NPTEL ONLINE CERTIFICATION COURSES

Course
on
Reinforced Concrete Road Bridges

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Lecture o1: Introduction

Hello everybody I am going to teach bridge engineering and a part of it that is reinforced concert road bridges.

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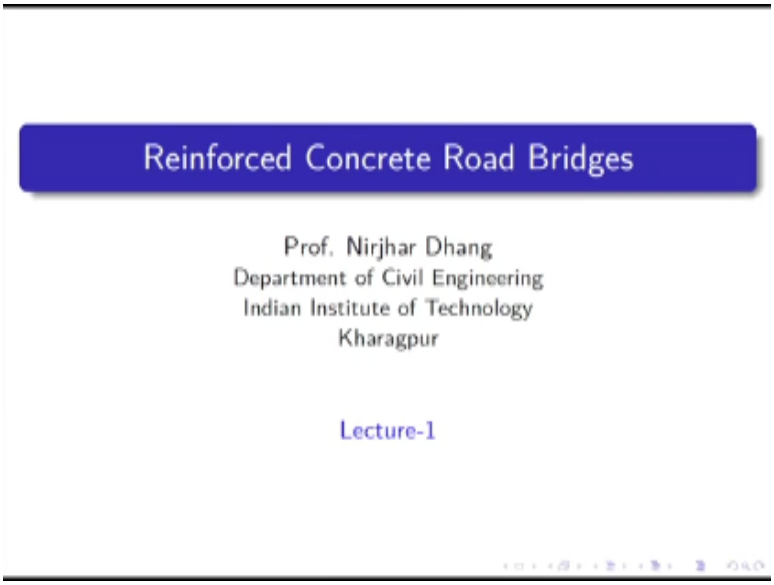

Why we have chosen this one reinforce concrete road bridges this module is having 20 lectures of each half an hour and this lecture number 1 where I am going to give the.

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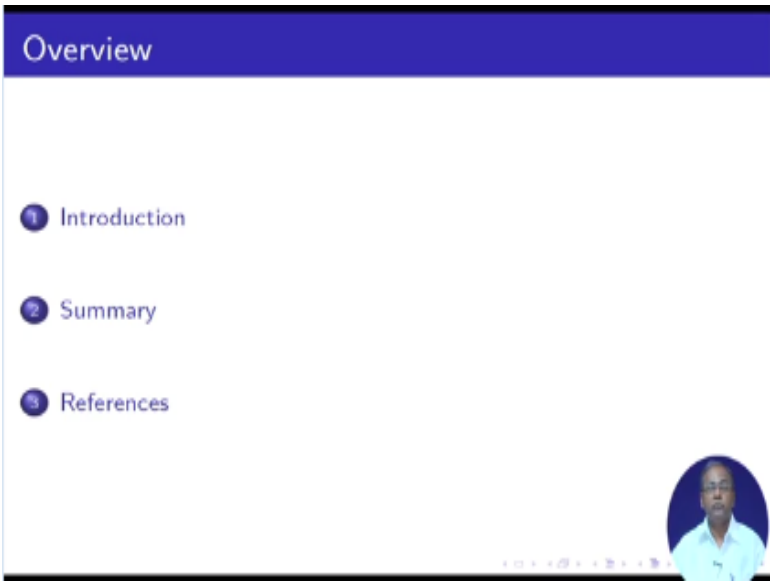

Introduction and then summary and the references which we are going to use the result give, now let me tell you.

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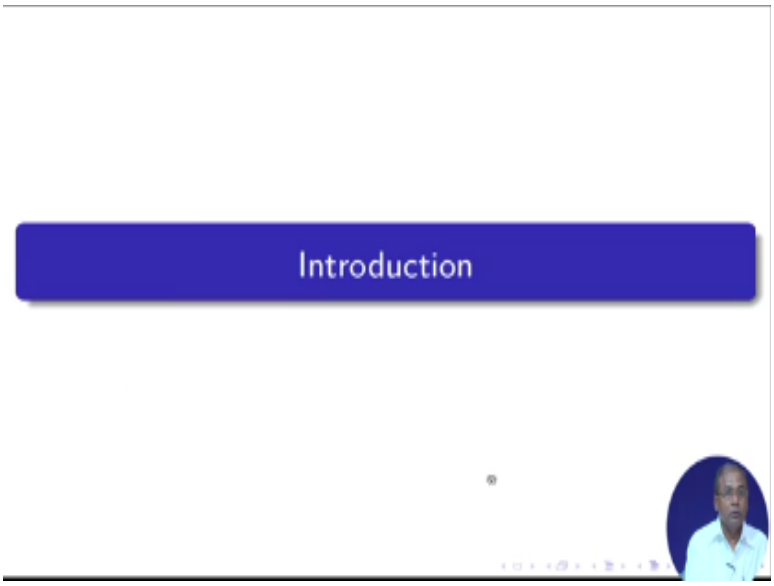

What is bridge engineering?

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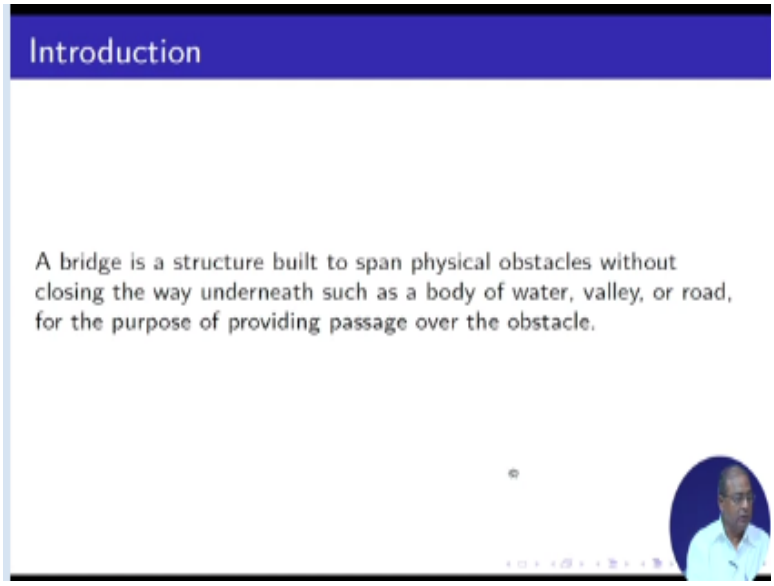

So a bridge is a structure with to span physical obstacles without closing the way underneath such as a body of water nil you can consider river, cannel valley or road for the propose of providing passage over the obstacle.

