Marine Construction & Welding
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Lecture No. # 05
Structural Subassemblies

So, today we shall continue with, we will look into the basic structural component little more because certain things were left yesterday and then, we will subsequently go on to structural sub-assemblies right. So, yesterday if we go back to yesterday's, so what we have looked into are the basic structural components.

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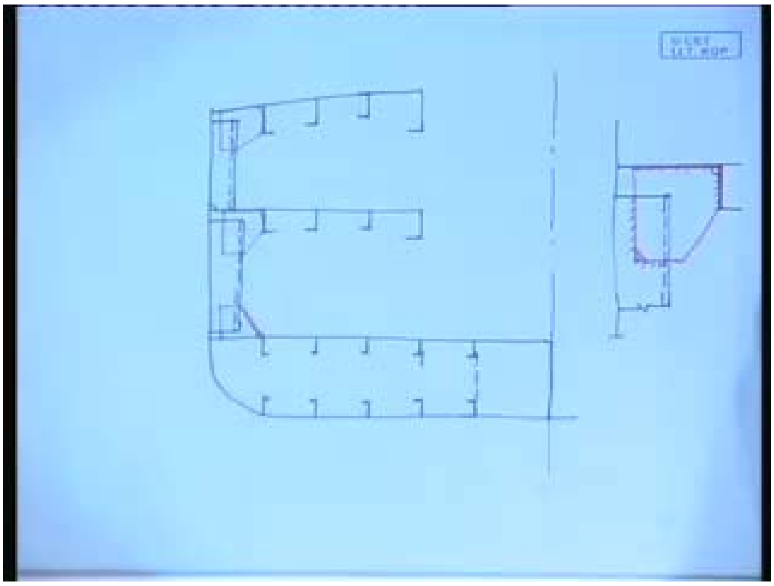

This is the role steel section plates and then, different kinds of stiffeners right. We have seen hatch end beams, hatch side girders. Then, we just initiated talks about the brackets because that is also one of the basic structural component brackets.

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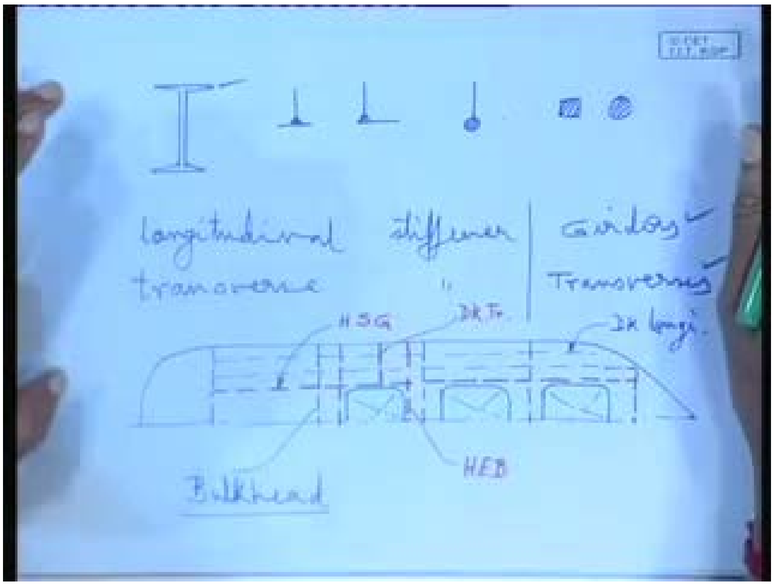

Here, I have made a small sketch, where in you can see, this this particular sketch of course. I mean it is a section at the mid ship, right. A section at the mid ship of a general cargo carrier or it can be refer to also as a mid ship section of a general cargo carrier, right or dry cargo carrier. Those details we will see little more later on, but what you see here is this particular member is stiffened panel. You can see I have drawn it little curved. There is some purpose for making it curve. This is basically the main deck, right.

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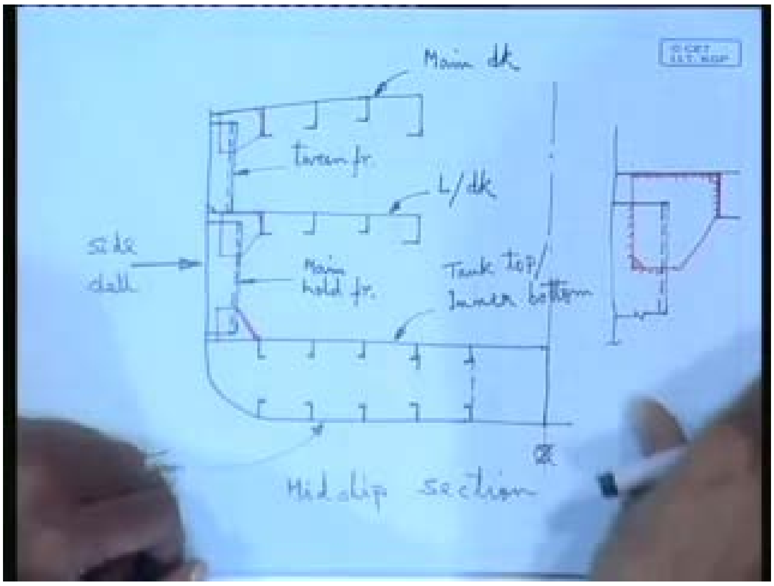

This is the main deck of the general cargo carrier. Here, I have another deck in between. This is the twin deck or also referred to as lower deck, right say, lower deck right and then, you have here another platform kind of a thing you can see here, horizontal platform. That is referred to as inner bottom plating.

