Marine Construction & Welding

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Lecture No. # 11

General Cargo Carrier

Today, we will start with the, actually will take a look on the midship sections of various ships. By midship section what you mean is? If you see the ship profile, it looks like this, so a section taken at around the mid length, that is what is referred to as midship section, why midship section is important? Because, if we see, from the bending moment diagram this is a typical bending moment diagram, which is obviously since the ship is floating; so it can be considered as a simply supported beam with uniformly distributed load. So, at its both ends bending moments is zero and somewhere in the middle, it will be maximum.

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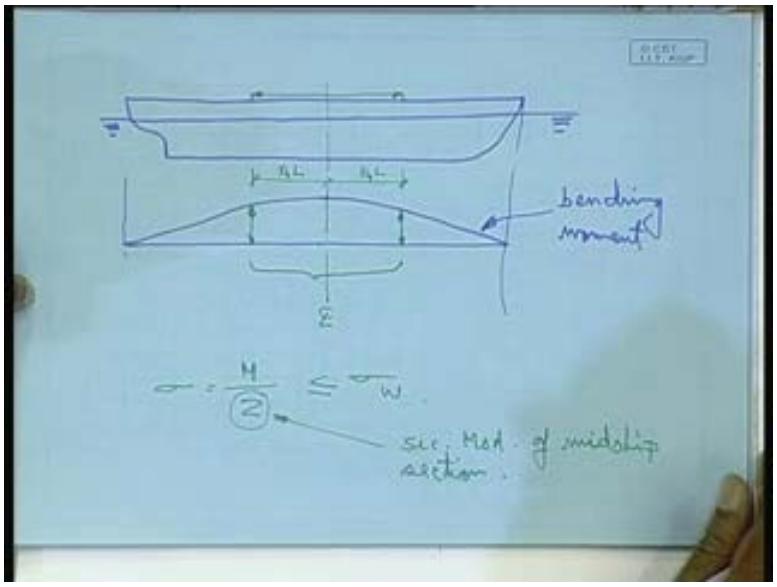

So, here I have shown, a zone of one-fourth of the length of the ship, aft as well as one-fourth forward, because what we see that, in this region the bending moment appears to be maximum within this zone within this zone of one-fourth the length of the vessel in

the aft one-fourth in the forward, we have a bending moment distribution which is on the very higher side.

So, once the bending moment is high means, it is expected that the stresses also will be high; that means the loading on the structure will be high and as you know we have already talked about it; that the longitudinal strength is one of the prime concern, when we make an structural arrangement for a ship. The longitudinal strength of the ship structure is a prime concern because, it is subjected to a very severe bending moments, so that severe bending moments because of various loading which is coming in the structure so that is how midship section takes its basically derives its importance; because that section should be structurally sound enough to withstand the loading, whatever is coming on the structure that means to withstand that bending moment, why because the section modulus which we will get from the midship section should be such that stresses will get, should be less than equal to the working stress this is a primary thing.

So, this Z is the sectional modulus, the Z is the section modulus of which one of midship section, section modulus of the midship section because why it is important because there, I have the maximum moment, so what in practice is done is that we physically draw, we do the physical drawing of the midship section, showing all the longitudinal structure members all the longitudinal structure members is shown; as well as primary transverse members and that arrangement is continued over this entire length.

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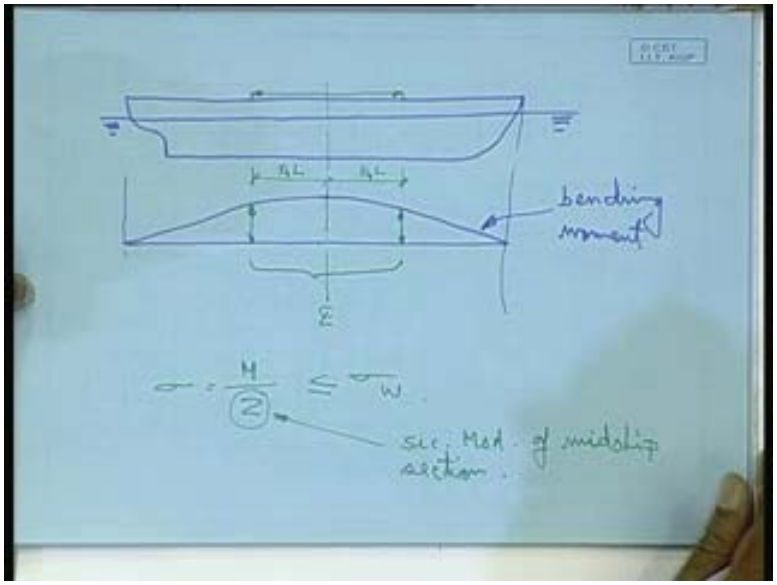

We have seen some structure arrangement in ford end construction also similarly, in the aft end also for somewhat similar reasons; we have some additional stiffening arrangement of course in the aft end. There is one additional thing the engine the propeller shaft is there and the propeller is supported, so that leads to a propeller excited so called loading comes and that loading becomes cyclic in nature, because the shaft is rotating; so, that gives a vibratory load such that there is no resonance taking place frequency of the structure as to be low; so the aft end structure is also heavily stiffened like the forward end structure. But, this midship structural arrangement will depend primarily on the bending moment it should be able to withstand the bending loads longitudinal bending loads.

So, whatever structural arrangements is decided for the midship section, that is extended up to one-fourth the length in the aft as well as in the forward; that means over this length that all the structural dimensions, the scantlings will remain same, not only your structural arrangement are same dimensions are also same; that means within this length the plate thickness whatever is there will be maintained constant.

Do there is a some drop in the bending moment, you can see from the drawing from a typical curve we have drawn there, it is dropping but still we continue the same bending moment, I mean same section modulus as well as the same scantlings so that is how midship section is an important sort of a drawing for which, we calculate the section

modulus and ensure that for a given loading condition or for the fully loaded condition and in worst kind of worst case scenario of web loading. The stresses coming on the deck as well as on the keel because they are the farthest member remains within the permissible stress or the working stress so that is that is, what is essentially the importance of midship section?

That is one part of it that means importance from the point of view of structural soundness. How structured is important? On other side from the functional requirement because a ship structure is arranged not only keeping in view, it is structural strength or structural soundness but also keeping in view of the functional requirement, so will see because of the functional requirement variation and functional requirement your midship section arrangement for a bulk carrier for a general cargo ship for tanker for container ship will be different.

