

## Habitability Study on Low-Cost House Design of Modern and Traditional Mid-rise House Units in the City of Mukalla, Yemen

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### ABSTRACT

This study investigates the measurable factors which influence the residential level of satisfaction in low-cost house units in Mukalla, Yemen. The importance of this study is due to the development of this city that has been influenced by modern architecture since colonial period. It is the tradition in Mukalla that most population live in traditional (known as tower houses) and modern mid-rise houses. The work aims to examine the level of habitability of modern house design in comparison to the level of habitability of house design of the traditional houses. The result shows that levels of satisfaction of the respondents who live at traditional house units are generally higher than those in modern house units. The finding of the study indicates house design as an important factor that determines the level of residential satisfaction. This research contributes several proposals from the research findings considered for house design guideline for the local authority to improve quality of modern house layout units with reference to the traditional house design layout in the present and future development.

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## 1. Introduction

Allen (1987: 355-356) in *Oxford Dictionary* argued that a house is defined as “...a building for human habitation.” It covers the “...dwelling of houses as a provision of shelter or lodging.’ The United Nations (United Nations, 1977: 4) defines a house as not simply as shelter but also as a mean of the creation of communities considering the functions a house has to perform. By house design, it means the quality of the house in terms of the organization and the allocation of space areas relative to the key functions that a household requires which is space planning and function. Caudill (1978) noted that an adequate house layout always takes care of both the current and the future needs; and such needs may be evaluated on the basis of quality rather than cost, size, light and building that make up the physical environment the residents interact with. Therefore, layout space in house design that man creates should meet a kind of needs, and the design adequacy calls for the ability of the designer to put all the required elements within a defined and clear relationships. Landau et al. (1988: 1453) in *Chambers English Dictionary* defines the term habitable as ‘...appropriate, proper, and fit’. Habitability therefore, can be defined as the state of being habitable, appropriate, or proper. Habitability, however, is relative term. In the context of a house, its habitability can be viewed in terms of its fulfilment to certain needs. Habitability in appropriate term is said to exist when needs are being fulfilled, or there is a match between what is needed and what is being supplied by a house, and inhabitability arises when there is a mismatch between the two. Habitable house plays a vital role in fulfilling the key functions that a household require. House plans must be set to measure the quality of house design that may be achieved by using quality indicators allowing future or current house layout to be evaluated based on quality rather than cost, site, size, light, and building that make up the physical environment they interact with (Caudill, 1978). This article does not provide a new idea but it is a social based house unit research topic which provides additional contribution of the existing knowledge supported with social survey on the house unit.

## 2. Issues on House Design in the Case Study

This habitability’s study tackles low-cost housing development in Mukalla, Yemen. In particular, it will look at the problem of inhabitable living conditions due to inappropriate house design as argued by UN-HABITAT (2002). This issue has always been underestimated by both the architects and the house builders due to the influence of modern

styles as noted by Damluji (1992:10) frequently considered as the solution. There has been a proposal by the United Nations (1977) that housing should be integrated with the functions of the interior house design for a habitable living condition. This aspect is as important as the quality of the materials that have been used towards its development. The public low-cost housing programmes are undertaken by the federal governments with supervision and monitoring under the Ministry of Housing and Local Government. The architects should focus on house designs that are based on the traditional Yemeni houses. They further assert that when designing houses for the habitation of the low-income groups, such a focus could serve as a guiding policy towards appropriate house design. Also they suggest that strict adherence to such a policy-guideline would certainly makes the finished houses not only friendly to the environment but are also able to sustain the local needs and traditions. Benton and Benton (1975:111) have mentioned the importance of this point. The purpose of this study is to examine the level of residential satisfaction level and factors affecting in low-cost housing in Mukalla, Yemen. Residential satisfaction reflects the degree to which individuals' human needs are fulfilled. Therefore, it acts a guide to policy makers to monitor the implementation of housing policies. Since no study of residential satisfaction level in low-cost housing in Mukalla, Yemen. The study hopes to fill the gap in this area. The results of the study will help in understanding of overall satisfaction level with low-cost housing built by government and monitoring the implementation of housing policy in the country. The relationships of theoretical factors are grouped into five components, namely dwelling units.

