

# Developing adequate economic urban land design based on different housing types scenarios

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**Abstract:** Urban land is a rare asset and housing developers look for their investment to highest consumption of urban land to earn more residencies, thus it must be a way to direct the sustainably and economic development for the housing land use

The study foresight scenarios using a number of housing types in the urban housing standards in a way that contributes to the economy on the urban land.

There are several densities, most notably, Population density, Housing density, City density, Building volume or Floor Area Ratio (FAR). The idea is giving decision makers various single and multiple-family housing scenarios, for choosing adequate housing types controlled by urban housing standards.

study case for the multiple-family, multi-story indicators on Hillah /2, shows us that its consumption of urban land was the highest in terms of residential use.

Through scenarios, we can produce more houses mix for the same land, for example 2<sup>nd</sup> scenario shows that residential use is approximately 57% of the housing complex, and provides the developer with 75 additional housing units.

one of the recommendations is making the FAR a reference in calculating urban land uses ratios, in cities, such as the educational or the health use.

Key words: Urban, land use, housing type, density, F.A.R., standards.

## 1- Introduction

Having residential urban land in a city is not an easy task, Because of increases in housing demand due to population increases in urban environments, it has become necessary to pay attention to avoid consumption of urban land, by managing urban land and calculating land areas in order to obtain as many housing as possible to meet the housing need and economy,

emphasizing the local need for desirable housing patterns in the light of societal trends and as provided by the official standard adopted and adopted when housing needs are met.

The general idea is giving decision makers various options for choosing housing densities that are controlled by urban housing standards to provide suitable housing environments is important for providing housing that is desirable to the urban designer in such a way as to ensure that official trends are met and that an adequate number of dwellings are maintained within economic, social, environmental and physical conditions and determinants.

### **- Research Problem**

Consumption of urban land, because of increases in housing demand due to urban population, makes it harder to obtain a piece of land in a city, as the urban land component is inflexible due to the scarcity of urban land areas in general.

### **- Search hypothesis**

We can provide scenarios that provide sustainable land use economy using the housing types that are tailored to the specific urban housing standards on the urban land use allocated to housing, thereby facilitating the needs of the population to meet a diverse type of housing.

### **- Search aim**

Provide sustainable land use economy using the housing, and develop housing use scenarios for the urban area that include different types of urban housing as established by approved housing standards and consistent with citizens' wishes and social orientation for adequate housing, with the lowest consumption of urban land.

### **1-1 - Urban land uses**

The concept is to maximize residential urban land ratio in , commercial , industrial, services, open areas, and transportation, all has land use ratios from one urban area to another, and from one environment to another, depending on many of the main factors, including economic overall cost of land, Social factors, such as privacy, desire to accept different types of housing, so the geographic and urban housing environment has different way to deal with urban areas [1]

To understand the how city components works, Dioxides divided the uses of the land into four elements, which are the general structure of the city[2].

1- Central area component with concentrated service uses, offices uses, linked to economic aspects such as banking

2- the areas that represent the movement or transportation system, such as roads, streets and walkways

3- The it is homogeneous areas is where one form of use, predominantly most of the land, such as in the neighborhoods, housing use in residential areas.

4- The component of areas , that has specialized land use such as industrial use, serves.

In this study, we will talk about a homogeneous residential land use, that mentioned in the third

point, and there is three important indicators the planners use to control the residential land use [3]:

Plot area : there is no standard has one fixed value for the house, and it varies depending on availability of the land, social-economic needs.

Housing density: it varies from on area to another according to many factors like: location, housing policy and planners- designers want for urban environment.

Land use percentage: for balancing housing with other services in the allocated residential area must provide people needs,

## 1-2- Types of housing

Urban housing is classified by family occupation are divided into single family housing and multi-family housing.

- 1- detached housing for single family
- 2- semi- detached housing for single family
- 3- attached housing for single family
- 4- attached housing or middle courtyard housing for single family
- 5- Multi-family housing and low-rise building 2-4 floors
- 6- Multi-family housing and medium rise building 5-8 floors
- 7- Multi-family housing and high-rise building 9-12 floors [4].

Each of these types has its own standard indicator, through which it can control the urban land consumption with reasonable for residential land use, which is the most important planning purpose for the urban environment through which, we can control the plot area that can contain all density of the population in the urban area . Providing good living circumstances like lightning, ventilation, services, privacy, and even the space- sense in the both public and private housing area [5].

## 1-3- Economy on Urban Residential Land

The people seeking for a house in urban areas is constantly increasing for a number of reasons, the first of which is population increases. In the National Housing Policy, which provides for the need for an economy on urban land and an important recognition of the need to pay great attention to this aspect and make it one of the first priorities of official national housing policies. It states that there is a "severe shortage of land for urban construction" [6].

Two basic policies was submitted for getting the best benefit from available urban land , the first is the "infill housing ", which can be defined as “ constructing residences on a vacant land in a buildup area” [7].

