NPTEL ONLINE CERTIFICATION COURSES

Course
on
Reinforced Concrete Road Bridges

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Lecture 3 : General Features of Design

Hello everybody today we shall start the lecture number 3 and let me again clarify that this particular course we have taken for reinforced concert road bridges and that is a very one part of that bridge engineering, why we have taken this particular one as I have I told earlier that is particular course reinforced concrete bridges particular solids slab and RCC team be those are very common so we have taken a one way we say that which is popular at the same time we can say which is simple in a sense that we know the reinforce concrete design so how we can apply two bridges.

Coming to this particular one here another objective of this course that at least we should be able to design a bridge either a solid slab or a RCC TVM bridge considering that aspect there are many more things are there which you will find out in different book but we are mainly interested in the point view design.

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Reinforced Concrete Road Bridges

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Lecture-3

Coming to this particular one here so this is our lecture 3 that we are taking of an half an hour module that way we can say and we are introducing here the general features of design and vehicle loading that is our objective here the general features of design and vehicle loading these are important last class we have shown you different kind of vehicles we have shown you the thing is that how shall we make it standardize which particular load shall we use for or design.

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General Features of Design

and

Vehicle Loading

Considering that aspect.

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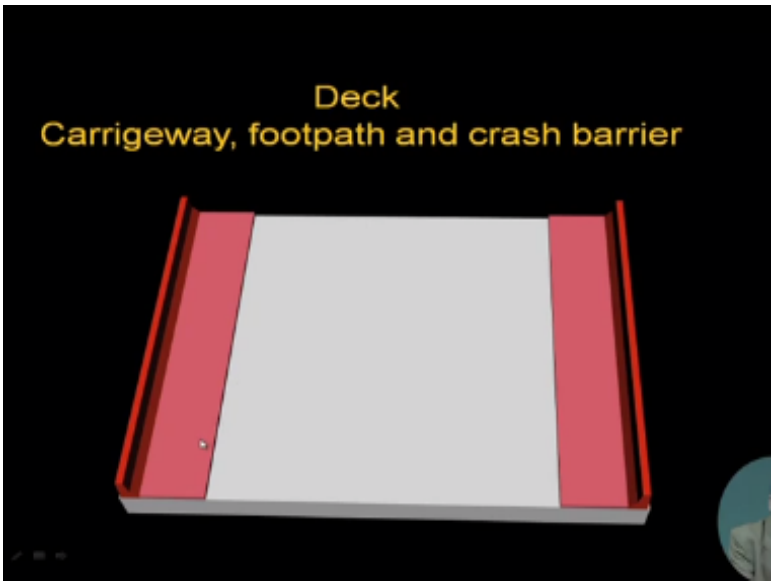

As I have told you this particular figure I have shown you many times and this one we are considering the deck so we require carriage way footpath and crash barrier the thing is that this one that means vehicles the middle part that carriage way part we can consider this then we are having foot path we have considered foot path in both sides and you are having crash barrier in both sides we can have rallying also that we shall come different time that we shall come.

So our objective is that what would be the first thing that as you know this is the deduction of vehicle so vehicle is moving in this particular direction so whenever it is moving in this particular direction then and that is actually we call it span of the bridge now whenever we are conceding the span of the bridge let us just make it very clear in that case whatever we can consider the first thing we are having say span of the bridge.

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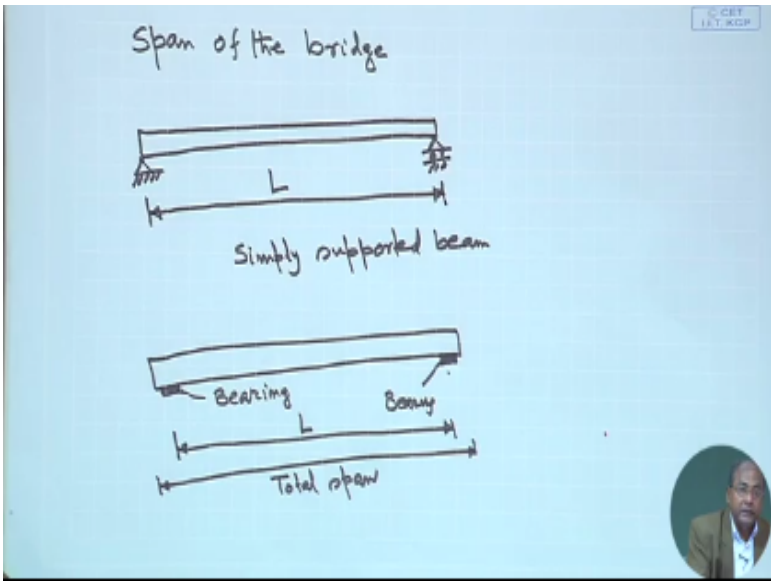

If you consider here again let me tell you we are considering here simply supported beam, so this is our simply supported beam as you can see that I have given these point at the end that means and if you see that any move when ever so for we have solved this problem any analysis problem structure and whatever it is there if consider this one that l we consider that l but in physical system what we really require we require something more that means if this is the one the deck we are talking here mainly say with the solid slab we are talking.

Here we shall have bearing so this is bearing this one another one so obviously this bearing will have certain kind of dimension so if you compare this first figure and if you compare this figure this is actual reality so we can get obviously it is vise to make the dimension from the center line of the bearing to the center line of the other side from the left side to this one so that means we can consider this one as L or effectives span.

Whatever we shall calculate that your bending movements air force we shall complete of the bases of that so we have another one this is another length that is the actual one you have to construct so these dimension that one we can consider that one say you can say that total span I can consider, so our bearing movements see our force ourt objective here to find out a physical dimension of this deck where all of them in this figure if you see all them will come into picture.