So that means you can say hole is whenever we require bridge we always require bridge on the orthogonal direction that means from one side one bridge is coming and other passage and another one we would like to overcome that one and then we require a bridge and it can in multiple level also in cities you may found you have found may be that there are so many levels of fully over's moving one after the above.

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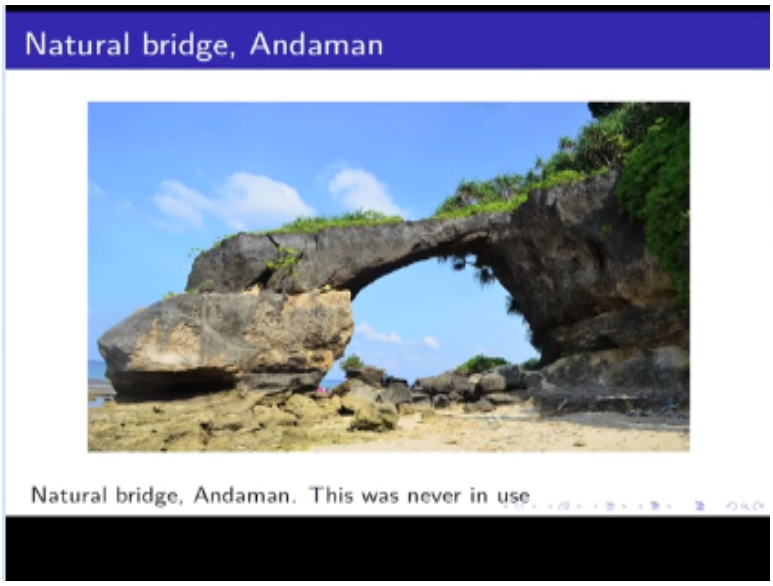

Just to give you a interesting way this is the one they call it natural bridge in Andaman and which was never in use you can see this one I can say this is the one we can use the passage and other one also you can use it here though it was never used but this one definitely as a very good produced spot in Andaman, jut to give a natural bridge that with they are popularly call it as actually Howrah bridge also.

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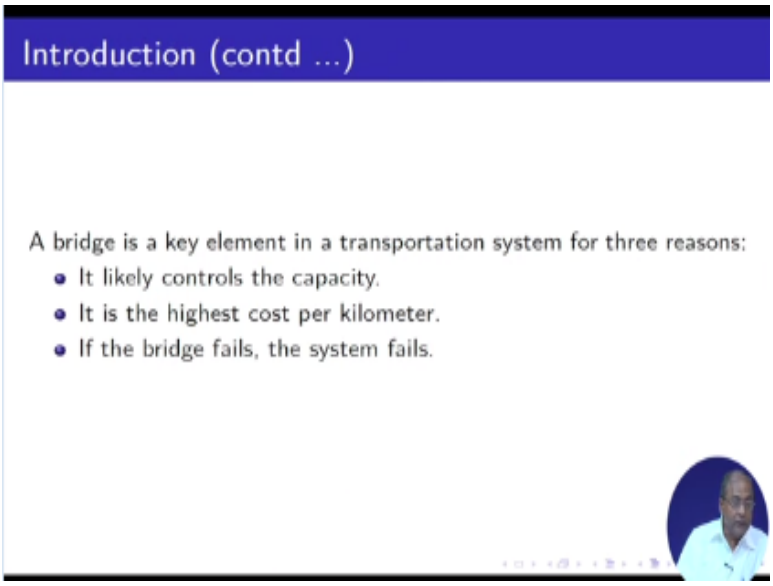

Now a bridge is a key element we can consider that one the bridge you can consider as a neck of the body that means if you consider that neck of the body that is very important because it is connecting with the head and other parts of the body so bridge is also like that if you consider any transparent system that the important part actually the bridge so one from one end to other end they will find they will find out so many bridges even in every kilometer of road you may find that one small bridge small span of bridge that also we can find out here.

Now it if you see this one here I would like to say these key element in a transportation system for three reasons, it likely controls the capacity. It is the highest cost per kilometer, that means if you consider the road any transportation the road then obviously the road part whatever you are having that you would say construction cost generally you may come up something in the range of two course per kilometer per length.

Originally when that was it was started long back in 2000 it was almost we can say one core rupees one core Indian rupees one core per kilometer per length that means for a high way if we consider that one say full length so let me construct one four one kilometer road then you require four core now it may come around say 8 core then is 2 core per kilometer, it can come in that range the second one that is the highest core the 3 one if the bridge fails the system fails it is like say neck that one having problem so your whole system will collapse that is the one we can show. So that is why bridge is very important one in our transportation system.

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I would like to give though it is not relevant but I would like to show you few bridges here because the first I am going to give you an introduction and then I shall tell you why we have chosen only the enforces concrete those bridges, so first let me tell you these particular one here you see that very old bridge so this is the one Rameswaram that one with the main land of our

This is the very, very old Bridge so this is the one in Ramaswaram that one with the mean land of our country India that is actually constructed but why I told you that one that is also very interesting thing that I am going to tell you with the name then it.

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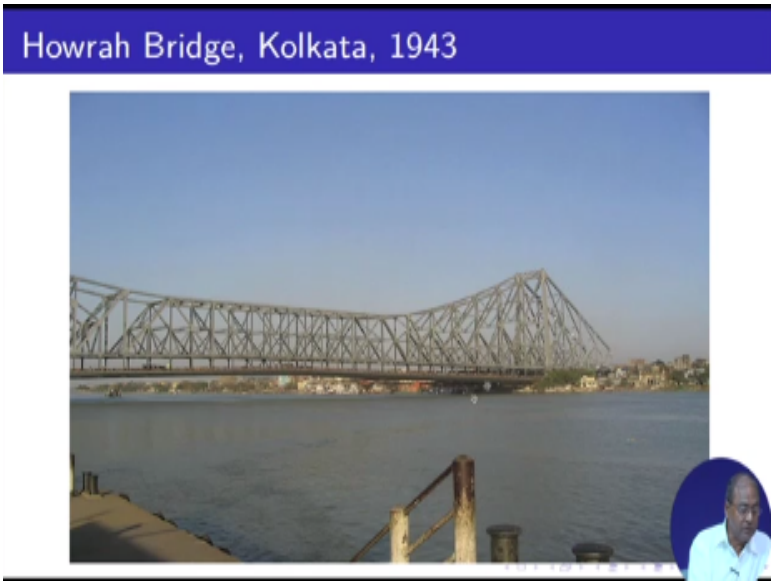

Next one that Howrah bridge Kolkata 1943 that is also it was a steel bridge actually that one we can consider that one this portion actually your having can tell your portion this one suspended portion over this where to other side also the similar kind of things there.

