Marine Construction & Welding

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Lecture No # 10

Fore & Altend Construction

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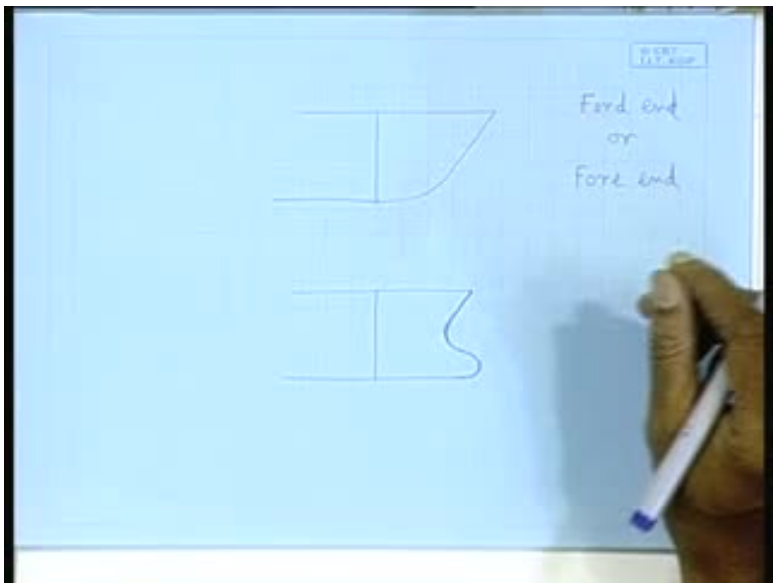

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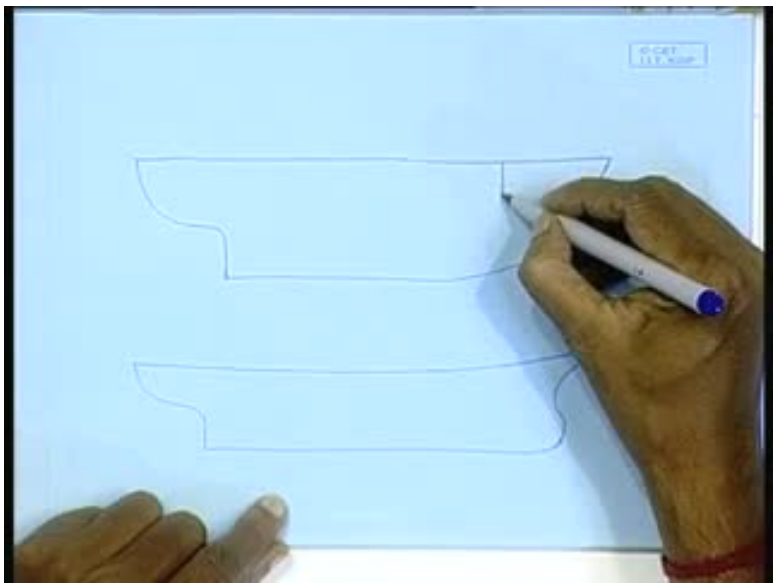

Today we will start with the ford end and after end construction. To some extent we have talked about it in some of our previous lectures. I mean as you can see the name, ford end construction, so it is written like this end or also it is written as fore end. That means the fore end of the hull, this part only. What is the great difference between these two hulls?

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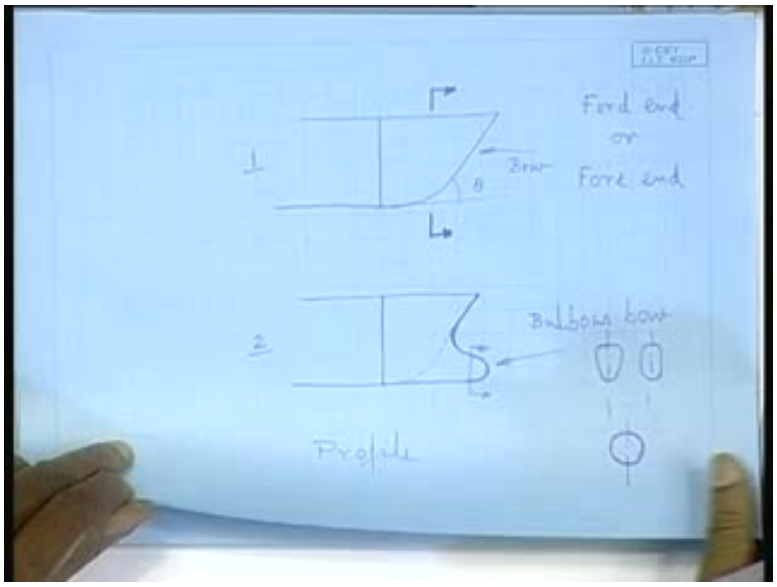

Just only this part I have drawn in here. This here you have the bow. This is what is referred to as bow of the section. Here you have a bow straight going up with at an angle, at a particular angle. This angle could be from 90 degree to some less than 90 degree. Generally it is not made 90 degree. Generally a rack is given, such inclination is given right. Those details why and how much effect, those things you will learn in some other course. For general cases either the ford part, the bow of the vessel or the ford part looks like this or the other alternative is here.

Here you can see some extra, as if some extra construction has been provided there. Instead of having the bow going like as we have I have said that conventionally or well going like this, through the dotted line I have shown, as if some appendage has been added. This is what is referred to as, you have heard about it? What it is called by chance? Well it looks like a bulb, as if some kind of a bulb has been put there. The cross section, cross section of this bulb, could be, if I see the cross section the cross section could be well let me some of them it can have a section like this. It can have a section

like this or even it can have a section like this. That means it can be either right from a circular section to some oval kind of section to various different.

Various different means mostly these type of sections. It is an inverted sort of trapezium kind of a thing, it can be a as if a rounded of rectangular section, a circular section, so different kinds this thing could be. It is referred to as bulbous bow. This particular appendage as, I mean the way I have shown here through the dotted line, as if this was the original hull and then this bulbous bow has been attached.

But in reality, of course this part of the original hull is not there. Straight away the bottom shell continues and it takes some such shape, there is a bulbous bow. There is a definite purpose why this is put. Well I mean you will learn much more about it. In one sentence it can be said like this, that providing a bulbous bow it reduces the resistance of the vessel.

Resistance means resistance of motion, I mean when the vessel is plying through water, the water medium offers resistance to its movement. So our objective is always how to reduce that resistance to a minimum, because then I can have very efficient propulsion. Our fuel consumption will be less.

So this is one of the ways of reducing that resistance, by providing a bulbous bow. How that happens? Well that we will learn later. So by ford end either it may look like this – this case number one or it may look like this - the case number two.

Where in you have the bulbous bow in the case number two, then the bulbous bow can have different kinds of sections. That is as far as the external view is concerned and that too which is visible in the profile section. By profile section I mean the section through the longitudinal central line, a section through the longitudinal central line or the central line along the length of the vessel we take a section, I get the profile, it will look like this. If I take a section here, that means transverse sections, then also you may have the four sections like this, or what is the difference between these two? These are the sections about this.

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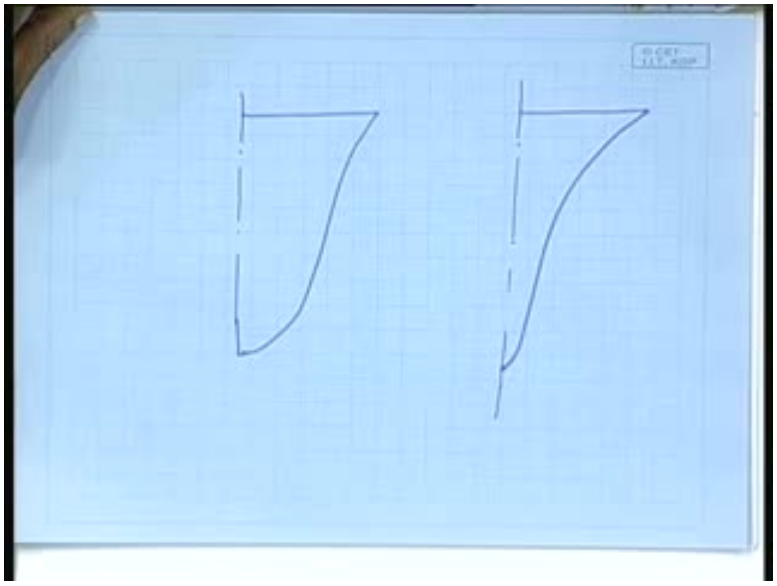

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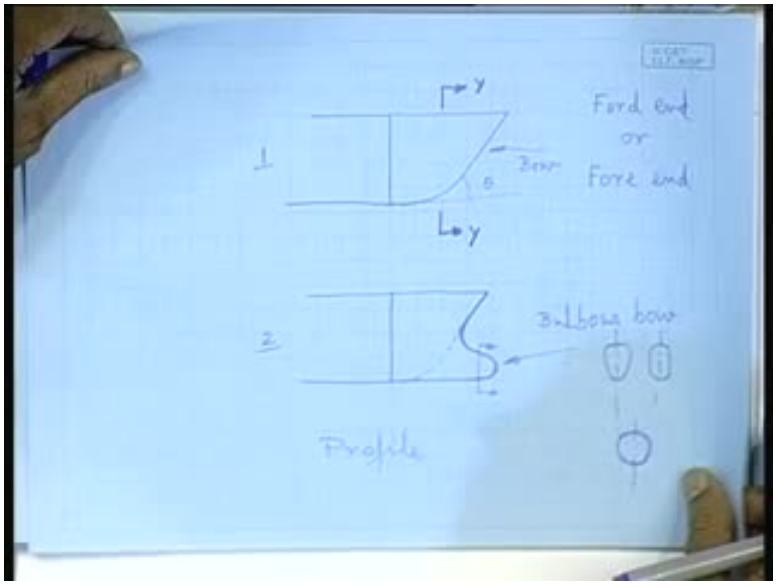

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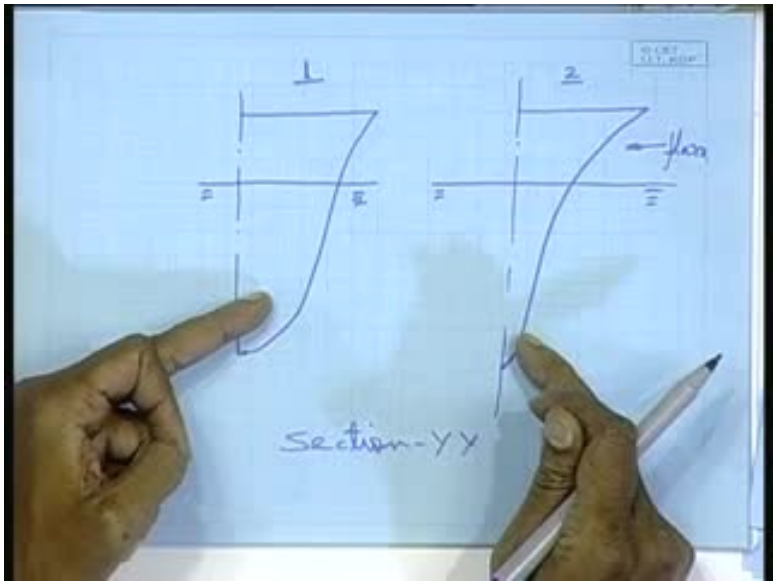

Suppose this is my y y. About this y y the sections are taken, obviously of two different forms. So what we can see here is that this particular is having a much larger flare. Both are suppose they are having the water line here. In this we see that it is having a must more flare, this is what is referred to as flare.

