

A Design Research Study for an affordable, low carbon housing development in Oxford



Introduction and Objectives

The aim of my design research is to propose an affordable, low carbon housing development in Oxford Northern Gateway Area. Researches have shown that Oxford is lacking affordable housing and that the existing stock is neither energy efficient nor designed to cope with a changing climate. Besides, the occupancy pattern is going to change in the future, with the consequent necessity of rethinking housing size and creating flexible spaces. In order to achieve a sustainable development the project aims to combine environmental improvements with socio-economic aspects. Strategies to make each housing unit more flexible have been investigated, trying to contain the costs and, at the same time, providing quality spaces. To make houses affordable and easy to construct, a timber frame prototype has been developed, it will be built by the local community through an on-site workshop, so as to provide practical skills and the possibility to freely define spaces and functions. The prototype has been tested through a building simulation software, DesignBuilder, in order to fine-tune its design characteristics and reduce energy consumption and CO₂ emissions. However time and costs have revealed to be some of the main barriers to develop a sustainable, self build housing model.



SUSTAINABILITY = ENVIRONMENT + ECONOMY + SOCIETY

Sense of community

- Accommodate a wider range of households over the house lifespan.
- People learn and share knowledge and skills with the rest of the community.
- Freedom in defining spaces and functions will avoid standardization.

CO₂ emission minimisation

- Use of reclaimed and local materials.
- Passive design strategies.
- Optimisation of space, materials and resources.

Affordable, Self build houses

Costs reduction:

- Manpower_people build their own houses.
- Transport_materials to be sourced locally using both road and water transport.
- Manufacturing_workshop on site to support design and construction processes, prefabricated and modular elements.

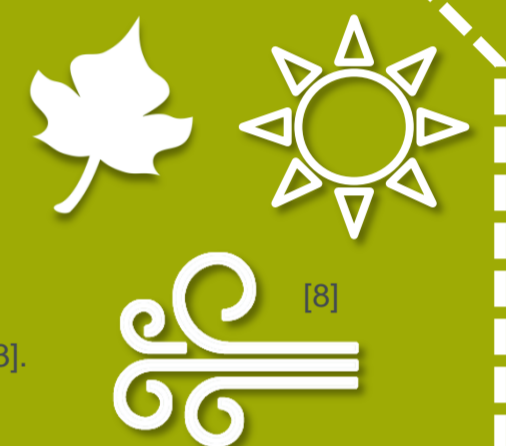
How to make them adaptable

- ▶ Flexible homes to accommodate a wide range of household over their lifespan [1].



How to make them low carbon

- Cross ventilation.
- Terraces facing south to maximise sunlight.
- Trees used as wind barriers and shading [2].
- Green barriers against road noise and pollution [3].
- Green spaces to reduce heat island effect [4].



How to make them affordable

- ▶ Self build: On site workshop to provide the community with the needed skills.
- Modular timber structure, prefabricated elements: Less material waste, quicker construction cycle [5].
- Locally sourced materials: Transport cost is reduced [6].
- Reclaimed materials: The closer they are the better [2].



Methodology

Inspiring Precedents



Rue de Meaux Housing – Renzo Piano



Borneo Sporenburg - West 8



Self build house, Honor Oak – Walter Segal Way



Hammarby Sjöstad - Stockholm

MY VISION



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Performance modelling

- DesignBuilder software tool was used to predict energy breakdown and daylighting of one housing prototype.
- The thermal performance of the building in the initial design stage was assessed in order to observe and address the issues to be solved.
- A comparison with current design targets (Passivhaus standard) and effective passive design strategies, have then allowed to deliver a high performance building.

Conclusions and limitations

- The cost of the land in Oxford is high, therefore keeping the floor area at a minimum and building upwards is crucial.
- Reaching a high performance standard (as Passivhaus) might be expensive, making the houses not affordable anymore.
- A certain amount of time is needed to build the houses, if local people have a job it might be difficult to carry on the construction process.
- This study can help to further investigate valuable design solutions for sustainable and affordable houses, given the current need of cutting carbon emissions and providing affordable dwellings for everyone.

References

- [1] Friedman, A. (2002) The Adaptable House. London: McGraw-Hill.
- [2] Pelsmakers, S. (2015) The Environmental Design Pocketbook. 2nd edn. London: RIBA Publishing.
- [3] Agroforestry (2007) Trees as noise buffers. Available at: <http://www.agroforestry.net/> (Accessed: 11 February 2016).
- [4] Oxford City Council (2015) Northern Gateway Area Action Plan. Oxford: Oxford City Council.
- [5] Borer, P. (2001) Out of the Woods. 3rd edn. Machynlleth: Centre for Alternative Technology.
- [6] South Oxfordshire District Council (2008) South Oxfordshire Design Guide. Wallingford: South Oxfordshire District Council.

List of figures

- All icons have been obtained from pixabay (<https://pixabay.com/>)
- [7] Kratochvil, V. (2008) Family of three (online). Available at: <http://all-free-download.com/> (Accessed: 02 July 2016).
- [8] Markbartle (2015) Free wind (online). Available at: <http://fav.me/d9adyw5> (Accessed: 02 July 2016).
- [9] Manning, L. (2008) Rue de Meaux Housing (online). Available at: <https://www.flickr.com/photos/laurenmanning/2727550634> (Accessed: 02 July 2016).
- [10] Hyde, R. (2009) Private houses - Scheepstimmermanstraat, Amsterdam, 1999 (online). Available at: <https://www.flickr.com/photos/roryrory/3842323636> (Accessed: 02 July 2016).
- [11] Zubairy, L. (2012) Walter Segal houses in Sydenham, London (online). Available at: <https://www.flickr.com/photos/rankinmiss/7248005268> (Accessed: 02 July 2016).
- [12] Kylberg, H. (2006) Hammarby Sjöstad. Available at: <https://www.flickr.com/photos/visulogik/150441896> (Accessed: 02 July 2016).