



3rd Stage/ Spring Semester/ Housing

Housing Planning Techniques

Urban Densities

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* **Density:** The quantity of people or dwelling units in a given area or space.

* **Urban density** is a term used in urban planning to refer to **the number of people inhabiting a given urbanized area**. As such it is to be distinguished from other measures of population density.

* **Urban density** is considered an important factor in understanding **how cities function and expansion**.

* In the city, Master plans recommended allocation **residential area** for different types of housing for example:

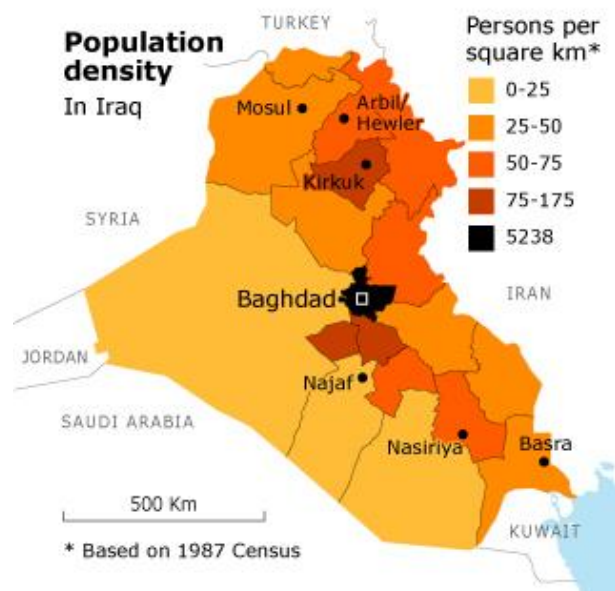
- 1- Housing for low income
- 2- Housing for middle income
- 3- Housing for high income (special housing).

Usually a type related with different levels of population densities such as high, medium, low densities but the same problem against planner and designer together is the **type of residential buildings which are achieved supposed density** according to the requirement standards in project are they "villas, attached, detached, twin, row house buildings".

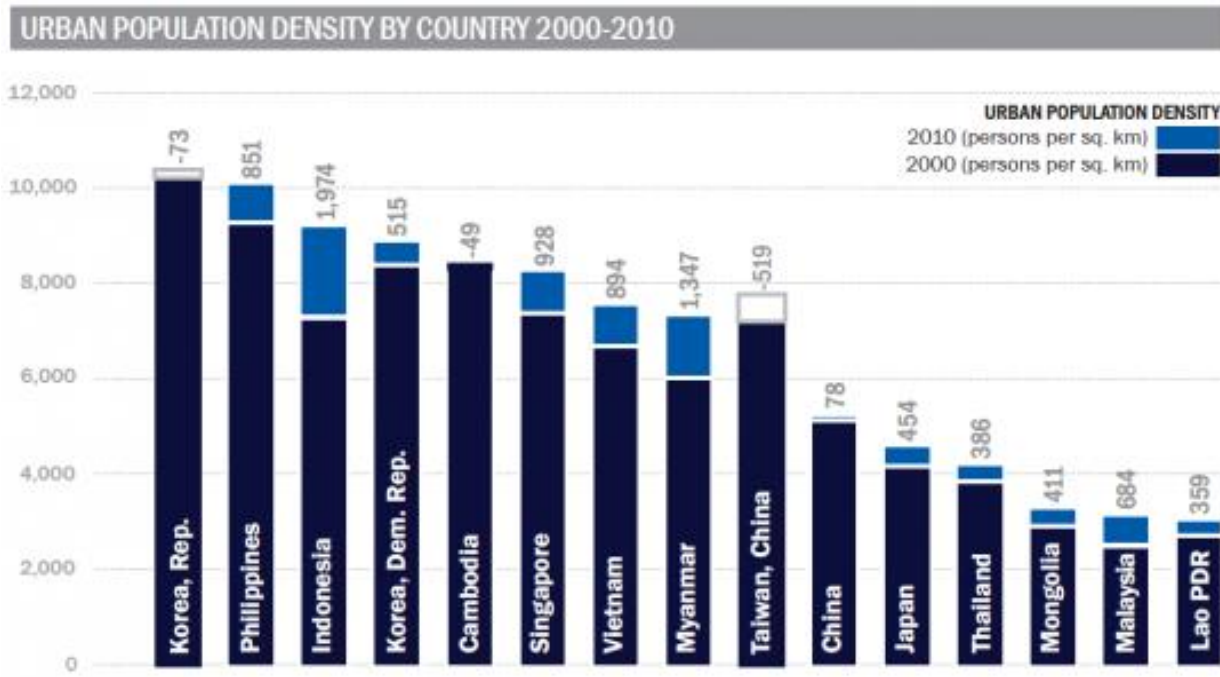
The general definition of density is the average of people or families or dwelling Per any area unit (fadan, hectare, square km,).