The side shell is flaring out. In this what happens, you can see the water plane at the load water line is much narrower in this case compared to this. Well for a different hull form, for a different block coefficient, all these things you have heard about? Strongest form coefficients? If the form coefficient, if the block coefficient is less then it will tend to this type of a section which is suppose this is number two this is number one.

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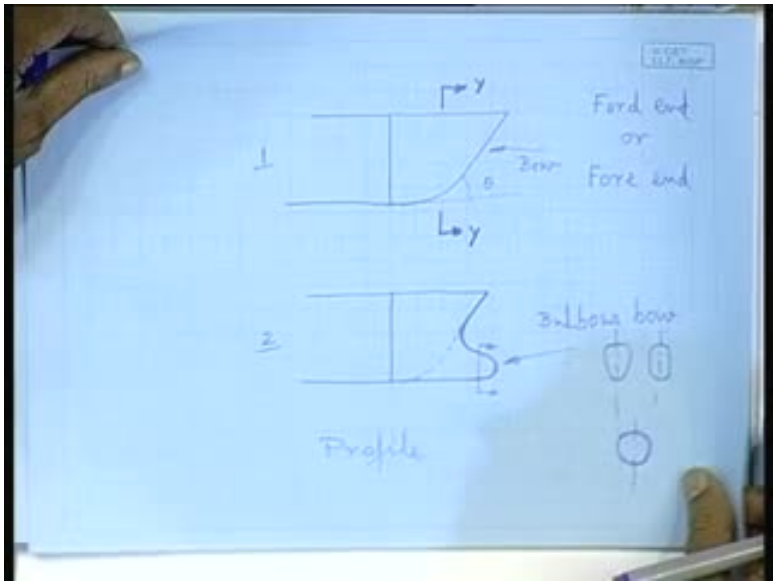

With a higher block coefficient it will tend to be like this, but in both the cases I am having more or less than the same deck area. Let us assume that these two sections are taken more or less at the same location of two near identical vessel. Only thing, in one vessel the block coefficient is of the order of say 0.8, in all the vessels the block coefficient of the order of 0.6

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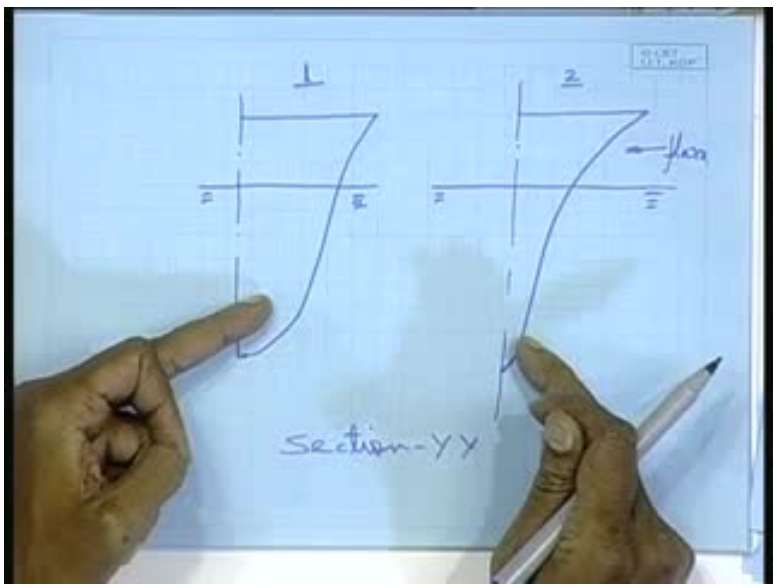

So 0.8 would be somewhat like this, 0.6 would be somewhat like this. You provide a much bigger flare so that you get achieve the required deck area right. Less flare, much

flare is not needed because you do not unnecessarily widen the deck. But by doing this what is happening?

These are actually based on the requirement of block coefficient and other aspects. Once the lines and how the hull form would be, have been decided then one goes for the scantling calculations. Scantling calculations and followed by stiffening arrangement, which is the aspect we are looking in to.

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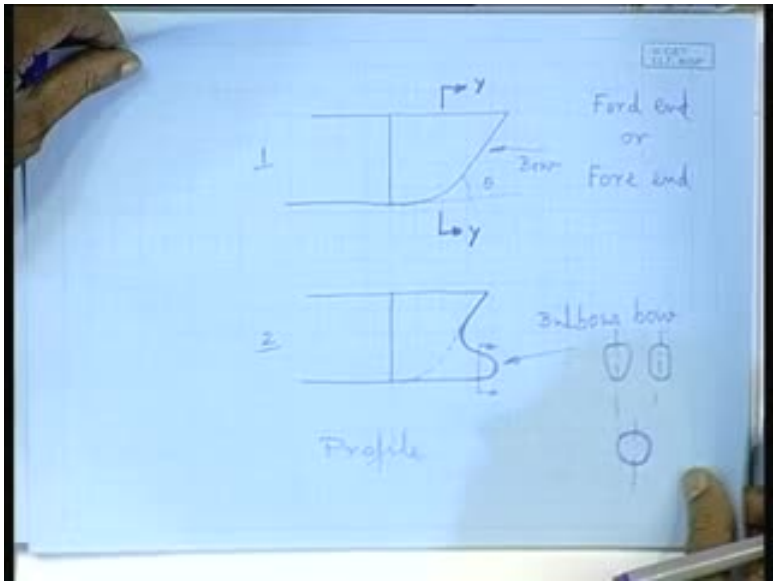

So as we go for stiffening arrangement, then we see that a somewhat little extra care is given to this ford end constructions. Though we have talked about that, if is the primary strength considerations are essentially because of the longitudinal bending.

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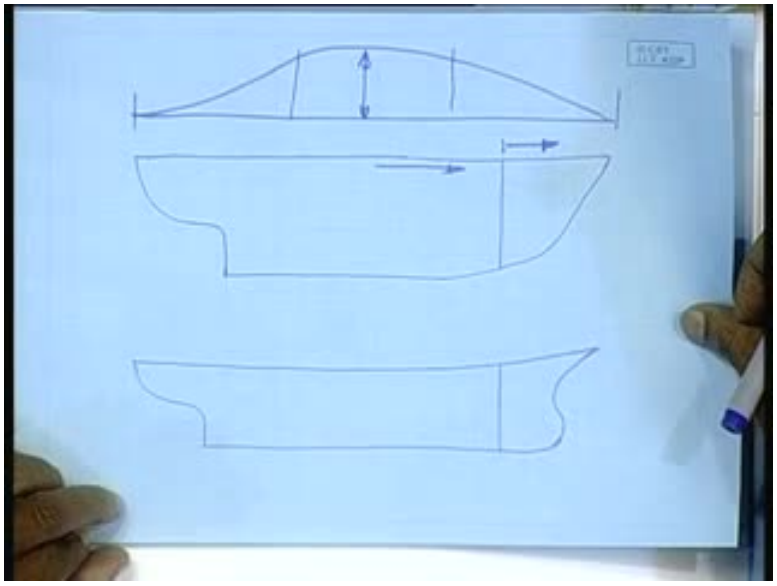

Because of the longitudinal bending, the longitudinal bending movement is somewhat like this. So we see that around the mid length of the vessel I have maximum bending movement right. This is my bending movement curve, so as we go forward or aft the bending movement is zero. The load coming due to the bending movement or the stresses generating due to bending movement in the ford end is gradually going down, it is lower.

So in the process what happens as you move from the centre to the forward we will see that there is a gradual reduction in plate thickness, gradual reduction in the scantlings of the stiffeners, but again, when we go beyond a certain point and go further forward then again we see rise in the scantlings.

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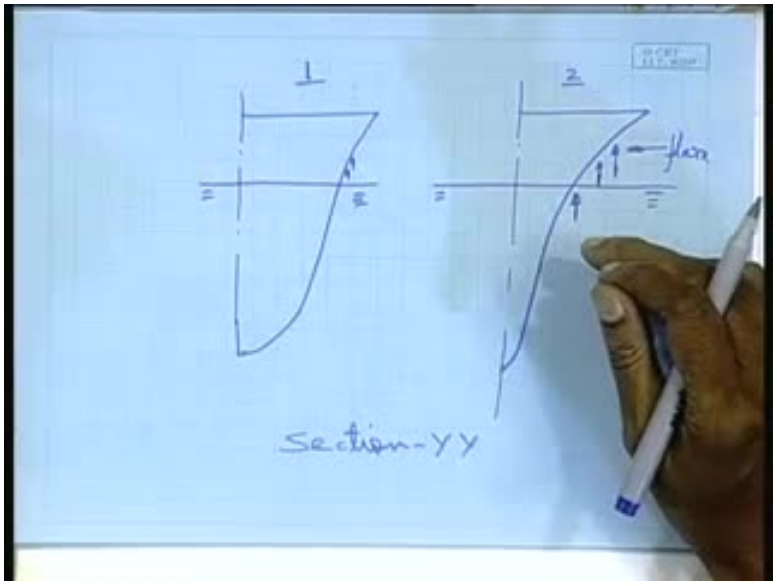

That means there it is no more the case of the stresses due to bending moment, but it is the local loading which comes into play, local loading takes over. So in these two forms as you can see if both the vessels are plying and imagine it meets a somewhat rough weather and the vessel starts heaving, heaving means it goes vertically up and down.

