Engineering/Architectural Graphics – Part 1 Orthographic Projection

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Lecture – 21
Projection of a Plane Perpendicular to Both the Reference Planes

Good morning. Welcome to the week 5 of this online ongoing course on architectural graphics or engineering graphics or what you commonly know as engineering drawing. So, till the last week we have seen, we have learned how to draw orthographic projections of lines, parallel lines, perpendicular lines, lines inclined to one of the reference planes or lines inclined to both the reference planes.

From this week, we will be learning about how to draw orthographic projections of planes, various types of planes or various conditions, planes which are perpendicular to both the reference planes, parallel to one of the planes or inclined to both of the planes or what we call as oblique planes. So, today we are going to learn about the planes which are perpendicular to both the reference planes.

So, this is the first quadrant which we consider. Now just imagine that we have say a plane maybe a triangular plane which is perpendicular to both the reference planes which is the horizontal plane and vertical plane. Now a plane which is going to be perpendicular to both the planes will be something like this which is perpendicular to both the HP and VP. So, this plane which is perpendicular to both the planes is going to be parallel to a side projection plane either side.

So, it is going to be parallel and we have known it as a rule that a plane or a line or an object will be reflected or will be projected in its true dimensions on a plane to which it is parallel. So, this plane in question for which we have to draw orthographic projections will be seen in its true shape in a side plane. Another thing when we have to classify these different types of plane is to also see where the axis of the plane lies.

So, for example, in this case if this is the plane and this is the plane for which we have to draw the orthographic projections. A line which is perpendicular to the plane is called its axis. Now in this case when the plane is perpendicular to both the reference planes, the axis is parallel to both the planes. So, in this case when we say that the plane is parallel to a reference plane which it means that the axis of this plane is going to be perpendicular to that reference plane.

So, here if we look at it from an axis point of view then the plane to which the axis of a given plane is perpendicular is where the true shape of the plane in question will be cast or as simply I explained earlier the reference plane to which this plane in question is parallel is where its projection will be cast. So, let us see how to draw the projections of planes perpendicular to both the reference planes in orthographic projection.

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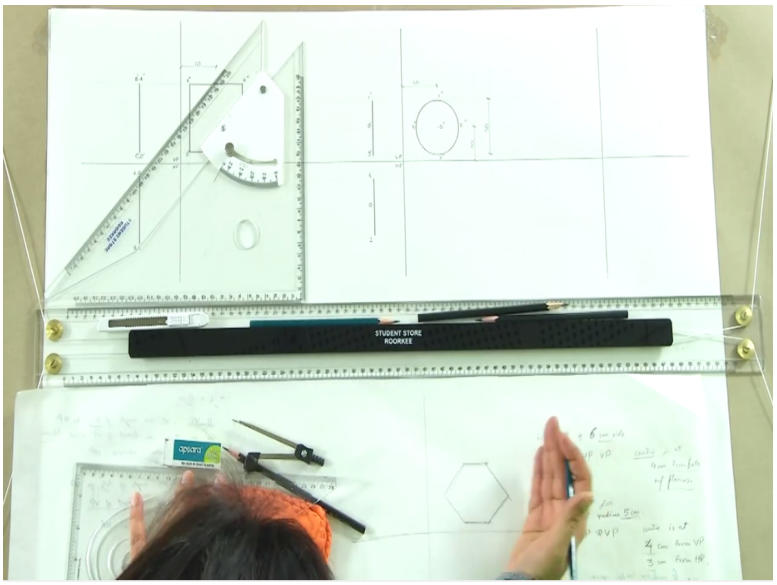

So, let us start with first problem where we have say a square of 8 centimeter side or say 6 centimeter side which is perpendicular to both HP and VP and its center is at 4 centimeter from both reference planes. So, we have a square plane which is perpendicular to both HP and VP and its center is at 4 centimeter from both the reference planes. Now to start with I have already drawn these VP, HP and a side plane here.

And since the square is perpendicular to both HP and VP we will be seeing its true projections in the side view. Now to start with we will draw this center we will mark the

center which is at 4 centimeter from both the reference planes. So, we have to mark a center at 4 centimeter from both the reference planes. So, this is the center. Now the square is a 6 centimeter side square.

So, what we take from here is 6 centimeter square. If you see, maybe that you are having a difficultly in seeing what I am drawing because I am drawing using a 2 H line which is going to be very thin and here I am drawing it thin because we have to first draw the center of the square and then determine that what is our final square shape going to be. So, this is the true projection which we get here.

This is the final object which we will see in the side plane and hence that is going to be the darkest which I am now drawing using the 2 B pencil. When you draw the final object try to maintain the thickness and darkness of all the lines. So, we should not have a variation in the lines. Till now we were looking at the lines. So, there was just one line, but when we are starting with planes we will have multiple lines representing one single plane.

So, this is the square plane in question it is 6 centimeter side, its center is at 4 centimeter from both the reference planes. Now this is vertical plane representation of vertical plane and this is representation of horizontal plane for this side plane. So, this is what we have already made and now we will draw the projections on to the VP and HP. So, in this case just like the case of a line which was perpendicular to both the planes we have drawn the projection.

First in the side plane and then we are projecting it further. Now, it says that it is at a distance of 4 centimeters from the VP and HP and it does not tell us any distance from the side plane. So, what we are going to get here is a line both in HP and VP. This is what our final projection is. Now, let us try to understand when we are seeing a square which is perpendicular to HP.