It is addressed through policy No. 9-1-2, which provides "for the delegation of authority to prepare and implement projects and manage land at the local level. The second is the policy of expansion, through the policy No. 2.1.8, which provides "for the arrangement of the conversion of agricultural land to urban uses and its public dissemination of the various information required, including land use rights, to urban areas[6]. Most urban areas broadened, and in some cases 25% of the housing use in the residential areas is wasted land [8], which puts heavy economic difficulties to provide sufficient land to roads, services. The urban land consumption control in residential complexes is purpose for using a different housing types in the residential complexes

#### **1-4- Planning by housing density**

The definition of housing density is: a quantitative measure of the intensive land use in building and residents, and it may considered the most effective way of planners to control land use [4].

Because the urgent need to accommodate the high population and large urbanization, the UN-Habitat has developed a set of principles High densities concept of the residential sustainable neighborhoods, of in communities with a minimum of 150 people / ha[9], , for the rational use of land to accommodate growth and urbanization, that what we called population density, and there are other types of densities, most notably[4]:

- 1 - Housing density: It means the number of dwellings in the cadastral unit, which is what we're interested in here, because it's directly connected to the Earth, , (one hectare represents 10000 m<sup>2</sup> of urban land area).
- 2 - City density: It's the ratio of city population to city area.
- 3 - construction density ( F.A.R.): is the proportion of the identical area that represents the total number of floors built multiplied by the area of each floor relative to the area of land allocated to the residential building, as it shows in table (1). These densities are illustrated in the 2018 Iraqi Urban and Regional Housing Standards as shown in Table (1).

Table (1) shows the types and indicators of densities

Family type	resident type	FAR	Area m2	Housing density u\h	Population density p\h
Singles family	Detached	0.39-0.45	250-300	25-35	120-150
	Simi-detached	0.45-0.65	250-200	30-40	180-240
	attached	0.6-0.8	200-150	35-55	210-330
	courtyard	0.75-0.9	150-120	50-65	300-390
Multi-family	Low rise 4-2	0.65-1.3	-----	47-96	230-480
	Middle rise 8-5	1.2-1.9	-----	60-192	240-780
	High-rise 12-9	1.8-2.25	-----	108-240	430-960

Source: update Urban and Regional Housing Standards in Iraq, 2018 [9].

These densities are illustrated in updated Urban and Regional Housing Standards, 2018 as shown in Table (1), shows the areas and density indicators.

### 1-5- Adequate housing type

The type of housing is one of the most important indicators to be taken on account of its direct connection to the land, to assess a particular type of society needs[9].

Based on this logic, some experts and specialists were involved in housing and urban planning[[10]. If city planners want to choose a single-family horizontal type of housing, different planning indicators will be dealt with than in the case of vertical multi-family type of housing. Many schemes have been made by planners and designers of a number of types of housing, which have been developed within acceptable legal, economic and social dimensions and not just economic in urban land, for example, there are areas for horizontal housing, single families, and other specific are for housing in residential with vertical multi-family housing. And that's why urban planners and designers have tried to give the best urban hosing types to meet those desires and within the privacy of each urban area.

## 1-7- Global standards to control land use

### • LEEDS [11]:

Through the LEED Energy and Environmental Design Leadership Center of the American Council for Green Buildings, the American Council for Green Buildings has worked to harmonize the residential environment with green architecture and to transform residential environments into environmental orientation by creating sustainable residential area by putting standards, as shown in table(2), through three basic strategies:

1- Smart Location Selection (SLL):

2- Housing Patterns and Design (NDP), which is concerned with defining those interested in the particular spatial arrangement of buildings and their forms

3- Green Infrastructure and Buildings (GIB) shows how negative environmental impacts are controlled.

Table 2 represents the relationship between density and urban land area required

FAR	Housing density u\h	Housing area in m <sup>2</sup> / hectare
0.5	17.5	5050
0.8	30	8035

Source: (LEED, v4.2019) [12].

Table(2) shows the housing densities and the effect of FAR on the total housing area required in the hectare.

## 1-8- How to control housing land use

The challenge in land use planning is to design proper house for different policy zone for example the urban central areas tends to be higher density neighborhood, while the edges out of the central area of the city or the suburban tends to be lower density neighborhood [13].

Housing at the urban area level has non-fixed rates of residential use for urban land use, which is the largest percentage of land use in the city, and housing is determined primarily by type of housing. The fact that housing that covers large areas of the block for a particular type of residential building, such as housing for single, low-density families, has less service space because large areas of the lot consume land for urban agglomeration. This is probably due to the fact that within the dwelling there is room for movement, private parks and indoor car cages, which reduce the need by a certain percentage of the service space. In a few cases, the official authorities in Iraq have referred to the relationship between housing and urban land use through the regulation of densities in residential areas, where no precise proportion of each type of housing has been identified.

The spatial organization and distribution of densities have been mentioned in the basis of the urban housing standards prepared by the Iraqi Ministry of Planning, the Regional Planning Authority, through which open spaces for roads, parking and services have been defined in aggregate, leaving the remaining area for residential use. For example, the first 200 m<sup>2</sup> urban area has a housing density of 150-180 inhabitants, and the proportion of area devoted to roads, parking and open areas has been determined at 35-50%. The table below shows the organization of residential use by population densities by the Regional Planning Authority's 1977 criteria. Through this guide, housing land use ratio is between 40-65% of the total area allocated to urban land in residential complexes.

