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NPTEL ONLINE CERTIFICATION COURSE

Course
On
Reinforced Concrete Road Bridges

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Lecture 17: Design of RCC T Beam Bridge (Part II)

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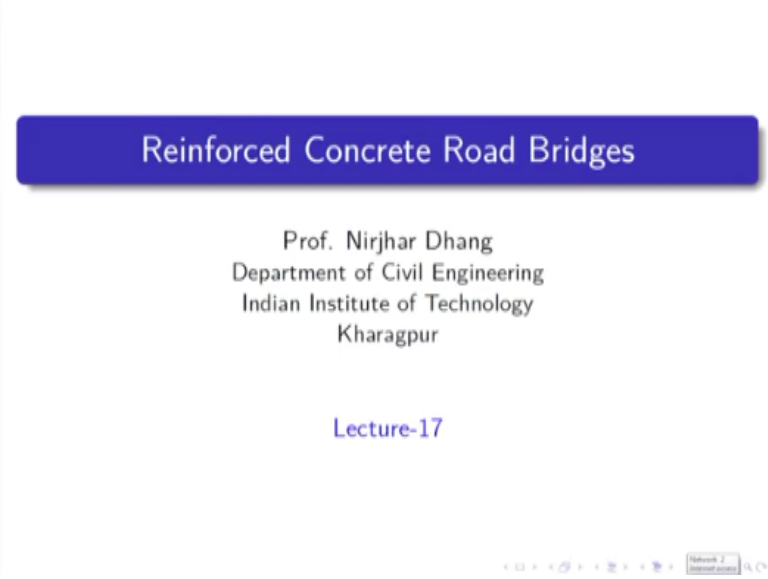

Hello everybody today we shall start lecture number 17 on reinforced concrete road bridges.

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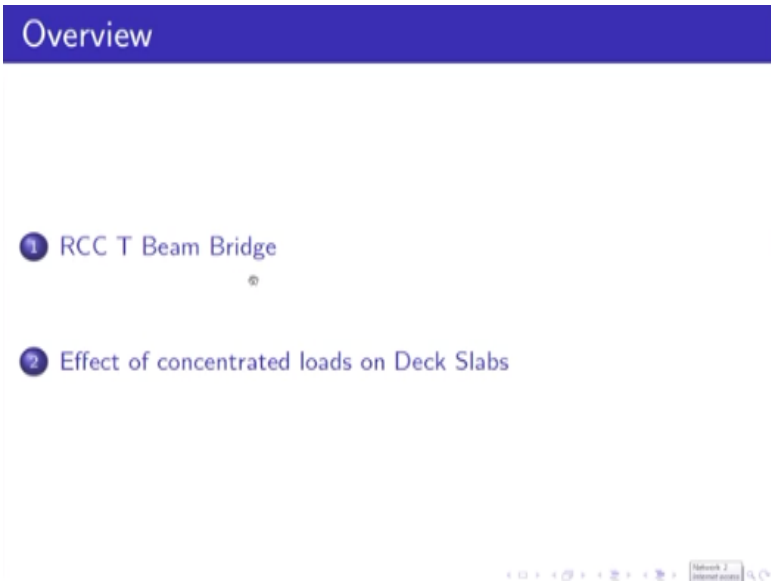

And we shall take a problem on RCC T Beam bridge and then there we shall find out that effect of concentrated loads on Deck Slabs. We have already done for one way slab that means when the bridge is supported in opposite directions, opposite sides that we have done. Now we shall do it for when the beam is supported in all force, that we shall show you that one.

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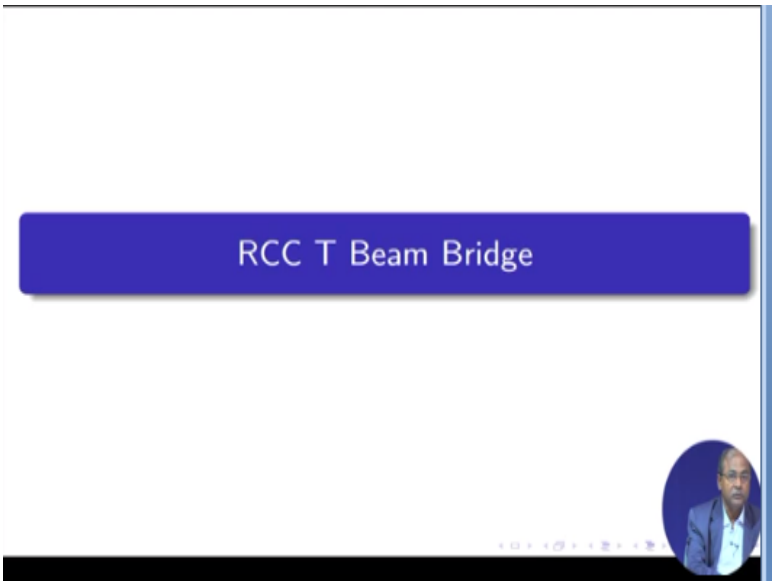

Now RCC T beam bridge as we have told you this one, this is also most popular and we can see from this slab bridge and which we have discussed in the last class also, that depth is going to be increased and that you have to reduce.

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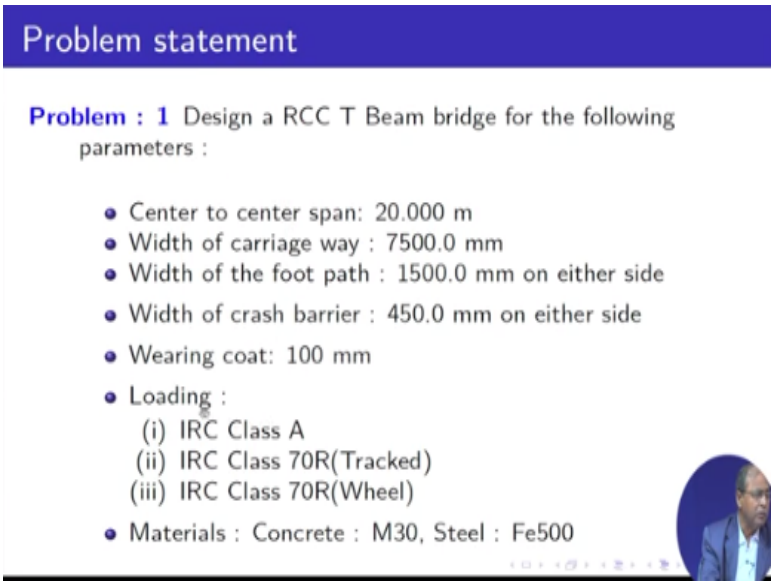

And considering that aspect we are taking one problem the design a RCC T beam, bridge for the following parameters. So first we have to give the parameter for which you would like to solve it. One is that center goes in the space 20m, that is the most common, as we have told you that slab bridge if you consider slab bridge then that one comes, the comfortable room span I can say, and that is set in meter 8-10 meter that we can say.

