Design of Steel Structures
Prof. Dr. Damodar Maity
Department of Civil Engineering
Indian Institute of Technology, Delhi

Module - 2
Connections
Lecture - 1
Connections

Hello, today we are going to introduce a new chapter name is connections when we are going to design a steel structures completely. First we have to know the elementary design; elementary design means design of a beam member. That means, flexible member, design of a compression member or column member, we can say design of a tension member then base plate, foundations and similarly the connections. The utility of the connection is that to withstand the load and to transfer the load from 1 member to another member like suppose beam and column. Now, the load from beam to column when it is going to pass it will be going to pass through that joint. Now, if joint is not sufficiently strong then chances of failure will be there.

In general, we see we use to give much importance on design of different type of elements, but often we forget go design the connection properly. We must give deep importance to the connection aspects, because a steel structure may fail if there connections each improper. So, the beam beam member or the column member may be strong enough to which tend the load. But if their joint is weak then as a whole the structure will fail. Therefore we need to consider the connection aspects also with same importance. So, that the failure does not occur at the joint level. Now, connections means different types of members are connected at a joint different type members means like say beam and column.

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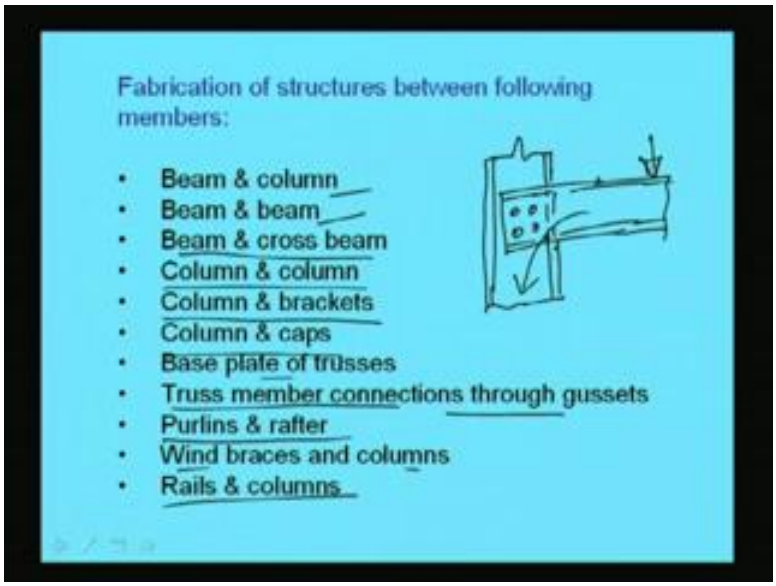

Then say beam and beam beam and cross beam then column and column column brackets columns and caps like this base plate truss members. And then purlins and rafter wind bases and columns rails and columns I am just showing 1 picture say suppose 1 column is there and another beam is here. So, how to connect it? So, this is a column and this is a column and this is a say beam now, connection has to be made. So, what we use to do? That connections can be made either temporary or in permanent in nature.

So, we have providing say suppose some bolted connection or riveted connection to withstand the load coming from beam to column. Now, connections means differentiable connection. We have as per the requirement in the field. We need to choose the connections like riveted connections bolted connections or pin connections. And the welding connections in general bolted connection or pin connections are temporary in nature. That means, we can sorry that means we can use as a temporary basis and riveted connection and bolted connections are permanent in nature.

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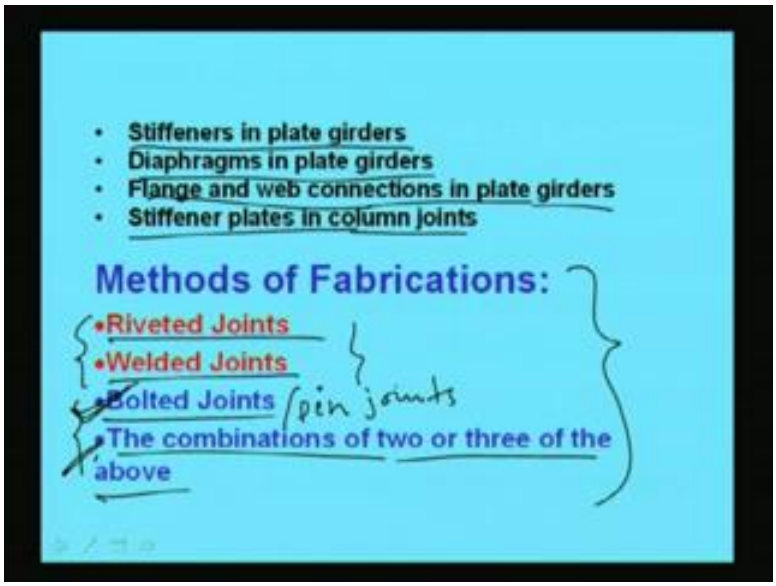

Other type of connections made like stiffeners in plate girders diaphragms in plate girders flange and web connections in plate girders and stiffener plates in column joint. Now, as a told that method of fabrication is 1 is riveted joint another, welded joints then bolted joint are pin joint also we can say we can use pin joint. And then the combination of 2 or 3 of the errors means any of the combinations also can be made. Now, these 2 joints are permanent in nature and these 2 joints means connections are temporary sorry these joints are temporary in nature and this is the combination of any right.

Now, when we are going to talk about the connections we must. Now, what are the requirement for a good connections means what are the points we have to remember to make a good connection? That is one is it should be rigid enough to avoid fluctuating stresses which may cause fatigue failure this is one important factor. Another is it should be such that there is the least possible weakening of the parts to be joined. And it should be such that it can be easily installed inspected and maintained these are very important that it should be easily installed inspected and maintained.

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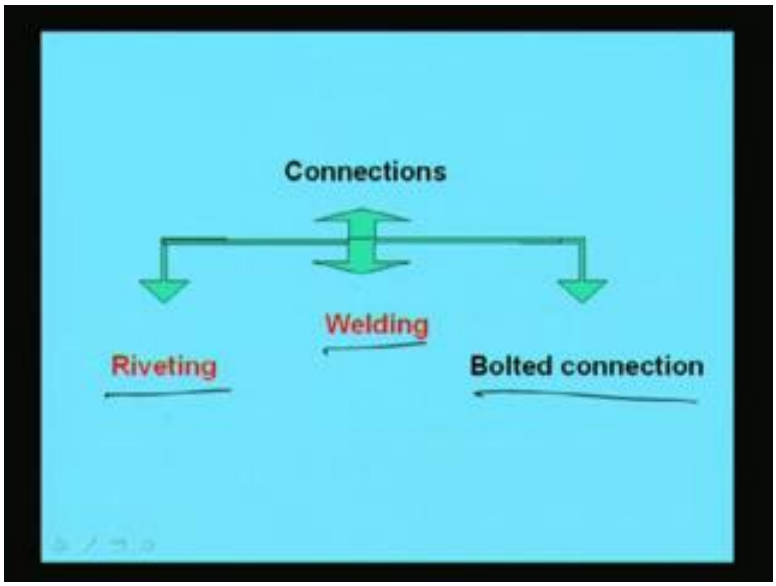

Now, connection as you told there are 3 types of connections basically 1 riveting another welding and another is bolted connections. Now, we will discuss in details about rivet connections.

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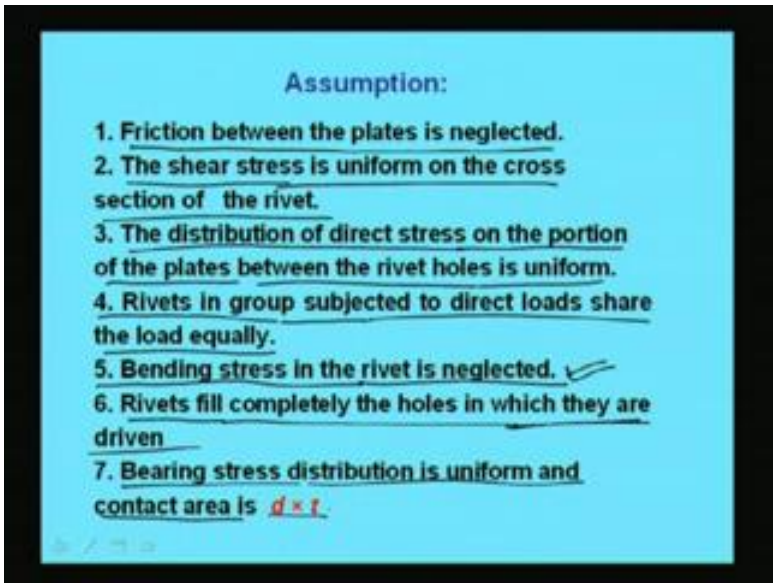

Now, in case of rivet connections analysis if it is in general difficult certain assumption has been made to make analysis simple. What are the assumption assumptions like friction between the plates is neglected. This is the first assumption between 2 plates the friction is neglected. Then the shear stress is uniform on the cross section of the rivet

there shear stress will be uniform. Then that the distribution of the direct stress on the portion of the plate between the rivet holes each uniform. So, direct stress will be considered as uniform then the rivets in group subjected to direct loads shears the load equal. That means if the end number of rivets are there and the total load is carried by as p then the load shear by each rivet will become p by n.

So, another assumption has been consider as bending stress in the rivet is neglected in case of rivet joint the bending stress has been neglected. And rivet, fail completely the holes in which they are driven that is also another assumption which we made for the sake of the simplicity of the analysis. And bearing stress distribution each is uniform and contact area is consider as d in to t where d is the diameter of the rivet and t is the thickness of the plate. So, with this assumption the analysis would be done analysis means the, what is the strength of the rivet, how many rivets will be required to connect the particular joint? All these things will be decided under these assumptions. Now, how the rivet look like as you know rivet.

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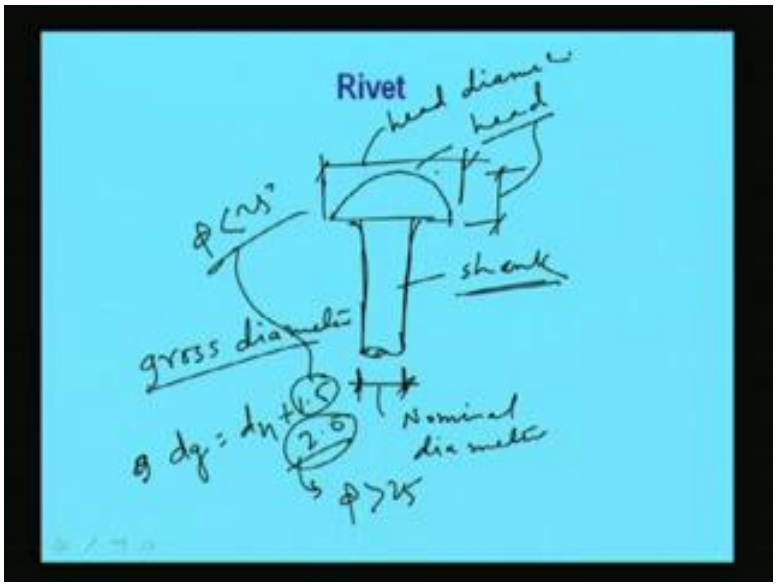

If we see it has a head and another part is called shank, so this is called shank and this diameter is called nominal diameter. And this head and this is. In fact, this is called head diameter and this height this height is called basically. So, a rivet consist of shank and head shank the length of the shank depend means will decided on the thickness of the plate how much it is required accordingly shank would be decided. Now, nominal is

diameter is that diameter of the shank and here another term will get which is called gross diameter which is basically the same clearance. That means, whole diameter whole diameter is made nominal diameter plus some additional clearance and as per the codal provision. It is shown that if the nominal diameter is below 25 mm then 1.5 millimeter etcetera clearance has been taken for the cross diameter. And if the diameter of the rivet is more than 25 millimeter then 2 millimeter additional has been taken for calculating the gross diameter. That means gross diameter will be say dg will be nominal diameter plus 1.5 or 2.0 this 2.0 will be if it is if diameter is greater than 25 and 1.5 it will be if diameter is less than 25. So, all these things I will come details later.