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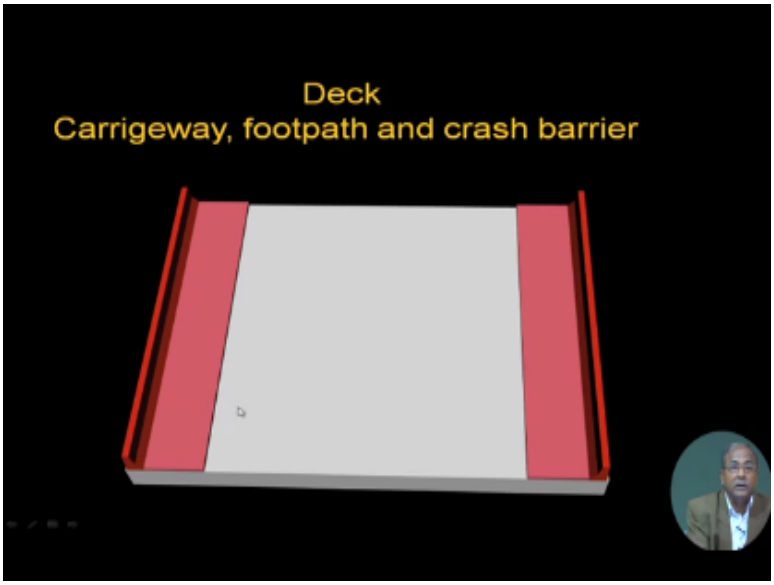

That mean this one that it will be carried by this deck you foot path both sides I have given this color different color to distinguish because otherwise it will come the same the thing is that foot path also made of concrete or may be different in grade then this crash barrier also another grade of concrete like that so that means we shall come forward later on that where we shall another important aspect that we have to consider that is what is will be the grade of concrete what is then grade of steel anyway past we are coming to our physical dimension so these dimension as you know the span is depended that means span we can understand from the how much we have to actually negotiate how much we have to overcome the situation their particular one that barrier that barrier that obstacle that how much we have to overcome and that one we call it the span so that is the first parameter.

That means we can say if it is a cannel if it is a repair we can say that this much I have to move forward so that way we can consider that one as a span and as you consider we are having now two difference spans one is we are called fill in that effective span we can consider and oh, we can call it another one you can concrete that total span that total span of the bridge total length of the bridge that is one aspect so length wise if we consider this one that is your x axis I can say that means.

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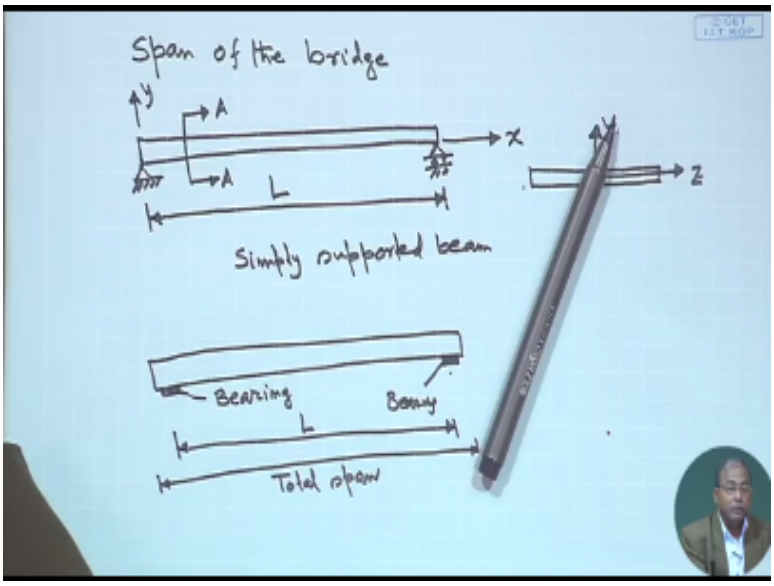

That means these particular one I can consider that I am moving along that x axis and this is your x axis it is customary to write down this one as y but we tell generally we write down as y so if you take a cross section A A if you take across section then I shall find out these cross section the deck part where we are having this one say your y x is the one that normal to the page and then we are having this one here said z so this is your direction that means your cross section will be in yz plane longitude will be in your say xy plan so and the plan whatever we are getting that one will be in zx plan so coming to these one here if we see this figure within because come back to this figure again that where we are showing this particular when the screen.

This figure if you come back here so that means these dimensional whenever we are talking we are having two spans effective span and total span from the construction point view of basically we have to create the total span so that is the actual quantity actual dimension we have consider for analysis point of view it will come to effective span and now the question is that one what will be the these length that means you are in the z axis so this is your x axis and this is your z axis so how much will be your that z axis that particular when you point out was the that one will come later one I mean the shape considering the pending Shear force and different other aspects also that we shall consider that later on.

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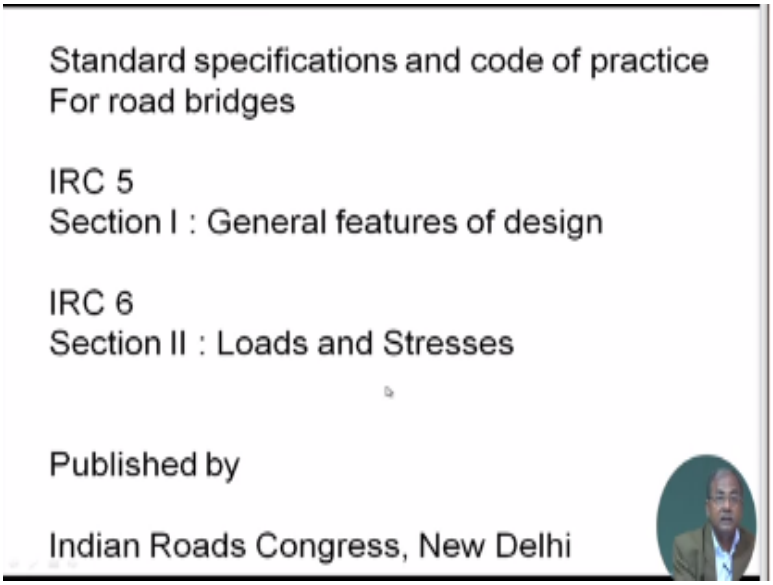

So this is the one we like to find out where we shall get the information question is that wire form we shall get the information the information we shall get it from this Indian roads conveys New Delhi they publish this different road like say Indian standard code we are having thi9s higher similarly your having the IS and generally you are having in code also and different other countries also having different codes coming to this particular one here.

So scan that specifications and put a practice for road bridges this is our focus and then in sce4tion one and section two IRC 5 that is section one general features of design IRC 6 section two that is actually loads and stresses so mainly we shall consider that vehicle load that we shall discussed today that now.

