Mining Machinery
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Module - 08
Lecture - 44
Off- Highway Trucks: Rimpull Curves and Tires

We are discussing about the transportation machinery in surface mining and in that we have already discussed and introduced about the mining trucks. So, in that mining trucks of that Off-highway Trucks, few important concepts are there; particularly, the Rimpull and this Drawbar pull and another most important component is the tire.

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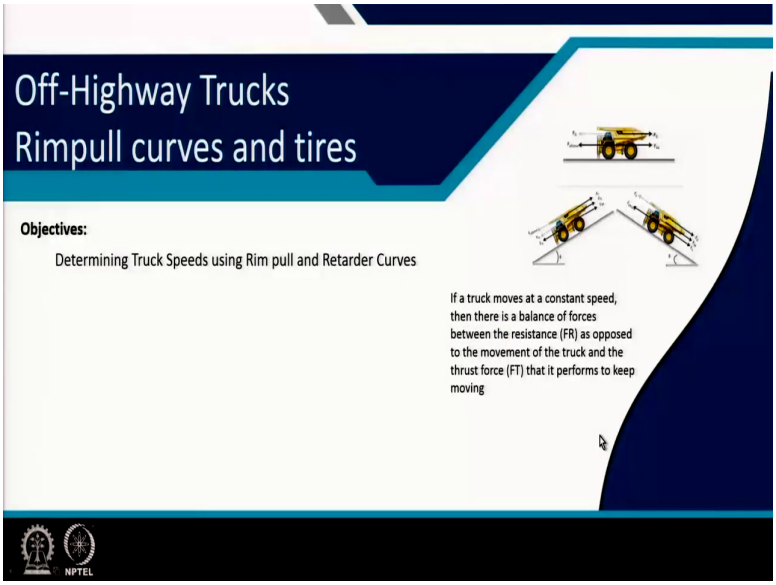

So, in today's class, we will be discussing about little bit of this basic concepts regarding the rimpull and this mining tires. So, as you know that exactly a truck when it will be moving, it

is exactly number of resistances it will be overcoming and that when there will be it will be overcoming the frictional resistances.

And then, it will be having a thrust force by which it will be going and then, the truck can go upgrade in a gradient or it may go downgrade in the gradient and this is the whole phenomena.

That means, the truck will be moving on a horizontal road or a it will going up the gradient or it will go down the gradient and this could be under two conditions; in the loaded conditions and in empty conditions.

So, the different forces, how it is working and how the power is being utilized in the truck and where it is, how exactly you need to get the engine power rating, how will you develop. So, today's discussions may give you some idea, where you can do some additional studies and also, what are the important points you need to cover.

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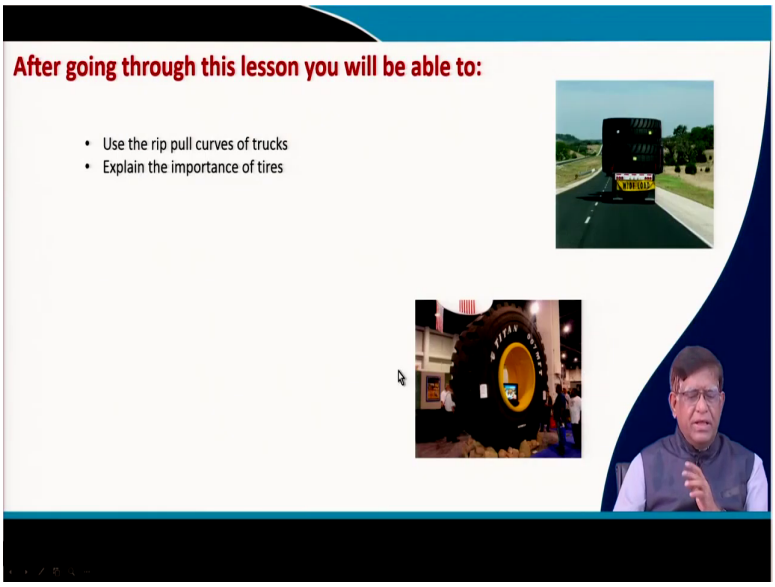

So, as exactly our main discussions today will be for how to use the sorry this rimpull diagram, not the rimpull curve. Rimpull curve is a that is a the how the manufacturers give some this graphs, so we need to use those things in which way that will be discussed today.

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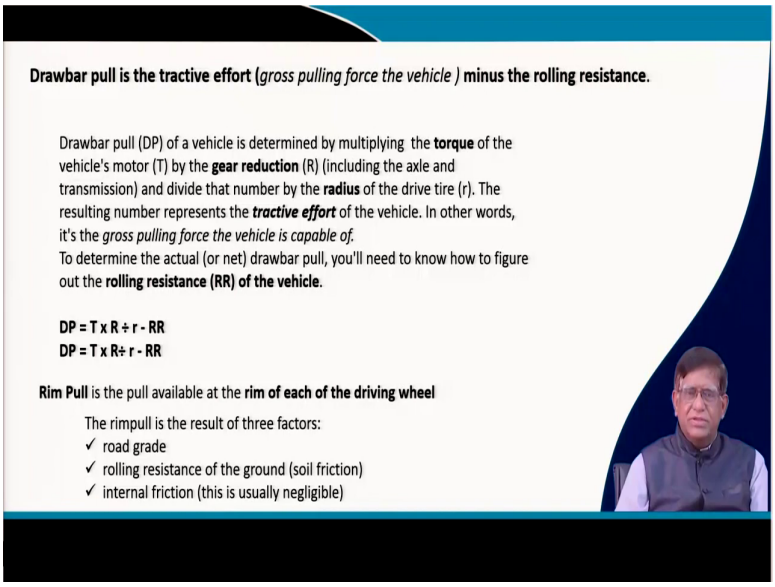

So, a Drawbar pull is the tractive effort or the gross pulling force of the vehicle; that means, that engine power, it is giving that so that this it can take pull the vehicle forward and then, drawbar pull is that minus the rolling resistances. So, that is what exactly when you are pulling the vehicle up, it is exactly overcoming the rolling resistances. So, we are getting a drawbar pull over there.

Now, the drawbar pull of a vehicle is determined by multiplying the torque that a vehicle motor by the gear reductions, that is from the machines components point of view, we can calculate out the drawbar pull. And that is exactly the relationship as you know that torque is forced into this radius that you apply to determine the drawbar pull.

And the resulting number, it will be giving exactly a tractive effort of the vehicle that is a how the main gross pulling force the destructive effort is that pulling force which is coming up

over there. Now, to determine the net drawbar pull, you need to know that is exactly what is the rolling resistance of the vehicle.

So, this drawbar pull is exactly we are getting this say to tell that your total load, you are calculating it out that is what is the vehicle that is torque being applied. And then, what is the reduction ratio of the gear and what is the radius of the shaft and then, minus the rolling resistance, this is they gives.

And that Rimpull, it is that whatever is the pull available at the wheel; that means, the wheel will have to be moving, it will be overcoming the frictional resistances. So, there comes the your Rimpull. Now, the rimpull will be depending on the road grade that rolling resistance of the ground and the internal frictions, often the internal friction is rotated.

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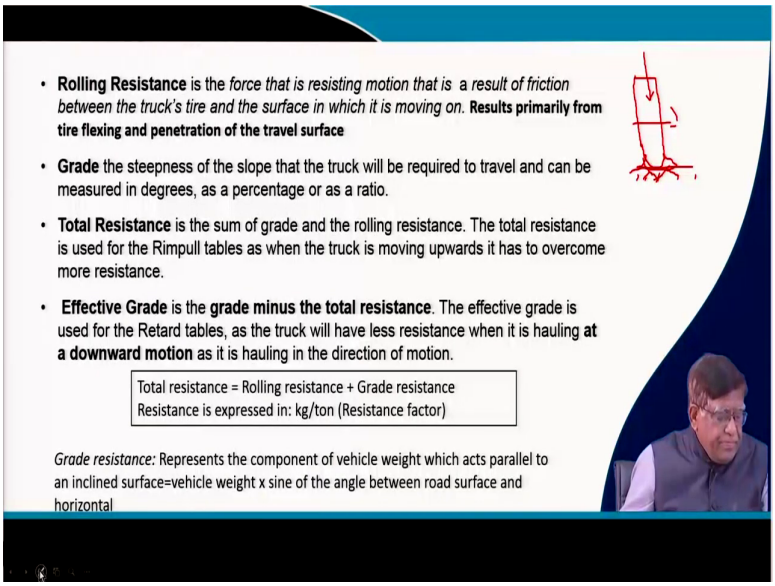

So, that means, when you are talking about the driving a vehicle, a truck, you need to know about the rolling resistance that is the force that is resisting the motion that is result of the friction between the truck and the tire and the road surface of which it is made of and then, the resulting primarily from the tire flexing and penetrations of this.

