Site Analysis and Planning

Lecture 3

Welcome to UGC lecture series, today's topic is Site analysis and Planning. Unit 1 - Introduction, Lecture 3. Subject code - 6512. Presentation outline - the presentation has been divided into three categories. First, introduction. Then we move on to studying about the Need for surveying. Then we go on to Drawing from measurement. As we have studied about what surveying is and how do we do it and what are the different instruments and objects that are required in surveying. We are going to continue seeing about what land surveyors do and what are the limitations and how we can measure a plot and convert the measurements that we have got on our plot to an actual site drawing.

Land Surveying

What is land surveying? Surveying and land surveying is the measurement and mapping of our surrounding environment using mathematics, specialized technology and equipment. Surveyors measure just about anything on the land, in the sky or on the ocean bed. They even measure polar ice-caps. Land surveying is something that is being done by surveyors and they measure almost about anything. They can even measure contours, roads, flat lands and sea levels and coastal boundaries and even the height of polar ice caps. Only with this information we can compare what is being happening from the past to the present and we can predict the change that is going to happen in the future and we can make an informed decision about our policies and quotes and regulations, only with the help of land surveying.

What do surveyors do? In general, the work of a surveyor can be divided into five parts - Research analysis and decision making. Selecting the survey method, equipment, most likely corner locations and so on. It first depends upon research analysis, in which they collect the basic information you receive first hand, called first hand information. You need to survey a piece of landmark the existing roads, existing landmarks like school buildings, historical buildings or post offices are for a reference and then we mark the north point. This is the initial research phase which covers the basic information for the site. Fieldwork or data acquisition. Making measurements and recording data in the field. First is, after collecting what is present around the site and what you know about the site, then we go in for actual field work. What is the starting point of your site, length, width and breadth of your site; what are the contours of your site, how your site is being terrained; all this can be analyzed after you do your fieldwork on the site.

Computing or data processing. Performing calculations based on the recorded data to determine locations, areas, volumes and so on. Surveyor's work doesn't just stop with field work, after field work, they need to transfer the data collected on the field to an actual

drawing. What they do is, they take the information from the scene, go to an office and then they sit and make the drawing. While they prepare the drawing, they come across few errors, accuracies and decisions that have to be corrected in order to match their existing documents or what they have measured.

Mapping or data representation - plotting measurements or computed values to produce a map, plot or chart or portraying the data in numerical or computer format. After they do the computing process, they move on to mapping. Mapping is a graphical representation of what they have surveyed. When you are making survey measurements, you have your formulas to calculate the areas, once you are done with that, you convert it into graphical representation that can be used by various designers, architects and contractors.

Stakeout - setting monuments and stakes to delineate boundaries or guide construction operations. They have to make their boundaries within which construction can happen. This also goes hand in hand with the quotes in regulation, that is present for that particular area. For example, if you take one piece of land, we also need to analyze what type of zoning it comes under and what is the floor area ratio, floor area index taken plot under, only with which we can make the design changes. Say, the height of the design can be decided only if you know the FIR of the space.

The importance of surveying - land surveying is basically an art and science of mapping and measuring land. The entire scope of profession is wide, it actually boils down to calculate where the land boundaries are situated. The importance of surveying cannot be said to be little because it varies from measuring a small plot size and also to marking boundaries of the state, country and even coastal regions. The importance and scope of surveying or a surveyor is very wide. This is very important as without this service, there would not have been railroads, skyscrapers could not have been erected and neither any individual could have put fences around their yards for not intruding others land. Only through the process of surveying, you'll know the boundary of your plot as well as the boundary of your country, your state within which you are living. This becomes very vital because this is the boundary that protects us from being intruded or being disturbed by our neighbours.

