

# Inside the box

responsive design for diverse and changing households

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Submitted in fulfilment of the requirements for the Research Field Studies 890 (RFS 890) and Mini-dissertation 895 (ARG 895) for the degree MSc Applied Science in Architecture in the Department of Architecture, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria.

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### DECLARATIONS

I declare that this thesis is in accordance to the General Regulations for dissertations and thesis. I hereby submit this thesis as fulfilment for the degree of MSc Applied Science in Architecture at the University of Pretoria as my own work.

I further declare that no part of my thesis has been or is currently submitted to any other tertiary institution for any such degree, diploma or other qualification.

I finally declare that this thesis is substantially my own work. Where reference has been made to works of others, the extent to which the work has been used is indicated and fully acknowledged in the text and a list of references has been compiled and included in the thesis.



Xongile Muthambi

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### INFORMATION

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### ACRONYMS

**ARP** *Alexandra Renewal Project*

**BNG** *Breaking New Ground: A Comprehensive Plan for the Development of Sustainable Human Settlements*

**DHS** *Department of Human Settlements*

**DoH** *Department of Housing*

**HDA** *Housing Development Agency*

**JHC** *Johannesburg Housing Company*

**NDoH** *National Department of Housing*

**NHP** *National Housing Policy*

**RDP** *Reconstruction and Development Programme*

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## ABSTRACT

Buildings need to be adaptable with relative ease to new requirements, regulations and uses for diverse and changing users. Designing buildings which can adapt to changing demands poses a considerable challenge.

Residential satisfaction on dwelling is a function of three groups of variables; the user's characteristics, the physical attributes of a space and the beliefs and perceptions of the user's on the experienced space. Particularly in residential environments, the user tries to solve the emerging spatial problems by making some alterations and thus adapting the space to his/her changing needs. With this regard, flexible and adaptable design solutions can be an important potential to meeting the needs of various users throughout a building's life-cycle.

Adaptability reduces the effort and expense involved in adding, changing or replacing building components (such as partitions, doors or plumbing features) throughout the building's life-cycle. This increases the building's value, sustainability and most importantly, the users' satisfaction. In practice however, most buildings are designed and constructed to cater for the present use for the present users. Future adaptability is ignored and not designed for.

This research intends to focus on the evaluation of the "dwelling space" in terms of the physical attributes of space. The research will critically review literature on adaptability and flexible designing in order to construct a theoretical platform for understanding the knowledge on how buildings change can be used to inform design decisions of internal spaces of Social Housing units.

The research follows an approach which is based on the systemic separation of building components and adjusting buildings to accommodate the frequently changing needs of inhabitants. The objective of the research is to develop a methodology which supports the design of internal unit spaces so that they can be adapted throughout the building's life-cycle.

# Inside the box

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To Henry Josiah Muthambi...gone but forever in our hearts.



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Submitted in fulfilment of the requirements for the Research field Studies 890 (RFS 890) course for the degree MSc Applied Science in Architecture in the Department of Architecture, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria.

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# 1 context and background

## 1.1 INTRODUCTION

During the apartheid era, South African cities were systematically planned to support political ideals of segregation and separate development for the different racial groupings (Osman & Lemmer 2005:2).

The NE51/9 model, Non-European house designs developed during the 1950s became the norm and the notorious matchbox house became one of the most visible symbols of apartheid policies. Since the demise of apartheid in 1994, housing became an important playing card in the political transformation of South Africa (Osman & Lemmer 2005:2). Post-apartheid, low-income housing has been shaped predominantly by a subsidy system which has sought to provide basic shelter for the majority of its previously disenfranchised population (Low 2011:46). Delivering well over one million housing units in the first decade, this policy has favoured the public/private partnerships and fostered the one-house-per-site family approach to delivery.

The South African government has been very successful in delivery in terms of meeting the

numbers of housing units per year (Osman, Arvanitakis & Sebake 2011:1). Despite the impressive record in the delivery process, these results have not proven successful with respect to quality measures. They have been unsuccessful in creating functional and sustainable environments which provide vital services, facilities and economic opportunities for communities.

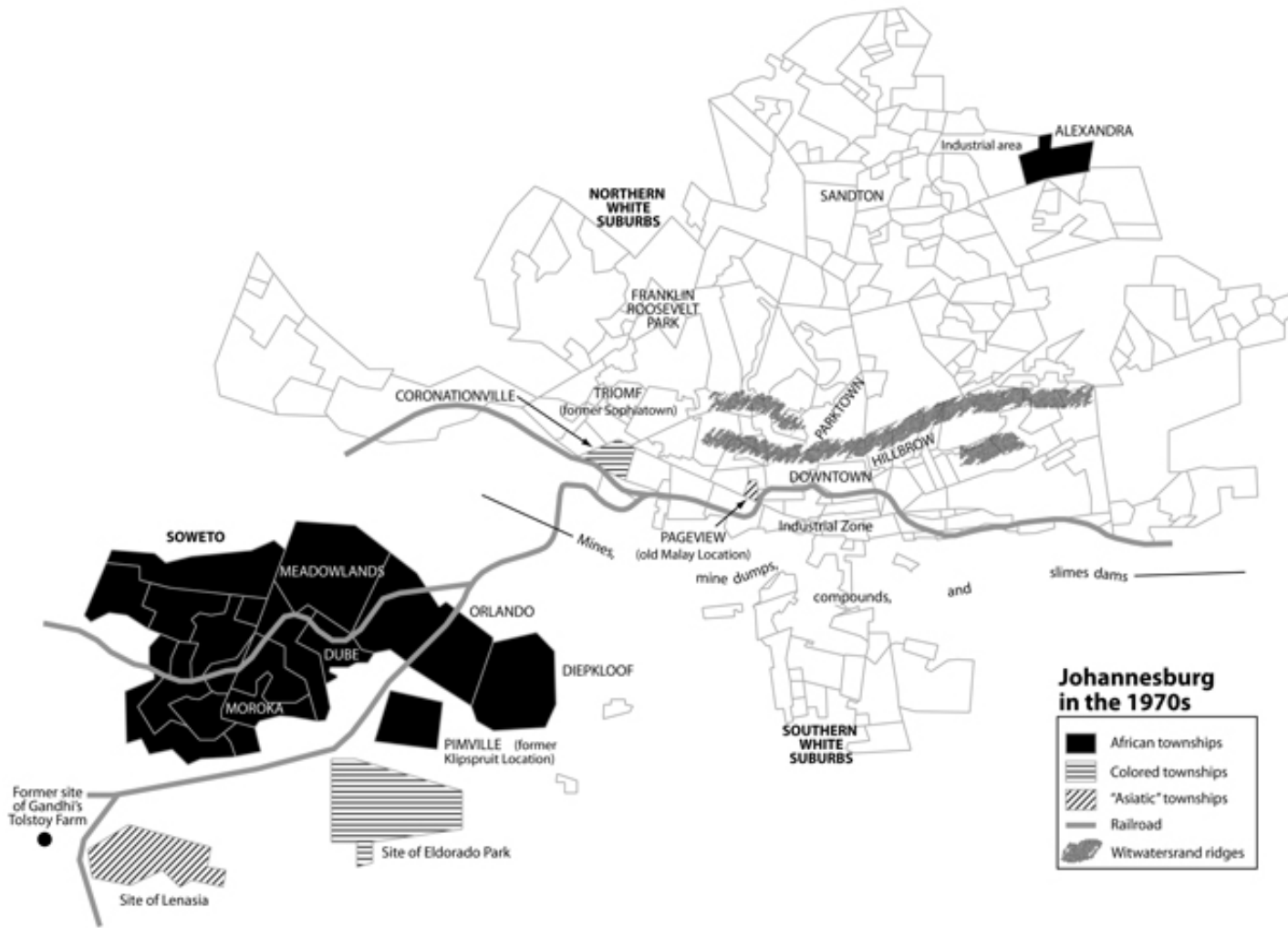
According to Osman et al (2011:1), this has further perpetuated the structure of the apartheid city characterised by low densities and urban sprawl, fragmentation, strong cultural divides and strict zoning of residential, commercial and public facilities. This has negative impacts not only on the environmental sustainability, but on the social and economic sustainability.

To the housing practitioner involved in housing on a daily basis, the issue of housing quality may be compromised and lost among the more pressing realities of the need to house large numbers of people very quickly (Osman & Lemmer 2005:4).

Yet, some reflection will reveal that the present approach is unsustainable and that some projects may soon be inappropriate or altogether redundant. Osman & Lemmer (2005:4) argue that the existing policy frameworks do not encourage innovative approaches and designs. Legislation and the subsidy systems are restrictive and need to be challenged as it is important to note that the more diversity is accommodated for in housing developments, the more the diversity will become visually and spatially evident.

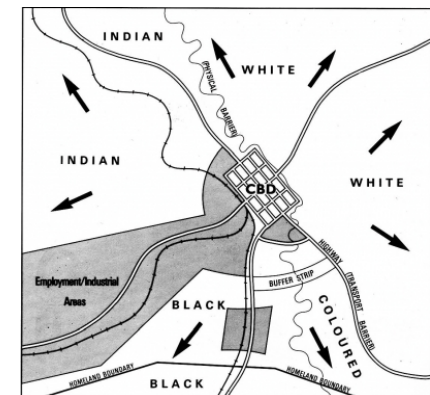
Many problems still need to be addressed in order to reshape South African cities since the urban landscape still suffers from the spatial legacy of apartheid (Verster 2009:1).

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**Figure 01:** The rigid racial zoning of Johannesburg and Soweto after the forced removals of the apartheid era. Map by Kailee Neuner ([www.mascontext.com](http://www.mascontext.com))

**Figure 02:** Diagrammatic illustration of the apartheid city planning ([www.pmbhistory.co.za](http://www.pmbhistory.co.za))



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The low-income housing provided is still of the inefficient matchbox typology consisting of isolated housing units on individual plots set against a barren landscape (Osman & Lemmer 2005:2). In order to encourage more effective and sustainable housing, alternative ways of housing delivery are currently being developed and put into practice.

Buildings are increasingly becoming more complex and social change is accelerating. It is important to design and construct multi-unit buildings with new approaches (Kendall 2004:90). Several initiatives have been undertaken in the search for solutions to the growing backlog in South African housing demand and general unrest with regard to the government's ability to deliver in terms of quantity and quality (Osman & Herthogs 2010:1).

A new government-led initiative to the housing delivery emerged in 2009 and was signalled by the changing of the name *Department of Housing* to the *Department of Human Settlements* (Osman et al 2011:1). Subsequently, government has used various platforms to acknowledge that housing is not just

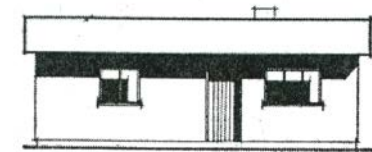
about the construction of the individual houses or blocks of housing units, but also about the creation of new types of mixed residential environments which stimulate sustainable communities (Osman et al 2011:2).

The government's *Breaking New Ground: Comprehensive Plan for the Development of Sustainable Human Settlements* (2004) was devised to provide a new housing vision to redirect and enhance responsive and effective delivery. The BNG policy intends on supporting the entire residential market.

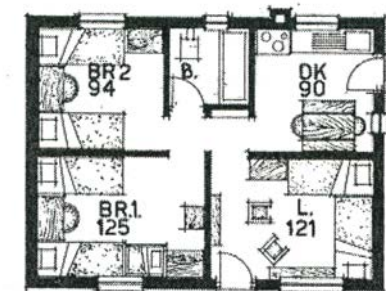
The housing problem cannot be solved through a *one-size-fits-all* approach. This realisation is largely based upon the apparent mismatch between the existing housing need and the way in which that need is met, both quantitatively and qualitatively (Development Action Group na:1). Social housing is one of a range of housing instruments and institutional arrangements recommended in the BNG plan; providing an important shift in urban development through which the socio-economic



**Figure 03:** Perspective of the NE 51/9 housing model developed by the Apartheid government (Chipkin 1998:172).



**Figure 04:** Elevation of the NE 51/9 housing model developed by the Apartheid government (Chipkin 1998:172).



**Figure 05:** Plan of the NE 51/9 housing model developed by the Apartheid government (Chipkin 1998:172).

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and spatial restructuring of the South African landscape can be confronted (section 4.2 of the *BNG* 2004). In the South African context, the term *social* housing is *social* in as far as it utilizes government subsidies for households earning between R 1 500 and R 7 500 per month, but not *social* because it is intended to house the extreme poor (Development Action Group na:1).

In the context of the *Social Housing Policy*, social housing can be described as a housing option for low to medium income persons that is provided by housing institutions and excludes immediate individual ownership. This housing option is not a housing option for the very poor. Tenants accessing accommodation from housing institutions will have to earn a secure income in order to be able to pay the rental and other periodic payments for the accommodation (section 2 of the *SHP* draft 2003).

According to the section 2 of the *SHP* draft (2003), social housing cannot be limited to specific income groups if the broader integration, regeneration and

market demand objectives are to be realised. The housing option should therefore promote a mix of income groups covering both the low and medium income persons as prescribed in the regulations for social housing.

Due to the nature of social housing, it is important to achieve appropriate quality standards in these developments. According to the section 4.3 of the *SHP* draft (2003), a social housing development may house many residents over the building life. Finishing therefore needs to be of sufficient quality and robust enough to sustain this. In addition, the units must have low maintenance characteristics. The *SHP* further defines that the social housing designs should also aim for as much flexibility as possible within the financial limitations to allow for retrofitting in future (section 4.3 of the *SHP* draft 2003).

Social housing needs to be successful in improving people's lives through their living environments and access to opportunities (section 4.3 of the *SHP* draft 2003).

**Figures 06-09:** RDP housing developments in South Africa



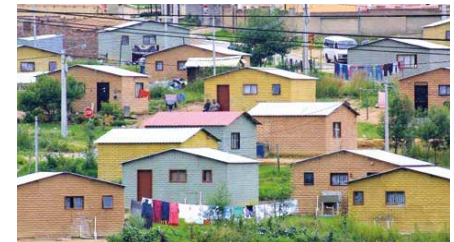
**Figure 06** (ellenschnier.wordpress.com)



**Figure 07** (www.mimages.co.za)



**Figure 08** (www.pbase.com)



**Figure 09** (www.thenewage.co.za)

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Social housing developments must be flexible enough to cater for the changing spatial needs of its inhabitants; for example, a family may acquire a new car and require secure parking, or at different times of the lease period may require a different unit size. There should therefore be given consideration in terms of whether social housing is a stepping stone to some form of tenure or provides a flexible environment that caters for the entire lifecycle of a family (section 4.3 of the *SHP* draft 2003).

Social housing is perceived to have the capacity to contribute to the transformation of the fragmented South African cities as compared to the massive roll-out of government's subsidised one-house per plot typology (Osman &Herthogs 2010:3). The research study will thus be based within the realm of social housing. Carr Gardens, Brickfields and K206 will be the focus developments for the study.

The researcher will thus investigate whether these social housing developments are able to offer a flexible, adaptable and changeable environment which can accommodate for the future unseen needs

of the occupants, thus ensuring market viability and also assessing the capacity of the buildings and or the building components that can be adapted and changed to the inhabitants' needs.

The research will investigate the concepts of *flexibility* and *adaptability* in multi-unit residential buildings. In the study, the investigation will focus on social housing developments in South Africa and their ability to accommodate the future user and cater for their spatial needs. The research will therefore investigate concepts of building *adaptability* and *flexibility* based on John Habraken's (1972) theories of *Supports* and Stephan Kendall's (2004) *Open Building* theories as these theories include the conceptual framework relating to the topic of investigation. Within this framework, the research seeks to investigate how *flexibility* informs an *Open Building* approach and identify the extents and limitations of *flexibility* in social housing developments in South Africa.

In this chapter, the researcher will give a synthesis of the historical background of government

subsidised housing in South Africa; the policy environment in 1994, the policy shift in 2004 and how the *SHP* is structured and informs social housing developments in South Africa.

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**Figure10:** Typical subsidised housing in South Africa illustrates the resultant poor quality living environment and lack of variation in typology ([www.trekearth.com](http://www.trekearth.com))



## 1.2 HISTORICAL BACKGROUND

South Africa is characterised by lingering spatial inequalities and a pronounced rural-urban divide (Tissington 2011:25). The housing terrain is complex, in large part due to the deliberate policy and legislative framework of socio-economic, spatial exclusion and marginalisation created during the apartheid era, but also due to the failures on the part of the post-apartheid government to adequately redress these problems since 1994 (Tissington 2011:1).

The morphology, layout, visual and physical qualities of a residential setting are directly affected by the methods of delivery which are guided by policy (Osman et al 2011:3). While housing is generally a complicated issue globally, it has been further complicated in the South African context due to the apartheid spatial policy. The strict zoning, segregation and fragmentation came about as a result of various policies and acts enforced during the period spanning from the 1900s till the 1970s when the current spatial patterns became

entrenched.

The acclamation of democracy seemed a great opportunity for the development and housing of South Africa's poor. The government aimed to develop building skills, provide on-going skills and employment, evoke pride in place by creating more sustainable living environments and connect the fractured components within the cities (Cooke 2009a:001). Many new laws were passed concerning land reform and many subsequent promises were made (Dewar; in Vladislavic et al 1998). Although the old housing systems were rejected in the new political dispensation and legislative obstacles were removed, operative barriers to the delivery of sustainable housing still remain (Osman et al 2011:3).

Despite South Africa's new democratic dispensation, the reality of entrenched poverty and the historic urban exclusion of the majority of its citizens is not merely resolved by the simple provision of a house and services (Low 2011:47).

Post 1994 there is evidence of the government's initiatives in providing subsidised housing for the poor (Cooke 2009a:001). South African residential areas are formed by suburbs of houses on individual plots, providing limited access to the urban economy and thereby excluding the urban poor from entering the economy (Wimpey 2004:23). Even the smallest towns and settlements shimmer with roofs glinting in the sun. To the eye it is impossible not to notice the numbers and acknowledge the number of people who have been housed (Cooke 2009b:025). Upon penetration of these new neighbourhoods, the feelings diminish. The *White Paper on Housing Policy (1994)* has produced a large quantity of houses, but many districts of poor urban quality. The segregated apartheid city structure has not changed; in fact, cities have become even more spread-out (Verster 2009:1).

The autonomy of the one-house per plot model has predominated in people's perception of what formal housing needs to be. This housing typology

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has proven problematic as they are autonomous and incur severe inefficiencies in terms of land use, infrastructure provision and in social terms (Wimpey 2004:23).

Spatial fragmentation is still perpetuated 20 years into democracy. South African cities rank among the most inefficient and wasteful urban environments in the world (Du Plessis & Landman 2002:3). The low densities and the *disconnect* does not make environmental, social or economic sense (Osman et al 2011:3). This challenge has been highlighted in the *Diagnostic Report* (2011) issued by the National Planning Commission. According to the National Planning Commission (2011), the spatial legacy of apartheid continues to weigh on the entire country. In general, the poorest people live in remote rural areas. In the cities, the poorest live far from places of work and economic activity.

### 1.3 THE POLICY FOCUS IN 1994

At its inception, the *Housing Policy and Strategy of 1994* focused on stabilizing the environment to transform the extremely fragmented, complex and racially-based financial and institutional framework inherent from the previous government whilst simultaneously establishing new systems to ensure delivery to address the housing backlog (section 1 of the *BNG 2004*).

The *White Paper* was set up to mark the beginning of a process that marks progress. The approach adopted has been the search for creation of an enabling environment, and not for the publication of a new set of rules. It aims to contribute to the certainty required by the market (section 1 of the *White Paper on Housing 1994*). Through the *National Housing Policy and Strategy*, government strived to establish viable, socially and economically integrated communities which would be situated in areas allowing convenient access to economic opportunities, health facilities, educational and social amenities (section 4.2 of the

*White Paper for Housing 1994*).

The *Housing Act* provides for a sustainable housing development process, laying down general principles for housing development in all spheres of government; it defines the functions of national, provincial and local government in respect of housing development; and lays the basis for financing *National Housing Programmes* (Tissington 2011:14).

Over the past decade, housing has been focused on the provision of low-income subsidised housing units underlined in the *Reconstruction and Development Programme's* housing. This kind of tenure was based on the suburban model of one house per stand.

Through *RDP* housing, the government has produced large quantities of houses but many districts of poor neighbourhoods. Concerns in the current housing crisis relates to the poor urban districts and the continuation of fragmented

Neighbourhoods (Cooke 2009b:25).

Following the *White Paper on Housing*, a new framework was created which was thought to be a more inclusive policy structure, the *Breaking New Ground: Comprehensive Plan for Housing Policy* (section 1 of the *BNG 2004*).

#### 1.4 THE POLICY SHIFT IN 2004

Government's perceived solution to most of the problems with housing is through the implementation of the *Breaking New Ground* policy, which was launched in 2004 (Department of Housing 2008:4). The *BNG* is based on the principles contained in the *White Paper on housing* and outlines the strategies to be taken to achieve the government's overall aim (Tissington 2011:21).

The role of the *Breaking New Ground: Comprehensive Plan for Housing Policy* is to give a statement of organisational (Department of Human Settlements) expectations with respect to the state of housing in South Africa. The Policy gives a definition of the National Department of Human Settlements' objectives and guidelines on how to achieve these objectives. The *BNG* housing policy utilises the existing mechanisms as a driving force to ensuring a more responsive and effective policy (section 1 of the *BNG* 2004).

The *Housing Policy and Strategy* focuses on stabilizing the urban environment, transforming it, establishing new systems to ensure delivery, to address the housing backlog through the development of sustainable human settlements as opposed to the delivery of a subsidised housing unit (section 2.2 of the *BNG* 2004).

At the heart of the new housing vision is to move beyond the provision of basic shelter towards achieving the broader vision of sustainable human settlements and more efficient cities, towns and regions (section 3 of the *BNG* 2004).

Objectives of the *BNG* include the increasing of densities; the promotion of social cohesion; the de-concentration of poverty and the improvement of quality of life for the poor.

The *BNG* intention of supporting the entire residential market implies moving away from the understanding that government only supports

housing for the very poor is seen as an integral part of the functioning housing market. This is reinforced by the renaming of the Department of Housing as the Department of Human Settlements in 2009 (Osman & Herthogs 2010:2).

The *BNG* policy manifests the expansion of the state-assisted Housing Scheme to support the lower-middle income groups. It serves as a financial subsidy system for households earning R 3 500 to R 7 000; to address and finance the sector which doesn't qualify for bank loans because they don't earn enough and don't qualify for *RDP*'s because they are not considered poor enough (section 2.1 of the *BNG* 2004). The policy tries to remove the financial constraints in housing and strengthen new human settlements through supporting the development of sustainable human settlements and the development of housing assets. The new human settlements plan moves away from the commoditised focus of housing delivery towards more responsive mechanisms which address

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the multi-dimensional needs of sustainable human settlements (section 2.2 of the *BNG* 2004). This approach according to the *BNG* is intended to provide maximum flexibility and will ultimately enhance the mobility of households.

The *BNG* policy envisages the expansion of the mandate of the *Department of Human Settlements* to encompass the entire residential market (section 2.1 of the *BNG* 2004). Through this, the housing sector demonstrates a balance between ownership and rental. Housing alternatives have the power to change perceptions about housing for both the people and the government (Osman & Herthogs 2010:2). This is well understood and articulated in the *BNG* and is one of the strengths of the plan. The various sections of the *BNG* mention:

- enhancing housing product
- shifting from product uniformity to demand responsiveness

The social housing instrument is seen to be aiming towards housing products which provide adequate

shelter to households whilst simultaneously enhancing flexibility and mobility.

Social Housing being one component of the *BNG*, is seen to have the capacity to contribute to the transformation of fragmented South African cities more than the massive roll-out of government subsidised one-house per plot typology (Osman & Herthogs 2010:3). According to the *BNG*, Social Housing is generally medium-density. This housing intervention may make a strong contribution to urban renewal and integration (section 3.5 of the *BNG* 2004). It aims to develop human settlements with adequate access to economic opportunities, a mix of safe and secure housing and tenure types, reliable basic services and other amenities.

## 1.5 THE SOCIAL HOUSING POLICY

Social housing is pinned under the government's *SHP*. The *SHP* (2003:4) defines social housing as *a housing option for low-to-medium income persons earning between R 1 500 to R 7 500, provided by housing institutions, and excludes immediate individual ownership*. Since the social housing programme provides rental housing, it is guided by the *Rental Housing Strategy* (Osman & Herthogs 2010:3). The context of social housing is in medium density and has inner-city regeneration objectives (*SHP* 2003: 5).

The objective of social housing is to facilitate the production of effectively managed institutional housing in areas where there is a demand for institutional managed housing (Hopkins 2006:10). It is essential that social housing ensures the inclusion of all income groups and accommodates a range of housing product designs and tenure options to meet spatial and affordability requirements. Social housing strives to achieve socially, racially and economically integrated societies (Toolkit for

Municipal Social Housing Policy 2007:5).

Social housing must not be viewed as an instrument for mass delivery of housing units but must be viewed as a means of restructuring the urban landscape (Toolkit for Municipal Housing Policy 2007:5). It needs to be responsive to the housing needs of a specific area it is located in (*SHP* 2003:9). Requirements of the structure, servicing, financing and quality standards become important considerations in social housing. Due to its complex nature, it is important that the viability of social housing developments is seen in a broader context with a long termview. Compromises on quality, spatial standards and the exclusion of social amenities will have long term impacts on social housing developments as the aim is to create interactive environments.

The principle of an integrated development approach is fundamental to government's housing development approach. Due to the scope of social

housing, this approach thus becomes important. The integrated development approach is defined under three elements;

1. physical and spatial integration of social housing developments to ensure that housing is located within the urban inner-city areas
2. social integration, mixed communities and mixed use
3. economic integration and the mixture of different income groups (*SHP* 2003:13).

Social housing must be seen in a broader context with a long term view in mind (*SHP* 2003:11). Compromises on quality spatial standards and the exclusion of social amenities will have a long term impact on social housing projects; they will remain projects and not environments. It is therefore important to view social housing developments in a holistic manner.

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The total social housing development encompasses the unit design, common areas, service and amenities that contribute to the social environment. Due to the nature of social housing, it is important to achieve appropriate quality standards in these developments.

According to the section 4.3 of the *SHP* draft (2003), a social housing development may house many residents over the building life. Therefore the finishing needs to be of sufficient quality and robust enough to sustain this and the units must have low maintenance characteristics. The *SHP* further defines that the social housing designs should also aim for as much flexibility as possible within the financial limitations to allow for retrofitting in future (section 4.3 of the *SHP* draft 2003).

Social housing needs to be successful in improving people's lives through their living environments and access to opportunities. Social housing developments must be flexible enough to cater for this; for example, a family may acquire a new car and require secure parking, or at different times of

the lease period may require a different unit size. There should therefore be given consideration in terms of whether social housing is a stepping stone to some form of tenure or provides a flexible environment that caters for the entire lifecycle of a family (section 4.3 of the *SHP* draft 2003).

Social housing differs from conventional low-income housing (Schoonraad 2002:31). It represents an area of housing that has been neglected in South Africa as it addresses the low-to-medium income housing backlog by creating high quality urban developments. Social housing is currently the only progressive government supported housing programme that actively contributes to the reversal of the apartheid city (Schoonraad 2002:31). Given the advantages of the social housing programme; emphasis lies on the broader development far beyond the boundaries of the site. However challenges still remain within the individual unit designs and spatial simulation.

Social housing may take various forms and it is essential that social housing typologies can be

conceptualized broadly to ensure the inclusion of all income groups (section 2 of the *BNG* 2004). Social housing must be understood to accommodate a range of housing product designs to meet spatial and affordability requirements.

The housing products must thus include multi-level apartment options for higher income groups.

Whilst the social housing model may present itself as an important housing model for future housing, it may become a model linked with stigmatisation since it caters for a specific income group. It is thus important that a different approach to the design of Social housing developments must be considered (Osman & Herthogs 2010:4).

Two distinct constraints of social housing developments can be identified when assessing the design factors and considerations of these developments;

1. The internal constraints of the unit
2. The external constraints of the unit

(Toolkit for Municipal Social Housing Policy 2007:36)

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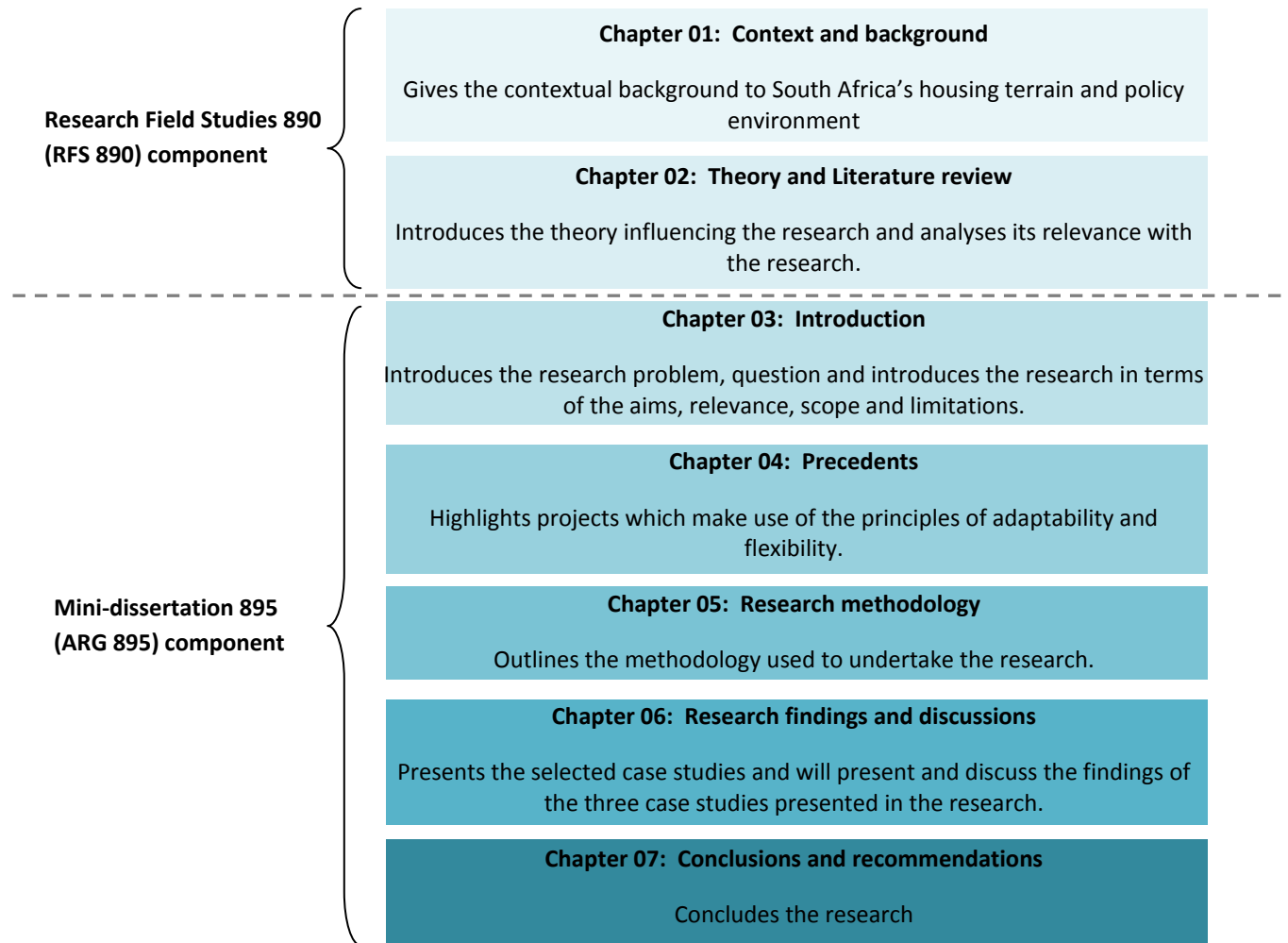
According to the *Toolkit for Municipal Social Housing Policy (2007)*, social housing needs to be facilitated in order to provide adequate Social Housing units which will respond to the unknown future demands. However, little attention is paid to the internal unit design.

While policies may continue to change, the question of integrating fragmented South African cities remains. More engagement with this issue means that the professionals could present tools to implement a restructuring agenda (Osman & Konigk 2009:55). Implementation strategies need to go far beyond the confines of a single project.

For the purpose of the study, the research will critically assess the spatial design considerations of the internal unit design of selected social housing developments and whether the units are responsive and adaptable to the future unknown tenants. The study is motivated by continual neglect of the spatial design of internal spaces which are unable to adapt and be flexible to cater for a wide range of end-users with different requirements.