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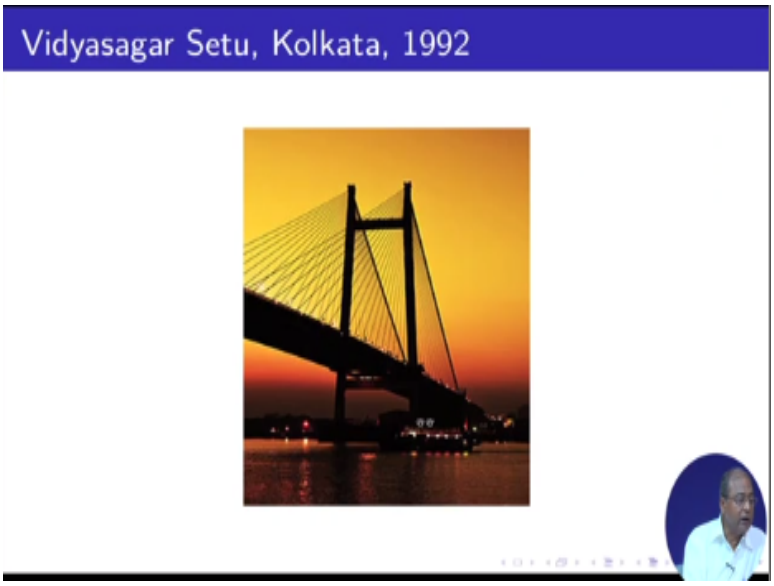

Then you are having sorry, that.

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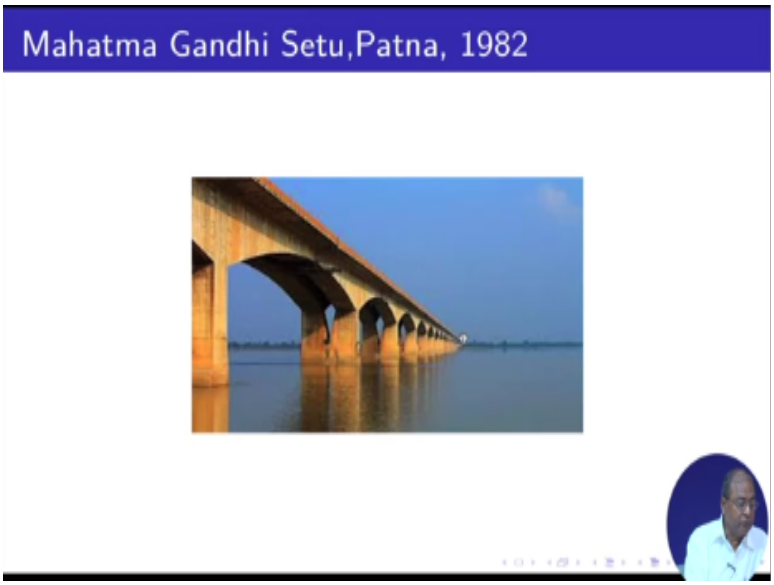

Mahatma Gandhi Setu in Patna that you can you can see that is one step in 1982 and the 4th one the Vidyasagar Setu Kolkata in 1992 now the question is that why I have chosen these there are so many bridge very, very iconic bridge in the wall that why I have chosen.

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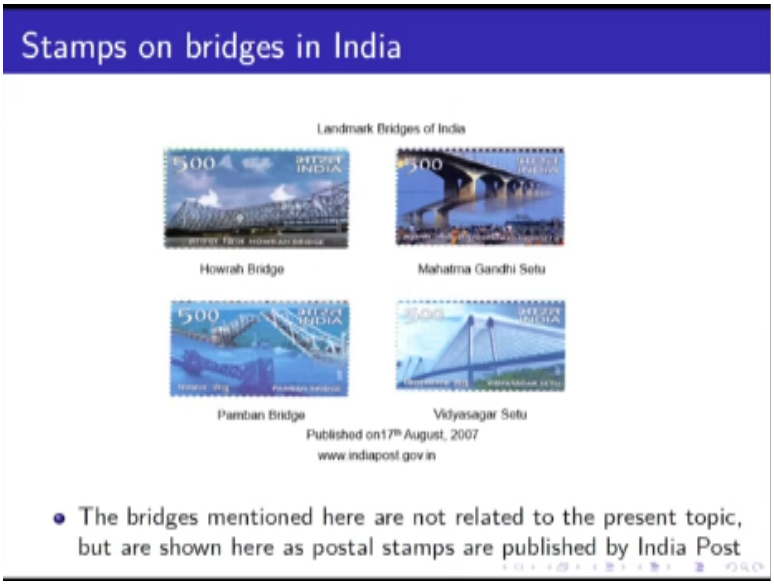

Because these bridges actually that one that you see 5 rupees stamp that one published by India post in 2007 and where you are have in Howrah bridge, Mahamta Gandhi Setu from Pamban bridge and Vidyasagar Setu so that is why you I thought it is good idea to show you that because bridge in very , very fast area not only from the design point of view also from the construction point of view and the last one in more most important one that is actually all mix maintenance that bridge monitoring that is also equally very, very important.

We will find out few actually or said that just one bridge failure that famous one the bridge failure or which happened in 1940 in Deck narrow bridge that bridge Deck narrow bridge that one within 6 months so there are many more such things are there I am not going to detail up all this things which are come back to when your mainly or in first but I think it is what to be in the first introduction as a bridge engineering course I can say it is important to show this one now the next thing.