### 3. Methodology

The methodology of this study is derived from the aim of this paper which is to examine the level of habitability of modern house design in comparison to the level of habitability of house design of the traditional houses. Following the ideas of Johnson and Christensen (2000:136), these definitions have been identified as mentioned in the previous discussion on habitability. The same factors have been used in the qualitative and the quantitative surveys. The data obtained have been used in the qualitative and the quantitative analyses. The adoption of the two analyses is congruent with Badar's (1982: 314-343) contention that it is better to follow more than one method to get to the truth and to avoid biased data, such as the respondents' bias. Finally, the control sample has been selected by the same method used when selecting the practical sample (random/stratified/survey). Therefore, all the different

elements represent both the control and the practical samples with the same percentage. This has been done in order to be able to compute the impact of factors under study which we need. There are two types of analyses: qualitative and quantitative.

### 3.1 Measurable Scale

According to Hanks (1977) in Collins English Dictionary, satisfaction is defined as the, ‘...act of satisfying; the state of being satisfied; the fulfilment of a desire; the pleasure obtained from such fulfilment; a source of fulfilment...’ (1977: 1297).

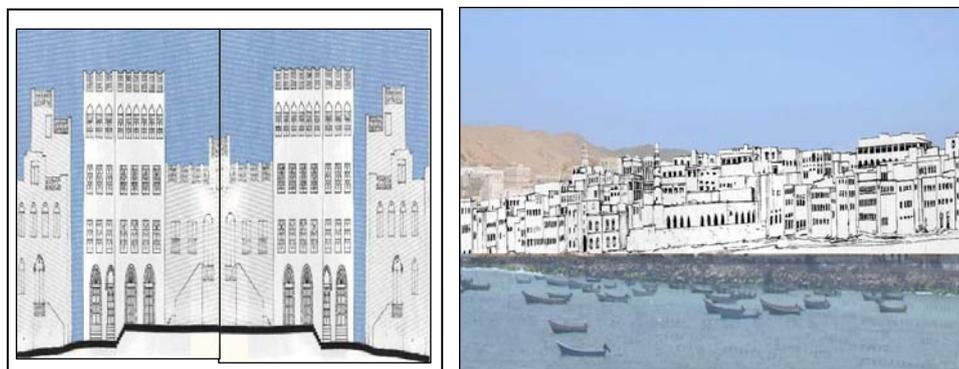
The opposite of satisfaction is dissatisfaction, which means ‘...lack of satisfaction or contentment’ (Allen, 1984: 212). According to the *Oxford Dictionary*, the concept of level of satisfaction cannot be measured in absolute terms; instead, it is usually measured in a continuum ranging from very satisfied to very dissatisfied, and that the level of satisfaction varies in relation to several factors such as circumstances, time or between person-to-person depending on each individual background. Residential level of satisfaction first is recognised as important component of individuals' quality of life and second individuals' evaluation of house design determine the way they respond to residential environment. Therefore, the knowledge about factors that figure residential level of satisfaction is critical for understanding of household moving decision process (Lu, 1999). Residential level of satisfaction is based on the notion that residential satisfaction measures the difference between households' actual and desired house design layout and situations. They make their decisions about residential conditions based on their needs and aspirations. Satisfaction with their residential conditions indicates the absence of complaints as their needs meet their aspirations. On the other hand, they are likely to feel dissatisfied if their house design does not meet their residential needs and aspirations. Morris and Winter (1978) presented the idea of ‘housing shortage’ to conceptualise residential satisfaction. Their housing adequate theory contends that if a household's current housing meets the norms; the household is likely to express a high level of satisfaction with housing needs.

