

Towards Adaptive Standards for Multi-Purpose Interior Design in Low-Cost Housing Projects in Kenya

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Abstract

The Kibera Soweto East Housing Project was developed under the Kenya Slum Upgrading Programme (KENSUP) whose main objective was to improve the housing conditions of the residents of Kibera through the construction of 822 low-cost formal houses. However, phase one did not take into consideration the adaptive standards for multi-purpose room occupancy as prescribed under the KS Building Code (2009 Edition), thus negatively impacting the recommended habitability standards of KENSUP. This study therefore sought to establish the adaptive standards for multi-purpose interior design in Kenya as well as assess the extent to which the Kenya Slum Upgrading Programme has applied them. The research design was the case study model where the research employed the collection and analysis of qualitative data obtained through examination of documents, interviews and observations. The study was carried out at Kibera Soweto East Housing Project, Kenya. When spaces created for low-cost housing are not up to standard as prescribed under the code, the quality of life of the residents living in these particular houses are negatively affected. The preliminary output of the research was the emergence of three necessary strategies for the improvement of future slum upgrading housing programmes, which include employment of the open plan concept by combining the living room and kitchen into one big space, elimination of corridors to create more space for other rooms and installation of sliding doors instead of hinged doors.

Keywords: Adaptive standards, Furniture layout, Low-cost housing, Multi-purpose.

INTRODUCTION

An adaptive standard for 'multi-purpose room occupancy' was first developed in Kenya as part of Code 92 by the Inter-Ministerial Task Force in 1992. It was later gazetted in 1995 as Code 95. The standard applying to a multi-purpose room (i.e. single room occupancy) was 10.50 square meters which has been carried forward to the current KS Code: Building Code of the Republic of Kenya (2009 Edition) (Republic of Kenya [ROK], 2009). These adaptive standards have been applied to single-storey tenements in several areas, but the Nairobi City Council has not sought to make use of this code, nor has the Ministry of Lands and Housing in the Kenya Slum Upgrading Programme.

Until September 2010, Kibera was considered as the second largest slum in Africa. The neighborhood is divided into 13 villages, including Mashimoni,

Laini Saba, Lindi, Kisumu Ndogo, Gatwekera, Kianda, Makina, Soweto East and Siranga. A UN-Habitat socio-economic record shows that Soweto East has 19,318 inhabitants spread out in four zones: A, B, C and D. Zone A is the largest in size with an area of 6.9 hectares and accounts for 37% of the houses in Soweto East. It has 876 structures and a population of 6,288. This therefore means that on average, each unit is occupied by seven people, which is a relatively high figure compared to the average size of a residential unit in Nairobi which has close to four occupants.

The Government of Kenya, in collaboration with UN-Habitat and other stakeholders, initiated the Kenya Slum Upgrading Programme (KENSUP) in 2004, which aimed to improve lives and livelihoods of people living and working in the slum areas through various initiatives and interventions. KENSUP's main objective was to improve the housing conditions of the residents of Kibera

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through the construction of 822 low-cost formal houses. The project was launched in 2012 and the handing over ceremony of the completed houses took place on the 8th of July 2016. The apartments comprised of a living room, bedroom(s), kitchen, bathroom and toilet. The area of the living room for the one-bedroom house was 8.12 square meters, while that for the two-bedroom house was 9.30 square meters. The area of the bedroom for the one-bedroom house was 7.56 square meters, while that for the two-bedroom house was 8.40 square meters. The area of the kitchen for the one-bedroom house was 2.66 square meters while that for the two-bedroom house was 2.94 square meters.

The objectives of the research were to establish the adaptive standards for multi-purpose interior design in Kenya, to assess the extent to which the Kenya Slum Upgrading Programme (KENSUP) has applied the adaptive standards for multi-purpose interior design in Kenya, and to recommend strategies for the total implementation of adaptive standards for the improvement of future slum upgrading housing programmes.

THEORY

KS Code: Building Code of the Republic of Kenya (2009 Edition)

A building code, also known as building regulations or controls, is a set of regulations that state the standards for constructed objects such as buildings and non-building structures. There exist a number of codes which specify these guidelines depending on different countries. Currently, the KS Code: Building Code of the Republic of Kenya (2009 Edition) is in force and is being regulated by the Local Government Authority. Its content was revised from the then Code 95 which was developed by the Inter-Ministerial Task Force in 1995. It proposes coming up with multi-purpose rooms and incremental houses that are more affordable for the low-income earners; a majority of whom have a large family size with an average member number of seven, unlike the middle-high income earners who have four members. The code aims to; standardize house and room sizes through reduction of building costs, encourage use of locally available resources and appropriate

technology, promote innovative designs, and put emphasis on performance and functionality (ROK, 2009).

The code is indeed vital in attaining sustainable, well-planned, safe, decent, healthy and affordable housing. For a successful model, building code legal status and capacity should be executed so that it's embraced by all the stakeholders in the building industry. Unfortunately, it has become outdated in the face of many changes and oppositions that have emerged in the industry; and truth be told, it only exists on paper as the reality on the ground is that many constructions have not adhered to it (Rukwaro, 2012).

Building codes should provide minimum standards that should be adhered to to ensure safety, building standards, security, and health of the property from all hazards that may occur to the structure. It should also increase growth, control and transform housing sector and make good use of the available local materials without any constraints. The steps towards execution, adoption and popularizing codes of practice plays a pivotal role in life span of its existence. They serve as an instrument of guiding and reforming the building sector in any economy (Habitat, 1995).

Multipurpose Room

The overall plan area of any multipurpose room shall not go below 10.50 square meters as illustrated in **Figures 1** and **2**.

Kitchen and bathroom

Every dwelling of more than two habitable rooms shall be provided with a kitchen having an area of not less than 3.30 square meters for plots up to 50 square meters, and 4.50 square meters for plots above 50 square meters, with the minimal horizontal dimension of which shall be 1.82 meters. Every kitchen shall have a ceiling to floor height of at least 2.43 square meters. Every kitchen shall be provided with a satisfactory means for cooking food, suitable sink, approved ventilation and lighting. In a dwelling having only one habitable room, there shall be provided properly distinct cooking place of nothing short of 3.23

square meters in area having a minimal dimension of 2.13 meters in height and 1.21 meters in depth. It shall have a sufficient outlet for fumes and smoke as well as be ventilated and lighted. The minimum requirement for bathroom in plots up to 50 square meters is 1.20 square meters, while that of above 50 square meters is 1.80 square meters as shown in **Figure 3**.

