

Engineering/Architectural Graphics – Part 1 Orthographic Projection
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Lecture – 04
Types of Lines and Graphic Symbols

Good morning. Welcome to the 4th lecture of this ongoing course on architectural graphics or engineering graphics. So far what we have already learned is what are the tools that we are going to use and how to setup your board and how to make borders on your sheet, how to draw the title block and so from today we are ready to actually learn the language of graphics. So, the first thing that we will learn is what are the different types of lines?

And as I said that there is a standard language which we are going to be using and this will not change, this does not change if we make one particular type of line it imply something. So, today in this lecture we are going to look at the different types of lines which are going to be used in architectural graphics and we will also learn about the different graphic symbols which will be used in engineering graphics and architectural graphics.

Some of these symbols may not be of use to engineers or some of these may not be of use to architects. but this is an entire set of graphic symbols that I am going to talk about today so that whether you are going to pursue an engineering course or you are going to pursue an architecture course this subject will still remain relevant to you. So, we left this board yesterday in this manner.

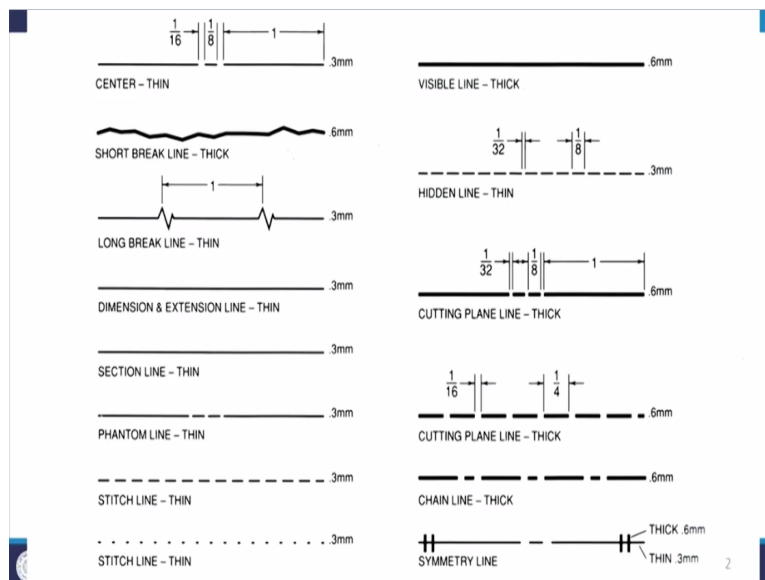
And if you notice I covered the sheet with a butter paper, a butter sheet. You should always do this, you should make this as a habit because the butter sheet allows this line not to smudge. It helps it to stay intact and your sheet will not get dirty. So, always you should cover it with a butter sheet at least a set of these sheets you should keep. Next thing that we will do when we come to start working on a sheet is to clean our instruments particularly the edges should be cleaned ones every time you start working because these edges they pick up the blackness, the graphite of the pencil.

So it be your set square or it be your T pulley we should always clean the edges and the edges should remain clean. Once we have done that, we will start working on our sheet and whenever we are working on the sheet we should try not to place our hands on the sheet, but the butter paper. So, if we move the butter paper our hands will still remain on the butter paper and the sheet will not get smudged.

So, what I have already done for you is I have drawn some of these lines, very thin lines, very faint lines using the pencil 2 H. So, these are just guides, we are not going to be needing them later these are just to guide us. So, we are starting with the different types of lines here. I am using this pencil HB, I could also use 2 B because I have a firm hand, but you may always start with 2 H and then go on to HB and then go on 2 B or whatever.