## 4. House Design in Mukalla

The architecture of Mukalla is dominated by white painted houses and buildings, (Figure 2). The architectural styles are a mixture of Arabic, Yemeni and Indian patterns. It is characterized by unique architectural designs of the 18<sup>th</sup> and 19<sup>th</sup> centuries. The space

planning in the traditional houses in Mukalla has been moulded by the culture, values and lifestyles of the Hadhrami people. In addition, the space planning has been influenced by their attitude to give priority to privacy. At the same time they have emphasised their preference for community intimacy, their needs for seasonal feasting and other cultural activities. The study of the interior space is focused on the following factors:

- a. *Diwan*, dining area and bedrooms
- b. Bathrooms
- c. Corridor and storage
- d. Courtyard and balcony
- e. Compositions of the rooms' layout



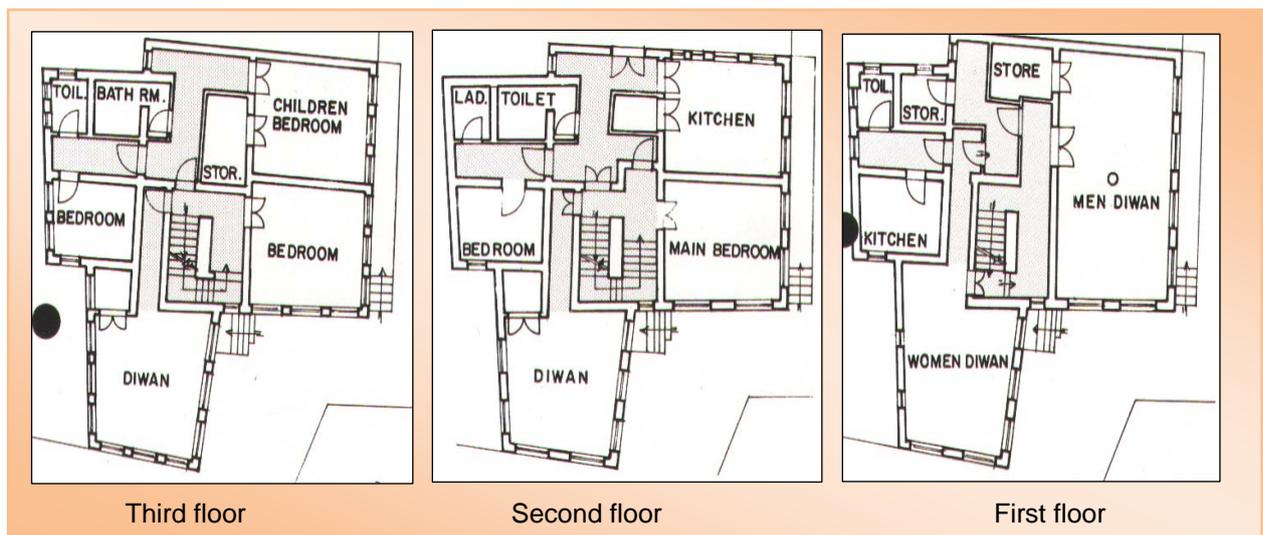
**Figure1:** View of Old Picture's Part of Mukalla showing a typical traditional mid-rise houses (right) and an example of a house facade (left).

### **a. Bathrooms**

In a traditional house in Mukalla, usually the *diwan* is a space located in front of a house and which is essentially for males and is separated from the private areas of the house which visitors or strangers do not see. In this respect the location of the *diwan* plays an important role in the layout of the house design unit as a whole. An analysis of the survey revealed that this factor seems to have been recognized in the design of most of the houses. Some interior spaces of a traditional house are generally not named by the conventional labels such as *diwan*, dining room, but rather by the actual activities in the space at a particular time. The only exceptions where the spaces are named permanently by their uses are the kitchen and the toilets. There are, therefore, no permanent spaces with specific labels such as the living room, the bedroom, the dining room, the hall or the study room, which are directly named after