Windows

Every habitable room; kitchen, roofed latrine and bathroom, shall be provided with adequate number of windows opening to the external air so as to provide a clear lighting area equal to at least one-tenth of the floor area of such room, and of which at least one-twentieth of the floor area shall be capable of being opened.

Low-Cost Housing

Open plan space concept

The open plan space concept was first implemented into the interiors of low-cost housing in 1950 after the Second World War. This meant that the conventional division between rooms disappeared, either through elimination or reduction of interior walls. This was so that the living room, kitchen and dining room could occupy one free flow of space, running from the back to the front of the house as illustrated in **Figure 4**. The kitchen counter

could then be used as a transition space between the spaces. This therefore meant that the open plan space included a sitting area with sofa-beds and extendable dining tables to accommodate for guests, as well as a large pantry and island within a fully accessible kitchen. This meant that within the same space, one could entertain guests, watch television, work with a computer, use the telephone, relax, prepare meals and dine with friends and family (Ward, 2017).

Furniture layout

Fay (2005), states that the interior plans and layouts for low-cost housing should be kept simple, regular/standard and to a bare minimum so as to make the most of the available space and allow maximum repetition of interior elements such as fittings, fixtures and materials. This provides residents with the choice in the way they use space and arrange furniture with the aim of allowing their living patterns to be accommodated as their needs change over time. It also meets social needs by allowing inhabitants a degree of personal expression and it also ensures that housing has a long life. Lack of it, thereof, denies them the opportunities for self-expression resulting in isolation and stigmatization.

In the case of Dolphin House, the furniture for each type of room is organized in three different

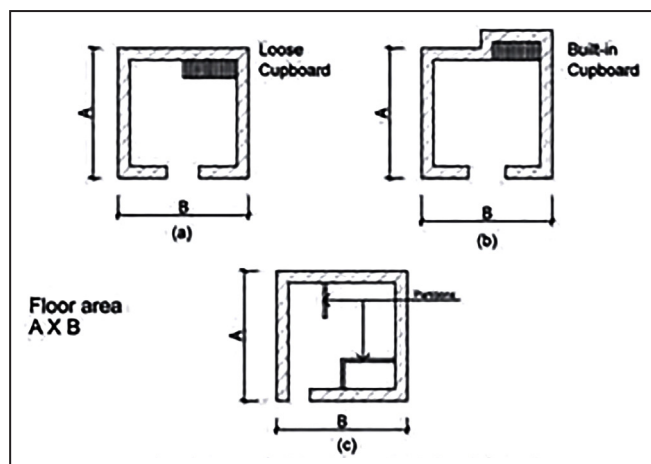


FIGURE 1
Measurement of floor plan
Source: Planning and Building Regulations 2009

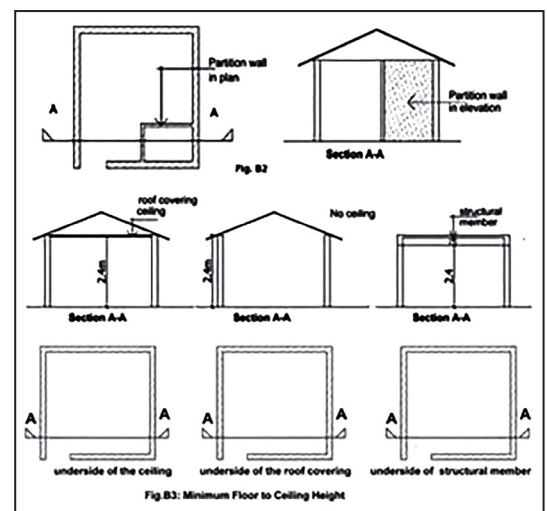


FIGURE 2
Partition wall and height of the room
Source: Planning and Building Regulations 2009

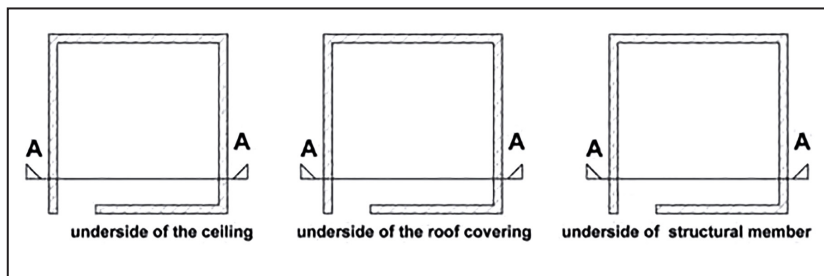


FIGURE 3

Minimum floor to ceiling height

Source: Planning and Building Regulations 2009



FIGURE 4

Open plan living space

Source: www.self-build.co.uk

configurations: circle, square, and line. Since floor and wall material can be customized, when multiple rooms are placed adjacent to each other and furniture styles are varied, room size, function, and materiality can be mixed throughout the house, generating a unique arrangement of rooms that can fit into almost any site condition. The systematic use of components allows users to fully control their spaces by deciding how to combine these parts to create a whole. Rather than piecing spaces together from various individual items at random, residents choose from cohesive units that, in conjunction with each other, create endless possibilities (Knezo, 2016).

Efficient interior spaces

MacDonald (1996), designed a number of affordable house prototypes, including a studio home for single people (single parents, retired widows/widowers, young people, unmarried workers and those leading a lonely and

unremunerated contemplative life'). This studio home is a single-storey building with a ground floor area of 18.2 square meters and a loft of 5.8 square meters (below the pitched ceiling) that can be used for storage, a bed space, or work area, depending on local regulations. The dwelling in the ground floor area has basic furniture including a sofa bed, dining table for two people, and a number of storage units and has a bathroom, walk-in storage space, a large living-sleeping space with kitchen joinery along one wall and a niche at one end in which a prefabricated fireplace can be installed. One of the strategies that have been employed to make the small space appear larger than it is, is having high ceilings of 2.6 meters. This highlights the importance of design, especially if construction costs are to be reduced by keeping floor area to a minimum.

