Engineering/Architectural Graphics – Part 1 Orthographic Projection

Prof. Avlokita Agrawal
Department of Architecture and Planning
Indian Institute of Technology – Roorkee

Lecture – 12
Orthographic Projections: 1st Quadrant Vs 3rd Quadrant

Good morning. Welcome to the lecture 12 of this ongoing course on architectural graphics or engineering graphics and we are discussing about orthographic projection here. So, we have already understood the basic fundamentals related to orthographic projections and today we are going to discuss the difference between first quadrant and third quadrant.

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So, as I had explained to you with the help of this quadrant system just to quickly revise the fundamentals which we had visited yesterday the plane which is vertical is a vertical plane. And before you confuse these planes are the screens on to which the views will be projected. So, these are not actually just any planes, these are the projections screen where the object will be somewhere in either of the quadrants.

And then we will see how the projections, the views are seen on to these screen. So, the one which is vertical is a vertical plane or a frontal plane. So, always we have the front view being seen perpendicular to the frontal plane. So, we have the object kept here may be and we are seeing perpendicular to the frontal plane. So, this is the frontal plane, vertical plane, this is the horizontal plane and then these are the extensions beyond it.

So, horizontal plane going beyond the vertical plane and vertical plane going below the horizontal plane creates three more quadrants like this. So, this is first, second, third and fourth. What I explained is to draw it on sheet. We assume that this quadrant system, these planes are folded like this. So, this is how the sheet would like this, this is for the first quadrant.

Now what is it for the third quadrant? So, let us understand that difference. If we are assuming an object to be kept in the first quadrant any object.

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For example this sphere we assume that this sphere will be kept somewhere in the first quadrant and it will be projected on to these screens. While in a third quadrant what we would assume that the object is kept somewhere here whether the object is kept here or here the planes would still fold like this. So, what will happen? If I had the object placed in the third quadrant which was at the back of it.

How would I see? Because I am anyways and then we are always seeing it from this side. Our viewing will always be perpendicular to this front plane in the first quadrant. So, when we are seeing it in the third quadrant how do we draw the front view? How do we draw the top view? And top view we are seeing from top. So, it could be here or it could be here. So this is how we are going to be seeing the object from the top.

So, let us understand this difference between the first quadrant and third quadrant. In first quadrant, we have the vertical plane in top and horizontal plane in the bottom. The reference being this reference line which is XY while what has happened in third quadrant just see we actually had the horizontal plane, this is the horizontal plane. So, the horizontal plane is coming to the top because if the object say the object is here and I keep this quadrant here.

So, if the object is here and we are seeing from the top the view is actually being achieved here and the front view since we were seeing it from this side the front view is being projected on to this vertical plane which is extended beyond. So, when we fold it we actually have the horizontal plane going up and the vertical plane coming down below the XY line the reference line.

So, what we have we have a reversed view from first quadrant. So, in this first quadrant we have the front view on top and top view plan in the bottom. While in the third quadrant, we have the top view in top the plan above and the elevation in the bottom. There is not any difference. Another thing that we have to keep in mind is that the position of the object will have to remain identical if you want to either see it in first quadrant or in the third quadrant.

So, the distance that it has from the front plane and the horizontal plane will have to be maintained as the same in the third quadrant. So, whatever distance it had in the first quadrant will be the same distance that we will maintain in the third quadrant and so the view will remain exactly the same.

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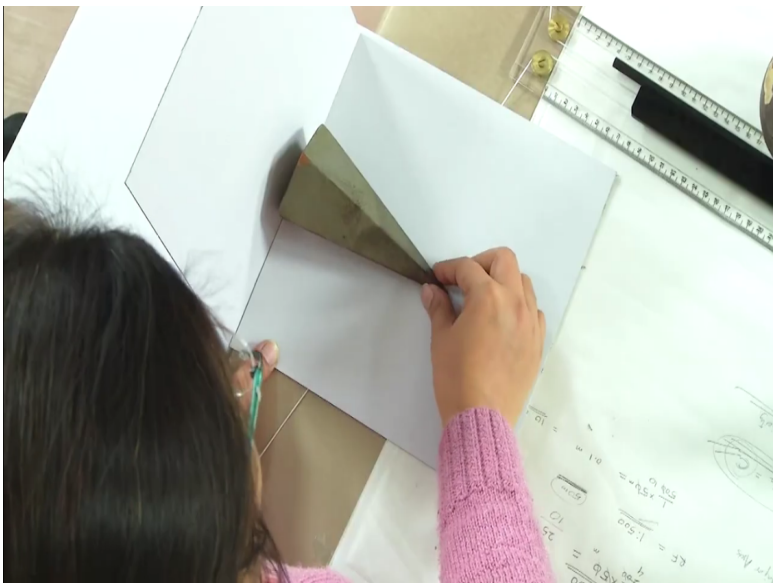