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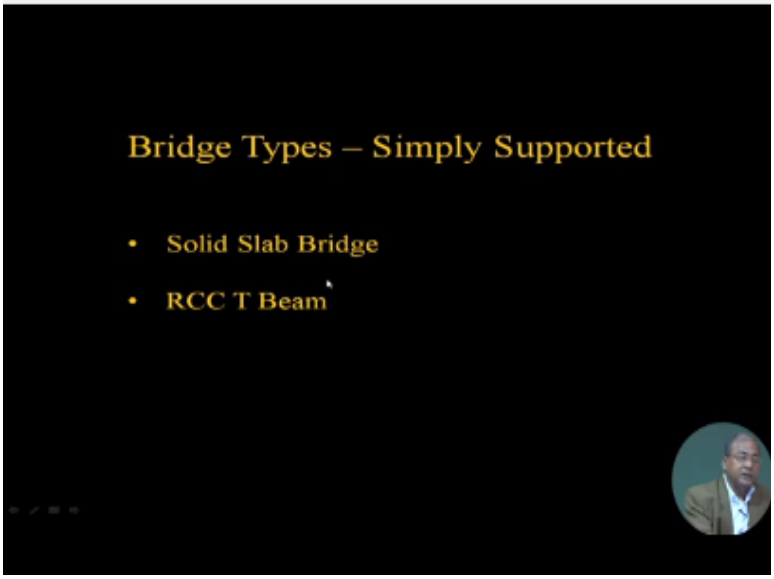

Ourselves per our objective for this particular course we shall only consider this two solid slab bridge and RCCT bean because I personally feel that if we can understand this one other one will be easier to understand.

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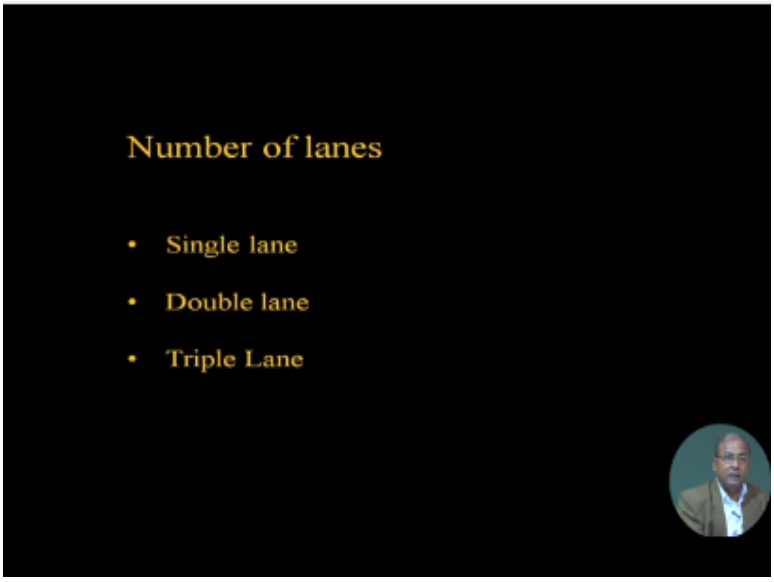

Solid Slab Bridge and RCCT now coming to this one here the single lane double lane triple lane so this is the one that we have to consider single lane double lane and triple lane let me clarify this one just a general ideas for example

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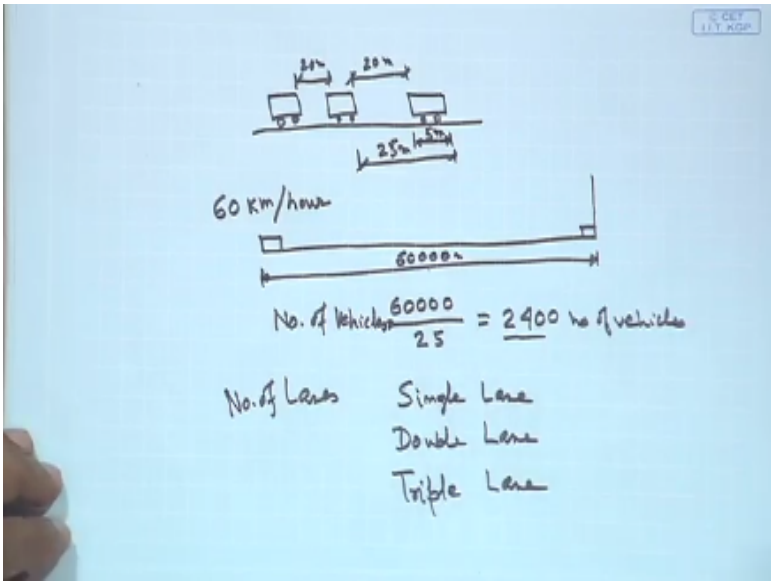

How shall we decide that we can decide this one here let us consider that you are having vehicle on the roads you are having vehicles on the road obviously that you should have another vehicle like this it is moving there is a you on road will find out that there is a gap but what we feel that o shall keep some things 2x meter that means I shall get this one 20m that result keep that mean between the two vehicles I shall be let us assume rapily say 5m so that means this one it is coming so 25m that this one we are having 25m let us at the vehicles are moving at 60km/hr that means in a 60, 000m.

In a 60, 000m this is for that means 1 hour that means I am considering a particular one so all the vehicles will move to move from these particular vehicle and the last vehicle it moves so it will take 1 hour because I am assuming all of them moving at 65km/hr so that means here if we consider 60, 000/25 that means it will come 2400.

This is the one number of vehicles we will find out this information in IRC relevant code generally that is done by the transportation engineering group but you can immediately you can see that it is coming 2400 that number of vehicles it can be 3500 like that we can consider that so this is a very, very comfortable one if you go little more than obviously it will be crowded like that.

Now this is a very, very decision factor say for example I am assuming that I self give for each length I self give 3000 vehicles in an hour if I consider that if I stand in one place and if we just keep on counting then I can say that I should not get more than 3000 vehicles are passing. If it

goes more than that means it will be coming crowded on the basis of that we say beside that at a particular point we say this side that how many vehicles are coming and on the basis of that we say this side that number of lens.

So number of lanes means single lane, double lane that means two vehicles can park keep a line like that it can go. So this is the one we consider that one we have to decide that one how shall we consider with a single lane, double lane or triple lane if we see that in a remote bridge road that we do not have that much of vehicles, so what we can do we can go to single lane only and if we go to single lane then we say very real situation it may come that one another vehicle has come so you have to give that side so that other can move.

