Site Analysis and Planning

Lecture 7

Welcome to UGC lecture series, today's topic is Site Analysis and Planning. Subject code - AR 6512. Unit 3 - Site Analysis, Lecture - 07.

The overall presentation is divided into three major categories - first is introduction, then we move on to Environmental factors that affect the site planning, then, we move on to Natural factors.

Importance of Site

First, importance of site and its contents. A site plan is an architectural plan, landscape architecture document, and a detailed engineering drawing of proposed improvements to a given lot. A site plan usually shows a building footprint, travelways, parking, drainage facilities, sanitary sewer lines, water lines, trails, lighting and landscaping and garden elements. When you take a site plan it is detailed planning that is done after your initial research phase and synthesis phase. After you collect all your data collection and after you are done with your surveying, after a client comes up with the design vision. Then the designer or architect who sits for the site plan, designs a complete document which states not only architecture but also gives information about landscape design and engineering works such as servicing sewer lines, how the utilities and various services are going to come together in this site plan.

Importance of site and its content - as you can see in the image, such a plan of a site is a 'graphic representation of the arrangement of buildings, parking, driveways, landscaping and any other structure that is a part of a development project." When you give a site plan, it is not just a plan or document of the building that is going to come in but it is also a graphical representation of how you are going to connect to your inner roads to the main roads and how the parking is going to come in place and how two wheelers are going to approach your site from roads and where the residential zones, commercial zones and the mixed zones are going to come on one side. All this information put together is called a site plan. A site plan is a set of construction drawings that a builder or contractor use to make improvements to a property. It is a set of construction drawings. As the word suggests, it gives complete construction drawings that can readily be executed on site. This is the final layout for a given site. This drawing is created by the builder or a designer who envisions the whole project. Counties can use the site plan to verify that development codes are being met and as a historical resource. Once your site plan is made, it acts as a reference drawing to cross check the progress happening on the site. It can also be used as a historical document which means you can save this site plan and down the road if you need to make any changes or if you need to extend your site, you can use the present site plan documents and make a better design according to the changes.

Site plans are often prepared by a design consultant who must be either a licensed engineer, architect, landscape architect or land surveyor. These are the four professionals who are eligible to prepare a good site plan since they understand space and how a site is located and how different utilities and services are going to come together. They can envision the whole project as such.

Environmental factors

We are moving on to different factors that are going to affect site plan. First, under these factors, it is being divided into two major categories. First is environmental factors. Let's have a look at environmental factor. Environmental study for architectural design involves collection of data, reconnaissance survey, creative ability and imagination and the design of solutions to solve building problems. As you see, a site plan comes together when you have data collection, Reconnaissance survey, creative ability and the imagination for the whole site i.e after execution how the site is going to act. Such type of an imagination is usually created by the builder, designer, contractor or even by the surveyor. Final design solution is being created solving each and every problem that is being created or that is present on the site. The solution also caters to the needs envisioned by the client.

When an architect is given a design assignment, there are many environmental factors that are to be considered. The site is the major factor that has to be considered. When you start with the design, the first thing you need to look at, is the site. The site is the place on which you are going to build something or make a development. That is the first or primary source that ought to be considered. The site planner decides on the uses of the site in detail by selecting and analyzing it for the various characteristics of soil, slope, vegetation, etc. Under environmental factors, when you do site planning, you need to consider different elements such as soil, what type of soil is present on the site because this will determine the type of foundation that this place can hold and also the slope. This will determine how the natural water such as rain water, drain from the site or how the water from outside is going to come into the site. You need to know what type of soil can hold what type of vegetation. This can give good shading as well as allow sunlight during the winter. To understand these type of elements, you need to study each and every characteristic of the site.

As you see in this picture, this is a very terrain site. The buildings are placed in such a way that they will have good views in the outside space as well as trees which are going to provide shade to the building on the sides which are going to receive more solar radiation. The landscape involves the design of an outside space. This should be thought about carefully to make an architectural design complete. As we know, we can never separate ourselves from nature. It is

similar even in architecture. So, when you design a building, you need to also consider architecture. Only when you think both in parallel, the design is complete. Landscape designer is usually commissioned for this type of work.