Heaving is this motion, goes vertically up and down or for some reason if it slams, slams is as if about some horizontal axis it is oscillating, that is slamming. Either heaving or slamming, in both the cases, this type of form is going to experience much higher loading in this area.

Because this surface is bigger it will go on hitting the water surface, whereas in this the load will be less somewhat. In any case both will be subjected to that load due to the slamming of the water surface that means the local loading, primarily the local loading.

Greater slamming will have the one which is having bigger flare. The one which is having bigger flare from the very central, from this figure you can see that here the water hitting, this effect will be less, but here the effect of this surface hitting the water, effect will be much more. That means if these are my load vectors, this will be bigger because it is a more projected; more area which will go and hit the water surface.

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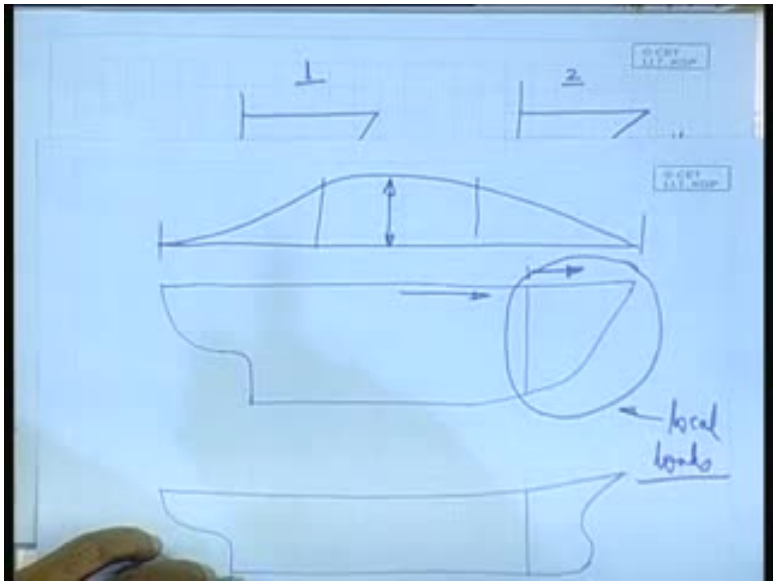

So in any case what we like to highlight is, that means the ford end of the ship is subjected to primarily local loads, local loads of various kinds. One is due to the ship motions of heave or slamming, that is, the underwater hull will get affected because of that, another is as we have said that the deck plating.

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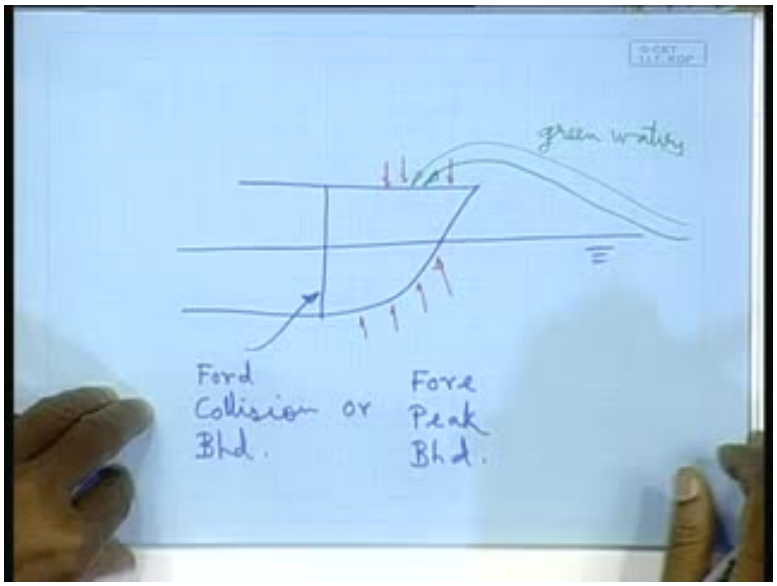

The deck plating means you have the, suppose I am just drawing the ford part of the ship, this is your water surface. In a bad whether there can be, it can the waves may become too high and come and hit the deck. So you need additional strengthening at the deck, to

this water coming and falling on the deck. They are referred to as green waters; the terminology is shipping in green waters. That is how it is referred to shipping in green water. I mean does not have any anything do with the color of the water, just the way it is said, shipping in green waters. So anyway this can be really huge. There are instances that this water coming and hitting here and made a hole in the deck.

Because such a huge mass of water comes and falls, that force breaks up in the deck. So that is how we see that the ford end has to be additionally stiffened; not only the bottom shell part of it, because bottom shell is subjected to your loading, due to the slamming action or heaving action of the vessel.

And this is because of the shipping in of green waters; it needs extra loading, though the stresses due to bending movement are near zero. That is how we see it is primarily the local load. Second aspect is, as you know that this particular bulkhead, this is the forward most bulkhead. It is referred to as I have told this, do you recall? Ford collision bulkhead or also referred to as fore peak bulkhead. This is fore end or fore peak. Also that term is also used - fore peak.

This is a fore peak bulkhead. What is the very logic of this? Why this name forward collision bulkhead? Idea is in the event of some situation where the ship may get may hit head on then this part should be able to absorb the entire impact load. So to do that you can well imagine the momentum of the vessel by virtue of its size. So that impact if it has to take care of, it has to be of heavy construction. So that is how fore end construction is well, is taken separately.

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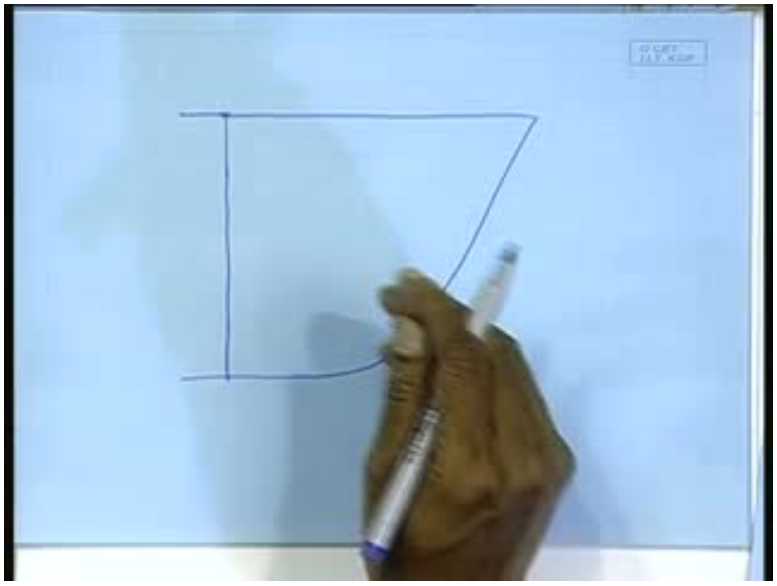

Like we will later see that the mid ship section, mid ship construction is taken separately. Similarly, fore end construction is also taken separately. What are the salient features of this ford end construction? One of the salient features is if we, in ship construction, when we go about sort of the primary, you can say the primary frame of reference in ship construction is; the so called frame spacing.

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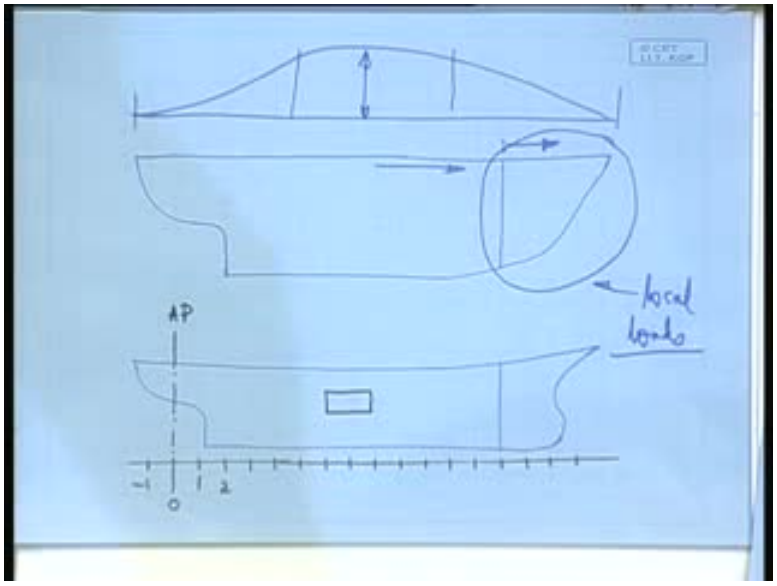

Some particular, so because you see, I mean whenever you want to suppose construct something, fabricate something you should have a something, what one may say a

starting point. Suppose I say that the length of the pen is say, ten centimeter. What does that mean? That means from some point to some point ten centimeter.

Or if I say add a component at that tenth centimeter position. So well, if I say add a perpendicular component at five centimeter position of the pen. Now whether this or this, because both are five centimeter. This is five centimeter from here; this is five centimeter from here.

So I will have to give a frame of reference. I have to say from the ford end, I mean aft of, suppose this is my ford end. If I refer in the ship terms aft five centimeters, aft of forward end, so it comes here or I say five centimeter forward of sorry it was what I said five centimeter aft of forward end.

Here I will say five centimeters of forward of aft end. So that aft end, forward end these are the frame of references, well defined frame of references, you should have that. Not only that, this is a very simple example. As I have said this entire hull as we have seen is composed of stiffened panels. That means individual flat or curved panels and then subsequent units, blocks all those things will be constructed. One will be joined to the other.

So how do we know that which one, where and what distance all that? So the primary reference is the frame spacing. That gives me the reference of the location of my stiffeners, as well as the entire definition of the vessel comes from this frame spacing. Now it should start from a zeroth frame.

So that is fixed. I mean whichever way you want; wherever you want to fix that, fix it. Generally by convention, it is fixed at this point which coincides with the, what is it? What is this line? Aft end perpendicular. Generally it is done that way, that this is why, well, let me write here is aft end perpendicular, so this frame here becomes what? Minus one simple, minus one. This is one two and so on, and the aft end perpendicular is the location where you have the central line of the rudder stock. There is a rudder for maneuvering the access, vertical axis of that shaft of the rudder which is called rudder stock.