Efficient interior spaces can also be archived by providing quality finishes and detailing. By restricting the overall square footage of a house, more resources can be budgeted towards the purchase of materials, improving the finish quality and detailing to make a house exceptional. Reducing the size of the house may also be a method to include some of the 'green' building products and materials that are pricier, such as natural granite countertops, linoleum, top-efficiency appliances, certified wood flooring, etc. Another strategy would be increased dwelling size, decreased housing specificity, allowance for change (walls to be removed, added or moved), provision of movable elements such as wardrobes, cupboards and walls and provision of developments containing a number of different types of units allowing residents to move as their needs change, such as children no longer live at home, etc. (Boehland & Wilson, 2005).

Multi-purpose interior spaces

Multi-purpose interior spaces are those spaces which can be used in a variety of ways; generally without making any physical changes. This is primarily through the way the spaces are organized, the designation of rooms and the circulation patterns. Boehland & Wilson (2005) suggest combining functions of different rooms for space optimization. For example; combining a home office with a guest bedroom and provision for both music functions and television viewing in the living room. Hartany & Le (n.d) developed the Gio Ponti Project as shown in **Figure 5**, with the idea of a single space that is surrounded by vital minimum of services, that is, cookerys and washrooms that are thrust to opposite sides of the single large space. A series of angle sections of wall provide the connecting point for concertina panels. These walls allow the creation of different connections between different areas and maintain the aspect of them being multi-purpose.



FIGURE 5
The Gio Ponti Project
Source: www.pinterest.com

Van der Rohe, one of the pioneers of modernist architecture, achieves multi-purpose in interior spaces by only building the circumference walls and two columns- which hold the ceiling- and the rest of the space is as open as it can be. Van der Rohe proceeds to produce cheap plywood walls then later designs the cookery and washroom as immovable rooms and the rest of the space as varying dwelling space so that he is able to

split these spaces according to the needs of the occupants. This would also have advantages insofar as it would provide the likelihood to change the layout of a unit according to changes within a family, without large modification costs. Any joiner or down-to-earth laymen would be in the position to shift walls (Till & Schneider, 2005).

RESEARCH METHODS

The research design adopted by this study was a case study. Case studies are in-depth analysis and descriptions of a system or single unit, for example, individuals, events or groups, held up by time and space (Hancock & Algozzine, 2016). The case study model was applied since the researcher sought to investigate if at all the sizes of the interior spaces of the Kibera Soweto East Housing Project have attained the adaptive standards for multi-purpose room occupancy in low-cost housing projects in Kenya. Insights and results from this case study will then be used to recommend strategies for the total implementation of adaptive standards for the improvement of future slum upgrading housing programmes (Mwituria, 2018).

In this study, critical analysis was done on existing resources, such as government policies, guidelines and reports on the Kibera Soweto East Housing Project and notes derived from them as well (Prior, 2003). Information in journals, conference proceedings, books and media publications on adaptive standards for multi-purpose interior design, both in Kenya and worldwide, were also looked at in detail.

The population for this study mainly consisted of the residents living in Soweto East, Zone A, whose population was estimated to be around 5,900 (UN-Habitat, 2008b). Several professionals, who included electrical engineers, architects, plumbers, contractors, mechanical engineers and quantity surveyors, were also involved in the study. Purposive sampling was used to identify professionals involved in the project. They included Architect Koech, Quantity Surveyor Busei, Engineer Mutalanga, Engineer Wambugu, Contractor Muthinga, Engineer Koech and Plumber Karago.

Stratified random sampling design was used to come up with a proper representation of the residents. Population was grouped into 2 strata, that is, residents who live in the one-bedroom houses, which number 570, and two-bedroom houses, which number 144. Simple random systematic sampling was then applied to each stratum. It was the preferred option since every resident had an opportunity of being sampled (Frankfort-Nachmias & Nachmias, 1996). The sampling unit was selected randomly using a table of random digits. 101 residents was the desired sample in this study with 81 residents interviewed from the one-bedroom stratum and 20 residents interviewed from the two-bedroom stratum. Therefore, drawing from Mulcahy and Chu (2009); $K=N/n$ where K represents the sampling interval, N represents the population to be studied and n represents the desired population. Thus, for the one-bedroom house; $K=570/81$, $K=7$ and two-bedroom house; $144/20$, $K=7$. Every seventh house of each stratum was selected for inclusion in the sample, and one resident interviewed from each household. The sampling distribution can therefore be presented as indicated in **Table 1**.

Semi-structured interviews were conducted so as to obtain first-hand information and reactions from the residents in regards to the size of their interior spaces. Interviews are helpful to explore beliefs, occurrences, thoughts or views on particular issues. Reports can be explored and differentiated with others to develop an appreciation of the fundamental structures of beliefs (Mwituria, 2018; Green & Thorogood, 2010). A total of 101 interviews were conducted among the residents. 7 professionals were also interviewed. This then brought the total number of respondents interviewed to 108. This was indeed of great importance to the research as it helped the researcher understand what the real issues were and get suggestions directly from the

residents on how to upgrade the interior spaces of these housing units meant for the low-income earners. The professionals interviewed also helped understand how the low-cost housing project was conceptualized, implemented and the results thereof.

Observations were made in 10 different houses. Observation may be participant observation or non-participating observation such as using ethnography or video recordings where one participates, openly or covertly, in the daily lives of people for a long time period; listening to what is being said and watching what happens (Hammersley & Atkinson, 2007). The various aspects that were observed during the research include furniture layouts, different activities/functions carried out within a particular space, circulation and movement of people and human interaction with the different objects. Listening attentively to the residents as they went about their business was also important as it helped the researcher understand to what extent they appreciated their interior spaces.

Qualitative analysis was employed during the study to analyze non-empirical data derived from in-depth interviews which were analyzed thematically. For each set of the data, a different code sheet was generated with an effort to determine and explain the relationships and patterns of the responses. This was done systematically so as to come up with meaningful recommendations and conclusions for the research undertaken (Mwituria, 2018; Mugenda & Mugenda, 2003).

