

PROJECT REPORT

# Development of Incremental SI (Structure-Infill) Housing for Low-Income Population in Malaysia

Funded by British Council Institutional Link Grant 2015-2016



Edited by Kyung Wook Seo and Sharifah Salwa Syed Mahdzar

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## FOREWORD

The world population has been increased steadily over the last century and reached 7.3 billion as of 2015, and it is expected to reach more than 9.0 billion by 2040 (United Nations 2015). The increase in number of people on Earth will cause an inescapable problem of deficiency in natural and artificial resources. It is anticipated that for the people living in cities this will be a more critical issue. As of 2014, 54% of global population lives in urban areas compared to 30% in 1950, and it will be 66% by 2050 (United Nations 2014). As more and more people move to already dense cities for opportunities, urbanisation became a universal challenge for our immediate future. One of the most essential requirements for living is housing. Along with population growth and urbanisation, providing affordable housing for citizens became a worldwide agenda. Asia is relatively less urbanised (48%) than North America (82%) and Europe (73%) but its urbanisation rate is currently the fastest than all the other regions (figure 1).

Responding to the increasing volume of housing demand has given a priority in every government in the last century, but its meaning was quite different in Asia, especially for East Asian countries. It is the region where almost every country has gone through a rapid economic growth in less than a half century which was led by the authoritative power of the government. Shifting

from agricultural to manufacturing industry, East Asian countries all have experienced higher growth rates of GDP (Gross Domestic Product) per capita than those of developed countries. In this context, the housing industry has been regarded as the central object of development-oriented economies as well as an ongoing social problem (Ronald and Doling 2014).

In Malaysia, the urbanisation rate and population have been doubled during the last three decades. In 1980, it had 13.7 million populations with 34.2% urbanisation rate but in 2010, it became 28.3 million and 71.0%. With their rising GDP, the government also took a more 'interventionist role', and unlike western social housing style, supported housing market with an aim to support economic growth (Aziz et al 2014). Beginning from the first Malaysia Plan (1966-1970), the government has continued to emphasise the importance of public housing, particularly focusing on low-income housing. They also provided regulations to put the ceiling price and minimum requirements for low cost housing while encouraging the participation of private developers to take the major role in housing supply. For private developers attempting to get permission to build housing, it is demanded that they build at least 30 percent of low cost housing.

By and large, Malaysia has succeeded in continuously building a considerable amount of low cost housing to meet the national demand (Abdullahi et al 2011), but there are still some intractable problems remaining. First, many low income households are not able to buy the low cost house because of the unaffordable price; thus they rent it or stay in squatters while those in the upper income band purchase the unsold houses which occupy 15% of the housing stock as of 2010 (Department of Statistics 2010). Second, most of low cost housing built in urban areas is the highrise apartment type with poor living conditions; internal spaces are too small to accommodate large families. Third, the housing location does not provide easy access to suitable services and transportation. Fourth, many low cost developments become urban slums due to the concentration of low income groups and conflictive nature of mixed races (Sani and Rahim 2012; Aziz 2012). Historically, Malay people or Bumiputeras are the ethnic majority in the country living



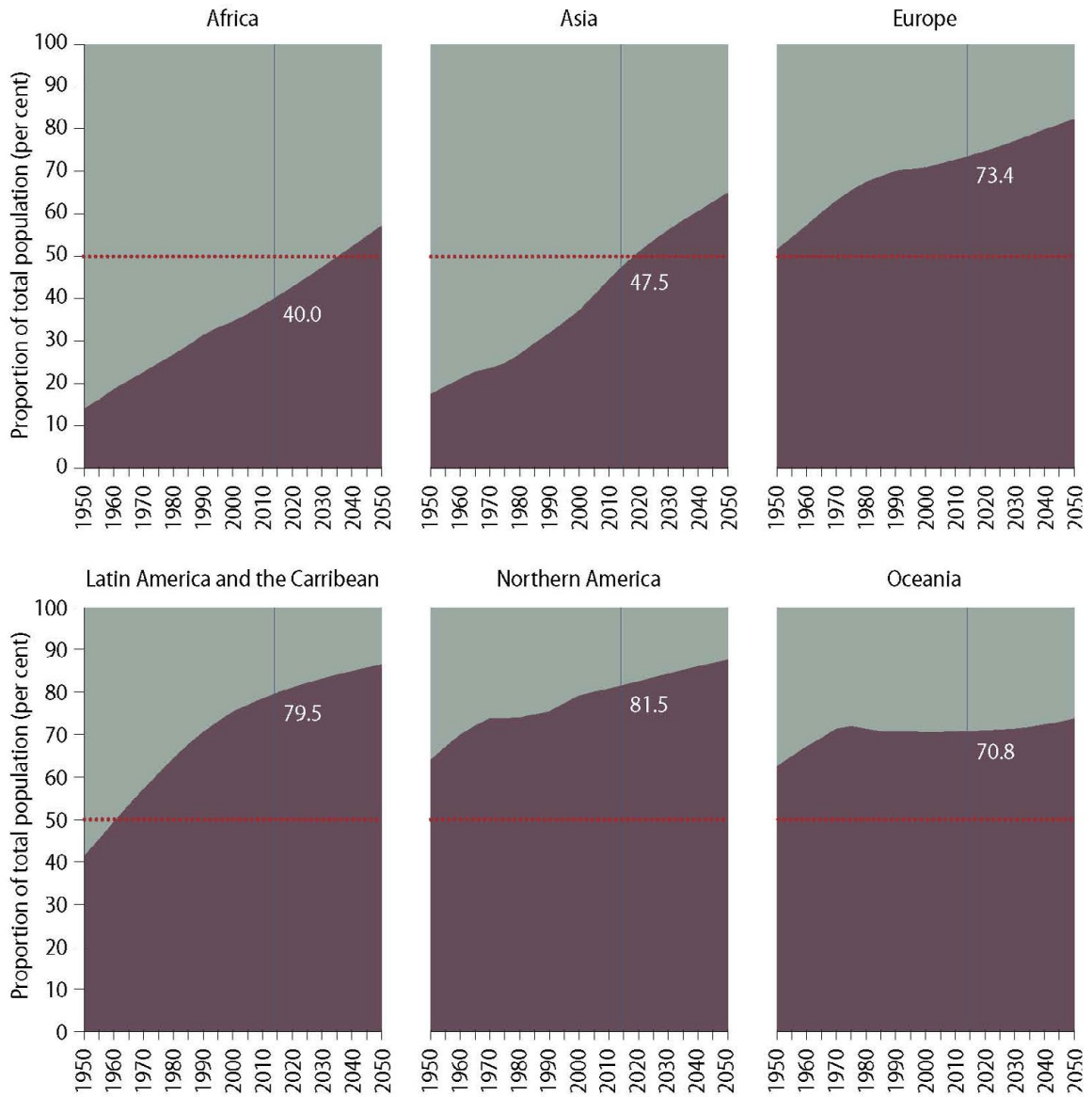


FIGURE 1. World Urbanisation Prospects, United Nations, 2014

in rural villages, called kampung, and working on agriculture or home based enterprises. Following the government's policy to encourage them to move into urban areas, huge number of them moved to cities especially from 1970s and many of them settled in vacant lands and built their squatters. The dwelling condition in these squatters was poor, typically built with cheap materials in a make-shift manner but they could still support the similar collectivistic community of kampung.

From the 1990s, however, squatters were seen as a problem in the modernised urban landscape. The government and local authorities began to set up policies, such as Squatter Zero 2005 programme in Selangor state, to forcefully relocate them to modern highrise low cost housing. The modern setting of domestic living in highrise buildings was contrasted to the ground level dwellings in squatters. Disconnected from the land, housed in a small concrete shell, and mixed with different ethnicities, residents could not find it suitable for appropriate living. Crimes, racial conflicts, building deterioration and poor maintenance have made it a new social problem in the city (Aziz 2012).

This research attempts to mitigate this problem by suggesting a new approach to the design of low cost housing in Malaysia, especially for those who relocate themselves from rural villages or urban squatters. Whereas the low cost housing construction has managed to catch up with the planned target, the urban highrise apartments do not provide appropriate domestic space to meet the people's needs. Dissatisfied with their houses and surrounding conditions, residents lose their attachment to the community. From the architect's perspective, we believe that one of the main reasons behind this malfunction is the spatial configuration of the house plan. Soaring price of available urban plots makes it the best option to build highrise flats for new housing constructions, and especially for low cost housing, it became an unavoidable choice. Since the design of multi-level collective housing typically imposes limits to plan configuration, this has entailed a sudden transition of domestic living pattern from old to new. How can we accommodate Malay vernacularism into the modernised urban home? It was the question we asked to

tackle the issue of providing affordable home to low income people.

In following chapters, we will make an overview on affordable housing in general and take an in-depth review on the situation in Malaysian affordable housing market combined with the squatter problem. Based on these, some proposals will be made for a new design approach for the apartment housing typology in Malaysian urban setting. In the course of design development, we tried to make sure the solution will be socially, environmentally, and economically sustainable. Through the field visits, seminars and forums, we tried to illuminate deep-rooted problems and then actively delivered our ideas to squatter residents, research institutes, local authorities, and stakeholders. The design schemes are now at the basic level, but its innovative concept will be offering a new opportunity to stimulate the housing industry in Malaysia for the low income population. In the wider perspective, we believe that this will eventually contribute to the economic development of the country.

## ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to British Council who makes this project possible. With their support, we could initiate this international collaboration between the UK and Malaysia and explore our academic thoughts to solve the real-world problem. We are very certain that this project is not finished with this final report. As can be found in this report, we have set up a specific direction to enable our proposal work within the Malaysian context. In the broader spectrum, it is hoped that our way of approaching the humanitarian problem of providing proper shelter can make a meaningful impact on all the separate endeavours in the world to support basic human living for the unprivileged people.

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## NEW DIRECTION FOR LOW COST HOUSING IN MALAYSIA CONCEPTUALISATION AND STRATEGY

*With the fast growing economy and urbanisation, Malaysian government and local authorities have built affordable houses under the Public Low-Cost Housing Programme (PLCH) from the First Malaysia Plan (1970-75). After decades' of effort, significant number of houses were built but the poorer people in the urban squatters are still in trouble in securing money to buy them. This research has targeted this vulnerable informal urban area to apply our design solution. As new high-rise apartments causes many problems including cleanliness, small unit size, inadequate facilities, and inability to allow home-based business, we suggested a new solution that acknowledges and supports local people's exiting way of living. The proposal is based on Open Building and Self Help concepts. As construction process is divided into several stages, poorer people can move in with lower budget and start living in a small basic house, and later they can incrementally fit out additional parts of the house. Encouraging a number of different layouts, the housing can be adapted to different family needs.*

## MALAY CONTEXT

The tropical climate in Malaysia influenced the indigenous house form. Due to the humid monsoon season, the traditional house has developed the timber-frame structure elevated on piles. Malaysian housing culture has gone through a radical change during the last half of the twentieth century. With fast-rising numbers in the indexes of population, industrialisation, urbanisation, and gross domestic product (GDP) per capita, the mainstream housing culture has moved from the traditional floor-sitting culture in a detached house towards modern furniture-based living in a collective housing. For the Malaysian government, providing low cost housing has been the most important goal and many related policies have been adopted to achieve this.

Along with the overall population growth in Malaysia, the proportion of urban population has increased much faster from 26.8% in 1970 to 61.8% in 2000. To cope with a housing shortage problem in cities, the Malaysian government and local authorities have built affordable houses under the Public Low-Cost Housing Programme (PLCH) from the First Malaysia Plan (1970-75). The main objective of the programme is ‘to improve the quality of life, eradicate poverty among the low-income group and to resettle the urban squatters’ (Mohit 2010). In urban areas, due to the high land price, both the public and private sectors opted for a higher density type: apartment housing.

In particular, for the low-cost housing developments, which should comply with the regulation of ‘less than RM 25,000 of unit price’, the high-rise would be the only feasible option. Therefore, increasingly, the house buyers or renters had no other option but to choose the multi-storey housing which is radically different from their previous residences (figure 1). The 2010 population and housing census shows that apartment housing occupies 19.9% in the whole country, but when Kuala Lumpur is taken alone, its proportion goes up to 66.6% (Department of Statistics Malaysia, 2010).

Those who were accommodated in the apartments were not only from rural areas outside the city but from squatter settlements within the metropolitan area. In any case, adapting their family life to the new multi-storey dwelling was a significant challenge for them, disrupting their existing routines. It has been reported that the main issues of dissatisfaction in low-cost high-rise apartments are cleanliness, community breakdown by racial conflict, small unit size, inadequate facilities, crime and social ills, and inability to allow home-based business (Aziz, 2012). Amongst these, in the perspective of this research where



FIGURE 1. Highrise Apartments Dominating the Landscape in Kuala Lumpur (photo by the author)



FIGURE 2. Modern Vernacular House in Kuala Lumpur (photo by the author)

the main goal is to design affordable multi-unit housing that works better for the poorer people, we are more interested in two particular issues: small unit size and inability to allow home-based business. These issues have been pointed out by many researchers. The new housing is smaller than their former squatter homes and thus typically called 'pigeon holes' and 'chicken coops' by dwellers (Ali, 1998; Yeoh, 2001; Bunnell, 2002; Suffian, 2009). For low income families, home is not only for living but needs to be used to generate income by allowing proper spaces for home-based enterprises for those who want to work but cannot leave their homes (Aziz, 2012).

In developing the low-income housing, we examined the way Malay people live in their traditional setting. Although life styles have changed, there are things that still have significance in modern life style. First, there is a unique way of treating the level of the floor in Malay houses. Traditionally, the front living area was elevated by taller stilts while the cooking and dining area was positioned lower, and this practice continues even in modern vernacular houses (Figure 2).

It is based on the distinction between the served space which is formal and clean and the serving space dirty and informal (Seo 2015; Figure 3). In principle, any space that belongs to the former is elevated and that to the latter lowered. Thus even in modern apartment houses, we can find that bedrooms, living rooms and formal dining rooms are typically positioned higher while toilets, bathrooms, kitchens and balconies are lowered at least a few centimetres in their level of the floor. Second, along with the distinction between the formal front and the informal back, traditional houses had two entrance doors as in Figure 2. In this hierarchical spatial sequence, it was more effective to have two separate entrances rather than one. Although this has almost disappeared in modern apartments, many high-end flats still provide two entrance doors; one for residents and the other for servants. Third, traditional Malay houses were not constructed all at the same time. Once you build the main structure of living house, it was gradually growing by adding additional spaces. The housing has the characteristics of incremental growth following people's demand and family sizes.

In developing our design scheme, these three indigenous traits were examined and applied. As the main complaints of apartment residents are attributed to the radical change in domestic environment, it was considered to implant these elements to the new home design.



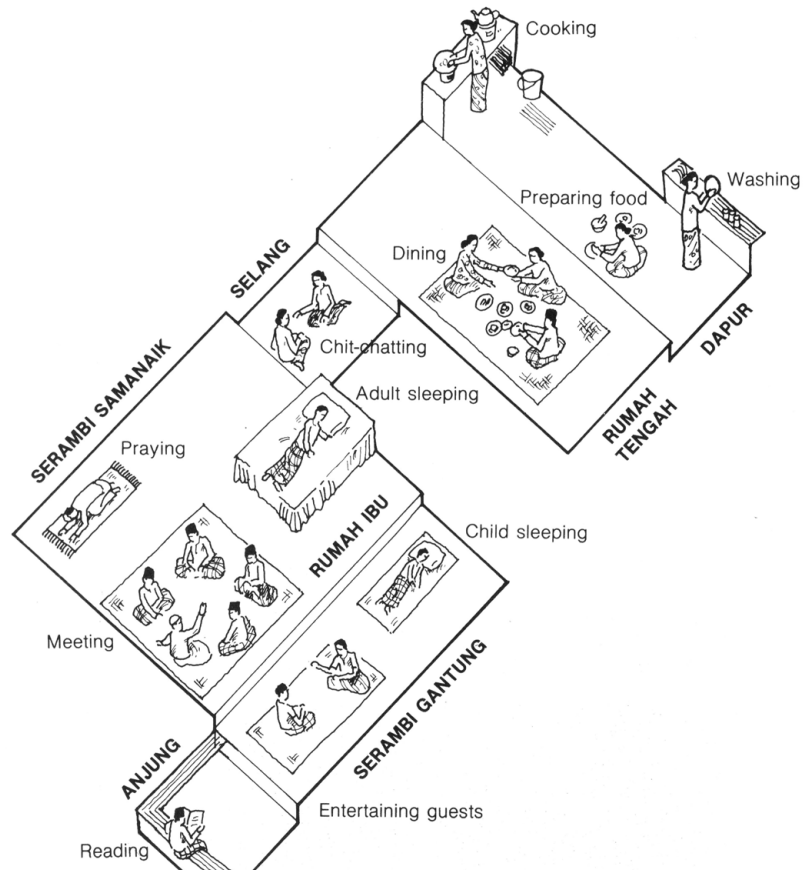


FIGURE 3. Domestic Activities and Floor Distinction in Traditional Malay House (Source: Yuan 1987)

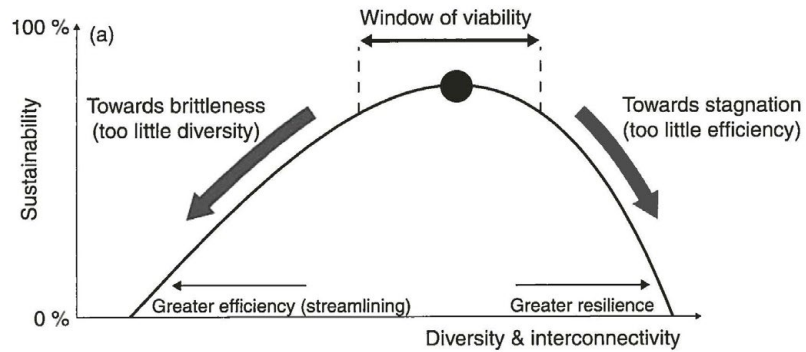


FIGURE 4. Efficiency - Resilience Diagram (Source: Smets et al 2014)

## OPEN BUILDING AND INCREMENTAL CONSTRUCTION

The issue of providing spatial flexibility has at least a half-century long history. It has been constantly discussed throughout the second half of the twentieth century. On a small scale, it could be applied to a single house level by providing movable partitions as in Schröder house and on a bigger scale to a mass construction level by utilizing the frame/infill concept as represented by SAR method. When we use the term ‘open building’ however, it includes more comprehensive meanings that surround the issue of flexibility. It means that the process of construction permits at many different levels a possibility of architectural intervention or participation of users or experts. Across the world, many open building approaches have been developed and practiced for many decades under various names: support/infill, skeleton housing, support and detachables, houses that grow, etc. (Kendall & Teicher 2000). Standardized multi-unit housing typically has a limit in allowing a wide spectrum of lives due to its small number of unit types, but open building can offer more configurational freedom to residents. In this research, we will use the term, ‘Structure and Infill (SI)’ to describe the process where the building structure works as a skeleton or framework to which demountable components are added on in the later stages. Our strategy aims to increase the resilience to cope with future transformation of domestic layout but without sacrificing too much of efficiency by modularising the demountable components (figure 4).

The most critical problem of low-income housing in Malaysia is its affordability for poorer people. As described at the beginning, although the ceiling price has been set by the government, many low income families cannot secure the amount of money to buy it. For the government and local authority, it is also difficult to fund the low income housing more than they do now. We aim to solve this social problem by adding the time dimension to open building construction with the name ‘Incremental SI (Structure-Infill) housing’. It is the housing supply system where structure is built first with reduced amount of budget, and infill is attached later in an increment manner. Unlike normal open building construction, this allows the bare structure of the first phase construction to be utilised as a basic shelter, and in the following phases, those who moved in can participate in the incremental construction of their homes. By splitting the total construction into smaller manageable volumes, it is expected that the local authority can initiate the development with less risk and financial burden within a limited timeframe. As the nature of house is ‘incremental’, those who moved in can also have flexibility of handling and managing their construction plan, based on their own financial status. One brilliant example of



FIGURE 5. Villa Verde by Elemental (from Elemental Homepage)



FIGURE 6. Villa Verde with Self built Additions (from Elemental Homepage)

incremental housing is villa Verde housing by Elemental architects in Chile (Figure 5).

The concept of incremental construction is not new. In many developing and developed countries, this kind of participatory housing development has been experimented. There are expected gains by implementing incremental housing. First, by support approach rather than supply approach, the number of low-income houses can be increased. Second, government can share the cost of development with households. Third, the managerial communication between authorities, communities and participants can be made more efficient. Fourth, it can reduce uncontrolled, low density urban sprawl and encourage high density, compact development. Fifth, through the engagement of households and community leaders, a good governance can be established. Sixth, local communities are strengthened, job opportunities are created, and household incomes are increased; curing social conflict and anti-social behavior (Turner and Wakely, 2015). In spite of these potential benefits, many attempts have been failed due to the malfunction or dissatisfaction in delivery, finance, location, and maintenance.

In our research, we decided to put the issues of the delivery and finances aside because our goal was to suggest a new design solution. We targeted the area of urban squatters as potential sites and investigated a possible solution that is more liveable and affordable and also adaptable to poorer people's needs. In the viewpoint of building as an asset, it has been observed that the typical reason of failure in the development of incremental housing is the deterioration of built environment by using varying non-standard materials by non-professional workers (Hassan et al, 2015). Thus we attempted to provide certain level of building quality by obligating the use of standard component, i.e. windows, partitions and doors. In the following section, it is suggested how we conceptualized the design approach and how we solved the problem of incremental construction, flexibility, sustainability, and quality control.

## DESIGN CONCEPT AND BASIC PLANS

Looking at the old precedents of housing around the world, one can find that the rooms are generally for multi-purposes, and activities in a room can be transferred to others without much conflict. The Palladian villa in Figure 7 shows how this was possible. Rooms have plural number of access openings that lead to others, not to a mediating space for movement, i.e. corridor or a central hall. When a row of rooms are directly

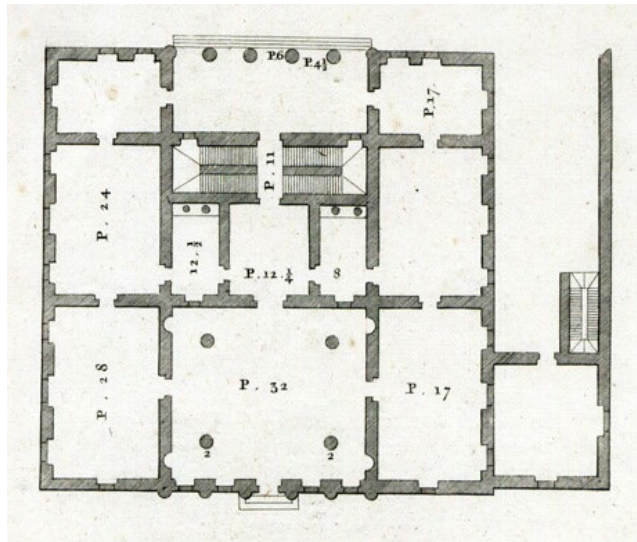


FIGURE 7. Pallazzo Antonini, Andrea Palladio, 15C

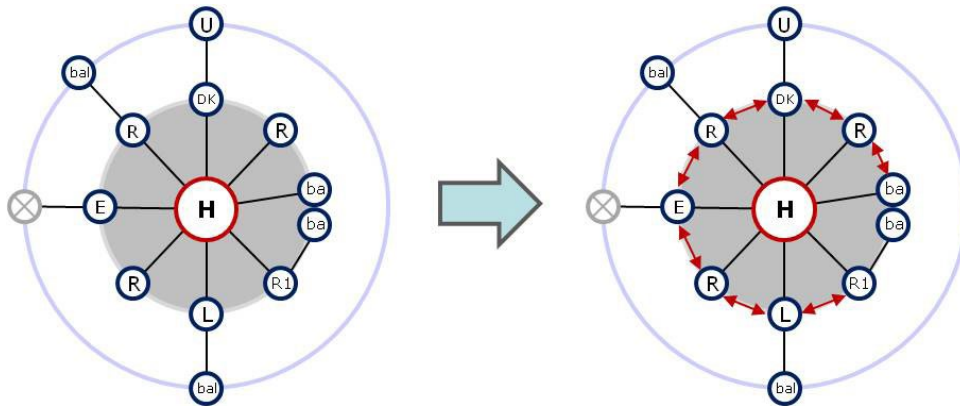


FIGURE 8. Diagram of Modern Apartment Unit and Possible Links (copyright @Kyung W Seo)

connected sequentially like this, it makes a spatial configuration known as a ‘room-to-room enfilade’. It is suggested here that this enfilade is an effective spatial device that can generate an enhanced degree of flexibility in space use as in Palladian villas. When two rooms of similar sizes are placed next to each other and directly accessed, they could support each other by accommodating similar activities when needed. When three rooms of comparable sizes are directly attached and accessed in a row, the room in the middle can support the two in each end. In this case, due to its innate ambiguity, the middle room can have a higher degree of adaptability. It can be a central zone that integrates the three or act as a buffering zone. This is how the enfilade operates for flexible functions. Since a room can readily support the adjacent one, activities are interchangeable.

If the room-to-room enfilade makes a ring-shaped spatial structure that can allow an unending circular movement, then the freedom of movement and the freedom of activity allocation is maximized as in Palladian villas. In the modern house, however, the ring structure is hard to be realized. This is because the modern house, especially the apartment houses are becoming a compact unit of functional container where the movement optimisation and space efficiency are encouraged by making the whole configuration linked by the central hall. Another reason is the ever growing number of furniture that requires more wall surfaces, not openings. The diagram in Figure 8 shows the typical configuration of the modern apartment unit. Centred around the hall or corridor, each functional space becomes a dead end, allowing no interchangeability of functions. As portrayed in the second diagram in Figure 8, by actively providing access links to neighbouring rooms, the ring structure penetrating functional rooms can be retrieved to induce polyvalent functionality again.

With the spatial strategy described above, two types of multi-storey walk-up apartment housing were planned, namely Incremental Housing 1 and 2. The former is a central courtyard type where the communal staircase is located in the central void space linking the surrounding building block, and the latter is a slab block type. Both types are sustainable and have its original concept but Incremental Housing 2 was developed more recently based on the analysis and evaluation of Incremental Housing 1, thus possessing a more advanced concept with more feasible solutions. In this chapter only the Incremental Housing 2 will be discussed for its concept, and Incremental Housing 1 will be discussed in other chapters.

The block type of Incremental Housing 2 is a slab block where units are linearly added

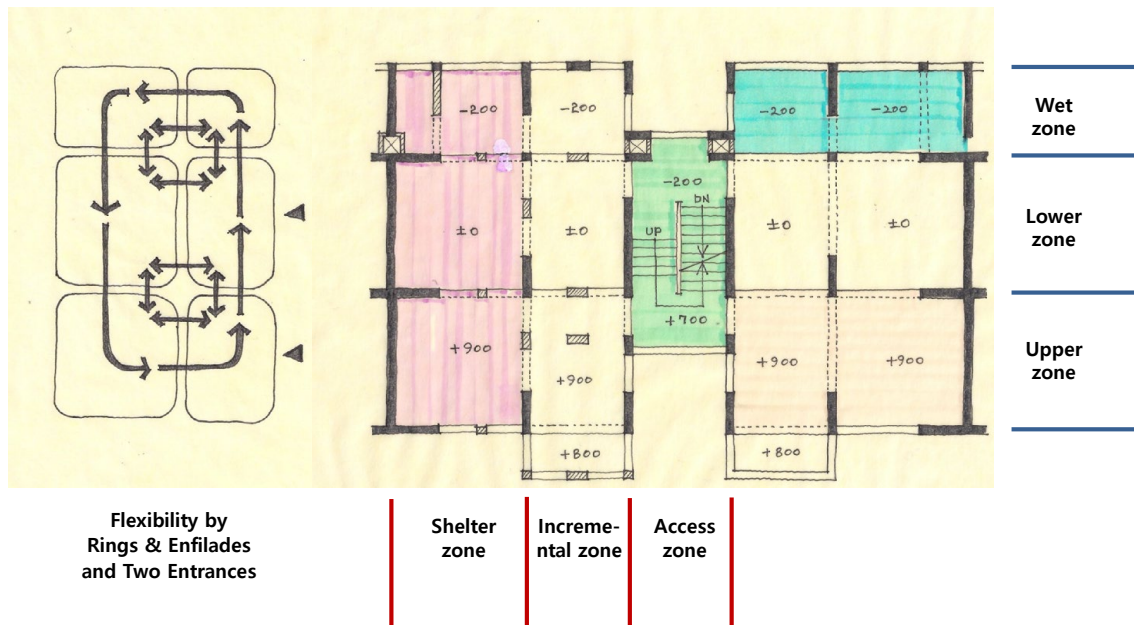


FIGURE 9. Incremental Housing 2 - Unit Plan and Zoning (copyright @Kyung W Seo)

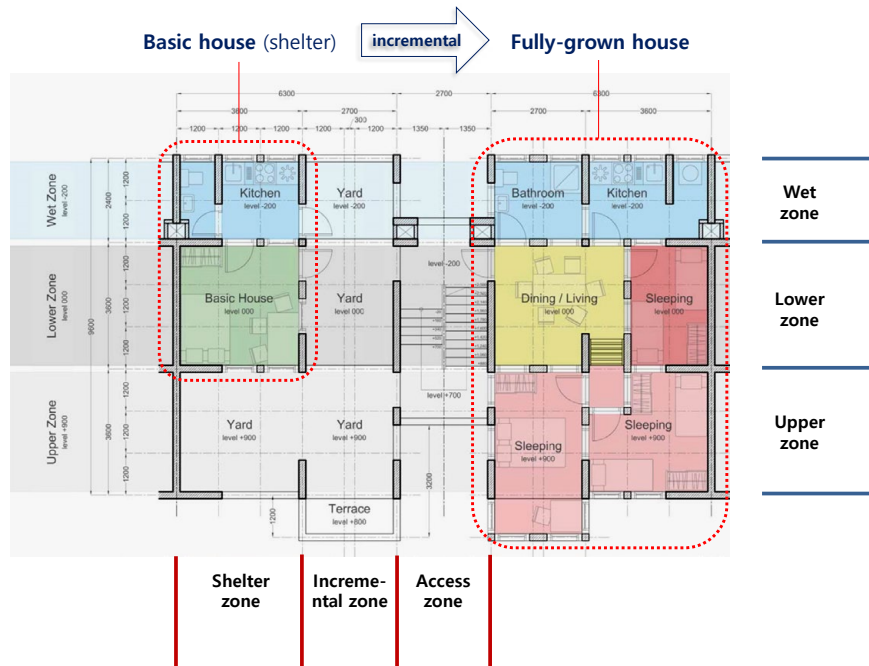


FIGURE 10. Incremental Housing 2 - Basic House and Fully Grown House (copyright @Kyung W Seo)

side by side. For vertical access, communal staircases are inserted between them in such a way that one staircase flanks two units on each side at each floor as in Figure 9. Reinforced concrete structure makes the basic skeleton of the whole building and each unit has six rooms that are spatially connected to each other. The unit is entered by two entrances that are positioned in separate landings, thus making +900mm difference in floor levels. The unit floor plan has three horizontal zones and three vertical zones. Vertically, the deepest column is named 'shelter zone' because it will be the initial living area when residents first move in. At the first phase of construction, the very basic fit-out will be provided in this zone and other zones will be left as bare skeleton for future growth. The middle column is 'incremental zone' which is gradually filled in or fit-out in the later stages. Horizontally, the top row is 'wet zone' which has the lowest floor level of -200mm. This is the zone to accommodate bathrooms, toilets, and other service spaces such as balconies for wet or dirty activities. The middle row is the 'lower zone' ( $\pm 0$ ). It is named so in relation to the 'upper zone' which is +900mm higher. This upper zone and lower zone split the living area into two just as in the traditional Malay house where formal living zone is typically elevated higher than the informal dining and cooking area. Due to this level change, the two entrance door in different levels of staircase can allow access to the domestic space with just one stepping up of +200mm.

When the first phase construction is completed, the shelter zone will be fit-out by using the standardised components as in figure 10 (see also figure 11). These components are basically variations from the same sized module of 1,000 x 2,700 mm and functions for windows, doors and partitions. Having the same size and joint details, these three components can be attached and detached from their positions and interchangeable. This will allow the change of links to other rooms and therefore change the overall configuration of the domestic layout even after the occupation. Starting from the basic house, the unit can grow to occupy the whole floor to become a fully grown house, or depending on residents needs some rooms can be left as exterior space for other functions such as home-based enterprises or a large balcony space. During the process of this expansion, more components would be required to fill in additional openings. In this way, the additional cost for more components and other finishing materials can be earned while users are living the basic house and spent when additions are needed. Moreover, there is a potential of the local community's involvement in manufacturing the whole or parts of the component, if we consider the low-tech design of the component, to generate their own income to meet the incremental construction cost. Figure 7 shows the basic house on the left side and the fully-grown house on the right. By changing the opening and closing



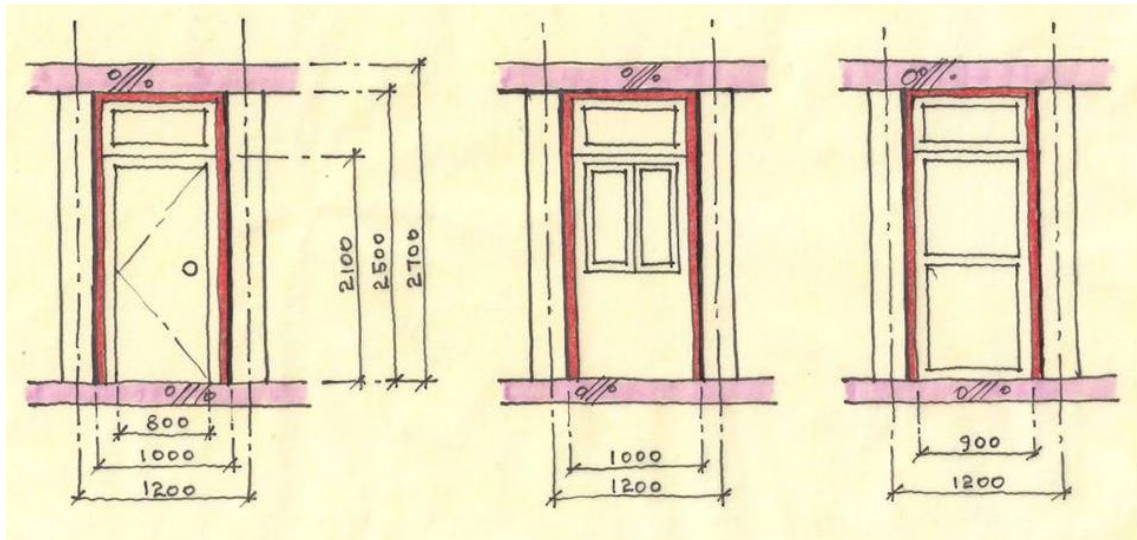


FIGURE 11. Standardised Component for Doors, Windows and Partitions (copyright @Kyung W Seo)

of the access pattern, a large number of unit variations can be made. Since the house has two entrance doors, it is even possible to split the house into two smaller houses of which are inter-connected or completely separated.

## CONCLUSION: APPROPRIATE TECHNOLOGY AND HOUSING INDUSTRY

We have targeted urban squatter area to apply our design solution. It is the area stigmatized as an urban ill and the government and local authorities want to remove and build a new high-rise apartments. It has been pointed out by many researches that this new apartments are not conforming to needs of the low-income people and actually creating another problems for the city. We saw the most critical problem of the new housing from the design aspect, and suggested a new solution to it. Amongst all problems described earlier in this chapter, we expect to a certain extent the problems of cleanliness, small unit size, inadequate facilities, and inability to allow home-based business can be cured through the introduction of our new plan. We also hope that the issues of community breakdown by racial conflict, crime and social ills can be cured eventually through the time.

What is more, we anticipate that the development of incremental SI housing can bring

the economic boost in the construction industry of Malaysia. There emerge three different sections where builders in the public and private sector can participate: the construction of the first-phase structure, that of subsequent infill fit-outs, and manufacturing of components. In addition, there will be a number of chances for small-sized remodelling businesses on an irregular basis. The design of the incremental SI housing can be customised and conform to Malaysian context by extracting and applying the genotypical characteristics of Malay domestic architecture. This will remove the risk that the mass housing schemes will become alien modern concrete boxes.

In the broad perspective, the general concept of the housing can be utilised in other parts of the world to help building affordable homes for poor populations. The usability of the incremental SI concept in a wider context will become an on-going subject for the theoretical and practical enhancement even after the Institutional Link period ends. The development of the incremental SI housing will actively utilize the sustainable tradition of vernacular Malay architecture where houses are made with local materials and grow in time in relation to the family size. Thus, this new housing concept will bring not only the opportunity for the economic development in the region by offering a viable solution to build more affordable houses for the poor population but also revitalise the vernacular wisdom and heritage of building homes.

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MARCO CIMILLO

## DESIGN STRATEGIES FOR THE DEVELOPMENT OF AN AFFORDABLE AND SUSTAINABLE HOUSING SYSTEM IN THE MALAYSIAN CONTEXT

*The affordability issue is reviewed in literature and defined in the local context and in relation to a wider vision of housing adequacy, through which demands such as sustainability, accessibility and others are given the appropriate consideration. Furthermore, self-building is regarded as a possible affordability approach. Accordingly, a design strategy for housing affordability and adequacy in Malaysia is set, with regards to the architectural and technological side of the problem. The proposed solution is mainly based on the concepts of Structure-Infill (or Open Building) and Incremental Growth. The former allows for high flexibility and for a distribution of responsibilities and financial burdens on different stakeholders. The latter makes possible a rapid solution to satisfy households' basic needs and to reduce the upfront costs for either families or housing providers, maintaining the opportunity to extend and improve the residential units at a later stage.*

*The two approaches associated allow to combine a series of apparently antithetic concepts, which instead can work together for the provision of rapid, high-quality, affordable housing solutions: High standard / Self build; High density / Self build; Industrial technologies / Local traditions.*

## INTRODUCTION

Housing affordability can be defined as a condition in which a household can pay for a decent accommodation and, at the same time, sustain other basic living costs with their available income. However, the problem has wider implications and is complex to define univocally, as housing conditions affect other expenditures, such as transport and energy, and cannot be considered in isolation. Nonetheless, there is an urgent need for research and action over the provision of a substantial affordable and sustainable housing stock in the next future. In fact, while housing affordability is already a major issue (McKinseyGlobalInstitute, 2014), world population is projected to increase by 1,16 billion in the next fifteen years and to reach 9.72 billion by 2050, growing by 19% (5.7 million) in Malaysia during the same period (UN-DepartmentOfEconomicandSocialAffair, 2015), with urban population rising even faster (Figure 1). Even though the final price of houses is influenced by many other factors, construction costs are certainly the most impacting factors being more than a half of the total production costs (section 5). At the same time, running and maintenance costs affect both health and financial conditions of the residents. The aim of the research is to define the problem in the Malaysian context and to identify design and management strategies to contribute to its solution.

## HOUSING AFFORDABILITY AND ADEQUACY: THE NEED FOR A HOLISTIC APPROACH

The definition “Affordable Housing” is often very generic even in technical and/or scientific texts, where it is used indistinctly:

- As a synonym of Social Housing, which encompasses a broad range of instances as well, generally all housing offer not on the free market (Council Housing, Housing Associations etc.)
- Housing addressing the needs of specific categories of people (first time buyers, young families etc.);
- Housing whose buying price or renting costs fall below a given threshold, regardless the way they are provided (including free market);

Such a threshold is defined with the objectives of identifying households needing assistance, controlling renting prices, providing off market housing or developing affordable design solutions. At least three different main approaches have been developed to measure it (Whitehead, 2009; Cai and Lu, 2015):



FIGURE 1. The process of densification in Kuala Lumpur, Source: Author



FIGURE 2. Models for new high-density urban development in Johor Bahru. Source: Author

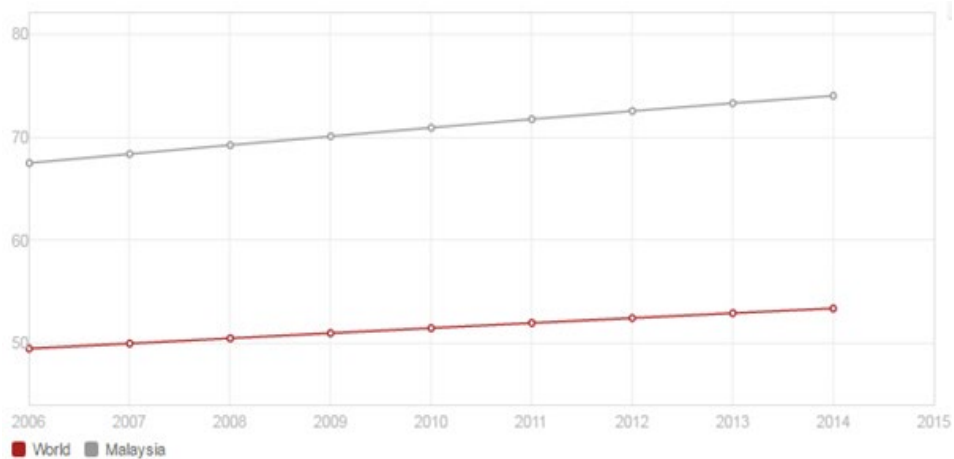


FIGURE 3. Urban Population (% of Total); in Malaysia urbanisation is higher and faster than the world average. Source: data.worldbank.org [accessed 13.04.2016] Urbanization

1. Price-income ratio: house expenditure is considered affordable when the rent is under 25-40% (depending on the context) of the household income, or when the buying price is not more than 2.5-3.5 times the household gross annual income. The advantage is simple application and comparison among different situations, whilst the method fails in taking into account more specific parameters such as household dimension.
2. Residual Income: house is affordable if the income (including housing benefit) left after paying house expenditure equals at least “Income Support Applicable Amount”, i.e. if the total income + housing benefit is enough for house and other basic living needs.
3. Annual income necessary to buy a house: houses are affordable if the actual income at least equals this figure, estimated taking into account also finance costs. The method is mainly used to assess households’ capability to access offer from housing association.

However, given the complexity of the problem, these options are not exhaustive and there is a range of indexes used to account for more variables, to fit a specific context or to target the assessment to specific group. For example, when evaluating the housing affordability in a country or city, median values are typically used for prices and incomes, but this does not allow for a clear understanding of the circumstances of the poorer strata of the population. A more specific index is the “Down Market Penetration” (Ismail, 2015), which measures the ratio between the price of the cheapest, unsubsidized, formal housing unit produced by the private sector in significant quantities (minimum 2% of annual production) and median annual household income. It is meant to assess the access of lower-income households to the private formal housing market.

Furthermore, it is widely recognised that the location of the house plays a crucial role, as the burden of commuting costs may well compromise, in a broader sense, the affordability of living in a place apparently inexpensive, but without easy access to jobs, schools and other amenity. The “Housing and Transportation Affordability Index”, developed by the Center for Neighbourhood Technology in the USA, accounts for the costs of housing and transportation combined, setting the affordability threshold at 45% of the households’ income. (Fisher, 2009) Developed an Index taking into account amenities such as accessibility, school quality and safety, which are assigned an implicit prices used to adjust the level of affordability. Similarly, an adequate housing solution must be free from forms of “energy deprivation”, by having access to appropriate energy facilities



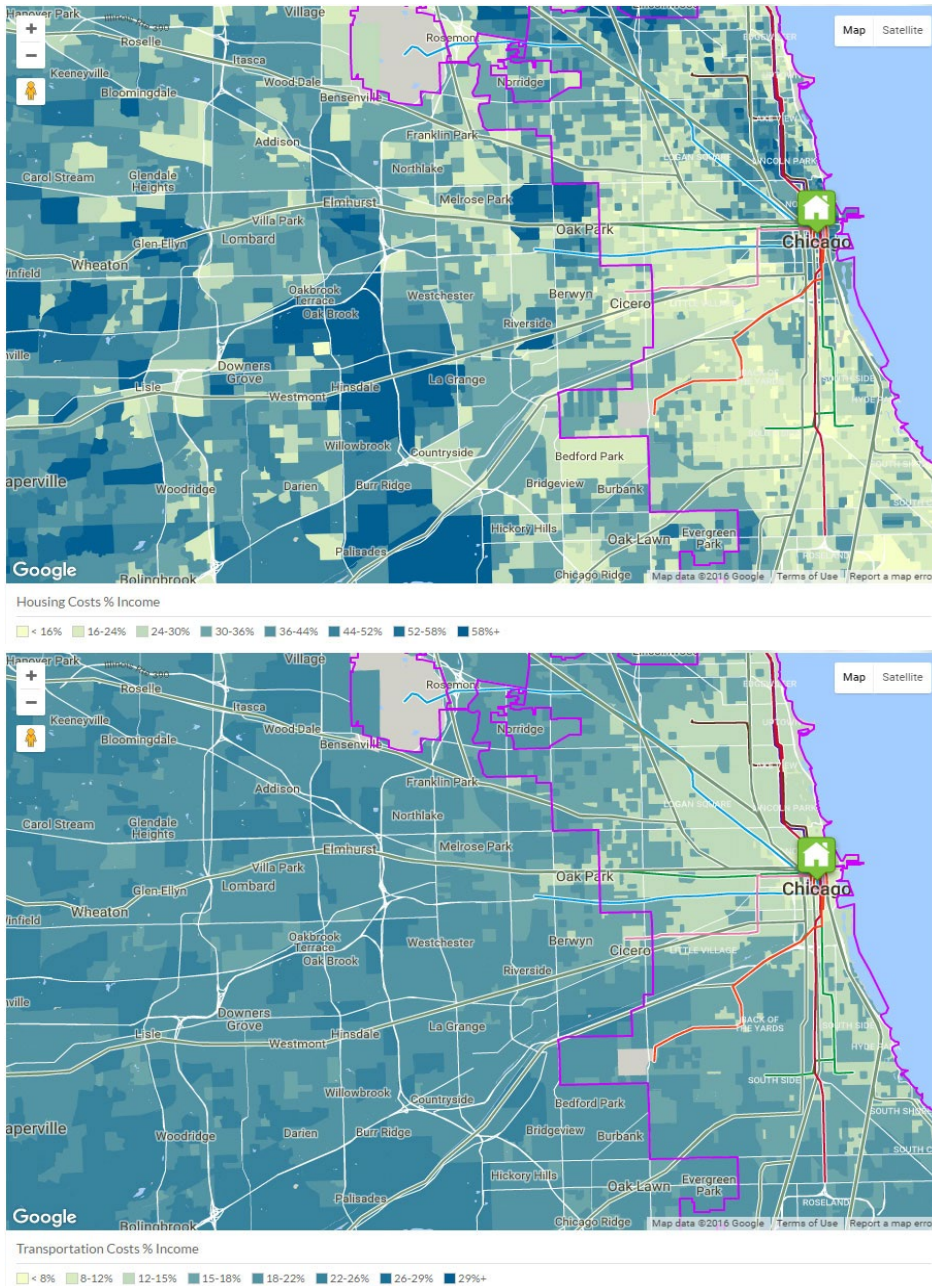


FIGURE 4. The Housing and Transportation affordability index shows income expenditure in Chicago: affordable Houses come with high transportation costs; Source: <http://htaindex.cnt.org/>

and by performing efficiently the energy services required in the house (Bouzarovski and Petrova, 2015). The lack of access to suitable and modern energy facility has several detrimental impacts on environment, economy and health; indoor pollution caused by the use of open fires accounts alone for over 2 million deaths per year in the world (González-Eguino, 2015). Also, a poor energy performing building might seem more affordable when considering buying or renting costs isolated, but it will prove more expensive to heat/cool. When energy costs become unaffordable, then households are forced in “fuel poverty” with implications, again, on comfort and health of inhabitants.

Another important factor to be considered is the access to finance (Whitehead, 2009), which may prevent the opportunity to buy a property even for household theoretically able to afford it. To account for financial costs, the “Housing Affordability Index”, used mainly in the USA, measures the ratio between the median family income and the qualifying income to buy a median priced single family house. The index, published by the National Association of Realtors, is based on a 25% qualifying ratio for monthly housing expense to gross monthly income, with a 20% down payment (NAR, 2016). Besides, (Gan and Hill, 2009) drew a distinction among Income affordability, measuring the ratio of house prices to income, “Purchase affordability”, measuring the ability to borrow enough funds to purchase a house and “Repayment affordability” measuring the burden imposed on a household of repaying the mortgage. They also showed how the three measures may vary independently of each other. There are also financial problems related to the tenure situation for those living in informal accommodation without a proper ownership title (Zang, 2008). This condition immobilises huge capitals in assets excluded by the formal and by the financial markets, therefore creating also greater effects to the real estate market and the economy in general.

These issues have been largely tackled since the 1980’ by means of “enabling” strategies, aimed at the introduction of incentives and facilitation to allow the low-income to find housing solution on the market. However, the real effects of such policies, also backed by the World Bank in many developing countries, are controversial. In fact, criticisms have been raised about resources being diverted from direct public housing provision and informal settlements upgrading, in favour of middle classes (also suffering affordability problems), but to detriment of the poorest (Ferguson 2014).

In Europe (both EU28 and Euro area) 11% of population spent 40% (the affordability threshold) or more of their equalised disposable income on housing in 2014, with a



FIGURE 5. Informal settlement in Johor Bahru, Malaysia Source: research team original photo



FIGURE 6. Informal settlement in Johor Bahru, Malaysia Source: research team original photo

peak of 40.7% of population in Greece and a figure of 12.1% in the UK (Eurostat, 2015). Considering those below the 60% of the median income, the percentage raise up to about 38% in Europe, 28% in the UK and above 70% and 90% in Greece and Denmark, respectively (Pittini 2015). Using a 30% housing costs/income, it is estimated that urban households in the world overburden or lacking of a decent accommodation were 330 Million in 2014 and, based on current trends, will be 440 Million (1.6 Billion people) in 2025 (McKinseyGlobalInstitute 2014). However, a household with a rent-income-ratio below the threshold may be simply under consuming housing (Thalmann, 1999), not having access to affordable housing, adequate to their needs, for example living in overcrowded dwellings (Cai and Lu ,2015). Furthermore, even though it allows for relatively simple evaluations, a merely financial evaluation is universally recognised not to be exhaustive of the problem and there are a number of other criteria to be considered. As an example, in order to account for the multidimensionality of the problem, (Mulliner, Malys et al., 2016) proposed a multiple criteria decision making approach to assess housing affordability, based on 20 evaluative criteria. The bottom line is that housing affordability cannot be isolated by a more comprehensive evaluation of housing adequacy, even though providing the required features most of the times imply an increased cost. In brief, the most important criteria to be considered are:

**Accessibility:** the ability to reach basic facilities such as workplace and school, but more in general desired goods services and activities. It considerably increases the land cost, but significantly affects affordability of life when transport costs are an issue, particularly in heavily urbanised areas (Isalou, Litman et al., 2014; Cai and Lu, 2015);

**Habitability/Amenity:** the presence of basic amenities such as running water, sewage and electric power (Cai and Lu, 2015), which is a concern mainly in the developing countries currently. Access to internet may be considered part of the basic requirements nowadays. Also the condition of the environment surrounding the home has to be considered (Statistic New Zealand).

**Occupancy/crowding:** As a reference, the Canadian National Occupancy Standard (in use also in other countries, such as Australia and New Zealand) states that:

- a household of one unattached individual may reasonably occupy a bed-sit (no separated bedroom)
- no more than two people should share a bedroom
- parents or couples may share a bedroom
- children under 5 years, either of the same sex or opposite sex may share a bedroom

- children under 18 years of the same sex may share a bedroom
- a child aged 5 to 17 years should not share a bedroom with a child under 5 of the opposite sex
- single adults 18 years and over and any unpaired children require a separate bedroom

Sustainability: energy and environmental performance are not only a concern in relation to the environmental impact, but also (primarily for the purpose of this research) in terms of occupants' comfort and health. It can imply up to 12.5% cost increase for a zero-carbon new building, and up to 21% for wider sustainability measures; however, benefits outweigh costs, with up to 30% increase in asset value; furthermore, it is recognised as a generalised improvement in health and an increase in productivity in commercial buildings up to 25% which testify for an enhancement of comfort and well-being (regardless of the building use, even though productivity cannot be measured in residential buildings) (WGBC, 2013; Dwaikat, 2016).

Universal design/usability: it affects adequacy for physically impaired people (increasing in number with growing life expectancy). Increase in construction costs are estimated between 0.1 and 1.3% (Davidson and Malloy, 2009). De-concentration of poverty: to reduce social threats, but in turn it contrasts with the risk of dissolving existing communities and of gentrifying the new developments (thought to be affordable) (Davidson and Malloy, 2009). Freedom from discrimination: is one of the six dimensions of housing adequacy (Affordability, Suitability, Habitability, Tenure security, Freedom from crowding, Freedom from discrimination) defined by Statistic New Zealand. It must be avoided that housing conditions result from a discrimination made on the ground of race, sex etc. (Statistics-New-Zealand).

Tenure security: defines to what extent the tenure is guaranteed over a period of time. Statistic New Zealand defines a scale in six grades:

- a) Dwelling owned without a mortgage;
- b) Dwelling owned with mortgage;
- c) Dwelling provided rent free;
- d) Dwelling rented (state);
- e) Dwelling rented (private);
- f) Transitionally and episodically homeless;
- g) Chronically homeless.

In conclusion, housing affordability is rather complex to define, and is not just an intrinsic quality of the building, but it must be assessed in relation to each specific group and context. However, the cost of the house is certainly a critical variable and, for the purposes of this research, the efforts will be concentrated on the production inherent features of the building that can contribute to lower the financial burden on households and providers. These include the characteristics related to architecture, technology and construction and management process.

## AFFORDABILITY AND SELF-BUILDING

Possible strategies in addressing the affordability problem on the production side are self-build and self-help housings. Whilst self-build usually involves completely new constructions, self-help is a process through which abandoned or substandard buildings are redeveloped. In both cases the perspective inhabitants are directly involved in the design and construction of their home. The definitions are, again, rather wide and include both situations in which the self-builder actually perform the greatest part of the construction work or in which they simply buy the lot and contract professional designers and builders. This is by far the most common case in Europe, where it account for 7-10% of new houses in the UK, but up to 60% in France and 80% in Germany (Wilson, 2015). In fact the option works effectively where favourable conditions are provided. As self-building is considered as higher risk, finance access is limited and also regulation, land supply and procurement can be problematic (Wilson, 2015).

The situation is rather different in developing countries, where self-build has been the most common practice in the construction of informal settlement that are now housing more than 1 billion people around the world (World Habitat Day 2015 key housing facts). In this context self-help strategies have been implemented in several Asian countries, such as Indonesia and Sri Lanka, mainly with the objective of improving slums and informal settlements in general, which in the short term will remain the only alternative for the poorest part of the population (Yap).

According to (Bredenoord, 2014) three main issues limit the validity of self-building as an effective strategy for the urban development: 1) the inability to achieve high-density settlements, more sustainable but unfeasible due to the low-rise building typology and to the slow growth and consolidation of self-built developments. 2) Low technical quality

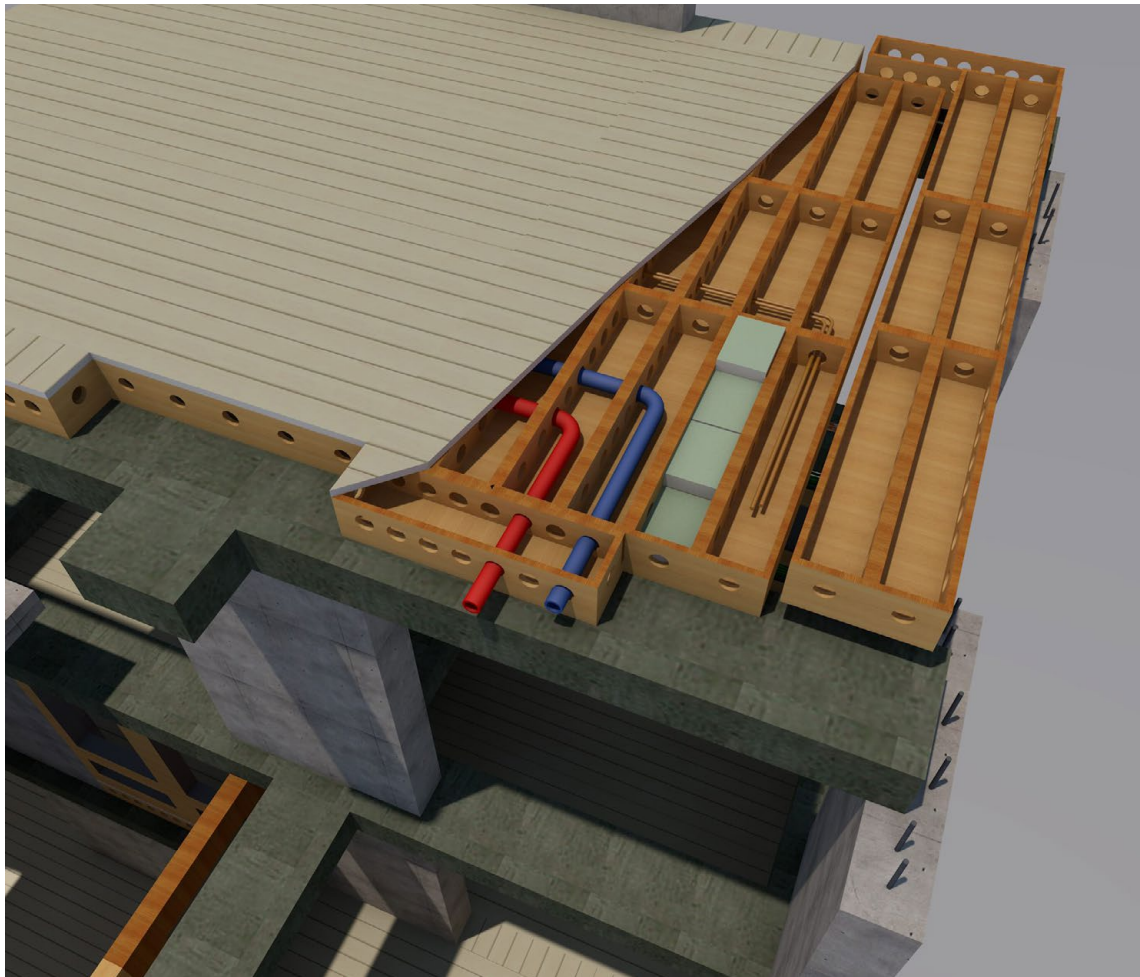


FIGURE 7. Modularity and demountability in the design proposal (Incremental Building 1): elements are designed to implement a structure-infill approach, to increase flexibility and to facilitate self-construction for non-structural parts of the building

(and low safety), due to the use of cheap materials and unskilled builders, but also to the lack of regulation and control. 3) Low sustainability, due to lack of planning and, again, poor technology standards. In some cases, however, self-help strategies have been integrated with a public provision of more conventional structures, where the initial building is allowed to grow incrementally, within given constraints and limits; examples are the Solanda Project in Quito, Ecuador and the projects developed by Elemental in Chile and Mexico. These projects are based on low-rise units, but in Solanda the residents added up to five floors to the original buildings, showing a good potential for vertical densification (Kessler, 2014).

