NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Course
On
Reinforced Concrete Road Bridges

by
Prof. Nirjhar Dhang
Department of Civil Engineering
Indian Institute of Technology Kharagpur

Lecture 15: Abutment

Hello everybody we have just completed design of slab the superstructure though we have only super concentrated on the working scale but the thing is that we shall give you the problem solution that I shall give. so that you can go through it and you can understand that what we are trying to say now before the row because the only superstructure will not help so that is why we thought that it is useful to go for at least introduce the abutment though we shall not go detail of that but at least you should know that what should a de that your geometry of that abutment that at least we should know so we shall at least we should spend some time on that before going to the RCC driven bridge.

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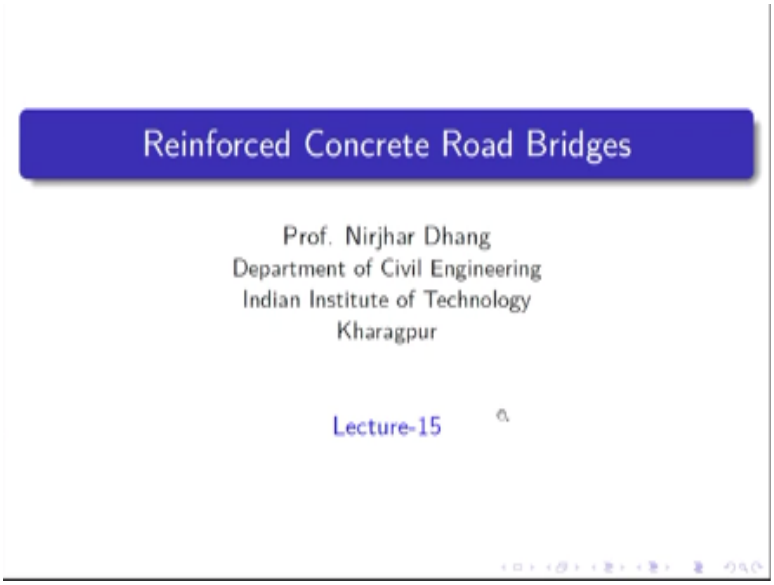

So coming to this one here that we are considering your reinforced concrete road bridges that we are called clearing that one selected 15here we are considering here and then, we shall consider that one so mainly we are considering your say abutment so we abutment selection of abutments so that one we are considering here.

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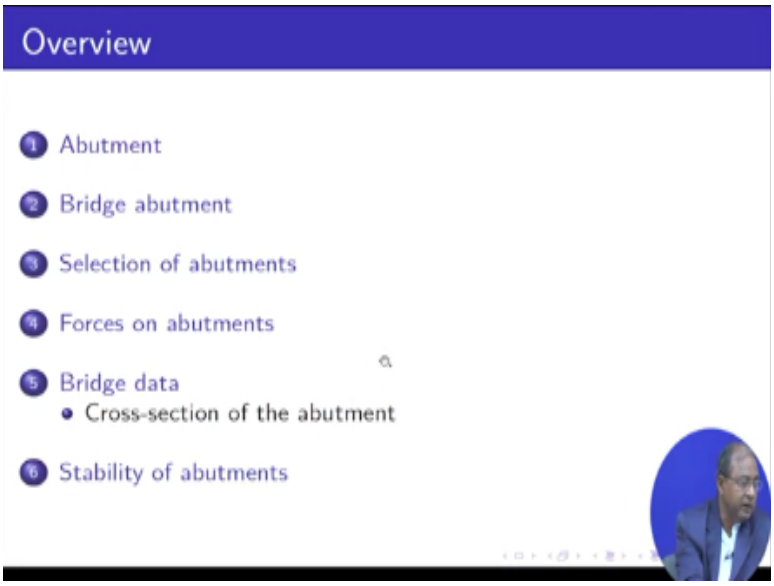

And why you why we have chosen this one here because I have told you here just to give you idea how shall we choose the geometry of that rest of the things because that one we consider separately because our objective mainly says superstructure mainly, we are considering in this particular case now coming to that particular one here whatever we can consider that bridge.

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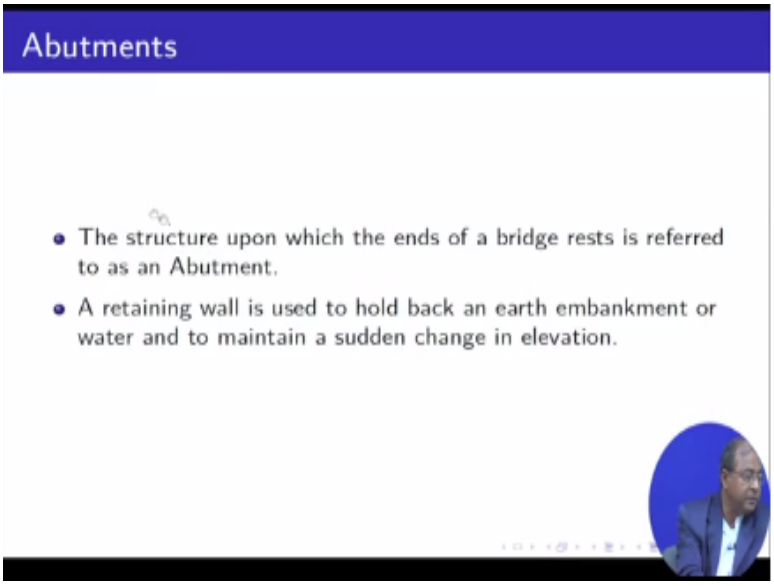

That abutment at two ends so you can consider that one abutment at two ends that we can consider so what is the department so that abutment means the structure upon which the else of average rates is referred to as an abutment retaining only used to hold back an earth emigrant or water to maintain a sudden change in elevation. so this is the one we consider here.