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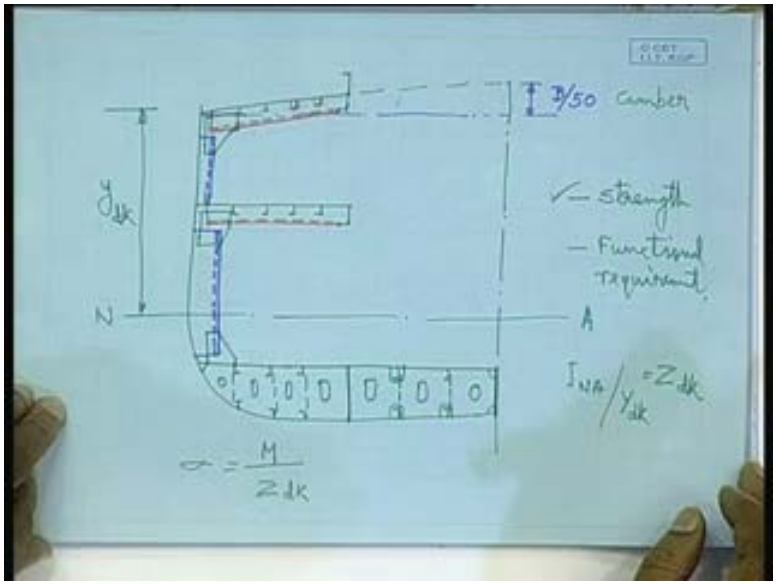

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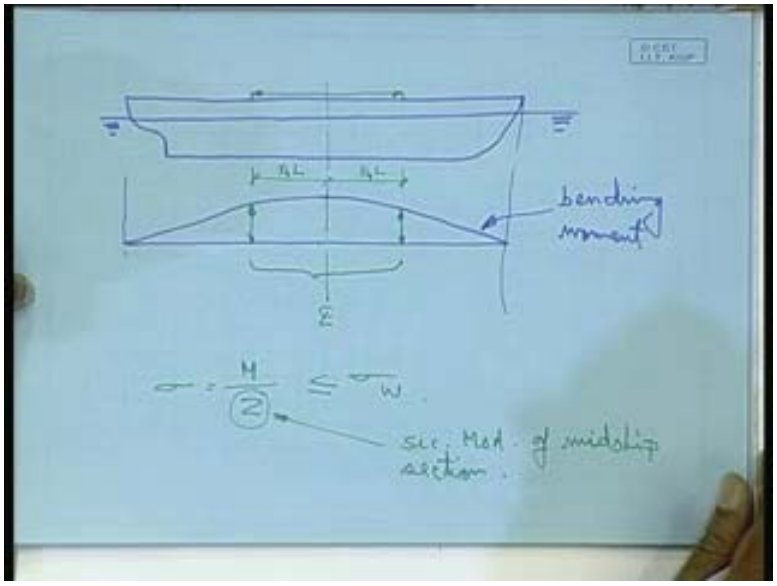

So, will see one after another let us take the case of a general cargo carrier, so general cargo carrier the will only draw one half of the section and will draw a section in line of the hatch opening; that means as if I mean the section we are taking is going in between the hatch, in through a hatch opening; so in that case what we see, that we have the deck like this.

You may have observed whenever, I try to draw any transverse section, I make the deck plate inclined, this intentionally done inclined it is not a horizontal deck whereas, when I draw a lower deck, you may have observed its horizontal, there is a inclined this is horizontal. Can you tell from common sense why it is? I am drawing it means generally it is done, this way is not it I mean the construction also the top deck will have a kind of a slope.

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This is not in the longitudinal plane, this is a transverse plane.

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You mean to say that well instead of having a flat plate, if it is little curved that obviously its section modulus increases fine, that it will contribute to definitely instead once the plate is flat; and if I give a little curvature to this, it has much higher bending strength stiffness.

So, if that is so then why the lower deck is flat it also contributes, it also undergoes a longitudinal bending, what you are saying, is correct so by providing a general curvature it does contribute the additional strength too, but the primary purpose is something else simple drainage simple drainage of water, there is no harm if I make it horizontal.

And the necessary strength, I provide by means of stiffening members, but it is given drainage of for such that water naturally drains out on the sides, this is called camber and generally this camber is, there is my horizontal is of the order of D by 50, that is the kind of slope given; D is the breadth module at midship, that means the breadth at midship 150 of that is the camber given, this is called camber; and this the plate has been shaped it is a part of parabola basically, but there is no hard and fast rule that will have to make a parabola.

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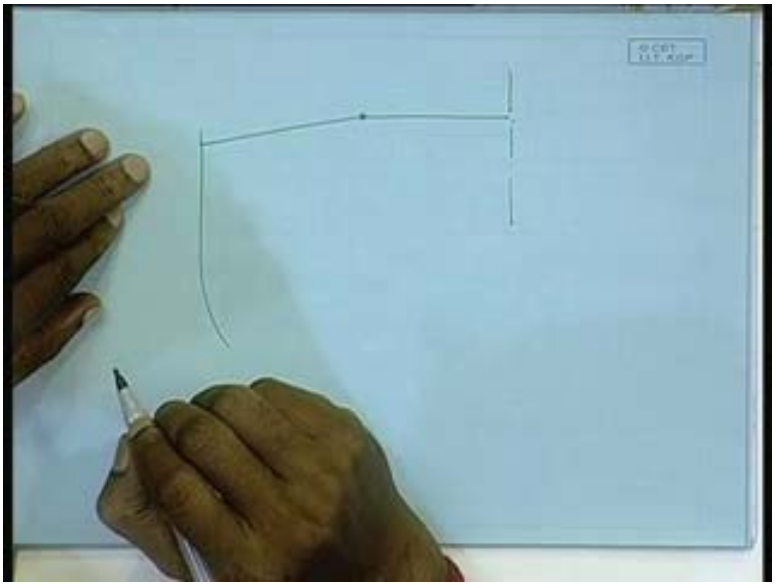

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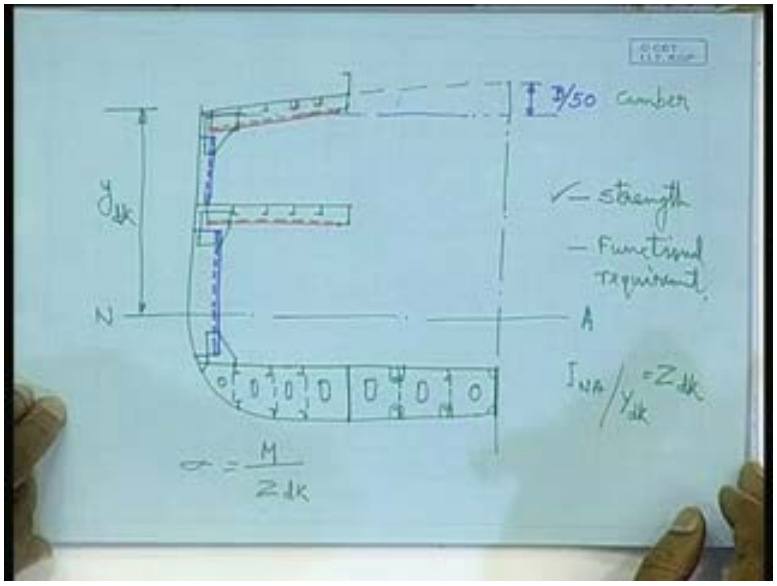

In fact from the construction point of view, I am drawing a little enlarged section such that it becomes better visible. I can even have, like this is it visible what I have done, the central part of the deck, I have kept it horizontal flat only here I have made it an again a flat plate inclined. The difference between these two is, it is a continuously curved plate and here both are flat plates it is welded here so construction wise this is much easier, there is no bending operation involved so I can also do this depending on requirement it can be done.

In any case, that is one aspect the deck and then where, we have this well whereas in the lower deck, I am drawing there is no camber needed, because it is inside there is no question of drainage. So, wherever we draw a midship section of any vessel, what we are trying to do we are trying to show indicate, what are the structural members are there more importantly, what are the structural members which are contributing towards longitudinal strength.