The climate at the location of the site is very important as it affects the building that is to be constructed. After we know about the site, we need to study about the climatic condition present in the whole city as well as the microclimate of the space, this will determine where each building be located and how will different factors, say size of openings, amount of air exchange per hour, can be decided by the architect or the designer to create a sustainable design. Services such as water supply, drainage, sanitation, electricity, fire protection, air-conditioning system, etc. Even services have to be considered while designing. Also have to be considered in order to make an architectural design complete.

Identification of site and its preparation - Each site has a unique nature of its own. The purpose for which it is to be used should be clearly understood. Every site when disturbed takes time to experience the mutual adjustment of its elements. When you take a site, each site has its own unique nature. Few sides may have a very good view, whereas few sites may not. There might be different types of contour for each type we design. So, you need to understand each and every factor for individual sites and you need to address them separately.

For example, the flow of water creates a drainage pattern. Many factors are involved in the analysis of the site. These include the factors above the ground, below the ground and on the ground, as discussed in the following.

As you see in this image, this is a huge site in which we have contours. We know higher point and this is going to be the lower point, in which the drainage system and the waterbody systems are connected such that the floor is towards the drain. The drainage or the run off can be managed very easily and the water will not get stagnated within the site. This is one example why we need to consider terrains when site planning.

Natural Factors

Moving on to the next aspect to site planning, Natural Factors. First is, Geology. Geology is the study of rocks and what type of rocks are present on the site. In order to determine what type of foundation and how deep the foundation can go, we move on to topography, slow analysis. This is also the study about how slopes and gradients are going to happen on your site in order to take care of water, drainage and other services. Hydrology which is streams, lakes and swamps. We need to know the water table present on your site in order to cater to different water requirements of the end users. For which you need to know if there is any lake, stream or

even a pond, present on your site or close to your site. Soil - classification of types and uses. We need to know what type of soil is it, in order to also determine the type of foundation. Vegetation - what type of vegetation can be adapted or grown in that type of soil is also very mandatory to know. After which the landscape architect or the landscape designer can come up with what type of trees and shrubs can be grown on the given site. Wildlife - we need to make sure the wildlife of the whole space is not disturbed. Since we all are a part of a huge food chain, we need to make sure the wildlife of the whole site is not disturbed in order to keep the food chain intact. Last but not the least comes the climate factors which is a preliminary and major aspect to be considered during site planning. This takes care of solar radiation, wind movement and wind speed, precipitation, humidity, etc. Now, let's look at each topic in brief. First comes Geology.

Geology is the type of rock below the surface of soil,the depth, and the characteristic features of rock should be identified. Such rocks could act as a foundation for many buildings. These are natural and could form visible landforms. The stability of such geological formations is also important. As summarized previously, it is a saying that stresses on the importance of knowing what type of rock formation is being formed below the soil in order to determine the type of foundation. Geomorphology - the geology dealing with the origin and nature of landform with emphasis on erosion process. Geomorphology is a type of rock that is being formed over the years. When you know this, you can understand what can be predicted in the future. Physiographic is the description of landform. Bedrock is consolidated rock material lying at various depths below all points of Earth's surface. Bedrock is the much thicker rock form that is present usually below the soil but varies in depth when compared to your surface of the soil which determines if your foundation can be laid to what depth.

Geologic map - The importance of geologic information, where to get the information, which is usually present during surveying. Geologic base - The depth and type of rock below the soil's surface are significant factors for site development, to answer the question of its specification as a foundation base.