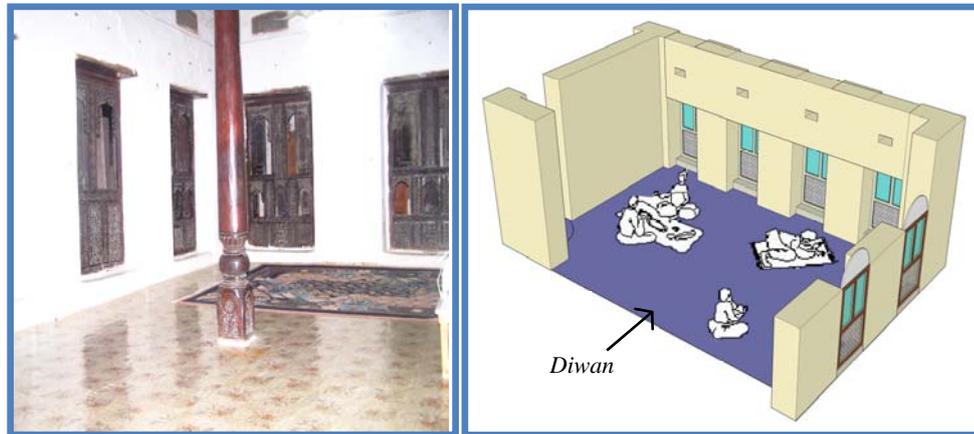
In contrast to the above, the life style in the traditional houses in Mukalla is unique and exceptional. Indeed, the social functions behind the general aspect of the house design have become private within the family. In a Mukalla traditional house, the other *diwan* is usually located on the first floor. It is for accommodating visitors according to the gender (males and females), (Figure 3). In the secluded *diwan* for women, the women do not need to cover themselves and they are free from unforeseen visitors when they come in. Sometimes, the rooms in the first floor are lent to the neighbours when they have important social activities. The use of minimal furniture in a traditional house also helps to create a more flexible use of the interior spaces. Bulky furniture not only cluster and break up interior spaces, they also define and confine the spaces for certain uses only.



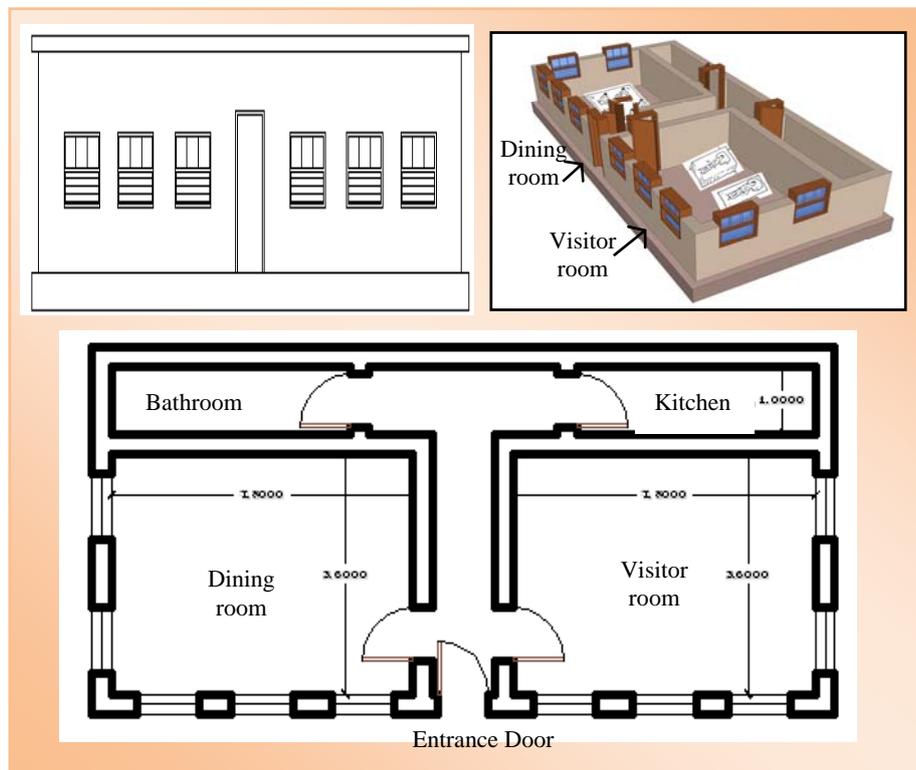
**Figure 3:** Floor Plans of a Traditional House Unit in Old Zone Scale 1/200 metres Shows First Floor Level (right plan), Second Floor Level (middle plan) and Third Floor Level (left plan).