Anyway, so I coincide my zeroth frame location with (( )) then I have one, two, three etcetera. So that gives me, then I can define any plate, anywhere. Suppose a patch of

plate here, I can define that. I can say that it is between frame 35 to frame 60 or it is 100 millimeter. I mean the frame 35 is 100 millimeter forward of one edge. From one edge 100 millimeter draw a line, there is frame 35 and say the frame 60 is the location, 50 millimeter before the other edge. In any case, so this way the whole thing can be defined. Well, frame spacing is, it plays the important role as far as giving the references. Second important role is spacing. Spacing of stiffener so I can have it small, I can have it big.

Spacing can be 500 millimeter, spacing can be 1000 millimeter. What spacing I will take that will again depend on your, what I mean depending on your structural design what you are carrying out. If you choose 500 it will give you something, if you choose 600, something else and so on and so forth. So how do you choose this frame spacing? On what basis should be there to decide upon the frame spacing?

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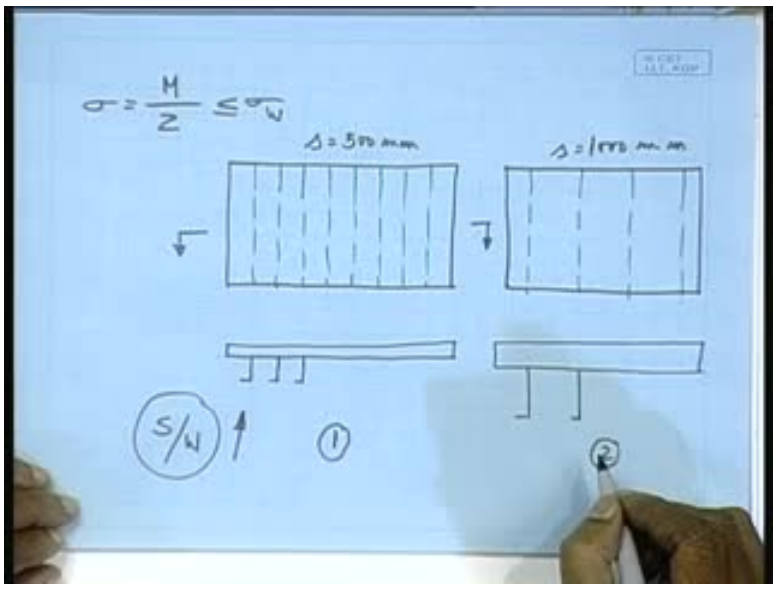

I mean this is in general. This has nothing to do it forward end or aft end. It will be worthwhile to look into this aspect also. Say a panel is there, well, two identical panels. Sorry I mean one looks smaller, another is bigger but let us assume both are of the identical overall dimension, five meter by six meter, whatever, identical overall dimension. In one case, I have a frame stiffeners, say 500 millimeter apart. I have stiffened it, let us assume in this fashion and let us say transverse stiffening. In another case I have stiffened it 1000 millimeter apart.

So straight away the effect would be, in one case there will be less number of stiffener and in other case more number of stiffeners. What will be the other differences? Because my final objective is, that both the panels is to sustain the whatever design load. That means they should be structurally sound under the service conditions.

So what I will expect? Let us draw a little exaggerated view of these sections. These section (( )) exaggerated view means, let me put by double lines showing the thickness and by single line the stiffener scantlings, say it is going like this. What would be the case in this? What would be the difference? Definitely, it will be a spaced far away. Scantlings will be higher. Simply scantlings ought to be higher is not it. Because here whatever, suppose loading I am considering in this direction, or whatever, the section modulus it is giving because more number of longitudinal, here it is less number of longitudinal but the section modulus requirement has to be same is not it.

Suppose both are being subjected to similar bending movement. If that is so, then I have, because what finally I will have to satisfy is the stress, whatever is coming, it should be less than equal to your working stress. Same bending movement, so z will either be higher or lower. That means here physically it would be something like this. That means the plate thickness will be expected more.

Your scantling of the stiffeners will be also quite high. Like that it will go. So what is the ultimate difference between these two? Which one to choose? Now tell me. Here I have provided frame spacing 500 millimeter and here I have provided frame spacing 1000 millimeter, which one to choose or choose something else altogether? 500, no what should be the criteria? There has to be some criteria.

Strength by weight ratio, simple. There criteria should be strength by weight, it has to be maximized. I cannot say off hand whether this, the option one gave me a higher this or option two gave me higher of this.

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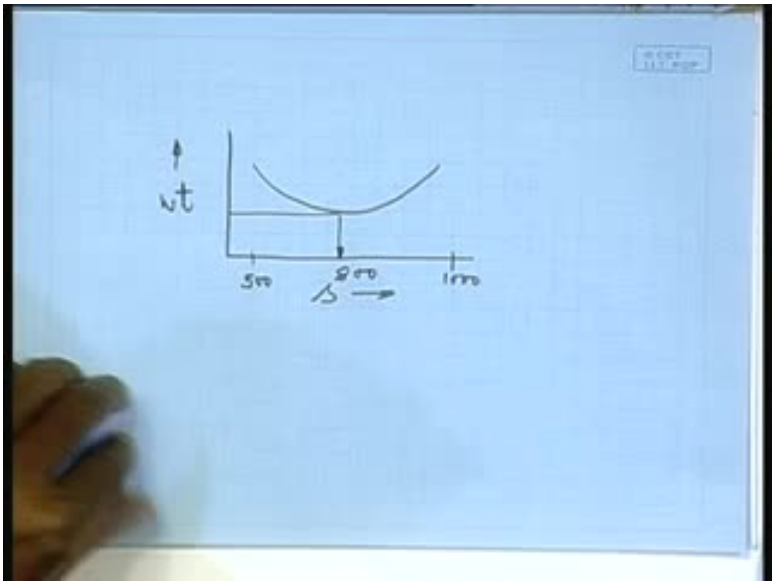

So in fact for doing it more systematically, one should do for various frame spacings. Then plot a curve and see where you are getting the minimum. Say various frame spacings you have 500, 600, 700, 800, 900 and 1000 suppose, and here you have, instead of going by strength weight ratio, I can straight away calculate only the weight. I have to minimize the weight because strength all I have given same, near same because that criteria we have satisfied through this, so straight away only the weight.

So it is expected that the curve would be, how the curve would be? Curve would be well, possibly something like this. That means, well I do not know I have not done this exercise, but what I have drawn is, that shows that both whether I put 500 for a given case of course. I mean it is not an universal truth for a given case, for a given loading condition, for given plate material that providing frame spacing as low as 500 and providing as high as 1000 both are giving higher weight of the structure. So somewhere in the middle, is my better value that could be say I do not know could be 800.

The logical way would have been this, that you find out the frame spacing where in you have the minimum weight of the structure for the same strength. Once that is done, but in reality, in practice what is done is you take help of the standard rules, read out in the classification society. There some standard formulae given through which it is easily done.

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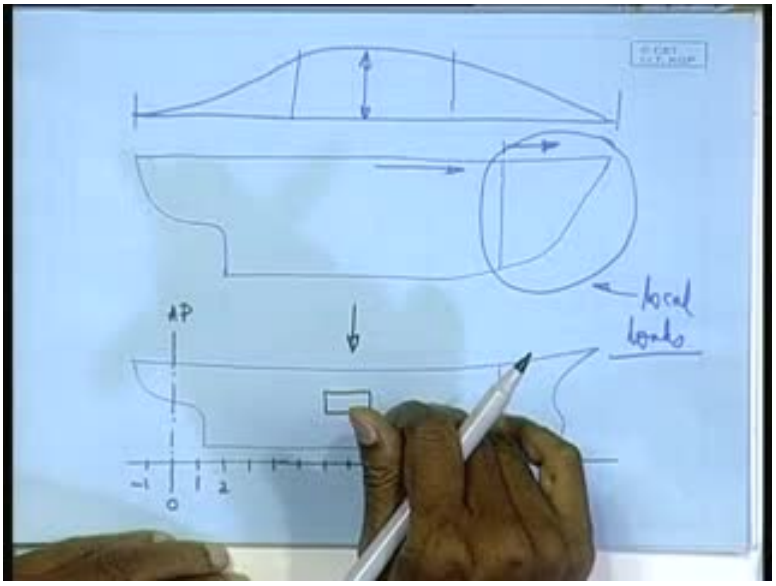

So from there you choose what is the but the basic philosophy is this in the behind, that you choose what should be the frame spacing. Once the frame spacing is done what does that mean? That means the spacing between these lines I have drawn, they are basically say 800 millimeter. That means at every 800 millimeter there will be a stiffener or every multiple of 800 there will be a stiffener. So if say the side shell is transversely stiffened I will have every frame position a transverse frame.

The deck if it is longitudinally stiffened the frame locations by the frame position, you are dividing the ship in and I mean there is imaginary division. The deck is, if it is in this plane, so there also we take the course through this frame spacing because they could be like this. Say I have my after peak bulkhead here and these are my longitudinals.

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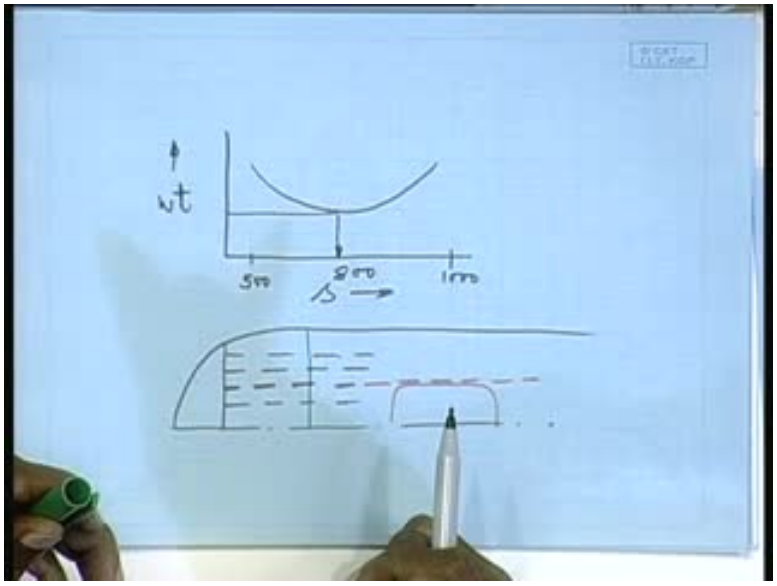

So spacing between the longitudinals also will be equal to that frame spacing. If you are providing a centerline girder, if you are providing a girder here, suppose I have hatch opening here then this particular longitudinal is replaced by a hatch side girder.