## 1.6 RESEARCH SUMMARY AND STRUCTURE



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## **2**theory and literature review

## 2.1 INTRODUCTION

This chapter presents a literature review and works towards a conceptual framework which will guide the further exploration and case study analysis presented in the thesis. The chapter will include the principles relating to *flexible housing, adaptable housing* and *open building*. Both Habraken (2008) and Schneider and Till (2007) illustrate that the concepts are very similar in meaning and often overlap, the literature review will thus discuss the related concepts in the housing context. The researcher will highlight their key conceptual frameworks. Within this framework, the researcher seeks to find answers to how flexibility informs an open building approach and identify the extents and limitations of flexibility in social housing developments in South Africa.

The literature framework is constructed based on the following main sources; the works of Tatjana Schneider and Jeremy Till on flexibility in their book titled *Flexible Housing* (2007), two articles titled *Flexible Housing: The means to an end* (2005a) and

*Flexible Housing: Opportunities and limits* (2005b), John Habraken's (1972) theories on *Supports and Infill* and Stephen Kendall's (2004) theories on *Residential Open Building* in multi-residential buildings.

## 2.2 SECTION A: A HISTORICAL OVERVIEW OF FLEXIBLE HOUSING IN THE TWENTIETH CENTURY

### Introduction

The turn of the twentieth century and the introduction of modern architecture placed new values at the forefront of architecture (Museum of Modern Art 1946:8). There was a revived interest in social development and human involvement. The demands of modern life led to an increased spatial movement of people and a smaller household size. In this era, people were constantly migrating; which was a part of the ever changing and rapidly modernizing world. Architects sought to respond to these new human conditions by allowing residents to have more control over their built environment, particularly in their homes (Sousa 2012:25). Le Corbusier, Walter Gropius and Buckminster Fuller all attempted to use new design theories and technologies to design for rapidly evolving households.

This section of the discussion discusses the themes

related to flexible housing design and its evolution in the twentieth century under the following three titles;

1. The 1920s: Modernity and the human dwelling
2. The 1930s- 1960s: The Industrialization of housing and mass housing production
3. The 1970s: Open Building, participation and user choice

This section will focus on the examples which reflect on open building strategies in the design and construction process as a key in the transition from the traditional closed-static to the open dynamic building systems.

#### 1. The 1920s: Modernity and the human dwelling

The 1920s were the most important years for the formation of the principles that controlled the Modern Movement in architecture until the Second

World War (Sharp 1972:60). The concept of flexibility in the context of domestic architecture is introduced under two topics; *the evolving conditions of the vernacular* and *the external pressures that have prompted housing designers and providers to develop alternative design solutions* (Schneider & Till 2007:13). It can therefore be claimed that flexible housing evolves from the continuation of traditional tendencies in housing design and emerges as a design technique following the social influences in the twentieth century.

In the twentieth century, architects were questioning existing patterns of living and approached the building as something that could change over time and something that could adapt to the needs and demands of its residents (Schneider & Till 2005a:158). In this respect, buildings built in the 1920s and early 1930s demonstrate a radical change and the first intentions in developing flexibility in

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multi-family buildings.

According to Teige (2002:234), minimal dwelling can be defined as dwelling with subsistence minimum. Minimal dwelling reflects the first transition from the conventional or traditional way of building to a new systemic design and construction process which responds to the changes in the lifestyles of individual users (Schneider & Till 2007:16). The idea of minimal dwelling was to find out the limited space standards of housing to satisfy the housing demand. The concept of flexibility played a crucial role in the development of minimal dwelling.

The consideration of new design techniques and construction in architecture was to improve the living conditions, particularly of the working class and in social housing after the First World War. According to Schneider & Till (2007:16), the main idea behind the design of minimal dwelling was to explore the use of minimal spatial standards in housing in an adequate and efficient manner. The new spaciousness which the open plan gives a building is among the most important design innovations of

the modern era (Museum of Modern Art 1946:12). The continuous and fluid quality of space in modern architecture is unlike the handling of space in any architecture of the past, and can be one of the most distinctive elements of a modern building. A minimal dwelling was built with a permanent building structure, but was designed to allow flexibility for the interior space transformations, leaving the residential area free from load bearing elements.

Minimal dwelling developed as a consequence of not only World War I, but also due to the changes in society as a result of the modernization process (Teige 2002:234). The Weissenhofsiedlung Experimental Housing Project designed by Mies van der Rohe in Germany (1927) served as a context for minimal housing. This project can be considered the first successful example of minimal dwelling which makes use of *soft* form and *soft* use (Sharp 1972:61). *Use* refers to the way that the design affects the manner in which housing is occupied over time and refers to the flexibility in the plan (Schneider & Till 2005b:289). On the other hand, technology refers to the issues of construction and servicing and how this

affects the potential for flexibility. From these differentiations, two techniques are therefore referred to; *soft* and *hard* techniques. According to Schneider & Till (2005b), *soft* refers to the tactics which allow a certain indeterminacy, whereas *hard* refers to the elements that determine the way that the design may be used. *Soft* use allows the user to adapt the plan according to their needs (Schneider & Till 2005b:289). With *hard* use, the designer works in the foreground, determining how the spaces can be used over time.

In this project, Mies van der Rohe only designed the permanent components of the building in order to provide an indeterminate open space within which the users could arrange and re-arrange accordingly (Frampton 1985:137). The typical construction of the housing units consisted of the use of large spans of columns and beam system with perimeter walls and the infrastructure for the service spaces of the units were predetermined and built (Schneider & Till 2007:20). Van der Rohe designed the unit blocks in frame construction as this was an appropriate form of construction to balance the fixed needs and

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varying needs of the occupants. In this way, Mies van der Rohe was able to grant the residents' freedom in the unit by allowing them fill the main open space with light infill partitions whenever they want (Sharp 1972: 88). This project can thus be considered an example of *soft* form and use due to the structural design and construction.

Another prominent example of the minimal dwelling which makes use of a design approach based on the hard form is the Hufeisensiedlung designed by Bruno Taut. According to Schneider & Till (2007:18), in this system, the residential housing unit offers flexibility in usage within the permanent boundaries of the unit itself.

The Hufeisensiedlung multi-storey apartment building provides rooms with no designated uses. The basic aim of Taut's architecture was achieving architecture with the active participation of the people (Frampton 1985:117). The architectural layout of the units is composed of which are similar in size. In this project, Taut used standard dimensions which were appropriate for diverse use.

The neutral spaces he created could therefore accommodate users with diverse lifestyles (Schneider & Till 2007:18). The structural system of this project is composed of load bearing walls. In this sense, Taut's approach differs from van der Rohe's project; Taut's project is more determinate than that of van der Rohe's.

Another design approach to achieving minimal housing is that of convertible space which is determined by the architect (Schneider & Till 2007:18). In this approach, the main consideration is creating an architecture which responds to the patterns for different uses. This approach can be regarded as dealing with flexibility-in-use over time. Architects control and organize the usage of spaces through the use of folding furnishing elements, moving/sliding/folding walls as elements of the convertible space. According to Schneider & Till (2007), this form of approach and use of space can be considered as *hard*.

Le Corbusier developed the *five points in architecture* which he regarded as the necessary principles in

*minimal architecture* (Sharp 1972:60). Le Corbusier's Maisons Loucheur Housing project (1928-29) can be regarded as a clear example of *minimal architecture*, a prototype of the *Domino* house and a manifestation of some of the principles of which Le Corbusier set out in his *five points in architecture* (Sharp 1972:66). This project is based on the idea of an adaptable floor plan with minimal space through the use of moveable and foldable furniture and partitions. Le Corbusier employed the idea of using the large living space during the day and dividing the unified space into smaller spaces during the night. Le Corbusier determined and designed every detail of the unit. The users could therefore adapt and adjust the unit according the predetermined conditions created by the architect.

In brief, minimal dwelling in relation to modernity can be asserted as one of the important developments that reflect a change in the concept of dwelling. According to Le Corbusier, minimal dwelling is an outcome of a new attempt in solving the great future problems in mass housing (Le Corbusier 1960:9). In order to produce housing

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blocks appropriate for all, standardization that connotes universal suitability and maximum adaptability became an issue in the planning of minimal dwelling.

In the 1920s and 1930s, there were two controversial approaches to flexibility in architectural design that belongs to the rhetoric of flexibility (Schneider & Till 2007:5). On the one hand there is a tendency to advocate the necessity of minimal dwellings designed in the form of indeterminate unit plans, and on the other hand, there is a tendency to support more determinate new modes of housing with technical and mechanical equipments. In the 1930s, these tendencies continue through the adaption of industrial solutions to construction techniques in housing (Sharp 1972:108).

### **2. The 1930s- 1960s: The Industrialization of housing and mass housing production**

While the first period was guided by social and cultural aspects, this period is focused on the technical and economic aspects of housing production (Sharp 1972:236). This period

corresponds to the development of innovative ideas in the construction techniques of minimal dwelling; its reflections and further developments (Sharp 1972:108). In this era, Le Corbusier's analogy of the house as a machine for living became the subject of satire. New construction techniques and industrial technologies made a link between the minimal dwelling and the industrial production resulting with mass housing after the Second World War. After World War I, the discussion on standardization, normalization, rationalization, constructivism and functionalism bought the idea of prefabrication in housing construction (Kirsch 1989:9). Most of the post war multifamily buildings were built as finished products with no possibility to be transformed and adapted to new users' requirements.

According to Le Corbusier (1919), the solution for the problems in housing could be solved by offering standardised solutions (Sharp 1972:108). These developments made possible standardised and comparatively perfect types of production. They also led to a standardized solution that was universally accepted as the proper and appropriate type of

housing for all human beings. From this point of view, the neutral skeleton system called, the *Maison Domino* (1919) developed by Le Corbusier can be regarded as one of the pioneering schemes for mass produced housing constructions (Sharp 1972:66). In this system, the frame (the support) is separated from the infill. In terms of its form, it is *hard* because flexibility operates in the foreground. Le Corbusier developed this system specifically to achieve flexibility (Sharp 1972:155).

The 1940s, *the Frugal Forties*, *the utility years*, *the war-torn period*- these epithets emphasized the problems of the period in architecture (Sharp 1972:154). In this era, European architecture virtually came to a standstill. It was a period of austerity but not entirely devoid of innovation. The war created many new opportunities for the industry.

Buckminster Fuller who had been agitating for fabrication since his Dymaxion house in 1927, had a vision of a technologically based building industry which provided a drive to other creative thinkers to

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establish new solutions outside the mainstream Modern Movement (Sharp 1972:154). The process of standardisation led to the development of modular design prototypes in housing. These are mostly assessed as *hard* form because the modular system is determinate and designed for flexibility and *soft* usage as the users are given the opportunity to select what they want and need. According to Sharp (1972:154), particularly in America, an acceleration of productivity, unprecedented since 1929 occurred and led to what has been referred to as a qualitative change in consumer demands in the post war period. Housing was particularly affected and the practical breakthroughs in building technology which had existed in the minds of designers and manufacturers before the war.

Habraken's (1972) *Support and Infill* theory is one of the important theories to the design of multifamily buildings (Habraken 1999:x). Habraken improved mass housing quality by developing the idea of Support and Infill with the Foundation for Architects Research (SAR) in 1964. Habraken advocates a built-in opportunity in residential blocks for a variety of

types by making the architectural layout independent from the structural system, which improves techniques and technology in mass production. One of the other opportunities offered by this theory is that the users are seen as an indispensable input in the design process, thus buildings allow users to make adjustments in the future. This shifted mass-productions focus from the home as a combination of spaces to the home as a combination of mass-produced systems.

In brief, the *support and infill system* in the design of housing units seems to be based on the separation of the structural system and infill system (Habraken 1999:79). Users have no right to interfere with the structural system, while the infill system refers to configuration of the detachable units according to users' needs and requirements. The housing projects designed according to *support and infill systems* can be examples of both *soft* and *hard* form.

The Kristalbouw project (1952) by Jan Trapman provides a base to Habraken's theory. The project has a concrete frame structure with an outer layer of

balconies, which can be accessed through the inner access units or open access galleries (Trapman 1964:15). Beside the permanent components, the use and design of the block is left open. Thus it is an example of *soft* form and use.

On the other hand, the Kallebäck Experimental housing (1960) designed by Erik Friberger can be regarded as an example of *hard* and *soft* use (Till, Wigglesworth & Schneider 2004:6). The design employs a column and slab system which is based on an initial idea of shelves to accommodate the units. The form of the project is *hard* because of the specific solutions for construction such as demountable partition walls, wall cupboards and doors which are determined by the architect to make the housing units flexible. Users can extend their units by moving the demountable partition walls. In this way, the architect allows the users to participate in the design process. The innovations in design techniques for achieving flexibility allow user involvement in the design stage (Till 2008:10).



### 3. The 1970s: *Open Building, Participation and User choice*

Habraken's *support and infill* theory led to the *participation and user choice* in housing design, providing an exception to what Rabeneck, Sheppard & Town (1973) say about mass housing. According to Rabeneck et al (1973) in the public sector, mass housing needs to respond to the housing design problems by addressing the users' needs as a means of generalizing the conditions of the invisible clients of public housing architects (1973:698). The use of standardised components would allow adaptation over time, in terms of replacement or addition with minimum disruption. However, according to Schneider & Till (2007), the analogy cannot be totally regarded as *soft*. According to Habraken (2008:292), the appalling reason for keeping flexible housing at arm's length was that when participation came to the fore, many architects resented the idea that users would be able to make design decision. The involvement of users had the potential of producing environments which were safer, cared for and also tailored to the needs of the users by the very fact

that the residents were involved in making decisions relating to the house and the direct dwelling environment (Habraken 1999:viii).

In this period, two important housing projects can be explored; The Wohnanlage Genter Strasse by Otto Steidle and Partners (Schneider & Till 2007:85) and The Überbauung Hellmutstrasse by ADP Architektur und planung (Schneider & Till 2005b:290). The structural systems in these projects differ significantly; the Wohnanlage Genter Strasse consists of a base structure while the Überbauung Hellmutstrasse has a polyvalent organization.

Wohnanlage Genter Strasse was built in three phases in the 1970s where the architects used a structural system called *Elementa*, which is composed of reinforced concrete column and beam system with ceiling panels (Schneider & Till 2007:85). In this project, users are given the opportunity to define the open space according to their needs and wishes. Users are also able to customize their units by using glazing or solid infill panels. Additionally, there are excess spaces which the users can claim over time as

either outdoor space or indoor space. In brief, as a base structure, the fixed parts and the infill parts are separated from each other. Thus this project is an example of *soft* form and use.

On the other hand, the Überbauung Hellmutstrasse designed by ADP Architektur und planung is another project in the 1970s which employed principles of flexibility and adaptability. Although there are interior load-bearing partition walls, users are given the opportunity to make future changes in their units. The housing project consists of multiple unit arrangements to fulfil the needs of the users with diverse lifestyles. The project allows for future changes through the enlargement or reduction in size of the units. This project is another example of *soft* form and use. The architects allow user participation in the design process and also give users the opportunity of customizing their residential units (Till 2008:8).

Three European architects; Lucien Kroll, Nabeel Hamdi and Nicholas Wilkinson are also significant in this framework (Habraken 2008:291).

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Hamdi and Wilkinson improved Habraken's *support and infill* theory and developed an approach called *Primary System Support Housing and Assembly Kit (PSSHAK)* in Britain (Rabeneck et al 1973:727). They tried to separate not only the structure from the infill but also the service spaces of the housing block. The implemented goals of the approach are as follows;

- To allow tenants to choose the plan layout before moving
- To allow the layout to be adapted to a family's changing needs, and to subsequent tenants
- To provide longer term adaption of the basic structure to different mixes of dwelling sizes thus allowing for future increases in spatial standards and family size (Rabeneck et al 1973:727).

In this context, *PSSHAK* flats designed by Hamdi, Wilkinson and GLC Architects in the 1970s are considered as the product of a successful design process (Habraken 1999:viii). Varieties of housing types are provided for users with diverse and changing lifestyles and as a result of the zoning

principle of the service spaces, the users were given the opportunity to adapt and adjust their houses according to their demands. In this approach, users can implement their individual choices within the *soft* infill area.

The idea of separating the elements of construction in the *support and infill* system is not only a technical solution in flexible housing design; it also empowers the user as a participant in the design process.

### Conclusion

The approaches to housing design related to flexibility in the twentieth century are discussed under three sections. In the first epoch, the discussion was based on new models of housing schemes with respect to minimal dwelling and spatial standards. The discussion shifted to the second epoch, where the focus was on standardised construction techniques which were influenced by the industrial era. In this era, Le Corbusier is one of the pioneers with his *neutral skeleton* system for mass produced housing along with Habraken's theory of *support and infill*. The last epoch introduced new

themes of participation and user choice in the design process.

This section reflects on how flexibility was achieved in the twentieth century. Accordingly, the approaches in flexible housing were based on standardised solutions with an indeterminate way of design referred to as *soft* systems and on the other hand, a more advanced and complex determinate way of design referred to as *hard* systems.

The brief presentation of the developments in flexible housing pointed to the changing demands such as the need for housing and limited space standards, innovation in construction techniques and technology, and user participation in the design stages.

## 2.3 SECTION B: AN OVERVIEW OF THE TERMINOLOGY AND THE CONCEPTUAL FRAMEWORK

### Introduction

The theoretical background is rooted in an approach to architecture where the design of systems and the interface between systems is given importance. This will generate a richer environment that caters for different categories of users, while at the same time achieves long-term relevance by allowing buildings to adapt and transform over time with minimum disruption of the urban built environment.

This section aims to clarify the meanings of the terms *flexibility* and *adaptability*. Habraken (2008) and Schneider & Till (2007) mention that flexibility and adaptability are very similar in meaning and often overlap. The researcher will define the terms and illustrate the key concepts and characteristics pertaining to flexibility and adaptability. The colloquial and technical meanings will provide a point of departure for the clarification of the terminology.

### 1. Flexibility and adaptability

The concept of flexibility is an important concern for open building design. Flexibility refers to housing that is designed for choice at the design stage, both in terms of the social use and construction (Schneider & Till 2005b:287). According to Schneider & Till (2005b), flexible housing includes the possibility of choosing different housing layouts prior to the occupation as well as the ability to adjust the housing unit over time. Flexible housing has the potential to also include different technologies over time, to adjust to the changing demographics or to even completely change the use of the building to something else.

Flexible housing in this definition is a much wider dimension as compared to adaptable housing. Adaptable housing denotes housing that adapt to the users' changing physical needs (Schneider & Till 2005b:287). It is therefore important to note that the two are closely linked and their applications are

variable.

The English colloquial usage of the word flexibility is:

- the quality of bending easily without breaking
- the ability to be easily modified
- willingness to change or compromise (Oxford English Dictionary Online 2013)

In its ordinary use, flexibility denotes not only a spatial-functional change, but also physical change, modification or adaption, for a variety of purposes or uses. The word flexibility points out the quality of being adaptable or having the capacity of being adapted. Adaptability denotes to the quality of being adaptable; the capacity of being adapted or of adapting oneself (Oxford English Dictionary Online 2013).

### 2. Flexibility and adaptability in the architectural environment

In architectural discourse, flexibility and adaptability

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have been defined in different ways. A brief description of flexibility and adaptability according to Rabeneck et al (1973 & 1974), Hertzberger (1991), Groák (1992), Maccreeanor (1998), Forty (2000) and Schneider & Till (2007) are included.

Rabeneck et al published two articles, the first in 1973 titled *Housing Flexibility* and the second one in 1974 titled *Housing flexibility/ adaptability?*. In the first article, they describe flexibility as a design option proposed against a tight-fit functionalism (1973:698). They further describe *flexible housing* as being capable of offering choice and personalisation. Rabeneck et al (1974) in the article titled *Housing flexibility/ adaptability?* describe flexibility as a concept which deals with the constructional technique and services distribution. Adaptability in the housing context is refers to housing units that can be easily altered as circumstances change (Rabeneck et al 1973:699). Rabeneck et al (1974:86) further define adaptability as being related to planning and layout of a building including the sizes of rooms and the relation between rooms. In this sense, flexibility deals with how the permanent and fixed parts of the

building are configured; the structural system and the service spaces.

Rabeneck et al (1973) see flexibility as a tool make the minimal housing capable of offering opportunity for choice and personalisation. On the other hand, they criticise flexibility especially for it can lead to too technical or complicated housing projects (1973:701). Rabeneck et al (1973) claim that while the design decisions about the structure and service spaces are related to flexibility. The consideration of architectural layouts and the remaining spaces are associated with adaptability.

Within the context of housing, Rabeneck et al (1973:701) define flexibility as the design and provision of housing units so that they are able to fulfil the occupants' expectations. For them, a housing unit may be considered as being adaptable if the unit can be easily altered as circumstances change. In summary, Rabeneck et al (1973) assert that while the design decisions about the structure and service spaces are related to flexibility, the consideration regarding the architectural layouts of

the remaining spaces are associated with adaptability.

Groak (1992) discusses his views on the differences between flexibility and adaptability within the housing context from a different perspective in his book titled *The Idea of Building: Thought and Action in the Design and Production of Buildings*. Groak (1992) defines adaptability as the capability of a housing unit to accommodate for different social uses. In his definition of adaptability, the author therefore relates adaptability with the internal spatial configurations in the housing units and is also related to the use of space. On the other hand, he defines flexibility as the housing unit being suitable for different physical arrangements which is related to the physical aspects of the housing unit. It therefore can be inferred that Groak (1992) agrees with the definitions of Rabeneck et al (1973). In their book titled *Flexible Housing*, Schneider & Till (2007) further elaborate on Groak's definitions of flexibility and adaptability.

According to Schneider & Till (2007:5), adaptability is

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achieved through designing rooms or units so that they can be used in a variety of ways, primarily through the way the room or unit is organized; the circulation patterns and the designation of the rooms. Flexibility is defined as being achieved through the alteration of the physical spaces of the building by joining together the rooms or units by extending them through sliding or folding walls or furniture. It can therefore be inferred that adaptability is associated with the internal organization of the housing units in order to accommodate for unforeseen future uses while flexibility is related to the physical changes occurring in the remaining spaces such as adjustments related both to the envelope and the interior spaces. Although Schneider & Till (2005:5) emphasize the fine distinction between adaptability and flexibility as where adaptability is based around the issues of use and flexibility as involving issues of form and technique; these terms do not have strictly defined territories as their meanings often overlap.

In *Lessons for Students in Architecture*, Hertzberger (1991) emphasizes the importance of the concept of

flexibility in architectural design as the absolute denial of a fixed clear cut standpoint (1991:146). From his perspective, flexibility in the housing context refers to houses that are capable of proposing different solutions for diverse uses with no single solution but the most appropriate solution. Hertzberger introduces the term polyvalence in his discussion on flexibility. *Polyvalence*, according to Hertzberger (1991), refers to a characteristic of a static form, a form that can be put to different uses without having to undergo changes itself so that a minimal flexibility can still produce an optimal solution (Hertzberger 1991:147).

Maccreeanor (1998) supports Hertzberger's (1991) argument by stating that flexibility does not simply imply the necessity of endless change and breakdown of accepted formula (Maccreeanor 1998:40). Both Hertzberger (1991) and Maccreeanor (1998) in their arguments point out the unsuccessful housing environments that are designed mostly figuratively as a result of the misunderstanding of the concept of flexibility. According to Forty (2000), the confusion in the meaning of flexibility is based on two contrary

roles; firstly, flexibility served to extend functionalism and so make it viable and secondly, it has been employed to resist functionalism. In this sense, flexibility is neither characteristic of indeterminate space that allows endless change, nor is it a characteristic of determinant space with too much technical equipment (Forty 2000:148). Therefore if architects leave buildings open for infinitely different solutions for the users, they lead to open-endedness and uncertainties (Hertzberger 1991:117; Schneider & Till 2005a:158). By the same token, if architects put more emphasis on flexibility through building with moveable parts, they will create false neutrality as a result of too much technicality or strictly defined spaces (Schneider & Till 2005a:158).

In his definitions of the concepts of flexibility and adaptability, Maccreeanor (1998) emphasizes that flexibility includes adaptability. According to Maccreeanor (1998:40), adaptability is another way of viewing flexibility. Adaptable buildings, according to Maccreeanor (1998) are both trans-functional and multifunctional and must allow the possibility of changing use. Adaptability is not primarily concerned

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with a designed idea of flexibility based on the collapse of the traditional layout.

The need for physical change in housing emerges due to two reasons (Maccreanor 1998:40). Firstly, housing units are expected to offer freedom of choice (typology variety) for users having a diversity of lifestyles prior to occupation. Secondly, housing units should provide the opportunity to make adjustments and modifications according to the changing future demands of the inhabitants. In residential housing units, the need for change may occur as a result of demographical changes such as an increase or decrease in the number of household members or a possible decrease in the capacity of inhabitants to do certain things.

The above definitions illustrate that the design of residential housing needs to be flexible and adaptable in order to provide the housing units to have the capacity for change and respond to the changing needs and demands of the users over time. Therefore a long-term thinking in the design process is required. In addition, flexible housing should

accommodate typology variety in order to make the units offer a freedom of choice prior to occupation. As an inclusive concept, flexibility embodies the concepts of adaptability and typology variety and is achieved by designing in fixed elements which are the structural systems and the servicing of a residential block in a way to allow change.

In summary, flexibility makes residential spaces adaptable according to the demands of the users with diverse and changing lifestyles. Adaptability on the other hand refers to the situations that allow users to adjust and modify their houses according to their wishes. In the residential context, adaptability refers to the allowance of variety of architectural configurations in accordance with the diversity of use. Flexibility and adaptability are closely linked.

### **3. An introduction to *Open Building***

#### **a) What is *Open Building*?**

The origins of the concept of open building is best captured by John Habraken's 1961 quote (Cuperus 2001:2);

*We should not forecast what will happen,*

*but try to make provisions for the unforeseen.*

In order to accommodate the future changes and building adaptations, Habraken suggested introducing the *levels of control* and the *controlled hierarchies* of the building parts in building design. Independent levels have supported building division in two major groups of parts; firstly the parts that correspond to the building infrastructure, the building support and secondly the parts that correspond to the building units, the Infill. The division is done according to different life cycle of different building parts (Cuperus 2001:2).

*Open Building* has been defined by numerous authors, as discussed in the following section.

Bensonwood Homes (2003) defines *Open Building* as an innovative approach to design and construction that enhances the efficiency of the building process, while increasing the variety, flexibility and quality of the product (Homes 2003:1). In the *Open Building* perspective, the building is viewed as a well-organised combination of systems and sub-systems,

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each of which can be carefully coordinated to ensure a better process and product for the homeowner and a parallel positive outcome for the building professionals. According to Homes (2003:1), the major systems include the building site, the structural envelope, the division of space inside the building, the plumbing, wiring, heating and cooling, furniture and all the other belongings that people put inside the building. By disentangling the systems and sub-systems from each other, opportunities are increased for better organisation, increased consistency, quality and more control and flexibility for the user.

For as long as humans have lived in dwellings of performance, they have also been constantly remodelling, renovating, changing and updating their living spaces. Occupants display much about their constantly changing lives in their homes (Homes 2003:1). *Open Building* is a contemporary design and building method that specifically addresses the radically changing social and technical environment in which we live and work.

*Open Building* is a new approach to the building and

remodelling process which acknowledges the human need to constantly alter and upgrade our living environments (Homes 2003:1). *Open Building* was conceived to address problems in the mass housing industry. In *Open Building*, the building is seen as a potentially well organised combination of available systems and sub-systems (Homes 2003:2). *Open Building* is a theory that addresses the need to serve present and future occupants while making the work of designing and building a home easier and more interesting for planners and builders (Homes 2003:4).

According to Kendall (2004:90), an *Open Building* approach enables a more dynamic balance between physical assets and changing household income over time. *Open Building* helps to avoid the trap of real estate development and building practices based on income class.

Cuperus (2001:2) defines *Open Building* as being a multi-faceted concept, with technical, organizational and financial solutions for a built environment that can adapt to changing needs. It supports user participation, industrialisation and restructuring of

the building process.

*Man no longer houses himself. He is housed* (Habraken 1999:9). *Open Building* tackles the housing needs from a totally different perspective. The individual is put into the centre of the equation rather than removed from it. Decisions which have to do with the lifestyles and preferences of the occupant are clearly distinguished from the decisions that are more public and concerned with local politics, zoning, geo-technical issues and the climate (Homes 2003:3). People naturally tend to customise their homes to suit their needs and express their values, but do so in the context of the society at large with its conventions and regulations. *Open Building* allows for this distinction between the individual and the larger community, and also makes provisions for future changes.

Stewart Brand's *How Buildings Learn* (1994) explains the inevitability of change in buildings. According to Brand (1994), over the life span of a building, the architects' original intention is forgotten. Brand (1994) maintains that a building learns from its

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owners. Habraken (1999) also strengthens this by stating that the inhabitants who live in a space need to be involved in its planning and the building needs to be able to accommodate what cannot be foreseen. Builders of mass housing projects and more traditional buildings consider the finished product to be a fixed entity. Each building exists on its own, with or without its occupants. According to Homes (2003:4), in *Open Building*, the owner and the future occupants are considered in every step of the building process.

### b) *Open Building* as a concept

As a concept, *Open Building* is about disentangling the sub-systems of a built environment to allow change to happen in one part of the building without disrupting the other parts of the building; it is about distributed decision-making in the built environment as opposed to the centralised, top-down processes (Osman & Konigk 2009:054). According to Osman and Konigk (2009), *Open Building* is about understanding the environment in terms of levels with different agents acting at each level and it is about the organisation of

this inherent complexity. *Open Building* is a term that is used by an international network of practitioners and researchers to define this particular approach to the design of the built environment (Osman & Konigk 2009:055).

Habraken promoted the concept of *Open Building* in the 1960s (Habraken 1999:x). The term *Open Building* covers a number of ideas relating to a building and its environment which Habraken defines as;

- The idea that, more generally, designing is a process with multiple participants also including different kinds of professionals
- The idea that the interface between technical systems allows the replacement of one system with another performing the same function
- The idea that built environment is in constant transformation and change must be recognised and understood (Habraken 2006)

In Habraken's statement, building design stands for

more a systematic view of both;

- Building design process referring spatial organisation and functional disposition
- Building construction process referring to the technical composition and building configuration

From improved participants decisions and possibility for choice, to standardised interfaces between building systems that are compatible and sustainable, the *Open Building* approach is introduced in multifamily housing design and building process.

A building can allow for all agents in the built environment to co-exist by organising the relationships between them (Osman & Konigk 2009:054). Theoretically, this means that there is a level of the environment (referred to as the *Support* or *Base Building*) which is permanent, of high quality and robust. Within these support or base buildings, another level exists (referred to as the infill or fit-out level) which is less permanent and of varying quality.

*Open Building* maintains that housing should be



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adaptable within a stable and robust structure; a structure that gives an environment its character and identity within which there exists another level that changes over time and that allows for participation. It is a way of organising complex relationships in the built environment (Osman & Konigk 2009:055).

According to Dekker (1998:312), the aim of *Open Building* is to find principles of ordering and combining sub-systems to give optimal freedom of design layout and installation and thus allowing for efficient buildings and better possibility for choice. The building becomes sustainable and able to undergo interior alteration to remain useful; thus the base building or support level can be designed to have optimum capacity for diversity and efficiency at the infill or fit-out level (Dekker 1998:312; Habraken 1999:72).

It is important to note that the application of *Open Building* is not only at the urban design level but can also be applied at the level of the individual building.

### c) Levels and agents of control in the built environment: democratic process

*Open Building* acknowledges the large number of participants in the development of the built environment, thus creating a richer, layered, sustainable environment rather than a sterile, repetitive, monotonous one (Osman & Lemmer 2005:4). *Open Building* empowers people in that it involves them in the decision making process and the implementation process. Habraken (1999:28), states that the built environment may be described solely in terms of live configurations operating on different levels. In so doing, it is described as a dynamic form controlled by people, fully taking into account that the built environment is a product of people acting in it. Dewar & Uytendogaardt (1991:35) refer to it as a process of *negotiated reactions* whereby continuous transformation is achieved within a stable environment. This is perceived as a common characteristic of successful urban places.

### d) *Open Building* systems as a tool to achieve diversity

The aim of *Open Building* is to find principles of ordering and combining housing subsystems to give

optimal freedom for design layout and installation (Dekker 1998:312). This according to Dekker (1998:311) allows for efficient building and makes possible the redesign of a subsystem or its replacement, allowing for alteration over time and higher possibility for user choice. This can be used at all levels of development and enables both stability and transformation in the environment. Parts of the buildings constructed according to local building style and regulations can remain constant within an *Open Building* framework, while the interiors can be changed more rapidly (Habraken 1999:7); thus variety in the quality of infill/fit-out level. According to Habraken (1999:72) and Dekker (1998:312), the infill or fit-out level refers to equipment, non load bearing partitions, pipes, cables and ducts. This maintains the building or support level as the essential provision of space and shelter. The building there becomes sustainable, is able to undergo interior alteration and so as to remain useful to the users and meet the needs and requirements of the residents.