The densities are considered the important indicator in planning process.

* The density is varied between nations and countries according to the location and activities, land use, social, economic level of population therefore its proportional.



Negative population growth means that there are more individuals leaving the population than joining the population.



$$\text{Growth Rate} = \left[\left(\frac{\text{Present}}{\text{Past}} \right)^{1/n} - 1 \right] * 100$$

Iraq / Population growth rate

2.3% annual change (2020)

Sources include: World Bank

Erbil - Historical Population Data

Year	Population	Growth Rate
2019	833,000	1.46%
2018	821,000	1.36%
2017	810,000	1.38%

Iraq
Country in the Middle East

Iraq, officially the Republic of Iraq, is a country in Western Asia, bordered by Turkey to the north, Iran to the east, Jordan to the southwest, Syria to the west Kuwait to the southeast and Saudi Arabia to the south. The capital and largest city is Baghdad.
[Wikipedia](#)

Destinations View 10+ more

Baghdad

Erbil

Sulayma...

Najaf

Basrah

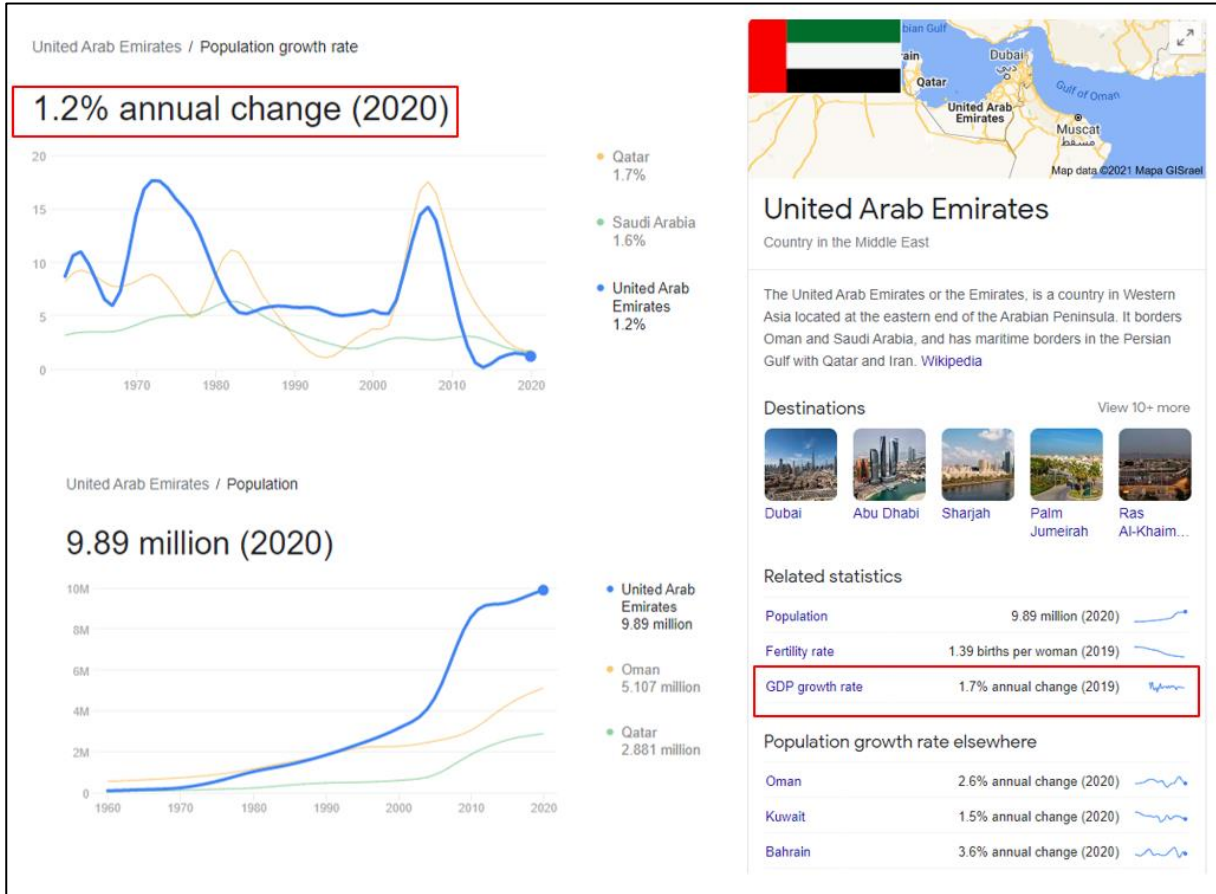
Related statistics

- Population: 40.22 million (2020)
- Fertility rate: 3.60 births per woman (2019)
- GDP growth rate: -10.4% annual change (2020)

Population growth rate elsewhere

- Afghanistan: 2.3% annual change (2020)
- Syria: 2.5% annual change (2020)
- Saudi Arabia: 1.6% annual change (2020)

$$\text{Growth Rate} = \left[\left(\frac{\text{Present}}{\text{Past}} \right)^{1/n} - 1 \right] * 100$$



1-Population Density

