DS²BE

Doctoral Seminars on Sustainability Research in the Built Environment

Thermal Comfort In Residential Building Stock of Quetta, Pakistan

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▶ Research information

Keywords

Thermal comfort, climate responsive design, Resource efficiency, Decision support, Renewable energy

Introduction / Context

- Household sector in Pakistan consumes more than half of the energy [1]. Quetta is the capital of Balochistan province and 10th largest city of Pakistan with an urban population of over 1 million [2]. There is knowledge gap regarding housing and comfort in Pakistan. A common housing typology, i.e. reinforced cement concrete (R.C.C) houses is wide spread [3].
- Quetta has dry and arid climate with hot summer and mild to extreme cold winter. City lies out of monsoon region; it receives snowfall mostly in December, January & February [4].
- The study aim to explore the thermal comfort by monitoring of indoor climate in R.C.C houses. The overall aim of the study is to improve the indoor thermal comfort of free running R.C.C houses in Quetta and raise the awareness of builders about climate sensitivity.
- This poster presents indoor climate of 10 houses in Quetta, Pakistan. The selected houses represent the same housing typology, climate and geographical location.

Methodology

A housing survey was conducted to identify the common housing characteristics and typologies in Quetta, Pakistan [5]. The most common housing type (R.C.C houses) was selected for further study. 10 houses (large-small in size) were selected in different residential areas of Quetta city. Fig. 1. showing the plans of two houses and fig. 2. represents the basic information of the selected houses. Indoor temperature and humidity was monitored for 4 weeks (2 weeks each in summer & winter) and a structured interview was conducted from the head of the households to get more insights.

Results

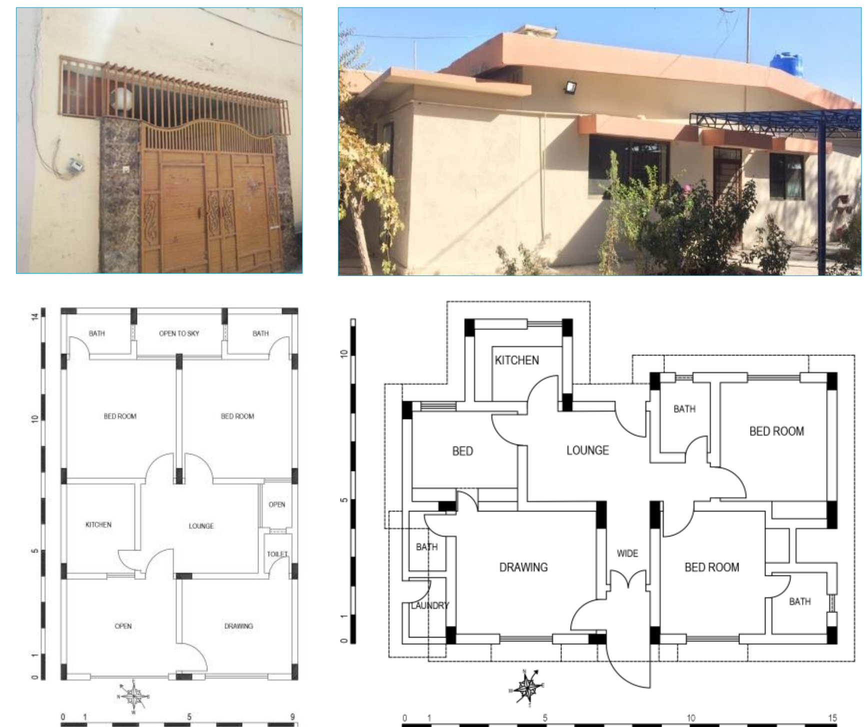
- Energy: Households face 4-8h load shedding (electricity outage) in summer and winter. Low gas pressure is common in cold winter which make it difficult to do cooking and heat the rooms.
- Temperature: Indoor temperature is high in summer and low in winter making it uncomfortable in both seasons. More ventilation is needed in summer while more heating in winter. Turning off heating for short time suddenly turn the rooms cold [Fig. 2].
- Humidity: Humidity is usually low in both seasons. When temperature rises humidity level decreases which creates more discomfort [Fig. 2].

