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NPTEL ONLINE CERTIFICATION COURSE

Course
On
Reinforced Concrete Road Bridges

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Lecture 16: Design of RCC T Beam Bridge (Part I)

Hello everybody so we have just completed design of slab bridges and we have just introduced apartment not in detailed but to get an idea that how should shall we decide the geometric of the apartment that is more important and which comes from the mainly from the function requirement and what are the changes to be done that also we have discussed because more time that is why we were just given just preliminary idea or continuity, because only super structure design is not sufficient which would also know how to that find out that one so you see how that apartment is placed.

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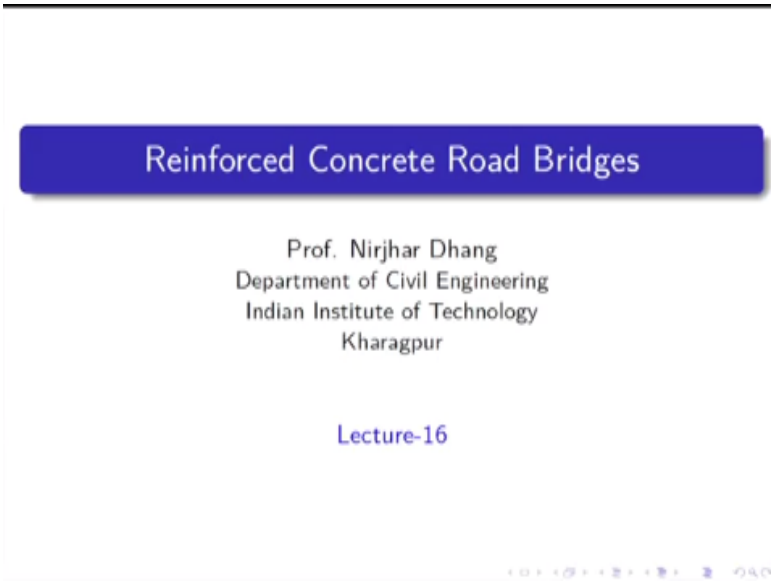

Now coming to this one the last one so over this course concerned that we are considering that one that topic that is your RCC in these bridges, so we are considering this one in your lecture 16 and that you have considering here and then we shall discuss.

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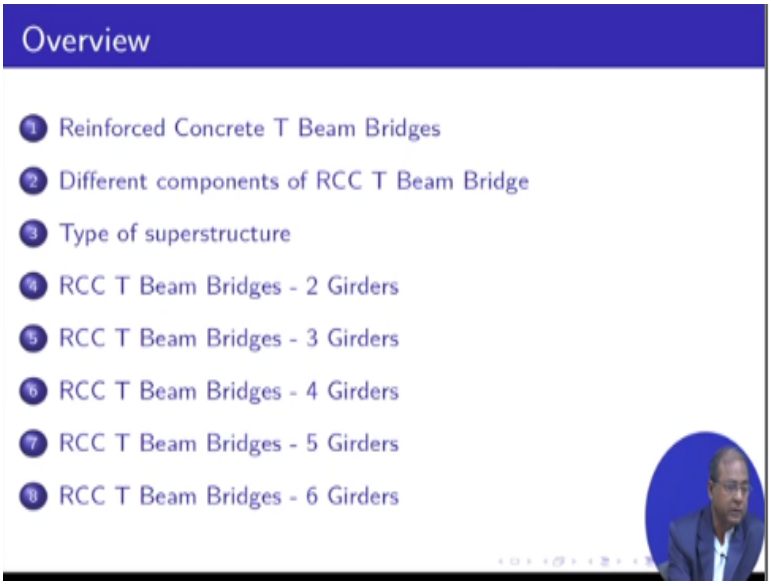

On the reinforced concrete T beam bridges we define kind of thing all those things we are just given the sketches that we shall given that want to just we compare I shall tell you why we require so many and that one.

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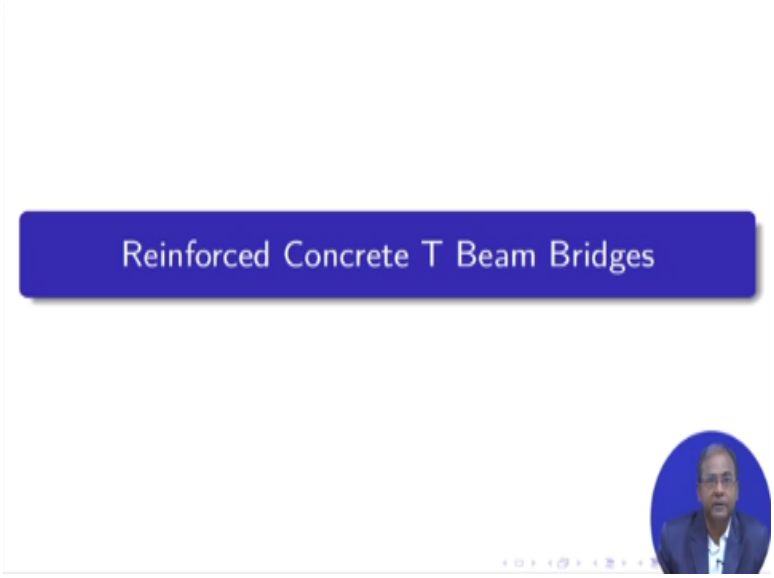

So reinforced concrete T beam bridges that is the one topic we are considering and again here we shall consider the basic these are in philosophy and this is geometric whatever we required that we shall discuss now in this lecture.

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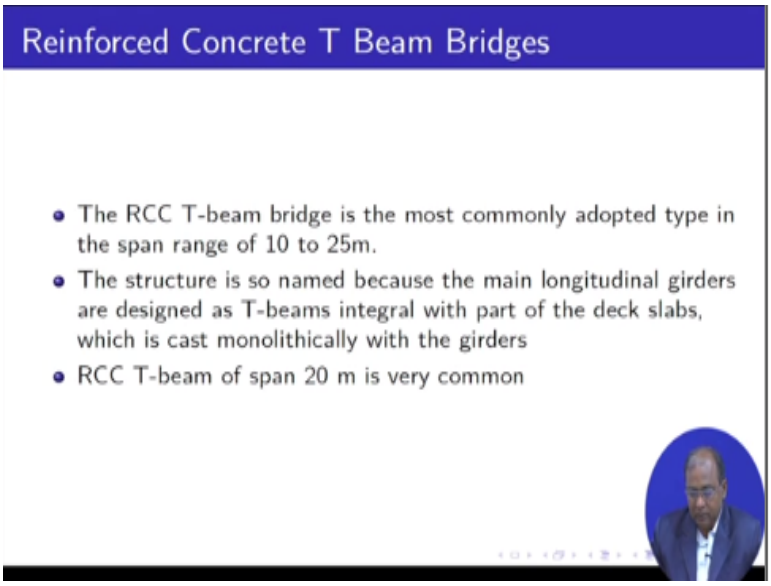

RCC T- beam bridge is the most commonly adopted type in the span range of said into 25m, as I have told you this particular one here whenever we consider the slab bridge so the comfortable in span we can consider that one say 8 to 10m let us say for general purpose 10m for the design of slab bridge and we find out that 20m most of the cases in different cases we will find out that more RCC T – beam means that is actually 20m that one, in few cases you get little bit more or little bit less you may get it.