RESULTS

Respondents responses on the interior spaces

From the responses received from the respondents,

TABLE 1: Sample frame

Size	Residents	Professionals	Total
Population	5,900	7	5,907
Sample	101	7	108

Source: Field survey 2019



63.9% of them suggested for more open spaces, especially between the living room and kitchen, while 29.6% were okay with how the rooms were currently. 6.5% were not sure.

Multi-purpose spaces

52.8% of the respondents interviewed preferred spaces where they could carry out more than one function. Taking the example of the bedroom, in addition to it being a place for sleeping, children can also use it as a study space. In addition to the kitchen being a place where people prepare meals, it can be a space where a family dines together. 35.2% preferred carrying out specific functions for which the different rooms are designated while 12.0% did not know about the idea of the spaces being multi-purpose or not.

Functional furniture pieces

Of the 101 residents of the Kibera Soweto East Housing Project interviewed, 71.3% of them stated that they had furniture pieces in their spaces that were not functional, 16.8% had functional furniture while 11.9% were not sure if they were functional or not.

Actual space sizes

The one-bedroom house occupies an area of 38.44 sq. m. as illustrated in **Figure 6** while the two-bedroom house occupies an area of 69.16 sq. m. as illustrated in **Figure 7**. Each room in the house is clearly distinct and separated from each other with floor to ceiling concrete wall of height 2400mm. The area of the living room for the one-bedroom house is 8.12 sq. m. while that of the two-bedroom house is 9.30 sq. m. The area of the bedroom for the one-bedroom house is 7.56 sq. m. while that of the two-bedroom house is 8.40 sq. m. The area of the kitchen for the one-bedroom house is 2.66 sq. m., while that of the two-bedroom house is 2.94 sq. m. as shown in **Figure 8**.

The area for both the bathroom and toilet is 1.68 sq.m. and the separation between these two rooms allows for people to use them at the same time. The area of the balcony for the one-bedroom house is 2.80 sq.m. while that of the two-bedroom house is 1.40 sq.m. The walkway distance for both the



FIGURE 6
One-bedroom floor plan
Source: Author's construct 2018

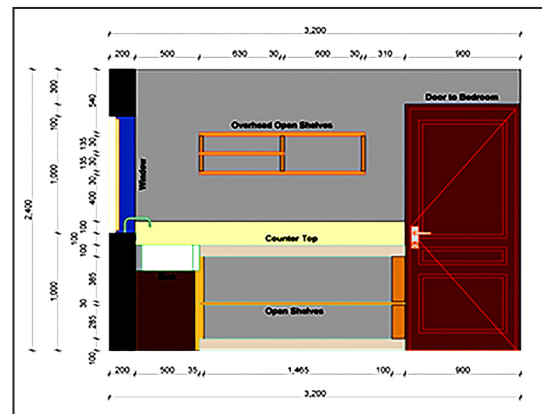


FIGURE 7
Two-bedroom floor plan
Source: Author's construct 2018

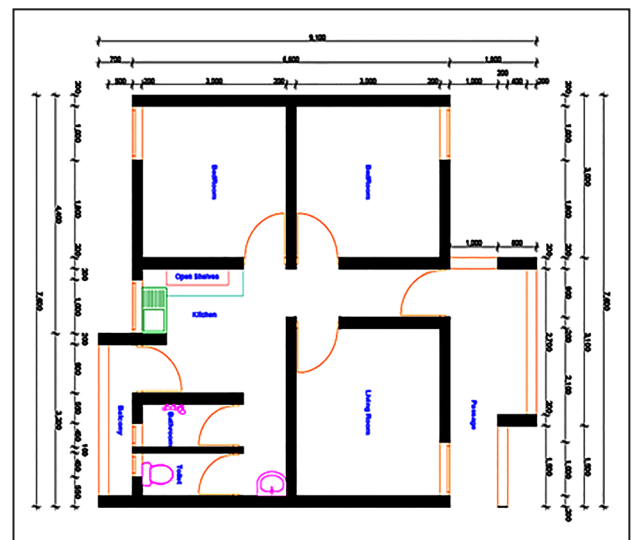


FIGURE 8
Kitchen shelving particulars
Source: Author's construct 2018

one-bedroom and two-bedroom house is 900mm. Windows have a standard height and width of 1000mm as well as a distance of 1000mm from the floor. The doors have a height of 2100mm and width of 900mm. Sanitary ware is provided with a shower kit in the bathroom, a wash closet in the toilet and wash basin in the corridor. Tiles have been installed on the floor and walls of the bathroom as well as on kitchen countertops. Countertops with inbuilt sink and dryer have been installed in the kitchen. Open wall mount cabinet has been provided in the kitchen allowing one to modify them in the best way that accommodates their lifestyle as illustrated in **Figure 8**.

Non-functional furniture pieces in living rooms

Out of the ten analyzed houses, 80% had furniture pieces that were either partly or fully non-functional while 20% of them had all their furniture pieces fully functional.

Dead spaces in living rooms

Out of the ten analyzed houses, 50% had dead spaces while 50% had all the spaces inside the room fully utilized.

Insufficient space in living rooms

Out of the ten analyzed houses, 60% had insufficient spaces while 40% had sufficient spaces.

Insufficient space in bedrooms

Out of the ten analyzed houses, 80% had insufficient spaces while 20% of them had sufficient spaces.

DISCUSSION

Individual interior spaces

As prescribed in the KS Building Code 2009, the overall plan area for any multi-purpose room in low-cost housing shall not be less than 10.50 sq.m. As for the Kibera Soweto East Housing Project, the area of the living room for the one-bedroom house is 8.12 sq.m., while that for two-bedroom house is 9.30 sq.m. This falls short of the recommended adaptive standards by 2.38 sq.m. for the one-bedroom house and 1.20 sq.m. for the two-bedroom house. This affects the living standards

in that, in an ideal setting, the living room of the one-bedroom house can only accommodate two furniture layouts, while that of the two-bedroom house can only accommodate three furniture layouts while maximizing on space. One furniture layout for the one-bedroom living room can only accommodate seven furniture pieces and a sitting capacity of five people, while the other layout can only accommodate nine furniture pieces and a sitting capacity of four people. This is indicated in **Figures 9 and 10** respectively.