So, you can understand over here that is a if you are using a that whenever there will be a tire which will be on the road surface. In this, there will be a load will be coming over here and this is along that axials, where it is a moving. It is rolling over here. Now, this tire if it is less inflated, it will be getting a flexing in the both these sides.

So, that will be here more surface will be taken over and then, if it is a sometimes if this surface is very loose, at that time what will happen? This will be giving a penetrations over here. When there will be a penetrations, there will be additional resistances will be coming over here. So, that is while taking of the rolling resistances, we will have to take care of these things over there.

So, now whenever we are using a truck on a mines road, you will have to know that whether the tire is properly inflated or it is exactly whether the road surface, there is any penetrations because these two things will be affecting your rolling resistance. Then, the grade that is a it is known as you have shown in the figure there, it will be going upgrade or it will be going downgrade.

Then, the total resistances, it will be is exactly the sum of the rolling resistance and the grade resistance. Now, this resistance is expressed as a kg per ton of the vehicle, gross vehicle weight ok that is kg per ton basis it is expressed. So, the effective grade or the grade minus the total resistance, exactly when you are working in a real like practical problems, it is the effective grade which is there. That is the it will be the total resistances they find it out.

So, while you are going to use the different that your rimpull curves given by the manufacturer based on their lot of testing's, you will have to have this concept of what is

grade resistance, rolling resistance and then, also the speed methods. We will be coming to that.

Now, the grade resistant represents the component of vehicle weight which acts parallel to the inclined surface. So, that is your we find out that one by vehicle weight into that sine of that slope angle that is how we are finding out the grade resistance.

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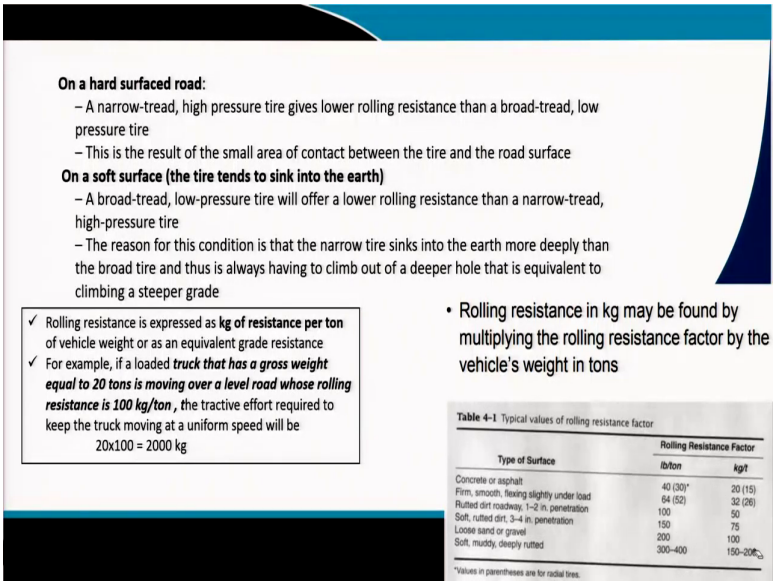

Now, if you come to that on a hard road surface, I that what type of tire should be used? The narrow tread high pressure tire gives a lower rolling resistance and in case of your soft surface the tire tends to sink or that as I said there is a penetration and then, that is here you will be having a broad road that is a low-pressure tire; the tire design and all will have to be there.

So, that means, you should keep it mind because the our mining conditions, the haul road conditions that will have to be taken into considerations while selecting the what type of tire will be used. So, the rolling resistance is expressed is a kg of resistance per ton of the vehicle weight. This is a point you need to keep in mind.

So, if a loaded truck that has a gross weight of say 20 ton and moving over a level road, whose rolling resistance is 100 kg per ton. Then, you can find out how much kg is the that is your and that will be multiplied by your 9.8 or sometimes equivalently 10, that will give you the total that force or in a Newton haul will be calculating it out.

So, take care of the unit and then you can do it over there. So, now, that rolling resistances, it varies depending on the surface. That these are standard tables are given. If you take concrete or asphalt road, you find that is your rolling resistant factor is taken as 20. For other soft, rutted or that your rolling resistance, you can see here, it may vary up to even 200.

Now, these questions arises that whether you know about the rolling resistances of our road surfaces or not. Now, equation shown exactly how will you do it. We do not have experimentally determine rolling resistances of our different road surfaces Tata steel for their some of the mines, they did some experiment if I remember, but there are still that is many of our in the coal mining area, you go in any mines ask that what is the rolling resistance of your road, nobody will be able to tell.

And that will be a varying item depending on the that seasonal things and depending on the haul road maintenance, this rolling resistances may vary. Now, we need to develop a small tool by which we can measure the rolling resistances. It can be any tool. If you are just taking your making a some vehicle to move at the back, if you are having a trolley and then, if you just measure on a the trolley, how it is being pulled.

At their the tension, if you measure that would be giving a rolling resistances. So, devices can be designed or found out how to do it over there.

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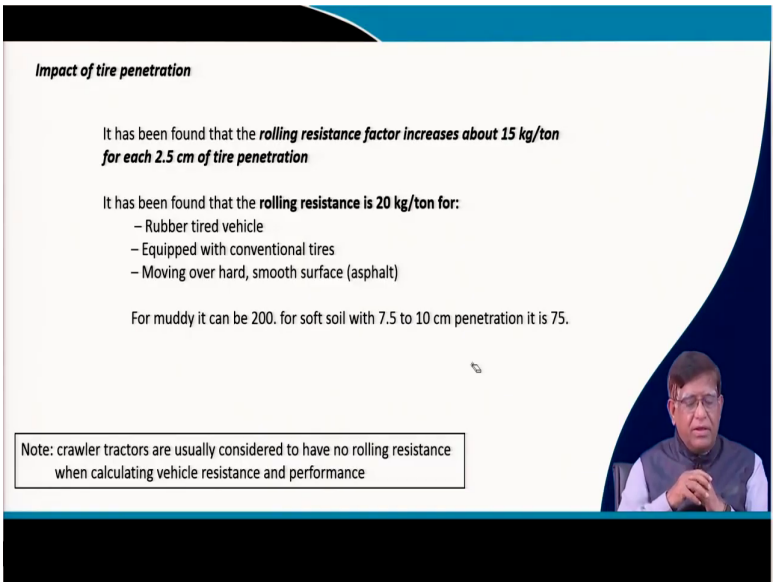

So, the impact of tire penetrations that how much it will be penetrating, depending on that exactly the that your calculation of the rolling resistance will vary. So, for example, that is your the crawler tractors they will not be having considering their rolling resistances because crawler tractors, they have got a different way of moving. Rolling resistances factor will be coming only our tired vehicle; tired vehicle only.

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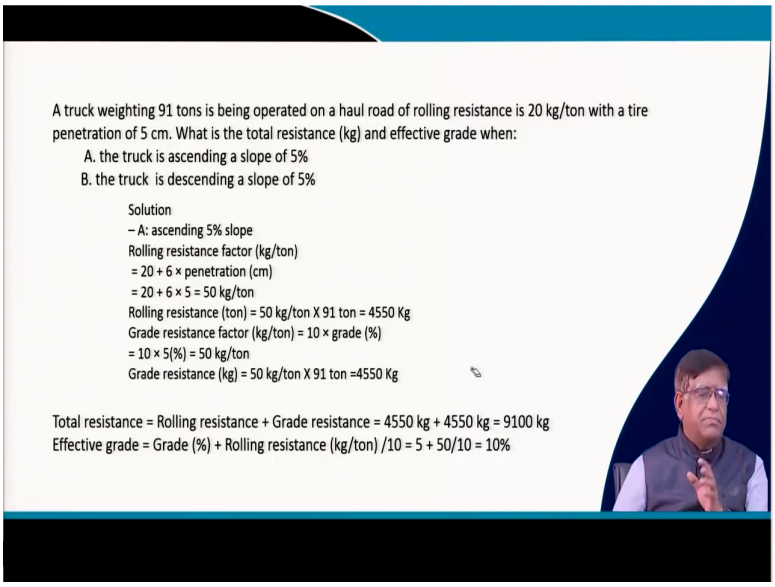

So, just try to do it little bit of mathematically. A truck weighing 91 tons is being operated on a haul road for rolling resistance of 20 kg per ton, that haul road just like your asphalt or concrete road with a tire penetrations of 5 centimeters, it is there. Now, what is the total resistance that effective an effective grade?

So, we can usually calculate a the truck is ascending at a slope of 5 percent and the truck is also descending. So, under these two conditions in that haul road, where it has got about your 5 centimeter penetrations. How will you do? The normally that is your for the penetrations, they take exactly that 6 into that.

This is a rule, they are following. This is everywhere while doing the calculations, we follow that the rolling resistances in that kg per ton, it is determined by using this relationship. So,

you can find out here with the given value, it is a rolling resistance. You can determine, it is coming 4000 that resistance due to the mass of 4550 kg.