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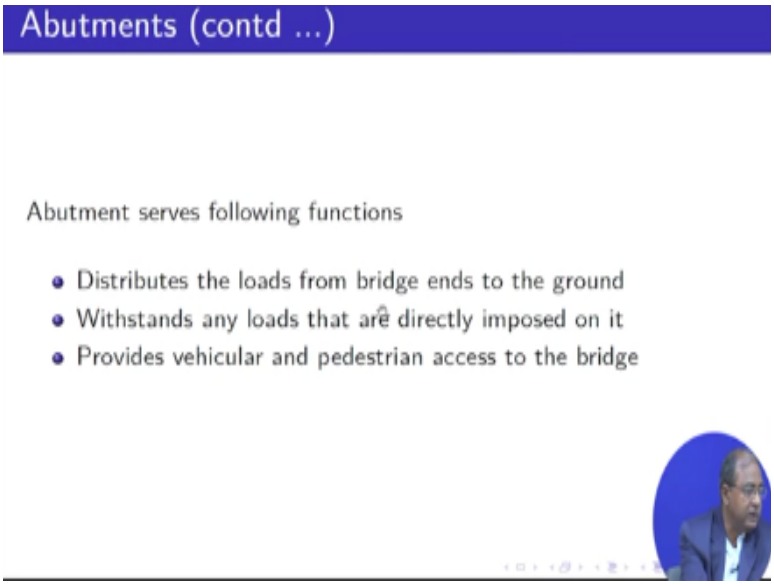

That one we conclusion Evert meant curves following functions distributes the loads from these ends to the ground which tells any loads that are directly imposed on it provides very clear and pedestrian access to the bridge. So now coming to that before going to the abutment to that one because we have whatever a problem I have shown that one we are having at the two ends that abutment that is the one single span now as I have told you here.

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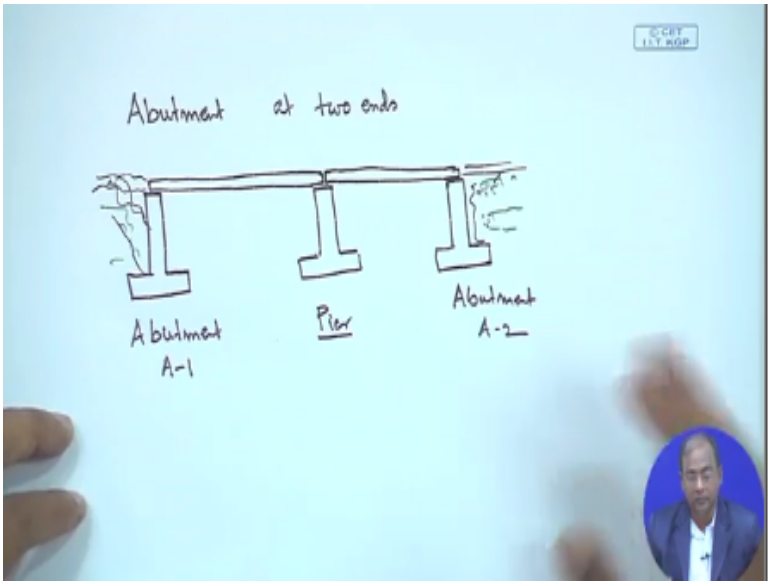

Just I am taking a simple case so this is the end we are having here then we are having the bridge it can be there are different kind of forms so you can keep on moving, and I can say, so we are considering this one here out of there that will be implemented one here actually you are having that art, there is a approach road will come here yeah else approach so that means here that art will come that one will come here that at these two ends.

If we consider that and this is called that abutment may be say a bat means a one similarly this is another abutment this is a two considering that respect here that means here their additional thing are also coming into picture but here in between there is no such thing so this is your core intermediate one or this one you can consider say you SAT hours ago. Now coming the conjugating the soil condition this one we call co consideration is sub structure considering that we require certain foundation system also which may be pile also that means it may be see your shape that one also may come into picture difficult.

So we are not going to defile other things because that one it requires the sub structures and foundation C requires another quite some time actually but our idea of this particular one to give you idea that athletes we should know the geometry of that one house and we decide that and what is the basic principle of design because if you understand the basic principle of design then you will be able to solve it design it on your own because the thing is that what I mean to say here that most of the cases everything actually based on certain design principle and that principle actually either design for bending design for shear force or combination and the torsion.

So like that so that means and also axial force so whenever you are getting that means if you know the design for these basic four then you can design any structure that you can design particularly in this case for that infrastructure that way I can say.

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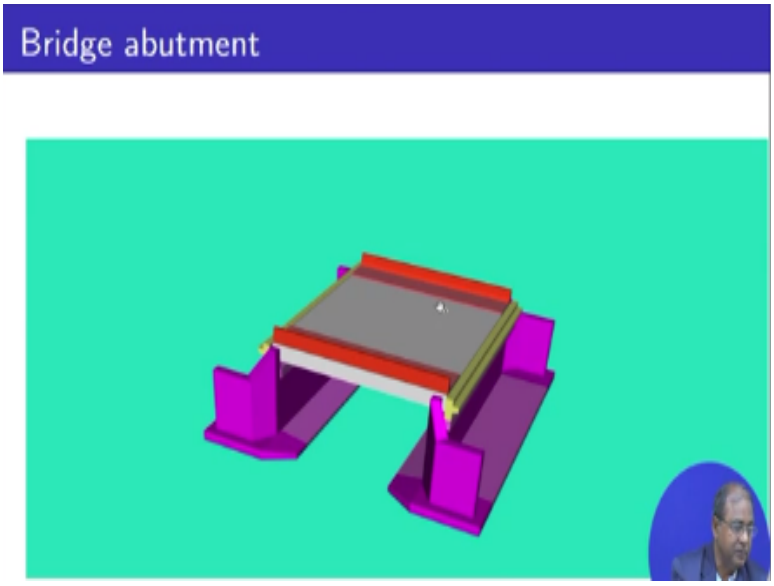

So be apartment whenever we are talking have shown this figure so this is the one because it is 11 to tell you here also that part could also be supported that means whatever you have designed so far we have designed this portion ,so now we would like to find out this is another view we can say this is another view can find out here and then these are the different component reverse side that we require one of them actually or say that I can say that your bass the steam then abutment cap we call it.