Since the open building approach aims at the separation of responsibilities and levels in the building process, the self-managed part can be introduced at a stage in which the above mentioned barriers are neutralised. There are other kinds of obstacles though, and among them the lack of standardisation and of user-friendly technological systems. The building market does offer a range of prefabricated solutions manageable by self-builders, but they are mainly intended to provide “kit” for the assembly of predetermined houses, with few or no flexibility in the final product.

## AFFORDABILITY, ARCHITECTURE AND TECHNOLOGICAL SOLUTIONS

From an architectural point of view, affordability can be improved by reducing construction, management and maintenance costs over the life cycle of the building. It is a complex and multifaceted problem, so the solution must be articulated on to address multiple aspects. Through an analysis of the state of the art and a review of the current literature, a number of measures have been identified to improve financial efficiency:

- Density: it allows decreasing the incidence of land and basic infrastructure costs; furthermore high density improves sustainability at the urban scale, by reducing soil occupation, transportation and infrastructure. There is also evidence that urban density reduces urban segregation and is an obstacle to social upward mobility (Ewing, Hamidi et al., 2016).
- Flexibility and adaptability: solutions, which allow households to access an “entry-level” dwelling and improve and/or expand (and possibly reduce it later) it over the time. The advantages are several, because the initial costs are reduced (for the households or the public provider), the construction time is faster and the environmental impact is lighter. Total costs over the life cycle of a building are



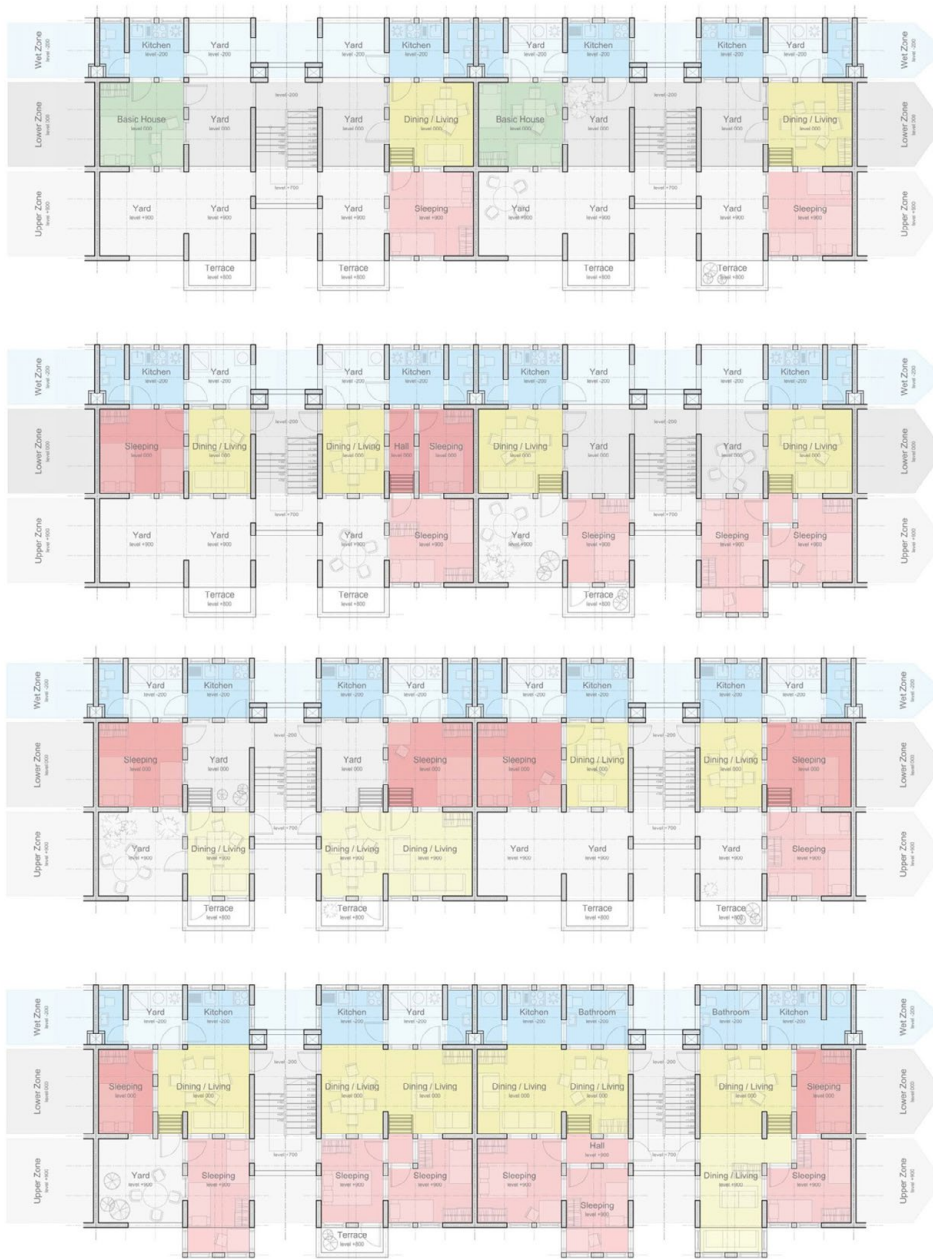


FIGURE 8. Flexibility in the design proposals (Variation of Incremental Building 2): 16 possible configurations using the same structure and movable partitions.

estimated to be reduced up to 50% (Milwicz and Nowotarski, 2015), but is crucial that flexibility is addressed since the very first stage of the design (Bogenstätter, 2000). An “Open building” or “Support-Infill” approach is also functional to this purpose.

- Modularisation and Prefabrication: it is functional to flexibility and adaptability, but also allows reducing construction time and scraps and to increase reusability at the end of the building life cycle. Given increasing the economic weight of developing countries in the global economy and the fast demographic growth and the chronic housing shortage, affordable housing is now perceived as a potentially profitable business (Ferguson, 2014), making possible to engage industry in the process.
- Waste minimisation: by reusing and recycling on site, a 2006 study based on a Malaysian case study (Begum, Siwar et al., 2006) found that this strategy can save up to 2,5% on the total project budget.
- Value engineering: it is a technique used to reduce construction and lifecycle costs, based on the analysis of both costs and performance of materials/components used in a project. Combine with other industrialisation measure, it can cut construction costs up to 30% (McKinseyGlobalInstitute, 2014).
- Use of local materials and skills: it reduces transportation costs and facilitates the finding of labour force. Furthermore, it improves the sustainability of the construction process and support local economy.
- Climate responsivity and Energy efficiency: it saves plants installation expenditures upfront (due to the reduced plant power sizing) and decreases management and maintenance costs over time as heating-cooling energy consumptions can be reduced by up to 75% cost-effectively (Dwaikat, 2016).
- Water efficiency: it decreases management and maintenance costs over time and financially sound strategies can reduce by up to 60% water consumption, (Dwaikat, 2016). Furthermore water efficiency saves energy as well, since it reduces consumptions for service hot water, pumping and depuration.

## AFFORDABILITY IN THE RESEARCH CONTEXT

In South-east Asia in general, even though urban population living in slum has decreased in percentage, 49.5 to 31% between 1990 and 2010, it has grown in absolute number, from 68.9 to 76.5 million in the same period, because of increasing urbanization. In Malaysia, urban population was about 9 million in 1990, 20.1 million in 2010 and is expected to reach 29 million in 2030 (UN-Habitat, 2012). The provision of affordable

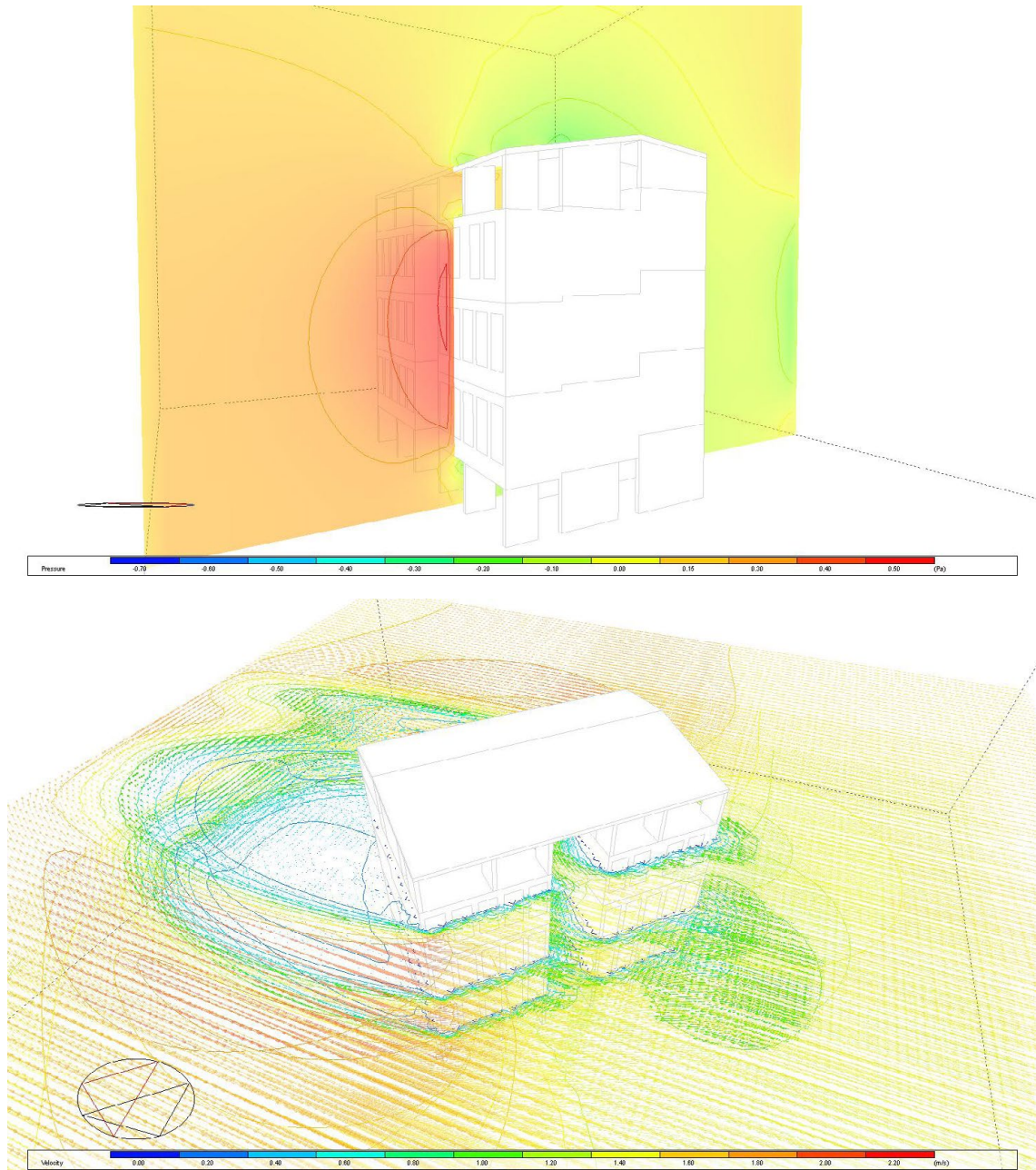


FIGURE 9. Climate responsiveness in the design proposals (Incremental Building 2): Computational fluid dynamic simulations to study interactions with wind and the potential for natural ventilation

accommodations is therefore a recognised priority and low cost housing policies in the country have been implemented since the beginning of the 1970s. Significant results have produced so far (Shuid, 2015):

- 4.36 million public low cost housing built in the period 1971-2010, 23.2% built by the public sector and 76.8% built by the private sector within the 5-year Development Plans. One more million planned in the period 2016-2020.
- Urbanization level at 34,2% in 1980, 71% in 2000, 75% by 2020 (anticipated).
- Rural household income 46% lower than urban.

Unlike many other countries, Malaysia policy focused on the building of new housing rather than on the upgrading of informal settlement (Shuid, 2015), which have proved successful to some extent in several other Asian contexts (Yap). However the problem is still in place and there is an affordability issue for medium income households, which are not able to pay increasing free-market prices and, at the same time, are ineligible for public housing and housing benefit in general. In order to progress further, in the governmental Strategy Paper 6 it is stated that in the next future “Affordable housing will be enhanced through the provision of financing facilities, availability of suitable land and provision of environment-friendly facilities and infrastructure” and that “The private sector will encouraged to develop public housing through public private partnership” (EconomicPlanningUnit, 2015). So, enabling strategies will be given the priority over additional direct public housing provision.

Regarding the housing typology, high-rise and strata accommodations are increasingly predominant as they allow addressing land scarcity problem and to relocate more effectively people living in slums. Even though it is not the traditional way of life and not everybody seems willing or ready for such a change, acceptance is growing and in 2013 10% of the Malaysian population was already inhabiting strata/high-rise buildings (Shuid, 2015). High-rise can therefore be a useful option in the Malaysian fast-urbanizing context. However, it is demonstrated that such sudden shifts can have serious consequences, including those on the mental health of the inhabitants, particularly for those forced by economic circumstances, and particularly when the relation to the natural environment is strongly precluded (Evans G.W., 2003). A pilot study conducted in Selangor revealed an overall satisfaction, among the occupants of low-cost flat housing, regarding their outdoor environment, including access corridors at each level. Minor complaints were made about the small dimension and poor exposition to sun of the drying areas.



FIGURE 10. Typology in the design proposal (Incremental Building 2): the building is design to reproduce the spatial configuration of the traditional Malaysian houses (level distinction, double entrance , open yards) in a more dense apartment block.

The typical low-cost Malaysian development ranges between 5 and 18 storeys and between 12 and 18 700-square-foot units per floor, tending to be higher and denser in urban areas; each unit is generally conceived for a 5-person family, with a living room, a dining room, a kitchen, three bedrooms and two bathrooms (Goh, 2011; Mohamed, 2014). Residential buildings other than detached, semidetached and terrace house are also subject to disable requirements.

Malaysian household's median income in 2015 is expected to be 61,452 MYR (DSM 2015), which, assuming a maximum price-income ratio of 3.5, can be translated in a maximum median affordable price of 215,082 MYR. However, in 2014 18.2% of the households were earning less than 30,000 RYM (Departments of Statistics, 2015), with a maximum affordable price of 105,000.

Currently, the minimum size standard size for a three-bedroom residential property in Malaysia is 65 m<sup>2</sup> (700 ft<sup>2</sup>) (EconomicPlanningUnit, 2013) and that the construction cost for a standard apartment ranges between 1,700 and 3,000 MYR (RLB, 2014, Turner&Townsend, 2015). Therefore, considering 20% in soft costs, site infrastructure and contingencies, the production price of a minimum unit should range between 132,600 and 234,000 MYR. This figure does not include land costs, which vary sensibly according to the specific location. In some instances, "free" public land may be available, but when it is to be bought on the market it typically represents between 40 and 80% of construction costs (McKinseyGlobalInstitute, 2014).

Based on the same assumptions, Table 1 reports more detailed data for different groups, regions and house typologies.

United Kingdom: for Comparison, excluding land, in the UK the construction cost for an affordable house (2-3 bedrooms) is 1,282.94 £/m<sup>2</sup>, while an affordable apartment in a mixed open-market/affordable development is 1,829.29 £/m<sup>2</sup> (AECOM, 2016). As the minimum gross internal floor area for a family of four is 70 m<sup>2</sup> (DepartmentForCommunitiesAndLocalGovernment, 2015), the construction cost can be estimated between 89,805 and 128,050 £ per unit. With a median disposal income of 25,600 £ per household (OfficeForNationalStatistics 2015), the production cost-income Ratio is between 3.51 and 5. The ratio would be higher, between 3.26 and 4.64, even using the 65 m<sup>2</sup> Malaysian standard, indicating therefore lower affordability and confirming that the problem is global.

Demographic groups							
Malaysia population	Urban population	Rural population	Kuala Lumpur	Johor Bahru	Low Income		
Annual Salary (MYR - Malaysian Ringgit)							
55,020	61,872	37,476	127,548	74,484	32,148		
Max Affordable price (MYR) - Threshold 3.5 price-income ratio (PIR)							
192,570	216,552	131,166	446,418	260,694	112,518		
Production costs-Income Ratio (excluding land costs)							
Min Cost	132,600	2.41	2.14	3.54	1.04	1.78	4.12
Max cost	234,000	4.25	3.78	6.24	1.83	3.14	7.28
<b>Production cost range for a 65 m<sup>2</sup> unit (MYR)</b>							

TABLE 1. Based on median income for different Malaysian demographic groups, the table reports maximum estimate affordable prices compared with construction costs. The low income group and urban population in general do not have access to affordable housing even assuming that land is provided free of charge.

## A STRATEGY FOR THE DEVELOPMENT OF AFFORDABLE HOUSING IN MALAYSIA

Holistic approach: financial, environmental, social

Based on the analysis of the problem and on the possible measures identified in paragraph 4, a design strategy is proposed to address the housing affordability problem in Malaysia. It is focused mainly on the side of construction and maintenance costs, but with an impact also on the financial side. Concisely, a model of sustainable, incremental, support-infill building is adopted to address the complexity of the housing scarcity issue in the Malaysian context. The model is meant to be very flexible in its final configuration, and can be also adapted to different context.

The strategy, at urban and typological levels is based on the following concepts:

- Moderate (high) density and moderately high-rise (at the full potential development, to take into account both land costs and people expectations in relation to the traditional dwelling environment);
- Open spaces for each unit;
- Consideration for the traditional housing typologies;

The strategy, at the technological level is based on the following concepts:

- Support-Infill (or Open building) approach: first proposed by (Habraken, 1972) it consists basically in the separation of the support structure and the interior outfit (infill) in two separately designed and built levels. Based on the consideration that the former can last for centuries, whilst the latter have a much shorter life cycle, a more convenient management of the buildings can be achieved by making them technologically independent. In an affordability context, this approach helps by facilitating the incremental growth (and de-growth) and by lowering the initial financial burden and delaying in time part of the costs for the provision of a completely developed building (incremental affordability approach) (Bredenoord, 2014).
- Incremental growth: the idea is to provide a basic home, but with the potential to be easily expanded by the inhabitants, possibly through self-building. The expansion can follow the family's growth and/or the financial possibilities of the households. At a later stage, if a family decreases in number again, the unit can be reduced accordingly, for example by splitting it in two separate houses. Combined with the Structure-Infill approach, it provides the self-builders with the opportunity to simply mount standardised components on the main structure, reducing the



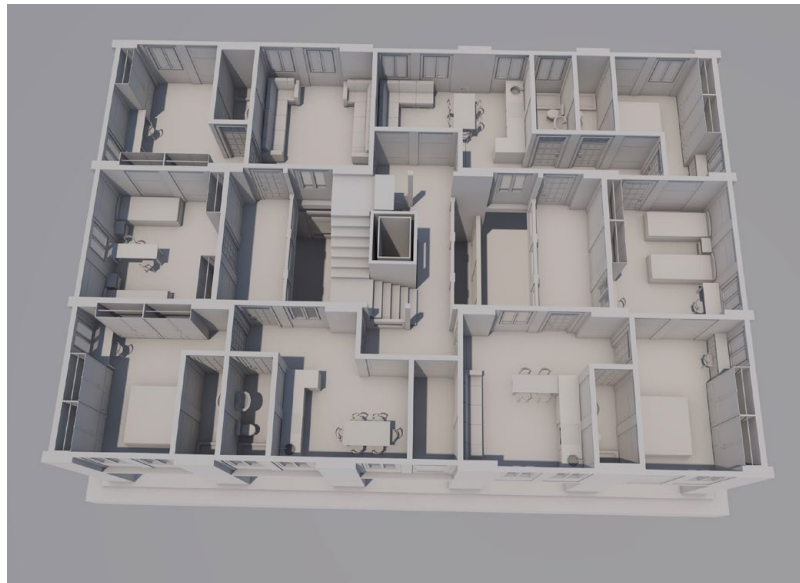
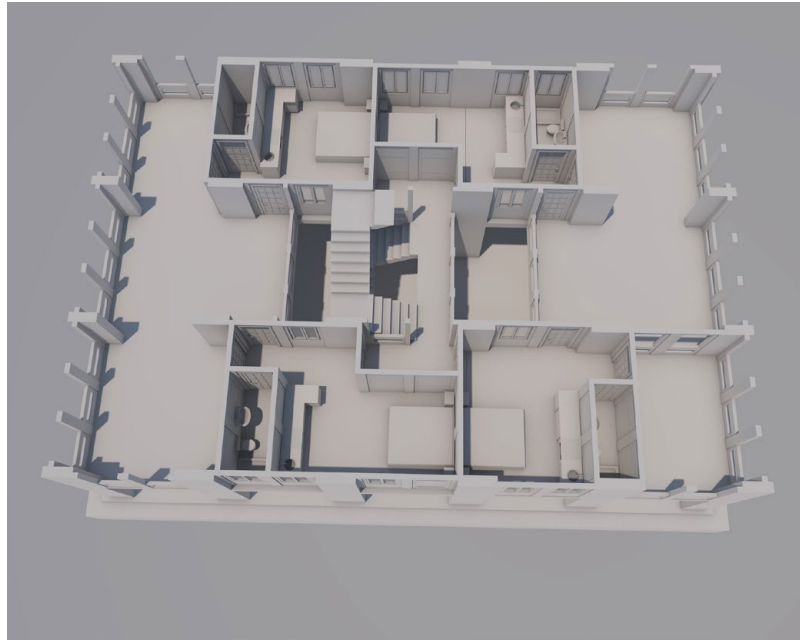


FIGURE 11. Incremental growth in the design proposal (Incremental Building 1): the configuration of one floor at the initial stage (4 basic houses with large open spaces) and at the fully developed stage (2 medium and one large units with smaller open spaces)

technical complexity and the demand for highly skilled workers. Before (or instead of) the expansion, the undeveloped space can be used as an open (possibly green) yard, for social/leisure activities.

- Environmental and energy efficiency: the model is intended to perform efficiently by using passive design techniques to take advantage from the interactions between the building and the local climate; other than making the houses more healthy and comfortable, it improves affordability by decreasing upfront costs for thermal and ventilation plants and by reducing energy running and maintenance costs over the entire life cycle of the building;
- Resilience and adaptation: intrinsic high flexibility in the model, combined with its energy efficiency (from the initial stage), makes it adaptable and resilient to climate change, households evolution and societal transformations.

The combined use of these concepts is meant to overcome the main difficulties currently limiting an effective provision of affordable housing, as outlined in the previous paragraphs, and to make possible the association of concept normally not compatible, as follows:

- Combination of high density and mixed use (in every single unit): people currently inhabiting informal settlements, frequently run small home-based activities which require the availability of some external space; in an incremental building, at least over a transition period, a family could use part of the allotted space to run a small business instead of expanding the living unit. Having different options (open yard, bigger house or home-based business) can also make a sensible difference in the process of adaptation for newly urbanised immigrants not accustomed to high-rise apartments.
- Combination of industrialised technologies and local crafts techniques: the idea is to use a standardised frame with the potential of being developed in different ways using local materials and skills. The frame will provide modular coordination and joints, in order to be easily fitted in the structure, while the craft made internal panels will offer flexibility, and connections to local traditions and economy. Therefore, the infill elements will be able to perform different functions and to make the buildings more sustainable from an environmental, economic and social point of view.
- Combination of self-building, standardisation and high density: a major drawback in self-building/self-help strategy is the low standard on the technological side, due to the lack of training and professionalism among the builders; the same issue most of the times prevent the opportunity to realise buildings higher than two floors, forcing to low-density settlements., which are non as sustainable (both environmentally and

## INCREMENTAL GROWTH

### STAGE 1

#### Basic House

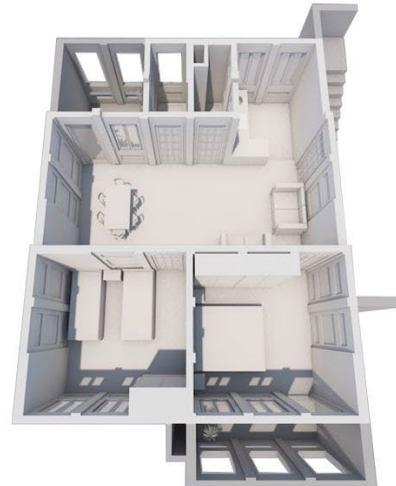
Studio apartment  
+ open yard  
(Alternative configurations  
with another apartment  
or small office/workshop)



### STAGE 2

#### Medium House

1- Bedroom apartment  
+ open yard  
(Alternative configurations  
with another apartment  
or small office/workshop)



### STAGE 3

#### Full House

2- Bedroom apartment  
with 2 bathrooms  
and small yards  
(Alternative configurations  
with 3 bedrooms  
or small office)

FIGURE 12. Incremental growth in the design proposal (variation of Incremental Building 2)

financially) as higher density projects;

## CONCLUSIONS

The housing affordability issue has been studied in the Malaysian context and a design strategy has been outlined to contribute to the solution of the problem. Even though the strategy is concerned with design issues, it approaches the problem from a holistic point of view. The strategy has the potential to be implemented in several different ways; however, two possible solution has been developed and documented in this report. The result is a highly flexible concept model which pursues high density at the urban scale and is based on the ideas of open building and incremental growth at the architectural scale. It is also intended to implement passive design and energy efficiency measures to reduce energy consumptions, environmental impact and running costs for residents.

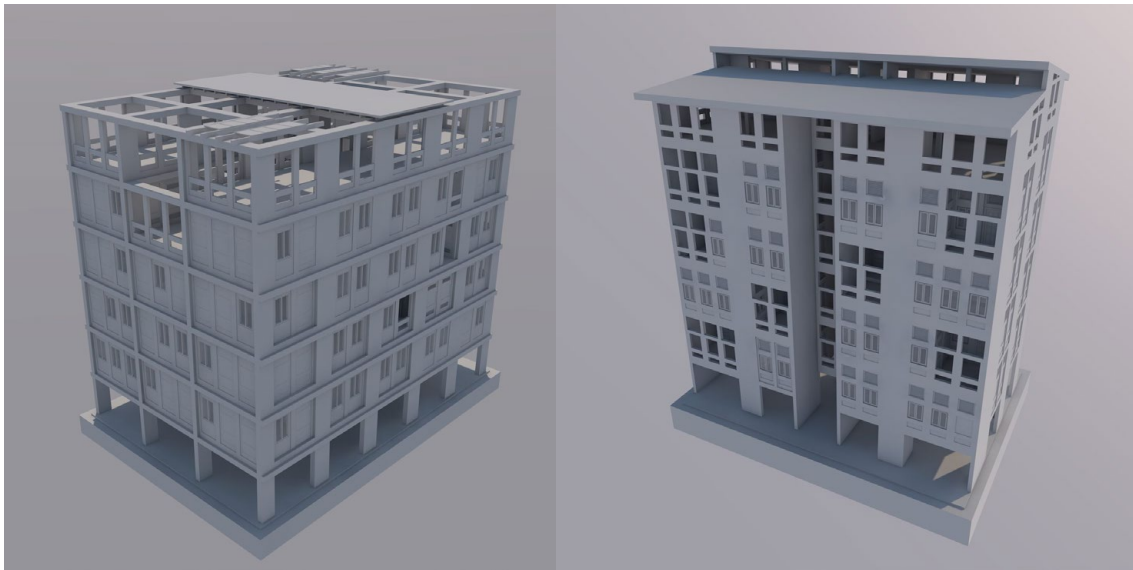


FIGURE 12. Conceptual models of the two design proposals developed within the research

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LAURA FLOREZ

BUILDING COSTS AND USER EXPENSES  
TOWARDS A MORE COMPREHENSIVE ANALYSIS  
OF INCREMENTAL HOUSING IN MALAYSIA

*Cost estimating has a profound impact on construction management. The accurate prediction of costs can have a positive impact in helping owners control the budget to ensure a successfully managed, conceived and completed project. This chapter shows the cost estimate of an affordability housing option in Malaysia. Costs are estimated for the initial stage and developed stage of the project. Results show that the affordable housing option is a viable alternative in terms of costs for low-income inhabitants when compared to a regular building house in Malaysia. The most interesting part is to be able to understand the cost implications of the two stages because its flexibility give residents the opportunity to extend and improve the units while maintaining a close control on the costs.*

## INTRODUCTION

Cost estimation is an important task in construction management. The correct estimation of plant, materials, and labour costs is essential for the appropriate investment of resources and the success of a construction project (Adeli and Wu, 1998, Chou, 2009). To estimate costs, professional quantity surveyors or estimators take client's requirements to identify needed resources and foretell how much a project will cost (Spon's, 2016). This process must be comprehensive and can have a positive impact in helping owners control the budget to ensure a successfully managed, conceived and completed project (Ishii et al, 2014).

Cost estimating is the process of predicting the cost of a building through a detailed quantitative analysis of the work and resources required by the design documents (Dell'Isola, 2003). Because the estimate is a forecast of the anticipated future cost, it is not a guarantee that the real cost will be what was planned during the quantification process (Sweet and Schneier 2000). Consequently, the process of estimating contemplates the uncertainty involved in the calculation of costs and is often referred to as an educated guess given by the estimator (BIS, 2016). The estimator typically includes a level of variability in the estimated costs to consider variances between estimates and actual costs that often do occur (Remer and Buchanan, 2000). One common practice used, is to employ different parties to prepare a detailed estimate, in which case the estimates are reconciled and assessed (Dell'Isola, 2003). Nevertheless, the job of the estimator is to minimize the extent of variance between the estimate and actual cost and this is often done by using historical information on past projects and industry wide data (CIDB, 2016). With appropriate documentation and project information, estimators properly measure and price building items to stay in business and compete for work (Dell'Isola, 2003). Building costs are also needed for insurance purposes (RICS, 2016).

In construction, there is no business skill more relevant than estimating (Halpin, 2006). It not only helps quantify and predict the cost of a project for financial investment, but also is a key part of the overall construction management and budget control process (CIDB, 2016). Some studies have shown that one of the major reasons for the failure of contracting firms is incorrect and unrealistic bidding practices (Halpin, 2006; Cartlidge, 2013). Once the estimate is finalized, it serves to establish a benchmark for a construction bid or negotiation and as a basis for financing by confirming the cost status of a project (Ishii et al, 2014). It is expected that an accurate defined budget will help complete the

project under the required scope, quality, and performance expectations all within the specified budget.

## ESTIMATING PHASES

Today's owners expect their design and construction team to manage project costs in an accurate and responsive manner (Dell'Isola, 2003). Owners expect that an accurately defined budget will be prepared and modified (if needed) early in a project and that the project will be completed to required scope all within the budget without compromising excellence in design, performance and quality (Ishii et al, 2014). For this reason, cost estimating is a multiple-phase process that initiates early and finalizes with the final cost once the project is completed.

Figure 1 shows the estimating phases for a construction project. Initially, the owner conceives the project and determines the purpose of the building. With the initial project concept, an estimator or quantity surveyor develops a conceptual estimate.

Conceptual estimates are used early in the design process to establish the owner's idea of the project and to get the funding. Costs are typically broad (i.e. cost per floor area) with an accuracy around 15% (Adrian, 1993; Halpin, 2006). Figure 2 shows an example of the conceptual cost estimate of rebuilding a semi-detached 2 storeys house from the Building Cost Information Service (BCIS) in August 2016.

After the conceptual idea, the owner hires a design firm to conceive the project and this firm is involved in developing a preliminary estimate. The preliminary estimate offers the owner an opportunity to review the project before the actual design process commences. Often multiple disciplines such as the architectural, mechanical, electrical and geotechnical get involved in this phase while the owner checks budget coverage. The level of accuracy for the preliminary estimate is around 5% to 10% (Adrian, 1993). After the review, the design firm along with the owner prepare the contract documents and develop a detailed estimate. The accuracy for the detailed estimate is around 3% (Adrian, 1993) and is used helps to finalize the project and develop plans and specifications that are given to multiple contractors for bidding. With the project documents, contractors develop a detailed estimate that includes materials, labour, plant, overhead, insurance and bonds costs. Typically the project is awarded to the most responsible, responsive

bidder, that is, a contractor that will conceive, construct and complete the project. Once the project is finished, the final estimate or final cost is determined.

## METHODS FOR ESTIMATING COSTS

A number of methods can be used to estimate the costs of a construction project. Costs can be predicted by the traditional approach which uses rough rules of thumb based on projected square footage and the rate of cost per area. Costs can also be predicted by using more accurate techniques such as quantifying resources and item by item of labour, materials and plants to get a price (Sweet and Schneier 2000). Other more sophisticated techniques for cost estimating involve neural networks (Adeli and Wu, 1998; Jafarzadeh et al, 2013; Liu and Pan, 2012; Sonmez, 2011; Cheng et al, 2009), regression analysis (Cirilovic et al, 2013; Sonmez, 2008), support vector machine (Kim et al, 2013), genetic algorithms (Kim et al, 2005; Kim et al, 2004), linear and hybrid models (Chou, 2009; Kim et al, 2012), artificial intelligence (Cheng et al, 2009), and probabilistic models (Signor et al, 2016) amongst others.

### *Factors for estimating costs*

Given the difficulty of design professionals to predict costs, it is better for a designer to give the owner a cost estimate. A cost estimate allows the designer to give an estimated amount of the cost of the work without needing to give an accurate amount. Therefore, a cost estimate contemplates the uncertainty involved in the calculation of costs and contemplates the events beyond the control of the design professional. To produce the estimate there are a number of factors that are often considered (Turner and Townsend, 2015; Cunningham, 2013):

- 1. Construction type:* takes into consideration the main purpose of the building. For instance a project is classified as apartment (high rise or low rise), commercial, office block, general hospital, school, shopping centre etc.
- 2. Geographic area:* price level can vary greatly between regions and even between individual states. Typically costs for different regions are given and/or location factors weights. For instance the cost of a project in Kuala Lumpur will be different (higher) than the cost of a project in Penang in the Malaysian peninsula.

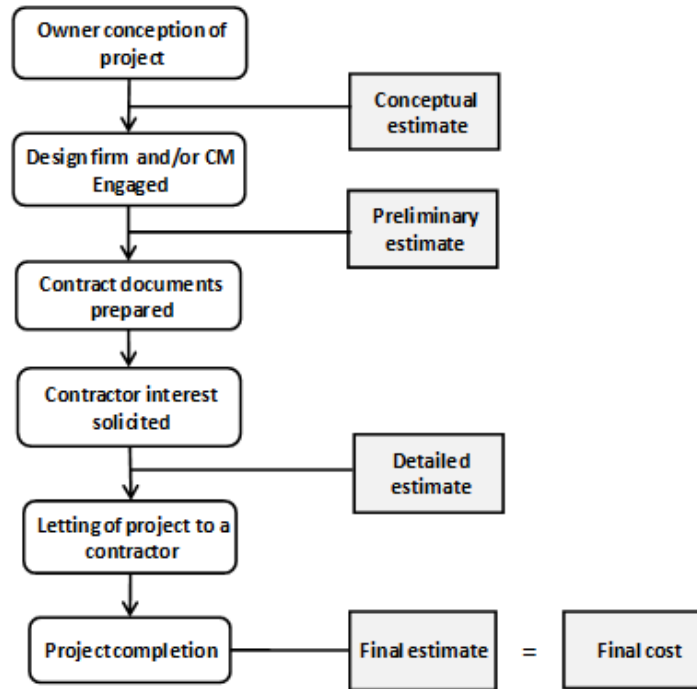


FIGURE 1. Estimating phases (Adapted from Adrian, 1993)

Style:	<input type="text" value="Semi-detached (inc. end of terrace)"/>	Number of bedrooms:	<input type="text" value="Three"/>
Number of storeys:	<input type="text" value="2 storeys"/>	Number of bathrooms:	<input type="text" value="Two"/>
Postcode:	<input type="text" value="NE14LZ"/>	Number of garage spaces:	<input type="text" value="None"/>
Approximate year built:	<input type="text" value="1960"/>	Wall type:	<input type="text" value="Brick"/>
For help in calculating the external floor area click here		Roof type:	<input type="text" value="Flat"/>
External floor area:	<input type="text" value="120"/> m2 <input checked="" type="radio"/> ft2 <input type="radio"/>	Cellar:	<input type="text" value="No"/>
		Listed/unusual property?:	<input type="text" value="No"/>

The rebuilding cost is estimated to be £148,000 based on the information and assumptions listed below (1).

Quality and facilities make a big difference to the rebuilding cost. While the figure above is a reasonable estimate of the likely cost for a good quality house with typical facilities, a basic quality house of the same size with minimal facilities might be rebuilt for £126,000 while an excellent quality house might cost £191,000 to rebuild.

FIGURE 2. Conceptual estimate using the BCIS calculator

3. *Practices*: methods such as Building Information Modelling (BIM) can be used to increase productivity and reduce the unit cost of construction. For instance the cost of a project planned with BIM can be as low as 5% compared to the cost of a project that does not use BIM (Eastman et al, 2008).

4. *Procurement*: the procurement strategy sets the basis of how the project is structured, the price basis the contract is to be awarded and the level of risk taken by the contractor that leads to choices under which the work will be completed. For instance under the traditional procurement (design bid build) economic designs are typically delivered with low to no risk whereas under a construction management at risk (CM-at Risk) quality of design is typically the priority which contemplates changes and higher risks.

Note that an estimate contemplates uncertain aspects that are common to any bid amount. Therefore, there will always be some level of uncertainty, that is, not all factors may be considered to determine costs. More information on factors that affect estimates can be found in Cartlidge (2013), Brook (2008), and the Chartered Institute of Building Code (2002).

#### *Construction cost data sources*

Many construction cost indices have been created to compile information and construction cost data, becoming very useful tools for the process of planning and estimating. Indices give owners, developers, architects, quantity surveyors, engineers, and contractors comprehensive information that can be used to develop competitive estimates and also to control construction costs. Construction indices are typically obtained by averaging industry wide-data and market conditions to provide locally relevant, accurate, and up-to-date information (RS Means, 2016; BCIS, 2016).

One of such indices is the Spon's price book widely used in the UK. (Spon's, 2016). The first edition was compiled in 1873 making it the first cost data book for construction. The Spon's price book provides a complete cost breakdown of items and materials. Besides this source, the Building Cost Information Service (BCIS) (developed in 1966) is also used in the U.K. as a tool for project cost forecasting and budget control. Other construction databases have been launched and are currently widely used in different countries. RS Means in the US (RS Means, 2016), the Hong Kong Statistics in Hong Kong, the Thai Appraisal Foundation in Thailand (Thai, 2016), the Australian Construction Services (ACS)

in Australia, the Eurostats Construction Costs Index (CCI) in the European Union and the Construction Industry Development Board (CIDB) in Malaysia (CIDB, 2016) just to name a few. Very comprehensive inventories of available cost indices for construction can be found in the Royal Institute of Chartered Surveyors (RICS) publications (RICS, 2016) and the study conducted by the Organisation for Economic Co-operation and Development (OECD), which is an intergovernmental organization that gathers construction cost data around the world (OECD, 2016). Note that inputs and outputs of construction activities constantly change so the challenge faced by organizations compiling cost indices is that of comparability over time. To ensure comparability factors such as size, finish, style, and fashions are kept constant over time (OECD, 2016).

Like many of the indices, the CIDB construction cost database in Malaysia is divided in different sections containing cost figures that have been derived from historic and surveyed data (CIDB, 2016). Sections contain data such as building prices per functional unit, prices per square metre, costs per building type, estimating rates, and prices for measured work. Prices for measured work include separately materials, labour and plants cost and these are often used for detailed and final estimates (see Figure 1). Prices do not necessarily and are not intended to represent the lowest cost in the market but rather intended as a guide to expected price levels for the items described (CIDB, 2016). Through each section, estimators can use data for different estimating phases to evaluate costs and control the budget. Although these sections can be treated separately, they are comprehensive and as a whole can help different construction practitioners throughout the life cycle of a project. That is, cost data can be used for new construction, refurbishment, restoration, facility management, and demolition (OECD, 2016). In addition, a complete life cycle cost analysis can be performed to reduce prices for affordable and sustainable building options through the correct choice and substitution of materials, labour, and plants (OECD, 2016).

## COSTS

Building or construction costs are vital for anyone who is intending to build or rebuild to help budget and plan the work accordingly (RICS, 2016). To correctly determine the estimate, price books are often used (see section 3.2) to help builders decide how much the resources are likely to cost. Resources typically include (and are divided in) labour, materials, and plant and these need to be quantified and priced to determine the costs.

### *Labour costs*

Labour costs include the basic hourly wage (basic cost to contractor) and is for work done in a day of eight working hours. It excludes deductions from levy charges, accommodations, insurance, medical and transport charges as well as margins, overtime and bonuses (CIBD, 2016). Labour costs were taken for the Kuala Lumpur region. Labour hours are calculated on the crew rate (skilled or unskilled) and the time needed to complete the work (Spon's, 2016).

### *Materials costs*

Materials costs are the actual prices of the main materials products such as bricks, blocks, concrete. Although loads can be part or whole, the size of the purchase is generally in bulk or whole loads delivered to a hypothetical site. The price includes transportation cost, that is, materials are delivered on site within reasonable distances. Prices are inclusive of all necessary taxes and also take account of trade and quantity discounts (CIDB, 2016).

### *Plant costs*

Plant costs are defined as the daily rental price paid by the contractor to a machinery leasing company. The price often includes rental rates and installation, insurance on machinery, operator daily hire rate and repair and maintenance costs. It does not include cost of petrol used and transport costs from the machinery leasing company's location to the construction site. Note that some contractors may own the machinery or plants so the in this case it is the transaction price between the contractors and suppliers. The price is inclusive of all the necessary taxes if applicable payable to the government and the transportation costs within practicable distances.

## CASE STUDY IN MALAYSIA

To illustrate how to estimate costs to support decision making, let us consider an affordable housing option in Malaysia. The project is located in Kuala Lumpur with an area of approximately 1,600 m<sup>2</sup> and is six storeys high. The projects' plans and specifications are as detailed in Chapter 1. The typical floor plan of the initial stage and the developed stage are shown in Figure 3 and Figure 5, respectively. Based on the project documents



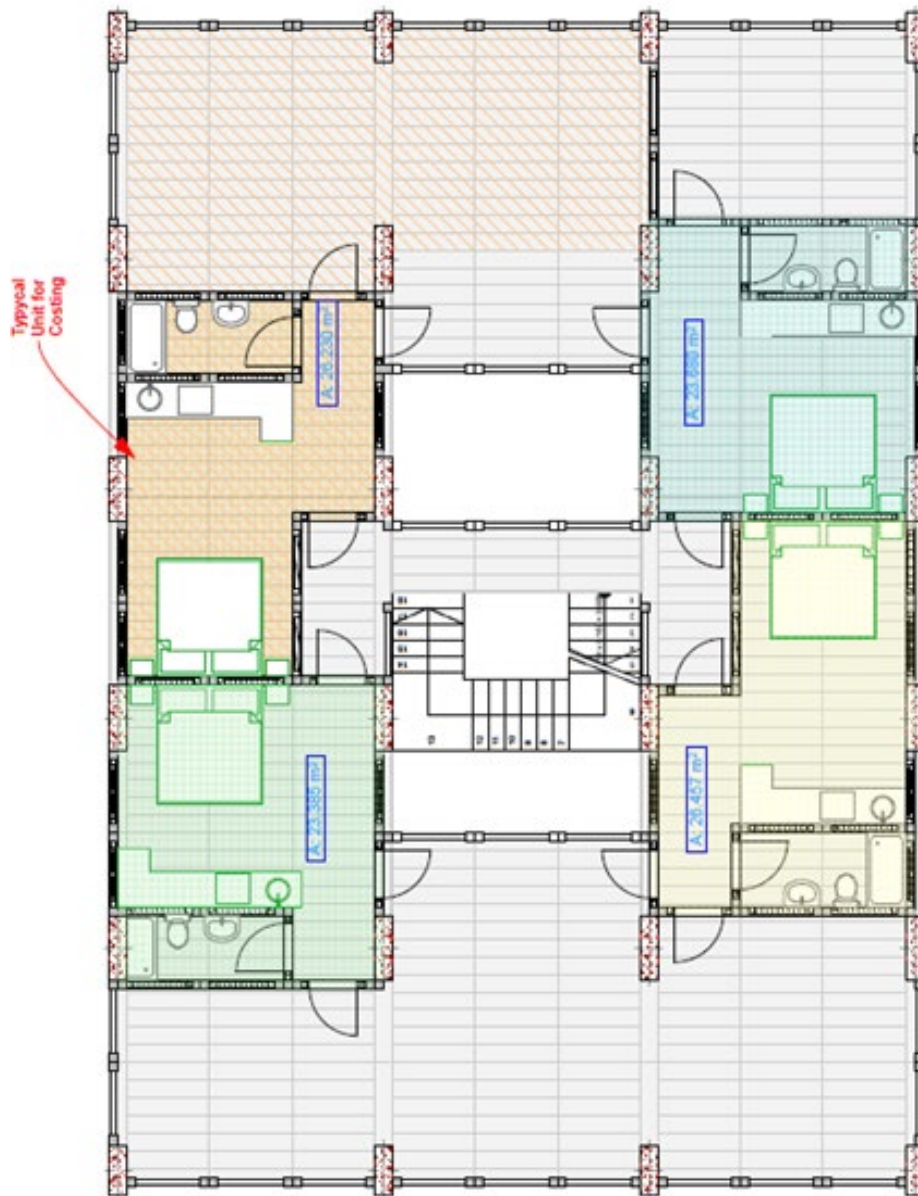


FIGURE 3. Floor plan initial stage

and considering regional factors, the cost estimate for the affordable housing will be performed, that is, the cost of the initial stage and the developed stage will be calculated. The objective of the cost estimate is to determine if the affordable housing option is a viable alternative in terms of costs for low-income inhabitants when compared to a regular building house in Malaysia.

For the case study, the wage for workers is the average amongst skilled and unskilled for the Kuala Lumpur region (CIDB, 2016). Materials costs are the actual product costs for bulk quantities for the Selangor region (comparable region to Kuala Lumpur) (CIDB, 2016; JKR, 2016). Using labour and materials prices, the cost per unit was calculated to forecast the costs for the affordable housing option for both the initial stage and the developed stage. No preliminary work and site preparation is considered. Other costs such as plants, overhead and profit, as well as insurance are not included. A total of six work sections are considered: 1) reinforced concrete and stainless steel bars used in the structure elements (columns, beams and stair cases); 2) wood temporarily used during construction, such as formwork for concrete elements 3) wood elements used in the building interior, including slabs, beams, panels, ceilings and wood finishes; 4) steel and metal sections used in the vents and hollow sections of panels; 5) glass and ironmongery assemblies of panels; 6) plywood and waterproof. No carpets as well as paints, coatings, vinyl, and varnishes were considered.

#### *Data sources for Malaysia*

The cost per unit of dimension for each material is mainly obtained using the CIDB construction centre database for Malaysia (CIDB, 2016). Although the CIDB database is not the only source available for quantity surveyors and estimators, it provides reliable information for a wide range of construction materials and comprehensive wages for labour. However, labour hours to complete each item as well as some alternative materials' properties are not included in the CIDB database. Thus, other sources of information for construction are used to complement the main data source. Labour hours and labour productivity rates for each item are obtained from the Spon's Price Book (Spon's, 2016). Information regarding regional materials comes directly from suppliers in Malaysia and the public works cost information centre JKR data set (JKR, 2016). Information regarding imported materials comes directly from international suppliers.

Work sections	Type	Item	Material	Labour hours	Labour	Unit	Total rate	Quantity initial	Cost initial
Concrete and reinforcement	Ready mix concrete- Normal mix- Grade 25 Granite	columns	220.07	4.20	12.25	m3	271.52	23.06	6260.71
		beams	220.07	3.70	12.25	m3	265.40	40.13	10650.57
		stairs	220.07	5.25	12.25	m3	284.38	2.04	580.48
Formwork	Sawn formwork	columns	45.00	1.92	16.38	m2	76.44	22.68	1733.66
		beams	45.00	1.92	16.38	m2	76.44	76.44	5843.07
		stairs	45.00	4.17	16.38	m2	113.28	3.24	367.04
Wood	bamboo beams	beams	1008.01	0.69	12.25	m3	1016.46	26.79	27227.57
	bamboo boards	slab	1008.01	0.69	12.25	m3	1016.46	5.39	5481.44
	bamboo beams		1008.01	1.71	18.75	m3	1040.07	1.28	1328.92
Steel and metal sections	Square hollow sections- 150mm x 150mm x 4.45mm (20.5kg/m)		3284.00	1.71	18.75	MT	3316.06	10.68	35429.44
Glass and Ironmongery	Figure/Obscured Glass 5mm Thk, Local/Imported, Inclusive Cutting	panels	50.13	1.71	18.75	m2	82.19	61.86	5084.58
	Concorde 102mm x 76mm x 2.0mm SS hinge SUS 304		31.13	1.71	18.75	pair	63.19	8.00	505.54
Plywood	MS Decking - Ajiya Euro Step Roofing M350 G28, 0.40mm TCT, Clean Colourbond	ceiling	50.98	0.30	12.25	m2	54.66	134.82	7368.41
	Waterproof	waterproof	12.00	0.30	0.00	m2	12.00	134.82	1617.80
								Total cost/m2	1252.14

TABLE 1. Cost estimate for the initial stage (prices are shown in RM)

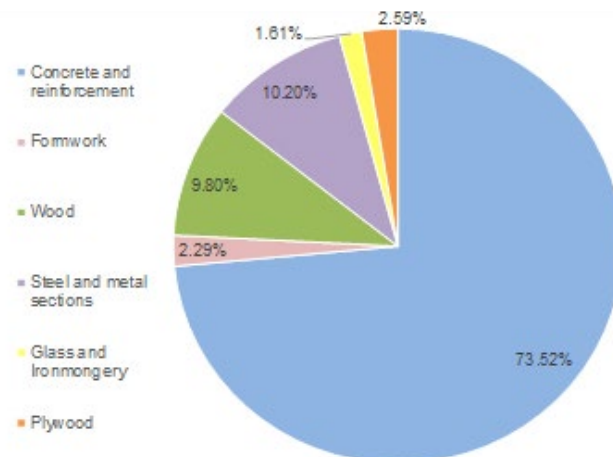


FIGURE 4. Percentage of the cost for each work section (initial stage)

### *Estimate for housing affordability initial stage and developed stage*

Figure 3 shows the floor plan of the initial stage for the housing affordability option. Note that the initial stage provides a basic home or decent living space for inhabitants (DCLG, 2006). The basic home (shown in Figure 3) has the potential to be expanded for instance with the provision of mounting panels for new units and/or spaces. The undeveloped spaces of the floor plan shown in Figure 3 can be used initially as open (possibly green) yards for social/leisure activities.

Based on waste factors for estimating in Spon's Price Book (Spon's, 2016) and Adrian (1993), typical waste factors are considered: concrete and formwork (5%), reinforcement (10%), wood and other panels' components (3%). Table 1 shows the results of the cost estimate, where the column labelled quantity indicates the quantity of each system to be built for the initial stage. Prices are given in Malaysian Ringgit (RM), where 1 RM is about £0.19 as of August 2016.

For instance, it is estimated that the total cost of concrete for beams, columns and staircases is around RM 17,492 and the stainless steel for reinforcement costs about RM 238,000. Although these results show the cost of the work sections, it can also be used to quantify the required amount of each material. For instance, the estimate determines purchasing 23m<sup>3</sup> of concrete for building the columns. Note that the cost of materials for the concrete elements does not change while the productivity (labour hours) does change. As shown in Table 1, once the costs of all materials are estimated, the total cost for the initial stage is about RM 1,253.

The initial stage is an option that delays part of the costs for the provision of a completely developed building (Bredenoord, 2014). The solution shown in Table 1 only considers the initial costs of the high-rise building without any further developments and additions. In other words, this estimate does not consider the completion costs of the building so a further estimate to determine the costs will add value to the decision making process. Figure 4 shows the percentage of the total cost for each work section. The concrete and reinforcement elements account for about 74% of the total project costs whereas the wood elements, in this case bamboo, account for about 10% of the total costs.

Figure 5 shows the floor plan of the developed stage for the housing affordability option. Note that the developed stage provides a fully constructed home that has been expanded compared to the initial stage shown in Figure 3. The developed spaces shown in Figure

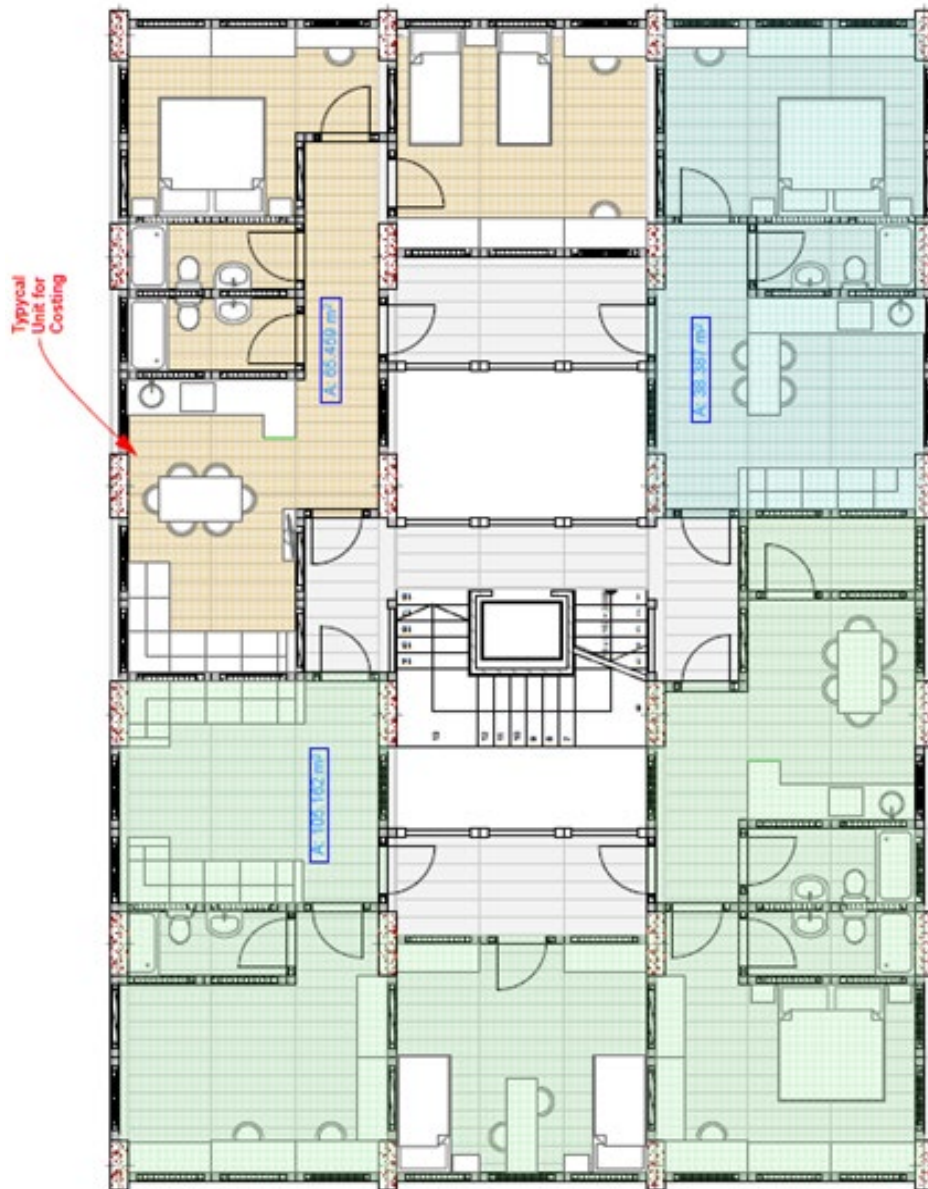


FIGURE 5. Floor plan developed stage

5 can be self-built by the inhabitants due to the family's growth or financial possibilities. The new units/areas are a result of mounting standardised components on the structure, which are less complex.