Conclusion

The city is facing energy problems. Houses are mainly inefficient and do not provide optimal thermal comfort. Mechanical means are used to obtain indoor comfort. Climate responsive design strategies and use of passive techniques can be helpful to solve the problem and optimize the indoor thermal comfort.

Further steps

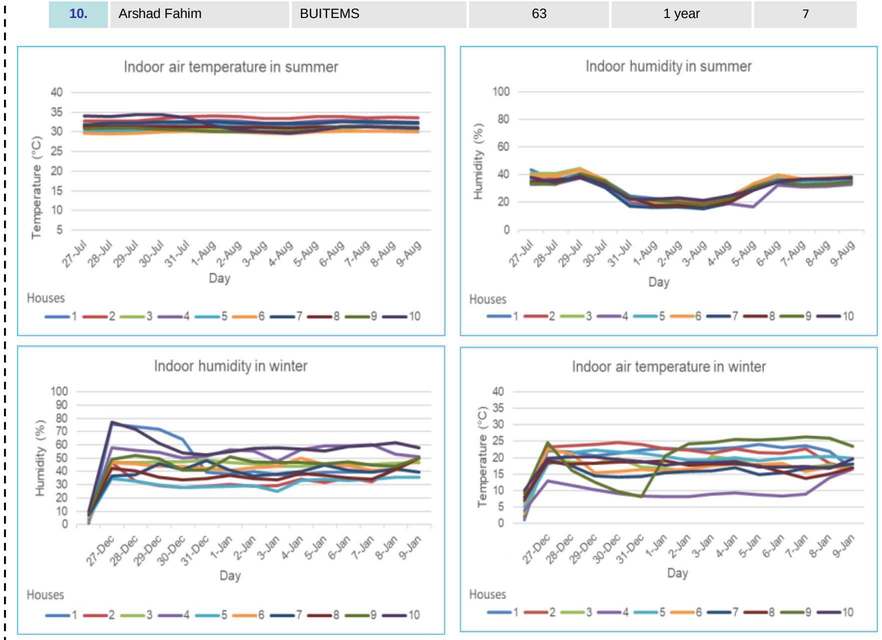
- A benchmark study by selecting the most representative house(s) which will be analyzed for comfort using dynamic simulation. This model will be calibrated and optimized by applying design strategies and techniques to improve indoor thermal comfort.
- Development of methodology based on the results of information gathered and simulation. Solutions based on cost effective, low-tech and locally adaptable techniques.
- The developed methodology will be validated by discussion and interviews with experts and future residents. Detailed interviews may also be conducted to get further opinion regarding the validity, acceptability, and the adaptability of the concept in the local context.



House No. 8; 130 m²　　House No. 9; 140 m²

▶ **Fig. 1:** Two of the houses selected for monitoring of indoor climate

S.No.	Name of the owner	Location	Area of the house m²	Monitoring period	Household size
1.	Zeeshan Zaib	Airport road	650	4 weeks	11
2.	Amin Mengal	Sariab road	408	4 weeks	12
3.	Jahangeer Khan	Spini road	307	1 year	8
4.	Asif Iqbal	Jinnah Town	278	4 weeks	8
5.	Jalal Faisal Khan	Sirki Kallan/Double road	213.6	1 year	7
6.	Mir Hamza Jogezai	Samungli road	148	4 weeks	12
7.	Adeel Zahoor Malik	Killi Deba	130	1 year	6
8.	Bilal Achakzai	Quarry road	130	4 weeks	7
9.	Mamoon-Ur-Rashid	BUITEMS housing	140	1 year	6
10.	Arshad Fahim	BUITEMS	63	1 year	7



▶ **Fig. 2:** List of the houses; Mean temperature and humidity monitored in 10 houses during summer and winter (2 weeks in each season)

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▶ References

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