NPTEL ONLINE CERTIFICATION COURSES

Course
on
Reinforced Concrete Road Bridges

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Lecture 02: Classification of bridges

Hello everybody so we have just introduced the bridge engineering in general but I think it is worth to give you idea about the classification bridges before going to the our main topic that fix with enforce concreted road bridges what we shall do it here I shall tell you this figure one so we are considering.

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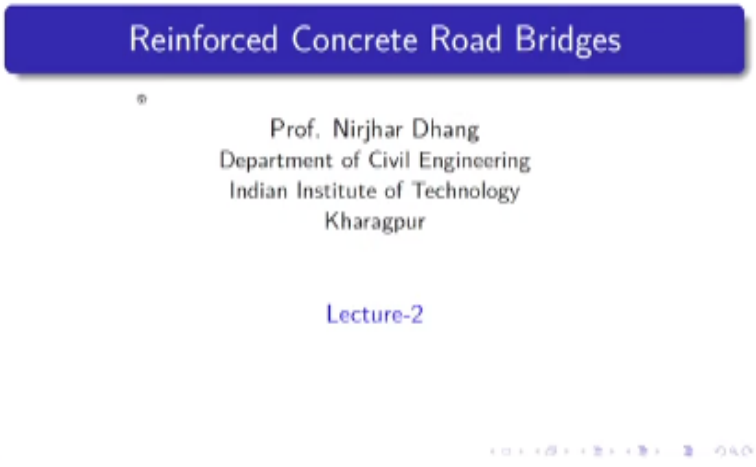

So we are considering this one as a your second part second lecture we can consider on that reinforce concrete road with this though we are still in the that region engineering in general because it is I feel it is appropriate to give you idea about bridge engineering before going to the our main topic.

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As usual I shall give you on that classification of bridges and then obviously summary just to give you an idea and the reference which particular book we are following fort this particular lecture that I say give you.

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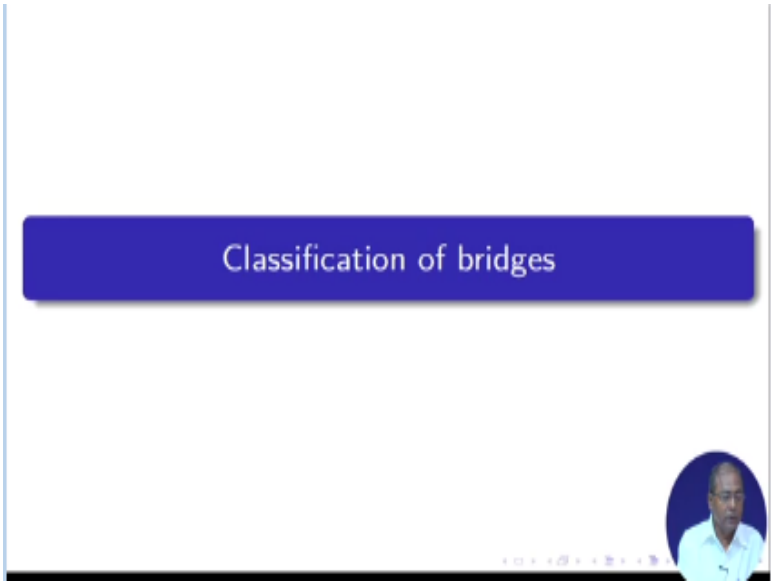

So let us just discuss on the classification of bridges I has have told you the it can be given in many ways as I have told you in the last lecture I have told you for learning purpose obviously it is better that we shall not go span wise that 10m, 15m, 20m, 30m, like that we shall never go like that it is better to go whenever we are learning or for teaching purpose enviously we shall go for the reinforce concrete that is one way. Then we shall go for bridges concrete then say steel

bridges the obviously the combinations steel and concrete composite every supported regions there is an interesting things is that cable state bridges and suspension bridges there should be del separately.

Whenever you are going for long span bridges obviously that will not say your 10m, 20m, not like that so in that case whenever we are going for long span bridges it should be deal separately, this is the that project is a separate one you can consider that one that whenever you are doing the construction of roads there the way we make it separate for the your say that bridges and then we can consider your say long span that is again another separate one we should consider here coming to this one here.

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As I have told you here our because mainly we are considering a road which is that is why am I showing say the vehicles on roads but similarly there are actually it is very interesting just to give your idea because railway having separate loading separate configuration and now a days the time is coming where your having say your say high speed trains and there are another one say heavy hall.

So high speed train that you have to move very fast that is one and other one heavy wall that vehicles are trains are heavily loaded that your transfer of goads, loads that particular one you are having that is your another one but her mainly we are focusing on road bridges. That is why we are giving the road vehicles only which I have already show this particular one here.

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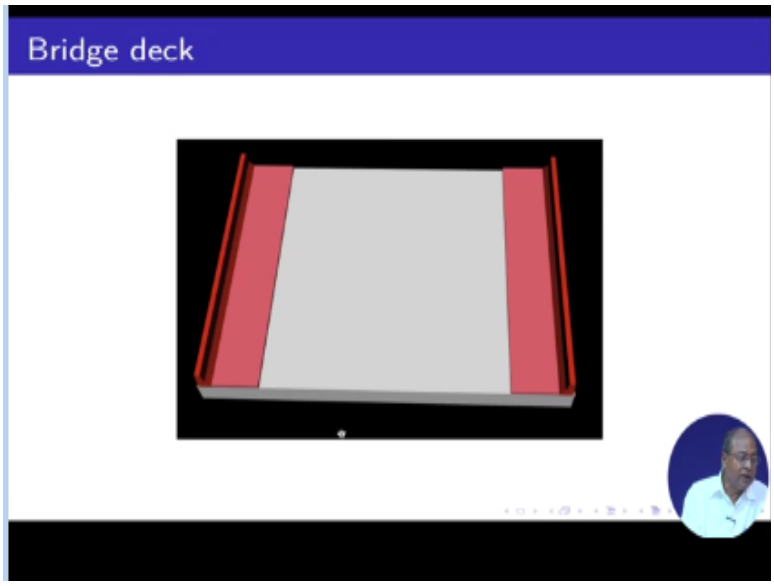

And our objective here that I have told you here the main objective here first I have to find out how much will be this length, because the thing is not only you are the vehicles you have to support you have to support for pedestrian also, you have to support for this cross barrier also, so whenever you are considering this cross barrier, this support that for that also you have to provide that deck, this is very important here and here obviously that deck will be depended on that size of the deck will be depended on traffic volume.

This is one part and then weight which will come how the weight will contribute the weight will contribute on the base in a different way that is your same ending movement and see air force. So that means whenever you are having that bending weight and se air force for the same w you can consider here then you can find out this particular one her just to give you idea that we are considering here.

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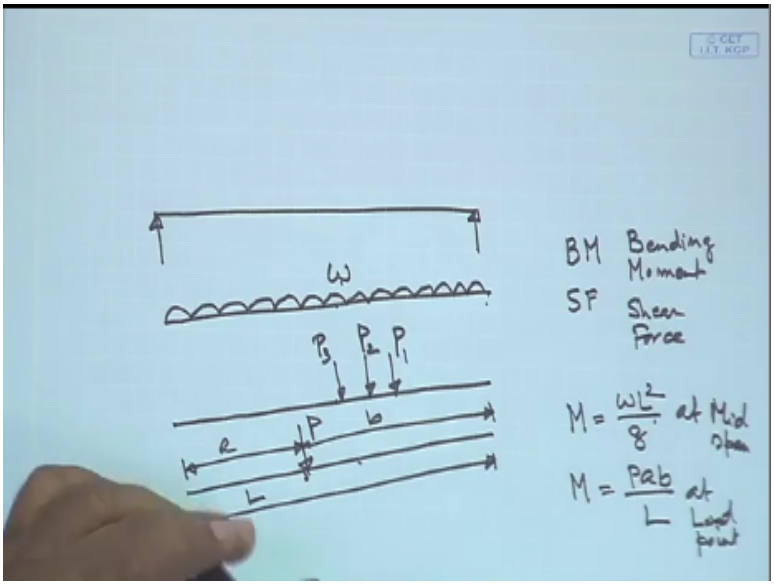

That this is the one that say simply supported beam here we will find out that we are mainly considering her simply supported beam that we are considering here there is certain load we shall discuss again but any way just to give you idea before moving further, this is your w which will mainly come from the self weight of the vehicle or self weight of the bridge the other one will come certain that we will load the question is that how many we will set there how much load we shall consider.