Description: Population density is the concentration of individuals within a species in a specific geographic locale. Population density data can be used to quantify demographic information and assess relationships with ecosystems, human health, and infrastructure.

Measuring by:

Total population /Km P/Km

This is usually used in **wide area region** or **nations levels** as a total, for example in Egypt the density is 40p/Km, in Germany is 247 p/Km; in France is 94 p/Km, in Iraq is 80p/km.



Capital: Erbil

Area: 40,643 km²

Population: 5.123 million (2014)



* Population Density (Kurdistan Region) = $5123000 / 40643 = 126 \text{ p/K}$

2-Residential Density

Measuring by

Total inhabitants (p)/hectare (H).

And relative to the total area or part of it (sub area) and this type of density is divided in to two types:

A- Gross density: total inhabitants /gross residential area (P/h)

B-Net density: total inhabitants /net residential area (P/h)

***Residential density** is a quantitative measure of the intensity with which land is occupied by either development or **population**.

*** Net Residential Area** including built up area which are contain: (court yards, small gardens, entrance and gates of houses, area of garages which are serve the residential community in case study.

In the case of **Residential Gross Density** there are other areas adding to the previous areas in residential net density specified for activities and sharing utilities besides the area specified for traffic in side this example clarify these cases:

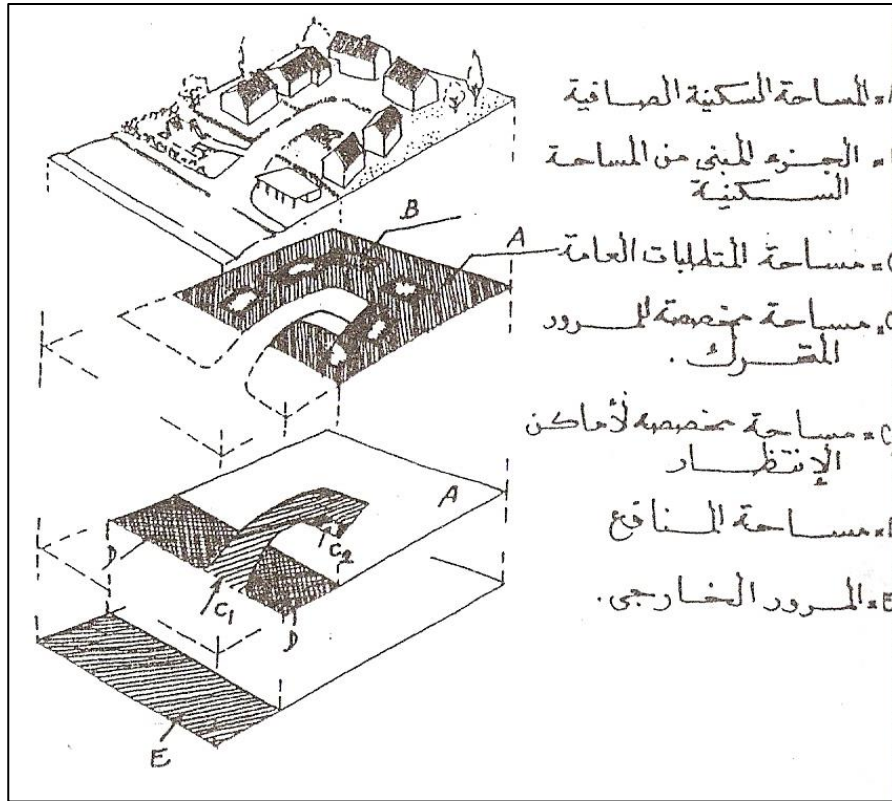
*** Net Residential Area:** built up area, courts, gardens, Entrance of buildings