Table 2 shows the results of the second cost estimate, where the column labelled quantity indicates the quantity of each system to be built for the developed stage. As shown in Table 2, once the costs of all materials are estimated, the total cost is about RM 1,543. This increment of RM 397 from the initial stage to the developed stage implies that new panels will be built in the open areas and undeveloped spaces. Note that the cost of the concrete and reinforcement elements for the initial and developed stages is the same. In other words, the structure or outer skin once it's finished for the initial stage is kept for the developed stage and price differences are accounted for the interior panels that will be added over time.

In addition, note that the project is an incremental building, that is, the developed stage can be built by the inhabitants by simply mounting standardised components on the main structure, reducing the technical complexity and the demand for highly skilled workers. Therefore, a reduction in labour costs is expected to occur in the developed stage.

Figure 6 shows the percentage of the total cost for each work section in the developed stage. Note that the concrete and reinforcement elements account for about 60% of the total project costs whereas the wood elements, in this case bamboo, account for about 21% of the total costs. Note that in the developed stage, the concrete and reinforcement elements account for a smaller percentage of the costs (60%) as compared to the costs of the concrete and reinforcement for the initial stage (74%). In addition, note that the total costs for a regular building in Malaysia according to the ICMS (2016) costs about RM 1,900 and the proposed housing option on this study costs about RM 1,600. As a result, the housing affordability option in this study is a potential housing solution for a low-income resident in Malaysia.

Figure 7 shows the total costs of the affordable housing option for both the initial and developed stages. Note that in the initial stage the concrete and reinforcement, formwork, and plywood work sections are completed. Therefore, in the developed stage these elements can be reused, that is, the original structure will be kept and only the interior panels and materials such as wood, steel and metal sections, and glass will be added.

Work sections	Type	Item	Material	Labour hours	Labour	Unit	Total rate	Quantity developed	Cost developed
Concrete and reinforcement	Ready mix concrete- Normal mix- Grade 25 Granite	columns	220.07	4.20	12.25	m3	271.52	23.06	6260.71
		beams	220.07	3.70	12.25	m3	265.40	40.13	10650.57
		stairs	220.07	5.25	12.25	m3	284.38	2.04	580.48
	Mild steel round bar; R16 MS1646	beams, columns, and stair	2420.67	21.66	18.75	MT	2848.46	83.50	237839.93
Formwork	Sawn formwork	columns	45.00	1.92	16.38	m2	76.44	22.68	1733.66
		beams	45.00	1.92	16.38	m2	76.44	76.44	5843.07
		stairs	45.00	4.17	16.38	m2	113.28	3.24	367.04
Wood	bamboo beams	beams	1008.01	0.69	12.25	m2	1016.46	81.92	83265.70
		bamboo boards	1008.01	0.69	12.25	m2	1016.46	6.08	6185.00
		bamboo beams	1008.01	1.71	18.75	MT	1040.07	1.28	1328.92
Steel and metal sections	Square hollow sections- 150mm x 150mm x 4.45mm (20.5kg/m)		3284.00	1.71	18.75	MT	3316.06	16.82	55762.86
		panels	50.13	1.71	18.75	m2	82.19	101.63	8353.23
Glass and Ironmongery	Figure/Obscured Glass 5mm Thk, Local/Imported, Inclusive Cutting Concorde 102mm x 76mm x 2.0mm SS hinge SUS 304		31.13	1.71	18.75	pair	63.19	10.50	663.52
		ceiling	50.98	0.30	12.25	m2	54.66	134.82	7368.41
Plywood	MS Decking - Ajiya Euro Step Roofing MBS0 G28, 0.40mm TCT, Clean Colourbond Waterproof		12.00	0.30	0.00	m2	12.00	134.82	1617.80
		waterproof						Total cost/m2	1542.36

TABLE .2. Cost estimate for the developed stage (prices are shown in RM)

## CONCLUDING REMARKS

Cost estimating is the process of predicting the cost of a building through a detailed quantitative analysis of the work and resources required by the design documents (Dell'Isola, 2003). For many clients a detailed estimate is a required deliverable of the procurement process, and therefore it is made a deliverable of the design team. If the results of this estimate do not indicate that the costs are within budget, the design may be modified or the procurement plan may be slightly changed.

The real-based case study illustrates the cost estimation in an affordable housing option in Malaysia. The estimate was developed for the initial stage and the developed stage of the project. With the estimate, the decision makers can obtain a detailed purchase plan that describes the materials that should be used and their extent of use. The estimate also provides the total cost of the materials and labour. Moreover, the estimate shows the amount of additional money required to fully develop the houses, providing decision makers with the necessary data to evaluate the finished building project in Malaysia. The results of the case study show the importance of the availability of prefabricated materials. If materials with desirable properties are not available, effective cost solutions for affordable housing are nearly impossible to build. In the case of the Malaysian market, the housing option is highly dependent on the use of materials easy to assemble. Materials with these characteristics would allow residents to build sections of their houses minimizing labour costs. Additionally, these materials would allow residents to expand their houses once resources become more available for them. As no regulations currently require manufacturers to report data, the lack of information about alternative materials –some characteristics are unknown even to the manufacturers– will continue to challenge affordable housing options. Affordable housing options may be achieved by considering life-cycle costs savings, extended equipment life, and reduction of labour hours.

The case study showed that the budget can determine the success of affordable housing, many of which are not an option for people of low income. The results demonstrate that sometimes an alternative material or construction method could lead to a significant reduction in costs. Finally, the trade-off analysis also shows that the marginal cost of the developed stage could be expensive, depending on the price of the materials involved in the expansion and the assembly techniques used in construction.

The development of housing options while considering alternative and prefabricated



materials contributes to minimize costs and formulate strategies to provide affordable housing for low-income regions and developing countries. The proposed panels described in this study can contribute to develop more sustainable buildings to prevent social burdens in an attempt to make housing more accessible and available for low-income inhabitants.

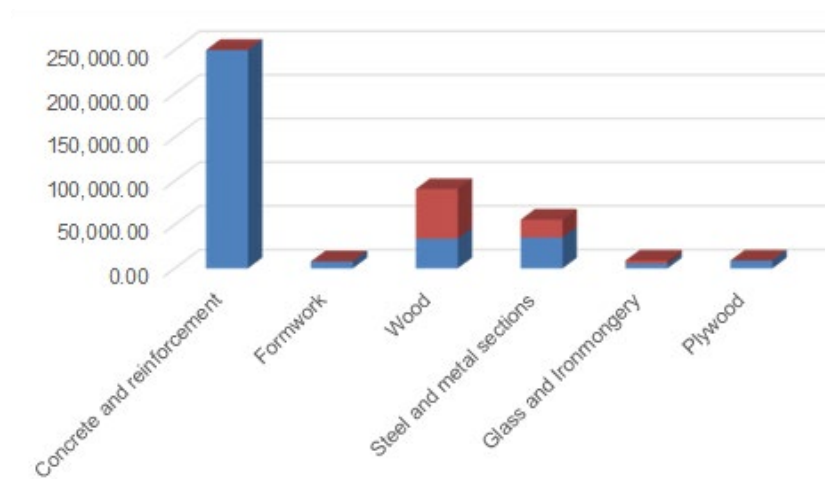


FIGURE 6. Total costs for the initial stage (blue) and developed stage (red)

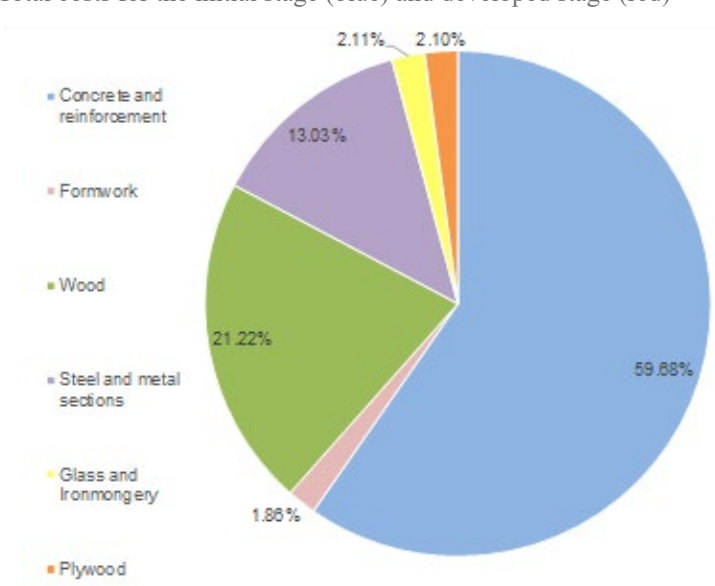


FIGURE 7. Percentage of the cost for each work section (developed stage)

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PEDRO N. MONTERO GOSÁLBEZ

SELF-HELP BUILDING  
WANDERINGS INTO A RESILIENT STRATEGY OF  
LIVING

*This essay wanders into the potentialities of self-help building for allowing a more social and ecological resilience than ready-made housing delivery systems do. Understanding the self-help building of the environment not just as a practice forced by the increasing urban populations in the Global South but as a strategy of living worth to be considered the world over, firstly, I will address the misconceptions surrounding the meaning of self-help. A clear understanding of what self-help housing entails, constitutes and success in, will allow me to step further into the self-help building of the environment as a resilient strategy of living. Then, and in order to highlight the particular potentialities of user-driven self-help housing I will contrast it with large-scale systems and institutionally-driven self-help programs for housing provision. Finally, all signs found along the path will make inevitable the comparison between current self-help housing and so-called vernacular settlements where the issue of control, in particular to property and participation, stands out as the fundamental aspect in which to foster future search and research for sustainable alternatives in dwelling.*

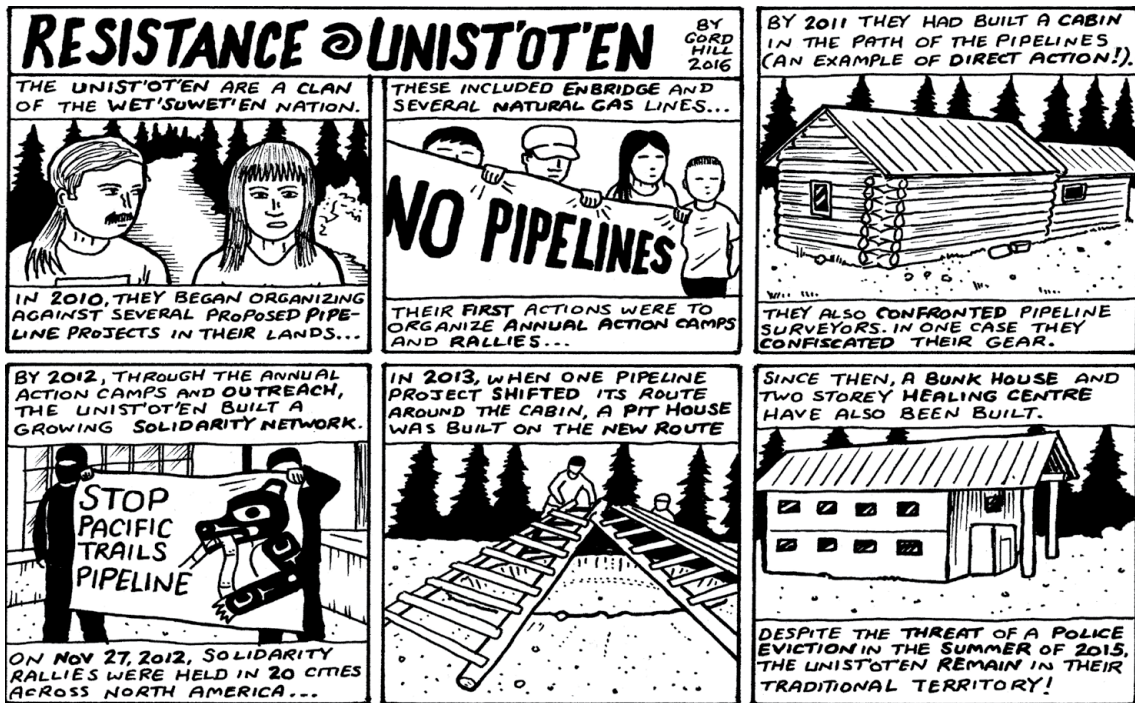
## INTRODUCTION

The rapid urbanization of the world —particularly in developing countries— is increasingly drawing institutional and scholarly attention to ‘self-help’ housing as “the most universal process that is practised worldwide by urban low-income citizens” (van Lindert et al. 2014: 399). However, it should be acknowledge that, beyond the current urban phenomenon and besides the delivery system of mass-produce housing, the self-help building of the environment has been, and still continues to be, the most common practice for human shelter (Oliver 1987, in Jenkins and Forsyth 2010: 18). That means that self-help building should not be understood simply as “an inevitable way of living” arising from the current circumstances of urbanization in developing countries (Bredenoord et al. 2010: 274), neither as a practice that will be transcended by “the processes of economic development” (Crane, in Harris 2003: 253). So much so, that since the dawn of the Industrial Revolution and the rise of the ‘welfare state’, even in the world’s most industrialized regions where the shift from ‘do-it-yourself’ practices and small local industry to globalized mass-production has been considered a measure of progress (Parvin et a. 2011: 7), economic and ideological crisis have recurrently lead to the resurgence of self-help building practices in the search for alternative ways of living (for current trends in Europe see, Tummers 2015).

Thus, in our current world driven not just by an increasing resource scarcity but, primarily, by a big inequality in the access to the most basic resources, although self-help housing is seen as the only ‘affordable’ way for low-income groups to have a house (Bredenoord et al. 2010: 274; van Lindert et al. 2014: 399), ‘economic affordability’ should not be understood as the main factor that explains self-help housing practices. But, neither the ‘emergence’ or ‘absence’ of self-help housing is just determined by economic development, the success of public and institutional housing nor the way a government approaches housing strategies for low-income population (Bredenoord et al. 2010: 274). To say that would imply that both, anyone economically able to overcome self-help building practices, as well as, all population under successful welfare states enjoying economic development would ultimately rely on external delivery systems for housing in order to ‘transcend’ the previously ‘inevitable’ practices. However, that’s far from being always the case; neither for those moving up from the bottom of the ladder of economic wealth (Perlman 1986; Turner 1976; Ward 1990) nor for those already relatively wealthy (Tummers 2015).



PICTURE 1. Over the hill El Agustino spreads one of the many informal settlements emerging all around the world due to the increasing urban population. Lima, Peru. Author: Maddalena Iovene



PICTURE 2. However, the potentialities of self-help housing practices can be adopted through many strategies and with many aims. Wet'suwet'en organizations against pipe-line developments across their lands show the importance of self-help building in their strategy. Author: Gord Hill.

Source: <http://www.brokenpencil.com/news/comics-by-gord-hill-resistance-unistoten>

In fact, and bridging the significant differences between the Global South and North or between those relatively wealthy and the most vulnerable, self-help housing is a strategy of living in the open-ended and uncertain reality in which, indeed, we all live. Mainly fostered by people's willingness to have the widest possible freedom of choice in each particular context, through the performance of self-help housing practices people seek to enhance their own social and ecological resilience in the environment (for so-called developed countries see Tummers 2015: 2, 6, 11; for countries in development see Perlman 1986: 43). Thus, were it not for both, the disdain that an increasingly pervasive 'consumer society' generates about many aspects of self-help building, as well as the constraints that welfare states generally deploy in order to eradicate any informal practice and improvisation that cannot be regulated, as well as to control the access to the most basic resources for human dwelling (for general practices of regulation derived from state's welfare provision see Scott 1998), the self-help building of the environment may become, even in the Global North and among those relatively wealthy, the rule rather than the exception. In any case, we should embrace the complexity of life and go beyond partial definitions of resilience that split the social from the ecological or the local from the regional. The resilience of a system, indeed, has to be understood holistically and not just considering an isolate aspect of a whole.

Finally, and due to the vast literature on self-help housing produced since the 1950s (for a review on this issue see Harris 2003), along this essay I would reflect only through those works that allow me to expose most relevant misconceptions and to frame the right questions in order to understand how to engage the potentialities of self-help building for a holistic sustainability and, thus, a more widespread social and ecological resilience.

## THE MEANING OF SELF-HELP

Most discussions about self-help housing and, therefore, the attempts to define it arise from concerns coming up since the 1950s as a result of the increasing informal settlements resulting from the rampant migratory movements from rural to urban contexts that mainly take place in the Global South. However, as a strong alternative for human dwelling, the meaning of self-help building should be relevant in any context, even if it has long been a practice highly stigmatized and almost eradicated from the western imaginary<sup>1</sup>. Nevertheless, and although much research and work has been done on self-help housing, when officials, scholars and other housing professionals approach this general practice,



they usually misunderstand the many different forms it can take, misleading their actions and, quite often, distorting the main processes that self-help building practices generate and regenerate for the sake of social and ecological resilience. Three issues stand out from these misconceptions: what self-help housing ‘entails’ and what ‘constitutes’, as well as its evidences of ‘success’.

*Neither just built nor just managed*

First of all, we should be aware that professional and user perceptions of what it is involved in informal housing are usually quite different. Moreover, even among those ‘professionals’ or ‘experts’ that already think of informal housing for the Global South as the ‘solution’ rather than the ‘problem’, there are different understandings of which actions are significantly involved in these processes. On the one hand, as Janice Perlman (1986: 43) points out, most experts who see squatter settlements as the solution think of informal practices of building the environment as means for savings “by counting on contributed labour” and, therewith, lowering the costs of housing production and public investment. This view mistakenly narrows user participation in informal housing to construction activities and, therefore, reducing ‘self-help’ housing to ‘self-built’. But indeed, as John Turner (1976: 86) shows, the most important household’s savings are made “by being one’s own general contractor”; that is, not by labouring in construction and implementation activities but, mainly, by managing the housing process. On the other hand, among those professionals who acknowledge the key role of management in the making of informal housing, there are many who use the term ‘self-managed’ to encompass both the management of all building activities by the owner-occupier and his or her possible participation in the construction (Bredenoord and Lindert 2014: 56). However, the contrary could be also valid, as any construction performance entails, however minimal, certain management of tasks, materials and space-time. It is preferable, then, to maintain the distinction between ‘self-built’ and ‘self-managed’ without subsuming one to the other. Furthermore, we should recognise that housing “is more than building adequate shelter” (Dayaratne and Kellett 2008: 53; see also Harkness 2009). Thus, when highlighted that, to the user’s “participation in housing relates to *choice* over the decisions that affect them” (Perlman 1986: 43)[emphasis in the original], experts should not automatically narrow the scope of choice to issues of user’s energy investment on shelter (ibid.: 43), neither of land, services or finance (Dayaratne and Kellett 2008: 53). If, as far as dwellers are concern, housing is an act of ‘making home’ (ibid.: 53), choice is about the constitution of social life in which people, their hopes and memories, as well

as the many other things and processes in the environment continuously have to come together. Thus, informal housing implies more than building and managing, requiring far more than skilled craftsmanship and rational stewardship. The dweller's need of material, social and ecological engagement in the making of a home overwhelms the narrow scope of such terms as 'self-built' or 'self-manage'. Seeking for a word beyond the particular aspects in which building and managing focus, the 'ambiguity' of the term 'self-help' in housing has the potentiality both, to embrace more appropriately the labile unfolding of the informal and to cover all activities involved in the informal building of housing and its environment: that is, from construction activities to their management, as well as from material to social and ecological relationships. Thus, we should not use vaguely 'self-help' housing as just 'self-built' neither just 'self-managed', but embracing both and much more.

### *The Good, the Bad and the Ugly*

Pablo Picasso is credited with the famous quotation: "The chief enemy of creativity is good taste"<sup>2</sup>. Although Picasso probably implied that 'good taste' prevents people from further experimenting along the creative process afraid of making a mistake and ruining a work already between the boundaries of the conventionally accepted, his words could be also understood in a broader social context beyond personal experimentation. Good taste, as a contextually constitute prejudice of what is enough and adequate, prevents external observers to perceive the creative process that continuously unfolds overtime, confusing the immediate form with the ultimate reality. Thus, a stroll through an informal settlement accompanied by officials, scholars or other housing professionals more related with management or design, generally arise profound confronted perceptions of the place. Feelings, then, oppose between 'depression' and 'delight', depending on each personal understanding of reality.

On the one hand, although deepening in the issue of informal housing radicalize even more the common debate "between the conventional left which condemns capitalism and the conventional right which condemns personal dependency upon state institutions" (Turner 1976: 8), for those clustering around a feeling of desolation the most common solution to the problem of housing in informal settlements lies in the eviction of those 'poor' people for the destruction of their houses and the provision of ready-made professional alternatives (Turner 1976: 22, 23 and 61). Moved by a general perception of self-help housing as an 'ill-suited' strategy and an 'unsustainable' practice where the lack



PICTURE 3. It is through a walk with housing professionals in a place like Kampung Padu, one of the squatter settlements around the centre of Johor Bahru (Malaysia), where the most controversial discussions about the nature of proper housing and the suitability of self-help building practices can take place. Johor Bahru, Malaysia. Author: Pedro N. Montero Gosálbez

of professional management, planning and construction has to lead inexorably to a waste of space, time, money and other many resources, informal settlements, in particular, are seen as “ugly, irrational, unauthorized, unmodelable, dangerous or even unfair” (Hamdi 2014: 21). Thus, in particular for those professionals of housing what poor people do for themselves cannot be right and proper (Ward, in Turner 1976: 7, 8). On the other hand, and as I pointed out previously, among those housing experts who think of self-help housing as the solution rather than the problem, there are different understandings of which tasks are significant and worth implementing in the process of building the environment. A majority among these professionals, who confuse the partiality of self-building with the wholeness of self-help housing, see the participation by the inhabitants in the construction activities as means for savings through free labour (Perlman 1986: 43). Consequently, then, those experts usually appeal for the enactment of assisted self-help housing programs along with the development of adequate financial schemes, construction regulations and housing controls by the government (Bredenoord and van Lindert 2014: 70), dangerously tipping the balance of ‘control’ to the side of external institutions. For dwellers and still a minority of delighted housing professionals, however, the self-help building of the environment is a strategy of living based in people’s practical knowledge and inventiveness fostered by informal improvisation where, if any, “the role of central administrations must be limited to ensuring personal and local access to essential resources —such as, in the case of housing, appropriate technologies, land and credit” (Turner 1976: 65).

Nevertheless, self-help housing practices and those programs trying to develop their potentialities have been severely criticized by Marxist theorists of the political Left (for an example see Burgess 1977), in general, as “the ultimate triumph of the process of capital reproduction” (Ward 1990: 9), where people have to house themselves at their own cost, with their own time and their own labour. However, historically and currently self-help housing is much more than just “the product of the general condition of neo-colonial capitalist development” (Burgess 1977: 57) and, therefore, beyond a ‘productivist’ (capitalist or communist) understanding of reality where there is a tendency “to reduce all human relations to exchange” (Graeber 2011: 18). It can be acknowledge that self-help housing practices enable the potentiality for a house and the land to shift from ‘use-value’ to ‘exchange-value’ (Burgess 1977: 52-56) reproducing, to a large extent, the processes of commoditization and capitalization of human society that generally increase the constrains over the most disadvantaged. Examples of that change in the nature of ‘value’ through self-help housing practices are both, the ‘useful’ possibility of reselling

the implemented house unit (Perlman 1986: 43) and the state's legalization of land tenure previously or after people's settling. But, even so, recognizing, on one hand, that there is no fundamental opposition between State (whatever the form it takes) and Market (or Debt, in general), but a mutual and continuous constitution that makes impossible one without the other (Graeber 2011: 18, 50 and 71) and understanding, on the other hand, that self-help housing is an act of 'making home' involving sensitive material, social and ecological engagements far beyond relationships of 'exchange', presents the self-help building of the environment 'as a strategy of living' as a truly viable alternative not against states or markets but beyond their control and their failure. Whereas, through their inherently hierarchical structures, the State and the Market can just operate as 'deranged'<sup>3</sup> systems unable to follow and attune with the complexity involved in self-help building activities in particular and, in people's 'lines' of life in general, the 'informality' inherent to self-help housing allows its practices to continuously enter and escape those 'alienating' hierarchies, thus, enabling an alternative way of living that enhances human resilience in the environment.

Thus, on one side, the 'good taste' of most housing experts has grown in an increasingly pervasive delivery system of ready-made commodity-objects and is educated in an understanding of architecture as the achievement of very few gifted humans capable to project in their mind a complete form to be imposed upon passive materials. Consequently, this pervasive perception and making of housing among professionals, as an isolated 'object' either as a 'complete' designed form or, at its best, as a singular process of construction, lifespan and demolition, leads to an experience of self-help housing, respectively, as a 'problem' or just as a 'solution' that has to be controlled and planned by an external authority. On the contrary, the quotidian engagement with 'open-ended' self-help housing practices guides dwellers and a few housing professionals to understand self-help housing as a continuous strategy of living. Furthermore, whereas the understanding of self-help housing as a 'problem' or 'solution' that needs to be externally controlled ultimately leads to conceive housing as a complete object or singular construction process, the understanding of self-help housing as an ongoing strategy of living allows dwellers to conceive housing as a highly resilient 'lifelong' process where to establish the conditions of existence for their own and subsequent generations.

#### *A controversial sense of success*

In fact, are those different understandings grown along people's particular ways of

building and dwelling housing as a complete object, an isolated process of construction or as a strategy of living, what orientate opposite senses of success in the self-help building of the environment. Whereas the first and second perspectives are ground in an 'objective' understanding of reality, the third posture emerges as a 'relational' continuity. Thus, if for the former groups housing can only be conceive as 'what it *is*', for the latter "the important thing about housing is [...] what it *does* in people's lives" (Ward, in Turner 1976: 5; see also Turner 1976: 51-72) and, therefore, is "not necessarily related to the imposition of standards" (Ward, in Turner 1976.: 5, 6).

Indicators of Success	Priority	
	Sponsor Institution	Self-Help Household
Value created by self-help	High	High
Cost recovery	High	Low
Construction speed	High	Low
Physical appearance in early stages	High	Low
Adherence to building codes and standards	High	Low
Adequate shelter and safety	High	High
Security of tenure	Low	High
Proximity of central city	Low	High
Proximity of friends and family, and so on	Low	High

FIGURE 1. Interpretations of Success (Perlman 1986: 44)

Generally, these opposite understandings are drastically accentuated along the implementation of sponsored self-help housing programs, where sponsors and users, although may agree on some objectives, "tend to assign very different priorities to the various indicators of success" (Perlman 1986: 43). It is obvious that for the sponsors, officials or housing professionals interested in increasing the value and enhance the cost recovery of the monetary investment of a housing program, the speed and timing of the construction process is of great importance. If the larger amount and longer duration of construction permits and credits increase the investment cost of the program, it becomes necessary to reduce to the minimum the phases of construction, as well as to schedule the construction process into a preferably fixed beginning and end that, even, for the convenience of politicians can be timing with an electoral period. In addition, on one hand, the adherence to building codes and standards becomes fundamental in order to secure

construction permits, as well as to close building schedules and budgets to access credit and to preset its refund to avoid late payment charges. On the other hand, the ‘good taste’ of those external agents regulating the program invites to control the final appearance of the construction process aiming for a tidy and legible image that particularly allows, first, to verify the completion of the program in order to comply with the expiration date of the construction permits; secondly, to facilitate the regulation by the government of the built environment and its implementation for the sake of taxation; and, finally, to enhance the good publicity for politicians, construction companies and architects with a picture of a finished new building, as Perlman (1986: 44) would say, “on ribbon-cutting day”. All this much bureaucratic regulation, systematization and categorization, orientate to and derive from an understanding of housing in particular, and building in general, as a ‘noun’ —what it *is*—, from which only the ‘exchange-value’ of a complete object or product can be considered, facilitating all phases of transaction between the client, the architect, the constructor and the user (not always the client), but irrespective of the user’s inhabiting experience and life’s unfolding. It is a way of making that follows and leads to a conception of reality as ‘objectively quantifiable’. However, as some scholars illustrate (Dayaratne and Kellett 2008: 66-68; Kellett 2011b: 342-345; Perlman 1986: 43, 44; or Turner (1976: 51-72), for self-help building households ‘home’ is never complete but a continuous process over the course of generations. Thus, not time or appearance of completion are mainly relevant, of course, once “a minimum, secure, and weatherproof space” (Perlman 1986: 43) has been achieved. For those people, both researchers and dwellers, housing is much better understood as a ‘verb’. However, a verb that does not just implies ‘what it *does for* people’, but ‘what it *becomes along with* people’, too.

Furthermore, whereas issues of tenure security or proximity to potential markets and jobs, relatives and friends, basic resources or, simply, a location with a desired life-style are not relevant for most sponsors, officials or housing professionals involved in housing programs who primarily conceive housing as an ‘enclosure’ or ‘container’ where to reside, for dwellers are those matters fundamental. In fact, for everyone and everywhere, but mainly for those people living in informal settlements of any kind, both the process of home-making in particular and of dwelling in general continuously develop, in their unfolding, an entangled building of the environment and field of quotidian activities that extend outside the ‘walls’ of the house unit leading, therefore, to a definition of the dwelling as “the group of interrelated settings (indoor, outdoor, privately owned or shared) where everyday domestic activities take place” (Rapoport, in Shehayeb and Kellett 2011: 86). This understanding of dwelling allows to think of housing as an ‘opening’ or ‘bind’

from where to nurture and manage material, social and ecological relationships over time, as well as to glimpse that any distortion of the relational ‘mess’ in which those people inhabit would not just trigger a material crisis but a holistic one.

However, all the foregoing elaboration emphasizing the opening of a process (verb) over the enclosure of an object (noun) does not mean that housing should be judge just by the value to its users instead of according to its physical appearance (Smets 2006: 598) mistakenly opposing, thus, the social to the material. Otherwise, we should understand ‘appearance’ as a process in itself where the material, social and ecological take shape and show themselves overtime as the constitution of the building of the environment and, therefore, properly evaluating the aspect of a self-help housing program or its comparison with large-scale standardized construction “several years into project life” (Perlman 1986: 44). Thus, on one hand, although erected and maintained through a far greater scarce and polluting resource consumption, the life of modern buildings is notoriously short (Turner 1976: 35, 46), particularly in the case of social housing which typically deteriorates over time due to vandalism and a chronic lack of maintenance (Perlman 1986: 44). On the other hand, when enabled to thrive, self-help housing comes to constitute a process where the making of ‘home’ and the ‘sense of achievement’ that emerges from its quotidian performance (Dayaratne and Kellett 2008: 66) grow over space and time spreading towards a sense of ‘identity’ and ‘belonging’ to a place that reaches an environment far beyond the house and into the future, perhaps, formalizing its potential continuation in what we actually praise and admire as vernacular architecture (Kellett 2011a: 10).

## A RESILIENT STRATEGY OF LIVING

It is in the contrast between those confronted understandings of housing, on one side, as a ‘noun’ where the focus lies on the conception of an ‘object’ or ‘singular process’ of construction that contains and encloses a detached dimension of social life opposed, on the other side, to a ‘verb’ unfolding in a ‘continuous process’ that opens and binds social life to a context that exceeds the house unit, what better illustrates the self-help building of the environment as *a resilient strategy of living*. On one side and conceiving reality as long-term predictable, large-scale and institutionally-driven ‘self-help’ housing programs are convinced of being able of planning future events in advance. On the contrary and amid the flux of life, user-driven ‘self-help’ housing practices rely on the quotidian engagement of informal daily tasks for apprehending the inevitable uncertainty and unpredictability of



the many processes in the environment, whatever it is.

### *'Large-scale' housing*

As Turner exposes, in order to provide affordable housing large-scale organizations “must standardize procedures and products” (1976: 51) mostly through the development of large blocks of standardized flats that not just cost more to build and maintain, but that direct most of the monetary investment to the fossil-fuel based technologies and companies as much as to ‘big city’ financiers groups (ibid.: 49, 50). In addition, the standardized methods of providing housing, based on a reduction of ‘what means to be human’ into what it is statistically understood —by those hierarchically driven the housing programs— to be need by a ‘proper’ human being, “had been notoriously bad at meeting the needs of anyone in particular” (Hamdi 2010: xiii; see also Hamdi 2014: 71). Thus, standardization fails to meet people’s ever-unfolding lives, on one hand, because economic affordability forecasted by bank and government officials of what people *can* spend rarely meet what they *will* finally spend (Turner 1976: 37, 38) and the differences in investment capacity and priorities among the people targeted in a large-scale housing program are enormous (ibid.: 39). On the other hand, because people’s wants depend on past experiences and future expectations (ibid.: 96), as well as one priorities vary as one’s circumstances change (ibid.: 61). Furthermore, even the acknowledgement by some housing professionals of the importance of user-performing physical flexibility for the house to cope with people’s varying circumstances over time, has mostly exalt the development of standardized construction systems that allow for internal rearrangements as well as the expansion and contraction of the house but, first, at very expensive costs (ibid.: 43) and, secondly, reducing the range of adaptability to a very narrow dimension of the dwelling experience such as the house unit. Thus, this mechanical or technological view of flexibility or ‘loose-fit’ obviates that people’s life requirements “are not measured only by arrangements of rooms and windows, but by the degree of accessibility that they have to their friends and relatives, to their sources of income and to the places where they spend it” (ibid.: 46). Thereby, as Turner severely points out, “large-scale systems have created the most segregated cities the world has ever known” (ibid.:46), mostly providing nothing but un-economic and socially dysfunctional housing and infrastructural solutions. On the one hand, they have not only worsen the life of a large part of the people relying on this kind of housing systems (as the financial crisis of 2008 has shown even among the middle-class in so-called developed countries who couldn’t pay their mortgages) but have negatively impacted the entire society which has to bear the exorbitant costs from which,

almost exclusively, only few wealthy people benefits. Moreover and paramount of the problem, on the other hand, large-scale systems of building the environment continually reinforce the processes and categories of a ‘productivist’ way of life (Harvey 2009 [1973]) that makes almost impossible for anyone living in it to think outside the frame of the apparently opposite poles of ‘capitalism’ and ‘communism’ and, therefore, laying barren our imagination in times of change.

### *Institutionally-driven ‘self-help’ housing*

As an epitome of ‘institutionally-driven’ programs, ‘aided self-help’ housing has been supporting and still supports house construction by users themselves with state’s assistance and sponsorship (Harris 1999: 281). From its first evident steps in Europe after the First World War and its praised incorporation to homestead schemes on both sides of the Atlantic by the 1930s (ibid.: 281) to the many programs implemented in developing countries in the 1950s and 1960s (Harris 2003: 252-258), as well as the conspicuous entrance of the World Bank in the housing scene by the 1970s (ibid.: 246) and its strong influence on the field up to now, aided self-help housing has adopted over the years many different forms and related in varying degrees with financial institutions and NGOs. Accompanying mainstream social housing policies from the outset, throughout its development aided self-help housing seems that have been shifting government’s role from housing ‘provider’ to ‘enabler’. The state, for its part, develops “the legislative, institutional and financial framework” (Smets et al. 2014: 2), in order to address issues on ‘resources’ such as land or construction materials, ‘building’ skills or technologies, as well as ‘finance’ solutions. This strategy, however, seems to left self-helpers with a narrow marginal role as free building labour and in a situation of almost total lack of significant control. This marginalization of self-helpers in the process of housing notoriously mirrors the main problems that aided self-help housing, indeed, shares with large-scale housing. If, usually, ‘poor location’ and ‘accessibility’ to material, economic and social resources is negatively rated by the inhabitants included in those housing programs, mortgage payments become difficult or impossible to meet for many households and, more shocking, aided self-help fails to accommodate the poorest of the poor (Burns 1983: 300), even if this is a main claimed objective.

Paradigmatic examples of aided self-help programs have been ‘site and services’ schemes and ‘settlement upgrading’ implementations internationally promoted by the World Bank since the 1970s on (Bredenoord and van Lindert 2010: 279). ‘Site and services’ focus on

the provision of an ‘incremental’ basic shelter to be self-implemented by the inhabitants in a given plot of land with legal title and usually supplied with water, electricity sanitation and street infrastructure (Bredenoord and van Lindert 2010: 279; Goether 2010: 24). Often situated on urban peripheries due to the relatively low value of the land, ‘site and services’ helped to reduce government’s investment for the acquisition of the land (Bredenoord and van Lindert 2010: 279). However, this peripheral position implied, on one hand, the increasing cost for the provision of infrastructures (ibid.: 279) and, on the other hand, the dislocation the inhabitants’ lives from income-generating activities, family and friends as well as basic resources, worsened even more by the lack of appropriate public transport. In addition, despite the low land prices “the total acquisition costs simply proved to be too high for the urban poor” (ibid.: 279). Thus, although one may acknowledge that ‘site and services’ schemes were evaluated too soon, misleading their focus on an incremental process of construction instead of a standard ready-made housing program (Wakely, in Goether 2010: 24), ‘site and services’ developments are often unpopular (Smets et al. 2014: 2) becoming, then, “desolated areas that did not serve their target group” (ibid.: 9). Paradoxically, although self-helpers seemed to be a fundamental part in ‘site and services’ schemes, they have been relegated to the margins of the strategy where only their free labour is required.

Through the implementation of ‘settlement upgrading’ programs, governments seemed to recognize the importance of the ‘place’ in the making of a home. In the 1970s and 1980s, the objective was to provide “a favourable environment for development of the self-build initiatives of the urban poor” (Bredenoord and van Lindert 2010: 280) that, still nowadays, focus on the regularization of land tenure as well as on providing basic services and infrastructure in informal settlements (Bredenoord and van Lindert 2014: 60). Thus, by securing land ownership, the lack of personal investment by the inhabitants due to an ever present thread of removal that derives in the stagnation of their informal settlements (Bredenoord and van Lindert 2010: 279) give often way to an explosion of self-help building activities, ensuing the consolidation of the informal settlement (Bredenoord and van Lindert 2014: 60). However, although physical improvement of dwellings has been generally acknowledged, critics claimed that there was no evidence that those interventions actually reached the target groups (Bredenoord and van Lindert 2010: 280). Indeed, unilateral infrastructural implementation by governments, financial institutions and NGOs have usually lead to strong processes of ‘gentrification’ where claimed target groups have suffer indirect processes of eviction. Moreover, the small-scale of the interventions hardly transmit their momentum to adjacent districts, therefore,

being unable to cope with the increasing urban challenges (ibid.: 280). Indeed, already by the mid 1980s it became clear that individual ‘aided self-help’ housing programs “would not be able to meet the increasing housing need” (Bredenoord and van Lindert 2010: 280) derived from the exploding of cities and the growth of poverty. Since the 1990s, then, the relevance of aided self-help housing “seems to have totally disappeared from international, national and municipal policies” (ibid.: 280) shifting from a ‘reductionist’ housing approach towards what were thought to be broader ‘city-wide’ perspectives that “integrate urban management, local governance and poverty reduction” (ibid.: 280). However, the complexity of what was seemed to be ‘a comprehensive habitat approach’ focused on integrated urban development and stakeholder engagement, has ultimately prevented to appropriately address the housing question any further (ibid.: 280).

In order to overcome the failures of both, aided self-help housing programs and the following ‘city-wide’ strategies aiming to integrate urban management, local governance and poverty reduction, it has been claimed that a much better approach would be “to create a diversity of housing options *for* the urban poor” (Smets et al. 2014: 9) [emphasis added]. However, to create diversity *for* the urban poor in order to enhance the chances of sufficient housing solutions to survive (ibid.: 9), on one hand, would be a clear waste of resources in a stock surplus of ready-made houses that, as many examples show around the world, remain empty as people never move in and rapidly deteriorate. On the other hand, to create *for* would not fit anyone particularities of living, relapsing on the misunderstanding that addresses the issue of housing as a problem of ‘provision’—both, ‘object provided’ or ‘process of provision’—, rather than as a ‘life project’ at the core of the inhabitant’s autonomy reached through the widest possible freedom of choice.

If the ‘potential’ of aided self-help housing has not been unfolded until now, it is not because there is a lack of a readily accessible corpus of knowledge previous to any intervention to guide the processes involved in any specific context (Bredenoord et al. 2010: 276) but, primarily, because aided self-help housing has been resuming the main misleading strategies than large-scale programs deploy. Relying in self-helpers for participation just as a resource for free labour, usually ‘aided self-help’ housing still requires inhabitants to adjust to defined package of basic services, mortgage payments and, moreover, “to accept fixed building standards, thereby depriving them of their capacity to make decisions about what and how to build” (Turner, in Harris 2003: 249) and, therefore, broadening the gap between institutional plans and people’s life. The settling, building or upgrading priorities of inhabitants are overshadowed by the involvement to which aided self-help is

lead within the land market, the upgrading or new implementation of ‘basic’ services and infrastructures deployed with large-scale building technologies and within city master plans, as well as the creation of housing markets (Smets et al. 2014: 2) and the reassertion of political control that can be achieved through governmental ‘assistance’ (Harris 1999: 284; Turner, Harris 2003: 256). Thus, if aided self-help housing has been a ‘reductionist’ approach (Bredenoord and van Lindert 2010: 280), it is not because the engagement in small-scale processes of building the environment but because of the alienation that people suffers in everyday life “by organizations that reify activities and institutionalize their values” (Turner 1976: 12). Indeed, despite all the strategic developments introduced through aided self-help housing from the 1960s until now, “in terms of control it was not a great improvement” (Harris 2003: 249). In the support of self-help building practices as complementary or alternative to large-scale system of ready-made housing, the issue of ‘control’, strongly highlighted by Turner (1976: 11-34, 154, 155), has been rarely addressed by those discussing about housing and not significantly embodied by any institution (Harris 2003: 263) although it continually reveals itself of great importance if not as fundamental. From so-called ‘aided’ self-help housing to the more ‘autonomous’ self-help practices in which governmental and financial institutions as well as NGOs and housing professionals barely intervene in a direct form along the building process, the way those external agents ‘participate’ with self-helpers and, therefore, the degree in which control is shared among stakeholders not just determines to a large extent the nature of the housing process and its materialization but orientates people’s potentialities of improvisation and lines of imagination. Thus, if one acknowledges that ‘technology’ is never neutral and understands that bureaucratic protocols and institutionalized knowledge used by institutions and professionals are social technologies, one may recognize that the compliances with which those external agents have to go through in order to engage in any self-help activity generally obligate both, institutions and professionals, to ultimately take control of the process and alienate its informality. In complying with the open-ended requirement for housing and the complexity of the different stakeholders involved in it, we may finally have not just to shift governmental, institutional, NGOs and professional role from ‘providers’ to ‘enablers’ but to go beyond them and trust in what people can do for themselves.

#### *User-driven ‘self-help’ housing*

If self-help housing has an incomparable ‘potential’, it is not just because its capability to greatly improve the inhabitant’s social and economic condition in the course of life time (Turner 1976: 55). It would be a mistake to engage the informal practices of self-help

housing just as a way to enter the formal economy and social status in a better position. It would be a waste to support self-help housing practices as a back door to the ladder's bottom of economic development and consumption society which, through its reification of reality, does not assure happiness nor satisfaction even to those already in the middle or the top (Wilkinson and Pickett 2010). To support the potential of self-help housing and the informality of its practices is a unique opportunity to avoid 'productivist' categories and dynamics towards an alternative way of living beyond the increasingly frequent crisis of capitalism (and communism). Moreover, it is a way to prevent the traps of what are conventionally thought to be alternative economic models based on 'reciprocity' and 'redistribution'—that, in fact, have reveal themselves as particular versions of exchange—and reinforce, instead, those relationships that acknowledge that 'sharing is not a form of exchange' (see Woodburn 1998). However, to overcome those economic models driven by practices of 'exchange' does not mean the 'absolute' abolition of their performance but to escape their trend to 'reify' or 'objectify' the open-ended reality by not enabling those practices of exchange to define or structure people's understanding in a general way that mislead the particular with an impossible universal or absolute<sup>4</sup>. Another question that would remain open by the change in the degree of practice of exchange vis-à-vis sharing would be to know if the character of 'exchange-value' would remain focused in the 'object' or would shift to the agreed 'relation' between persons<sup>5</sup>. Thus, as a quotidian practice which, as such, couples perception and action, self-help housing may lead not just to a different processual materialization of the world but to an alternative understanding of social and ecological reality. In any case, the potentiality immanent in the self-help building of the environment and its continuous 'in-formality' (a never-ending process of formation) would allow people to remain attentive and flexible to the many unfolding processes in the environment in order to enhance social and ecological resilience in the practices of 'settling', 'housing' and 'making', even in times of scarcity.

*Settling:* Despite nowadays mainstream understandings of dwelling as a fragmented collection of spaces interconnected by specialized infrastructures for physical or informational transportation that left the house as an inner space for residence, still for many people and most self-helpers the selection of land where to settle down is fundamental in the process of making a home and grounding it (Dayaratne and Kellett 2008: 64). Thus, although the general trend would lead to think of people living in squatter settlements by default, the fact is that quite often they are there by 'choice' (Perlman 1986: 41). In minimizing resource expenditure for shelter, they maximize a widely varying priorities that go from the proximity to social (relatives and friends) and economic sources (natural



PICTURE 4. Self-help building initiative of the Cultural Centre Matarya. Cairo, Egypt. Author: Emmanuel Dorsaz



PICTURE 5. Matarya centre is a user-driven aided building project helped by students of architecture and small NGO fundings. Cairo, Egypt. Author: Emmanuel Dorsaz

resources, informal market niches and wage labour) to the access to education, life-style and security of tenure (Perlman 1986: 41; Turner 1976: 99). The appeal of choice is so strong that, as Maddalena Iovene (2016) highlights in her fieldwork's blog during a research in Lima (Peru), not just the poor or the very poor people inhabit informal settlements but there are professionals, policemen and other people from middle class for whom "improving housing conditions is often not a priority". Being able to move to other areas of the city where life conditions are apparently better, people prefer to remain "where everything happens" (Iovene 2016). In fact, when public space in informal settlements is suitable many activities spill out from the house unit to the street itself (Shehayeb and Kellett 2011: 92) not just maximizing the use-value of the home environment with limited resources (ibid.: 85) but giving sense, security and resilience to people's life through their entanglement within this field of quotidian activities and relationships that reaches outside the residence. Thus, as Peter Kellett (2011b: 342) remarks, contrary to the conventional perceptions of informal settlements "as being on the periphery of the city", inhabitants experience their settlement "as the centre and focus of their world". In addition, the 'sense of security' seems fundamental in order to enable self-help housing initiatives to properly unfold and further consolidate the settlement.

*Housing:* In general, it can be asserted that for self-helpers the houses and places they have managed and built constitute a great source of joy (Turner 1976: 22, 23) where to reflect the proud of their collective efforts over time (Kellett 2011b: 343). However, for the released of the creative improvisation inherent to self-help housing practices to remain resilient in an unpredictable context, house and environment have to allow both, for their continuous change of use and 're-signification', as well as for their incrementation as the family and other home-based activities grow. On one hand, whereas in order to maximize the use-value of the home environment daily activities extend beyond the house, a way to increase the value of the dwelling is to become a place to accommodate other non-residential activities (Shehayeb and Kellett 2011: 85): from a simple house, storage space for the construction materials used for the house implementation and a farm to grow animals or an orchard to grow vegetables to a place where to host income generating activities as a shop, a factory or rooms to rent. Indeed, one should be aware that, generally, in informal economies the 50% of the income is home-based, being the 60% generated by women (Hamdi 2014: 24). In addition, home-based economic activities "can stimulate the development of local economies" (Smets et al. 2014: 7). On the other hand, as the family grows and the different activities inside the house increase, the dwelling space extends through the incremental implementation of the house unit and the spill out of





PICTURE 6. In the hill El Agustino new building structures are continually emerging both, as a part of a new home for a family to settle or as an implementation of a previous construction. Lima, Peru. Author: Maddalena Iovene



PICTURE 7. Any worthy material at hand can be appropriated for the implementation of a growing house. Lima, Peru. Author: Maddalena Iovene

some dwelling activities into the home environment. However, for a household to be incrementally implemented and to spread into the residential environment, an appropriate house and building form (low-rise housing instead high-rise) become fundamental to facilitate both, the gradual purchasing and storing of affordable materials and manageable standardize elements, as well as the relationship of income generating business or activities for the self-production of food with a broader social and ecological environment<sup>6</sup>.

Nevertheless, as already emphasized before, the ‘informal’ practices of self-help housing and its inhabitants creative ‘improvisation’ do not entail an absolute lack of design, skilled labour or construction budgeting and scheduling (Montero Gosálbez 2015: 9). Instead, first, ‘design’ should be understood as an indicative orientation through the crafting *in situ*; secondly, the ‘labour’ of self-helpers and their community, besides as a way for economic saving, should be understood as a possibility for enskillment and knowledge reproduction in the engagement with master builders and craftsmen, as well as process of identification with the building and the environment through participation and exploration; and finally, ‘budgeting’ and ‘scheduling’ should be a way to reconcile and be aware of investment capability and priorities in order to avoid a critical financial situation (ibid.: 9, 10). Thus, through a non-specified but orientative process of managing, constructing and implementing, “the open-ended dynamics of informal architecture enable social engagement and regeneration [...] to deeply correspond with the unpredictable on-goings of social life” (ibid.: 9, 10): that is, living self-help housing as a verb that reaches far beyond an enclosed shelter space into the community where social life is constitute and regenerated, becoming along with the dwellers life’s and hopes.

*Making*: Nonetheless, it has been argued that given the rapid growth of the urban population everywhere around the world, high-speed housing production is necessary to solve an increasing shortage of housing that self-help initiatives cannot settle by their own (Bredenoord and van Lindert 2014: 68). In addition, ‘in one go’ approach for housing has been shown as more sustainable than the incremental practices involved in self-help housing as the latter changes and implementations produce more waste over the years (Malpezzi and Pugh, in Smets 2014: 11). However, first, to render the problem of housing as a failure in closing “the gap between demand and supply of shelter” (Landman and Napier, in Bredenoord et al. 2010: 275) mislead the issue of housing. Because, how to ‘close’ an ‘on-going’ process? Thus, even if an over-stock of houses can be produce to accommodate a growing population or the number of world’s inhabitants decrease, the process of housing can never be complete as a house continuously undergoes processes



PICTURE 8. Secondary School project by Kéré Architecture and the community of Gando, Burkina Faso.  
Author: Emmanuel Dorsaz

of change and implementation. Secondly, given the autonomous resourcefulness of self-help housing, its shortage cannot be seen as inherent to the self-help processes of building but as the symptom of inappropriate circumstances surrounding self-help housing in each particular environment. Indeed, as Turner (1976: 17) remarks, ‘liberated’ from distortions and helped by lightweight, low-powered and decentralizing technologies the possibilities for effective action and resilience by self-helpers “are vast and immediate”. However, although I think that self-help housing practices are able to cover all ‘interest’ (instead a ‘demand’ focused in external provision) for shelter, the ultimate decision about the way a house is built remains personal. Lastly, ‘in one go’ approach lacks for the flexibility required by the informal both, in the economic affordability of the house as well as the family growth and the variation of its informal activity. If the failure meeting the mortgage require by ‘in one go’ projects can result in the abandonment of the house and its resulting deterioration over time, the rigidity leads, ultimately, to the ‘illegal’ transformation of the house unit and the consequent production of waste. Moreover, the incremental practices of self-help housing have proved very successful, on one hand, in the reusing and recycling of previous waste, as well as, on the other hand, producing less waste by meeting the variability of the natural resources, the capacity of the household to invest and of the market through the gradual storing and purchasing of materials, standardized or not. Therefore, the fact of leading the discussion about building materials to “the marketing of these materials through local traders” (Ferguson and Smets, in Bredenoord et al. 2010: 275), does not just avoid the importance of the self-gathering and production from natural resources and their availability but reinforces both, the dominant position of the market over people’s lives and, indirectly, the distortion set by the subsidy policies set by governments that mostly benefits large-scale production companies. This economic dynamic makes people to relay in sponsored large-scale prefabricated materials in which the incommensurable ecological costs for environmental regeneration are never included, creating a pervasive delusion that leads self-helpers to think of large-scale prefabricated materials as more cost-effective than the natural local materials ready to be appropriate for self-production<sup>7</sup>. On one hand, the use of natural local materials rather than imported or large-scale produced components stimulates domestic economy in small-scale industries (Burns 1983: 299), prevents households to get trapped in high-debt situations and promotes local traditional knowledge for construction (Jiroudy 2012). Moreover, on the other hand, through the attention to the different local material resources that will be at work in building —such stone, mud or wood, as well as the wind, rain and sun— and their process of selection, the social and ecological knowledge of the local environment can be enhanced and ‘regenerated’ (Montero Gosálbez 2015: 10).



PICTURE 9. Along the many developments involved in the project Gando, led by the architect Francis Kéré in his own home village, self-help building practices have led to the villagers identification with the new buildings, the professional formation of young men in improved traditional technics that afterwards spread over the region and the appreciation of local materials and landscapes long time stigmatized by modernity. Gando, Burkina Faso. Author: Maddalena Iovene

Along the practices of self-help housing, then, the building of the environment emerge not as the production of an object for consumption but as a never-ending process of social and ecological reproduction (Montero Gosálbez 2015: 10). Therefore, if one is able to understand, as Heidegger (1971: 144) clearly grasped, that “building is not merely a means and a way toward dwelling [since] to build is in itself already to dwell”, one come to the conclusion that “as we build, we live” (Montero Gosálbez 2015: 10). Thus, through the purchasing of a ready-made house or the self-help building of the environment, one inevitably partakes in a different constitution of the social life, the ecological relationships and the reality we all are living in. Each one of us decides!

## EPILOGUE. THE DECAY OF SELF-HELP HOUSING

An issue, however, remains almost untouched: why self-help housing practices ‘thrive’ in a particular context and ‘decay’ in another? Judged from the same ‘object’ oriented logic that voice objections to self-help housing on the basis of its apparently untidy and uncontrolled appearance (Perlman 1986: 43), if an informal settlement or an ‘aided’ program lose quality even after ‘several years into project life’ housing professionals usually point to the lack of construction skills and knowledge by the inhabitants —and even, in the case of low-income populations, an apparently ‘intellectual and moral inferiority’— recommending the intervention of governments, institutions and professionals of housing in order to stop the process of decay that they think as inherent to the lack of top-down control. However, if one acknowledges the informal processes that once led the constitution of the nowadays generally praised ‘vernacular’ settlements and, moreover, the multiple points of commonality that suggest contemporary self-help building practices as “a continuation of existing vernacular processes” (Kellett 2011a: 10), the causes of decay or success in current informal settlements have to be sought beyond the ability or inability of self-helpers for managing or constructing by themselves. Thus, whereas it is usually accepted that vernacular environments has been constrained by rigid social structures, the climate and the limited variety of local resources (ibid.: 9), current informal settlements, in general, emerge in urban areas or rural regions regulated by dominant groups through top-down control. From here arise two questions that, however, have to be somewhere else elucidate: while, on the one hand, it can be acknowledge that even in our current urban environments marked by an unprecedented scale of migrations and a radical shortage of resources, self-help housing practices and informal organizations thrive or decay “as a result of actions and inactions by hierarchic structures” (Turner 1976: 33) that exert their

control over the access to basic resources, on the other hand, many informal settlements have fail as well throughout the course of history, never becoming the vernacular of today. Both, however, stress a lack of understanding about, on one hand, the issue of ‘control’ in regard to the appropriation of resources —‘property’— and the processes of building —‘participation’— and, on the other hand, the balance or imbalance of informal processes of human settlement and inhabitation in their correspondence to the ecological cycles of resource regeneration. Both understandings and, therefore further research, are fundamental in the building of a sustainable future, not just for self-helpers but for people everywhere.

## NOTES

1. From the slum areas and squatting movements infiltrating western cities, the revitalization of co-housing initiatives in Europe and the increasingly trending Earthships all the world around to the ‘log cabins’ and ‘pit houses’ of Gwich’in and Wet’suwet’en people in the north of the American continent, self-help housing has actually never left so-called developed countries. The continuation of those self-help building practices is not just a result of capitalist economic constrains and crisis but, mainly, its critic and alternative (about co-housing see Tummers 2015; and about Earthships see Harkness 2009).

2. There is another version of this sentence in which good taste is exchange for *good sense*. However, the use of good taste remains closer to the Spanish meaning ‘buen gusto’ which stays in the original: “El principal enemigo de la creatividad es el buen gusto”.

3. Here, I take the term ‘derange’ in its etymological sense: French *déranger*, from Old French *desrengier*, from *des-* *de-* + *reng* line, row (Merriam-Webster Dictionary). In this sense, a ‘derange system’ is one that because of its inherent structure it is unable to follow the processes (or lines) that claims to embrace.