Similarly, grade resistance, you can find out and then, the total grade resistance in terms of the mass. So, that this much kg of force will be applying as a your resistance. So, the total resistance of 91 dozen 9100 kg force will be coming. So, that is effective grade is calculated by sum of these two, that will be giving you the total effective grade. So, this is the way how exactly the resistances are calculated.

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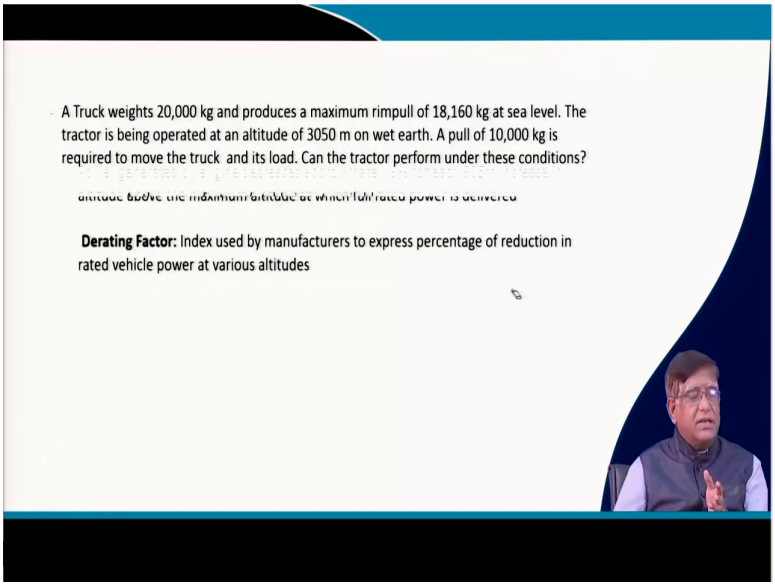

So, a truck when used at high altitude mine, the power of the truck is to be derated. That is another things you need to know say for example, a truck which has been for our (Refer Time: 13:10) mining area, if we have to use that truck say for example, at high altitudes of say for example, in Panchpatmali hill that bauxite mine or if you are to do a mine in

operations in Sikkim, there exactly we will have to because of the altitude differences we will have to derate it.

So, that means the same power will not be available because of the less oxygen in the air. So, this derating factor normally for every 305 meter increase, your 3 percent decrease in the power rating is done. So, that means, what will be the carrying capacity of the truck, that will be determining with the help of this.

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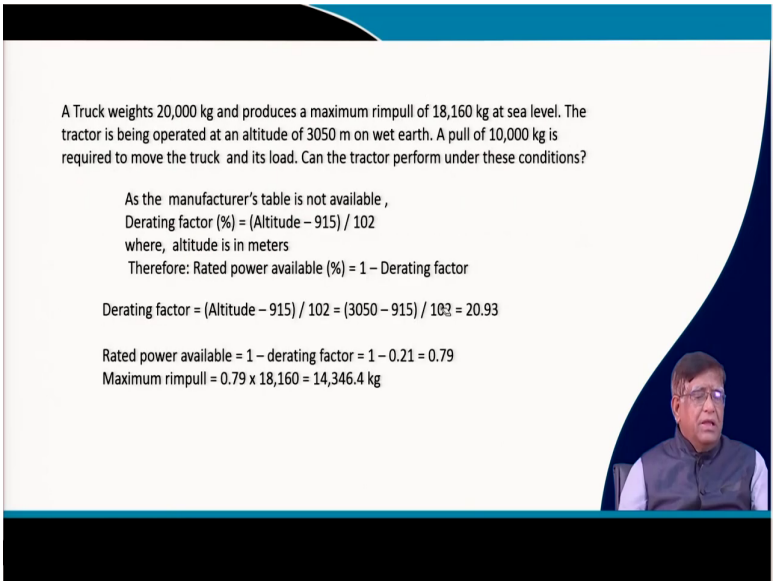

So, a we can calculate there is another problem has been given over here. A truck weights 20,000 kg and produces maximum rimpull of 18160 kg at sea level. If the tractor is being operated at an altitude of 3050 meter on the earth, then a pull of 10,000 kg is required to move the truck and its load.

Now, can the tractor perform under this conditions? So, that means, you will have to find out that after derating, how much rimpull will be available. Once you calculate that after finding out that is your, then you can get the initially you will have to find out the derating factor. So, you can find out the derating factor as because you know that every 305 meter, there is a thing so, with your given altitudes, you can find out that altitude in meter and you can do distance.

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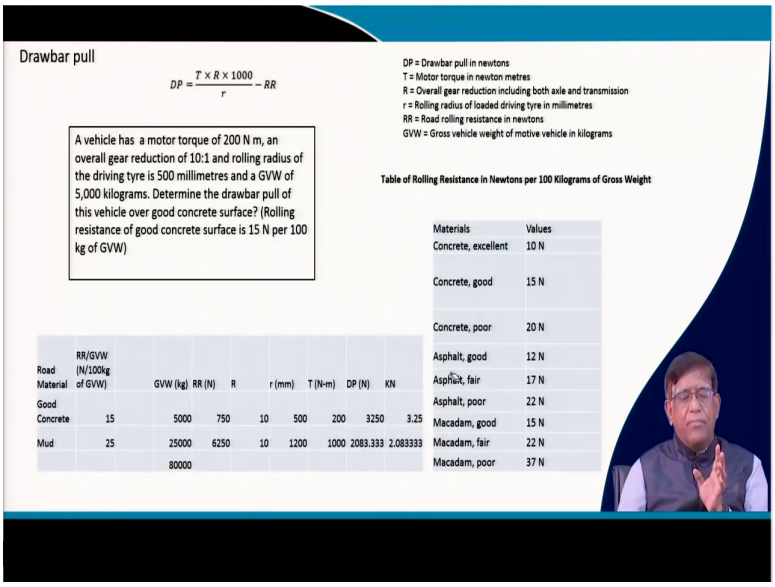

This type of problem when you will solve, you will be knowing about that exactly that how you will be going to select the engine power. So, that drawbar pull as we give in the very first slide, the equation is you T R 1000 by r into RR. So, you can find out another problem here. You solve it.

A vehicle has a motor torque of 200 Newton meter and overall gear reduction is 10 is to 1 and rolling radius of the driving tire is 500 millimeter and then, gross vehicle weight of this a 5,000 kilogram. Determine the drawbar pull of this vehicle over good concrete surface.

Rolling resistance of good concrete surface is given as a 15 per 100 kg of gross vehicle weight. If a very well-defined problem. If it is given you know that the parameter that with the different materials, what are the resistances are also there, this type of charts are available. You will have to consult that to find out.

Here of course, the value is already given. If it were not a very good road, then then your poor road, it could have been you can change this value over here and you can find out the drawbar pull. So, in that way, you make a tabular form and find out the drawbar pull and you can find that how the dependencies are there.

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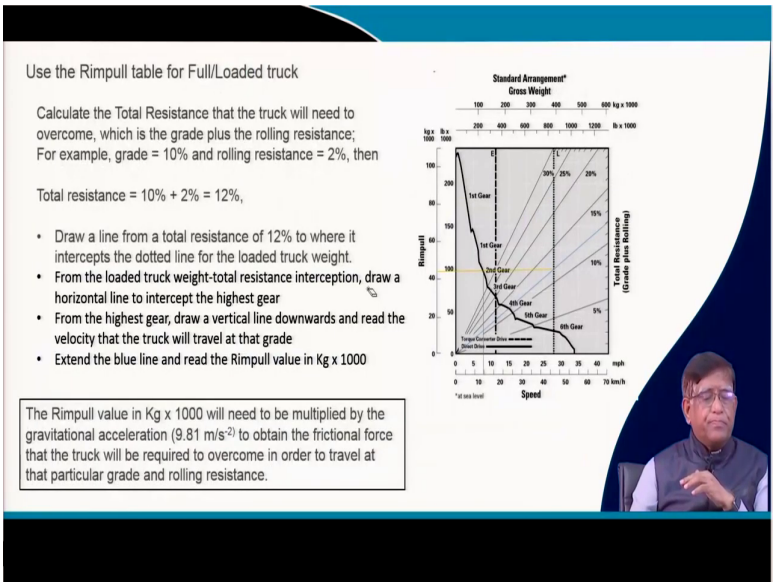

So, now, this when we say a rimpull curve or rimpull table, this type of graphs are given by manufacturer in which a rimpull is given and then, whether at different grade of the resistances, these grades resistances are given and then, the curve gives at which gear the vehicle will be running.

Now, these graphs get two lines are given; E for the empty trucks and L for the loaded truck. This type of graphs will be available for scrapers or the other vehicles also, cranes that is your even the motor grader, you find all these a tire mounted machines which will moving with a diesel engines, such type of graphs will be given by the manufacturer.