Table (3) shows different land percentages housing standards

Residential area	open areas %	services %	housing %	Housing density h/unit	plot area m <sup>2</sup>
multi-story	65	15	3 story	250-200	According to designer
first	50-35	15-10	50-40	180-150	200
second	40-33	10-7	65-50	140-120	300
third	37-30	8-5	65-55	110-75	400

Source: Foundations and Standards of Urban Housing [14].

### 1-9 - Best type of housing to reduce land consumption

For the purpose of creating and creating sustainable residential neighborhoods, UN-Habitat, has developed a set of principles that promote the concept of sustainability in neighborhoods and communities [9]:

1. High densities: As a result of high population growth and large urbanization, there is an urgent need for the rational use of land to accommodate growth and urbanization with a minimum of 150 people / ha.

The idea of giving decision makers various options for choosing housing densities that are controlled by urban housing standards to provide suitable housing environments is important for providing housing that is desirable to the urban designer in such a way as to ensure that official trends are met and that an adequate number of dwellings are maintained within economic, social, environmental and physical conditions and determinants.

Each plan and initiative , at the minimum, must have a guidance documents or applicable program to be used as inspiration device by planners and designers [15].

## 2- Methodology

Complex of 14.25 hectares. It contains 66 residential multi-story buildings of four floors, including the ground floor, and on each floor there are 528 residential units of 155 m<sup>2</sup> apartments as shown in the detailed blueprint plan in Fig. (2) .

With a mathematical calculation, we can calculate how many houses we can add to the same percentage of use.

The percentage of the total area of buildings as complex gives incorrect indication of the proportion of residential use. Here, urban housing standards need to be reviewed to see the real percentage of housing land for the multi-story residential building to use the land scientifically, and the way in which this is calculated is to refer to the proportion of floors or FAR.

F.A.R. = floor area ratio =  $\frac{\text{Sum of total floors area}}{\text{total building area}}$ .

From that we can predict the total building area needed for the multistory residence

The total area required = No. of Buid.\*  $\frac{\text{Sum of floors area}}{\text{F.A.R.}}$ . Checking the results match housing standards, we're going to calculate housing density

Checking the results match housing standards, we're going to calculate housing density.

Housing density =  $\frac{\text{number of units}}{\text{total area of housing complex}}$

And then we can know how many number of additional units that could be increased if we use a different scenario

### 2-1 - Case Study

A multi-story residential complex in the city of Hillah, 90 kilometers south of Baghdad, as location shown in the master plan, in Fig. (1) was selected as an example of a model that uses planning indicators within the urban housing standards for 2018 and within the parameters and densities defined by them. In certain proportions, they can be changed depending on the situation and the effects of each urban environment