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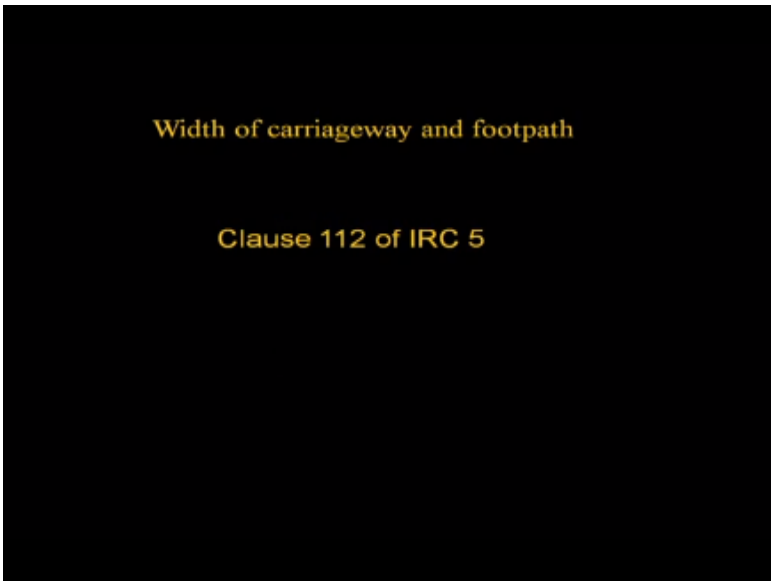

So this is the one cross 112 of IRC 5 that is the one consider again.

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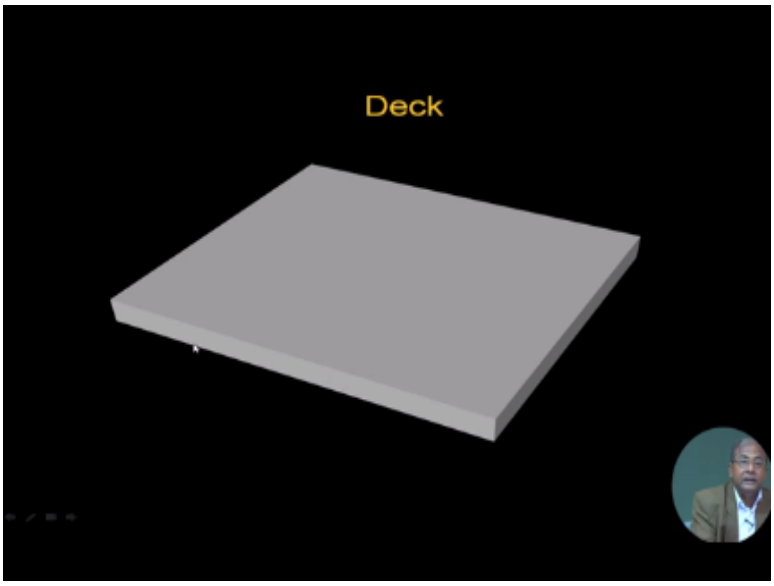

So as I have told you earlier this is the one that deck which is actually taking care of all the load vehicles the chemistry and the footpath and also you say cambria like that you are considering.

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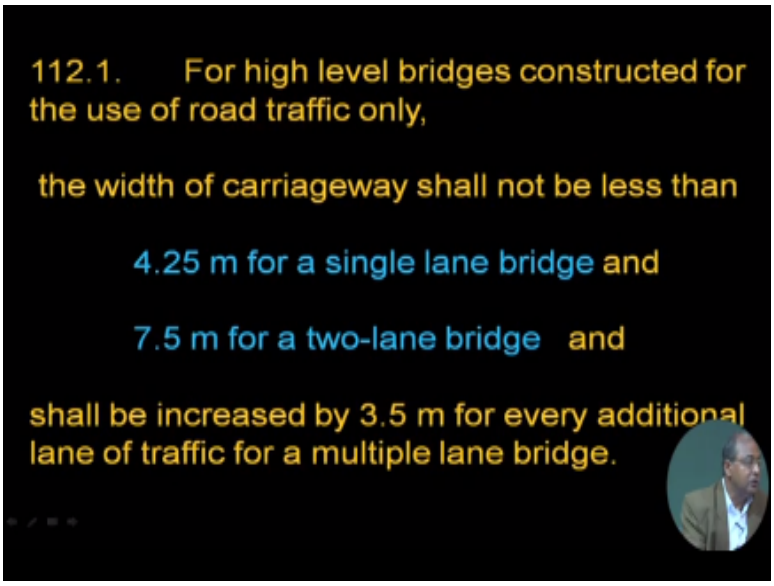

So here for high level bridges constructed for the use of road traffic only. The width of carriageways shall not be less than 4.25m for a single lane bridge and 7.5m for a two lane bridge and shall be increased by 3.5m for every additional lane of traffic for a multiple lane bridge. So that means here if we really consider that so we are having three numbers.

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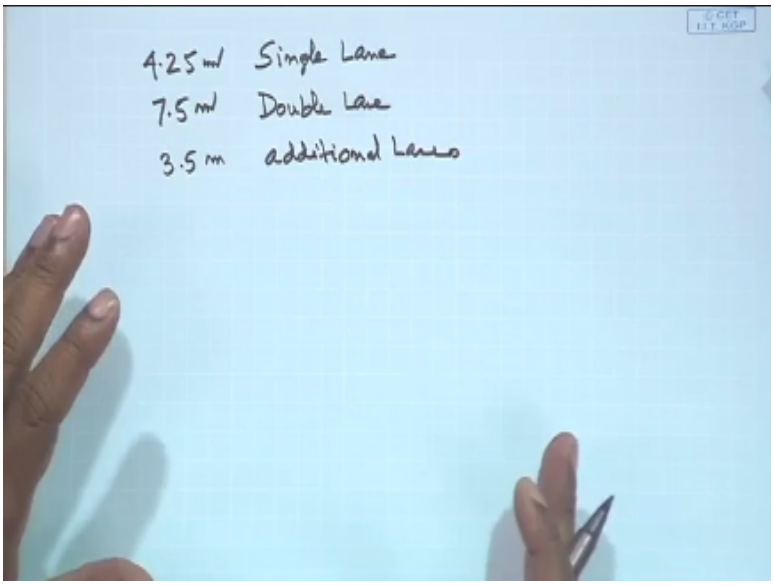

4.25m, 7.5m and you are having 3.5m so this one very specific single lane when it is only single lane so obviously it is why is to give little more because 3.5 maybe sufficient for one lane but whenever we are giving only lane so obviously I have to give little more this is for double lane and this is for additional lanes. So we can consider this one here so on the basis of that we can calculate that how much will be your that length of the, width of the bridge.