Now, from here, if you were to find out that a at what will be the maximum speed at which you can go say for example, here a problem can be to what will be the total resistances, you can find out. Now, there your you see here the speeds are given. Now, if your truck is running

on a road, say you are having a say 15 percent or say you are in this you are having a 20 percent gradient, we are having a 5 percent gradient. If you are going moving in a 5 percent gradient, then you can find out your with what is the load on the vehicle.

You can see from here this is into 1000. If it is your 3 ton or it is a 500, 1000 kilo 5 ton that is a coming over here. So, in this line, you can find out and then, you can form the graph, you can determine that what will be the at which gear it will be running. Say if it is running on a second gear, it will be running at a speed of say 10 or that is about 14 kilometer per hour speed, it can run with a Rimpull. It will be giving about that is your 40 into 1000 that is 40 ton rimpull will be given over here.

So, that is in a the you can calculate the total resistance of the road depending on the grade resistance and a rolling resistance, you are finding out Once you find out the total resistance, then you can draw a line from the total resistance. This 12 percent gradient wherever it is coming, you can draw a line over here.

This 12 percent gradient will be meeting at this point. So, here that is a you are loaded from there, you draw a horizontal line it goes. That means, at this conditions, it can run on the second gear of this will have to that maximum speed you can get this much and then your rimpull available will be this much. This is how exactly the graphs are read.

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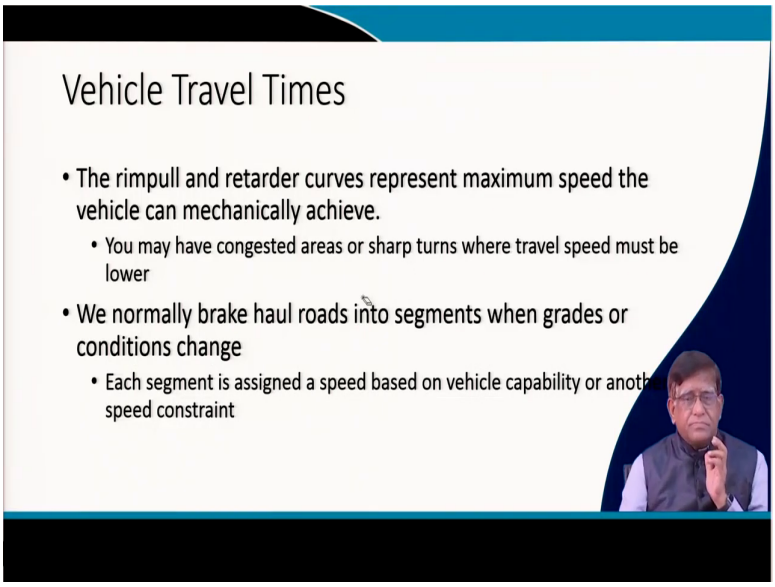

So, another thing is there; the travel time graphs. This is also available that is your under different conditions, how much time that will be travelling for a loaded truck and as an empty truck. To by determining that you can also find out this calculations.

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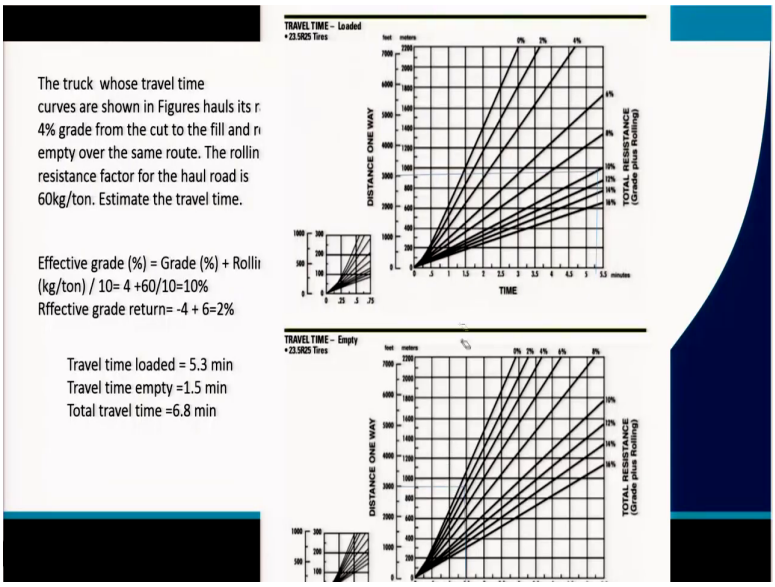

Say for example, a truck whose travel time curves are shown a you can see is a in a figure, you can see here say for example, this is a travel time graphs. So, in a loaded and then, one it is given in empty. So, here if you have to use this type of graph. So, suppose your total distance which you are going to travel is 3000 meter that is 3 kilometer distance to be traveled.

If you go horizontally, you can find out what is your resistance. If you are telling here that you have got a total rolling resistance is 4 percent and then, your grade resistance. So, total if you are finding out the total effective grade is 10 percent. If your effective grade is 10 percent, you go where this line is meeting at the 10 percent line.

At the 10 percent line you come down; that means, it will take how much time. It is coming about your this about 6 minute or a 5.5 minute, this much time 5.3 minute time is required for

travelling. Now, if you see the empty one, same thing from here your because it is a negative gradient now, their effective gradient will be 2 percent gradient. So, that is why you come from here, come up to this graph.

So, that is a 2 percent choline. If you come down here, you will find that this is getting at your about 1.5 minute. So, total time taken is 6.5 minute. So, that means, when you are doing calculating your productivity, you can do the planning and estimations by using these curves.

Wherever you see this our scheduling or mine planning software, they take these curves and from there, they put right a code and this they take these things into the system so that you can just find out you give the your conditions that things will be taken up and you can produce.

So, earlier it could be a simple exercise getting such type of graphs, you can do a little axial based calculations and you can find out and do productivity or the other mine operational calculations can be carried out. So, that is why you should be able to read this type of graphs and then find out what it is. Then, the basic thing is how to determine the rolling resistance and things.

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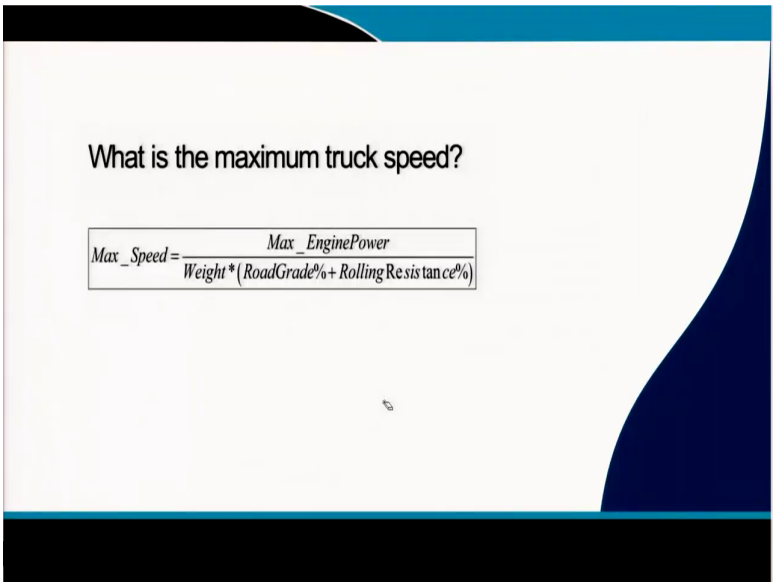

So, that is now once you know they wrote grade rolling resistance and you can find out if you once you have found out the maximum speed, the relationship of the with the max engine power that is how much will be the engine power required for that particular vehicle, you can find out and then, you can find out whether your truck is having the right engine for operating under that condition or not.

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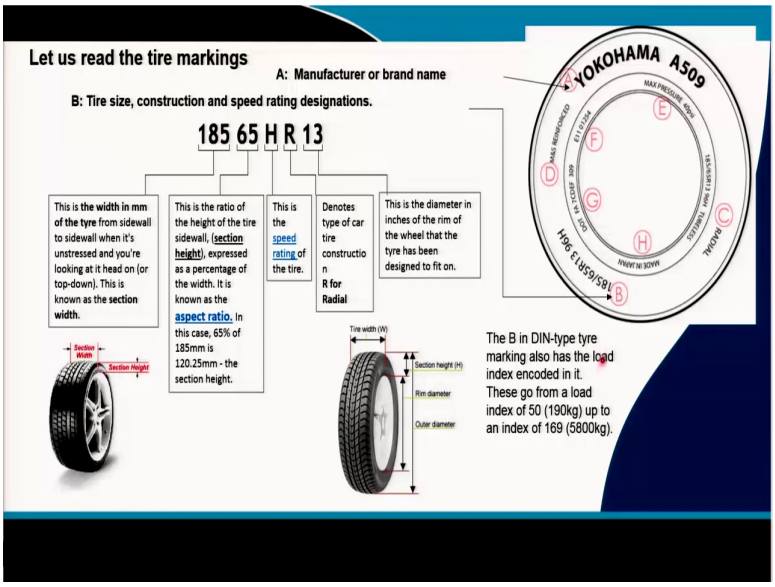

So, now we have discussed about this truck that is it is speed, we have reached this force. But the main thing in any a truck is as I told that is their tires; tires play a very big role in trucks life. So, today we will be introducing a little bit about the tires. So, let us see that is your whether the tires has got certain marking. So, whether you understand those markings or not.