Similarly whenever you are talking say reinforced concrete road bridges that RCC T beam bridge that one you can say that is you are saying that comfortable that span that one we can say 20m. so we shall take the 20m span width of carriage way that is 7500mm, width of the footpath in both sides 1500mm on either side with the crash barrier that is 450mm on either side, wearing coat 100mm, loading obviously IRC Class A, IRC Class 7OR tracked, IRC Class 7OR wheel, material say concrete M30, and steel we will say Fe500. So this is the one we are considering, so if we draw the figure, so we can find out that one here.

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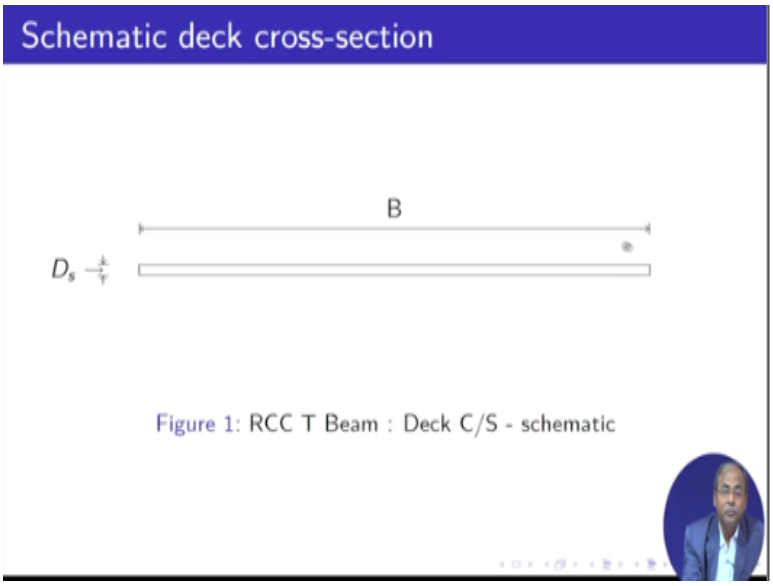

So this is the one we can consider that B and Ds.

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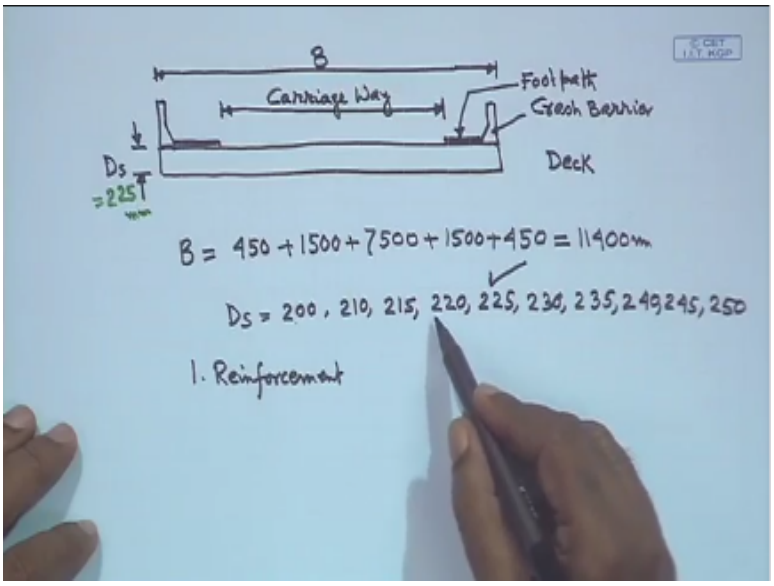

So we have footpath, so according to this, this is your deck, this one is called crash barrier, and this is footpath. So first question is coming here to support all these things and these portion that carriage way. So this is your carriage way, now coming to this one here we are talking to support all those things we need is deck, that is the basic one. And then to require certain depth, if we consider so far we have done the slab and then we have increased the depth as much as required, maybe you can get 800, 1000 also like that we can go.

But obviously that if you go up to certain 10m span other things that you can accommodate, you can – but if it is more than that, then it will be, it will not at all be economical. So when that be the case, then what shall we do. Then we require something and that one we require and that is one is got from crash barrier, they are if we consider this is the one that basic thing required that where we are having crash barrier, then we are having footpath, then we are having carriage way.

The footpath can be both this side also or it can be one side also. And then crash barrier here we are having. So when we have that one to support all of them that we require the deck and they decide of the deck that is B and depth Ds. So B means how much B that B will be equal to from this end to this end I am talking. So B will be equal to 450, I am doing from the left, this is 450 that crash barrier width.

Then I am having 1500 width o the footpath, then we are having carriage way 7500+1500+450 so which comes as if we add it this required one, so 7500 this one, this one 1500+1500=3000, so 7500+3000=10500+ this 450+450=900, so 10,500+900=11,400 that means we require this one

11,400 mm to accommodate all of them. Now the next question is coming here, what will be the depth of the slab.

This is very, very important, because whenever we have done the solid slab, then we come to that one say solid slab whenever we are considering that and there we are getting say, 1000mm, 800mm, 900mm, 750mm like that. Obviously whenever we are going for these RCC T beam bridge or other bridges also, so we do not want this one will be the magnitude of that will be in that range, rather it will be very small, but how much.

Now coming to this one here I can say for residential building we generally use 125mm, here how much it will be, this one we can provide that depth that we can provide as say, 225mm. Now Ds the range where from I have got it 225, so Ds it can be say, 200, sometimes you find 210, 215, 220, 225, 230, 235, 240, 245, 250, so it can go in that range it can go. One way I can say that one criteria of basically from the reinforcement that we telling.