4. For example, so-called hunter-gatherer people, in general, are able to engage different kinds of livelihood practices —from hunting and gathering, to bater, redistribution and exchange based in agriculture, pastoralism or wage labour— without compromising their ‘relational’ way of engaging and understanding reality (for further information on the alternatives enacted by the economic and social relationships among hunter-gatherers, see

Gowdy 2004 and Ingold 2004).

5. In the practice of hxaro, “a delayed form of not equivalent gift exchange” (Lee 2013 [1984]: 131), by the Ju/'Hoansi of the Kalahari Desert, the ‘object’ exchanged just incorporates a ‘relational value’ that allow people to lay sustainable social and ecological relationships over time and space in order to remain resilient in the uncertainty of their particular environment. The ‘value’ in this kind of exchange has to do more with the respect and trust in a relationship set up over the years than in the ‘abstract’ time invested in the production of a particular commodity. As one member of the Ju/'Hoansi clearly put: “we don't trade with things, we trade with people!” (!Xoma, in Lee 2013 [1984]: 131).

6. Famous examples of aided self-help projects with such an ‘incremental’ approach are the housing compounds of ‘Quinta Monroy’ (2004) and ‘Villa Verde’ (2013) designed by the architect Alejandro Aravena and his studio ELEMENTAL, awarded with the Pritzker Architecture Prize in 2016.

7. Through my experience as an architect in projects built in Burkina Faso, I came across the curious paradox that, even in rural areas, the purchase of mass-produced concrete blocks began to be more economic for self-helpers than the self-production of adobe or stabilized-earth blocks. However, real costs of production show over time in the form of social, economic or, even, global warming crisis.



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## VERTICAL PUBLIC HOUSING IN SUBURBAN FOR LOW INCOME PEOPLE

*The objective of this universal home proposal is to give opportunity to the low income family to have quality homes which have the same quality like other public housing in the first world country. The concept proposed for the public housing in this paper is flexible and can be expanded that can be lived by wide range of people from different background, age, religion and way of lifestyle. The idea of this project is also to provide a public housing could help this low income people to generate income. A mechanism for them to lodge economic activities which can improve their living conditions in future. Issues has been listed down and case study has been reviewed by content analysis with macro and micro Planning. Suggested studies proposed based on the applicable method from other location. Finally, flexible and expandable homes are some of the design features that can give them a good housing that easily adapted to their needs especially among the low income people.*

Malaysia is one of developing country in the world which experiencing rapid urbanization. Limited job opportunity in rural area is one of the reason that influenced people to migrate into cities and large metropolitan areas. The needs of housing and land for low income people are increasingly urgent. Nevertheless, majority cannot afford the cheapest legal housing plot which later leading to the largest cities inhabitants live in residential developments of self-constructed dwelling on illegally occupied or subdivided land with basic services. Seeing this as a serious issue which can influence the development of the country, the Malaysian government had introduced programs and policies to cater this problem. In 1998, an Integrated Public Low Cost Housing Program (PPRB) had been introduced by providing low-cost rental units for the urban poor populations. The government had also included this matter in the economic policy where one of the objectives of New Economic Policy (1971-1990) is to eradicate poverty and to restructure the society by applying Human Settlement Concept in housing development where priority is for low cost housing development. While for the New Economic Policy (1991-2000), Human Settlement Concept still been used but the emphasis is more on sustainable development and squatters elimination by the year 2005. The demand land area for more profitable proposed especially for commercial, shows declining in residential land use. Because of this phenomenon, the government had introduced 30% of low cost housing provision in every private sector's residential development in New Economic Policy (2001-2005).

In order to survive in construction industry, most of the developers had to cut cost of the construction by building houses with minimum area, low quality material and cheap construction method especially for low cost housing or public housing in order to stay afloat seems they could not obtained good profit from this low cost project. Recently, the price of low cost housing had been raised up to RM 60k till RM 70k start from RM 42k resulting from the quality and overall environment upgrading that consist of well-designed building component, proper management, used of durable materials and the providing of minimum amenities such as roads, schools, shops, bus/taxi and playground for the people convenience with efficient public transport systems. Most of the low cost housing in Malaysia are not convenient for the occupants. The units are too small that sometimes only one bedroom was provided. Each houses required minimum 3 bedrooms. Because of the limitation of spaces in the house, the activities that can be done in the house are also limited. The occupant could not have events or occasions inside the house that force them to rent another places that might be way too high from what they can afford. The visitability of the houses also become an issue where friends and relatives found it is hard to gather and stay longer with the occupant of the house especially during religious



FIGURE 1. (a) Kids in squater area



FIGURE 2. Open spaces underneath the blocks becoming a place to play among the children

festive seasons. This situation can cause the decreasing of family and community bonding that led to the inharmonic environment where people start to be self-centred and do not mingle to each other anymore. The lacking of public amenities and facilities at the public housing development creates conflicts among the community. There are no open spaces or pocket spaces for each floor for them to interact, to have a small garden in front of the house and doing some religious activities which later creates privacy violation issues.

The objective of this universal home proposal are to give opportunity to the citizen of this country especially for lower income family to have quality homes which have the same quality like other public housing in the first world country such as in United Kingdom where it response to the human needs. This new concept of public housing is very flexible and can be expanded that can be lived by wide range of people from different background, age, religion and way of lifestyle. The house evolves together with the occupant that makes their life easier where they can live at the same house for how long they want or for the rest of their life. By having this, they will not face with any other problems in searching for a new affordable house in the future seems the house price increasing over the years. They can just live at the same house and becoming their “Life time home”. The idea of this project is also to provide a public housing which could help this low income people to generate income. The housing is not only for a place for them to stay but also as a mechanism for them to lodge economic activities which can improve their living conditions in future. Low cost housing development is very crucial to ensure social and economic stability in promoting national development. By applying this universal house concept, it can attract more developer in construction industry to commit more serious involvement in low cost housing project seems this type of housing do not require high budget and it can be build fast. Other than that, the idea of this universal home is to enhance social interactions among the community. Architecture is one way of means to inject the community spirit among the residence.

Good housing gives the greatest impact on children. A clean, decent and stable housing give opportunity to families to provide stability for the children where their health, physical safety and security are been improved. This design can also be a platform for creating their own wealth where they can own the property as well as generate income in the place where they live. The house is not only acts as a living habitat but also acts as a large social and productive mechanism that profitable to the occupant and community as a whole. It also helps in growing the family’s sense of dignity and pride thus made the educational and job prospects increase. This is a good thing in bringing Malaysia





FIGURE 3. Some of the flexibility of the spaces that can be achieved  
 Source : [www.miltonkeynespartnership.info/DocLibrary/Tattenhoe\\_Park\\_Development\\_Framework](http://www.miltonkeynespartnership.info/DocLibrary/Tattenhoe_Park_Development_Framework)

to be the same line with the other developing country. By having more and more high quality low cost housing, it creates more job opportunities for migrants to cities, thus stimulate creation of small business. These small business activities will attract economic investment and development by having school system and community organization at the residential area that becoming the catalyst for civic activism and stimulus for community. Therefore, it helps to build social stability and security which is very important to the health of economies, communities and populations.

## VERTICAL PUBLIC HOUSING

According to Longman Dictionary of Contemporary English, public housing means, houses or apartments built by the government for poor people. This housing development is built, operated and owned by a government at a nominal rental rates for low income individuals and families. Usually, the low cost housing is owned, sponsored and administered by a municipal or other governmental agency. For instance as in Australia, the public housing is provided by department of state and territory government funded by state and federal government. There were 300 000 public housing in low density housing in sub urban area where as for the urban or inner city, they were built in high rise apartment in Melbourne and Sydney. Other than that, “Life Time Homes Concept” is an adaptable housing which can be lived by wide range of people from different background such as single or families, disabled and non-disabled, young and old. It can be modified easily in the future to suit occupants’ needs that fully accessible, no structural changing required and minimal cost. The characteristic of this adaptable housing is preferable seems it response to the changes of the occupants such as family growth, running a business from home, caring for relatives especially elderly and people with temporary or permanent disabilities. The adaptation of the house does not impinge of the general designs that offer flexibility on minimal cost. Other than that, it also response to the local custom, culture and lifestyle where the house can be adapt on certain occasion such as wedding ceremony and tahlil for the Malay people and other religious gathering or activities. First and foremost, this design concept has a highly accessibility for wide range of people as mention before in the introduction. In terms of costing, it is cost benefits because of the adaptations and flexibility of the house unit which do not require greater space standards and the house always felt more spacious because of the effectiveness utilization of the spaces. One of the most important features in “Life Time Home Concept” is the super flexibility that can be achieved in the house by using open plan layouts or generic layouts. It uses partition walls that can



FIGURE 4. Plan layout of a unit apartment



FIGURE 5. Plan layout of a unit apartment after renovation and extension

easily be removed or repositioned. Other than that, the flexibility also allow some easier interchange between employment and residential area where the house can be transform to be a live working unit such as retail space.

Basically, the problems and issues that arise in public housing can be divided into two categories, in terms of macro planning and micro planning. For macro planning the issues are more about the overall zone planning in the masterplan such as the lacking of community interaction spaces or open spaces and lacking of community facilities. As for micro planning, the issues are about the house unit itself. The house unit is small and not flexible to allow any changes. There are also no spaces provided for gardening and other kind activities. The issues that had been recognized in the low rise housing in terms of planning and design can be the reference for the next upcoming research. The purpose of this study is to identify the issues so that a new design approach can be apply as one of the solution and alternative in providing a new typology or prototype of public housing which responds to the users' lifestyle and culture.

For micro planning most of the low cost housing in Malaysia is not convenient for the occupants. The units are too small that sometimes only one bedroom provided. Each houses required minimum 3 bedrooms.

It is stated that the condition of the house unit in flats which is too small creates an

unconducive environment that interfere the family relationship. The compromising of privacy among the family members gives a big impact to the children's' growth especially teenagers. The situation became more complicated when there are additional of new family member in the house. Most of the teenagers decided to spend much time outside rather than inside of the house seems there are not enough space for them to do activities at home. The visitability of the houses also become an issue where friends and relatives found it is hard to gather and stay longer with the occupant of the house especially during religious festive seasons. This situation can cause the decreasing of family and community bonding that led to the unharmony environment where people start to be self-centred and do not mingle among them.

On the other hand, the macro planning shows that Public facilities and amenities are seen not provided very well in public housing development which sometimes can create small conflicts among the community. An open space or a small hall at the house blocks should be provided for the residence that can be used especially during death or for any other events such as wedding, meeting or gathering. The location of the facilities also plays an important role in making sure that they are used very well by the residence and not to be abandoned. Wrong location or unstrategic location of the facilities will create a passive environment which later will lead to an unhealthy activity such as vandalism. Most of the public housing developments are not sensitive in providing green space for the residence. Therefore, the residences of public housing have difficulties in having flower pots as part of their home decoration. There are some of them had done some changes and renovations at the corridor to be a part of their small garden which later obstructing the walkway circulation in front the house. Other than that, it is also hardly to see any transition space in the public housing other than a long corridor in front of the house. An open space should be designed to incorporate with the house unit to be a transition space for the residence that works as a house compound where they can interact to each other.

## DESIGN APPROACHES AND SOLUTIONS

The design approach for this project can be divided into two, in terms of macro and micro planning. The idea of this is to make sure that all the problems and issues that occur in the public housing can be tackled and solved systematically. The design objective in macro planning are to encourage and enhance social interactions between the residence, to improve the infrastructures planning in public housing development and lastly, to



FIGURE 6. Planting along the small and narrow corridor becoming an obstruction to the people who pass



FIGURE 7. A small storage built by the residents to put the their belongings such as bicycles and other stuff

provide open space for gardening activities, gathering and other activities. The focus of the macro planning is more on the masterplan planning and zoning. In order to achieve the objectives, vertical and horizontal spatial interactions had been design and planned in a way that allow for direct and cross interactions between the house floors with the surroundings of the housing area.

Each block is provided with community facilities and commercial area such as shop lots, food stall, playgrounds, nurseries, kindergarten, balai raya and others on the ground floor. The idea of having it all centralized in one block are, first and foremost, it does not require any extra land to build all these facilities and amenities by make full of use the ground floor. It also provides natural surveillance by having activities around of the block, especially to the kids who are playing at the ground floor. They do not have to walk far to play around. On the ground floor, the space is used for commercial activities such as shop lots and food stall while the other part, which is on the upper floor at the other wing of the block, the space is used for community facilities such kindergarten, nurseries. The idea of having it separated by different level is to distinguish between public and semipublic area. The public area is used for commercial activities while the semipublic which is the upper level is used for community facilities. The ground floor is used for commercial activities because it has a direct contact with the surrounding which is very important in sustaining the business performance while the upper floor is used for community facilities to give safety and privacy especially if there are kindergartens and nurseries. They are raised up and not at the same level with the road.

There are two wings for each block which is separated by a central staircase. These two wings have different level of half flight of a staircase and the idea of the separation is to allow cross interaction between the floors in order to sustain the home business by the people where the visibility of the home business is increased where every people can see what is going on at the other part of the floors or wings. The house units also are grouped in 6 units per wing for one floor to encourage social interactions between the residents. On top of one of the wings, there is an open space or roof garden provided to be a place where this people can do some gardening activities and other social activities. There are also multipurpose open spaces on the ground level. These open spaces can be used for various types of activities that can encourage more interactions between the residents. At one time, it can be used for recreational activities, space for small business such burger stall and at one time it can be a space for the crane during the extension work is done. The open spaces also can act as a focus point for the overall development where they indicate



FIGURE 8. Horizontal and vertical spatial relations

Issues	Solutions
#1 Lacking of community interaction space between the blocks	#1 Create multifunction open space between the blocks
#2 Lacking of community facilities	#2 Provide public facilities for each block
#3 No green / open space	#3 Introduce roof top garden

FIGURE 9. Solutions for each issues in macro planning of public housing

Issues	Solutions
#1 Lacking of community interaction space at each floor	#1 Locating micro communal area for each floor
#2 Limited and small house area	#2 Designing 2 systems of extension method - "beam" system and "box truss" system / foldable wall system
#3 No space for other activities at home (multipurpose space)	#3 Provide multipurpose space for home business activities / temporary storage / extension for kitchen / religious purpose
#4 No green space	#4 Provide a small compound in front of the house - transition space and small garden

FIGURE 10 Solutions for each issues in micro planning of public housing

the main entrance to the block. They also become a linkage that linked together all the blocks.

As for the micro planning, the focus is more on the house unit itself and also the surroundings of the house floor level. The design approach is by using non-permanent wall in some part of the internal layout of the house where spaces are separated by foldable wall that flexible to increase the adaptability of the house. For example, the house might be can be adjusted to have 2 bedrooms or 3 bedrooms and can be open plan layout when needed especially during occasion. The house also is equipped with a multipurpose space that can be used either for small home business activities, temporary storage or it can be combined together with the kitchen so that they can have a wider kitchen. In order to respond to the family growth or any other events that required some changes in the house layout, the house also been design to grow by having 2 extension systems, “Box Truss System” and “Beam System”. The house floor is designed in a way that can encourage more community interactions and also providing green spaces for the residents. The small business activities not only help to generate income among the residents but also can encourage more social interactions among them. The area of the home business becoming a focus point and micro communal space for each floor where people can actually meet and chit chatting that area and it helps in sustaining the business. There are also green

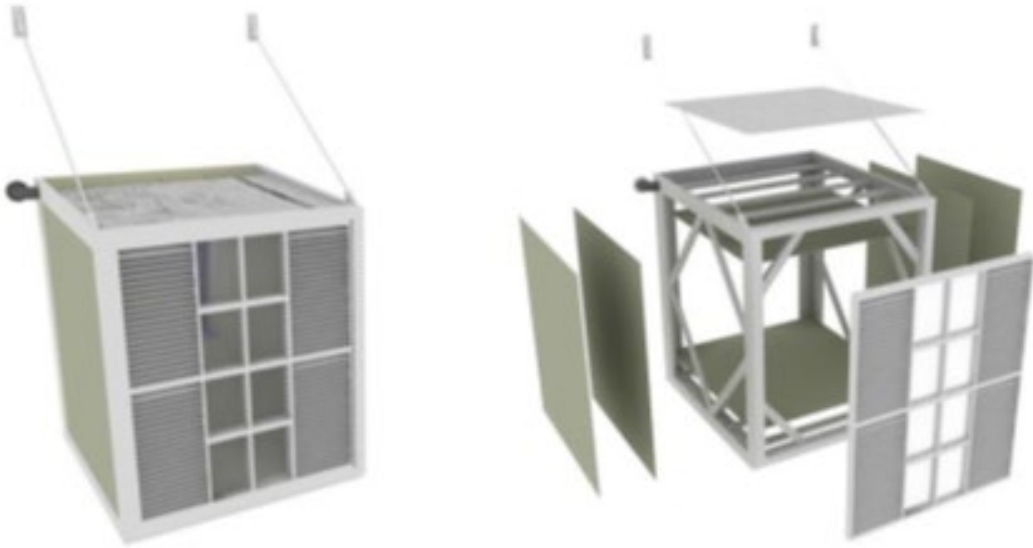


FIGURE 11. Box truss system module 1





FIGURE 12. Box truss system module 2

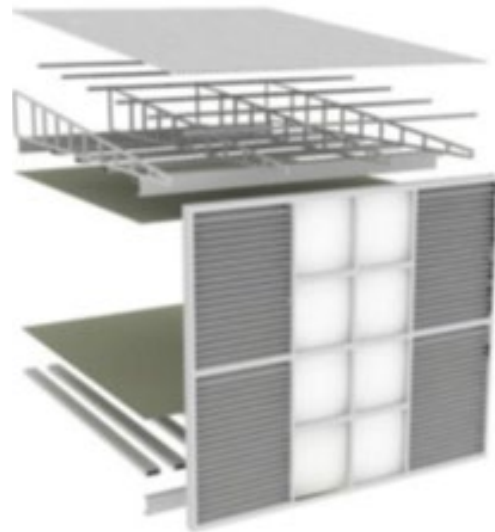
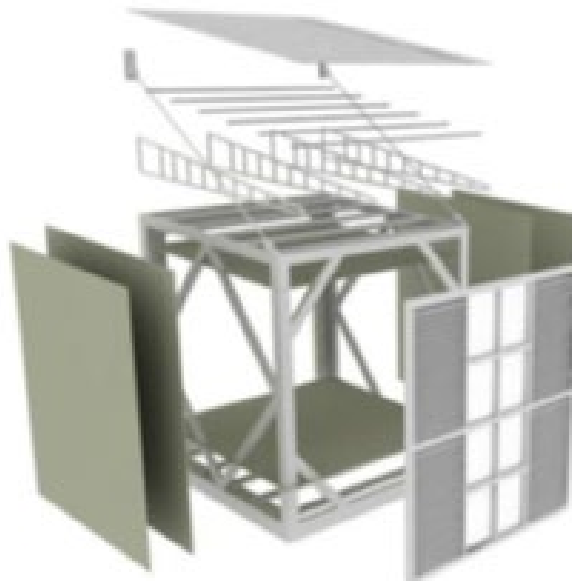


FIGURE 13. Beam system extension system



FIGURE 14. Box truss system that can be used for balcony



spaces at the porch area provided for each house unit to put all the pottery plants. Planter box also are provided along the corridor for the residents' convenience. The porch also acts as a transition space from the corridor towards the house.

The existing public housing nowadays can be improved by having new innovative designs and new building programs that can lead to a quality life among the low income people. Flexible and expandable homes are some of the design features that can give them a good housing that easily adapted to their needs. By having this 'Life Time Home Concept', this low income family can stay at the same house for the rest of their life seems this housing scheme allow for renovation and expansion of the house unit. The house is actually flexible to meet whatever comes along in live such as family growth. Moreover, the house is not only acts as a shelter but also as a mechanism for them to generate income through the production of further dwellings and this mechanism also can enhance community social cohesion among the residents. Providing a good housing to the people means we are one step to the front as they can lead to a much better quality life. Quality life means the arising of educational and job prospects which consequently influence the country development in all aspects, social, economics and politics.



FIGURE 15. The house unit life cycle

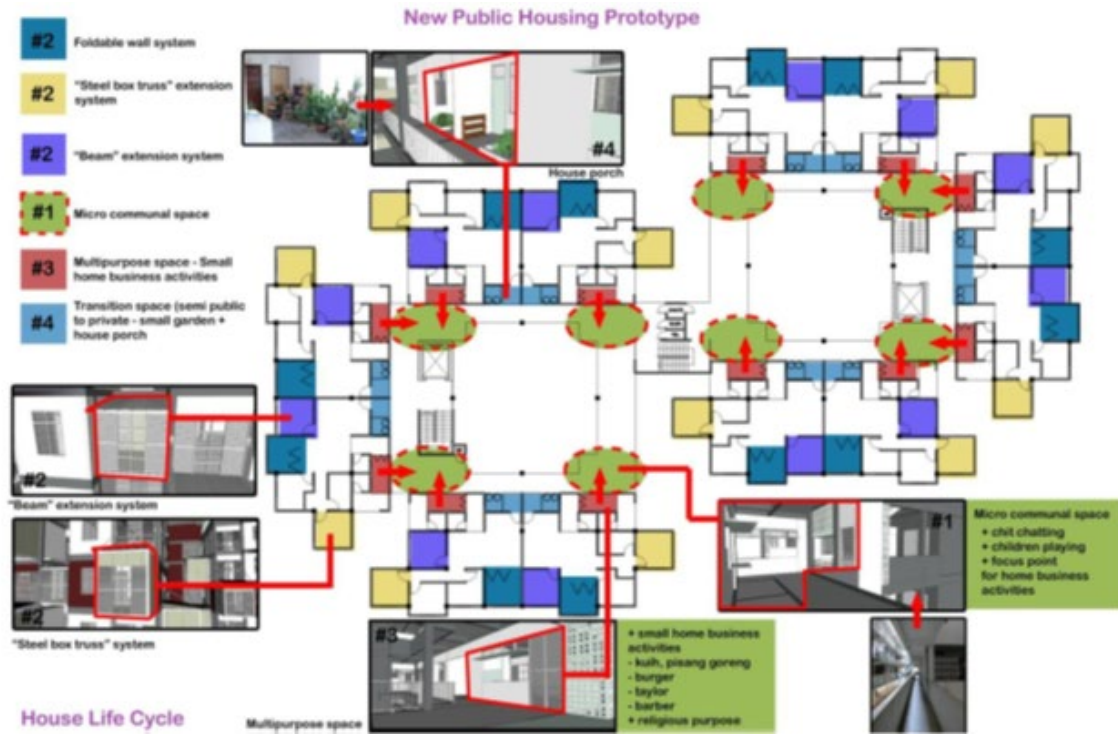


FIGURE 16. Contextual diagram of the design approach for the house floor

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## IKEA-BOKLOK - THE FLAT PACK CONCEPT DELIVERY OF MASS CUSTOMISED HOUSING FOR THE EUROPEAN MARKET

*The need for an economic and mass produced housing type that specifically targets the market to achieve the balance for the need of affordability and the benefits of mass customisation is a key focus for delivery. The UK housing market has, over the recent 10 years experienced considerable economic pressures both from the market place and the construction sector.*

*This case study sought to deliver a mass produced housing system that could also deliver a high level of customisation. To achieve successful delivery using non-traditional methods of delivery a shift in the procurement of the design is required for such housing typologies. Historically housing that has been mass produced can create high levels of affordability, however these economic benefits reduce dramatically the high level of customisation the market place often insists upon and to ensure that the final costs of the housing is controlled. This case study explores the design factors that are integral to the process of delivery affordable housing, and observes the gaps between mass customisation and affordability of the mass customisation approach.*

## THE STEP CHANGE FROM TRADITIONAL DELIVERY TO OFF-SITE CONSTRUCTION METHODS: CONTEXTUALISATION OF HOUSING DELIVERY IN THE UK

The BoKlok approach to affordable housing was launched in December 2006, in the UK to great acclaim. As the name suggested Bo – Klok literally translated means (Bo) live and (klok) smart. The smarter living concept was created originally in the 1990s by the joining of IKEA and Skanska in Sweden. The fusion of these two large companies brought together a strong design company that understood the market place and customer needs for affordable housing, with a construction company with over 100 years constructional experience.

Boklok is the housing arm of the parent company IKEA. IKEA the organisation and its approach are strongly orientated towards its market. The customers drive the products sold by IKEA and BoKlok based on demands and selection criteria of their customer base. Therefore the production of these products needs to both be affordable and customised to each customer's needs or demands. The BoKlok housing was considered as a 'product' as all items sold by the company are classed in this manner. Each 'product' is developed from the initial idea to product launch in house involving economic, technical and market driven factors derived from analysis of the companies' clients and customer base. This approach may be considered unique by competing companies of IKEA and Boklok, however it is seen as the only way to deliver what the customers wish to buy. This approach allows the company to learn from its customers' specific design requirements and how this may impact on their buying behaviour and predicting to some extent, the potential needs and requirements that may well occur in the future.

The paradigms of analysed and structured use of both the Manufacturer-Active and Customer-Active Paradigm. These explain a structure of opportunities that can be utilised by an organisation that arise from the market the company supply, for generating new ideas with the customers input and feedback from the initial stages of development. Customer feedback can create better market intelligence that can increase market strength in the short term, followed by market predictions in the long term. Examples of such active intelligence research was initially explored in the Manufacturer-Active paradigm (MAP) and the Customer-Active Paradigm (CAP) were originally defined by Eric von Hippel in 1978.





Image 01. Initial Concept for BoKlok UK Housetypes, Architect: David Morton. (Image: D.Morton)

Founded in Malmo in 1987, Boklok was formed with the aim of unifying the use of technology to deliver both a system of delivery for mass produced housing whilst retaining the individual need, from the customer perspective, of customisation. The original concept for BoKlok as a direct response to the market need for low priced housing in Sweden in the mid 1990s. For a period of 10 years prior to the Millennium, there very limited private housing built even though demand was high. In 1995 the BoKlok concept team was formed and later, in 1997, the initial BoKlok houses were completed. The concept was then extended to other Nordic Countries and in 2006 launched in the UK. The BoKlok house types are known collectively as ‘Generations’ or Gen1 for the apartment type blocks and Gen2 the first BoKlok housing, developed in conjunction with British Architects. The underlying architectural aim was a design approach allowing for an open plan flexible living format on one or two floors, with kitchen, dining and wet rooms providing the serviced spaces. Creating a series of floor plan forms that would minimise servicing routes and connections and also optimize the internal floor area and reduce circulation. An algorithmic approach to usable space and circulation space was created that would allow for multiple options for number of bed spaces (bedrooms) and create flexibility within the plan form.

## AUTOMATION FOR FABRICATION OF DESIGN: A THEORETICAL MODEL

The proposed theoretical model for this study has its origins in the automation of fabrication and design. The original model was implemented initially by Duarte and Simondetti (1997). This model was further developed with the introduction of the generation of 3D abstract objects that allowed for the fabrication of these models utilising rapid prototyping. Prototyping for the BoKlok houses was initially explored via virtual modeling and use of small scale physical modelling. As the design for the base BoKlok dwelling (the smaller of the house types that could be expanded with extra bedrooms) was developed, full scale builds of each element of the houses were constructed and systematically deconstructed to ascertain improved buildability and flexibility. Wang and Duarte (2002) developed the computer programme that allowed the generat-ing of the abstract objects and codification of the models elements. Duarte (1995) proposed the first general model for integrating housing design and production as one combined approach. The fundamental element of the model was in the codification, creating a series of house types.

The underlying paradigm that architects have persistently endeavoured to solve is the standardisation of components and the systemisation of the construction process, the combination of which was seen as the panacea to affordable housing. The primary issue with this paradigm in past endeavours was that it created minimal customisation. Mass production is not new in many not construction industries, such as motor vehicle manufacturing. Historically, the concept of mass production in this industry was created by Henry Ford, who mass produced the Model T in 1910. The famed quote of Ford at this time was that you could purchase a Model T in any colour as long as it was black. Many researchers' have taken this as to offer one colour was inherently cheaper to produce. The actual reasoning behind this choice was the fact that black paint was faster drying, so the production line could be operated at faster rates.

Such combinations of factors, which look at design, materials and processes, have yet to be used in the broader observation of the affordable housing market. For example current purchasers of motor vehicles today are offered many customised options such as trim colour, exterior col-our, wheels and more. These options are accounted for in the construction, or in this case, the build process, but do not affect the final completion date at the end of the production line. These options allow for customisation of a mass produced product, the question being, it should be possible to affect the same modus operandi in the construction industry producing affordable housing.



Image 02. Completed BoKlok UK Housetypes, Architect: David Morton. (Image: D.Morton)



Image 03. BoKlok Generation 1 Apartments timber framing system under construction (Image: D.Morton)

## MASS PRODUCTION: THE ORIGINS OF THE CONCEPT

This study has its origin in the concept of mass production for the affordable housing market. The concept on mass production has been discussed earlier in this paper, with the concept of the production line from Henry Ford in 1910. During the 1970s the new wave of production began with Toyota using the concept of so-called lean production. This concept took the original production line methodology and removed the waste from the process. This so called waste was a combination of time and cost in the processes that serially followed on to each next stage. The solution in the main was to develop just in time delivery procedure. These procedures minimised storage and the need to collect materials and deliver them to the production line. Instead, the materials or components would be delivered directly to the factory and taken straight to the location needed to build the final product. This process was developed further to optimise the time and cost, via the removal of element of the production process as a pure linear process. The product was now delivered using smaller teams gather around the product to complete smaller combined tasks. The repetition and variation of tasks created higher productivity amongst the workers. What has been termed ‘the third wave’ of lean production began to emerge from these, the idea that along with mass production, the need from the end users for personalization or customisation could be achieved. The concept of mass-customisation was first predicted by Alvin Toffler in 1970 and again in 1980 in his book ‘Future Shock’. However, the term ‘mass-customisation’ was coined by Stanley Davis in ‘Future Perfect’, (1987).

## THE STUDY AND METHODOLOGY

This research aims to detail and explain the systematic evaluation of the ‘BoKlok Housing Types’. Allowing for the assessment and demonstration of BIM adoption in the design of affordable housing typologies in the European market. The purpose and Scope of this research was to capture how the use of BIM in the mass customisation of affordable housing. The justification behind this research originates from the need for architectural industry to face the current challenges that BIM adoption creates. BIM adoption is seen as a panacea to lean productivity and efficiency in the studio and has many advantages that should be embraced in order to achieve advantages in building design and the processes that are needed to create those designs. From such an approach and embracing BIM, the aims of creating more affordable housing typologies is exponentially achievable.

The current delivery system of affordable housing does not involve the end user at an early enough stage. Therefore to capture potential market share, mass custom approach to design and build should be introduced. The use of greater standardisation will allow the end user to directly assess and select each element of the home. This creates a true mass custom model, in a market that currently dictates a set design with very little option for modification other than fixtures and fittings. The systems proposed by this research are limited but provide a platform from which future mass customisation could be used to realise the desires and expectations of home buyers or prospective self-builders. The research was undertaken via an external link with architectural practice and Northumbria University at Newcastle.

The originality and value of this paper stems from the adoption of BIM in the design process and the systematic approach that is possible based on the study and its findings. Developed originally as the response to a research project brief for an affordable housing system that would allow the prospective self-builder the opportunity to become the master builder, utilising BIM and related software. Allowing them to accomplish all of the design stages from initial layouts, elevations, to costing and then towards completion on site. This brief asked for an affordable housing design that could be created from a simple kit of parts. These parts, once used to create a completed design. The BoKlok house types design utilized a complete set of new panels for the timber frame system. This created a high initial set up costs for the IKEA once the system was piloted on the proposed development site. This created a different paradigm for the project, the adoption of a semi-open system. Upon commercialisation of the system this allowed the successful achievement for the goal of customisation of a mass produced system.

The research project involved three main stages; first the deduction of base house design and system of rules for the linking of these internal spaces to each other within the confines of the external panel system. The second stage of the project was to codify the relationships of the internal spaces to ensure compliance with various European codes for construction and building regulations. These relationships in turn required further codification to relate to the external fabric, which became stage three. In addition to this, the use of a semi-open system reduced the concern over dependence on one supplier or manufacturer of parts for future sites. The drawback of this flexibility was the high levels of co-ordination to integrate all of the possible elements seamlessly. The extra overall costs of this flexibility was countered in the final design by the use of service walls and shared service routes throughout the dwelling, that could be shared and utilised with all

variations of internal layout and external form. Such design framework follows the work of Alvaro Siza, who in 1977 foresaw the need for mass produced customisable housing. Siza developed the SAAL system, which followed an intuitive set of design rules. The rules allow the house design to be extended and modified within a set of rules, similar to a design code.

## WHAT IS AN AFFORDABLE HOUSING ARCHETYPE?

It is often the case in the development of housing schemes by house builders wishing to construct a development of 25 or more dwellings would employ the standard convention of utilising a small number of house types that would be repeated around the development. Such an approach is commonplace and allows for cost efficiencies at all stages of the design process. From the initial design stage, the convention of designing a small number of dwellings that can be repeated throughout the site reduces the potential of large amounts of information for the individual dwellings. Focusing on a small series of dwellings allows for this information to be vastly reduced. This reduction brings with it efficiencies in both time and cost. The construction phases also benefit from this reduction in variation, as the purchasing of components, fixtures, fittings and general materials are often replicated throughout the small series of dwelling designs to optimise cost efficiencies. The repetition of both design elements and material choices allow for lower overall construction costs and therefore more affordable housing for the market. However, all of these efficiencies stem from the reduction of choice and the repetition that remove the individuality and customisation of the final product. The result is housing that is mass produced and therefore deficient in the required levels of individuality frequently sought from potential buyers in this market.

The aim of this research was to surmount the accepted norm that mass production in housing cannot also achieve levels of customisation that limited today's affordable housing market. Secondly, it aims to explore how Building Information Modelling (BIM) can be used to increase levels of customisation that are directly controlled by the end user and/ or user of the final dwelling. This need can only grow as the market segment for low cost housing increases, the clients of these housing types are becoming more accustomed to dealing with an increasing number of the tasks once deemed the role of the professional. Although this trend stems from the reoccurring need to retain a low initial costs ceiling in relation to the need to retain overall control on the smaller budgets such projects are constructed within.

ORIGINAL 'MASS CUSTOMISATION FORMULA (Noguchi and Friedman, 2002)

$$MC = f (PS)$$

Image 04. Mass Customisation Formula, Noguchi and Friedman, 2002.

ORIGINAL 'MASS CUSTOMISATION FORMULA FOR PRODUCT SUB-SYSTEM  
(Noguchi and Friedman, 2002)

$$S = f (l,p,t)$$

$f$  = FUNCTION of  
l = LOCATION FACTORS  
p = PERSONNEL FACTORS  
t = TOOL FACTORS

UPDATED 'MASS CUSTOMISATION FORMULA FOR PRODUCT SUB-SYSTEM  
(Morton, 2014)

$$S = \left( \frac{d_m + d_p}{T_r} \right)$$

$d_m$  = DISTANCE TRAVELLED BY MATERIALS  
 $d_p$  = DISTANCE TRAVELLED BY PERSONNEL  
 $T_r$  = REPETITION OF TOOLING/TASK

Image 05. Service Sub-System of Mass Customisation Formula, Noguchi and Friedman, 2002.  
Updated Mass Customisation Formula, D.Morton 2014.

## IT'S ALL A NUMBER GAME: A DESIGN METHODOLOGY THAT ALLOW CUSTOMISATION WITH THE MINIMUM OF COMPONENT OPTIONS.

The methodology that allows customisation with the minimum number of components was developed by Noguchi and Friedman in 2002. This formula denoted that mass customisation 'MC' was a function of the products that could be mass produced 'P' and the user interaction in the form of services, which allow these end users to customise the product to their own particular needs. Therefore mass customisation is a function of services and products.

Each of these elements (product and service) is created from a sub-system that stems from a complete systemisation of the mass custom process. The conceptual model for the services and user interaction is a merger of 'l' location, 'p' personnel and 't' for tools. The location factor is included in the services sub-system as it forms the input of the location for user interaction when customising the house design. This interaction may be held in the office of the home supplying or designing company. However, the increasing trend for interactions is remote, often via internet based websites. The personnel factor 'P' allows for the inclusion of the role and impact the sales team have on the level of customisation chosen by the end user. This factor will be significant when the sales personnel carry out their role effectively and explain the variations and options available to the end user. This factor includes some element of 'tools' however these are limited to the role they are providing as these tools would include brochures, web sites and allow the levels of customisation to be fully understood by the end user. The tools 't' factor may include the catalogue and web pages of the personnel factor.

However, it would also include signification elements to assist in the end user immerse themselves into the services available. This immersion can include full size prototypes, 3D visualisations' and augmented reality devices. Therefore, it can be seen below that the original 'MC' formula is derived from a function of six sub-systems. This allows for complete systemisation of the mass customisation approach. The product factor comprises of four sub-system factors that consider the interior and exterior components of the mass customised house and include the volume of the dwelling and variable options on components that would be fitted in the latter stages of the construction sequence such as kitchen and bathroom fittings.

Therefore the sub-system, in the BoKlok house types has spatial limitations that were



ORIGINAL 'MASS CUSTOMISATION FORMULA (Noguchi and Friedman, 2002)

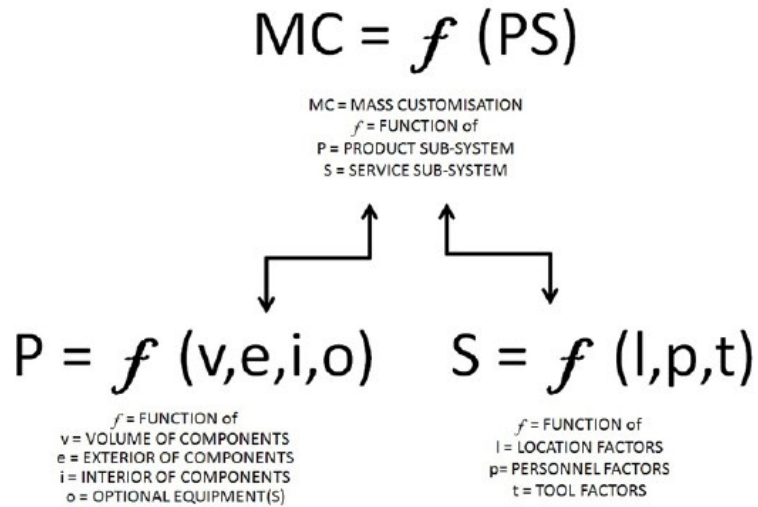


Image 06. Sub-Systems of Mass Customisation Formula, Noguchi and Friedman,2002.

ORIGINAL 'MASS CUSTOMISATION FORMULA FOR PRODUCT SUB-SYSTEM  
 (Noguchi and Friedman, 2002)

$$P = f(v,e,i,o)$$

$f$  = FUNCTION of  
 v = VOLUME OF COMPONENTS  
 e = EXTERIOR OF COMPONENTS  
 i = INTERIOR OF COMPONENTS  
 o = OPTIONAL EQUIPMENT(S)

UPDATED 'MASS CUSTOMISATION FORMULA FOR PRODUCT SUB-SYSTEM  
 (Morton, 2014)

$$P = \left( \frac{S}{C_s} + Re \right)^{Sh}$$

S = SERVICES (TYPES & COSTS)  
 $C_s$  = SIZE OF COMPONENTS  
 Re = REPETITION OF COMPONENTS  
 Sh = SHARING OF COMPONENTS

Image 07. Product Sub-System of Mass Customisation Formula, Noguchi and Friedman, 2002. Updated Product Sub-System of Mass Customisation Formula, D.Morton 2014.

not considered in the original Noguchi and Friedman formula. However, customisation can still be achieved in the manipulation of the dimensions of these spaces to allow for custom arrangements of the floor plans to suit individual end user requirements. The exterior components have been designed and dimensioned to co-ordinate with a large number of 'options' for internal layout. These components can then be selected by the end user to enclose their desired plan in standardised structural wall panels, prior to choosing the exterior cladding options.

The study has shown that there is a potential hybrid of Noguchi and Friedman's formula when BIM is utilised in the formation of a mass customised home. The product sub-system is now influenced by the potential of sharing components within larger areas of the design, without impacting on the levels of customisation. The repetition of elements and details for services is also possible when BIM is used to consider higher levels of design investigation. Therefore, this study has shown that Noguchi and Friedman's formula, published in 2002, had considered and established a comprehensive systemisation for the mass customisation approach. Updating this formula using BIM to create an enhanced level of systemisation.

The current trend for a potential home owners to opt for a design build and construct route that sees them take a key role from inception to completion started in the UK in the 1970s with early pioneers such as Walter Segal. The first Segal scheme was constructed in Lewisham. Three small sites, that were not deemed applicable for mainstream housing were offered to Segal to allow for the construction of houses using Segal's self-build approach. The paradox of mass customising has considerable potential impact on the affordable housing market. Customisation with only minimum component options is somewhat of an architectural panacea but also a paradigm. The level of customisation adds to the richness of possibilities for the home owner, whilst the increasing levels of customisation require increased levels of complexity. These are common constraints of a mass custom approach. The system takes its name 'BoKlok' which translated from Swedish means 'Live Smart' from its ability to be changeable and react to changing needs. It is a system that allows for a complete structural envelope for dwellings to be created from a timber panel system that can be constructed in either open or closed format. Timber panel systems on the market today are of these two derivatives 'open' or 'closed'. As the names suggest, they differ in the fact that one of the panel systems is manufacturer without an internal closing element (usually plasterboard or similar). This allows the dwelling to be constructed from the panels whilst retaining the flexibility of changes

UPDATED 'MASS CUSTOMISATION FORMULA (Morton, 2014)

$$MC = \left( \frac{S}{C_s} + Re \right)^{Sh} + \left( \frac{d_m + d_p}{T_r} \right)$$

S = SERVICES (TYPES & COSTS)  
C<sub>s</sub> = SIZE OF COMPONENTS  
Re = REPETITION OF COMPONENTS  
Sh = SHARING OF COMPONENTS

d<sub>m</sub> = DISTANCE TRAVELLED BY MATERIALS  
d<sub>p</sub> = DISTANCE TRAVELLED BY PERSONNEL  
T<sub>r</sub> = REPETITION OF TOOLING/TASK

Image 08. Mass Customisation Formula, Noguchi and Friedman,2002. (Image: D.Morton)

being made during this programmed construction period. Such changes may be altering plug socket positions, heating pipes or other services. Whereas the closed panel, as the name suggests is fully completed in the factory, with all socket and switches located in position on the internal board of each wall panel. The latter system creates a faster mode of construction, whilst the former creates maximum customisation.

Most timber panel systems have a large variety of panel widths, and a small number of panel height variants. This number of options is controlled in the BoKlok House system, never the less the system is very versatile and can accommodate a large variety of dimensional tolerance in variations from the mass customisation approach. The overall build-up of each panel has been design to allow for the need to adapt to a variety of external cladding options. This has been achieved by coordinating all of the panel widths to brick sizes as a base dimensional size. This allows the system to co-ordinate with a large array of external materials, rendered block, tim-ber cladding and rain screen systems. The system allows for eight external panel types. Three of these are full height wall panels, the remaining five are variations of infill panels the accommodate options for window positions and arrangements within the façade.

#### THE SMART-WRAP APPROACH: AN ENVELOPE DESIGN METHODOLOGY THAT IS ESTABLISHED VIA INTERIOR SPATIAL CONDITIONS.

The concept of the Klok-wrap or 'smart wrap' approach to the BoKlok House focused on the cost effective balance between the external surfaces of the interior spaces to yield the most flexible spatial core with the minimum exterior surface area. The affordable housing market has a number of key drivers that dictate size, layout proportion and types

of materials used in the delivery of housing in this sector. The methodology was aimed at the ability to create systems for internal layout and exterior construction that achieved the greatest code/ regulation compliance or accreditation in Europe. The design approach for the BoKlok House Project does not align itself with the recognised approaches of panels system in general, that of production, semi-custom and custom. The concept of the panels interconnectivity and flexibility affording the system alignment with the mass-customisation approach or mass custom design. This is the result of three basic design elements for housing; the overall volume, exterior and interior as stated by Noguchi (2001). The utilisation of daylight was an important consideration for the design. The concept originated from the Scandinavian housing market, where the internal spaces are design to maximise the extent that daylight penetrates the internal volume of each room. The term 'leading to light', which also originates from Scandinavian home design, is given when the architect positions the internal doors and fenestration on the external envelope to align directly. This alignment affords the end user the view of external spaces surrounding the home and emotional connection with the surroundings whilst still remaining inside the home as they open the door and enter a room. This direct visual reference with external space is further enhanced by utilising higher ceiling heights for all internal spaces. In the UK the standard ceiling height is 2400mm, whereas the ceiling height in many Scandinavian homes is 2700mm (+/- 50mm).

The use of prefabrication was exploited to minimise onsite waste and improve overall quality of the final product. When logistics, planning and design drawings have been completed and agreed prior to commencement, then construction times can be reduced by 20-30%. The re-search project was commercialized. Standardisation of the building components (notably the windows and doors) have been exploited to minimise overall cost per dwelling. Research carried out within the BoKlok House Project suggests that development(s) of over 100 homes, using this off site manufacturing method, can achieve cost savings in excess of 8.5%, and reduce the overall construction programme for traditional UK building techniques from 21 months down to nearer 12 months, whilst also increasing the useable area of the site by 29%. The system, if used for a typical site of 100 dwellings, the first home may be ready within 100 days, after which point the hand over rate would be 4 to 6 dwellings per week. Therefore allowing the home owner to choose from this standard library of components to assemble their own grand design. These components are in turn mass produced, whilst the choice and final combination of these is completed by the home owner/ self-builder. The combinations of these choices from the standard components of the Chameleon House system make each home customised. This concept therefore follows the design methodology and concept termed 'mass custom

house' developed by Noguchi in 2002.

## A SUM OF THE PARTS: THE EFFECTIVE DELIVERY OF MASS CUSTOMISED HOUSING

The system of perimeter external wall panels for the BoKlok house types was designed to allow for dimensional alignment with the possible variations in internal arrangements of rooms. The internal systems of room parameters and circulation zones were assessed in terms of geometries and potential characteristics of layout. This internal arrangement of spatial geometry was then aligned with the external modularisation of panels to allow for adaptation of location and sizes of the external wall panels. The system uses a standard kerto beam to the perimeter of the floor zone to receive the floor cassette. A kerto beam is a laminated veneer beam that can be formed into structural components such as beams, frames, roof and floor elements within a timber framed building. This detail was chosen for its simplicity and cost effectiveness. This use of a cassette floor also allows for maximum flexibility in terms of locations of ground and first floor internal partitions, as the floor cassette spans from external wall to external wall with no physical loading taken by internal walls. As a result the system allows for complete open plan living as an option if required by the home owner. The rules of the system for both the internal spatial options and associated components were aligned with the rules for the external envelope panels. Each was identified calibrated and encoded into the overall housing system.

Each panel of the external walls was then constructed in SketchUP and Revit to ensure a BIM compatible component. Each external wall component was coded and then used in varying combinations to assess flexibility of wall runs against the criteria of internal special options and external cladding choices. It was envisaged that the number of wall panels could be made smaller, but after trialling various combinations of internal layout, it was found that a minimum of five external panel widths were required. The components of the BoKlok House System were created using SketchUP and Revit software. Each house types model could then be interrogated for data, in terms of numbers of components, elements which can then be used to develop simple costs analysis. Utilising the potential of the BIM software the components were imported into Revit to trial build a basic two bedroom dwelling. From this model 3D representations could be readily extracted and rendered. The components could also be counted and listed in terms of a basic schedule, from which basic costs could be applied. These stages used BIM to enhance the ability for the home owner to assess affordability and then redesign or customise the dwelling further.

Such an approach could also be used on a much larger scale and allow for developments of large numbers of dwellings that could achieve levels of customisation.

## THE STUDY'S FINDINGS AND FUTURE CONSIDERATIONS

'Quantitative advances of this magnitude create qualitative shifts', Davis (1987). These shifts are currently being used to engage with problems of leaner and more cost effective segmentation of the design components, in order to deliver better results. However, such advances have and will lead to better constructional detailing, increased quality at a level of affordability not previously achieved.

### Discussion Point 1:

The domestic dwelling as an archetype should also consider a new element to the original Mass Customisation Formula, Noguchi and Friedman. That of internal layout and sharing of circulation space, as there is potential correlation between the optimum useable 'room'. This spatial construct to the original formula or that of the updated formula should assess the perimeters of the internal 'rooms' to that of the perimeter of the circulation space. A optimum boundary condition could then be extrapolated from this formula. It would then be possible to ascertain the distribution of doors onto corridors by assessing the resulting spatial distribution of circulation to 'other' room spaces within proposed home design.

### Discussion Point 2:

The systems design conventions that, along with the specification and details that accompanied the panelised system would achieve corresponding compliance. It was found that system allowed far greater levels of design freedom throughout the design and customisation process, without the need to have detailed knowledge of what the design implications were when exploring differing floor plans and elevational options for fenestration and doors. However, it was found that the number of planning options could have been improved with further development of the rules and components on the internal spatial options. Therefore, further extrapolation of the 'p' product and its sub-systems could be a future research area in mass customisation approach to design.

### Discussion Point 3:

During the BoKlok House Project the SketchUP software being used to create the components for use in modelling and exporting to BIM software such as Revit. This has

created a greater array of possible compatibility and ready integration of the components to be used in other BIM related software. This step change in compatibility has created a series of additions to this project that originally were not considered. There is now an increasing diversity of compatible software such as BIMx and 3Dvega. Both of these products are available as apps to which the end user can upload the SketchUP components. At the conceptual level it facilitates exploration of solutions and allows these to be readily understood.

#### Discussion Point 4:

Although the study used Revit, its capacity to explore the components parametrically was not included in this pilot. The use of parametric components, via BIM software would greatly enhance the options of customisation to the end user. However, with this greater flexibility comes the need to create far more complex sub-systems. The use of visualisation in the BoKlok House Project facilitating assessment of the proposed design from the assembled components and can be undertaken to varying levels of sophistication. A complete list of components can also be exported to create basic costing for a project. The project did not explore the use of stereo lithographic (stl) files. These files can be created as a direct export from both SketchUP and Revit to create an industry standard 3D modelling file. Used on a 3D printer such as a Makerbot this file can produce accurate 3D scaled models of the proposed mass customised home. Assessment of the design could also be achieved using augmented reality (AR). This follows the earlier studies by Sass and Botha, *The Instant House* (2006) which explored the use of digital fabrication of housing.

## CONCLUSION AND FUTURE IMPLICATIONS

The study has also indicated that such a system could be readily implemented to create mass customisation, however the drawback being the requirement of the designer to create the system and sub-systems from which the design will evolve. The current delivery system of affordable housing does not involve the end user at an early enough stage. The future markets may demand far greater customisation, lifestyle choices today demand far greater options for customisation, this mindset will permeate the affordable housing market and increase the demand for mass customisation in homes. Therefore to capture potential market share, mass custom approach to design and build should be introduced. The use of greater standardisation will allow the end user to directly

assess and select each element of the home. This creates a true mass custom model, in a market that currently dictates a set design with very little option for modification other than fixtures and fittings. Considerable investment would be required to create a greater number of rules to enlarge the framework of differentiated solutions. These systems have many layers of sub-systems which all require testing to ensure they yield varied solutions that are compatible. The systems proposed by this paper are limited but provide a platform from which future mass customisation could be used to realise the desires and expectations of home buyers or prospective self-builders.

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SHARIFAH SALWA SYED MAHDZAR  
AHMAD SHUIB YAHYA

## THREE SPATIAL HOME STRUCTURE PROPERTIES THE GENOTYPE OF MALAY TRADITIONAL HOUSES

*After forty five years in the housing development for the low income group in Malaysia, the effectiveness of the space provisions in the overall design of the households is still the main issue being debated. Understanding on the hierarchy and the spatial properties of each home designed for the dweller's unit seem to be poorly understood by the general house providers and developers alike. Thus, the general low income occupants would simply modify and renovate their homes extensively, 'illegally'. This research seeks for new solutions and directions by adapting the concept of 'three spatial home structure' properties; the underlying principle of home making and development in Malay Traditional Houses. Such a principle is described as the 'genotype' of the configuration of the Malay Traditional House. The Space Syntax permeability map and break-up convex technique of analysis are used to reveal the underlying principle of each house built; unlocking the wisdom of the traditional home making that was lost in modern houses. The incremental infill could then be made possible once the users are familiar with the basic concept of living in occupying their own individual spatial built form.*

## INTRODUCTION: THE SPACE PROVISION OF LOW INCOME HOUSES PREDETERMINED

Much has been debated that the overall layout of the low-cost housing units in urban centres in Malaysia has been unconflicting to the general need of the basic space provision of the occupants. The report made by Ghani and Nor'aini (2006) that focussed on the effectiveness of low-cost housing development in Malaysia found that the one to three bedrooms house layout also hardly satisfy the overall spatial needs of the house owners as well. Such dissatisfactions lead to people moving from house to house dynamically, uncontrolled and illegal renovation to take place and, due to the low budget, some are somehow forced to settle within the cramped and crowded home of his or her own. Quite clearly, social imbalances and disorganised activities in the household as well as the neighbourhood area could be seen from afar - damaging parts of the city landscape.

Along with Hanson (1998), Bellal (2010) also argued that in designing one's home space of living, the main goal one would like to achieve would be the need to optimise the integration of spaces within each household. By connecting and integrating the spatial needs (domestic activities distributed in the household's own space) of the users. It is then possible for the owners to have its own social stability in organising various dynamic activities in each of the household.

Within the context of low cost residence in Malaysia, Mahmud (2010) and S. Mahdzar et. al (2011) found that the goal above has not much been achieved. Responses from the residents mentioned that it is normal for them to adjust and modify the houses they occupy in order to cater to their need according to the individual lifestyle. That said, the recent study by S.Mahdzar (2011) confirmed that the majority of low-cost housing residents simply renovated their homes simply because the living room and the kitchen spaces designed do not fit to their own spatial need. The access is limited, crowded due to the non-existence of space division between male and female domain, as well as having to compromise with encounters, i.e the visitors in their own home. This view is in line with Mahmud (2010), who studied on the renovation phenomenon of low cost terrace houses in Malaysia, and said;

*“Provision of low-cost houses, through whatever approaches, should be treated as providing means... that the owners must be considered as developers who will continue the making of their own house” (Mahmud, 2010; p.63)*

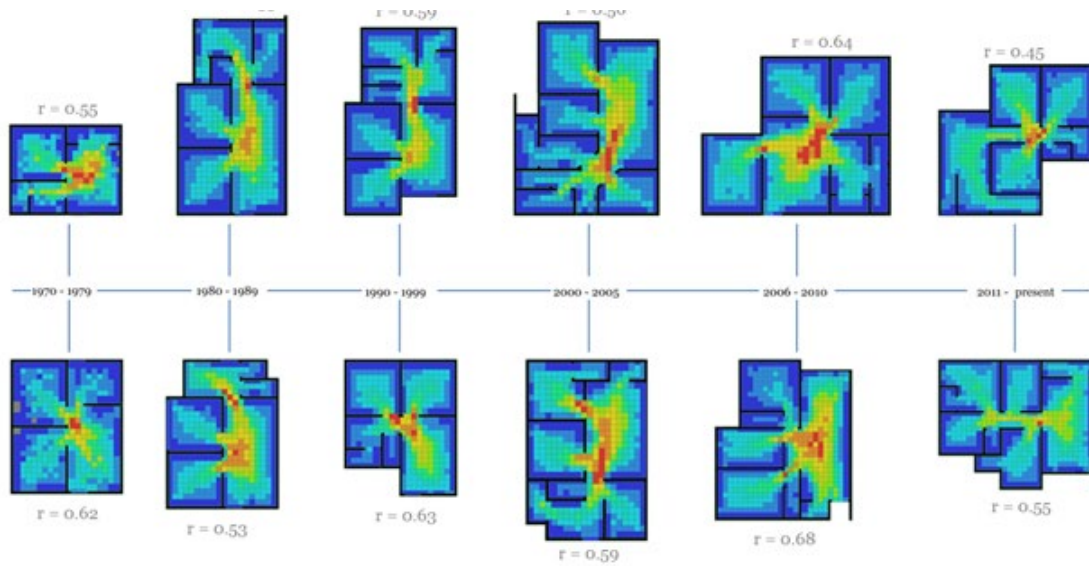


FIGURE 1 : The morphology of current typical low income houses development from 1970 to 2015. (Copyright@Sharifah S. Mahdzar)

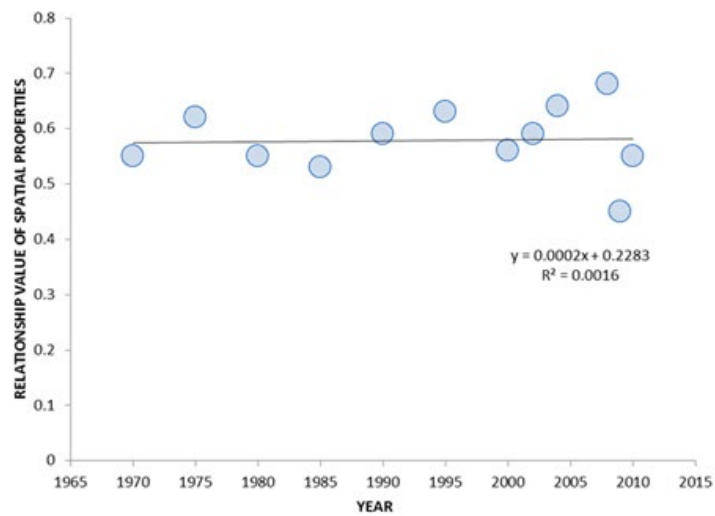


FIGURE 2: The stagnant, unprogressive development of spatial configuration layout for low income houses (Copyright@Sharifah S. S. Mahdzar)

Figure 1 are the basic layout of the low cost housing development ranging from the 1970s until to the present time. The initial graph (i.e Space Syntax analysis on space linkages and movement activities), the 'red areas' are shown within those spaces. It implies that the same route pattern of movement is seen throughout, suggesting that the strict and limited access of a person in one's own home has been controlled and imposed in the plan. The 'controlled' access of route pattern is too straightforward to have any other alternate access elsewhere in the house. Seemingly no options are given to the owners to adapt and hence apply routes of their own choices and convenience in those spaces according to their needs and time, when needed. For example, one might need to have alternative of route to use in one's own home in the need for other convenience or avoidance, such as when encountering visitors in one's own home. Quite understandably that the visitors and host route of access need not to be placed in the same space area.

