Engineering/Architectural Graphics - Part 1
Orthographic Projection
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Lecture – 27
Projection of Solids in Simple Positions

Welcome to the second lecture of Week 6 of this ongoing online course on architectural graphics or engineering graphics. And in this week, we are learning about how to draw orthographic projections of simple regular solids. So, we are largely focusing on regular solids only. In the first lecture, we talked about different types of solids. We understood what those different types of solids are.

And from today, we are going to see how to draw the projections of different simple solids in simple positions. So, regular solids in simple positions only. So, now what are those simple positions? The very simple position could be that the solid is perpendicular to the base and its axis is parallel to the vertical plane, the VP. So, let us assume any solid in this position and then see how do we get the projections?

So, suppose we have a cone. We have a square pyramid not a cone but a square pyramid. And this square pyramid is kept in such a manner that its base axis is making an angle of 45 degrees with the VP not the axis the side of the base. So, if we look at this. **(Video Starts: 01:52)** So, for example, this is let us assume it to be a square pyramid. Now, what I say that this square pyramid is kept in such a manner that its axis is perpendicular to the HP.

So, this is the horizontal plane and this is perpendicular and this axis which is vertical is parallel to the VP. So, we have this axis parallel to VP very simple position the only thing is that the side of the base makes an angle of 45 degrees with h with VP. That is what we are going to draw. So, we will draw and let us assume that this is a square pyramid of the base being of side 5 centimeters.

So, when we see it from the top we will see the true shape of the base because the base is being kept parallel to the HP. So, in such a case, when the axis is perpendicular to the HP we

will see the true shape of the base in HP. So, we have this now. We will not see a full square what we will be seeing is.

So, this is the square base that we will see from the top. But, this is not all. What we will see along with it is the apex and the sides. So, these are the sides that we get to see. And this is the apex of this. And in this the side of the base is making an angle of 45 degrees with VP. Now, let us take the projections. So, the first thing that we do is to project the apex. Now, assuming that the height of this pyramid is say 10 centimeters, so, we get an apex here.

And it is in the same line which is perpendicular. We take the projections. And assuming that the pyramid is kept in the HP. So, we will now draw the final projections of this pyramid. This square base pyramid which is kept perpendicular to HP and its base is parallel to HP. And that is the reason we were able to see the true shape of this square here. Do you think I should add one more line here?

Yes, I should. Because what I am seeing as this line is this point joined by the apex. This line is this point joined by the apex. And this point joined by the apex will be seen in the front. So, I will draw a perpendicular line here. And in the plan, we will see a square as we have drawn here. This is the final projection of a pyramid which is a square pyramid which has its axis perpendicular to HP and parallel to VP.

Now, when we finalize the projections of the solid, what we have to do? To label it, say A, B, C, D and there is an apex O. And if I take it to the front elevation I will see A dash, C dash, D dash and O dash here. Now, I have already marked this 45 degrees here which was the condition given that the side of the base makes an angle of 45 degrees with the VP which is what we see here. Another thing that we have to mark as dimension is the height of this cone.

So, we will be having a height of this cone which in this case was 10 centimeters or 100 mm which is what we will mention. And we will also mention the side of the base. And in this case, we will only mention the side of the base because we are seeing and it will be inclined. So, what we are seeing here is the side of the base which was again in this case 5 centimeters or 50 mm. That is the condition.

Now, one thing which is left for us to draw is the extension of the x-axis line. So, axis is going to be seen like this. Since all the we will not be seeing axis anywhere but in the front elevation in VP. This is VP here and this is HP. So, what you see here is this axis which is seen as perpendicular to HP and parallel to VP which is why we see the true height in VP and the true dimension of the base in HP.

So, this is one of the conditions which we have. **(Video Ends: 10:04)** Now, assume that we have a prism. We have say a hexagonal prism which is perpendicular to VP. So, if this prism is perpendicular to VP which means its axis is perpendicular to VP which means that the base of this hexagon will be seen as parallel. The plane of the base is seen as parallel to VP. So, what will we see?

We will see the true shape of this base which is the hexagon in VP. And the condition is that the one of the points or the prism rests in HP on one of its edges. So, if it is resting on one of its edges, then what do we get? We get a hexagon with one of its points being seen here. **(Video Starts: 11:16)** So, that is what we are going to be seeing. So, assuming that we have a hexagonal base of 3 centimeter side, we will be the first thing that we start with is by drawing a hexagon.

And as I have always reminded you we should always keep the initial drawings the initial constructions to be very light. They should be absolutely light because you should not be needing to erase them later. So, this is the hexagon that we get here. So, this is the hexagonal shape based upon the condition that we have been given. That this prism, so, this time we are not dealing with a pyramid we are dealing with a prism.

And this prism is perpendicular to VP. So, we know that the base of this prism is going to be seen in its true shape in VP. Because the base becomes parallel to VP which is what we have drawn and we knew that one of its points. So, this prism is resting in HP on HP on one of its edges one of its sides. So, that is what we have seen. Now, it is given as condition that the height of this prism is say 10 centimeters again.

So, what we will draw? We will draw the projections. And, what we have? We have a prism of 10 centimeters height. This is what we see from the top. What we see is an edge here, an edge here and an edge here. So, the final shape will look something like what we see each of its faces as I had explained in the previous lecture is a rectangular face. So, what we see in the projections is also rectangular faces.