So the hatch opening I will not make arbitrarily. I will make in such a fashion that the head side girder also comes in some multiple of frame position. Why? Because then it becomes easy for me to keep track of where what is there, the stiffeners. Because the deck will be fabricated in multiple number of pieces, several and it could be few hundreds. So all those 100 pieces when you want to put them together, everything should match. Not only the plate the stiffener. Suppose there is a joint here means what? All these longitudinals should match.

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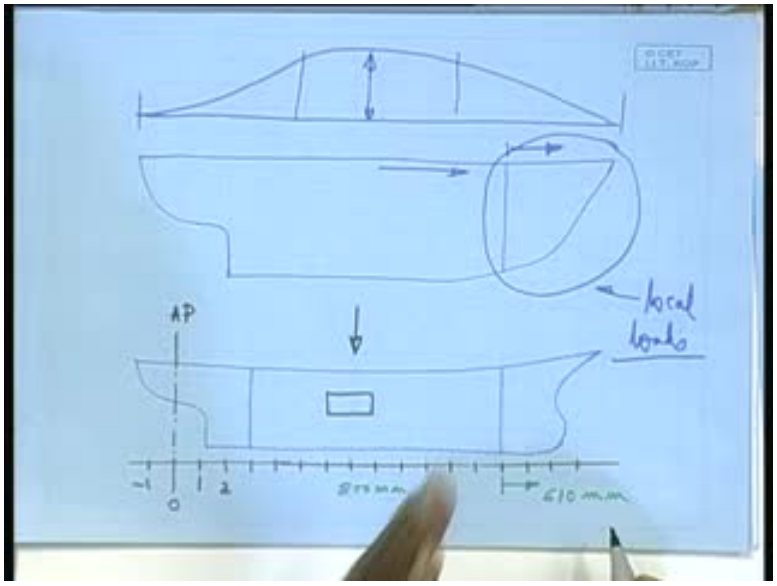

That is what is the function of frame spacing, I mean that is how the frame spacing concept is used. From the strength point of view so what we see? We will find suppose, as I have said say for this particular vessel I take a frame spacing of 800 millimeter, so we will find the frame spacing going like this. Here you will have 800, say this is my up peak bulkhead. Generally we will find, the entire this region is 800, then from the fore peak bulkhead forward it is reduced, the frame spacing is reduced.

Reduced to how much? 610 millimeter, irrespective of whatever the frame spacing was here. Had it been 500 then it remains 500 but if it is 700, it becomes 610, it is 900, it becomes 610. The 10 thing has come because it is converted from some feet and that is how the 10 has remained. The point is, that means you are not permitted to have a frame spacing greater than 600 millimeter forward of fore peak bulkhead. What does that mean? That means I am putting closely spaced stiffeners and closely spaced stiffeners;

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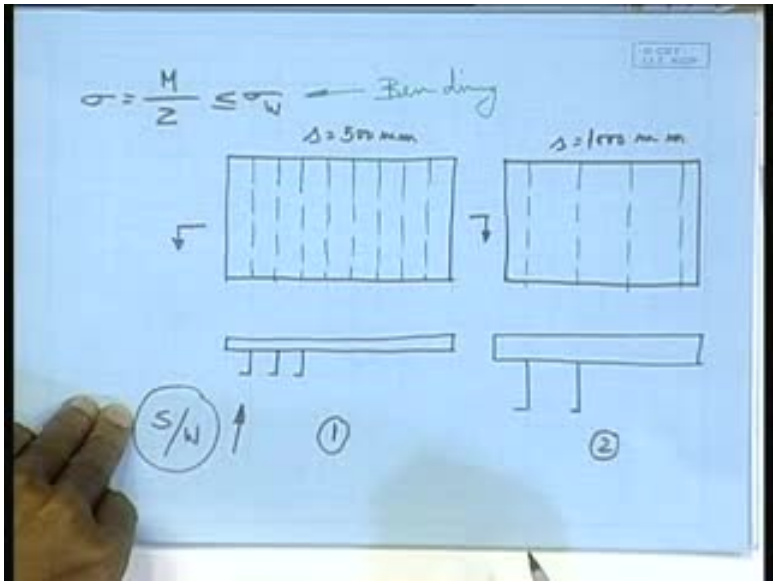

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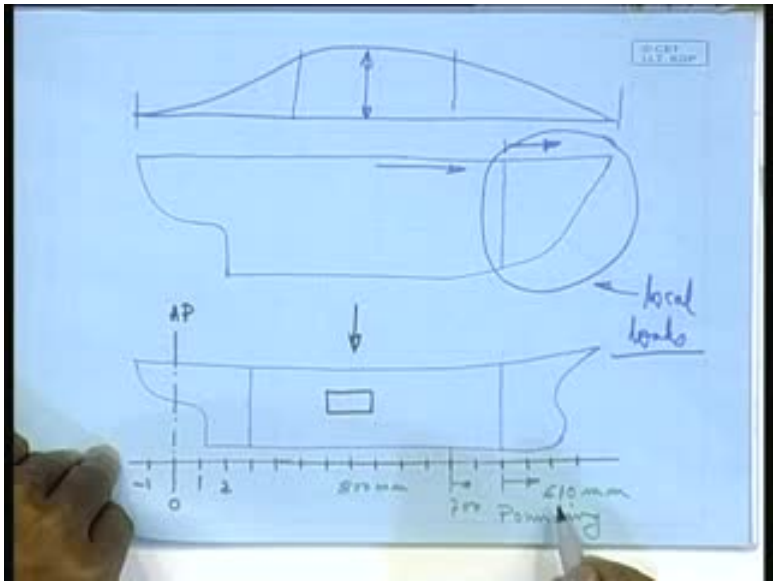

One implication is that it will become heavier. Let it be but stronger also, additionally stronger. There I am not only looking into this. This is essentially due to bending is not it because you have the bending movement. But, here I am looking for the local loads, so there by I make the spacing lesser. Instead of straight jumping from 800 to 600 there is generally some distance before it is reduced to say 700 and then to 600. How much before, these are all laid out. It is prescribed I mean the advantage of our doing all these job is, things are generally prescribed.

You will have to read, understand properly, interpret and apply to your requirement. So this zone is called pounding area I mean from where it is becoming 700, pounding, this area is called pounding means as if it is pounding on the water surface - the slamming. There by you have lesser so that is one of the aspect that forward of fore peak bulkhead your frame spacing has to be reduced to 610 maximum.

It can be less than that, but cannot be more than that. No, transverses there is no problem in the transverse section. So what happens? In that case, that does not mean this 600 the frame spacing I have reduced here, so all the transverse members come to 610 millimeter spacing.

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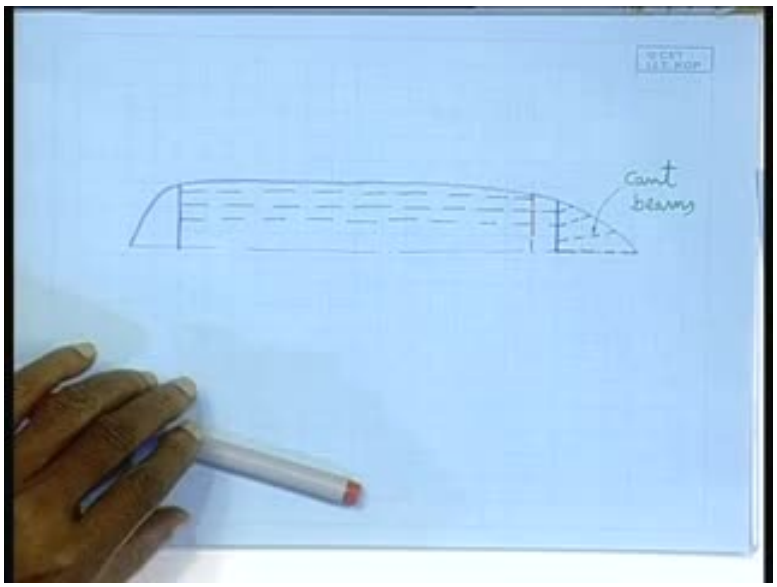

The longitudinal members what is happening is, it is like this; if I see the deck plan say that deck plan is like this, obviously we are drawing just the half of it. Let us assume my fore peak bulkhead is somewhere here, after peak bulkhead is somewhere here and let us draw only one or two longitudinals, just because no point drawing over.

And why I am drawing longitudinal not transverses? Because I said that it is a wise thing to do is to provide longitudinal stiffening arrangement because that gives you better buckling strength. If the same deck I would have had to provide a transverse stiffening arrangement, then the weight of deck would have been more.

Or strength to weight ratio of the deck would have been poorer, in one sense poorer, lesser, had this deck been stiffened transversely. Why? Because by providing transverse stiffening I will have to take care of the longitudinal bending and that longitudinal bending may cause buckling.

So to provide for required buckling strength or I will have to provide for additional scantlings, higher scantlings, additional longitudinal members probably, you have the transverses higher longitudinal members. So eventually the structure would have been inferior from that point of view, strength to weight ratio point of view. Well in that case, we will rather prefer a longitudinal stiffening arrangement like this.

So you see this stiffeners as I am drawing, they are going very nicely. Only thing the last one I have stopped there. The whole idea is, if I go further it hits the shell. As I have said you cannot terminate anywhere in the shell, just the end hanging, it has to be properly terminated in a transverse member.

So there is my one of my transverse member which is referred to as deck transverse. Deck transverse, we will see while doing the mid ship sections. I mean I have shown you some of it. That deck transverse, one of the versions of deck transverse is the hatch end beam. The same deck transverses when comes at the hatch end, we call it as hatch end beam.

So these deck transverse will be well widely spaced. For a longitudinal framing system my transverses, the transverse member will be spaced three to four times the frame spacing. It is terminated here at that. The other two are terminated in the fore peak bulkhead. Then what happens if I go still forward? Still forward if I go then it becomes very difficult.

Because the shape is closing sharply. Not only it is closing sharply and also not only you extend this longitudinal but wherever it goes there, you should have a transverse. Now providing transverse becomes difficult, so that concept of cant beams. That means these beams are somewhat radial in nature. They are referred to as cant beams.

So what we came from? We came from 610 millimeter frame spacing. So the spacing of cant beam you see it does not follow, neither 800, nor 700, nor 600. It is following (( ))

starting at a frame spacing of here well, it would be 700 or 800 and then it is radially going out.

