Human Settlements Planning
Lecture 3

Structure and Form of Human Settlements

Living cities have intrinsically fractal properties, in common with all living systems. The building of cities has a long and complex history. Although city planning is an organized profession, it has existed for less than a century, most cities display various degrees of forethought and conscious design in their layout and functioning. How can you go about describing different settlements? The factors we will be majorly talking about are; Area - How large is the area of a settlement is; Site - describes the actual land upon which a settlement is built; the third factor, Population - the size, as well as the type of people i.e the demographic, the ethnicity, what kind of people are going to live in that settlement; Shape - Describes how the settlement is laid out, it's basically a pattern; Situation - describes where the settlement is located in relation to other surrounding features such as settlements, rivers and communications; finally the most important, Function - The function of a settlement relates to its economic and social development and refers to its main activities. All these elements together will come up about how a settlement is going to be and even decide the future of that settlement.

The first pattern we will be seeing is; **The Dispersed Settlements -** A dispersed settlement refers to the scattering of houses over a large area. There is no particular pattern that emerges. So you will obviously not have any concrete roads or anything like that. Its just without any particular direction, there will be dwelling units. This is how it would be, this is usually in farmlands or hilly areas, occurs in rural areas, develops in hilly areas, extensive flat lands or rolling plains.

The next pattern is a linear settlement - **A linear settlement pattern** refers to the grouping of houses along a line. Here, in this case, in this diagram, the line is a river, but it needn't be a river, it could be a railway line that is very important, it could be a river, it could be any other water body. It could even end up being a communication line that's very important or a highway that's come about. So, anything that supports these dwelling units and along that main support line or at

the spine of the element, it is a linear settlement. Though, this tends to follow roads, railway tracks, along the coast or a river. This is found in both rural as well as urban areas, because it provides good transport and communication network. The example of Linear city is Navi Mumbai. Navi Mumbai is obviously grown along this particular spine. Many government and corporate offices have shifted from Bombay to Mumbai for that reason.

The third pattern is; **Nucleated Settlements -** A nucleated settlement pattern refers to the grouping of many houses around a centre called a nucleus. These are roads and at the core of the road, the junction, you have the settlement pattern. These roads needn't be normal roads when you look at it. It could be highways, it could be a very important, one could be a very important railway line, one could be a road way. A road just signifies a main linkage. This is developed at road intersections, focal points of an area or confluences of rivers. This grows in size to form a market town in the rural area. Towns and cities may develop into urban centres and increase in the number of functions.

Radial towns - Dwellings are located around the centre, streets circle around these dwelling units. The main building used to be on top of a small hill. The main building usually in the olden days was a palace, an institutional building or a place of worship. These days it could end up being an institutional building with respect to the government or even an educational institution.

The Towns around the centre - the centre could be a square, a town-hall. A town-hall is nothing but a basic building that houses all your government activities. Radial city, one of the examples is; Moscow. This is one of the world's biggest Megalopolis, the Russian Moskva is the capital of Russia. The city grew in pattern of rings and radials that marked Moscow's growth from ancient time to modern layout. The center of all rings is Moscow Kremlin and the famous Red square. So, inspite of it being an old town that has emerged over a period of time, you can see that it has grown in the same pattern. This is the current layout of Moscow and this is Moscow in 1893. In terms of layout, it has obviously become bigger but the radial pattern still continues. Successive epochs of development are traced by the; Boulevard Ring, The Garden ring, the Moscow little ring railway and the Moscow Ring Road. So, all of this still helps Moscow maintain the radial pattern city.

Now, combinations of these patterns and other emergent patterns that have happened over a period of time. The term urban sprawl has been used to describe a variety of urban forms, including contiguous suburban growth, linear patterns of strip development, and leapfrog or scattered development. These forms are typically associated with patterns of clustered, non-traditional centers based on out of town malls, edge cities, and new towns and communities. These various urban forms are often presented in the literature as poorer, less sustainable or less economically efficient towns. Urban form and structure are the patterns and spatial arrangements of land use, transportation systems and urban design elements, including the physical urban extent, layout of streets and buildings, as well as the internal configuration of settlements. So, within urban sprawl, what kind of types or forms have emerged? This is the compact development, where you actually have everything closely knit. This could be due to the lack of space in a city like Bombay, when space is an issue, the density would be much greater. This is the Scattered Development where space is not an issue, you can grow in any way possible. The outer limit is defined by the limits of the settlement, in terms of there could be another settlement there, it could be a natural characteristic there, it could be a roadway or a railway. So, that is what decides the boundary of these settlements. Linear Strip Development - it could because of a particular motorway, it could be because of a particular existence for major industrial belt or a commercial area. This is Leapfrogging Development, here you actually start off having a nucleus but then without any cohesion, it jumps all over the place and hence the term leapfrog. Initially it could start off because of a particular arterial road or a main suburban area but then without any cohesion, the other developments come into being. Polynucleated Development - instead of having one nucleus on one central part of the city, that gets distributed into four parts and the city henceforth, clusters around each nucleus. So, it is polynucleated development.