According to Kendall (2009:5), the *Open Building*

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theory suggests that while the built field can be understood and described in many ways, the most effective way is to use the concept of levels of control and the concept of change. Kendall (2009) defines the base building as being the parts of the building infrastructure with a longer-term use, the public or common service related design and the heavy construction while the infill or fit-out level refers to the shorter-term use, the user related design and the lightweight components (Kendall 2009:6).

### e) Industrialised systems and relevance to developing contexts

A systems approach to building includes modular and dimensional co-ordination, user-oriented design and construction, computational support of design, construction and manufacturing, industrialisation, rehabilitation of existing buildings and development of the principles of sustainable design (Dietz & Cutler 1971:112). *Open Building* systems have been promoted by those who have pointed to the incapability of traditional building processes to cope with sophisticated production (Westra 2002:1667).

Using modular systems may facilitate quicker construction and save costs (Martin 2001:32). This is a concern because South Africa is a developing country, which does not have the technology nor the money to support a system, which appears to depend on just that. A device may be to develop processes that adapt *Open Building* to the South African context and link up with existing industries, such as combining indigenous knowledge and modular building systems as a means of providing low-income housing as experimented by Brewis (2003:14). Modular systems are affordable, adaptable and their quality can be assured through manufacture under controlled conditions (Brewis 2003:17).

Houses have been adapted to inhabitants' changing needs in many contexts (Habraken 1998:7). Changes may mean the inclusion of income-generating activities, subdivision or extension. The more diversity is accommodated in a housing development, the more this diversity will become evident and the more solutions will address long term needs, thus rendering these approaches

sustainable (Osman & Gibberd 2000:6).

### f) Relevance of *Open Building* to South Africa and different tenure options

Housing landscapes in South Africa which have evolved during the apartheid era still manifest themselves as sterile, restricted and inefficient settlement patterns (Osman & Lemmer 2005:3). There is a need for sustainable housing systems. The premise of the research argument is that housing should be adaptable within a stable and robust support structure. The aim is to allow for flexibility while not subtracting from an efficient urban identity. According to Osman & Lemmer (2005:4), a careful adaptation of *Open Building* systems in the South African context may be the means to introduce in its potential change without disrupting the stability and quality of the environment.

The current housing plan and strategy in South Africa, outlined in *The Comprehensive Plan for the Development of Sustainable Human Settlements (2004)*, commonly referred to as the *BNG* reinforces the vision of government to promote the

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achievement of a non-racial, integrated society through the development of sustainable human settlements and quality housing (DoH 2004:7). While it builds on existing housing policy, it also provides a new housing vision to redirect and enhance responsive and effective delivery (Osman & Herthogs 2010:1). The *BNG* outlines that this is to be achieved through seven objectives, namely; stimulating the residential property market, spatial restructuring, social housing (medium-density), informal settlement upgrading, institutional reform and capacity, housing subsidy reform and housing and job creation.

The *BNG* advocates a move from a commoditised focus on housing delivery towards more responsive mechanisms which address the multi-dimensional needs of sustainable human settlements (DoH 2004:8).

Specific objectives set by the policy for social housing include promoting urban restructuring through social, physical and economic integration of housing developments into existing areas (Osman & Herthogs 2010:3). According to Landman, Matsebe &

Mmonwa (2009) the organisation and nature of the physical characteristics of housing, including the design and layout have been identified as a critical success factor for medium-density mixed housing. Research on housing has however tended to focus on the non-physical characteristics such as tenure and affordability (Weich, Burton, Blanchard & Prince 2005:267). Turner (1976) describes housing as both a product, from individual housing unit to a housing neighbourhood and a process, referring to the provision and maintenance of residential buildings. From this perspective, the residential environment can be viewed as a complex set of physical structures and processes that are mutually defined at different scales and times (Landman et al 2009:17). Urban and housing environments are complex environments and hence there is a need to address the whole housing terrain, including the physical characteristics of dwellings and the wider environment (Lawrence 2004:5; Weich et al 2005: 267).

The *BNG* intended to shift away from a focus of the quantity of households delivered but rather to the quality of houses delivered (Tissington 2011:66). The

quality of design includes the size and workmanship of the units provided, settlement design and alternative construction technologies. Despite the aims of the *BNG*, it has been criticised for not fully addressing the key weaknesses of the previous policy.

However in the South African context, the housing practitioner is involved in housing on the daily basis is confronted with the reality of the need to house the large numbers of people very quickly and thus the issues of quality become lost and redundant (Osman & Lemmer 2005:4).

As far as the quality of housing units is concerned, social housing must be seen in the context of medium to higher density developments ranging from group housing to multiple level, multiple unit dwellings. It is therefore a much more complex building type than the single unit dwelling model and subject to many more requirements with regard to its structure, servicing, financing and quality standards (section 5 of the *SHP* draft 2003). Though the *SHP* briefly discusses the issues regarding bringing quality

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into social housing developments, there is very little evidence on realising these ideals and how they should be translated and implemented on grass root level. These policy gaps are daunting and result in the frameworks to not be fully understood and realised by the housing practitioners. It thus can be argued that existing policy frameworks do not encourage innovative approaches and design solutions.

In South Africa, there are special considerations that support the implementation of open building in such a way as to allow maximum accessibility and transformation (Osman & Konigk 2009:054).

In the development of the built environment, *Open Building* acknowledges the large number of participants and thus creating a richer, layered, sustainable environment rather than a sterile, repetitive and monotonous one (Osman & Konigk 2009:056). According to Osman & Konigk (2009:056), in the South African context, when addressing aspects regarding housing quality such as accessibility and appropriateness, affordability is argued to be a

constraint. There is no single solution to cost efficiency; it needs to be addressed in creative ways with a long term vision.

### Conclusion

The theoretical argument outlined the historical overview of flexible housing in the twentieth century, outlining its evolution as an architectural concept in residential buildings and designs. This was discussed under three themes. The first theme was based on a discussion of the new models of housing schemes with respect to minimal housing in the Modern Movement. The second theme the focus shifted to the standardized means of construction for mass housing. Le Corbusier was highlighted as one of the pioneers for mass produced housing along with Habraken's *support and infill* theory. The last theme outlines how Habraken's *support and infill* theory led to the theories of *open building*, participation and user choice in housing design.

The second section highlighted the conceptual framework influencing the research under three concepts; *flexibility, adaptability* and *Open Building*.

The concepts were defined and discussed within the context of housing developments. The characteristics of flexible and adaptable housing were identified. *Open Building* was defined and examined with regards to the relevance as a concept in the South African housing terrain.

The following chapter will introduce housing developments which have successfully employed the concepts of adaptability, flexibility and open building in achieving residential satisfaction to the users.

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Submitted in fulfilment of the requirements for the Mini-dissertation 895 (ARG 895) course for the degree MSc Applied Science in Architecture in the Department of Architecture, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria.

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## 3introduction

### 3.1 CONTEXT TO THE PROBLEM

The Department of Human Settlements advocates the pursuit of a more compact form of housing, facilitation of higher densities, mixed-use developments, as well as the integration of different land use as an alternative to strict zoning (CSIR 2011:1). Developments which incorporate these principles are considered important in changing the nature of South African cities and contributing to the creation of sustainable human settlements. The reality is that there is nothing particularly new in the approach to housing policy being advocated (Dewar 2009:14). However, what makes the approach unique in the South African context at this time is that it makes it possible to tackle a range of the most pressing developmental problems facing the country along one integrated policy front.

According to Dewar (2009:14), it is increasingly clear that the built environment of the urban poor is unlikely to improve substantially by *fiddling* with the existing policy. It is furthermore clear that the housing issue is much more than the simple concern

to provide shelter (Dewar 2009:14). The challenge is about finding ways of using policy creatively in order to open up a range of development possibilities.

Housing policy has produced large quantities of houses, but numerous districts of poor urban quality. A decisive change in thinking is therefore necessary (Cooke 2009b:25). Fundamental changes in the planning and provision of state-assisted housing have been implemented following the attainment of democracy; however the existing housing stock is no longer properly accommodating today's population. State-assisted housing in South Africa reflects the out-dated ideals.

South Africa's national Department of Human Settlements (previously known as the Department of Housing), currently advocates the pursuit of a more compact form of housing with higher densities, mixed-use developments and the integration of different land uses (CSIR 2011:1). These kinds of developments are considered

important in changing the nature of South African cities and contributing to the creation of sustainable human settlements.

Social housing is one of a range of housing strategy and institutional arrangements recommended in the *BNG* policy which provides an important shift in urban development through which the socio-economic and spatial restructuring of the South African landscape can be confronted (*BNG* 2004). Social housing developments are perceived to have the capacity to contribute to the transformation of fragmented South African cities more than the massive roll-out of government subsidised housing (Osman & Herthogs 2010:1).

Social housing is defined as a housing option for low to medium income persons provided by housing institutions, and excludes immediate individual ownership (section 02 of the *SHP* 2003). According to the *SHP* (2003), social housing in the South African context covers the rental tenure option.

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This therefore implies that the housing unit will be occupied and inhabited by different households over the building's life cycle. Due to the nature of these housing developments, the building stock needs to remain marketable and viable in the long run (Osman & Herthogs 2010:9).

Due to the nature of social housing, it is important to achieve appropriate quality standards in these developments. According to the section 4.3 of the *SHP* draft (2003), a social housing development may house many residents over the building life and therefore the finishing needs to be of sufficient quality and robust enough to sustain this and the units must have low maintenance characteristics. The *SHP* further defines that the social housing designs should also aim for as much flexibility as possible within the financial limitations to allow for retrofitting in future (section 4.3 of the *SHP* draft 2003).

It can therefore be concluded that these housing units should be flexible and adaptable in order to cater for different users with different needs and

requirements. Allowing easier maintenance by this entangling of building systems and components would be one aspect that needs to be addressed.

Following a study carried out in 1999 by a housing company, a survey of the users found that adaptability was the most desired characteristic (Osman & Herthogs 2010:9).

In the study, it was also found that 25% of the housing budget was spent on renovations and an additional 25% was spent on basic maintenance. It is thus important to note how the initial design considerations of *flexible* and *adaptable* structures would have contributed to user satisfaction and on the financial implications. In Landman's study titled *Medium Density Mixed Housing in South Africa: Two pilot case studies in Johannesburg* conducted in 2008, many residents were dissatisfied with the unit sizes and its inability to cater to the changing family structures. In this study, the unit size was seen to restrict comfort and privacy while limiting the opportunities for different spatial appropriation for larger family sizes. There is a need to adjust

certain aspects of a social housing unit depending on the tenants needs at a specific time (Osman & Herthogs 2010:9).



### 3.2 PROBLEM STATEMENT

Social housing projects need to develop as thoroughly integrated parts of the greater urban fabric of their contexts and must be integrally connected through various scales (Palframan & Wintermeyer 2005:39).

Housing is not just about building houses with bricks and mortar. It is also about transforming our residential areas and building communities. There should be a focus on creating settlements and districts that aim at the improvement of people's lives, settlements with good public spaces and social amenities. According to Tissington (2011:25), access to housing is also bound to access to other socio-economic activities and amenities which include; access to land, water, sanitation, electricity, livelihoods, transport, clinics, hospitals, schools, universities and other cultural and recreational amenities such as parks, libraries and public spaces.

Low (1997:139), describes the process of housing as a process far preceding the planning and construction phase but extends beyond the owners

taking up residence; it is not a commodity or a product. Kendall (2004:91) also describes the practice of housing as a process which needs to fit into its local fabric and it's about processes that extend over time.

The built environment is not static. It provides an interesting context in which to study the relationship between stability and transformation. The quality of changeability is inherent in houses and cities throughout the world (Osman & Konigk 2009b:55). According to Osman and Konigk (2009b), a residential unit is a changing organism, adapting throughout its lifetime to suit the changing social status, economic status and lifestyles.

Social housing stock being built now is generally three or four storey walk-ups with minimal space standards (Osman & Konigk 2009:56). These housing developments do not have the built-in capacity for adaptation and change. Despite the progressive nature of social housing developments, the design and spatial planning of these units remains stagnant.



Figure 11

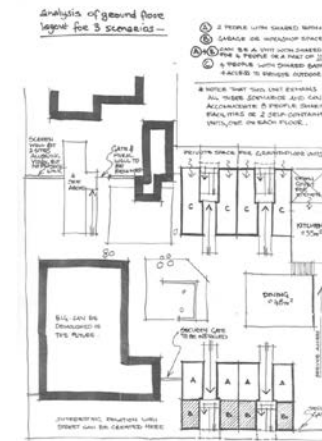


Figure 12

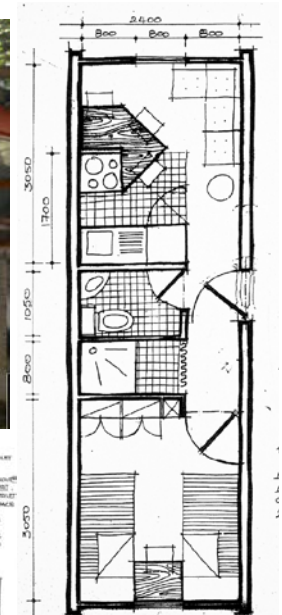


Figure 13



Figure 14

Figure 12-15: Images of Potters' House, Pretoria, by Paul Munting (Osman & Davey 2011:14).

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The problem with this approach in social housing is that there seems to be an assumption that the end-users' profile will remain the same over time (Osman & Herthogs 2010:9). However, communities, society and the demographics are constantly changing and present different needs and requirements.

The ability to choose and change the size or finishes of a housing unit could be crucial in improving the sense of ownership and general living quality of the occupants. Internal living spaces should not assume a stable tenant profile with the same needs and requirements for space because especially in rental units, a living unit will be occupied by various tenants over the building's life-cycle.

Currently, housing is delivered without taking into consideration people's highly varied needs by subsidizing and delivery a housing unit represented by the repetitive mass housing developments which are institutional in character (Osman et al 2011:4). In simple terms, everyone is given the same flavoured drink mean while they would prefer a different flavoured drink. According to Osman et al (2011), in housing projects, the level of the residential unit is the most personal and decision making at this level need to include the residents. There is a need for the development of sustainable housing systems (Osman & Lemmer 2005:3).

The premise of the argument is that housing should be adaptable within a stable and robust support

structure (Osman & Lemmer 2005:3). The concept of adaptable design may at first glance seem rather high-tech, but that is not necessarily the case. The aim should be to allow for *flexibility* whilst not subtracting from the overall urban identity of the urban landscape. According to Osman & Herthogs (2010:8), *adaptability* can be introduced by maximising the compatibility between different constructional components and thereby maximising the number of configurations that can be made.

A careful adaption of the *Open Building* systems in the South African context may be the means to introduce in its potential for change without disrupting the stability and quality of the environment (Osman & Lemmer 2005:3).



Figure 15(Low 2005:4)



Figure 16(CSIR 2011:8)

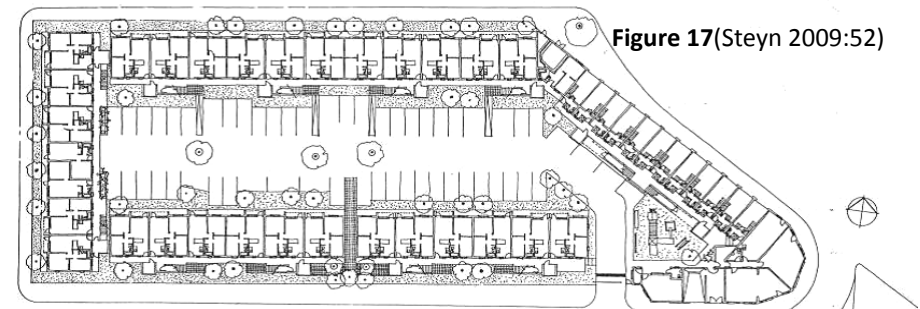


Figure 17(Steyn 2009:52)

Figure 15-17: Images of Elangeni Gardens, Johannesburg, by Savage + Dodd

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### **3.3 RESEARCH QUESTION**

What physical changes can be made in a social housing unit in order to allow the unit to adapt and meet the needs of multiple users and residents?

### 3.4 RESEARCH STATEMENT/ HYPOTHESIS

The built environment is created by professionals who, in the context of social housing, may never know the users of the buildings (Sebake 2010:1). This has created a widening gap between the built environment professionals and the end-users, thus resulting in environments which fail to meet the varying needs of the users.

In rental housing, a unit houses different needs through its lifetime (Osman & Konigk 2009:56). If rental buildings are not designed to allow for change, they are at a risk of being unable to cater to the needs of future tenants. According to Osman & Konigk (2009b), the social housing rental stock is relatively new but the lives of the buildings are much longer. The performance of these buildings in future should be addressed in the initial design process.

Internal spaces of social housing units should be designed and planned so that the housing unit can accommodate and cater for all the needs and requirements of a diverse range of tenants and

end-users. The planning and arrangements of these housing units' internal spaces should be able to cater to the needs of the future unknown tenant/household by utilising principles of *open building*, *flexibility* and *adaptability* in architecture (Schneider & Till 2005b:287).

### 3.5 RESEARCH AIMS AND OBJECTIVES

The premise of the research study is that housing should be adaptable within a robust and support structure (Osman & Lemmer 2005:4).

The research study evaluates the spatial planning and appropriation of internal unit spaces in social housing units. The researcher will base the study on theories and concepts of *Open Building* in residential developments. With the application of *Open Building* concepts, the researcher will explore a residential unit as a flexible and adaptable entity rather than a fixed final product.

According to Dekker (1998:311), *Open Building* is a way of building in which subsystems making the whole are given optimal freedom for design layout and installation. It brings together many strands of development in architecture, construction and industrial production of building parts which have been taking place.

*Open Building* is a theory that addresses the need to serve present and future occupants while making

the work of designing and building a home easier and more interesting for planners and builders (Homes 2003:4). It maintains that housing should be adaptable within a stable and robust structure; a structure that gives an environment its character and identity within which there exists another level that changes over time and that allows for participation. It is a way of organising complex relationships in the built environment (Osman & Konigk 2009:55).

This approach will result in a high quality offer for the support and a flexible response to individual needs within the infill/fit-out level. This approach allows the existing tenants to remodel and redesign the inside of their housing unit without financial problems for the housing corporations. It also allows for the flexibility of the housing unit to be able to fulfil the different needs of new tenants.

A theoretical discourse on the applications of *Open Building* principles in residential rental housing level will be included in the research. The relevance of this system as an effective tool in achieving diversity in the

South African context. This will be evaluated through the investigation of existing social housing developments in the form of a case study report.

A critical investigation of whether social housing internal unit spaces have the potential to change within the structural frame according to the needs of the end-users will be included in the research. Social housing developments will be the focus as it is crucial to the viability of rental housing to be able to adapt and change the building stock over time (Osman & Herthogs 2010:7).

The research will ultimately aim to prove that while maintaining the same area, size and boundary of a social housing dwelling unit; the internal space has the potential to be adaptable and flexible to meet the needs and requirements of multiple users through adequate design and physical manipulation of the unit.

The value of this process is that it will put emphasis on the neglected aspects of housing design in South

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Africa (Osman & Davey 2011:25). According to Osman & Herthogs (2010:1), currently social housing is conceived as a static representation of current needs.

### 3.6 RESEARCH MOTIVATION

In response to the challenges within the housing terrain, the South African government has promoted the development of medium-density mixed housing in its *BNG* housing plan (Landman 2010:9). Social housing being one component, it is perceived to have the capacity to contribute to the transformation of the fragmented South African cities more than the massive roll-out subsidised housing (Osman & Herthogs 2010:1). It is also perceived that higher densities are more economically and environmentally sustainable. With particular reference to social housing, it is important to ensure market viability by assessing the adaptability and changeability of the housing developments to accommodate for future unforeseen needs.

The research challenges the concept of a residential unit as static and fixed. Therefore, the research will contribute to the knowledge and research of flexible and adaptable housing within the context of social housing in South Africa.

The best guarantee to ensure good rentability of a housing development over the long term is to undertake a market orientated and flexible rent policy, in which the tenant and his needs become central focus (Dekker 1998:314). It is impossible to have a standard answer to each individual requirement. The lessons to be learnt from the study will add in the facilitation of coherent development frameworks aimed at assisting the social housing sector in South Africa.

*Open Building* in the South African context is of particular importance as it has the ability to address issues of housing quality, such as accessibility and appropriateness. It is however argued that affordability serves as a constraint in the implementation of *Open Building* concepts (Osman & Lemmer 2005:5). It cannot be ignored that there must be specific considerations in the South African context. In rental housing, a unit houses different people through its lifetime hence a standard quality of infill is not viable.

A social housing development in South Africa is mostly rental stock and thus the concept of open building cannot be ignored. *Open Building* systems can cater for the unique social and economic characteristics of South Africa.

The research will thus contribute to the study and research of future social housing developments and ensuring end-user satisfaction by adequately meeting the various needs and requirements of different households throughout the building's life.

The importance of the academic connection with housing practitioners and becoming involved in real housing projects cannot be underestimated (Osman & Lemmer 2005:9). The research acknowledges the importance of these approaches and its full investigation being tested in existence.

### 3.7 RESEARCH SCOPE

The research study evaluates *Open Building* principles in residential developments in the South African context. The research will investigate internal spaces of social housing developments and their ability to adapt and be flexible throughout the buildings lifetime.

The research will start with outlining the basic principles of *Open Building*, *adaptable design* and *flexibility* and will then contextualise these principles within the South African context. Three case studies; Carr Gardens, Brickfields and K206 have been selected and will be investigated in greater detail for the research study. The case studies will include analysis, semi-structured interviews. The following section will outline the case studies in more detail.

Thus, the study will investigate these case studies and suggest methods of achieving *flexibility* thus ensuring that these social housing developments



### 3.8 RESEARCH LIMITATIONS

*Adaptable* approaches to design and delivery are considered for the whole housing market. However, due to the pressing challenge of the South African government to deliver low-cost and affordable housing, it is hardly considered (Osman, Herthogs & Davey 2011:3).

Currently, social housing is conceived as a static representation of the current needs (Osman & Herthogs 2010:1). By assessing existing projects, it will be possible for the researcher to assess the theories of *adaptability* and *flexibility* in social housing developments in South Africa. The case studies will allow for the identification and assessment of the existing buildings and whether the theories of *adaptable* and *flexible* design are relevant in the South African context.

By assessing existing projects, it will make it possible to align the theories and its relevance in the South African context and to see its applicability (Osman et al 2011:2). The research includes two pilot case studies in Johannesburg; Brickfields and Carr Gardens.

Carr Gardens was implemented as part of the *Blue IQ* initiative aimed at contributing to the regeneration and transformation of the inner city of Johannesburg (SHI-DEF 2000:218). The project was completed in 2003 and developed and managed by the Johannesburg Housing Company (JHC). This social housing project was selected based on the fact that though it was implemented prior the implementation of the *BNG* strategy for urban renewal policy, the project is in line with the aims of the Department of Housing's (the now Department of Human Settlements) vision of urban regeneration, provision of quality housing and densification initiatives. The project also aligns itself with the main objectives of spatial, economic and social sustainability of social housing in South Africa (Development Action Group na:1).

The Brickfields project was selected on the basis that it was developed with the intentions of inner-city regeneration through the provision of quality, value-for-money accommodation and service for its

#### Brickfields

<b>Architects</b>	Savage & Dodd, Fee & Chalis Architecture, Makhene Architects & Associates
<b>Year</b>	2005
<b>Location</b>	Newtown, Johannesburg
<b>Total number of units</b>	724 units (1 bedrooms, 2 bedrooms and lofts/studio units)

#### Carr Gardens

<b>Architects</b>	Micheal Hart (MHCD) Architects and Urban Designers
<b>Year</b>	2003
<b>Location</b>	Fordsburg, Johannesburg
<b>Total number of units</b>	211 units (1 bedrooms, 2 bedrooms and studio units)

#### K206

<b>Architects</b>	ASA Architects (Anca Szalavic)
<b>Year</b>	2010
<b>Location</b>	Alexandra, Johannesburg
<b>Total number of units</b>	2200 units (520 of the total are rental units)

**Table 01:** Brief information of the selected case studies.

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occupants in a manner which is both sustainable and promotes growth (Poulsen & Silverman 2005:13). The Brickfields project was the pioneering step in the process of a broader urban regeneration initiative to revitalise the old industrial area of Newtown. It is also in line with the Department of Housing (now Department of Human Settlements) *BNG* strategy for urban renewal, human settlement and sustainable development (Meyer *ed* 2005:11).

It is important that adaptable approaches to design be considered for the whole housing market. Thus the K206 Housing development in Alexandra will be used as a third case study for the research because of its variances from the two pilot case studies.

The K206 project aims to increase housing densities and combines ownership and the rental occupation on the same property (CSIR 2011:2). This project forms part of the Alexandra Renewal Project (ARP) and aims at upgrading housing, social and physical infrastructure in Alexandra. The project was selected to form part of the study because it also is in line with the housing strategies of the

Department of Human Settlements.

The Department of Human Settlements advocates on providing sustainable human settlements through:

- increasing and promoting densification and integration
- enhancing spatial planning
- enhancing location
- supporting urban renewal and inner city regeneration
- enhancing housing product (section 3 of the *BNG* 2004:5).

The *SHP* outlines specific parameters for social housing developments (section 4 of the *SHP* 2003:8). According to the *SHP*, the framework for social housing includes the location, typology, tenure structure and building uses and functions as important aspects in social housing developments. The case studies were therefore selected based on

the general criteria outlined in the *SHP*. Social housing developments are expected to conform to the norms and standards stipulated by the Minister of housing, National Building Regulations and the National Home Building Registration Council (NHBRC) (section 4.3 of the *SHP* 2003:11). The policy document gives an overall guide of what social housing should be and how it should be developed. These factors include;

- Typology: medium to high density developments ranging from group housing to multi-unit dwellings
- Use: multi-uses which will support the urban restructuring and economic integration
- Form and tenure: rental housing option
- Location: inner city developments which will support urban renewal and regeneration

•**Typology:** The architectural typologies for Brickfields and Carr Gardens are similar. Carr

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Gardens consists of three and four storey walk-up town houses built around open courtyards. Brickfields consist of four storey walk-ups and nine and ten storey walk-up buildings at the corners. The housing development also has tower blocks up to 20 storeys. K206 consists of clustered double storey buildings.

•**Use:** K206 has rental rooms adjacent to the family units. Brickfields include rental housing units, live-work units and a small component of retail. Carr Gardens is a mixed income housing complex with a crèche and playground.

•**Form and Tenure:** Brickfields and Carr Gardens both offer social rental options and exclude immediate ownership. However, K206 combines the option of ownership and rental occupation.

•**Location:** K206 housing development is a Greenfield development in a typical South African township setting. Carr Gardens and Brickfields are an urban regeneration and restructuring inner-city project. Brickfields, however is also a part of a broader initiative to revitalise the old industrial area

of Newtown.

The case studies will be used to demonstrate that the future building of social housing developments need to bear in mind issues of adaptability and flexibility which will allow buildings to remain relevant within their building life and not become obsolete.

The research will be limited to a number of semi-structured interviews with a focus of in-depth descriptive information will be held rather than a broad statistical representation.

The research will not question the housing delivery system and financial support mechanisms, but will focus on the architectural aspects pertaining to the internal spatial appropriation and planning.

The research will exclude all the implications of the concepts of flexibility and adaptability in the policy environment.

The research will exclude statistical and demographic studies which will prove that households are changing.

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**Figure 18: Brickfields**, Newtown, Johannesburg, Gauteng 809 units (Steyn 2009:52)



**Figure 19: Carr Gardens**, Fordsburg, Johannesburg, Gauteng 211 units ([www.jhc.co.za](http://www.jhc.co.za))



**Figure 20: K206**, Alexandra, Johannesburg, Gauteng 2156 rental units ([www.skyscrapercity.com](http://www.skyscrapercity.com))

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## 4 precedent studies

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Precedent studies for the research were selected in conjunction with the research theme. The study aims to investigate whether social housing internal unit spaces have the potential to be adapted within the boundaries of the unit in order to meet the varying needs and requirements of multiple users. Through the precedent studies, a thorough understanding of the contextual realities of social housing design and the extents of employing flexibility and adaptability in social housing design will be achieved. This will allow a good platform in extrapolating lessons on employing the principles of achieving flexibility and adaptability in social housing design.

Three precedent studies have been selected for the research; Weissenhofsiedlung designed by Mies van de Rohe, Nemausus I and II by Jean Nouvel et Associés and Quinta Monroy designed by Alejandro Aravena (Elemental). These precedent studies were selected on the design approaches outlined in the theoretical discourse of the techniques in achieving flexibility and adaptability. The criterion for the selection was informed by *use* as a method

for achieving flexibility as this aspect of flexibility forms the basis for the research. According to Schneider & Till (2005b:289), *use* refers to the way that the design affects the way in which the housing unit is occupied over time and it generally refers to flexibility in plan.

Weissenhofsiedlung and Nemausus I and II illustrate *soft* use as the projects allow the users to adapt the plan according to their needs. In these projects, the *soft* use design approach illustrates the physically fixed but socially flexible layout through the provision of raw space in which the users can define as their needs will dictate. The notion of *soft* use allows participative approach by allowing the users a degree of control at both design level and building level (Schneider & Till 2005b:293).

Quinta Monroy on the other hand illustrates *hard* use. In this project, the designer designs the units in a way that the spaces are determined on how they can be used over time.

The precedent studies will be investigated separately in the following section.

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**1927 | Weissenhofsiedlung | Mies van der Rohe | Germany**

**PROJECT DESCRIPTION**

Located in Stuttgart, the Weissenhofsiedlung apartment block consists of floor plans which are completely open plan with only one or two internal structural columns (Kirsch 2013:47). To one side of the staircase is a smaller apartment of 45m<sup>2</sup> and on the other side a larger apartment of 72m<sup>2</sup>. In this project, bathrooms and kitchens are placed against the party wall and stair enclosure (Kirsch 2013:55).

The project consists of four identical units, a staircase, a small and large apartment are set up repetitively next to one another; House 1, House 2, House 3 and House 4 (Kirsch 2013:47). The combination of open plan spaces and services are arranged around a core is representative of flexible principles of the speculative office block, where the generic space is provided for the client to fit out as they wish.

Mies van der Rohe then allowed other architects to

finish the raw spaces to be finished with internal partition walls, demonstrating both the ideological basis and the practicality of this approach to flexibility (Schneider & Till 2005a:158).

The large apartment on the ground floor of House 1, designed by Lilly Reich, features two living rooms, one bedroom, a kitchen and one bathroom. On the first floor of House 3, the Austrian architect Franz Schuster planned an apartment for a childless couple; one bedroom, living room, a large kitchen and a bathroom. On the second floor of House 4, the Schweizer Werkbundkollektiv proposed a bachelor apartment with a room for a piano and a small study separated from that room by a moveable partition wall. Next door, the larger apartment is fitted out by the same architects to accommodate two bedrooms; one with a double bed and the other one with two single beds, a small dining/living room and a study room (Kirsch 2013:47).