So we can decide on the basis of that we can decide on the width of the bridge and then we can find out so that means the carriageway we shall decide on the basis of that. Now additional dimensions for footpath whether you are giving one footpath in one side whether you are giving in both sides because fund is another important aspect and on the basis of that we decide that whether we shall go for that we all say footpath in both sides so whether we shall go it is wise to give say railing only we give but nothing it is better to give as bridge. So that the vehicle will never go out of the bridge, so that way we consider there.

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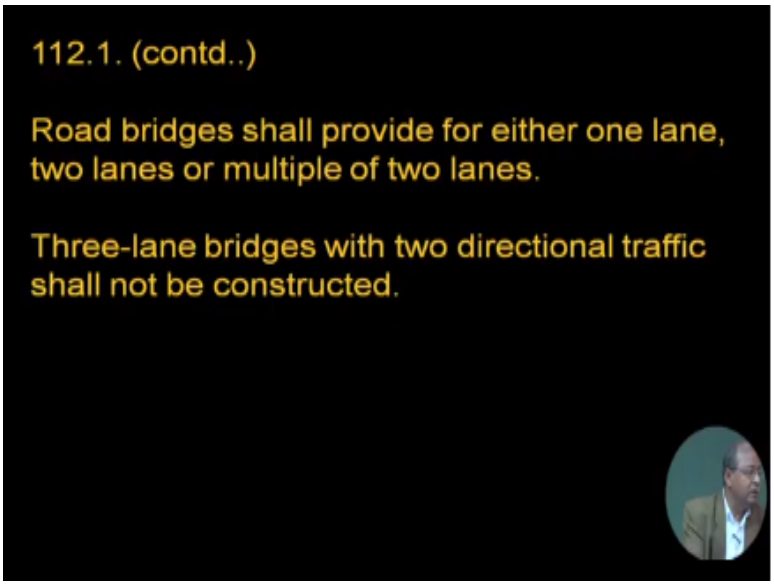

Road bridges shall provide for either one lane, two lanes or multiple of two lanes this is very, very important here please note this word multiple of two lanes. The case that generally we do not give whenever the vehicles are we are considering vehicles then whenever we are considering vehicles that moving in opposite direction then obviously that it should be if it is a single lane that we know that single lane means we have to wait we have to give pass to other one if somebody comes from the other side.

Double lane means I do not have any problem that I self use one my left lane and the other side of the lane will be used who is coming from the opposite side. Now if we go for three lanes then you are having one ambiguity of one lane, one lane left lane you can consider that lane for the person who is going upward direction you can say the one in the right hand side the further right hand side you can consider that one the person who is coming that one you can say.

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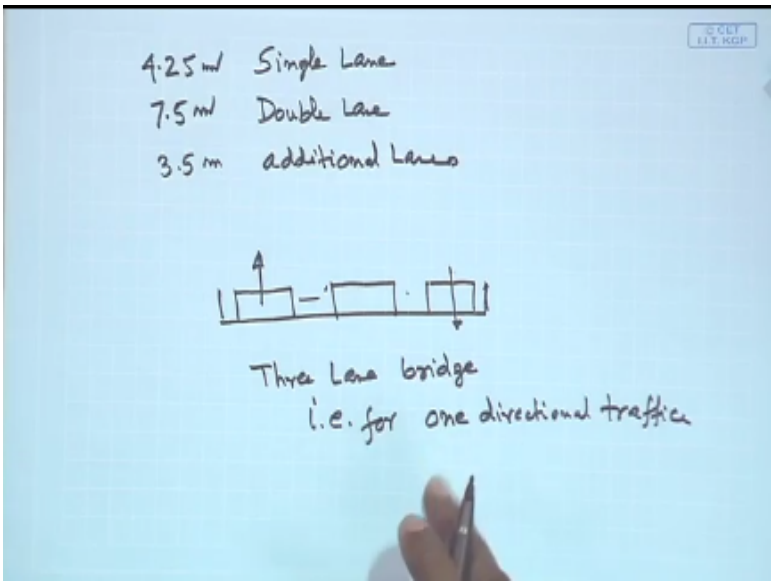

That you can say like this that this is the vehicle and this is the one so this one going up this one coming down now this portion the vehicle who will use it, so that is why it is told that use that not multiple of two lanes so it should be multiple if you say what number of lanes C lanes then it should be one direction only and you will find out in particular high way the three lane bridges are constructed but that is for one directional traffic uni-directional it is never used for both.

So that is why you will find out highways that you will find out three lane bridges you will find out for up as well as for down the two, three lane bridges will find out particular in highways you will find out and that is the one and that is for one direction so that means one exclusively for the up direction another one exclusively for the down direction that way you can consider here. Three line bridges will two directional traffics.

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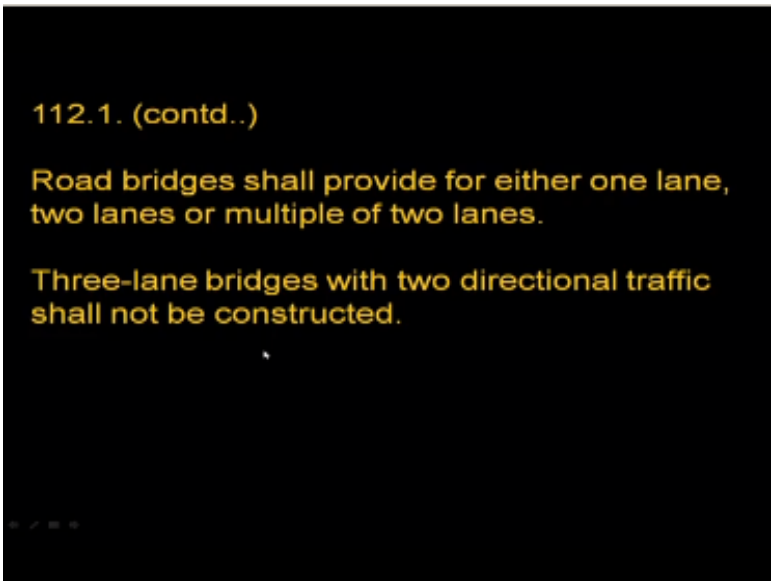

Shall not be considering that is the one we will find out.