But that is as per the site requirement that is why either trunked in that way that is the general way we find out here the structure is so named because the main longitudinal griders are designed as T beams integral with the part of the deck slabs which is cast monolithically with the griders RCC t beam of span to 20m is very common, so this is the one that we can consider and find out that here.

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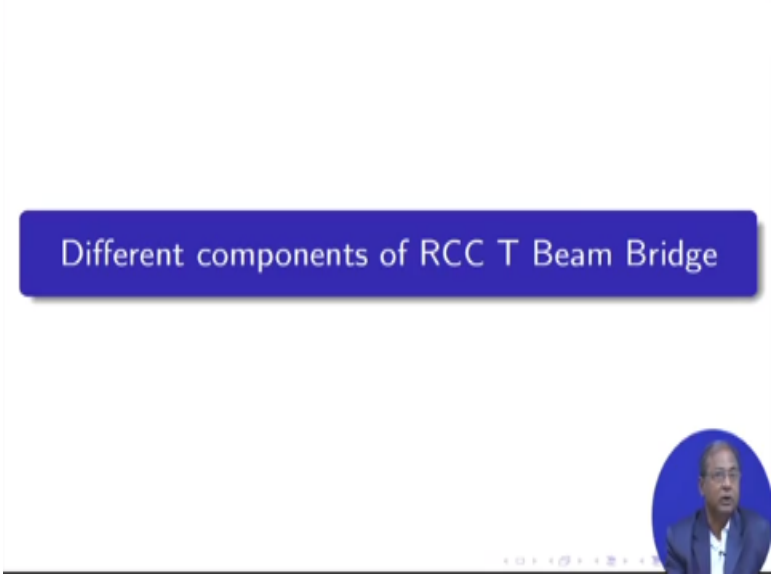

So let us see that like that previous one whatever you have given, so let us see the different components of RCC T beam means you know whatever we are having so you can consider that one here.

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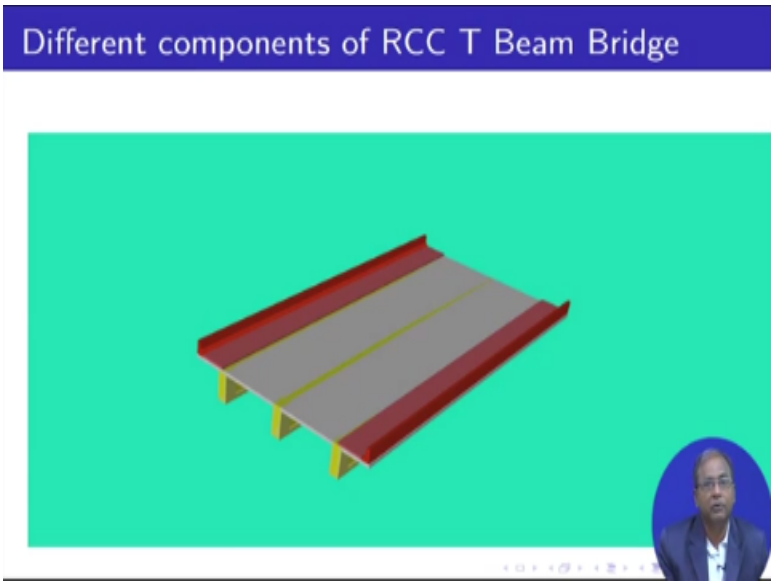

So let us see the different components of RCC T beam means whatever we are having so you can consider that one here, that you can find out in your say that again we are taken a single span and we are having two apartments and we can find out this one in two ends we are having cross here this is the one we are having that your said okay, carriage and this is the big which is to be supported and we are providing here the super structure, so you can consider compare to the slab, slab is where it comes something 800m.

The last one we have even that so on that one is that one say you can did 50mm that we have shown, so here whatever we are doing here this deck part the major one that we can reduce the deck of the slab that is the one objective and then would like to provide this your say that grider, like that you can see another view we can find out that we can see this is the other one from the bottom that you can see that how it comes these particular one how it comes this one just to show that one there are the few.

That how it comes this particular one here and so this is the view just without your say footpath we can find out this particular one here and this one all coming together all of them just to given that one to give an idea that how it is placed.
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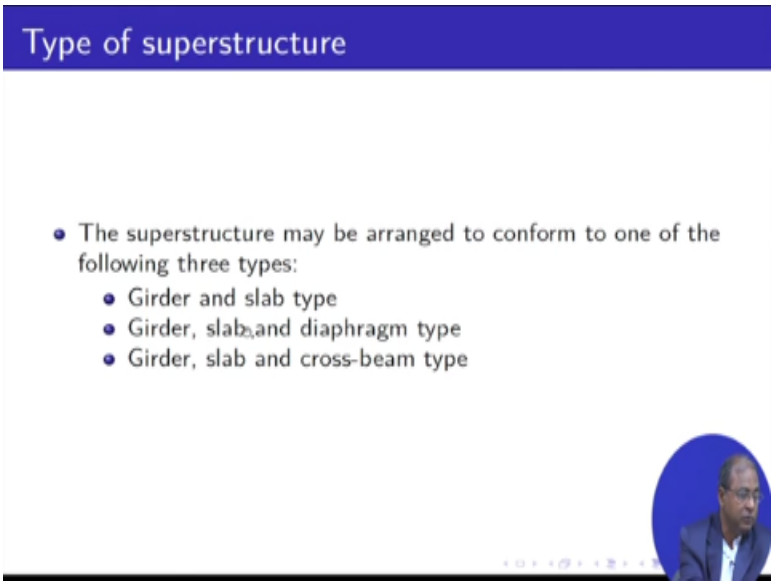

So coming to that one here we can say the super structure mar be arranged to conform to one of the following three types grider and slab type the one which we have shown in that this one only grider and deck nothing else, so this one only grider and deck so that one we are considering here that particular one we can say and now next one we can say grider slab and diaphragm type and the other one griders slab and cross beam time so these are the different cases that we have and now would like to find out the geometry of the bridge we can consider that.

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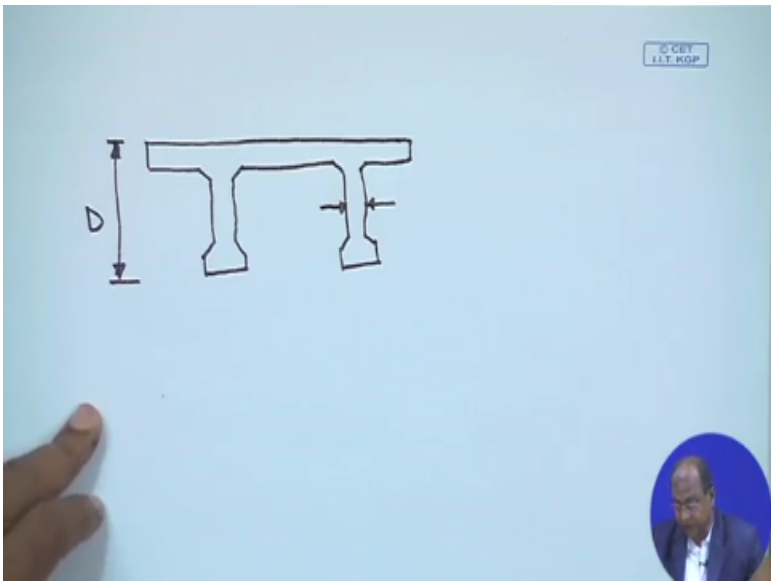

We can say that just I am drawing this one, so let us consider this one here RCC T beam bridge if we consider that we are having so many say your band so you have to mix certain dimension and here that is actually important here so we can find out this one that has a very overall depth that we can take it the overall deck at the bridge that we can find out this particular one here just for reference what I would like to say here.