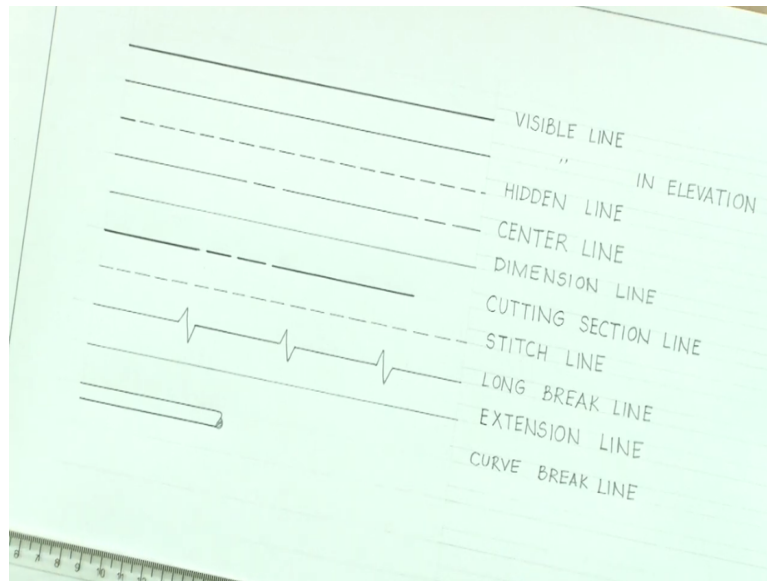
So, these are the guidelines that I have already in place and I will start with the first type of line.

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So, the first line that we are going to look at is the visible line. Whenever in an object something is visible it could be either in section or in elevation, we will draw continuous line which is called a visible line.

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Now this line that we are talking about is a thick line because this is what we are going to be seeing. So, whenever we draw on a sheet we will have a thick visible line and I am going to simultaneously write the different names for this. This one is a visible line here all you have to do to draw a visible line is draw a straight continuous line. This is visible line if a curve is visible then you will draw a continuous curve a curve in a continuous line.

In case the same visible line is seen in elevation there will be slight difference in the thickness. It will be dark, but it will be thin. So, we will draw a thin dark line, there is a difference between darkness and thickness and I am making it equally dark, but it is thin. So, this is a visible line in elevation. So, we will have a visible line in elevation. Next, we have a hidden line, sometimes some parts of the object may be hidden behind.

So may be that there is a cavity in between, there is a hollow and we are not able to see the inner parts in that case the hidden line is used and hidden line is a dash line where we have continuous dashes of equal size and spaced equally. This is again a thin and a dark line so there is darkness in it, but it is relatively thin as compared to the visible line in section. So, if you draw for architects if you are drawing staircase.

So, the steps of the staircase on the first floor will actually be seen in this line which is the hidden line and it is also called the dotted line. So, here we will use the nomenclature as hidden line, this is also very commonly used in engineering. So, for engineers if you are

drawing certain machine where hollow part is there, a hole has been drilled into the body of the object then this line will be used which is the hidden line this is also used often.

The next line which is often used is a center line. Center line is again having almost the same thickness as that of the visible line in elevation and what we have in center line is that we have a long dash and a small dash in between. This is what the central line is. I will show you a completed drawing where we will also see that where is the center line and how is it used, but this center line is used to represent the center of the object in case there is a center.

In case there is no center to it we would not be using it, but then this center line is often used for machines because most of the machines are symmetric about a center line. So, this is also a commonly used type of line. Next, we have dimension line. Whenever we draw an object and since I said that graphics is actually a language. Now if I have to draw if I am making drawing of a residence and I say that the wall is 9 inches thick or 230 mm thick.

In that case I will have to dimension the object, the part of the drawing and which is where we will use a dimension line. Now dimension line is thin it is very fine, but it is slightly darker than I will come to those lines the darker than the leaders, darker than the guidelines, but lesser than the visible lines. So, this is dimension line and I will also show how to draw the arrows and how to complete the dimension line.

But for now we will only understand the different types of lines. So, our next lecture is on dimensions only. So, this is a dimension line. Next, we have a section plain line. A section plain line is a very thick line and which is also called a cutting plain. So, what we have in this one is we have a thick very thick line a bigger dash then two smaller dashes it is very similar to center line.

So, this is what we use for the cutting plane line. So, whenever we are going to be drawing section for an object that what will be seen if the object is cut along this particular plane. This line representing the section of that object the plane where the section is being drawn is called a cutting section line or a cutting plane line and often you would find in objects that it is marked with an arrow.

So, when the object is being cut at this particular plane which side are you seeing in the drawing is also marked here then we also have a stitch line. Now the stitch line is very similar to the hidden line, but it is thinner and slightly lighter. So, we have equal sized dashes here and it is called a stitch line. One more line which is often used is break line. I will tell you the long break first.