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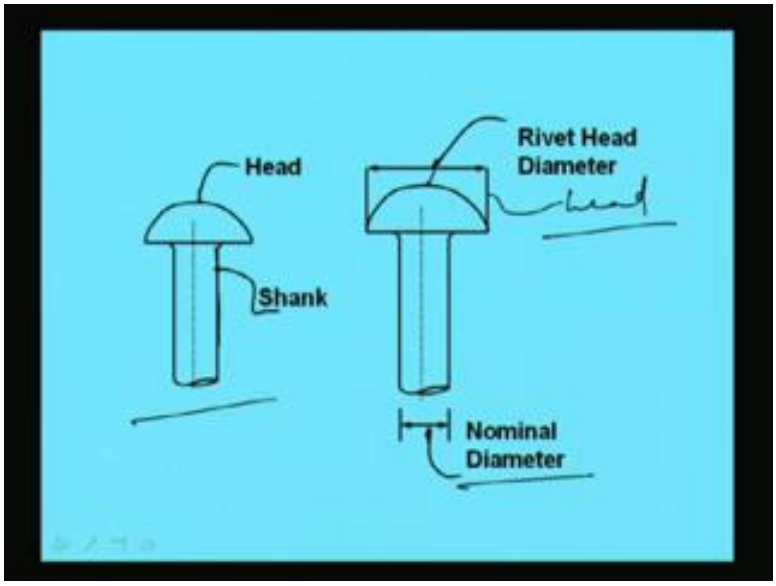

So, the rivets look like this one is nominal diameter another is rivet diameter, and this is called a head I mean this is rivet head diameter and this portion is called shank.

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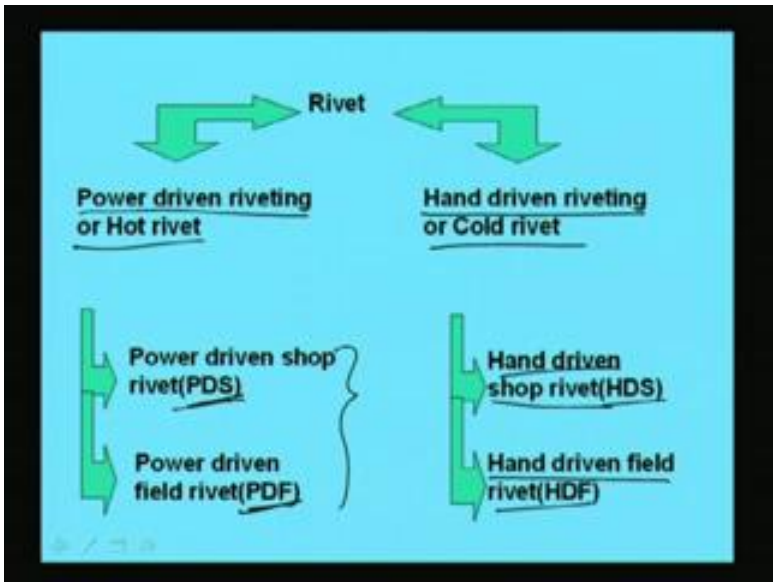

Now, rivet can be divided into 2 category; one is power driven riveting or hot rivet another is hand driven riveting or cold rivet. Now, power driven rivet is again of 2 types 1 is power driven shop rivet another is power driven field rivet in short we use that PDS or PDF oftenly. We will see we are using the stamp PDS; PDS means power driven shop rivets and PDF power driven field rivets, similarly here in case of hand driven riveting. We use to category as hand driven shop rivet HDS and hand driven field rivet which is called HDF now, we will show will some commonly used rivet head.

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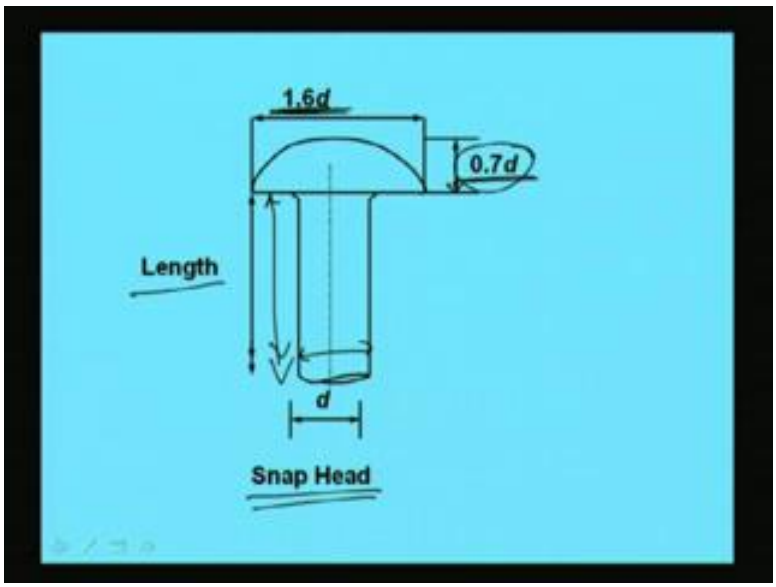

One is that is snap head this is the most commonly used rivet in practice we make and the standard dimension is like this the, if the diameter of the nominal diameter of the rivet is D. Then the diameter of the head will become 1.6 d and the height of the will become 0.7 d and this is called length. Length means the length whatever it is required to feed the connections to feed the thickness of the plate right. So, snap head is looking like this where the standard diameter and dimensions is like this. That head will be 0.7 d and the diameter will become 1.6 d where D is the nominal diameter; that means diameter of the shank.

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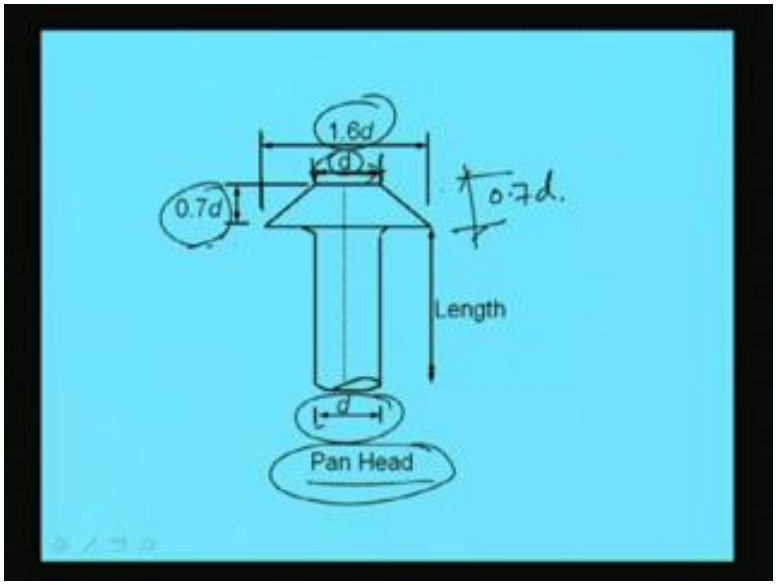

Another type of rivet is called pan head, in this pan head the head is look like this. Here if the diameter is D then the height will be 0.7 d like the previous one like the snap head the diameter 0.7 d here the height also is 0.7 d. And the width will be 1.6 d here maximum width will be 1.6 d and here the width will be D this is D right. So, the specialty of pan head is that the head will be 0.7 d and the width maximum width will become 1.6 d where the width at the top will become D.

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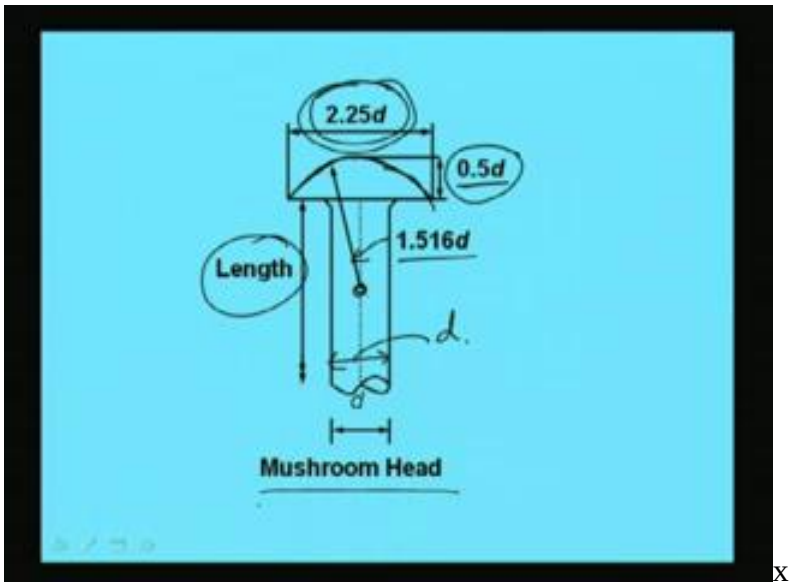

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Another common head is called mushroom head Mushroom head means here the diameter will be 2.25 d the diameter of the head will become 2.25 d. And the height of the head will become 0.5 d and the means center of the curve will be at 1.516 d. So, this distance is 1.516 d this is length all right and if this is this is d the nominal diameter. So, the specialty of mushroom head is that height of the head will be 0.5 d. And width of the head will become 2.25 d where the center of the circle will be at 2.25 d from this right.

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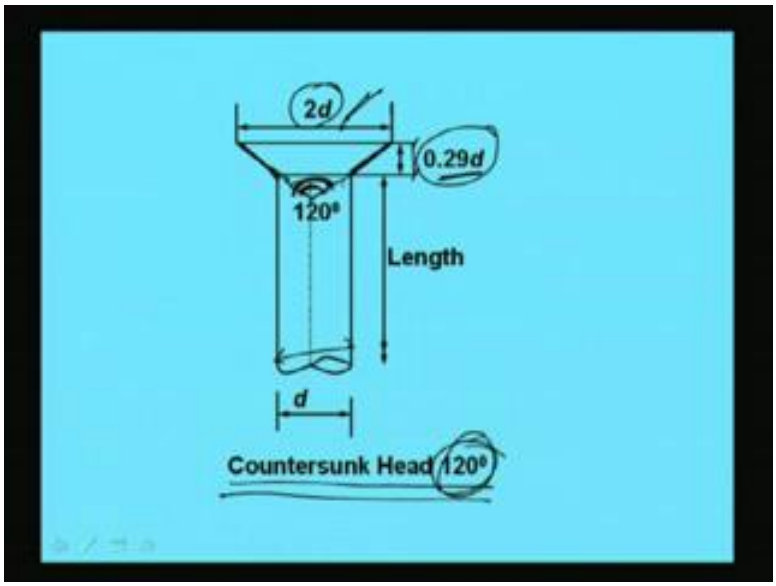

Another is countersunk head 120 degree here if the diameter is d then the width of the head will become 2 D and the height will become 0.29 D. And the slope will be made in such a way that this will become 120 degree the angle between these 2 will become 120 degree. So, in case of countersunk head and we have informing that this is 120 degree if it is 90 degree then this will become 19 degree. So, according the countersunk head this height will become 0.290 and this will become 2 D and as it is 120 degree it does not show the angle between these 2 will become 120 degree.