Because we require that reinforcement top, bottom in different places, so it will be crowded for that also we got separating this, because if we provide 125 mm, you will not be well tracked one of that. And there are other issues crepes incases other issues also there, that function will be point of view also different in that one.

But anyway so major one we can consider, that means we can consider this one our objective is that, we shall make it such a way the depth will be within this range. If it is all required we shall go 250, but otherwise you shall not, you shall prefer in that range that means this one is a very, very common one 225 is a very, very common one, you can find out 150. But one way that designer I would like to say, the designer actually prefers some or other I prefer in a range of say, not in the range of say 230, 225 in that I do not prefer.

I prefer something in multiple of 25, that is my choice and obviously the market is very much competitive nowadays and when the market is competitive so what we can actually, if you can say for 5mm or 10mm like that obviously that will be cost effective.

So that way comes also anf 225 and 250 and talking that I have told it look that like acongucative but any way that isnoe I feel that one I felling that one finally in the long one youare not saving that much only say thyat the inforcement said in the different kindathat we shall come we discusss inforcerment if you give the different things of the inforcement and that

one will be the lot of the possiblity that will bwelot of possiblity and also nowthe next question is thyat is coming in to the feature.

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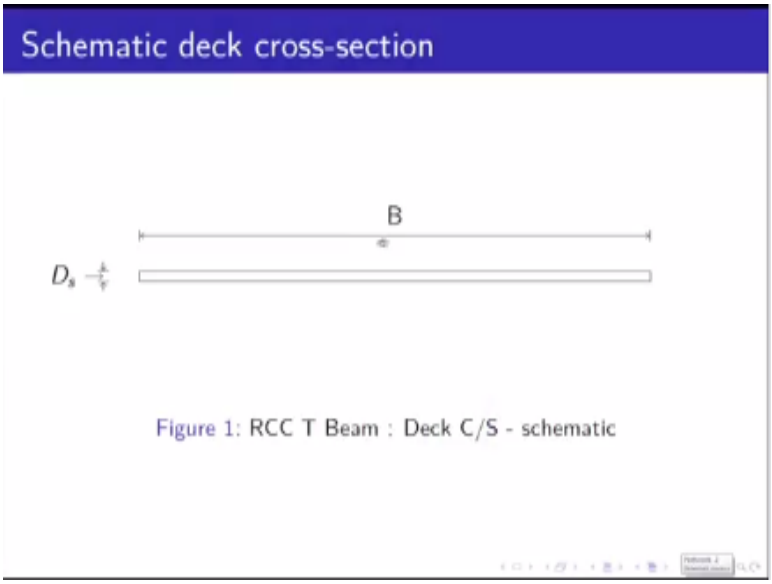

To support the system what recently we made is it possible this is possible that is provide together they and it will come with the next question is coming I have told you that these bridge coming in the eleventh in the hundred millimeter ,so if we provide say .

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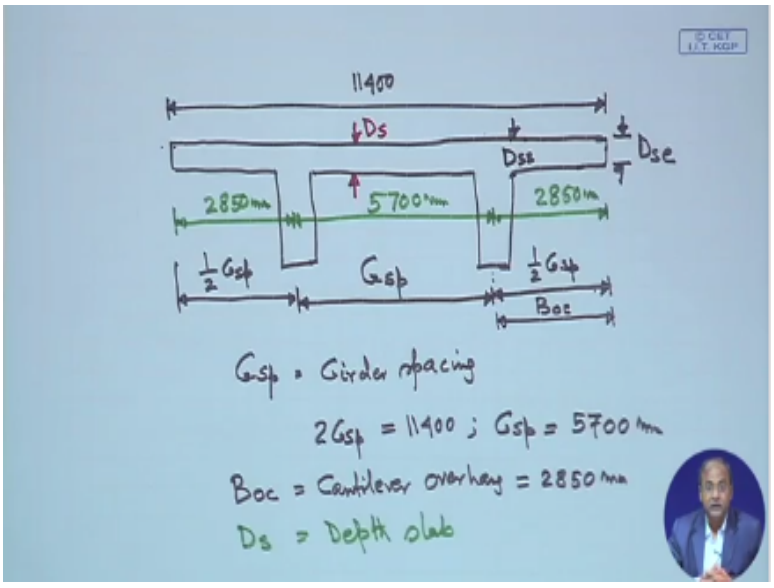

Just little let us draw us schematic one, so we can say eleven thousand four hundred now how shall I this side these is your centre ,this one let us say G S P ,so the G S P regard spacing so I shall provide here half of the G S P when the common one so the symmetric of G S P ,so these will be then the two term lane that anything is two G SP regarded spacing in the 11400 and the so the G S P =5700 millimeter ,so over hang these overhang let us consider as these one as the BO C I mean to say B O C is stands for cantilever and over hang from the centre and it will be equal 2850 millimeter that means here I can say these one is coming 5700millimeter and these one is coming 2850 millimeter .

So this is the thing were are getting it here why I am spending so much time for these because I would understand that the overhanging mode means here the cantilever is depth will be so mode these spacing more means that these depth also will be more that means if I say the depth of the slab D so the D s stands for depth of the slab.

So the D s I am trying to make the different parameter whenever you are describing a particular same bride I will find out these one is nothing but that you give the parameter with that you can describe that ,then you find out the another one that here this is the another parameter I can say D s say that the depth of the slab at the yield similarly I require at these end also which I can qualification that D s is then the depth of the slab support.

So these way we can actually describe these particular bridge with the defied parameter and the parameter you can describe and if we can actually it can make it general then it is very easy to describe that your problem and I personally feel that one the possible come to your mobile as earth for these types of structures, we have to mention these perimeter and the bridge canoe designed and I think it is and not too far that I personally feel okay, coming to this only that is here what I mean to say the that these parameter whenever we are talking here these length, so these length and tense should have the optimum value and more these and the depth will increase told just earlier want something between 200 to 25o millimeter.

That is the one our object over here w e want to go more if we want to go these dimensi0n are more like these, these are the possibilities that the depth also come more and it will not choose on all desirable. So then the thing is that used for the certain kind of span that the width we require that how many guard are mainly required that is actually very much important here, how many regarded we have wanted hare that a particular if it is a 7500 actually two lane, if it two

lane both sides we are having foot path crass beerier then how many regards we need there, so that way we can find out here.