More considering RCC T beam which cast all together just for information I would like to say that RCC T beam that is also in equally for civil and that one let me use it in some other paper, so that we create the.

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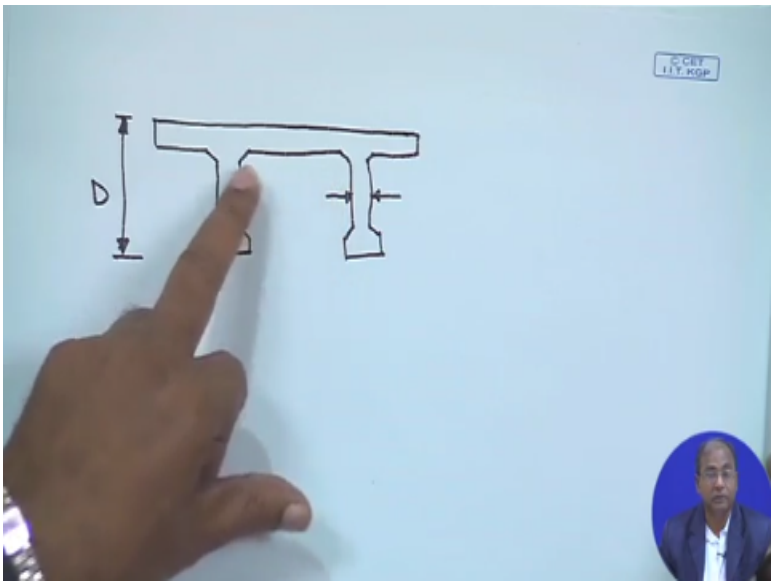

One we can say like this and then another one, so what we are doing basically here the difference what I mean to say please note what I have drawn this figures let me show that figure other paper first if we consider this one there is no line here with these we need to say that these all together actually cast this one on the same base and time both of them actually a cast.

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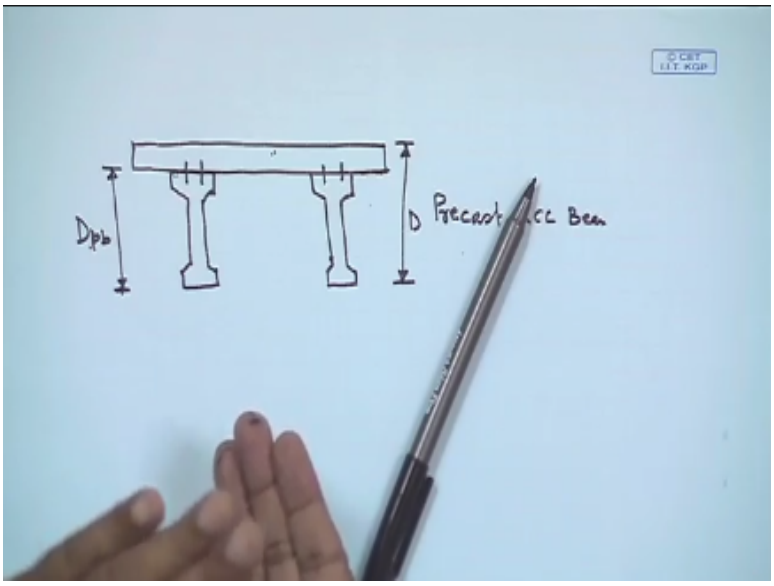

Whereas this one whenever you are giving this line we need to say that this is actually a cast earlier so that is why we call said pre cast, RCC beam and then we are placed and then over there big cast so these are the two back we are consider these is just for your information that this type of actually or main objective that to give information what are the things available here what is the difficulty here whenever we are considering this one here so I can say here I say depth of pre cast beam and this is the overall depth.

So how can we actually this one because this is the one we have already cast this particular one that means here these deck actually just transferring the load desk is not participating to resist that your say moment the desk is not participating, provide it we keep sufficient bonding encourage here then only it will work together that means in other way what I mean to say that whenever you are keeping one after the another one.

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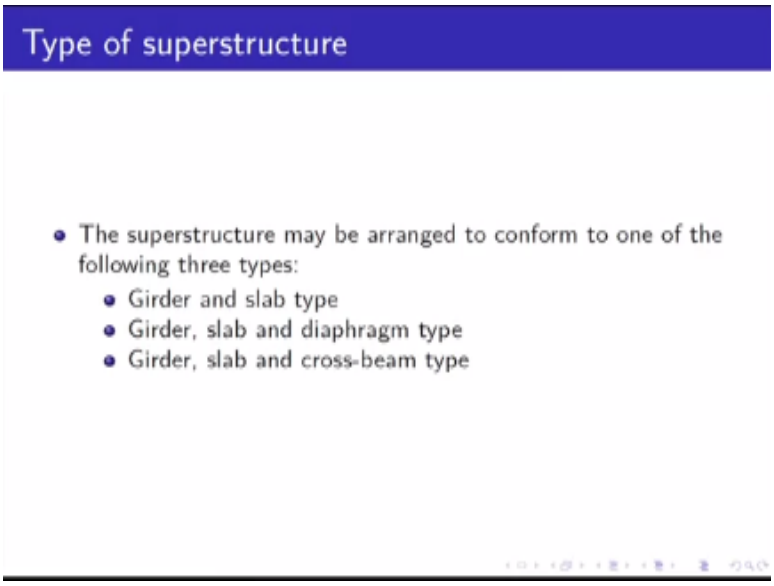

Whenever you are keeping one over the another one here like this that means it may slip this particular one may slipped so if it slips then the top portion will not contribute anything on the strength actually it will just simply transfer the load, it has to be taken separately that one this is the one actually that particular one is separate one that we should consider here.

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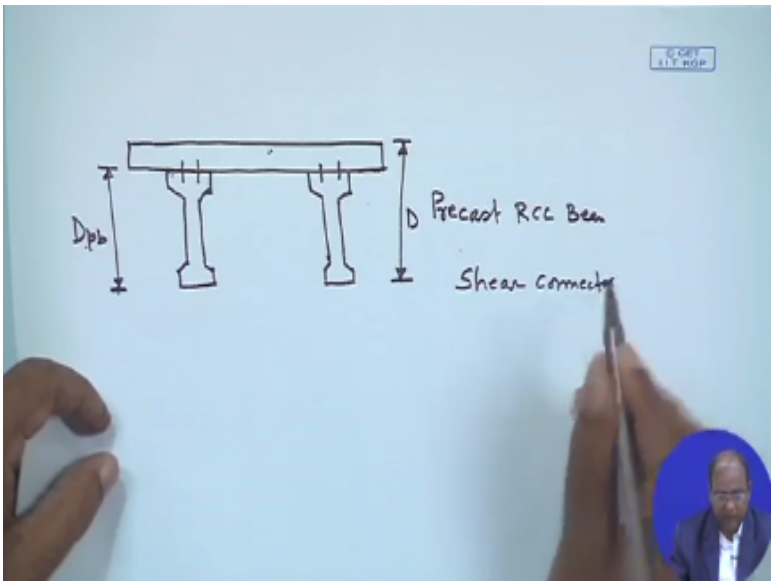

That increases concrete and your say steel concrete composite there also you have to considered that this is called actually just to you reference that one say you can say shear connector this is just for your reference I could say. So we are coming back to this one also now it is also very much popular because it will be very fast in construction that way actually because you are doing that features.