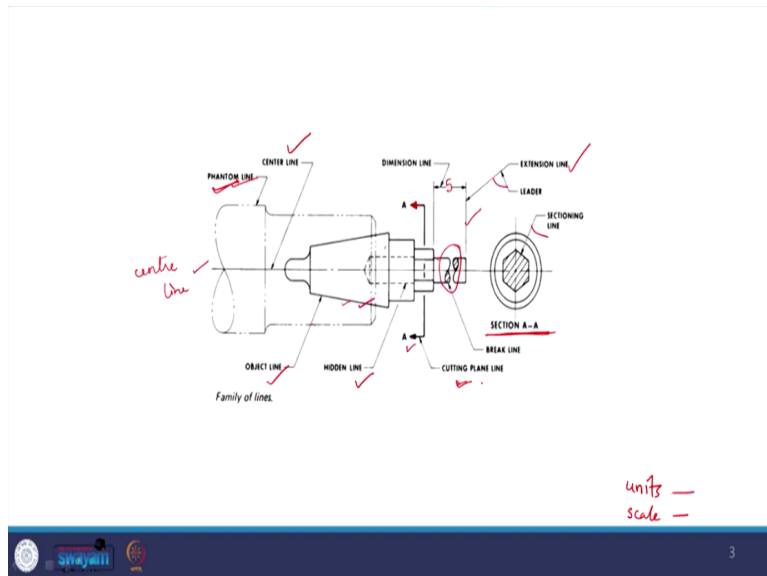
So, what we do we make equal dashes and we leave some part in between a dash size space in between and then in this break part we draw lines like these. So, sometimes when a drawing is very huge it is a big drawing we cannot probably draw the entire drawing in one sheet. So, what we do is we just draw a part of this object, draw a section line and then continue with the remaining part of the object and continue it on the next sheet.

So, this is a long break line. This is often used in both engineering and architecture and you will be using these break lines often. This is what you will use and then the same dimension line, similar to dimension line we also have an extension line which is a very thin line. It is the thinnest line so very thin, thinner than dimension line and this is called an extension line. These are the most common lines which will be required, which will be used by you. Sometimes we also use break lines for say curved objects for example hollow pipes.

In that case what we normally do is if there is a pipe there will be two parallel lines which will be drawn in elevation or in section whatever. So, just imagine that this is a pipe which is going to be cut and at the cut end we will draw a curved part like this and it is then hashed. This is the break line this is the standard for showing a break line for the curve. So, we can write it as the curve break line.

So, these are some of the most common lines which we will be using. There is another one which is called phantom line which we will see in the object.

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So, just consider this object which we are seeing on the screen. So, this is the main object which is in question. So, if you see here this is the object line which is a visible line so this is the darkest line here. So, it means that this is the visible part of the object when we are drawing this object. Now this object is symmetrical about this center line. So, if you see there is a long dash and a small dash then a long dash and a small dash, this is the center line.

So, we have a center line here about which the entire object is symmetrical. Now in this object there is a hole which is drilled. So, if you see it here this particular curved part a cylindrical part will be drilled inside. So, this is the hidden line which we are not seeing, but we know that there is a hole in there so this is what we say is the hidden line. So, if you see the nomenclature these are the dashes equal size dashes which represent the hidden line here.

Now this must be a curved part because we can see the break so this is a break line which is used for the curve. Had it been a rectangular or a square part then we would have used a different break line here. Now you also see there is a cutting plane line or a cutting section line. So, it means that the object is being cut from here when we are seeing the section. So, if we cut this object here and we look to this side.

So, when we cut it and see it from this side we can see that there is a hexagon which is being cut and that is why we see a dark line with shade this hatch here. So, this is the hexagon then we have a circle which is marked by this then we have another circle which is marked by this.

So, we are seeing and we are seeing it towards this side which is what I was telling you when we draw a cutting plain line we also have to mark an arrow to which side are we seeing.

This is the center line we have already seen the object line, the cutting plane line. Now, in case we have some dimension to be mentioned. Suppose, I have to mention the dimension of this piece even after it is broken I will extend this object, the edges of the object which is what we will see we see as represented through extension line which is the extension line and this is the dimension line.