The second floor, however, is to accommodate the elders and the relatives to live in. Some rooms in this floor are designed for different functions, for instance a room which is occupied by women in the day time as a *diwan* could be a bedroom at night for many people. The third floor is entirely private as it places the bedroom for the head of the family and his wife. Here the wife can receive, in private, her intimate friends. Children have their own rooms on the third floor as well; they are not secluded and are free to move anywhere in the house. Figure 4 depicts the first floor of a tradition house which is "socially" closed. In a sense, it is only a semi- public space of the house. All visitors are not allowed to enter

directly. Only family members or close friends are allowed to enter the *diwan* (Figure 3 and 4). Strangers, if they are expected, can stay and wait for a while in the corridor, which is a transition space. In the case of women visitors, the *diwan* is used but the men have to leave the floor or even the house.



**Figure 4:** *Diwan* Interior Space (photo-left) and axonometric layout (right) of a Traditional House Unit in Old Zone of Mukalla.



**Figure 5:** Illustrating the Absence of a *Diwan* in Low Income House Unit showing Main Facade (top left), Axonometric Layout (top right) and Floor Plan (bottom) of Modern One Unit Low-Income Modern Apartment.

The second floor is reserved for the children and use during the day as the *diwan* for the women of the family. The third floor is used by the parents. This floor keeps its original function (bedroom) all day long (Figure 4). The foot bridge at the first floor which is used to communicate with the next mid-rise house units is not used any more. The top floor room/terrace which is an open spatial area is used for sleeping area during the hot summer season. There is a traditional house in old zone which is more than 100 years old. It is one of the best examples of a traditional house built in a traditional way with supporting walls in freestones and flag in clay maintained by wooden grids and beams. In fact Old traditional houses are very unique in their constructions as they are commonly adorned with purified ornaments, come with special openings, built with terraces of parapet type and decorated with wooden sculpture. This may be attributed to the division of the old buildings (previously lodging a single family) into separate small apartments. In modern zones, the houses are small due to economic grounds. One seemingly critical problem to a comfortable living life style is that in all these small houses, (Figure 5), there is a significant absence of a *diwan* and other spaces which are multifunctional in the traditional houses mentioned above.

#### **b. Bathrooms**

The design of modern houses does not cater a separate bathroom for the male and the female members of the family. Instead, they have a common bathroom for both genders. This is due to a dire shortage of space for any extra bathroom facilities. The lack of these facilities is partly attributable to the apparent erosion of the religious values with respect to the social interaction between a male and a female. In contrast to the above modern houses, the traditional houses in the old zones contain their conventional sewage system that permits them to possess flexible access to these facilities. That is, male and female members of the family are assigned with separate bathrooms and toilets (*Mukalla Master Plan*, 1982).

#### **c. Corridor and Storage**

The corridor spaces and the space for the stairs in a modern house (apartments/flats) is unsatisfactory by dimension and lighting and by the regular needs to move masses of goods. Also, there is no storage and basement due to a limited area within the apartment. In a traditional house, on the other hand, the main entrance provides sufficient space for the traffic flow of the pedestrians in the house. Usually the entrance leads into a narrow passage to a

staircase which opens to a corridor space which in turn ushers the user to other spaces. Therefore, the specific space layout in the traditional houses is sufficient. In particular, the stairs are built around a huge pillar at the entrance or the main support of the house. In addition, in the traditional houses there is sufficient storage space and a basement floor.