And there is another aspect to this why this is important, because you know suppose you are designing a vessel now there should be somebody to certify your design certify your design means, that is needed because these are very highly capital intensive things lot of money is involved; so, if something happens so the owner would like to have this these things insured now insurance company like, if you want to get yourself insured the

company ask a certificate from a doctor a third party, who can tell your condition about health, so accordingly you get your insurance premium etcetera, same thing here.

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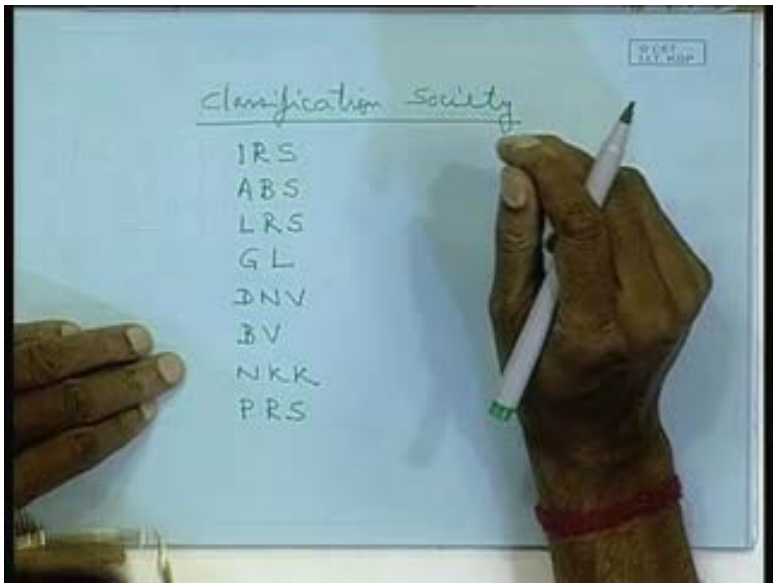

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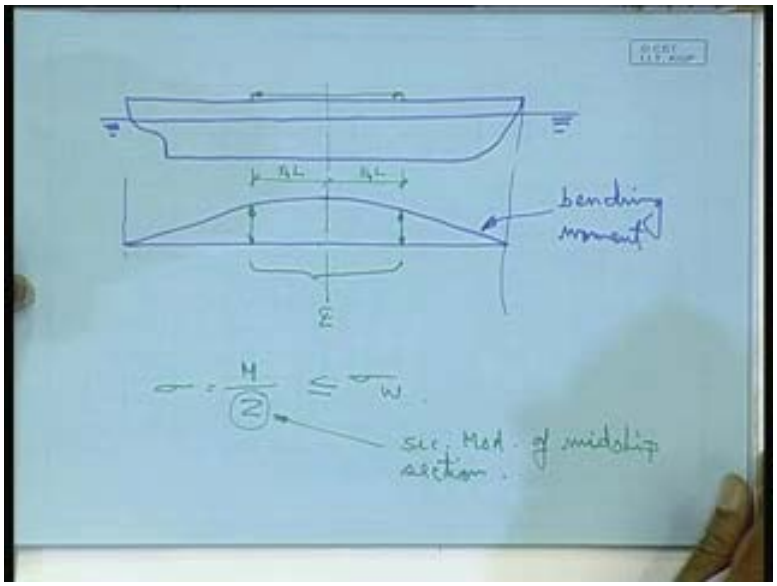

The insurance company will ensure providing, he gets a certificate from a third party and that third party is the classifications society. There are in what you call in ship building the one of the, this refer to as classification society, these are the function of these are to provide guidance to the ship builders towards the structural soundness of the product, primarily this, that means because otherwise you can very well imagine, that if I really

want to find out the load distribution; and the stresses coming and from there I go and calculate the scantlings; that means I do entire calculations from the so called first principles, it may become virtually impossible. Because loading are not straight forward, the structures are not straight forward. They are very complex geometric shape very complex structural arrangement, so first principles should have been extremely difficult.

So, what happens? Classification society over the years through their historical data, through the statistical analysis, analysis through using other numerical tools and so and so, for to research come up with very simple formulae? Kind of some semi analytical semi empirical formulae through which, you can very easily you can calculate, what should be the deck plating thickness, what should be the section modulus or scantlings of the deck longitudinal so and so forth.

So, that is one purpose using that, I can calculate very easily and secondly if I calculate through that, then they guarantee that your structure is safe and sound, so from the insurance point of view, the company is also happy, they will insure your product. So, the classification societies job does not end there only that means they may give us the guideline for design, they may give guidelines for calculations, I do that but in the fabrication, if I do something else then again everything goes anywhere. So, they keep a tab all throughout the process right from the design to delivery they have the means of mechanism of checks.

So, first point of check is drawing approval, that means they have given you guideline based on that guideline, you have calculated made the drawings, made the calculations, so those things are to be approved by them; they will check cross check your people have done, shipyard designers have done it, they will cross check it when they say they are fine then you go for production; and in the production again their representatives will be there who will check whether the as per the design things are happening or not.

Because, somewhere I may show 8 millimeter but in practice, if I put 6 millimeter, because of my unscrupulous nature, so I am compromising with the product, is not it? Such that that is not happening those checks are there.

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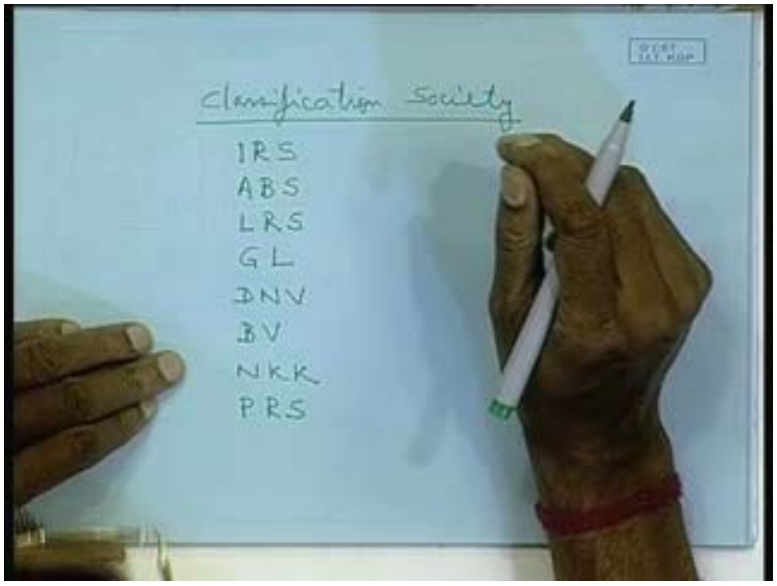

So, in the first stage, when you go for design approval, so one of the designing is midship section design, details of the midship section; so that is how that is also important, because that is the so called the backbone for the longitudinal strength. Since, we have written classification society, the various classification societies our Indian classification society any name you know? Anybody, Heard about? What tells me, Indian Register of Shipping that is the Indian version of the one of the ship building classification society any other, you have heard about.

What is that? No, I do not think so, is the right ABS that is American Bureau of Shipping, then we have LRS Lloyds Register of Shipping, this is a British one; then there is a GL Germanischer Lloyd, this is a German one, similarly, you have DNV, Det Norske Veritas, this is an Norway region one, just for the sake we should know the names then you have Bureau Veritas French one, then you have NKK this is a Japanese one Nippon Kaiji Kyokai; some such thing NKK there is PRS (( )) this is a polish one.