This is very important that means for these 2 loads many be this is say P_1 this one may be P_2 this may be P_3 P_1, P_2, P_3 all may be equal may be different so for that we shall get bending moment and then we shall get Shear force so bending moment and we shall guess Shear force so bending moment will be may are the meet spend Shear force near support so that means if w increases for this case so obviously in this is the one we shall get this worker one just to give you idea let us you are haven said P and this is say you a b and this is your L so M = Pab /L now this one of the load point but this one at mid span and this one at load point.

The problem comes I am getting at the Mid span here and I am getting here so that means how much is the load that you need to find out so our objective is there within this particular one the span where is the maximum environment where is the one maximum Shear force and that we have to take here so that means if span increases bending your integer that in a quadratic manner this is very, very and this particular portion also we will find out that means here so obviously

that depth of the beam or slab that one will increase so to overcome that situation obviously there is not a single solution.

That means which shall we simply keep on increasing thus depth of the slab that is not at all a why this is in and obviously it is not at all not an economic solution also that is why we are going for so many bridges which we consider.

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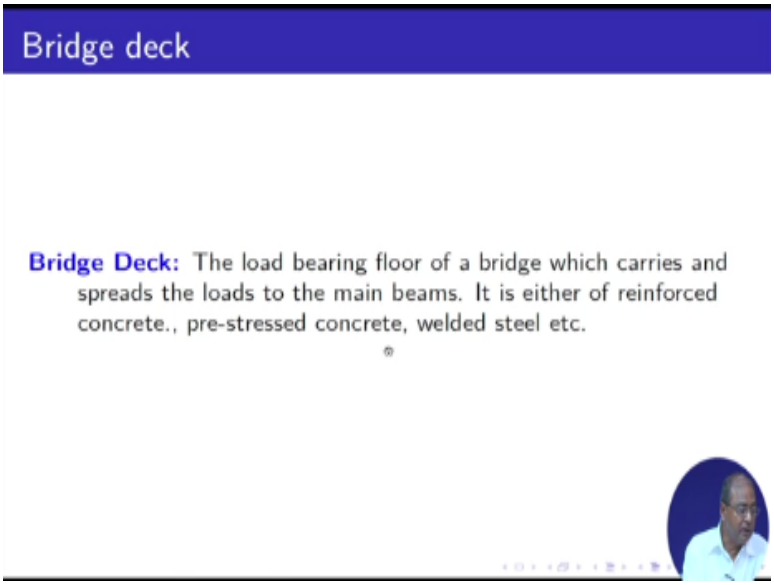

And I have told you already the load bearing floor of bridge which carries and spreads the load to the main beams it is either of reinforced concrete pre-stressed concrete welded steel whatever may it can happen.

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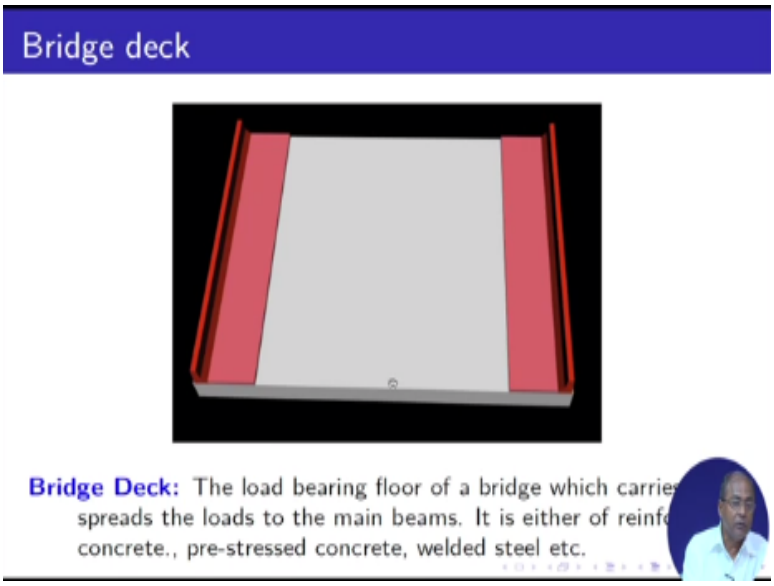

So this is the one that whatever we have discussed.

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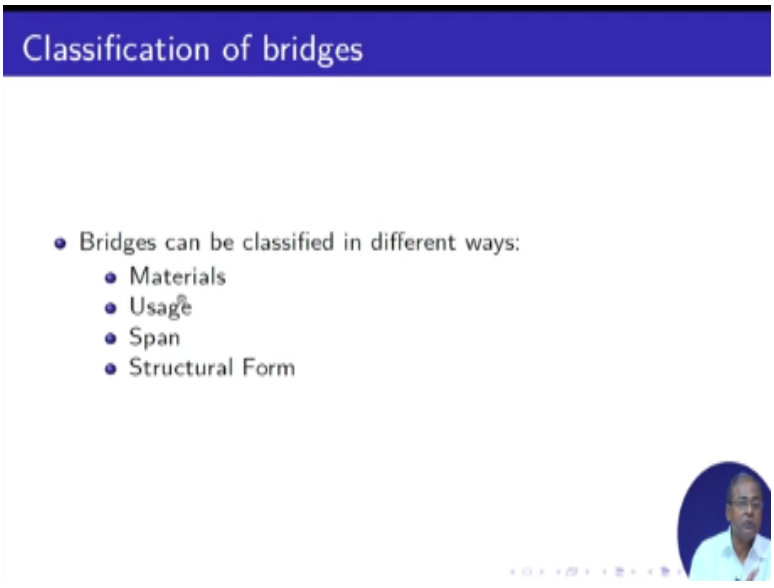

So we can classify the bridge in different ways how the materials point of view from the usage point of view from the span or is the length of the beach or structural from earlier I have told you from the materials point of view we can consider that one that is the mean path you can consider there the reinforced concrete that are going in one materials pre-stressed concrete though it is a combination of your concrete and your Suffy stick so that you can consider separately like that you can find out materials means.

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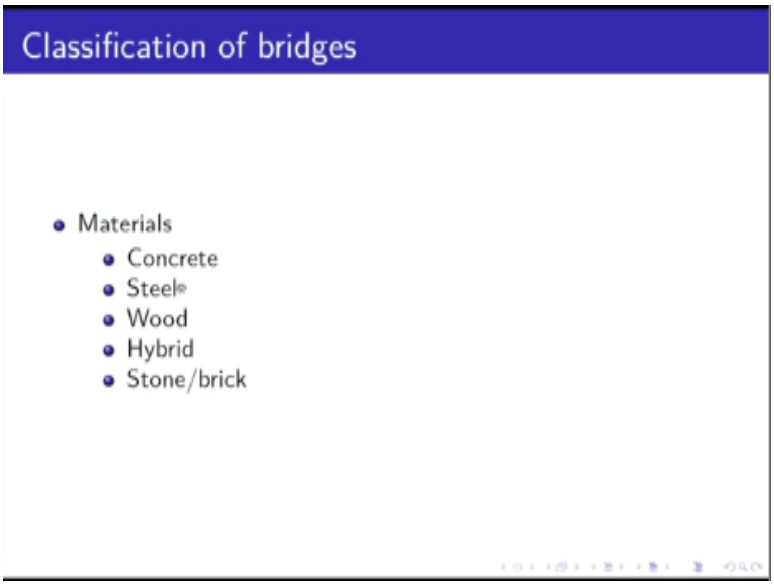

Here we can consider your concrete steel, wood, hybrid combination of that one you can consider that one hybrid steel concrete composite were you also call it composite is our steel part and concrete part that one it can be just own in bridge there are so many Arch bridges we will find out may actually your stones and bricks you can find out that that steel their existing

particularly in your say and really is you will find out so many Arch, bridges are there or else you can consider almost all over India 1, 20, 000 bridges are available.