#### **d. Courtyard and Balcony**

Modern houses do not have any allocation of space for a courtyard and a balcony due to a limited area and also due to the fact that their construction is from reinforced concrete. In contrast, in a traditional house, the courtyards are very significant components as they provide the ventilation and the cooling system. Costa (1995) mentioned that courtyards are built with the intention of generating a constructive link between the external and internal environments. Also they are designed to accommodate the different social activities such as the family gatherings, a reception of guests and other related social occasions

#### **e. Compositions of the Rooms' Layout**

The arrangement of space between each pair of rooms and the rate of movement between them play very important role in the locations and in the layout of the rooms. In modern houses, the location of the rooms is very poorly laid-out due the limited space that is available in them. However, in the traditional houses the location and the layout of house design account the interior space elements like the doors, the windows, the interior walls, the floors, and the ceilings. Usually, in a traditional house, the entrance leads into a narrow passage and then to a staircase that leads to a corridor space which opens up to other spaces. The ground floor is usually reserved for storage purposes while the first floor is allocated for social activities. Such a composition of the space takes into account the emotions of the inhabitants and accommodates their daily needs, wishes and ambitions. Therefore, in a traditional house space layout is the central consideration as it accommodates the basic needs of the inhabitants in organized and systematic ways which have been carefully thought out by the local master builders.

## **5. Space Planning and Function**

This category has following factors: (a) *Diwan* (living room, visitor room and furniture setting), (b) dining area, (c) bedrooms, (d) bathrooms, (c) corridor and storage, (e) courtyard

and the balcony, (f) compositions and layout of the rooms. In this qualitative study, the criteria for evaluation are on qualitative analysis from checklist factors as discussed in the literature review based on the researcher's observation on the house design during the site's visit. The answer "Yes" represents as satisfactory and "No" as unsatisfactory. For example, if the visitor's room is satisfactory, the answer "Yes" will be marked as 'x', but when it is unsatisfactory, the answer is "No" will be marked as 'x'.

**Table1:** Items of Factors on House-Design.

Item	The Space planning and function	Qualitative survey of Modern Mukalla		Quantitative survey of Modern Mukalla (% respondents)	Qualitative survey of Old Mukalla		Quantitative survey of Old Mukalla (% respondents)
		Yes	No		Yes	No	
a	<b>Diwan</b>			<b>55%</b>			<b>72%</b>
	(a) living room	x		53%	x		70%
	(b) visitor room	x		56%	x		73%
	(c) furniture setting		x	57%	x		74%
b	<b>Dining Area</b>			<b>42%</b>			<b>64%</b>
	(a) Dining room		x	40%	x		62%
	(b) Kitchen	x		42%	x		65%
	(c) Top floor room/terrace		x	43%	x		66%
c	<b>Bedrooms</b>			<b>54%</b>			<b>67%</b>
	(a) master bedroom	x		52%	x		65%
	(b) Bedroom for male		x	55%	x		68%
	(c) Bedroom for female		x	56%	x		69%
d	<b>Bathroom</b>			<b>62%</b>			<b>70%</b>
	(a) Bathroom for male	x		60%	x		69%
	(b) Bathroom for female		x	64%	x		71%
e	<b>Corridor and Storage</b>			<b>45%</b>			<b>73%</b>
	(a) Corridor Space	x		42%	x		71%
	(b) Stairs Space	x		46%		x	74%
	(c) Storage and basement floor		x	47%	x		75%
f	<b>Courtyard and Balcony</b>			<b>35%</b>			<b>46%</b>
	(a) Courtyard		x	33%	x		44%
	(b) Balcony	x		37%		x	48%
g	The Composition of the room's layout		x	<b>58%</b>	x		<b>70%</b>
N=17	Total	8	9	7	15	2	7
	Total number of positive answers over the total number of the items	8/17	9/17	351/7	15/17	2/17	462/7
	Overall answers in percentages	<b>47%</b>	<b>53%</b>	<b>50%</b>	<b>88%</b>	<b>12%</b>	<b>66%</b>