So, dimension line is slightly thicker and darker than the extension line. Extension line is very faint this is the dimension line. I told you that it is a straight line now here will be a break where whatever dimension it has will be mentioned. The units for it will be mentioned in the title block. So, units will always be mentioned in the title block, the scale of the drawing will be mentioned in the title block.

These are the common things, also if you see when the object is cut at the section which we receive is mentioned as section A-A which is the section seen when the object is cut at the plane A-A which is the cutting plane line. When we represent something, when we mark something so all these lines are called the leaders. Now I was telling you about the phantom line.

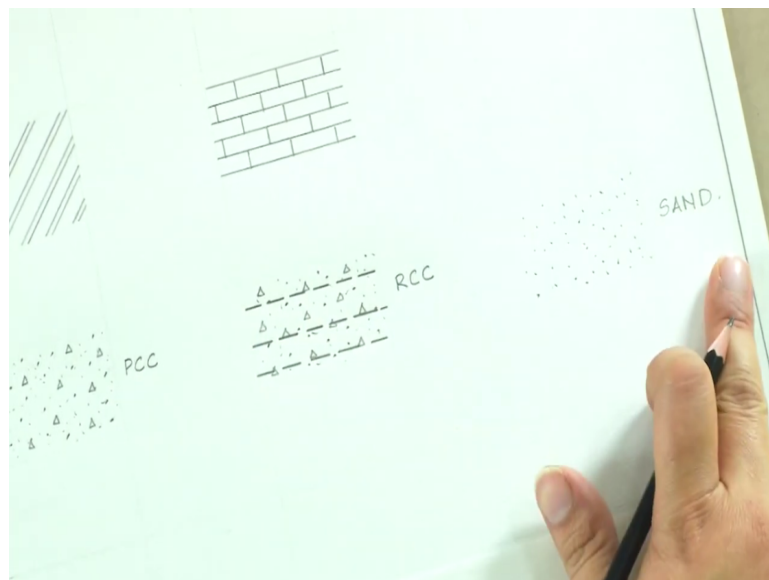
So, phantom is a line which is an imaginary object. So, we are assuming that though the main object in drawing is represented here. This particular object is going and fitting into another object which is not the concern here, but of course we know that there is an object intended. This object is represented using this line called phantom line. So, we have a bigger dash and then two small dashes here bigger dash and two small dashes and it is drawn in very light.

It is not very thick and dark it is very light line. This particular line is called the phantom line. So more or less almost all different types of lines are covered here and I just hope that you understand what are these different types of lines. So, this was the first part which we were going to learn in this lecture. The second part is graphic symbols. Now just assume that we are going to draw the plan of a house.

Now what material will be used in this particular wall or whatever section, whatever drawing we are making. So, those materials will be represented through graphic symbols and which is what we are going to learn here. So, the one which is most common is that of a brick in section. So, assuming that there is a room and the walls of the room are being cut at say 1 meter level.

So, what would you see? You would see these walls and they will be called brick in section. Suppose, the walls are being constructed out of brick so this is brick in section.

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What we do to represent brick in section is we draw hash lines at an angle usually 45 degrees and we draw two close lines and repeat them at an equal interval. So, this is the most commonly used representation for brick in section. When you are drawing it on your sheets you can make small boxes and you can repeat these. So, this is the most common representation for brick in section. Now brick in elevation.

Suppose, we have an exposed brick where the brick is going to be seen the pattern of the brick is going to be seen in that case we will just have equidistant lines. We will draw the pattern as would be seen in elevation that is the simple representation of brick in elevation. So, there is no section in it, it is just being seen in elevation this is the exposed brick which is not being cut.

This is brick in elevation and sometimes when it is a plastered surface the brick is being plastered then in that case it will just be a blank thing which is what we will be seeing here. This in brick in section, this is brick in elevation, exposed brick in elevation and the plane one will be brick in elevation with plaster. The next we have concrete, the components of concrete.

So, suppose you have PCC plane cement concrete. So, all of you would be knowing that there are three components that go in the concrete. So we have coarse aggregate, we have fine aggregate and we have cement. All those three parts are represented for PCC plane cement concrete in section. So, we first make the coarse aggregate representations. So, we have these coarse aggregate represented by small triangles.