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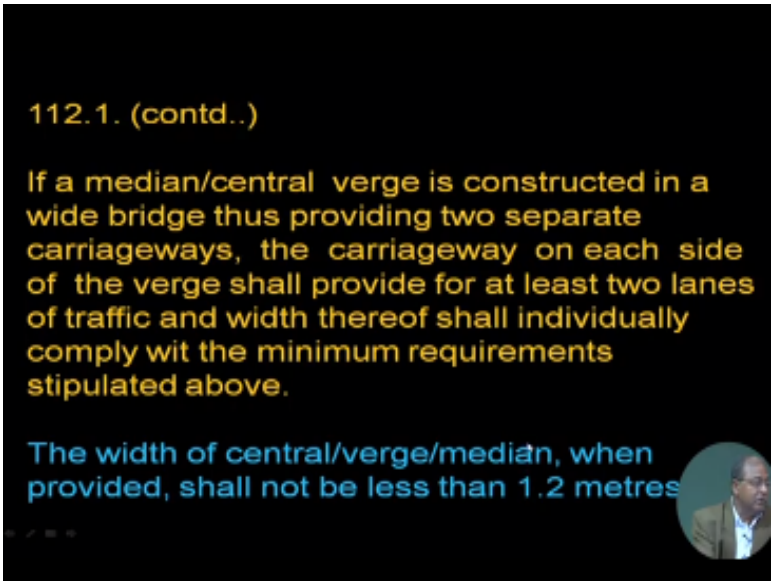

The carriageway on each side of the verge shall provide at least two lanes of traffic shall individually comply with the minimum requirements stipulated above the width of central verge median, when provided shall not be less than 1.2 meters, so if we have something say median portion so it should not be less than 1.2m.

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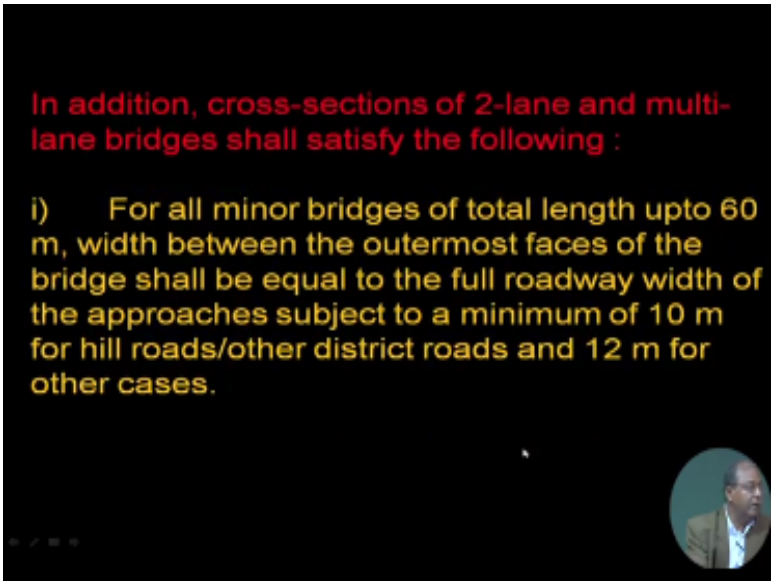

Cross section of lane and multilane bridges shall satisfy the following that means for all minor bridges of total length up to 60m as I have told you that the different category of that one based on the span that we have discussed out of that we have discussed that one so 60m you can consider that one with the minor bridge between the outer most faces of the bridge shall be equal to the full road way width of the approaches subject to a minimum of 10m for hill roads other district roads and 12m for a other cases.

So this is your that guideline as you can see that means our objective here whenever you are deciding that width the width will be such the roads width should not be more than the bridge width if it happens then obviously there will be a congestion of traffic during movement. So that is why I that always I should have the knack should not be actually the less then the body that is the one we should not have.

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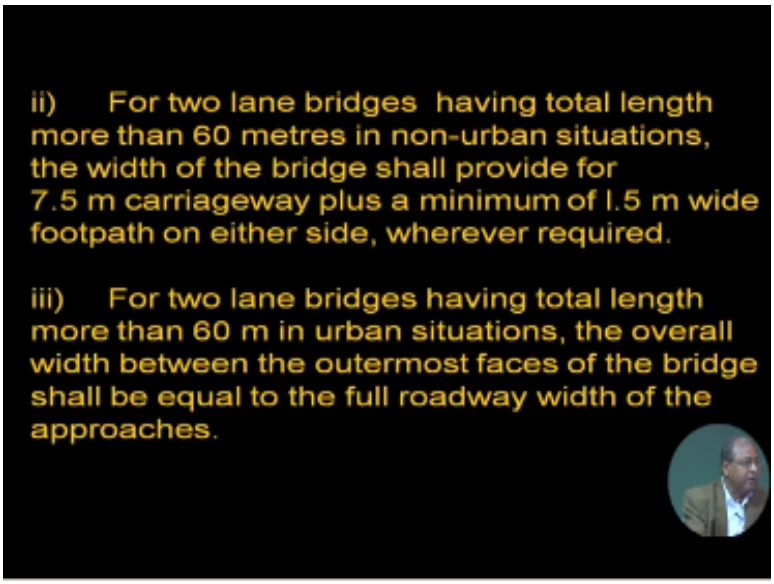

For two lane bridges having total length more than 60 m that is we call it actually you are say measure width you can say the width of the bridge shall provide for 7.5m carriageway plus a minimum of 1.5 m width wide footpath on either side wherever required. So we have to give minimum share this is a 1.5m footpath sometimes they restrict but that is not the right choice so the thing is that here as I have told you many times that bridge actually one important aspect the road path you can easily expand it but whereas the beach path once it is done you will not be it is very difficult and under knowledge you expand it.

So that is certain kind of expansion actually possible that was one now it is many that state have you edge or national highways they are doing in that particular one. So that is why it is always wise to go for certain kind of dimension that occur one in this case I have told you 1.5m wide footpath sometimes they make it's a 0.75 or 1m that is not wise decision, for two lane bridges having total length more than 60m in urban situations the overall between the outer most faces of the bridge shall be equal to the full roadway width of the approaches.

So whatever you are having that full road way we talk that bridges now the thing is that whenever you are talking full roadway width in that case what happen actually that 7.5m that is for the double lane and that is very, very common and then you can go for your say 11m that way we can consider for that 3 lane generally width, but that one again should be actually unit detection that particular one we should consider here.

So coming to this spectrum here so with that full road way whatever you have to talking say 7.5m or whatever one you are considering that one that should be a met.

