through window design and improving ventilation

Before charrette: Fully glazed, sliding windows. Sliding windows are 50-75% openable.



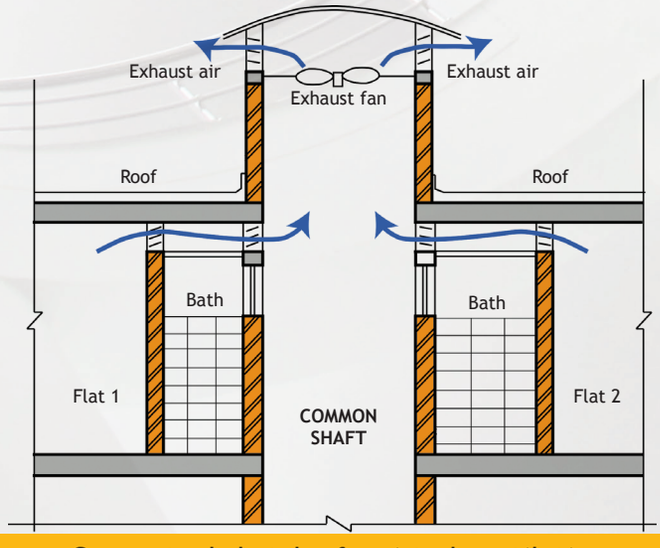


After charrette: Taller, partially glazed casement windows. Casement windows provide better natural ventilation as they are 90% openable. The window shutters are 2/3rd opaque, which prevents heat gains from entering. Glazing is reduced to 1/3rd, which provides adequate daylight.

Improving ventilation through common service shaft

Even though Rajkot has good wind speed, the design and layout of buildings are such that the wind does not reach all the flats. Often there are instances when there is low or no wind flow.

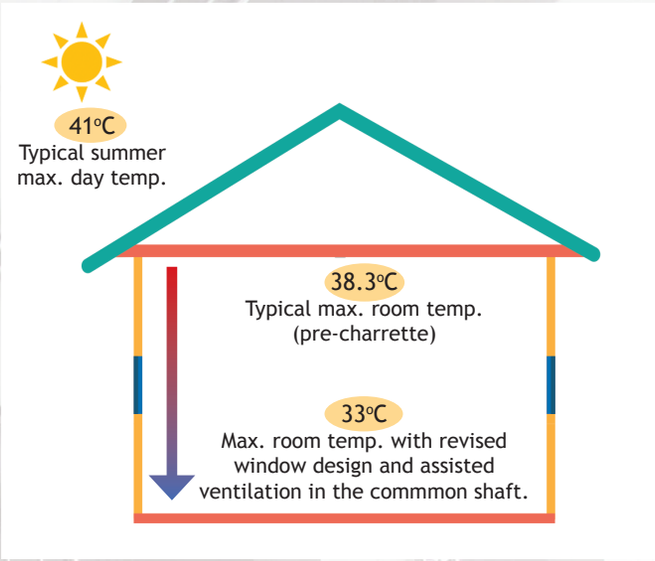
A provision has been made to ensure adequate ventilation (10 air change rate) through all flats, by using the existing service shaft between two flats. This assisted ventilation concept will have a roof feature and a fan on top of the shaft, which will create negative pressure in the shaft (with / without ambient wind) improving air-change through the flats.



Conceptual sketch of assisted ventilation through the common shaft between flats

[1] These features were already included in the project by RMC before the charrette.

SMART GHAR III AS AN EXAMPLE OF "GREEN" AFFORDABLE HOUSING:



Municipal Commissioner- Rajkot Municipal Corporation (RMC), Mr. Banchhanidhi Pani, receiving certificate of appreciation from Mr. Piyush Goyal at the BEEP International Conference in November 2016, for incorporating energy efficiency measures in the design of Smart GHAR III.

By adopting the energy efficiency measures[2] it is estimated to reduce peak summer room temperature by >5°C, as well as increase the number of comfortable hours (those below 30°C) from ~2600 hours to ~6300 hours.

Rooftop solar photovoltaic (PV) system will be installed by the RMC for electricity requirements of the building common services.

The RMC is also providing for rainwater harvesting through ground recharge system.

[2] Energy simulation results for a west-facing bedroom, i.e. exposed wall and window of the bedroom faces west.

The Indo-Swiss Building Energy Efficiency Project (BEEP) is a bilateral cooperation project between the Ministry of Power (MoP), Government of India and the Federal Department of Foreign Affairs (FDFA) of the Swiss Confederation. The Bureau of Energy Efficiency (BEE) is the implementing agency on behalf of the MoP while the Swiss Agency for Development and Cooperation (SDC) is the agency in charge on behalf of the FDFA.

For more information on BEEP charrettes, please visit the BEEP website
http://www.beepindia.org/content/apply-integrated-design-charrette

Indo-Swiss Building Energy Efficiency Project | www.beepindia.org
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