Next, moving on to Topography. The form of land is called its topography. This is the most important factor to be analysed. Geology and the slow process of natural erosion are responsible for landforms and slopes. Since topography is how the land is being formed, you need to know what is your elevated point and what is your lowest point, how the water is going to come from the top point to the low point, how the rain water as well as sewage water that's going to come from end users are going to get drained out. This information is very dependent on the topography of the site. Geology is a slow process which determines land sliding. A topographic survey will reveal the badly drained areas and natural drainage channels. It will

also be revealing places that have good views and parts of the site that are visible or hidden from any selected point outside the site. Taking a topography map is not only beneficial to help find out the rainwater runoff or the valley in which it can be stored but also gives information about the views and vistas that can be created from the site or the designer is going to propose. The slopes will decide the roads and paths, a steep slope will increase building costs. We need to know at what gradient these slopes are located in order to reduce the architectural design cost.

Landform - Topographic map and interpretation. To create a landform, to know about the information of a landform, we need to create a topographic map, which is a contour map, which is created by interpretations. Then we do a slope analysis in which we find out what is the place in which rain water catchment can be created, where the valley points are dark purple colour are going to be steep slopes and runway of paths. This is a typical slope analysis diagram. The constraint and opportunity of landform, Hydrological survey department/ harbour department can convey the information of what type of hydrological information you might need. Slope analysis is the tool to indicate each portion of land with percent slope to see the potential in developing each part for suitable use. Slope analysis can determine what can be used. For example if you take a hill station, there might be places that have a flat portion that can be used for human needs whereas there might be huge slopes that cannot be used for any type of construction purpose or even if it is being used for construction, it is just going to increase the architecture building cost. Contour interval, pattern of landform. All this information depends on contour interval, which means how much is the distance between each contour line given. More closer the lines are the more accurate the results. It also gives information about Natural drainage pattern and unique features that are the views and vistas that can be viewed and few things might not be seen when you get to the site. Whereas, when you take a topographical survey map, you might be able to understand the site much better. Slope analysis and percent slope, how much gradient has been formed along the contours. After you create a topographical map, you might also determine that there might be a huge slope just behind the site and the path has to be completely kept with a huge boundary wall to protect the users from falling off or something like that. This creates a Site danger signal. For example, this is how a site analysis is being done for contours. As you see, this is the actual contour map and this is the elevation. The green ones are very much tilted, the ones that are marked in red with more horizontal planes, which have minimum gradient or slope, this is much more beneficial for usage, this place can be used more for landscaping or for creating views.

Grading Process - A site contains design objects such as alignments, parcels, and grading groups. Using a site, you can organize boundaries, alignments and parcels in a drawing. Drawings can have multiple sites, each of which can have associated objects. Different sites can

occupy the same geographic space. As you see here, the gradient is being found out, we are doing a cut and fill. This dotted line shown in the figure is the actual slope of the project. For architectural purposes, we are going to cut some land, take some sand that is going to be in this cut part, we are going to fill spaces that are completely depressed.

When you see this image, this is the cut place where the sand has been excavated. This is the fill slope in which the sand that has been taken from the cut space is replaced here to make a much more flatter space for development.

Slope and Grade - Percent grade refers to the number of vertical units of drop along the line divided by 100 units (ft/100 ft or m/100 m). Slope is often used as a ratio of the number of horizontal units to vertical units of drop along the line. (3H : 1V or 3:1). It depends upon how much distance you need to travel in order to achieve 1m. Say example if you need to travel 3m to climb a height of 1m, this is what is meant by 3:1. The soil to be removed is being mentioned in the dark line. The proposed contouring is this line. This is the proposed contouring. There is a huge space that is being created. The soil is being removed and replaced someplace else to make a more horizontal plane for development to take place.

Spot elevation - Spot elevations are inserted points that designate a design point position and elevation. Design surface, a surface created by the designer to represent the finished condition following construction. Design surface is what we are making after we cut the soil and then we fill it up elsewhere. After we alter the contours, the surface we get is called design surface. Grading objects - Grading objects are created from feature lines and consist of slope projection lines, a target (a surface, a distance, an elevation, or a relative elevation) and a dynamic daylight line. Grading objects are created by feature lines which means how much grading is being done for each space and what type of development can typically be done.