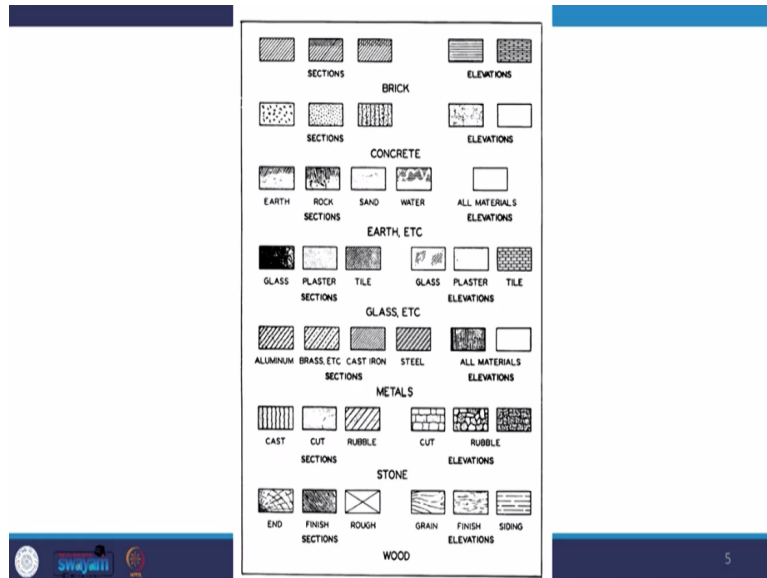
And then we have the fine aggregate which is sand represented by thicker dots. So, we have the fine aggregate represented by this thicker dot which is say sand and then we have very thin points dot to represent cement because cement is the finest material which is used in concrete so that is how we represent PCC plane cement concrete so this one is PCC plane cement concrete.

Now, suppose we have to draw RCC which is reinforced cement concrete we used the same representation as PCC because what is RCC? RCC is nothing, but PCC plus addition of reinforcement. So, we will make the same representation as we did for PCC. We will make those triangles, we will make those thicker dots and then we will make those finer dots and then we will add the reinforcement representation for the reinforcement.

Now what is reinforcement? It is the (()) (24:10) now they will usually not be seen. So, we use the nomenclature of a hidden line while drawing the RCC. So, we will have these dash line, the hidden line representing the possible reinforcement which might be passing through it. So, this is the representation for RCC. Now if we are just making a sand fill in that case we would just have this thicker dots filling up the space wherever we are filling it up.

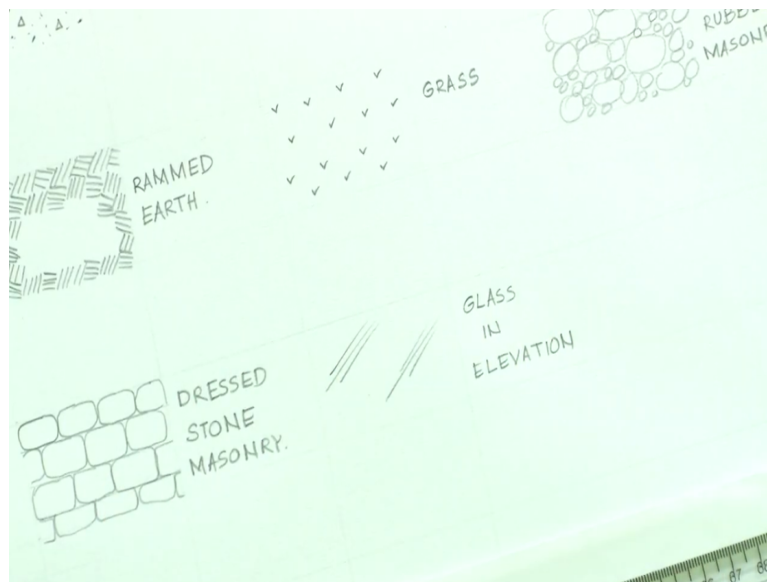
So, this is how you would represent sand if there is a sand fill. So, we have done brick, we have done different components for concrete.