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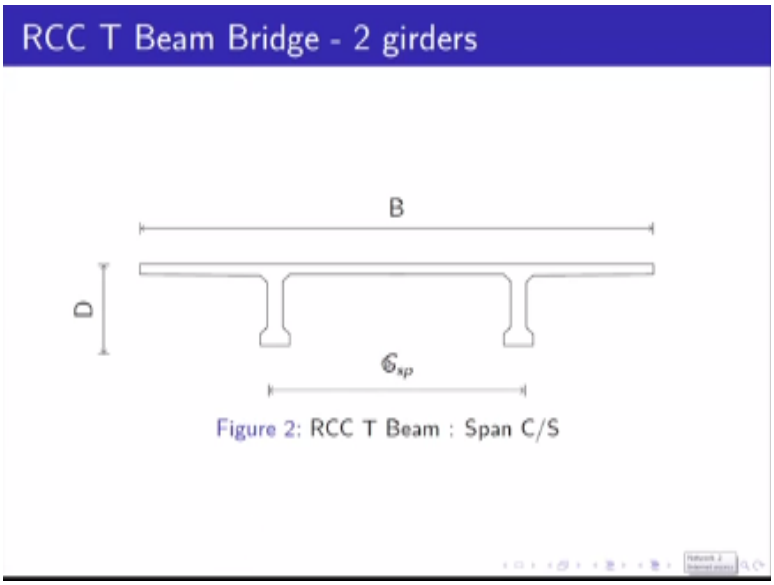

So this is your that one you can say that one I have told you D then GSP then D then your DS nothing whatever told those thing can mention so this is your another one this particu7lar one you can consider the GSD and the we can consider, so just let us find out that one quickly without going deeply.

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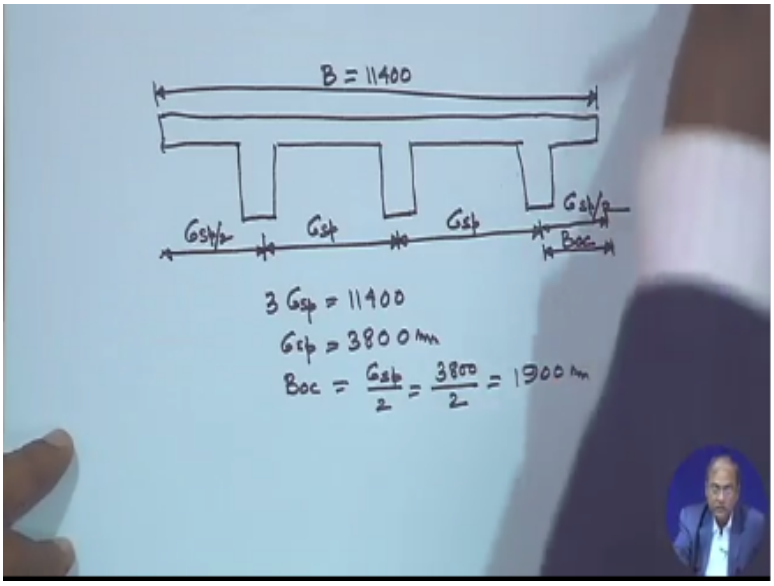

We will be the detail all those thing you can make it here and then the schematic 1 you can make it here, so we are talking these one as GSD and this is our B as per the requirement to accommodate to case as the food path and carriage way we will require B=11400 this is the again GSP /2 this is also GSP regarded spacing ,so we can say 3GSP =11400,soothe GSP =3800millimeter as have told you to the parameter these one we are calling as the B O C cantilever overhang .

So BOC will become GSP /21900millimeter. So just to give you show you back so here we back, so here we 5700 2850 and we are getting here 3800 1900 so this is the one we are getting it one for we are getting it one for the 3 girders. So for 4 girder we will quickly make it, then obviously it will be here in-between usually have for the 4 girders just schematic only show you 1, 2, 3, 4, this is one GSP two GSP and three GSP so that we can consider and than half and half so you can say 281/2G S P +3G S P =11400. So you can say 4 Gsp=111400, so Gsp= 2850 so there you can get these particular here.

And half of that b or c I can say 2850/2= 1425 millimeter so you can make it here how we can make it actually these two that one also 2850 we can reduce it and we can add something more

will see this one this is coming very less so we can add our objectives is that, that which would helps certain balance here.

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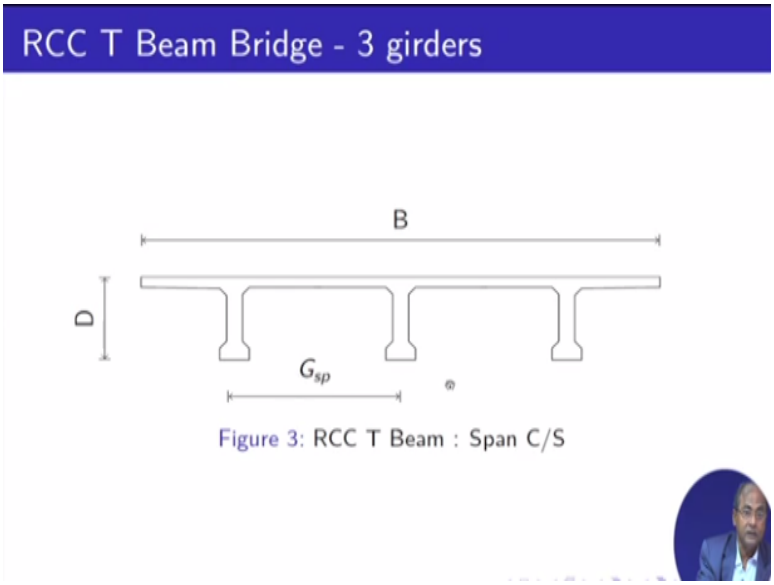

Figure 3: RCC T Beam : Span C/S

And that not like that is very small that is not economic so that but you have to go high not like that so once this side that show you how many girders we required so that why we can say that three girders there we can find out here that 200 to 300 girders on the screen.