Grading groups - Grading groups are contained in a site and contain individual grading objects. A collective number of grading objects are called grading groups. Grading objects within the same grading group are aggregated for volume calculations. It has been taken as an average to understand the volume of sand that has to be cut and filled. A site can have multiple grading groups. It depends upon the type of site we are going to choose, if it is going to be continously the same terrain, then the grading will be grouped together. If there are a lot of undulations on your site, then there will be a lot of different grading groups present.

Grading Criteria - A set of criteria that defines how a grading object is created. Criteria are contained in sets, which can contain individual criteria for each target type. Parameters include such items as cut/fill format, cut/fill slope and conflict resolution methods. It depends upon

what type of format we are going to create. If it is going to be cut and fill format or cut and fill slope. If you are going to create a slope or a horizontal surface for development.

Target - A surface, a distance, an elevation or a relative elevation specified as the desired endpoint of the grading object's projection. Daylight line - A line that intersects the target, a surface, a distance, an elevation or a relative elevation of a grading object. It is a line that connects the ends of the projection lines from the grading objects' feature line where they hit the target. When you have a target point, there is a distance between the actual point to the target point, the line that connects these two is called a Daylight line. Projection line - A line projected from the grading object's feature line at the cut or fill. Slope specified in the grading criteria, until it hits the target.

Moving on to the next factor which is Hydrography. The study of water in all its forms (rain, snow and water on the Earth's surface), and from its origins to all its destinations on the Earth is called Hydrology. It's a complete understanding of different forms of water. Hydrography provides information about all types of water bodies present in and around the site; lakes, streams, and marshy land (swamps), or natural wells. It also reveals the availability or otherwise of a groundwater table and the depth at which it is available. When you study about hydrology, it can give you a bigger picture about the whole Earth, how much water is available in mountains, seas, oceans, canals and such. But when you need to understand a small site, you need to understand how much water is being present under a site in order to determine if it is satisfactory for your end users.

Hydrological Cycle - The hydrological cycle describes the continuous recirculating transport of the waters of the Earth, linking atmosphere, land and oceans. It is the constant circle which is being followed which creates the hydrological cycle. The water holding elements of the hydrological cycle are- Atmosphere, Vegetation, Snowpacks, Land/surface and Soil, Streams, lakes and rivers, Aquifers and Oceans. These are different elements in which hydrological water is being trapped in various forms. Say for example, even in the atmosphere the water content is present in terms of relative humidity. Whereas in vegetation, water is trapped within the leaves, even in snowpacks, water is being condensed into ice forms. These are different elements in which water is trapped. The hydrological cycle is from clouds, due to condensation, water happens, due to the slopes, there is a surface runoff, some goes into the sand which goes inside the ground within percolation and that's how you get your groundwater flow. This surface runoff goes to lakes and rivers which then due to the presence of the sun goes back to the clouds from the water body as evaporation, from landscape as transpiration. Then again, the clouds are formed, it is a continuous cycle.

Hydrological Process as we discussed - Precipitation, Evaporation, Transpiration, Infiltration, Overland flow, Surface runoff, Groundwater outflow. Why do we need Hydrology? Hydrology helps in the following ways - Hydrology is used to find out maximum probable flood at proposed sites e.g, Dams. The variation of water production from catchments can be calculated and described by hydrology. Engineering hydrology enables us to find out the relationship between a catchment surface water and groundwater resources. Getting a clear picture of how much water is available, how much water is needed, a lot of problems can be solved after you understand the whole hydrological cycle.

Let's summarize what we have learnt from the whole presentation as learning outcomes - Importance of relationship between site and its context. Various environmental factors affecting the site conditions. Then we moved on to study about the classification of various natural factors and their contribution to site conditions. Hydrological cycle and its importance. Questions - What is the relationship between site and its context? What factors contribute to the context of the site? Explain briefly about the factors affecting the site. Explain hydrological cycle in detail, How does geology and topography contribute to the site conditions. Thank you!