So, in a tire, this is a Yokohama my tire. Any tire make you take, there will be number of marking in the tire. So, one need to know that what this marking means. There will be a first thing, it will be given a manufacturer brand name and there will be a tire size construction and speed rating designations will be written over there and then, there will be this rating. Here a number will be given.

This number has got certain meaning. That is the first one, first three letters, it will be giving the width in millimeter of the tire from the side wall to the side wall. So, that is exactly the

length it is given and it is you are looking at it head on the top down. So, this is known as the section width, that section width of the tire is given over here. You can check this is been in your bicycle, in your car that is everywhere it is a standard form it will be given.

The next two digits, it is the ratio of the height of the tire side wall and expressed as a percentage of the width. It is known as the aspect ratio. In this case the 65 percent of the 185 millimeter that is your 120.25 millimeter is the section height. That means, from the tire how you find out that section height, this length, it will be determined from this number.

So, by looking at the tire, you can tell that what will be this tires, this width. Because that in your mining operations, when the tire will be wearing out their trading will be done and how it will be behaving on the road surface, this section height is also an important parameter.

Now, next you have got this is the speed rating of the tire, that speed rating will be given under different road conditions, different climatic condition, different rubber manufacturing. There will be a speed rating, these are given by number. There is a meaning with that there is a tabular form, you can find out what is this H means.

Similarly, next there will be this number will be giving the type of car tire construction, that is if it is a R it will be radial. You know that there is a two type of tires. I just briefly told in the previous class that is a cross ply and radial that is your bias tire, how they are there. So, this will be giving, it is a type; it is a radial tire. You might be hearing most of the time car coming with a radial tire and the last one these two digit, this is the diameter of the inches of the in inches of the rim of the wheel.

Now, how that the diameter is this is the Rim diameter, you can see here in between and then, what is the section height? That is total height is given over here and then, that is your the section height part is this much and outer diameter is there. So, now, does it give you an idea about now that a tire what are the things you should know? So, if you know the tire markings, it will be giving an idea about this whole tire height which is there.

And then, that is your here a number it is written, this number it goes about the din type that is a standard type of the tyre by marking this has been given over here.

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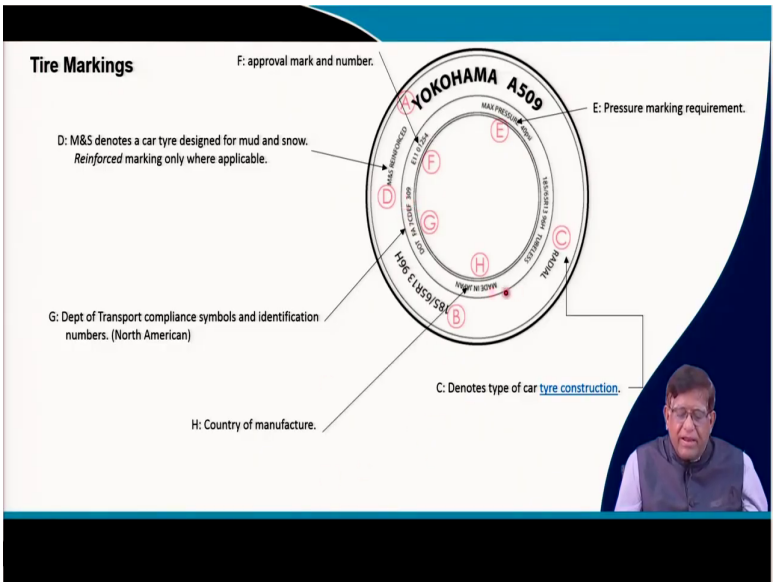

And then, you can find out that tire marking from here this C it gives that means, here exactly that what is the tire construction. Then, this tires how it is designated that is whether it is for the mud or it is for the asphalt road or that is there given. Similarly, there will be a an approval that is whether you have got proper approval or not, that will be also marked over here.

Then, the department of transport compliance; in US, they give a compliance number over here, in US. Then, a country of manufacturing; where it is manufactured, that is also written over here.

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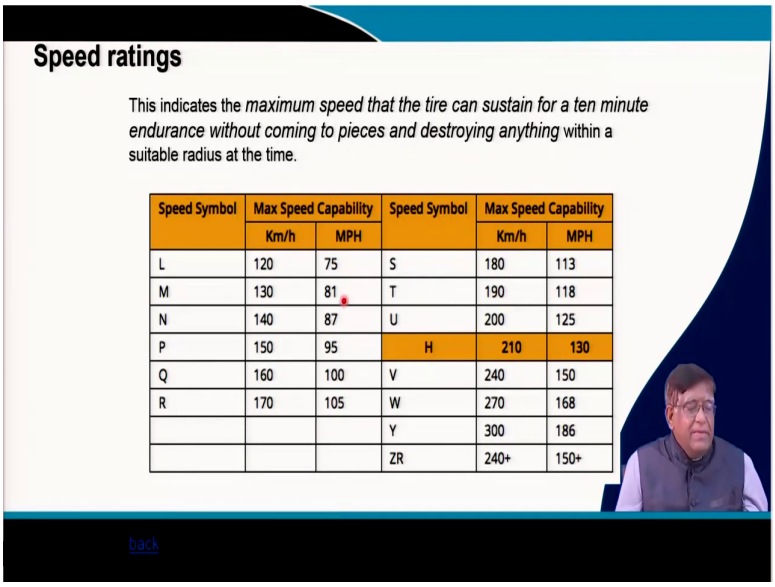

Speed Symbol	Max Speed Capability		Speed Symbol	Max Speed Capability	
	Km/h	MPH		Km/h	MPH
L	120	75	S	180	113
M	130	81	T	190	118
N	140	87	U	200	125
P	150	95	H	210	130
Q	160	100	V	240	150
R	170	105	W	270	168
			Y	300	186
			ZR	240+	150+

So, now that as I said that this is this different speed symbols are given depending on that what speed for the your small cars that is your in US up to 170 kilometer per hour basis, you are getting that L, M, N, O, P, Q, R.

So, these numbers are given. From that speed symbol, you will have to see. In the previous, I we saw that there was a symbol given H. So, that means, a tire with an H symbol can go in a very high speed that is a 210 kilometer per hour it can go. So, this is the way how exactly the tire ratings are given.

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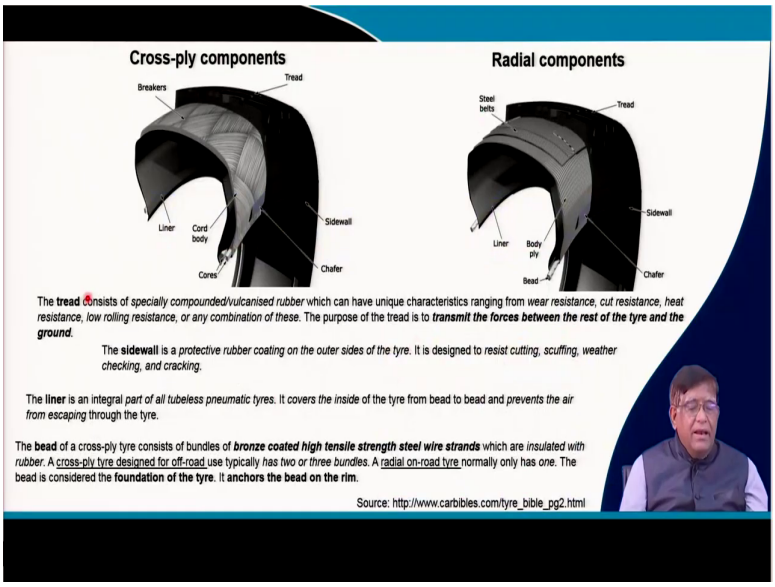

Similarly, as I told you that tire could be a cross ply or radial component. In radial tire what you always hear, people talk about it. There are exactly two beads; here on the bead and then we are having this is this portion is called chafer. So, that a hardening hard it will be made hard by this chafer and then, there is the side wall and at the top there is the tread and there is a this is a steel belt type of steel cords things are ride over there.

You can see their inside that this is the main carcass, they say it is the carcass and there inside this liner is there. So, this is a radial tyres component. In a cross ply that there are these are breakers exactly there at a 60 degree angle, they are put it over here and then, they width like this. So, this is a cross ply type of tyre. Here also you are having the liner, the cord body, that cores, sidewall and chafer are there.