And almost you can consider 20, 000 bridges are there which are actually yes on the Arch or that it is a stone Arch bridges that are actually still available and obviously that particular one there are certain cracks available so how to take here that it is really heavy issue though people are in the well voice there is a lot of actually work is going on and there is solution also that how to do it but that is a separate thing not open it with that.

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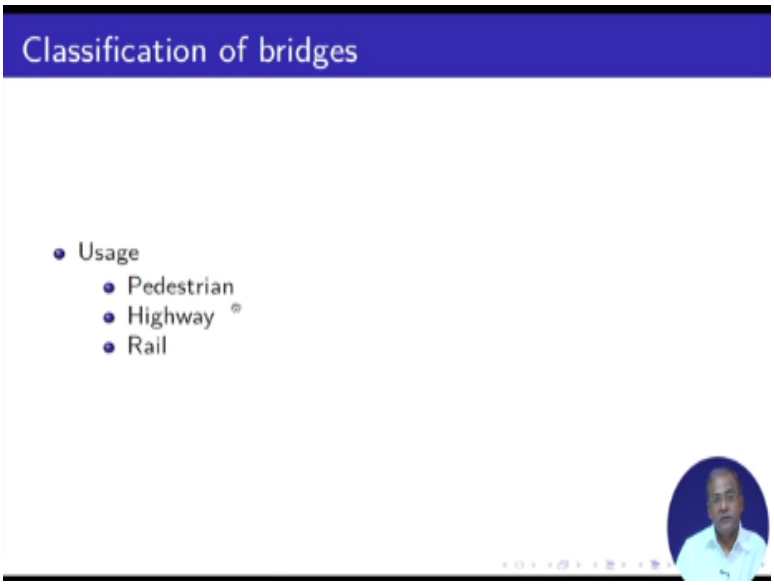

You just point out few Pedestrian, highway the road that and then Rail so these are the three actually we can consider here that Pedestrian exclusively for a highway or exclusive for rails that is possible or it is possible for combination of all three that is also in a equally possible that particular one here there are few bridges are they are where you are having for realize actually as for roads that is actually have a level.

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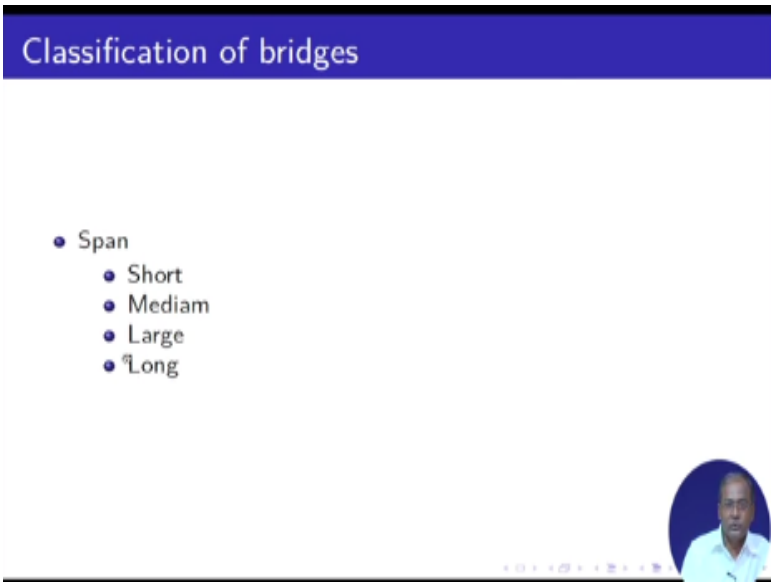

Now coming to these particular one here this is very, very interesting one to say that whenever your trucking the span the span of the bridge on your very considering first we have told you some materials that is the one from the teaching point of view also it is better to go as from materials point of view and then structural formal so and which I told you structure form and obviously whenever you considering materials the obviously a structural form also equally coming into picture.

Now coming to this particular one here I can see the bridge the span wise I have given actually very, very few things that is what span medium span, large span and long span.

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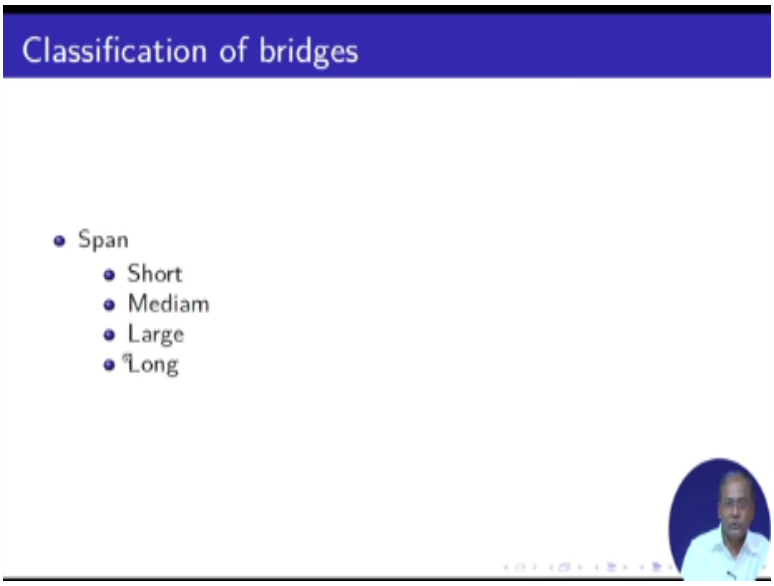

Just to give you idea the span short, medium, large and long so how it looks like what do you mean by short, what do you mean by medium because it may vary from person to person whenever I am having short how much it is so that at least you have to give you certain number generally this is you can say this is a project state you are telling short, medium, large or long you can say this is project.

The way we talk that today is one today is cold, today is chilling weather so this is the one the temperature whenever we say that hot, whenever we say warm, whenever say cold then the person with whom you are talking he understands what you mean to say. Similarly here also whenever you are talking short, whenever you are talking medium, whenever you are talking large or long so we mean to say that it is actually related with certain kind of a number that particular number let us see how much it is.

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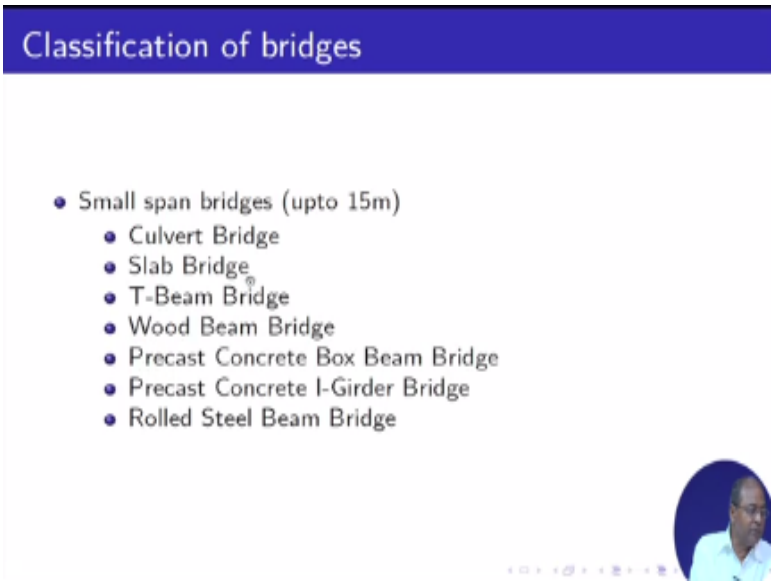

Before coming to that I self come back to this what we are, so let me first show you that particular small span bridges or short span bridges what I mean to say. I can further classify that one very interesting way I can say so small span bridges means up to 15m that is the one you can consider. No one can say which is 15m only no, there is no such sacrifice number 15m it can be 20m also that we also you can say that 20m also you can go like that. So under this category you can say that culvert bridge which this that one that also which will tell you that particular one. Slab bridge, T-beam Bridge so mainly we are having Slab Bridge and T-beam Bridge in this particular course.