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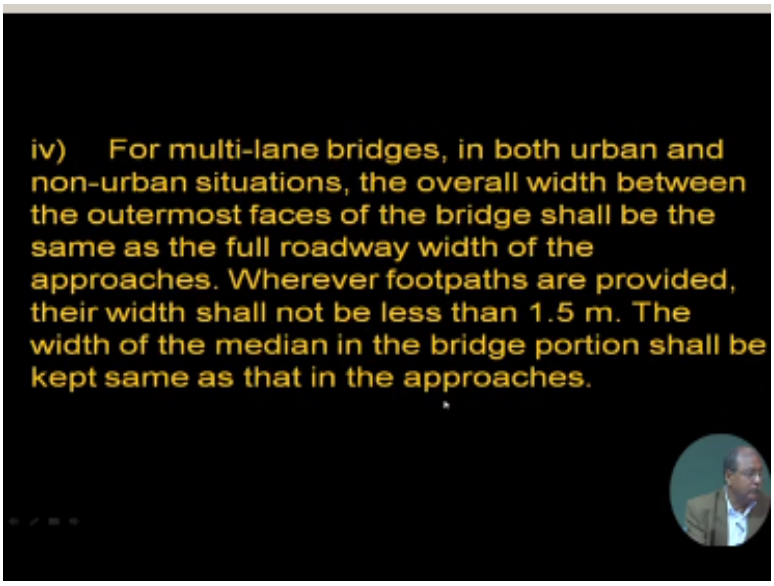

For multi lane bridges in both urban and non urban situations the overall width between the outer most faces of the bridge shall be the same as the full roadway width of the approaches wherever footpaths are provided their width shall not be less than 1.5m the width of the median in the bridge portions shall be kept same as that in the approaches. So that particular one we should keep it in our mind.

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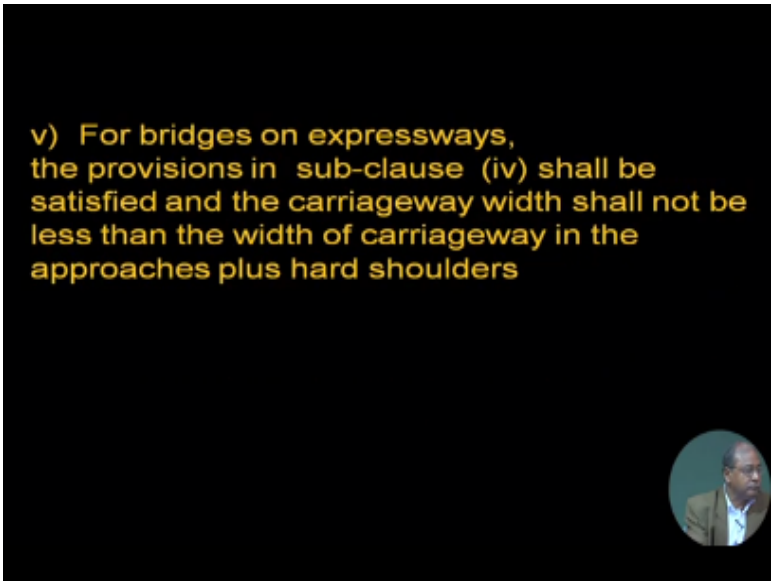

For bridges on expressways the provisions of that shall be satisfied the carriageway width cannot be less than the width of the carriageway in the approaches plus hard shoulders. So these are the guidelines whatever given in higher say 5 so this is most important on 4 and that I have given here that particular one here for expressways so with respect to the earlier class that we shall consider.

So the idea is very simple that we can consider this one this is very simple that means you can consider that one here that your.

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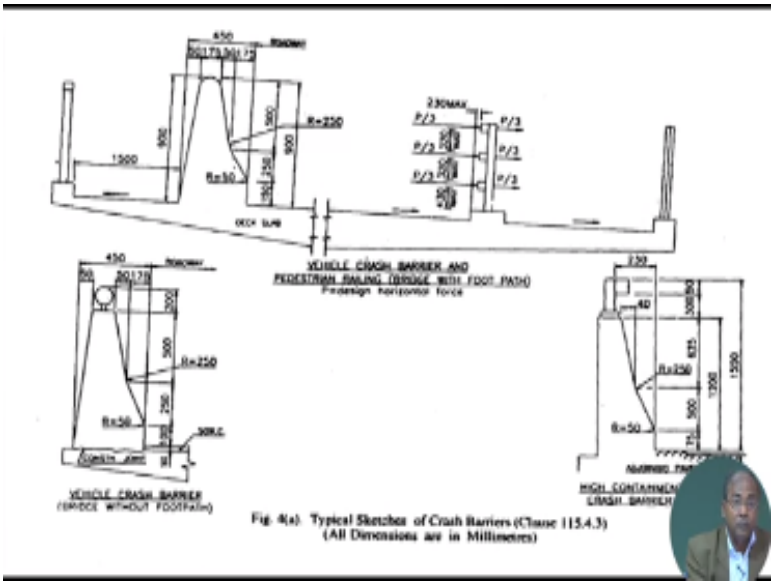

You can consider that road width that you can find out so it is very simple 4.2m once more let me tell you 7.5m and then 3.5m that is the guided factor on the basis of we have to do it. And then your width of the approach road that is actually very, very important here. Now coming to this one here just to this is one we call it actually your sacked gas beadier, gas beadier can have this type of dimension this one I am taken from higher 5 and then we are having therefore this is very, very standard dimension that we call one city you can do it you can use it for all your project if you want to do it.

So these are the things we can going to do and this is your realign part here you have consider this one say here that you have take have would this one that means the bridge way and because there is a possible to the hard way case the vehicles will make come to the footpath but in this case the vehicle will never come to the footpath so that may pedestrians can go in a comfortable manner without any density so that way you can consider here.

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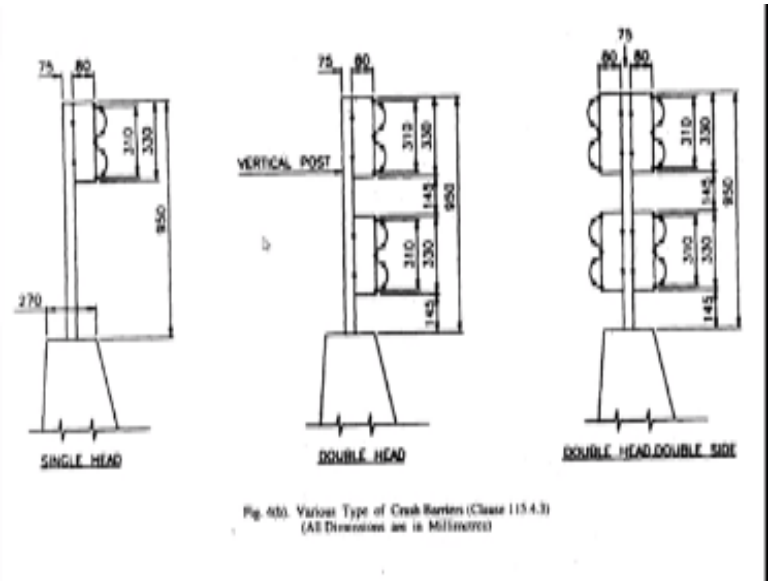

This is your single head this is the double head of particle post double head double side the both sides that is possible that means this is in one side this is also one side and this one whenever we are using the both sides that particular one vehicles are moving that you can consider that.