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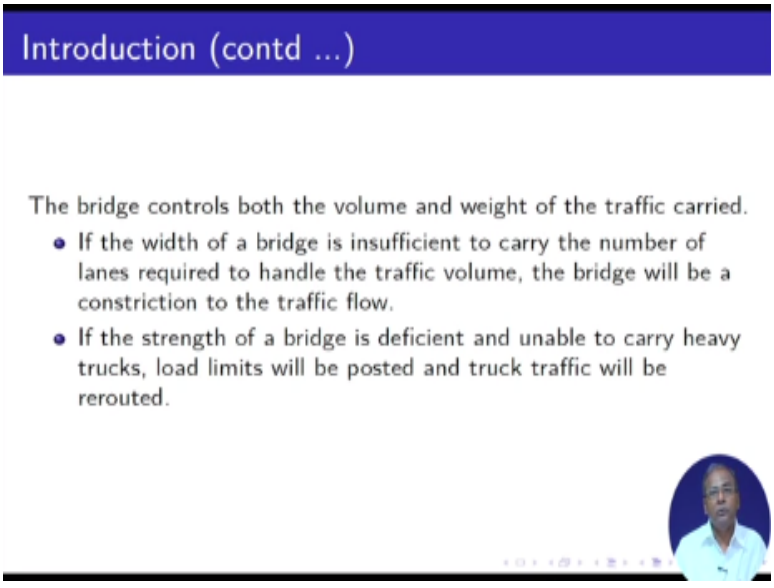

Is that the bridge controls both the volume and weight of the traffic carried so balloon and weight these are important here now the thing is that how do set the capacity how do slit the capacity of a road it is very, very interesting one that means how do I know that how many lines we require that is actually very, very important here so just to give you idea.

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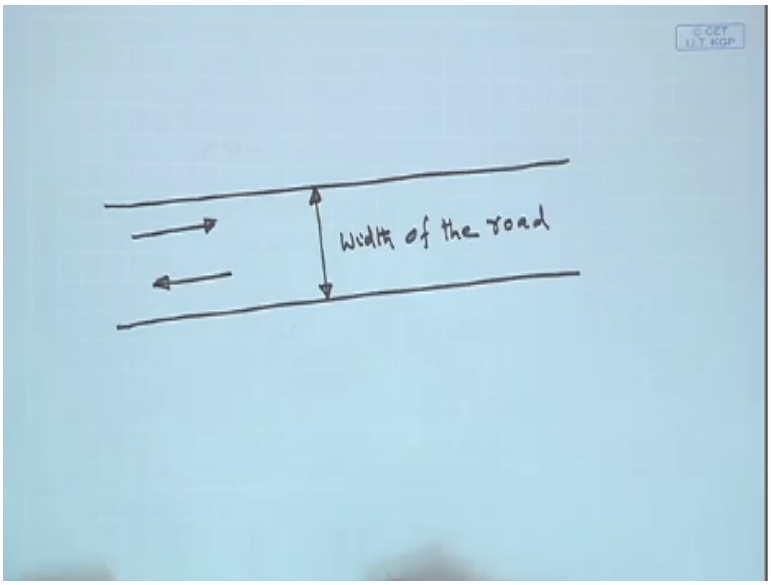

So for example here you are having the road it is following moving like this and obviously I have to consider the other one also the position is coming here it is a common detail that what to be done width of the road, so there are number of issues here there are number of issues if we really consider this one how do decide that up to down here that volume of traffic and also equally important that weight that whatever you have to put here if the width of a bridge is insufficient to carry the number of lanes to required to handle the traffic volume the bridge will be a constriction to the traffic flow.

So let me you will have that your set traffic which aim in that particular area you find out and it happens actually because of say in proper plan in it happen roads are actually why did not but originally if the bridges are they are in the narrow length that you are say width and then it followed find out possibly you have also first any time in any city or it may happen that one that you may face that particular problem and that they are you are having the traffic jam it happens like that so that is why bridge is very, very important in the future planning also.

If the strength of a bridge is deficient and unable to carry heavy drugs load limits will be posted and tractor truck traffic will be rerouted so this is the one also very, very equally important actually here that not only you have consider the balloon which will make it jam in the road and the that one is that is the weight that heavy vehicles other things it will consider that one and they are in find out in that your that it will become actually deficient so we have to reduce the load so that it was a heavy traffic that heavy that highly heavily loaded trucks that one should be actually read out it that it happens in the in that particular passion.

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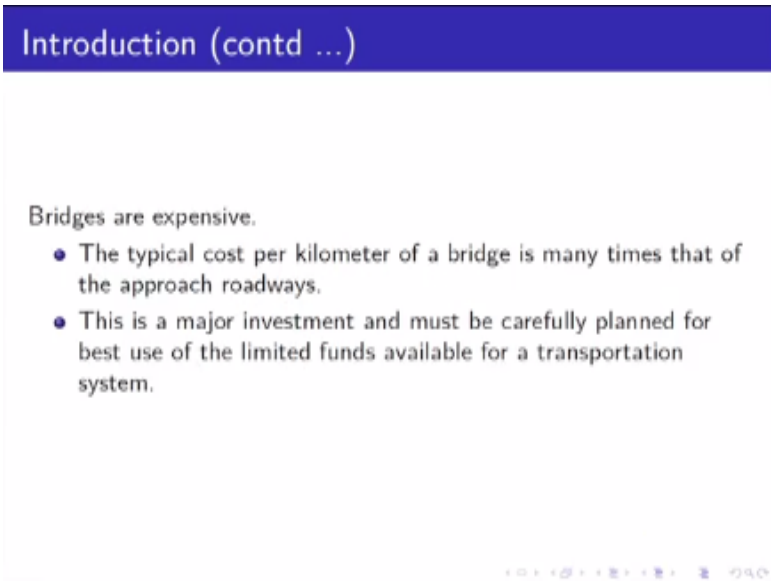

Bridges are obviously considering the road bridges are obviously expensive that is the part and we deal it separately, whenever you consider the road construction so bridges separate and road for separate whether it is actually concrete one or bituminous one whatever we consider that what called ship payment so these part we take it separate one that means if we consider that one though it comes under the same civil engineering you will find out the bridge that part will be taken care of by the structural engineering group and whereas spare spend part will be taken care of by the transportation engineering group it happens like that.

The typical cost per kilometer of a bridge is many times that of the approach road this is one important part that you will find out. This is your major investment and must be carefully planned for best use of the limited funds available for a transportation system, so that means this is the one actually major investment considering the road so wherever you can consider if you have that for roads we estimate in kilometers whereas in bridges you have to consider in meters. So you can imagine that the cost part that you can find out here.