This one you said dot one so that means I will not come here for slab of course it is supported here so nothing but I think that here the god that one if it is here our CCTV mother you find out which and show you later on that we shall find out that soil make a mark may come in this side also that we do not want so now the thing is that your objective that one here how shall we decide this dimension.

These diamonds on how they decide reinforcement that one inside whatever will come that one bending moment shear force other thing on the way but how shall we decide this diamond son so that the structure will be shape and it will stand, so that is the one we can consider here that we can find out so base how to make it this is the one only I am telling you say base and stream part

then I have added the dot one and then finally we are getting this one the slab only and then you are having that when your say that whole thing that you are getting here.

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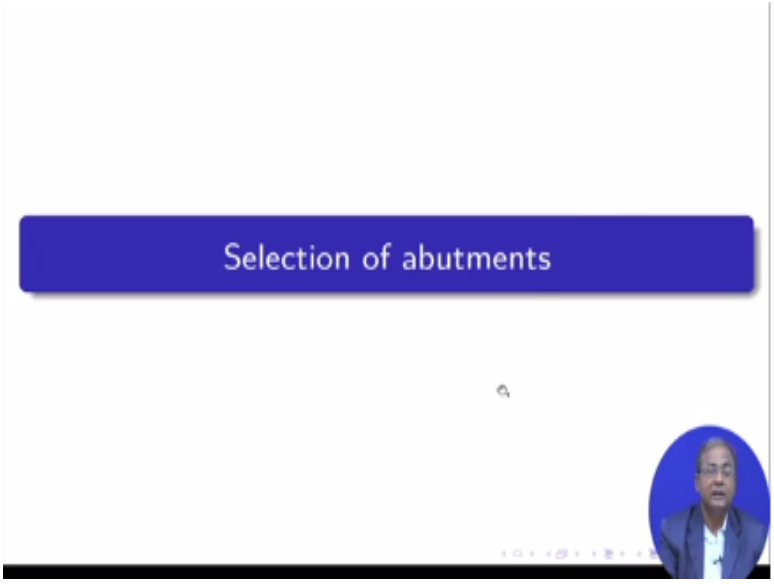

So this is the one that you have to find out that your objective that the colonial how shall we get the physical dimension of that apartment at least it will fulfill the basic requirement that equality so this is just I am introducing that one to get an idea because main there are many more purposes of in your busy line one is that you can say that general element going is made before actually or say structural design you can say though you can see how it is possible because it will be based on experience later on detailed design other things are done that only consider almost based on the preliminary design you can say.

But basically thing that I can say that about my design or those things that value that should be mentioned that what will be the well because their quantity is estimation can be made way for the budget allocation.

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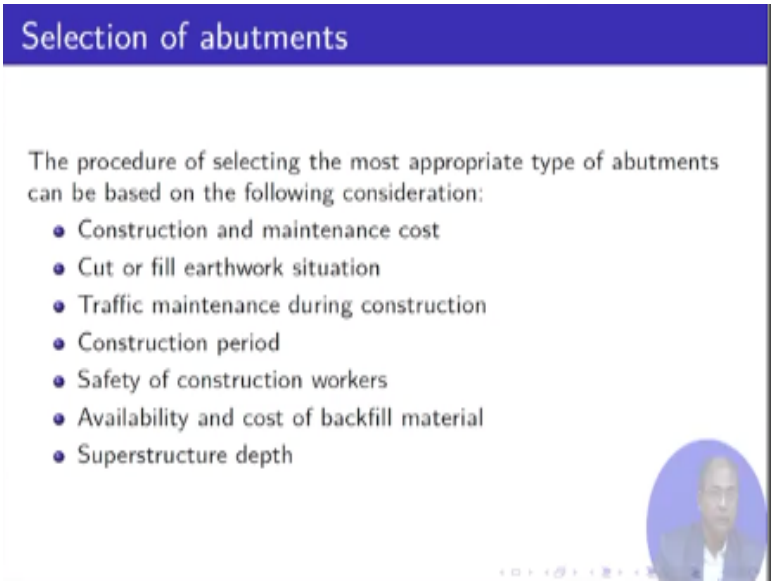

The procedure of selection the most appropriate type of abutments will be based on the following consideration, so basically the construction and maintenance cost that is one part you can consider here cut or fill artwork situation that how much you have got how much you have to feel that one also you can consider here traffic maintenance during construction so during construction what will be the your traffic that one also very important then construction period that we can say construction period how much time it will take safety of construction workers availability and cost of backfill material.

So for that sufficient material and superstructure depth so what is the depth of the superstructures based on that actually we go for actually your that apartment selection that way we decide so now next one we are having the size of apartment horizontal and vertical alignment changes area of excavation aesthetics and similar to adjacent structures previous section with the type of government is of access for inspection and maintenance then anticipated life loading condition equality of deformation.

So all those things actually we have to consider and then you have to find out that way we can consider yes so this is the one then we consider for the selection of that apartment that theseare the things you have to consider so that way you have to consider all often.

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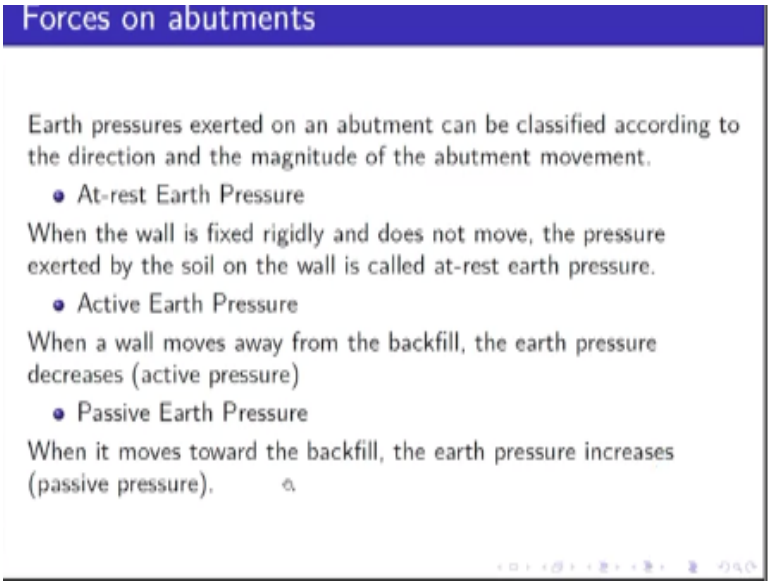

Now what are the forces on abutment one very important part here that I can say whenever you are talking that once a yoke?