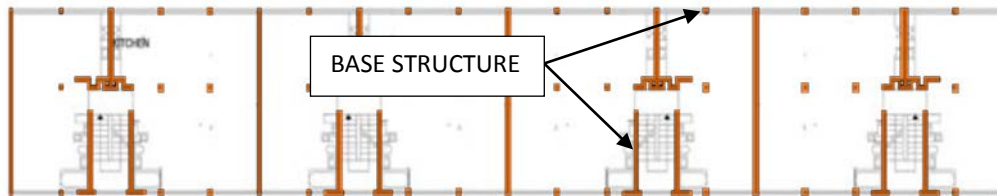
<b>Architect</b>	Ludwig Mies van der Rohe
<b>Location</b>	Stuttgart, Germany
<b>Design completion</b>	1927
<b>Context</b>	Suburban
<b>Number of units</b>	24 family units
<b>Building type</b>	Four storey detached apartment houses
<b>Tenure</b>	Rental Apartment Housing
<b>Construction</b>	Iron frame filled with single-tier brickwork skeleton construction

**Table 02:** General Information about the project

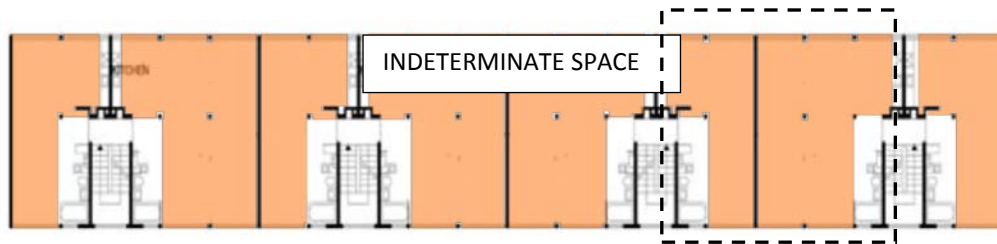


Inside the box | responsive design for diverse and changing households

Analysis of the Weissenhofsiedlung apartment building (Drawn by the Author of the Thesis 2014)



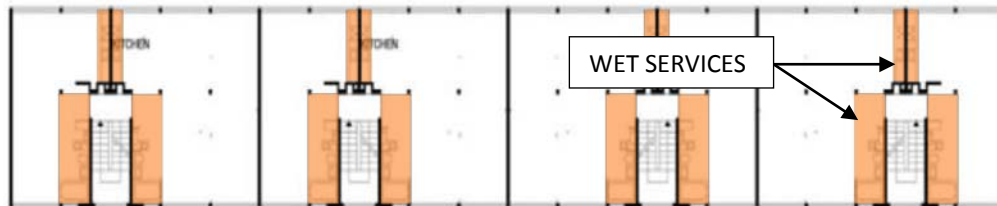
**Figure 21:** The base structure of this development consists of columns and grouped service cores.



**Figure 22:** The main indeterminate space illustrates techniques of soft form and use. Spaces are determined in the infill level.



**Figure 23:** Access systems and circulation zones are strategically positioned and shared between apartments.



**Figure 24:** Wet services are positioned along adjacent to the circulation zones and thus maintaining the open indeterminate spaces within the housing apartments.

## Inside the box | responsive design for diverse and changing households

### Lessons

This project offers initial flexibility by providing typological variety in the architectural unit layouts provided. Users therefore had the opportunity to select the most suitable housing unit from a variety of unit types.

The project puts emphasis on the grouping of service and circulation cores as these become the fixed aspects of the dwelling unit and thus making the permanent components of the buildings to have the characteristics of *soft* form. This then allows the unit to leave the rest of the space as a blank canvas in which the user can interpret according to their spatial requirements. The users are then able to determine their own spaces and uses in the dwelling unit through spatial divisions by partitioning walls. Although they do not use fixed internal partition walls, it is not always feasible and always possible for the users to make changes in the size of the units over time.

The housing project accords to some of the key factors of flexibility in the Modernist regime; it elides

with both the technically determined agenda of industrial prefabrication and in the quest for new models of habitation (Schneider & Till 2005a:158). It makes use of the *soft* use where the designer provides the physically fixed elements but leaves the housing unit socially flexible in layout. The buildings can be evaluated as using *soft* form.



**Figure 25:** View of Wohnzeile, Weissenhofsiedlung ([www.afewthoughts.co.uk](http://www.afewthoughts.co.uk))



**Figure 26:** View from the garden side (Kirsch 2013:55)

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**1977 | Molenvliet | Frans van der Werf | Netherlands**

### PROJECT DESCRIPTION

<b>Architect</b>	Frans van der Werf, Werkgroep KOKON
<b>Location</b>	Papendrecht, Netherlands
<b>Design completion</b>	1977
<b>Design concept</b>	Support and Infill construction
<b>Number of units</b>	124 family rental units and 4 office blocks
<b>Building type</b>	Two to four storey courtyard apartment buildings
<b>Construction type</b>	In-situ concrete construction

**Table 03:** General Information about the project



**Figure 27:** View of Molenvliet (Nascimento 2012:11)

The Molenvliet project is located in Papendrecht, western Netherlands (Nour 2010:94). Molenvliet was one of the earliest residential buildings which implemented Habraken's *Open Building* theory (Nascimento 2012:10). It was completed in 1977 and was the first project in the Netherlands where the residents of subsidised rental units could select the size and location of their units and were given the opportunity to do the internal fit-out themselves. The dwelling infill's included the interior walls, doors, finishes, bathrooms and kitchens, electrical and mechanical equipment for each unit, windows and doors inserted into the support facade framework.

This project shows a very careful application of the *Open Building* theory, based on the available building systems of the time. The project has a strong sense of unity and identity with a distinguished formal and spatial idea.

The housing process in this project comprised of four stages (Nour 2010:95). The first stage involved the

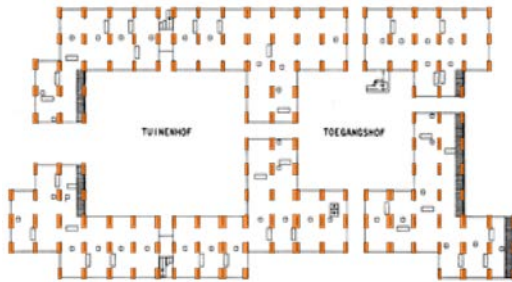
process of decision-making of the wider context and neighbourhood. The second stage included the negotiation of the built area in the form of open spaces and building zones. Planning the support structure was the third stage. The final stage of the design process was designing the individual infill's, which then determine the floor plans and finishes.

The apartment blocks were designed around courtyards which contain the infrastructure and access for the houses.

In this project, the principle of support and infill allowed the free subdivision of the structure into a complex apartments ranging in size from one to six room units (Nour 2010:96). The project relied on the users' involvement in the designing of the individual housing units. Through meetings held with the users', dwelling spaces were allocated and adjusted according to their (users') actual needs (Smisek, de Bruijn, Zu 2013:23).

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Analysis of the Molenvliet apartment building (Drawn by the Author of the Thesis 2014)



**Figure 28:** The base structure allows for free subdivision of the structure into complex apartments ranging in size from one to six room units.



**Figure 29:** The main indeterminate space illustrates techniques of soft form and use. Residents define their own spatial needs at the infill level.



**Figure 30:** Access systems and circulation zones are positioned and determined at the infill level and therefore remain flexible.



**Figure 31:** Services and wet services are determined by the users' at infill level. These are flexible and easily adaptable.

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### Lessons

Molenvliet makes a clear distinction of the *support* and *infill* levels both in technical and architectural terms.

The project grants the users' the liberty to design and focus on the small scale of their individual units and facade details. The living units are therefore all different as they were designed to meet specific needs of the future users'.

Overall the project is successful as its design is meticulous. Users can adapt their dwellings according to their varying and changing needs and thus they stay longer in these dwellings. The project illustrates *soft* form and use.

The project clearly illustrates that the small scale level of freedom for inhabitants is the most important.

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**1985-87 | Nemausus I and II | Jean Nouvel et Associés | France**

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<b>Architect</b>	Jean Nouvel et Associés, Jean Marc Ibos, Jean-Rémy Negre and Frédéric Chambon
<b>Location</b>	Nîmes, France
<b>Design completion</b>	1985-87
<b>Context</b>	At an arterial road on the periphery
<b>Number of units</b>	114 family units
<b>Building type</b>	Six storey detached apartment houses
<b>Parking</b>	Open parking beneath the buildings
<b>Material finish</b>	Corrugated steel, metal railings, stairs and windows
<b>Construction type</b>	Reinforced concrete frame

**Table 04:** General Information about the project

**PROJECT DESCRIPTION**

The Nemausus I and II were built in the industrial zone of Nîmes as part of a programme to renovate the district of the 1960s public housing (Mira 1992:67). Nemausus was seen as a radical alternative model for the desolate programmes of rent-controlled subsidised housing, it was a radical experiment in applying the principles and materials of

industrialised building in the construction of social housing (Nouvel 2007:22).

In addition to providing a fresh new image for public housing, the application of industrialised construction sought to reduce construction costs and provide larger and better dwellings (Mira 1992:67).

Nemausus I and II is an important reference with regards to flexible housing. The social housing project allows the units a rare spatial generosity and has the dignity of a proper house that has been stacked (Mira 1992:67 & Nouvel ca:4). In this project, Jean Nouvel emulates Le Corbusier’s principles of stacking residential dwellings.

The typical apartment is defined by 5x12m bays. These bays included the space of the terrace which is covered by the cantilevered balcony above. The project includes 17 different typologies which include different flats, duplexes and triplexes which range in size from one bedroom flats to three bedroom flats (Mira 1992:67; Nouvel 2007:26). Most of the flats are on the top floor; however, some of the triplexes

extend into this level where the top floor bedrooms have separate entry and exit. Every apartment has bi-fold metal doors opening full width of the housing unit. The industrial quality extends to the interiors where the concrete is left unfinished with manufactured panels and stairs.

In other apartments, the 5m bays have been divided into smaller rooms but in most apartments, the full width of the structural bay is kept and the impression is a very generous open loft space (Mira 1992:67; Nouvel 2007:26). The housing units offer an abundance of space initially both in terms of area and volume.

In the project the argument is that quantity of space is more valuable in the long term to the occupants than the quality of the finish. Services and wet zones are either grouped as a free-standing block in the centre of the entrance level or as one long strip located against one of a unit’s perimeter concrete walls.

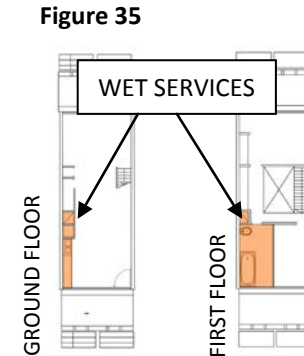
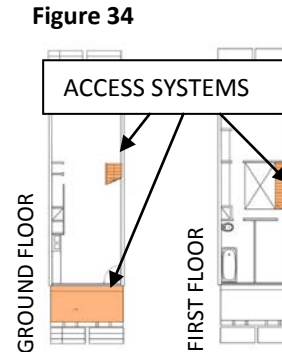
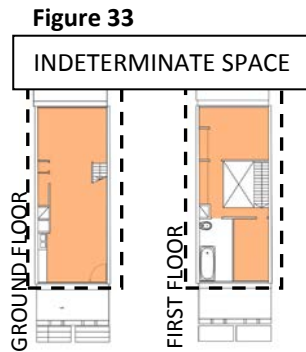
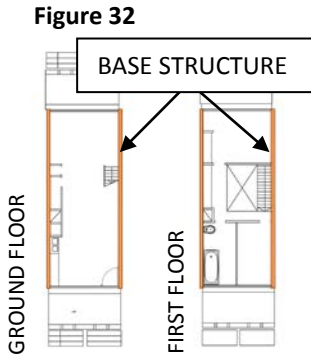
The rawness of units implies that the unit can be



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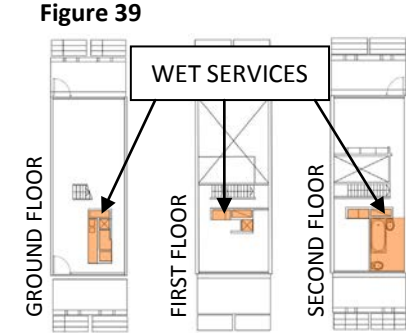
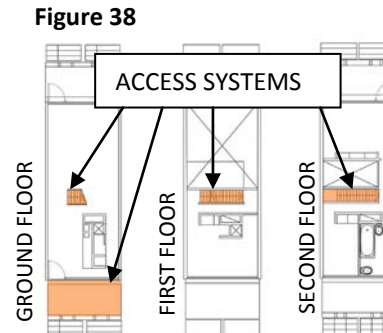
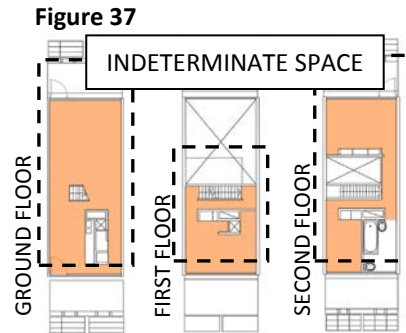
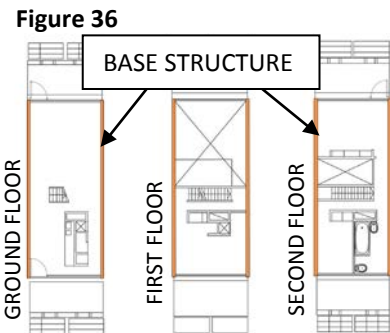
Analysis of the Nemausus I and II apartment building (Drawn by the Author of the Thesis 2014)

DUPLEXES APARTMENT TYPE



Figures 32- 35: Analysis of the Duplex apartment type

TRIPLEXES APARTMENT TYPE



Figures 36- 39: Analysis of the Duplex apartment type

The base structure of the apartments is set on 5m x 12m structural grids.

The indeterminate space illustrates soft form and use. The base structure allows the space to be free to interpretation by the tenants.

Access and circulation zones are positioned either centrally or along the perimeter wall of the apartment. They are strategically positioned to function as space separators.

Wet zones and services are either grouped as free-standing blocks in the centre of the entrance level or as a long strip located against the unit's perimeter wall.

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changeable and be adapted by the users (Mira 1992:67). The design of Nemausus I and II allowed for the residents to interpret the spaces to their individual spatial requirements.

### Lessons

This project illustrates a spatial generosity which is not common in social housing. Jean Nouvel et Associés incorporate multiple unit designs in these schemes. This allows a sense of versatility and flexibility in the overall building functioning and in what is offered.

A distinct feature of the project is the rawness of the material finishes and the industrial feel the building has. In doing so the project compromises the quality of spaces over the quantity of the space. This illustrates the notion that over a long term the size of the unit becomes a more important aspect than the finish of the unit.

This project offers initial flexibility by providing typological variety in the unit types provided. This allowed the users the opportunity to select a unit

suitable for their spatial needs. The structural systems and service spaces have characteristics of *hard* form though they are strategically placed in order to give the users a sense of freedom in the remaining spaces.

Users are able to adapt and alter their interior configurations in the living spaces and thus providing *soft* use of the units. Although they do not use structural materials for portioning, it is not always possible and feasible to make changes.

The building is of *hard* use as the users are not at the liberty of completely altering their unit sizes; they need to work within the boundaries of their allocated unit space. The project clearly achieves flexibility and adaptability through *soft* use in the design and construction approach.



**Figure 40:** Internal layout of the dwelling units illustrating the rawness of the space (www.em2n.ch)

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**2004 | Quinta Monroy | Alejandro Aravena (Elemental) | Chile**

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<b>Architect</b>	Elemental- Alejandro Aravena, Alfonso Montero, Tomás Cortese, Emilio de la Cerda
<b>Location</b>	Iquique, Chile
<b>Design inception</b>	2003
<b>Completion</b>	2004
<b>Site Area</b>	5 000m <sup>2</sup>
<b>Construction area</b>	3500m <sup>2</sup>
<b>Number of units</b>	100 family units
<b>Density</b>	35m <sup>2</sup> per family
<b>Tenure</b>	Individual ownership
<b>Building type</b>	Three storey row houses
<b>Parking</b>	Available in front of each unit
<b>Circulation</b>	Each unit has an internal and external staircase that can be altered according to the needs of the inhabitants
<b>Communal open space</b>	Project favours the use of communal space designed for extended families living in collective spaces, urban centrality and the creation of public spaces
<b>Private/ Semi-private open spaces</b>	Collective spaces work well at the scale of about twenty families

**Table 05:** General Information about the project



**Figure 41:** View of Quinta Monroy before extensions (www.archdaily.com)



**Figure 42:** Illustrating the before and after extensions (www.archdaily.com)



**Figure 43:** View of Quinta Monroy with the extensions done by the residents (www.archdaily.com)

Elemental is an Architectural practice founded in 2000 and grew out of the desire to address the problem of Social Housing in Chile. Quinta Monroy was Elemental’s first project located in Iquique (Elemental; Company-Santiago, Chile). Elemental’s insistence on referring to their housing works as urban projects is an indication of their desire to protect existing communities and design neighbourhoods rather than individual buildings. In their designs, Elemental uses participative design processes which respond to the individual needs and circumstances of each community. Through acknowledging what is available economically and socially, they act as spatial agents who transform the meagre housing subsidy into a tool that can genuinely be used to address the huge housing deficit.

**PROJECT DESCRIPTION**

Elemental was commissioned by the Chilean Government to design a settlement for 100 families of Quinta Monroy on the 5 000m<sup>2</sup> site they had illegally occupied for the past 30 years (Osman & Hinds 2005:63). The project was designed around the framework of the Chilean current housing policy (Low 2011:48).

## Inside the box | responsive design for diverse and changing households

The project makes use of the row housing typology which can be linked to the terraced house concept in the United Kingdom (Quinta Monroy/Elemental 2008), Osman & Hinder 2005:63). Due to the specific requirement for future adaption, the high rise typology could not be used. The architects then explored the row housing typology by incorporating an additional flexibility element to the housing development so that the dwelling units could allow for future expansions.

Along with the architects, Elemental based the design of Quinta Monroy on four principles (Low 2011:49).

- They had to achieve enough density without overcrowding.

- The design had to allow for physical expansion for the *extensive family*.

- The building had to be porous enough to allow for each unit to expand within its structure due to the fact that 50% of each unit will eventually be self-built. This therefore meant that the initial building provided a supporting rather than a constraining framework in order to avoid any negative effects of self-construction and also facilitate the expansion process.

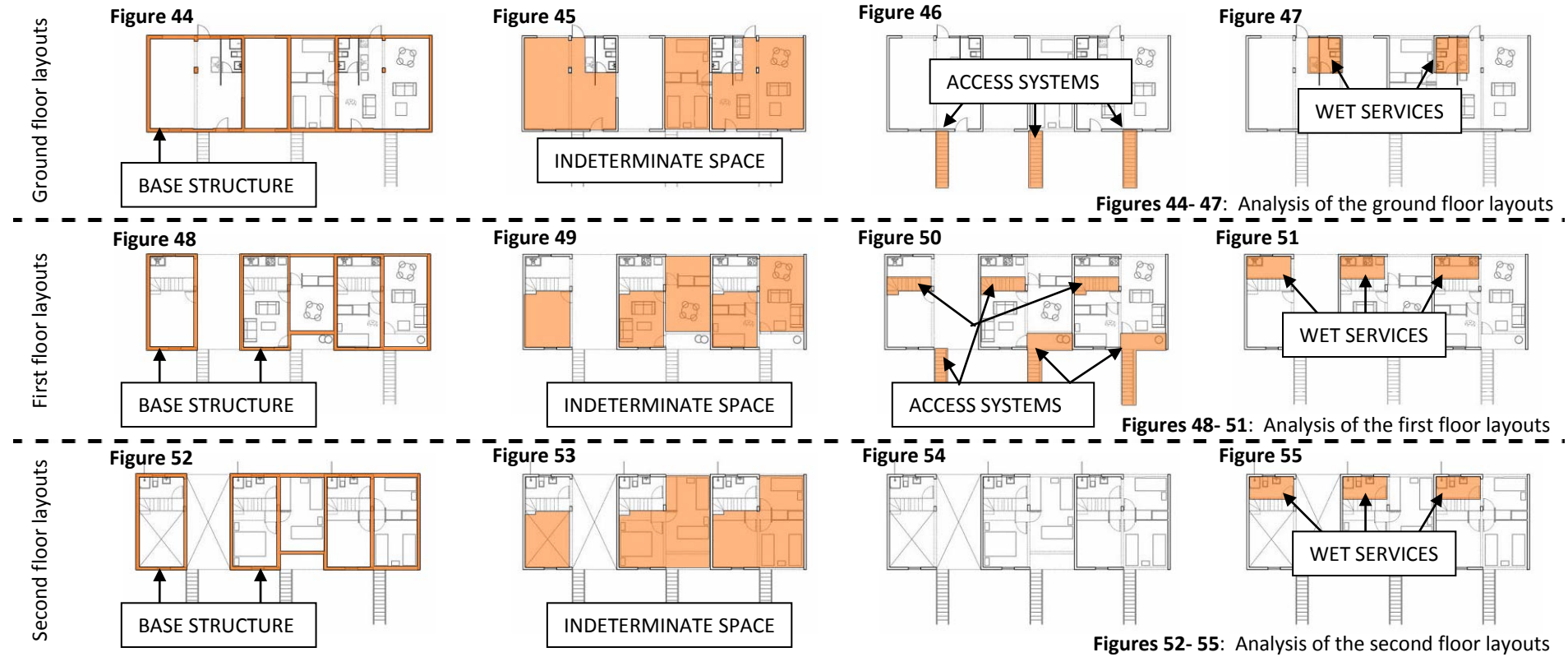
- A middle-income house was designed out of which a small part was initially built for the residents and therefore a change had to be implemented in the standard design of services, wall partitions and all the difficult parts of the house had to be designed

for a final scenario of a 72m<sup>2</sup> house.

The potential for change and additions is achieved to a great extent in Quinta Monroy (Low 2011:49). In the housing development, the units were specifically designed to act as a supporting framework to accommodate for easy and inexpensive occupant expansion through horizontal and vertical additions in the directions in which the buildings were designed to accommodate. This ensured that the desired spatial quality of the public domain was maintained.

# Inside the box | responsive design for diverse and changing households

Analysis of the Quinta Monroy apartment building (Drawn by the Author of the Thesis 2014)



Figures 44- 47: Analysis of the ground floor layouts

Figures 48- 51: Analysis of the first floor layouts

Figures 52- 55: Analysis of the second floor layouts

The base structure is based on a modular grid system which corresponds with the room widths. The base structure allows the housing units to be expandable and adapted with ease

The man indeterminate spaces illustrate *hard* form and use due to the construction technique and materiality.

External access systems do not compromise the internal unit spaces. Internal access staircases are located centrally and are positioned adjacent to the service areas.

Wet spaces and serviced spaces are grouped, positioned on the periphery of the unit and are vertically stacked.

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### Lessons

Quinta Monroy explored the question of providing a basic quality house under a strict budget and enabling the possibility of expanding the housing unit. The project demonstrates this possibility of expansion and creating adaptable dwelling unit which allows the residents to add and expand their house whenever possible and in many different ways. The residents are able to customise and individualise their dwelling spaces. This clearly exhibits that residents will take responsibility when given the opportunity to do so. The project proves that it is feasible to give the residents control over their own infill.

In the project, residents were given a middle class house in appearance, size and amenities. This gave the residents room to negotiate and aspire and eventually to have the house they had always

dreamed of. It can further be learnt that the provision of low-income housing need not be of poor quality and standards, but with good design decisions better housing units can be developed.

Quinta Monroy builds an open and varied scenario that lets life unfold in all its potential (Gallanti 2005:52). It registers in the interrupted tradition of modern architecture as a supportive action aimed at resolving the problem of the home, where the architect is a mediator within social, technical and political processes.

The project using principles of adaptability and flexibility as essential tools in developing support environments which are responsive, adaptable and flexible to encourage growth within the residential market.

The approach to flexibility in this project is that which allows for user participation by extending the control of the architect and dissolving it. The project therefore makes use of *hard* form and use. The architects in this project contributed to creating opportunities which offers the residents opportunities in making their markings and identifications in such a way that the place truly feels like it belongs to them. Here flexibility is seen as something that gives the user the choice as to how they want to use spaces.

The users are at liberty to make permanent alterations and modifications to their housing units but must still adhere to the regulations set out by their governing body.

## CONCLUSION

As presented above, the approaches to achieving flexibility and adaptability are investigated in the three housing projects from the three different contexts. The precedent studies explored how the concepts of flexibility and adaptability can be achieved in housing design.

The theoretical discourse identified that flexibility is reliant on four different spheres of the building; the structural system, service spaces, architectural layout and the furnishing finishes. Taking this into account, one can conclude that the structural systems and service spaces influence the initial flexibility of the housing unit. The permanent flexibility from the way in which the users can adapt and use the space depends on the architectural layout and furnishing finishes.

From the above precedent studies, one can conclude the following;

-the degree of flexibility in the interior space depends on the configurations of the permanent parts at

support level. This includes the structural systems and the serviced spaces.

-the degree of flexibility in the interior spaces is also influenced by the degree of flexibility of the infill materials and structure. This includes the architectural layout and the furnishing for flexibility.

The following chapter will evaluate whether the internal spaces of social housing using within the South African context are flexible and adaptable to their users. This will be evaluated under the basic methods of achieving flexibility as identified above; the structural system, serviced spaces, architectural layout and furnishing for flexibility.



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## 5 research methodology

#### 4.1 RESEARCH DESIGN

Research design provides the overall structure for the procedures in which the researcher will follow, how the researcher will collect the data and how the data will be analysed (Leedy 2005:85). Mouton (2001) describes the research design as a plan or blueprint on how the researcher intends on conducting the research.

This chapter will describe the methodology in which the research process will follow and give a rationale as to why the specific methodology will be used. The chapter will also provide an overview, explanation of the research techniques, data collection methods and how the data will be analysed and reported.

## 4.2 RESEARCH METHODOLOGY

A research methodology is a process in which meaning is extracted from data (Leedy 2005:93). The methodology to be utilized for a particular research problem must always take into account the nature of the data which will be collected in the resolution of the problem. Numerous methodologies for conducting research have emerged in order to accommodate the numerous different forms of data. According to Leedy (2005), there are two distinct types of methodologies; the qualitative and quantitative method.

The research study seeks to explore, describe and interpret whether interior unit designs of social housing developments allow for flexibility and adaptability for the diverse and changing users over the building's lifecycle. Due to the nature of the research, the research will be conducted under qualitative research design.

Qualitative research is a multi-method involving an interpretative and naturalistic approach to its subject

matter. This means that qualitative researchers study things in their natural setting, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them (Groat 2002: 76). The strategy of qualitative research is one of the first-hand encounters with a specific context.

Qualitative research acknowledges rather than disavows the role of interpretation in the collection and presentation of data (Groat 2002:179).

A qualitative research approach will be utilised for the study due to the fact that a descriptive exploration of the topic is required rather than a quantitative statistical account. Two pilot case studies and an additional case study will be analysed and explored.

A qualitative research strategy seeks to piece together an in-depth account of a social context by means of a variety of tactics (Groat 2002:119).

### 4.3 RATIONALE FOR USING THE QUALITATIVE METHOD

The qualitative research method does not seek any statistical inquiry technique but rather it goes beyond the simple description of events and phenomena and creates an understanding for subjective interpretation and critical analysis (McNabb 2004:341). Qualitative research recognizes that the issue being studied has many dimensions and layers and thus portrays the issue in its multifaceted form (Leedy 2005:133). The purpose of the research is to describe, explain, explore, interpret and build theory on utilizing the principles of flexibility and adaptability in social housing internal unit designs. The nature of the research is holistic, with flexibility guidelines and is context bound.

Qualitative design is therefore the most suitable method as the researcher aims to give a holistic approach of inquiry and give subjective and critical analysis of the problem while promoting a

philosophical view of inquiry.

There are numerous research techniques associated with qualitative research design, namely; case studies, ethnographic studies, phenomenology approach, hermeneutic approach, historical approach and grounded theory approach (Leedy 2005:96).

In the context of this research study, case studies will be utilized while taking into account the strengths and weaknesses of the case study approach. Semi-structured interviews will be conducted in order to gain insight to the problem. The researcher will also use observations as a technique of collecting and analysing the data.

#### 4.4 DATA COLLECTION

Increasingly, researchers in many fields including architecture are advocating a more integrative approach to research whereby multiple and diverse methods are incorporated in one study (Groat 2002:361). This enables the researcher to bring about necessary checks against weak points in other methods while simultaneously enabling the benefits of the different methods to complement each other. This kind of approach is referred to as Triangulation. Groat (2002:361) defines triangulation as the principle of combining the strengths and neutralising weaknesses. Researchers generally advocate triangulation to address issues of research validity and objectivity.

The research study involves three case studies located in Johannesburg. The method of triangulation will be used to extrapolate data from the three cases. This implies that there will be a combination of methods of data collection and analysis for the study.

The researcher will conduct spatial analysis through methods of observations and diagrammatic representations of the factual scenarios. Information sources in the form of publications, images, photographs and visual data will be used.

Semi-structured interviews with the residents residing in the social housing developments selected for the study will be conducted. The researcher will refer to a selection of international projects as precedents.

The research study sets out to determine whether internal unit spaces of social housing developments in South Africa are able to cater to the future needs of its tenants through;

- Identification and describing the factors necessary for social housing developments to be adaptable and offer flexible designs
- Determining whether these factors can be achieved and what should be considered within the South African context

##### 1. Case studies

A mixed-method approach will be used and the case study research approach will be used as one of the three devices under the research design.

In a case study, a particular individual, programme or event is studied in depth (Leedy 2005:135). Three social housing developments will be of focus, where the internal unit and spatial designs will be evaluated and investigated to see whether they are flexible and adaptable to cater to the needs of the diverse and changing households. According to Leedy (2005:135), the use of two or more cases serves as a platform for the researcher to make comparisons, build theory and propose generalizations. Groat (2002:94) confirms this by stating that the use of two or more case studies can be used to reach a general set of observations.

Case studies can also be used as illustrative examples which highlight larger abstract principles.

## Inside the box | responsive design for diverse and changing households

In this study, three case studies were selected to investigate the physical changes which can be made in social housing units in order to allow the housing unit to adapt and meet the needs of multiple users and residents.

Brickfields (Newtown, Johannesburg) and Carr Gardens (Fordsburg, Johannesburg) have been selected as the two pilot case studies and K206 housing development in Alexandra, Johannesburg has been selected as the third case study.

### Criteria for Case studies

The criteria used for the selection of the case studies encompass the following aspects;

1. Social housing developments- the selection of the projects had to be that of social housing considering that it is the focus of the study. The case studies were therefore selected based on the criteria outlined in the *SHP*. According to the *SHP*, the framework for social housing includes the following:
  - Typology: medium to high density

developments ranging from group housing to multi-unit dwellings

- Use: multi-uses which will support the urban restructuring and economic integration
  - Form and tenure: rental housing option
  - Location: inner city developments which will support urban renewal and regeneration (section 4.3 of the *SHP* 2003:11)
2. Urban regeneration and medium densification- the projects had to contribute to the urban regeneration through the provision of quality accommodation and restructuring neighbourhoods.
  3. Densification- the projects had to be of medium density
  4. Period of residency- the case studies had to be such that they reflected a significant change in the structures over time. The time frame for such change is therefore decided upon as being over five years.

### **1.1 Method**

In a case study, extensive data is collected on the subjects on which the investigation is focused (Leedy 2005:135). The data often includes observations, interviews, documents, past records and audio-visual material. Leedy (2005) further explains that the researcher will also record details about the context surrounding the case, including information about the physical environment and any historical, economic and social factors that have bearing on the situation.

### **1.2 Data analysis**

In case studies, data analysis often involves the following steps:

- Organisation of details about the case
- Categorisation of data
- Interpretation of single instances
- Identification of patterns
- Synthesis and generalisation (Leedy 2005:136)

## 2. Interviews

Interviews can yield a great deal of useful information. In qualitative study, interviews are rarely structured as those in quantitative study (Leedy 2005:146).

Unstructured interviews will be conducted as they will be flexible, allow the participants to freely express their views and perceptions of the spaces without feeling rigorously questioned. Semi-structured interviews will be guided with a questionnaire which will have questions based only on the internal unit space the respondents are residing in. Questions on the space, size of the unit, number of residents residing in the unit, the layout and design of the unit will be included. This will allow the respondents to voice their opinions and satisfaction on whether their spatial needs are fully realised or not.

For the purpose of this research, details, names and documents from the participants are of no concern. The researcher is however interested in the

participants' opinions of the internal unit designs within the social housing developments they reside in. The participants' opinions and views on the spaces will offer viewpoints on the subject matter. In order to successfully conduct the research, the participants' opinions will offer a viewpoint on the subject matter. An opinion offers a person's perspective, understanding, particular feelings, beliefs or desires (Oxford English Dictionary Online, 2013). Their (the participants) opinions will therefore be valuable as they result directly from the emotive response or interpretation of the facts.

The main focus of the interviews will be to establish how the residents utilise the internal space in their housing unit and whether they can manipulate the space to suit their spatial needs.

The study continuously refers to the *needs* of the residents in social housing developments. It is therefore paramount that what is referred to by the *needs* is clarified.

According to Max-Neef (1991:49), human needs can be understood as a system as they are interrelated and interactive. In this system there is not hierarchy of needs apart from the basic need for survival. There are many ways in which *needs* can be classified. Max-Neef (1991:32) classifies fundamental needs as subsistence, protection, affection, understanding, participation, leisure, creation, identity and freedom. *Needs* are also defined according to the existential categories of being, having, doing and interacting. Maslow (1987) however distinguishes *needs* and their hierarchy in the form of pyramid with the largest most fundamental levels of needs at the bottom and the need for self-actualisation at the top. The need for home and property as defined in Maslow's (1987) pyramid is classified under the need for safety which is the second most important need. Max-Neef (1991) defines the need for shelter, living space, social environment and dwelling under the needs of subsistence, protection and affection. Therefore the

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*needs* for shelter and living space are classified according to Max-Neef (1991) and Maslow (1987) as one of the most fundamental levels of *needs*.