Why do I need a survey? Surveying and land surveying is the measurement and mapping of our surrounding environment using mathematics, specialized technology and equipment. Surveyors measure just about anything on the land, in the sky or on the ocean bed. They even measure polar ice-caps. As we saw in the previous slide, this is why we need a surveyor. Only with the presence of the surveyor, we will know what is our limitation and what can be done wherever the site is located, the opportunities, the pros and cons of your site. Surveying becomes very

essential and very vital for design. Land surveyors work in the office and in the field. In the field, they use the latest technology such as high order GPS, Robotic Total Stations, Aerial and Terrestrial scanners. To map an area, making computations and taking photos as evidence. The job opportunity for a land surveyor is not confined to just the site work, he also has to convert all the site details he has collected into a drawing that can be used by anyone else. It varies from site and office work. On the site, they use instruments that we have covered in the last presentation such as GPS, Theodolite, total station and steel tapes. They use all these instruments to measure and record the site. They also take pictures and photographs to support what they have been measuring.

In the office, surveyors then use sophisticated software such as Autocad to draft plans and map the onsite measurements. What we have discussed earlier is their job on the field. When we come to the office, what they do is they convert all the information they have collected on the site to a drawing. In a drawing, what they do is, they draft it in drafting softwares such as autodesk and other drafting tools which they use on everyday basis. There is a software called lan desktop which can also note the contours present on the site and it can also tell where the catchment area is and where the valley is being formed. So that they can calculate how much water can be retained during the rains.

Site Plan Drawing

How to draw a site plan? A site plan is a map of your site. It is drawn 'to scale' which means that all of the real life dimensions are reduced to the same degree. What site plan means is what exists on your site is being mapped and is being graphically represented, this is called a site plan. When you make a site plan, you have to make sure everything you do is to a certain scale. Only when you do a technical drawing to a scale, you'd understand how much property is remaining and what are the sizes of the existing components that are present on the site. Scales can vary depending on the size of your site and the size of your paper. To what scale you are going to set your drawing, completely depends on how large your site is or how large your paper size is. When you are taking a very huge size of site plan, obviously the scale you'd be choosing is very small. If you are going to choose the site plan for a very small plot, you can go for a much bigger scale. A typical scale for a small site might be 1 inch equals 1 foot. The larger the site, the smaller the scale you would use, such as 1/4 inch equals 1 foot. It might vary. If you are taking a smaller site, you can take it as 1 inch is equal to 1 foot, the degree at which you are going to reduce your information. If you are taking the cube side, you can reduce it to 1/4 th of an inch = 1 foot. It changes according to the size and dimension of the site plan.

Why draw a site plan? A site plan is a very helpful planning tool. When you are able to see the dimensions and layout of your site on paper it is much easier to calculate the materials you will

need and to see where different activities can occur. Once you have a site plan you will know how much design and architectural development can be made to the site and tentatively how much material you need. You can simultaneously work on the cost that might be completely dependent upon the client. This site planning is the first hand information that has to be recorded before making any design. The site plan makes your project portable. You can carry it in your pocket or mail it. You can make copies. Your planning group can sit around a table and discuss the project over a copy of the plan. When you make a site plan, it is converted into a sheet of graphical representation. Since it becomes very handy, you can take it to your client and discuss over it. When you are going to a site, you can take the site plan with you, note the changes that have to be incorporated according to the design of the site. According to what is actually happening on the site, that can be converted into a design. It becomes very handy for the designers and architects and also the client to track the development and the design changes that is going to happen in the future.

Tools - to measure the site, tape measure or the measuring wheel and a compass to find north. The first thing you need is to find the north point. Only after finding the north point will you realize how the site is being oriented, how the sun is going to move around your site, what is the sun path movement, the sun dial movement, where your site is going to more shade, more sun; everything will be noted only after knowing the orientation, for which we need a compass. We also need a steel tape to make all your measurements.

To draw the plan; graph paper, pencils or pens, ruler or scale. When a surveyor goes to a site, he not only carries his tools but also other supporting resources such as pen, pencil and paper to convert whatever he is measuring to his sheets.

Measuring

Measure the length and width of the lot, or the portion of the lot you want to work on. At first, when you begin measuring, you need to measure the entire site or the plot in which you are going to start working for, for which the site plan needs to be developed.

Locate important built features such as buildings, sidewalks, streets, fences, etc, and mark them on your plan. When you start measuring, after measuring your plot dimensions, you need to mark where your roads are and where the surrounding, existing, important buildings are located, with which you will know how will you access these main amenities and services. You will also come to realize how your site will get affected because of the presence of these surrounding buildings.