So, not necessarily all countries in world they have their own classification societies, but many of them has these are some of the societies which are there. What is the difference between them, as such there is no big difference, because the final objective is same is only different path sort of or but then still why it is there, like that because simply, if we want to build a ship as per say ABS classification; then we have to pay money to ABS money goes to US, is not it? If you build as per DNV then money goes to Norway. So, I

better build as per IRS money remain in India, that is a basic logic why there are so many classification of each country.

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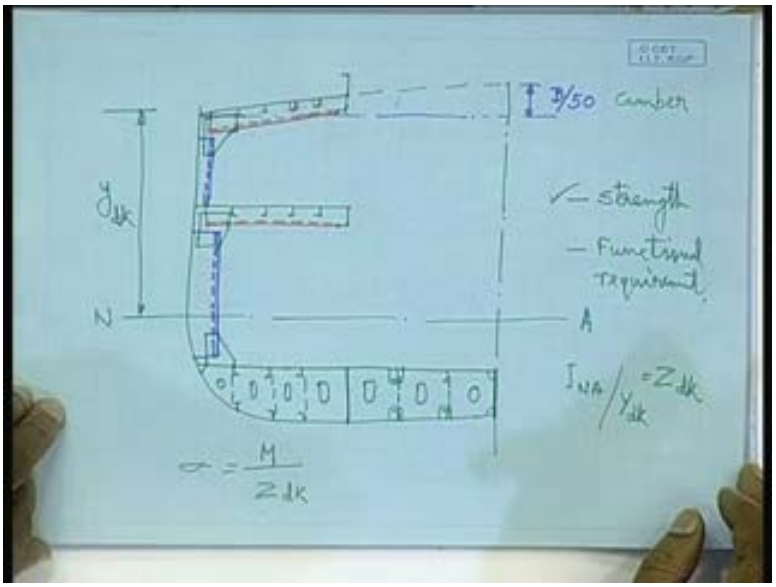

So, anyway that is, what is the business of classification societies, any way so coming back to that midship? So, we have seen that midship section one is one of the fundamental requirement is that, it takes care of the structural strength structural strength from the point of view of longitudinal bending primarily longitudinal strength; and second important is functionality, functional requirement, these are the two aspects it will look into, will automatically get structural soundness or structural requirement satisfying the structural requirement; if we properly follow the guidelines of these classification societies.

And functional requirement, that is the designer job. So, we have to look into for, what purpose the vessel is being built, because if we again little bit go back, to that stage of when we talked about the these products are not rather always a, so called a customer driven means, these are done on customers requirement, on basis of requirement not a kind of a show case product not yet.

All other products are generally a show case kind of product like, if we want to buy a aircraft, if you approach McDonnell Douglas, they will say we have only this range of product, you have to choose one from them; if you go to Boeing, they will say these are the things available; but a ship builder he will not say I have these, generally will not say,

he will say this is what I want; and based on that he will come up with the final product so what do you think, he will ask for that means the customer.

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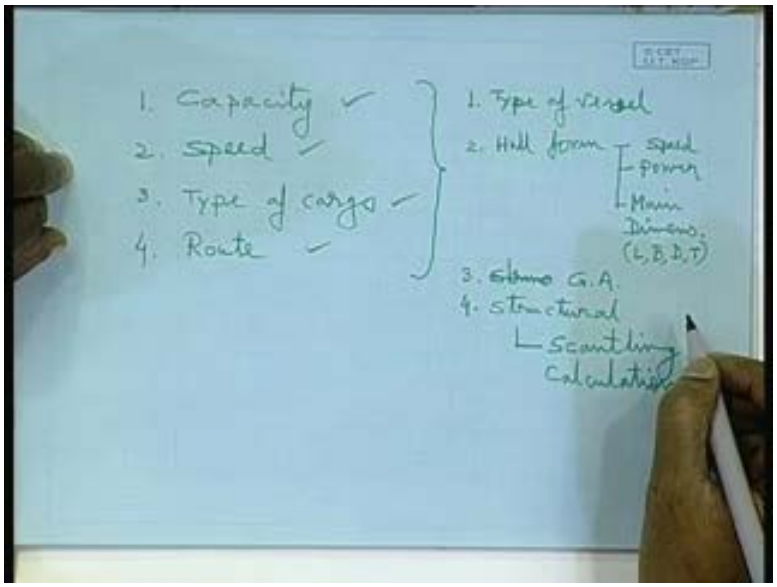

What are the requirements he puts forward, when he talks about, when he want, when he looks out for a ship, can you tell me, what are the basic parameters to be told to the designer or to the builder such that.

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Tell me, capacity speed, what else? Budget is later, budget will come, and cost will come, once you spill out your requirement, so first you give your requirement, what you want? You want to carry a certain amount of goods, so capacity; but what goods that also you will have to say that type of cargo whether, you want to carry crude or you want to carry passenger so different is not it? So, the type of cargo, anything else, do you think anything else is needed? Route, yes that is important the route, what is the spelling of route r o u t e, the route anything else? I do not think anything else.

This is the basic four requirements, you can well imagine the customer has only, because he does not care, he only wants to transport certain amount of cargo through a given route, port of origin, port of destination and via the route and at a certain speed, that is all. So, from this you will have to give a solution, what the solution will comprise of? It will comprise of the type of vessel, is not it? That means, whether it say container ship or

a RO-RO ship or what the type of vessel what else later, it will be hull form, because that will decide your speed, I mean decide means well, we will have a bearing on the speed and the power requirement.

If the hull, form in the solution in the hull form you come out with the hull form, he comes out with the different hull form and there the well both are giving the required speed say speed of 15 naught so you asked for the customer; and you are giving it at a expense of 10000 of BHP motor and he is giving at an expense of 8000 BHP motor definitely he is better. If higher power if you installed means your specific fuel consumption is more operational cost will be more.

So, power what else; obviously from here you will have the principle particulars, the principle particulars means the so, called main dimensions from these the solutions are coming from first and foremost we decide on the type of the vessel, decide on the hull form and the principle particulars, in fact first you will come to the principle main dimensions, main dimensions are nothing but, what length, breadth, depth and draft. Then, while we come to the hull form, they are basically the form coefficients and the hull lines block coefficient prismatic coefficients all those things and the hull lines, how the line should be.