Suppose, this was the cone so if we were seeing this cone from the front it would appear to be a triangle. And if we were seeing it in the third quadrant like this we are still seeing it from here and it would still appear as a triangle in the front elevation. The only difference being that the front elevation in case of third quadrant is drawn below the reference line.

While in case of first quadrant, it is drawn in the front elevation which is above the reference line that is how this difference is. Another difference that we have is when we draw the views so if we assume that the object is kept here and we are seeing it from the top. Now, there is nothing between the viewer from where we are viewing it and the object. The plane is actually beneath the object.

So, the horizontal plane is beneath the object and the vertical plane or the front plane is at the back of the bottom. So, in this case in case of first quadrant we are assuming that this plane vertical plane and horizontal plane are opaque planes. So, the viewer actually is also casting the shadow. So, the shadow from the straight light rays are being projected on to the screen and this is what we see in the front plane and the horizontal plane the frontal plane and the horizontal plane.

So, assuming that this is actually an opaque projection screen, it is a screen. While if you assume that this is how the object is going to be and if really had a screen like this where it is an opaque screen. If I want to try to see it from top I would not be able to see anything. If I

try to see it from the front because the front is this side I would not be able to see anything. So, in the third quadrant when we project we assume that the plane the horizontal plane is transparent.

And the front plane is also transparent. In this case, the projection plane is between the viewer and the object. So, it has to be transparent that is how we will see the object. So, that is the difference between the first quadrant and second quadrant and all other things will more or less they will remain the same. The projections lines will be parallel to each other, they will meet each other.

So, if we have any object we should be measuring one dimension only once that is how it is. So, for example, if this is a cone what all dimensions do you require to depict a cone that okay this is the cone we need the height of the cone, we need the radius of the base and that is all. Now, if I were to draw it in any projection system. By the way the third quadrant projection is used in United States and several other countries.

While for us in India as per Bureau of Indian Standards, we always go for a first quadrant projection. Henceforth, we will be discussing about the projections in first quadrant only. Now, I was explaining about measuring one dimension only once. So, if I have to draw this cone from the top what would I see? We will see a circle and in that case if it is flat what would we see?

We would see a circle and the actual radius of that circle why because this surface which is the base is kept parallel to the horizontal plane. So, any surface which when kept parallel to a projection plane will appear to be in its true dimension that is the fundamental base because we have these light rays which are perpendicular. So, the distance between the light rays is exactly the same as the dimension of the object.

So, we see the circle from here we will get the radius and if we draw it in the front view we will get a triangle where we would see the height and also the diameter, the radius of the circle. So, what we actually have to do is dimension this object only once the height in the

elevation and the radius for the base circle or diameter for the base circle in the plan that is what we are going to do.

Suppose, it was a cube for example or maybe it was a complicated cone suppose we have a pentagonal pyramid. So, what we have is we have a pentagon in base and we have a cone like structure. So, all of it is merging in the vertex on top. So, in the plan if we draw we would see a pentagon coming, the dimension of it will be seen and in the front elevation we would see the height which is what is required.

Now just imagine that the cone is not placed like this. If the cone was placed like this then in that case what would we see? We would actually not be seeing the pentagon in its true shape here because it is not perpendicular to this. If it was perpendicular the apex of this cone will not be resting on ground. The moment it rest in the ground we will see a deformed pentagon both in plan and in elevation.

So in that case we will either have to assume that the cone was first placed like this and then it moves like this so that we know the true dimension or else we can draw the projection of this particular base pentagon on another plane which is kept parallel to the base which is assumed to be parallel to the base. So, that is another requirement or another feature which we have to keep in mind.

Anything which is parallel to the plane will appear to be in its true shape and that is the reason why if we need to show the true shape of the object, true dimensions of the object we would have to project it on to a plane which is parallel to it. So, besides these defined planes which is the vertical plane and the horizontal plane and we also have the side vertical planes as well which are like perpendicular here and they will be opened up like flaps.