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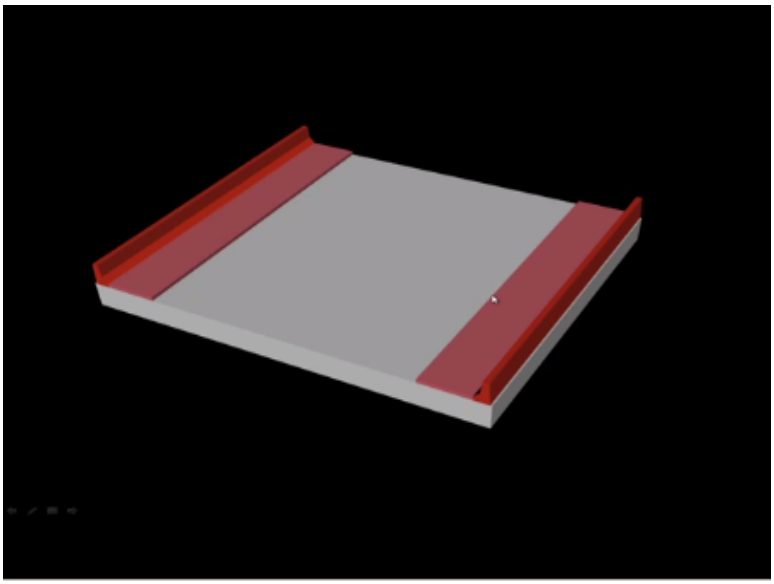

So coming to this one here before that I taught I shall tell you this what is called so this particular one here so now we have bought this information that I know the span that how much we have to negliciate how much we have to overcome out how much of stickle we have to move on that this is of desk span is decided the next one we are getting this one here say that your these portion footpath whether this is given or not then gas beadier then you are having really on the basis of that deck we decide and then we can find out this these are find out our first part that we can say that we can find the dimension we can get it the question is coming here depending on the spam thus the structure will be decided and I have told you7 one that we are considering a simple one of RCC slab.

the one I am showing and second one we shall concede ring RCC to beam that you can find out you will go there little more then you require that the day is coming quite high and that one will not accept from the economic point of view consider coming to these spectrum over here this is the quality consider a sense we are doing here the second part we shall consider that to obviously will coming that one here just quickly let me come back that are tell you for these circular case we have studied.

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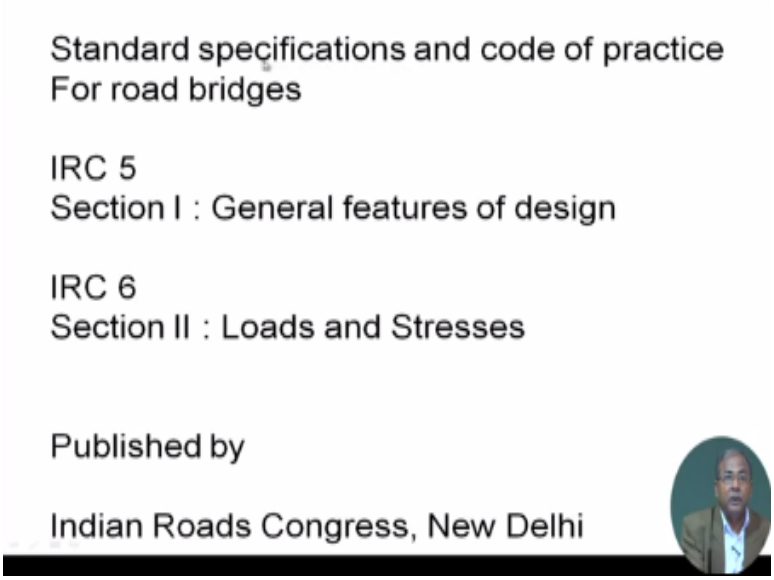

That we are consider only say we are given the general features so the design for if I met consider the second part we shall consider that we are show the logs and stresses in that we shall consider in the second part of this topic in the load congress so many could so many also consider here that other codes I shall show you the other codes particularly so say euro code and most of the cases euro code we will find out that we are bias i9n the Indian standard all I rc that is mainly for the load once we have followed you the euro code and you will find out the our objective here that step by step we are moving towards.

To the design that5 not only that the form only behind only in the planning stage that means how to decide that what type of spam what type of that is the first part and that is the disease of that we required that two of person so I have given you the plan of the bridge if you look from the top of the bridge the at get the span of the bridge and white of the bridge so far I have not told you what will be the depth of the bridge that one will come in to the picture when you know their loafs and what type of loading are coming and different types for loading will coming to the picture male user coming to the self quit of the bridge and the other one which I shall consider.

That one that you are say that vehicle loading we are considering with us in the next one we consider that an spaces particularly you have vehicle loading so many vehicles are going the question is that what will be the load vehicle that one will be the important part that we have to consider that one so everybody all digit that follow that one and that is obviously very important here.

So example just to give the idea for the Indian standard code that ix75 whenever confidential building in the obviously we are considering that is the example and 8 kg per square meter but it will one may be 300 kg per square meter even it is a balcony then it is then and the star vase perusal connotes crowded having a balcony if you are then balcony it is in the road side there is possibility that will happen that it will all crowded to see going on the balcony there is a presages something .

So that we can understand that is one is a coverall loading and that is called as say crowded at the balcony we can say balcony for four kilometer square similarly Newton per square meter a food path also o we have food path how much we are one and which we all come this that I have six and two load stresses by Indian.

So only we are3 taken these one we are wearing code then we are having concrete code like that we are having defended code but you should introduce the code whish the particular course ok with these let me conclude this particular one and go to the next one that is the loads and stresses thank you very much.