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Now, if we have Earth now Earth can be used in multiple ways. There could be rammed Earth fill, there could be just plane Earth loosely filled. So, most common when you are doing flooring you will be using the rammed Earth.

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The rammed Earth is represented by a hatch which is drawn like this. So, you have a hatch pattern which goes in different directions. So, we fill it up like this and this is the representation for rammed Earth. So, in case there is a huge area which needs to be filled up

you do not fill up the entire area with the rammed Earth hatching because it is not very fast unless you are doing it on computer.

So, if we have to do it by hand we will only fill up the sides of the box, sides of the space which is represented to be filled up with rammed Earth. So that is what we will be using. So, this is the representation for rammed Earth. Suppose, you have grass, there is a grass lawn. So, whenever you are designing suppose you say that there is just a grass lawn. So all that you do is make small V like marks and fill that area up.

This is for a grass lawn or just grass which will be represented like this. Suppose, we have random rubble masonry. So, if there are these bigger pieces of rock which are going to be filled up together. So, you will just make these representations for random sized rocks, some small, some big. So as the name suggests it is a random rubble masonry. We do not have very distinct or defined way of packing them up which is what we see here.

This is called random rubble masonry. This is often used in walls especially for the retaining walls. We also have a dressed stone masonry. So, dressed stone masonry is if you see the forts from Rajasthan you would see that they use random rubble masonry. So, you will draw very thin guidelines and then within them we will draw these freehand representations for dressed stone that is how the dressed stone masonry will be represented.

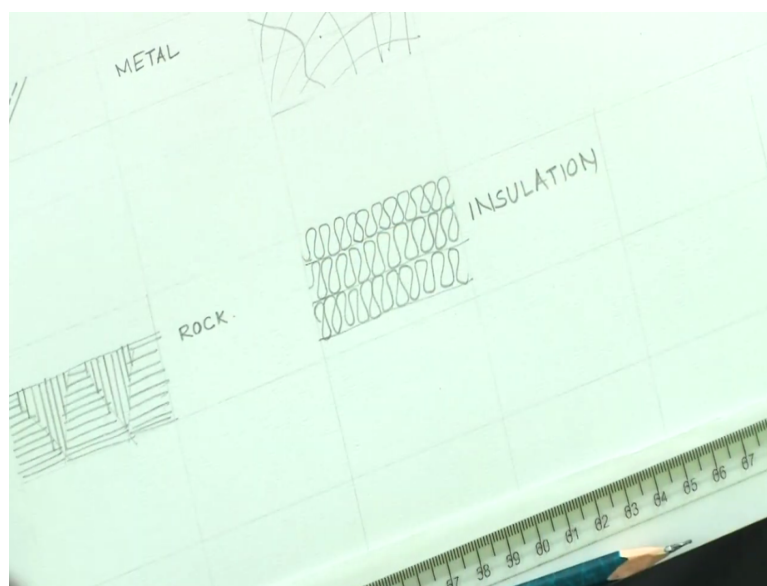
This is dressed stone masonry. Another very commonly used material in our architectural work especially is glass. So, now glass could be seen in elevation because most of the time we see glass being used in elevation. So, what we do in elevation if you see, if you look at glass and elevation it has nothing, but just some reflection. So, we just have a plane surface and we will make three lines freehand parallel lines which represent the reflection.

This is glass in elevation. So, all these graphic symbols which we are using are standard and they are used like this especially in India these are the standard formats in which we will use. Now, suppose if the glass is cut suppose there is a section and you have a section being made out of glass usually the windows are quite thin so you do not have it, but in case there are

walls made out of glass all you do is you hatch that entire thing in parallel lines, but very thin lines.

So this is glass in section. So, you fill up that entire area it is rarely used, but still if you have glass being used as structural (()) (30:33) and there is a thicker part where glass is used this is how you represent. It is also very similar to how metals are represented. Now, suppose if there is aluminum it is slightly different very similar, but slightly different. So, you will have a thicker line and then you will have.

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The next one is a hidden line dash line. So, continuous line and a dash line is usually used to represent metals especially aluminum so that is how we represent. So, we have a thicker line and then we have dash line. So, this is glass again in section and this is metal aluminum mainly in section here. Now we also have wood which is often used. So, we have the wood in section.