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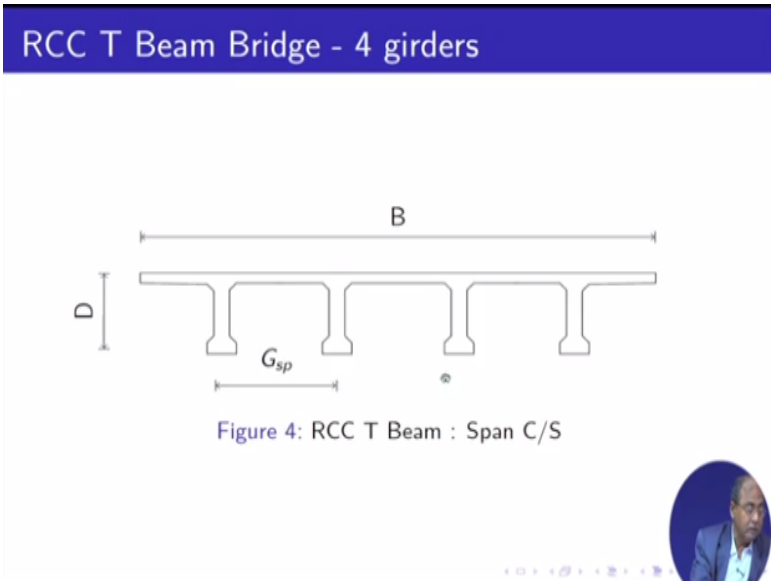

Figure 4: RCC T Beam : Span C/S

You can have 4 girders like that we can make it here four girders this spectrum is one also I have told you that once there are certain kind of thing that we can find out there actually original 300 now it is 150 or 250 like that and those things already we are discussed in the last class so this is the one very important that way you can find out now further while we require say 5 or more sometime it happens that they textually there we cannot go beyond certain value that is the certain restriction at site so what we have to do we have to give more number of griders and then we can reduce the depth.

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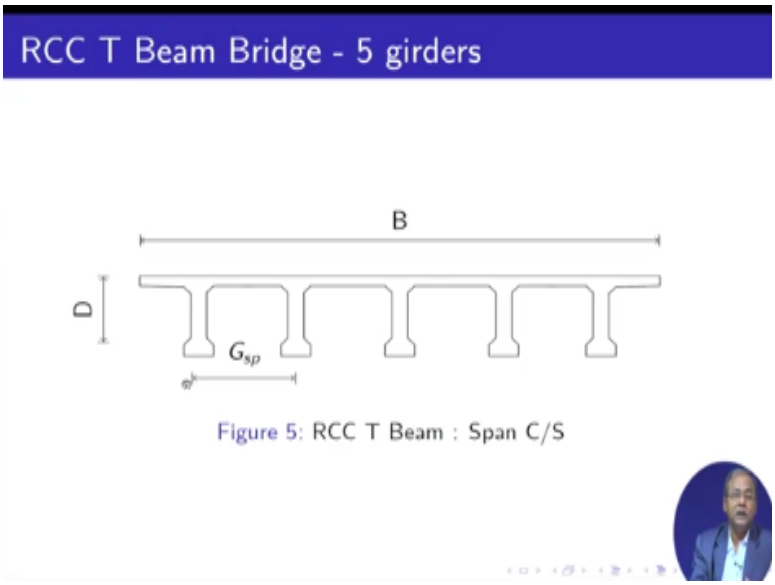

Figure 5: RCC T Beam : Span C/S

That is 1 we do it so that means either it can be say 3 grider for lane 4 lane 3 grider 4 griders, 5 griders like that we can find out and then on the bases of that we can do that just for your references I could say that in building also whenever we provide column the column special will search that your slab dimension will be 125, 130 maximum 140 like that we can for residence building. That is the one and on the bases of that we decide that what will be the column specific in other way that beam phasing also.

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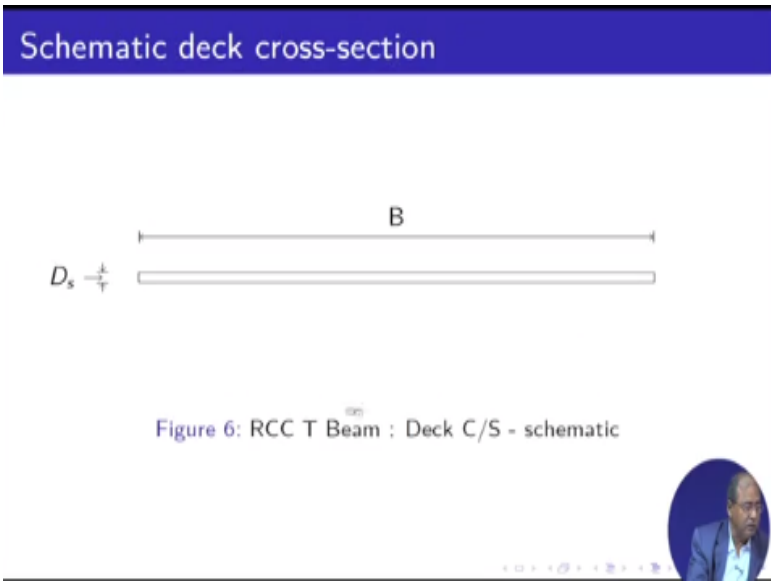

Now coming to this one here so now we shall come to our problem that D and you Ds that we can do it.

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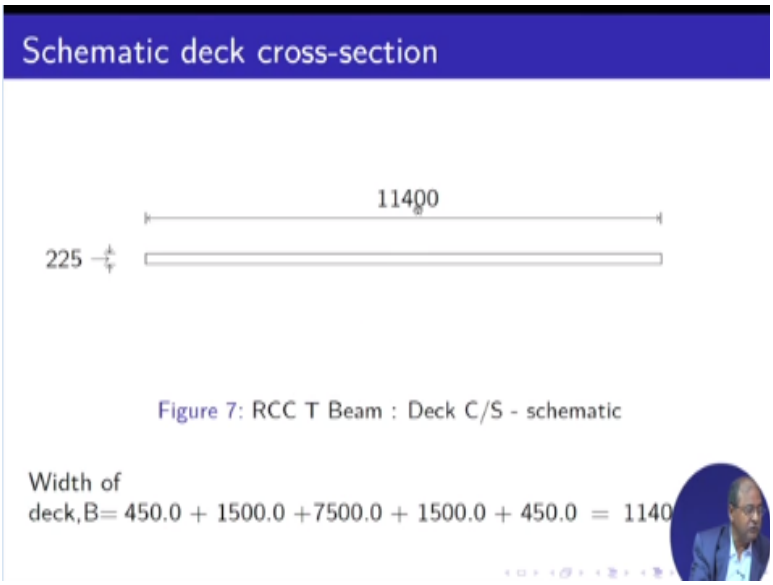

So which we will say the 11400 this one that which already we have discussed that already I have shown you that particular one I will shown you so this is one we can consider here.