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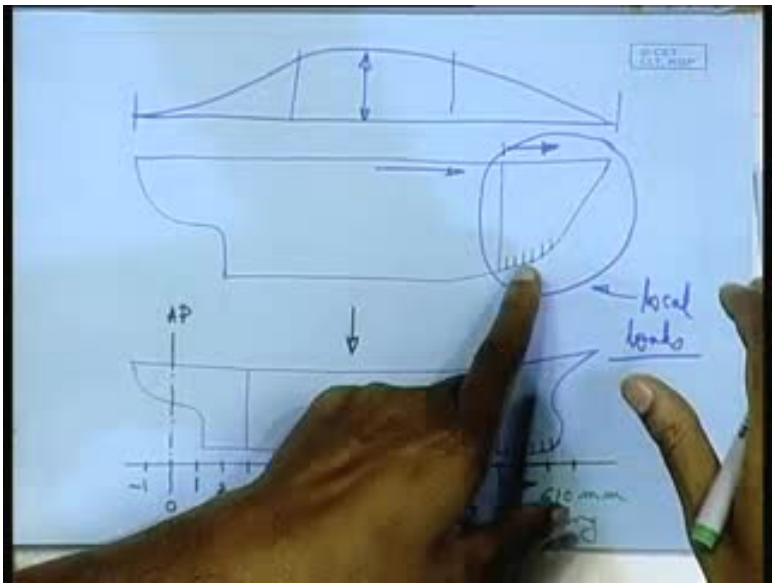

So that is not creating any problem. Here 610 is for primarily for the transverse members whatever is coming. What are those transverse members? They are the floors, those plate floors. So you will have plate floor at all place all frame spacing to a certain extent. Here we had plate floors at every three to four frame space. In between we had bracket floors. In forward I will give at every frame position plate floor. Like I said in engine room at every frame position I give a plate floor because heavy load is coming. Here heavy local load may come.

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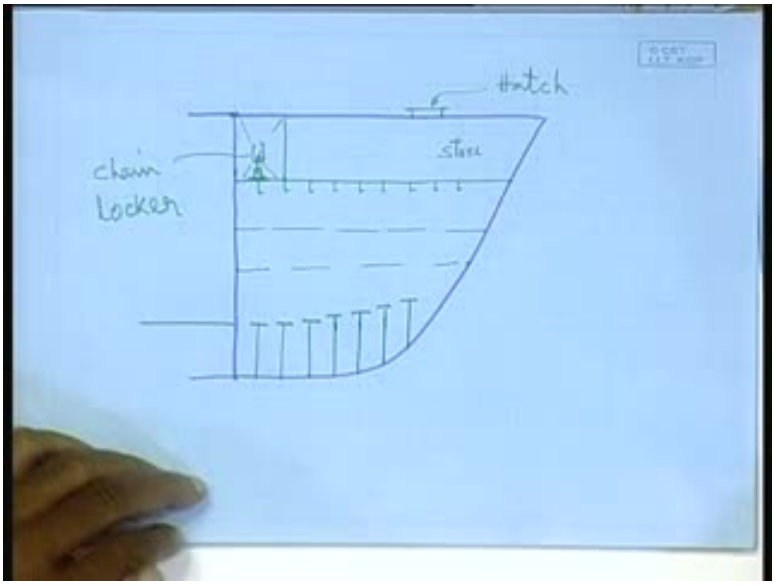

In addition to that, what we will have here is, at every frame location you will have the plate floors. Obviously, here you do not have the concept of double bottom. In the rest part of the ship there was double bottom.

Here I do not need a double bottom. Double one is not provided. So what is done? Because these floors can be of different, at different heights, where the shape is going up, so you have girders simply, not girders sorry floors with flanges on top. That provides further strength and then additional strength by way of, as you are saying, stringers. In between let us also draw some more things like, here you generally have a, in the forward there can be one lower deck all together.

In the forward end one lower deck. The access to this deck will be through some hatch here, through some hatch opening. This could be a hatch. This is for access hatch, not cargo hatch. Because fore peak is not meant for any cargo carrier. You cannot carry any cargo by rule, but this can be a storage space. I can store mooring rope. It can be a kind of a store this space.

Plus what you have here is you can have another space carved out here which is referred to as chain locker, anchor chain. This anchor will be somewhere in the side, so when you haul up the anchor where the chain goes? It cannot lie on the deck is not it? The chain has to be properly kept somewhere. You can only just keep through the chain on the deck, because this chain is not a very thin chain, it will be huge. Each link will have this

diameter those anchor chain, so it has to be kept properly. So this is a there is locker specially meant for that which is referred to as chain locker. That means the chain will be anchored here.

So the chain is essentially anchored here. That means clamped, the end of the chain has to be clamped somewhere is not it otherwise the whole end will go in the water. So this space can be used as a chain locker, and then the rest part of this space, well, here if it is a deck, then naturally it has to be stiffened. So it has it is necessary normal transverse stiffening, because no more your longitudinal stiffening. It could be well either transverse or cant beams.

And then I said that it should be strengthened against forces in this direction. So you have stringer running along this, along the side shell there will be. Depending on the depth of the vessel it will decide how many stringers, these stringers alongside shell means;

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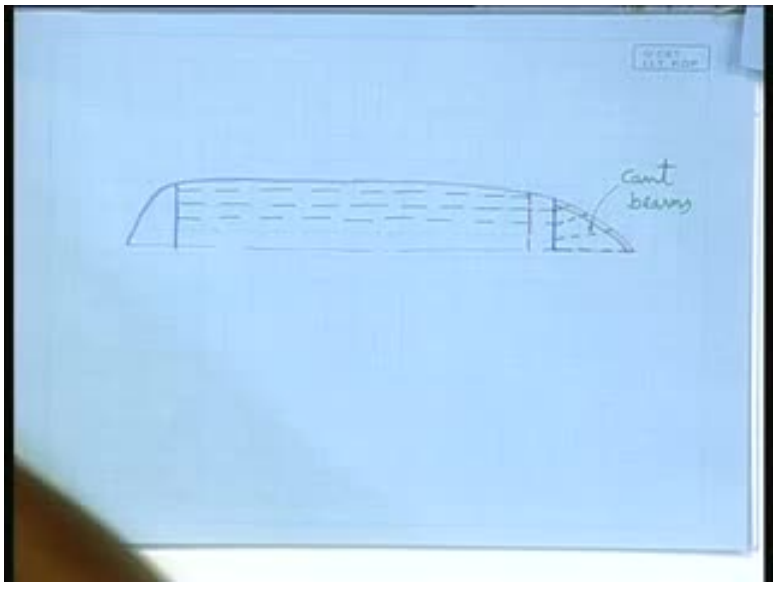

It is essentially, well in this figure probably, it will be easier to make out that a stiffening member going like this, that red line along the side shell. So if we see a view, a transverse view may be in our previous drawing we have done, so the stringers, let us assume this is our, that I said some deck we have provided.

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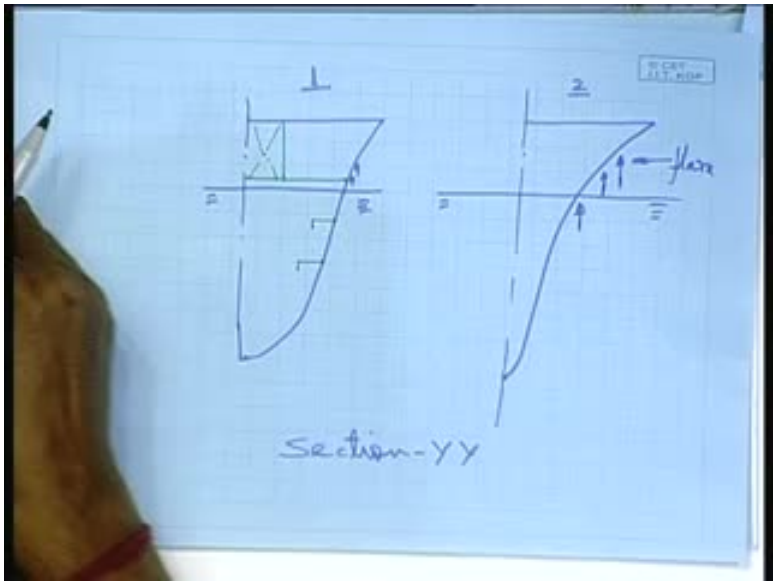

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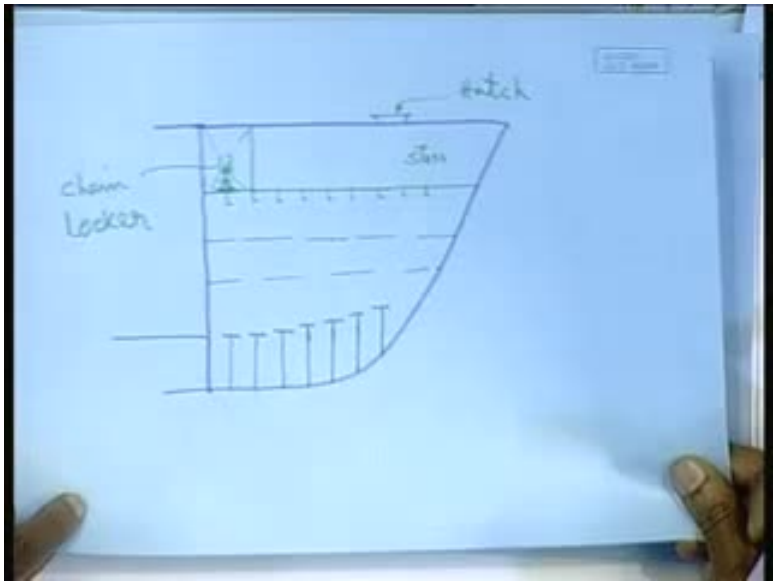

We have the chain locker and then the stringer, two stringers we have shown. It is nothing but a member like this. In the profile view along the length, along the side shell, that angle section is going like this. If I take a section here, along this, this section is this one, so stringer is coming here in this fashion.