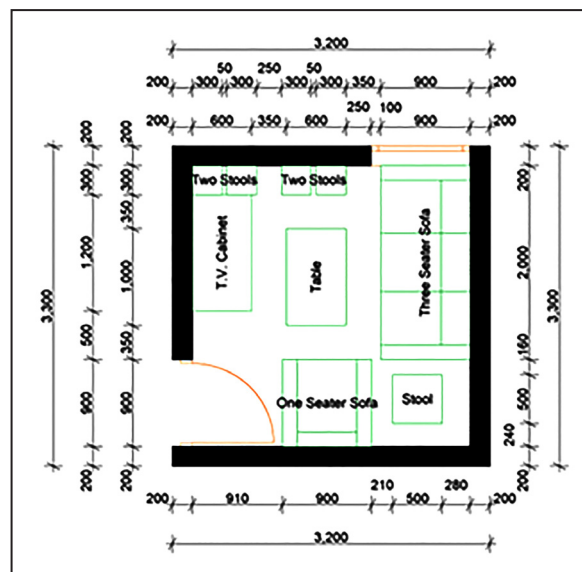


FIGURE 9

One-bedroom- living room furniture layout one
Source: Author's construct 2018

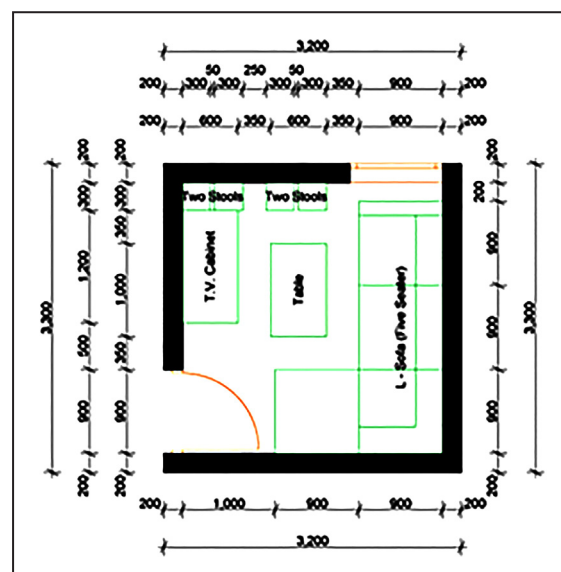


FIGURE 10

One-bedroom- living room furniture layout two
Source: Author's construct 2018

As for the two-bedroom house, the living room can only accommodate three furniture layouts. The first layout accommodates three significant furniture pieces and a sitting capacity of six people, the second layout accommodates three significant furniture pieces and a sitting capacity of five people, while the third accommodates three significant furniture pieces and a sitting capacity of five people; all illustrated in Figures 11, 12 and 13 respectively.

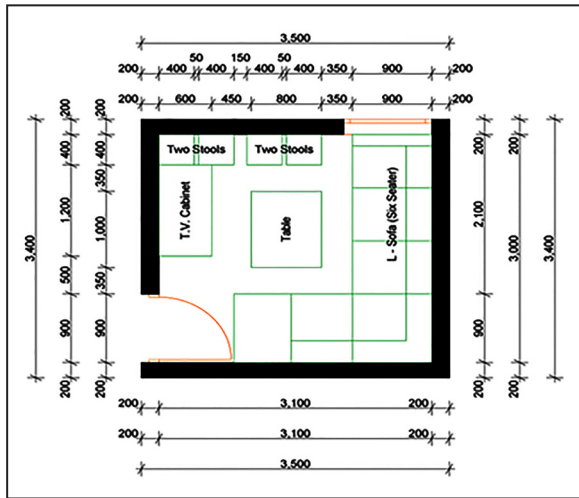


FIGURE 11
Two-bedroom- living room furniture layout one
Source: Author's construct 2018

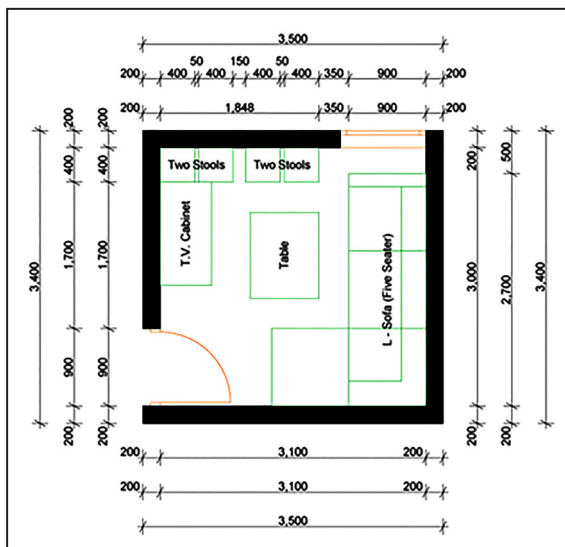


FIGURE 12
Two-bedroom- living room furniture layout two
Source: Author's construct 2018

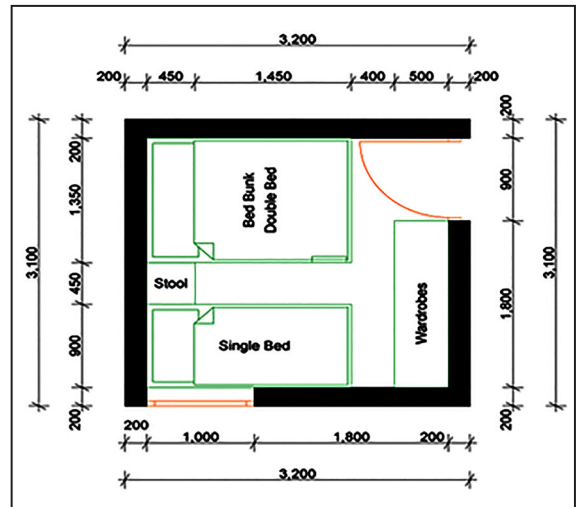


FIGURE 13
Two-bedroom- living room furniture layout three
Source: Author's construct 2018

The area of the bedroom for the one-bedroom house was 7.56 sq. m., while that for two-bedroom house was 8.40 sq.m. This falls short of the recommended standards by 2.94 sq.m. for the one-bedroom house and 2.10 sq.m. for the two-bedroom house. This also affects the living standards in that, in an ideal setting, the bedroom for the one-bedroom house has only one furniture layout that accommodates three significant furniture pieces and a sleeping capacity of five people as illustrated in Figure 14, while that of the two-bedroom house had only two furniture layouts. The first layout accommodates three significant furniture pieces and a sleeping capacity of four people while the second layout accommodates three significant furniture pieces and a sleeping capacity of six people as illustrated in Figures 15 and 16 respectively.