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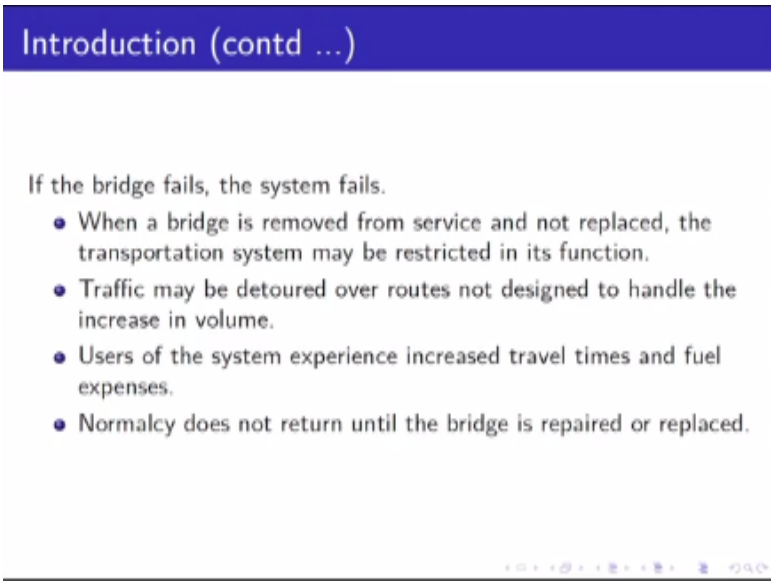

Now this is very, very important here if the bridge fails the system fails, the road you can consider the road as the lifeline road or transportation system in for a country or for the civilization you can consider this one as a lifeline to our system, lifeline of our civilization you can consider that one here is for example major ports that major sea ports or whatever available there from there you are always having the supply line.

So now whenever you are considering the supply line there from the, so now if any problem there sometimes it happen because of certain accident of the things it happens the road is blocked for some time and if it happen the road is blocked for some time then you will find out the traffic actually accumulated and to disperse the traffic it takes lot of time and it happens many times it happens like that so that is why bridge is very, very important if it happens because this is a very, very small part of the system but it creates lot of problem if there is any problem there.

So that is why you have to very, very careful in our bridges, so when a bridge is removed from service and not replaced the transportation system maybe restricted in its function, so this is a very, very important part so that means if the bridge is removed for sometime actually that particular one blocked then it happens. Traffic may be detoured over routes nor designed to handle the increase in volume.

Possibly you may also have this that kind of problem in your life that we are going that much of shortest route but sometimes it happens whenever we are moving from shortest route sometimes we have there is any disturbance whatever the problem there many things happens actually and

because of that what happens actually you have to go through another route. Now whenever you are going to another route everybody is trying to use that route and what will happen then their route there it would have their volume will be more again that route will be not be sufficient to carry that particular one say that volume there is one very important part here.

Users of the system experience increased travel times and fuel expenses, so obviously that you will find out that you would saved the travel times also will be increased and in that way your time also will be spend more and then also you will find out that fuel also that one also will come into here. Normalcy does not return until the bridge is repaired or replaced, so this is very, very important here that how much time will give it happens.

Sometimes in the bridge that happens there is one car or vehicle or truck that one happens say for example, that is actually due to whatever reason that one may be due to accident or whatever reason actually it is just simply standing there and if it happens there then you will find out the traffic either the traffic actually you are detouring or they are waiting and if creates lot of problem there.

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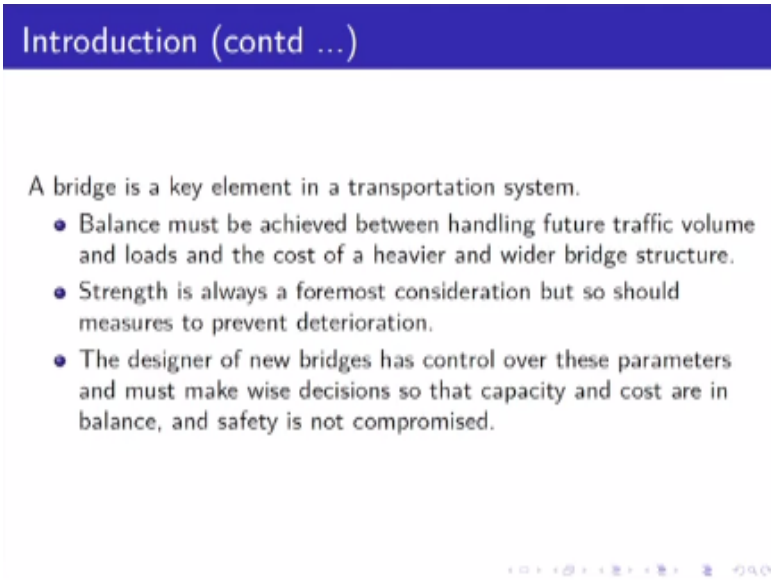

So as I have told you here a bridge is a key element in a transportation system. Balance must be achieved between handling future traffic volume and loads and the cost of a heavier and wider bridge structure. Strength is always a foremost consideration but should measures to prevent deterioration. Designer of bridges has control over these parameters and must make wise decisions so that capacity and cost are I balance and safety is not compromised. First of all as I told you in the very beginning of this lecture I have told you that particular one that is it should be you should consider bridge in future building.

It happens particularly for examples say your say village roads over your states highway they are because of say you are safe pond availability it happens that one originally possible if you go to any removed villages you will find out that whenever in the beginning when the roads are constructed bus roads that for your say traffic that one constructed that time they have taken single lane okay. I say come back to that single lane double lane treble lane, lane means that particular lane is used for your, that vehicles.