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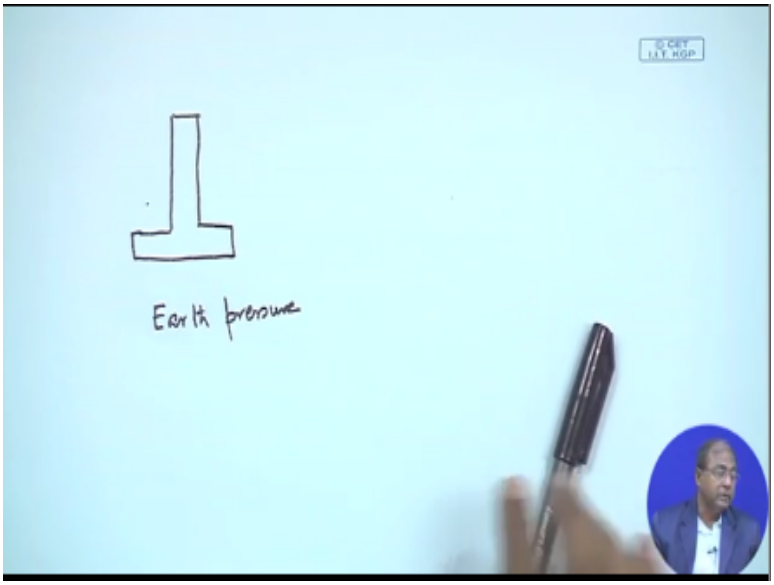

First I am taking a simple one since in abutment one side is filled with ark because you have to protect that one so that it will not fall in that case whatever we can consider here that our this up this is actually very important here so that one just to give you idea that we have three cases so at

rest earth pressure when the wall is fixed rigidly and does not move the pressure exerted by the sword on the wall is called a at least with at least earth pressure that one we consider here, so another one is called active earth pressure .

So in that case when a wall moves away from the backfill that is a decreases that is active pressure Percy was pressure when it moves towards the backfill the earth pressure increases so these are the three casesthat we have that we have to consider and on the basis of that you have to find out the value of your say that your1 you will get it here that your Sybillamoments here force other things that we can find out here.

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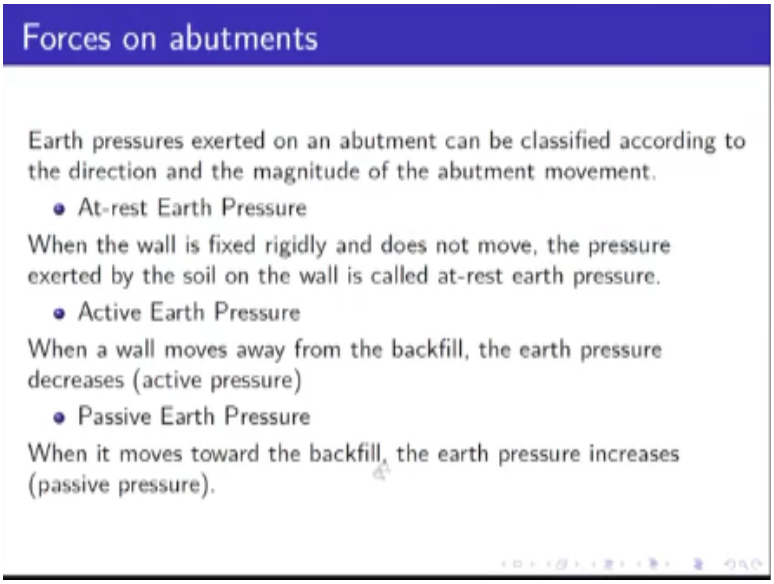

That we can get it here so now this is the one just to give you idea we shall come back to that one but before that let me just make it this data means actually see prism them how we classify that.

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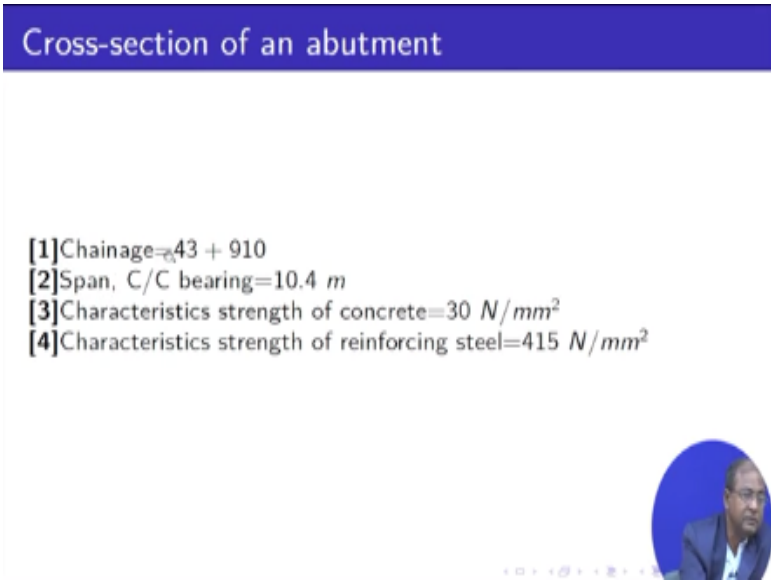

Chain age generally we have to give that the condition is very important the change of the bridge that from which local can that be is actually being started then only generally it happens from the main city from how far from the main city that way the starting city of that one is a your starting point may be zero and then we go ahead with that M how in kilometer so that means here forty three plus nine one zero that is done forty-three kilometer was nine one zero meter that means almost near say a 34 meter forty four kilometer that view is being constructed and span centers in thebuilding a simple kilometer assistant of concrete that is 30 Newton per square millimeter that is the usual unit nowadays of course you use 500 Newton per square meter now available so this is the one I can say that we require this one we require this one.