In the case of the bathroom, the KS Building Code 2009 states that the minimum requirement for bathrooms in plots that are 50 sq.m. and below is 1.20 sq.m., while for those which are above 50 sq.m. is 1.80 sq.m. The one-bedroom for the Kibera Soweto East Housing falls under the category of those plots which are under 50 sq.m. since it occupies an area of 38.44 sq.m. The two-bedroom house falls under the category of those plots which are above 50 sq.m. since it occupies an area of 69.16 sq.m. The area of the bathroom for both the one bedroom and two-bedroom house

is 1.68 sq.m. This falls short of the recommended standards by 0.12 sq.m. for the two-bedroom house.

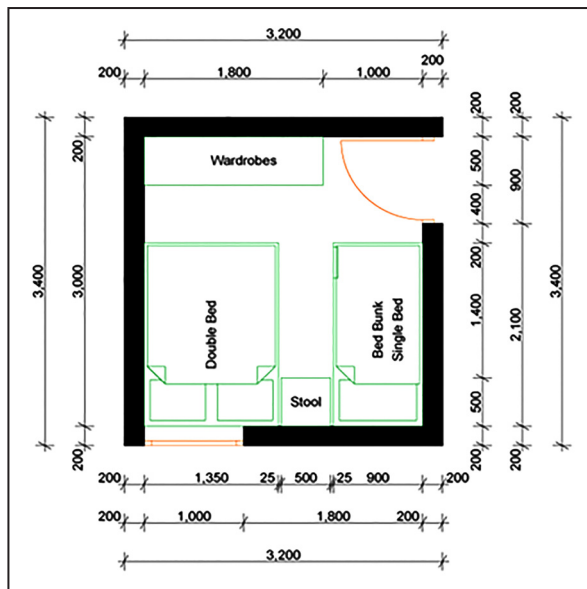


FIGURE 14
One-bedroom- bedroom furniture layout
Source: Author's construct 2018

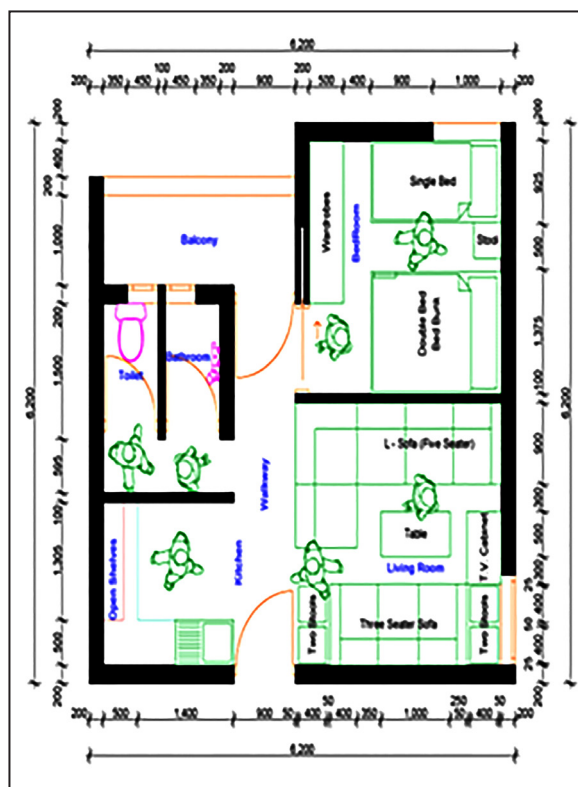


FIGURE 16
Two-bedroom- bedroom furniture layout two
Source: Author's construct 2018

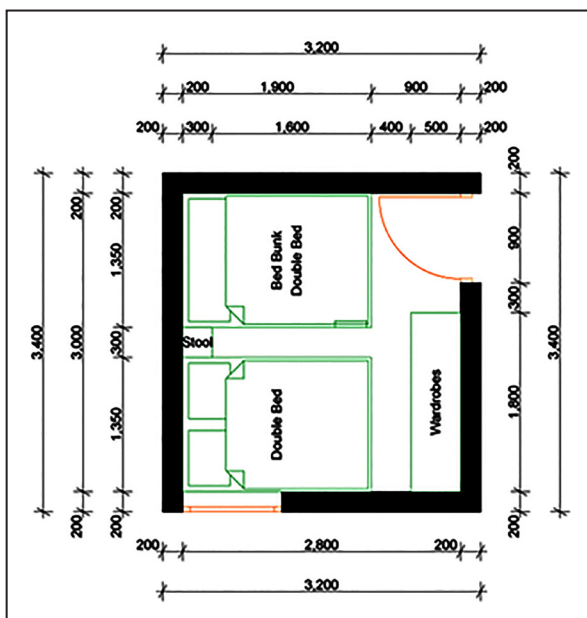


FIGURE 15
Two-bedroom- bedroom furniture layout one
Source: Author's construct 2018

CONCLUSION

One of the ways that the government is using to elevate the poor in the slum areas is through the construction of housing units meant for the low-income earners. This is achieved through various initiatives such as the Kenya Slum Upgrading Program (KENSUP). However, during construction a lot of focus is placed on constructing these houses with the least amount of materials to ensure that the project takes up the least finances. With this in mind, they end up creating small spaces that are not up to standard as prescribed in the KS Building Code 2009. The area sizes of the specific spaces are therefore reduced significantly, in turn limiting the number of furniture layouts, furniture pieces, sitting and sleeping capacity, as well as the number of tasks and functions that can be carried out within a particular space. This then beats the sole reason why the Code was put in place; which was to provide adequate, affordable, sustainable, well-planned, safe, healthy, decent and quality low-cost housing. This then negatively affects the living standards and quality of life of residents.