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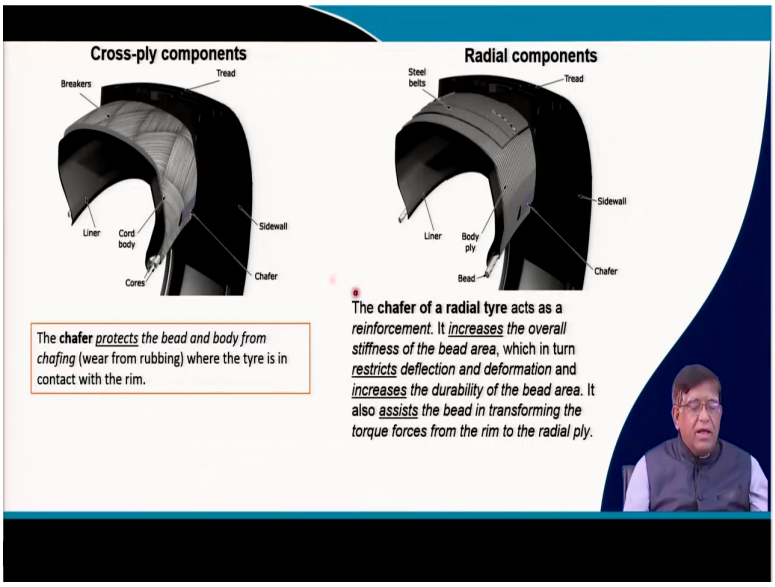

So, this how the tread will be there? At the tread means on the top, you might have seen that in your different tyres have got at a different type of tread. So, here you can know about that what is the function of each of this component. You can make a study and the on this different component in case of the chafer of a radial tyre acts as a reinforcement so that it takes the total load on it.

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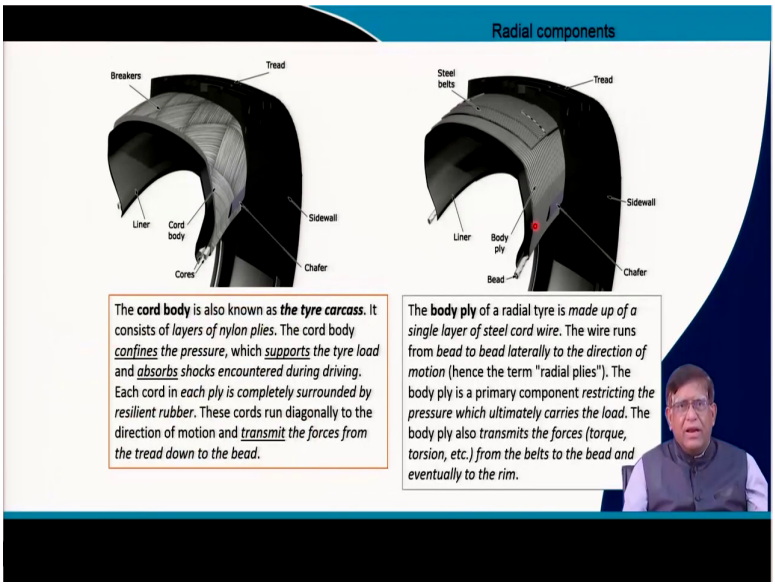

So, how exactly the cord there, what is there that is your the carcass role, those things are also you need to know.

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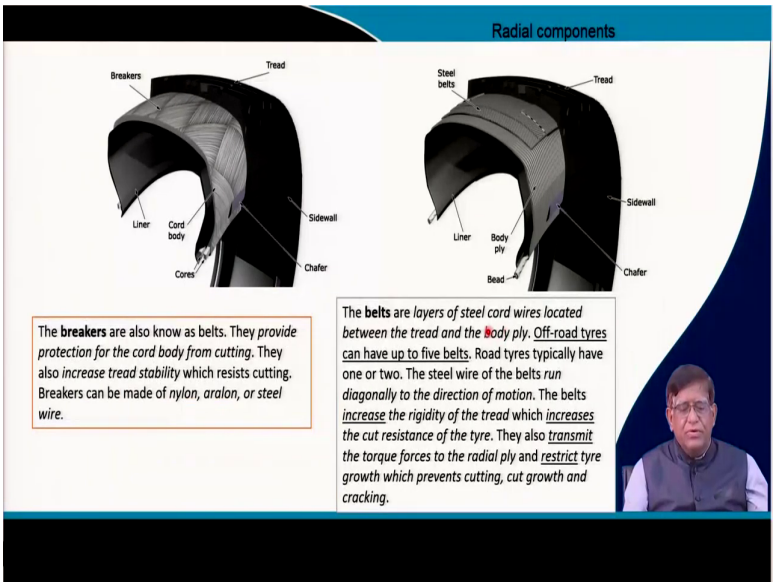

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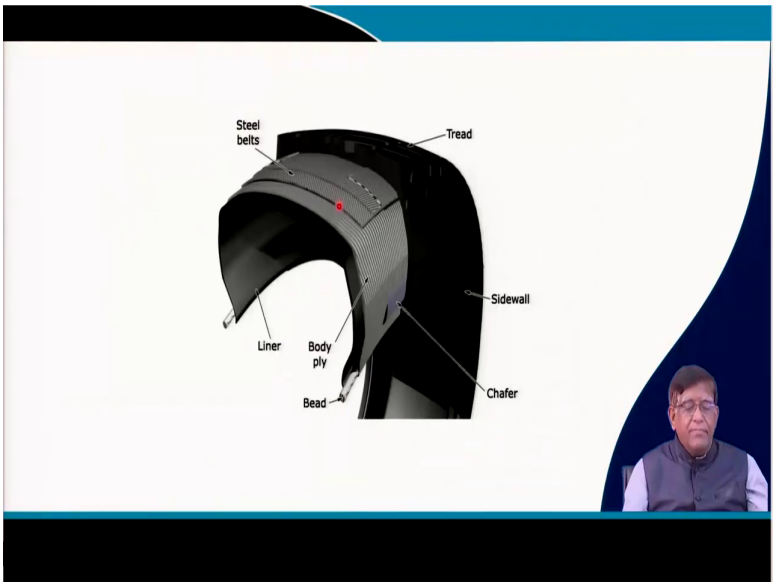

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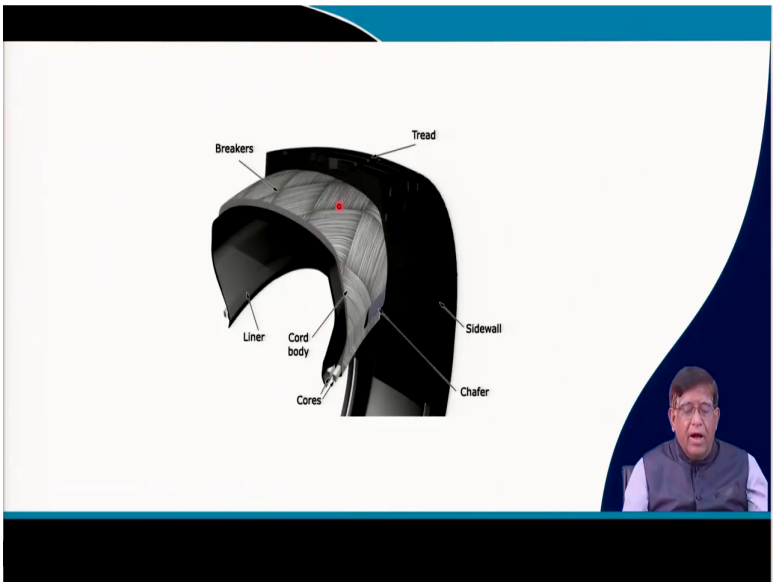

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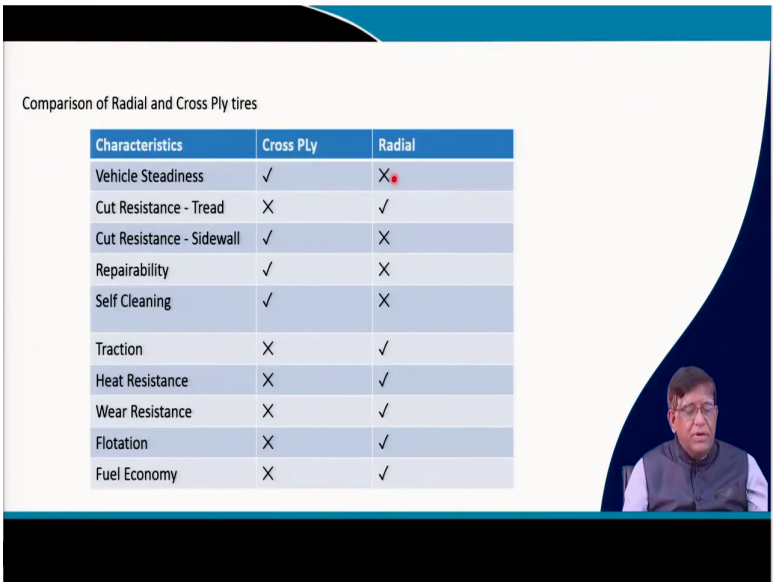

So, here we talk about this tread which is very very important, but that cross ply and radial, these two tires if you compare; then, you can make this type of comparison table. That is the vehicle steadiness, cross ply is better. For a cut resistance and tread, your radial tire are better; cut resistance of the sidewall, your cross plys have got better strength.