Site Factors

Now what are the basic Site factors? We are talking about settlements, how do these factors come into being? Some sites had specific advantages that meant settlements developed in that place. These are called site factors. Bridging point -

where a river was shallow enough to be crossed, so a ford or a narrow enough bridge could be built. This happened in Oxford. If the bridge was not possible, this town could have not been established. This is the first point, the Bridging point. Next, Drypoint - In especially wet areas, settlements were built on slightly raised land to avoid flooding or the unhealthy marshland. This is Ely in Cambridgeshire. You can see again, because of flooding that could occur, the site itself has been raised. So, even during monsoon, if the river does tend to flood, it will not affect the settlement point. Then you have the, Nodal point - where natural routes meet, such as several valleys, example: York, or at the confluence of two rivers, St. Louis on Mississippi. So, when two rivers meet at a particular point, this could be a very good fertile junction that will occur or it could be various valleys in the mountain ways. Defensive - In order to protect themselves from attacks, settlements were often built within a river meander, with the river giving protection on three sides. For example : Shrewsbury, or it either located on a hill in Edinburgh. This actually makes sure you are avoid invasions from people because you have rivers and on one side you could either be on a hill or a raised platform. Wet point - These settlements were built on a source of water in an otherwise dry area. For example: in lowland Britain, many settlements were built at springs at the foot of the chalk escarpments. For example : Kemsing At near the North Downs. Aspect and shelter : Settlements were built in sheltered areas such as valleys, or in bays on coastal locations. Aspect was also an important consideration. Settlements would be more ideally located on south-facing slopes in Northern Hemisphere an vice versa. How important are these physical side factors discussed today? Technology means that many site factors are no longer critical in influencing the site of a settlement. For example : The water can be piped, road networks allow the delivery of food supplies via supermarkets, and computers and the internet provide communication. Political, social or economic factors, are usually more important. These day, defence is not an issue. When you are talking about nuclear weapons and things like that, needing to put a city on top of a mountain is not required for defence. So, now as we are becoming a technologically driven society, even the factors that are assigned that decide where the settlement is going to start off, will change. Besides talk about Urban form and how did it actually emerge? It can be defined as spatial pattern of human activities at a certain point of time. Here, time as a dimension is very important because over the past 100 years the urban form has changed tremendously. So, the point of time, the time dimension is very

crucial. Urban form is the term used to describe the physical elements within a city. It refers to the arrangement, function and aesthetic qualities of the design of buildings and streets which overlay the land dues and transport system. Generally, urban forms can be classified in various dimensions. However, the four key metrics: density, land use mix, connectivity and accessibility are very important.

Urban density, it is the measure of an urban unit of interest. Example : population, employment and housing per area unit where the units could be block, neighbourhood, city, metro area and finally, the country. There are many measures of density and three common measures are population density i.e population per unit area. Built up area density i.e what percentage is the open area and what percentage is the built up area and Employment density, very crucial for deciding the economic future of the city, jobs per unit area. Land use mix - it refers to the diversity and integration of land uses, examples; residences, park, commercial at a given scale. As with density, there are multiple measures of land use mix, including; **(1)** the ratio of jobs to residents; **(2)** the variety and mixture of amenities and activities; **(3)** The relative proportion of retail and housing. So, it's not enough that people exist in a city. If they do not live happily and cohesively in the environment, the city will soon die and decay if people tend to move out. So, it is very important that there is a good level of employment, very good activities and amenities for both commercial and entertainment factors; the relative proportion of retail and housing, it can't be a bedroom community where there is a completely residential area and people have to travel to work vice versa. It cannot be a completely commercial area where people find it that it shuts down after a particular time and it becomes barren after office hours.

Connectivity - This refers to street density and design. Common measures of connectivity include intersection density or proportion, block size, or intersections per road kilometre. Where street connectivity is high-characterized by finer grain systems with smaller blocks that allow frequent changes in direction-there is typically a positive correlation with walking and thereby less pollution which makes it more environment and eco-friendly.