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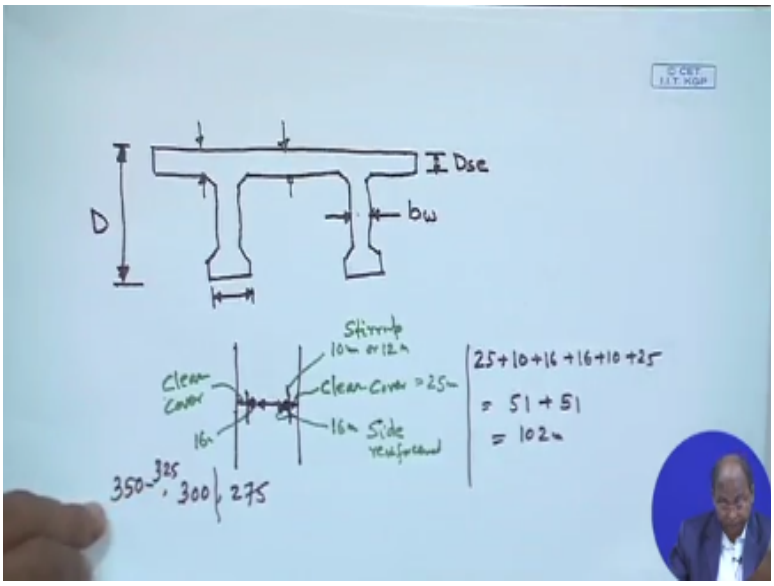

Because earlier days we can see that picast means only priest concrete but nowadays reinforce concrete also priest things are available. The next question is coming here what will be the bw, so overall depth then bw then this one this depth here support how much will be this one so those things are very, very important this dimensions all those things we have to find out so that we have to find out and that we have to provide.

Now how way this side this one here there is now general tendency that to reduce that particular one but that should not be the case we should not do like that how can we decide that, one way we can consider here so we can consider here like that there is a side reinforcement and stirrup, stirrup and side reinforcement this is the one we are having so this one say clear cover and the other one also we can consider so clear cover this one we shall provide that these two we can make it here clear cover.

Let us consider this one we are giving side reinforcement maybe say 16mm, 16 or 20 that we shall find out this one we maybe we are giving say 10mm or 12mm like that this side this is stirrup here also this is 16mm that one say side reinforcement it may be 12mm also, so if we consider clear cover say 25mm so we can find out here from one side let us take so 25+10+16 I am giving it maybe 12 also this is this side from other side we are having again 16+10+25 so we are getting here this side 51 and then we require something more.

So on the basis of that we have, we can decide that what will be the width of that earlier days we used to give in the range of say your 350mm then 300 or 325 and then we are having say 275

that one but it is better to go for actually the span go for at least 300, 325mm that things actually pay for level this particular one here that we have to find out and that is also from that CR or through or the end that we have to do it. Now since it is simply support beam.

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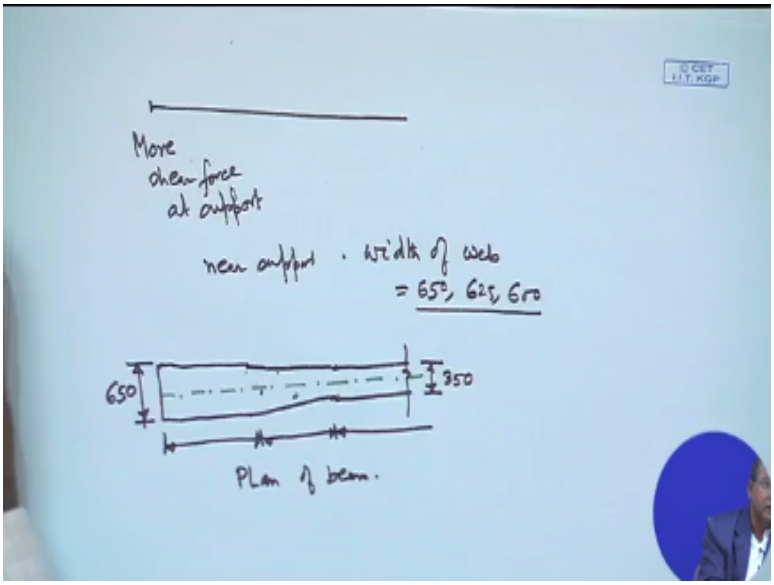

Since it is simply supported beam, so at support you will get more shear force our objective is that more shear force so that means here if you provide then at all was things here than in support that you will require more, so that is why in near support the width of beam that web it may say your say 650, 625, 600 like that it can come. Now this is your that requirement because web from when your shear force that particular one they are on the basis of that actually we get this particular one that you have to avoid.

So coming to that one here if you see the plan of the beam so this is say let us consider this one say 650 let us say, and then somewhere I am getting that one say let us say 350, so here I am getting 650 so that means here from these point to these point there should be a lope 1 because this one I have considered 350, so the next question is coming how much will be this one, how much will be this one and rest of that whatever it is, so that means this is the plan of beam.

So this one just to give you idea we have not shown that particular one here this figure if you see on the screen.

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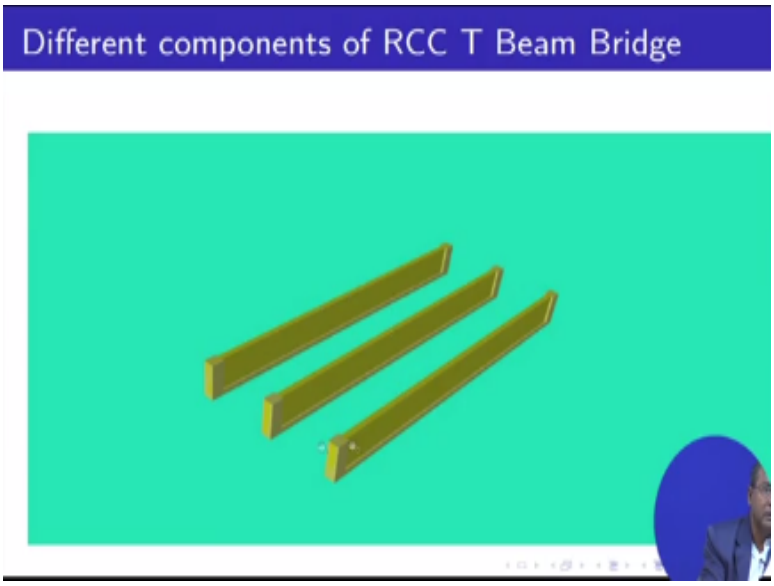

So you can find out here whatever I have given here that see this one it is going here, now here I have just not that one actually it is suppose to be here slope also just not abrupt just to give you idea that one you should not be abrupt here, so this one you can consider and how far we will consider that how much so obviously these length is dependent on the shear force.