So that is your one lane that one Len means that whenever you are moving that one as I have shown here in this particular figure I am showing this particular figure here.
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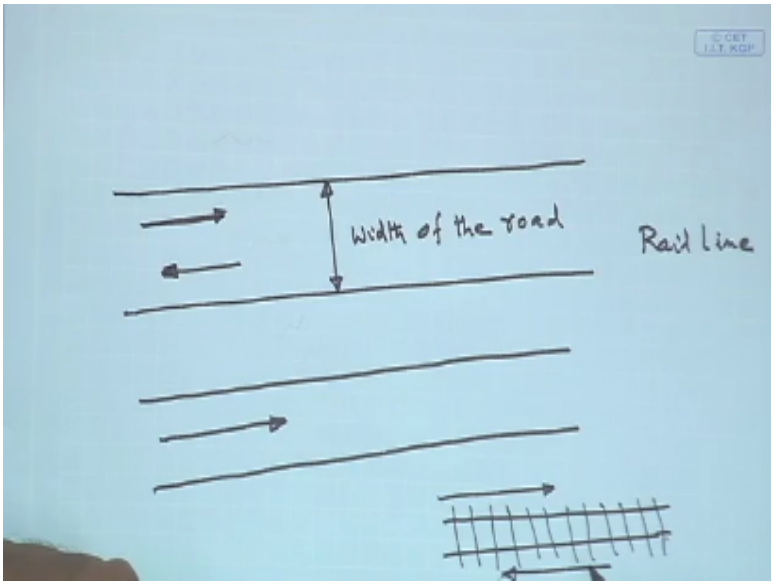

That here I mean to say that there should be uninterrupted flow; now let us consider this is the road here I am telling at a time only one vehicle can move so that means there from other side if it comes then you have wait somewhere you have to give pass so that you can pass and then you can move. Possibly you have experience that where originally it is worth to show that when you

are having say real Len for real track that one actually first introduced most of the cases will find out during first whenever in produced in a particular locality in area you will find out that rail line actually given only in one place.

That means only one rail line there just to give you idea to show that how that line looks like these are the call sleepers this is the general symbol we generally we using. Now whenever you are using rail lines then the you have possibly you I do not know whether you in a experience that then can move either in these direction or in this direction because only one track we have.

So the train has to wait somewhere in the stations train has to wait then only it can go because in stations will find out there are only two three tracks are available there.

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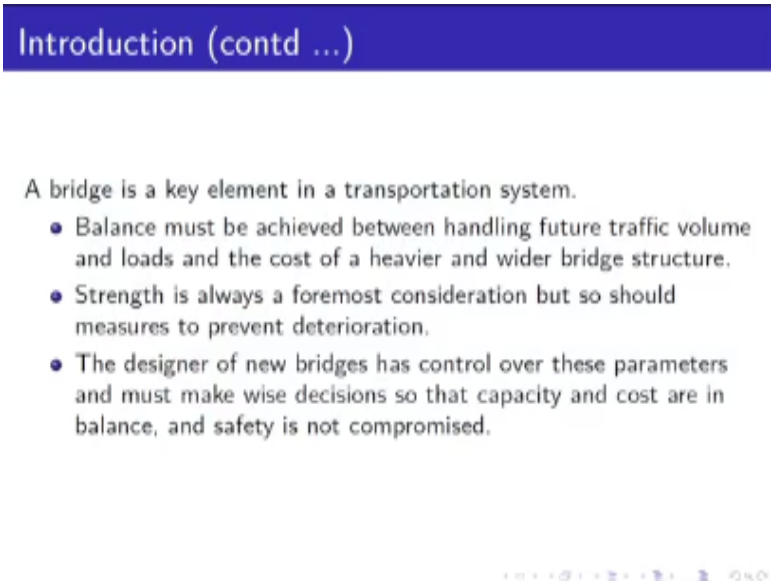

This is the one. Similarly this is call the lane width so that we have to decide that means if you want uninterrupted so I should have sufficient space so that vehicles can move in either direction on left to right as well as from the right to left. So what happens you doing homo early stage or planning generally the roads if it is made say only for one vehicle then it will face problem when the roads are widen but because of that you are say turning and also fun the bridges are not widen because it is not so easy to widen that bridge if you do not have any provision in future planning.

So that is why you will always most of the cases we will find out that vehicles are going and then you have to wait and you have to be careful whenever you are passing that bridge this is your very, very important.

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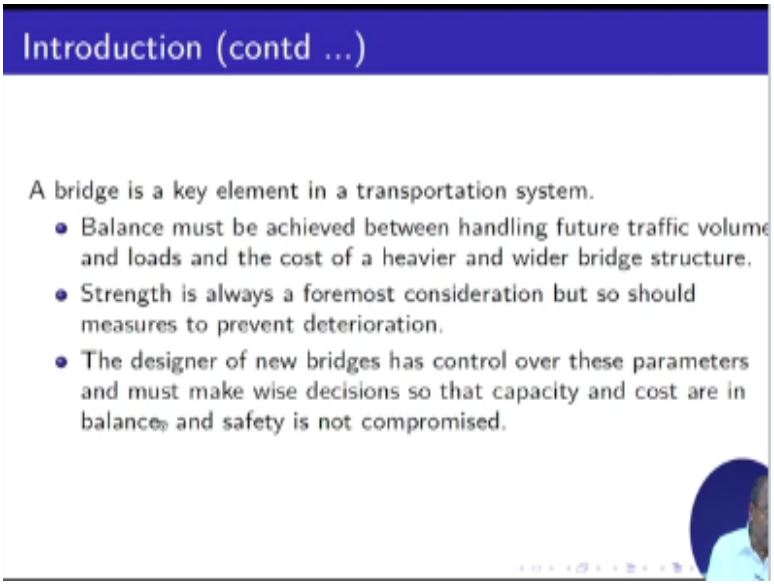

So this is that's why no one very good thing in planning that roads you make it smaller width or single lane or double lane but your bridges you make it at least double lane so that two vehicles can move or you can keep it for three also then we say three vehicles can move like that. Strength obviously as a very important aspect that you can find out and then obviously that will be this parameters that we are consider that one say safety that also be a consider here.

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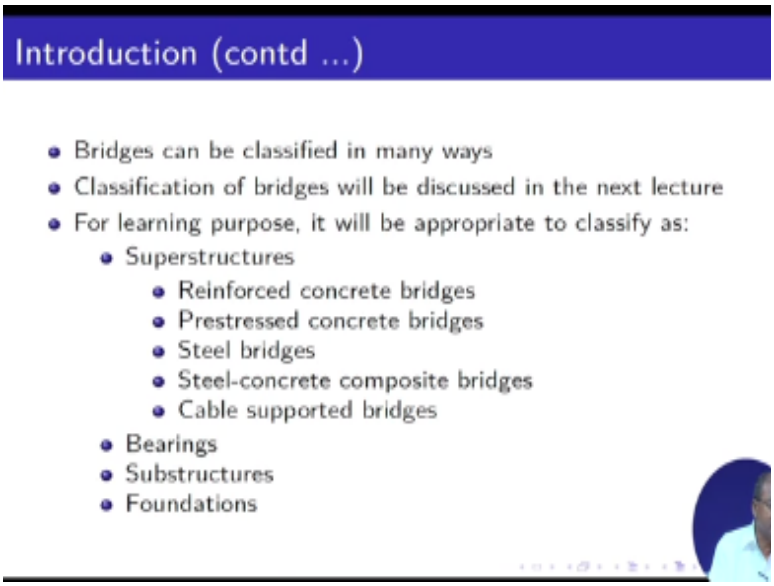

Now coming to this particular one here I will like to tell you that the thing that this particular course that we are having here that only reinforced concreted road bridges that one we have taken a very, very small part or small segment of bridge engineering so that is why it is worth or it is wise to tell you that what actually the complete bridge engineering means, so I can classify in many way in the next lecture I self tell you that classification also so for learning purpose it will be appropriate to classifiers we are having in bridges super structures and we call it substructures.