We also have auxiliary planes. These auxiliary planes can be placed anywhere as per our convenience and they are required to see the true shape of the solid.

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So, we also have an octagonal pyramid here. So, we might be keeping it like this or it might also be kept like this which is absolutely from nowhere can we really see that what is the true shape of this octagon. To determine this, we will have to assume the object to be in different positions first and then try to see what its final projections looks like or suppose we have a section.

So, what would be the true shape of the section will actually be determined only if we have a plane parallel to this section surface. So, that is where the auxiliary planes come into picture. However, all this is going to come much later pick into the syllabus and we would be starting with the projections of very simple object starting with projections of points first, but here what we have to understand is the difference between the first quadrant and third quadrant.

And we are going to restrict ourselves to all the projections in the first quadrant only. So, that is all in the lecture today. From the next lecture onwards, we would start to draw the projections of different objects starting with point to line and then planes and then moving on to solids and then section of solids. So, before I close my lecture today let us see a glimpse of what would be the object if projected with the light source look like if it is a light source which emits only parallel rays.

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So, let us see a quick demo of that so that you are very clear about how the projections are really cast. So to explain this concept of orthographic projection in first quadrant just assume that this is the vertical plane where we are seeing this light coming from. So, this is the vertical plane and this is the horizontal plane where this makes the first quadrant and that is the side plane.

So, just assume that we have a point for example or maybe a line to start with. So, if I keep this pencil like this in the center of this what do we see? In the front view, we will only see a straight line while in the plan we would only see a single point because we will be seeing it from the top. Now replace this with a say plane. For example, this is a plane assume it to have no thickness.

If I keep it right straight in front of this so this plane is actually perpendicular to the horizontal plane and parallel to the vertical plane what do you see in front is actually a rectangle, but in horizontal plane we would only be seeing a line. So, what we get out of this is anything which when kept perpendicular to a plane will be seen only as that is in case of point or a line that it will only be seen as a straight line.

However, when we put it parallel we will be seeing the true dimension of it. So, if you look at it like this where it is perpendicular to the VP we will only be seeing a line in VP vertical plane while in the horizontal plane we would see a rectangle. This entire true shape of the

rectangle while in the vertical plane it is only the one dimension of this rectangle that we are seeing.

Let us see how the solids look like. So, this is the cube the example of cube that I have been explaining to this. So, if I hold this cube like this such that it faces are either parallel or perpendicular to these projection planes. What do we see? We see a square in the front view and a square in the top view the plan. Now, I am rotating it at 45 degree what do you see in the front view.

We see a rectangle, but it is actually not a rectangle it is a deform square. So, we are actually seeing these two squares here and when we see we will be seeing one edge which appears as a line. So, we will be seeing a rectangle here a smaller rectangle another smaller rectangle and in all we will be seeing one single rectangle with a line in the center. If I keep the same cube on one of its edges like this.

What do we see? We see a very deformed shape it is not rectangle, it is not square, it is a combination of some rhombuses. So, that is what we are seeing, but none of it in actual true size, its actual true dimension. Again, if I put a cone this is a pentagonal cone what do you see? You see a triangle. Now this triangle does not give us a clear idea about what is the size of the pentagon the base, but it gives us a very clear idea about what the height of this cone is.

While if I keep it like this then you can very clearly see that it is a pentagon and then we will seeing these line, these edges merging to the apex. So, we will be seeing a pentagon and some lines coming merging into a point. So, what I wanted to explain to you was that in the first quadrant and in orthographic projections we will always assume the light to be coming, the light rays the projections rays to be coming parallel to each other and perpendicular to this plane.

We cannot be assuming them coming parallel or at an angle to this vertical plane and horizontal plane otherwise the views would become deformed. So, this was all about orthographic projection here in this lecture today.

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So, all that we were understanding about first quadrant projection is what we are seeing here. This is the vertical plane that we assume, this is the horizontal plane and this is the side plane and we were assuming the objects to be kept in the first quadrant like this. So, we would either have the projection coming as elevation or plan or the side view. I hope with the help of this you have fairly understood the difference between the first quadrant and third quadrant and also the fundamentals of first quadrant.

So, henceforth we will only be restricting our discussions and our drawings to first quadrant drawings because that is what is prevalent in India. From next class onwards, we will be discussing about the projection of point lines, planes and solids. So, thank you for being with me today and see you in the next class tomorrow. Thank you.