Culvert bridge also can come but that one I have taken that culvert bridge is separate one because they are actually art piece or other things also is really important that is why you have to decide that whether we shall go for this one as a part of sub-structures though we are considering this one as a bridge or as you say super structure that means this is combination super structure and sub-structure both this is a very, very important one.

Because art piece are is equally important here so that is why for an introduction part in civil engineering that I am not consider that particular one. And then wood beam bridge precast concrete box Beam Bridge whether it will be 15m that small span or medium that is also you will find out. Precast Concrete I-Girder Bridge and rolled steel beam bridge that particular one you can consider. So this is one we can consider that one say 15m span.

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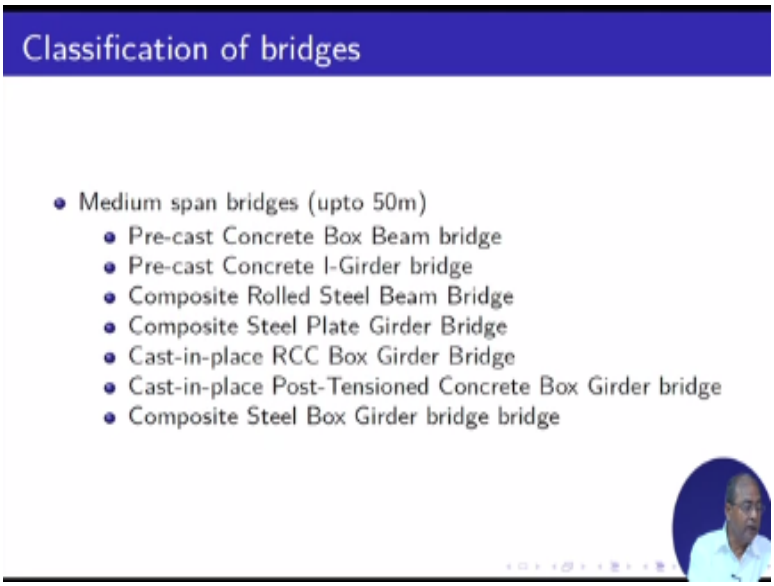

Then medium span bridges up to 50 meter we are considering, precast concrete box beam bridge, precast concrete I-Girder bridge very interesting thing I would like to say here that we generally consider T-Beam Bridge T-beam we call it and generally we consider I-Girder this is the general normal girder generally we follow that one can say I-beam also there is nothing wrong in it. But generally we consider in that particular person then composite rolled steel beam bridge that we can consider composite steel plate Girder Bridge.

Cast in place RCC box girder bridge, cast in place post tensioned concrete box girder bridge and composite steel box girder bridge sorry one bridge is extra so that is do not consider so only up to this the bridge. So this is, these are the under actually may be on span bridges that way you can consider that here, that we consider here.

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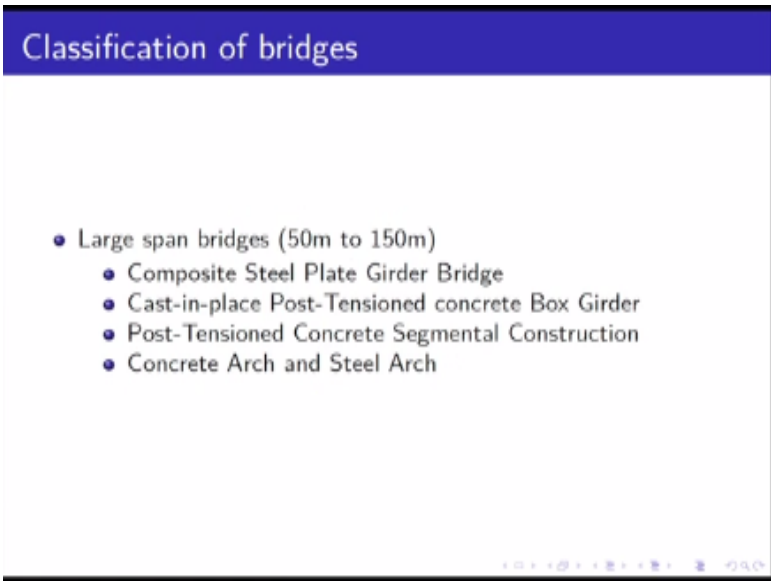

Now large span bridges 50m to 150m so here we consider that one say composite steel plate Girder Bridge, cast in place post tensioned concrete box girder, post tensioned concrete segmental construction, concrete arch and steel arch bridges that we can consider here. now coming to this one here there are few you will get it here also as I have told you this particular here so it comes like that and then we are having.

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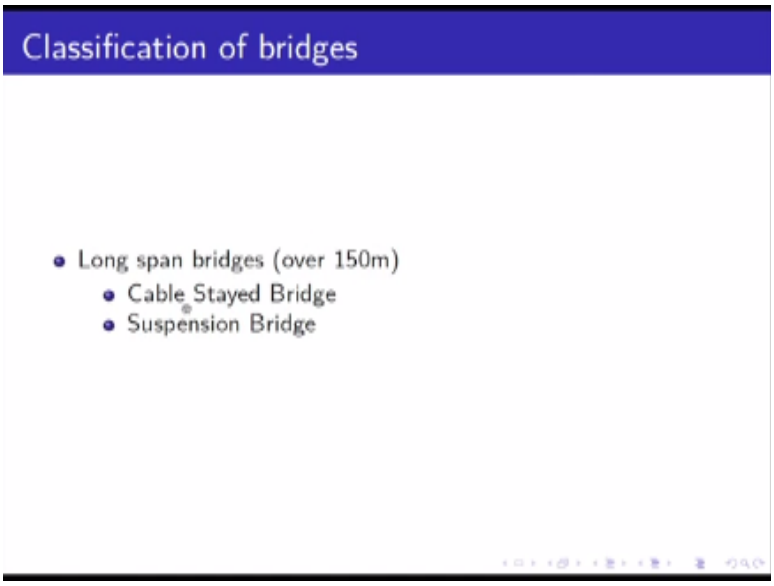

Long span bridges over 150m cable stayed bridge or suspension bridge that we, you can consider here. So coming to this one here what I like to say, the short span, medium span, large span, long span that way you can find out. And on the basis of that on the span wise you can consider that would be just you can classify so and this one will come to each one of them will come to each roll, so one very important part here I would like to show you here that.

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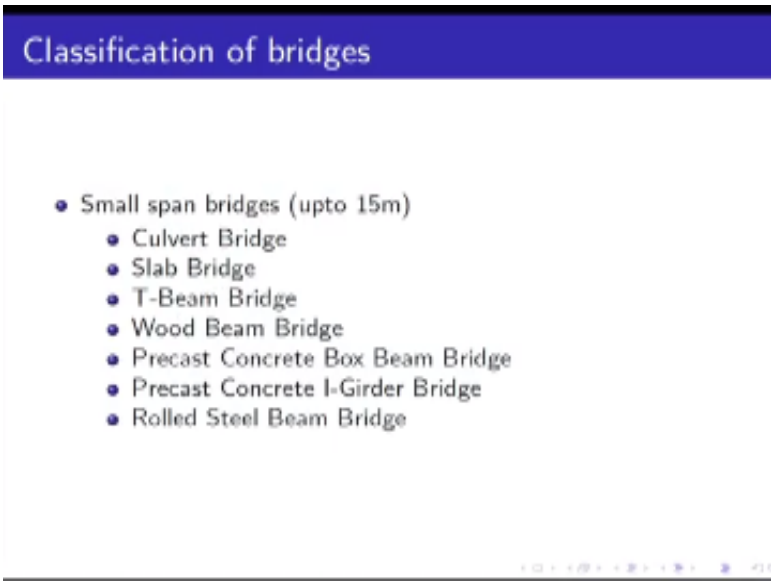

Span wise we are having certain say, we are moving like this then we are telling some number say 15, some number say 50, some number say 150 so whenever we are talking this one what we mean to say that everybody having their own room it can go shall we make it up to this move it can go up to this also may be I can say 20 or it can go up to this also 25m so this is the range you can say which is coming for you say small or I can further I can say short, short means something like this may be say 5m or 10m also, so this is the one the range so that why I do not say that one that if you say just small bridge or short bridge like that.