So super structure whatever we can see that is called super structures here so obviously the reinforced concrete bridges then pre stressed concrete bridges. Here the road part I have removed. Why? It can be for real also it can be road also it can be for industrial also.

That is why I have given here I general that reinforced concrete bridges, pre stressed concrete bridges, steel bridges, Steel concrete composite bridges, cable supported bridges. That means the cable supported bridges. Now this is called superstructure, now whatever load the particular carries vehicles rays whatever it is all those carrying it has to be finally transferred to the ground. We have to transfer the load should be transferred to the ground.
That is basic fluty of design, then finally you have to transfer the load to the ground. That is one. So we require something that the sub structure or foundation. Now here you can see that I have shown you a particular here the bearings. If you see this one I have shown here the bearings and

they have their sub structure and finally foundations I am consider on that. You can consider the substructure foundation together also.

But bearings means bearings will be above the sub structure where the load will come and the load will be finally transferred to the sub structure and it will go to the foundation that one we can consider that one here. This is the one we can consider here as you can see bridge ring such a vast subject here I have considered only from industrial point if you and design point of you. The other part obviously we can consider that is called inspection and monitoring and inspection.

Because that is the bridge whether the health that good or not also you have to check, so coming to the particular here only we can consider that one reinforced concrete bridges only these part are only we are considering because we will consider this particular course because if you consider this is one semester course it is very difficult. so that is why we can consider it has 40 lecture course.

So reinforced concrete bridges can come as one and then the pre stressed concrete bridge as other steel bridges it will come on the other term. Term means I want to tell it will come as one hour each. Steel concrete composite bridges, that is very important actually and in the coming days you might find this particular will come. Cable supported bridges, another separate topic and obviously bearing substructure foundations.

So that means you can consider this one I can say if it is not here one year actually for you to understand that course fully you need at least one and half semester course that you can consider. That means I can consider these one as I say approximately say 60 hours actually you can consider that lecture. This is the one out of that out of that we have taken this one, but we feel this most general and most commonly actually constructed.

If we understand this particular one we will understand the other one also easily where we address where we have to focus we have to find out over here. This is the one we can consider that way we can consider, now coming to this one.

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Have I told you here that we are considering the road bridges that we are considering having different kind of vehicles? Starting from you are own car to public transport say your buses or say loading vehicle like trucks all those thing you will find out. That means you have to design bridge, so that the bridge can take care that particular loads and then obliviously you have to find out what loads we have to consider that. it is very important over here.

Just now I have given you these particular photographs I have taken from the internet. Just to give you one the truck and here there is another kind of truck and one kind of vehicle and another kind of vehicle you are having and this one is the buses. These are the things there are some many other is actually heavily loaded trucks mainly for construction that also being used in the particular case consider here coming to issue on here if you see that particular wheels this one whose to see and this is called as dahe. So you mcan find out I have given you different colour to distiungish that one is reached

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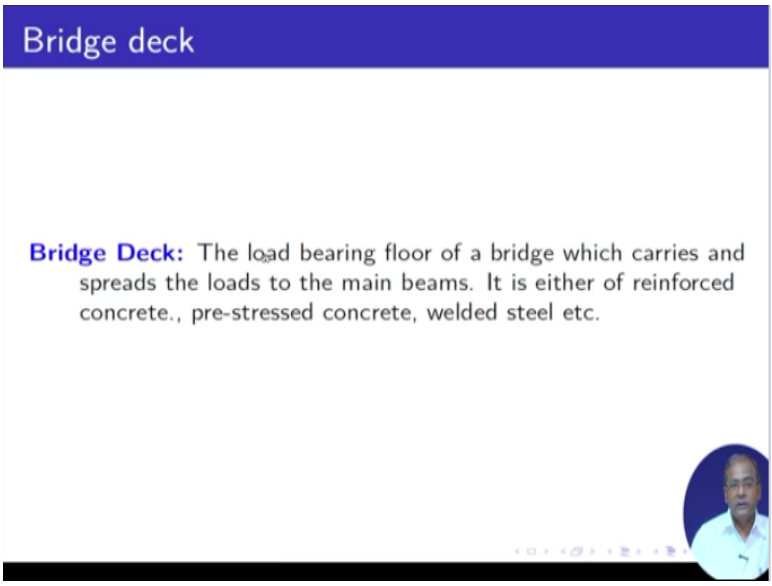

Take the load bearing floor bif the bridge which carries a spreads the loads to maintain beams it is neither to rein forced concrete pre stressedconcrete welded steel etc.

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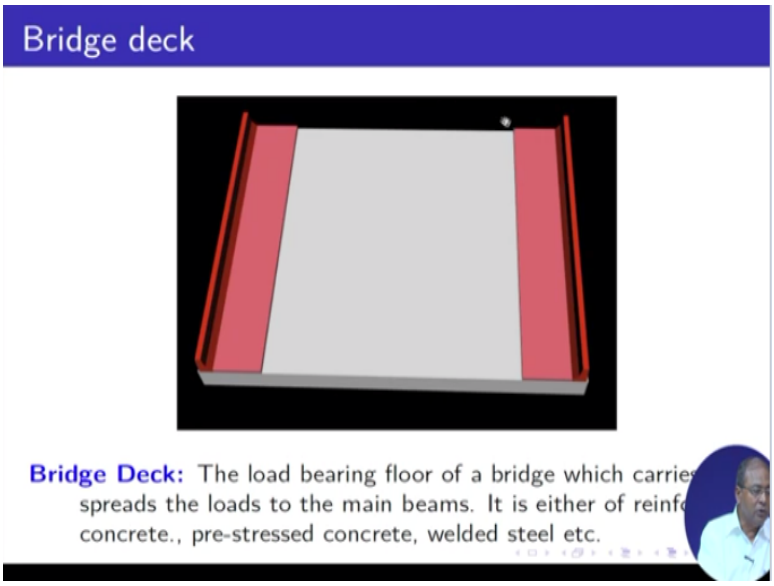

We can consider here what are the different parts in these parts what we are considering foe a vehicles these parts we are considering for the vehicles that can be considering these part can be consider equally has be bigger really also now if you like to distinguish that the cars at the more time it could exceeding or whatever be mirror come here.