Then, repairability of cross ply is better; self-cleaning cross ply is better; then, traction that radial is better; heat resistance radial is better; wear resistance radial is better; then, your flotations radial is better; fuel economy radial is better because of these things the radial tires are nowadays everywhere used.

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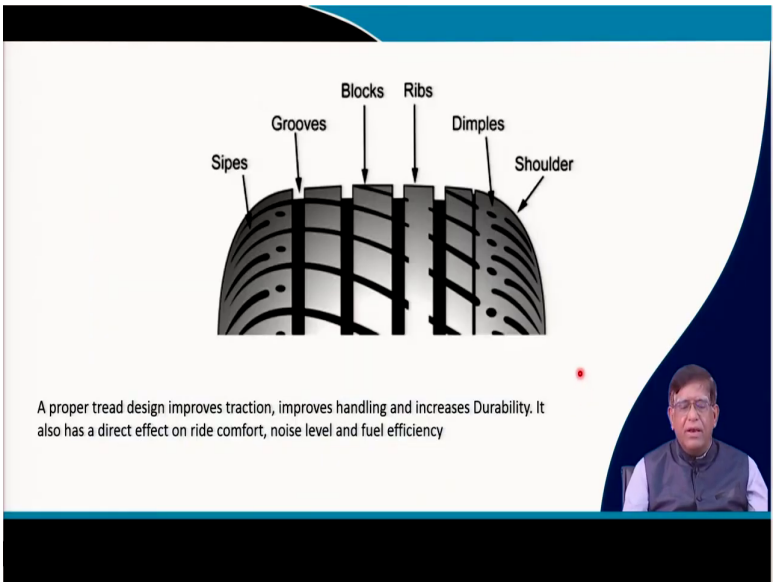

Now, when we talk about the tires tread. Do not think that is a many shapes coming with you might have seen in your bicycle also, now this there are some things you can find out there is a shoulder of the tyre and there are some sipes, you can see a small like that. Then, there are some grooves and there are in between this, there are some these are the blocks and these are the ribs, they make the tyre.

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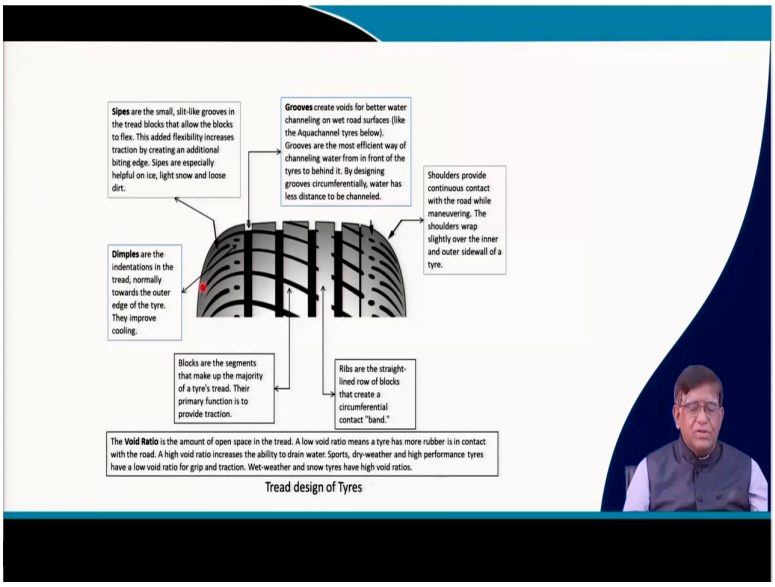

Now, designing of each of them has got a particular functions, they do on a road surface. So, that what are their functions that is particularly that sipes are the small slit like grooves in the tread blocks and allow the block to flex. These added flexibility increased traction by creating an additional biting edge. Sipes are especially helpful on ice light snow and loose dirt.

So, that means, how this will be looking, you can see now the different car of different country and you can compare that they when the tyres treads are designed differently. And many a time, we do not manufacture tyre in our country for the big trucks and then, sometimes if they have designed it for some cold country, the same tyre may come over here, if we are not very much aware of that why it is there and what should be given.

So, I request you to kindly see the tread designs of tires, how it is there. Then, the ribs are the straight line few blocks that creates a circumferential contact band and then, your blocks there

that exactly primary function is to provide traction and then, these grooves, they play a very important role for that how exactly that they will be behaving; your tire will be behaving on water.

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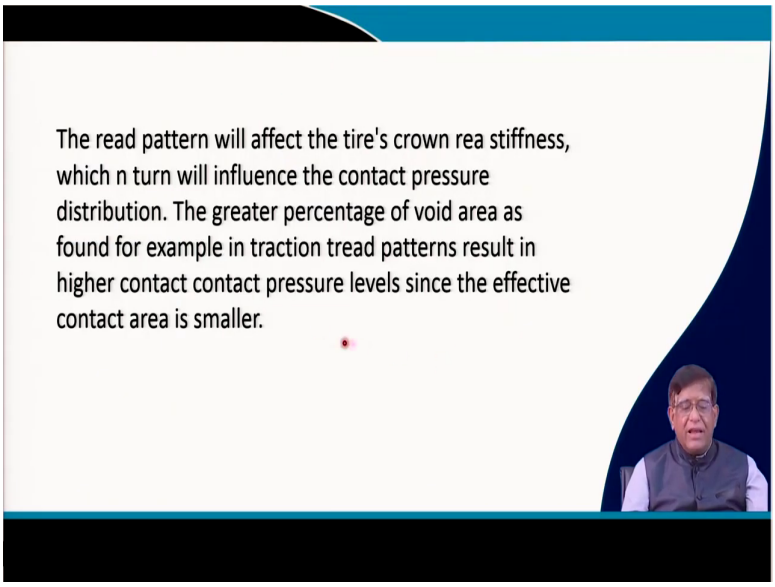

So, this tread pattern will be affect the tire’s crowns rea stiffness, which in turn will influence the contact pressure and pressure distributions.

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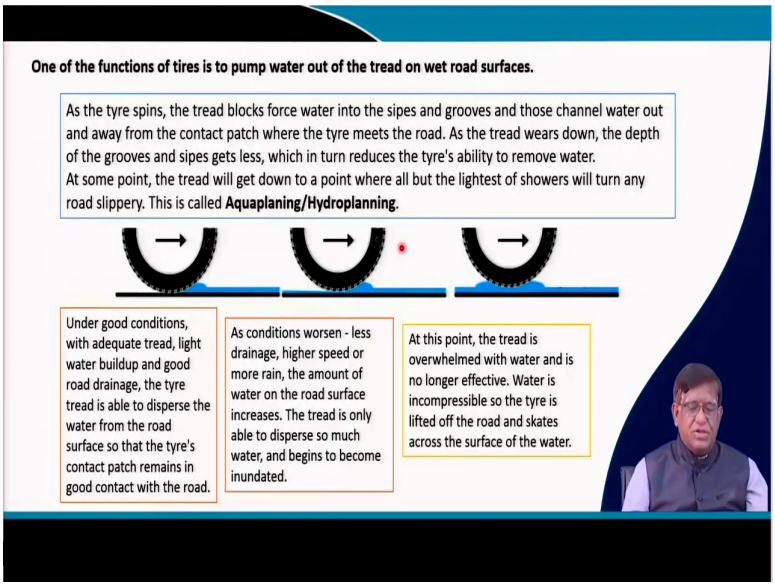

Now, most important thing that because of the tread, they have got a pumping action. In the rainy season on a road when water will be there that exactly when it will be moving, you can see that their physics at the that portion because that water will get suck over there and they will be thrown out at, that way the water will go.

Now, if the tread becomes smooth; that means, the tires are that the trades have got worn out, at that time you might have got that experience that these are bicycle also, it skid the truck skid and then it floats, that action is called your aquaplaning or hydroplaning. Exactly what happens over there? This water they get accumulated, they do not get pumped out of that and then, a layer of water get dropped up; that means, as if it is floating and here that it already it will be rotating.

At that time, it will get skid and the (Refer Time: 32:42) this. So, you please read it about what is this hydroplaning or that aquaplaning. This is a under good conditions with adequate tread, light water build up and good road drainage, the tyre tread is able to dispense the or disperse the water from the road surface so that the tyres contact patch remains in good contact.

So, you can see here that good treads that water is moving. So, if your road is also road drainage is not proper, then your tire treads are worn out. At that time, some water will be there and if the tires are really the treads are become flats, then your that more water will be coming a dangerous situation will come. So, these type of things you need to know and study about this.