We started with basic structural component. I said we will talk about brackets, but you have not yet reached to the bracket. Let us first sort of describe what these items are and then again we will come back to bracket. This is referred to as inner bottom plating. Inner bottom or inner bottom plating also referred to as tank top. This particular top is tank top or inner bottom plating or also inner bottom. If that is inner bottom, then obviously, this is outer bottom, right or bottom shell. More frequently, it is referred to as bottom shell. Obviously, this is my side shell right. So, now, we can see that the main deck is stiffened by angle sections. These are angle sections. Twin deck or the lower deck is also stiffened by angle sections right.

Similarly, your tank top and the bottom shell are stiffened by angle sections and on the side shell; we can see that there are vertical, 2 such vertical things I have drawn, right. These are essentially side shell frames right. So, here is also one side shell frame, here is also another side shell frame. Just to distinguish between these 2, this lower one is called hold frame or main hold frame and this is called twin frame or twin deck old frame, whatever just to differentiate. Now, you see these longitudinal or these stiffeners in the main deck or lower deck or bottom shell, they are basically longitudinal as you can see here because this is a section at somewhere around the big length. So, it is a transverse section.

So, all the members here, we are seeing, some of them are running longitudinally. So, this obviously, your deck plate, the shell plate and these stiffeners in the deck and the shell plate are running longitudinally. So, we can say that the decks are longitudinally stiffened. Longitudinal framing has been adopted right, whereas the side shell, these are in the transverse plane. Is it not? They are transversely framed. Side shells have been transversely framed, right. So, these these are also stiffeners. Well, I can use angle section, right. Here, you can see I have put a dotted line here, one form line and another dotted line.

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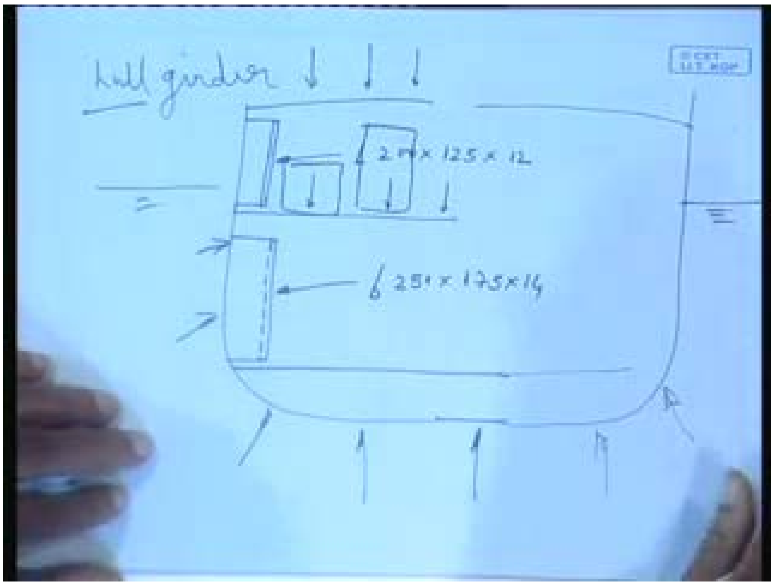

What is the indication of that dotted line? It indicates that the flanges on the other side. It is a flange. If I do not put the dotted line, just make a sort of, if I make a section like this. Suppose you have the side shell, you have the deck right and you have that twin frame. If I just draw like this, it implies it is a flat bar. The moment I put another double line here, it implies that it is either angle section or a bulb section and flanges looking at me facing this, this means perpendicular to this plane upwards.

If I draw the same thing in this fashion, please do not draw this. I am just showing you because on the above, it will be facing this side and bottom, it will be facing the other side. It never happens right. Just using the same drawing I am showing you. If it is dotted, it obviously means, it is a flanged. It can be either a bulb section or angle section and the flange is downwards as if, right, well whether it is angular flange that will be known by when the scantlings are written.

Suppose it is written like this. All right. Say, it is written like this, then it implies that it is an angle section. If it is written like this, it is a bulb section. So, this dotted line or this form line, it has a significance, all right. So, it is done in this way, means I show that the flanges on the other side. Now, we have been talking about the basic structural components. One of them is the bracket; instead we talk about the load path. That means, whatever load is coming to the deck, whatever loads are coming on the deck, this is the, it can be whether load it can be deck load, anything you are keeping on the deck or some equipment you are keeping on the deck. Here, in the twin deck, the loads are nothing, but it is a load of the cargo. There can be some cargo inside, right. So, all these loads and the load due to its own weight, structural weight, right etcetera.

Finally, at the end, it should get supported by the buoyancy. Is it not It is floating. So, the buoyancy forces are acting. So, it should get supported by the buoyancy. So, whatever load, that load must get as far as possible, evenly distributed over the entire hull girder. This particular term is used hull girder. That is nothing, but the hull, and the hull is taken equivalent to that of a girder. Girder we have seen. What is it? It is longitudinal stiffening member of higher scantling, we refer to it as girder, right and generally, hull, a ship hull is referred to as hull girder. Why? Because as if the ship is a cylinder beam, right. So, that is how that name. It is just a conventional name hull girder, anyway.