RECOMMENDATIONS

From the research preliminary results, there's clear evidence that most of the standard area sizes for specific rooms in low-cost housing, as prescribed in KS Building Code 2009, have not been adhered to. However, the adaptive standards for multi-purpose interior design in low-cost housing projects in Kenya can be attained through a number of interior modifications that do not interfere with the exterior structure of the building. One would be to employ the open plan concept by combining the living room and kitchen into one big space as shown in **Figures 17, 18, 19** and **20**. The kitchen counter top would then be used as a partial divider between the two spaces. One of the factors that necessitated the coming up with the space standard sizes under the Code was to create room for innovative design concepts. The open plan space concept is indeed one of them as it enables the room areas to attain the set sizes. This concept allows for different furniture layouts which brings about well-planned spaces as well as performers of different tasks and functions within a particular space which also enhances performance and functionality; factors which contributed to coming up with the standards under code.

The corridors should be eliminated to create more space for other rooms as indicated in **Figures 17, 18, 19** and **20**. The entrance door should be moved to the living room and the doors to the bedroom share the same wall as that of the living room and kitchen. The space created should then be distributed to the other rooms, hence creating more space. This would increase the distance between two furniture pieces, hence easing circulation and therefore create safe interior space. It would also bring about the accommodation of a variety of furniture layouts and interior space configuration which results in well-planned interior spaces. This allows residents to modify their interior spaces since their lifestyle, needs and wants tend to change rapidly over time.

Sliding doors should be installed instead of hinged doors as indicated in **Figures 17, 18, 19** and **20**. The extra space created can then be used either for more storage or other functions. The interior spaces would now also accommodate more or larger pieces of furniture, which would then

accommodate better or a greater number of family members. This would raise the living standards as most people in the slums have large families.

With these changes in effect, the living room's area for the one-bedroom house would increase from 8.12 sq.m. to 11.31 sq.m., which is higher than the prescribed 10.50 sq.m overall plan area for any multi-purpose room. This would result to the sitting capacity increasing from a five to an eight seater space, while the number of furniture pieces to be incorporated would increase from seven to eight as indicated in **Figure 17**. The living room's area for the two-bedroom house would increase from 9.30 sq.m. to 12.9 sq.m., which is higher than 10.50 sq.m. This would result to the sitting capacity increasing from a six to a nine seater space while the number of significant furniture pieces to be incorporated would increase from three to eight. The number of furniture layouts would increase from three to four as indicated in **Figures 18, 19** and **20**.

For the two-bedroom house, the area of the bedroom would increase from 8.40 sq.m. to the highest square meter being 12.60 sq.m., which is greater than 10.5 sq. m. as illustrated in **Figure 20**. This would result to the sleeping capacity space increasing from six to a nine while the number of furniture pieces to be incorporated would increase from four to six. The number of furniture layouts that residents can work with would increase from three to four as indicated in **Figures 18, 19** and **20**.

The kitchen area for the one-bedroom house would increase from 2.66 sq.m. to 3.42 sq.m., which is higher than 3.30 sq.m. for plots up to 50 sq.m. as indicated in **Figure 17**. For the two-bedroom house, it would increase from 2.94 sq.m. to 5.40 sq. m., which is higher than 4.50 sq. m. for plots above 50 sq.m. as shown in **Figures 18, 19** and **20**. The bathroom area for the two-bedroom would be 1.84 sq.m from 1.68 sq.m., which is higher than the recommended area of 1.80 sq.m. as indicated in **Figures 18, 19** and **20**.

This study is of great importance since the recommended building standards will be applied to the other housing units that the government