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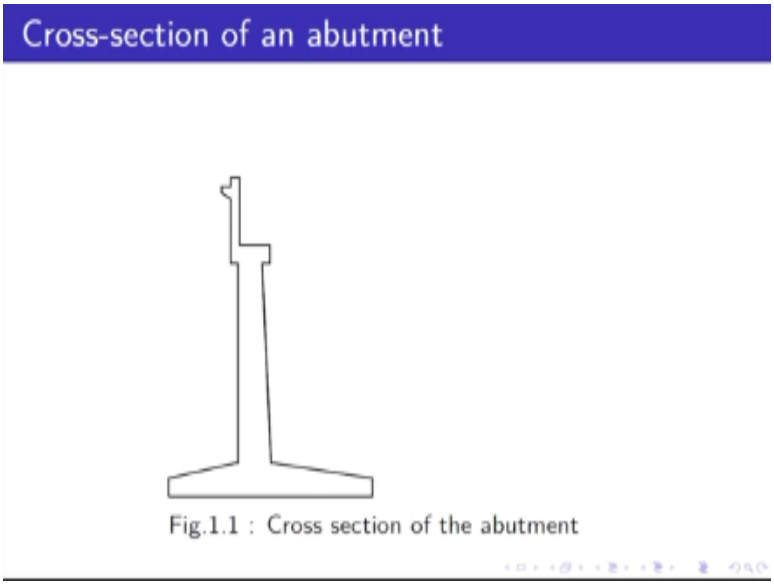

These are the standard most of the case is that one this one also you can say depending on the height of course important but anyway we can make that one, so if we consider that we are having certain loaded beam we are having certain pleasure and that is due to that earth pressure we can get that means here we can find out this one this will give certain kind of say your bending moment that one it will make actually here so we can find out due to axial force P and there is a same moment also will be there.

So we can find out that use the stress distribution you, so this is your that force which will come and this one should not be more than that bearing pressure of the soil, otherwise it will fail, so you can understand that vector one that you have to find out and similarly we have to find out the bending moment and then you can see the corresponding load.

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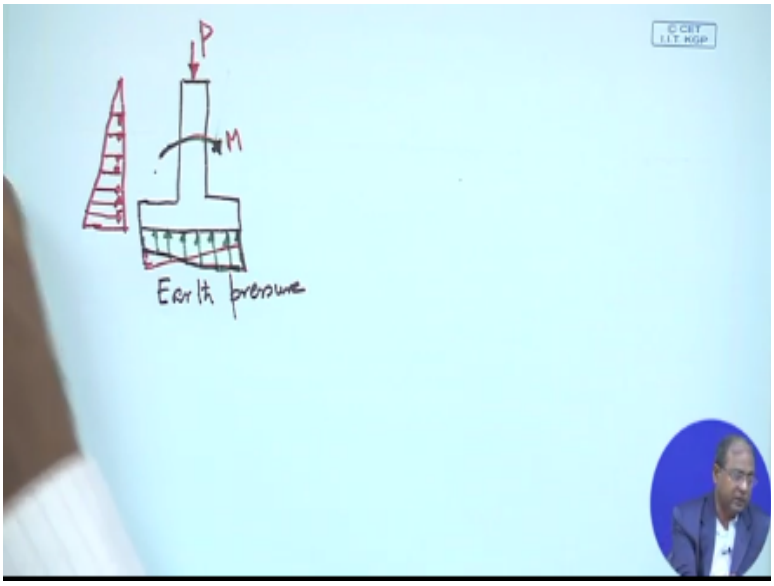

That we can find out here so this one you have to find outland as usual for this case how much will be that one that you can say that means we require something say your 400because if it is less than 400 if it isles than 400 now that means this particular foreign air so we can go along get little bit degrees acrosssection and again so these are : look and make a so you can say for example here we recursive this dot was it three hundred and another one in equal say four hundred millimeters

Then we require and then we can find out we can find out that say four hundred and three hundred that means we because is have an animal we can now the thing is that I do not want so I can project that one also this side or this otherwise I have to give it is a 700 that means this one will come at a 700 that one will come into picture therefore Caronia so this is the one that cross section of the beam the abutment that you have to find out similarly from the stress we can find out that your say stress here bending stress here well we can find out that bending stress may here also that we can find out and on the basis of that we can actually solve it.

So this is the one that we like to read now one more important one that considering that aspect other the structural section.

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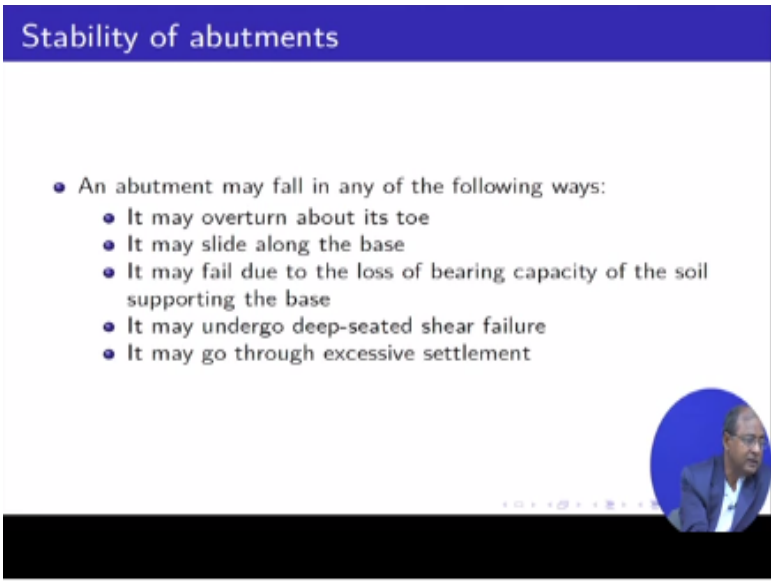

This is very important the stability of abutment so whenever we are considering that stability of abutment that also we have to consider here and that one.