On the other hand, the quantitative analysis is from the respondents' answers (300 respondents) on their satisfaction level from questionnaires related to the same checklist factors. The measurable scale is based on five rating scales of preferences in which each respondent is required to identify by ticking only one answer ranging from 1 to 5 for each question. These ranging scales are: No. 1: worst, No. 2: bad, No.3: no comment, No. 4: good and No.5: best. According the Likert Scale (2006) an important distinction must be made between a Likert scale and item (respondents' answers from questions in the questionnaires). The Likert scale is the sum of the responses (respondents' answers) on Likert items (questions). The total answers from each question are converted to obtain the mean average ranging from 1 to 5 ( $x^1 + x^2 + x^3 + \dots x^n$  divided by 5 = Mean Average). Finally, this mean average of each question is converted to percentage scale to represent the percentage of the respondents' answers. The objective of the quantitative survey in this study is to identify the factors of the level of satisfaction as perceived by the respondents represented with percentages. The results of the qualitative and the quantitative analysis of the data are presented in subsection of space planning and function, as in Table 1.

## 6. Results

### 6.1 Qualitative Analysis by Factors

#### a. *Diwan*

- i. The furniture setting in modern house design is unsatisfactory compared to the same items in the traditional house due to the limited floor area for such purpose in the traditional house design.
- ii. The living and visitor rooms in the modern house design are found to be less satisfactory than the same items in the traditional house design.

#### b. Dining area

- i. The dining room and top floor room/ terrace in the modern house design are found to be unsatisfactory compared to the similar items in the traditional house design due to a limited floor area.
- ii. The modern and the traditional house for kitchen have a similar level of satisfaction.

#### c. Bedrooms

i. The residents of the traditional houses find satisfaction with the house design of the bedroom for the males and the females, while the residents of the modern houses find these same items unsatisfactory. Both residents, however, find the house design of the master's bedroom as satisfactory.

d. Bathroom

i. In the modern house design, there is no allocation for separate bathroom for the male and the female members of the family; hence the residents find this situation unsatisfactory. In comparison, the residents of the traditional house design enjoy different allocation of separate bathrooms for the males and the females.

e. Corridor and Storage

i. The residents of the modern houses find the allocation of space for the stairs satisfactory. In comparison, the stairs in the traditional house design and the allocation of the basement space are found unsatisfactory by its residents.

f. Courtyard and Balcony

- i. No courtyard is found in the modern houses, and the residents find its absence unsatisfactory. In comparison, the residents of the traditional house find enjoyment and satisfaction in the availability and use of the courtyards there.
- ii. The modern houses have balconies, and the residents find satisfaction in using them. The traditional houses, however, do not have such similar balconies as they have regarded them as a way of exposing the women to the areas outside the house which is counter to the Islamic teachings. In fact the residents prefer the traditional premises to be without the balconies, although some find its absence wanting.

g. Composition of the room's layout

i. On the whole, the residents regard the composition of the layout of the rooms in the modern houses as unsatisfactory due to the limited built-up area in the modern house designs. As a comparison, the residents of the traditional houses find satisfaction with the nature of the layout and the organization of the interior spaces.

## 6.2 Qualitative Analysis by Category

Table 1: shows that under the category of space planning and function, the average result of Old Mukalla is 88%. Hence, it can be regarded that the residents there have considered the factors within that category to be satisfactory. However, modern Mukalla has 47%. So, relatively the residents seem to have felt that the traditional house designs on space planning in the old zone have been considered as more habitable than those same factors in the modern houses.