Do not consider that particular one here that number is just for our guideline or our say understanding we can say that particular one but do not say that particular one here that it should be 15monly no it is not like that. Similarly whenever you are taking 50m it can go just to give you idea if you consider that one just to give you idea it can come like this also something it can comes 70m like that also it can come.

Here 150m something it can come little here to something say 160, 170 like that. So that is why I mean to say it is not the number to give you idea that it is within this particular range but it does not mean that I cannot go little beyond of that particular number always you can go and sometimes we do it also this particular here, that I self daily something that to give you idea that what I tell you.

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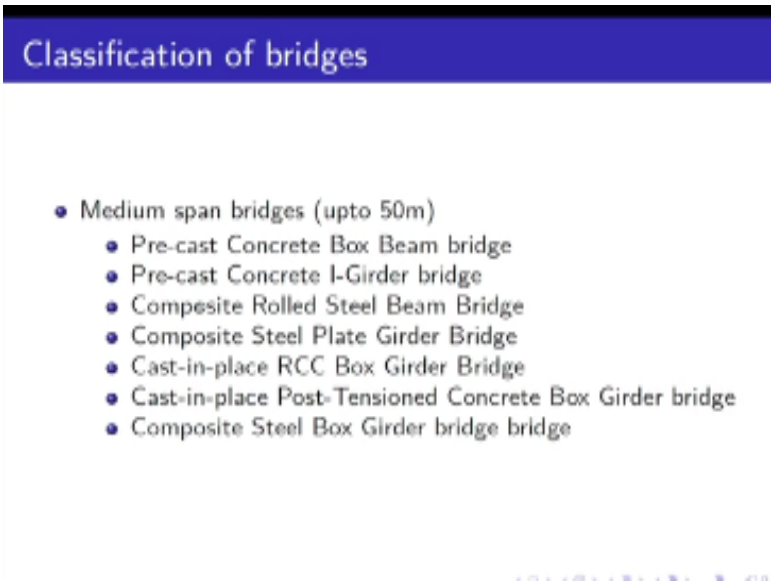

So medium span bridges I have already told you those things whatever the things are there.

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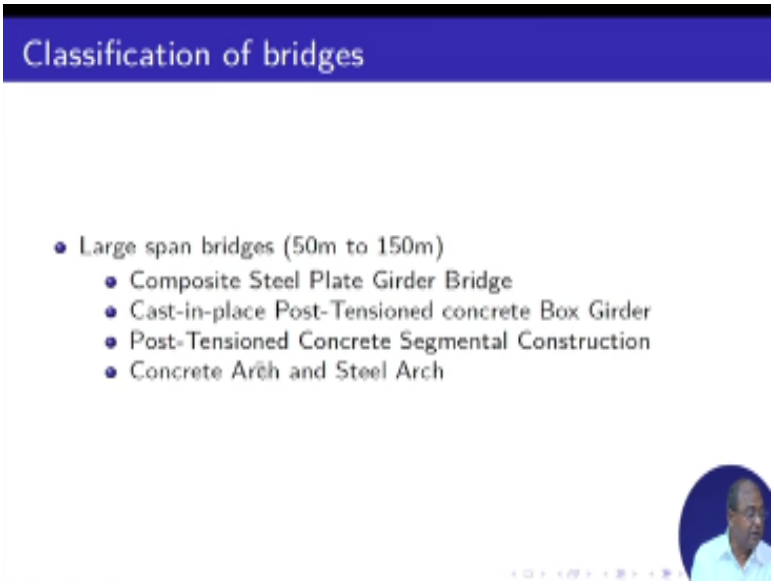

The large span bridges I have given you this one.

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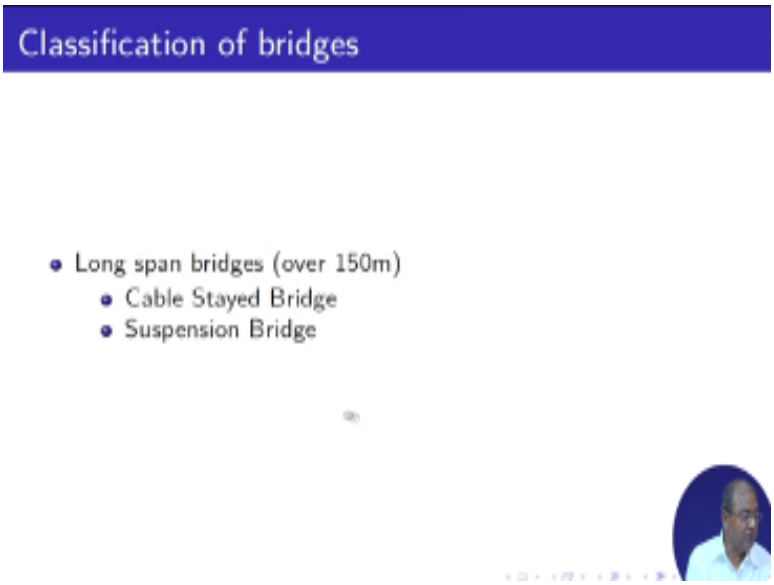

And long span bridges I have told you.

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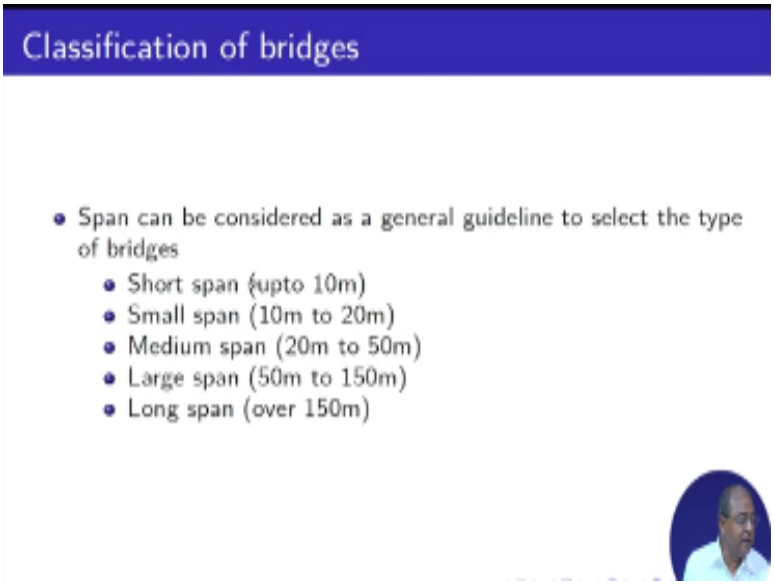

One thing this particular here that I will like to show you.

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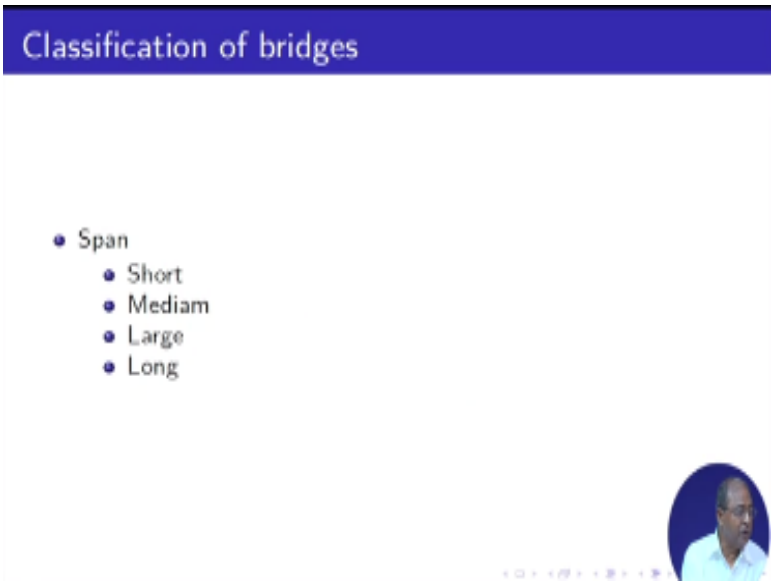