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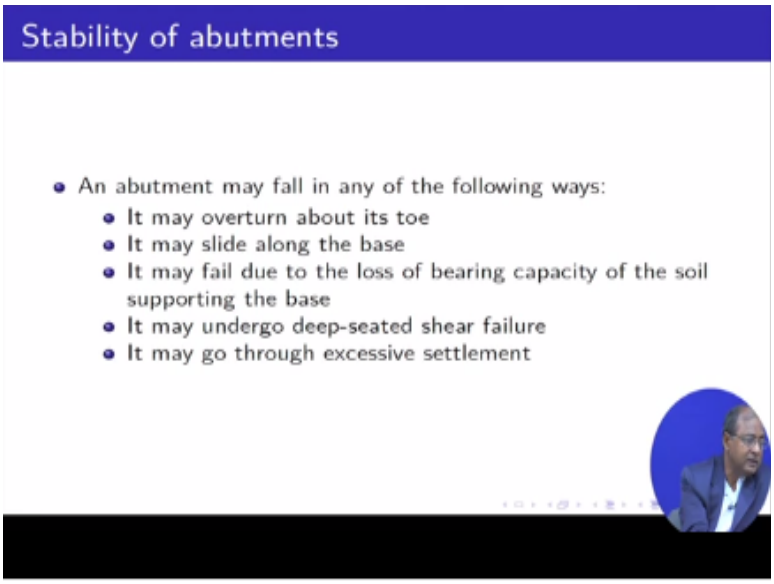

That cases into a overturn about it too so.

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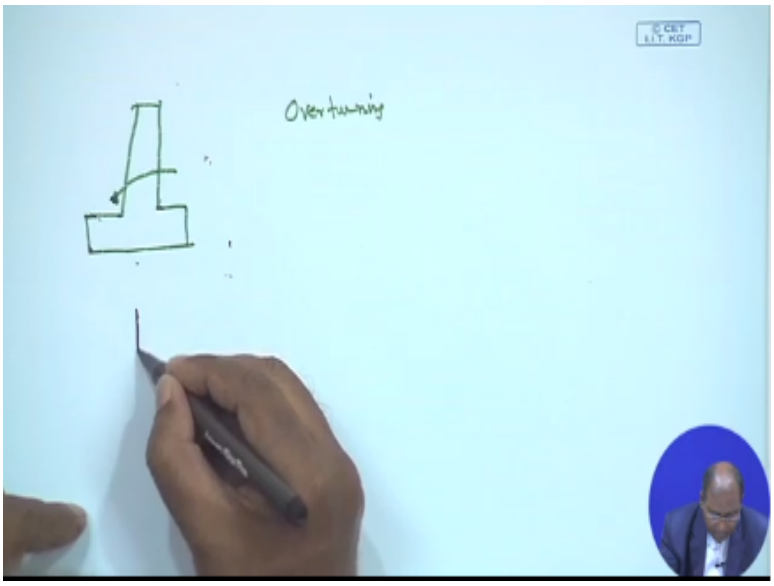

So if we consider that because of moment this is my to decide your says why so arc so it may overturn actually here so overturning is the one that also your project there are many more such cases where the structure has not failed that concrete remains as it is there is no deterioration but the overall structure actually overturned so not only you have to consider from the design point of view you have to also consider from the your that from the rigid body you point of view that means whether that your load a special I think that whether it will overcome their word turn it and then it will fall that is the one very important particle.

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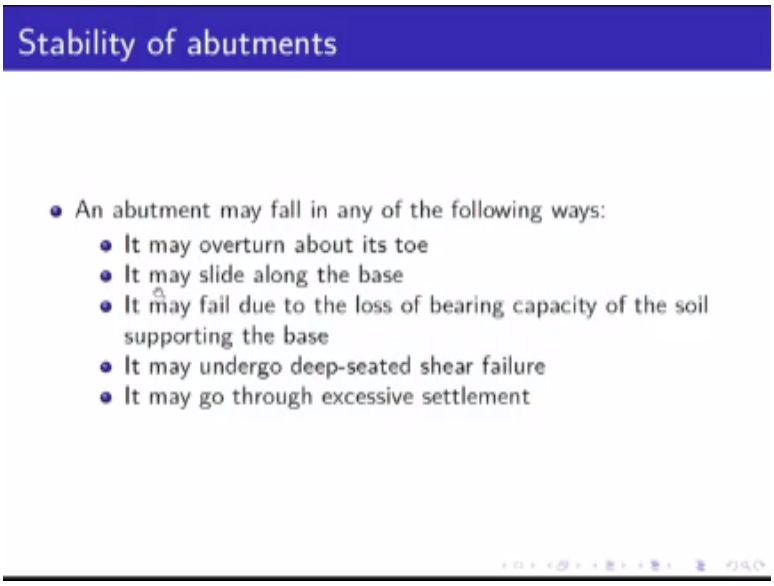

So then another one is called actually along the base slide along the base so that one is can consider so if we consider. This line should not be there because we are going to goings these particular case it may slide the sliding if it happens there is certain kind of restriction also that you can consider for the slide that the: that it should not actually move that you can consider here so this is your the other check you have to do it and you have to find out that where the horizontal force and the vertical one we are having.

So that say for example here and whenever you are designing all those things here than in the end in abutment there whatever you can consider that the sliding other things that overturning that should not be there that also you have to check the separately that means is not the one only your vertical force and that vertical force.