In response to the analysis above, the scatterplot in figure 2 shows the  $r^2$  value of the spatial properties of the one, two and three bedrooms layout of those houses from the early beginning of the modern housing development to date, have been consistent. Such a consistency in the route pattern of the space provision in the home design could have been pre-predetermined. It implies that the route pattern of the spatial built form of those houses have been stagnant, dormant, seemingly pre-determined with limited exploration on the need to adjust those home plans according to other aspects of the dwellers' needs and lifestyle. It is quite unrealistic to have the same pattern of homes for every household in any circumstances. One should be given alternatives to have the flexibility to adapt one's own space according to one's own need. Ever since, the problem of space provisions of the home provided for the low income group prevails.

The implementation of comprehensive strategies for concept change in the development of the housing units is needed. Through the study of the spatial configuration that emphasises the active search for an understanding of the social system, some changes of the current concept could have an impact on the design space. By doing so, residents will be able to diversify its activities and administer their homes more efficiently.

## BACK TO BASIC: THE MALAY TRADITIONAL SPACE DWELLING UNIT

Yaakub (1996) found that the Malay culture organised their home spaces according to the zone; i.e it is the way the individual organises one's own home according to one's

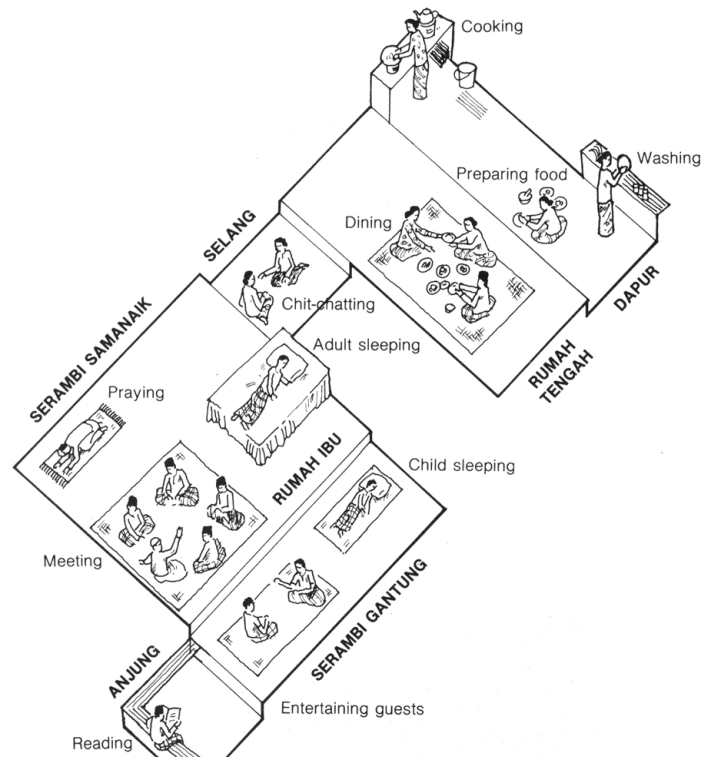


Figure 3. Malay traditional configuration concept. Wan Hashimah (2000)



Figure 4: The portrait of Malay Traditional Houses (Petronas, 2014). <https://www.youtube.com/watch?v=c2iEsf-TkII&list=TL0IfL3nAQUpA>

particular system of zoning (see also Tajuddin et. al, 2000). The particular cultural identity that influences the space they organised is determined by the comprehensive need to protect the overall living from the outside and then to the inside, and the reverse. The consequent protection of the inside household would then take place according to the hierarchical need of the genders. As such, the protection of the women in the house is the top priority. The women domain is and must be located in the middle, i.e in between the male domain (the front) and the family domain (the rear). The front is monopolised by the presence of the male members whilst the middle mainly by the women, and the consequent rear area gathers both the presence of the male and female of the house. The general finding of research by KALAM (Malay Built Environment Research Center, Universiti Teknologi Malaysia) has also found that the social interaction in Malay traditional house is objectively controlled by the arrangement of space that protects women's domain.

Figure 3 and 4 illustrate the inside layout and outside look of the traditional built form of the Malay Traditional House.

*“From the site plan, if we draw it into a piece of paper, we can see that Malay traditional houses are the simple and minimum label of space. In front of their home they call it ‘Serambi’ (Front House) where that space is to entertain the visitor, in the middle (Middle House) a place for sleeping, and at the back (Kitchen House) its quiet segregated but still connecting to the house for their place to cook” (Yaakub, 1996; pp.: 6 cited from Za’ba 1961)*

The writing above was originally from a journalist from China in the 14th century ago describing his experience living in Malay traditional dwelling unit. The writer, assumingly a stranger to the original Malay culture (i.e the home owner), clearly explained the different experience he has had at various levels of spaces in the general configuration of the house. According to Hillier et al (1984), such a mode of experience is sustained by oneself when entering into each domain (or space) by the virtue of structural comparability.

When drawing the ‘experience’ above on a simple two-dimensional map, figure 5 a and b, further illustrate that the middle zone (the women's domain) is the most honourable within the whole system of the organisation of the Malay traditional home. To get into the front zone, strangers must remove their shoes and wash their feet.

When entering the domain, the spatial arrangement of furniture, seats and tables are



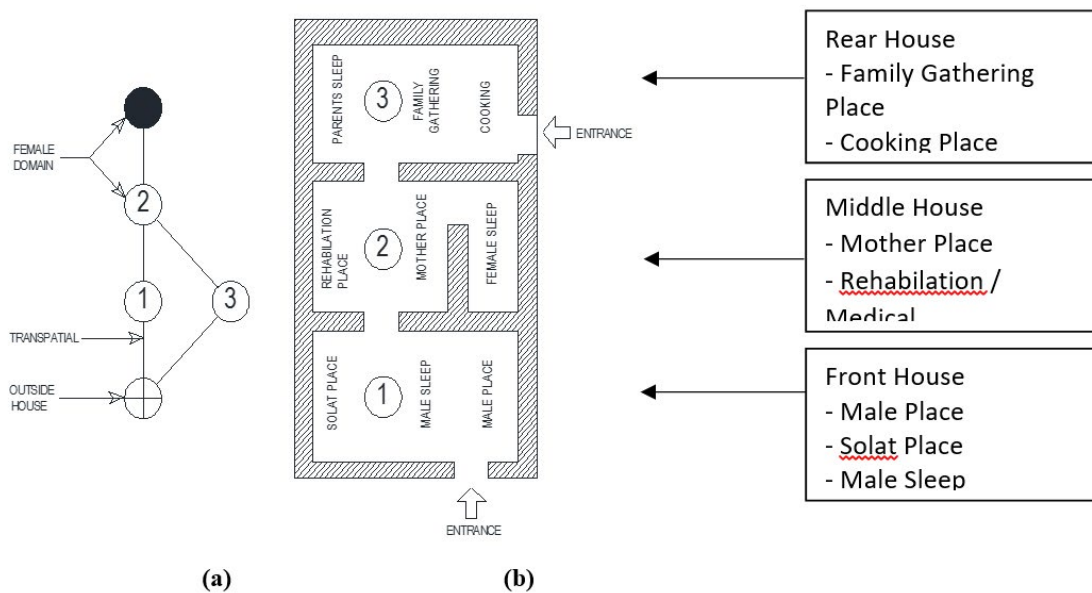


Figure 5: The concept of the three general spaces in Malay traditional house approach in crafting the space. (a) permeability map analyses (Hillier & Hanson, 1984) about hierarchy of space. (b) concept diagram to justify cryptic theory from a local researcher about Malay traditional houses space organisation.



(a)



(b)

Picture 6 (a) shows the front home activity distribution in the day time with the presence of visitors. Clear demarcation was placed through the furniture arrangement. Picture 6 (b) shows the night function during when the middle home is naturally 'guarded' by the male resting and sleeping in the front home area (Petronas, 2014)

readily available and welcoming. Figure 6a describes the three dimensional formation of these spatial structural distribution within the front home area. Quite tactfully, though clearly (two-dimensionally) separate yet visible (three dimensionally), the furnishings arrangement is also a signal to the strangers demarcating their limited movement within the house. The space area allocated for strangers only cover about one-third of the entire front zone area. Another two-third of the zone is allocated for male family members to rest.

The sleeping area for the male and the youngsters are located immediately next to the rest area that functions mostly at night (see picture 6b). The co-presence of the visitors in the house is compromised and allowable but with limited access and movement through the entire space of the house. To S. Mahdzar (2008) the 'compromise' arising from the conflict of interest between the movement and stationary activities, could be regarded as the balance that needs to be achieved and integrated between the sociability and accessibility aspects of space.

As earlier indicated, the middle zone is a special room for mothers, daughters and other female members in the family. The space is designed to keep the privacy for women from other non-family members. Concurrently, within this private space, other activities such as attending the maternal care, nursing, rehabilitation and taking care of the sick family members, and the elderly could also take place. In this area, the entire family members can observe the whole spatial home structure properties embedded within the household organisational zoning system.

The rear zone (i.e the kitchen) is the area where most social interaction occur for the family in the Malay home culture. Similar to other cultures, for the Malay family, the kitchen is the place where everyone in the household will come together to eat, cook, chat while drinking coffee in the morning, lunch, afternoon tea time as well as at night for the dinner. The kitchen in the context of the home spatial distribution for the Malay home functions as a 'fortress', a secured space wherefrom the whole configuration of the household organisational system is controlled by. The 'controlled' method only occurs when all family members gather and aware of the other spaces being visible from the front, middle and to the end of the house. However, interestingly, the strangers entering the rear zone from the back entrance would have limited ability to observe the entire space in the household as the rear zone is totally designed as an enclosed space.



FIGURE 7. The two examples of transpatial system configuration graphically. (a) Shallow configuration – Ringingness Type (b) Deep configuration – Tree Alike Type

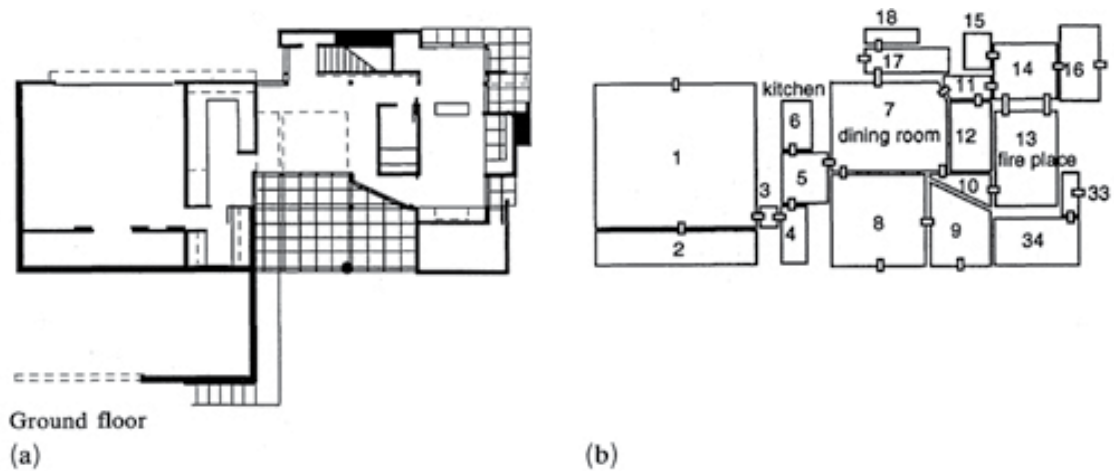


Figure 8: House design by architect Richard Mier Giovannitti , 1967-1969 . ( a ) set a floor plan ( b ) the break-up convex(Hanson, 1998).

## DISCOVERING THE GENOTYPE IN MALAY TRADITIONAL HOUSES

In the process of designing a home, there are many factors that could influence our decision, which is key to conform to the need of the occupants. In this research, we analyse the fundamental aspect of designing the home by using space syntax analyses (Hanson 1984, 1998, 2012). This method offers us many spatial variables related to movement pattern of activities. The analysis concentrates on describing the way the Malay dwellers control their house in the effort to protect the women's domain in the middle part in the overall home system.

Some scholars have seen the significance of this controlling item in the domestic space institution. Joseph (1947) and Paul (1973) saw this control as a potent force in organising, structuring and establishing the social structural order, signifying the idiosyncratic nature of one's own socio-cultural identity. The inhabitant remains as the main controller controlling strangers in their habitat. This scientific research manifests the social phenomenon in this particular aspect of human living.

### *Permeability Map*

Permeability map is a syntactic tool to identify the integration of space graphically (Hanson1994). The graph is drawn from the noticeable entrances that will eventually link to other entrances showing how the living process were embedded within the configuration. The two dominant shapes (see figure 7) usually come out as a shallow configuration, which is the promenade, is recognised as the actual architectural route choice, whereas the deep configuration is more utilitarian and a straight forward one.

The basic configuration (see figure 7a) is an open plan which has more than two entrances, the same as the convex space class 3 and 4. Linkages of the respective entrances of each cell forms the 'ringingness' type of route. As Hanson, (1994) and Stuart et. al (2012), agreed that ringingness has been frequently used as a concept by architects to achieve a dramatic architectural promenade in home design.

### *Convex Space*

Next, the technique of break up convex has been used to rank the convex items identified in the system that affect the value of integrated spaces in the house. This item can help

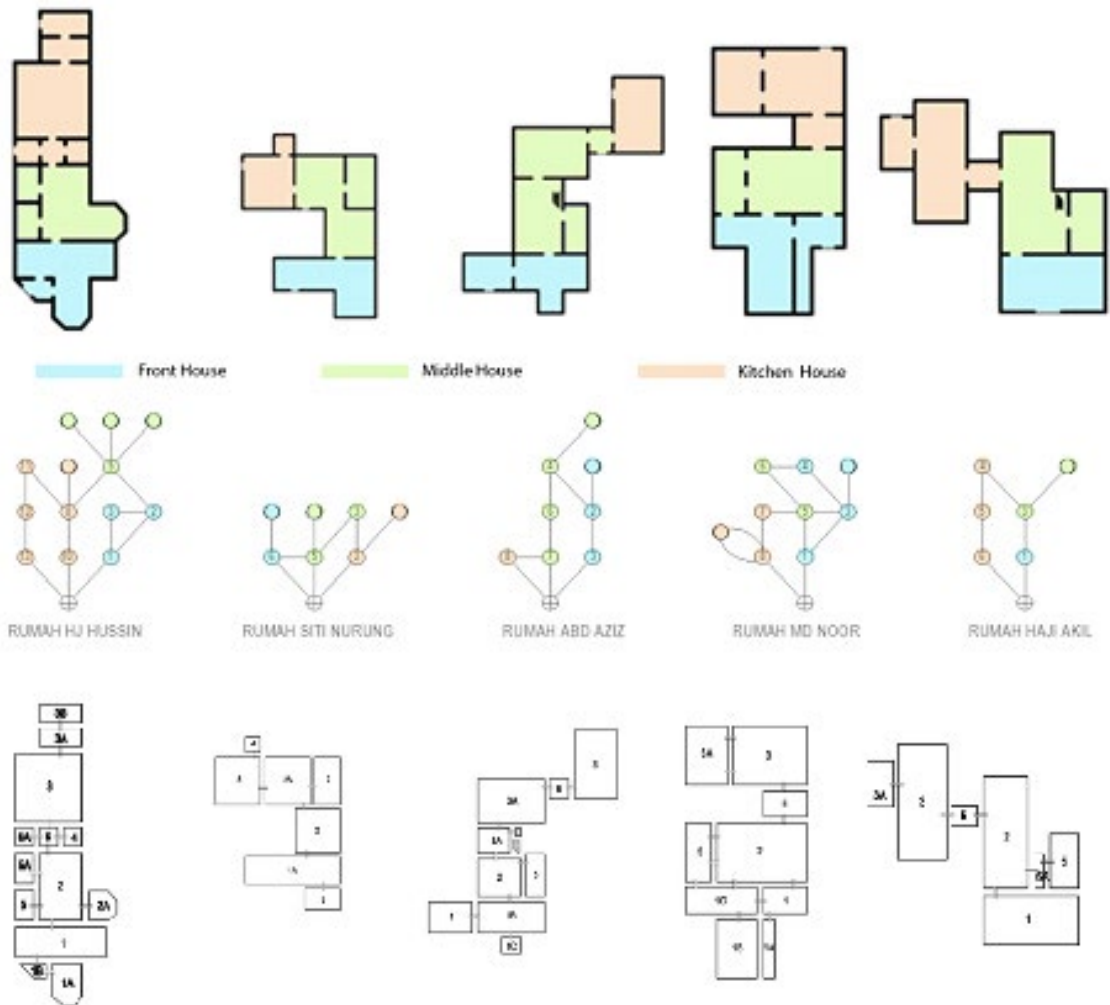


Figure 9: The syntactic analysis of Malay Traditional Houses. (a) The three home of the house that categorized by colour code. (b) Permeability map of each sample of the house. (c) the break up convex space.(Copyright @ Sharifah Salwa Syed Mahdzar)

residents to visualise the dynamic concept of the organisation of activities they perform (reading, sleeping, eating, watching television and so on). These syntactical analysis of the spatial configuration has been used to discover the modern concept of the house (Hanson, 2012). This requires empirical values to be manipulated for statistical analysis in finding the relations between space and humans. Figure 8 shows the example of the result of the total amount of space that integrates the shape of a building plan that can be considered if space is break up into a series of convex (Hanson, 2012).

### THE THREE SPATIAL HOME STRUCTURE PROPERTIES: PROTECTING THE MIDDLE HOME

Figure 9 shows when the stranger enters the front home (blue colour code), the house controller can observe the stranger's movement from the middle home (green colour code). Consequently, the permeability map in figure 9b shows that the middle home is located in the ringing route of the system. This gives an advantage for the controller to move in the entire house without encountering the stranger. The middle house is strongly controlled by the Kitchen House and Front House. Thus the bedroom has the lowest integration space subset to the high integration space; the high integration space is a high social control (Hillier & Hanson, 1984). Figure 9c further describes the above by the break up of convex spaces in the house whereby no negative spaces are detected. All spaces in the traditional home system is fully functional and utilised.

The middle home, within it, exists both high and low integrated spaces. It is located within the highest integrated route area in the global home dwelling system. It contains more than two entrances and act as the link agent between the men and family domain. Since Islam came, this home zoning system has been made more established (Yaakub, 1996 and Tajuddin et. al 2000).

### CONCLUSION: THE GENOTYPE CONCLUDED

It can be concluded that the middle home is the most honourable space that is guarded and belonged to the top most hierarchical position in the overall concept of the spatial built form of the Malay Traditional house. This particular 'honourable space is not necessarily the most integrated, but instead it is the least one, naturally positioned within

	Rumah Hj Akil	Rumah Siti Nurung	Rumah Muhd Noor	Rumah Abd Aziz	Rumah HJ Hussien	Median
Total number of convex space	6	7	9	8	13	8
Total convex space in front house (FH)	1	2	4	3	3	3
Total convex space in middle house (MH)	3	3	3	4	4	3
Total convex space in kitchen house (KH)	3	2	2	1	6	2
Route pattern	Ringingness	Ringingness	Ringingness	Ringingness	Ringingness	Ringingness
Total Number of entrances from outside to inside	2	3	2	3	3	β

Figure 10. The finding of basic Malay Traditional Houses spatial properties. (Copyright @ Sharifah Salwa Syed Mahdzar)

the ‘protected’ highest integrated route or space. The natural touch of the wisdom of the home making activity is manifested in the way the space is protected by the other two homes, which are the front home (serambi) and the rear home (kitchen). Therefore, the adaptation of the natural layout and configuration of these three built forms of the spatial home structure properties, could be the solutions and be suggested in the development of low income houses.

A concept of middle house, which is controlled by the front and kitchen house constitutes the space design practice that should be carried out in parallel to the development of houses in the modern era. Though the scope only focuses on the fundamental of configuration’s space properties; the permeability and convex space analyses have demonstrated the idiosyncrasy of the Malay cultural identity of the dwelling being.

As an example; through permeability maps; all samples of the traditional have shown the same route pattern formed the ringiness type in the household system. It which has a high integration values that predict the most used route by inhabitants in every day live.

A segregated space for women sleep is located in the lowest integration value but subset in high integration space.(see figure 9 and 10)

The three spatial home structure properties concept with the presence of the middle home must be upheld and applied, in order not to break up the constitution of the whole household system of Malay Traditional House. Such should be reintroduced in the making of home design for the low cost houses for the people.

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AZHAN ABDUL AZIZ  
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SOCIAL CONTACT AMONG LOCAL RESIDENTS  
WITHIN THE SPATIAL PROPERTIES IN LOW-COST  
FLATS CONFIGURATIONS

*This study aim to find relationship between social interaction and engagement could be influenced by spatial configuration of the outdoor spaces that regulate these visual access and exposure. From a sampling pool of 68 low cost walk-up flats in Johor Bahru (NAPIC, 2009), four were selected based on the generic types characterized by circulation configurations (Long, 2007, p. 179). They were screened to control for building height, year of occupation, racial homogeneity, and population size. This study employs UCL Depthmap software to measure the most visually connected points and the least visually connected ones within the outdoor space of each flats block. This will illustrate how the surrounding spaces, as well as the people or activities within them, are extensively visible when occupied. All possible visual fenestrations from the units were considered as possible visual accesses and exposures. Different flats configurations integrate the dwelling units spatially, as well as isolate them among each other. The current trend of reducing spaces close to home, despite the positive intention of providing more privacy, not only affects the social use of the near home space, but also negatively affects the visibility and integration level. The comparison in this study shows that such changes relate to difference in the size of residents' local social network.*

## INTRODUCTION

Provision of urban housing, particularly for the lower income group, has become increasingly critical in Malaysia as urbanization expands, rural-urban migration escalates and the proportion of urban poor enlarges. The zero squatter policy of some state governments added to this growing need for low cost houses. Housing types provided have been shaped by the economic viability and the strict building standard. In urban fringes, walk up flats have become one of the most viable forms of low-cost housing due to the relatively low construction and long term maintenance costs. The type was also considered to fit in better with Malaysian landscape (Tan, 1979, p. 139). The lower density and better opportunity for social encounters and informal social control are also advantageous properties for families with children (Kosman, Long, Abdul Manan, Mohd Tazilan, & Mohamad Rasdi, 2008, pp. 14-15). Understanding social implication of such housing design should accompany efforts to fulfill the statistical demand for housing units. Design of housing should serve as important instruments for social functioning and complementing tools for sound community development (Jamaluddin, 2001; Paim & Yahaya, 2004; Salleh & Yusof, 2006). As economic constraints are decisive in the development of low cost housing, marginal effects of small variation in physical design could help advance social performance of housing. Building configuration not only organizes the arrangement of dwelling units but also provides spaces for routine circulation and domestic functions, as well as supporting casual encounters and interaction close to homes (Abdul Aziz, Ahmad, & Nordin, 2012). Subsequently, such active outdoor space would influence the extent to which the residents are connected to each other. This comparative study investigates the influence of basic residential building layouts of flats on the development of local social network among the residents. It explores any probable relationships between two of the major attributes of building configuration, namely visibility of outdoor near home spaces and connectivity among the units, and the block level size of local social contacts among residents.

Insufficient space in low-cost dwelling units renders the surrounding outdoor spaces as an important extension of the homes (Abdul Aziz, et al., 2012; Abu-Ghazze, 1999; Klaufus, 2000). Home boundary also extends into the outdoor where relationships and opportunities are available for one to invest care and attachment (Mee, 2009). Recurring informal encounters in the outdoor and the resulting familiarity promote collective actions in a community which is displayed in the individual actions in public, such as the contribution to curb appeal and collective participation (Adriaanse, 2007). Abu Ghazze (1999) found



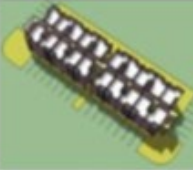
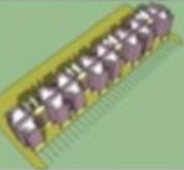
	FT-1	FT-2	FT-3	FT-5
Near Home Outdoor Space Characteristic	Open corridor with large central court	Open corridor with narrow air well	Single internal corridor	Cluster around staircase
Block configuration				
Year of occupation	1998	2002	2000	2000
No. of units per block	80	80	80	64
Nett Density (units/acre)	30.76	39.02	45.45	47.06
No. of units per floor	16	20	20	16
% of majority ethnic group	86%	84%	72%	76%

TABLE 1. Summary of selected flats types

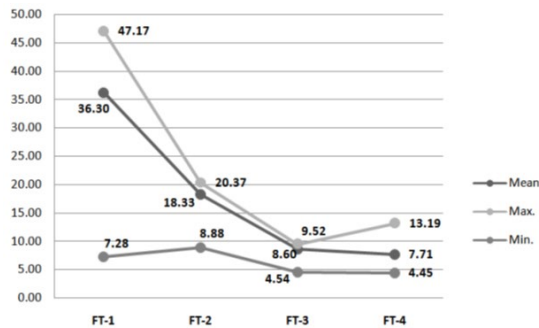


FIGURE 1. Visual integration of outdoor near home spaces

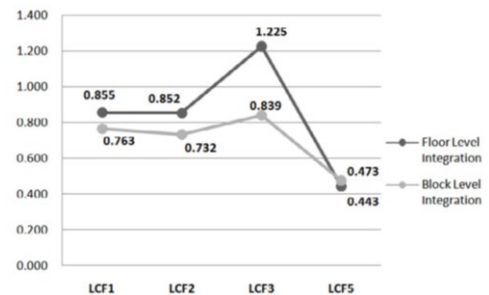


FIGURE 2. Integration among dwelling units

that near home spaces often substitute large open space for social functions as people value opportunities to walk around their homes and sit in small groups forming local friendship and nurturing existing relationship. Therefore, it is necessary to pay attention to outdoor near home space to understand how favourably local community environment or social climate develops and sustains.

Spatial conditions of the outdoor space, including visibility and spatial arrangements are also seen as important factors influencing decision of residents to engage in interpersonal interaction or avoid the events or people in the surrounding environment. People behaviourally adjust to the surrounding events and activities based on the ability to monitor surrounding activities increases and to gain awareness of emerging behavioural opportunities (Archea, 1999). Arrangement of the physical environment regulates the distribution of the information upon which these behavioural adjustments depend. Regulation of interpersonal behaviour is influenced by the possibilities for monitoring the behaviour of others (access) and by the possibilities that others can monitor one's own behaviour (exposure) (Archea, 1999, p. 8). Thus, social interaction and engagement could be influenced by spatial configuration of the outdoor spaces that regulate these visual access and exposure.

A number of studies, in different contexts of residential environment, indicate the strong possibility of relationships between visibility and integration and the local social relations. Residents in more segregated dwelling units within a high rise block, particularly those in the top levels, had less opportunity for spontaneous social encounters which was also reflected in the smaller size and spread of their social networks (Raman, 2010). Visibility in housing areas becomes important means for a community to monitor each other's behaviours (Amster, 2008, p. 176). Proximity of dwelling units, as well as visibility of plazas, organize co-awareness and co-presence within the community which promoted, as well as controlled, social encounters (Beckwith, 2010). Higher visibility among the dwelling units could also help enlarge the size of local social network among the residents in similar environment (Raman, 2010). Nonetheless it is not known how the relationship could be affected by different configurations in low-cost housing context.

Social interaction in the context of neighbouring includes neighbour recognition, knowledge about one another, socializing, friendship patterns and mutual aid & reciprocity (Bridge, Forrest, & Holland, 2004). Being aware of fellow residents, knowing them and developing neighbouring relationships are important factors in the development of sense

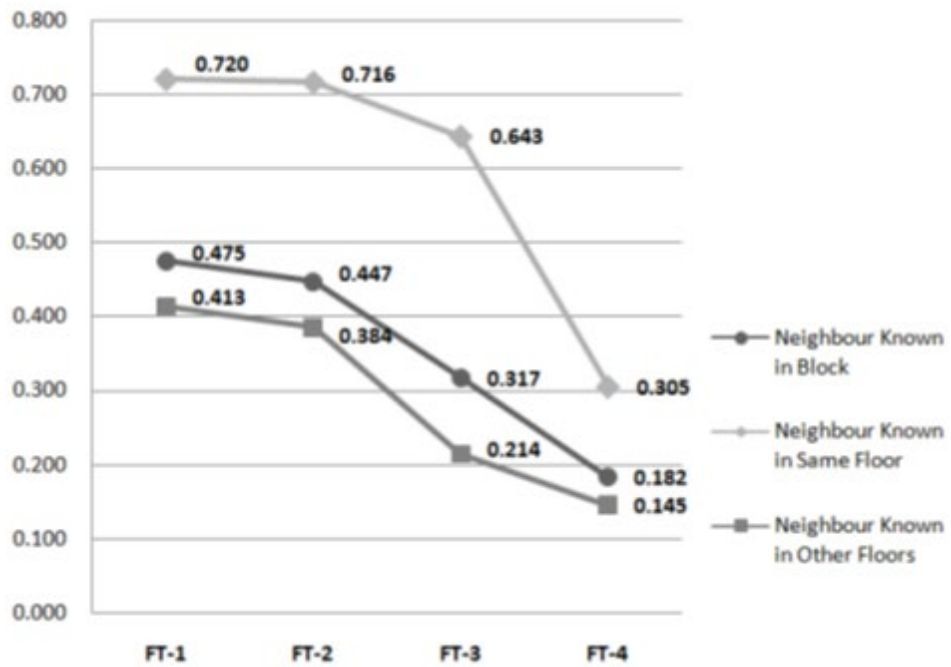


FIGURE 3. Mean scores for neighbors known

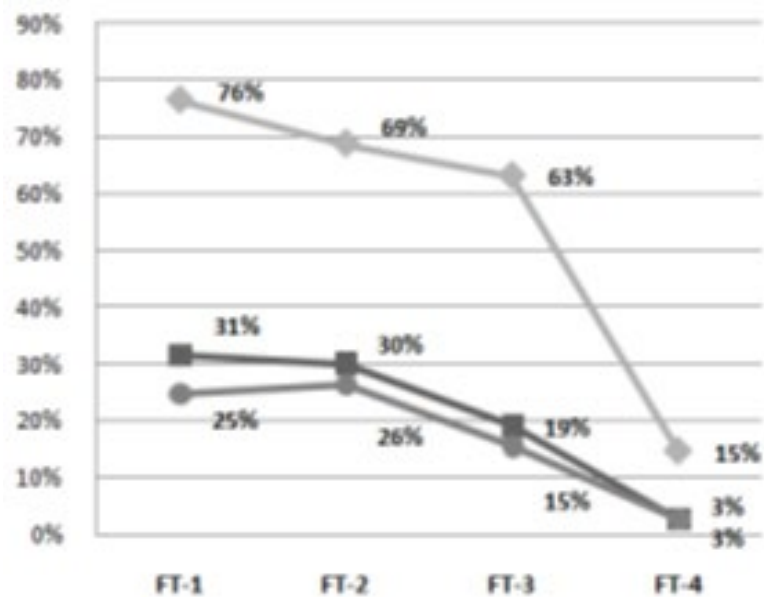


FIGURE 4. Recognizing 60%-100% of neighbors

of community (McMillan, 1996). Friendship formation and awareness of the others' presence also helps develop the residents' sense of belonging and generate potential local social support. Engaging with neighbours strengthens the feeling of vernacular village where the residents originate and return to occasionally (Bay, 2004; Chang, 2000). Potential social contacts in daily routine at a local level are still significant as a factor of the richness and vitality of social life despite the current advancement in information and communications technology and private transport (Argent, 2008).

Area around the residential block serves as suitable units for analysing residential social contacts as it involves daily mundane activities generating repeated exposure and encounters, casual surveillance, and shared norms at the block level found to affect residents' social and physical attachment (Taylor, 1997). In housing, the house and the exterior spaces are physically and socially interconnected. Such potential social contact and the resulting potential social support are particularly important in low income residential area (Boyce, 2006; Mee, 2009). Formation of friendships and emotional connections among local neighbourhood members begins through knowing others. In this context, social network analysis presents unique analytical approaches and methods commonly used in planning to examine the formation of social contacts among residents (Dempwolf & Lyles, 2011).

## METHODOLOGY: VISIBILITY AND INTEGRATION VALUES

From a sampling pool of 68 low cost walk-up flats in Johor Bahru (NAPIC, 2009), four were selected based on the generic types characterized by circulation configurations (Long, 2007, p. 179). They were screened to control for building height, year of occupation, racial homogeneity, and population size (Table 1). FT-1 is a u-shaped single-loaded open air corridor type with units on ground level forming an open court occupied by parking. In FT-2, two rows of unit face each other across a central vertical air well that provides light and ventilation. In FT-3, a single internal corridor runs between the two rows of facing units. FT-4 represents the most recent flats type containing clusters of units organized around staircases and minimal corridor space. All areas contain six blocks five-storey flats. However, covered common courts occupy the ground levels of FT-3 and FT-4. The sequential organization of the type (FT1 FT-2, FT3 and FT-4) relates to a number of theoretical and hierarchical relationships between the FTs for the purpose of this comparative study. In terms of the development period, FT-1 is the earliest form



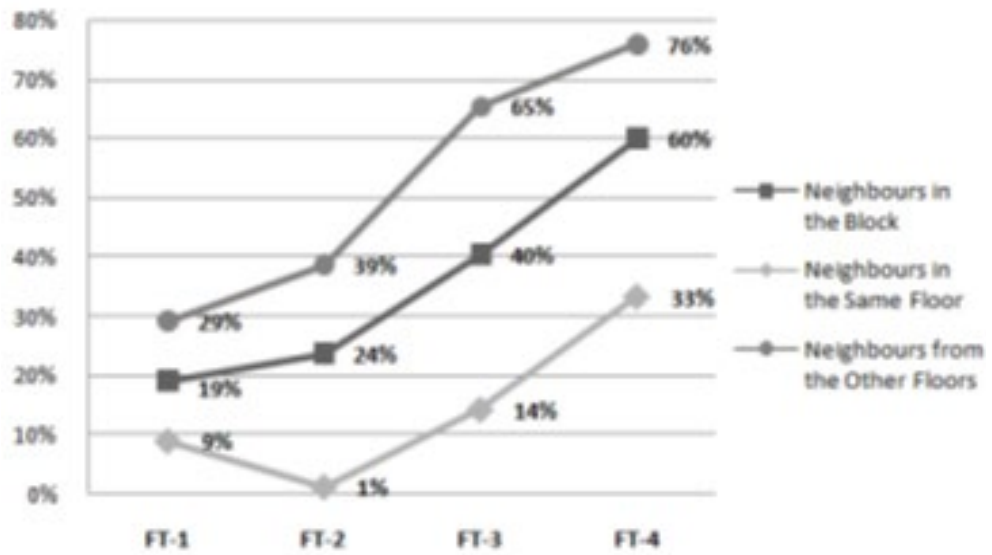
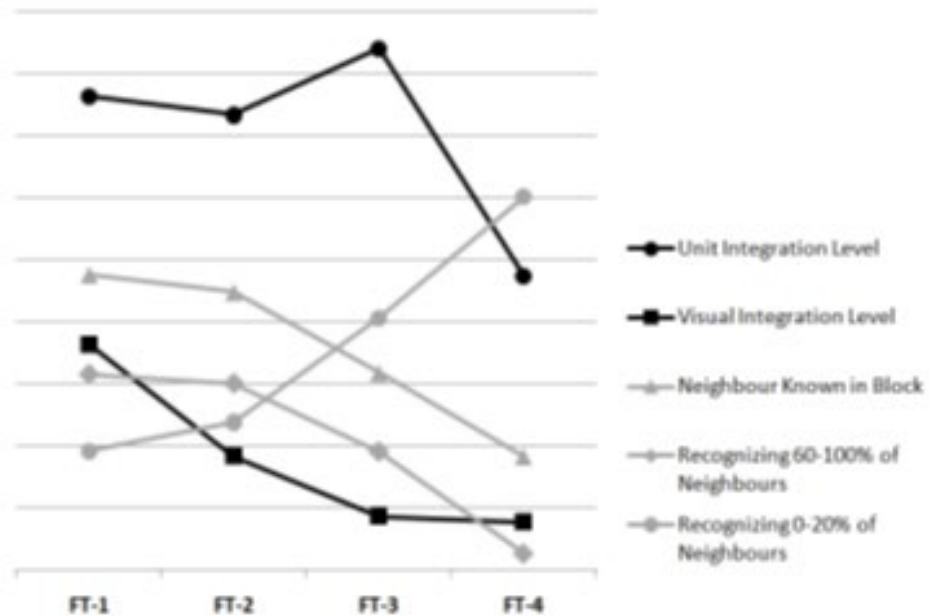


FIGURE 5. 0-20% of neighbors



of walk up flats (Long, 2007). On the other hand, FT-4 represents the most common and recent form of low-cost flats comprising 60% of all housing sites in Johor Bahru. FT-2 and FT-3 represent the sequential reduction in the near home space (corridor) as well as decrease in openness or exterior exposure as we progress from FT-1 to FT-4. The block footprint areas also shrink as we move from FT-1 to FT-4, which increase the nett density (Table 1). Privacy is also increased as we move from FT-1 to FT-4 (Long, 2007, p. 214). In sum, the hierarchical organization of the FT-1 to FT-4 represents the increase optimization of space and privacy.

Visibility graph analysis evaluates the visual interrelationships of all potentially occupied points in a space (Turner, 2001). This study employs UCL Depthmap software to measure the most visually connected points and the least visually connected ones within the outdoor space of each flats block. This will illustrate how the surrounding spaces, as well as the people or activities within them, are extensively visible when occupied. Such measures demonstrate how the occupants are able to be seen by others or are able to be aware of others while in the space such that one's presence could be socially significance (Peponis, Wineman, Rashid, Bafna, & Kim, 1998). A visual level at the height above 900mm was taken to consider railing obstruction, and the grids were set at 600mm intervals. All possible visual fenestrations from the units were considered as possible visual accesses and exposures. Different flats configurations could possibly integrate the dwelling units spatially, as well as isolate them among each other. Series of convex map graphs would indicate mean measures of distance among the units in terms of the number of the convex spaces that existed between them (B. Hillier & Hanson, 1984; B Hillier, et al., 1987). These measures would describe, in other words, how deep or shallow the units are to one another in terms of spatial distance instead of physical distance. UCL Depthmap also generates convex maps to measures spatial integration among the dwelling units within the floor level as well as the whole block level. Low integration value indicates that the units were more isolated from one another.

Network mapping was used to measure the residents' social contact size in their respective blocks. On the floor plans of their blocks, respondents identified locations of: 1) their own units, 2) their neighbours with whom they have familial relationship or working relationship or whom they presumably know prior to moving to the current location and, 3) their neighbours whom they know by name after moving to the current location. The size and distribution of social network were examined using the average scores within three spatial boundaries: 1) the same floor, 2) the other floors, and 3) the whole block.

Mean number of known neighbour acquaintances and neighbours the respondents could recognize within these different spatial boundaries were used as indicators for the size of local social contact. The data was normalized according to the actual number of occupied units in the respective blocks. A total of 328 residents, aged between 25 to 55 years, participated in the survey comprising 89 in FT-1, 80 in FT-2, 84 in FT-3, and 75 in FT-4.

## RESULTS AND DISCUSSION: SOCIAL CONTACT AMONG LOCAL RESIDENTS

The overall outdoor near home spaces of FT-1 displayed the highest mean visual integration value of 36.30, which ranged from a minimum of 7.28 to the maximum of 47.17. The flanking corridors contained most visible spaces with high visibility values. Nonetheless, the central corridor displayed a slightly lower range from 33.55 and 38.06. In contrast, the elbow spaces connecting the middle staircases, the wing corridor and the central corridor contained spaces of the lowest visual integration values ranging from 29.02 to 10.45. FT-2 showed a lower mean visual integration value (18.33) as well narrower value range (8.88-20.37) when compared to FT-1. The middle areas of longer corridor contain spaces of the highest visibility measure with a maximum of 20.37. This space was highly visible to the other spaces within the corridors as well as from the dwelling units. All four corner corridors had the lowest average visual integration value of 11.48.

The mean visual integration value of the outdoor near home space was further reduced in FT-3. The single double loaded corridor had a mean value of 8.60. Only small sections of the internal corridor space were visible from the unit openings which were also barely visible from that of others. Nonetheless, having a single central linear corridor, the visual integration value along the corridor was very much uniform (ranging from 8.96 to 9.52). Spaces with the highest visual integration values were the landing areas of the middle staircase, followed by the corridors faced by the dwelling units. The two ends of the corridors had the lowest average visual integration values despite having views outside of the block. The overall outdoor near home space of FT-4 exhibited the lowest overall mean visual integration value (7.71). The corridors recorded a mean value of 8.85. The mean difference was significantly lower even when compared to that of FT-3 ( $t=5.893$ ,  $p=0.000$ ). The four dwelling units attached to the corridor space had no fenestration, except for the front door. There was no visual connection at all between corridors of different clusters, even on the same floor. The minimum value reaches as low as 4.45. Dwelling units in FT-1 recorded a mean spatial integration value of 0.855. Within the

same floor level, the most integrated units were those in the middle corridor (0.990), while those in the two flanking corridors had slightly lower integration value of 0.810. At the block level, however, the mean integration value was lower (0.763). Dwelling units located on the second floors middle corridor exhibited the highest spatial integration value (0.867), while those in the flanking corridors of the top floor were the most isolated units (0.686). Within the floor level of FT-2, all the units recorded the same mean integration values of 0.852. The ring form of the layout could be attributed to this sameness. On the other hand, at the block level, the mean integration value was lower (0.732) with a range of 0.265. The most integrated dwelling units (0.853) were located on the second floor, while those units on the top floor were the least integrated (0.588).

FT-3 recorded the highest mean integration values both within the floor (1.225), and within the block (0.839). Within the block level, the values ranged slightly from 0.777 to 0.884. The single central corridor and the three staircases located along the corridors kept the units closely integrated spatially. Those dwelling units on the second floors were the most integrated ones, while those on the top floor showed the lowest integration values. Mean integration value of all the dwelling units was found to be the lowest in FT-4 both at the floor (0.443) and block (0.473) levels. This indicated that the units were highly isolated from each other. This was due to the disconnected corridors even on the same floor level. At the block level, the integration value range was only 0.81 indicating close similarity among the units. Within the same floor, the units in the end clusters recorded the lowest integration values (0.402), while the most integrated units in the middle cluster showed a slightly higher value of 0.483. In contrast, at the block level, those dwelling units on the first floor of the middle clusters, displayed the highest integration value (0.535), while those on the top level of the end clusters were the most isolated ones (0.413).

Residents in FT-4 reported to having the lowest mean number of people known in their blocks. The results of t-tests analysis indicated that the differences in the distribution of the responses in knowing neighbours in the whole block were significantly low in FT-4 (0.182) when compared to all other flats types. On the other hand, FT-1 displayed the highest score of 0.475. This was significantly higher than those of FT-2 (0.307) and FT-3 (0.266). The mean scores for knowing neighbours in the same floor were higher than the scores for knowing neighbours in the whole block. Overall findings implied that the residents knew almost everybody on the same level. Consequently, there was a greater tendency among them to form neighbouring relationship. Majority of respondents in FT-1 (0.720), FT-2 (0.716) and FT-3 (0.643) knew significantly more of their respective

neighbours from the same floor than those respondents in FT-4 (Figure 3). No significant difference was found between FT-1, FT-2, and FT-3. This suggested that the residents in FT-4 had fewer opportunities to interact with neighbours in the same floor level than those residents in other flats types. This could deter them from expanding their social contacts. The cluster arrangement of FT-4 disconnects the residents from the same floor levels. Overall, the mean scores for social contacts from other floors were lower than those in the whole block and the same floor (Figure 3). The results of the t-test analyses indicated that the variations were significant in some comparative cases. The mean scores decreased as we move progressively from FT-1 to FT-4. Participants in FT-1 showed higher mean of social contact size than those in all other flats types. However, the differences were only significant against those of FT-3 ( $t=4.411$ ,  $p=0.000$ ) and FT-4 ( $t=6.828$ ,  $p=0.000$ ). The low score of 0.384 in FT-2 was not significant when compared to that of FT-1. Both had similar levels of social network size. However, the lowest mean score of social network size (0.145) in cluster type housing (FT-4) revealed that the residents had less opportunity of knowing their neighbours in other floors. FT-3 showed a similar result to that of FT-4 despite the higher score ( $t=1.886$ ,  $p=0.061$ ).

This section analyses the level of agreement among respondents to the percentage of the neighbours in the block that they could recognize without having to know them by names. This determines the extent to which the residents have visual access to their social surrounding (Figure 4). More than 30% of the respondents reported that they could recognize 60% to 100% of their neighbours in the same block in both open corridor type of FT-1 (31%) and FT-2 (30%). Meanwhile, only 19% and 3% of respondents in both FT-3 and FT-4 could say the same. In fact, 40% and 60% of respondents in FT-3 and FT-4 respectively indicated that they could recognize less than 20% of their same block neighbours compared to only 19% and 24% of respondents in FT-1 and FT-2 respectively. This implies that residents in the cluster type flats (FT-4) gain the least opportunity to be visually aware of neighbours. Majority of respondents in FT-1 (54%), FT-2 (45%) and FT-3 (39%) could recognize 80% to 100% of their neighbours on the same floor (Table 10). Two sample t-tests revealed that the differences among FT-1, FT-2 and FT-3 were not significant. FT-2 had the least number of respondents (1%) who were able to recognize less than 20% of their neighbours on the same floor. The score of this compressed open corridor flats was even significantly lower than that of the expanded open corridor flats of FT-1 (9%,  $t=2.220$ ,  $p=0.028$ ). Similarly, the same score was significantly lower than that of FT3 (14%,  $t=3.075$ ,  $p=0.003$ ) which was the double loaded corridor type. Similar test did not show significant variance between FT-1 and FT-3. In linear corridor flats type,

bringing people closer in physical distance, while keeping the high visibility among the units, could possibly improve neighbour relations on the same floor. In cluster type flats (FT-4), 73.3% of the respondents knew less than 40% of their same floor neighbours. In highly visible open corridor flats (FT-1 and FT2), residents generally had greater opportunities to recognize their neighbours from different floors. However, as high as 76% of participants in FT-4 indicated that they could recognize less than 20% their other floor neighbours. The score in FT-3 (65%) did not differ significantly to that of FT-4 ( $t=1.449$ ,  $p=0.149$ ). Meanwhile, in FT-1 and FT-2 respectively, 29% and 39% ( $t=1.209$ ,  $p=0.229$ ) of the participants reported that they could recognize less than 20% of their neighbours from other floors. These findings indicate possible relationship between visibility and ability to recognize neighbors.

The relations of the dependent variables to changes in the different layout designs were significant in some comparative analyses. Spatial analyses conducted established that population density and privacy increase, while the visibility values of the near home space decrease as we progress from FT-1 to FT4 (Figure 5). The subsequent comparative analyses revealed that social contact sizes vary significantly with these configuration changes. Overall, the results showed that the residents knew less of their neighbours, and could recognize less of their neighbours in the same block, as we progress from FT-1 to FT-4. There was more possibility of relation between social contacts and the decreasing level of visibility from FT-1 to FT-4 than the changes in unit integration values. Possibilities of visual access and exposure in the residential outdoor spaces could encourage informal social interactions. They could also promote visual or social encounters, which were crucial in the development of social contacts. On the other hand, the mean size of social network shrunk as we move from FT-1 to FT-4. The possibility of recognizing less than 20% of neighbours increased as we move from FT1 to FT4 which indicated an inverse relationship to the visibility values of the outdoor space.

With the growing pressure of land scarcity and low-cost housing demand, coupled with the increasing cost of housing development, most efficient design of flats configuration is increasingly favoured over the earlier open corridor type as found poll sample surveyed. The current trend of reducing spaces close to home, despite the positive intention of providing more privacy, not only affects the social use of the near home space, but also negatively affects the visibility and integration level. The comparison in this study shows that such changes relate to difference in the size of residents' local social network. Nonetheless, such finding should realize the tradeoff between privacy and visibility as

two ends of residential needs that require compromise through design innovations. The study did not imply causative effect of visibility. Social interaction depends on how the residents perceive its importance, and how it would benefit them. However, the study attempted and has shown that, all other things being equal, changes in the configuration has an apparent relation to the change in the amount of social contact and the size of social contacts. While it is acknowledged that physical forms can only condition or fix social relationships when occupants dismiss the importance of such connections, the significant differences in the purposive comparisons shown in this study cannot be dismissed. Even though social activities could happen anywhere, social ties among neighbours are nurtured and maintained mostly through repeated encounters in the outdoor residential environment (Greenbaum, 1982).

The greatest challenge of this study was to acquire perfectly matched comparisons. Careful and thorough selection process was employed in the present study in an attempt to control most of the pertinent compounding variables, such as income level, housing area size, population size as well as the ethnic heterogeneity. Nonetheless a more focused comparison along specific attributes and conditions, as well as inclusion other configuration variations, could improve the comparative analysis and the outcome. Overall, in views of all the caveats, this study emphasizes the possibility the social impacts resulting from designers' selection of flats types. Potentials for social encounters and interactions, which influence social engagement and reinforcement of social relations, seemed to relate to the visibility level of the different flats configurations. In this respects, the configurations of flats blocks affect the visual access and exposure which possibly enhance or inhibit opportunities for social encounters and interactions, and thus, influencing the residents' ability to recognize neighbours and generate social contacts. This was illustrated by the significant variations of social contacts size measured among the four sites. There is possible interrelationship, prompting further correlation analysis, between the level of social network size and the visibility of the outdoor near home spaces as well as the physical connectivity among dwelling units. Understanding the significances of flats configurations and the resulting near home outdoor space could potentially facilitate efforts of local community integration.

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ALICE VIALARD

NEGOTIATING PRIVACY AND CO-PRESENCE  
DESIGN VARIATIONS ON SOCIAL INTERACTIONS  
IN INCREMENTAL HOUSING IN MALAYSIA

*The design of incremental building provides a permanent structure that may at first seem generic and not adapted to domestic living associated with a culture. This chapter focuses on how the decisions made in the design of the non-permanent structure can help in responding to specific social structures by providing variations to negotiate patterns of interactions within the unit and with the outside.*

## INTRODUCTION

Space syntax recognizes that social structure is embedded in the configuration of spaces (Hillier and Hanson 1984). The way we design our housing carries some spatial properties that influence social behaviour. One property of spatial configuration for example is to facilitate encounters or avoidances between people. These are characterized by how the spaces are connected with each other (visually or physically), providing, or not, alternative ways. For this study, we are mainly interested in how incremental building can be adapted to households with different social structures. More specifically the interest is in how their modularity can adapt to changes in these social structures (growth of the family, new functions, prosperity...) while retaining local features that are specific to a culture and a climate. This study shows that small design decisions can help in supporting certain types of interactions: interactions within a unit with pattern of co-visibility and co-presence which facilitate interactions between people, or interaction with the outside by moderating levels of privacy.

These design choices can be made in the design of the floorplate and how the permanent structure relates to the voids for access and ventilation. It is also in the subdivision of the floorplates into units with the placement of partition. The first part then introduces the different methods used to measure formal and spatial properties to compare the different design decisions at the level of the floorplate. A second section focuses more specifically on the design of the unit and where the modular panels are placed in relationship to the permanent structure, with their position changing the perception of space. Finally, it is shown that outdoor covered spaces are keys components to the idea of increment by providing provisional space for future growth. They also act as buffer with the outside and play a role in social interactions within the household.

## CASE STUDY: AN INCREMENTAL BUILDING IN MALAYSIA

The selected building on which this study is based has been developed by a group of architects to adapt to the culture and climate of Malaysia by including traditional features such as air-wells and drying yards<sup>1</sup> that play an essential role for natural ventilation. These

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1. "They are primarily used as a backup space for the kitchen; using an extra set of gas ranges and sinks." (Seo 2016)

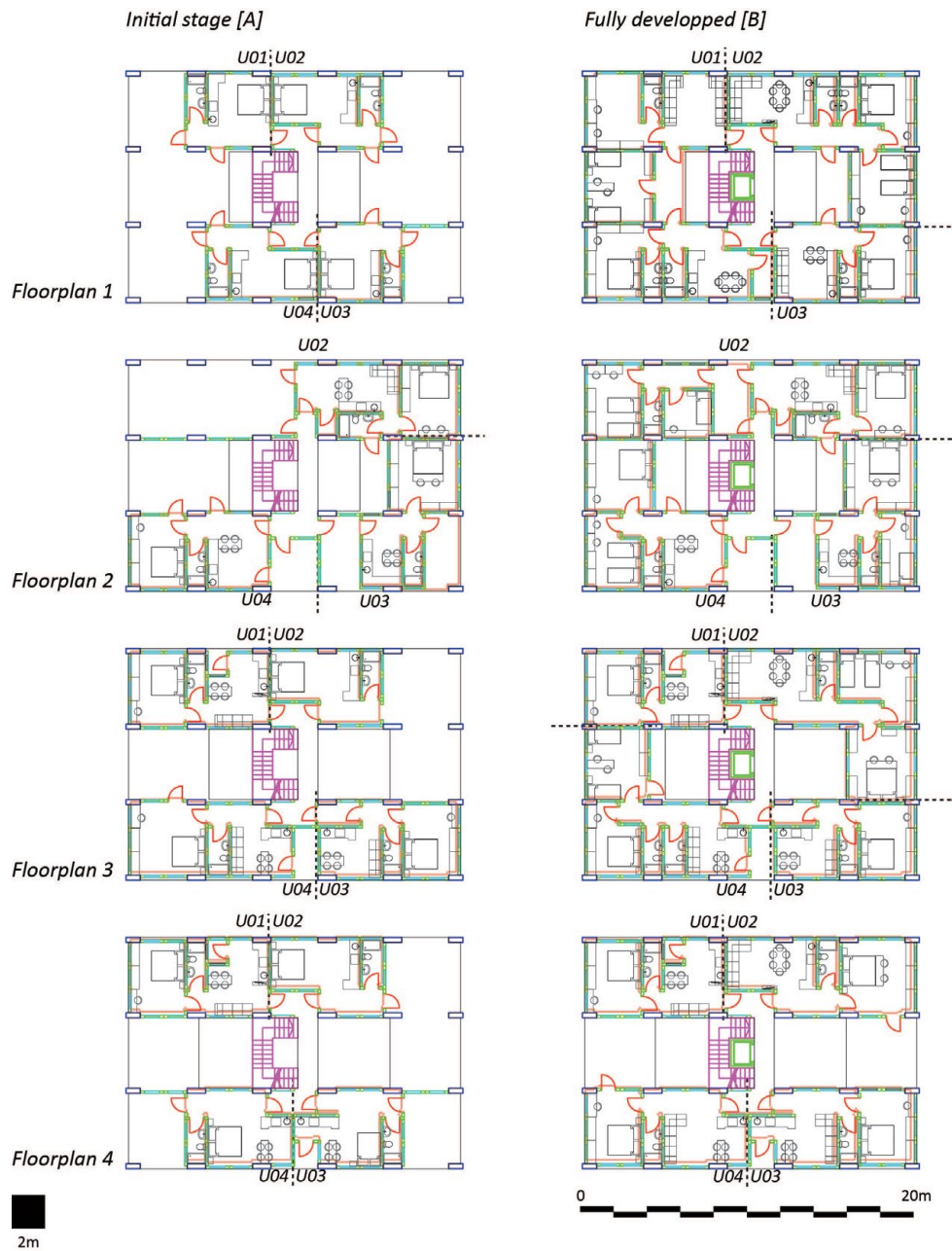


FIGURE 1. Plan for each unit with suggested interior layout with furniture: initial stage [A] on the left and the fully developed plan [B] on the right.

features are also related to domestic living in Malaysia where collective life requires fairly open design (Seo 2016). The other aspect of the design is its incremental properties and a certain flexibility in its partitioning with a permanent structure that is minimal. The building is to provide for the initial stage basic units – in this case 15 in total with 3 to 4 units per floor – with various sizes, number of rooms, and types of room. As incremental building, the same unit can grow and adapt over time to accommodate new function or new member of a family, which add 14 new layouts – on the 1st floor, two units are combined into a single one. Overall, the building provides a total of 29 units over two stages, which embed in their design various properties. The plans for the initial stage [A] and the fully developed version [B] are presented in figure 1.