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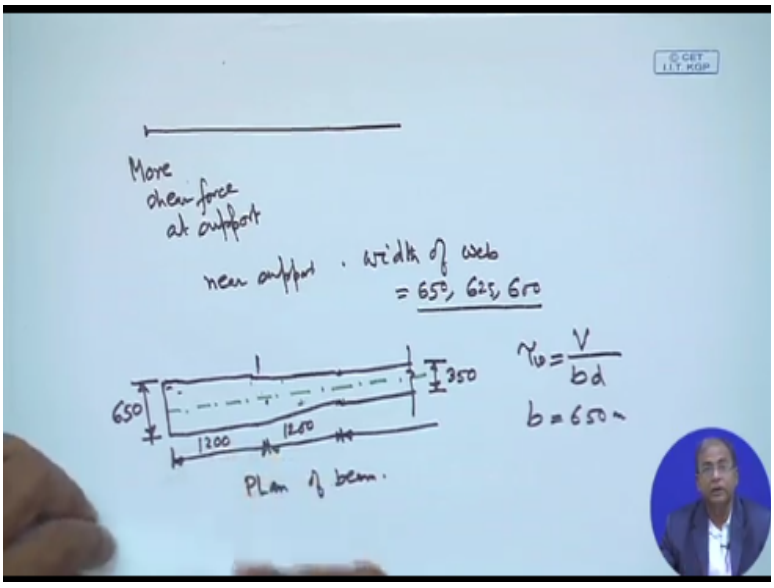

Bbecause this is 650, so τv= say v/bd and where b= your talking say 650mm, d whatever it is also. So that means this b is divisible by τv that particular one so that is why we have to provide that over all width of the beam in such a way, so that it can resist the shear force at that particular point, so that is very, very important here. generally it comes something in the range of say 1200, 1200 like that actually generally it comes that way and 650 which maybe 625 this one is 600.

Also that particular one we can consider here, because main thing what I am mean to say that your objective is to see this problem before that there should be certain kind of design philosophy and that way you can consider that one it should be consist that will one unit sometimes you will require this may not like that, you make a certain value which will give an idea whether it is alright or not.

So then it will be easier that one with that shear force that one should come within this range that is should be able to stand within that range, because we should check the section 650 and next session we should take the 350, so within that zone it should come alright then we can see. Now another important part, you know this is the basic thing that I would like to say that 650 or 625v whatever we consider, because sometimes you can say that your concrete great actually, so that way you can get the particular one here. Now next part I would like to tell over here this is the one the basic geometry I have told you in the end part I am telling you and one more important point here.

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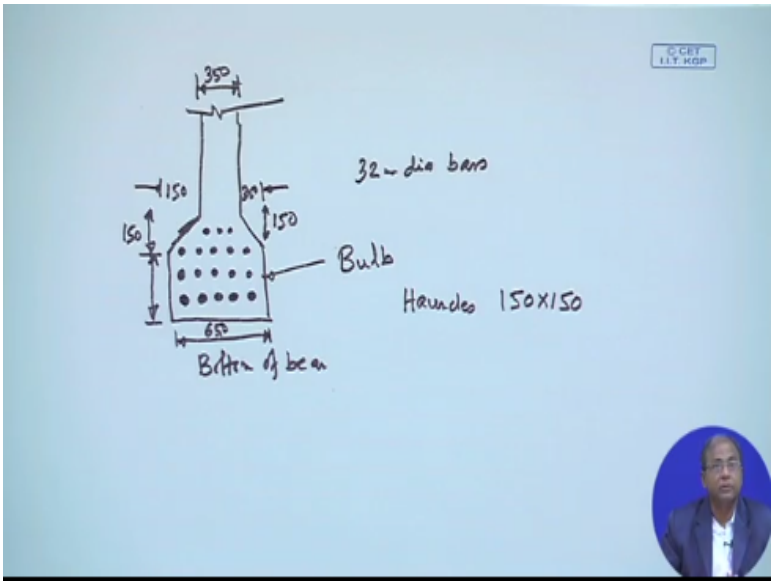

That we will see here, this is the bottom of the B and you have provided the enforcement. Generally you provide enforcement like this, there is 5, so like that it can come, nearly we will provide say 32mm dia bars, as you can see that in the bottom here we are providing the enforcement, to accommodate that is why we are providing this bulb. So this is your another important one you can get it over here.

Then how much will be this one? Here also you can put it, how much will be this one? So like that, let us consider that one as 650 or say this one 350, most of the day you will find out 650, 350 that is 300 and this is 150 and 150 and this one also, so on the basis that we show all the, we generally provide 150 x 150, this is the one that we provide and that we will show. That means in your first step you need to provide that one and that will goes with the width of the wave.

And that one we can consider the width of the wave we can consider over here and then the next thing coming into the picture that is your say analysis.

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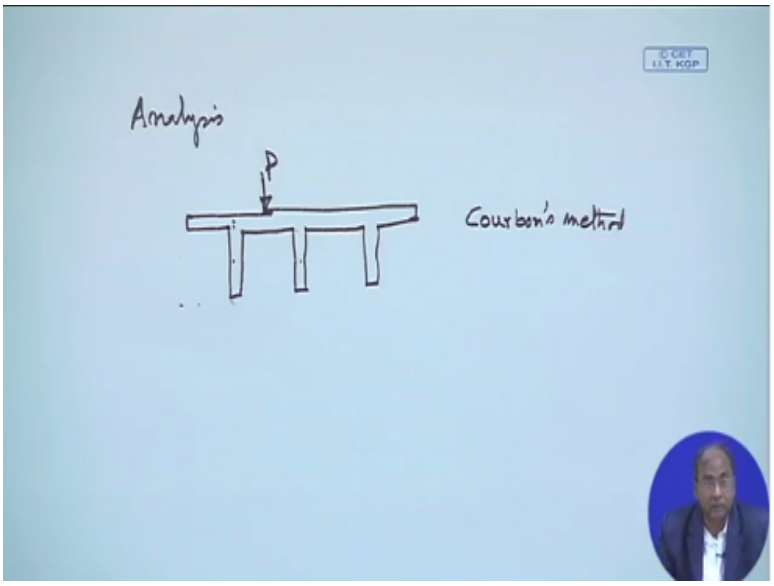

What can we do here actually analysis? One way we can consider this one has beam element and fine element but other one whatever we can do it here? Whenever you are having this B, if there is a load P, so that load how much load will be distributed that much, that we can consider, that is called Courbons method. It is a very old method and with that you can find out and you can see

the result, that you say which particular guard will take how much load that we can find out, that we can see.

That when we shall solve the problem that we shall check and we shall see that particular one over here.