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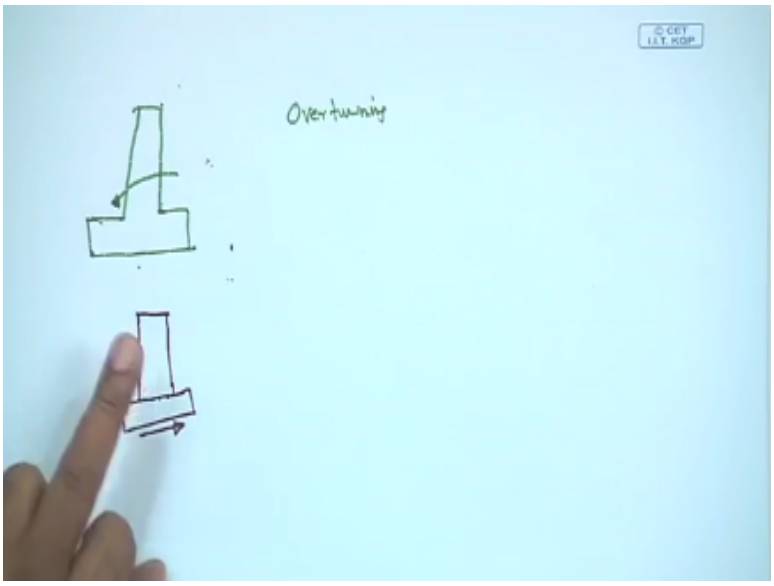

If we consider that one it may be say variable it will get traffic actually you can find out that going at night the traffic actually that one say very less, so you can consider during night that means that we is not at all fully economic that fully actually being occupied butgreed is not fully occupied so that way we can consider here that you see slide.

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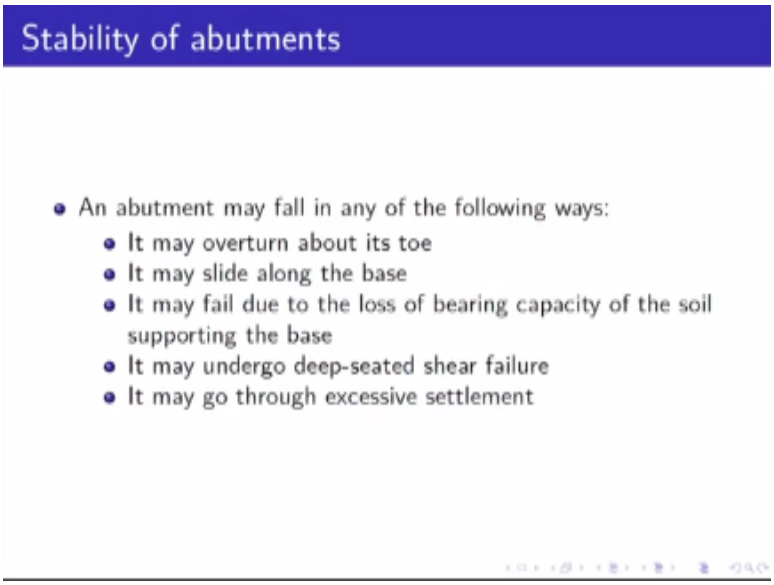

That particular one you can find out and we can consider this aspect we can find out here and next one is coming into picture that means here it may feel due so the loss of bearing capacity of soil the soil capacity of the soil also it may come actually that one or whatever the load is coming here the soil capacity also if it comes less then also it can fail so that consideration you have to consider here.

So that means here you are considering that particular one here you are considering here that whenever you are having that article load and horizontal load and then due to that whatever stress is coming here at the bottom and that one should not be more than the bearing capacity of soil and otherwise what will happen that it did not need to be pulled that one you can see it can fail also now deep-seated fear failure that is your other case actually.

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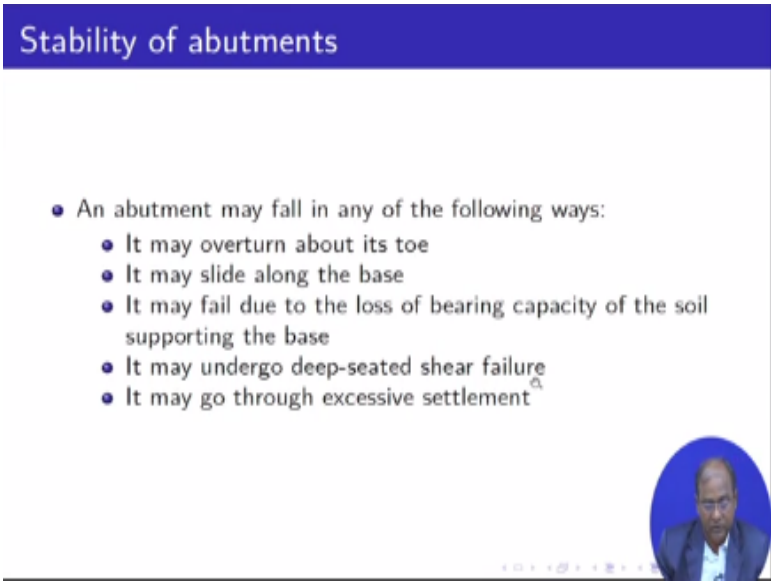

It can consider that which may happen at the bottom so like that here it may happen like that that one we can consider so that would happen and then it may go through excessive settlement that means people having say settlement that is alsopossibleit may happen like that also so coming to that patron here now the question is coming into picture that how they decide that your say that abutment depth another things.

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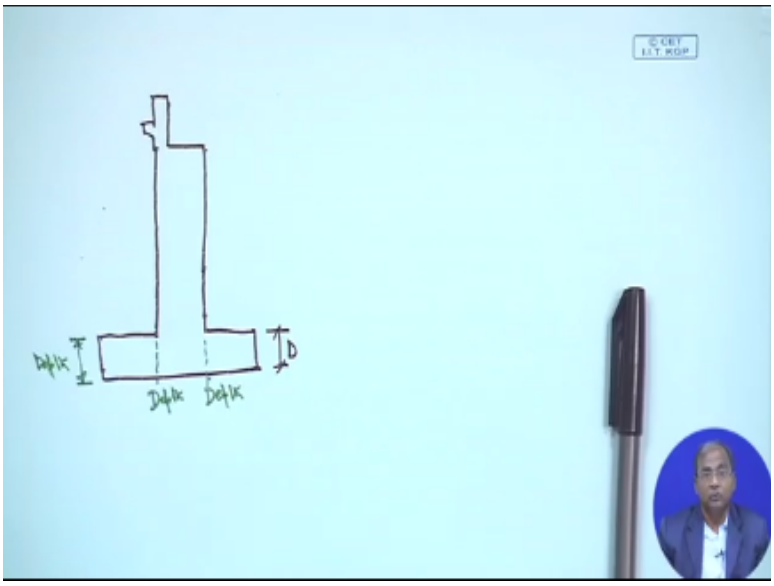

So obviously that one we can consider here just your general guideline so the bearing width is very important including the dot wall let us go to that fever so this is the one that figure you can consider so that means our main aim this recognizer I have told you so one simple way instead of giving any projects and other things we can do it actually like this and then and can just simply come down, and obviously it is generally an accrual this we are given this what go on here so we can find out these depth here also.