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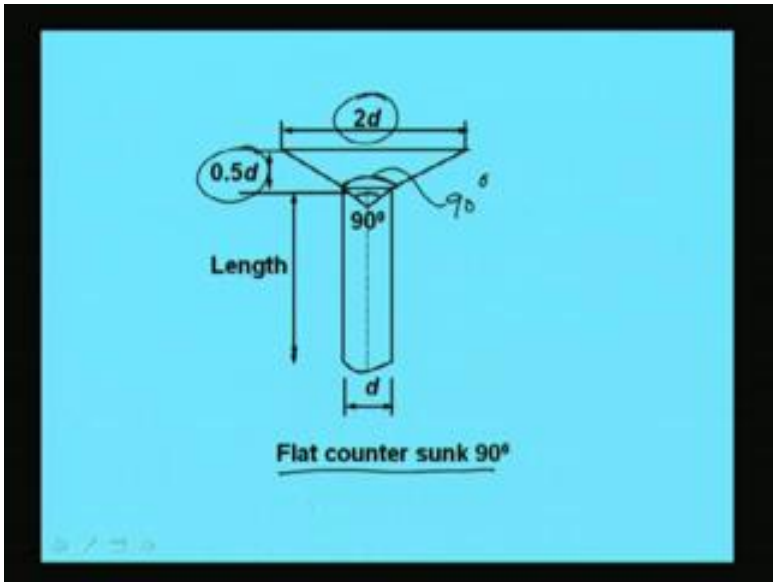

Another type of rivet is called flat countersunk 90 degrees in case of this the dimensions are given like this that the height of the head will become 0.5 D. And the width will become 2 D and the angle between these 2 will become 90 degree, so in this way it has been designated.

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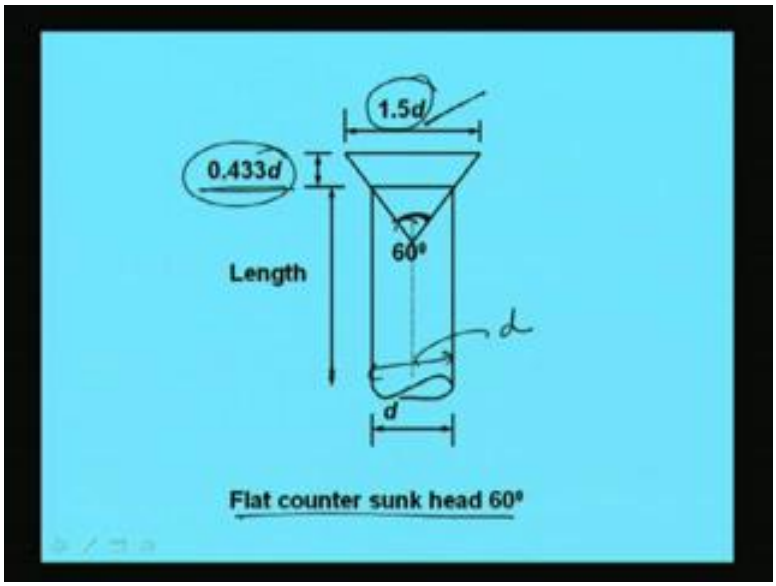

Another is flat countersunk head 60 degree flat countersunk head 60 degree; that means, here the angle will be 60 degree and the width of this head will become 1.5 d and the height of this head will become 0.433 d right. So, if the d is the nominal diameter of the sunk the, if this is d then the width of the head will become 1.5 d. And height of the head will become 0.433 d and the angle between these 2 will become 60 degree.

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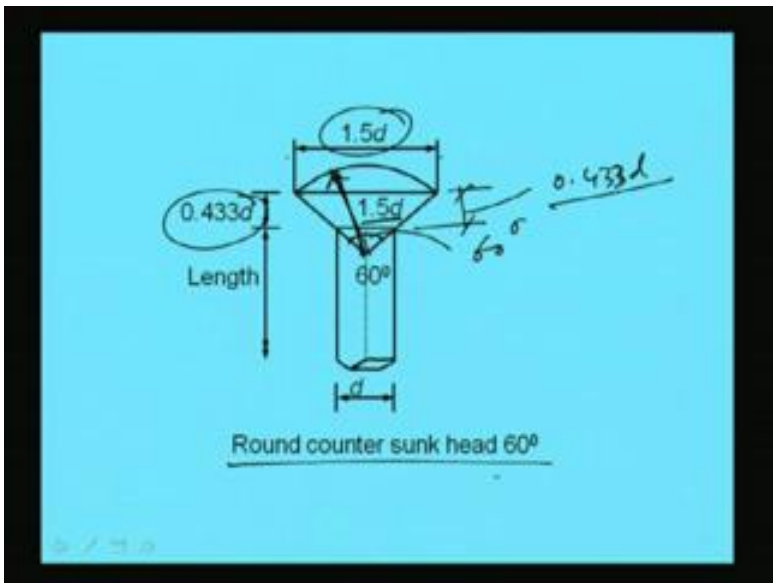

Another type of rivet is called round countersunk head 60 degree round countersunk head 60 degree here the angle between these 2 will become 60 degree. And the this

diameter will become 1.5 d means this diameter will become 1.5 d, so the diameter will become means the width will become 0.5 d of this circle. And the height will become 0.433 d height means from here to this will become 0.433 d, so in this way it has been made.

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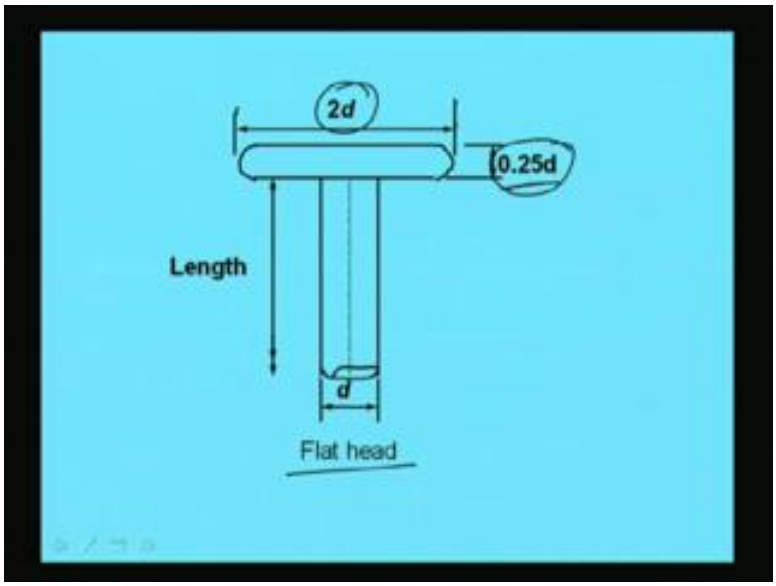

Another type of rivet is used which is call flat head in case of flat head the height of the head will become 0.25 d where D is the nominal diameter of the sunk. And the width will become 2 D width of the head will become 2 D and height of the head will become 0.25 D. Now, we will discuss about different type of conventional symbols this conventional symbols has to be known for knowing that drawing. And engineer which executing the construction at the site he must know how to read the drawing. That means in a drawing some symbols have been given for the connection. So, he should know what is it is meaning and what type of connections the design engineer has made and accordingly he has to make. So, for the sake of simplicity certain conventional symbols has been use which I am representing now for our learning purposes.

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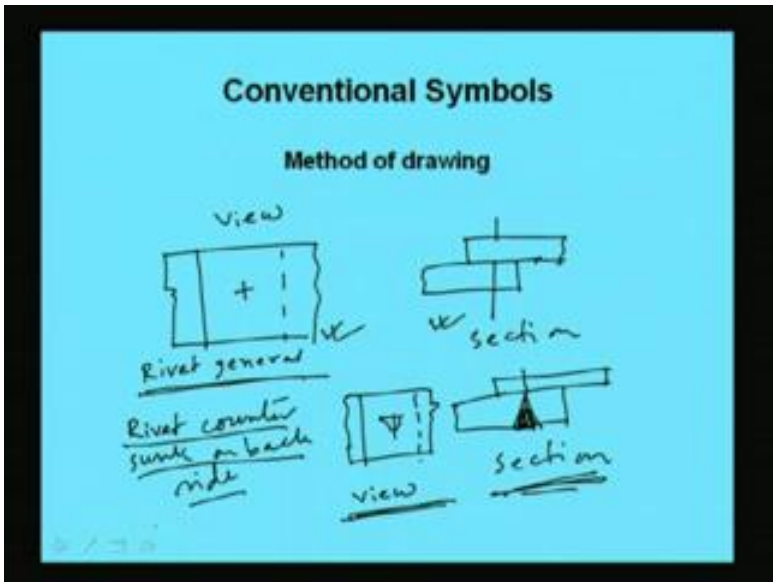

One say rivet generally we use to make say like this say 1 plate is this another plate is say this 1 plate and another plate is this sorry. So, this is rivet general this is rivet general this is the view and section when we made this will look like this this is the section. So, in general rivet the view will be seeing like this and section will be shown like this is the method of drawing. And say suppose rivet countersunk rivet countersunk on back side to mean this the drawing will be the view will be something like this. This is the view and if I see the section this will look like this, so this will be section. So, to represent the rivet countersunk on back side the view will be representing like this and the section will be looking like this.

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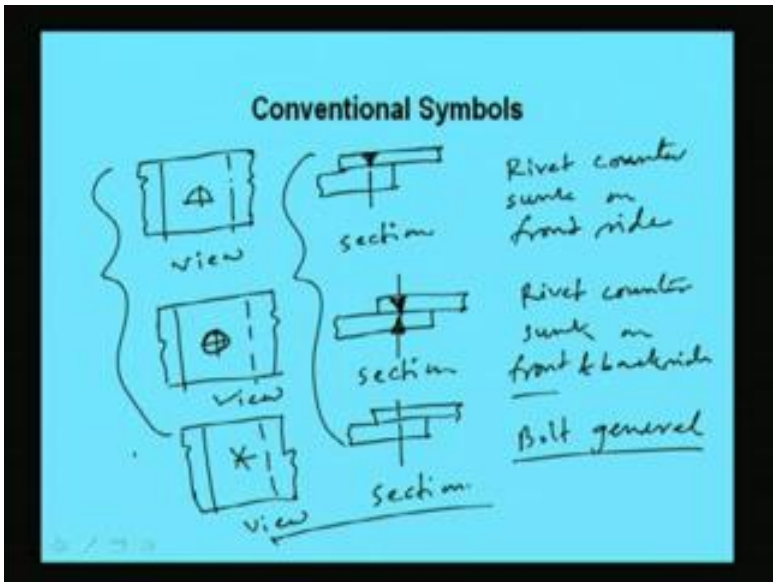

Few more conventional symbols I like to show here, so that we can understand how represent in drawing say if it is shows like this. This is the view and this is the section, so this section and this is view this represents basically rivet countersunk on front side Earlier 1 I have shown as backside here rivet countersunk on front side. So, if drawing is like this say this is like this and this is simply like this, so this will be this is section and this is view. And this is section if such drawing appears it means rivet countersunk on front and backside front and backside means in 2 side this there.