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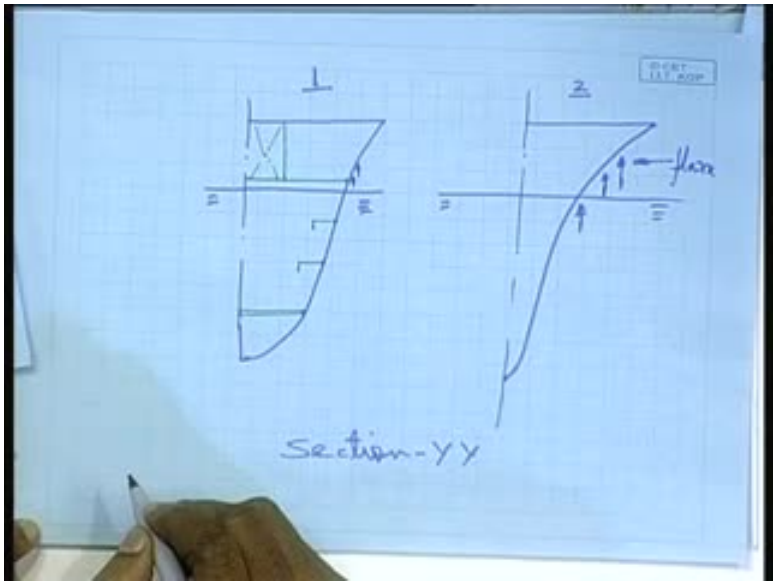

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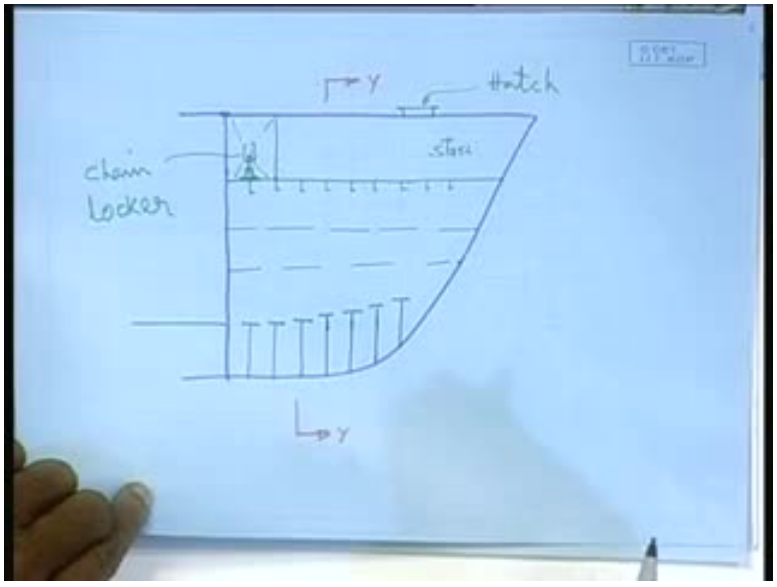

And well this is my floor. This is a section y y. I am drawing a section about this floor. So this section y y means I am looking from this side suppose, so I see the full plate of the floor is not it.

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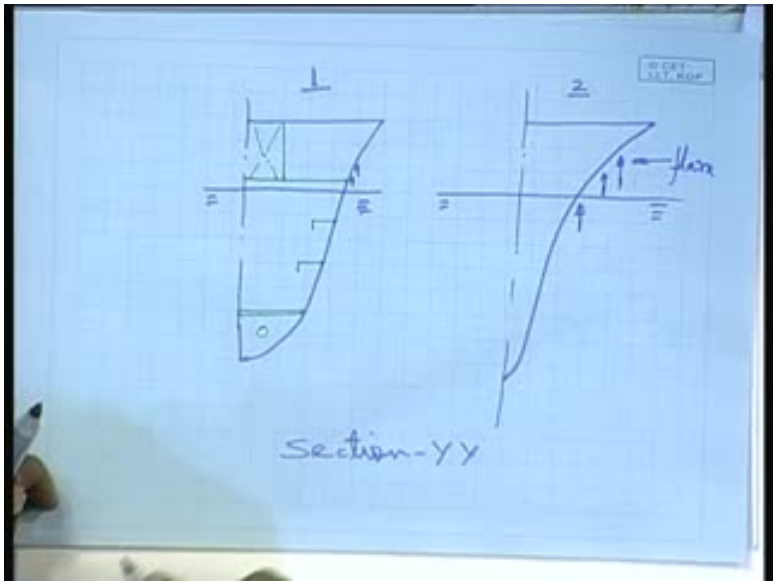

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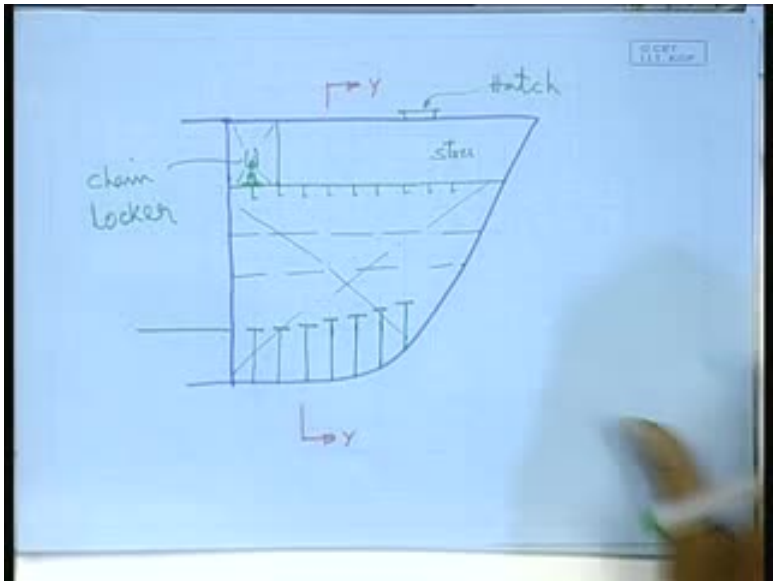

Well that plate may have opening here, lightening hole. Then what about these spaces? What happens is depending on the requirement etcetera one can have even a central line wash bulkhead. This I have drawn, that means there is a central line bulkhead, a plate here in the central line.

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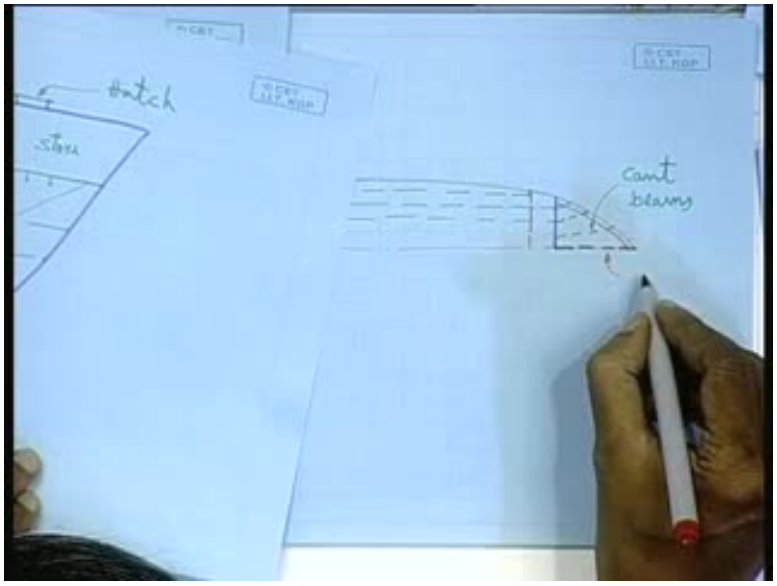

That means that will be visible well, this one here the red dotted line, this is my central line bulkhead. That means provided a central line. By central line bulkhead means a full plate, but obviously the plate we are keeping it, that will have its stiffeners connecting from the beams to the floors.

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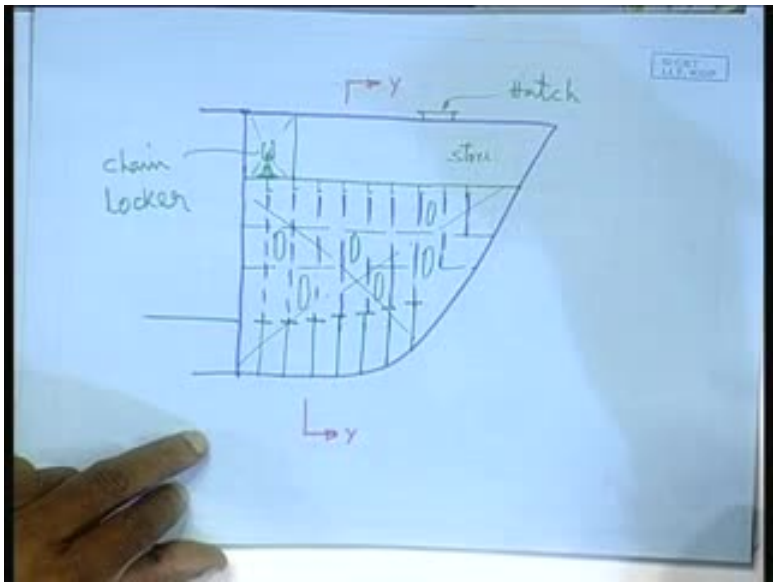

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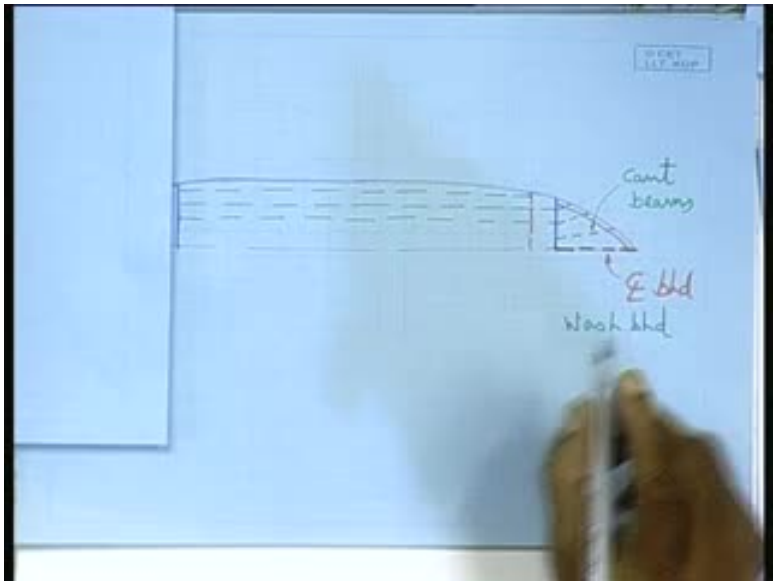

Because it is a longitudinal member. Then you have in this those well, in the same fashion those big openings to keep it in a lighter condition. as well as right This is a longitudinal member here. This one this is a central line bulkhead. It is also referred to as wash bulkhead, because this bulkhead is not the one we have talked about, transverse sub division bulkhead.