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RCC T Beam Bridge - 4 girders

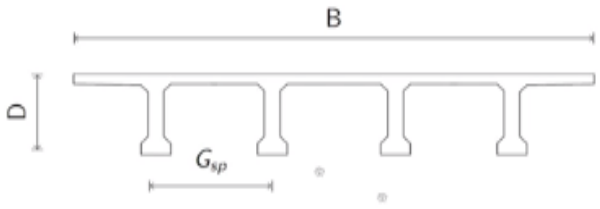

Figure 8: RCC T Beam : Span C/S

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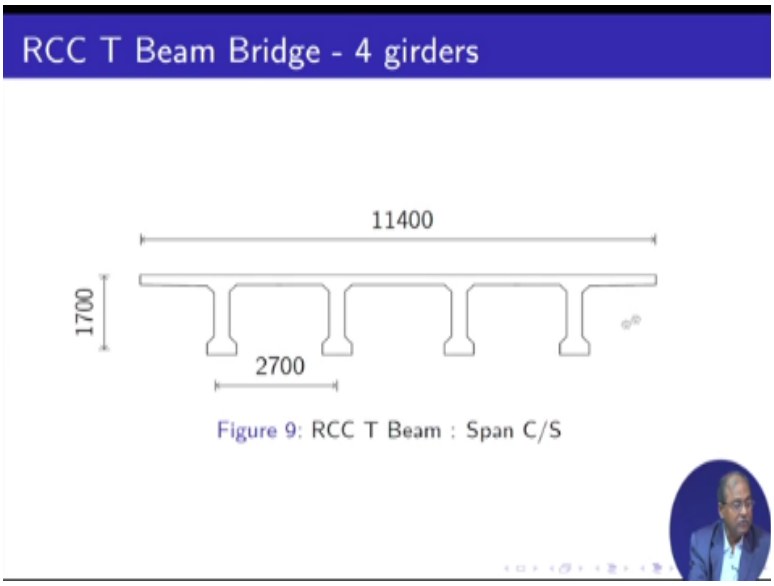

And we shall take let us say we shall take 4 grider that we shall take it and then we can find out this dimension here 1700 that particular one we can find out here so we can consider that we have taken something here this dimension we have taken such way so that we can increase this particular one we can do it here earlier whatever we have computed here I have shown you that putting 25 instead of that we have given that one we reduce this one and then we can increase this that particular one can we do it, we can find out that one that depending on the situation what will the depth that we can find out here.

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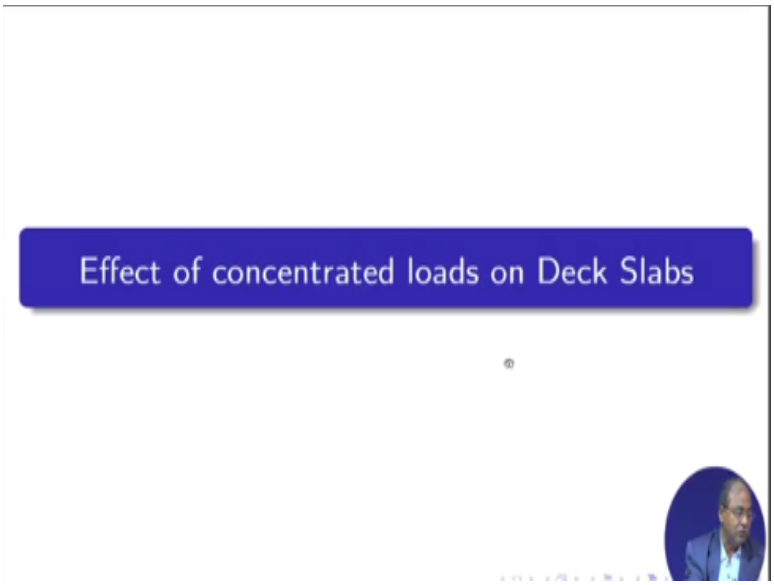

Now that thing we shall tell you quickly effect of concentrated loads on deck slabs that I shall tell you that particular one earlier I have told you that one say one when that opposite direction that your slab is supported and here you can find out that how do to it.

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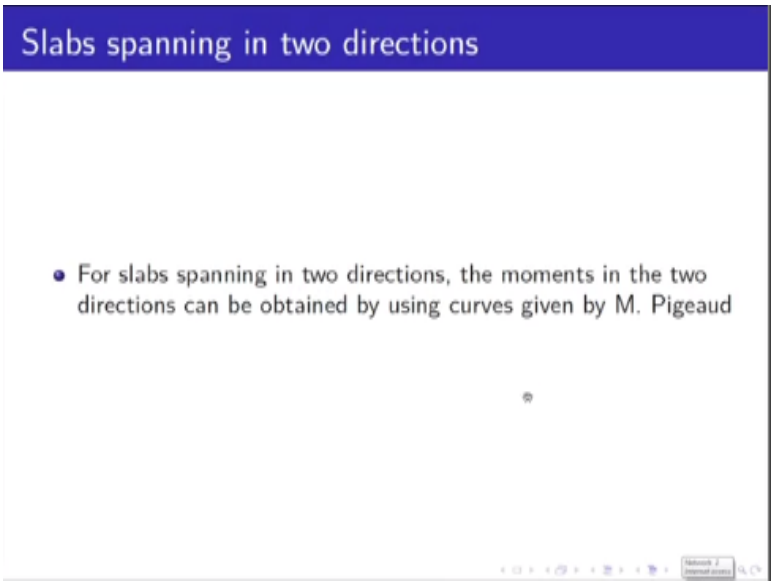

So for slabs spanning in two directions the moments in the two direction can be obtained by using the curves given by M.Pigue that is called popular known as and pigue is curve that particular one that we call it actually pigue curve, now coming this particular one here.