So, the load should get evenly distributed, such that it gets supported properly by the buoyancy force. So, to do that, that means, suppose we take a look at this corner. What we see that the load is coming here. Let us assume the connection is like this. May be we make another drawing.

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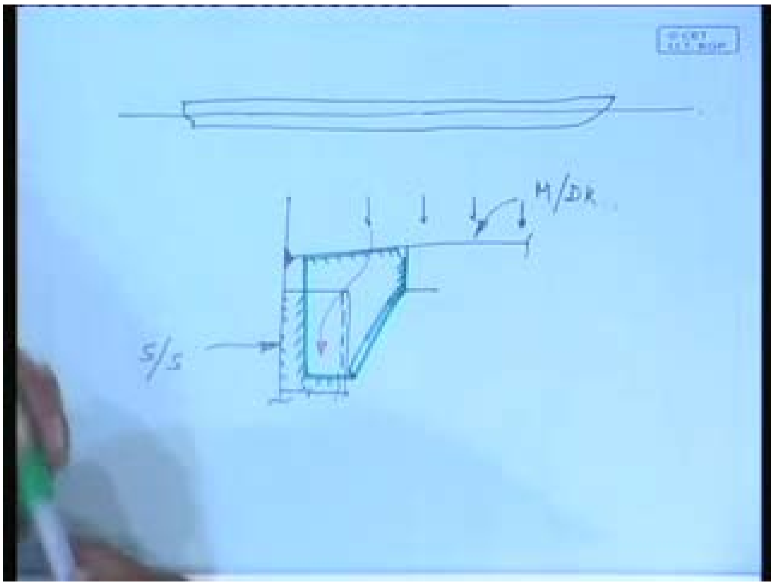

Let us see the corner part only. This is my part of the part of the side shell. This is my deck plating, main deck, right. This is welded. Right side shell is little more projected upwards. It is welded. Now, for some reason, I have my main deck longitudinally stiffen. So, I have stiffeners like this. I am assuming that stiffened by angle section, it can be bulb section also, but not t section. Either angle or bulb, generally not flat bar because you need sufficient strength there. So, flat bar, if I take the flat bar, scantling would be very big which is not worthwhile. If the scantling becomes big of the deck stiffener, then what happens? This clear room becomes less. Is it not The clear space, you need a clear space for cargo stretch.

Anyway, so, we are now looking at this joint. So, it is like this and the side shell is stiffened by a, it is transversely stiffened. It is also an angle section connected to the side shell like this. That means, what it is welded here. Now, let us think of how the load is getting transmitted, say some load is acting here, definitely if not anything, the weight of the structure itself. So, it appears as a cantilever. Is it not So, the entire load as if is coming, getting supported at this joint only as if you think of the entire shell plating of the deck. It is like that only.

At places, it is fully connected between the hatch openings. When the hatch openings are there, it is just a cantilever plate, the plate in line with the hatch opening. This is a plate cantilever. Is it not The deck plating. So, it needs proper support, such that the load gets transmitted to the side shell. So, that can be done very well, if I can provide a good connection between this two. So, what I do? I put a piece of plate like this. So, this is another piece of plate that is put there, and welded to the web of the side shell frame, welded to the web of the deck longitudinal. This is a longitudinal stiffener. Since, it is fitted at the deck, I call it deck longitudinal. It gets a name, so I can identify easily. Then, this part I welded to the deck.

So, what has happened now, that whatever load is coming, it is getting very well distributed to the side shell, right and eventually to the bottom shell, which is supported by the your buoyancy, right. So, this is what a bracket is. This is a very important function. It looks very trivial, but very important function. Now, so the bracket, what should be its dimension? What should be its strength because it is actually being subjected to a substantial loading, you can see. So, even the bracket may fail because of the load. So, how to increase the stiffness or the strength of the bracket? I provide a flange here, that is a bracket edge is flanged the way the stiffeners, they have a flange. Similarly, the bracket plate has a flange. You see this flange is looking at me upwards. Obviously, not that side because it will ford with that or even if I make it that side, the other side, it will be cut at this edge. Otherwise, it could have fallen. In any case, it can put either facing up or facing down.

So, I provide a flange or stiffness of this plate across this section increases. So, because of that compressive loading, the loading is coming from this side. Buoyancy force is pushing up. So, you are as if the bracket under compressive load. So, it will not fell if I provide a flange here. So, depending on where you are putting bracket or load, may come either you have a flanged bracket or you can have unflanged bracket, whatever.