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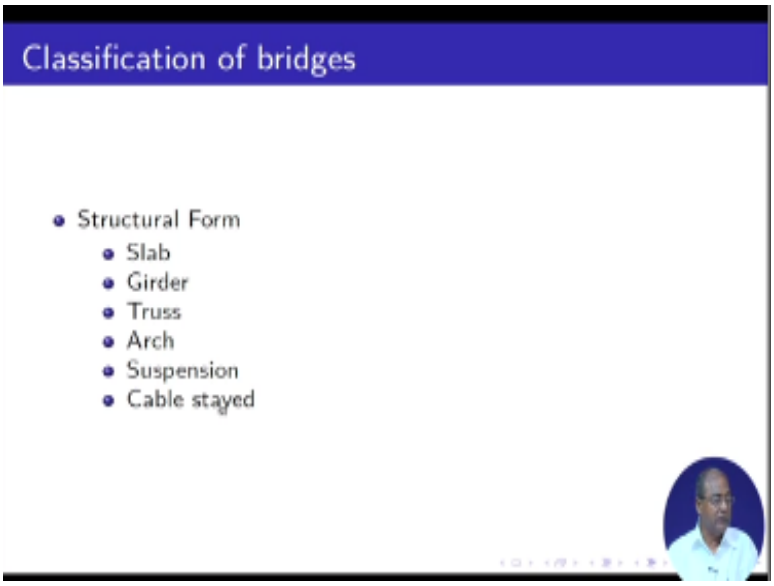

The structural form this is actually equally important that form so first we have told you that materials then I have told you that uses then I have told you the so just to give you idea is here.

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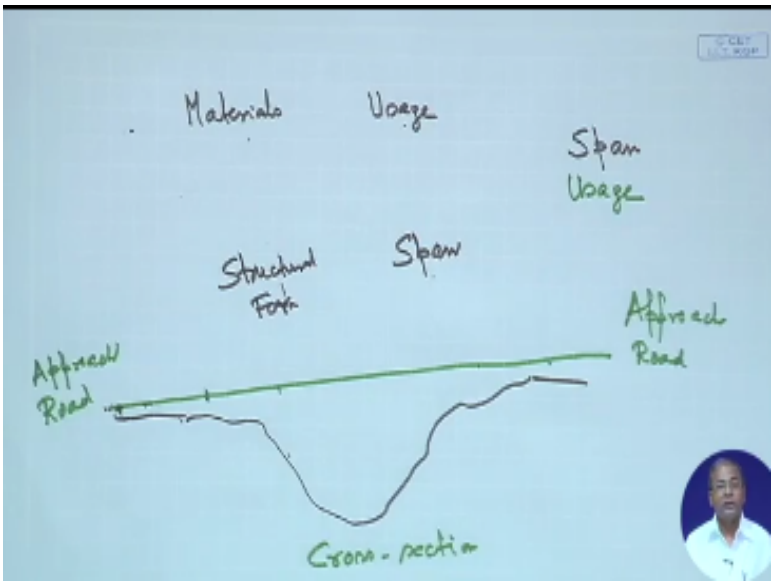

So materials uses structural form and then you are having span so whenever we are having this one so it is inter connected it is not a one that we have to consider say uses say what will be the structural form or will be the materials what is the span so that means first one that if we really consider that one say span, because first thing that it is coming in to picturing bridge engineering or bridges construction how much we have to overcome.

Let us consider this particular one here certain kind of say your that area that occur on the road is coming here and we have to overcome this particular one say can a lot over this is the cross section this may be a river and with like to actually travel this one. Now how much we shall consider here shall we just stop it here, shall we stop it here or I shall go little further that also we can decide that how much we shall go that particular one that approach road whenever you are taking this approach road and this side also you having a approach road.

So where that road will end and that bridge will start from this side also that is equally important so that means that what will be the span is that span are you going to make it a single span or we are going to make it at a say number of spans that are we going to make. That means a small, small one number of small. Small, small means again do not separate meter so then what will be the span that we have to decide. So that is why the past thing is important bridges span equally important that it uses.

So span and uses this one will come together so what is the purpose is it a state highway it is a national highway it is a village road so that one will be that one the uses. What is the purpose of

uses that for it is only for vehicles are we allowing for pedestrian in both sides or one side that also we have to decide on the basis of that then we shall go for that one say your materials and structural form.

So this two will come together and then one the basis of that we shall decide that which type of bridge we shall considering here. So that is why here you will find out the structural form that we are having slab, girder, then we are having truss then Arch bridges suspension bridges and then cable stayed bridges. So these are the different kind of that forms available for us.

So on the bridges of that we shall decide depending on the span, generally you will find out that I can say each of them having its own room that means this particular form we will behave in a optimum manner, optimum manner means from the strain point of view as well as from the economic point of view. So if you consider from the strain point of view as well as from the economic point of view if we consider that particular one here that you will find out that one that you will decide that particular once a different kind of forms you will considering here.

So each of them having own room that means if we consider bridge it is having certain place that you should not go beyond that if you go beyond that then it will be not economic because anyway it as to be same the depth of the six and you have to provide so anyway they has to be same.

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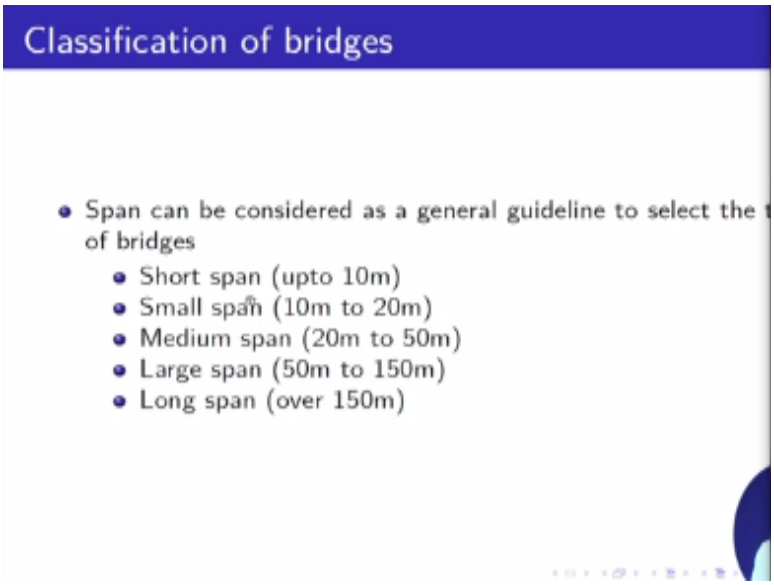

Coming to here I have told you already so as I told you this particular one here though I have told you the small one so I will introduce another one short span. Further I have classified the small to short that means I am telling 10m and then the small span 10m to 20m. Medium span to 20m to 50m earlier I have told you 50m.large span 50m to 150m and long. So these course whenever we are talking this particular one here I can say that we are talking onl7y these two the short span and small span.

If we go for medium span in that case a little more 25m if I can say there we can say that the particular these that one bridge that one will be. That is the one that you can consider large span again that particular one here we can consider, but long span it is better to get supported from cable state bridges or say suspensor bridges. In that particular course here it is very small but maximum used these two, and that is why having kept it has re informed concrete road.

Which is again the real part and only road bridges and that shall we do how to design that we will find out.