So, that is why it is given like it is given like this, so rivet countersunk on front and backside. And in case of bolt general means this will look like this this is like this this is bolt general. So, to represent the general bolt the view will look like this and the section will be represented like this. So, in this way one can make it, so in the drawing such type of view and sections will come into picture from which one engineer should understand what it represents. And what to execute some other type of conventional symbols also I would like to show.

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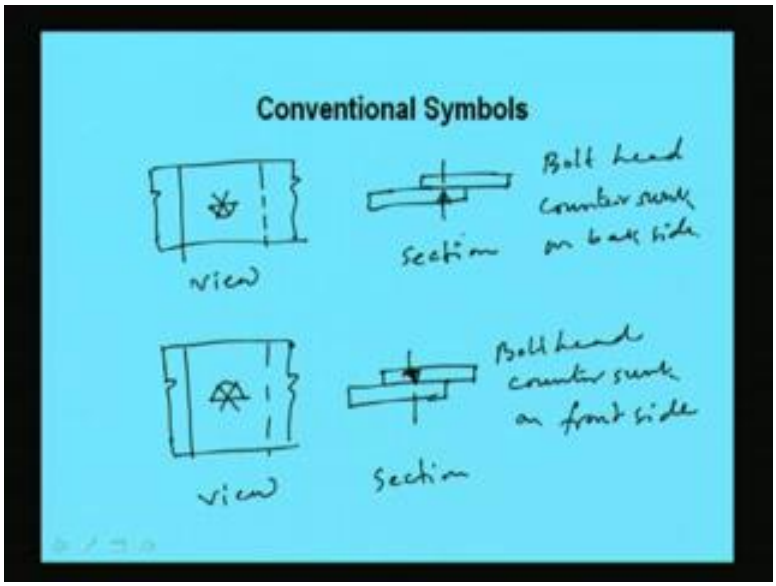

Like to show like if it is like this say this is like this and the section is like this then this is called this is section. And this is view such drawing represents the bolt head countersunk on backside. So, in this way one can represent but if the bolt head countersunk on on say head side or front side. Then the representation will be simply reverse that means this will become like this, this will like this right. And similarly, the section will become say like this in the upper part and this right. So, this will be the section and this will be the view.

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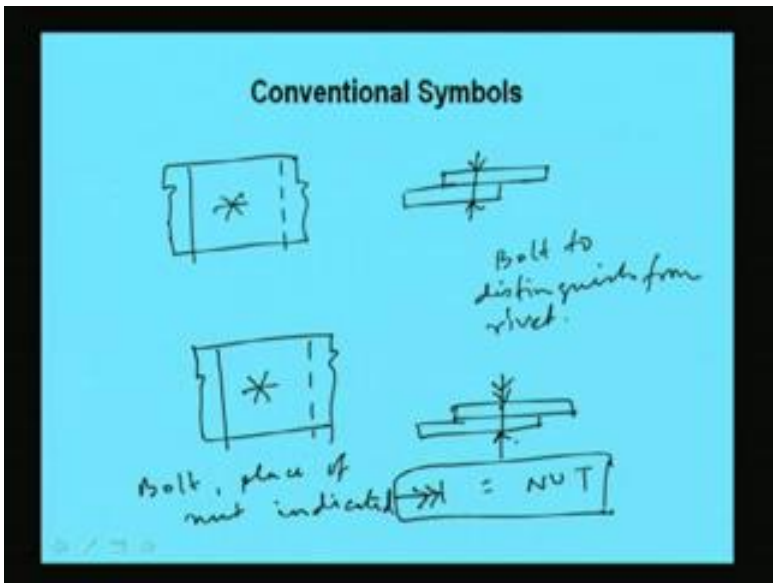

Now, another symbol; let me show here which will distinguish the bolt from rivet say this is 2 plates. Now, it something like this it is given and if 2 plates are over left like this and connected then this is basically bolt to distinguish from the rivet right. And if the drawing is shown like this 2 plates are there and if it is like this say let me draw little below, because say this plate another plate is here. Now, this will be like this if it is this means this basically called nut, so bolt place of nut indicated, so this symbol represents nut.

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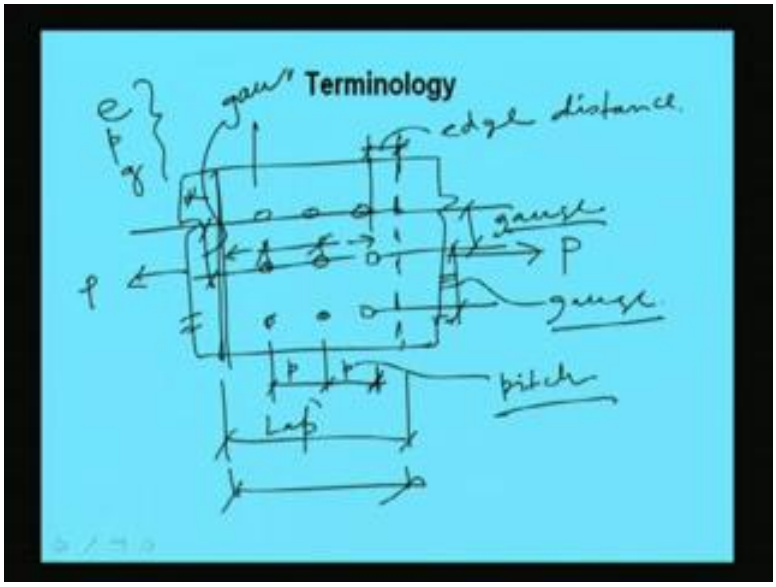

Now, will discuss about some terminology; terminology means for connecting 2 members. We need to know what will be the pitch distance edge distance. And another things what is pitch distance pitch distance means we will see that the distance between 2 rivet in a plane in a particular direction. And edge distance; edge distance means the distance from the outer most rivets to the edge. So, what should be the minimum edge distance? What should be the maximum pitch? What should be the minimum pitch? All these things has been given in the code; code means again. The code IS 800 1984 in that code all the details has been given and according to the codal provision we have to follow and we have to design accordingly.

So, before designing before going to analyze the details of the rivet joints we must know what are the codal provisions? And we should know some of the terminology so that we can know all these things before going to the analysis say this 1 plate another plate is

here over left. Now, say rivets are there, so like this. Now, if the load is acting in this direction then the pitch will be along the action of the load. The distance between 2 rivet distance between 2 rivets is called pitch and this is called lap means lap length this is lap.

That means, over lapping of 2 plates this is 1 plate and this another plate this plate is continue up to this and this plate is continue up to this. So, over lapping is from this to this which is called lap and edge distance is this 1 say this this is called edge edge distance. And the distance between 2 pitch perpendicular to the action of the load is called gauge, so this is gauge right. So, we should not mix up with pitch and gauge this p is basically stands for pitch right. So, what are the terminology we got from here? One is edge which is called e another is pitch p and another is gauge g. So, these 3 terms will be required frequently for analysis of the rivet joint.

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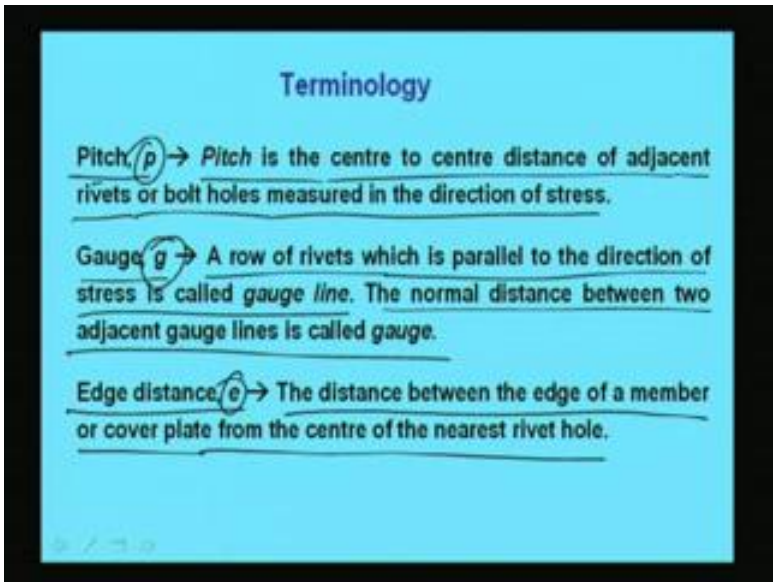

So, if we define the pitch; pitch can be defined as the pitch is the center to center distance of adjacent and rivets or bolt holes measured in the direction of stresses, because pitch. We are taking from this to this center to center distance of this, because load is acting in this direction. And gauge is just perpendicular to that; that means; a row of rivets which is parallel to the direction of stress is called gauge line. The normal distance between 2 adjacent gauge line is called gauge that means normal this is 1 gauge line this is another gauge line. So, normal distance between 2 gauge line is called gauge distance right. And edge distance is the distance between the edge of a member or cover plate from the

center of the nearest rivet hole. This is called edge distance, so this 3 terminology is important and the codal provision has been given that. What is the minimum edge distance and gauge distance and pitch distance should be maintained. Those things has been told in codal provisions which will come later through which we have to design the details of the joint

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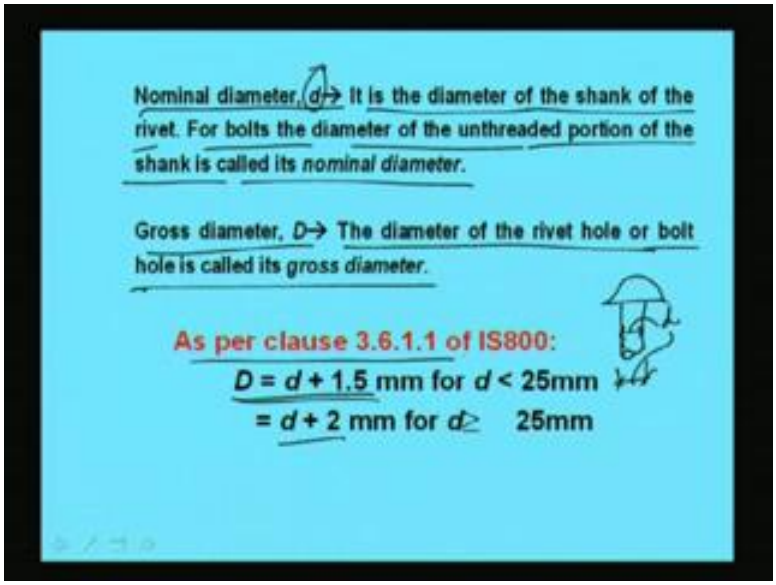

Another thing is nominal diameter nominal diameter is represented as d it is the diameter of the shank of the rivet for bolts. The diameter of the unthreaded portion of the shank which is called nominal that means if we see if this is a rivet. Then this is called diameter d this is the diameter right nominal diameter and gross diameter is represented as capital D which is the diameter of the rivet hole or bolt hole that is called gross diameter. And this gross diameter can be calculated as from this formula. As I told earlier this is given in clause 3.6.1.1 of IS 800 where it has told that gross diameter will become d plus 1.5 millimeter. If the nominal diameter of the rivet is less than 25 millimeter and if the nominal diameter of the rivet is greater than or equal to 25 millimeter then the gross diameter will become nominal diameter plus 2 millimeter.