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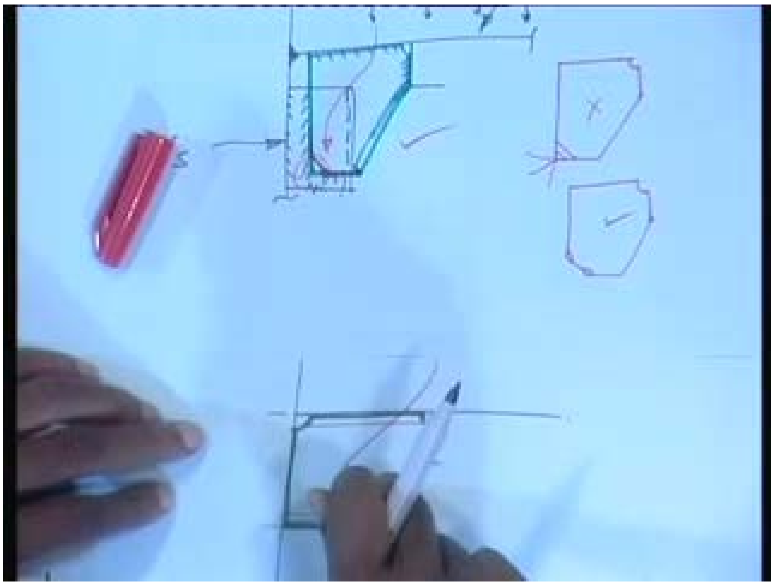

So, that is what the main function of this bracket is. Now, this same thing could have been done in this fashion also. Just take a look. You have this and the side shell frame. I extend it like this. That means it is another piece of plate as if the frame has got sort of extended like this. That means another piece of plate. I put it exactly fitting that gap, where the side shell has end. Stiffener side shell frame has ended from there. I put a bracket like this. The essence is as if the sides and stiffener has become edge has become enlarged. This also serves the same purpose because my purpose is to provide a suitable load path.

That is going, but obviously, this one is preferable putting a bracket like this, which is overlapping the flange, overlapping the side shell stiffener. Compared to this structurally, this is better, this absence structurally is better, but from production point of view, this is much difficult. Much difficult compared to this particular (()). Let us see why? This is structurally better, may be both of them we can keep. They are visible, yes. What happens in such case? These particular corners, they become little vulnerable, these corner.

What happens, it has been observed that from this corner, crack may occur, right. So, what is done is, these corners are generally cut. That means the bracket shape could be like this instead of a sharp corner edge, instead of that like this. So, like this, this corner has been cut because this sharp pointed corner here, you have stress concentration and cracks may originate right, whereas if I have a connection like this, that problem is not there. The entire problem all together is eliminated here. I have reduced the problem. This angle was much more acute. I have made the angle much wider. That is how I have reduced the stress concentration here. That is eliminated. So, this is a better solution structurally, but from production, it is not. So, can you tell me why? What is the great difficulty? If I do this in production or what is the great benefit in this? Yeah simple. What happens here is that the size it should fit perfectly. That means you will have to cut a plate, which will fit perfectly. If it does not fit, if it falls short here, you cannot weld or you weld there, it falls short at this edge. You cannot weld. The entire purpose is lost and to get it perfectly done, matching is difficult. Why difficult? Because the size of the vessel, this depth could be say 20 meter depth, the entire depth of the vessel.

So, you are gradually building up and this bracket size could be, say 300 by 300 millimeters. This is 300 millimeter, this is 300 millimeters. 300 against 20 meter is nothing. So, when you gradually erect the side shell and at the top, here this bracket is coming. There can be some discrepancy of 4 millimeter. 4 millimeter in 20 meter length, 20000 millimeter is running, but 4 millimeter here gap, it cannot weld, right. So, alignment problem becomes very severe here. You have no alignment problem whatsoever, right. So, this is always a very better way of doing things. I mean where this is not, this gives a production problem, right. In this you have a, I mean that alignment problem is not there and well, it is of your purpose well to improve situations this corner is (( )) corner is cut. It is not that after welding you cut it.

You made the bracket like this; you cut it and fit it, right. You may have observed here at this corner, there is some small notch. I have made here also when I have drawn. I have made a small notch like this. You know what is that? Why that has been provided? Can you guess, but here, I have not done on the left side. So, that is sharp corner is not creating as such any problem. It creates some other problem, yeah some welding problem.

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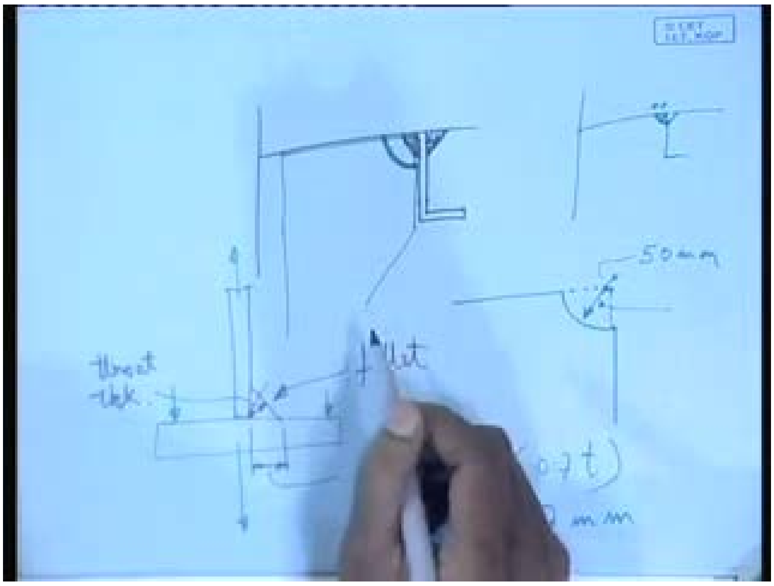

So, what happens is, you see again these are small details. When you have this, this is my well, suppose this is that angle section. So, what it will be done, it will be welded here and welded means, it will have metal deposition like this. Is it not Both side, right and now, if I put a bracket which has this corner, right. So, this corner will foul because in general when I am making the drawing, then I can see this deck plating the deck plating is there and the longitudinal is there.