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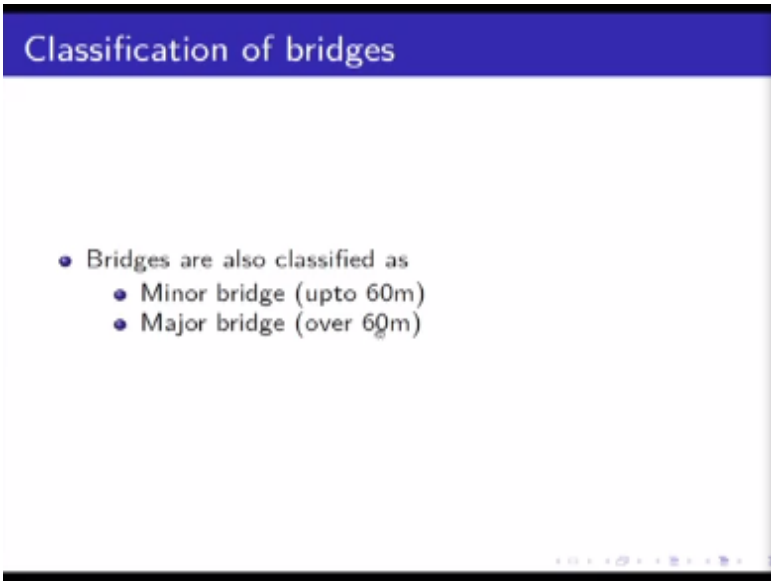

Bridges are also classified as minor bridge up to 60m so whatever we have discussed so far with so many times we are finally telling let see this has minor bridge 60m that is simple solution. So we can consider all of them say for example vocal part we can consider a slap bridge we can consider as a minor bridge and all other as a major bridge. Depending on you are situation how are you considering the bridge and also the basis of that also you can consider has minor bridge or major bridge.

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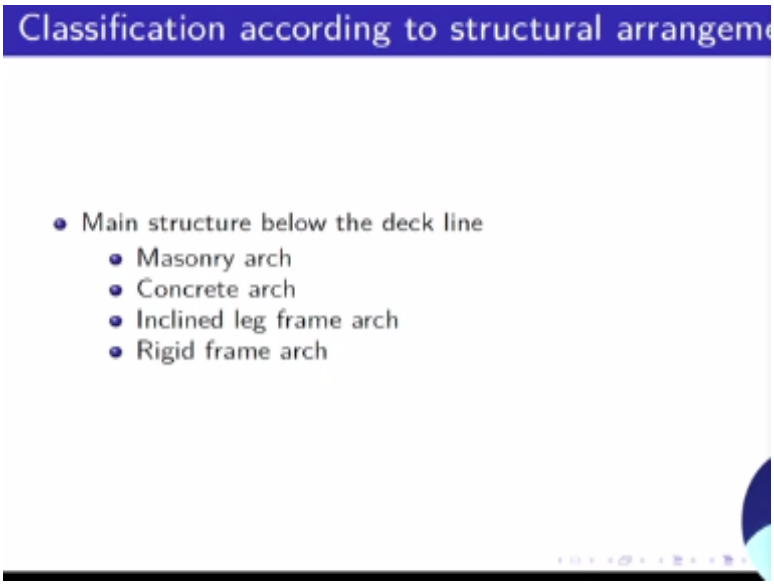

Now coming to this one I have already told you many times I have told this particular one over here that load bearing floor of a bridge I have told this is the third time I am coming to this one because the state is very important here and only you see the deck part only. Below whatever we are having that you do not see but we have to provide that. Which one we have shall provide that is actually important here.

Now coming to this one here I can say the main structure elements it is very important here below the deck line. Deck is one part and below the and above the deck line and inside the deck line that means you can say that less than zero = 0 or greater than zero. So this is less than zero you can say this is =0 and this is greater than zero. What are those let us actually see. Main structure below the deck line, masonry arch, concrete arch, inclined leg frame just to give you idea that particular one that will be easier and one can say, so this is one road line.

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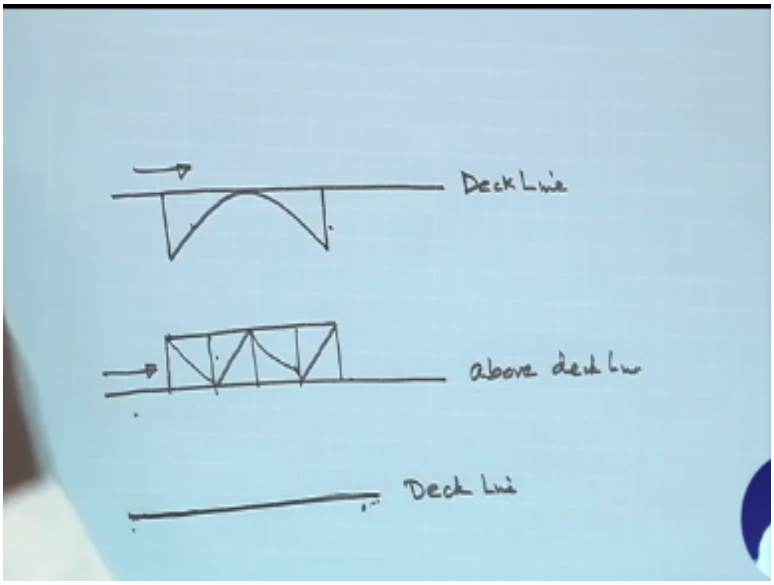

Whenever you are having below like that this one we are considering this one as below deck line. So whatever we are considering that one is here is fully below the deck line. Similarly we can have whatever we are having above this is actually above decline, so I can consider like this. So vehicles will move along this and the third one we are considering here is the deck line. So our objective in this case in this particular course we should only consider the deck line.

That means that whatever you are doing everything along with the deck line you are considering over here. There is one idea and another one the cable supported base that also you can consider in deck line. Tars bridge above deck line but we are considering as Slap Bridge that along the deck line that shall we consider over here.

Main structure deck line suspension bridges, cable stayed bridges and through truss bridges. These are above the deck line

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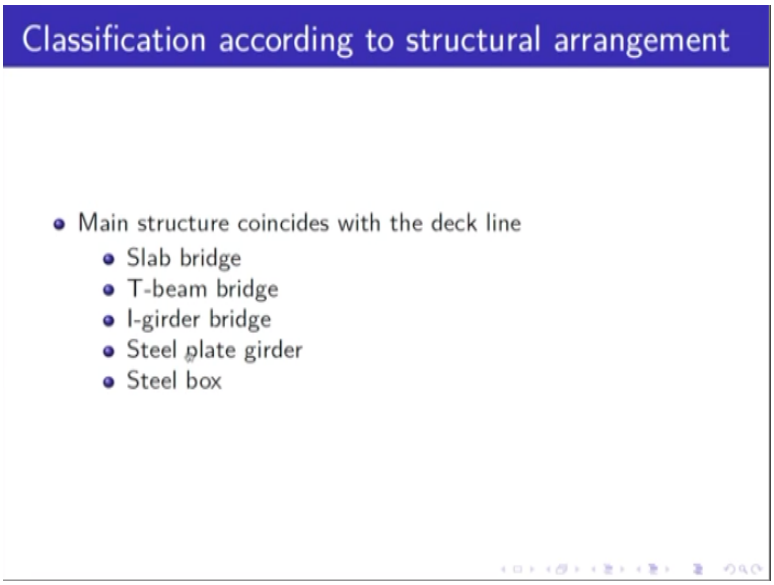

Main structure coincides with the deck line slab bridge T beam bridge, I girder bridge, steel plate bridge, steel box. This one we consider as with the deck line we can consider. So our objective here for this particular course Slab bridge, T beam bridge which is nothing but along the deck line and that one how it comes that shall we also discuss.

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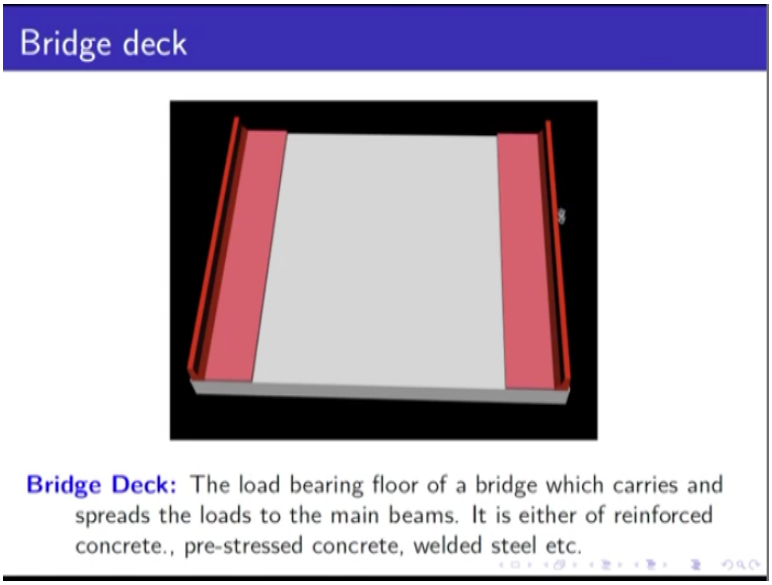

That I have alread told you many times so no need to tell it again these are the objectives the one I am telling number of terms I am telling in this figure just to give you in the other objectives that we have to find out the weight of the bride considering in the purpose and the depth of the deck this is you want but if we go for the other one that how to decide that.