So it should certain kind of block so that also we can consider here so this is the one that proper we can see now obviously we can seethed I shown you this is the reinforcement that we are consider here that is certain thing is and obviously that question comes here if you consider these part the lathe the spam that one if you increase it then automatically these portion can be increased so obviously cannot be here it always that increasing the spam and that increase.

The slot and not to work it is an good idea to way you are consider here so this is the one that the bass thing that I would like to do it here and owe object here is one the male object goes to the certain spam and were would be required that once say and that is objectively here and coming to the this one I like to summarize the whole thing here it is a very simple one bridge engineering in general is discussed here.

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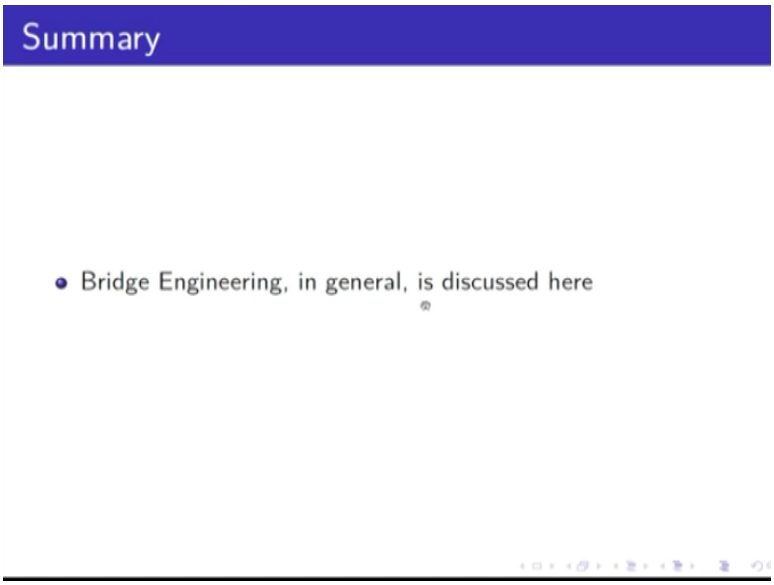

And just I give an idea what s the problem what thing that would do it that we have discussed that finally we have bigger in the entropy that we are said in concrete loads and bridges that were the deck part and the rick taking it out from that we are considering that we reduce.

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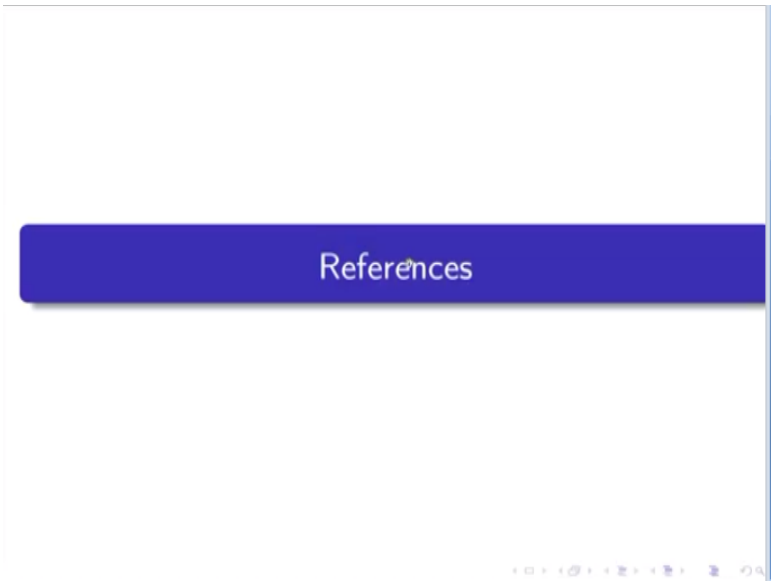

So that I have to show you said the collects and the dependents that we have consider in the hover other second edition okay join in 2007 regions in the many recessions are published by them and there are many more Indian goads in that that I have discussed whenever we should use these a part of millionth book we are consider here so these I like to say.

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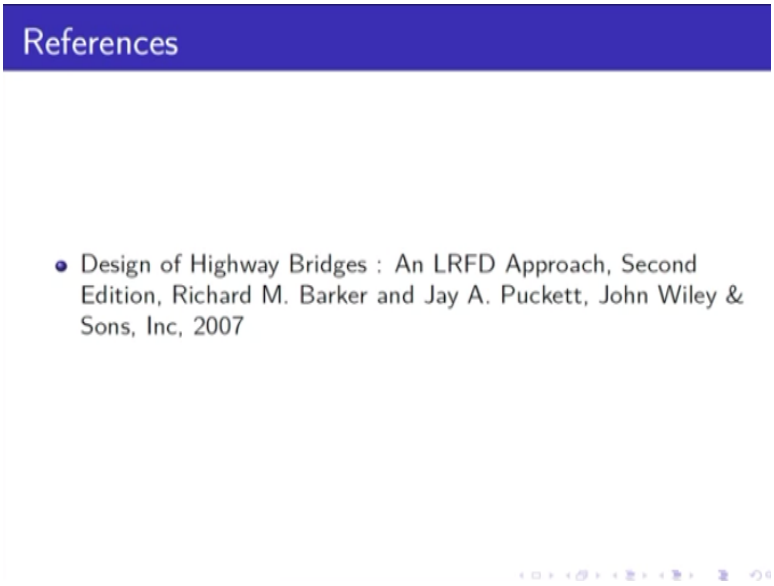

So that is just to come to the main thing is the main part we have consider that the with these we have our thing and we shall go to the next top classification of bridges based one defined in knighteria and that one is it thank you.