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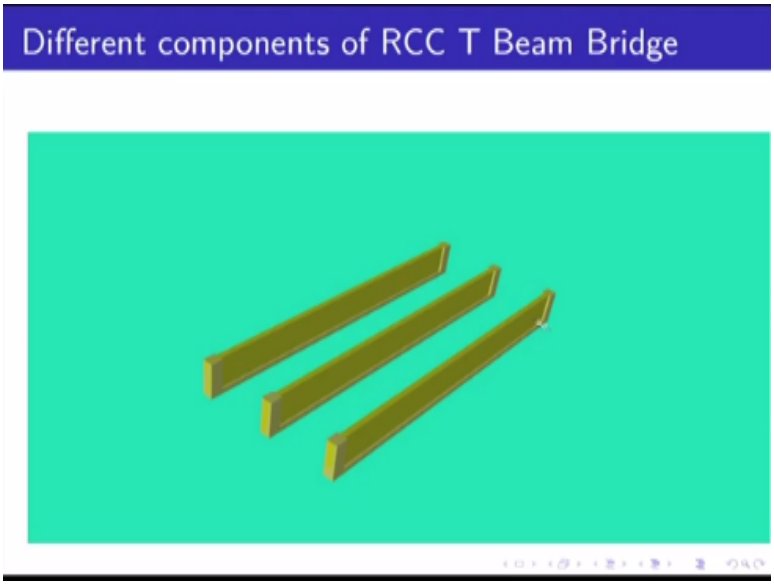

And with the different loading and other things we shall consider over here

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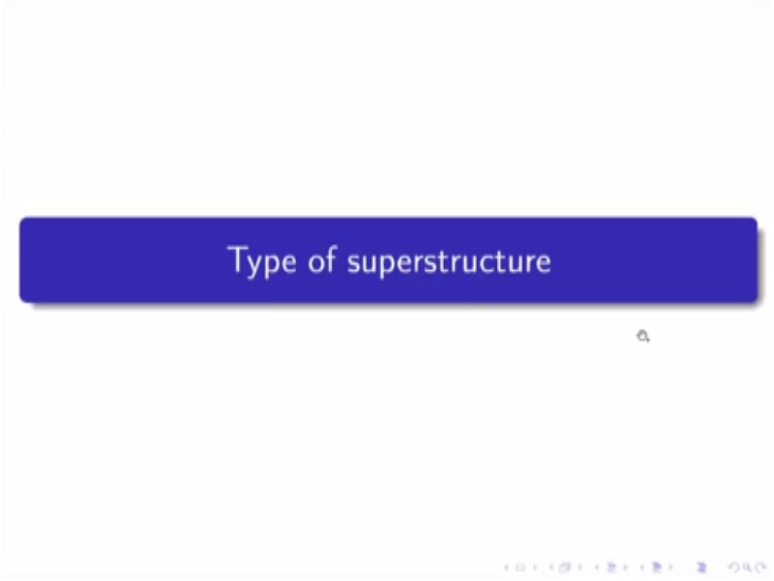

Because my main aim objective over here, first you should know what is the depth, the depth part I have not yet told, depth part is also we have to consider here, how much dept we have to consider here that particular one here, that span by 14 and 15 like that we can think of it on the basis of that we can find out and we can check. I have told you this particular one.

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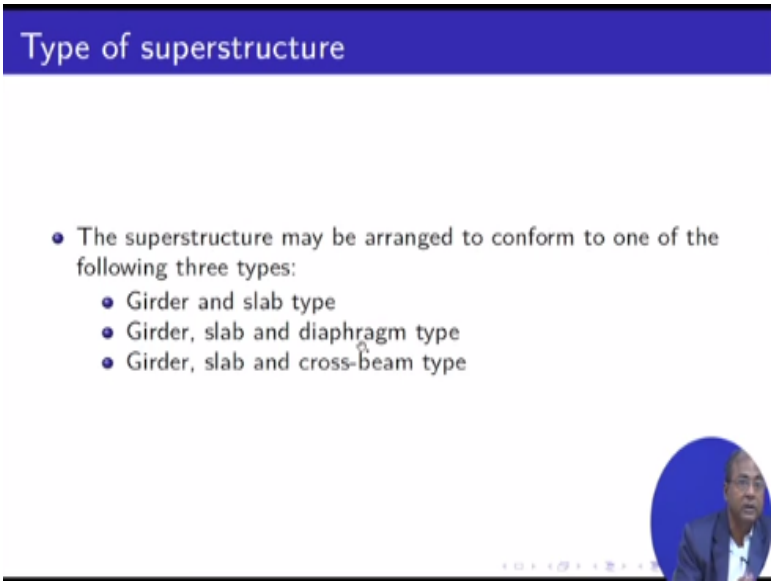

Girder and slab type, girder slab and diaphragm type means you are giving two ends that two ends will give you the diaphragm other one will get intermediate cause other also. So that it will not actually buckle that literally, so that particular one we will consider.

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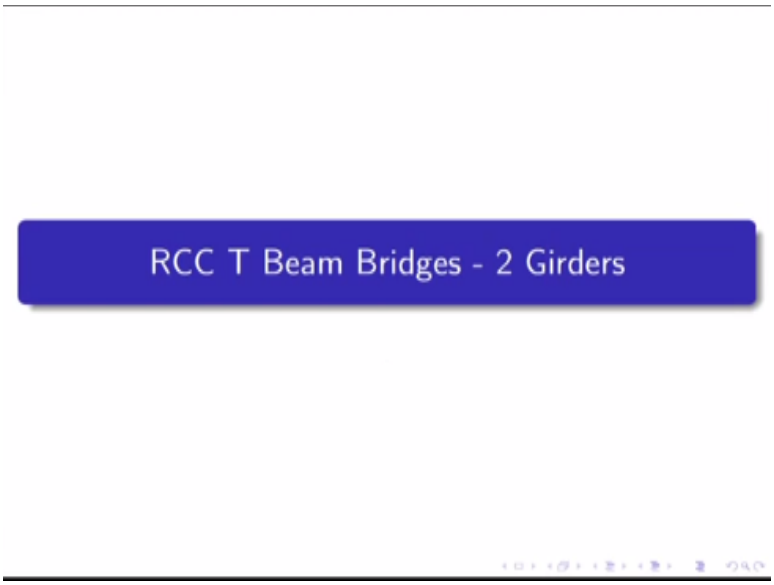

Now just quickly let me show few of them, because why I am taken this particular one here.

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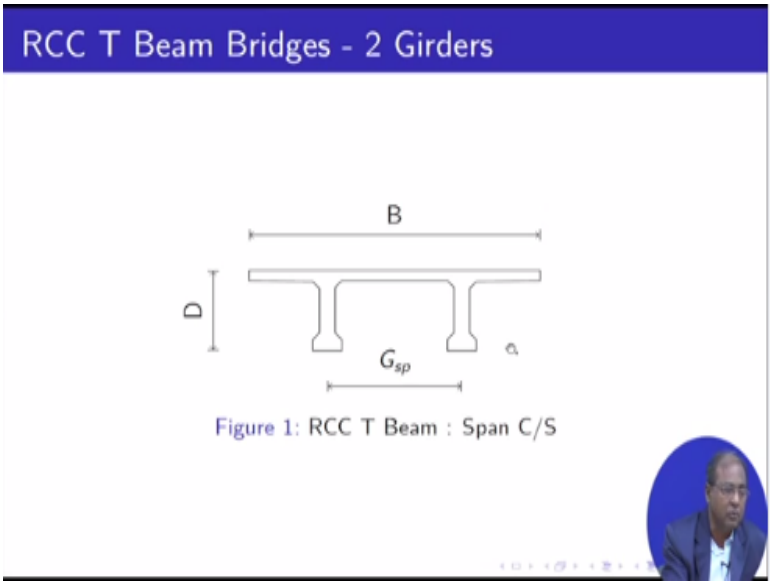

This is the overall depth b which includes actually rallying, car, carriage way everything that is one the physical one that will accumulate all of them how much actually casting if you have to concrete that is important over here. Then spacing of them and the D and depending on the situation you can find out that I have given you one that you say the two guarded that bear minimum.