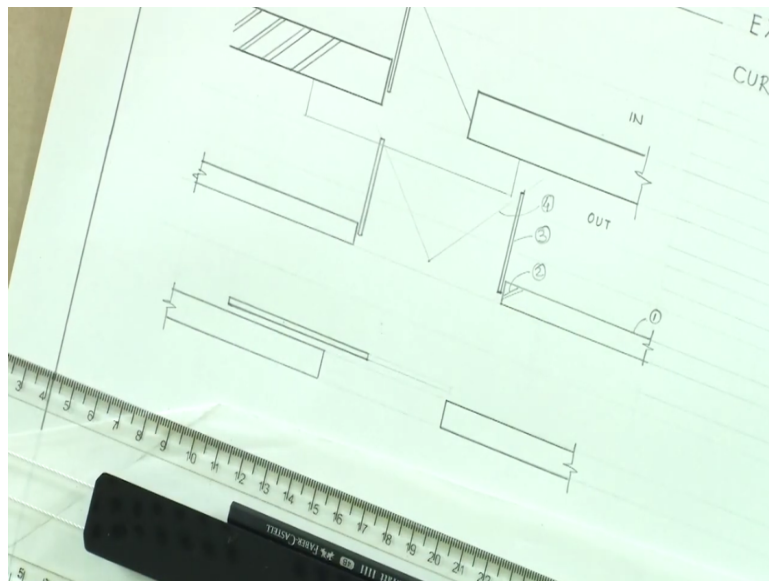
Suppose, if there is a wood in section then we would only use a section representation. So, if the wood is being cut you would only see odd style lines coming and this is what we use as wood in section while so this is representation for wood in section and if there is wood in elevation then you would see grains like this if it is a seasoned wood. So, you have to make some representation for seeing the grains in wood.

So that is wood in elevation. So, these are most of the different materials that you would be using. We have some more materials suppose there is a rock section which is there. So, in case the drilling is being done and you have a very deep foundation which is going to be used then in that case how we represent rock sections is that we will have this combination of hatching, a vertical and a horizontal hatch which will be placed together.

So, this is what we used for rock and I think for insulation again we have. So, this is mainly for the synthetic insulation that we use. So, we draw parallel lines and then we draw a pattern like this which represents insulation. Insulation is also now increasingly used in buildings so this is for insulation. So that is what we are using as far as the symbols for materials are concerned.

Next, if we are making an architectural drawing so then we would require different types of symbols for representing the doors and windows.

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So, in case we will start with doors if it is a single door so we will make the representation for the wall where the door is going to be fitting. Now this has to be on scale. So, if the wall is say 230 mm thick. Now, if it is a brick wall we will have a hatch which will be representing the brick wall. You can complete this section in this manner. So, this is the brick wall with the brick hatch represented here.

This entire thing has to be on a certain scale. So, we have to show the door panel and here we can either use a 45 degree line we could also use a curve. So, we could use a 45 degree line which represents how the door is going to be opening. So, this is the representation for a single door. Now this single door if it does not have any step towards the inside or out it implies that this is a door which is placed indoors inside the building.

In case we want to mention that there is a step outside. So, we will make a line in the elevation which will be representing the step not a staircase, but just a single step. So, this automatically represents that this is the outside and this is the inside. So, this is the representation of a single door. In case for the same space, for the same wall we have to use a double door.

Of course all this has to be on a certain scale which we have to be careful about. So, what scale are you using you have to know. So, the midpoint of this entire line is where the door is going to close. Again I say there could be a curve or quarter of the circle can be used here or it could be a 45 degree line. So, this is the representation for a double door. So, this is a single door only inside single door outside this is representation for a double door which is opening like this.