*** Gross Residential Area (G.R.A):** Housing Area+ Public utilities + Open space area (green area, play yard, street network)

G.R.A=Housing Area+ Social Infra. area+ Open Space Area

*** Area specified for inside traffic:**

- Traffic area moved through the area.
- Traffic area for residence in area (parking).



Floor Area Ratio - FAR

What is a Floor Area Ratio (FAR) and Why is FAR Important to Urban Planning?

The floor area ratio (FAR) is the relationship between the total amount of usable floor area that a building has, or has been permitted for the building, and the total area of the lot on which the building stands. This ratio is determined by dividing the total, or gross, floor area of the building by the gross area of the lot.

$$\text{FAR} = \frac{\text{Built Up Area} \times \text{No. of Floors}}{\text{Gross area}}$$

Perhaps the best way to define a FAR is to give an example. A FAR of 1.0 means that the developer is allowed to build the equivalent of a one-story building over her entire lot, or a 2-story over half the lot. A FAR of 2.0 means the developer is allowed to build the equivalent of a two-story building over her entire lot, or a 4-story over half the lot.

A FAR of 0.5 means the developer is allowed to build the equivalent of a one-story building over half her entire lot, or a 1-story over half the lot.

Land use intensity for residential ‘Housing Density/Accommodation Density’

This ratio used as indicators can be re-back as basic reference at the beginning of function.

In the end of the projects we will analysis it to know the ratio which we made it in projects according to the type of building (dwelling types):

***Land use intensity for residential= no. of dwelling units/ Gross residential area**

Land use intensity (%)

This indicator explains the relationship of structural mass and open space, this is the index of the analytical steps that must be taken into account in the preliminary study of the housing projects.

*** Land use intensity= (Built up area / total area) *100**

Planning Indicators

*Net Residential Density= total population/ N.R.A

*Gross Residential Density= total population/G.R.A

*Housing Percentage= Gross Residential Density/ Net Residential Density

*Land use balance (Housing Percentage) = Net Residential Area/ Gross Residential Area

* Land Use Density for residential= no. of D.U/Total area

* Open space percentage (%) =open space area/total area*100

* G.R.A =Housing Area+ Social Infra. Area+ Open space Area

* Built up area=Housing Area+ Social infra. Area

* Land use intensity (%) = (Built up area/total area) *100

*F.A.R = Built up area*No. of floors/ total area

The formula to calculate *future* population given current population and a growth rate is:

$$\text{POP. future} = \text{POP. Present} * (1+r)^n$$

Where:

r = Growth Rate

n = Number of Periods

The percent change from one period to another is calculated from the formula:

$$\text{GR} = [(\text{Present} / \text{Past})^{1/n} - 1] * 100$$

Where:

GR = Growth Rate

Present = Present Value

Past = Past Value

n = Number of Periods

EXAMPLE 1:

The directorate of housing planning in Erbil city collected a data about a residential zone to develop the zone and support it with necessary facilities such as (primary school, health centre, mosque, local market, and police station). The surveying showed (5000 dwellers) in the zone in (2021), and the percentage of the housing was (30%). According to the given data; calculate the following requirements:

- 1- Gross Residential Density.
- 2- Net Residential Density.
- 3- Land Use Density for residential.
- 4- Open space percentage (%).
- 5- Built up area.
- 6- Land use intensity %.
- 7- Population forecasting in (2031) for the zone.

Given:

- Average size of family= 5 persons - Growth Rate= 3%
- Plot area for one dwelling unit=250 sqm.

Answer:

$5000/5=1000$ dwelling unit.