Accessibility - this can be defined as access to job, housing, services, shopping and in general, to people and places in cities. It can be viewed as a combination of

proximity and travel time, and is closely related to land use mix. Common measures of accessibility include; population centrality, job accessibility by auto or transit, distance to the city centre or central business district (CBD) and retail accessibility. Basically, it is important that one person can achieve all of his activities in a time frame without too much time wasted on travel. Not only time but also energy. Not only physical energy but also the energy pertaining to natural resources like fuel. So, all of this together cohesively provides how accessible is a settlement.

Types of Form based on Density and Physical Configuration

A variety of urban forms can be described using a typology based on two continuous dimensions, which here are made discrete for explanatory purposes: settlement density and second very important, physical configuration which ranges from contiguous and compact to scattered and discontinuous. So, if you look at the types of form based on density and physical configuration; You have the compact continuous which is circular or radial using mass transit, low density it is possible but very rare. Linear strip Corridor - corridor development around the mass, transit is again an issue over here; Ribbon development along radial routes. Polynucleated nodal - urban nodes divided by green belts. Low density metro regions with new towns. So what happens is, you start creating an important town and smaller towns like satellite towns will emerge. Scattered/ Discontinuous - possible but very rare, metro regions with edge cities.

Now, theories explaining how towns are arranged. The first is the '**Grid' Model**'**.** the first example we will discuss is the 'City of Priene'. This was proposed by Hippodamus of Miletus who is considered the father of rational city planning. The center of the city contains the agora which is the marketplace, then you have the theatres and the temples. Private rooms surround the city's public arenas. The private rooms are nothing but individual dwelling units. The plan can be laid out uniformly over any kind of terrain since it's based on angles and measurements. So, site factors are least bothersome here. This is the grid model of Priene city, you can see this is the main core, around which how it develops, the roads and streets develop at right angles. The Grid Iron city, it is composed of straight streets crossing at right angles to create many regular city blocks. This form is typical of

cities built after the industrial revolution - because only then did cities play such importance on economic activity. A city gridiron plan facilitates the movement of people and product throughout the city. The advantages; high accessibility, minimum disruption of flow, expansion flexibility. So, what happens is a kind of module is created. This module can be repeated n number of times as the city expands vs if its a radial city, it has to be an entire concentric ring that will emerge which makes it more far away from the centre. Adaptability to level or moderately rolling terrain, it is very important that there is a kind of moderately rolling terrain present such that the flat city needn't be important but it can't work as a hilly region. The main reason being a hilly region will make sure that the scope of the straight angles is not possible but even though a flat terrain works, a mildly plateau or a slightly raised level will work but not a mountainous region. If we look at the disadvantages; Requires flow of hierarchies, it is linked to the adaptability to the terrain and potential it is monotonous. Exactly what we discussed as an advantage is also a disadvantage. As the modules can be repeated again and again, that creates a sense of monotony. Now, the Grid iron city, the example we have is the city of San Francisco. The main districts that emerged are the; **Office district, Retail District, General Commercial District and the Support district.** The support district was basically created to help office, retail and general commercial district run. So, you have both grids as well as certain amount of regular patterns can be seen in San Francisco and the main reason that happens is, because it is slightly on a hilly region. The next important model is the; Urban Realms Model. Again, this was developed by James E.Vance Jr, in the 1960's and this also was developed for the San Francisco bay area. Each realm is a separate economic, social and political entity that is linked together to form a larger metro framework. Suburbs are within the sphere of influence of the central city and its metropolitan CBD. Now, urban realms have become so large that they have exurbs, not just suburbs. So, if you actually look at the urban realm, it depends on the overall size of the metropolitan region. Amount of economic activity in each suburban realm, topography and major land features. Internal accessibility of each realm. If you look here, you have the edge cities and this is the Central Business District. These could even be referred to as Satellite towns or otherwise even known as Edge cities because no longer the population is completely supported by the Central business town, a newer downtown will emerge. You can see these hatched areas over here, they are the new downtowns that have emerged to help support these edge cities.

So, it becomes multi-nucleated as well as new realms or new rings are formed, which are not concentric in nature but because of the terrain they are formed as irregular patterns.

Core Frame Model - the Core Frame model is a model structure showing the CBD of a town or a city. The model includes an inner core where land is expensive and used intensively.So, that's where you will find the skyscrapers and the taller buildings. The outer core and frame have lower land values and are less intensively developed, various land uses are linked to the bid rent theory. This is the core formula. A, you have better residential properties. B, you have heavy industry and poor residential. A, is good residential because it is away from the Central Business district, so there will be better houses, larger houses vs the second core if you look at it; the zone of inner core is here. Then you have the outer core and this is the frame of the city. This is the zone of discard. Zone of discard is where all your services would occur, and here is the zone of Assimilation. This proves to be a linkage between the suburban area to the Central Business district or the higher offices.