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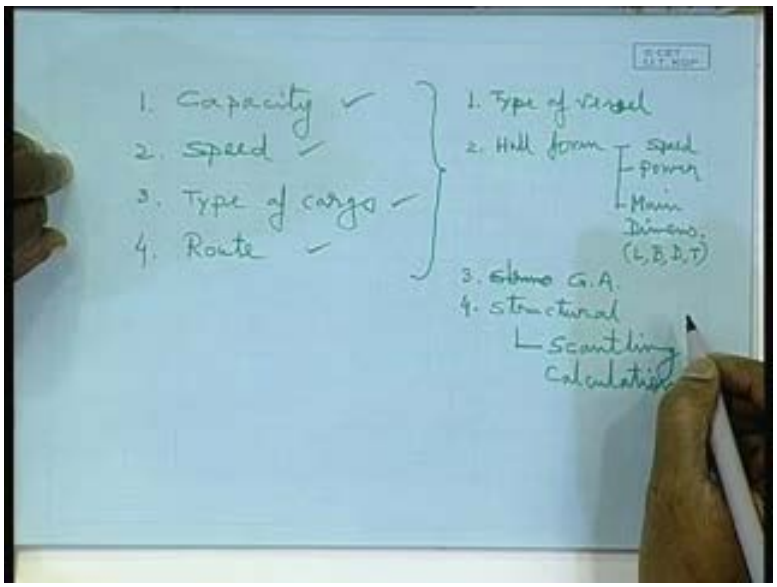

So, they are the basic two, first you come through, then subsequently go for detailing of structural design or may be before structural design, you write General Arrangement G

A, you make a general arrangement plan means, how the whole thing will look like? This how the whole thing will look like is not a, is not to be misunderstood as a sort of artist impression, not that; it is actually how the things will be laid out, not from the structural point of view, but from the functional point of view, like where your deck house if any will be there, where the cranes will be located if any; there can be deck cranes mounted on the deck, there will be your anchor handling winglets, where the winglets will be there, there will be various deck fittings, the (( )) fairly it is different fitting where they are to be located.

What will be the bulkhead positions transverse subdivision bulkheads, so before that you will do flooding calculation, bulkhead locations, so that the hold dimensions from that you do a capacity calculation to satisfy your capacity requirement.

Then you will work out the tanks various tank positions, where are the tanks, because tanks means what? Tanks for carriage for fuel oil, for ballast purpose, for fresh water, you will have to provide for that, you have to mention that this, so all these in general arrangement, also you will show the location of the main engine; though the final engine may not have been selected by the time, but you have a fairly good idea, what will be the engine dimension over all dimension, so you will have to see whether that engine is fitting there, length, breadth, height all those things, what would be the other auxiliary engines machineries, so all these in the general arrangement.

So, you have a fairly good idea of all the components coming broadly in that means, here you would not show details of what pipe lines and what valves and what swiss beers know, broad items theses are also needed because, you may need to calculate the C G location for stability calculation all that, so once that is done gradually it is coming through more and more through that you refine everything that, through that you refine your length breadth draft requirements.

Because, here you do that capacity calculation you find that things are falling short, you will have to increase the length or whatever increase the depth, so that your capacity condition is satisfied cargo type condition is satisfied and the hull form at that stage it is only whatever, will provide you the minimum resistance theoretically whatever, you are getting you come to that hull form so that speed condition expected will be satisfied provided providing required power.

So, then comes the structural design and in this structural design then you start with the, so called scantling calculations; that means up to the stage three, one stage three is over totally you design your hull lines, the form of the vessel, the principle dimensions everything has been frozen, you are not going to change that. Now, you have started detailing on that, first phase of detailing is the, so called you need to do the scantling calculations. Scantling calculations means, you start with calculating the plate thickness, section dimensions, stiffener dimension etc, for the entire ship once that is done, then you start with the midship section drawing, physically a layout, you draw the thing well, if do not draw also there is not a problem, provided you have all the structural items whatever is going to come in the midship section, you have calculated for them and you are going to calculate the section modulus.

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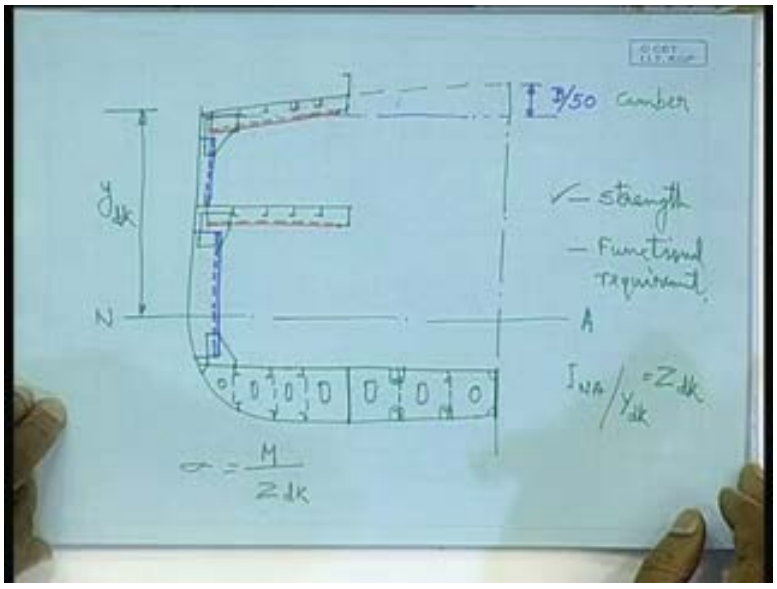

But, it is worthwhile to draw because, that will be needed for physical approval of the classification society, you will have to send the actual drawing, because in drawing it will be physically shown, instead of writing in words, that the deck plating thickness will be 30 millimeter and it will have the 40 longitudinal, because that becomes big then you have to write many lines, because in way of hatch opening it will be different and so and so forth, instead you draw it and show. So, that is how the in the structural design stage your after scantling calculation, you one generally starts with the midship section drawing.

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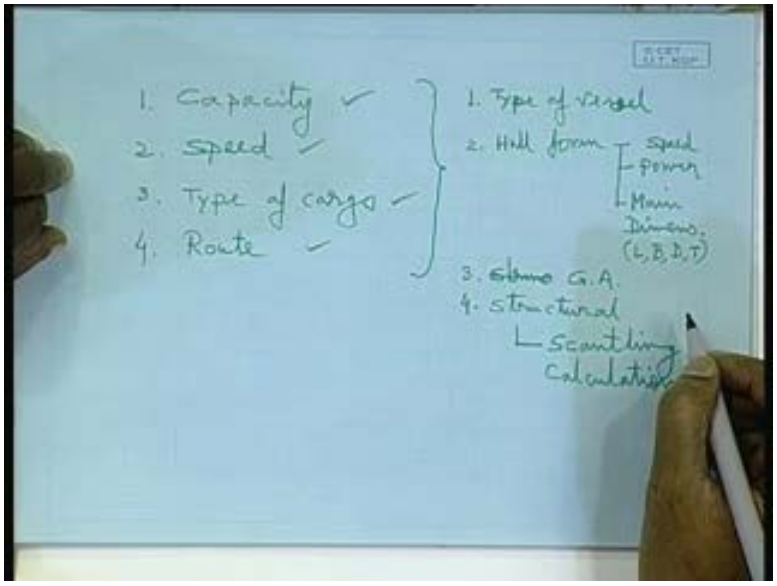