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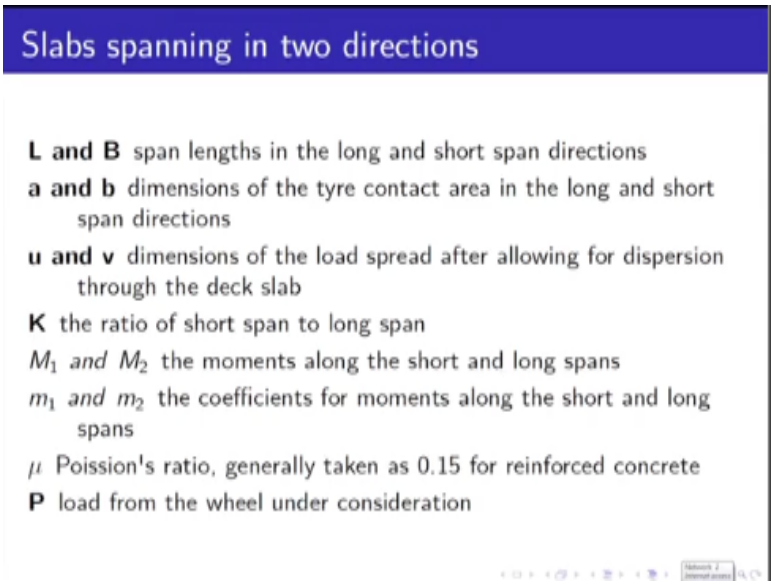

What I like to say just let me draw the figure so that it will be clear to you the thing is that here first a fall.

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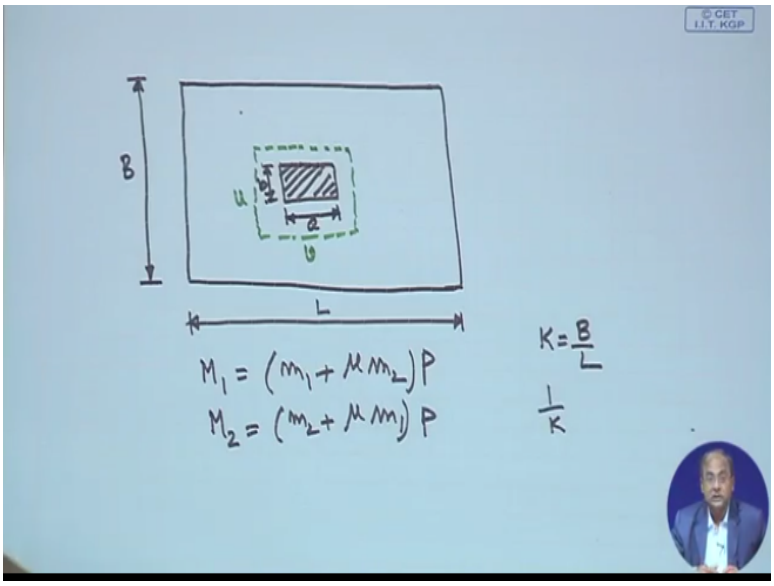

We shall take this is slab panel in this slab panel it is supported in all four sides and these line say L, and this length is B then we are having this is the entire impression A sorry it should be out band then, there is a dispersion, that one will go up to the depth and that one say u and here you say b, this is the one we can take it and considering that, we can find out this one and these load we can find out. So let us come to this one here.

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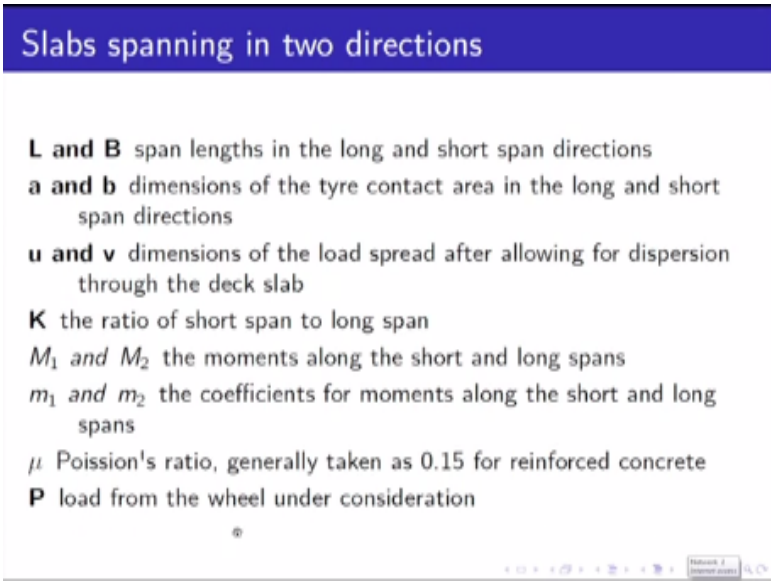

The dimension whet ever I have told L and B span length in the long and short span directions, a and b dimensions of the tire contact area in the long and short span directions. U and v dimensions of the lo9ad spread after allowing for dispersion through the deck slab, $M_1$and M_2 the moments along the short and long spans, m1 and m2 the coefficients for moments along the short and long spans, μ poisons ratio generally taken as 0.15 for reinforced concrete, P load from the wheel under consideration.

So these particular one is coming into the picture, that one. So now how that with these parameters whatever we have we can find out $M_1 = M_1 + \mu M_2$ P and M2=(m2+μm1)P. So we can find out these value we can find out, so K=B/L. So you can find out that and similarly we can get 1/K also, just I shall show you one graph for that for the UDL particularly.