## 6.3 Quantitative Analysis by Factors

For the quantitative analysis of the factors the relevant interpretation of the above responses are as in (a) through (g) below:

### a. The *diwan*

72% of the respondents from Old Mukalla are satisfied with the *diwan* (the living, visitors' rooms and furniture setting) as compared to merely 55% of the respondents from Modern Mukalla find the *diwan* there satisfactory. In another words, generally the residents of Modern Mukalla only slightly satisfied with the *diwan* of their houses.

### b. The dining area

The analysis finds that 64% of the respondents from Old Mukalla perceive the dining area facility in their houses to be satisfactory and that they are habitable. On the same factor, the respondents from Modern Mukalla score only 42% suggesting they are not as satisfied as their counterparts in Old Mukalla towards their dining area.

### c. The bedrooms

With respect to the bedrooms, 67% of the respondents from Old Mukalla see their bedrooms as satisfactory, while their counterparts in Modern Mukalla score only 54% on the same factor suggesting that they find their bedrooms not as satisfactory as the respondents of Old Mukalla find them.

### d. The bathrooms

With a score of 70% on this factor, there is no doubt that the respondents of Old Mukalla are more satisfied with their bathrooms than the respondents from Modern Mukalla who score much less, which is 62%.

#### e. Corridor spaces and storage

On this factor, with a score of 73% the respondents of Old Mukalla clearly have expressed much more satisfaction towards them than the respondents from Modern Mukalla have as they score poorly with 45%.

#### f. Courtyard and balcony

With a score of 46% satisfactory answers for the courtyards and a score of only 35% satisfactory answers for the balconies, the Old Mukalla residents are apparently more satisfied with the courtyards than with the balconies. This is quite understandable as generally, the traditional houses do not have balconies. The level of satisfaction on these two factors seems to be the reverse in the case of the residents of Modern Mukalla. That is, with a satisfactory score of 51% for the balconies as compared to a mere score of 19.5% for the courtyards, they obviously have successfully expressed their displeasure and dissatisfaction towards the absence of any courtyards in Modern Mukalla.

#### g. Composition of the house's layout

70% of the respondents of Old Mukalla have expressed satisfaction towards the composition of the layout of spaces as compared to 58% of the respondents of Modern Mukalla who have expressed similar satisfaction on the same factor. If these figures are any positive indication of their perception, apparently the residents of Old Mukalla have perceived their traditional houses to be more habitable with respect to this factor than their counterparts have with their houses in Modern Mukalla.

## 7. Conclusion

The perception of satisfaction on the nature of space planning of house layout, the traditional houses of Old Mukalla were to be considered already have given more level of satisfaction to its residents more than residents who live in Modern Mukalla. However, relative to these perceptions, with a composite score of 88% from respondents' answer for Old Mukalla and 47% for Modern Mukalla. The residents of Modern Mukalla have expressed dissatisfaction towards most of the factors. The main problems seem to have stemmed from those aspects surrounding the feelings of discomfort and dissatisfaction due to limited space areas, the absence of a *diwan*. In contrast, the residents of the traditional houses of Mukalla

seem to have expressed better views and more satisfied towards all the factors. On Old Mukalla, from the qualitative survey high scores in the column of Table 1 for all the factors, it is quite apparent that the respondents from Old Mukalla have rated highly all the factors. As such these high average scores undoubtedly have served as expressions of much satisfaction towards the house designs and the nature of the amenities there. In that light, within the ambit of this study, the house designs in Old Mukalla can and do serve as references for the houses in Yemen. The study has used the layout of the house design of the traditional houses of Old Mukalla as the reference model.

At the end of the study, it is suggested here that the study has made the contributions below with respect to people's perception on the habitability of house design for the low income group in Yemen in particular and some general ideas about habitability of house design in the field of architecture in general. It has provided the definitions of the terms house, designs and habitable within the ambit of the perception of the low-income group of Yemenis.

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