You can consider I guide also providing that you having the depth, that way also you can design that one, may be for the parietal purpose that you can do it. Minimum two of this is affordable you can consider that. Span cross section, that main span if you take the cross section it will look like this.

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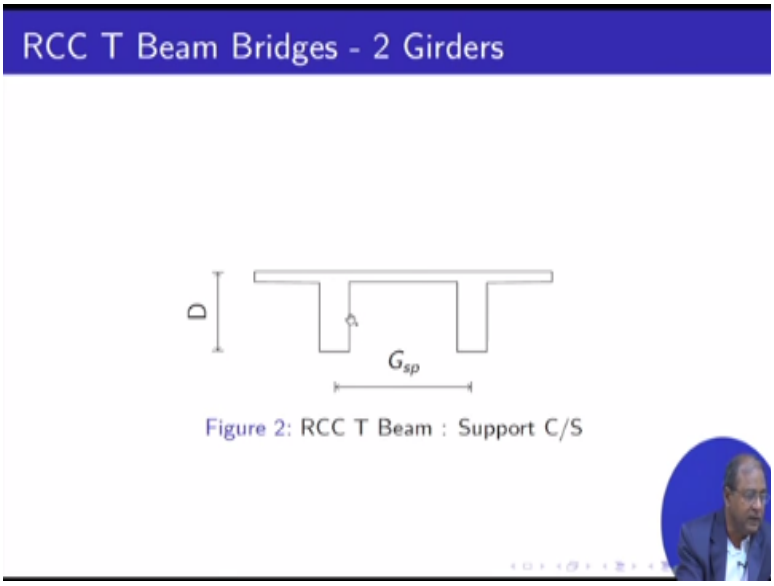

This is the one I told you that means this section is coming under the 350, where here it is coming as 650. So this is the one which support the cross section that we can get it here and from this two ends because what I am trying to get B and C at the end, the depth of the slab, that means her the particular one here, from the center line the bridge, you can consider this b_s , that is the support. Similarly this bs one will be same, the only thing we have to provide is this section we have to provide.

So that means here we can find the conclusion that we can find out, so this one is having the layer, so both of them will have the conclave layer that way we can consider. Now question is that one, now you say let us say go for that one 3 girders, 2 girders, because all of them depends on the number of the lanes. How many lanes are there? And another objective is that how many lanes you are providing? And how many girders are providing, so that you r depth of the gride will almost be same.

So that it will be easier, whenever we go for another thing that you should have 1 and it is always preferable that you say the Pr 2 of at the same level, when the you say when the bridges are coming here. Here we can say, if this is the pr then obviously the depth of the girder this side, depth of the girder from this side it will come same, this one will come same here. Otherwise if you are having the different depth, then obviously that you have taken this one. Sometimes we do it but not always, that we always avoid that one then what will happen this, whatever comes

from this side will have one seating and this side will have another seating that is the one we have that one problem. So that is why I am telling you that 3 girders also that

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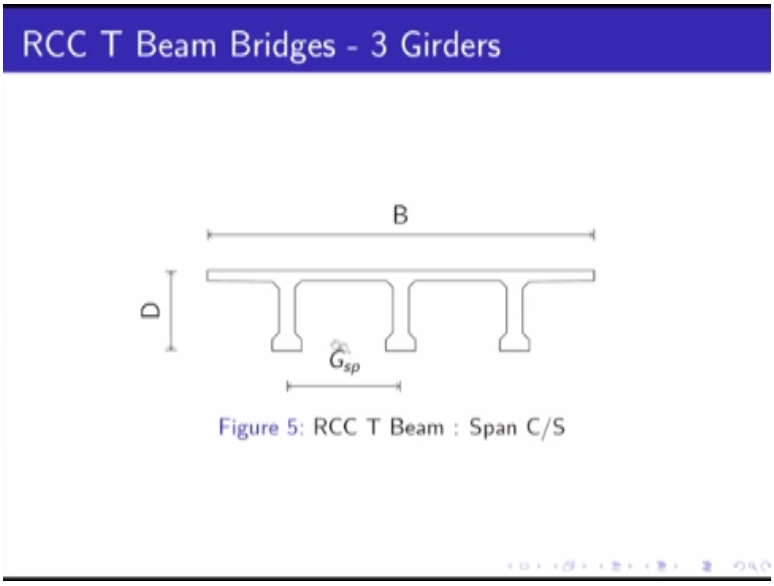

Figure 5: RCC T Beam : Span C/S

B sp that one D AND n for span support and then for that we are having one intermediate also because in this case we are having intermediate, so we have got this particular one say intermediate that you have to do it, because other than that you are only having the conclusive one your beam table also will be more than two.

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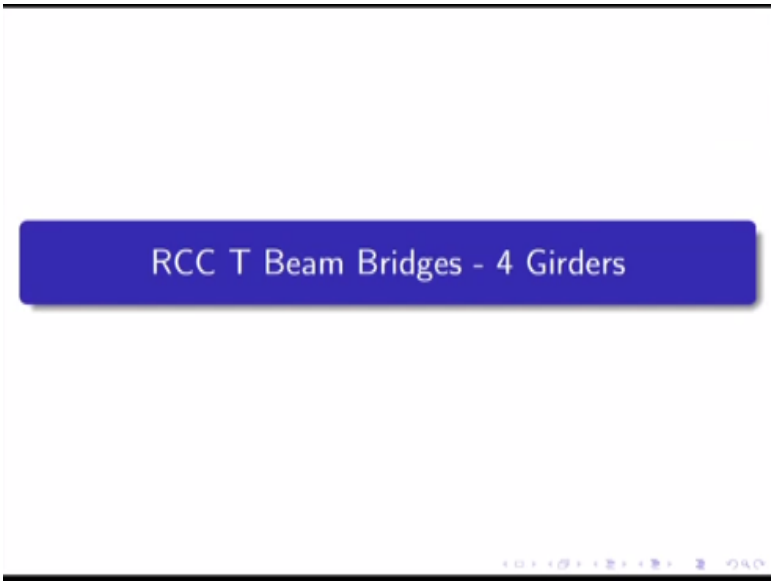