The most basic unit is made of a single room with a bathroom in which case kitchen and bedroom functions are located in the same room. The second basic unit has two rooms and a bathroom, in which case cooking and sleeping functions are physically separated. From initial to fully developed, several processes are applied to these units. In the 1st floor, Unit 01 and 04 are combined to create 3 bedrooms, 2 bathrooms, a balcony which are added between the two initial units using the open space. A drying-yard is created in the kitchen/bedroom of unit 04. Unit 02 uses the open space to add 2 bedrooms and 1 bathroom, while Unit 03 converts its terrace into a bedroom. On the 2nd floor, Unit 02 doubles its surface by adding 2 bedrooms and 1 bathroom separated by an entrance/terrace. Unit 03 converts the terrace into a bedroom and Unit 04 uses the back terrace to add a bedroom. On the 3rd floor, Unit 01 and Unit 03 remain unchanged. Unit 02 adds 2 bedrooms in the back terrace. Unit 04 partitions its bedroom to add a bathroom and adds a second bedroom and a balcony in the back terrace. Finally, on the 4th floor, Unit 01 remains unchanged. Units 02 and 04 add one bedroom in the back terrace but keep a large back terrace. Unit 03 transforms the back terrace into a bedroom.

These mechanisms of changes can be differentiated as such: 1) addition of rooms, 2) enclosure of terrace into a room, 3) combination of two units into a single one, and 4) new partitions are created in an existing room. They create a range of units that accentuate certain features over others depending on the choice of mechanism. For example, some units preserve an outdoor space with the additional room rather than fully enclosing the terrace.

Each floor has been designed to show different scenarios and to accommodate very diverse family units. A total of 29 floorplans are presented of which two remain unchanged from

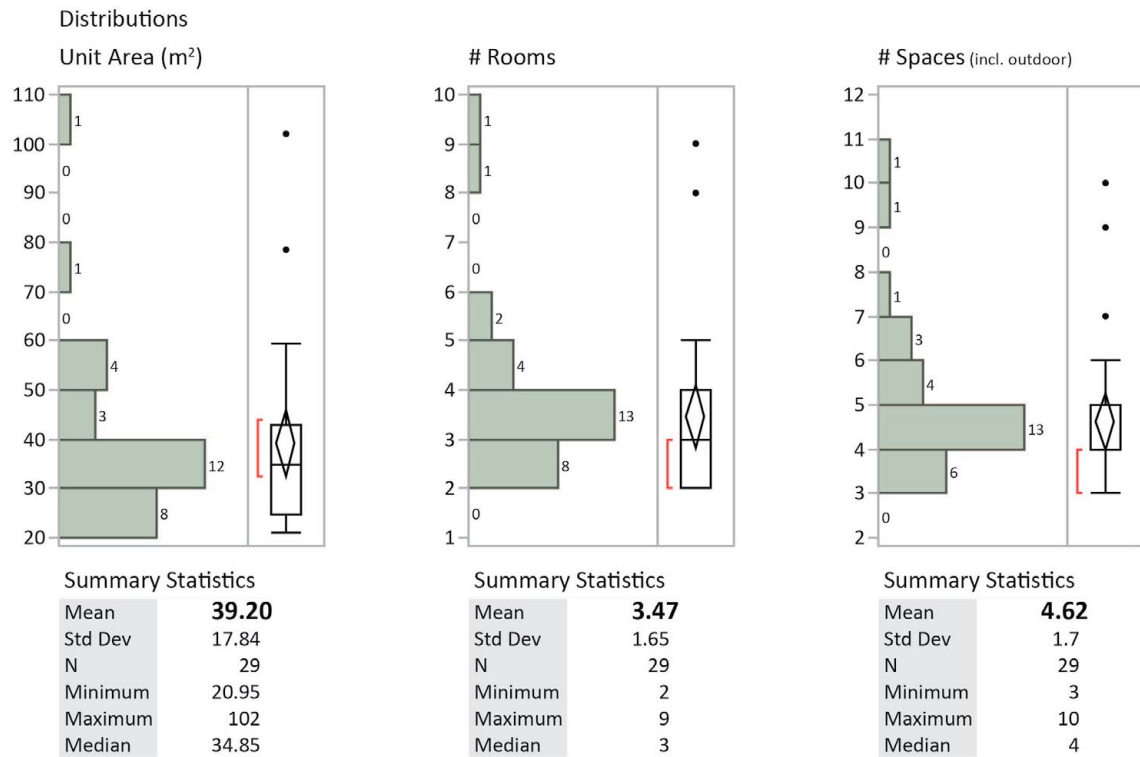


FIGURE 2. Distribution of formal properties for all the different units with mean, minimum and maximum values for the sample.

Stages	N Units	Unit Area	# Rooms	# spaces	VGA[HH]	% Iovist
A	15	29.3	2.63	3.93	23.19	56.42
B	14	49.9	4.36	5.36	11.60	40.27
Changes (%)	-6.7	<b>70.3</b>	<b>65.8</b>	36.4	-50.0	-28.6

TABLE 1. Changes of formal and syntactical properties as a percentage of increase or decrease from the initial stage [A] to fully developed [B] calculated on the average values of the units for a stage.

the initial stage to the fully developed one. As shown in figure 2, unit's size ranges from 21 m<sup>2</sup> to 102 m<sup>2</sup> with an average area of 39.2 m<sup>2</sup>. It is worth noting that most units (21) have a floor area below 40 m<sup>2</sup> and only two units are much larger, which corresponds to the combination of two initial units. The number of rooms provided by the different designs ranges from 2-rooms units to 9-rooms units. Rooms are enclosed space when doors are closed – half a room is counted for corridor and room below 2m<sup>2</sup> – in average a unit is made of about 3.5 rooms. In the graph, number of spaces include outdoor covered spaces such as balcony and terraces. It increases the average to 4.6 rooms per unit. The role played by these outdoor rooms will be studied in more details in a following section.

The difference between the initial stage and the fully developed one is highlighted in table 1. From a formal point of view, there is just one unit less in the second stage, due to the grouping of some units. The size of the units on another hand increases by 70 percent, which highlights the option for small basic units to grow over time to accommodate more functions or more people. The increase of 66 percent in the number of rooms shows the process of growth by creation of new rooms. The question then is about how the space is partitioned to create these additional rooms and what the impact on the syntactical properties is. These design decisions have a social impact on the use of the units.

## VISUAL INTEGRATION AND DESIGN DECISIONS

To measure the impact of the design alternatives, the first analysis compares syntactic<sup>2</sup> and formal properties provided by the layouts of the different units of a building. It compares the units within a building, within a floor, as well as before and after increments to capture the impact of the changes. The measures recorded are about these formal properties and syntactic properties. Formal properties include the total floor area and the number of rooms, including and excluding outdoor covered spaces depending on what is studied, which is linked to different functions. Syntactic properties are based on existing measures developed in the field of space syntax which records visual properties and degrees of connectivity between functions.

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2. "In the literature of space syntax, the word "syntax" variably refers to either the principles that govern spatial arrangements, the configurational patterns present in an arrangement, or, more simply, certain kinds of relationships, such as those based on transitions, or direction changes imposed by the placement of boundaries in space." (Peponis 2003)



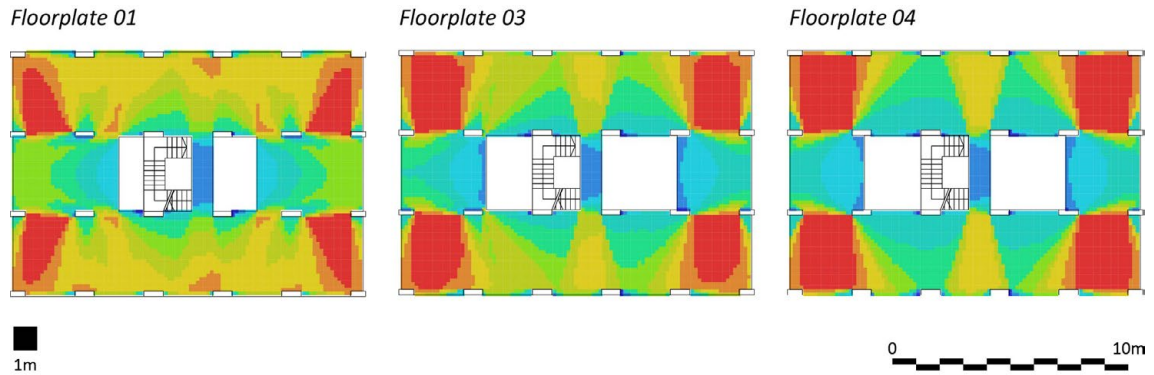


FIGURE 3. Visual Integration of the 3 floorplates before their partitioning into units. High visual integration is in red and low in blue.

Floor	Stage	N Rows	% of Increase VGA
1	A	4	-55
1	B	3	-69
2	A	3	-72
2	B	3	-75
3	A	4	-72
3	B	4	-74
4	A	4	-71
4	B	4	-71

TABLE 2. Percentage of increase for the mean integration value of each floor in comparison to the empty floorplate values for both the initial stage [A] to fully developed [B].

One of the measures for visual properties of spaces is Visual Integration from a visibility graph analysis (VGA). VGA is based on the average shortest paths from every location in a space to every other location (Turner, Doxa et al. 2001). Visual integration therefore measures how visible a location in space is from all the other location of the unit. For this building, a location is equal to a square of 20 centimetres. It describes mostly the visual connections that exist within the unit. In this case, visibility is linked to accessibility – windows are not considered as element of connection but as full partition. By being highly accessible, a location is conducive to co-presence of people within the household and therefore may facilitate interactions. The more visible, the more integrated this location is, therefore the least private. The most visually integrated locations are in red and the most segregated or less accessible are in blue. The VGA is done for three levels of design: the empty floorplate, the partitioned floorplate and each unit individually to better understand the impact of design decision.

#### *Floorplate and the design of air-wells*

The first Visual Graph Analysis measures how visually integrated each space is from all the other spaces when the floorplate is just a single open space (figure 3). High values (red) mean visually integrated and low values (blue) visually segregated. In this proposal, each floor is designed to show the possibilities of incremental buildings. The empty floorplates are already slightly different in their dimensions with central voids, acting as air-well, of different sizes. Three floorplates are provided with a total area of 238.56 m<sup>2</sup> (floorplates 1&2), 225.96 m<sup>2</sup> (floorplate 3) or 223.44 m<sup>2</sup> (floorplate 4). Looking at the overall values, the implication in terms of circulation and visual integration is minimum with values respectively equal to 19.1 (n tiles =5964), 17.2 (n tiles =5649) and 16.7 (n tiles =5586) with the size of a square tile of 20 centimetres.

However, some observations can be made on slight differences. While the first and second floor start with the most visually integrated floorplates, they also show more homogeneous and distributed integration areas. By comparison, the 4<sup>th</sup> floor defines much stronger zones. The difference in the design is permeability between the zones with a total of 5 connections through the circulation zone between the permanent columns on the 1<sup>st</sup> and 2<sup>nd</sup> floor, instead of only 3 for the 3<sup>rd</sup> and 4<sup>th</sup> floor. The design of the floorplates 1 and 2 allows more visual connections and alternatives routes.

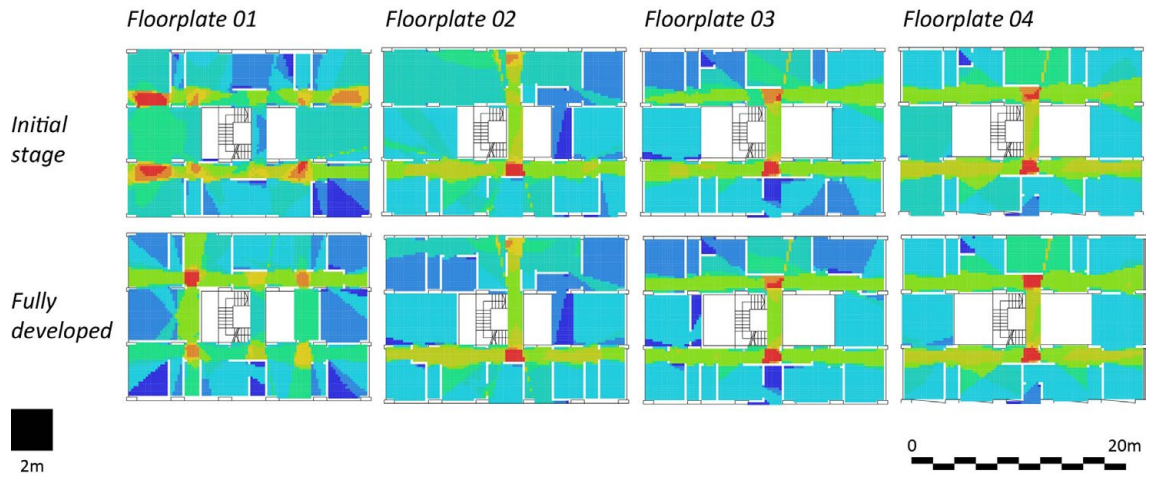


FIGURE 4. Visual Integration of the 4 floorplates after partitioning into units, at the initial stage and then fully developed. High visual integration is in red and low in blue.

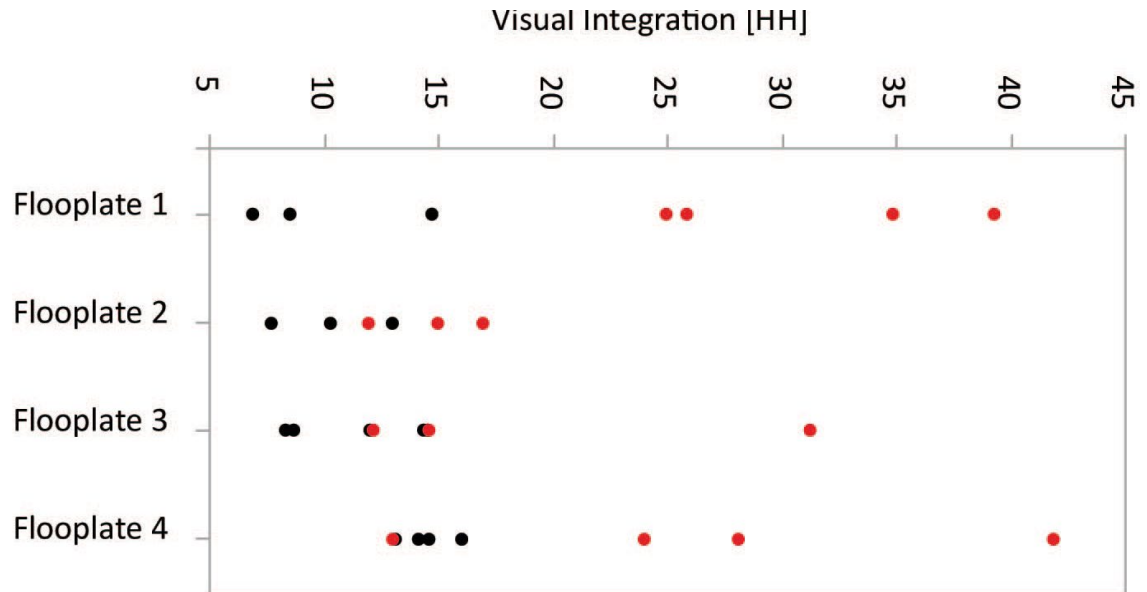


FIGURE 5. Visual integration for all the different units plotted by floor. Red dots show initial stage units and block dots represent fully developed units.

### *Partitioning the floorplate to control public access*

The second VGA analysis is done on the floorplates subdivided into units at both stages to highlight the overall pattern of connectivity between units. In this case, all doors are opened. When empty, the larger the area, the higher the mean visual integration. After partitioning, the visual integration systematically decreases from 55 to 75 percent, as show in table 2, with even higher values for fully developed by comparison to the initial stage.

Starting with the same floorplate, the subdivision of the 2<sup>nd</sup> floor has a much stronger impact than the one of the 1<sup>st</sup> floor. It is explained by the number of connections between the zones. Figure 4 shows differences in the location of visually integrated cores, which are the red zones. The most visually integrated spaces are in most cases at the crossing of circulation zones, excepted in the initial stage of development of the first floor. The initial stage in the first floor is more spread to the edges with large open space creating integrated cores in alignment with the circulation bands. When that same open space is partitioned and enclosed, there is a consolidation of the integrated cores into two types of crossings located at the entrance of the unit (public space) and at the crossing point between common spaces (living spaces) and private spaces (bedrooms and bathrooms). In all other configurations, the integration cores are only present in the public locations.

The implication in terms of interactions is that the different design decisions in the subdivision of units combined with the design of voids, creates different dynamics. The first floor is an example of layout where there is the possibility of more interactions in both private and public spaces of the building by providing highly visible locations in both realms. The syntactic structure of the other proposals tends to be less visually integrated overall and mainly in public spaces. This property can reinforce naturally the control of visitors, with the main access to the floor highly visible.

### *From undifferentiated unit plan to articulation by integration cores*

The third VGA analysis is at the level of each unit for only the indoor enclosed spaces. The outdoor covered spaces are excluded and all the internal doors are open. Figure 6 shows the impact of design on visual integration within each unit. In most cases, a similar observation is made as in the full partitioned floor. The integrated cores are located at the threshold between the common spaces and the more private spaces. But two types of units are provided: some that provide very private spaces (blue areas) other than the bathroom,

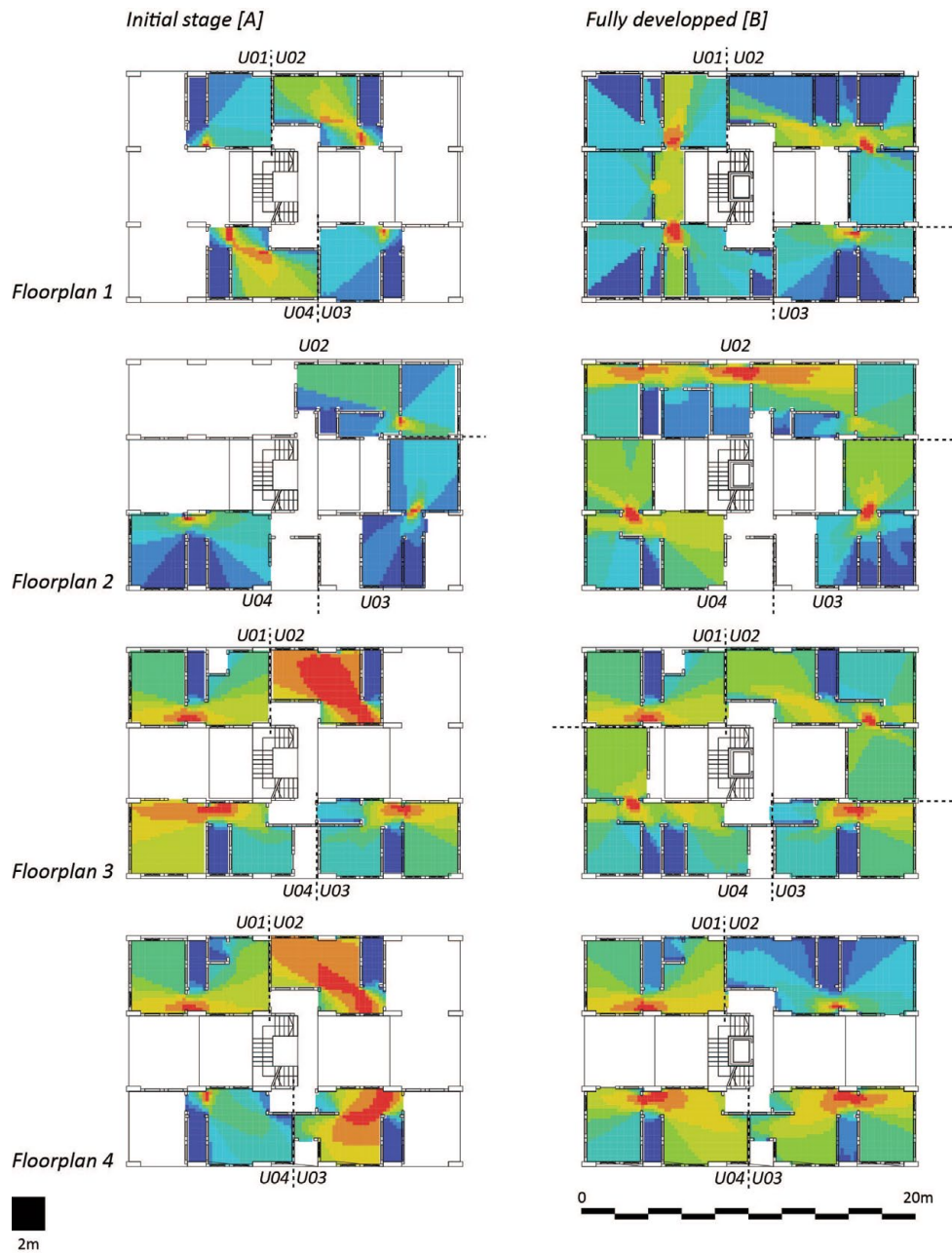


FIGURE 5. Visual integration values for each unit for all the enclosed spaces with covered outdoor spaces not included. High visual integration is in red and low in blue.

and some that are more homogeneous where every space is equally visible.

Figure 5 shows the distribution of the mean integration value per unit. The values for the initial stage (in red) are overall higher than for the fully developed layouts (in black). The second floorplate provides very similar units in terms of visual integration, as well as the 3<sup>rd</sup> floor with the exception of one unit. The 1<sup>st</sup> floor is the floorplate that provides the widest range of differences between integration values. On another hand, the size of the unit has a very strong logarithmic relationship with the mean visual integration ( $r^2=0.81$ ,  $n=29$ ,  $p<.001^*$ ): the smaller the unit, the higher the integration. This relationship to size is the opposite to the one at the floor level when empty, where the larger the area, the higher the mean visual integration.

Based on the previous observations at the floor level, the design of the first floor has values that are very different but interestingly the designs look very similar in the initial stage and they are of similar size: Unit 01 looks similar to Unit 03, and Unit 02 similar to Unit 04. These differences in visual integration with the Unit 02 of the 1st floor are even stronger with similar units located on the 3rd floor (unit 2) and on the 4th floor (unit2). Slight changes in size and placement of the partition create different dynamics. Three apparently similar units are compared in more details to understand what design decisions impact the mean visual integration (figure 7- a).

#### *Indentations to create further differentiation*

According to the values of figure 7-a, the most visually integrated is the unit 2 located on the 3rd floor while the biggest is the one located on the 4th floor. When their outlines are overlapped small design variations appear: the size varies, and the outline of the space is more or less regular, with the most regular boundary for unit 2 of the 3rd floor. To further test the impact of both size and boundary, hypothetical floor plans are developed to control for each variation.

The first plan has a smooth and regular boundary (A), the second has a small indent (B), the third another indent (C) and the fourth plan is the first plan (A) scaled at 105% (D). They are illustrated in figure 7-b. It appears that deformation in the boundary has a strong impact on the visual integration by creating small corners. These indents correspond to the placement of the window panel flush against the edge of the floor plate, and the smooth boundary when flush with the interior face of the pillars. The slight shifts create implied

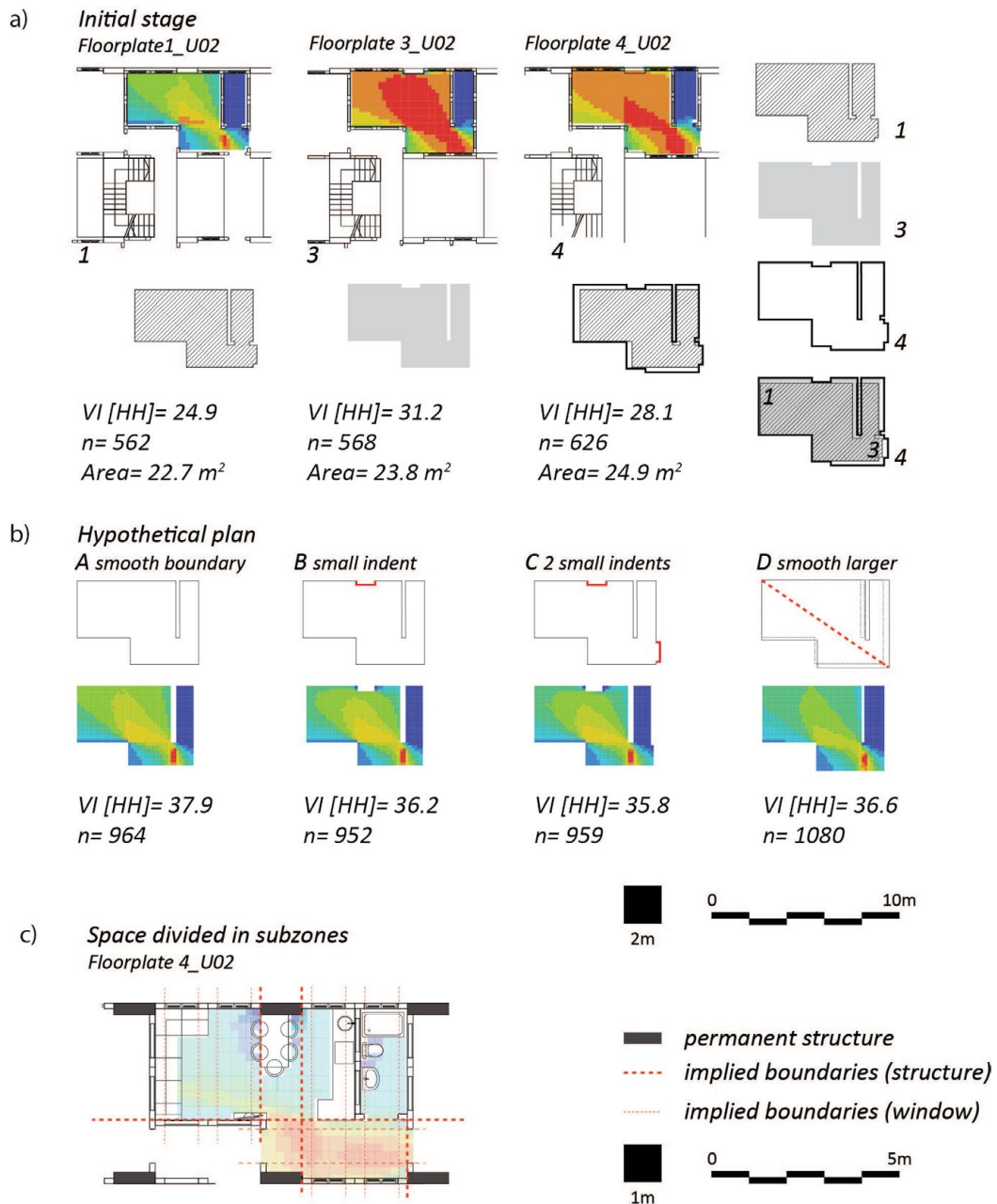


FIGURE 7. Visual integration for three similar units and the geometry of their outlines (a) and four hypothetical floor plans with slight variations in their boundary or size (b). Use of implied zones for placement of furniture (c). High visual integration is in red and low in blue.

boundaries that define subzones. These subzones can be reinforced by the placement of furniture and create more segregated or private spaces within an open-space (figure 7-c).

A way to provide more privacy within a similar unit is to mainly change the boundary by creating indents that generate implied boundary to demarcate subzones with different qualities. The placement of the window component/module with the structure gives a different understanding than placed in recess to the structure. The placement of the furniture can reinforce or minimize these sub-spaces.

## DEGREES OF PRIVACY

Visual integration and visibility at the entrance door are two measures that highlight the degree of privacy embedded in the design of the unit. While the first measures how visible the space is from any other space, the second is concerned by the relationship to the outside, from the point of view of the visitors. Previously, it has been shown that the zone in front of the entrances are highly visible (figure 4). Some design choices are then made to minimize the amount of space visible from the entrance of the unit, which highlights the degree of privacy of the unit to the outside.

It is based on the concept of the isovist. An isovist is the polygon that encloses the amount of space visible from a specified position with a 360° angle and has been developed by Benedikt (1979). It attempts to represent geometrically a 360° field of vision of a person. In this analysis, the isovist of each apartment is calculated as the area of the space visible from the front door (with all internal door opened) and given as a percentage of the overall area of the apartment illustrated in figure 8. There is a correlation between the overall visual integration and the amount of the unit area visible from the door. ( $R^2=0.65$ ,  $n=30$ ,  $p<.0001^*$ ) as shown in figure 9. The higher the mean visual integration of the unit, the more visible for a visitor the unit tends to be from the door.

The area of the unit visible from the main entrance door is equal in average to half the apartment. (49.7% of the unit area). It ranges however between 22 (two units merged together) and 86 percent. The units can be grouped into four categories<sup>3</sup> (table 3). In most cases the unit reveals less than a third of their interior (10 cases) or two thirds (11 cases).

3. Clusters are computed through a hierarchical cluster analysis using the Ward's method within the platform of jmp12 software.





FIGURE 8. 360° isovist polygon drawn from a location inside the unit in front of the entrance door. The percentage of area taken by the isovist polygon on the overall area of the unit.

Exceptionally, two units reveal more than 80 percent of their inside.

The internal subdivisions into rooms by partitions of the unit provides an opportunity to engage with the degree of privacy or openness to visitors. Some layouts reveal most of their interior while others only allow a glance at the circulation area by creating a corridor without necessarily enclosing it (see example 3 – 3<sup>rd</sup> floor version B which is enclosed versus unit 3 on the 4<sup>th</sup> floor version B that uses only a partition). Many units are designed around the concept of the corridor but in which the most public room of the unit is also visible (kitchen, dining/living room). For smaller units, similar use of partition visually protects parts of the main space. Figure 10 shows the mechanisms of design used to minimize the view on the interior from the outside. The two selected units are located on the first floor at the initial stage.

In these two examples, the position of the entrance from the floor landing restricts the view on the interior since the unit's entrance door is located on a perpendicular plane. The placement of a module between the two entrances in unit 01 reduces further the visibility to the interior. In unit 02, the panel supporting the entrance door of the unit creates a subdivision of the space. A person standing at the door has a restricted view to half of the main space that is located in front. The recessed area created allows more privacy from the exterior. Unit 02 is much more successful in keeping the bed invisible from people standing at either the landing entrance or the unit's door. Several functions and activities can be accommodated in a single space and the placement of entrances differentiates the degree of privacy. Design choices create variations to either increase co-visibility or to help in maximizing privacy.

## SOCIAL INTERACTIONS AND OPEN SPACES

The traditional basic house is designed to accommodate: “privacy for the womenfolk, together with hospitality for the casual guest. This call for three parts to the house: the main body (ibu Rumah), a kitchen (dapur) with separate entrance at the rear, and a reception room for guests at the front. [...] His house will be designed so that more rooms can be added” (Hilton 1956). In this description of the traditional house in the mid-20th century, the emphasis is on the duality of privacy and hospitality in an open plan. A distinction of outdoor covered spaces used to be made to control gender relationships: front porches and veranda were mainly used by the menfolk and kitchen and indoor veranda more occupied

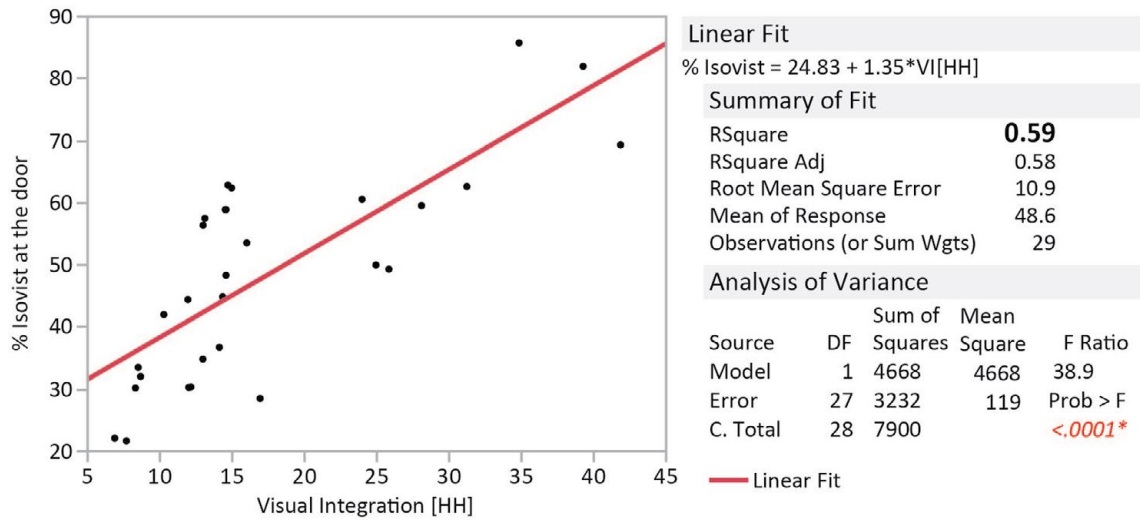


FIGURE 9. Linear Regression between Visual Integration and the percentage of surface visible from the door by units.

Clusters	N	Mean	Min	Max	Std Dev
1	2	83.9%	82.0	85.8	2.7
2	11	60.3%	53.6	69.3	4.1
3	6	46.5%	42.0	50.0	3.2
4	10	30.0%	21.7	36.8	4.9

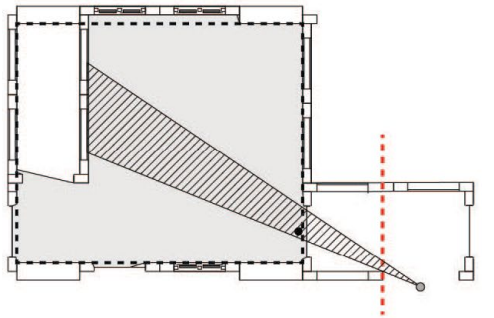
TABLE 3. 4 clusters by Percentage of the surface of the unit visible from the door.


by the womenfolk (Nasir and Teh 2011). Several activities are taking place within the traditional Malaysian house: entry/circulation, cleaning, cooking, eating/entertainment, sleeping, storage and work (Abidin 1981). While these activities used to overlap in space, they tend to be nowadays more separated. The apartment type also differs from the house mainly by the single access to the public space. However, the design of the units should try to support different activities in a fairly open plan layout as well as some possible control of interactions between the inhabitants and with visitors/guests.

Pattern of interaction are then represented by a justified graph that shows connections between the different functions of a unit. Generic labels are used to describe the function associated to a room. In this analysis, the labels are: kitchen (K), bathroom (Ba), Bedroom (Bd), Dining-room (DR), Living-room (LR), corridor (Co) and other rooms (R). Often a room may have multiple functions such as for example a kitchen/dining/living-room (K/DLR) or a kitchen/Bedroom (K/B), they tend to be more related to traditional mode of living. A space that is not fully enclosed and accessible by more than one unit is called open space (OS), otherwise it is considered a terrace (T) or a balcony (Blc) depending on the shape and dimensions. The different labels of a unit are placed in a justified graph to show the physical links (usually door) between functions in a house and arranged them depending on their distance to the main entrance. The depth of a room equals the number of spaces that is required to pass through to reach that room. Results are illustrated in figure 11.

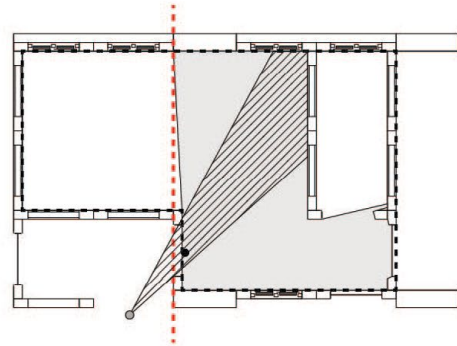
In this building, the units are fairly shallow. The rooms are located no more than three steps away from an entrance door, which is the equivalent of traversing two spaces. The most complex layouts occur when two units are combined together (type 3 and 9). Organisation of functions for some units are shared and there are overall 19 types available for 29 units. In terms of interactions within the household, it is worth highlighting the layout that provides more potential for interactions happens when there is a choice of alternative route to reach a space. In the graphs, the alternative routes are recorded as “rings”, they are present in types 3, 6, 8 (double), 9 and 11. In these variations, the ring is always passing through an outdoor covered space (open space, terrace or balcony). In most cases it is also passing through the main entrance, excepted for the second ring of 8 located deeper in the layout.

*Floorplate 1  
Initial stage [A]  
Unit 01*



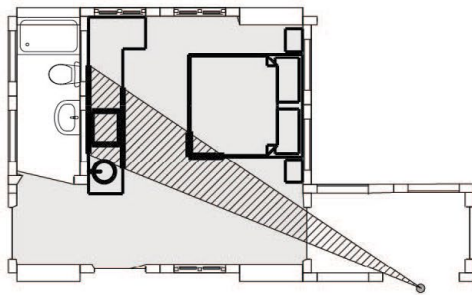
 *visibility polygon from the door (a)*

*Unit 02*

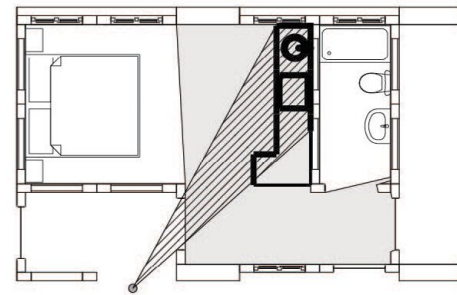


 *visibility polygon from the landing (a)*

*with furniture*



— *not visible*    — *visible from door*



— *visible from both door and landing*



FIGURE 10. The design of two units are compared to show how the level of privacy is achieved by use of recessed spaces and placement of partition and doors.

## MULTIPLE ROLES OF THE OUTDOOR COVERED SPACES

The role of the outdoor spaces in traditional houses is critical for the social structure of the household. More than just helping natural cross-ventilation, the outdoor covered spaces provide alternative functions. They can act as buffer between inside and outside, help to generate more movement, or be used as provisional spaces. They are present in most layout types excepted two, types 14 and 16 (total 3 units) and they play a different role in the configuration.

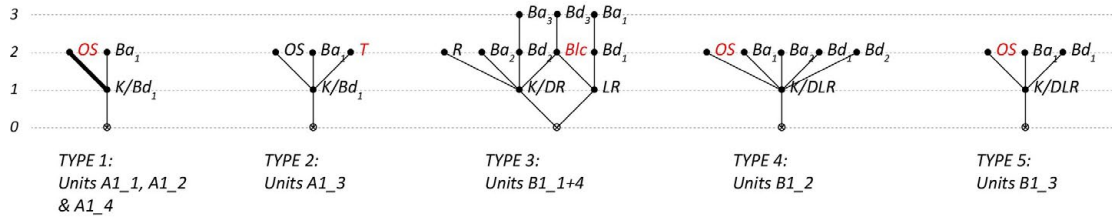
Outdoor covered spaces can be in the front, a through space. They act then more like a front porch that allow to maintain a distance with the guests or some members of the household (type 7 and 10). In some cases, they provide an alternative way to enter the unit creating possible route for avoidance, or replicate the front and back entrance when linked to the kitchen (types 6, 8, 9, 11, all located in the second floor). The third type of covered open spaces are the ones located the deepest in the graph, which represent often the space for potential extension of the incremental unit. In most cases, they are used for an additional bedroom. It is the case for type 5 which is a variation of type 2, and type 10 which is a variation of type 7. In regards to these three functions of outdoor spaces, the most successful unit is located in the 2nd floor and illustrated in figure 12. Unit 03 provides the equivalent to a front porch linked to the cooking/living spaces and provides as well a back porch. That back porch is later enclosed to create a second bedroom. The full translation of the front and back spaces of the house into an apartment layout is only achieved in unit 04. That unit provides a front porch that can be accessed directly from the landing or from the kitchen: these two accesses are the closest equivalent to the back door and the front entrance of the traditional house in an apartment layout. The back terrace is transformed into a second bedrooms but there is still a balcony that is preserved as an outdoor spaces more private that the one in the front.

## CONCLUSION

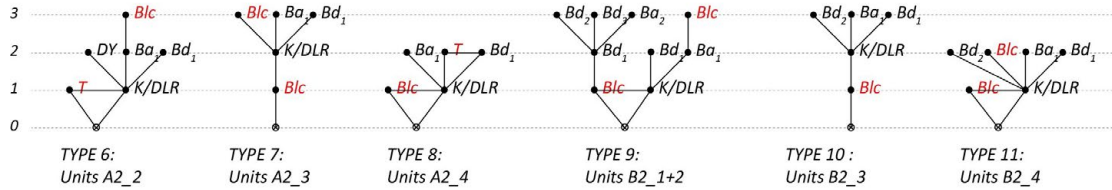
“From the front porch to the back yard. It seems that this openness is a necessary condition for better ventilation, but it has been also argued that Malay people do not install partitions because they value collectivistic life style over individual privacy in their traditional domestic living” (Seo 2016).

The translation of traditional houses layout into contemporary apartment is partially

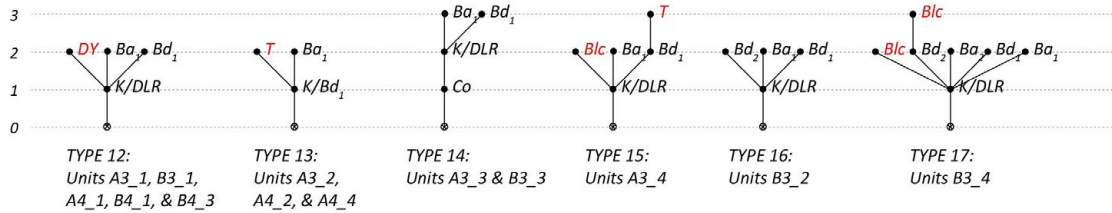
### Floorplate 01



### Floorplate 02



### Floorplate 03



### Floorplate 04



FIGURE 11. Justified graph representing the different types of unit organisation of rooms and spaces in relation to the main entrance of the unit.

achieved with emphasis on different aspects of these traditional elements. It has been shown that outdoor spaces are still fulfilling the potential for further extension but also depending on their size, location and connections can reinterpret the traditional front porch or intern veranda (back terrace/balcony). While some of the activities such as cleaning has been completely enclosed and thus removed from other activities, the basic units still carry the overlapping of activities within a single space. To support this traditional way of life of Malaysian culture, threshold and receding areas are created to subdivided undifferentiated layout such as open plan which is more suited for human purposes (Peponis, Wineman et al. 1998). The placement of the non-structural panels incrementally can help the subdivision of a single space by creating various receded areas to facilitate the co-existence of different activities within a single space without partitioning it. This can be reinforced by the placement of furniture in alignment with the indents.

The interactions within the units is reinforced by high co-visibility due to the openness of the basic plan of the initial stage. The addition of new rooms and the further partitioning tend to reduce the overall visual integration and co-visibility. Co-visibility is mitigated by interface purviews<sup>4</sup> in the fully developed units. They are these spaces highly visible (integration cores) that don't have a very specific function other than linking spaces together: small halls and corridors (enclosed or not) that link all the different functions within a unit. They help in the legibility of the interior and act as transition to different types of spaces. The interactions with the guests or visitors are dealt by different design features that include the location and size of air-wells, the placement of entrance doors and the use of outdoor covered area acting as buffer zones. The control of visitors is negotiated by the combination a highly visible landing from all the different units with sometimes a front terrace or balcony functioning as front porch keeping the visitors out of the main room.

To conclude, the proposed design for an incremental building in Malaysia fulfils several aspects necessary to the climate such as cross-ventilation, but also reinterpreting the design of the traditional houses into an apartment layout to partially maintain cultural

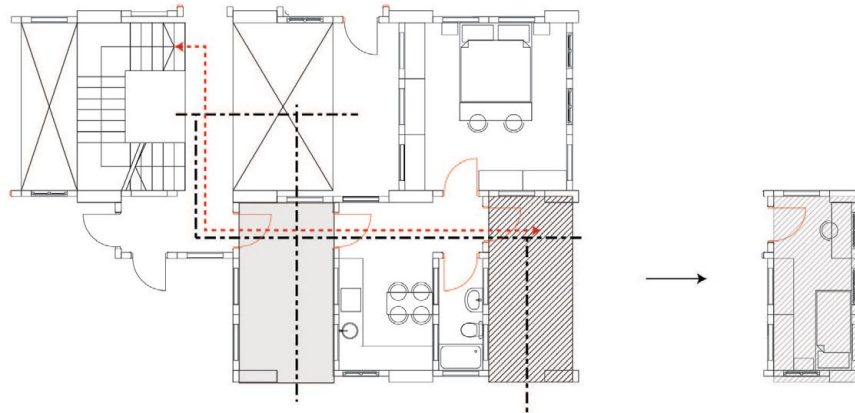
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<sup>4</sup> "This is generalized by the idea of the purview interface: the interface between ordinary spaces confining perception to a limited part of the interior, and prominent spaces providing overview not only of area but also of connections. The purview interface can function as a rudimentary foundation of layout intelligibility" Peponis, J. (2012). "Building layouts as cognitive data: purview and purview interface." *Cognitive Critique* 6: 11-50.



Floorplate 2  
Initial stage [A]  
Unit 03

Fully developed [B]  
Unit 03

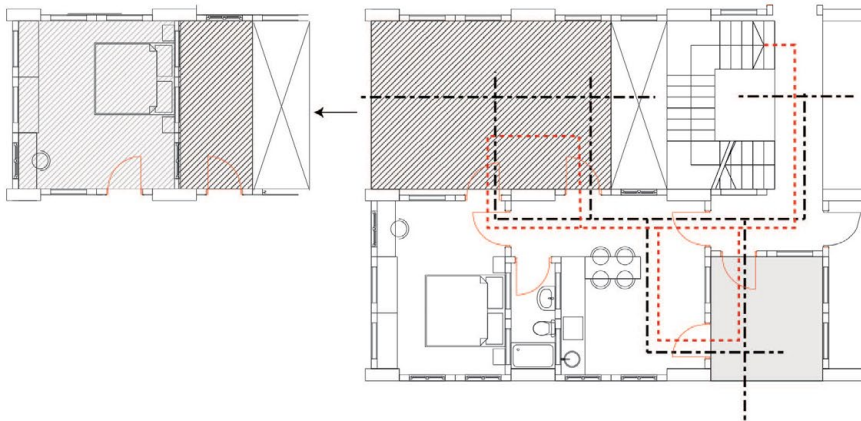


outdoor space for future extension   
  outdoor space as front porch through space.   
 X air-well through space.

natural ventilation   
  movement

Fully developed [B]  
Unit 04

Initial stage [A]  
Unit 04



1m

0 5m

FIGURE 12. Natural ventilation and movement of two units using outdoor covered spaces at the initial stage and fully developed.

and social structures. Various design options are proposed and each negotiates to various extents the relationship between the interior and the exterior, between the private and the public through the mean of small design decisions. These decisions can be found in the permanent structure but can also be negotiated and mitigated with the modular elements and the placement of furniture. It can also be transformed to better fit the changes in the house structure through the design and use of the outdoor covered spaces. Further work should be done to compare this design with other proposals for incremental building.

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AGNIESZKA WIR-KONAS

## FLEXIBILITY AND INCREMENTAL APPROACH IN POST-DISASTER HOUSING RECONSTRUCTION

*Permanent post-disaster housing reconstruction is a complex process determined by available resources, funding and time. Governments and agencies aim to provide as many houses as possible in the shortest period of time to ensure a fast recovery. In most cases this leads to tight timing constraints giving little time to cater to individual preferences and expectations.*

*Even though, there are multiple approaches to post-disaster reconstruction, in this chapter we will focus on the two most common strategies: standard housing and the core (incremental) house approach. Through the use of a number of case studies, we recognise the strengths and limitations of each type of post-disaster reconstruction strategies and hope to aid the understanding of both standard and core/incremental mass housing developments in all scenarios, not only emergency and disaster environments.*

In the face of natural disaster, when many lives are lost and many villages destroyed, there is a pressing need for a fast recovery. The post-disaster housing reconstruction process, however, proves to be more challenging than providing enough shelters for affected vulnerable communities. The local government and aid agencies have to follow the standard housing construction procedure but with added challenges and on an enormous scale. The whole process is challenging, because: the houses have to be provided as fast as possible to assure the recovery, the affected zone is chaotic and lacks resources needed for the reconstruction process, and the new houses need to conform to the reconstruction building policy that stresses reduction of structural vulnerability in case of the future disaster (Davidson, et al., 2007). Additionally, the ‘tyranny of the urgent’<sup>1</sup> (Delaney & Shrader, 2000) tends to result in housing that not only doesn’t meet the needs and expectations of the beneficiaries but is culturally inappropriate (Boen & Jigyasu, 2005).

In most cases the post-disaster recovery process starts with providing transitional or temporary shelters and establishing the supplies that will help the affected communities. The relief phase is followed by permanent housing reconstruction which consists of the following stages: (1) initiation and financing, (2) design, (3) construction, and (4) post-reconstruction phase - when beneficiaries are able to adapt and modify their houses. The reconstruction process can take five different forms, these are described by the World Bank as: the cash approach, owner-driven reconstruction, community-driven reconstruction, agency-driven reconstruction in situ, and agency-driven reconstruction in relocated site (Jha, et al., 2010). Even though, all of the listed methods are commonly used in the post-disaster scenarios, World Bank favours the owner-driven reconstruction as “the most empowering, dignified, sustainable, and cost-effective reconstruction approach in many types of post-disaster situations” (Jha, et al., 2010). Although, the owner-driven reconstruction is advocated by many experts and researchers as the best solution for the beneficiaries (Barakat, 2003; Barenstein, 2008; Jha, et al., 2010), many aid agencies and governments are convinced that the quickest and most efficient way to reconstruct the post-disaster area is the contractor-driven approach, led by hired construction companies (Barenstein, 2008).

When considering the examples, three design solutions can be observed: (1) *total house design*, used in either the agency- or community-driven approaches (termed the

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<sup>1</sup> Term coined by Delaney and Shrader, describing rapid reconstruction process in post-disaster scenarios (Delaney & Shrader, 2000).



FIGURE 1. Damaged houses in Banda Aceh after 2004 Indian earthquake and tsunami.  
Source: Michael L. Bak - [https://en.wikipedia.org/wiki/2004\\_Indian\\_Ocean\\_earthquake\\_and\\_tsunami](https://en.wikipedia.org/wiki/2004_Indian_Ocean_earthquake_and_tsunami)  
(Accessed: 01/08/16)

‘one size fits all’ approach) (Russell, et al., 2008); (2) *extendable core house* solution, again applicable in either the agency- or community-driven approaches; and (3) *custom individual design*, applicable to only the owner-driven approach. The owner-driven approach enables the home owners to adjust the design while constructing and think ahead about possible modifications and adaptations (Russell, et al., 2008). Although, this method is advocated by many experts and researchers and allows the most flexibility in adjusting to the personal needs (Barakat, 2003; Barenstein, 2008; Jha, et al., 2010; Russell, et al., 2008), many aid agencies and governments are still pursuing the contractor-driven approach, led by hired construction companies (Barenstein, 2008). It is understandable that because of the scale of the housing project and time constraints, the agencies want to provide as many houses as possible and the easiest solution is to create one detailed house design that can be applied in various situations with minor adjustments to the family size. Those total ‘one size fits all’ designs not only create monotone villages with lack of consideration towards cultural and social issues, but are difficult to modify because of the rigidity of the structure. However, some humanitarian agencies begin to recognize the importance of the post-reconstruction personal modifications and are advocating for more flexible designs (Ahmed, 2011). This chapter is focused on an overview of post-disaster housing reconstruction models with distinction between model and core designs. Additional focus is directed to flexibility and adaptability of each housing type and strengths and limitations of each approach are discussed.

## STANDARD / MODEL HOUSING – ‘ONE-SIZE-FITS-ALL’ APPROACH

The most important phase of the whole reconstruction process is the time when all the humanitarian aid agencies have left the post-disaster zone and people have to make the new houses their homes. The typical solution to the housing reconstruction problem provided by government through the agency-driven approach is to design a typical house and distribute the same solution to all the beneficiaries. This approach focuses on providing as many houses as possible in the quickest period of time and make sure that they are structurally resilient in case of the future disaster. Unfortunately, the standard house design most likely won’t meet the requirements of each individual family and in the future affected communities might have troubles extending or maintaining the house (Barenstein, 2008).

After the 2004 Indian earthquake and tsunami in Tamil Nadu the government launched





FIGURE 2. Standard concrete houses after 2004 Indian earthquake and tsunami.  
Source: Ammainfo <http://www.ipsnews.net/2009/12/development-tsunami-brings-sea-change-in-coastal-lives/> (Accessed: 01/08/16)

a constructor-based approach that involved little participation from the beneficiaries. The main assumptions of the new policy was to provide new permanent housing ‘pakka’ (Barenstein, 2008) to all affected families and to relocate most of the post-disaster zone to new sites. In the end, the relocation proved to not be feasible and to keep the promise the agencies started reconstruction in situ, which led to demolishing of most of the existing pre-disaster stock. The new standard houses were designed for a nuclear family, as a ‘one-size-fit-all’ approach (Russell, et al., 2008), with a size of less than 30 m<sup>2</sup> and internal space consisting of 3 or 4 rooms. The standardised housing unit provided by the agencies led to a monotone image of the village, where all houses ‘were identical, painted identically’ (Russell, et al., 2008). The buildings were too small to house an average family and in most cases lacked a veranda, which was an important part of the local culture (Barenstein, 2008). It was also difficult to modify the internal layout, because of the rigidity of the whole structure, so most of the beneficiaries focused on marking the boundaries around their sites with plants and fences and furnishing and decorating the inside (Russell, et al., 2008). Not only, the design of the standard house represented lack of any cultural or social considerations of the local fishing communities, but it was designed in such way that made any modifications difficult and time-consuming.

The standard housing design, with little or no participation from the beneficiaries, is a popular approach to provide as many houses as possible and/or satisfy the donors financing the projects. In most of the studied cases, this approach results in empty isolated villages abandoned by beneficiaries, because the design of the house didn’t consider the local culture or climate. In Zoranje and Morne a Cabrit – after the 2010 Haiti earthquake – the government funded two ‘exemplar community’ projects, consisting of respectively: 3,000 and 400 houses that remained empty years after the disaster (Chege & Chege, 2012). The same fate met the housing projects in Yemen, following the 1982 Dhamar earthquake, where the target beneficiaries left the new housing project, because it didn’t meet their social and cultural expectations (Barakat, 2003).

In aftermath of the earthquake in Bam, Iran, the Housing Foundation of the Islamic Revolution (HFIR) pursued two-pronged strategy, which combined top-down technology-based and community-driven approaches (Gharaati & Davidson, 2008). In this case, the focus of the whole housing reconstruction was shifted to the improvement of the construction methods. The developed standard steel frame was showcased and presented to the affected community which was used to different building materials, like adobe bricks and earth. However, the whole design process and the decision-making on the

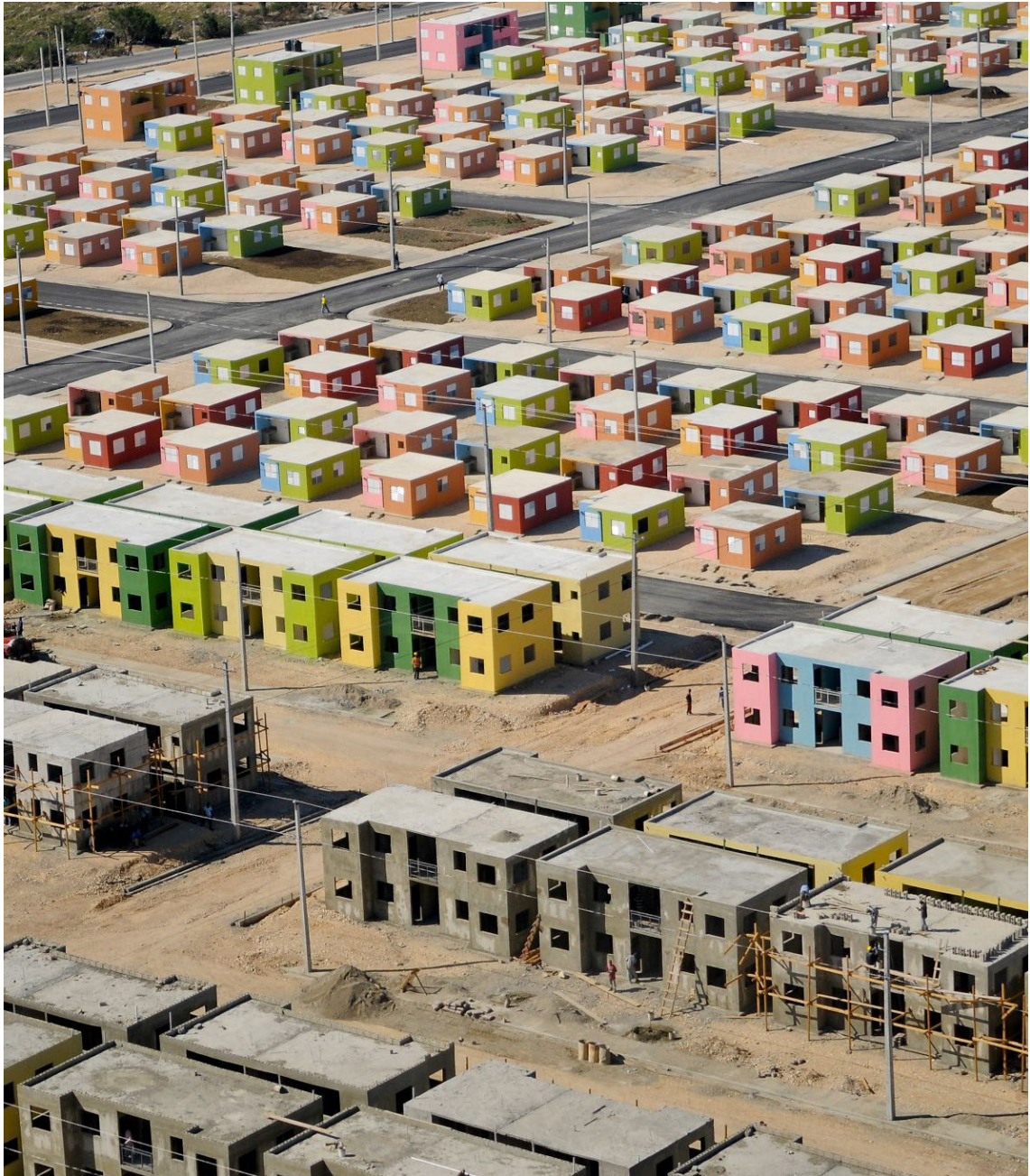


FIGURE 3. Standard model houses - constructor-driven approach after 2010 Haiti earthquake.  
Source: <https://ramase.wordpress.com/2013/04/17/morne-cabrit/> (Accessed: 01/08/16)

shape and size of the houses was passed onto international companies invited by HFIR. The proposed model houses didn't meet the local expectations and most of the Bam beneficiaries declined this solution. Although, the standard frame technology introduced a degree of flexibility, the model houses were designed as a complete and rigid whole. Even though the agencies proposed an adaptable technological solution, the house design itself was inflexible and functionally and culturally unsuitable for affected community (Gharaati & Davidson, 2008).