Locate natural features such as trees, large rocks and water and mark them on your plan. When you are making the first recording or surveying of your site, you also need to mark where your existing trees are located. Let's consider a small plot within which you have a group of trees, when you are designing, the architect knows the group of trees present and he might want to integrate the same with this design as well. But if there is a huge tree that cannot be integrated with the design or is taking up a lot of space within the plot, then they will make changes to uproot the tree and plant it elsewhere or cut it down completely. Only when you record this information, will you be able to foresee what's required on the plot. It is also important to record the water bodies on the site. If there is a water body whose water table is going to be very high, you can locate your motors and water points from that particular location.

Find north, knowing where north is will be helpful when you want to know how much sun your site gets. Make a 'north arrow' on your site plan. As we previously mentioned, north point is very important to know how the sun is going to move around your site throughout the year and in a day as well.

Drawing - Later sit down with your notes and graph paper and draw your site plan. First draw the outside edges, or boundaries of the site. Then put in the other features you noticed, such as buildings, sidewalks, trees and fences. This is a site plan. When you start, what do you need to do is, after you have recorded all your measurements, you need to convert it into a plan in which you are going to mark your site and you are going to mark your north point and your surrounding spaces that has been recorded when you made your measurements.

Copying - Make some xerox copies of your plan so you can draw directly on it and try out a few different ideas. Pass copies around to get feedback on your ideas and to let other contribute theirs. When you are working with a team of designers and architects, first the project architect sits with the site plan. After all the measurements have been made, he scribbles around and makes schematic sketches of the design or site planning that he wants to develop on the site. Once that is done, it is very tentative and not a fine as built construction drawing. It is just a sketch of his ideas. Then what happens is, he discusses the same idea to a group of people who are going to contribute to their project. After they give their feedback and after brainstorming, a final program can be assembled after discussing with the client.

How to measure and make a working sketch of your site? First, let's have a look at a step by step procedure of how you can take your drawings, how you can convert your measurements to drawings.

Accurate measurement of the site is the essential first stage. Draw the outline of your property, your house, existing plantings, etc, freehand. First what you need to do is, you need to draw a freehand sketch of existing elements that you are noting when you go and look at a site. When we go, what we do is, we just sketch a small picture of the plot and the existing road from which we are going to access the plot and the surrounding buildings and trees present or just a block around the site. Record all the measurements you make of the site on this rough plan. You have to convert all these things that you see into your sketch or you can also take photographs in order to convert them later on into this plan. Find the corners of your property either by using fence corners, property markers or survey pins. Measure your plot size. Once you know where your plot is, you can pin up fence points from which you can start your measurements. Once you start your measurements using steel tapes and compass, you can convert these measurements to your drawings. Then, measure your house. After you measure your plot, from the plot boundary, you need to measure the distance or the setback distance of the existing house line to the house wall, you need to measure point which automatically gets converted into your drawing.

Next break down each side to its smaller components. Remember to show which windows open, if they open in or out, how tall each window is and how far above the ground the window is. Note which way the doors swing. When you are going to record, you need to record every detail including small details such as how your windows are going to open, if it's going to be a two wing openable window, three wing shutter window, which side is going to open if it's going to be sliding, this is the extent of detailing the surveyor has to cover. Using triangulation, site your house on your lot. Triangulation is the method used to record an unknown fixed point by measuring to it from two known fixed points. When you have two fixed points via triangulation method that we saw in our earlier presentations in which you can break your site into smaller triangles and you can find the area of each triangle and you can add the area of all triangles to get the site area.

Use the same method to site existing plantings, path, etc. To measure a landscape curve use the offset measuring method. Take 90 degree offsets at regular intervals, say every 3 ft to record the general shape of curves such as in a flowerbed or a lawn. Mark each measurement and join the points freehand. When we are measuring something that is a geometrical shape, it is easier when compared to measuring something that follows a free curve or a curvy structure. When you need to measure something like a curved structure, what you can do is, you can measure different points from your border property line or your fixed straight line and you can measure them as close as possible and you can mark all these points on your sheet and you can use freehand to join everything together which will give you an idea of a curve is going along. This can be used to measure long boundaries or even when you have a golf course where the

boundaries are not actually following a proper geometrical style, you can use this type of measurement to predict the boundaries.