Welding is a small part there, very small. This longitudinal depth could be, say 300 millimeter, could be 100. Anyway, that depends on what big vessel and what size? So, let us assume, this is a 300 millimeter depth, but what the size of this welding is. That is small amount of metal which has been deposited. This size may vary anywhere between 4 millimeter to 10 millimeter, only this length that is vey nominal, right.

So, that may not figure as such in the general drawing, but when you make the details, then it will become visible, right. So, when you make this bracket because the bracket drawing is needed there. One thing is there, here you cannot really do anything without a drawing. You have to give the drawing. The drawing goes to the soft floor and accordingly, the plate is cut because these brackets, they are nothing, but flat plates and to provide necessary strength, I may provide a flange here.

That flanging can be the edge can be bent. Just by bending the edge, I provide a flange. It is something like this straight way. So, this plate is having a flange, right or I can weld a piece that is also feasible. So, in any guess drawing is needed. So, in the drawing and these cutting will be done. These days virtually in all shipyards you have a so-called (( )) flame cutting machine numerical control flame cutting machine. So, all this will be program you put the plate and it will be cut through the required size and shape etcetera.

So, there you have to show this small cut out right. So, that is how what happens that this plate will have a small cut out here right. So, the bracket corner will be like this. What radius? How much you cut? So, it is actually this part you have cut it out. As I have said, when a welding is done, suppose you have a plate, there is another vertical plate. It is being welded. This weld is referred to as fillet welding. This dimension, what is that? Any idea? This is referred to as leg length and this particular dimension along the mid plane; this is referred to as throat thickness. So, how much this leg length will be or how much the throat thickness will be? Throat thickness and leg length, they are related, is assuming that this fillet is an isosceles triangle, right.

So, any way, generally the leg length is given. How much the leg length will be? That depends on, what thickness of the individual components are being welded. Obviously, with thicker the individual components, more is the leg length because leg length gives you the bearing area because what are the loads that may come. One of the loads that may, worst kind of load that may come is like this. Is it not Or even well worst could be even this. That means, this particular plate is pushed in that side and the plate which is welded to this is pulled from that. So, you will have a tearing action.

So, the failure mode would be where there can be sheer failure along this or initial failure here which is probable sheer. Obviously, because you are the failure stress needed is much less, right. So, it can be a sheer failure here. If the loading is like this, then it will not be even a failure. It may fail somewhere here along this, along this direction, right. Anyway, this welding will be both sides done, whatever. So, such this, it does not fail. It should have necessary leg length, proper leg length. Now, the question is how much is the leg length? Just a sort of a thumb rule is. Thumb rule is that 0.7 that thickness of the thinner one. The thinner component here as I have drawn, this is thicker than this, right. So, the leg length will be 0.7 thickness of the thinner one, say if the thinner plate is 10 millimeter thick, out of this is 10. This is a 16, then I take point 7 of 10. So, leg length becomes 7 millimeter.

Let us assume, here I am doing a welding of 7 millimeter. So, how much this should be kept? These are very small trivial things, but it leads to very big. What I mean, very significant implications it can have that you have learnt slowly through experience. Here, I see that if this plate is hardly 10 millimeter thick, then the leg length becomes 7 millimeter and I say, that I cut it off this corner because otherwise, it will foul this, that corner will foul with that. If it founds, then the bracket would not fit properly. Is it not So, I cut it off. So, how much I should cut off? What should be the radius of this? Not 0.8 millimeter, say 8 millimeter. May 0.8 millimeter is very infinite, I mean very small. 0.8, here I am saying, it is let us assume the leg length is 7 millimeter. So, if I say keep a radius of 10 millimeter is more than enough. It does not found but generally, a radius of around 50 millimeter is kept 54 zero much more you have hardly, say 10 12 14 15 leg length, not more than that.

Generally in such structures, whatever the thickness will come, but you keep a generous opening of 50 millimeter. I mean 50 millimeter radius. That means, I give a substantially big cut. You know why? Can you guess, why such a big no? No there is no question of any more fouling and after I put it, well you mean to say if it is 7 and if I keep only 8, there can be some mismatch. It can found. In that case, I could have kept 14 double it fifteen in in for a 7 I keep a fifteen millimeter instead of I am keeping fifty millimeter much more; that Means, it indicates that it is not only the case of falling that I have solve by cut by giving a cut here, but there is another necessity; that means, accessibility

To this small corner accessibility is needed because what happens after you have you have fabricated the structure.

You have to paint everywhere. You have to apply paint, anti-corrosive paint and all that. Otherwise, the structures will corrode. So, if I do not have access here, how do I paint that small part, that is small weld band there and not only that, you see if I draw it in a mode little more enlarged possibly. It will say, this is your stiffener and here, I am giving a cart, may be a different color would have been (( )).