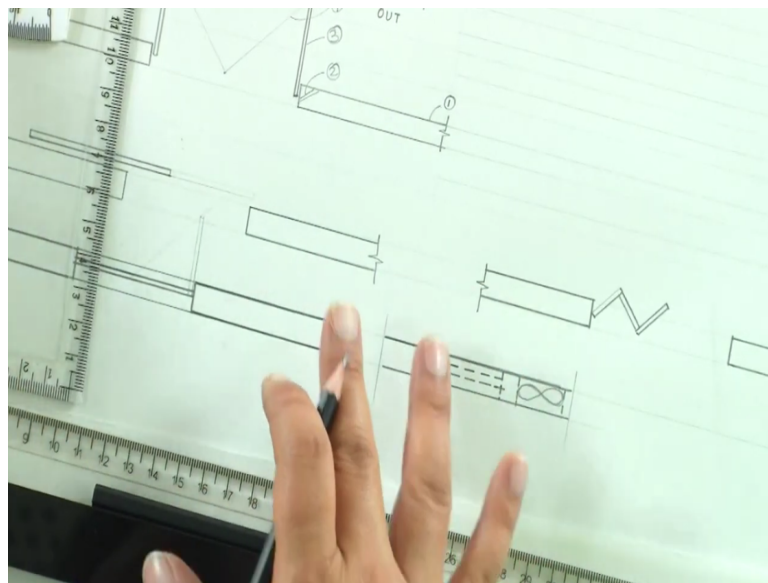
And when you are drawing this kind of a drawing please mind the level of darkness. This line is going to be the darkest. So, if I write in descending order of darkness and thickness this is the darkest because this is brick in section and please remember that you will have to draw section lines on both ends of the brick. So, you will draw section line on both the sides whether it is here or wherever so that is the thickest.

The second is the hatch that we are going to use that is going to be the second level of darkness. This is the third level of darkness which is wood. Since, it is very thin you would usually not use a hatch in this, but it may be used if it is a big scale where you can see a substantial thickness of this wood and then the fourth level of thickness in this path. So, this is an imaginary line.

This is not a real line which is going to be there, it is just an imaginary path which is being traced by the door panel. So, these are the simplest types of doors. We also have some very specialized types of doors for example you would often find that we have sliding doors. So now these sliding doors could be sliding on to the wall. So, we will have again the representation for the wall.

And then we will just make a door panel which is representing the sliding here. So, what we have here is this is the sliding door here. So, we have the same representation for wall, hatch and then this is the representation for a sliding door. So, this door we could also show in very thin the traced path. So, how the door will trace its path when it has to move in this position, but otherwise the door is in an open position the door is closing to be placed here. So, this is the sliding door.

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There is another door if you would have seen it is called sliding folding. So, you fold it and you slide it simultaneously. So, what we have is it is also called an accordion door so it is like an accordion so you keep folding the door and then you can slide the door. So, in an open position this door will open up and cover this entire part which it is supposed to close otherwise it will fold and it will slide on to one side.

So, this is another type of door. Now, if you have window. So, suppose if I have a window so what do we have in window? We have a space which is open there is an opening. Now this

part is actually in section so this is a brick in section. So, this line is going to be the darkest, it is going to be the thickest. Now there is a window sill which is seen here. So, this window sill is going to be dark, but thin.

So, we have this window sill which is dark, but it is thin and we have a glass which is cut in section. So that is again dark, but thin. So, that is the representation for a window. Now, if you have openable window you will draw doors or the panels like the one which we have seen in door. So, we will have representation for openable window. So, thin line and a windowpane. So, this is how we will draw the window with an openable pane.

Suppose, we have fixed window we can just draw it like this in case it is a ventilator. Suppose, we have a ventilator now the ventilator is not being cut at a one meter level. So, what we do normally? We will draw the dotted line because it is not seen directly. So, if we have a dotted line being seen we will assume that there is a ventilator at a level higher than where the section is being drawn from or another way of representing a ventilator is that we draw the dotted line and we draw it like this.

So, this would also mean that there is an exhaust which is going to be placed in the ventilator, but at a level above. So, this is what we use for ventilator. So, these are the typical window types and door type which we will be using. In addition to these for architecture, we also use graphic symbols for plumbing accessories for electrical accessories which you will learn gradually and these are all standard types which can be found conveniently.

But to start with these are some of the different graphic symbol which you will be using. So, I hope you have understood the different types of lines, their usages and the different graphic symbols which will be used. Thank you for attending this lecture and see you in the next lecture where I will be telling you the norm for lettering, how to write on graphic sheets. Thank you.