You can find out the depth if it is required we can take the depth here also so that means here we can find out different depth we can find out here as usual this one we can say that we are having that upward pressure and we can find out this one here that as usual you can find out the bending moment and shear force and on the basis of that at this section we can find out the depth that we can find out similarly here also at the steam we can find out the reinforcement also we can provide here we can provide the reinforcement here also that way we can find out and things the art is here.

So we shall get the reinforcement here and similarly we can get the reinforcement here also certain reinforcement we have to give at the top just to because the depth if you really see this one this depth can do as I has1200 millimeter 1800 millimeter like that it can come. And so obviously that to confine that concrete you have to feed the reinforcement the main reinforcement of this we can consider this one similarly windows can be modular this all also and then we have to find out that your say solution that we have to find out that your ever been

but main objective in this particular one I would like to say that how to find out that so which is governed by the bearing width.

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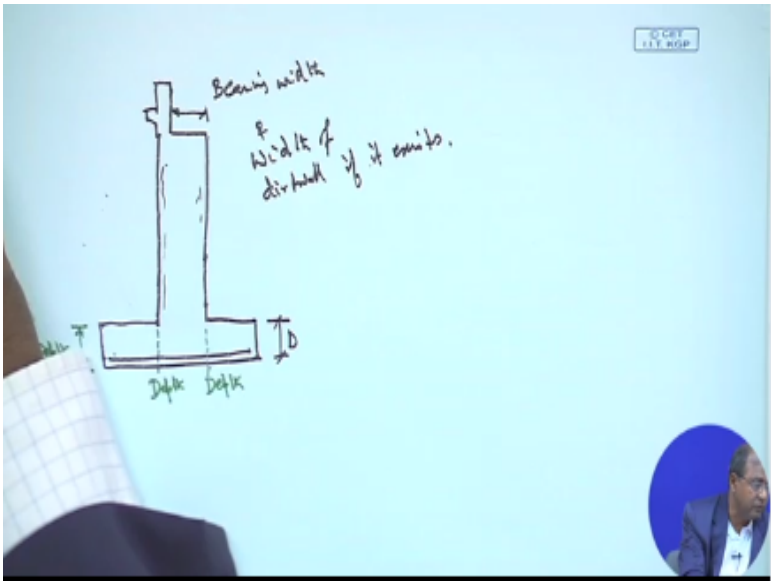

And we top that one if it is there so we can find out this one and then we can give the general one that based on your say what is called the geometry that overturning and that will prove for that you say five cases we have told that overturn about x2 and slide along the base due to loss of bearing capacity of the soil supporting base so all thosethings mean we can consider and then we can check the way we check it for retaining all the same way we can check it for that apartment also we can check now.

Because I am Telling you this particular in here that abutment similarly your CPR also that also we consider here a generally it comes from the geometry in point of view the another one I could say just to give you idea about failure.

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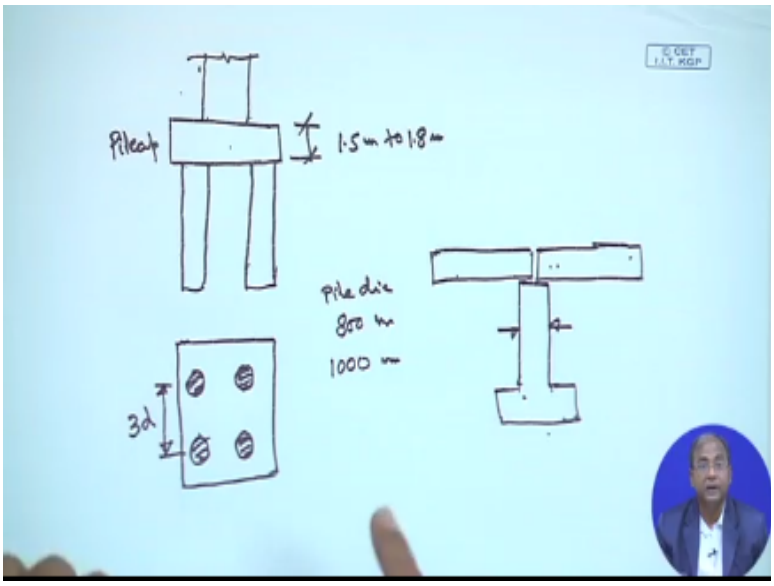

This one also that we are having a pile because I am giving this Packer on here so you have to provide the pile so you the pile diameter all those things generally it comes in the range of say800 millimeter then 1000, so like that it comes and D spacing generally it is coming in Yon i 3d that way we make it and then most of the cases we find out from 1.5 meter to 1.8 meters like that when we get that say your depth of say pile cap.

So that means in the abutment and your PR where now we can give the PRhere so we can read that paper 1depending on the mayor would say that both the things I mean to say you are having this one so what we can do it here we can we can consider this particular one here we can find out that your say that abutment one we can consider here and then in between we are giving that you are say Foundation and then we are having that your say physical dimensions other things we can do it so then it will berested by the pier where both the both from both side.

It will come so that's why you can find out that one here that these dimension other things most of the cases it is governed by de these two from two sides it is governed and that one also you can find out so that so these dimension generally provide that one this is the one I thought I should at least tell you regarding abutment how do you decide a dimensions we decide based on the requirement and if you check it then you will find out that if only reinforcement you have to provide that way you can see otherwise the whole section it is governed by the required geometry thank you very much.