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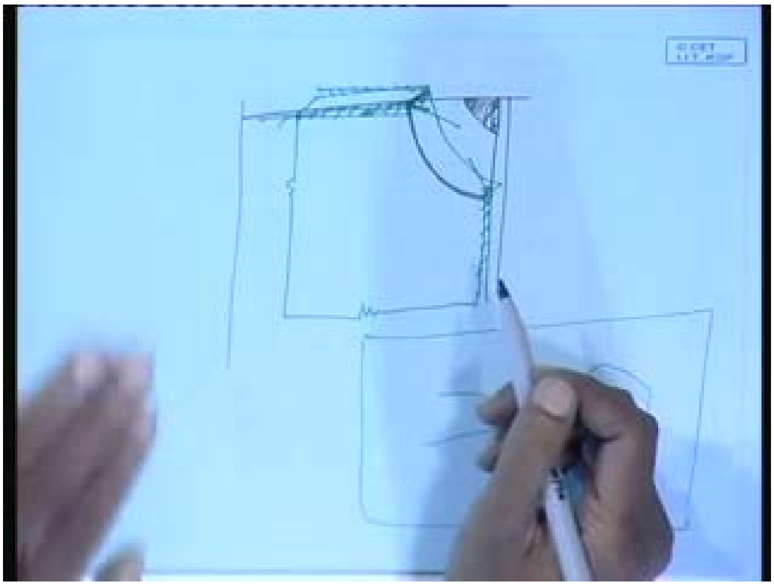

This is how it is going, right. So, what I am saying that I am welding it here, I am welding it there. Is it not Here, I have a fillet whose dimension is something like this, right. So, I have enough space. You know why? Because, then I can put my, firstly I can paint this region. I can apply paint, so that does not corrode. Secondly, think of this, these 2 corners. What is there? It is just a gap, small gap will be there. Is it not Because this is I am just drawing a part of it. This is a plate, this is a bracket. Is it not The bracket has a kind of a thickness say, the bracket is well 12 millimeter thick. That means, at these corners it is only 12 millimeter. There it is welded from this side, may be welded from the other side also, but what about here. It is a 12 millimeter plate like this, right this small area.

It is welded from the other side also, both the sides are welded, but this small area here, they will be a. If I keep it unwelded means, what they will be a very minute gap will remain, which may not be that visible as such part physical gap. Physical gap remaining means, what moisture will condense there. We need to inform a galvanic cell all right, and will start corrosion and its corrosion starts. Then, what happens? It will propagate corrosion starting means what it is reducing, the strength locally.

The material is getting wasted right and the structure is under all kinds of loading. So, that made it to a small crap formation and under the service loads, if a crack is found in a structure, the crack will propagate, born to propagate that is the characteristics of a crack.

In a ductile material, it will propagate because once the crack is formed and the loading conditions are not changed, that will propagate because at the first place, it has got form. If it is form means, further the strength is gone down for the structure because wherever a crack is formed, an inner crack is nothing, but something like this.

In a plate I am just seeing enlarge, that means there is a tip, very sharp tip right. Sharp tip means, here you have very high level of stress concentration. So, automatically it will go on propagating. They did not do failure, total failure, total detachment of the bracket. If the bracket gets detached, your inter purpose is lost of the bracket. There is no more this load path is working. So, this small corner is very important, that means how much you are cutting, such that you have enough space, such that you can insect electrode and weld this part. Understand, you are not only welding here, not only welding on the other side, but also welding this blocking. No moisture can go in no galvanic cell is formed no corrosion and also, you provide suitable painting accessibility. So, a bigger opening is cut.

So, this is called, this kind of cuts are referred to as scallop, right. So, you should give a, well radius accessible scallop, such that necessary welding can be done there, necessary painting can be done, right. So, that is what the bracket is.

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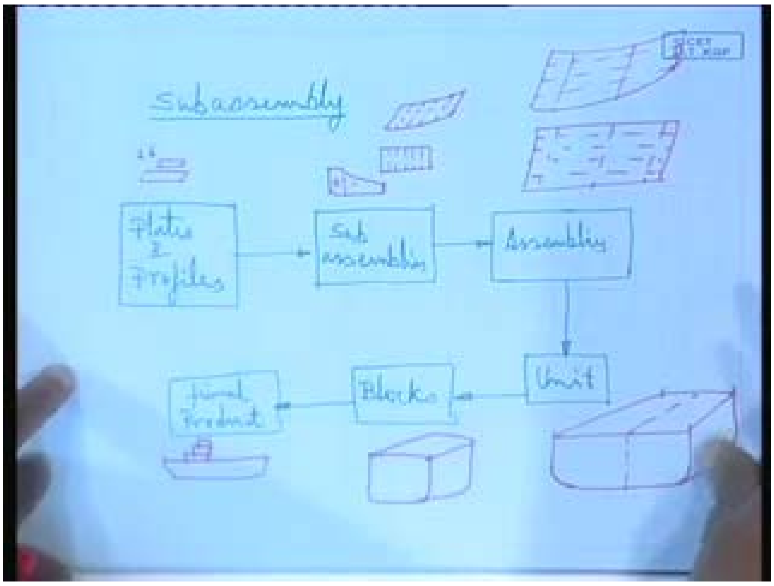

Now, let us go on to the structural subassemblies. Now, we have been talking about the basic structural components, now subassemblies. Now, what is the sequence of overall production? How do you see the sequence of production? It is something like this, say plates and profiles. Plates and profiles mean nothing, but what we have talked about the plates and the sections rolled steel sections and from the plates, you have cut the plates in small pieces. From the brackets, where ever we needed a fabricated stiffener or fabricated profile, we cut it to the required size of the web and flange welded. That is a fabrication section. So, this is my initial as if well some of the activities are there upstream also.