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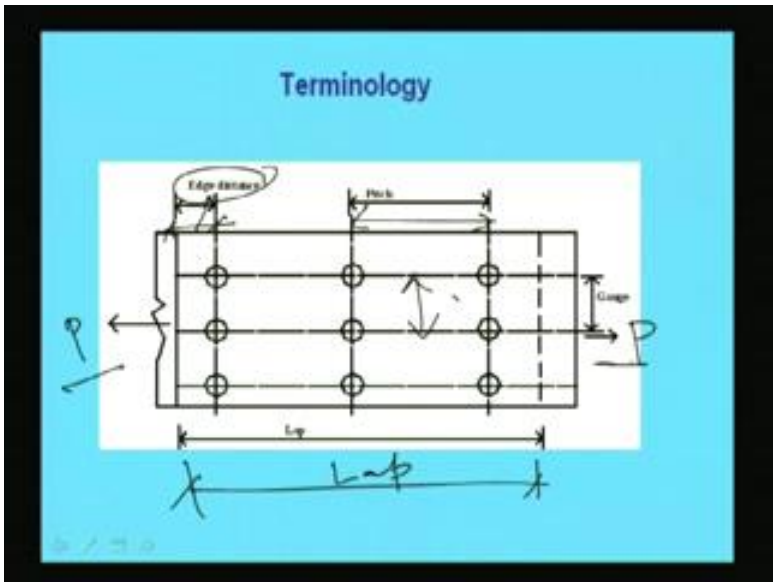

So, in short if I repeat once again this is called edge distance this; this is edge distance and this is the pitch and this is gauge and this is the lap. So, in short if you want to see if the load is acting in this direction remember we have to see the first floor in which direction. It is acting accordingly we have to decide what which 1 will be pitch and which one will be the gauge. Pitch distance is the means along the action of the load and gauge will be the perpendicular to the action of the load right.

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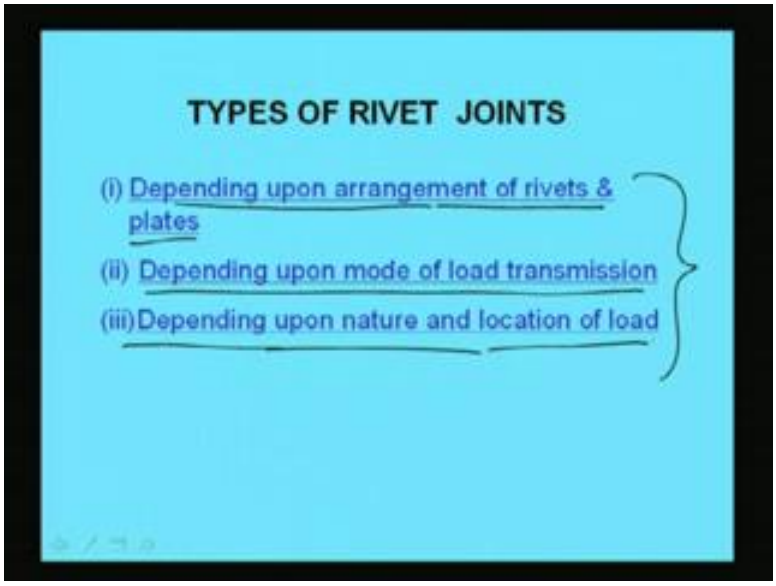

Now, the rivet joints can be classified into3 category 1 is depending upon arrangement of rivets and plates. That means how the plates and rivets have been arranged on that basis? The classification can be made another is depending upon the mode of load transmission how the load is transmitted on that basis? The rivet joint can be classified another is depending upon the nature and location of load. That means, where is the load and what type of load whether concentric or eccentric or only tensile is coming in to picture compressive is coming to be picture so on that basis it can be classified also.

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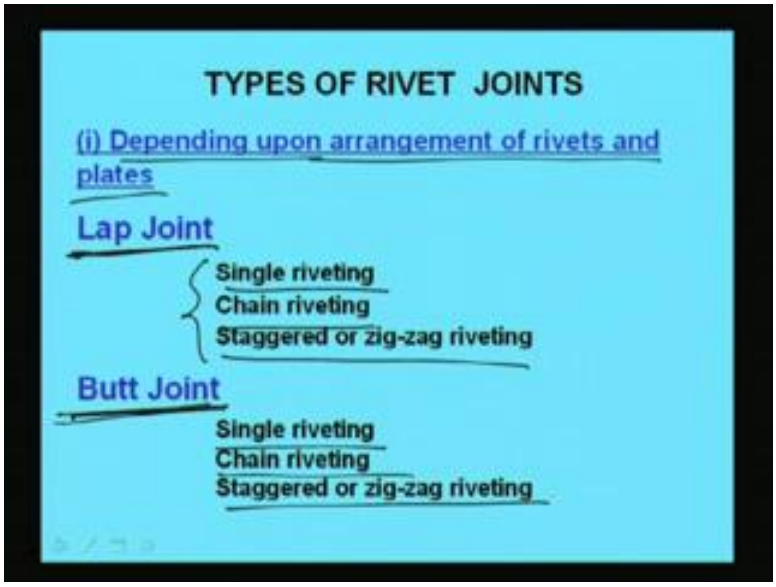

So, first will discuss about the depending upon arrangement of rivets and plates first we will discuss about this. Then will discuss other things means depending upon the mode of load transmission and depending upon the nature and location of load. So, in first case this can be divided in to 2. Category 1 is lap joint another is butt joint means depending upon the arrangement of rivets and plates. The rivet joint can be classified as lap joint or and butt joint, so lap joint again can be classified in to3 category one is called single riveting. Then chain riveting then staggered or zig-zag riveting. So, these3 category can be made similarly, in case of butt joint also single riveting chain riveting and staggered or zig-zag riveting.

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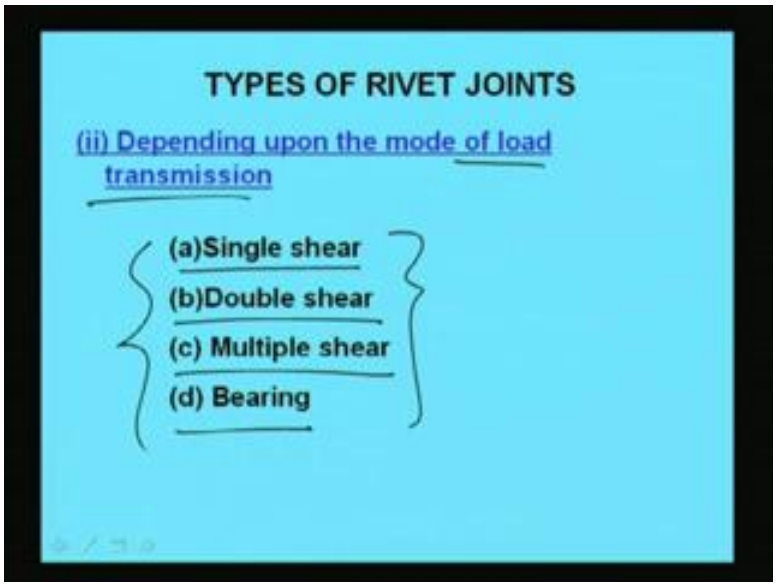

And in case of depending upon the mode of load transmission the rivet joints can be classified 4 categories. One called single shear then double shear then multiple shear. And then bearing that means in how the load is going to transmit? On that basis the rivet joint has been classified whether it is single shear or double shear or multiple shear then bearing, whether it is bearing or shearing. So, according to that the rivet joint can be classified.

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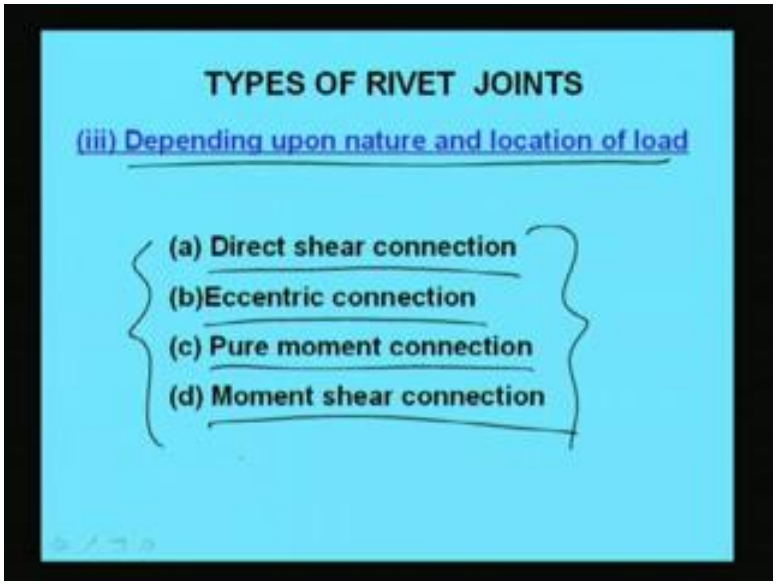

And another category as we mention that depending upon the nature and location of the load nature and location of the load. So, according to that 4 type of connections can be made one is direct shear connection another is eccentric connection. Then pure moment connection then moment shear connections, so this type 4 type of connections can be made 1 is direct shear connection. Then eccentric connection then pure moment connection and moment shear connection. So, all these type will be discussed now means what type of joint should be made in case of different rivet team arrangement? Those things will discuss now.

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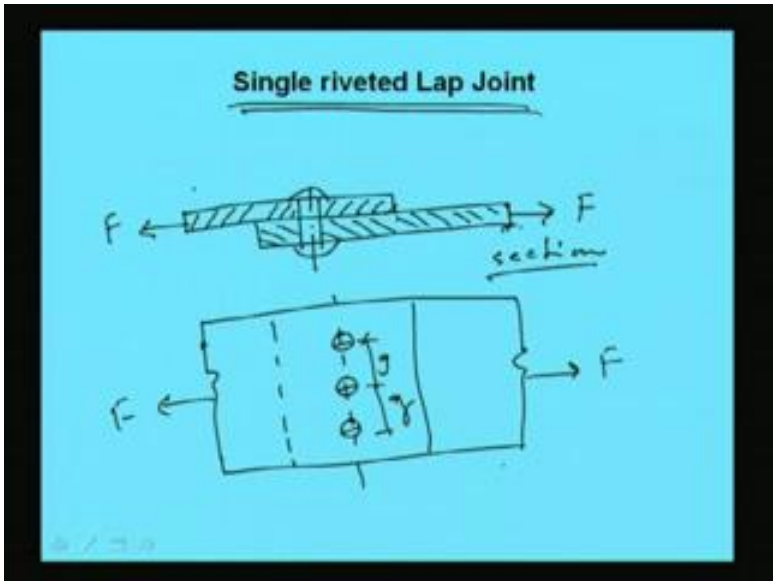

Say first let us consider there single riveted lap joint if single riveted lap joint is made then how it look the section and view. So, sections will be looking like this say force if force is F and this is the force and this is rivet. So, this 1 plate and this, another plate right this is the section in case of single riveted lap joint. And if we see the view this would be like this say this is F F say now depending upon the number of rivets in view it will be shown. So, this is called as we know this is gauge distance g right, so when it is penetrated like this this is called single riveted lap joint.