According to Osman and Konigk (2009:54), a house or residential unit is a changing organism adapting throughout its lifetime to suit the changing social status, economic status and the residents' lifestyles. Social housing units are designed to accommodate different tenants over its life cycle. Considering the nature of social housing developments it is therefore fundamental that the *needs* for shelter and living space are fully realised.

*Needs* will therefore refer to the fundamental requirements of the residents in acquiring satisfaction within their living spaces.

The interview questions aim to gather whether residents (respondents) regard the housing units meeting their spatial needs and requirements and if not, what changes they would implement in order to get the units to fully realise their spatial needs. The interview questions are attached to the appendix.

### 3. Observations

Observations in a qualitative study are intentionally unstructured and free-flowing. The researcher shifts focus from one thing to another as new and potentially significant objects and events present themselves (Leedy 2005:145). The primary advantage of observations is that they are flexible in nature hence the researcher can take advantage of unforeseen data sources as they surface. The disadvantages however are that the research will not always know what things to look for at the beginning and the presence of the researcher may alter what people say, do and how the significant events unfold.

The manner in which the participants use the spaces and how the design allows room for flexibility and adaptability within the unit will be observed and all the physical aspects of the internal spaces; the layouts, structural elements, spatial appropriation, materiality and the unit sizes will be documented.



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Cases	Brickfields	Carr Gardens	K206
<b>Architects</b>	Savage & Dodd Architects cc/ Fee & Chalis Architecture/ Makhene Architect and Associates	Micheal Hart (MHCD) Architects and Urban Designers	ASA Architects (Anca Szalavic)
<b>Project Manager</b>	Johannesburg Housing Company (JHC)	Johannesburg Housing Company (JHC)	Alexandra Renewal Project (ARP)
<b>Year</b>	2005 (Project completion)	2003 (Project completion)	2010
<b>Province</b>	Gauteng	Gauteng	Gauteng
<b>Municipality</b>	Johannesburg	Johannesburg	Johannesburg
<b>Type of development</b>	Greenfield site- new build development	Greenfield site- new build development	Greenfield site- new build development
<b>Location in the city</b>	Ntemi Piloso, between Gwigwi Mrwebi and Carr street, accessed from Mvume Dandala lane, Newtown	Fordsburg, corner Malherbe Street, Burghersdorp street and Carr street, opposite Oriental Plaza	Marlboro road (east) and London road (north), Alexandra Township
<b>Context</b>	Inner city, close proximity to opportunities and amenities	Inner city, close proximity to opportunities and amenities	Greenfield township settlement
<b>Tenure type</b>	Rental only	Rental only	Private ownership and rental options
<b>Building size&amp; unit distribution</b>	724 total units (two tower blocks, three and four storey walk-up blocks)	211 flats and 14 rooms with shared kitchen and ablution facilities	2200 housing units of different tenure types of which 520 units are rental housing
<b>Unit mix</b>	1 bedrooms, 2 bedrooms and loft and studios	1 bedrooms, 2 bedrooms and studios	8 to 10 cluster units of 40m <sup>2</sup> double storey ownership units and 40m <sup>2</sup> two bedroom rental units
<b>Character</b>	Medium-higher density mix housing (housing, income, land use)	Medium-higher density mix housing (housing, income, land use)	Low-medium density mixed housing with backyard rental opportunities(income and tenure mix)

**Table 06:** Information summary of the selected case studies.

#### 4.5 DATA ANALYSIS

In qualitative study, there is no single right way to analyse the data. Analysing case studies requires the categorisation and interpretation of data in terms of common themes, synthesis into an overall portrait of the case (Leedy 2005:144). A data analysis spiral can be used in the analysis of data. This is based on Creswell's 1998 model. The data analysis spiral comprises of four steps; synthesis, classification, perusal and organisation (Leedy 2005:151).

The researcher will analyse the data through the use of graphics, tables, photographs and figures which will be critical in the context of the research study.

## 4.6 VALIDITY

When considering the issues of validity, it is important to ask whether the research study has sufficient controls to ensure that the conclusions which are drawn are truly warranted by the data and if what has been observed in the research setting can be used to make generalisations about the world beyond the specific situation (Leedy 2005:97).

It is ideal that the researcher should consider both internal and external validity when designing a research study.

A researcher's conclusions are only valid and meaningful to the extent that they are warranted based on the data collected and have applicability beyond the specific research (Leedy 2005:100; Richards 2005:114).

### 1.1 Internal validity

Internal validity can be defined as the extent to which the research design and the data it yields allows the researcher to draw accurate conclusions about cause-and-effect and other relationships with the data (Leedy 2005:97).

### 1.2 External validity

External validity refers to the extent to which its results apply to situations beyond the study itself (Leedy 2005:99).

In qualitative research, researchers often use triangulation to support the validity of their findings (Leedy 2005:100; Richards 2005:21).

The researcher will use the principles of triangulation in an attempt to validate and support the data sources.

## 4.7 ETHICAL ISSUES

Whenever human beings are the focus of investigation, ethical implications of the proposed research need to be considered (Denzin & Lincoln 2000:662; Leedy 2005:101). According to Denzin & Lincoln (2001) and Leedy (2005), there are four categories within which ethical issues fall; protection from harm, informed consent, right to privacy, honesty with professional colleagues.

### 1.1 Protection from harm

Researchers should not expose research participants to undue physical harm. The risk involved should not be greater than the normal risks of day-to-day living. In such instances where the nature of the study involves creating a small amount of psychological discomfort, participants need to be informed prior to participating in the study and necessary debriefing or counselling should be provided to the participants (Denzin & Lincoln 2000:662; Leedy 2005:101).

### 1.2 Informed consent

The researcher will inform the participants of the nature of the research to be conducted and allow the participants the choice of either participating or not participating in the study. Participants must be informed that participating in the research is voluntary and that they can withdraw at any moment during the research (Denzin & Lincoln 2000:138; Leedy 2005:101; Richards 2005:178).

All participants will be issued with a consent form which will describe the nature of the research, description of the research, description of what the research involves, researchers details and contact information, list of any potential risk or discomfort and a place where the participants will sign and date indicating their acceptance in participating in the research.

### 1.3 Right to privacy

A researcher must keep the nature and quality of the participants' performance confidential. Under no circumstance should a research report be presented

in such a way that others become aware of how a particular participant responded or behaved (Denzin & Lincoln 2000:139; Leedy 2005:102).

### 1.4 Honesty with professional colleagues

A researcher must report the findings in a complete and honest manner without representing what they have done or misleading others about the nature of their findings (Leedy 2005:102). A researcher should not fabricate data to support a particular conclusion (Denzin & Lincoln 2000:140).

Due to the nature of this research, the researcher will not be exposing any of the participants to any form of harm or place the participants in compromising situations which could prove harmful or at risk.

Prior to conducting the research, the researcher will provide the participants with consent forms. These will give the participants the nature of the research and will be signed by the participants prior to conducting the research. The researcher will report only the data yielded from the research process.

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## 6 research findings and discussion

## INTRODUCTION

This chapter explores whether the internal unit designs in social housing developments are flexible and adaptable and whether the concepts of flexibility are used to inspire new ways of housing unit designs to allow them to cater to the varying and changing spatial needs of the tenants over the building's life. It also aims to understand the extents and limitations of flexible design approaches in the selected cases. In order to achieve this, two pilot cases; Carr Gardens housing development and Brickfields housing development will be studied. The K206 housing development in Alexandra will be the third case study in the research. The projects are discussed in terms of the methods and strategies used to achieve flexibility and in terms of flexible usage related to the ever changing needs of the users.

This study relies profoundly on a number of theories including Habraken's *Supports* theories (1972), Schneider and Till's theories on *Flexibility Housing* (2007) and Kendall's theories on *Open*

*Building* (2004). These theories provide approaches regarding the way in which materials, building components and the spatial organization of residential internal unit designs. The theoretical background for this study is firmly rooted in an integrated approach to residential architecture where the design of the different systems and interface between them is of importance in achieving flexible and adaptable residential units.

Semi-structured interview were conducted with the residents residing in Brickfields and Carr Gardens. The questions were directed to participants regarding the way they perceived the space, used the space, could use the space, and whether the internal unit space is able to cater to their changing and varying spatial needs. Information obtained from the interviews formed part of the discussion in this chapter and is attached in Appendix 3. According to Osman, Herthogs and Davey (2011), by assessing existing projects, it will make it possible to argue the theories of the subject matter are not

only relevant and applicable in the South African context but are of high importance if the long-term sustainability of residential building developments in to be achieved.

In the study the assessment for flexibility will be based on the physical characteristics which are easy to adapt to those that possess a higher impact on the structure. The capacity to be adapted will be linked with the ease or complexity of adaptation. Definition pertaining to the ease or difficulty of adaptation will be adopted from that of the CSIR's multi-year study on Mixed-density housing conducted in 2011.

According to Osman et al (2011:12), easy adaptations are usually short-term changes in that they deal with changing the appearance of the residential unit and regular maintenance work. These depend on the architectural analysis (multi-functionality of the plan layout) and housing regulations (to what extent users are allowed to make changes). The components include; changing

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of doors without changing the door opening, removing carpets, paving, tiling and any finishes, and any general fittings.

Moderate adaptations can be referred to general medium-term changes needed to update the building to changing market demands or government demands (Osman et al 2011:12). These include replacing or upgrading finishes, increasing or decreasing the unit size through reconfiguring internal layout and internal circulation to match the demography and updating the layout and services according to changing societal standards.

Intensive adaptations on the other hand involve intensive changes in the building and usually happen in the long-term period and only viable for the entire building. According to Osman et al (2011:13), these include major refurbishments; reconfiguring overall internal layouts and vertical and horizontal structural changes.

The different building components and their level of adaptability will be indicated as either being of easy adaptation or moderate adaptation whilst also

illustrating whether the elements are independent or have moderate or integral components. The level of adaptation will also highlight whether the adaptation can be made by the tenants/home owners or if the Social Housing Institutions are responsible for the adaptations.

The research study aims at exploring the physical changes which can be made in social housing units in order to allow the unit to adapt and meet the needs of multiple users and residents, therefore only the factors influencing the easy and moderate adaptations will be included as they deal with the individual residential unit and not the building in its entirety.

The research will present a broad assessment of the selected case studies as the priority is in acquiring a general assessment of the flexibility and adaptability potential. An in-depth assessment of every building component will be excluded.

The assessment table which will be used to assess the case studies is illustrated below.

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	<b>Structural systems</b> (columns, beams, roof and general structural systems)	<b>Service spaces</b> (wet services, ducts and electrical services)	<b>Architectural layout</b> (internal partitioning, space adjustment, additions and reduction)	<b>Furnishing for flexibility</b> (sliding, folding or moving partitions and furniture)
Easy adaption	Independent component			
	Moderate connection			
	Integral connection			
Moderate adaption	Independent component			
	Moderate connection			
	Integral connection			

Adaptation by Tenants/Home owner
  Adaptation by Social Housing Institutions

**Table 07:** Assessment table for the case studies as discussed above.



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The term housing in the context of architectural design is usually described by the physical dimension of the apartment (Živoković & Jovanović 2012:18). The properties of the physical dimension include all residential property norms such as the size of the apartment, its structure, open spaces and infrastructure. These define the spatial configuration of the assembly.

Spatial transformation happens during the operations phase of the building. According to Durmisevic (2006:70), it can be forced by the organisational changes within either the managing company or by market changes that require enlargement or reduction in the unit space. The key obstacles for transformation of buildings are often related to;

- The spatial inability to mutate from one use to another
- Inflexible load-bearing structure
- Inflexible installation systems that cannot easily adapt to different spatial typologies
- Lack of accessibility to the old installations
- Lack of space for the new installations

- Fixed integration between load-bearing and non load-bearing components of the building (Durmisevic 2006:64).

The parameters for evaluating flexibility are based on Habraken's theory (1999) which states that the flexibility of living spaces arises from the quality organisation of the basic, unchangeable aspects of the building.

The measurable aspects which largely influence the flexibility of residential spaces will be discussed under four themes;

- The Structural systems
- Serviced spaces
- Architectural layout
- Furnishing for flexibility

These aspects will be explored in light of the *soft* and *hard* analogy.

### The structural systems

The structural system forms part of the permanent components of the building. This is important in

determining whether the architectural layout will be flexible or not (Schneider & Till 2007:95).

### Serviced spaces

The position of the service spaces and service cores can be regarded as determinant for the configuration of the main spaces (Schneider & Till 2007:294). Service spaces can form part of the structural system or they can be designed independently. The location of the service core is a critical element in determining the flexibility of a building. It is the most permanent of all components and therefore it requires a position which will allow for it to not be intrusive to the living space.

### Architectural layout

The flexibility of the architectural layout depends on the configuration of the permanent components of the building. This can occur at building level (type of units/variety) or at unit level (spatial organization of the individual units) (Schneider & Till 2007:7).

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Architectural layout includes;

be used for numerous uses.

- Vertical or horizontal addition (the ability of the spaces to increase or decrease if required) (Schneider & Till 2007:185).
- Neutral functionality (providing un-programmed spaces and allowing the users to define the spaces themselves).
- Joining and division (allowing for expansion and contraction of space as well as the ability for the rooms to change ownership in the case of multi-dwelling housing developments).

### **Furnishing for flexibility**

Furnishing for flexible use can be achieved through the use of furniture as a surface or as a functional unit. This can include moveable partitions or foldable elements. While this can be the most common approach to flexibility, it can also be the most limiting (Schneider & Till 2007:190). Nevertheless, elements like sliding doors, foldable furniture and screens can greatly increase the spatial configurations of a housing unit and allow rooms to

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Project name	Carr Gardens
Architects	Michael Hart (MHCD) Architects and Urban Designers
Project Manager	Johannesburg Housing Corporation (JHC)
Year	2003 (Project completion)
Province	Gauteng
Municipality	Johannesburg
Type of development	Greenfield site- new build development
Location in the city	Fordsburg, corner Malherbe Street, Burghersdorp street and Carr street, opposite Oriental Plaza
Context	Inner city, close proximity to opportunities and amenities
Tenure type	Rental only
Building size& unit distribution	197 flats and 14 rooms with shared kitchen and ablution facilities
Unit mix	1 bedrooms, 2 bedrooms and studios
Character	Medium-higher density mix housing (housing, income, land use)

**Table 08:** General information about the project

### PROJECT DESCRIPTION AND LOCATION

Carr Gardens was the JHC's first social housing development in Fordsburg. Its construction was incepted in 2000 and a third phase completed in 2003 ([www.jhc.co.za](http://www.jhc.co.za)). The social housing precinct incorporates a historic monument, a 1922 police station, which had to be preserved by law. The offices of the old police station were converted into residential units and also house the crèche and playground (Tonkin 2008:223).

Carr Gardens is located within close proximity to the Oriental Plaza, Market Theatre, Newtown Cultural Precinct, Braamfontein Station and transportation routes (Tonkin 2008:218). On site, Carr Gardens does not provide employment opportunities to its residents and no small businesses have been set up in this project.

**Figure 56** (Tonkin 2008:218)



**Figure 57** (Tonkin 2008:226)



**Figure 58** (Tonkin 2008:226)



**Figure 59** ([www.jhc.co.za](http://www.jhc.co.za))



**Figure 60** (Tonkin 2008:229)



**Figures 56-60:** Images of Carr Gardens social housing development showing the building character and sense of place.

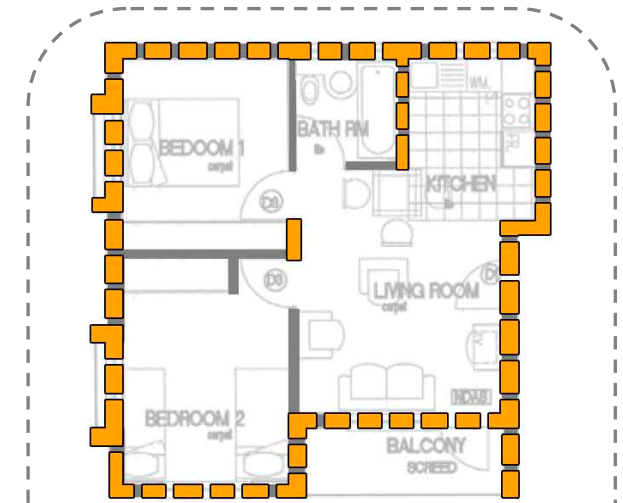
## PLANNING AND GENERAL UNIT DESIGN

The social housing development has been constructed in three phases; phase one included 145 one and two bedroom units. These units have access to communal drying areas. Garden units have access to private garden spaces while other units overlook the courtyards or the streets (Tonkin 2008:226). The second phase consists of 14 rooms with shared kitchen and ablution facilities and the construction of a crèche. Phase three was in the form of an infill building, which comprise of 12 one bedroom units each of 33,5m<sup>2</sup> and 60 two bedroom units ranging from 58m<sup>2</sup> duplex units to 50m<sup>2</sup> standard units. According to Tonkin (2008:227), the housing blocks vary from six units designed around a single staircase over three storeys to 16 units designed around a single staircase over four storeys. In these housing blocks, the two highest levels consist of two-bedroom duplex apartments with the fourth storey being constructed with a light weight timber floor. This was done to avoid major impacts on the structural capabilities of the bearing structure.

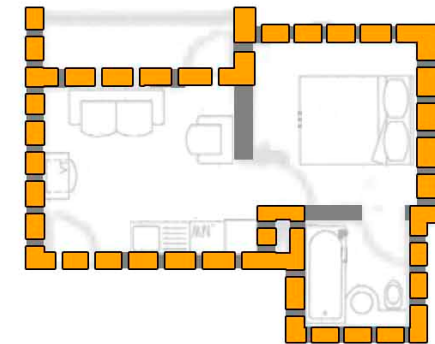
The positioning of buildings along the street edge responds appropriately to the street as public space, defining the site boundaries and enclosing and defining the private space for the inhabitants (Tonkin 2008:229).

### 1. Structural systems (columns, beams, walls, roof and general structural systems)

The structural system used in this social housing development is of reinforced concrete columns and beam structure with 230mm load-bearing masonry wall infill. The degree of flexibility in this project was compromised with the location of the structural elements inside the housing unit. The structural system used did not allow the internal unit spaces to remain free of the structural elements. Internal spaces were determined and separated with the use of 115mm non load-bearing masonry walls. These internal partitions are positioned according to the permanent components of the buildings; the columns, load-bearing walls and the external



**Figure 61:** Typical base structure of a two bedroom social rental housing unit at Carr Gardens.



**Figure 62:** Typical base structure of a one bedroom social rental housing unit at Carr Gardens.

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envelope. Due to the construction materials used in the project, the flexibility of the internal spaces were immediately compromised as the residents were at no liberty of determining their own spaces.

The structural system employed did not allow for a variety of unit types in separate unit blocks. Most of the housing unit blocks consist of identical two bedroom units. One bedroom units and single rooms sharing facilities were however incorporated.

Habraken's *Support and Infill* theory was based on the idea of giving the users the opportunity to tailor the main indeterminate space to fit to their needs. However, in this development all the design approach is not in line with Habraken's theory. The design approach can be referred to as *hard form* as the spaces are largely determined by the architects and designers of the social housing complex. The support system does not make it possible for the users to adjust the spaces and make changes according to their varying spatial requirements and needs. According to Habraken (1999:78), the support structure provides the basic infrastructure and should

therefore be designed as a long-life permanent base and the infill structure should be designed for a shorter life, should be user determined and adaptable.

### 2. Service spaces (wet services, ducts and electrical services)

The position of the technical installations is one of the basic unchangeable aspects of a residential space (Živoković & Jovanović 2012:27). The key role of this part of the design process for a housing unit flexibility is conceivable through the fact that these parts are the most inflexible elements of the unit. The service space in its composition consists of the wet services, ducts, shafts and accesses to the unit.

In this development, all wet services are grouped and positioned along load-bearing walls in the unit. These remain bare and uncovered and thus contributing negatively to the building's aesthetics from the inhabitants' perspective. Service ducts were omitted based on the design imperative of not compromising on the internal spaces and as a cost reduction factor. This has however assisted in



**Figure 63:** The main indeterminate space in the two bedroom housing units.



**Figure 64:** The main indeterminate space in the one bedroom housing units.

The main indeterminate spaces in this housing project are pre-determined for the users and illustrate *hard form*.

providing internal spaces which are not compromised with ducts and service shafts inside the buildings. The approach can be regarded as *soft* form, however the users are not at liberty to make any changes and repositioning of these systems as they are prohibited by the Rental housing act 50 of 1999. Electric services and plug outlets are provided and the inhabitants need to make use of the various ports only as according to the rental laws they cannot make any physical changes.

**3. Architectural layout** (space adjustment-addition and reduction)

The social housing development consists of 211 rental units in total; 33 units are one bedroom units, 164 units are two bedroom units and 14 are single rooms with shared facilities (www.jhc.co.za). The project does not offer a wide variety of unit types. In this respect, the development can be assessed as not catering to the diverse needs and demands of the users prior to occupation.

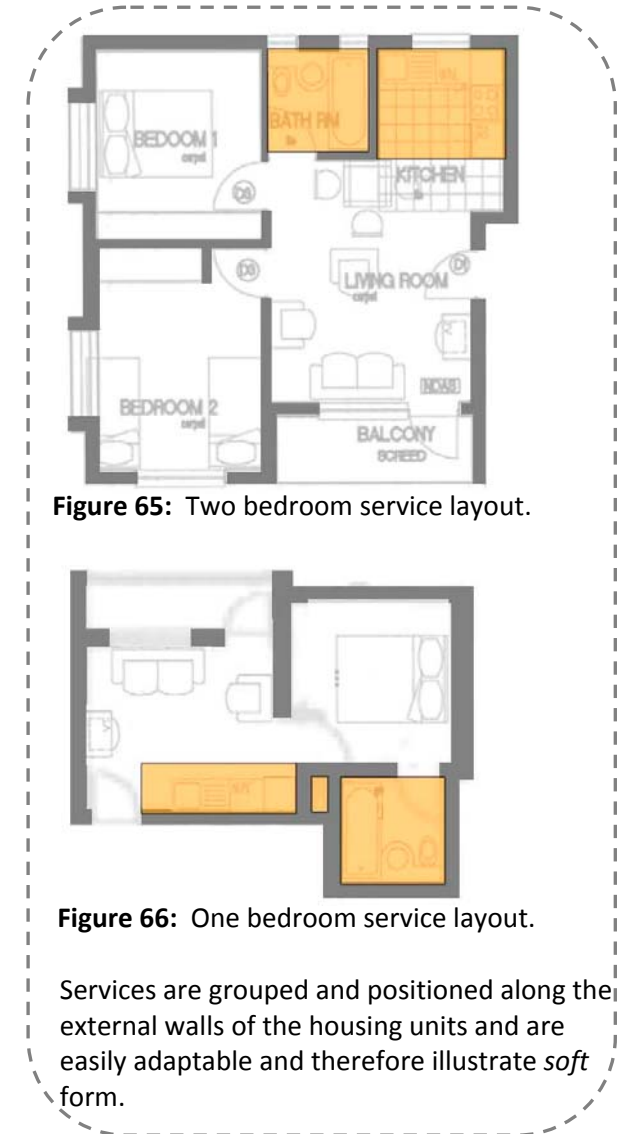
**a) Types of units**

The housing units are not capable of being divided or joined together in the layout as the structural system and design of the housing development does not provide definite opportunities for change. The idea of the shared rooms however is valid due to the units being designed to be attached. The possibility of changing the housing units outside the perimeter of the boundaries may not be feasible if the neighbouring units are already occupied.

The architectural layout of the housing development can be regarded as architect-determined. The housing units do not allow the users to physically adapt and make changes to their housing units. In terms of flexibility the housing units can be evaluated as *hard* form and use.

**b) Spatial organization of the units**

The presence of fixed internal partitioning makes it impossible for the users to adapt their internal unit spaces according to their spatial requirements and needs, users need to use the spaces as determined.



**Figure 65:** Two bedroom service layout.

**Figure 66:** One bedroom service layout.

Services are grouped and positioned along the external walls of the housing units and are easily adaptable and therefore illustrate *soft* form.

This restricts the users from making changes with the use of flexible internal partitions. Rooms cannot be integrated, joined or divided.

Internal spaces are fixed with predetermined functions. The spaces vary in size according to the different unit designs; however they all possess the same attributes.

The concept of open plan achieves greater flexibility of the interior space because the use of undefined polyvalent residential area can support unpredicted functions that appear over time (Živoković & Jovanović 2012:23). An open plan design strategy was utilised for the living areas but due to the size of the units, furniture and layout arranged are almost predetermined for the tenants. There are limitations in terms of physical changes within the boundaries of the housing unit.

Flexibility of spatial organization mainly involves changing the use of certain rooms within the housing unit (Živoković & Jovanović 2012:21). It is therefore desirable to design rooms as multi-functional and multi-purpose spaces. Carr Gardens however

represents the opposite design approach as spaces are predetermined. Carr gardens does not offer users to adapt and adjust the internal configurations of the units, they are not in control of their spaces. In terms of flexibility, the internal unit spaces can therefore be regarded as *hard form*.

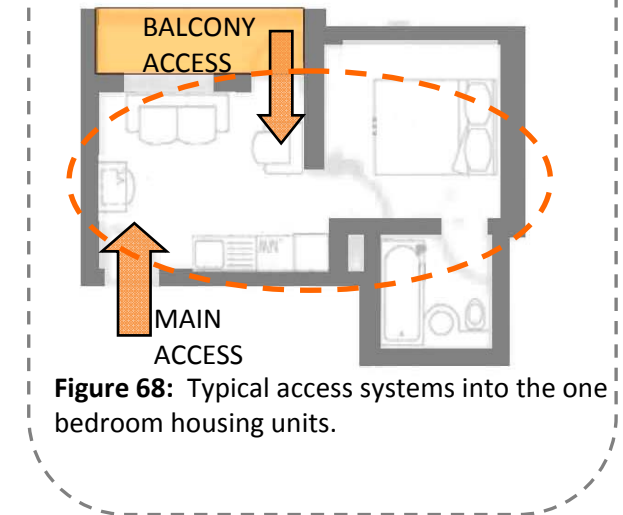
#### 4. Furnishing for flexibility

Carr Gardens was not designed with any storage spaces; the bedrooms have no cupboard spaces and the kitchens were only equipped with free standing sinks and no built-in cupboard spaces, no niches or articulate surfaces on the walls for furnishing as storage spaces was provided.

In this development, furniture was not used as space separators, the living spaces are designed as open plan spaces and thus allowing the users' the freedom to furnish their own housing units.



**Figure 67:** Typical access systems into the two bedroom housing units.



**Figure 68:** Typical access systems into the one bedroom housing units.



**Possibilities for internal adaption, extension and personalisation**

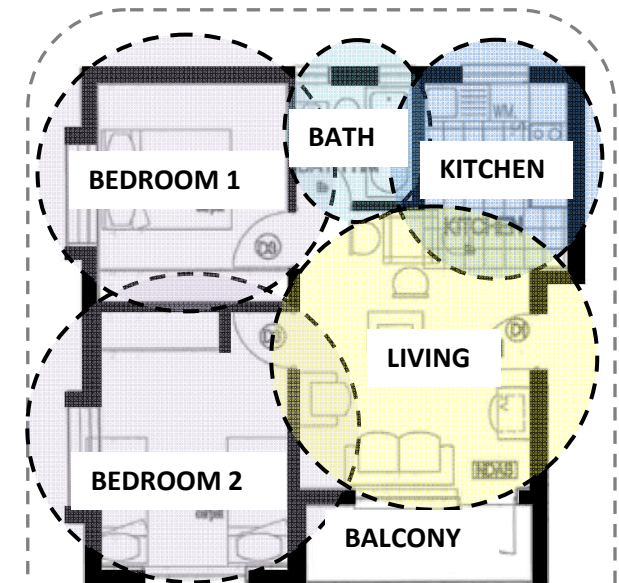
The overall layout and design of the internal unit does not allow for much adaption or expansion beyond the external bearing walls. The units currently can accommodate some internal adaptations of the way they utilise the spaces with the furniture layouts and furniture however due to the size of the units, it is difficult for tenants to arrange the furniture and thus deterministic living arrangements are prevalent. This is due to the tight designing along a modular grid system. Internal variances and spatial possibilities could have been achieved through the use of an irregular grid system.

The semi-structured interviews and questionnaire yielded both positive and negative comments. The most frequent negative comments were that the housing units were too small and could therefore not fully meet their (tenants) spatial needs. Positive comments included that the housing units were suitable for the present but not for the long term. Reference was made regarding the overall housing

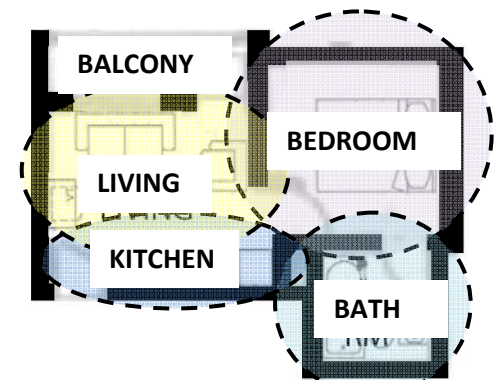
unit size; majority of the respondents mentioned that the size of the housing unit was too small and inadequate for their families but the unit size would be suitable for property virgins with a small family requiring lesser space.

Bedrooms and kitchens were reported as being too small. Kitchens specifically were reported that they should have been equipped with fitted cupboards and packing space. Bathrooms were said to be small and should have been designed to separate the wash room and have a separate toilet cubicle. The majority of the respondents mentioned that the housing units would not meet their family’s spatial requirements in the near future as their families are growing and will require more space and adjustments in layout and design.

When asked about being given the option to design and make changes in their housing units, the majority of the respondents said they would prefer such an



**Figure 69:** Typical two bedroom social housing unit layout.



**Figure 70:** Typical one bedroom social housing unit layout.

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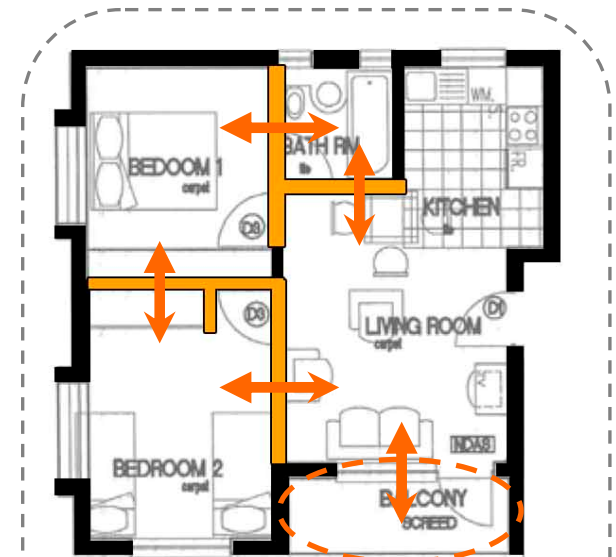
option as it would give them the freedom to manipulate and adapt the space according to their families spatial needs at that particular time and be able to make changes as the family changes or grows in size.

The fact that the housing development is a subsidised rental project, it does not permit much adaptation to the internal spaces by the tenants. Some of the internal changes would need to be done by the Social Housing Institution (SHI). A physical adaptation of the internal spaces requires breaking down the internal walls. Expansions of the social housing unit would require breaking down of the structural walls. There is relatively very little flexibility within the housing units. The balcony spaces can be built-up adding an average of 3,9m<sup>2</sup> of space. This would entail that the doors and windows would have to be removed.

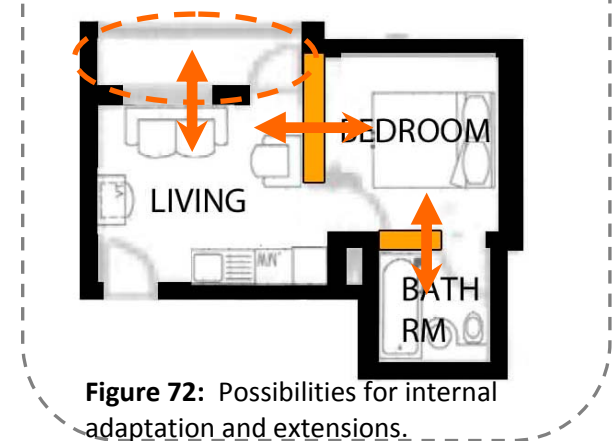
The masonry walls are not easy to adapt. A possible alternative could have been used to make the units more flexible and adaptable.