It is not sub dividing the vessel neither it is sub dividing the ford peak in port and starboard tanks. It is just a strengthening member, a member in the central line. So it is called central line bulkhead. I may or may not give. It is that designer's option. Whole idea is I have to make the ford end strong. How do I do it?

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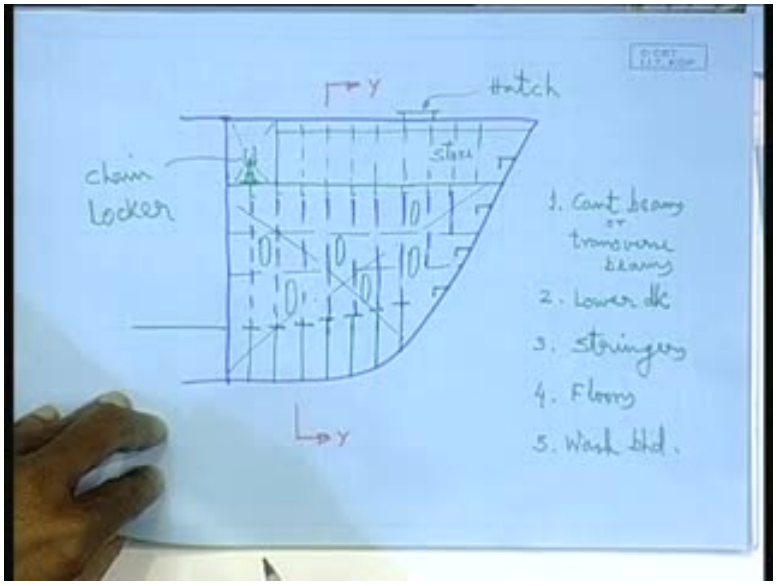

So what we can see? To make the ford end strong what we have put is that all these structural members we have taken to the course to. What we have taken? Well in the deck the cant beams or transverse beams, it can be or transverse beams. Here we have shown the example of cant beams. Cant beam is somewhere in between longitudinal and transverse, is going radial. Then second what we are doing? Well by virtue by providing another lower deck that adds to the strength.

The lower deck also provides some strength, so there can be a lower deck. So worthwhile to provide a lower deck, because then I carve out some space for carriage of some items, not cargo. One of the essential, one of the items are the mooring ropes. Mooring rope means when the ship is parked, the harbor, we have to physically tie it with the shore (( )) so where do you keep the rope?

We will have to keep somewhere, so this door. So lower deck, when we talk about lower deck it has its own stiffeners, has to be. Then three additional sides, this shell stiffening is the stingers. Stringer you have seen stringers are nothing but in the horizontal plane, stiffeners in the horizontal plane, in the plane of the water planes.

Then we have seen floors, in the same concept as that of we had elsewhere in the double bottom, in the same concept the floors. There we had the center girder, it came up to the fore peak bulkhead, then we have stopped the center girder because here the shell is going up, the bottom shell is going up. So taking the center girder is not possible.

Instead, of only center girder of depth of equal to that of double bottom, I am providing a full height wash bulkhead. It is nothing but as if the center girder is going and is becoming the full height. What is the full height? Well, from the floor to the lower deck.

So I am providing one wash bulkhead and that I am providing at the center line, so it can be referred to as centerline wash bulkhead. Obviously when I am plotting the wash bulkhead it itself has to be strengthened, so it has its stiffeners. There by with all this, I see you have made it quite strong. In addition to that, I can have again smaller stiffener like this.

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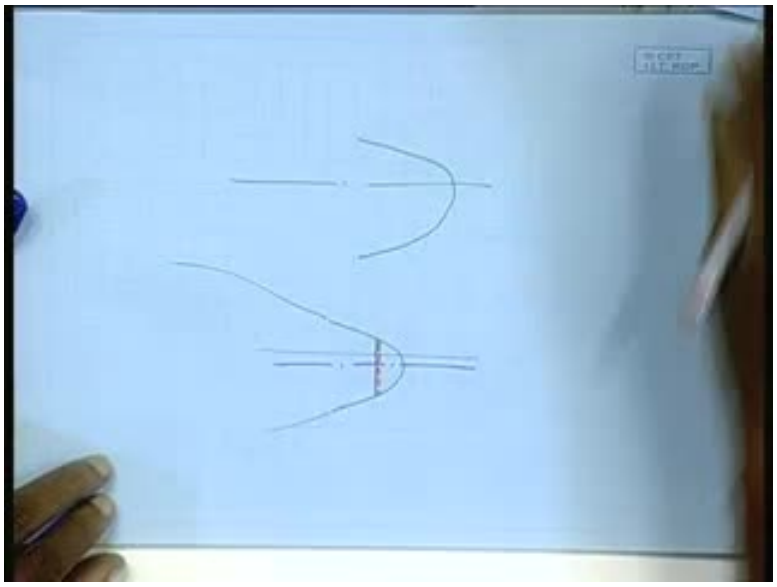

In between the stringers you see, that is smaller one. What are those? Those are actually if you take a section of the forward bow, a water plane section for bow, you will find the section is somewhat like this. is not off This is not correct. Take this line, I mean this is my central line. So part of the bow is like this. How do I make the bow? It is a plate bent in this shape and then from there it is further plates are welded and you get the rest part. Here you provide additional stiffener. These are the ones I have shown. This small, a small plate with a flange, that is this.

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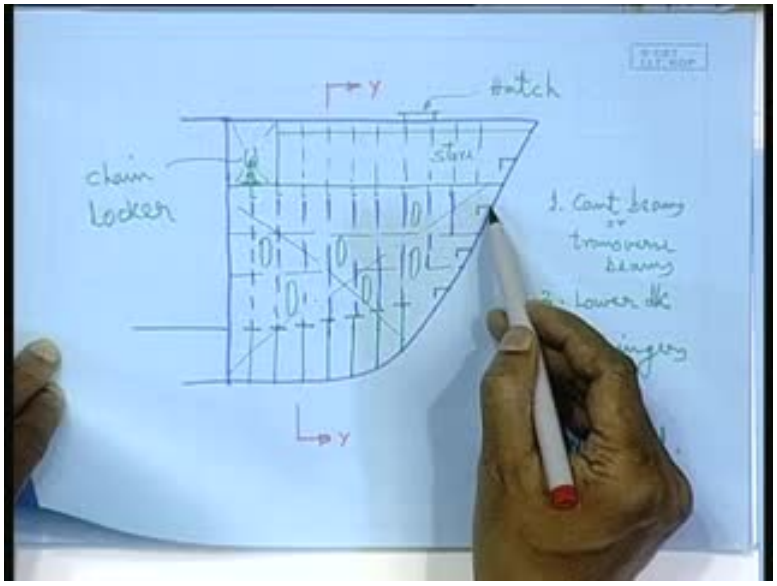

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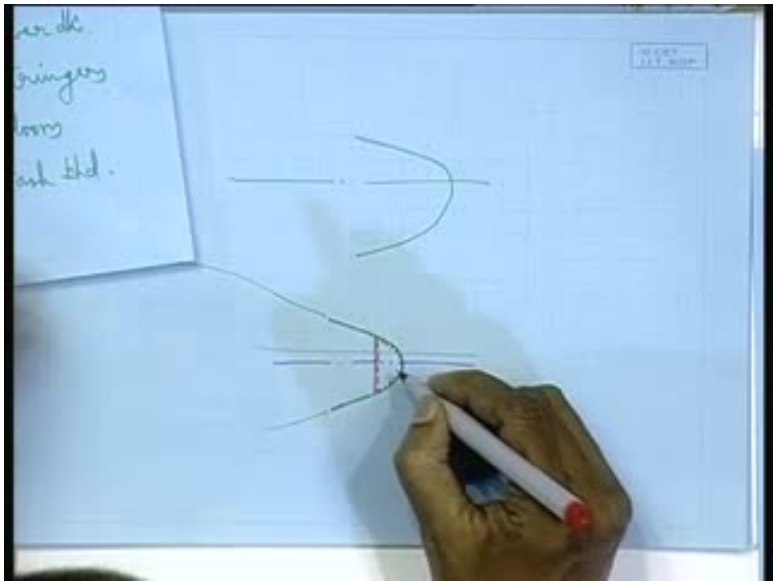

This is a small plate welded to the bow. That the bow plate only in the, where it has been bent. The entire bow plate is coming right from here, this whole plate but I am stiffening only a small part. How small it should be or how big it should be, that is a matter of so called design. So these stiffeners they are in addition, you see all these again in addition to that, because this forward nose, that is a nose of the ship that will hit maximum.

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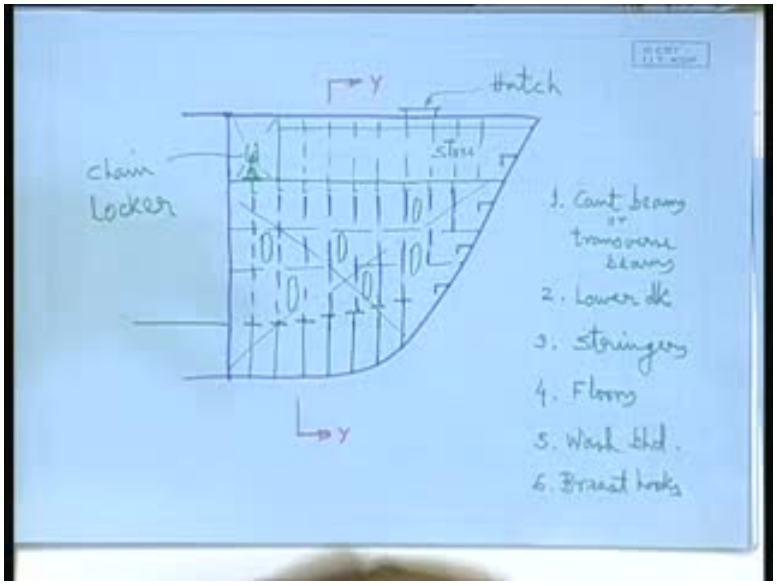

So you needs to be stiffened. They are referred to as breast hooks. That is how the name - breast hooks, they are referred to as breast hooks. So well, that is what is the little elaborate sort of construction arrangement for the ford end. The whole idea is to make it more strong, locally more strong; by floors, by stringers, by breast hooks, centerline bulkhead and then well the deck beams or cant beams.