For a pyramid, what we what I told you was that we have each of the faces as triangular faces. Now, here we are seeing triangular faces. They may be skewed but we will still see triangular faces. Here, the rectangles may be skewed. They are not the true shape of the rectangle that is actually there on the object. But we will see the rectangular faces only. And in the front view what we are seeing here is a hexagon.

So, we see a final hexagon. There is no apex because this is a prism. And we see rest of it as this rectangle. Now, let us quickly label this one. So, what we have here is a face represented by say A, B, C, D, E and F. And I will just mark a point because this is where the axis is passing. This axis is perpendicular to VP. So, what we see here is also an axis of this solid. The axis is an imaginary line.

But we should always draw it because it makes things easier for us. And now when we see it here, what we see? We see, so, here these are all dash because we are seeing it in elevation. And in plan when we draw this is B, C, D and we also have an E beneath it. And beneath C, we have an F. And beneath B, we have an A. Now, there is another hexagon at the back which is the second hexagon. So, what we have it as say we start writing it from P.

So, P, Q, R, S, T, U. So, what we will be seeing here is Q R S,T R,U and Q,P. And here in elevation also we will actually be seeing double points. So, I should have taken space but anyways let us write here. So, C,R D,S E,T F,U and there will be Q dash and there will be a P dash. That is what we are going to be seeing. It is very simple. Just imagine, where are you going to see the parallel faces?

So, in case the parallel face is going to be seen in HP, you will start drawing from HP. In case the parallel face is being seen in the VP, you will start drawing in the VP. That is the clear

rule. That is a simple rule. Because that is how you will be able to draw the true sides the true sizes and the true shapes of the solids. **(Video Ends: 19:03)** Now, let us take one more example. And in this case, this is again simple.

And in this case let us assume that the solid say in this case we will take a triangular prism. So, in this case this triangular prism is kept in such a way that its axis is parallel to both HP and VP. Now, how do we start? Where do we start? So, the true face of this triangle and here we are assuming that is it is an equilateral triangle. So, this equilateral triangle will be seen in its true shape in side elevation. So, in this case what do we start?

As in previous cases if you remember we started **(Video Starts: 19:55)** by drawing the side elevation first. So, what will we draw? We will draw the side elevation. So, depending upon whatever is the position of the triangle. Now, this prism could be resting on one of its edges or it could be resting on one of its faces. Here, let us assume that this is kept on one of its faces.

So, say the equilateral triangle this triangular prism is resting in HP in such a manner on one of its faces in such a manner that its axis remains parallel to both HP and VP. So, what we would do? We would start drawing. So, suppose this is an equilateral triangle of 5 centimeter side. Let us draw an equilateral triangle. So, we drew an equilateral triangle here which is representing the triangular face of the prism such that one of its faces is resting in HP.

And now, we will take the projections back. So, just like as we did. So, we will only take it reverse. So, we're taking it reverse back on to the HP. And what we see in HP? Since the axis is parallel to HP we will see the true height of the solid here in HP. So, assuming that the height of the prism is 10 centimeters, so taking 10 centimeters here, what we see here is rectangle like this.

And one thing which we did not get back and we should do it now is the top line which is what we are seeing here now. Now, if you look at the vertical projection let us bring it back here. And if we take it here again we are now at the final projections, very simple. So, what

we have is this line which is the top point corresponding to the top point and the side. This is in plan that you see. This is the line which represents the face which is resting in HP.

And this is the face as seen in the side view a side elevation. This is what we have. And I will just finish the side elevation. This is the final projection of this triangle or prism which is kept in such a manner that its axis which I will draw here is parallel to both HP and VP. And here what we will have to do is we will have to draw the axis in elevation also. So, this is the point where we will get the axis which is what we will see being drawn here.

So, this is axis is always an imaginary line. It is not a dark solid edge. That is why we will always draw it thinner than the actual lines and let us mark them here. So, suppose in the side elevation we have this face being seen projected from here. So, we have A, B, C double dashes here. And at the back, we have say P, Q and R. Now, if we see it here, what we have? We have this B, C and A. And this is P, Q and R.

And if we see it in elevation, what do we see here? This is C in the front. So, we should make some space for writing A. So, this is C,A because A is going to come at the back of it while B is here. And similarly, we have Q here. And here, we have R and P at the back of it. This is your VP. This is your HP. And this is your say left hand side elevation. This is the final orthographic projection of a triangular prism which is resting in HP on one of its faces not one of its edges.

But one of its faces and its axis is parallel to both HP and VP. And now you see that since the axis is parallel to both HP and VP we are able to see the axis fully in both these reference planes which is VP and HP. And it is in its true dimension while the triangular face we were able to see, the true dimension only in the side elevation. We could have drawn it directly here.

But that would have been a derivation not a geometric not a drawing derivation where we could have just drawn the full size of the base and then just divide it because that is what we know as a general geometric understanding. So, we could have done that. But we should

always avoid. And we should start from the plane where we are seeing the true shape the true dimension. So, we started from this triangle came back to HP and then went on to VP.

Now, here again, since we were drawing a prism you are seeing that we are able to get only the rectangles. And the true shape of the base is seen in one of the reference planes. **(Video Ends: 28:17)** So, I hope with this you are able to understand how to draw the basic orthographic projections of solids in simple positions where the axis of the solid is either perpendicular or parallel to one of the reference planes.

Or, it is parallel to both the reference planes and perpendicular to a side plane which is an auxiliary plane. So, this is about projections of simple solids in simple positions. From next lecture, we will see the orthographic projections of these solids when they are being inclined to one or more of the reference planes. So, thank you very much for joining with me today and see you again in lecture tomorrow. Thank you, bye bye.