The examples of the top-down approaches indicate that not including the affected beneficiaries in the housing reconstruction process may result in them abandoning or declining the proposed housing. Many agencies, policy-makers and researchers are convinced that adopting the community-driven approach and including the affected in the process will result in the best recovery result (Davidson, et al., 2007). However, there are many types of community participation and the beneficiaries control in decision-making varies. Pursuing a community-driven approach project doesn't guarantee a successful housing reconstruction. In 2000 an earthquake hit the Çankırı province, Turkey, as an aftermath of the disaster the Turkish government launched a permanent housing reconstruction project. A hired company was responsible for designing the new housing scheme and prepared three model designs, varying in size and number of units: from one-bedroom to three-bedroom house (Davidson, et al., 2007). The affected families had a choice of accepting one of the typical design or hire an architectural company to help them with an individual design. Davidson et al. found out during their research that most of the beneficiaries declined the proposed solution and those who approved the design were not satisfied with the house after it was built. The research showed that because the new village was isolated and beneficiaries couldn't modify their houses easily, most of the new houses were seasonally occupied or even abandoned (Davidson, et al., 2007).

## CORE HOUSING – INCREMENTAL APPROACH

The top-down approach is, in most cases, associated with agency-driven standard permanent housing reconstruction. Where the beneficiaries do not have any control over the decision-making and cannot influence the shape and division of their house, and because of the rigidity of the structure, they can't modify it easily after the reconstruction process is over. To focus on enabling personalization and further modifications to the affected family, some agencies introduced the 'core house' concept (Salazar, 2002). This



FIGURE 4. Jimmy and Rosalynn Carter Work Project after 2010 Haiti earthquake  
Source: Ezra Millstein /HFH - <https://www.canadahelps.org/en/giving-life/featured-series/shelter-from-the-storm-rebuilding-homes-in-times-of-crisis/> (Accessed: 01/08/16)

approach is characterized by designing a small core structure that can be further expanded according to the needs and at a pace suitable to each individual beneficiary.

The post-disaster situation is unique as a housing project because of the scale of the undertaking. The government and agencies tend to opt for a method that guarantees the quickest recovery for the affected community, which means that the individual needs are neglected. However, some aid agencies find the individual preferences of the beneficiaries as important as provision of the housing and pursue the ‘core housing’ approach. After 2004 Indian earthquake and tsunami, World Bank launched the reconstruction of incremental houses. The core was designed not only to structurally withstand the future earthquakes but to create a possibility of an additional floor, in case the family wanted to extend the house (Ahmed, 2011).

The ‘core housing’ approach was implemented by Habitat of Humanity (HFH) after the 2004 Indian earthquake and tsunami in India, Sri Lanka, Thailand and Indonesia. With help from Arup International Development the reconstruction process focused on creating core homes that were structurally resilient, culturally adequate, different in each country, and enabled personal modifications and further extensions. In all four countries the core structure of the house was similar: single-story masonry structure, containing on average, of two rooms (Maynard, et al., 2014). Maynard, et al. note in their paper that at the time of the assessment 45-60% of beneficiaries in India, Indonesia and Thailand extended their homes and more than 60% planned the further modifications (Maynard, et al., 2014). The ‘core housing’ strategy implemented here resulted in a significant number of new permanent homes that sped up the recovery process for the beneficiaries. The design and structure of each house was built to be easily adaptable and extendable if the need for change arises. Interestingly, the families tended to make similar modifications to their houses like: toilets, kitchen extensions or worship areas, which may mean that the core structure could have been designed in the more culturally and socially appropriate way (Maynard, et al., 2014). The ‘core housing’ strategy was pursued in many other post-disaster reconstruction scenarios, for example after: 2010 Haiti earthquake – The Jimmy & Rosalynn Carter Work Project in Léogâne, and 2010 Chile earthquake and tsunami – Villa Verde Housing in Constitución.

However, the ‘core house’ strategy is not a panacea for post-disaster housing reconstruction and has some limitations: (1) the construction of the core structure might not consider local climate and culture, (2) the growing house might become too complex and disturb some



FIGURE 5. Villa Verde Housing - after 2010 Chile earthquake.

Source: Archdaily - <http://www.archdaily.com/780203/alejandro-aravena-wins-2016-pritzker-prize>  
(Accessed: 01/08/16)

of the characteristics of the core structure (Fayazi, 2011). After 1990 Manjil earthquake the Iranian Government launched 'core housing' reconstruction process and based the design of the main core on the indigenous Zigali structure. When the modification and expansion of the core houses started, the new spaces created internal layout that wasn't meeting functional expectations. What is more, the extension didn't apply the local climatic solutions, which led to thermal discomfort inside the houses (Fayazi, 2011). The affected communities didn't understand the consequences of building too many additions and did not consider the building as a whole. It resulted in highly complex and chaotic internal layouts and problems with privacy and thermal comfort. This case study shows that rebuilding permanent housing is an intricate and complex process. While applying a strategy which was successful in other place we have to be aware of the limitations of the approach and keep in mind that it might not guarantee a perfect solution in different conditions.

## CONCLUSION

The post-disaster housing reconstruction process is complex and complicated not only because of the scale and urgency of the project. One of the considerations should be how beneficiaries will accommodate and make the houses their homes. The examples studied in this chapter defined three approaches to the design of the house: individual house (owner-driven approach), standard / model houses and core houses. The individual house approach was excluded from the analysis as all the decision-making concerning design and construction of the house are responsibility of beneficiaries, which leads to highly personalised and very different solutions. Standard houses are mostly connected with the top-down constructor driven approach with little or no participation from the affected community. As shown in the examples, when people are facing a 'take it or leave it' approach and the house doesn't meet any social or cultural expectations they mostly decide to abandon the provided housing.

Because of that, some of the agencies are implementing the core (incremental) housing strategy and providing structurally-enhanced core structure (in some cases starting as a temporary shelter) that beneficiaries can modify and extend if they wish to. However, designing core houses and just handing them over to the community may result in problems like creating too complex and big structures that might influence the performance of the house, both culturally and climatically. Agencies and builders need to either inform and





FIGURE 6. Rebuilding Philippines - after 2013 Haiyan typhoon.  
Source: <http://www.willexplorephilippines.com/willhelprebuildph/> (Accessed: 01/08/16)

teach the communities how to extend and modify their houses or include beneficiaries in the designing and building process so they can learn and understand the technology they will work with. Whichever approach is chosen for the post-disaster reconstruction, the agencies involved should be aware of the limitations of the strategy. Utilizing ‘core housing’ or pursuing the community-driven approach doesn’t automatically mean a successful reconstruction.

In this chapter we recognized three common solutions to post-disaster reconstruction: (1) the standard house, (2) the core (incremental) house; and (3) custom individual design. We expanded in detail on the first two types. A number of cases studies of both standard and incremental houses were studied, in order to recognize the level of flexibility, strengths and limitations of each solution. Even though, post-disaster reconstruction is an extreme case in housing construction, the large scale mass housing solutions applied in the process can be informative for the other housing projects. Multiple mass housing strategies were tested and applied in post-disaster environments. Considering the strengths and limitations of each can help us in creating a framework for all future mass housing projects, not only limited to disaster environments.

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SHARIFAH SALWA SYED MAHDZAR  
WONG ZHI ZONG

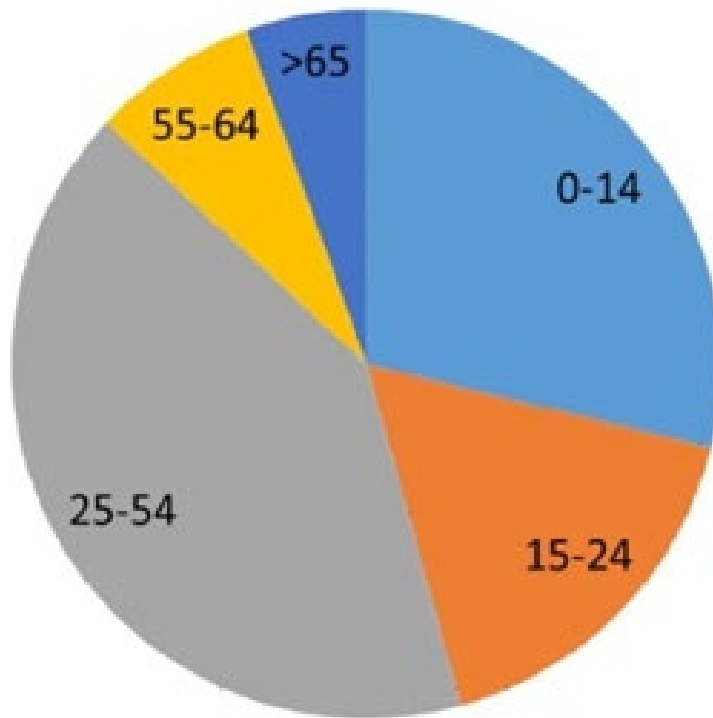
FLEXIBLE AND ADAPTABLE PUBLIC HOUSING  
FOR YOUTH IN MALAYSIA

*This study seeks to investigate and determine the affordability of middle-income earners especially young generation in few major cities in Malaysia. Specifically, the aim of this research intends to investigate and research towards the possibility of open building concept in public housing and provide architectural solution to increase the adaptability and flexibility of housing youth living high rise public housing that reflects the culture and image of the community towards interchangeable settlement pattern. Primary data consisting of non-participative and semi structured observation, which include questionnaire and interview session, field studies as well as site observation. Observation method is used in order to gather the information around the site at Kampung Bakar Batu and come out with site analysis at the end of research. For secondary data, lots of study conducted through few cases study. As Conclusion, there are few significant and difference needs between young couple with children and without children.*

This study seeks to investigate and determine the affordability of middle-income earners especially young generation in few major cities in Malaysia after drawing on case studies in different country and city. The respondents of the study were young graduate in Malaysia whose average age is among 22 to 32 years old. They must be at least a diploma holder. Household incomes of them are not more than RM 4500 per months. It have been identified that the main cause of early divorces in the national capital is the financial problems and high costs of living. Young generation nowadays found it hard to buy and own a house after they graduated because of the high living cost especially those who working and staying in urban area such as Kuala Lumpur, Selangor and Johor area. Specifically, the aim of this research intends to investigates and research towards the possibility of open building concept in public housing and provide architectural solution to increase the adaptability and flexibility of housing youth living high rise public housing that reflects the culture and image of the community towards interchangeable settlement pattern. The objectives are to provide affordable housing options for young couple (youth) that reflect their needs and circumstances, to explore the possibilities that engage youth and assist them to participate in planning and design process and to enhance communal living qualities in youth living housing.

The provision of public housing in Kuala Lumpur began before Independence. The Kuala Lumpur Municipal Council built the high-rise flats Suleiman Courts on Batu Road and Melati Flats on Jalan Loke Yew in 1956 to address the housing shortage & squatter problems of the time (Kamarul Afizi et al. 2008). The total number of public housing units in Kuala Lumpur under DBKL increased to 71,031 by end-2012 which is the largest stock of public housing in a Malaysian city (Shuid, S. 2013). Through DBKL, the Government intended to sell all 29,562 units under PPR-MTEN & 14,584 units under DBKL's Public Housing with a selling price of RM35, 000 per unit.

Lower or middle-income wage workers especially youth are compelled to go for rented homes or choose a place at the outskirts of the city because the property prices are now sky-high. There is only 27.5% of all newly-launched housing developments were for properties priced in the range of RM100,000 to RM250,000 according to the 2012 National Property Report. Mismatch between the provision of affordable housing and the needs of the low and middle-income groups especially in the Klang Valley and Penang. The respondents of the study were young graduate in Malaysia whose average age is among 22 to 32 years old. They must be at least a diploma holder. Household incomes of them are not more than RM 4500 per months. Based on the Figure 1, the major population



Population	30,073,353 (July 2014 est.)
Age structure	<p><b>0-14 years:</b> 28.8% (male 4,456,033/female 4,206,727)</p> <p><b>15-24 years:</b> 16.9% (male 2,580,486/female 2,511,579)</p> <p><b>25-54 years:</b> 41.2% (male 6,277,694/female 6,114,312)</p> <p><b>55-64 years:</b> 7.6% (male 1,163,861/female 1,122,746)</p> <p><b>65 years and over:</b> 5.5% (male 777,338/female 862,577) (2014 est.)</p>

FIGURE 1: Population in Malaysia according to the age group

in Malaysia from 25 to 54 and majority of them are youth within the age group.

Figure 2 show that there are 60% of graduates from studies that considered as low income group while some of them are unemployed. There are 25% of young families who have at least 5 years working experience. The affordability of buying a house decrease for the low income group as well as the mid-income group. Due to high cost, many household prefer to choose rental than owning a house. Because of high cost also many individual own their first home in their 30th or late 20th. Young people are finding it tough because of the insufficient homes and rising living costs in the wider context of high prices for home ownership and rentals. It lead to a greater reliance on debt for youth to pay housing costs, lower income levels than the general population which creates housing affordability due to the high housing costs.

According to Institute for Public Policy Research 2012, Youth want a chance to grow up, develop their lives, build careers and form relationships and they need decent quality, affordable homes in which to do so. Most obviously, buying a home is now beyond the reach of most young people. Over a quarter (26 per cent) of young people living with their parents said that their current housing negatively affects their ability to achieve life goals that are important to them. Living with parents meant that it was harder to spend time with new people, affected the way they felt about themselves, and impacted on their ability to feel confident in a relationship. Based on the Statistics from the National Population and Family Development Institute, it was estimated 20,000 couples got married each year and about half of that figure being young couples. Financial problems and high costs of living have been identified as the main cause of early divorces in the national capital.

## RESEARCH STUDY: FLEXIBLE AND ADAPTABLE HOUSING

Research methodology is a study on how research can be conducted scientifically. It solves the research problems systematically. The main purpose of the research is to determine the affordability of youth to own a house and explore the possibilities that engage youth in housing planning and design process. To access and evaluate above purposes, the Malaysia youth was chosen as the target group for this research. Data for the research was collected through some journal articles, interview and observation. There are two types of data used which are primary data and secondary data. Primary data consisting of non-participative and semi structured observation, which include questionnaire and interview session, field



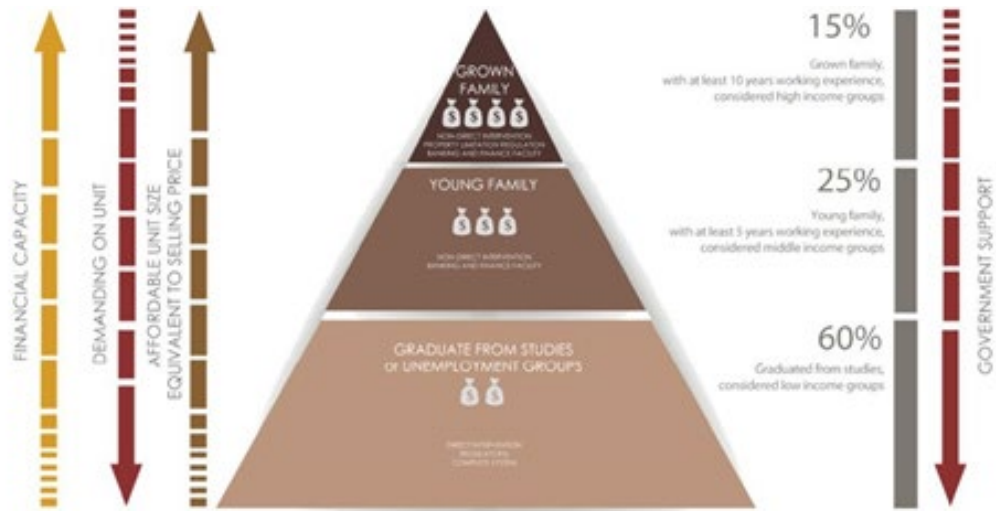
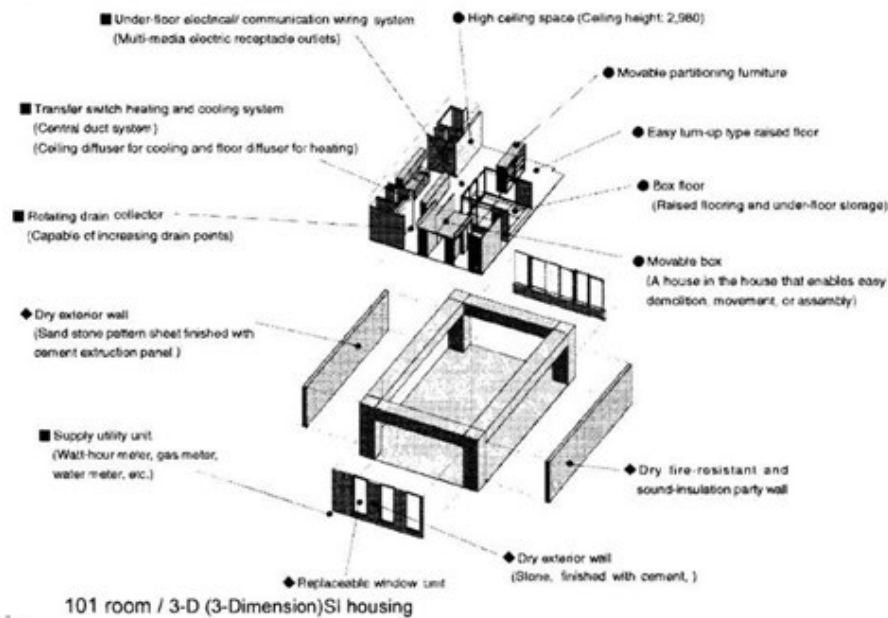


FIGURE 2: Housing Scenario In Malaysia



Note

- 1) The basic idea of 3-D is to keep story height higher (approximately 1.5 times of ordinary house) and realize a comfortable living space.
- 2) Although the story height is 1.2 times at this time, the principal concept is succeeded.
- 3) Water service area is concentrated at one side of plan to gain maximum volume of 3-D free space.
- 4) The space under the floor is used for heating pipes, electrical and multimedia wiring, storage units, etc.

FIGURE 3: Case Study on KSI Experimental

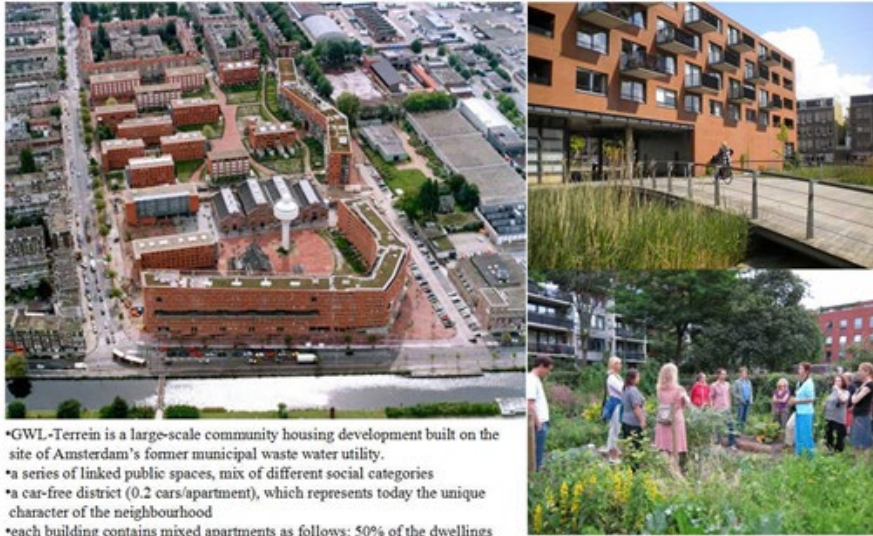
studies as well as site observation. For secondary data, lots of study conducted through articles, reports and books. To enhance the research of the proposal study, a few case studies also included.

There are five major types of qualitative research: phenomenology, ethnography, case study research, grounded theory, and historical research. Both of them can be subdivide into primary and secondary data which have distinct characteristics and tends to have its own roots. In this research, phenomenology, ethnography, case study research are implemented. For phenomenology, it helps the researcher to understand there are interview conducted among a group of youth and attempts to understand the current scenario for a youth to own a house. Interview session will be conducted on the youth target group at Johor Bahru, Malaysia. Survey research used in order to gather large amount of data. This method carried phase by phase which to collect the data that describe youth population. The interviews are more personal form of research and completed based on what the respondents comment.

Observation method is used in order to gather the information around the site at Kampung Bakar Batu and come out with site analysis at the end of research. Based on the guideline on the observation sheet which responds to the research objective, the S.W.O.T analysis is identified and analyse. Based on the gather information, the potential concentrated area, movement of human, existing pedestrians, vehicular in relation to time and space, sun orientation, existing facilities at Kampung Bakar Batu, Johor showed and the informative data will be consider during the design stage of youth housing. Physical environment consists of man-made features and natural environments that consists of surrounding environment also being study. To make sure the accuracy of data, the observation conducted on site for few days included weekdays and weekend.

Case study which are secondary data also using in this research especially focuses on the open building concept which can make the youth housing unit more flexible. This study will help me to understand more about the residential open buiding concept on realized housing projects. Due to the ‘open building’ movements pioneer’s practice and principles sometimes remain unknown, the case study methods spent me more time to find out the related information. Detailed account of few cases being study such as the KSI experimental housing, Henius House at Denmark by CF.Moller Architects, GWL-Terrein by KCAP Architects&Planners Dwelling of Tomorrow in Austria, NEXT 21 experimental housing at Osaka,Japan, and Pipe-Stairwell Adaptable Housing in Beijing,China.

• **GWL-Terrein - KCAP Architects&Planners**



- GWL-Terrein is a large-scale community housing development built on the site of Amsterdam's former municipal waste water utility.
- a series of linked public spaces, mix of different social categories
- a car-free district (0.2 cars/apartment), which represents today the unique character of the neighbourhood
- each building contains mixed apartments as follows: 50% of the dwellings represent social housing(allocated in 9 different buildings); 6 buildings contain market rate housing; 1 building contains apartments for elderly; and on the ground floor of 3 buildings there are specially fitted apartments for handicapped persons.
- residents have on spot commercial, leisure and educational facilities and services.

FIGURE 4. Case Study on GWL-Terrain



- -previously housed the Danish Eternit factories in Aalborg.
- It is now under the transformation from cement industry to new urban district. There are 240 new youth homes.
- a modern youth housing development with emphasis on the social community with many opportunities for shared activities.
- offer both shared kitchen facilities and common rooms on various floors, common fitness facilities, internet café and workshops as well as outdoor areas designed for sports, movement, health and social life.
- the common facilities are highlighted with colours, graphics and scenographic lighting

FIGURE 5. Caption, description, comments, source etc.

The first objective is to provide affordable housing options for young couple (youth) that reflect their needs and circumstances. High housing costs lead to a greater reliance on debt to pay housing costs, lower income levels than the general population which creates housing affordability.

It is general trend around the world that public housing only applies to the cost of the construction and refers to low quality. It is therefore essential to move towards a new definition where more importantly is the running cost of the building in term of sustainable construction method, water and energy usage. The low quality construction will usually need maintenance over time and costly. How affordable housing give the most with less money?

After some findings and study, the data shows that the building users are heterogeneous. There are few result summarized for the youth housing needs which show in the Table 1 based on the age group, occupation and income, needs and behavior pattern after some literature review and background study. There are few important elements that influence youth's behavior pattern which are their culture, education, income level, habits, social interaction range and hobby.

There are few significant and difference needs between young couple with children and without children. The basic spaces need for young couples are master bedroom, dining room, living room, bathroom, kitchen area and outdoor area. They can share laundry with their neighbour while those with children might need separate laundry room. For young couple without children, they enjoy the possibility to expand their home connection with the outside area and there are specific outside area for them to dry clothes. They also ask to have a pet office or mixed use room so that they can define the space themselves within the flexible area. Besides, they also concern about the economic of the unit and its privacy. For young couple with family, they hope to have activity or play area for their children and leisure area for their parents to enjoy. The possibility of having guests to their house is also one of the issues they concern. For this subgroup, they ask for safe environment with privacy.

The second objectives are to explore the possibilities that engage youth and assist them to participate in planning and design process. This is mainly to view the issue on young people live highly mobile or transient lives, moving regularly. Besides, shortage of suitable properties that meet their needs also one of the issues that can be discussed on.




	AGE GROUP	OCCUPATION & INCOME	NEEDS AND BEHAVIOR PATTERN
	Free roaming: (broadly, aged 18-27)	fresh graduate with no saving and short working hours	-those who prioritise <b>flexibility and independence</b> . They want to spend as <b>little money</b> as possible on their housing and <b>sacrifice quality and permanence</b> for flexibility and affordability.
	Transitioning: (broadly 24-30)	Medium income with little saving	-those who prioritise moving into <b>quality</b> accommodation and <b>having control over their space</b> . In order to feel more grown-up and to form relationships, they want to have <b>space to socialise</b> as well as control over their home and what happens in it.
	Establishing: (broadly 28-35)	with stable income and saving	-those who <b>prioritise stability and security</b> . In order to <b>start a family</b> or put down roots into a community, they want more certainty that they can stay in their home for the long term. <b>Children become the core of family</b> , concern about learning environment for their children

TABLE 1. Target user study

## User are heterogeneous!

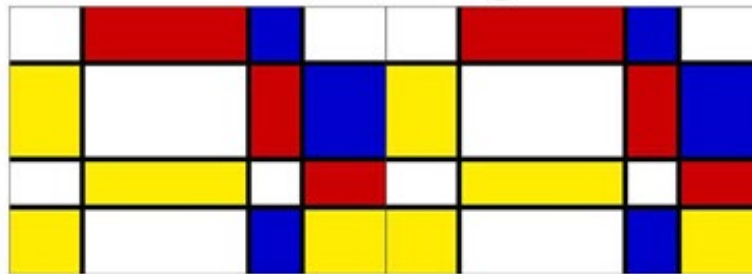


FIGURE 6. Heterogeneous users with different preference

Some of the strategies suggested are flexibility; mobility and multi-functional usage seem to correspond to our need for stability, security, ownership and identity, converging into a holistic experience of living. Flexible Interiors lend a creative and dynamic quality to dwellings VOICES of young people in planning. It ensures the needs of young people are identified as part of application and assessment processes. The implementation of the 'Open Building Concept' which maximum flexibility and typological variety using 'modular' change into different form and never stands still 'being like water'. The theme touches the aspect of community, sustainability and creativity.

Third objective is to enhance communal living qualities in youth living housing. This is to address the issue of anti-social or offending behavior (social isolation). Suggested strategy of improving the social and physical amenity in estates in order Enhance the connection between homes and feeling part of a community was a strong theme. Besides, ensure that community engagement strategies developed as part of tenant participation and community regeneration initiatives include specific strategies for engaging young people and monitoring their participation.

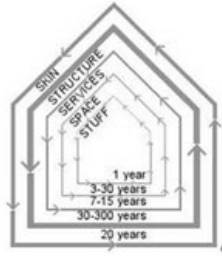
The independent living units are arranged in clusters, forming micro-communities within the larger context of the village and wider community. The units are inwards facing, to direct residents towards social and independent relationships with their immediate neighbours. Each cluster of units is centred around a shared spaces, composed of edible garden and seating areas. Each ILU has equal access to the outdoor social space which encouraging a shared sense of ownership and responsibility. The open recreational area and shaded pavilions are scattered throughout the site for larger social gatherings. The key to the success of all social spaces throughout the site are their central location, which allow access for all residents.

## CONCLUSION: STRATEGIES AND CONCEPTS

It would make no sense to implement adaptability into all structural elements. Research will sort out which structural elements provide a possibility and an additional value to flexibility in utilization by adaptability. This brings us back to the question posed in the introduction: How does one design for time? Technical feasibility alone does not accomplish a sustainable solution. If adaptability brings an understanding of time, it brings an emphasis on process and enabling the building to 'learn' and the users to

**Maximize building's lifecycle**

A building's different layers need to be changed more or less often. The load-bearing elements are often complex to change and have a lifecycle of 30-300 years. The room layout needs to be changed more often as it has a lifecycle of 3-30 years.<sup>7</sup> A building with modular components separates these elements with different lifecycles, creating a building which can sustain for a long time as every separate part can be exchanged with ease.<sup>8</sup>



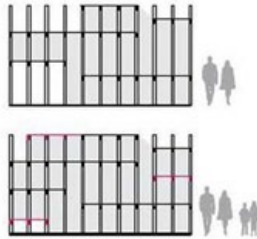
**Clarity in construction**

Because of the clarity in distinction between load-bearing and non-load-bearing elements, residents can easily understand how the building can be changed.



**Expansion instead of relocation**

Residents don't need to move when they require more space. Genter Straße holds a lot of reserve space. Additional space can be released from within the concrete skeleton, either by addition of floors and infill on the outside in the non-filled parts of the skeleton, or on the inside by filling in initially one-and-a-half or two storey spaces.



**Flexible services**

The locations of services is crucial for future change and flexibility. In the Genter Straße services are located in a fixed core where it allows for many plan layouts.<sup>22</sup> Next 21 utilizes a separate service floor containing all the plumbing and wiring. This separate service floor allows kitchen, bathroom etc. to be located anywhere.<sup>23</sup>

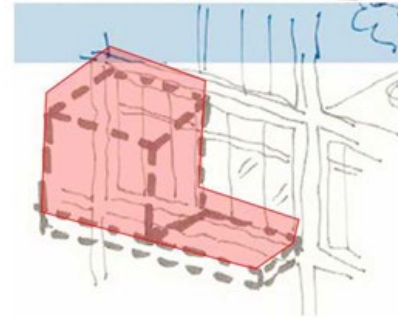
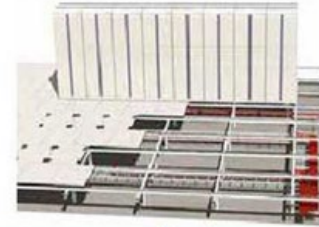
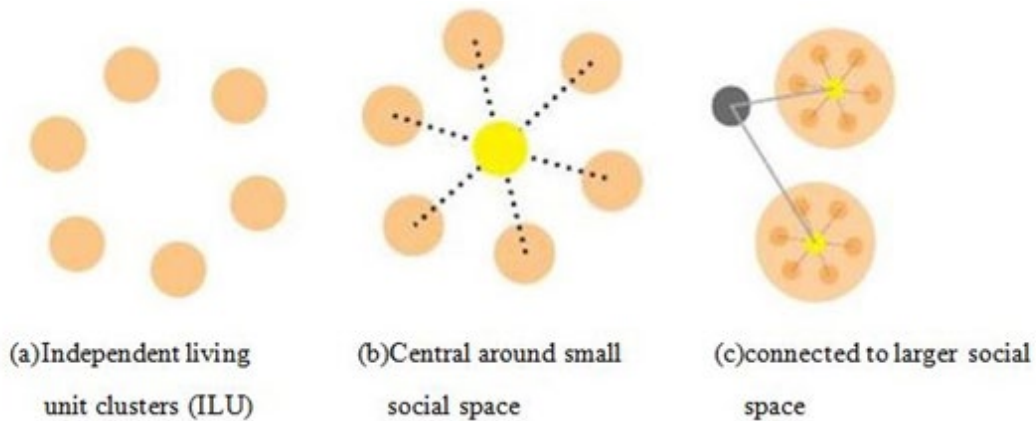


FIGURE 7. Strategy study to be implement to increase the flexibility of housing unit

FIGURE 8. Community Engagement Strategies



‘teach’ or shape the space themselves. Adaptability forces design to become an ongoing social process between designer and user over time. The designer must focus on enabling adaptation to take place; as opposed to attempting to control experiences and anticipate the future. Hertzberger (1991) stresses, “Architecture should offer an incentive to its users to influence it wherever possible, not merely to reinforce its identity but more especially to enhance and affirm the identity of its users.” Towards flexible construction method, the housing for youth can be more sustainable in term of its lifetime and also suit the preference of youth who might grow their family.

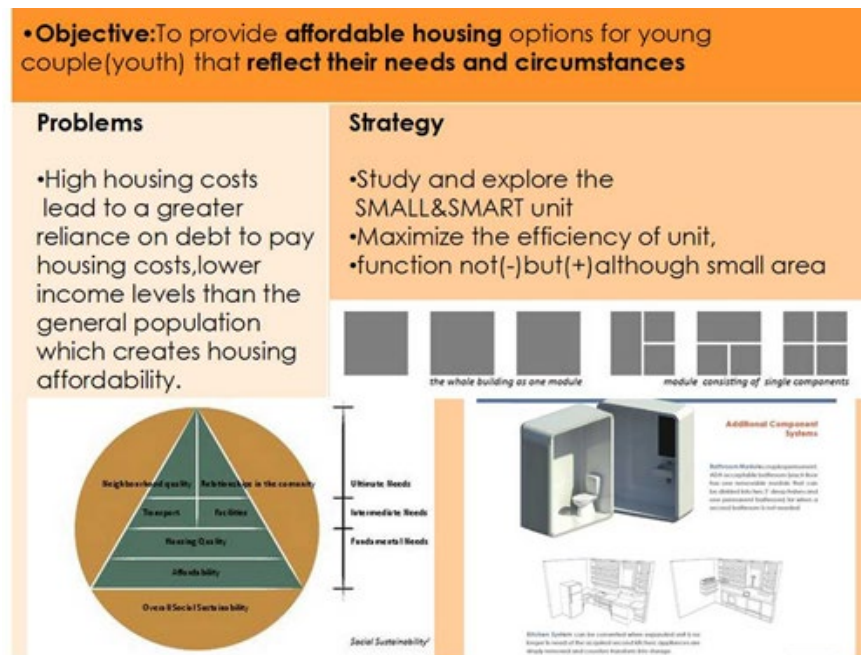


TABLE 2. Objective 1 with problems and strategy



•Objective:To explore the possibilities that engage youth and assist them to participate in planning and design process.	
<b>Problem</b>	<b>Strategy</b>
•A lack of safety and security	•Cluster design with courtyard concept which emphasis on natural surveillance.
<b>Issue</b>	<b>Concept</b>
•young people live highly mobile or transient lives, moving regularly. •shortage of suitable properties that meet their needs	•Flexibility, mobility and multi-functional usage seem to correspond to our need for stability, security, ownership and identity,converging into a holistic experience of living. •Flexible Interiors lend a creative and dynamic quality to dwellings •VOICES of young people in planning •Ensure the needs of young people are identified as part of application and assessment processes.

TABLE 3. Objective 2 with problems and strategy

•Objective:To enhance communal living qualities in youth living housing	
<b>Problem</b>	<b>Strategy</b>
• anti-social or offending behaviour (social isolation)	•Improve social and physical amenity in estates
<b>Issue</b>	<b>Concept</b>
•Community cohesion is suffering, lacking sense of belonging to a neighbourhood	<div data-bbox="911 1024 1294 1268" data-label="Image"> <p>Sketch showing a building with a courtyard and a person sitting on a bench. The sketch includes the text: 'Sketches → Future: Realistic, not too ambitious! Size: what? for 100's more to 1000.' and a small diagram of a person sitting on a bench.</p> </div> <p>•the connection between homes and feeling part of a community was a strong theme. •Ensure that community engagement strategies developed as part of tenant participation and community regeneration initiatives include specific strategies for engaging young people and monitoring their participation.</p> <div data-bbox="826 1471 1294 1589" data-label="Image"> <p>Three 3D block models showing different housing cluster configurations: a grey cluster, a yellow cluster, and a yellow cluster with a central courtyard.</p> </div>

TABLE 4. Objective 3 with problems and strategy

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iments

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# 12

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## DESIGN PROPOSALS - INCREMENTAL BUILDING 1 MODULAR COURTYARD

*This chapter illustrates the conceptual design of a residential block based on the principles of 'Open Building'. It is conceived as a composed by a "hard" concrete skeleton -the structure- and a set of "light" components -the Infill- providing flexibility and potential for "incremental growth". Compared to the second design (Incremental building 2), this project is more focused on the technological challenges posed by an "open" and "incremental" approach. Therefore it explores the potential for the combination of different technologies and materials in a modular, demountable and flexible system. In order to allow for a better environmental and climate adaptation, the proposal is based on the traditional courtyard typology.*

*This proposal is partially based on the strategies for affordability described in Chapter 2, and further analysed in Chapters 3 and 9 with regard to the economic feasibility and to the special interactions between the single units and the common spaces in the building.*

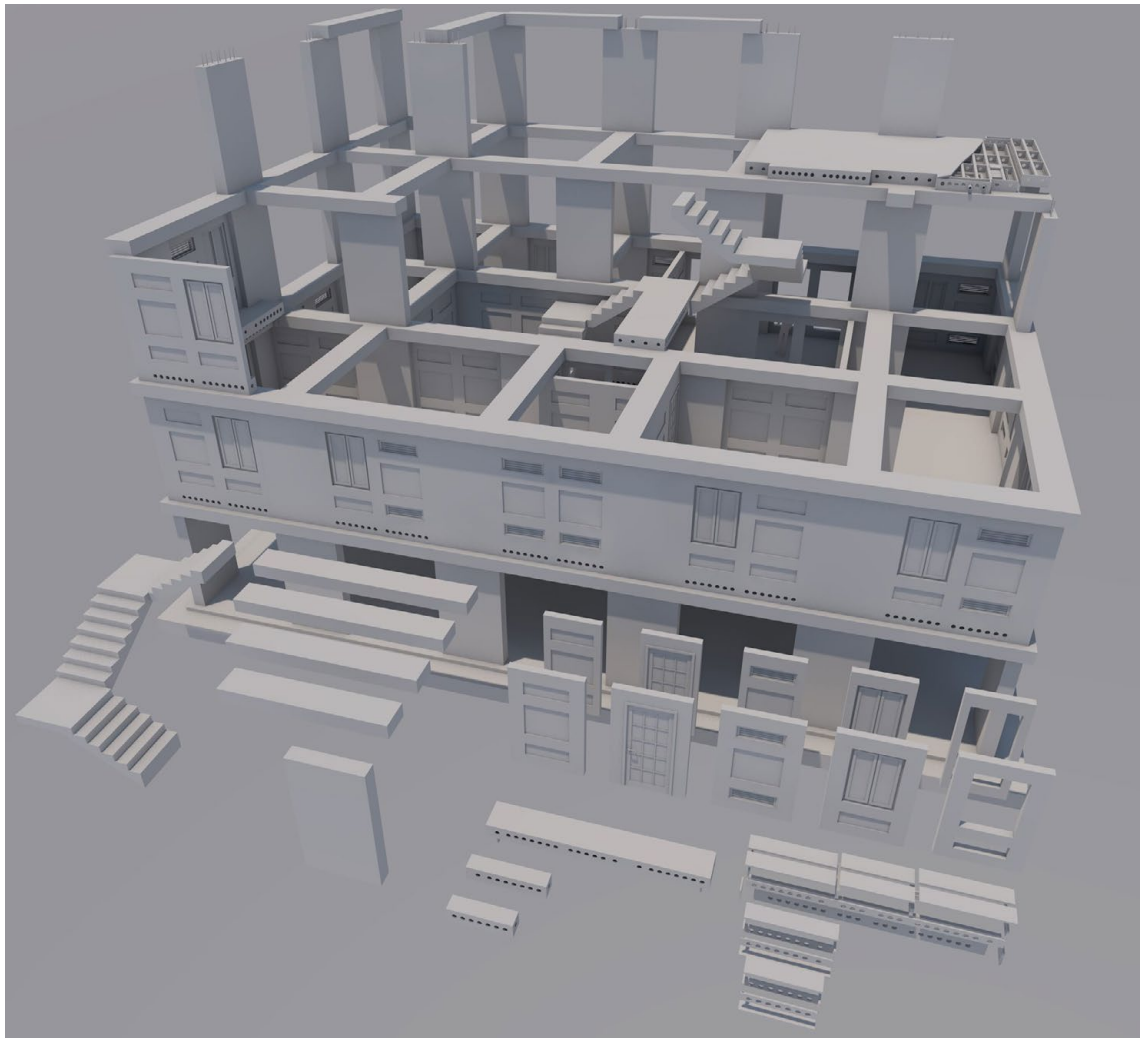
The proposal of an “Incremental Structure-Infill” building originates from the willingness to experiment new ways to provide affordable and sustainable housing in the Malaysian context, currently interested by a fast urbanisation process. The latter, in spite of a considerable housing provision on the market, is causing a substantial affordability issue for the low-income strata of the population, especially within the major urban areas of Kuala Lumpur and Johor Bahru (see chapter 2).

The separation between “Structure” and “Infill” has the potential to extend the life cycle of the building, by allowing for a longer preservation of the more durable components (the structure), and for the reuse/recycling of the rest. Furthermore, it introduces more flexibility, contributing, again, to extend the life of the building and to avoid/delay “hard” refurbishment interventions, more expensive in terms of financial resources, materials, energy, harmful emissions and waste production (demolition and reconstruction would evidently produce the same outcomes to a larger extent).

Yet, this approach implies a series of difficulties, most notably the need for modularisation and standardisation of all the building components, hard to achieve, as the building sector is characterised by a fragmented market. The research proposes the use of low-tech infill components, suitable for local manufacturing, in order to address this problem, to foster the use of local materials (reducing financial and environmental costs for transportation) and to contribute to the local economy.

The use of reinforced concrete is limited to columns and beams, while floors, external fabric and partition are conceived in light, renewable materials: wood or, when possible, bamboo. The higher environmental impact of the concrete structure would be compensated by an extended life cycle (compared to both infill components and other traditional concrete buildings).

The building-level circulation is organised around a “bridge” in the central courtyard, which grants access to the apartments from two opposite side. Since there are no predetermined subdivision between units, the ring of residential space around the courtyards can



The decomposed 3D model above provides a general overview of the constructive system de-signed for the experimental project. The hollow floor allow for simple installation and maintenance of plants, cabling and plumbing. The envelope/partition panels are all based on the same standardised frame and can be easily re-arranged in different configurations.

be allocated flexibly to a variable number of apartments. As an example, the incremental growth envisaged for the first floor results in a development from four studio apartments to three units ranging from one to three bedrooms, with the largest one occupying half of the floor, with two entrances and its own private central yard.

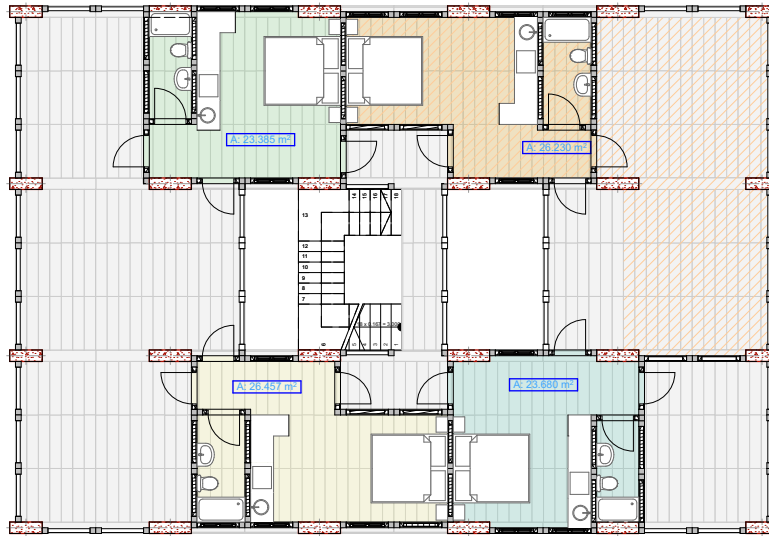
The hollow underfloor cavity and its direct connection to the exterior and to central courtyard guarantees higher flexibility also in the position of kitchens and bathrooms, which can be easily served by plumbing and drainage at any point of the floor.

The last floor is an open terrace, shared among the resident and suitable to accommodate photovoltaic and thermal solar systems. However, the building is conceived to be expandable in height as well.

The project proposal is a concept, not fully developed with regard to the technical details, and therefore more research would be needed especially in order to assess the performance of the infill components. More background research and specialised analysis on this proposal is presented in Chapters 2, 3, 9 and further architectural documentation is included in the Appendix.

The plans on the right and at the following pages exemplify the potential for incremental growth of the apartment and the flexibility of the building as a whole. Based on the same structure and circulation it is possible to accommodate a variable number of units, to interconnect them and to realise back entrances and open courtyard like in a traditional Malaysian house.



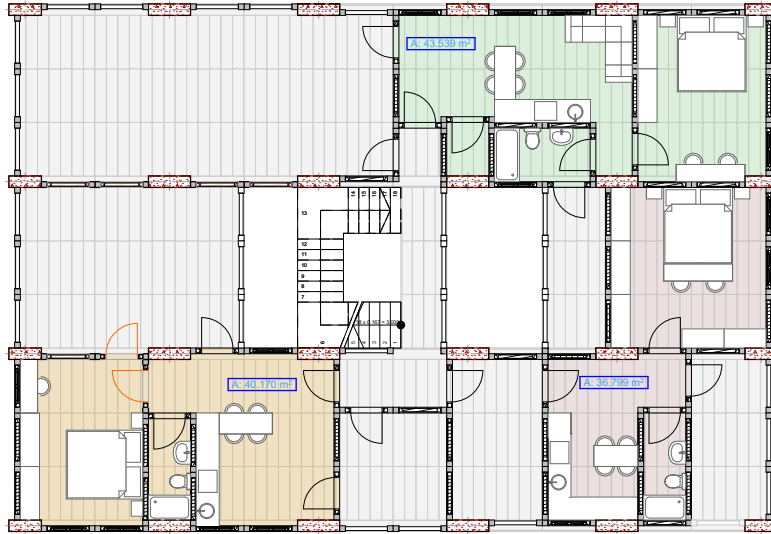


1st FLOOR - INITIAL STAGE

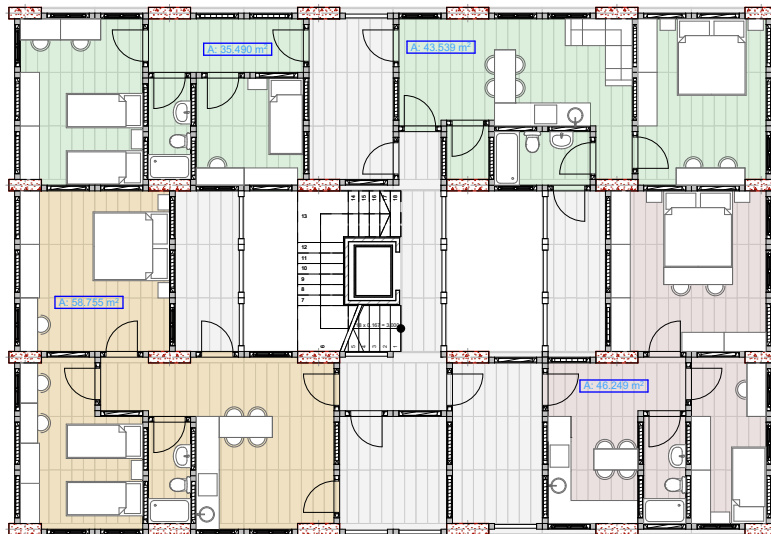


1st FLOOR - FULLY DEVELOPED

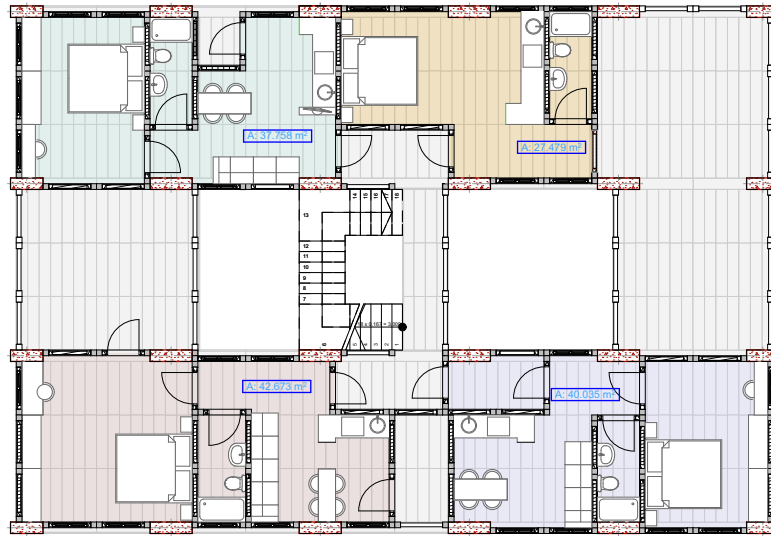




2nd FLOOR - INITIAL STAGE



2nd FLOOR - FULLY DEVELOPED

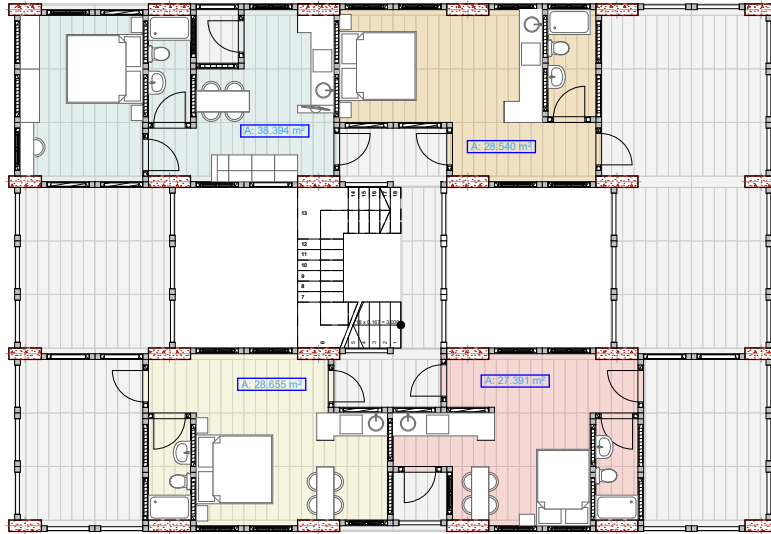


3rd FLOOR - INITIAL STAGE

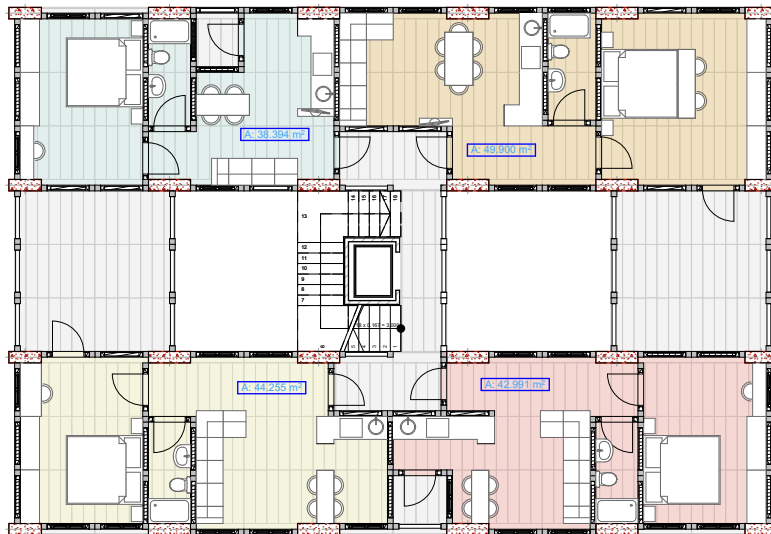


3rd FLOOR - FULLY DEVELOPED

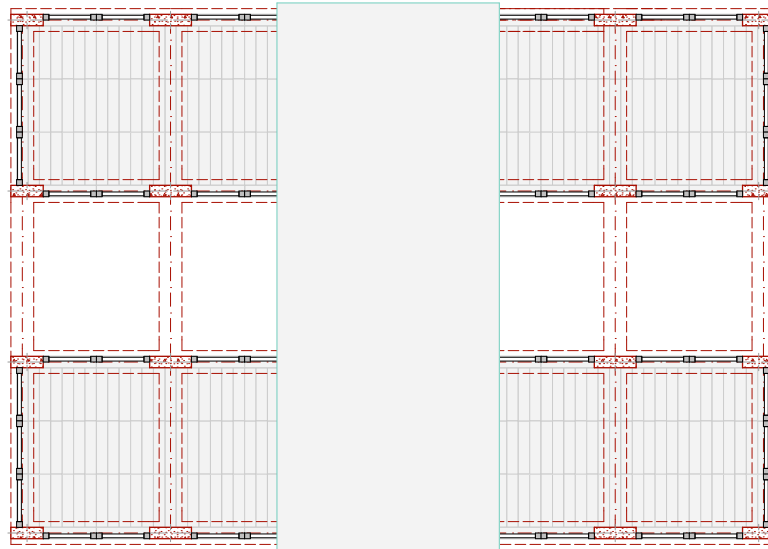




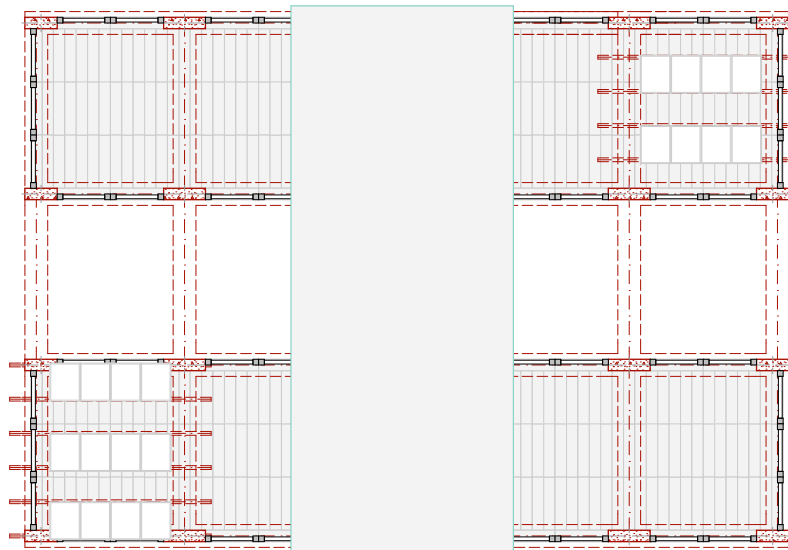
4th FLOOR - INITIAL STAGE



4th FLOOR - FULLY DEVELOPED



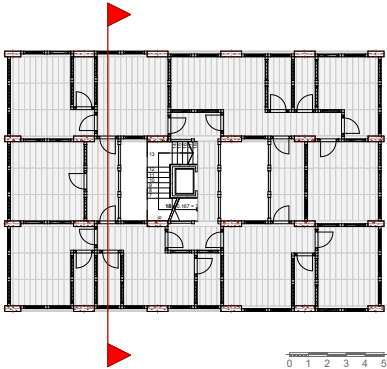
6th FLOOR (OVER ROOF) - INITIAL STAGE



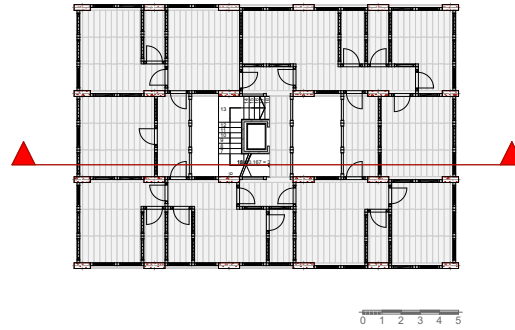
6th FLOOR (OVER ROOF) - FULLY DEVELOPED



The sections clarify the proportion of the central courtyard and show the relationship between the “hard” concrete structure and the “light” wooden components designed for the floor.