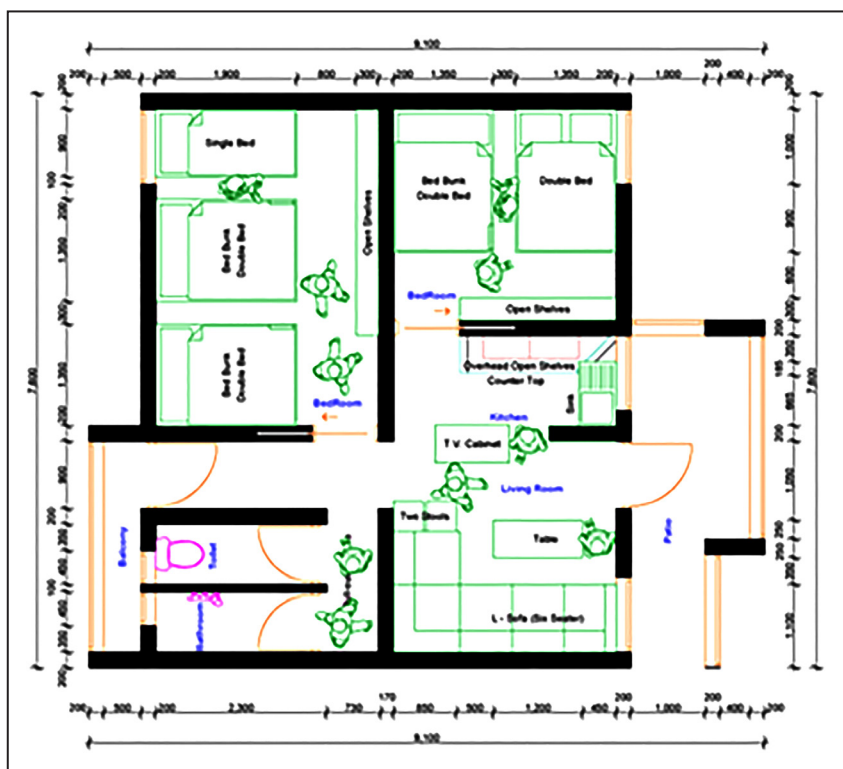


FIGURE 17
One-bedroom house floor layout plan
Source: Author's construct 2018

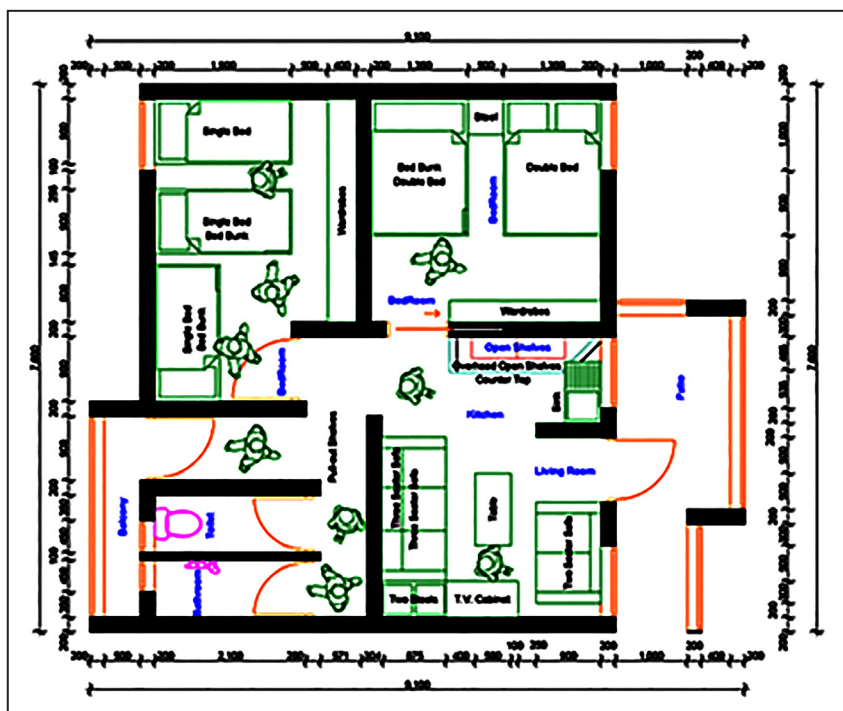


FIGURE 18
Two-bedroom house floor layout plan option plan one
Source: Author's construct 2018

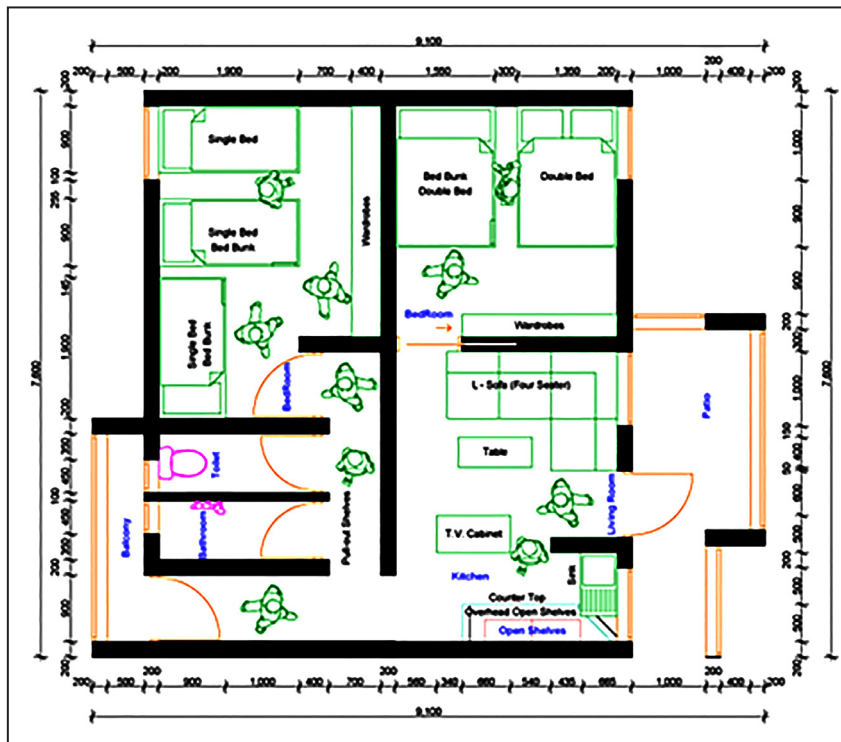


FIGURE 19
Two-bedroom house floor layout plan option plan two
Source: Author's construct 2018

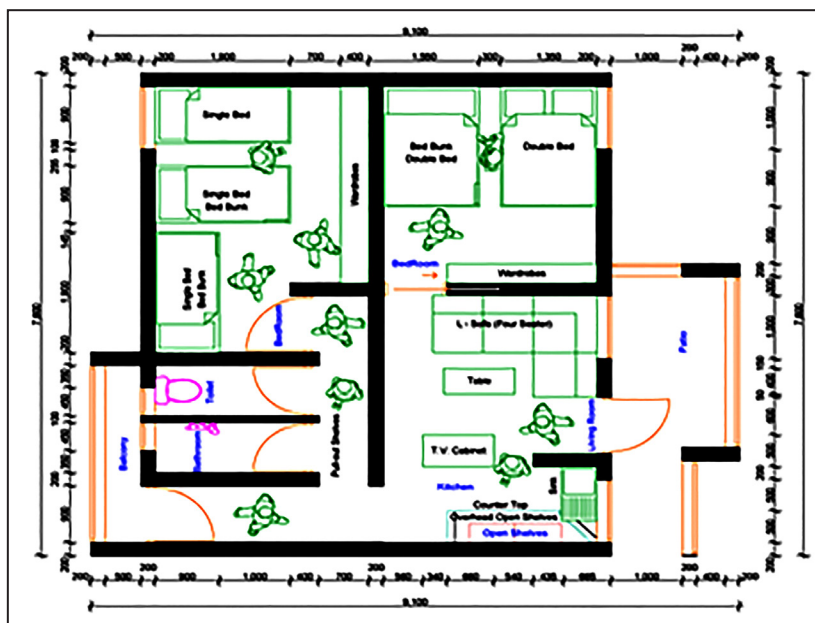


FIGURE 20
Two-bedroom house floor layout plan option plan three
Source: Author's construct 2018

seeks to construct in Zone B, C and D of Soweto East, Kibera. It may also act as a guideline to be used by the government and private sector when coming up with future projects for low-cost housing in other parts of the country. In the long run, this will see an improvement of quality of life and living standards, of not only the residents of Soweto East Zone A, but of other Kenyan citizens.

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