When examined from the perspective of flexibility,

the project does not reflect an innovative way of design and planning. Due to the strict and clear allocation of facilities within the unit, the potential of flexibility has been reduced to a minimum.



**Figure 71:** Possibilities for internal adaptation and extensions.



**Figure 72:** Possibilities for internal adaptation and extensions.

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		<b>Structural systems</b> (columns, beams, roof and general structural systems)	<b>Service spaces</b> (wet services, ducts and electrical services)	<b>Architectural layout</b> (internal partitioning, space adjustment, additions and reduction)	<b>Furnishing for flexibility</b> (sliding, folding or moving partitions and furniture)
Easy adaption	Independent component		●		
	Moderate connection				
	Integral connection				
Moderate adaption	Independent component			●	
	Moderate connection				
	Integral connection	●			

Adaptation by Tenants/Home owner
  Adaptation by Social Housing Institutions

Due to the nature of this social housing development, all the physical adaptations and changes can only be conducted by the managing Social Housing Institutions (JHC in this case). Tenants are not at liberty to make any physical changes. This therefore limits the levels of adaptations and flexibility offered to the tenants. The structural systems at Carr Gardens can be said to allow for moderate adaptations and have an integral connection. Making adaptations and changes to the structural systems would have an impact on other building components and would only be feasible at a medium-term basis.

Making adaptations to the serviced spaces can be considered to be easy and the service components are more independent. These adaptations can be of short-term as they would include changes in the appearance and regular maintenance processes.

Adaptations to the architectural layout is greatly compromised by the construction techniques and materials used in this development, however if adaptations were to be made, the internal structure is independent and would not affect the overall building and structure. The adaptations can therefore be considered as being moderate.

**Results: Moderate adaptation.**

**Table 09:** Assessment table for Carr Gardens

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## Inside the box | responsive design for diverse and changing households

Project name	Brickfields
Architects	Savage & Dodd Architects cc/ Fee & Chalis Architecture/ Makhene Architect and Associates
Project Manager	Johannesburg Housing Corporation (JHC)
Year	2005 (Project completion)
Province	Gauteng
Municipality	Johannesburg
Type of development	Greenfield site- new build development
Location in the city	Ntemi Piloso, between Gwigwi Mrwebi and Carr street, accessed from Mvume Dandala lane, Newtown
Context	Inner city, close proximity to opportunities and amenities
Tenure type	Rental only
Building size& unit distribution	724 total units (two tower blocks, three and four storey walk-up blocks)
Unit mix	1 bedroom, 2 bedrooms and loft and studios
Character	Medium-higher density mix housing (housing, income, land use)

**Table 10:** General information about the project.

### PROJECT DESCRIPTION AND LOCATION

The Brickfields social housing project is a Greenfield development situated in the Newton precinct (BSC Projects 2014). The social housing project forms part of a broader urban regeneration initiative to revitalise the old industrial area in Newtown which is now conceptualised as Johannesburg’s cultural precinct (Poulsen & Silverman 2005:13). Thus the social housing project became the pioneering project.

The Brickfields social housing project consists of four phases referred to as Precinct A & B, C and Precinct D & E. Savage + Dodd Architects, Fee & Challis Architects, ASA Architects and Makhene & Associates designed the project in a joint venture.

#### Figures 73

(www.asaarchitects.co.za)



#### Figures 74

(www.asaarchitects.co.za)



#### Figures 75

(www.jhc.co.za)



#### Figures 76 (www.jhc.co.za)



#### Figures 76 (Poulsen & Silverman 2005:15)



**Figures 73-76:** Images of Brickfields social housing development showing the building character and sense of place.

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The project consists predominantly of rental housing and a few retail units. Most of the residential units are accommodated in four-storey walk-up perimeter blocks built right up against the street edges (Poulsen & Silverman 2005:13). These buildings are then terminated by nine and ten storey tower blocks at the corners. Of all the housing units, only 20% of the units are defined as social housing units as they are government subsidised and therefore more affordable and thus offering an opportunity for greater social mix.

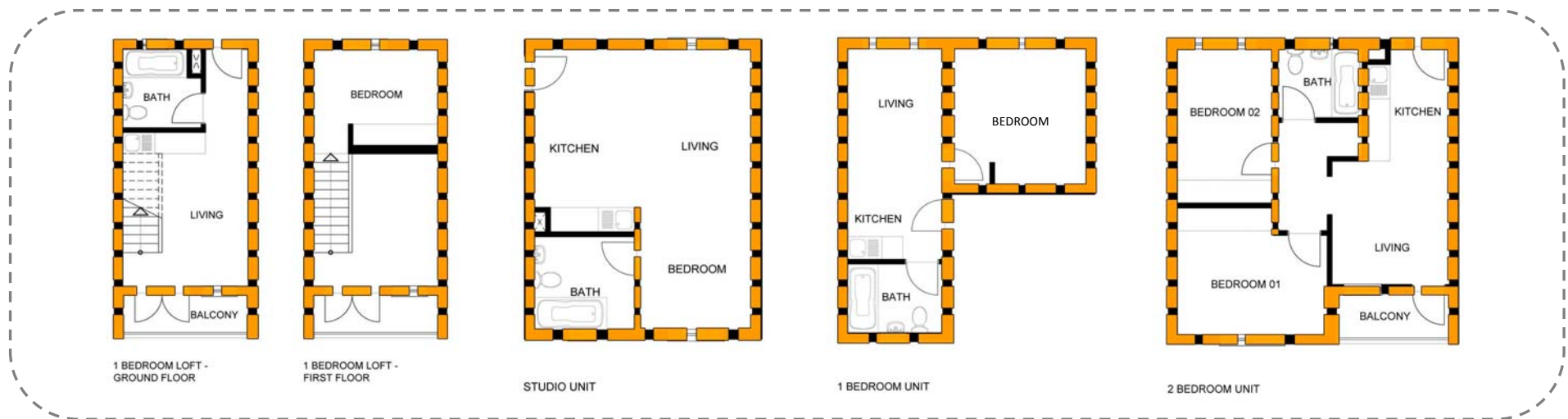
### PLANNING AND GENERAL UNIT DESIGN

The majority of the units (72%) are two bedroom units with the remaining being one bedroom and three bedroom units. Precinct D & E has incorporated live/work units on the ground floor and loft-type units on the upper floors (Poulsen & Silverman 2005:14). Housing units are designed to minimise noise transmission from the one unit to the next through the placement of the quieter areas (the bedrooms) next to each other and the living spaces on the outer edges.

Additional communal facilities have been incorporated in the social housing precinct. These include a crèche, a homework room, community hall and outdoor play areas for kids with a ball court and a skateboard ramp.

#### 1. Structural systems (columns, beams, walls, roof and general structural systems)

The structural system employed in this social housing development is of reinforced concrete columns and beam structure along with 230mm load-bearing



Figures 77-80: Analysis of the base structures of the social housing units in Brickfields.

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masonry wall infill. The columns are positioned on the periphery of the housing units, however, the structural system was not adequate and thus masonry load-bearing walls were used in the internal unit spaces. Internal spaces were determined through 115mm non load-bearing masonry walls. The vertical service cores are located on the periphery of the housing units. The internal unit space was therefore not compromised with service cores.

The structural system employed did not allow for a variety of unit types in separate unit blocks. Most of

the housing unit blocks consist of identical two bedroom units. One bedroom units and single rooms sharing facilities were however incorporated.

The structural system employed is similar to that used at Carr Gardens social housing development therefore; the design approach can also be regarded as *hard form* as the spaces are largely determined by the designers of the development. The structural system does not make it possible for the users to adjust the spaces and make changes according to their varying spatial requirements and needs. The

consideration of the construction methods is important as it directly affects the possibility of future adaptations to the housing units. According to Schneider & Till (2005b:287), the reduction of load-bearing and solid internal partitions will affect the possibility of future adaptations.

### 2. Service spaces (wet services, ducts and electrical services)

Like the structural system, the service cores including access units and wet spaces are the fixed



**Figures 81-84:** Analysis of the main indeterminate spaces of the social housing units in Brickfields.

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components of the development. The wet services (kitchens and bathrooms) are positioned in a linear manner on the access side of the housing units. The vertical service ducts are covered and accessed from the external inner facades of the housing units. Due to the careful positioning of the vertical service cores, the interior space of the housing units remain free from having service ducts.

In summary, the permanent serviced spaces of the housing development can be assessed as designed in a flexible manner as the positioning allows for future adaptability as no structural changes would be required to relocate the services. Services are not buried in walls and floors and thus it makes it easy to adapt, add or upgrade. The design of the service spaces can be therefore be regarded as *soft* form.

### 3. Architectural layout (space adjustment-addition and reduction)

Brickfields offers three different types of units to choose from prior to occupation; three bedroom units, two bedroom units and one bedroom units. Though there are different types of units offered,

these unit types do not offer variety in layout and design. Spaces and internal layouts are simply adapted to where they are placed within the based structure. The development can be assessed as not providing typology variety and thus not fully meeting the diverse needs and demands of the users.

#### a) Types of units

As previously mentioned, the structural design of buildings and the positioning of service cores are important considerations in achieving flexibility. Architects can achieve this by providing the opportunities prior occupation by providing a variety of unit types and by allowing users the ability to adjust and adapt their housing units as they reside in the housing unit in time.

In this housing development, variety is not provided prior to occupation and neither is it provided during the occupation period. The unit configurations are identical in layout and design.

Internal spaces are separated with 115mm masonry walls along with 230mm masonry load-bearing walls.

This type of construction does not offer the users the opportunities to join and divide spaces according to their needs and demands. The architectural layout of the housing development can be regarded as architect-determined. The housing units do not allow the users to physically adapt and make changes to their housing units. In terms of flexibility the housing units can be evaluated as *hard* form and use.

#### b) Spatial organization of the units

The presence of fixed internal partitioning makes it impossible for the users to adapt their internal unit spaces according to their spatial requirements and needs, users need to use the spaces as determined. This restricts the users from making changes with the use of flexible internal partitions. Rooms cannot be integrated, joined or divided. The positioning of services on the periphery of the housing units however could allow for easy adaptations by the SHI (JHC in this instance).

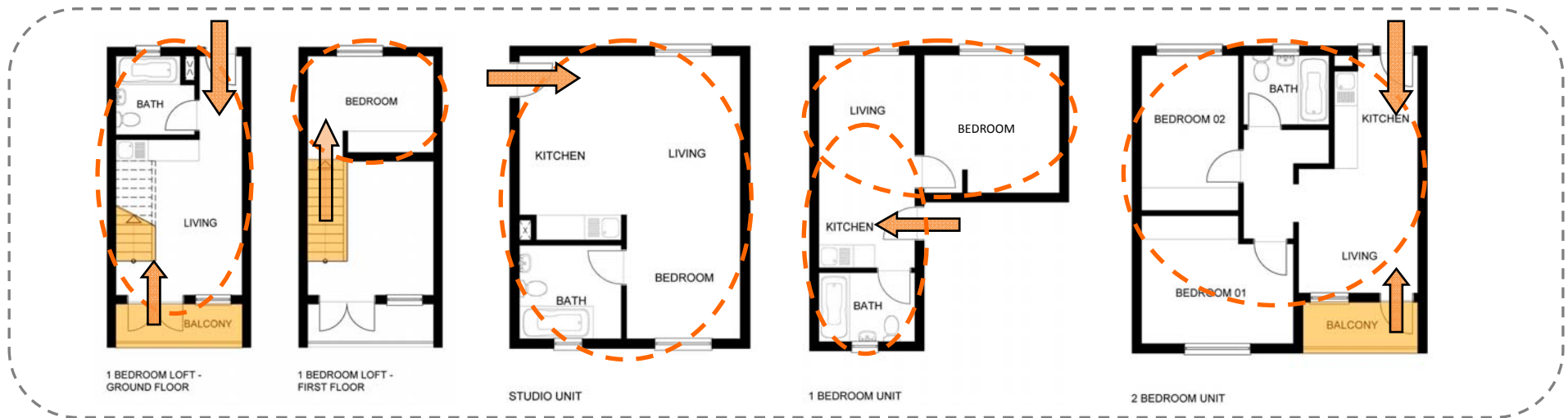
An open plan design strategy was utilised for the living areas but due to the size of the units, furniture and layout arranged are almost predetermined for



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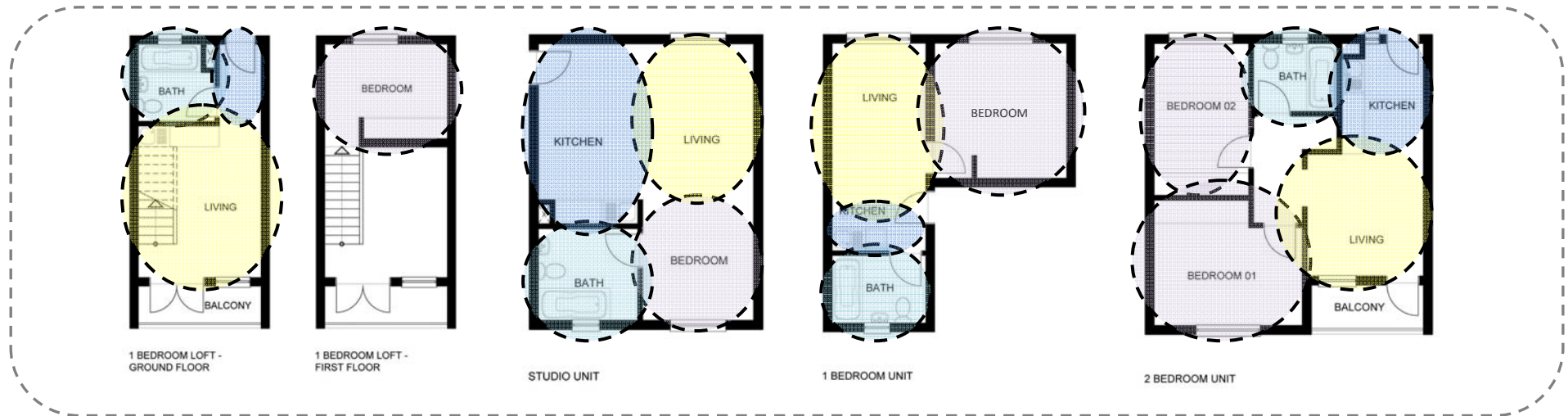


Figures 85-88: Analysis of the serviced spaces of the social housing units in Brickfields.



Figures 89-92: Analysis of the access spaces of the social housing units in Brickfields.

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Figures 93-96: Analysis of the architectural layouts of the social housing units in Brickfields.

the tenants. There are limitations in terms of physical changes within the boundaries of the housing unit. Additionally, the units on the site perimeters are equipped with balcony spaces. These balconies could offer possibilities of future extensions by enclosing them and adding the internal space.

Similar to Carr Gardens, Brickfields does not offer users to adapt and adjust the internal configurations of the units, they are not in control of their spaces. In

terms of flexibility, the internal unit spaces can therefore be regarded as *hard* form.

#### 4. Furnishing for flexibility

Unlike Carr Gardens, Brickfields was designed with storage spaces in mind. Kitchens are better equipped with a sink and a two door cupboard underneath. Though the wood work was not completed in the bedrooms, a clothing rail is provided in a clearly

demarcated cupboard space. Additional storage space is provided through niches in the walls right in front of the bedrooms next to the bathrooms, this space is interpreted differently by the residents but it primarily serves as a storage space. This additional storage space is however not catered for in the one bedroom housing units.

### **Possibilities for internal adaption, extension and personalisation**

Residential environments should be designed to respond to the modern living demands (Živoković & Jovanović 2012:17). Brickfields is a typical example of the living demands in the area changing. The social housing development was intentionally designed to be occupied by families seeking affordable rental options in the Johannesburg CBD. However with the Johannesburg inner-city regeneration programme, the living demands have changed. There is a greater influx of young people seeking accommodation in the CBD. The dynamics in the area have changed in the area and this was even so evident in the structured interviews held with the residents of Brickfields. 80% of the willing participants interviewed were young and upcoming families.

The overall layout and design of the internal units do not allow for much adaption or expansion beyond the external bearing walls. The housing units can offer minor adaptations in the open plan living areas. Flexibility in the units is highly affected by the use of

masonry walls to separate the spaces; residents therefore cannot move or adjust the space according to their needs demands.

The semi-structured interviews and questionnaire yielded both positive and negative comments. The most frequent negative comments were that the housing units were too small and could therefore not fully meet their (tenants) spatial needs. Positive comments included that the housing units were suitable for the present but not for the long term. Reference was made regarding the overall housing unit size; majority of the respondents mentioned that the size of the housing unit was sufficient but they would like to be able to adapt their spaces according to their spatial needs.

Kitchens and bedrooms specifically were reported that they should have been equipped with fitted cupboards and packing space. Bathrooms were said to be small and should have been designed to separate the wash room and have a separate toilet

cubicle. Majority of the respondents mentioned that the housing units would not meet their family's spatial requirements in the near future as their families are growing and will require more space and adjustments in layout and design.

When asked about being given the option to design and make changes in their housing units, all the respondents said they would prefer such an option as it would give them the freedom to manipulate and adapt the space according to their families spatial needs at that particular time and be able to make changes as the family changes or grows in size.

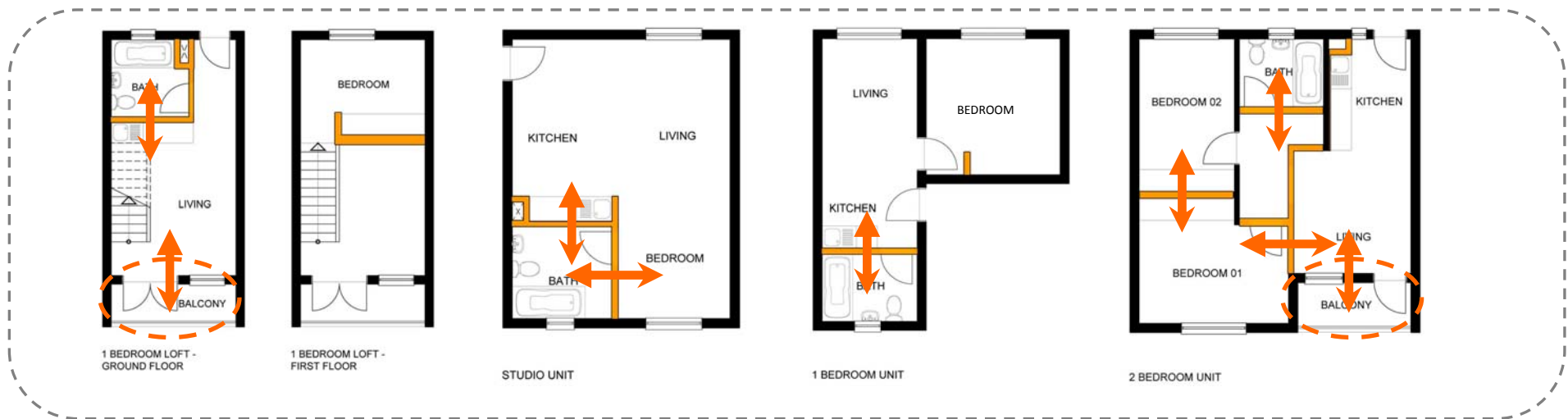
Similarly to Carr Gardens, the residents in Brickfields are not permitted to make any changes and adaptations to the housing units. The construction methods used in the development make adaptations not possible by the residents. However, the SHI would be able to make slight adjustments but this would require breaking down in some instance load-bearing walls and non-load bearing masonry walls.

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Residents living in the housing units which have balcony spaces are not satisfied with the provision of balconies; instead they would have preferred the balcony space to have increased the internal space. These balcony spaces can be built-up adding an average of 4m<sup>2</sup> to the internal spaces. However, this would entail that the doors and windows would have to be removed.

When examined from the perspective of flexibility, the project does not reflect an innovative way of

design and planning. Brickfields in many attributes shares the same weak points as Carr Gardens. In both case studies, it is evident that the ability of the internal unit spaces to be flexible is highly affected by the construction techniques of using the masonry walling systems to demarcate spaces. The potential of flexibility has been reduced to a minimum. The housing development represents *hard* use and form.



**Figures 97-100:** Analysis of the possibilities for internal adaptations and extensions.

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		<b>Structural systems</b> (columns, beams, roof and general structural systems)	<b>Service spaces</b> (wet services, ducts and electrical services)	<b>Architectural layout</b> (internal partitioning, space adjustment, additions and reduction)	<b>Furnishing for flexibility</b> (sliding, folding or moving partitions and furniture)
Easy adaption	Independent component				
	Moderate connection				
	Integral connection				
Moderate adaption	Independent component				
	Moderate connection				
	Integral connection				

Adaptation by Tenants/Home owner     
 Adaptation by Social Housing Institutions

Brickfields is very similar to Carr Gardens when assessing the adaptability and flexibility of the social housing units. Similarly to Carr Gardens, all the physical adaptations and changes can only be conducted by the managing Social Housing Institutions (JHC in this case). Tenants are not at liberty to make any physical changes. This therefore limits the levels of adaptations and flexibility offered to the tenants. The structural systems are integrally connected to other components in the building and offer moderate adaptations.

Making adaptations to the serviced spaces can be considered to be easy and the service components are more independent. These adaptations can be of short-term as they would include changes in the appearance and regular maintenance processes.

Adaptations to the architectural layout is greatly compromised by the construction techniques and materials used in this development, however if adaptations were to be made, the internal structure is independent and would not affect the overall building and structure. The adaptations can therefore be considered as being moderate. This is very similar to that of Carr Gardens.

### **Result: Moderate adaptation**

**Table 11:** Assessment table for Brickfields.

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Project name	K206
Architects	ASA Architects (Anca Szalavic)
Project Manager	Alexandra Renewal Project (ARP)
Year	2010
Province	Gauteng
Municipality	Johannesburg
Type of development	Greenfield site- new build development
Location in the city	Marlboro road (east) and London road (north), Alexandra Township
Context	Greenfield township settlement
Tenure type	Private ownership and rental options
Building size& unit distribution	2200 housing units of different tenure types of which 520 units are rental housing
Unit mix	8 to 10 cluster units of 40m <sup>2</sup> double storey ownership units and 40m <sup>2</sup> two bedroom rental units
Character	Low-medium density mixed housing with backyard rental opportunities(income and tenure mix)

**Table 12:** General information about the project.

### PROJECT DESCRIPTION AND LOCATION

The K206 project is a Greenfield development in Alexandra, Johannesburg and developed as a low-income social housing development. The project forms part of the Alexandra Renewal Project (ARP) which is aimed at providing formal housing to the residents of Setjwetla informal settlement (Osman & Davey 2011:2, Osman et al 2011:4). The aimed at increasing housing densities and combines tenure of ownership and rental occupation.



**Figures 101:** View of K206 from the street (www.skyscrapercity.com)



**Figures 102:** View of K206 from the street (Osman & Davey 2011:2)



**Figures 103:** Extensions to the buildings by the homeowners (Osman & Davey 2011:4)

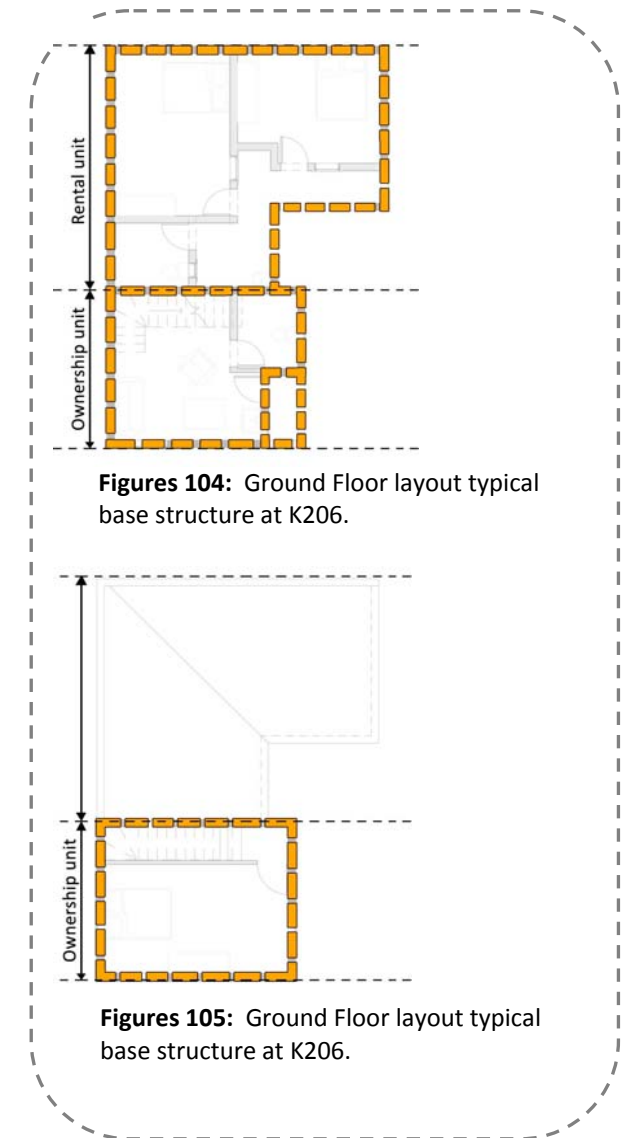
## PLANNING AND GENERAL UNIT DESIGN

The housing developed is designed in clusters of eight to ten housing units forming smaller communities around semi-private communal courtyards (Osman & Davey 2011:2). Every unit has a 40 or 50m<sup>2</sup> double-storey government subsidised dwelling for ownership along with two adjacent but independent rental ground floor rooms with shared ablutions totalling 30m<sup>2</sup>. These ground floor units are intended to be rental units managed by the homeowners of the main house. This design layout is intended to refer to the existing community interactions of the area, improve the quality of housing and increase densities in the community. The grouped buildings are fairly permeable to pedestrians. The residents are in close and direct contact with the general urban amenities and public transport. No designated parking bays are provided though the residents use the courtyards for their parking needs (Osman & Davey 2011:2).

- 1. Structural systems** (columns, beams, walls, roof and general structural systems)

Unlike Carr Gardens and Brickfields, K206 makes use of a low density housing typology. With the design being two storeys high, the structural system is completely different. The design approach employed in this social housing development can be related to that of Quinta Monroy. This social housing development had to allow for physical expansion of the housing units; hence, the buildings had to be porous enough to allow each unit to expand within its structure. However, the construction methods employed do not encourage this; the housing units offer very little possibilities for change.

The housing project consists of masonry wall construction with concrete floors and mono-pitched corrugated iron roofs along a 3300mm grid system (Osman & Davey 2011:2, Osman et al 2011:4). External walls have a face-brick finish. Changing the bearing structure would require professional input as these are the main structural components of the housing units.



**Figures 104:** Ground Floor layout typical base structure at K206.

**Figures 105:** Ground Floor layout typical base structure at K206.



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Internal spaces and rooms have been separated with non-load bearing masonry walls with an earthy palette of plastered finish (Osman & Davey 2011:2, Osman et al 2011:4). The internal walls can be changed with moderate ease however they would need to be knocked down and replaced with a partitioning system of choice by the tenants. This may not always be feasible to the residents due to the financial implications associated with it.

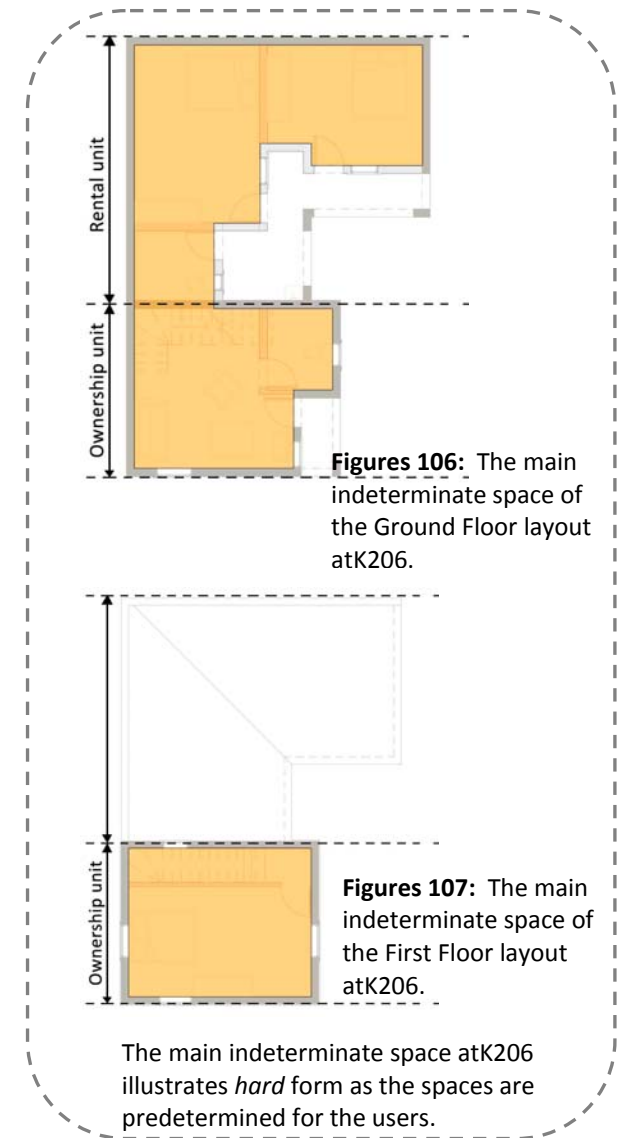
The structural system is robust in character and therefore making it not as feasible to make physical changes to the housing units. This also brings about vast cost implications to the residents and thus the structural system becomes the restricting factor in this social housing development. In flexibility terms, though the housing development has characteristics of the terraced house in scale, the correlation of space and use, construction and design makes K206 inflexible. The structural system is therefore of *hard* use and form.

**2. Service spaces** (wet services, ducts and electrical services)

The wet services (kitchens and bathrooms) are positioned on the ground floor and thus making them easy to be adapted and changed according to the users' needs. The serviced spaces of the housing units can be assessed as being designed in a flexible manner as future adaptability requires the simple relocation of sanitary fittings and adjusting the plumbing pipes. Plumbing lines are not buried in the walls or floors and therefore are easy to adapt, add or upgrade. The centrally positioning of the services also allows for easier adaptability as the accesses to these serviced spaces can be easily changed without having to completely relocate the services. According to Živoković & Jovanović (2012:29), central cores along one or more walls contributes to the possibility of combining of spatial organization. The design of the service spaces can be considered as *soft* form.

**3. Architectural layout** (space adjustment-addition and reduction)

K206 does not offer a variety of unit types pre-occupation. The social housing development does



not offer variety as all the units are identical in design and layout. One can therefore conclude that K206 does not offer typology variety to the diverse spatial needs and demands of the residents. Unit and layout variety would have been beneficial to the users as they could be able to select a housing unit which is suitable for their needs upon occupation.

#### a) Types of units

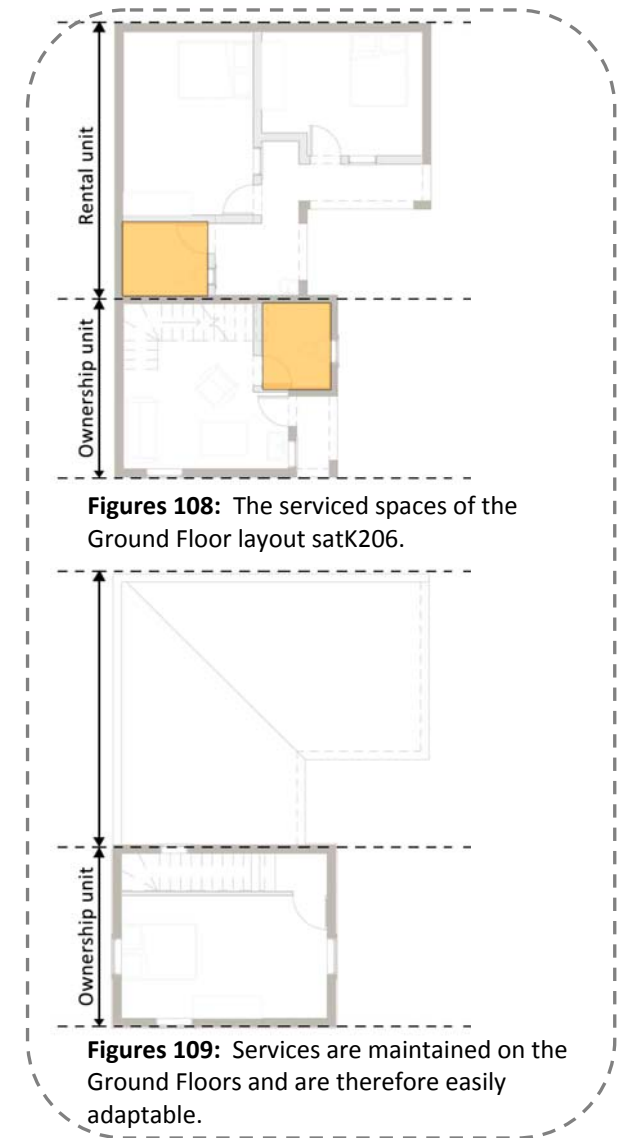
The government subsidised housing units are either 40m<sup>2</sup> or 50m<sup>2</sup> in size and are for full ownership. These units are then coupled with two rental units with shared ablution facilities.