The width of the central courtyard is flexible and in this configuration is larger on the higher floors to improve daylighting and natural ventilation on the lower portion of the building







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DESIGN PROPOSALS - INCREMENTAL BUILDING 2  
LEVEL DIFFERENTIATION

*This chapter describes the conceptual design of a residential block, inspired by the same approach adopted for “Incremental Building 1”: an “Incremental Structure-Infill” (or Open Building) approach. However, this proposal is more concerned with spatial configuration of the apartments and explores the adaptation of traditional domestic architectures into a more compact and spatially efficient conformation. The main innovation of this project consists in the adoption of the traditional level differentiation found in vernacular Malaysian architecture in a contemporary, multilevel apartment building.*

Malaysian transition towards a more urbanised society and the dominance of high-density housing development are threaten the preservation of the local housing tradition. Nonetheless, the culture and the society which produced this architecture are still alive, and so is the need for solutions able to meet the competing demands of contemporary Malaysia. The solution proposed by this project is the combination of a traditional spatial configuration based on level differentiation for different spaces and a modern apartment block.

Vernacular Malaysian houses features a double entrance (front-back), open yards and different levels for dry and wet zones of the house. In a regular apartment block is not normally possible to reproduce this configuration due to the regular sequence of levelled floors and to the common circulation system which allows for one entrance (at the same level) for each unit. The experimental project presented here developed a more articulated typology, much more complex in its structure, to overcome those limits. The differentiation of the ramps and the consequent shift in section of the stairs landing, allows for the development of a spatial configuration very similar to the traditional one (two entrances and multiple levels) but on a multilevel building. This innovation, combined with the incremental and structure-infill strategies creates the conditions for a flexible provision of spaces, able to adapt to several configurations.

The proposal combines also a fixed, reinforced concrete structure, with light movable wooden panels. However the idea is to use few movable panels in strategic point of the apartment, in order to make the aimed flexibility more viable and potentially manageable by the occupants themselves. The two entrances also allow for the subdivision of each half floor in two smaller apartments or a suite composed by apartment + office. The plans

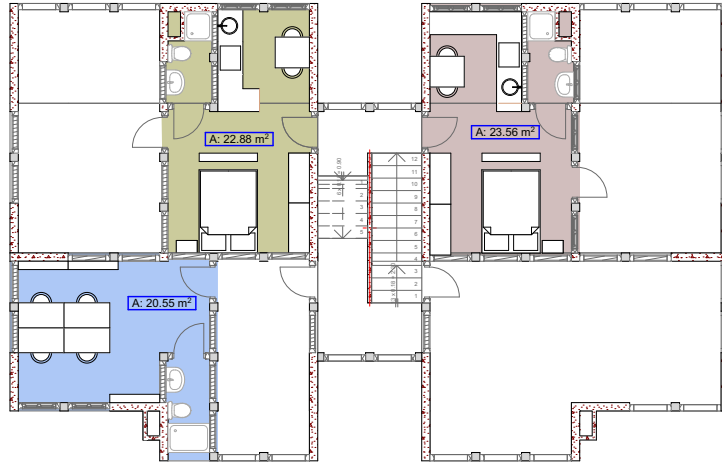
The complex spatial configuration of the proposed building which, similarly to the traditional Malaysian houses, when possible, accommodates kitchen and other wet zones at lower levels.



on the following pages present a series of possible combination, describing also the potential growth of the apartments over the time.

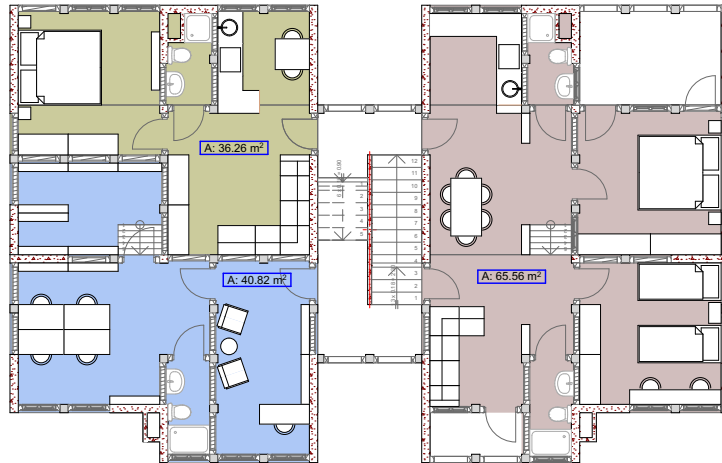
The panels are all standardised to a single size and are conceived to be easily manufactured using local renewable materials. The upper part of the panels include openable vents for natural ventilation.

For each floor two scenarios are described in the plans: an initial stage, at which only basic units are provided and a “Fully Developed” stage, showing the final result of the incremental growth. Many solutions preserve open spaces serving as yards in traditional houses

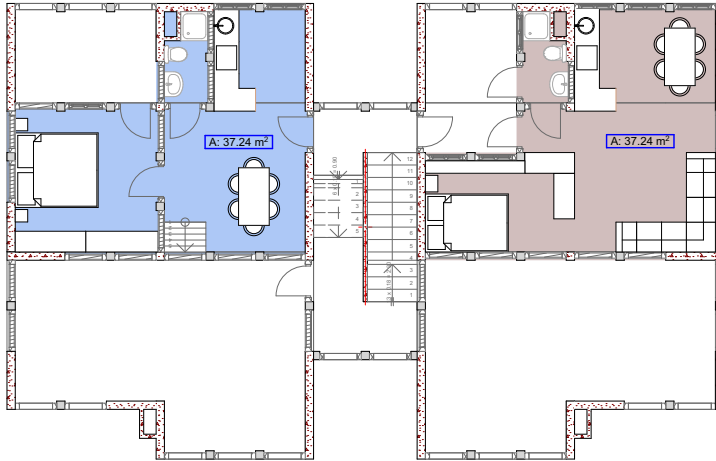


Initial stage

Fully developed

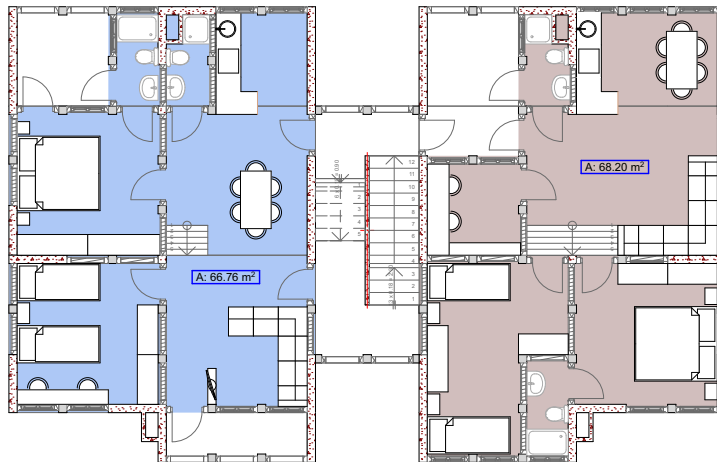


1<sup>st</sup> Floor

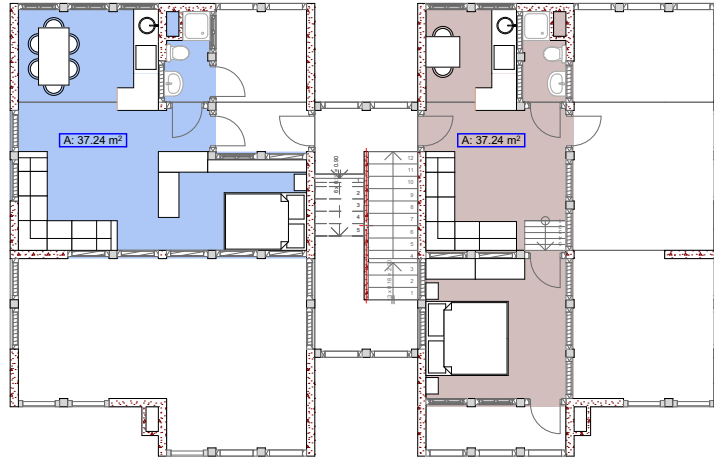


Initial stage

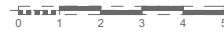
Fully developed



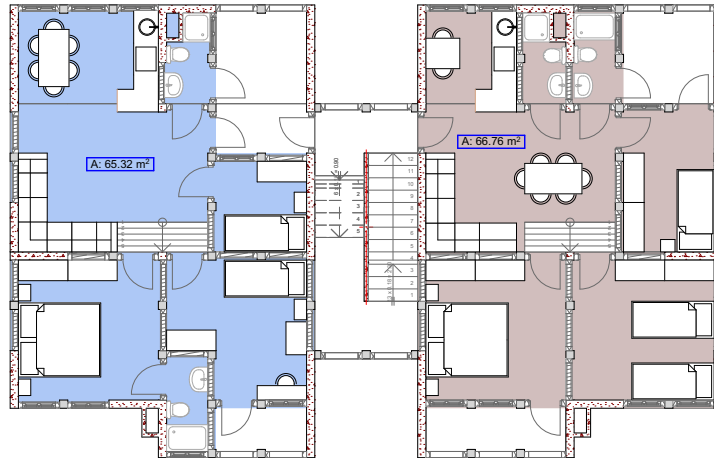
2<sup>nd</sup> Floor



Initial stage

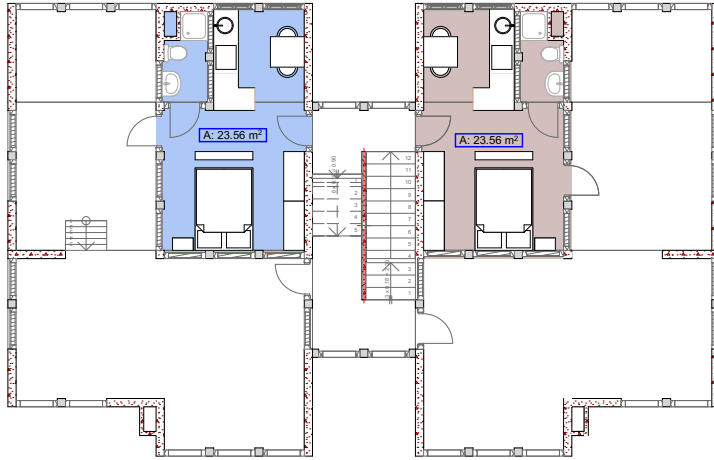


Fully developed



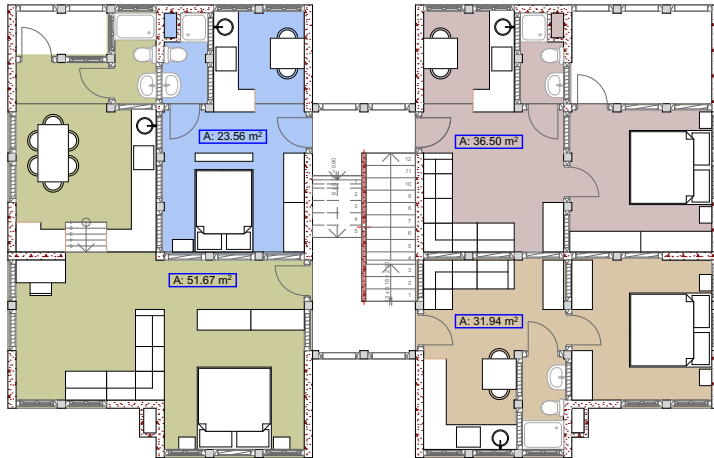
3<sup>rd</sup> Floor





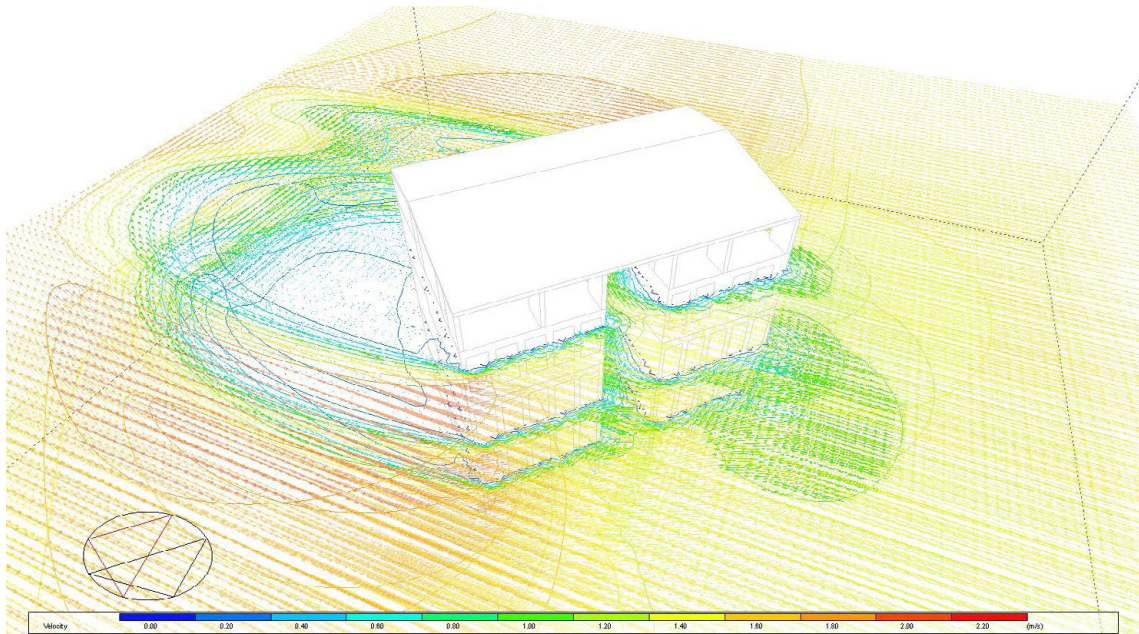
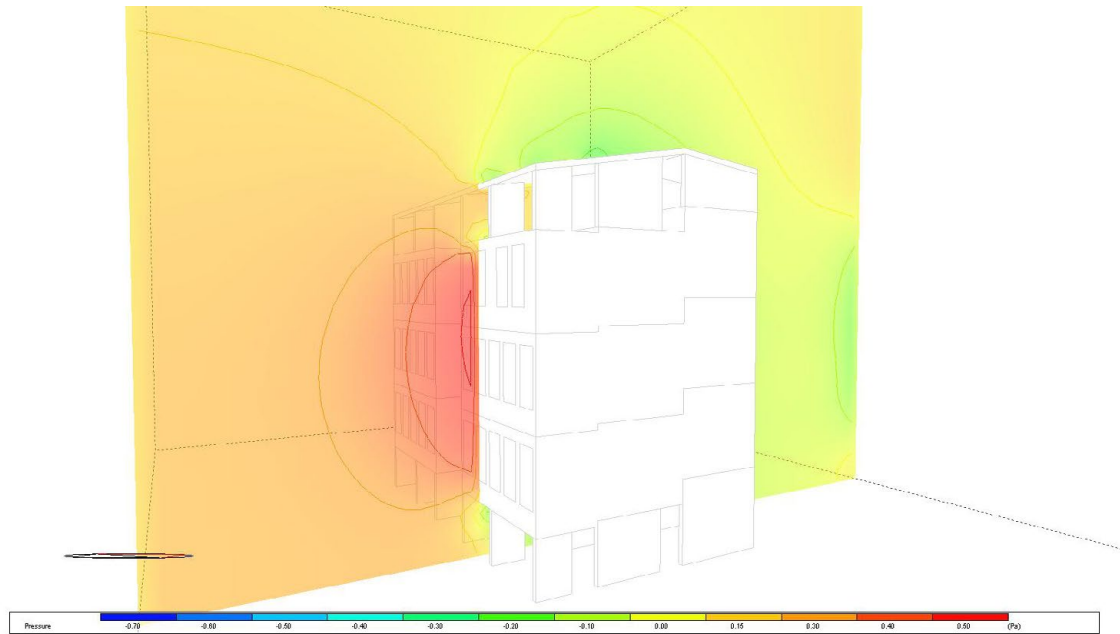
Initial stage

Fully developed

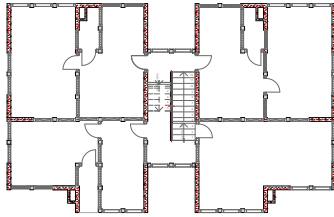


4<sup>th</sup> Floor

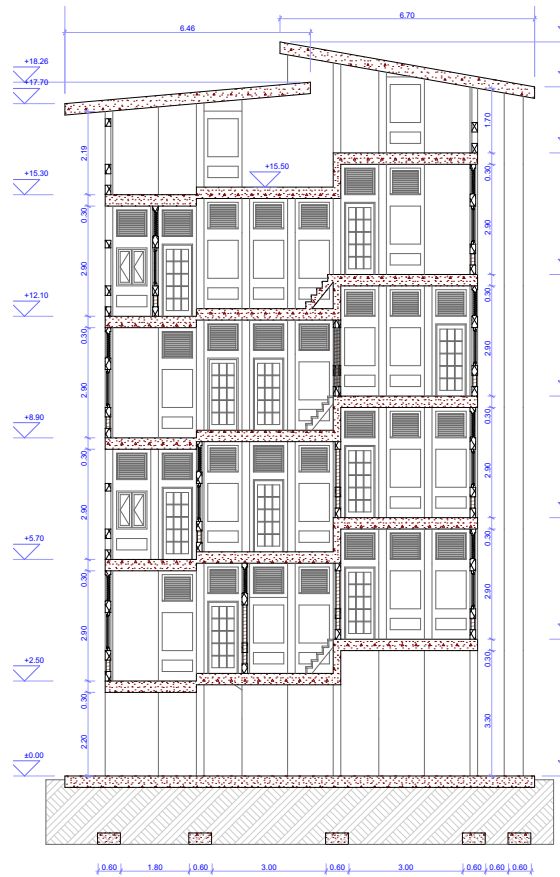


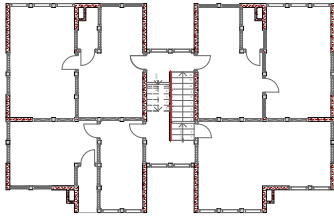


Fluid dynamic simulations have been performed to assess and optimise the potential for natural ventilation, a crucial energy saving and comfort measure in the hot humid Malaysia

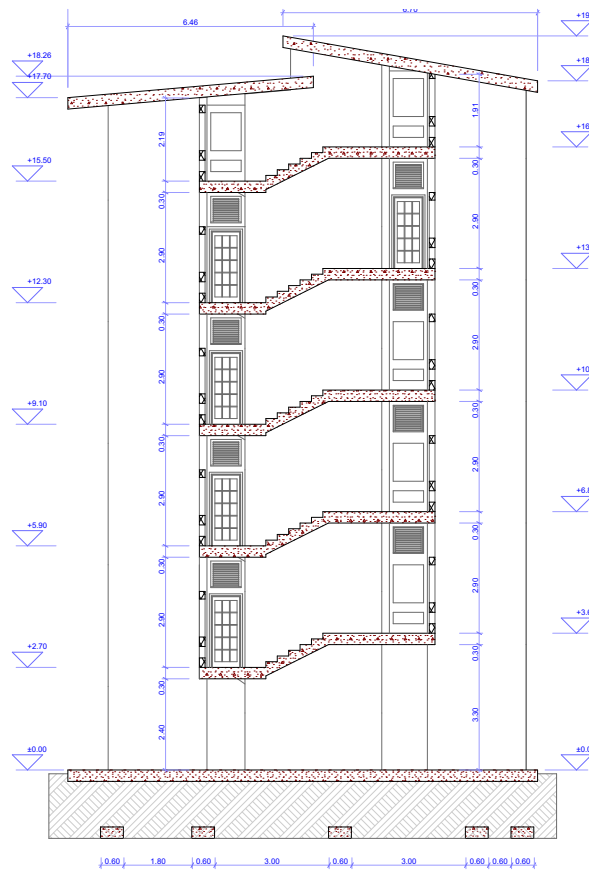


The spatial configuration of the apartments with the movable panels providing internal and external vents over the doors for natural ventilation.





The innovative configuration of the distribution in the buildings makes possible the provision of a second entrance on a different level for each apartment





## APPENDIX

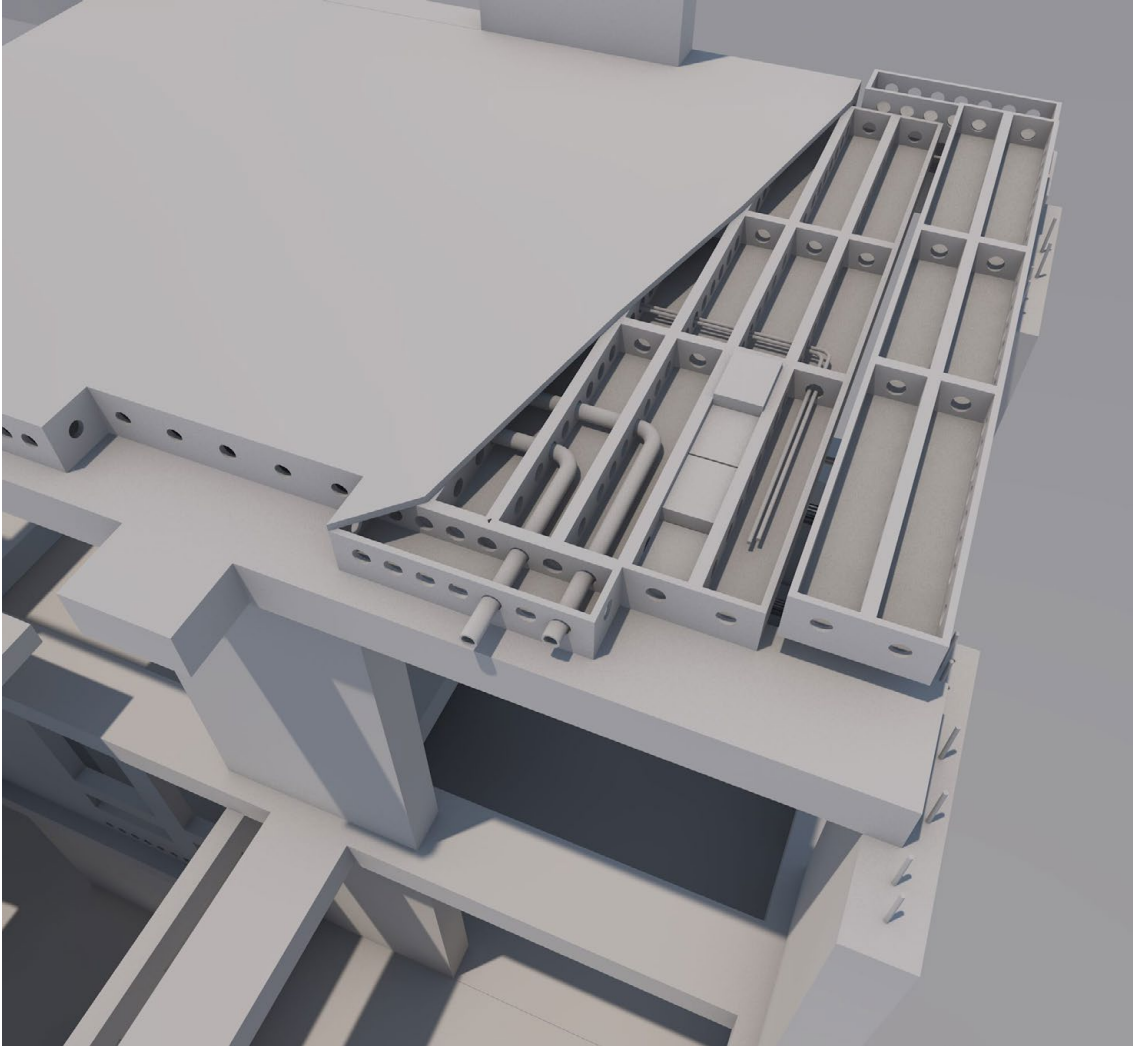
### DESIGN PROPOSALS - DOCUMENTATION INCREMENTAL BUILDING 1 AND 2

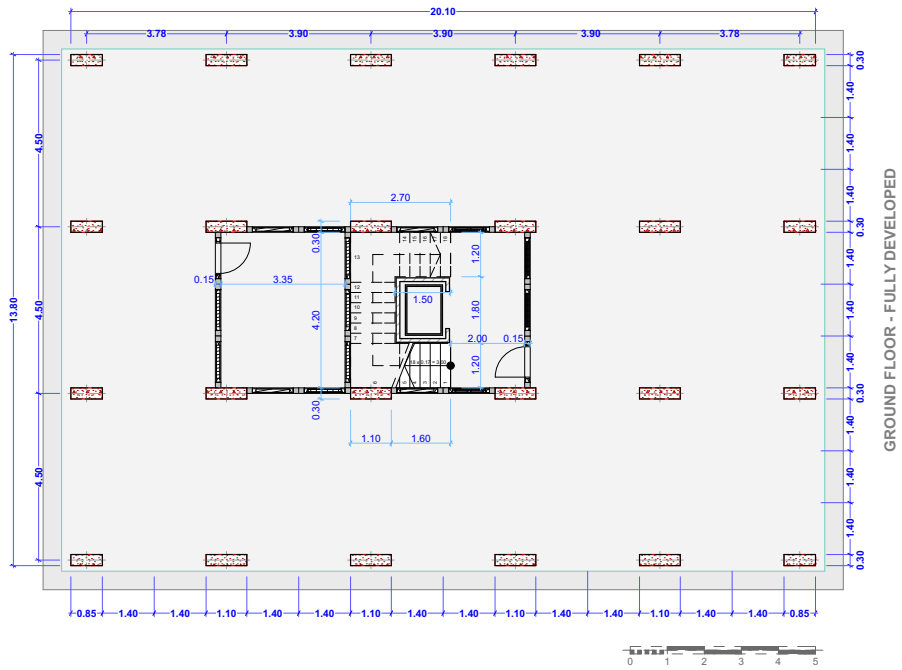
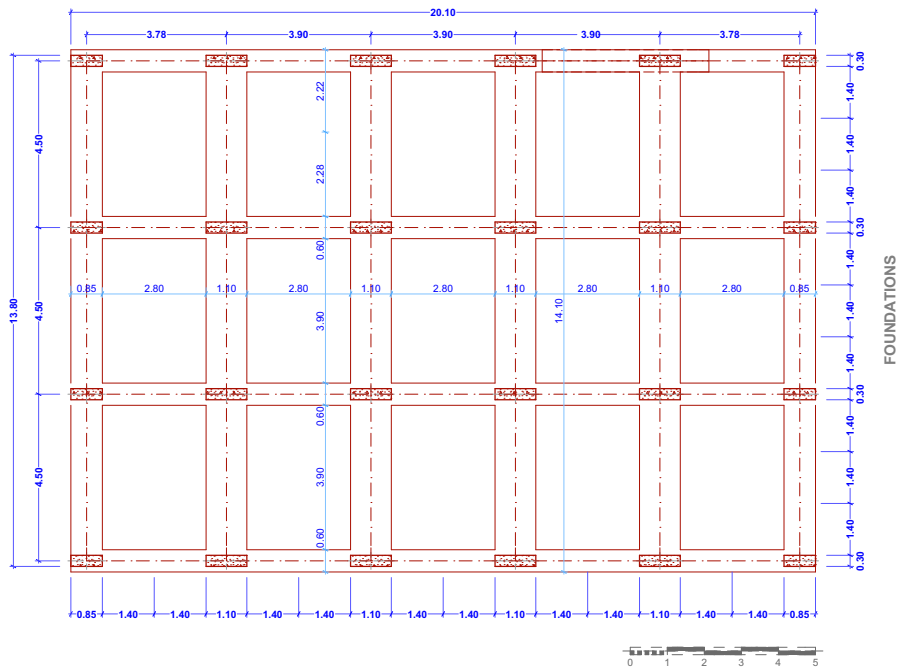
*This appendix contains a more detailed graphic documentation of the two design proposal (incremental Building 1 and Incremental building two).*

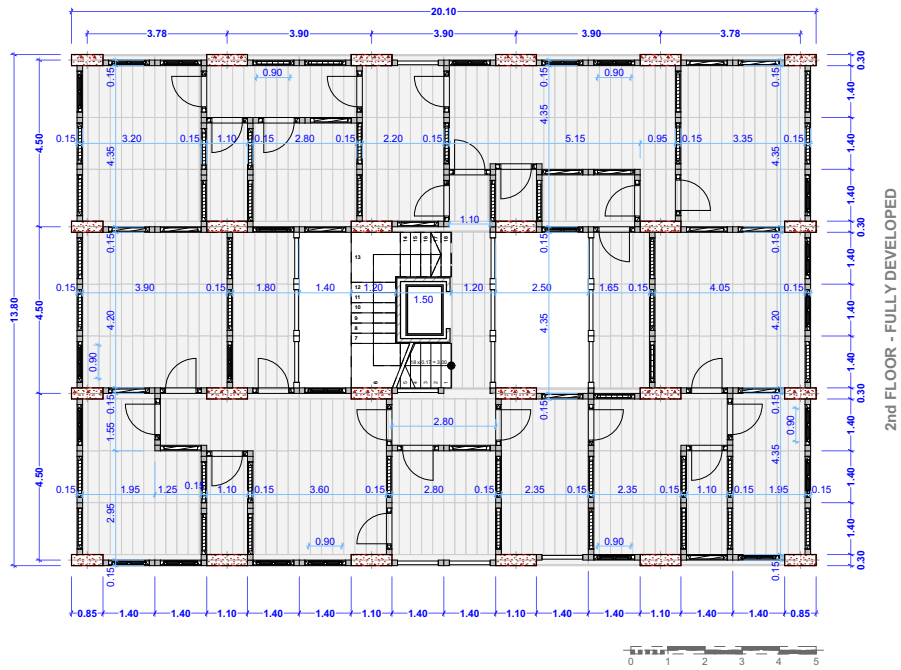
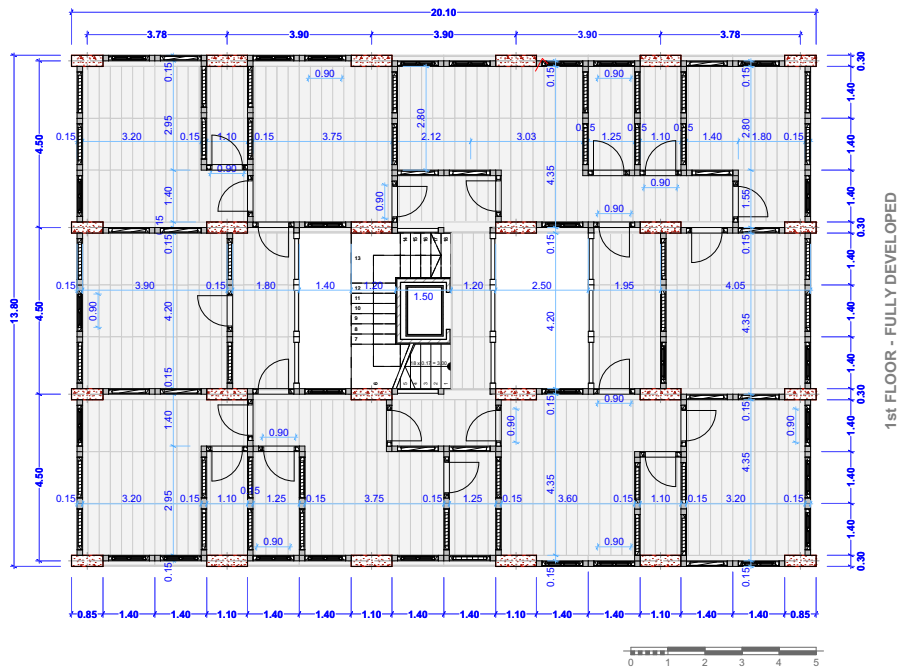
*Dimensioned architectural plans are provided for each floor of the two buildings at the “fully developed stage”.*

*For Incremental Building 1 is also included a simple catalogue of the modular elements designed for the structure and the infill components.*

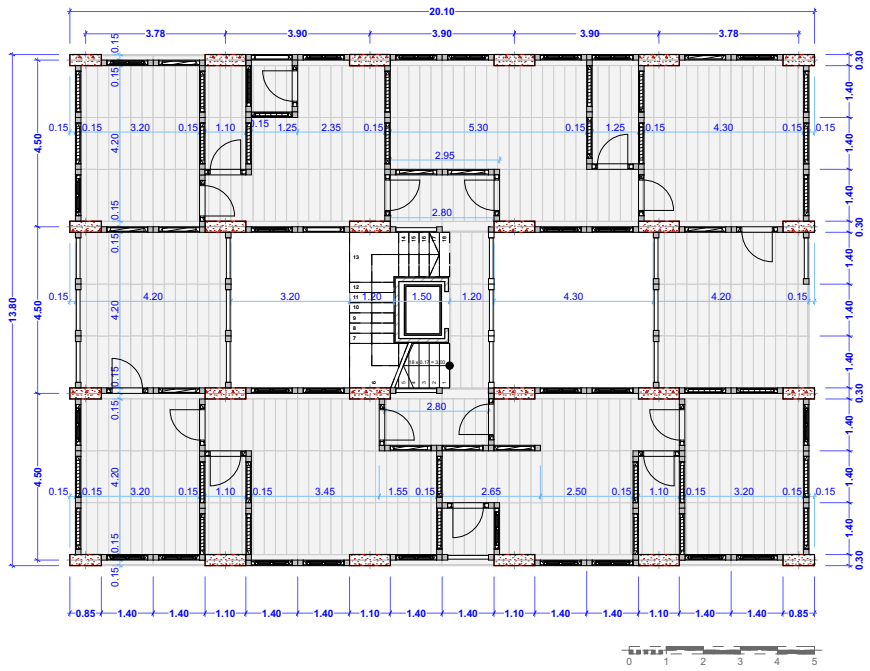
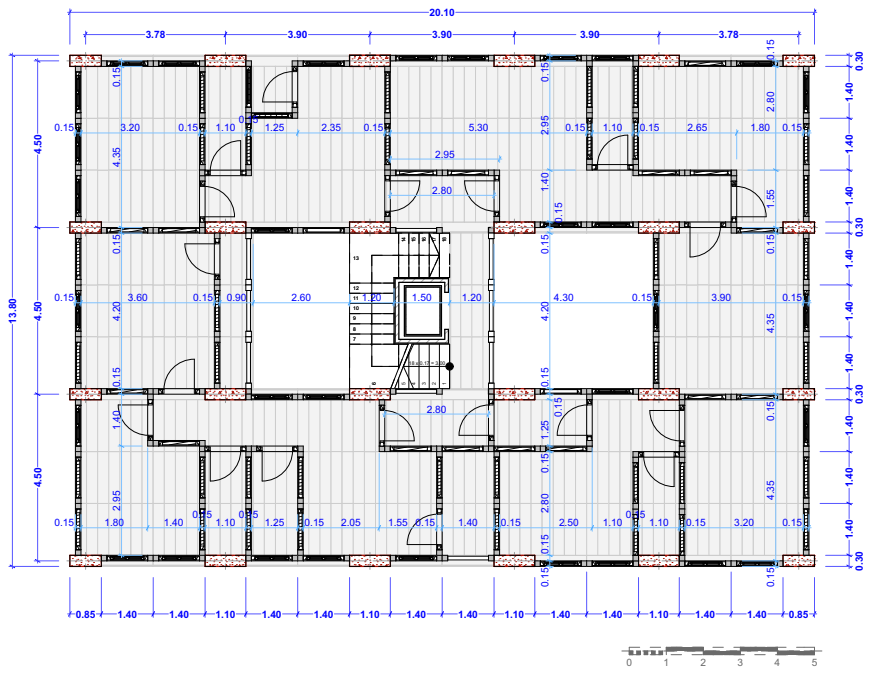
# INCREMENTAL BUILDING 1

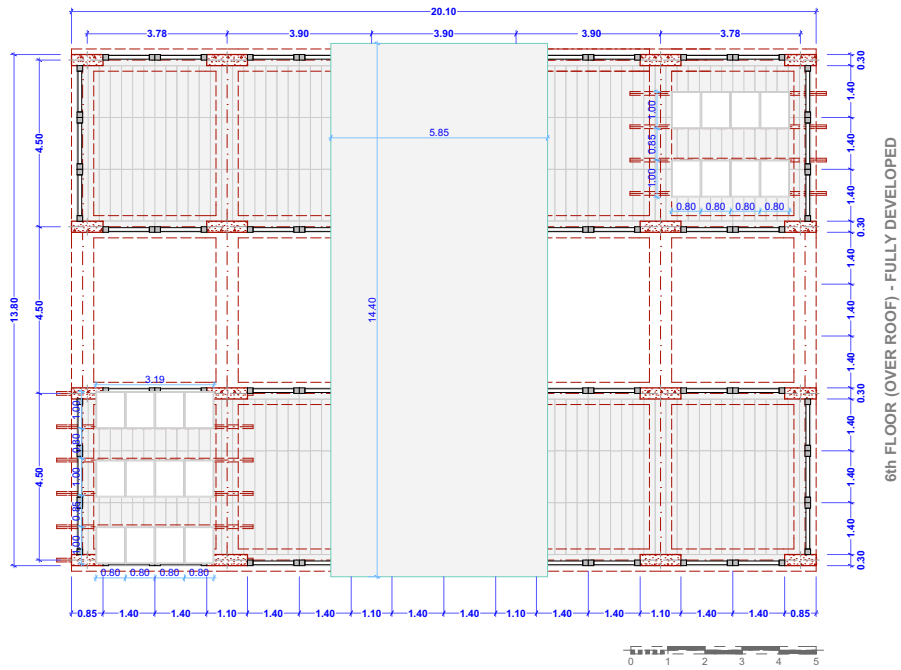
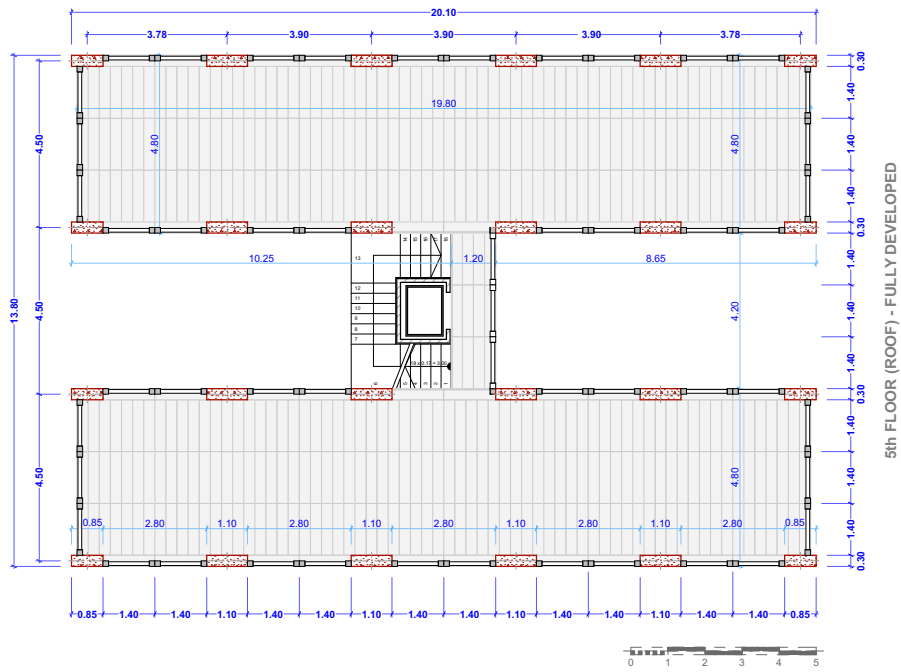






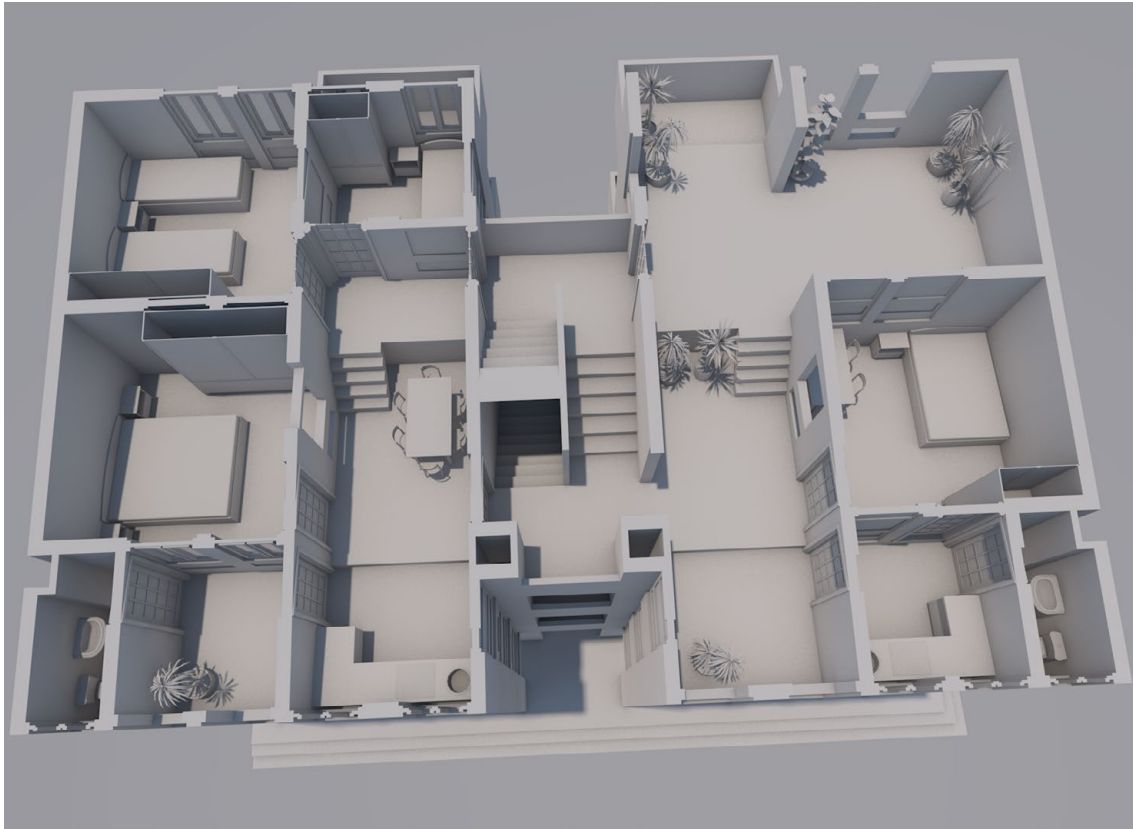


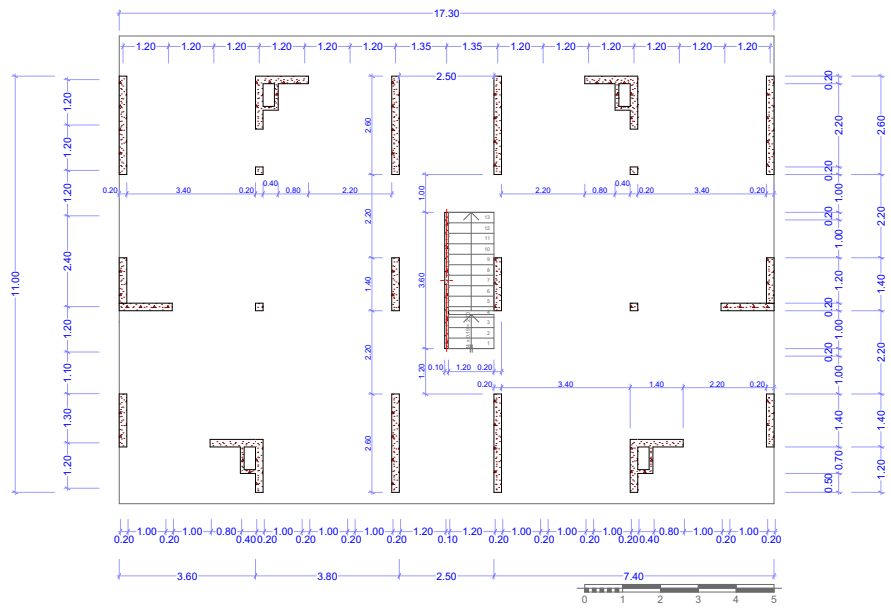
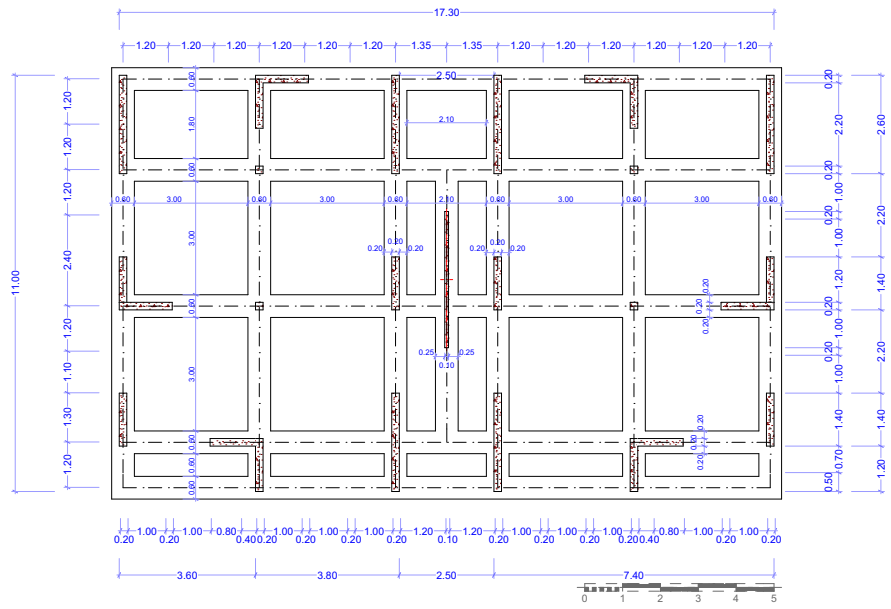






## INCREMENTAL BUILDING 2















# PROJECT TIMELINE - NORTHUMBRIA

- 2015
- APR Project started
  - AUG **UTM** visit to **Northumbria**  
Meetings and Seminars
  - SEP Open Building Conference  
Zurich, Swiss
  - SEP Research Fellow & Assistant  
employed at **Northumbria**  
Project extended for 6 months
  - OCT **Northumbria** visit to **UTM**  
Field Survey  
Ampang Forum with KL City Hall
  - NOV Cultural DNA Workshop  
KAIST, Daejeon, Korea  
Workshop paper published
- 2016
- JAN Housed by Choice Housed by  
Force Conference, University of  
Cyprus, Cyprus.  
Conference paper published
  - FEB **Northumbria** visit to **UTM**.  
Lectures and Seminars  
Field Survey
  - MAR Visit to Institute of Civil Engineering  
and Building Technology (KICT) and  
LG Windows in Seoul Korea  
for consultation of manufacturing of  
components
  - JUL **UTM** visit to **Northumbria**.  
Seminar and Meetings for  
continuing collaboration
  - AUG Visit to Research Institute of Eco-env  
ironmental Architecture in Seoul for  
consultation  
  
Lecture and consultation on BC  
project at British Embassy & British  
Council in Seoul
  - SEP End of Project
  - OCT Final publication by **UTM** & **Northumbria**  
Incremental SI Housing for Low-income  
Population in Malaysia  
(ebook and print book)
  - NOV A chapter 'Finding Genotype in  
Malay House' in Cultural DNA by  
Routledge will be published.





Dr Kyung Wook Seo, Principal Investigator, Northumbria University

Dr. Seo is a Reader in Architecture and Director of Teaching and Learning at Northumbria University. Before joining Northumbria, he was an Associate Professor and Head of Department at Kyonggi University in South Korea. He got the Bachelor's degree from Korea University, Master's from Georgia Tech, and PhD from Bartlett, University College London. As an architect and theorist, he has designed many residential buildings and published numerous papers on housing form and culture. His other research interests includes Open Building, Space Syntax of Buildings and Cities, and Human Cognition and Environmental Behaviour.

Dr Sharifah Salwa Syed Mahdzar, Partner Principal Investigator, Universiti Teknologi Malaysia

Dr Mahdzar is a Senior Lecturer at Department of Architecture, Faculty of Built Environment in UTM. She is also a Coordinator for a part time Architectural program at the department. She holds a PhD in Town Planning (Urban Design Specialism), from The Bartlett, University College London, UK. Her Bachelor of Architecture (Honour) was from University of Southwestern Louisiana, USA. Earlier, in her PhD career, Dr Mahdzar has received recognition and was awarded 'The Sir Terry Farrell Award' in the UK. An expert in Space Syntax technique, she has been working as an associate architect, a researcher and project design analyst, urban theorist and scientist in the UK as well as in Malaysia. Upon returning home, Dr Mahdzar served as an Urban Space Specialist for Iskandar Malaysia UTM Research Centre (IMREC) in 2009. Specialising in the development of Iskandar Malaysia ever since, Dr Mahdzar has involved in various other projects, amongst which are the housing development, ecotourism aspects of suburbs and the living condition of the marginal group (urban poor in slumps area, the aborigines, traditional malay culture of city living) in urban areas, especially in Iskandar Malaysia region, her own city where she is now residing.

Dr Marco Cimillo, Northumbria University

Dr Cimillo, Lecturer at XJTLU, was awarded his Master's Degree in Architecture and his PhD in Environmental Design by Sapienza University of Rome. He is also a fully registered architect, a LEED Green Associate and a member of IBPSA (International Performance Simulation Association) and SITdA (Italian Society of Technology of Architecture). Before joining XJTLU in August 2016, he carried out research and teaching activities at Northumbria University in Newcastle, at Sapienza University and the Italian National Institute of Architecture in Rome and at University of Camerino in Ascoli Piceno.

Pedro N. Montero Gosálbez, Northumbria University

I am a freelance practitioner and researcher in architecture and anthropology. I got a Bachelor and Master degree in architecture from University of Alicante and a Master of Research in social anthropology by University of Aberdeen. Through my work at Kéré Architecture, my experience ranged from urban regeneration and housing, in Europe, to low-tech high-quality housing and social infrastructure, in Africa. Afterwards, I worked as a Research Assistant at the Department of Architecture and the Built Environment

in Northumbria University focusing on ‘incremental’ and ‘self-help’ housing processes of building the environment. Currently, I combine my interests and practices on architecture, anthropology and ‘earthen’ masonry looking for social and ecological resilient alternatives of dwelling.

Dr Azhan Abdul Aziz, Universiti Teknologi Malaysia

Dr Azhan Abdul Aziz is a Senior Lecturer at the Department of Architecture, Faculty of Architecture, Planning and Surveying in Universiti Teknologi MARA (UiTM), Perak. His architectural education began at Washington University in St Louis, Missouri USA, where he received his Bachelor of Art in Architecture and Master of Architecture. He gained his professional practice in architecture in 1993 by joining one of Malaysia’s well established architectural and planning consultant firm, Perunding Alam Bina in Kuala Lumpur, and was involved in a various public and private projects including the prestigious Putrajaya development and Kuala Lumpur Central Terminal (KL Sentral). Dr Azhan started his career as a lecturer in 2000 at Universiti Teknologi MARA (UiTM) Perak, and continued studying architecture in Universiti Sains Malaysia, Pulau Pinang for his Master of Architecture in Housing. His interest in social aspects of housing and spatial design analysis lead him to pursue doctoral research project in the area at Universiti Teknologi Malaysia, Skudai, where he was awarded PhD in Architecture. He is currently the Faculty Coordinator of the Architecture Department at Universiti Teknologi MARA (UiTM) Perak.

Dr Laura Florez, Northumbria University

Dr Florez is a Senior Lecturer in Engineering and Built Environment at Northumbria University. She received dual BSc. in Civil Engineering and Industrial Engineering from Universidad de Los Andes, Colombia, and MSc. and Ph.D. in Building Construction from Georgia Tech. Dr Florez’s research is focused on decision making tools and innovative mathematical modeling applications for construction. Her areas of interest include: sustainability, workforce management, and productivity and process improvement. Prior to obtaining her Ph.D., she worked as a project manager in Pyramid Masonry in the US and as a structural engineer in P&D in Colombia.

David Morton, Associate Professor, Northumbria University

David is an Associate Professor in Architecture and Director of Enterprise & Engagement at Northumbria University. Before joining Northumbria, he was a Lead Architect for IKEA/ BoKlok GB and BoKlok AB and responsible for the IKEA ‘Flat Pack’ housing across Europe. David was awarded his RIBA Chartership from Newcastle University, Master’s from Northumbria University and is currently completing his PhD at Northumbria University. As an architect and designer, he has completed , industrial, tech facilities for major manufacturers and brands including Fujitsu, Siemens and IKEA including residential buildings for IKEA-BoKlok. He has published numerous papers on digital praxis, and digitizing the mass customisation processes for many building typologies. His other research interests includes Digital praxis, Mass Customisation within building processes, Algorithmic Production within construction and Architectural Pedagogy.

Siti Sabariah binti Mohd Noor, Universiti Teknologi Malaysia

Siti Sabariah binti Mohd Noor received her Bachelor Of Architecture with first class honours from Universiti Teknologi Malaysia (UTM) in 2010. Her thesis titled, “Life Cycle Home for low income people - Redefining Low-cost Public Housing for “Life Time Home Concept” focusing on micro and macro flexible planning of public housing that responds to the social and community development. Her design thesis won 1st Meritorious Award in UAC Architectural Student’s Design Award 2010. After graduating, she working as a tutor and studio master for Diploma in Architecture, UTM Space, Kuala Lumpur for a year before practising architecture. Currently, she is an architect in Public Works Department, Ministry Of Works, Malaysia and had involved in various government’s projects.

Dr Alice Vialard, Northumbria University

Alice joined the Architecture and Built Environment department in September 2015 after completing her PhD at the Georgia Institute of Technology. She teaches in both the interior and architecture program and her research interest is primarily in the urban design and urban morphology. She studies the interaction between urban form and architecture, particularly the way in which the development of urban blocks responds both to the programmatic needs served by buildings and to the context defined by location and the connectivity of the street network. Her research aims at promoting good urban form as one which can flexibly respond to changing programmatic needs over time. Using space syntax methods, she has also worked as a design consultant for clients including Dar Al-Handasah, John Simpsons and partners, Perkins + Will and Steelcase. She received her diploma in architecture from l’*école nationale supérieure d’architecture de Paris-La Villette* and lived in Paris where she practiced as an independent architect.

Agnieszka Wir-Konas, Northumbria University

Agnieszka is a PhD student in Architecture and Built Environment at Northumbria University. She received her Bachelor’s and Master’s degree from Warsaw University of Technology, Poland. During the course of her studies she won multiple international architectural competitions and attended international workshops - Touraterre Earth Building Workshop in Provence, France and Hello Wood in Hungary. In addition, she participated in University student exchanges with Eindhoven, Netherlands and Detroit, US. Her current PhD topic is investigating spatial boundaries with a focus on the boundaries between dwellings and streets. Her other research interests include Territoriality, Urban Morphology, Space Syntax, Flexible Housing, Post-Disaster Housing and Reconstruction and Environmental Behaviour.

Ahmad Shuib bin Yahya, Universiti Teknologi Malaysia

Ahmad Shuib bin Yahya, is currently a Research Fellow pursuing a Master of Philosophy in Architecture at Universiti Teknologi Malaysia, UTM. Before joining UTM, he was a Project Manager at Perunding Asatec in Kuala Lumpur. He obtained the Bachelor’s degree from UTM. As a practising architect, with more than a decade of experience he has designed many single unit houses. He is also an architectural and

design analyst, expert in dealing with cost-efficient design on construction technique especially for the low income group of houses in the sub-urban area in Selangor and Kuala Lumpur. Having vast experience in housing development in Malaysia, and in enhancing his academic interest, he is now focussing on the space syntax architectural analysis in understanding the idiosyncrasies of home culture living, the genotype of Malay traditional houses. His other research interests also includes Space Syntax analysis of other building typologies such as museum and shopping complexes, Human Cognition and Environmental Behaviour.

Wong Zhi Zong, Universiti Teknologi Malaysia

Wong Zhi Zhong is an postgraduate architectural enthusiast that approaches built environment designs towards urbanism, culture, and sustainability at Universiti of Teknologi Malaysia, UTM. He is now currently doing his master research that focus on “experience-related-system”, how spatial and cultural meanings are constructed in architecture and communicated to their viewers. His first Bachelor of Architecture was from Universiti Putra Malaysia. Wong worked as an assistant architect at SA Architects Sdn Bhd and involved in variety scale of projects before continuing his master degree. His other research interests includes Open Building, Space Syntax, Human Cognition, Sensory experience, “experience-related-system” and phenomenology in Architecture.