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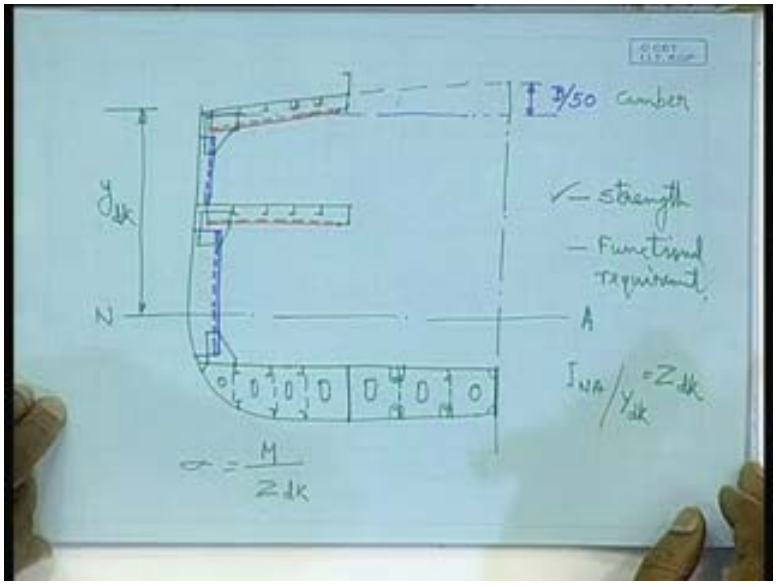

So, depending on the cargo type or the type of the vessel, your midship section arrangement will be different, because that is what is the for the functional requirement point of view, so when it is a general cargo carrier the arrangement is somewhat like this. Basic preliminary arrangement the moment you are talking about any type of a vessel, when we start the midship section plan the basic thing is done is, that the outer hull is drawn, the main deck is drawn, if there is a hatch opening you draw it, showing this particular line, I have drawn that is what? It is the hatch coming that means there is a

hatch opening here and then immediately you draw what is called is the inner bottom plating.

Because, all ships ocean going ships they have a double bottom, we have talked about double bottom, immediately all ocean going ships have a double bottom, so immediately once start with the outer hull, the main deck and the double bottom, this is a must for all vessels more or less. And now, when general cargo ship generally general cargo ship has at least one lower deck, so you draw one lower deck and wherever these decks are there, there is a hatch opening, the moment there is a hatch opening, you have a hatch side girder, so he draw a hatch side girder, same thing will be there in the in the lower deck also; hatch side girder and then the decks are what longitudinally stiffened, so you can show some of the longitudinals, schematically some longitudinals are shown, same thing is true for the lower deck.

You can see one thing the flanges of all longitudinals I have shown going outward but, the last longitudinal flange is inward why? So, such that the bracket connection is made easy, because you will have it has to be bracketed to the side shell stiffeners, whatever the stiffeners be whether it is a longitudinal or transverse it has to be bracketed, because of a better load path, because of better connectivity between the structural members. So, it is done the flange is on the other side such that the back side of the web is available for profile bracketing, so this is done immediately we go for the double bottom, double bottom construction we have already talked about in detail, they are identical for all type of ships, so and they are also longitudinally stiffened.

So, we have this bottom shell longitudinals inner bottom longitudinals and so on. It goes through this, we show that there is a here in line with the hatch side girder, we can provide a side girder and then you have the longitudinals by making these thing, we indicate that there is a plate floor.

So, that the double bottom is drawn and also to be more accurate make this a firm line indicating that, we have given a centerline girder and then make this small lines as scallops, one or two these openings you can show schematically, that indicates the plate is cut there plate floor for the longitudinal to pass through we have shown the detail of these drawings and draw this dotted lines, which indicates that the struts are there this is a side girder.

Now, there is one term called intercostals, the thing is the central girder is generally taken to be continuous longitudinal member, means the floor plates come and end at the central girder; again from the other side this is say this is my port side view on the starboard view, the plate floor starts from here.

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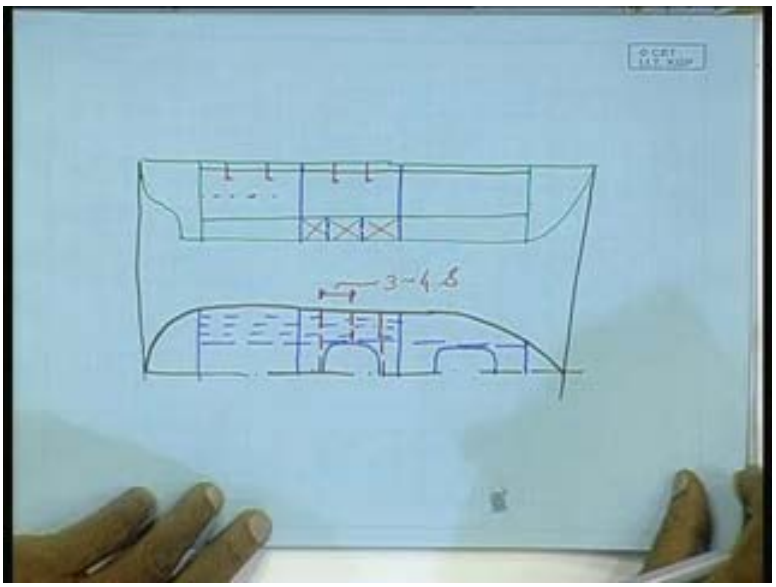

Side girders are generally made intercostals that means between two plate floor the side girder continuous, what is that mean? That means that would be visible in a longitudinal section.

The longitudinal section is say, I am drawing the only the say this is my double bottom and it is done little exaggerated say this my double bottom and let us assume, these are my transverse subdivision water tight bulkheads, say there are only three holds. And let us assume these are my plate floors say there are let us assume two plate floors in this hold which this is never shown, because there will be several of them; now the thing is this side girder the central girder will be warn continuous, plate by warn continuous plate means what? The ship length could be a 200 meter, we do not produce 200 meter long plates, it will be only 10 meter, so twenty of them will be put one after another and they are welded, not at one bow but in blocks in units that is a different issue, whole point is they are continuous means, nobody is penetrating them, but the side girders will be like this.

This is one side girder, this is another side girder like that, that means they are from floor to floor, that is what is called intercostals? From one floor to another floor the side girder is there, that means the floor is continuous and side girder is coming and ending at floor, floor is continuous from the side shell to the centre girder or to the duct keel side girder, if there is a duct keel kind of arrangement, so there are two girders so the floor comes from the side shell from the bilge to the girder.

And the side girders long side longitudinal girder, there will be continuous from one floor to another floor, that is how the constructions have done and this side girders are generally not water tight.

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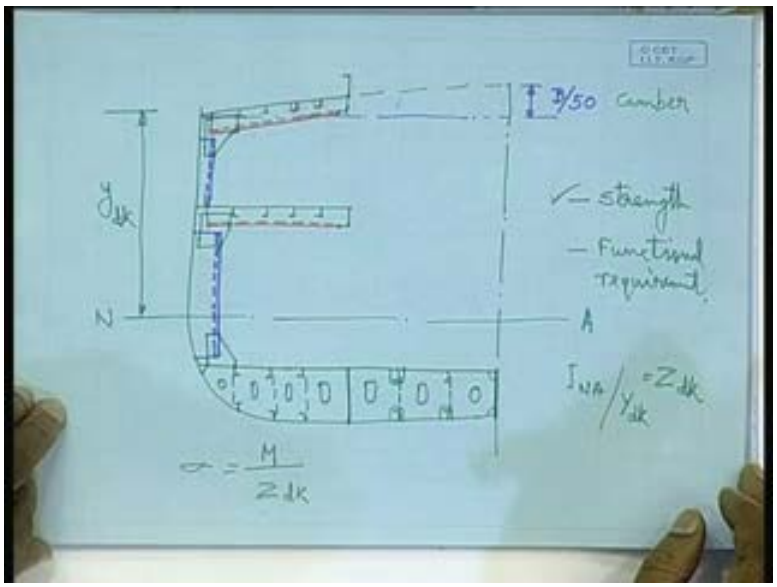

We will see later, some of the drawings which will make it more I mean some of the photographs, which will give you a better clear picture of the entire thing. So, here we get the double bottom, because any ship we need a good flat surface for space of cargo, so it has to be double bottom, that is one of the functional requirement another from the pollution like liquid cargo, you do not need a double bottom, because liquid can go anywhere, but from the pollution control point of view a double bottom is mandatory for oil tanker. So, once this is done so the bottom shell is done, I what you call the double bottom, the deck but here we have shown the deck longitudinally stiffened.