In this housing development, variety is not provided prior to occupation. The unit configurations are identical in layout and design. Residents are prohibited to make major physical changes in the housing units within the first five years of occupation but post the five years, they can make physical changes according to their families' spatial needs.

#### b) Spatial organization of the units

Post the five year period users can make extensive physical changes to their housing units. Users can extend vertically above rental units while retaining the rental units or adding an external staircase and relocation the rental housing units to the first floor. This would require structural changes in lifting the corrugated iron roofs. Users can also join or divide the ownership unit by creating an opening underneath the staircase and linking it to the rental units. The two rental housing units could also be joined into one unit by breaking down the wall separating the two. The users can also enclose the courtyard spaces in front of the units to increase the internal living spaces in the units.

Though these changes are possible, the construction materials do serve as restrictions and increase the complexity of making the needed adaptations. The housing units do allow for future adaptability and spatial changes. In terms of flexibility, the housing units can be regarded as having characteristics of *hard form* and use.



**Figures 108:** The serviced spaces of the Ground Floor layout satK206.

**Figures 109:** Services are maintained on the Ground Floors and are therefore easily adaptable.

#### 4. Furnishing for flexibility

This social housing development does not have designated storage spaces. The users are provided with a blank canvas to design and plan where they will equip the housing units with storage spaces. The space under the staircase could be used as storage and the users would be required to enclose it into a cupboard.

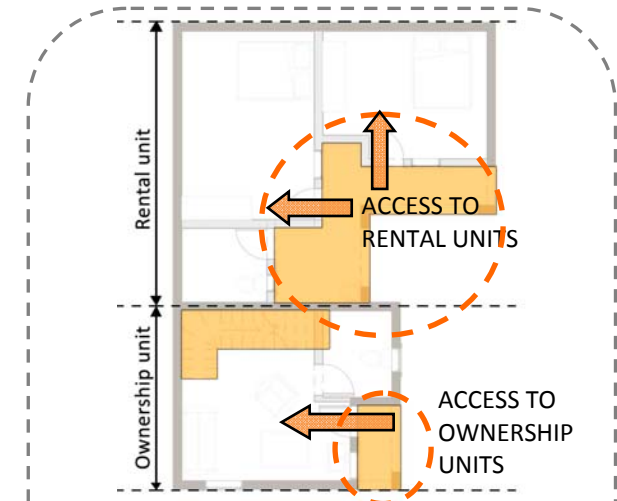
#### Possibilities for internal adaption, extension and personalisation

Current rules and regulations prohibit major physical extensions within less than five years of occupation, thus after five years, the home owner can make extensions and adaptations (Osman & Davey 2011:2, Osman et al 2011:5). Within the internal boundaries of the unit, the finishes and independent components are easily adaptable through painting, tiling, carpeting and replacement. The building services can also be adapted if the service areas are relocated or moved to a different location.

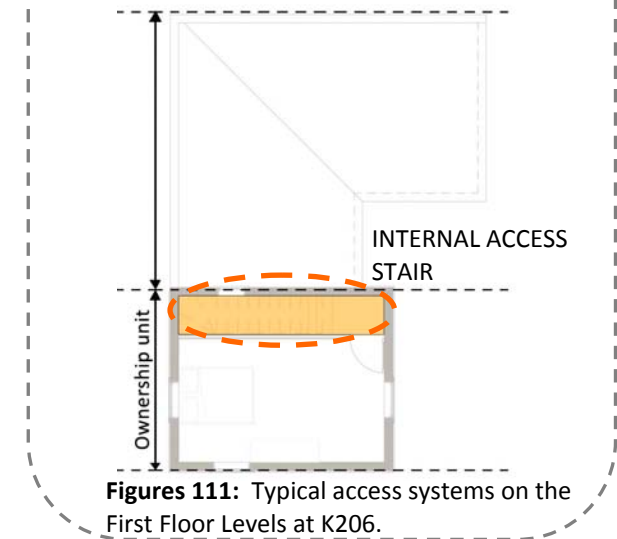
Internal space can be adapted through the

manipulation of the secondary structure which would involve the demolition of internal walls and re-planning of the walling system and repositioning of openings and points of entry and possibly losing some of the semi-private spaces provided externally. In other instances, major work would be required to adapt the internal space. For instance the staircase connections and demolition the load-bearing walls. The masonry walls are not easy to adapt. Alternative construction methods and techniques could have been used to allow for easier adaptation.

The primary housing unit has possibilities for change and adaptation but will be a costly and complicated exercise. The approach to flexibility in this project is that which allows for user participation. Flexibility in this development can be seen as something which gives the users the choice of how they want to their spaces over a long period of time. The housing unit provided in this instance is viewed as a support structure and not a final product and thus encourages the users to develop it further.

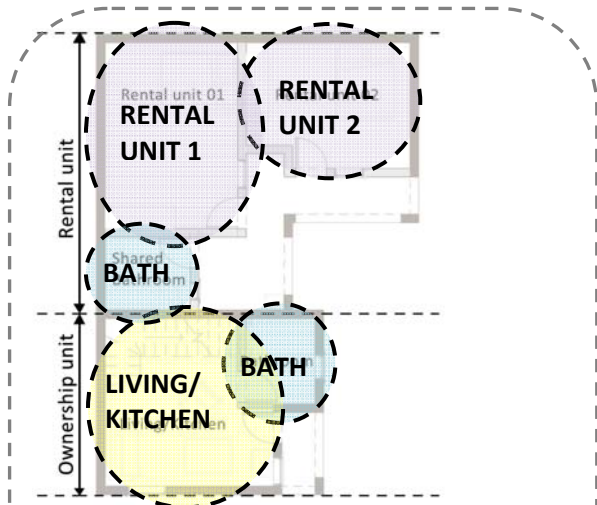


Figures 110: Typical access systems on the Ground Floor Levels at K206.

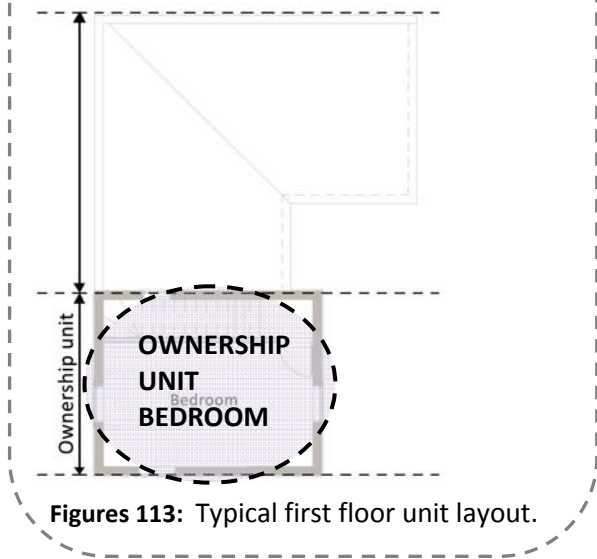


Figures 111: Typical access systems on the First Floor Levels at K206.

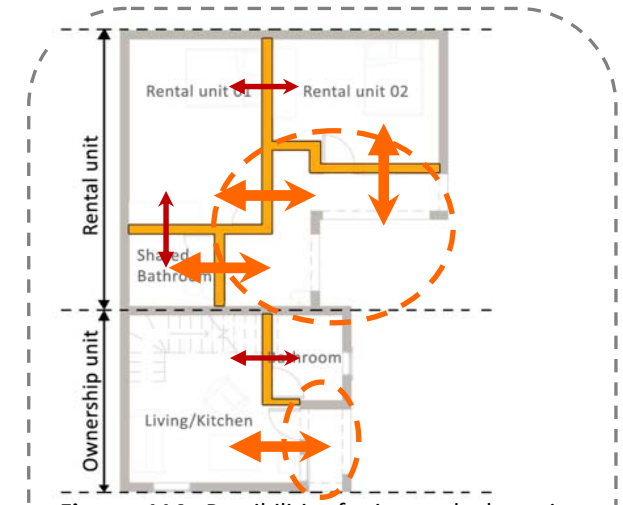
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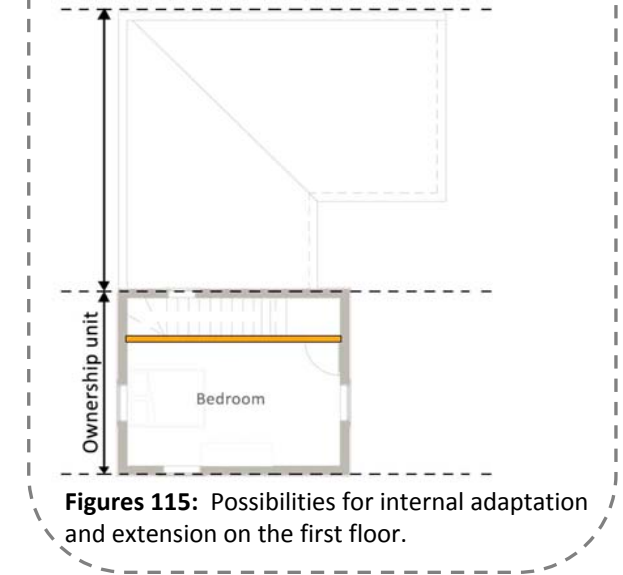
Figures 112: Typical ground floor unit layout.



Figures 113: Typical first floor unit layout.



Figures 114: Possibilities for internal adaptation and extension on the ground floor.



Figures 115: Possibilities for internal adaptation and extension on the first floor.

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		<b>Structural systems</b> (columns, beams, roof and general structural systems)	<b>Service spaces</b> (wet services, ducts and electrical services)	<b>Architectural layout</b> (internal partitioning, space adjustment, additions and reduction)	<b>Furnishing for flexibility</b> (sliding, folding or moving partitions and furniture)
Easy adaption	Independent component		●		
	Moderate connection				
	Integral connection				
Moderate adaption	Independent component			●	
	Moderate connection	●			
	Integral connection				

● Adaptation by Tenants/Home owner
⦿ Adaptation by Social Housing Institutions

When comparing K206 to Carr Gardens and Brickfields, the nature of the developments are very different. The home owners in this development are their own managers and are the landlords of the rental units. The home owners can make all the necessary adaptations and changes they deem suitable for their needs. K206 was built and intended to be a basis for the owners to incrementally adapt their units. In this light, the development seems to be quite flexible. However, when assessing the structural systems, they are of robust masonry construction and thus impact on the easy of adaptation. Due to the construction techniques and materials used, the structural systems offer moderate adaptation and is moderately connected to the rest of the building.

Making adaptations to the serviced spaces can be considered to be easy and the service components are more independent. Home owners can relocate the service zones, upgrade the services and make any changes to suit their needs.

Adaptations to the architectural layout is greatly compromised by the construction techniques and materials used in this development, however if adaptations were to be made, the internal structure is independent and would not affect the overall building and structure. The adaptations can therefore be considered as being moderate.

### Result: Moderate adaptation

**Table 13:** Assessment table for K206.

## CONCLUSION

Throughout, the study aimed to highlight the importance of designing responsive residential internal spaces. The selected methods and strategies which contribute to flexible residential design were outlined. This section illustrated three social housing developments as case studies for the research. In all three case studies, the degree of flexibility on internal housing units in multi-family residential units was evaluated.

The method of evaluation was based on the concept of independence of the physical factors which determine the flexibility. The structural system, serviced spaces, architectural layout and furnishing for flexibility were presented as the physical aspects influencing the level of flexibility.

The structural systems in all three case studies were of *hard* form. Despite the structural system being of *hard* form in K206, users were at the liberty to adapt and change their housing units according to their spatial needs. The structural systems in Carr Gardens and Brickfields did not yield freedom to the

users to make alterations and adaptations in their housing units. The predominant problem in all three case studies was related to the inflexible internal partitioning methods. All internal partitions were of masonry brick walls and therefore did not offer opportunities for making changes in housing layouts and spatial organization. Internal partitions are a primary feature of a housing unit's layout design; therefore it is a critical element to address when designing for flexibility (Martin 2005:9).

In all the case studies, serviced spaces can be considered as *soft* form as it was quite easy to adapt and making changes. Ducts and service shafts did not influence the internal layouts of the housing units.

Although Carr Gardens and Brickfields offered different unit types, in the context of flexibility, there was not enough typology variety and unit types. In the design of K206, no design exploration and consideration for different unit types and varieties were considered.

There is a lack of innovation and application in utilising furniture for flexibility. Using furniture as a factor in creating flexibility is one aspect of the design which has not been explored in all the case studies.

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## **7** conclusions and recommendations

## CONCLUSIONS AND FINDINGS

Social housing as the focus of the study offered an excellent opportunity for learning and dissemination of flexible and adaptable design in housing design. The study investigated whether internal units of social housing developments in the South African context were able to offer flexible, adaptable and changeable environments which accommodated the future unseen needs of the residents' residing in these developments.

Concepts of *flexibility*, *adaptability* and *open building* design principles in multi-unit residential dwellings were explored in the literature synthesis. These concepts were highly reliant on John Habraken's (1972) theories of *Supports*, Stephan Kendall's (2004) theories on *Open Building* and Schneider & Till's (2004) concepts of *flexible housing* and *adaptable housing*. Within this theoretic framework, the research investigated how these concepts inform housing design, their extents and limitations in social housing developments in South Africa. The study was motivated by the

design of internal spaces in housing units which are unable to adapt and offer flexibility for a wide range of end-users with varying spatial needs.

If a housing unit does not respond to the changes, it becomes unsatisfactory (Schneider & Till 2007:35). One of the prominent problems related to housing design lies in the way housing is seen as a static representation of the end-users needs and thus relating in a fixed design solution (Osman & Herthogs 2010:1; Schneider & Till 2007:4). This becomes more significant in the design of residential buildings. Inflexible construction of residential buildings results in the buildings not being able to fulfil the changing spatial needs and demands of the users. In addition, these spatial needs change over time.

There is an assumption that rental housing sees many cycles of tenants over the building's lifetime (Osman & Herthogs 2010:9). This argument is based on the fact that the users are not homeowners and therefore they will only inhabit the housing units

temporarily. This therefore implies that the ability for the internal housing unit to change and accommodate new tenants is paramount to meeting the market demands and making the building more viable over the long term. The research question therefore investigated whether the social housing internal units could accommodate for change.

Three social housing projects in South Africa in terms of the main dimensions of social housing, namely spatial, economic and social sustainability were evaluated. The projects are; Carr Gardens (located in Fordsburg), Brickfields (located in Newtown) and K206 (located in Alexandra). Through the case study analysis, the research highlighted the key issues relating to internal unit flexibility and adaptability.

The findings indicated that the planning and designing of social housing developments creates interesting paradoxes; while they offer a greater diversity in unit designs, they do not fully explore the potential of achieving flexibility and adaptability at infill level. Internal partitions are often load-bearing



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and roof spaces (in loft apartments) are filled with trussed rafters. Therefore this means that they can never be converted in future. If flexibility is built in, occupants would be able to adapt their houses according to their changing spatial needs and would thus be encouraged to stay longer in their housing units. Particularly in social housing developments, housing units should be designed to facilitate future internal remodelling through the implementation of innovative construction methods. It is concluded that the construction industry is very conservative in South Africa, but the importance of new approaches needs to be fully explored and tested.

Currently, significant changes to the internal layouts are complicated by structural implications; the need to locate and re-route mechanical systems and impacts on the interior finishes. These constraints are barriers to reconfiguring the internal layout housing unit as the tenant's requirements change over time or when new tenants occupy the unit.

In summary, integrating flexibility, adaptability and open building concepts in the housing context is

important and can inspire a new and challenging kind of architecture (Habraken 2008:291).

## RESEARCH CHALLENGES AND LIMITATIONS

- The research was challenging due to the limited data available which was specific to the South African context.
- It was challenging gaining access into the case study areas and even more challenging acquiring participants who were willing to allow the interviews in their homes. Security, protocol, the rules and regulations by the project managers were stumbling blocks and quite challenging to overcome.
- Upon explanation on why you were there and what the study entailed, there was initially hope and high expectations that their problems and concerns will be addressed immediately; this was quickly followed by disappointment and reluctance to even participate in the research when those expectations were dismissed.
- Although some participants were sceptical of the intrusion, others were welcoming and willing to take part.

Despite the challenges and limitations encountered, the experience was valuable and vital in understanding the lives of the residents, their experiences, problems and the aspirations.

## SUGGESTIONS FOR FUTURE RESEARCH

The exploration of concepts of the application of open building, flexibility and adaptability in residential design in South Africa, particularly in government subsidised housing can be more fruitful through more integrated and interaction with housing practitioners, policy makers and community representatives. The research served a great initiation in the flexibility and adaptability of social housing developments internal in it designs. This served an important exploration and immense potential in the South African context.

There is a need for the development of sustainable housing systems in the South African context. Whether this implies a major change in the way we currently build and a re-structuring of the construction industry or whether it is a simple evolution of construction methods still needs to be researched and debated.

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**APPENDIX 1: INTERVIEW QUESTIONS**

1. How long have you been renting the unit for? (Years/months/days) \_\_\_\_\_  
\_\_\_\_\_
2. How many people stay in this housing unit and how long has each individual been staying here? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Can you please describe the following;
  - a) The space. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - b) The size of the unit. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - c) The layout and design of the unit. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. In your opinion, is anything lacking that could change or improve the housing unit? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

No

Why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

***Thank you for your time and co-operation.***

**APPENDIX 2: INFORMED CONSENT FORM**

1 Title of research project:

**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

- 2 I ..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.
- 3 The nature, objective, possible safety and health implications have been explained to me and I understand them.
- 4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.
- 5 Upon signature of this form, you will be provided with a copy.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: \_\_\_\_\_ Date: \_\_\_\_\_



**APPENDIX 3: RESEARCH DESCRIPTION**Process of gathering data through the semi-structured interviews at Carr Gardens social housing development

**Location:** Carr Gardens, Fordsburg, Johannesburg

**Dates:** 17, 18 & 20 March 2014

**Times:** Varied

**Intended number of participants:** 5 households/tenants

**Actual number of participants:** 4 households/tenants

**Brief overview of how the interview process:**

It was relatively easy to gain access into the social housing development to conduct the interviews because there was a community facilitator who resided there. The participants were willing to take part in the research but it was quite difficult conducting all the interviews on one specific day. Hence the semi-structured interviews took place over three days.

It was quite challenging to explain the concepts of flexibility and adaptability and clarifying their questions without giving them a biased view and thus influencing the way they responded.

**Outcomes from the interviews:**

The interviews yielded both positive and negative comments. The most frequent comments were directed at the size of the housing units. The participants mentioned how their families' had grown since they moved in and they were outgrowing the space as the space could not be altered to their present needs.

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The lack of cupboards and furnishing in the kitchens and bedrooms was seen as a major problem and could definitely be improved. Bathrooms were reported as very small and should have included a separate toilet cubicle. Balcony spaces in units which had them were regarded as a waste of space as they were too small and could not serve the purpose of a balcony. They mentioned how the balcony space could have been more beneficial if it was incorporated into the living rooms.

Of the four participants, two participants were very keen and eager to have the liberty to design their own internal housing unit space. The other participant said they were fine with not having to design their own housing unit as long as there allocated spaces were generous enough. The other participant was very indecisive and opted not to answer the question.

Additional to the semi-structured interviews, the participants were asked to select between three types of units which one they would prefer to stay in. The first type of housing unit was similar to the one they stayed in, where everything was predesigned and allowed no room for any physical internal adaptations. The second housing unit type made use of flexible and moveable internal wall partitioning for the bedrooms and living spaces but had a designated fixed kitchen and bathroom. The third housing unit type was in the form of a blank canvas where only the bathroom and kitchen were fixed and they were at complete liberty to design their internal unit space. This was very successful as it allowed the researcher more insight as to the type of housing they were comfortable with and why they selected the particular housing unit type. 50% of the participants selected the second housing unit type as they said it would be beneficial for them to adapt their housing units as their family structures change over the long-term. The other 50% of participants were keen on the idea of being handed a blank canvas to work with and design their units to ensure that they had houses which were specifically designed for their families.

### **General observations:**

The participants at Carr Gardens consisted of an older age group. Participants who had stayed there for a longer time were genuinely concerned with their housing units and having their families' spatial needs satisfied and felt confined in their present housing states.

**The informed consent forms and questionnaires are attached below.**

Appendices

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Participant 1

CARR  
GARDENS. (1)

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APPENDIX 2: INFORMED CONSENT FORM

1 Title of research project:

INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS

2 I AASHEA LORGAT hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.

3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed: alorgat Date: 17/3/2014

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: Xongile Muthambi Date: 17/3/2014

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APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 14 YEARS.  
\_\_\_\_\_  
\_\_\_\_\_
2. How many people stay in this housing unit and how long has each individual been staying here? 3 ADULTS.  
\_\_\_\_\_  
\_\_\_\_\_
3. Can you please describe the following;
  - a) The space. ABIT SMALL.  
\_\_\_\_\_  
\_\_\_\_\_
  - b) The size of the unit. I WOULD LIKE IT TO BE BIGGER, BECAUSE IT IS TOO SMALL.  
\_\_\_\_\_  
\_\_\_\_\_
  - c) The layout and design of the unit. THE LAYOUT AND DESIGN IS OKAY.  
\_\_\_\_\_  
\_\_\_\_\_
4. In your opinion, is anything lacking that could change or improve the housing unit? NOT AT THE MOMENT.  
\_\_\_\_\_  
\_\_\_\_\_

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why? DEPENDING ON THE SIZE OF THE FAMILY.

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain. BECAUSE IF MY SON GETS MARRIED AND HE WANTS TO LIVE WITH US THAN THE UNIT WILL BE TOO SMALL TO ACCOMMODATE ALL OF US.

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

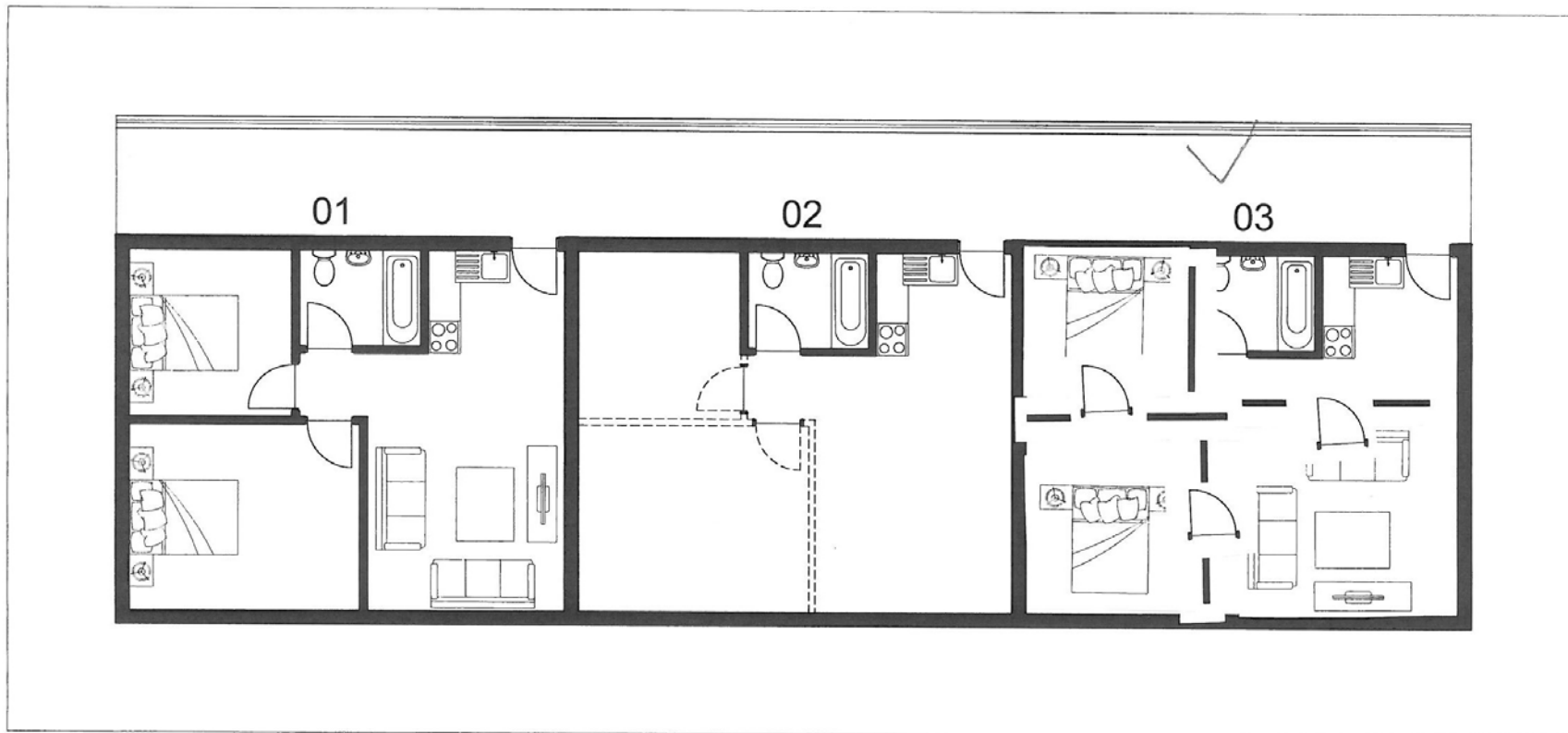
No

Why? SO THAT WE CAN DESIGN IT TO OUR STANDARD OF LIVING.

*Thank you for your time and co-operation.*

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CARZ  
GARDENS (1)



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Participant 2

CARR GARDENS. (2)

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APPENDIX 2: INFORMED CONSENT FORM

1 Title of research project:

**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I BLESSING KHUMALO ..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.


3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed:  Date: 17/03/2014

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher:  Date: 17.03.14

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APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 3 YEARS
2. How many people stay in this housing unit and how long has each individual been staying here? 4
3. Can you please describe the following;
  - a) The space. very small especially for a family. limited movement
  - b) The size of the unit. small and not spacious.
  - c) The layout and design of the unit. room for improvement. the bedrooms are small as well as the kitchen and bathing room or toilet.
4. In your opinion, is anything lacking that could change or improve the housing unit? definitely. I think the rooms could be a bit bigger for families and as well as add fitted cupboards or wardrobes in the bedrooms. as well as kitchen.



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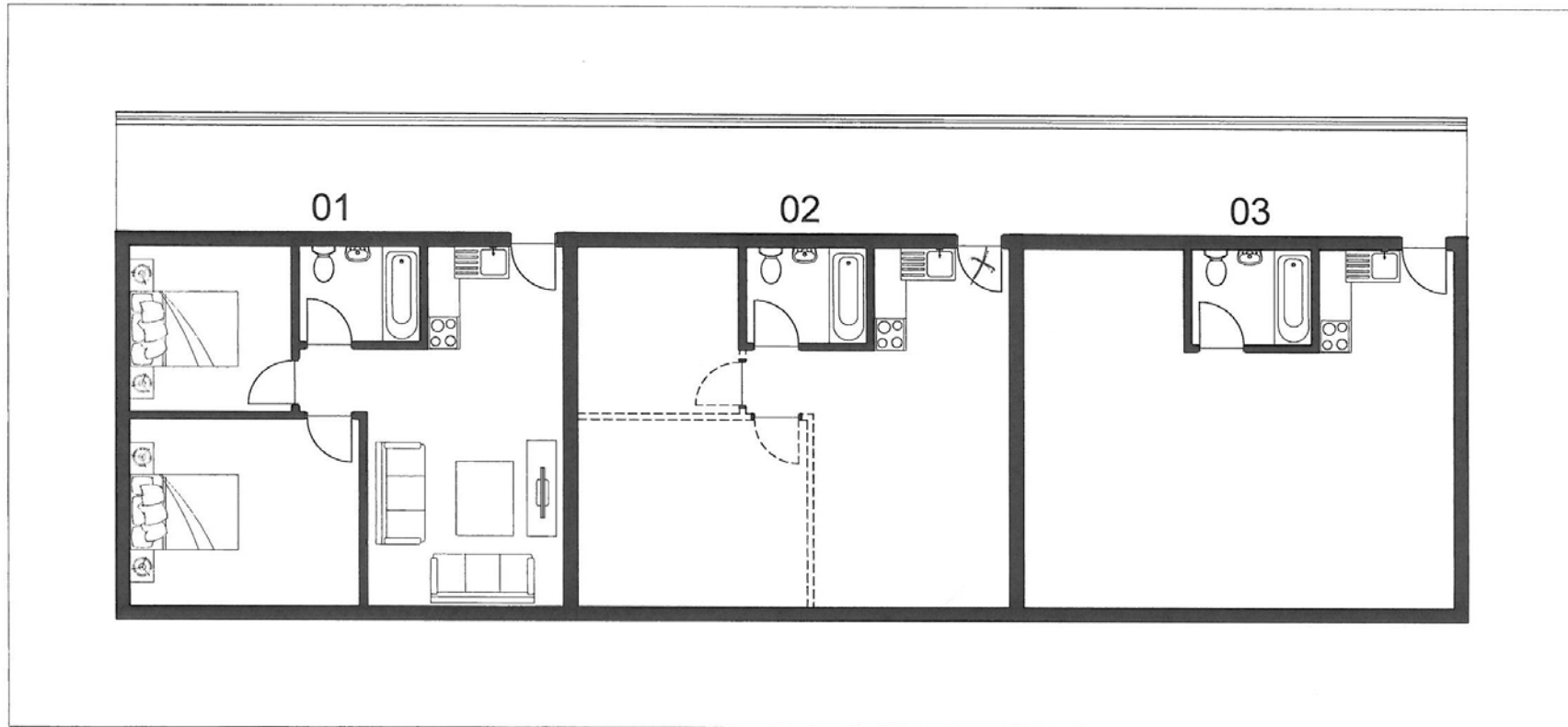
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5. Would you recommend the space to others with a similar profile as yours?  Yes  No  
Why? I have 2 kids and already I feel there are limited and confined in one space, but great for a person staying alone.
6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?  Yes  No  
Please explain. I find it difficult that they can make the rooms big, which is my major concern.
7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?  Yes  No  
Why? don't think its a case where I have to design but if they were a bit spacious then that would be great for me and my family

**Thank you for your time and co-operation.**

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CARR  
2.000 SQM (2)



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Participant 3

CARR GARDENS (3)

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APPENDIX 2: INFORMED CONSENT FORM

1 Title of research project:

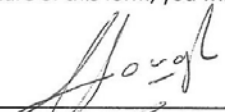
**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I KAREN HOUGH hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.

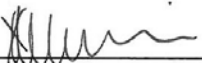
3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed:  Date: 18-03-2014

Witness:  Date: 18-03-2014

Researcher:  Date: 18-03-2014

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APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 8 YEARS
2. How many people stay in this housing unit and how long has each individual been staying here? 7 PEOPLE  
8 YEARS
3. Can you please describe the following;
  - a) The space. TO SMALL
  - b) The size of the unit.
  - c) The layout and design of the unit. 2 BED ROOMS, ONE BATHROOM (VERY SMALL)  
KITCHEN NO SPACES TO MOVE AROUND AND A SMALL SITTING ROOM
4. In your opinion, is anything lacking that could change or improve the housing unit? I WILL IMPROVE THE  
SPACE IN THE UNITS.