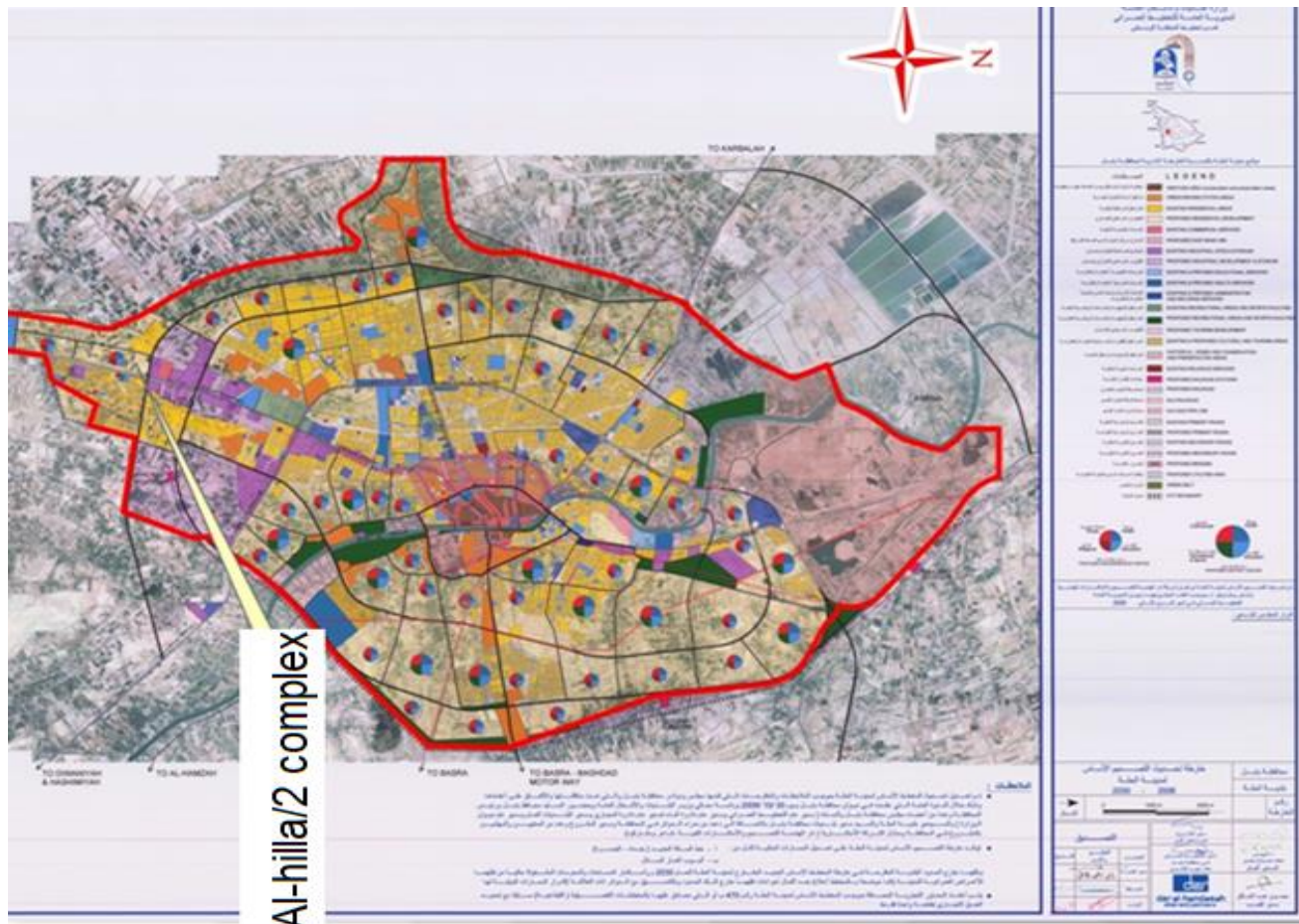
A planning study will be carried out for the Hillah\2 residential complex as an example of the multi-family multi-story residential complex in the Qas and Swilm area, which is the last vertical housing complex, with a population of approximately 2100 people distributed on buildings in a single housing type and with the same residential apartment area, as shown in image(1).

It was established by the Ministry of Construction, Housing and Municipalities in 2008, multi-story residential complex with service buildings for educational services and commercial use, as well as open parking areas for cars, as well as roads and green areas. The complex is equipped with infrastructure services from drinking water, electricity and telephone systems as well as sewerage systems.



Complex of 14.25 hectares. It contains 66 residential multi-story buildings of four floors, including the ground floor, and on each floor there are 528 residential units of 155 m<sup>2</sup> apartments as shown in the detailed blueprint plan in Fig. (2) .

Figure( 1) : Al-hilla master plan, 2008



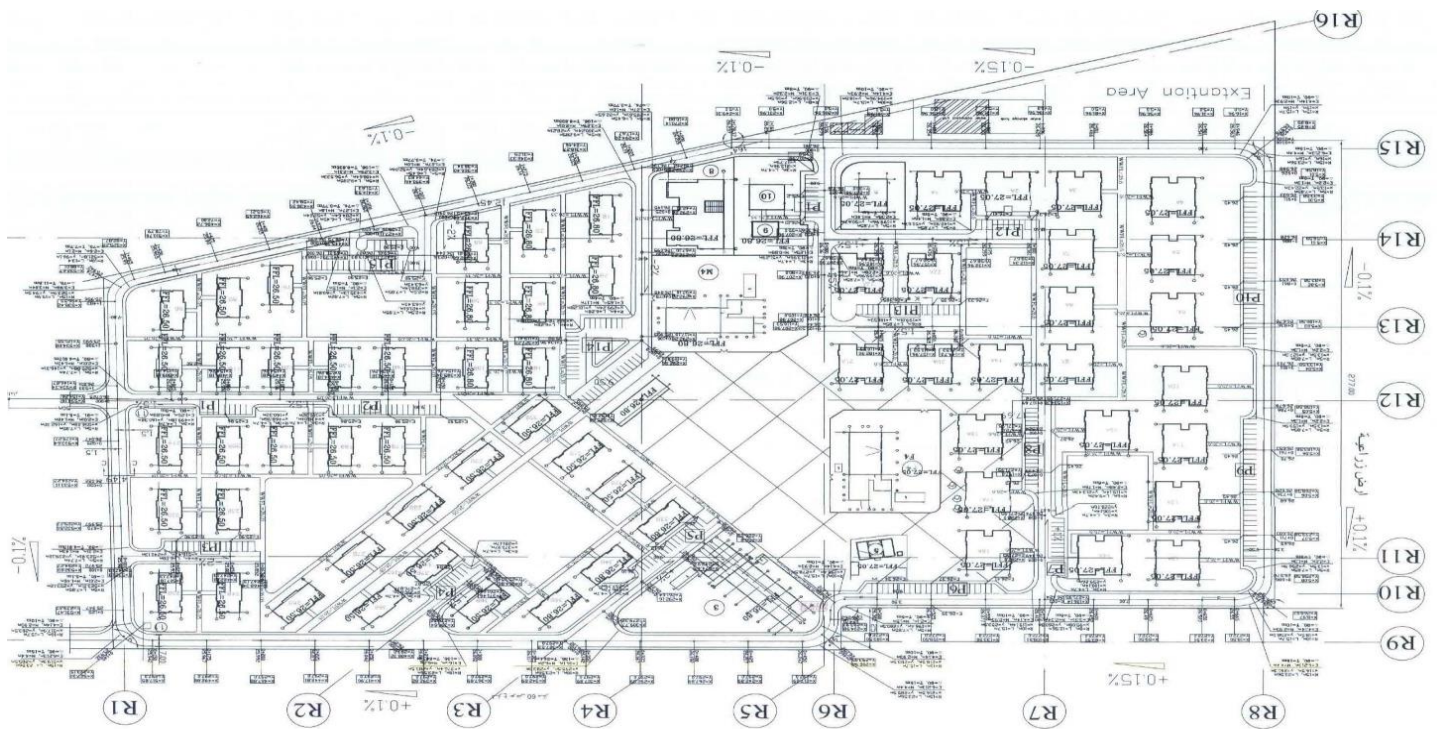
Source: scholar, according to Iraqi ministry of housing, municipality of Al-hilla [16].