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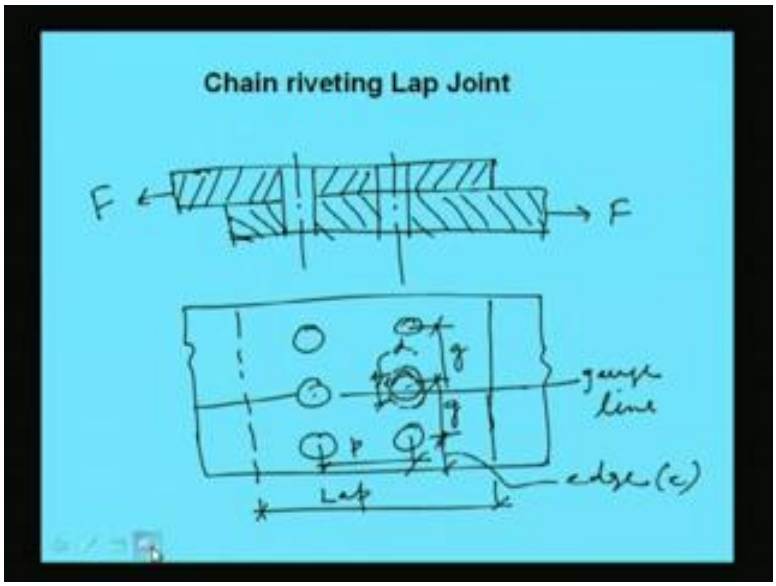

Similarly, if we see the chain riveting lap joint this will become like this another rivet I am giving like this say 2. Then this is 1 plate and this is a, suppose another plate force F is acting here now, if I see the view this will look like this 1 plate over lapping with another 1 and these are the rivet. So, this is called lap length this is lap and this is called pitch P and this is called g center to center distance of the rivet. So, this g right and this is called gauge line gauge line right and this is the edge edge distance means e. We can measure as e and this is the nominal diameter d and gross diameter will be little more, gross diameter is nothing. But diameter of the hole which will be d plus 1.5 or 2 depending upon the diameter of the rivet, so this can be represented in this way.

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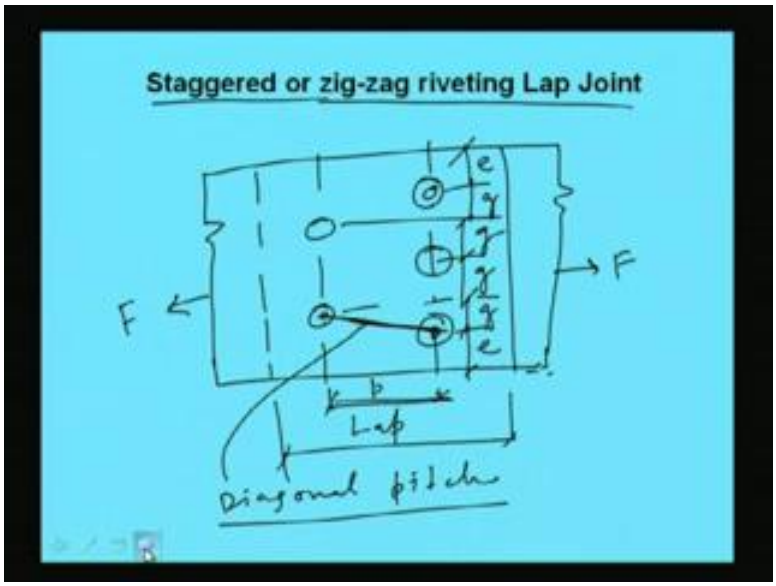

Now, another type of joint is called staggered or zig-zag riveting lap joint staggered or zig-zag riveting lap joint. So, in this case if I show the view that will be the sufficient to understand suppose 1 plate each overlap with another 1 and this is 1 plate this is another plate where this is the lap. So, this is 1 rivet line this is another rivet line say sorry say this 1 rivet another rivet another rivet here I am providing 1 rivet another rivet right. So, the, this is I can say e is distance and this will be the g gauge distance and this is called pitch or p pitch distance right. So, this will be g again this will be g again this will be g then again e, so in this way it can be represent means if the rivet is placed in this way this called the zig-zag riveting lap joint. And this distance is called diagonal pitch this is an, another term we are introducing here which is called diagonal pitch diagonal pitch means. The distance between 2 rivet in diagonal distance this is p and this the diagonal pitch right.

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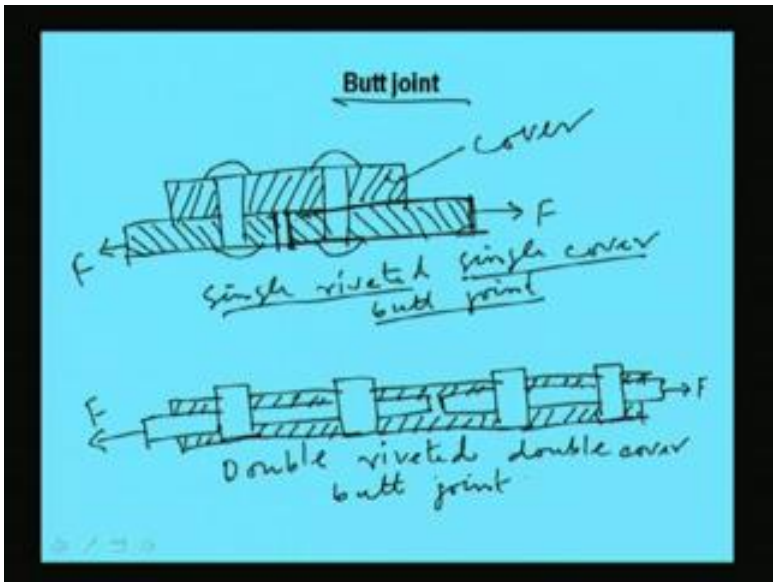

Another type of joint is called butt joint means apart from lap joint let us see what is called butt joint. And in case of butt joint also similar type things can be made means chain riveting zig-zag riveting all this things can we we can do. So, 1 butt joint if we show here we will understand that other things will be similar. So, in case of butt joint say these are the rivet which has been made here then this is 1 plate this is 1 plate and this is another plate which has been covered by 1 butt. So, this is a plate which has been additionally used this is 1 plate and this, another plate right. So, joints, has been made like this F F, so there is no question of lap right this type of joint is called single riveted, single cover, butt joint, single riveted, single cover butt joint means in each plate. This is 1 plate in this plate only 1 rivet has been made and cover is only this this is cover; cover is only 1. So, single riveted single cover butt joint similarly, I can means make double riveted double cover butt joint.

So, if let us make 1 rivet another rivet for 1 plate and for another plate similarly there is not like this. Now, this is 1 plate which is going through this is 1 plate carrying a float. Similarly, this is another plate which has connected together right. Now, we are making this is 1 cover this is 1 plate cover and another plate I am providing here. So, this is called double riveted, because 2 rivet has been provided for 1 plate double riveted, double cover cover has been made at top and bottom that is a double cover butt joint. So, this is another type of joint double riveted double cover butt joint. So, when we will go for analysis of the rivet joint we have to see what type of joint we are going to analyze

whether it is lap joint or butt joint. If it is butt joint whether it is single riveted or double riveted single cover or double cover accordingly the analysis will be done accordingly the strength of the joint can be made.

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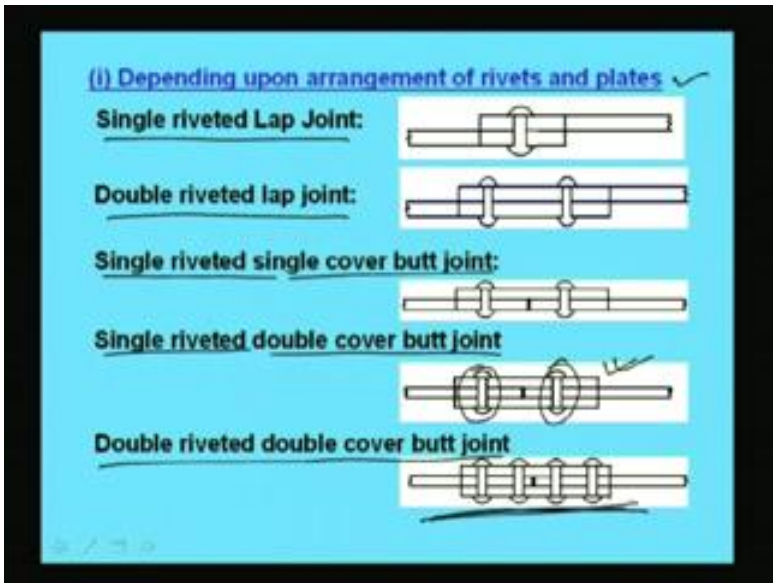

So, in short if we see that if we see the depending upon the arrangement of rivet and plates. The joint can be made 1 is single riveted lap join another is double riveted lap joint another is single riveted single cover butt joint similarly, single riveted double cover butt joint. This is single riveted double cover butt joint single riveted means 1 rivet in each plate in each plate 1 rivet we have given then again double riveted double cover butt joint. So, what type of joint we are going to make? And accordingly the analysis can be done according the strength of the joint can be determined another type of rivet joint which has been classified under the mode load transmission.

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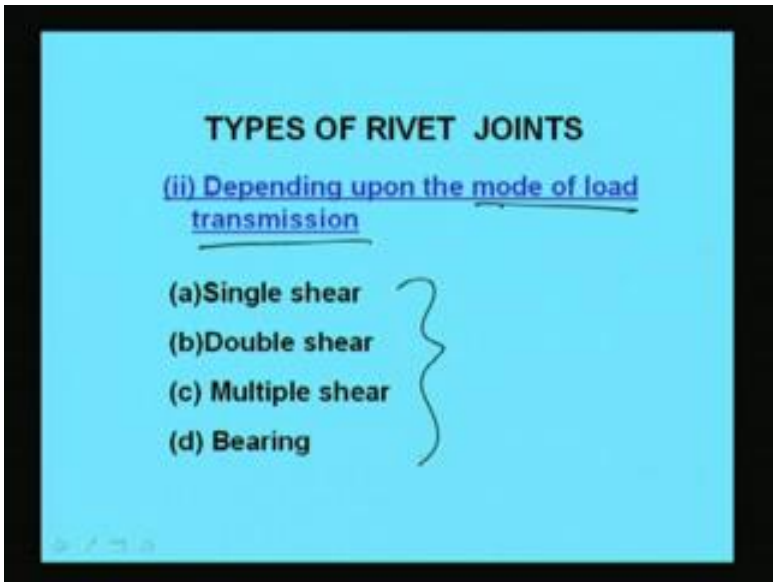

As we have told that if we see how the load is going to transmit then the rivet joint can be classified as this 1 is single shear another double shear then multiple shear and bearing. So, basically shearing and bearing shearing may be single double or multiple that we have to is decide means as for the arrangement of the rivet joints. We have we will find out whether it is single shear or double shear or multiple shear and then bearing. So, how does it look in case of single shear? Let us see.