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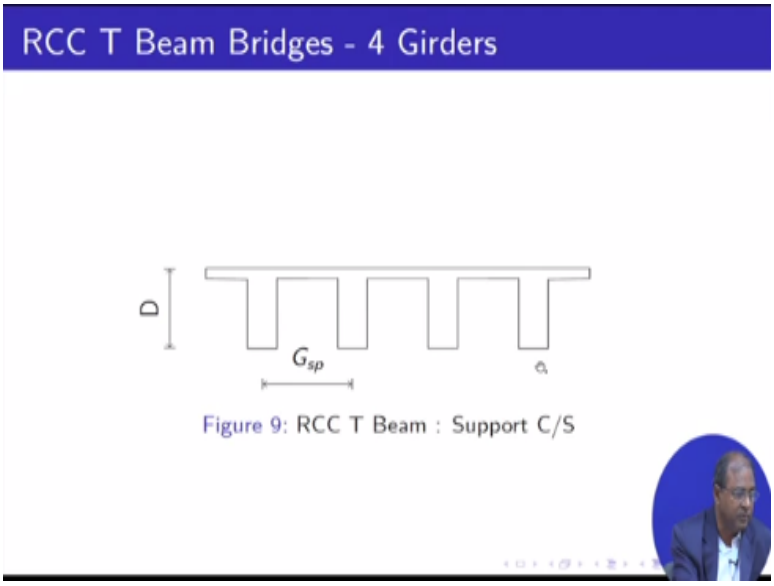

Figure 9: RCC T Beam : Support C/S

Similarly you are having 4 I am coming to say that you have check in a such a way depending on the lanes and loading we have to check with that you should also get D tht is the one you can make it you actually go for the number of girders that we can find out similarly we will go for RCCT support that we can find out.

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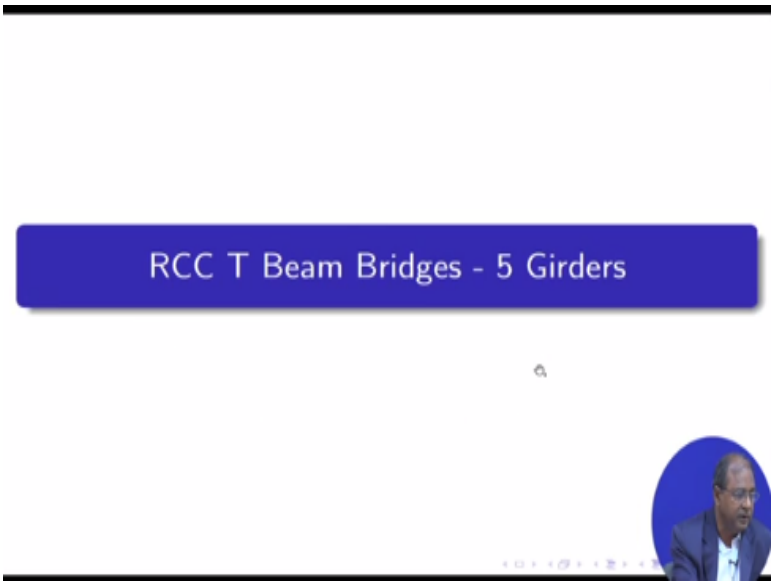

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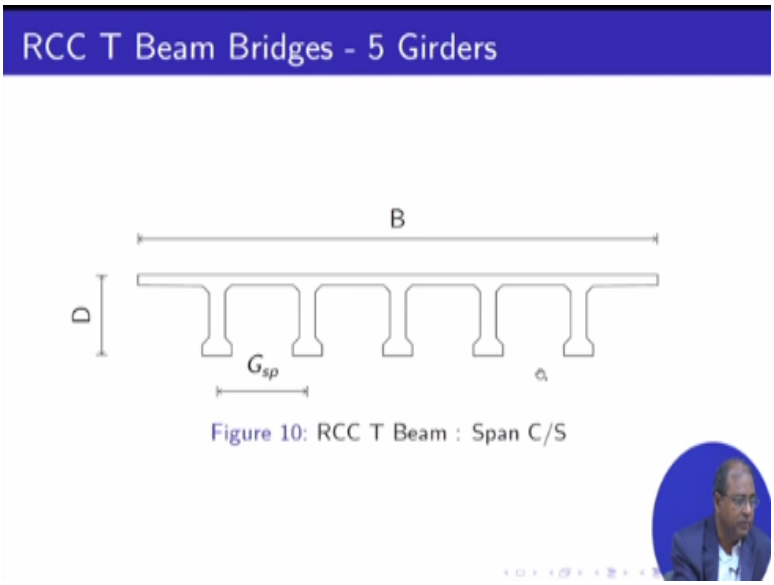

5 girders again we are making in that fashion then support.

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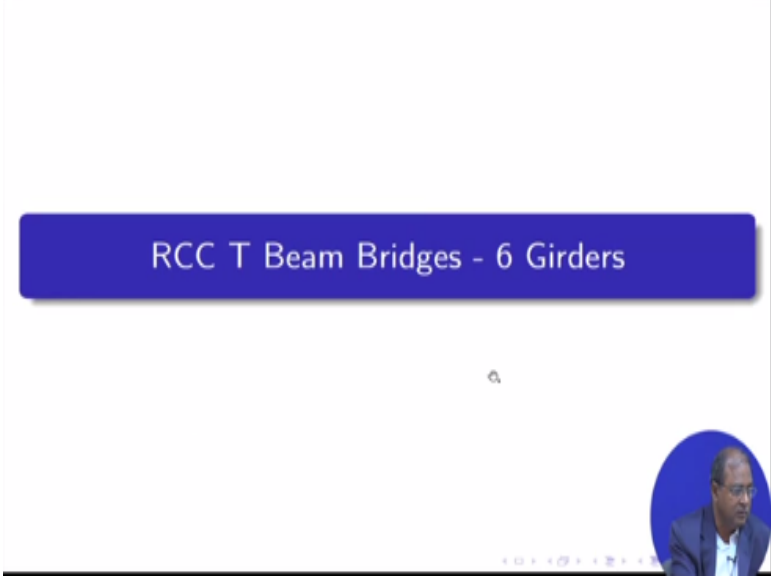

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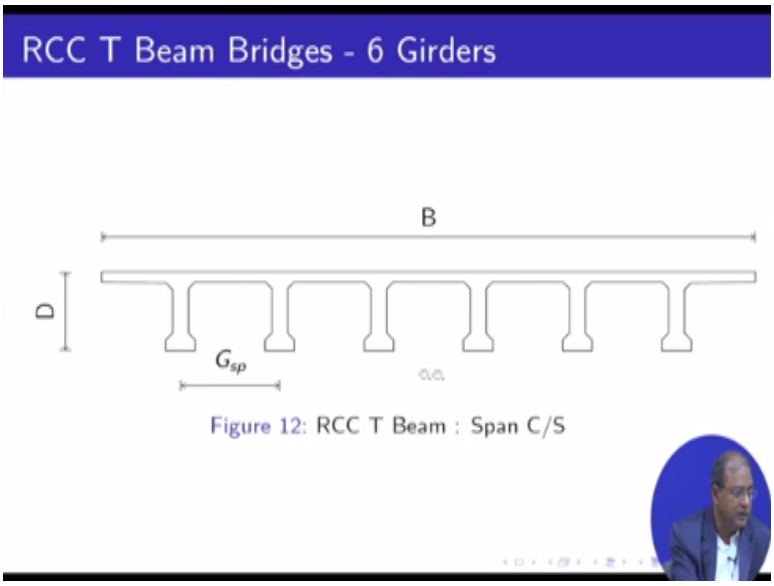

6 girders most of the cases generally not required anyway the span depending on the number of lanes we require that one. So in most of the cases it is same 2, 3gridres like that all those thing, so that it will be easier for us to conclude that means the same depth we will get, so this is the support that particular thank you very much.