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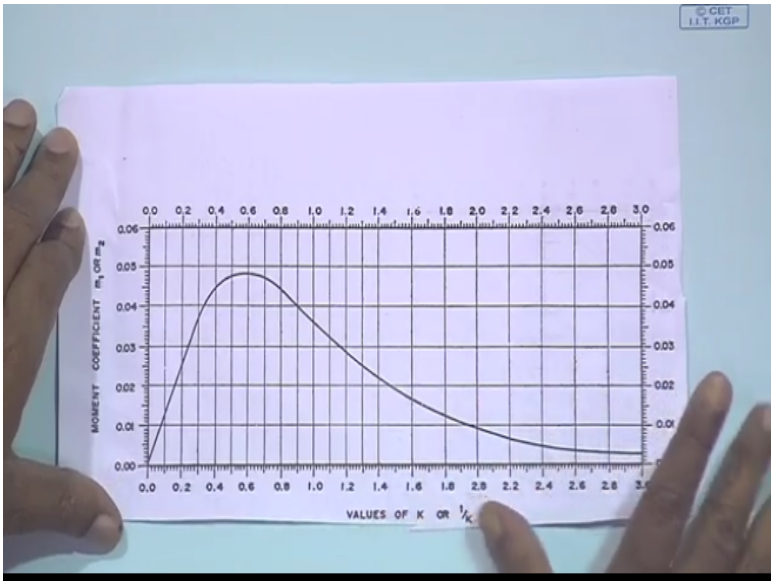

This particular one you will get is called the UDL whatever we can consider here just to show you the values of K or 1/K and here for M1 or M2. So M1 you will get it on the basis of K and M2 you will get it on the basis of 1/K. So that means I can find out the value of K and then from there I can find out M1, this is for uniformly distributed load. So this is, these type of charts have a level here.

Then you can find out that one also we can consider here, that similar kind of thing we can just get it here, that we can find out for different kind of things.

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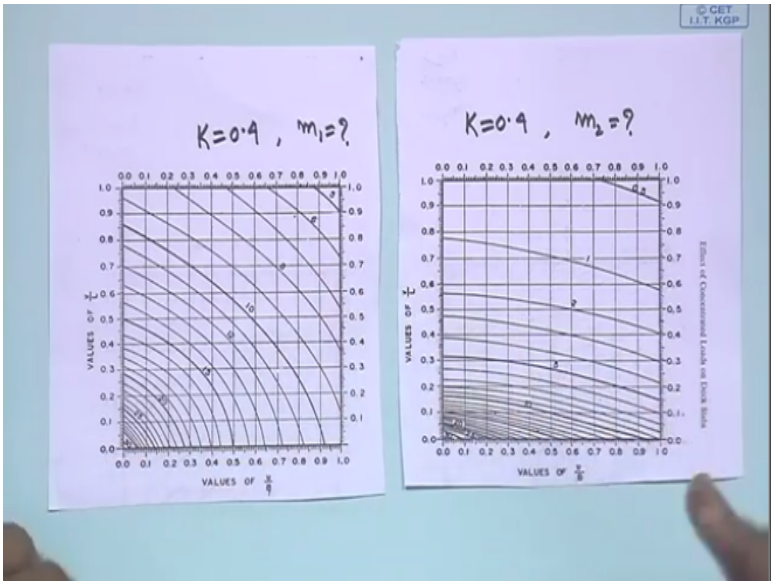

So we can say, this one also you can say, this is the curve you can get U/D and B/L that particular one, so one is U/D another B/L you can take it for different values of that for a particular value of K, this is for K=0.4, so you can find out the value of M1. Similarly I can take it for that K=0.4 we can find M2. So these two we know that values from the AB, UD, BL on the basis of that you can find out for that one, you can find out from this case M1, for this case M2 that is for value of K=0.4.

Similar fashion we are having different value for K and on the basis of that you can find out and you can go ahead.

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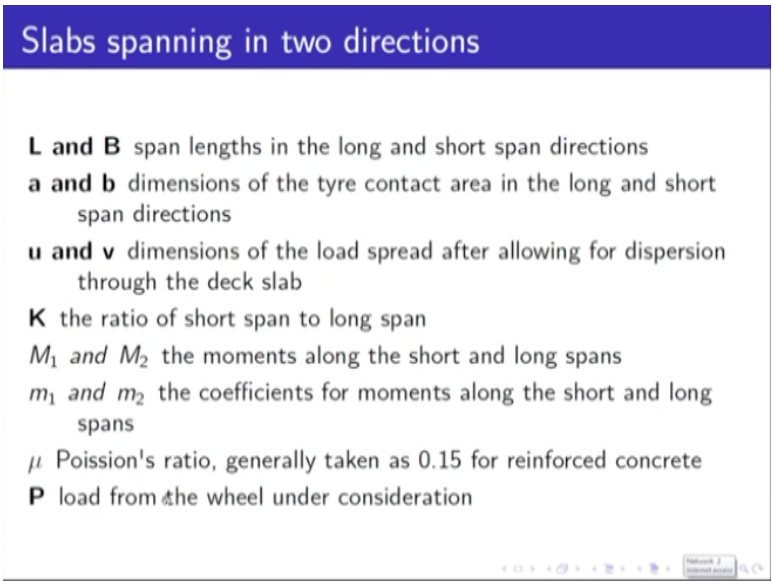

So this one has to give you that how can we get the bending moments, shear force that we can find, the bending moment we can find out and it is almost like set two ways slab in our, say I have given IS456 similar fashion we use it here, but the transmitted load you can find out here.

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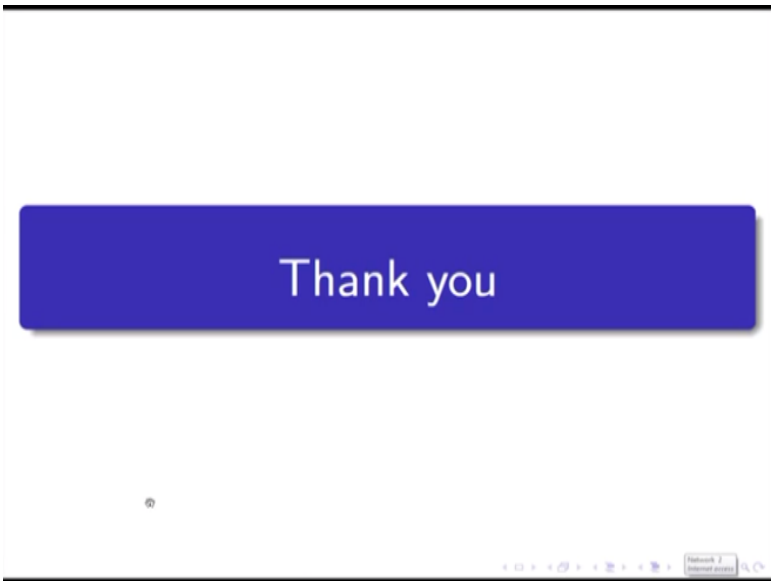

So thank you very much.