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

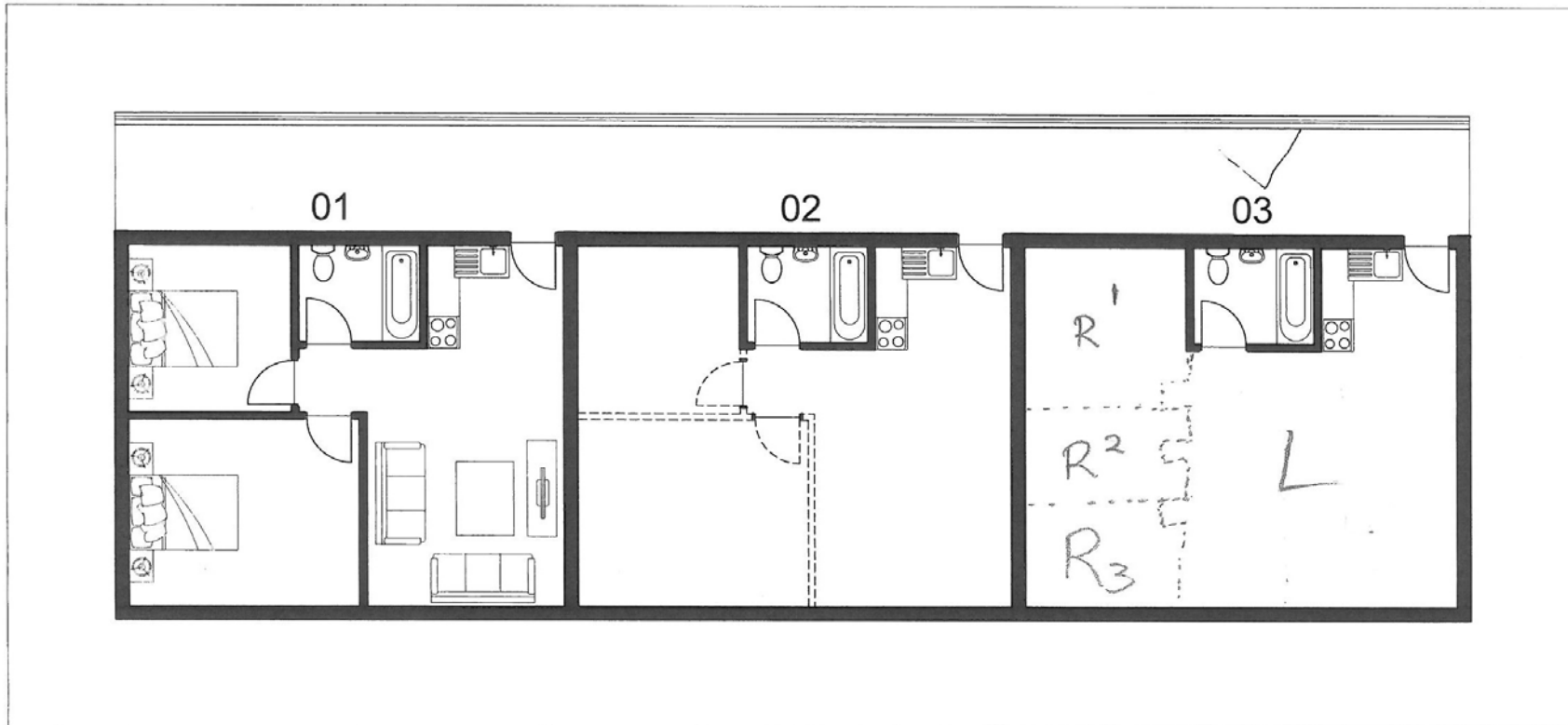
No

Why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*Thank you for your time and co-operation.*

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CARR  
GARDENS (3)



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Participant 4

CARR  
GARDENS (5)

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APPENDIX 2: INFORMED CONSENT FORM

1 Title of research project:


**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I Nomhle Gwaba hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.


3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed:  Date: 20/03/14

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher:  Date: 20.03.2014

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APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 14 years
2. How many people stay in this housing unit and how long has each individual been staying here? 3 people  
2 ppl - 14 years ; 1 - 11 yrs
3. Can you please describe the following:
  - a) The space. The space is small, but it's manageable for 2 people since I am not ready financially to buy a house.
  - b) The size of the unit. \_\_\_\_\_
  - c) The layout and design of the unit. 2 bedroom, open kitchen to the lounge, 1 bathroom with toilet.
4. In your opinion, is anything lacking that could change or improve the housing unit? The built-in cupboards and kitchen cupboards and toilet to be separate to a bathroom.



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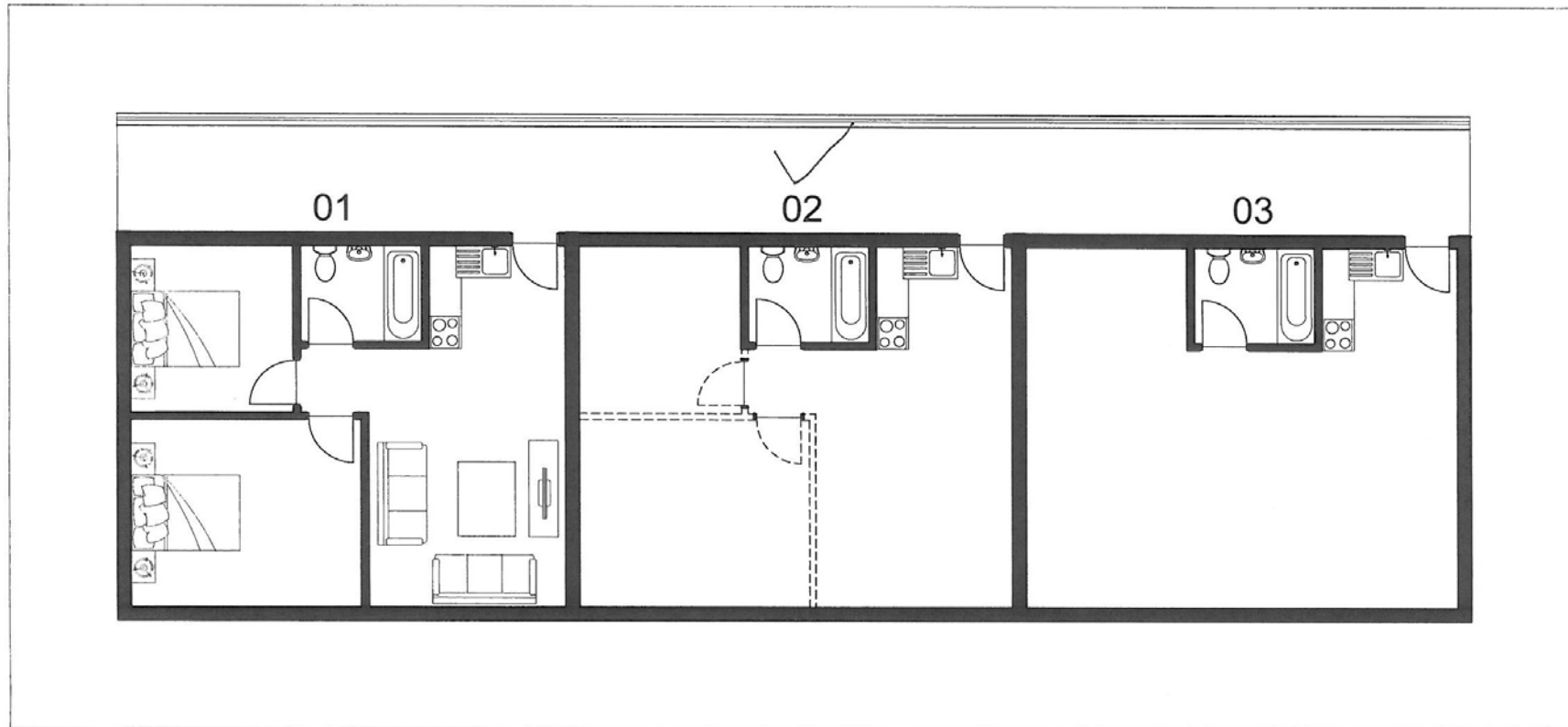
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5. Would you recommend the space to others with a similar profile as yours?  Yes  No  
Why? I can recommend to others if they can be able  
to maintain the space and they are 1st time buyers.
6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?  Yes  No  
Please explain. Because the family is growing and now the space  
is limited
7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?  Yes  No  
Why? At least to be able meet my needs and be the way  
I want and at affordable price.

*Thank you for your time and co-operation.*

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CARR  
GARDENS. (5)



## Inside the box | responsive design for diverse and changing households

### Process of gathering data through the semi-structured interviews at Brickfields social housing development

**Location:** Brickfields, Newton, Johannesburg

**Date:** 14 July 2014

**Time:** 16:00-18:00

**Intended number of participants:** 5 households/tenants

**Actual number of participants:** 5 households/tenants

#### **Brief overview of how the interview process:**

It was difficult to gain access into the social housing development to conduct the interviews. A rigorous process had to be followed with Johannesburg Housing Company. Once permission was granted, the process went quite smoothly as building manager recruited the participants. There was a bit of reluctance from other participants and others refused to take part in the interviews as they said “we are tired of these endless surveys which never materialize to anything”. The willing participants were cooperative and welcoming into their homes.

It was quite challenging to explain the concepts of flexibility and adaptability and clarifying their questions without giving them a biased view and thus influencing the way they responded.

#### **Outcomes from the interviews:**

The interviews yielded both positive and negative comments. The most frequent comments were directed at the size of the housing units. The residents thought the housing units were too small and could not fully meet their needs. On the other hand, certain participants felt that the housing units were

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sufficient for their current situations but stated that the units would not be suitable for their needs in the long-term perspective. When asked about the flexibility and adaptability of the housing units, all the participants pointed out that they would have liked to be able to adapt their housing units according to their needs.

The lack of cupboards and furnishing in the kitchens and bedrooms was seen as a major problem. Bathrooms were reported as very small and should have included a separate toilet cubicle. The participants with housing units which had balconies were unsatisfied with having the balcony spaces and said they would have rather had that balcony space being incorporated internally.

Additional to the semi-structured interviews, the participants were asked to select between three types of units which one they would prefer to stay in. The first type of housing unit was similar to the one they stayed in, where everything was predesigned and allowed no room for any physical internal adaptations. The second housing unit type made use of flexible and moveable internal wall partitioning for the bedrooms and living spaces but had a designated fixed kitchen and bathroom. The third housing unit type was in the form of a blank canvas where only the bathroom and kitchen were fixed and they were at complete liberty to design their internal unit space. This was very successful as it allowed the researcher more insight as to the type of housing they were comfortable with and why they selected the particular housing unit type. 40% of the participants selected the first housing type. When judged against their reasoning and their answers in the questionnaire, one can pick up conflicting view points. This can be attested to the uncertainty of what it would mean having an adaptable house. A further 40% undoubtedly were very keen on selecting the third housing type as they clearly pointed out how beneficial it would be for them if they could responsive houses which could without doubt satisfy their housing needs. The remaining 20% selected the second housing type. They indicated how being able to adapt their internal housing unit space would be beneficial to their families.

### **General observations:**

With the Johannesburg inner-city regeneration initiatives, the city dynamics have changed. With the close proximity that Brickfields has with Braamfontein and the numerous academic institutions around the area, there are younger people in the vicinity seeking accommodation. It was quite alarming at the

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number of young residents at Brickfields. This was also validated with 80% of the participants being young and upcoming families and individuals sharing the housing units.

### **General comments:**

Due to the concept of adaptability and flexibility in housing not being a common approach in the South African housing environment, the participants seemed unsure of what exactly it was and felt it was safer for them to opt for the unresponsive traditional housing stock which is already available. With a bit of explanation and creating scenarios of what that would entail, the participants seemed more willing and excited at the idea of having to design and personalise their housing units.

**The informed consent forms and questionnaires are attached below.**

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Participant 1

BRICKFIELDS

①

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APPENDIX 2: INFORMED CONSENT FORM

1 Title of research project:

**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I ..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.

3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed: \_\_\_\_\_ Date: 14/07/2014

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: \_\_\_\_\_ Date: 14.07.14

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Inside the box | responsive design for diverse and changing households

APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) Two years
2. How many people stay in this housing unit and how long has each individual been staying here? Five people  
and two years
3. Can you please describe the following;
  - a) The space. The space is fine
  - b) The size of the unit. Big
  - c) The layout and design of the unit. It's not okay, the sink doesn't work properly
4. In your opinion, is anything lacking that could change or improve the housing unit? Maintenance must be done regularly.

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why? It a nice place to stay in.

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain. Its not okay for the children, its very noisy.

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

No

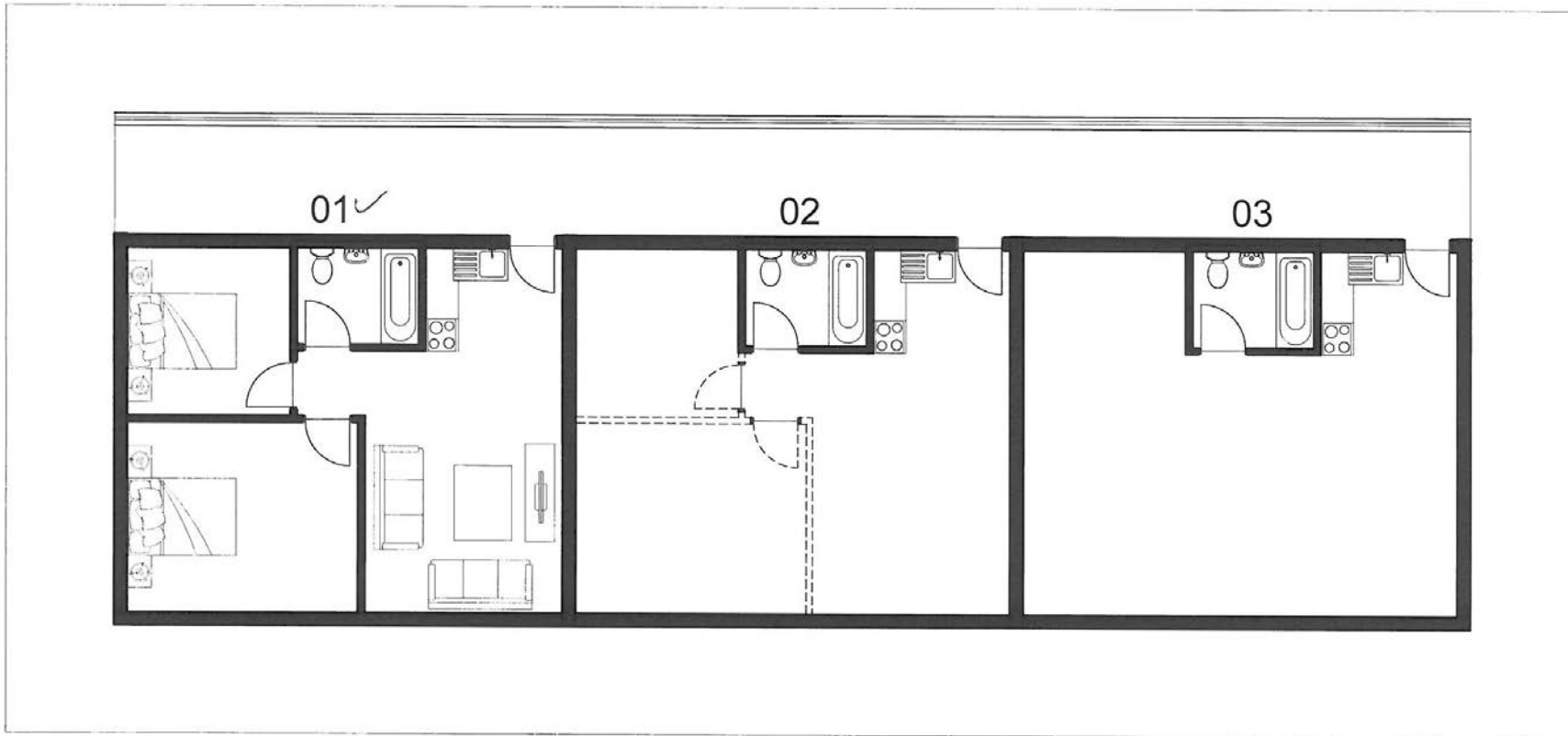
Why? Their layout is not okay, more especially the bathroom.

**Thank you for your time and co-operation.**



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BRICKFIELDS ①



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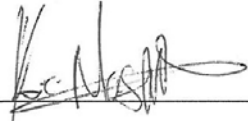
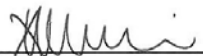
**Participant 2**

BRICKFELDS (2)

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**APPENDIX 2: INFORMED CONSENT FORM**

- 1 Title of research project:  
**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**
- 2 I ..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.
- 3 The nature, objective, possible safety and health implications have been explained to me and I understand them.
- 4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.
- 5 Upon signature of this form, you will be provided with a copy.

Signed:  Date: 14/07/2014  
Witness: \_\_\_\_\_ Date: \_\_\_\_\_  
Researcher:  Date: 14.07.2014

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APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 4 - years
2. How many people stay in this housing unit and how long has each individual been staying here? 3, I have been here for 3 years and one for a year.
3. Can you please describe the following:
  - a) The space. Its okay but very small.
  - b) The size of the unit. The unit is quite small for the rentals paid.
  - c) The layout and design of the unit. The design is beautiful but they should have atleast made a bathroom upstairs because its unpleasant to have to come down for a pee at night downstairs.
4. In your opinion, is anything lacking that could change or improve the housing unit? Yes, for starters we do not cupboards, we hang our clothes on a string, so it would have been better if they had at least tried to get us built-in cupboards.

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why? It is not user friendly especially for young people who want to start life.

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain. Unless if they will improve the living conditions and the interior of the building.

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

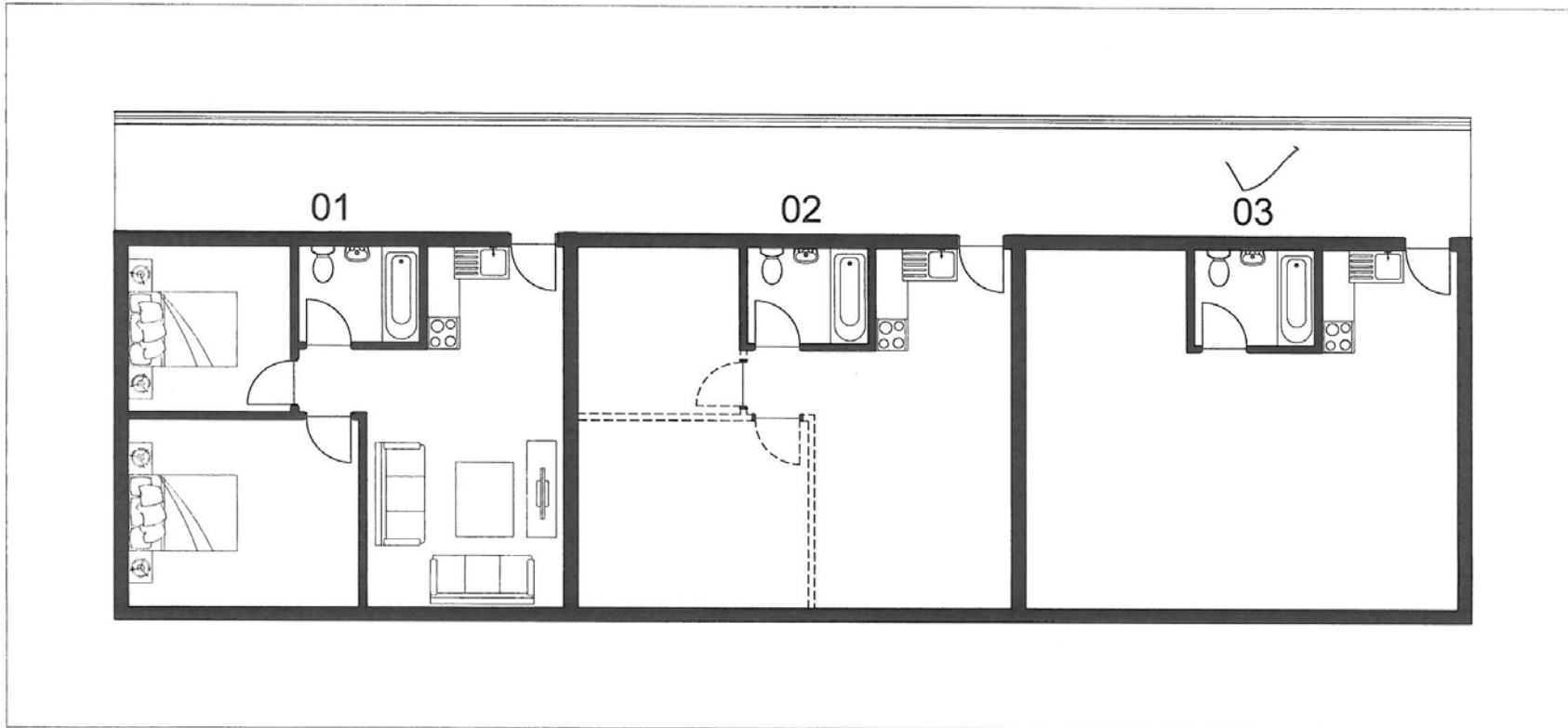
No

Why? At least then you would be staying in a place where you feel comfortable with the price where you are.

**Thank you for your time and co-operation.**

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BRICKFIELDS (2)



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Participant 3

BRICKFIELDS (3)

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APPENDIX 2: INFORMED CONSENT FORM

1 Title of research project:

**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I Nyika Nokeri..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.

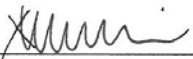
3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed:  Date: 14/07/14

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher:  Date: 14-07-14

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Inside the box | responsive design for diverse and changing households

APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 1 year 6 months
2. How many people stay in this housing unit and how long has each individual been staying here? 4 people.  
I just moved in don't have a month  
and the other 3 months
3. Can you please describe the following;
  - a) The space. The space is OK
  - b) The size of the unit. Also OK
  - c) The layout and design of the unit. 2 bedroom, bathroom, living room and kitchen
4. In your opinion, is anything lacking that could change or improve the housing unit? They could install some showers which could help  
save electricity

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why?

Because it has a great space and the environment is well off

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain.

Because eventually family requires a bigger space as we grow in numbers.

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

No

Why?

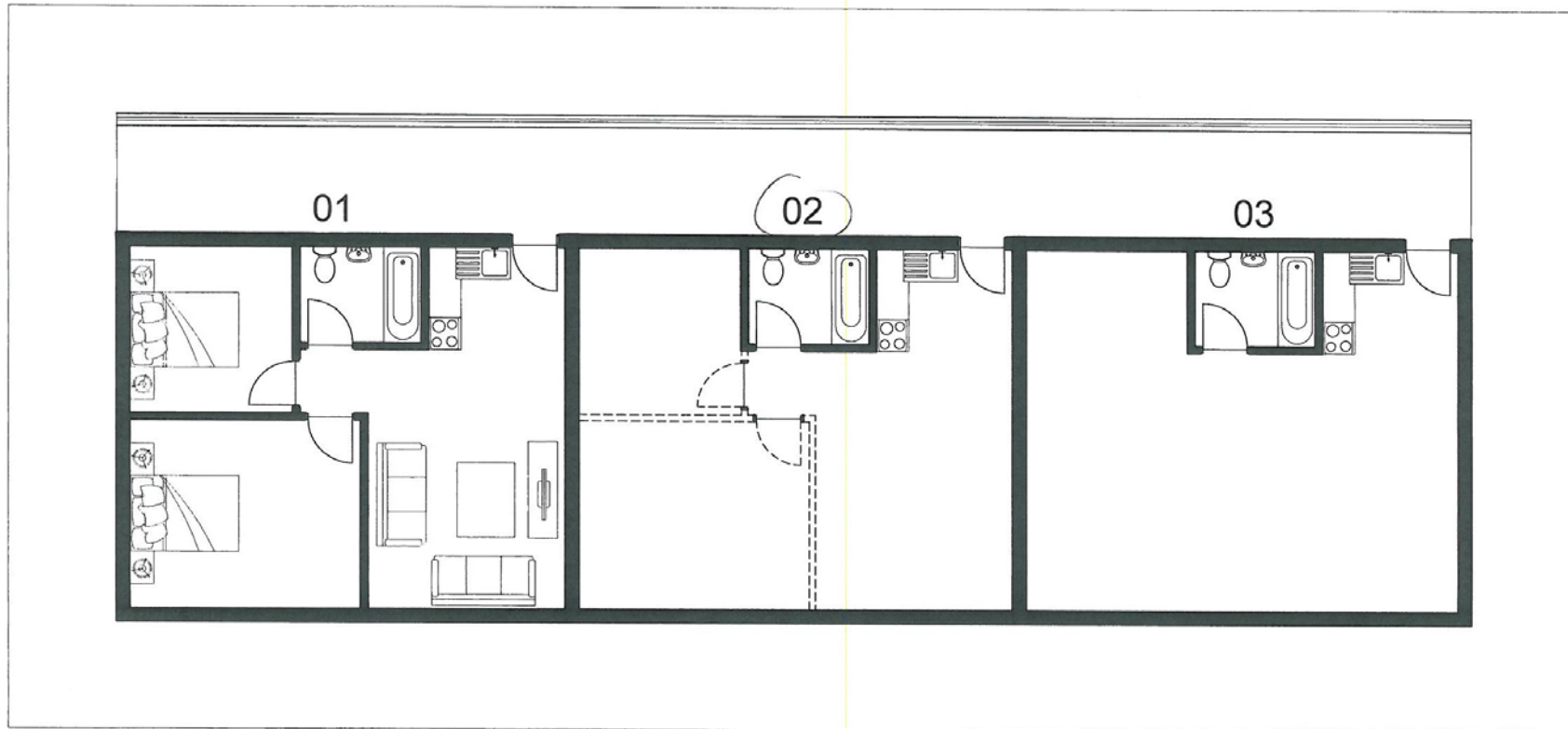
so that the unit is accommodative for my family

**Thank you for your time and co-operation.**



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BRICKFIELDS ③



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**Participant 4**

BRICKFIELDS

④

Inside the box | responsive design for diverse and changing households

**APPENDIX 2: INFORMED CONSENT FORM**

1 Title of research project:

**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I Lazola Mzimeli..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.

3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed: ~~XONGILE MUTHAMBI~~ Date: 14/07/2014

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: XONGILE MUTHAMBI Date: 14.07.14

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Inside the box | responsive design for diverse and changing households

APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) YEARS
2. How many people stay in this housing unit and how long has each individual been staying here? 4 people, others  
more than 4 years other 3 months
3. Can you please describe the following;
  - a) The space. Its enough for the number of us living here  
we not complaining
  - b) The size of the unit. Big enough for us
  - c) The layout and design of the unit. We need build in Corbords and walldrops.  
also need showers not bathing tubs. must fix intercoms  
because not everyday we have airtym.
4. In your opinion, is anything lacking that could change or improve the housing unit? Yes if they can have  
pool ~~er~~ maybe a place to gym it would improve a  
lot.

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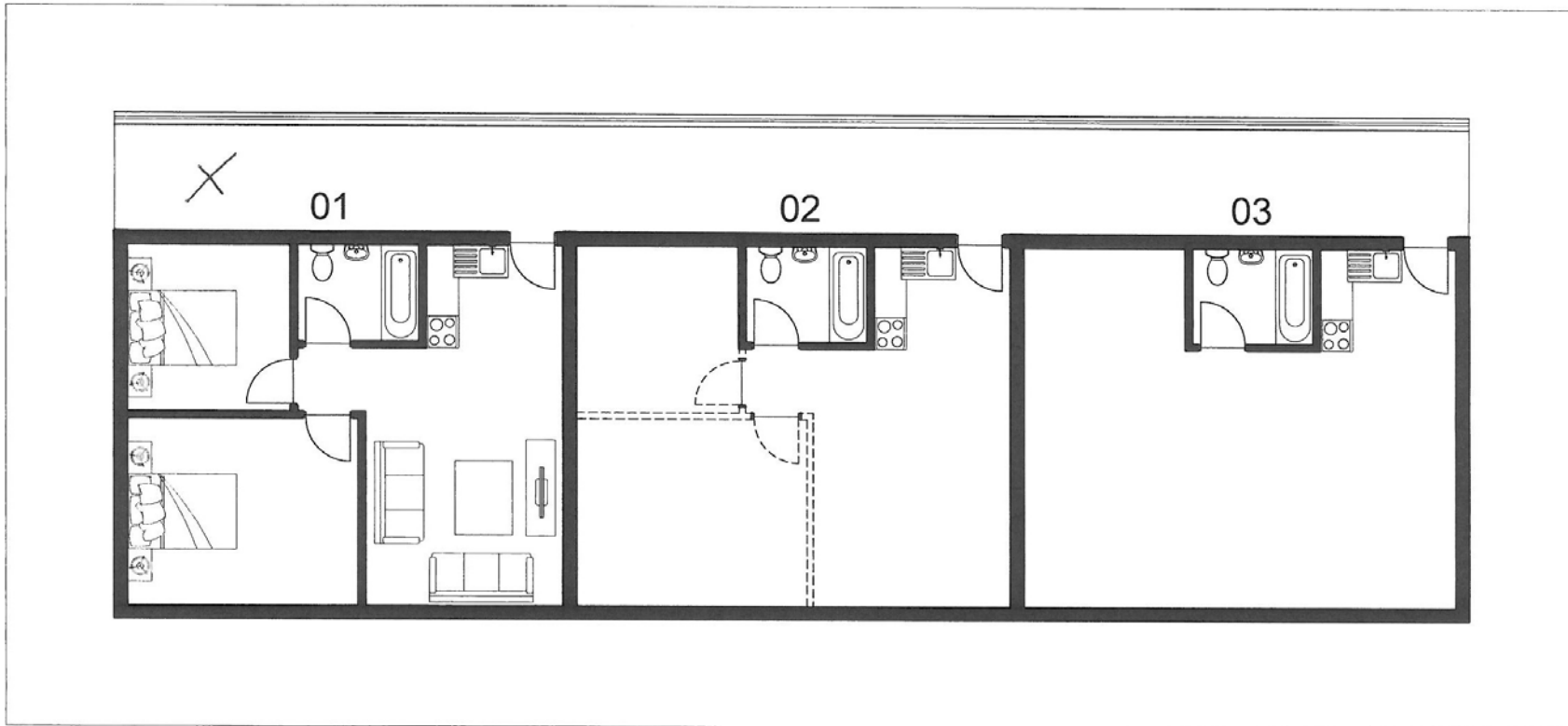
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5. Would you recommend the space to others with a similar profile as yours?  Yes  No  
Why? Because its not as bad as we think without  
those few things. those are just luxury things which  
we want not need.
6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?  Yes  No  
Please explain. Because they do clean the unit and make  
sure that everything is on point. so im sure they  
can maintain the standard.
7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?  Yes  No  
Why? Because some of the things we need/want they  
don't have but the rent that we pay is too much  
so we expect to have it all.

*Thank you for your time and co-operation.*

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**Participant 5**

BRICKFIELDS (5)

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**APPENDIX 2: INFORMED CONSENT FORM**

1 Title of research project:

**INSIDE THE BOX: RESPONSIVE DESIGN FOR DIVERSE AND CHANGING HOUSEHOLDS**

2 I ..... hereby voluntarily grant my permission for participation in the project as explained to me by XONGILE MUTHAMBI.

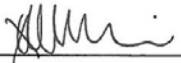
3 The nature, objective, possible safety and health implications have been explained to me and I understand them.

4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

5 Upon signature of this form, you will be provided with a copy.

Signed:  Date: 14/07/2014

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher:  Date: 14.07.14

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APPENDIX 1: INTERVIEW QUESTIONS

1. How long have you been renting the unit for? (Years/months/days) 1 year and 6 months -  
\_\_\_\_\_
2. How many people stay in this housing unit and how long has each individual been staying here? 2 - 1 year and 6 months  
\_\_\_\_\_  
\_\_\_\_\_
3. Can you please describe the following:
  - a) The space. The kitchen and lounge space is sufficient, the bedrooms are unequally divided considering that flats are occupied by single individuals most of the time rather than families with kids -
  - b) The size of the unit. Big enough to fit a family of 3 or 4  
\_\_\_\_\_  
\_\_\_\_\_
  - c) The layout and design of the unit. Layout is fine, its divided properly ~~is~~  
\_\_\_\_\_  
\_\_\_\_\_
4. In your opinion, is anything lacking that could change or improve the housing unit? CUPBOARDS!  
\_\_\_\_\_  
\_\_\_\_\_

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5. Would you recommend the space to others with a similar profile as yours?

Yes

No

Why? The level of class is proper, its clean, theres parking, affordable.

6. Do you think the housing unit will be able to still meet up to your family's requirements for space in the next five years or so?

Yes

No

Please explain. I don't think anyone in my profile would want to raise a family here, I wouldn't stay for more than 5 years.

7. In rental housing units, would you prefer to be able to design your own layout to your family's specific needs and requirements?

Yes

No

Why? You would want a place that'll suit your needs, if I'm gonna be raising a family here, firstly I'd need a ground floor unit, with a garden.

**Thank you for your time and co-operation.**



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BRICKFIELDS

5