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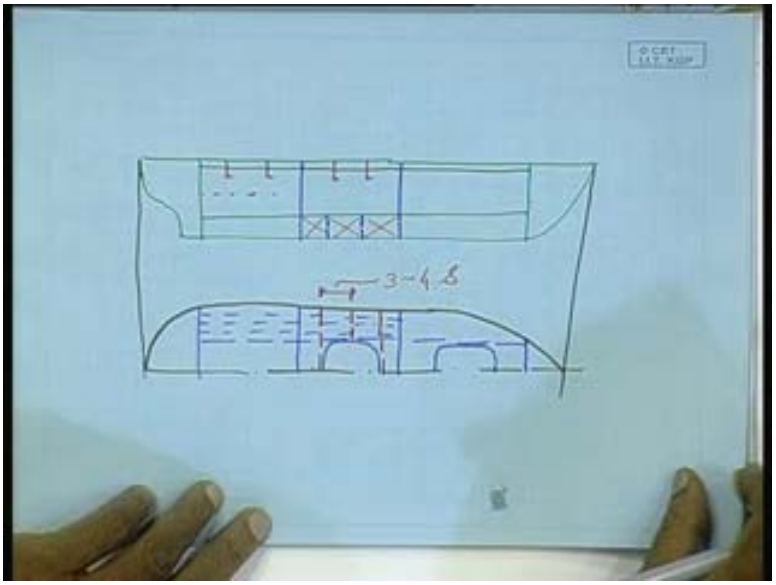

Now, we have said that these longitudinal should have a supports, because otherwise the lengths of the longitudinal will be from bulkhead to another bulkhead, say the deck is longitudinally stiffened means what? Longitudinal stiffener is running like this, it is passing through the bulkhead and then the transverse bulkhead will be sealed of buy those plates as we have shown. Now, in such a case, what it appears? It appears as if the longitudinally supported between these two points, because they will be welded at the bulkhead, so the span of the longitudinal will be this much and you know the bending moment is square of the span.

So, for a given loading, if this is my span the bending moment on the longitudinal will be very huge, if that is so to keep the stress within in the limit your section modulus of the longitudinal is very huge, so that is not very wise thing to do, because then the depth of the longitudinal may come up to this, is it not? So, what is done you will have to have transverse members which will provide additional support something like this obviously; this scantling of the transverse member has to be more than that of the longitudinal, because the transverse member is providing support to the longitudinal.

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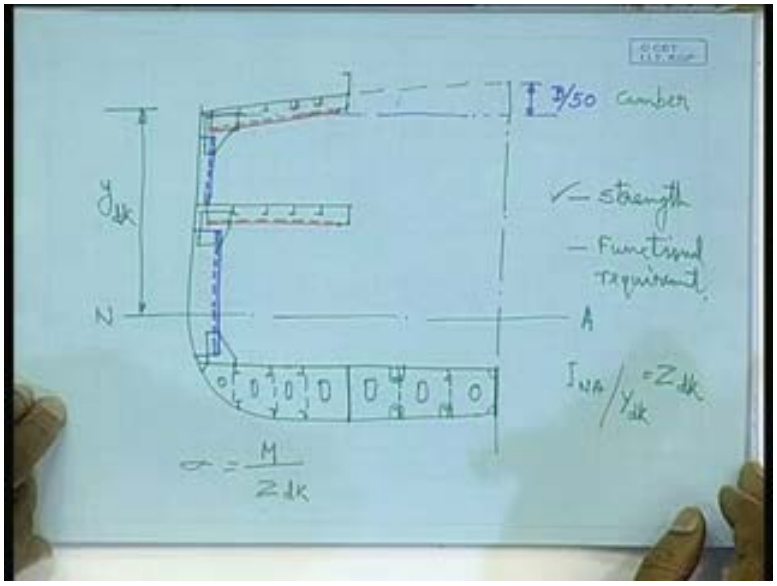

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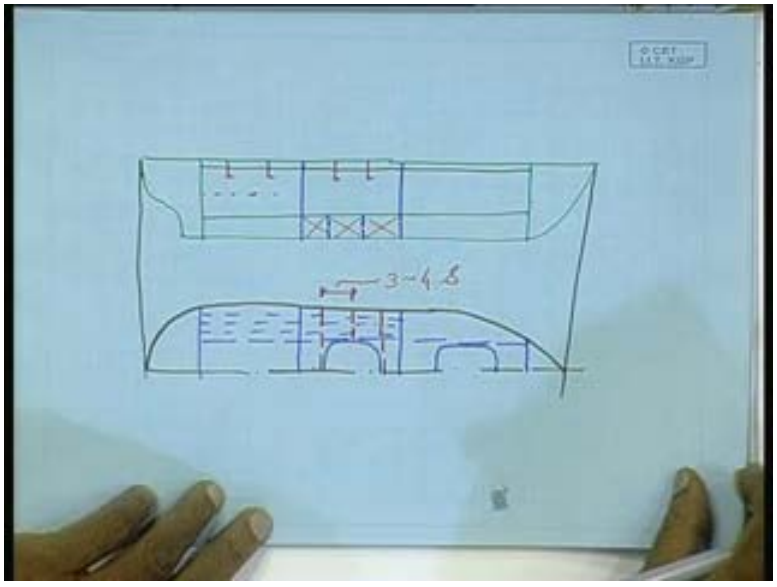

So, the transverse member would be like this, what is this red line I have drawn? This is one of the deck transverse, this is called deck transverse, it will be situated at certain intervals as I have shown at, what intervals generally they are, any idea, I have told you for possibly, what are the intervals of the plate floors? 3 to 4 frame space same interval, because the whole idea is you form a ring like a structure, ring like a structure means a plate floor side shell web from a deck transverse in between plate floors, you have bracket floor, normal frames, no deck transverse. So, that will be better visible in a plan view, if I draw the deck plan suppose, this is my let us say this is the bulkhead positions

and this is my deck plan, you have the hatch openings here, your this is the head side girder is running like this, you have the longitudinals, they are spaced as per the frame spacing right and the transverse members are here you have one, hatch end beam it is another hatch end beam and say another transverse.