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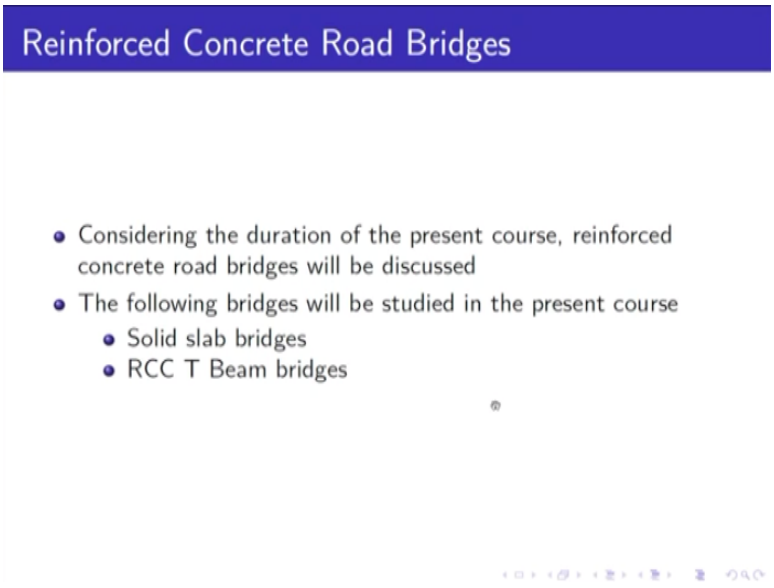

So considering the duration of the beam in the course we complete will be disussed that following we are studied in in the prevent course the solid slab bridges and the rccdvm bridges which we are consdering these are made to the one if we consider to if we no to properly I think that it is possible to other also these are very easy to the same thing will come to the studied in nothing but when the shear force axiall force and torsion because this shuld be these kind of properties and the loading will come so then if we understad in the spectrum 1 in the other port also so in summary.

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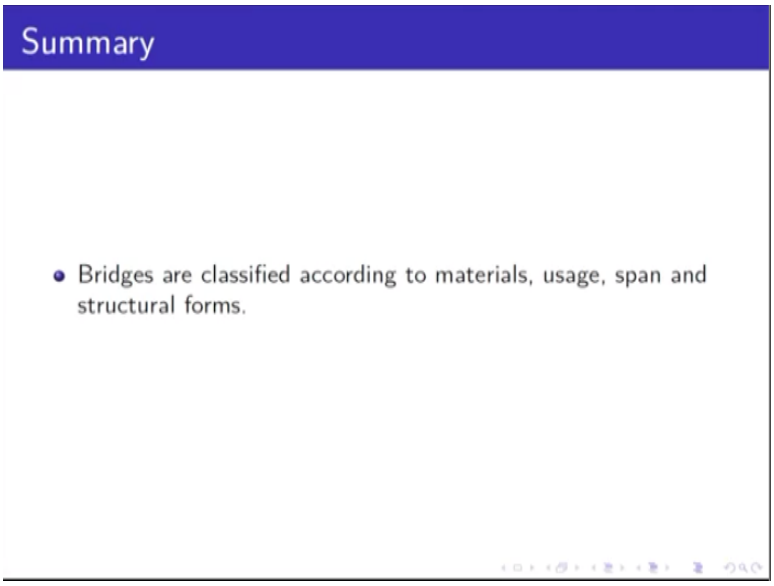

In the bridges are classified to the materials usage span and structural forms we are discussed that one that firsr one the first part of the lecture one and this lecture two like to say the the finnaly we are choosing in the inpressed confriguation it would be the bridges this one it comes up to say in so you can go twenty five meters and I have told you the brides having its own each bridge having its own road so what we can say on the room.

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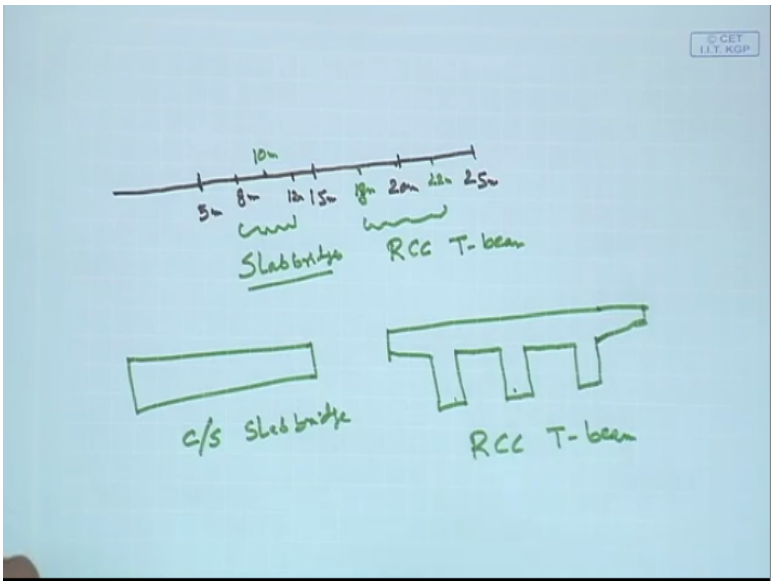

When we start from here high meyter high to the maxium high I can go fifteen vto like that I can go fifteen I can say eight to twelve meter then I having a lines to twenty meter and I shall go up to the twenty five meter so slab bridge we can go five meters also slab you can go generallly you can go team mater this is the range why the good one for the slab bridges then you consider this one may say eighteen meter twenty two meter this is a a very good place for rcc t beam so slab means this is the construction.

Then section of slab and this is the one for rcc t beam so obvisouly the question is the one how many beam will this is very important and how to the thickness and allthose things we have to decide and we have to find out so this that aware male topic here that's consider slab beams and rcc and t beam I have tell you the room for that time in the meter thsat we have seen twenty meter I can go little lesss little more and again you are axtually if that apprichihing some one go then we will brtter to go just one this is the one how I complete that which type of structural form of the particular spamso with this we again say the spectrum one.

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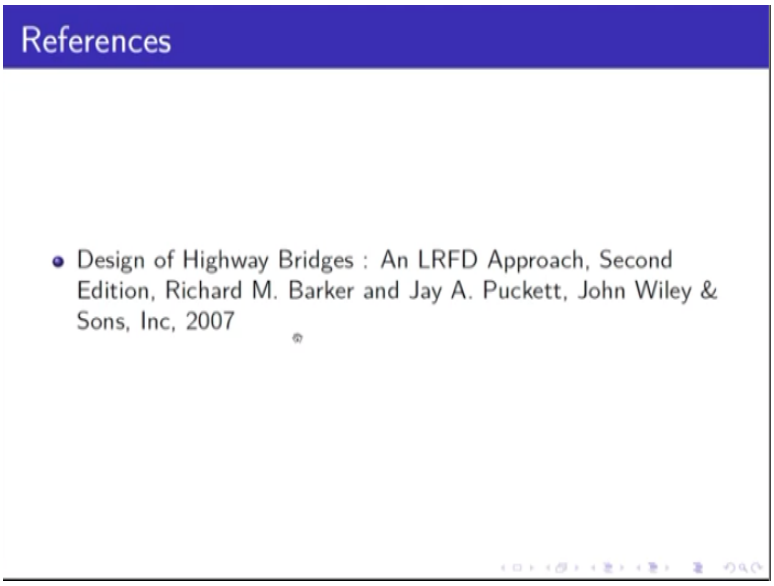

Taken from these book we have taken various an LRFD approch so we have consider the conisides in the next lecture and again you are loading its for the intence content from this we shall discuss the coming lectres with these so thankyou ver much .