Image( 1) : Al-Hilla\2 complex



Source: scholar, 2022

Fig. (2) : the blueprint of the complex



Source: Iraqi ministry of housing, housing directorate [17].

## 2-2- Study case calculations

The complex is designed as the following criteria

The plot area for the residential unit is 155 m<sup>2</sup> in all the complex

$$155 \text{ m}^2 + (155 * 2 * 10\% \text{ movement space}) = 341 \text{ m}^2$$

It's close to reality, as the total plot area for the building is 350 m<sup>2</sup>, as blueprint chart showing the layout details of the residential Al-hilla residential Complex\ 2.

Total area of the complex 14.25 ha Population by reality 2100 Occupant, and the details will be shown.

### - Calculations

The total area of all buildings for residential use

$$350 \text{ m}^2 * 66 \text{ buildings} = 23,100 \text{ m}^2$$

since the 10000 m<sup>2</sup> equals 1 hectare, That's 2.3 hectares.

The basic planning indicators of housing and population densities are calculated as follows:

population density = Population and area of the complex

$$\text{population density} = 2100 \ / \ 14.25 = 147 \text{ p/h}$$

Housing density = number of dwellings and total area

$$\text{Housing density} = 5287 \ / \ 14.25 = 37 \text{ units /h}$$

These results are relatively low and are not matched by mathematical analysis of population and housing density ratios when presented to the urban housing standards for 2018.

The area ratio for buildings is calculated on urban land in the complex.

$$\text{buildings area percentage} = 2.3 * 100 / 14.25 = 16.2\%$$

As we note, the percentage of the total area of buildings as complex gives incorrect indication of the proportion of residential use. Here, urban housing standards need to be reviewed to see the real percentage of housing land for the multi-story residential building to use the land scientifically, and the way in which this is calculated is to refer to the proportion of floors or FAR.

F.A.R. = floor area ratio = Sum of total floors area total building area.

From that we can predict the total building area needed for the multistory residence

$$\text{The total area required} = \text{No. of Buid.} * \text{Sum of floors area} \ / \ \text{F.A.R.}$$

The total area required =  $66 * 350 * 4 = 92400 \text{ m}^2$  or 9.24 ha

That is, the proportion of residential housing use for total area =  $9.24 * 100 / 14.25 = 64.84\%$  , as

total complex area is 14.25 hicktars



in Fig. 1.

Fig. (1) shows the areas percentages for the residential land use

and the calculations will be easier in table ( 4 ), that explain the detailed calculations for the site case in Al-hilla\2 complex.

Table( 4 ) the housing area percentage

Housing type	detach ed	Simi-detach ed	attache d	courtya rd	4 story	Up to 8 story	Up to 12 story	Housing percentage
	Unit\h ectare	Unit\he ctare	Unit\he ctare	Unit\he ctare	Unit\he ctare	Unit\he ctare	Unit\he ctare	
No. of units	30		45	50	72	126	174	
Area	275	225	175	135				
FAR	0.45	0.55	0.7	0.83	1	1.60	2	
No. of units in complex	0	0	0	0	528	0	0	
Area according to FAR					92400		92400	65 %
Sum of buildings areas					25740		25740	16%

Source: researcher according to calculations

### 2-3- Housing type scenarios

The vertical housing complex that has been established by applying standard indicators on land-related densities and the operation of mathematical calculations in this way shows us that its consumption of urban land was the highest in terms of residential use according to the standards established by the Iraqi Ministry of Planning.

Therefore we will put different scenarios to the same residential area.

#### - Scenario 1 ( establishing single-family accommodation 155 m<sup>2</sup> area)

This research will discuss the possibilities of taking advantage of land that is allocated to as many dwellings as possible within the permitted limits of the urban indicators specified in the criteria.