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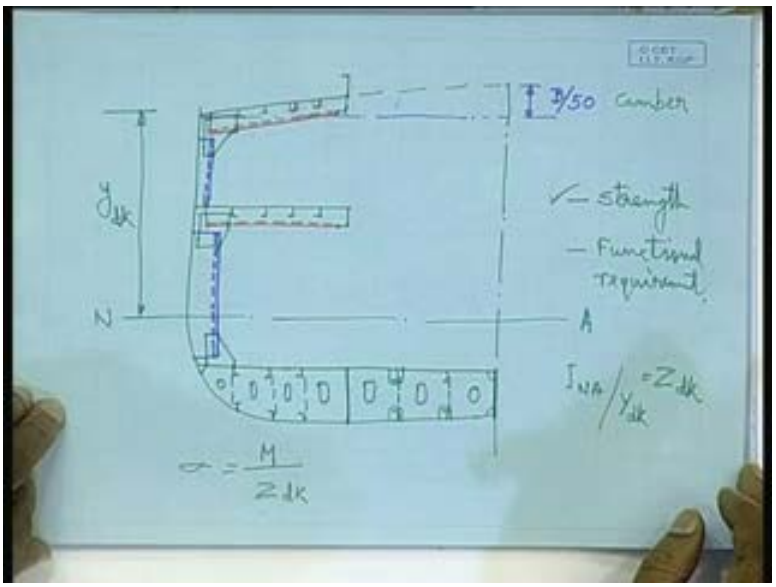

So, the spacing between the transverse would be 3 to 4 frame space, 3 to 4 frame space so this transverses will provide the support, so again the same thing here, you will have this small this so called openings, like in the floor you had like in the same connections, here the intersection of the inner bottom longitudinal and the floor plate or the intersection of the bottom longitudinal and the floor plate, whatever is the detail we have already discussed about it will be same here also.

So, there they are supported, so same thing will be there for the lower deck also, so you see when I am trying to draw a midship section, we are not drawing it through well it should have base, it should have that, not from memory but from logic, that is what you try to see, that whenever you are going to make a midship section arrangement say a bulk carrier will come to bulk carrier later you will see that we will doing through some logic instead of memorizing that well bulk carrier should have this type of arrangement, then if you forget then something you will miss. So, all these arrangements are done not note that, it has to be this way, but it is better to be this way because that satisfies my logic my

logical requirement, logical requirement is should provide me the required strength, should provide me the required functionality.

Now, and that logical requirement tells me that, the double bottom should be longitudinally stiffened decks to be longitudinal stiffened, because we know longitudinal stiffening arrangement provides me a better buckling strength thereby, I attend a better strength to weight ratio, so that is a better way of doing things we are doing it. So, in the same logic my side shell also can be longitudinally stiffened, but here we will see not do longitudinal but will do transverse framing, transverse stiffening. And the transverse stiffeners would look something like this.

(No Audio from 47:17 to 47:30)

That means in the side shells are transversely framed, they are in the transverse plan is not? Like that of the deck transverse in red, we have drawn they are in that plane and they will be obviously connected to each other by providing bracketing arrangement.

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And also bracket here, suitable bracketing arrangement. Now, we will see that our this midship section is fairly complete, we have provided for ample structure member to contribute towards longitudinal strength, what are the members well the shell itself, then the hatch side girders, decks longitudinals, inner bottom longitudinal, bottom shell longitudinal, central girder, side girder all these are longitudinal members and longitudinal members contribute towards longitudinal strength, so we have sufficient of them. And also we have the transverse members in the transverse plane, what we have the plate floor we have the side shell frame, we have the deck transverse; so this deck transverse and plate floors they are providing support to the longitudinals as well as providing transverse strength in the transverse plane, is not it? They are providing for the transverse strength.

So, we will have so this particular arrangement provides me with required apparently provides me the required strength, because we started with a strength requirement is to be satisfied for longitudinal bending, against transverse deformations, torsional and local. So, this is satisfying I mean this appears to be satisfying in both transverse and longitudinal.

Now, the thing is whether it is truly satisfying the longitudinal or not we will have to do a calculation, so what is that calculation? That calculation essentially involves finding out the neutral axis of the section, obviously while doing the calculation I will take the full section the full section, because whole section will contribute towards the strength.

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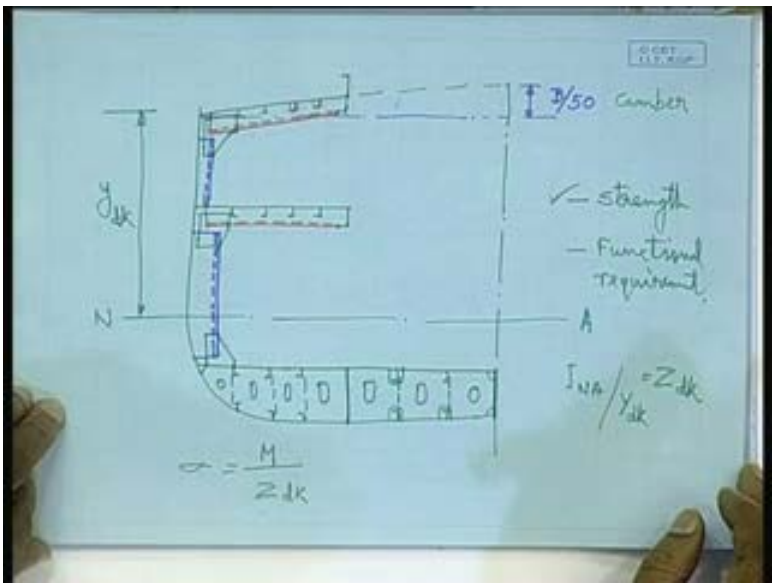

So, finding out the neutral axis and finding out the section modulus of this, how do we get that well? We get from to that will take only those longitudinal members obviously, this deck transverse, side shell frames will not contribute naturally, they are not contributing towards longitudinal strengths, so there sectional modulus does not come into picture.

So, through that we will calculate an obviously that is calculated in the way of hatch opening, because when a hatch opening is not there, the plate is continuous as well as you have so many additional longitudinals also, but you do not take that because firstly the longitudinals may not be there, they can be transverses we have talked about the cross deck structure and that plate is small between the two hatch openings, so they are not contributing towards longitudinal strength. So, thereby we find out the section modulus about the neutral axis, I mean moment of inertia about the neutral axis and then divided by Y deck or y keel, Y deck is this y keel is that its counter part.

Y deck is always bigger than y keel because we have a higher concentration of structural members below, so this is always the minimum value so this my so called Z deck the

section modulus for the deck, I mean section modulus of the section with relation to the deck plating.

You have the bending moment distribution, so divide that by this you will get the stress value, if that if that stress value occurs to be higher than the working stress, what we should do what has to be done, that may may happen all these, we have done by taking the scantling from the classification rules calculated and put based on that you have chosen the dimension of deck longitudinal based on that you have chosen the thickness of the inner bottom plating etcetera. But, after doing that you have done the calculation of I about the neutral axis divide by this this and you find the stress which is coming, is more than the permissible stress, so then what is to be done.

What to do, that is not permitted will have to give the stress below this means, we have to increase this Z deck has to be increased or in other words I N A has to be increased means, you will have to take a relook at the arrangement and you will have to see, that well scantlings has to be increased, now which one to be increased, those decisions have to be taken it is better to increase at the deck level which is furthest away, that provides for more I value all that, so that is how so one or two, three directions may go till you get the final scantlings of all the things.

Well, the side shells are transversely stiffened, why it is so we have to think about it, which you have told that it is better to have longitudinal stiffener, I mean longitudinal stiffening arrangement, but here we are seeing that no for general cargo ship, side shell will do transverse stiffening, there should be some reason what is that reason? Think about it and tell me in the next class.