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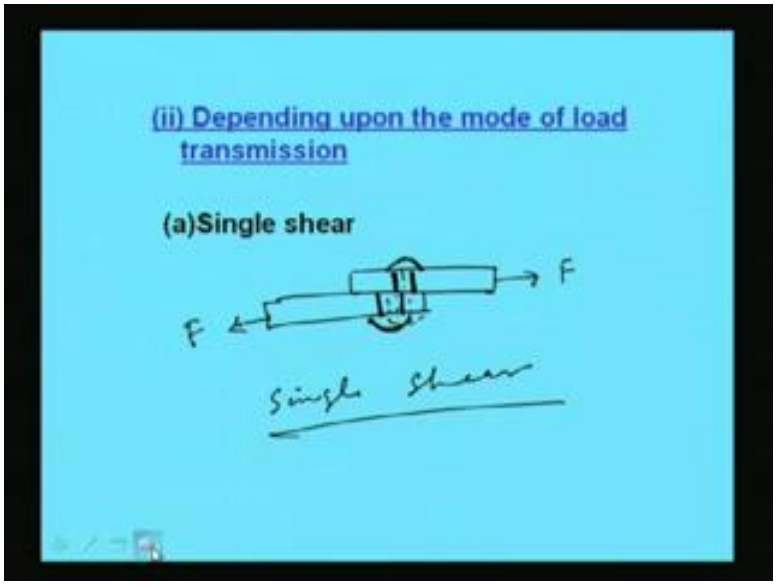

So, how does look the single shear joint? That means, 1 plate is like this and another plate will be like this. So, single shear means it is like this it should be, but if failure occurs then what will happen, so this will come here right. So, in case of single shear this failure will be in this way right F this is called single shear right. So, the failure of the single shear will be like this.

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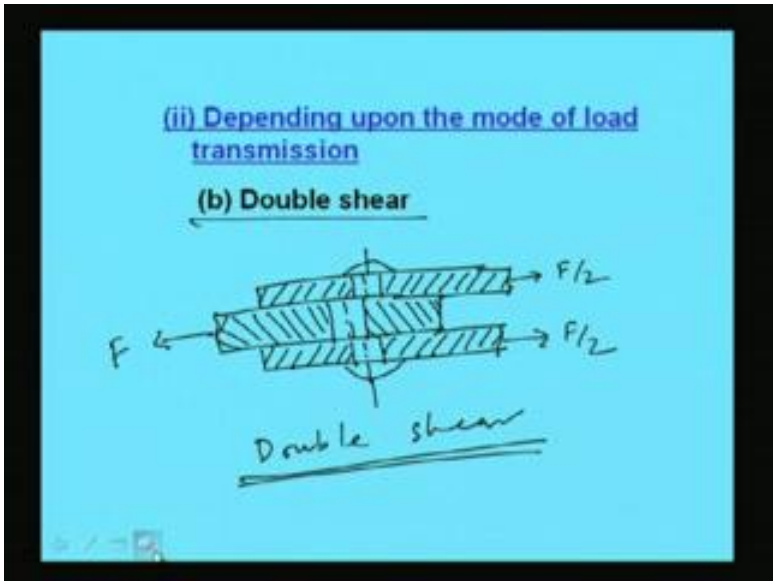

And if we see the double shear how it will fail? Let us see that double shear if we use to calculate then how we should calculate. And how it will fail we must understand, so this is 1 this is another plate, so if this is F then this will become F by 2. Now, this is the rivet and this is the rivet now, for failure it will come like this, right. So, this plate is under force F by 2 similarly this plate also will be under F by 2 and the main plate will be under F if failure happens means if the rivet going to fail. Then failure will be like this this is called double shear right. So, depending upon the mode of load transmission we can find out double shear in this way.

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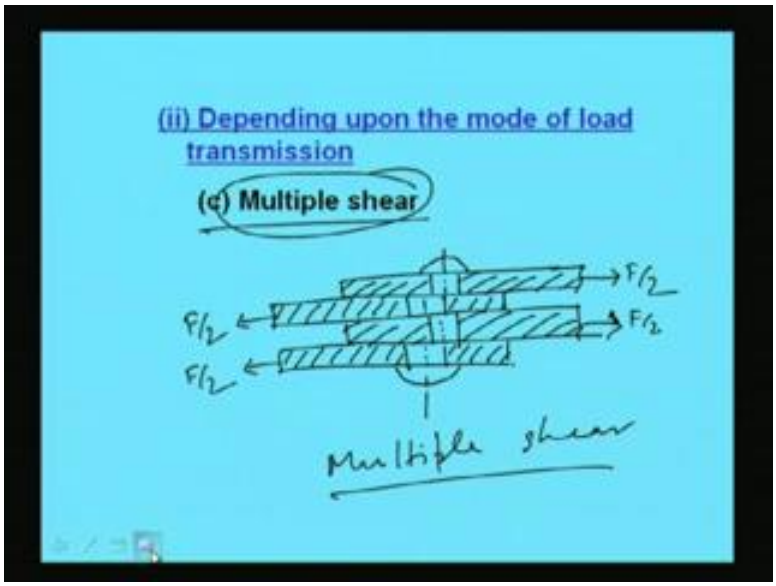

Another is multiple shear multiple shear how it look like this will be say this is 1 plate which is say F by 2 another plate is this. This is also F by 2 another is say F by 2 and another is say F by 2, so in this case the failure will be. So, this is in this way and this is in this way right. So, this is 1 plate; this is another plate and this is in other direction where the load is acting. And this is another plate load is acting towards right side, so if the connections is made like this; this will be fail under multiple shear this is called multiple shear right.

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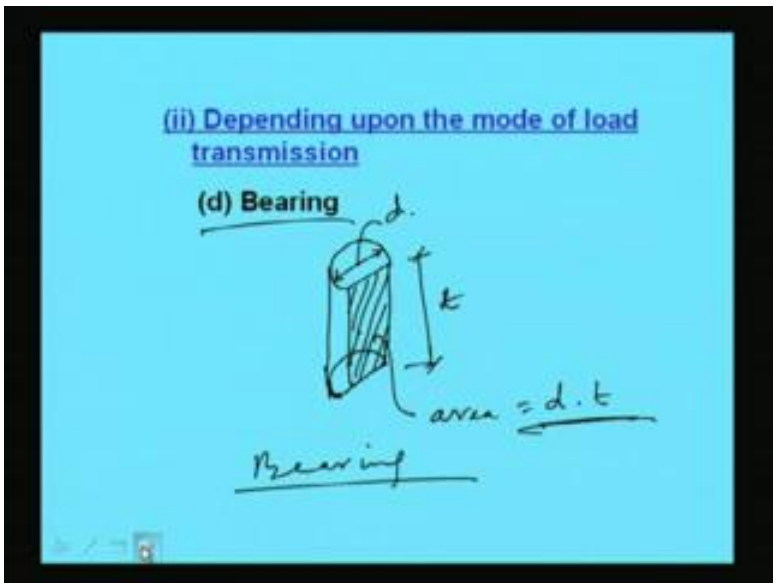

Another type of failure is called bearing in case of bearing what it will look this will look like this now, this will look like this right. So, this is the length, so failure will be due to bearing, so this is the diameter d and this is the say thickness of the plate if it thickness t. Then the total area this area will become d into t D in to t dt, so this will be the area, so this failure is called failure due to bearing.

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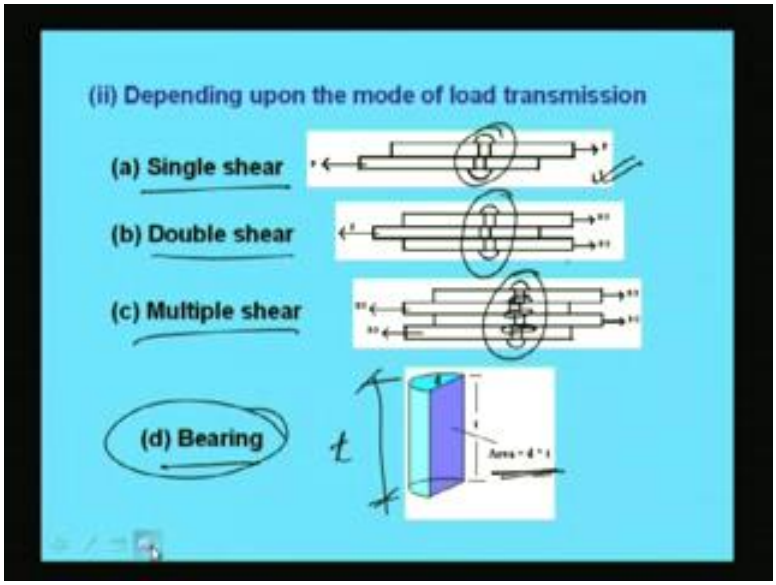

So, in short if we show the mode of failure that depending upon the mode of load transmission 1 will be single shear another is double shear. Then multiple shear and bearing in case of single shear. The failure will be like this if we see this rivet and in case of double shear failure will be happening like this failure will happen when the rivet is not strong enough to withstand that heavy load. That means the member is capable of taking load, but the rivet is not capable of taking load. So, due to shear it is going to fail in this case due to double shear it is going to fail another is multiple shear.

That means, if number of plates are more than 3 then multiple shear will occur. So, multiple shear means here 1 here 1 here 1, so more than 2 means more than double shear, so multiple shear. So, in case of multiple shear failure will be like this, so to withstand that load the analysis has to be done. The calculation has to be done accordingly show that the particular rivet can take care that much load. That means diameter of the rivet has to be increased or number rivets has to increase to shear. The load another failure is called bearing; bearing means the failure due to the bearing where the area will become d

in to t where d is the diameter of the rivet. And t is the thickness of the rivet no thickness of the plate this is the t.

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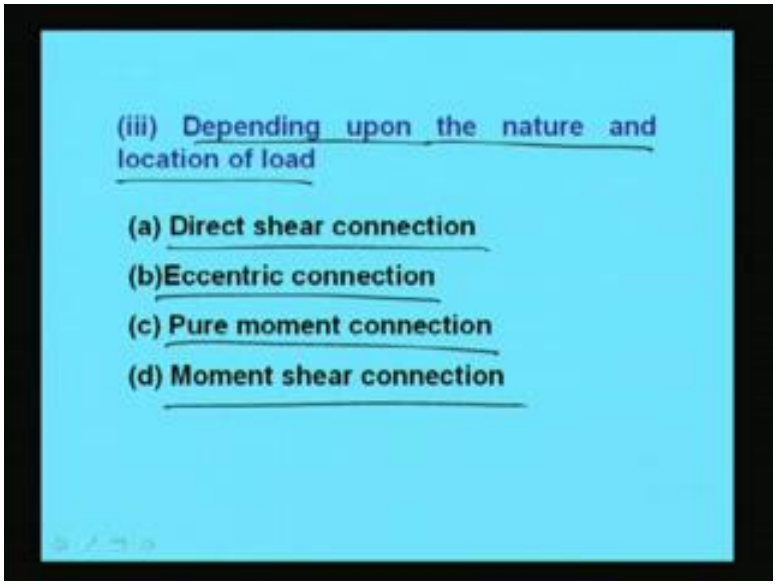

Another is depending upon the nature and location of load depending upon the nature and location of load. So, this will be 1 will be direct shear connection we can make another is eccentric connection pure moment connection and moment shear connections.