The first hypothesis is that the same apartment space should be fully distributed to single family housing as horizontal housing using the indicators provided by the planning criteria:

Total residential use area = 66 buildings \* 4t \* 2c \* 155 m<sup>2</sup> = 81840 m<sup>2</sup>

That is, the net area of the dwelling is approximately 8 hectares.

Ratio of residential use to total area = Ratio of residential use to total area of the complex  
 =  $8 \div 14.25 = 56 \%$

In other words, the proportion of the total housing area while distributed as single-family housing and horizontal housing would require 56% of the total land to be allocated to the housing complex.

Table ( 5 ) establishing single-family accommodation 155 m<sup>2</sup> area

Type	detached	Simi-detached	Attached	courtyard	4 story	Up to 8 story	Up to 12 story	Area m <sup>2</sup>	Housing area %
Avg. No. of units	30		45	50	72	126	174		
Avg. plot area	275	225	175	135					
Avg. FAR	0.45	0.55	0.7	0.83	1	1.60	2		
No. of units	0	0	0	528	0	0	0		
Al-hilla\2 site case	Required area according to FAR calculations				92400			92400	65 %
	Required building area calculations				25740			25740	16.2%
1 <sup>st</sup> scenario	155 m <sup>2</sup>	0%	0%	100%	0%	0%	0%		
	N. of units			528					
	Plot area			79200				79200	55.54%

Source: researcher according to calculations

From table (5), and with a mathematical calculation, we can calculate how many houses we can add to the same percentage of use.

Number of additional units that could be increased =  $65 \setminus 57 * 528 = 602$  units

So, we can establish single-family accommodation of (155) m<sup>2</sup> area, and increase the number of housing units by about 74 more.

Checking the results match housing standards, we're going to calculate housing density.

Housing density = number of units and total area of housing complex

Housing density =  $602 \setminus 14.25 = 42$  units \ ha

It corresponds to the standard that set the number of units (55-35) for 150-200 m<sup>2</sup> of land area.

The minimum housing density standard for low-rise, multi-family housing is no less than (150 persons \ ha) and (47-96 units \ ha).

### - The horizontal alternative scenario for a 120 m<sup>2</sup> dwelling

The lowest possible area for single-family construction of an intermediate courtyard by 2018 standards, is imposed 120 m<sup>2</sup>, the same number of housing units in the complex (528 units), we will need an area of urban land that can be calculated as follows:

Total area of horizontal pool 120 m<sup>2</sup> =  $120 \text{ m}^2 * 528 \text{ units} = 63360 \text{ m}^2$

That's 6.34 hectares.

The proportion of residential use in total area =  $6.34 \setminus 14.25 * 100 = 44.5\%$

The limits allowed in urban housing standards (50-65 units \ ha) and residential use range from 40-65% of the area of the residential complex.

We can add a number of housing units to the stock of the housing complex in order to increase its efficiency in absorbing the population and to achieve the goal of research.

Assuming we use the same housing density as the complex, in the case of 65 percent of the urban land for housing.

$14.25 * 65\% = 9.26$  H. as residential use

Number of single horizontal units =  $92,400 \setminus 120 = 770$  unit.

By calculating the rate of increase in the efficiency of the economy on urban land, it adds a good number of horizontal housing units to the housing stock.

Additional units =  $770 - 528 = 242$  unit.

We can also extract it as a proportion of the increase in the efficiency of urban land use for residential use

(  $770 \setminus 528 * 100 = 145\%$  )

For checking:

The standard density for housing of a single family type (50-65) u\h.

Housing density ratio =  $683 \setminus 14.25 = 54\%$

and that matches the standard for a 120 m<sup>2</sup> housing unit.

### - Scenarios that adopt a mixture of lanes for housing

Here, a number of models through which similar calculations can be made can be made through the creation of a applicable program for a number of different scenarios to arrive at a number of proposals that are put before the investment decision-maker and commensurate with the urban designer's desire for the appropriate type of housing in each housing complex independently depending on the specificity of each situation, the desire of each community, the economic situation and the overall policy of the direction of the State, as in table (5).

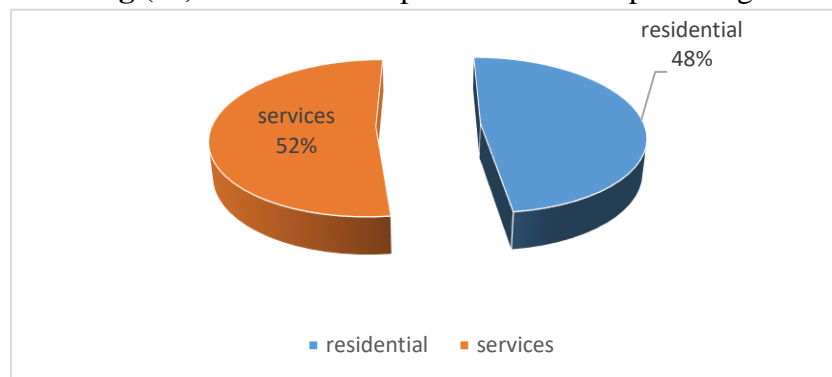
#### First Scenario

A mixture of percentages is made for single family housing types, and the largest dependence is for large block areas, which represent the lower density ratios of 275 m<sup>2</sup> for 35% of the complex.