So, this square is perpendicular to HP and let me mark it for you, let me label it for you so that it becomes easier for us to understand. So, if this square is named A, B, C and D. This square is kept perpendicular to HP and also perpendicular to VP. What do we see in HP? We

will from the top see A, B and we will not be seeing C and D. We will just be seeing C and D beneath A and B.

So, where is A? A is here so we see A and we see B here and we have C beneath this. So, B, C and A, D. This is what the nomenclature is going to be. In the elevation again this is the VP and we are seeing this from this side from the front. So, what do we see first? We see a B, C behind C we have a D and behind B we have an A. So, this is the elevation of the same square which we have seen.

Now just imagine that this square is not a plane and it is just four different lines. So, what do we see? A line here A, B A, B is a line which is perpendicular to VP and parallel to HP. So, what we see? We see a line A, B in its true length in HP while its reflection in front elevation in VP is just a point. Similarly, for C, D now if we look at this line B, C which is perpendicular to HP and parallel to VP.

So, we see this B, C and similarly A, D represented, projected in the true length in the VP and just a point here in the HP. So, this is what the final projection of this square is going to be. Where do we mark its dimensions? So, we have to now look at the dimensions only the dimensions which are given here have to be mentioned. So, what we have is we have a square of 6 centimeter side.

So, we will write SQ 60 so which means that this is a square of side 60 we do not need to mention it again and then center is at 4 centimeter from both the reference planes. So, what we have here is a dimension line up to the center which is 40 from the vertical plane and 40 from the horizontal plane. This is the total representation of this problem which we started with.

So, this is a very simple exercise for square you can do it very simply. Now, let us look at another problem of a circle. So, if we have a circle of radius 5 centimeter which is perpendicular to both HP and VP and its center is at 4 centimeter from VP and 3 centimeter from HP. So, the process remains exactly the same what we have to do. We have to draw the true projections.

Since it is perpendicular to both HP and VP, it implies that it is going to be parallel to the side plane. So, we will start with drawing or locating the center in the side plane. So, center is at 4 centimeter from VP. So, we will mark 4 centimeter from VP so the center is going to lie on this line and 3 centimeter from HP. So, which means 3 centimeter above HP is the center, center of the circle.

So, diameter of the circle is 5 centimeter which implies that its radius is 2.5 centimeters. So we take a 2.5 centimeter radius and we draw the true size and shape of the circle here on the side plane. This is the true shape of the circle. Now, we have to draw the projections of this circle on to VP and HP. So, what do we do we will draw tangents of this circle here and take its projection to both the reference planes which is HP and VP.

If you follow the process that I am taking for drawing this you will see that any dimension which is given here I will be measuring only once on the sheet. So, I measure this 4 centimeter only once I measure this 3 centimeter only once and I have measured this diameter of 5 centimeter which is radius of 2.5 centimeter only once. Once I have this dimension here all other dimensions will be referred or will be derived from the same drawing which is how geometric construction should always work.

So, because in orthographic projections all the projections should meet and result in the same point. So, which is why if few points are not meeting up in the projections there is something wrong about it. So, you have to clearly understand what is going wrong and if everything is fine you should be getting the same point as a deduction from the projections the orthographic projections.

So, what we have here is a circle with a point o and if I mark the four points on the circle by 1, 2, 3 and 4. So, this is what we have taken here and now we will now projecting it on to the horizontal plane and vertical plane. So, what we have here is this O and what we have here is this o. On the top we have 1 and in the HP we have this 2 and 4 and here we have this 3. One thing which I missed out was the nomenclature.

When we draw in first quadrant in first angle projection we mark the plan which is seen in HP as A, B or B, C. The elevations will be represented as B dash A dash C dash D dash and the side view is represented as double dash. So, A double dash B double dash, C double dash and D double dash and the same thing will be here. So, we will be marking these points with double dash which implies that this is the side view.

This is plan. So, we are not having any plan here. So, that is the final drawing and then you do the label. What is the dimension to be mentioned? We have 4 centimeter from VP. So, we have it here which is say 4 centimeters from VP, 3 centimeter from HP. So, this is 3 centimeter from HP and the diameter of the circle is 5 centimeters. So, we have to represent or dimension the diameter as 50.

This is the final drawing for this question. Similarly, you could be drawing anything, try drawing a hexagon which is perpendicular to both the reference planes and its two sides. So, when we are drawing a hexagon two of its side are parallel to HP. So, when you draw the hexagon it will be lying like this in the side plane because two of its sides are parallel to HP. So, you can start by drawing a hexagon in the side plane.

And then you can have its projections drawn on to this. This is it what you have to try at home. Just to give you a little hint you will actually be seeing a line in VP, but how many points on the line are going to be there? Similarly, you are going to be seeing a line in HP, but how many points are going to be there on this line is what you have to see. So, please go ahead and start drawing this hexagon.

So, I will give you the question which you can practice this is not the tutorial this is just for your understanding. So, we have a hexagon of side 3 centimeter. Now, how do you draw a hexagon of side 3 centimeter you have to know that first. So, that is where we learned about the basic construction. Now, this hexagon is perpendicular to both HP and VP and its center is at 5 centimeter from both HP and VP.

So, this is the problem that you should attempt and before we start the next class, we will have the solution for this problem ready here on the sheet for you to just see. So, that is all in

the lecture today. I hope you now understand how to draw planes which are perpendicular to both the reference planes. See you again in the next lecture till then bye-bye. Thank you.