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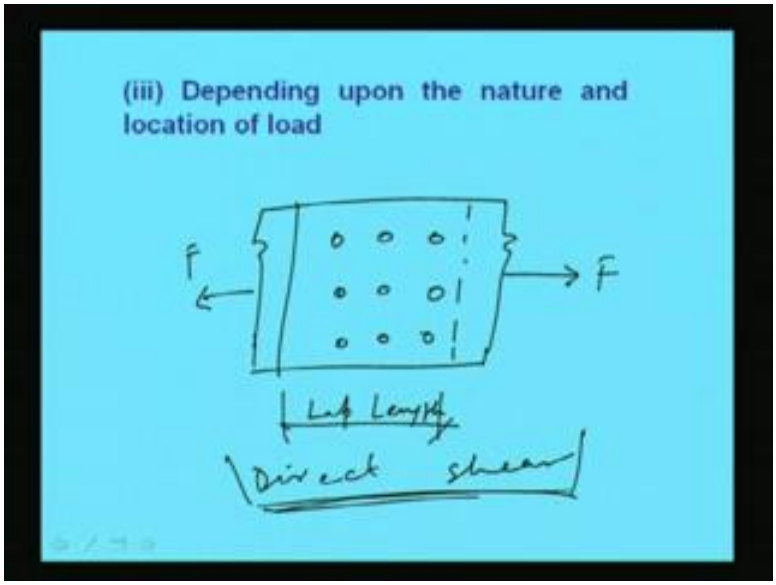

So, if we see the shear connection how it will look that means if 2 plates are over lapped and comes under tension say F and this F with a lap length of l say lap length and with

having say. Then this is this will come under direct shear, so this will be calculated the strength of the joint will be calculated under this condition that it is withstanding the direct shear. So, accordingly how much shear is going to be developed due force F and how much how many, number of rivets will be required.

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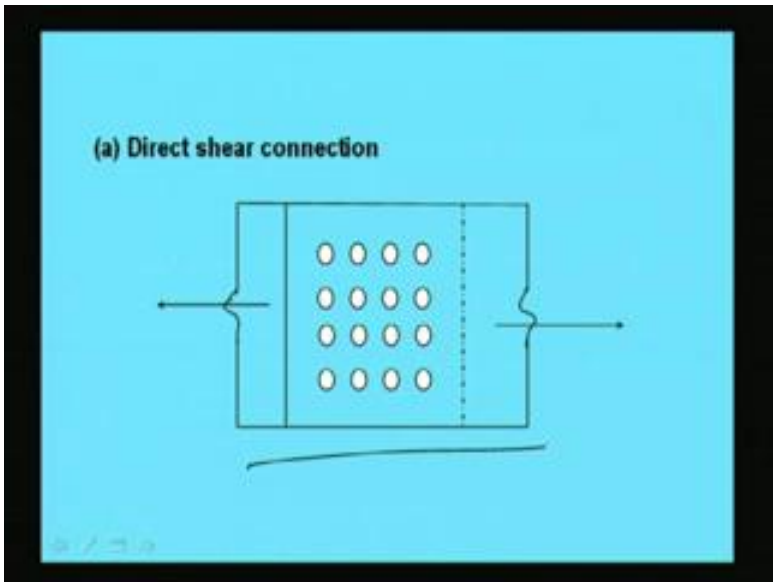

So, this is direct shear connection.

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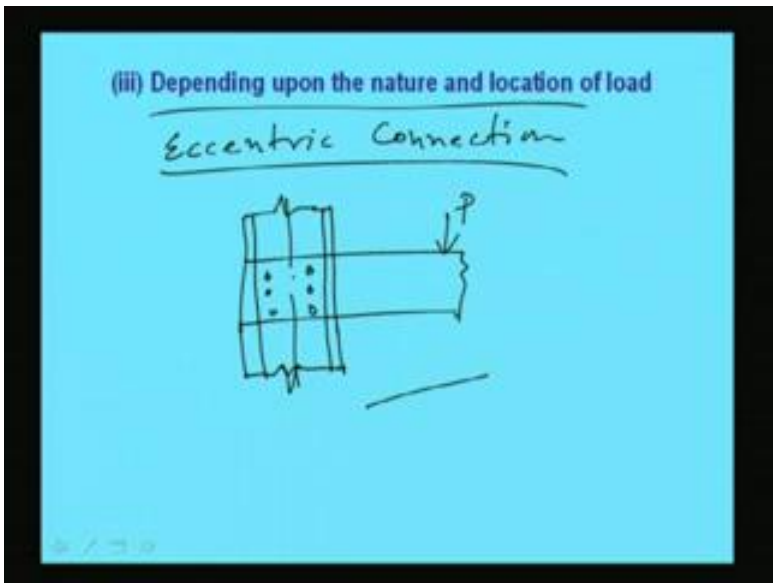

Another is eccentric connection eccentric connection, so in this case how the joint will be that means if a column is consisting of a beam with an eccentric load. Then we can make

this connection as an eccentric connection say if load p is there and say if riveting is in this way right. So, this is called eccentric connection right.

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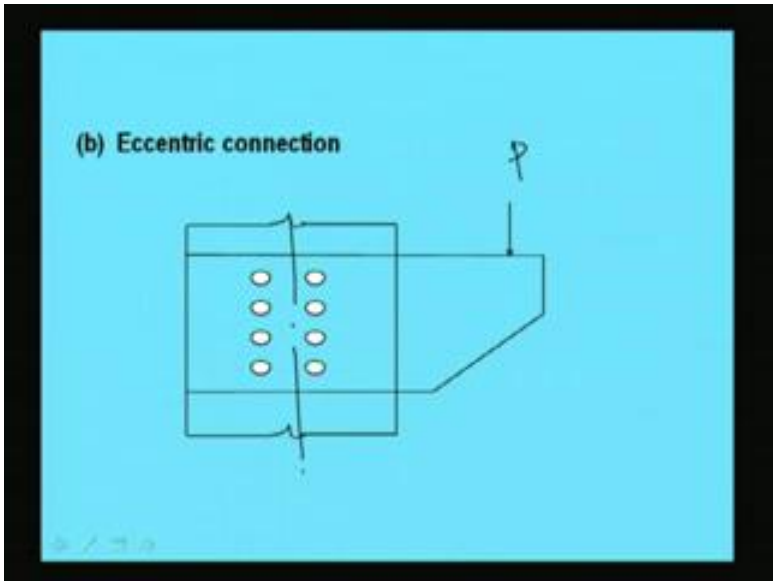

Another, so eccentric connection should be looking like this right.

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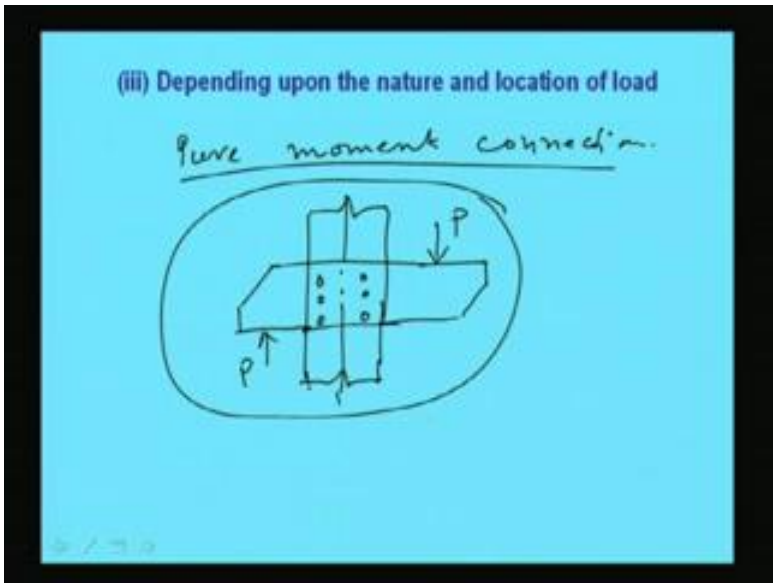

Another case will be happen when pure moment will come into picture and the connection will be called as pure moment connection. That means when it will come if the members are like this say this is a column which is taking the load like this right now, this p and this p. So, rivet is given here now, this type of connection is called pure

moment connection. So, in case of pure moment connection the calculation has to be make in such way that it will take care the moment properly. So, pure connection should be like this.

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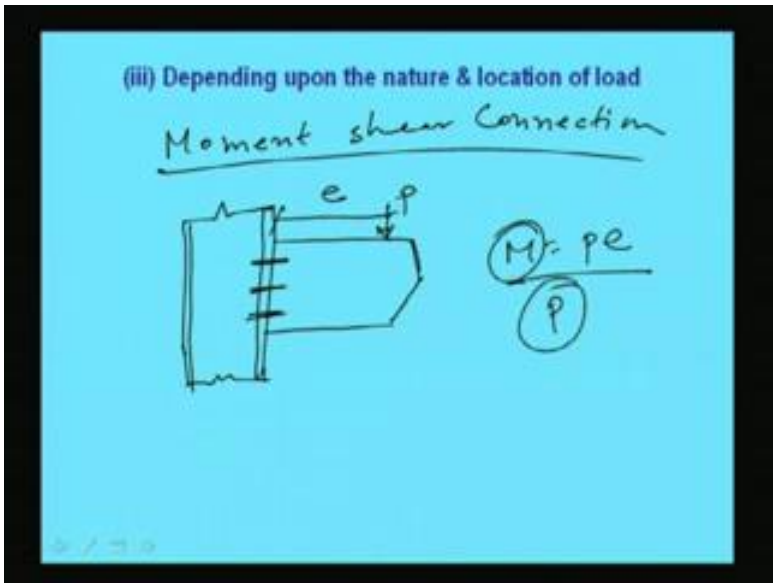

Another connection is moment shear connection moment shear connection; that means, here it will take moment as well as shear. So, if the connection is made like this, so this, a column and the beam or bracket is connected like this. So, this is connected through here to the rivet and this p, so what is happening here due to eccentricity of e moment is developing as p in to e. So, the joint has to take this much moment as well as shear of p. So, this is called moments shear connections means the joint has to be made due to moment m and due to shear p.

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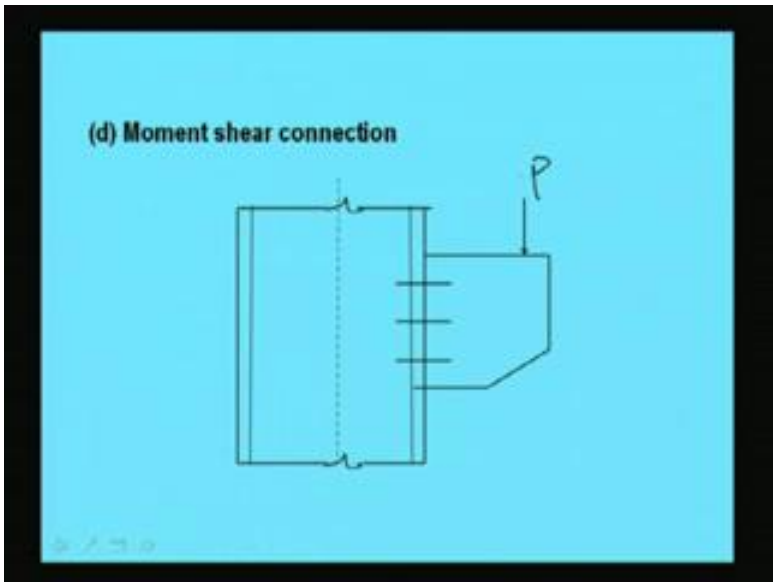

So, this look like this moment shear connections. So, what we have seen in this lecture is that the, what are the type of connections available? And we have discussed mainly on rivet connections. Rivet connections again can be classified in different way depending on the type of load type of arrangement. So, in that way we have classified and briefly we have discussed all this. And in class the remaining part we will discus and how to analyze a rivet, connections? We will try to discuss in next class. So, with this today's lecture I would like to conclude here.

Thank you.