For instance, this is the plot in which they have a tree. Tree is being used as a reference point. The first stage involves measuring everything you see on the site. They have made a sketch in which they have shown how the water wall is going in and out and they have also mentioned which is a window and which is a wall and how the door is getting opened. This is the first stage in which you need to draw everything. This is the triangulation method in which they split the entire plot into smaller triangles, calculate the area of each triangle and finally add up the area of each triangle to get the overall area. This is a curve that is present on the side. What they have done is, from this point, they have offered every three feet and they are measuring from each point the length or the depth of the curve. After measuring these points, using this line as a reference, they point out each point on the drawing and collect all this to reframe the curve.

Measure slope on existing patios and pathways, low and high points of the property and the bottom and top of all the visible slope sections. You may see these elevations shown in feet above sea level, as in the drawing below but that is generally unnecessary. It depends, if you are making a drawing that is closer to sea level, then it makes sense as to how elevated it should be from your actual sea level but when you are building something that is completely away from it i.e it's not necessary to measure what is the elevated level compared to the main sea level. We suggest that you transfer these findings to your drawing by arbitrary numbers. After you measure everything, you need to start transferring it onto your plan in numeric numbers so that all your measurement does not get missed out.

The lowest point is 0, each additional rise in 1 foot is counted by 1,2, etc. You can make note of slope changes by drawing arrows on your base map, pointing in the direction of drainage or by drawing contour lines. When you have a huge site, even for a small plot, there is usually a small gradient which follows. Usually when you see, it looks very flat but there is at least a 0.5 degree slope which shows how a natural rainwater or drainage can be drained out. This is very important and has to be recorded when you are doing surveying. If it is a very steep slope, you can draw contour plans and record how your site is sloping, in which way it is sloping; all this can be recorded, this is also the first information that a surveyor has to notify. This information is necessary to make slope changes and corrections, such as adding steps or creating a swale. Why do we need this information? Because we need to understand how the drainage and the water pattern is going to work. After this, we can also use this information to make design changes. For example, if there is a huge slope and you need to create a flat land, you can create one by cutting some amount of soil and using the same soil to fill in at other places, which can

be worked out cost effectively for the client. These is some of the information and design decisions that can be made using a contour map.

Once you are finished with your measurements, begin your assessment tour. Note areas that are sunny/shady, boggy/ dry. Once you finish your measurements, you need to go around the site, notice what's happening at different spots and you need to make all those records as well. You may find a shady path not because there is a tree on your side but there might be a huge building that is present next to your site which is going to cast shadow to your site. These are important recordings that you have to do to make design changes.

Where are the hose bibs? Which views do you want to keep, which to block? Where are the prevailing winds? These are some of the details that have to be noted as well either by photographs or by writings. While designing, this can be incorporated hand in hand. Don't forget utility lines and easements. Add your comments to your rough drawing. Refer to the drawing below to see what to include in your base map. Finally, take your rough drawing and transfer the numbers and notes to a finished drawing on graph paper. After you make all your measurements to your drawing, you need to transfer them to your graph sheet. When you do something on the graph sheet, you are going to follow a certain scale to which every thing you have noted is going to get converted.

For example, this is a site plan in which they have not only shown the plot and the existing roadways and from the mainroad how they have a small pedestrian entry to their residence. Also, a vehicular entry and they have also noted how landscaping is and how the slopes are being formed in the side. These are some of the base plan information that has to be recorded.

Let's summarize what we have learnt in this whole presentation as learning outcomes. First we saw the importance of surveying, then we moved on to the need of surveyor to do surveying. A brief discussion about site plan, measuring tools for a site plan and transferring data to drawing. Questions - Define land surveying, what are the limitations for a surveyor? How to draw a site plan? Student's exercise - measure your residence and convert into a land surveying document. Thank you!