Now, if we are starting from, so you have the plates and profiles, then from this, we put small components of plates and some profiles we get subassemblies. These can be, that means, we assemble some of these plates, some of the profiles together and makes small three-dimensional structure or may be two-dimensional structure which can be able to a subassemblies. Put some of these subassemblies together, obviously, we get assembly. I mean, that is how we basically plan to segregate different types of structural components. These are all structural components because my final component is nothing, but the full ship or the full platform, offshore platform. Prior to that, everything is a component at different stages of finish here. It is one stage of finish; this is another stage of finish, right.

So, assembly, then few of the assemblies put together gradually, the things are growing. You see here. You had only; well will draw that they are referred to as unit putting some of the units together, it is refer to as blocks. Put the blocks together, I get the final product. Obviously, this is just for the sake of showing the flow I have shown, but actual material flow does not take place like this. It will be well depending on proper t s material will actually flow of course, but it is not that. It starts from here, takes a turn and goes back not that right, but obviously, material will flow from this section to this section, from this to this, from assembly to unit, unit to block, block to this. What it is basically? Here, I mean if we try to see, these are essentially plates of different sizes cut and your angles bulk sections and so and so for of required.

Safe size and also here, you will have facilities for bending it for giving a required curvature. Then, it comes here. There the subassemblies, subassemblies means well, say a small subassemblies like this, some particular other sub assemblies could be like this, that means, flat plate subassemblies with stiffeners. Others subassembly could be a curve panel with stiffeners, right. It is small subassemblies, right. Then, assemblies I mean, these are smaller assemblies. Subassembly same thing here bigger once much bigger once, that means, some of the subassemblies put together your getting assembly, say a assembly, a deck assembly right a side shell assembly that way, so that also can be flat panel or a curve panel, right. Then, these subassemblies put together, you get unit. Some unit could be like this. Let us, you know what is this? Well, if you back to this bottom part, I have drawn this bottom part. That means, it is a bottom shell inner bottom shell.

So, this is made up of, this is flat assembly, the top of assembly, the bottom shell assembly, this curved path. This curved path is named as bilge. This is referred to as what termed as bilge plate. It is curved there right. So, anyway this is a unit. This unit as a name, it is called double bottom unit, so that can be separate, such that unit. Then, these units put together side, shell unit, deck unit, all those things and we come to the so-called blocks. These blocks put together, I have my ship, right.

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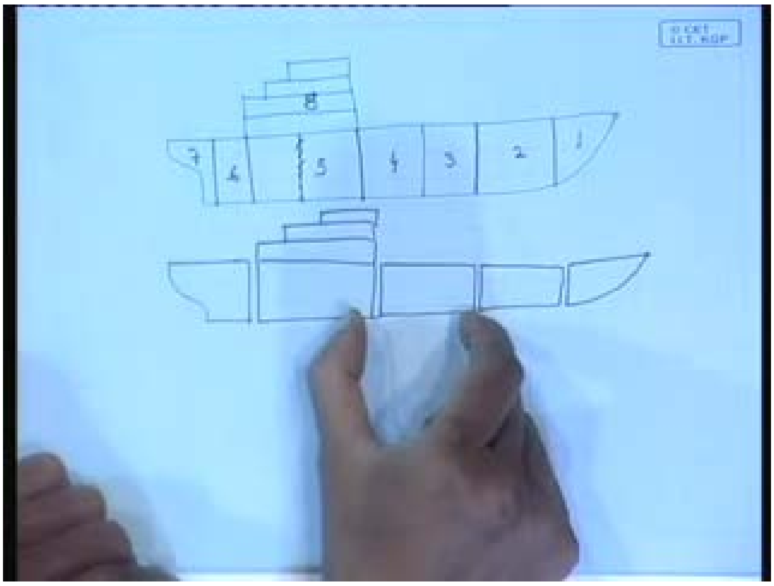

What are these blocks or if I go back from the final product to this. So, it is somewhat like this. So, you have with reference to that of a vessel, a ship. This is my, suppose let us, suppose a simple ship like this. There will be many other things. We are just looking at only on the primarily, the steel structure. So, it can be divided in separate, in several not only compartments, but components as if those components are (( )) depend on the number of bulkheads you have and all that. So, these could be block number 1, this is block number 2, block number 3 and so on and so forth.

So, the way I have drawn here, may be you cut it off 3, 4, 6, 7, 8. There are eight blocks. So, this can be a block by itself. Stun block, engine room block right. Then, say block 3, say block 2 and then, say the fourth block. Put the blocks together. You have the entire ship the so-called accommodation block, right. So, whole purpose of showing this is nothing, but to show we had been talking about the basics, structural components. You have come to the structural subassemblies. So, we are here subassemblies right structural subassemblies. This we have seen.