The Bid rent theory follows geographical economic theory that refers to how the price and demand for real estate changes as the distance from the Central business district (CBD). This is based upon the idea that retail establishments wish to maximize their profitability, so they are much more willing to be paying better or higher land rates to be closer to the CBD and less for land further away from this area. The amount they are willing to pay, is called the 'bid rent'. So, this is consumer driven, this kind of theory is completely consumer driven because as the population of the Central Business District increases, as the acceptance of it increases, the rent will also increase but once it reaches a plateau and it starts declining, the reverse will begin to happen. Say, the multinucleated theory follows and another CBD is following up, then the bid rent theory will apply such that; the shops, the commercial areas, the rent will begin to drop and the people will want to move out. This is the CBD again, the darkest portion you have the CBD, the distance from the centre as it increases. So, if you see XX, the rent is high, such that, this is the commerce they are willing to pay. So, as you go more farther away, the rent drops. If you look at Zone 1, this is the Central Business District with commerce and offices, if you look at Zone 2 - it consists of the industries and Zone

3 is Residential with highest density closer to the centre. So, even within Zone 3, as you move away, the density will also increase.

Irregular Pattern Model - Arrangement of public space that characterizes the stage of 'Transition from village to city' especially in the Third World. This urban model is due to lack of planning or construction and illegal without specific order. Basically, in a way it can be considered organic without any pre-defined plans, these patterns emerge. Includes blocks with no fixed order or permanent and temporary structures. Structures are not related to an urban centres near the place.

Now, we will move on to the, **Zonal Model - the Concentric Ring Model.** The Concentric ring model is a model of the internal structure of cities in which social groups are spatially arranged in a series of rings. The Concentric Zone model was the first to explain the distribution of different social groups within a particular urban area. It was originally based off Chicago, although it no longer applies to Chicago and we will see the reason why. The model was created in 1923 by Burgess, Robert Park and Roderick McKenzie. The idea behind the model is that, the city grows outward from a central area in a series of rings. The size of the rings may vary but the order will mostly remain the same. This model also suggests that, the social structure extends outward from the CBD, meaning that the lower classes live closer to the city centre vs the upper classes live far away from the city because they can afford to commute. Also, as you move farther away from the city, the density also decreases, which means, you can have bigger houses. The rent tends to increase as you get farther away from the CBD and residents are more likely to rent near the center. As you get further away from the CBD, it is most likely that you will find condominiums which is owned apartment complexes and no more rented properties. Indianapolis is the city that can be applied to the concentric zone model today. That is because more people rent near CBD than away from it. However, this model has it's weaknesses. It does not take into account any physical barriers and it does not take into account gentrification - which may occur in these cities. Gentrification is actually a process where a poor area or an economically backward area is suddenly regenerated to make it an upper class area. Outward expansion of CBD would invade nearby residential neighbourhoods causing them to expand outward. The process was thought to continue with each successive neighbourhood moving further away from the CBD.

It's suggested that inner-city housing was largely occupied by immigrants and households with low socioeconomic status. As the city grew and the CBD expanded outward, lower status residents moved to adjacent neighbourhoods, and more affluent residents moved further away from the Business district. Burgess's work is based on the bid rent curve. Like we just saw, this theory states that the concentric circles are based on the amount that people will pay for the land. This value is based on the profits that are obtainable from maintaining a business on that land. The center of the town will have the highest number of customers, so it is profitable for retail activities. Manufacturing will pay slightly less for the land as they are only interested in the accessibility for workers, goods in and goods out. Residential land use will take the surrounding land. So, that's clearly demarcation of every particular zone. Assumptions made are; You assume an isotropic plane and therefore transportation is equally cheap; Land near the center is of higher value than the land near the suburbs.; Building age is one move to the city center, there exists well defined separation either ethnically or economically so, a cast distinction comes in; those who can afford a transport live away from the center; there is no concentration of heavy industries. Limitations; The model is being challenged by many contemporary urban geographers. First, the model does not work well with sites outside the United States, in particular with those developed under different historical contexts. Even in the United States, because of changes such as advancement in transportation and information technology, and transformation in global economy, cities are no longer organized with clear zones.

This is the Concentric ring model, first you have the CBD Proper, then the Fringe of CBD, then the Zone in transition or the Grey zone, Lower income Housing, Higher income Housing and the commuter's zone. This is the Burgess's Model, from intensely high density to low density; low rent to high rent.