The scenario showed that residential use was approximately 81% of the residential complex, as in Fig. 2.

This is a scenario that consumes urban land in parks, which does not allow for the provision of other urban services necessary for the comfort and safety of residents.

**Fig.( 2 )** residential complex and services percentage

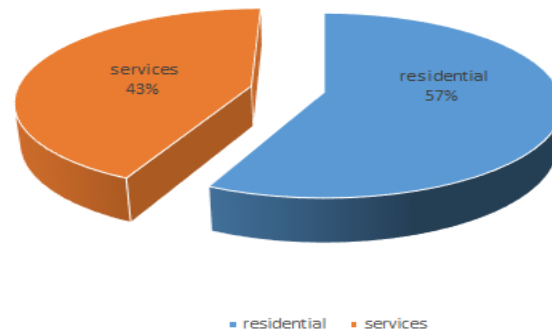


Source: researcher according to calculations

#### Second scenario

A mixture of roughly equal percentages is made for the types of housing reserved for single families, and the largest dependence is for the small block areas, as in Fig.3, which represent the higher density ratios at the rate of different areas in the complex.



**Fig.( 3 )** residential complex and services percentage

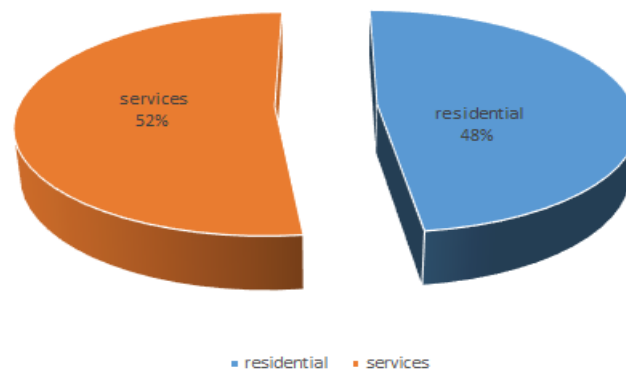
Source: researcher according to calculations

The scenario shows that residential use is approximately 57% of the housing complex, which in principle provides us with the possibility to add 75 additional housing units.

### - Scenario 3

A mixture of percentages of housing types intended for horizontal and vertical housing is made for single and multiple families and the mixture of spaces depends on a ratio of the land as in Fig. 4

The scenario showed that residential use was approximately 48% of the residential complex. In principle, this provides us with the possibility to create 715 housing units in total in the complex, i.e. the designer can work to add an additional 187 housing units.

**Fig.( 4 )** residential complex and services percentage

Source: researcher according to calculations

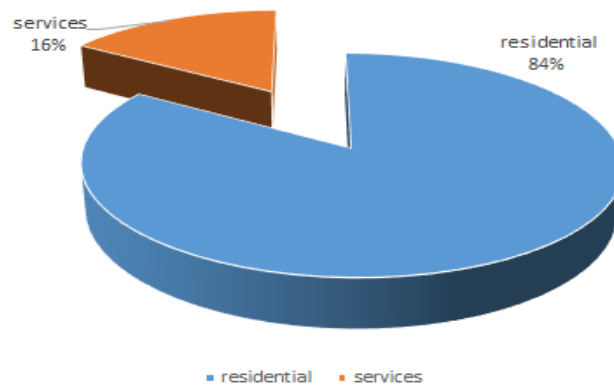
#### - Scenario 4

The largest dependence is on low-rise housing, which represents the highest density at the rate of different areas in the complex.

The scenario shows in Fig 5, that residential use is approximately 84% of the residential complex.

This is a scenario that consumes urban land in parks as in the first scenario, which does not allow for the provision of the remaining urban services necessary for the comfort and safety of residents.

**Fig.( 5 )** residential complex and services percentage



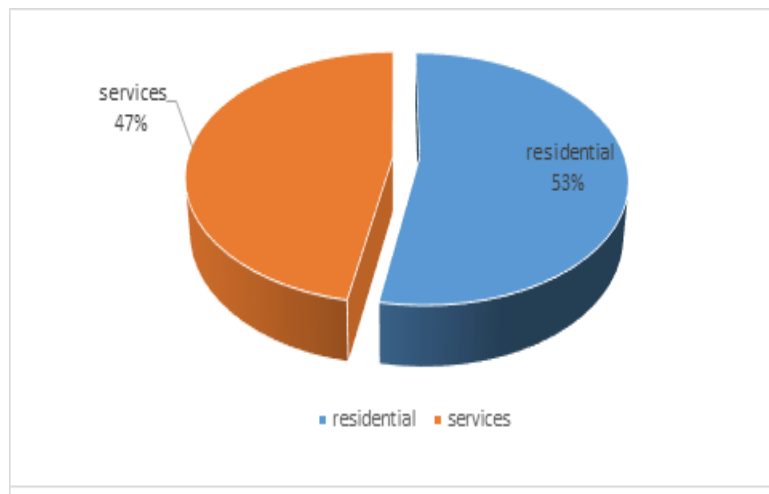
Source: researcher according to calculations

#### – Scenario 5

This kind of scenario is proper for low income families The scenario shows that residential use is approximately 53 % of the residential complex, as in Fig.6

This is a scenario that depends on high density with small area single family housing , which allows to the remaining urban services to be, and give us the chance to increase the number of houses to 648 unit, that means we can increase 120 dwells to the complex.