$1000*250=250000\text{m}^2=$ **25hectare (N.R.A)**

2-Net Residential Density= total population/ N.R.A = $5000/25=$ **200p/h**

* Housing Percentage= Gross Residential Density/ Net Residential Density

$0.3 = \text{G.R.D} / 200 \dots \dots \text{G.R.D} =$ **60p/h**

Social infrastructure area:

-primary school= $5000*17.5/100=875$ users * $20\text{m}^2= 17500\text{m}^2$

-health centre= $5000*100/100= 5000$ users * $3.5\text{m}^2= 17500\text{m}^2$

-mosque= $5000*0.75=3750$ user * $1\text{m}^2= 3750\text{m}^2$

-local market= $5000 * 0.75= 3750$ users * $1\text{m}^2= 3750\text{m}^2$

-police station= $5000*100/100=5000$ users * $0.1\text{m}^2= 500\text{m}^2$

Social infra. Area= $32750\text{m}^2=$ **4.30hectare**

Housing Area=25 hectare

H.P = N.R.A/G.R.A.....0.3=25/ G.R.A.....G.R.A= 83.33hectare.

3- Land Use Density for residential= no. of D.U/Total area= $1000/83.33=$ **12u/h.**

4- Open space percentage (%) =open space area/total area*100

G.R.A =Housing Area+ Social Infra. Area+ Open space Area

$$83.33=25+4.30+X\text{.....}X=54.03\text{h (Open space area)}$$

$$\text{Open space percentage \%} = 54.03/83.33 = 65\%$$

$$5\text{- Built up area} = \text{Housing Area} + \text{Social infra. Area} = 25 + 4.30 = 29.30\text{h}$$

$$6\text{- Land use intensity} = \text{Built up area} / \text{total area} = 29.30 / 83.33 = 35.1\%$$

7- Population Forecasting (2031):

$$\text{Pop}_{2031} = 5000 * (1+0.03)^{10}$$

Pop₂₀₃₁ = 6720 person.

EXAMPLE 2:

A residential zone in Erbil city was designed to occupy (1250) row house units with some facilities such as a primary school, police station, health centre, local market, and mosque. The neighbourhood plan followed the recommendation of the United Nation-Habitat to create (40%) as open spaces. According to the given data, find the following requirements:

- 1- The number of proposed residents in the zone.
- 2- Gross Residential Density (GRD).
- 3- Net Residential Density (NRD).
- 4- Housing Percentage (%).
- 5- Land use density for residential.
- 6- Population forecasting in (2032) for the zone (consider 2022 as a basic year).
- 7- What are the main planning standards (location standards) for the primary school and health center?

Given:

Facilities	Users Percent% (from total population)	plot user area for one-person m ² /p
primary school	20%	15
Police Station	100%	0.10
health care centre	60%	1.0
mosque	50%	1.0
local market	80%	1.0
Average size of the household= 4 persons Unit area=160m ²		Growth Rate (i)= 2.5%

Answer:

1- The number of proposed residents in the zone= 1250*4= **5000 persons**

Social infrastructure area:

- Primary school= 5000 * 0.2* 15= 15000m²
- Police station= 5000 * 1* 0.1= 500 m²
- Health care centre= 5000 * 0.6* 1= 2000m²

- Mosque= $5000 * 0.50 * 1 = 2500 \text{ m}^2$
- Local market= $5000 * 0.80 * 1 = 4000 \text{ m}^2$

Total area of facilities= $25000 \text{ m}^2 = 2.5 \text{ hectare}$

Housing Area= $1250 * 160 = 200\,000 \text{ m}^2 = 20 \text{ hectare}$

(GRA)= housing Area + infrastructure Area + Open Space Area

GRA= $20 + 2.5 + 0.4 \text{ GRA} \dots \dots \dots \text{ GRA} = 37.5 \text{ hectare}$

2- Gross Residential Density (GRD) = No. of population/ Gross Area= **133 p/h**

3- Net Residential Density (NRD = No. of population/ housing Area= **250p/h**

1- Housing Percentage (%) = GRD/NRD= $(133/250) * 100 = \mathbf{53.3\%}$

4- Land use density for residential = No. of units/ GRA= $1250 / 37.5 = \mathbf{33 \text{ u/h}}$

2- Population forecasting in (2032) for the zone (consider 2022 as a basic year).
 $5000 (1 + 0.025)^{10} = \mathbf{6400 \text{ persons in 2032}}$

5- What are the main planning standards (location standards) for the primary school and health center?

*** Primary schools-** location standards

- Isolate from other facilities.
- Far from circulation network.
- Close to residential buildings and recreation areas.
- Close to main pedestrian accesses.
- Should be accessible by foot path from dwelling units without crossing any street, if street must be crossed it should be a minor street.

*** Health Centre-** location standards

- In the center of served area.
- Close to common green areas.
- Isolation from noise and air pollution.