Now, we are here. Further, we will progress like this. Some of them will talk, right. The whole concept is that you go on assembling and gradually, you get the shell in the difference with civil construction. Is that the building is built at one place? You bring all material there, but here, it can be built at different locations and it moves. You can move the thing. It is not that at one location. Everything will come and you built. You make the subassembly, the whole subassembly move it to a station, where you do the assembly, the whole assembly. Then, you transfer where you get the units, say a double bottom unit, a wing tank unit.

So, this is the general flow pattern of the sequence of production of the sequence is going on and of course, to all these major main activity, you will have various inputs of various other things because in between your pipes will come, in between your cables will come, in between equipment will come, the machinery will come, right, so many things. Anyway, so this is basically the concept. Obviously, depending on the facilities, one has in a shipyard, depends whether you will. What is the size of block? What size of unit is serve assembly going to handle? Because if we do not have facility of handling this entire block, entire block means, it is becoming as we are progressing from the stage 1 to the final stage. Gradually, the weight of the unit, individual component being handled is increasing. So, you will have to have proper facility to handle that, right. So, thereby, it controls that how much you are going to, how much you will follow. This entire operation is referred to as prefabrication.

Prefabrication, you are prefabricating it like the example, I said in the building instead of bringing one brick, if I prefabricate the entire wall elsewhere and just erect it, it is a different thing all together production scenario, right. Same thing here, instead of doing this way, I could have done everything at one place. I erected a stiffener, then bring the plate weld it there, right. So, it is a kind of prefabrication is being done. So, what extent of prefabrication you will do? It will depend again on the shipyard facility. Obviously, this subassembly we have come to this structural subassembly.

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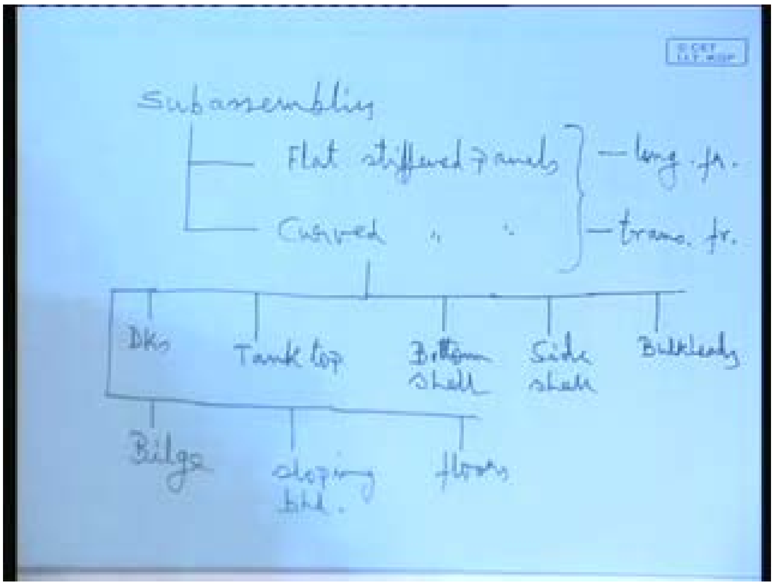

What it is primarily is the (()). Primarily, the subassemblies can be divided into your flat stiffened panels, right or curved stiffened panels. These are the basic two, right. They would be both. These flat or curved stiffened panels would be either longitudinally framed or transversely framed. That means, either longitudinally frame system will be implemented or transverse frame system will be implemented, right. So, this flat and curve stiffened panels. So, what are these?

Many thing decks, right tank top, bottom shell, side shell. Then, what else? Bulk heads, right still continuing bilge, right. Bilge bilge plate is a curve shell, then internal that can be in bulk head area. You will see it has internal partitions. I mean internal structural arrangement, such where sloping bulkheads, there will be something called sloping bulkhead, right. Well, the floors, yeah floors. There is some concept called floor, right. So, in this way, like this you will have primarily the subassemblies will be the decks, various decks, the tank top. If there is a double bottom, this is what is referred to as double bottom.

This part is referred to as double bottom because this is my inner bottom, this is the outer bottom. That is how double bottom, right. So, this tank top plating, the bottom shell plating, the bilge, the side shells, the decks and there can be some sloping bulkheads and also the bulkheads, the flat plates, transverse bulkheads. These bulkheads in the accommodation region, you will have non-water tight accommodation bulkheads there. Basically, the partition bulk heads because you will be forming the covings etcetera, right. So, all these form the subassemblies. Then, there is something called floor. Floor is a concept here in this region. This I was trying that time. This we will see later I mean in the next class again.

Say, what I am drawing here is this particular item is referred to as floor. This entire thing, this is referred to as floor. Conventionally understand floor is something in the horizontal plane, right. Here it is a vertical plane. This is a plate; entire thing is a plate in this vertical transverse plane. In this transverse plane, this is a plate and this green, these lines I have drawn there is nothing, but such types of openings are there. Here is a circular opening; here I have an elongated opening. That is all.

These dotted lines are nothing, but they are some kind of stiffener, stiffening this plate, right and these black angles that the tank top longitudinal, this is a bottom longitudinal, right. So, you will have openings in this floor plating like this because this longitudinal will pass through that opening. Is it not? Longitudinal are continued and your floor plates is only a plate in the transverse plane. That means the longitudinal members will intersect these floors. So, this is referred to as a floor. We will talk about this in next class. What are the significance of these floors, what are the different types of floors, why they are provided and why these holes and why the stiffeners, right.