Fig.( 5 ) residential complex and services percentage



Source: researcher according to calculations

And the table 6 shows the total calculation values for each scenario applied on the same urban land used for the residence complex provided by the government.

Table (6) varies percentage scenarios

Type	detached	Semi-detached	attached	courtyard	Up to 4 story	Up to 8 story	Up to 12 story	Area m <sup>2</sup>	Area m <sup>2</sup>
Avg. No. of units	30 275	35 225	45 175	50 135	72	126	174		
Avg. plot area	0.45	0.55	0.7	0.83	1	1.60	2		
Avg. FAR									
1 <sup>st</sup> scenario	35%	15%	15%	15%	0%	0%	0%	0%	
No. of units	264	79	79	79	0	0	0	0	

Required area	72600	17820	13860	10692	0	0	0	114972	81%
2 <sup>nd</sup> scenario	15%	15%	25%	25%	0%	0%	0%	0%	
No. of units	79	79	132	132	0	0	0	0	
Required area	21780	17820	23100	17820	0	0	0	80520	57%
3 <sup>rd</sup> scenario	15%	15%	15%	15%	20%	20%	0%	0%	
No. of units	79	79	79	79	13	13	0	0	
Required area	21780	17820	13860	10692	2244	1403	0	67799	48%
4 <sup>th</sup> scenario	0%	0%	0%	0%	50%	30%	20%	0%	
No. of units	0	0	0	0	1560	1950	2340	0	
Required area	0	0	0	0	51480	38610	30888	120978	85%
5 <sup>th</sup> scenario	0%	0%	20%	80%	0%	0%	0%	0%	
No. of units	0	0	106	422	0	0	0	0	
Required area	0	0	18480	57024	0	0	0	75504	53%

Source: researcher according to calculations

### **3- Conclusions**

- 1- Residential use represents the largest proportion of diverse uses provided by the city to Sak
- 2- one of the land elements is that it is rare and not always available.
- 3- The Planning Direction, through Iraq's housing politicians, has long demonstrated the importance of giving the subject of finding a way to design housing blocks in such a way as to make the economy of the land.
- 4- There are many types of housing that have been selected for family housing and a number of different options, each with its own planning indicators.
- 5- Certain rates of residential use have not been established in all theories concerned with the planning of residential complexes, but at best determine the population, the area of the complex or both.
- 6- No importance has been given to the issue of densities that can significantly affect the distribution of cadastral ratios of services, which are considered to be a formal determinant of influence in providing urban environments suited to the reality of urban communities.
- 7- construction density, FAR, is an important and influential indicator in residential complexes, especially those that rely on multi-family housing for multi-story buildings.
- 8- The rate of residential land use in Iraq ranges from 40 to 65%
- 9- The population and housing density are low in this complex.
- 10- In examining the state of affairs of the vertical housing complex and extracting its own planning indicators, it was observed that the proportion of residential use, if done according to the ratio of total area of residential buildings, gives an incorrect indication that the ratio shows a tribe and does not correspond to the required housing standard.
- 11- applying planning standards for building densities on the complex shows us that vertical complexes were within the upper limits of the approved planning criteria, which does not allow for the addition of additional numbers of block layouts from residential buildings to take advantage of urban land.
- 12- these scenarios have developed ideas that an urban designer could use to take advantage of the same space allocated of urban land in the residential complex to add more housing than the standard-setting indicators , and housing policy to assist the investors and decision maker to find the best complex .
- 13- Through this scenarios, we can produce any housing type mix, that can be based on the economic needs or social desires of each society, depending on the specificity of each urban environment, and in a way that gives freedom to the urban designer to put several ideas in front of decision makers and investors to choose from according to each private conditions of each housing complex

### **4- Recommendations**

- 1- recommending decision makers to adopt planning decisions to refer to planners and designers to work according to the planning standards indicators when setting up a plan in order to make the adopt urban environment with adequate housing, as approved by the Iraqi constitution.

- 2- Requiring from urban designers and planners to adopt a obvious and detailed adequate land use programmed scenario, that would develop planning ideas in the form of numbers and areas of houses.
- 3- Adopting the construction density as an indicator key to determine the size of residential area specially in the multi-story buildings.
- 4- recommending making the building FAR as a reference in calculating all urban land uses ratios, especially in city center, such as the educational or the health use.
- 5- Suggesting that the residential complex should be based on a mixture of different types of buildings in the same residential complex, but according to building density indicators.

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