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So, the performance properties exactly you need to know that there are mechanical and then, your tires should be that your traction noise, it should not make many heavy noise.

You can see in a roadside that in a traffic side, the traffic noise in a near the highways that has got to a lot of aerodynamic noise due to the tire can be determined. This is another area of study of importance and you need to know about that how the durability the tread, where how the cutting cracking will take place over there.

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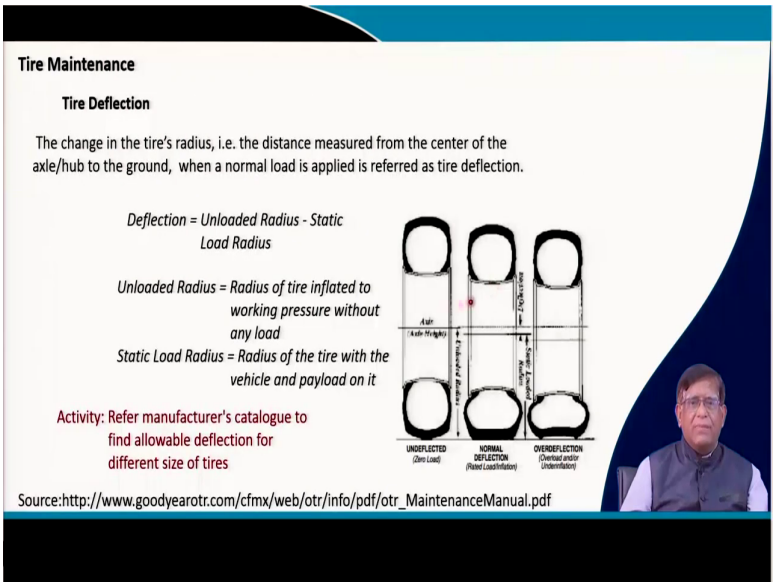

The tires can be a very important area where you can study that how exactly the deflection will take place, under this is whether that your a undeflected tire, how it will behave? A normal deflections, it will be having appraised over here and then, over deflections there are different situations may find out over there.

The tire which will be a toroid shape, how it is designed; this is a very important thing. So, one activity I am assigning giving with an assignment, refer manufacturer catalogue to find allowable deflection for different size of tires, that how much deflection is allowed.

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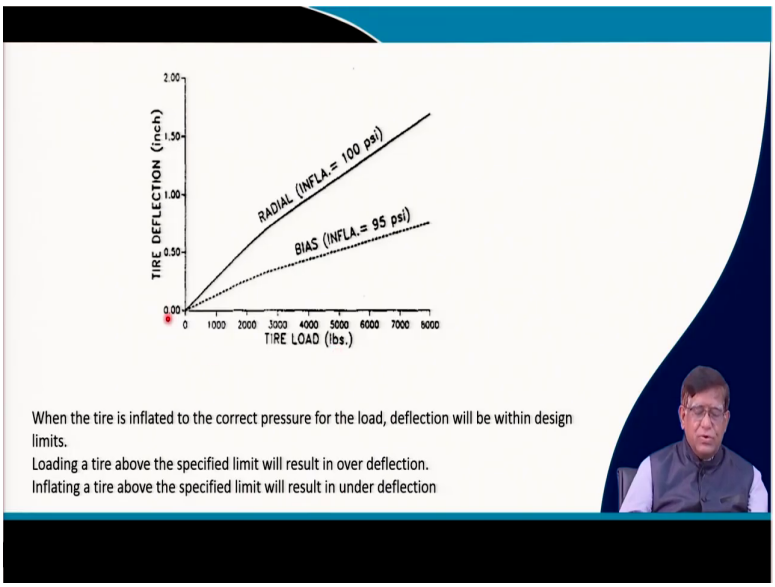

So, this we can find this type of graphs, where the different tire load, the tire deflection is there. You can find in case of radial tire that more allowable deflection is more; but in case of bias tire, the allowable deflection is less.

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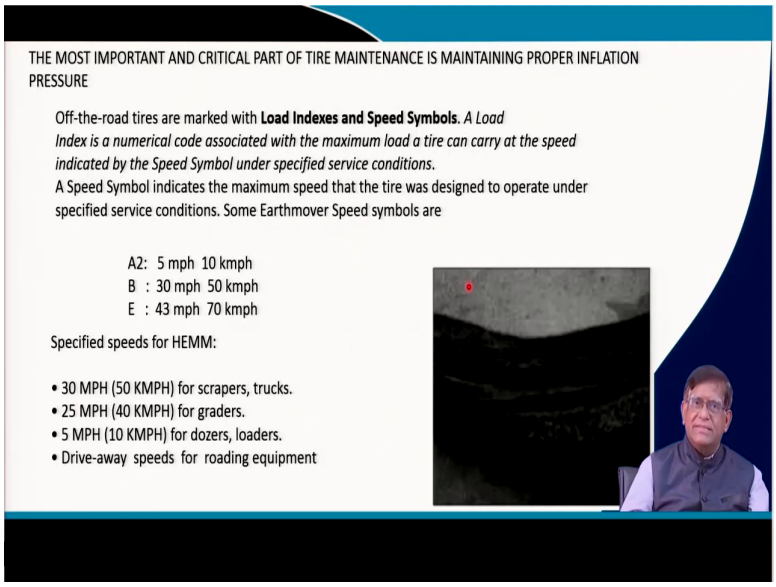

So, you can find out that is your what is the how will you maintain this, that will depend on if your speed as not properly maintained with a particular design of tire. Then, your tires will be damaging faster. So, that is why for every tire, their speed range must be known properly.

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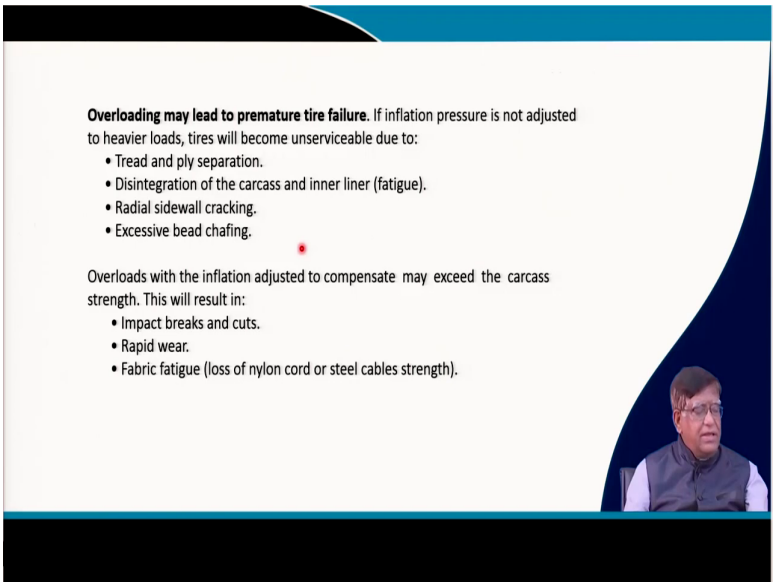

So, this is a overloading and then, premature tire failure, this is also a case you need to study about there.

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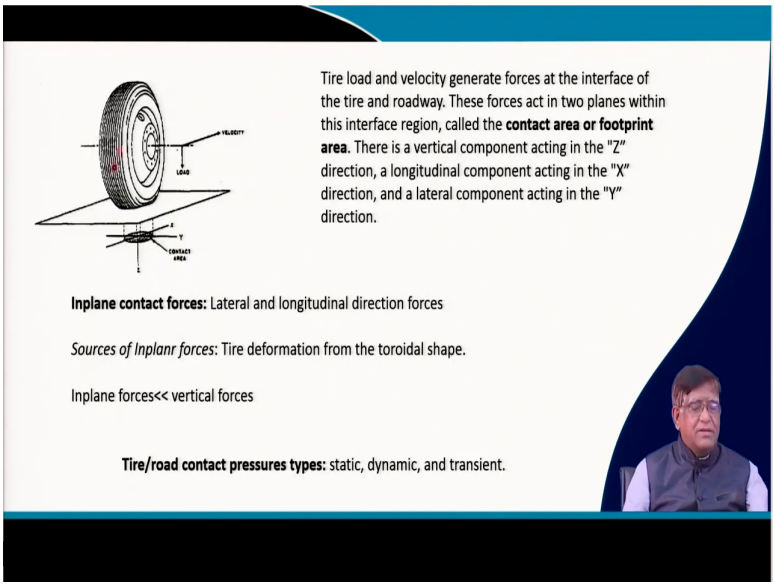

Because if you have to do a tire economics in a mine, that will be how you can reduce the premature failure. And for that, a detail studies can be carried out under that you can make a type of what are the forces coming over here, there you can use a very good your finite element method for your stress analysis. By doing the stresses, you can find out how it will behave.

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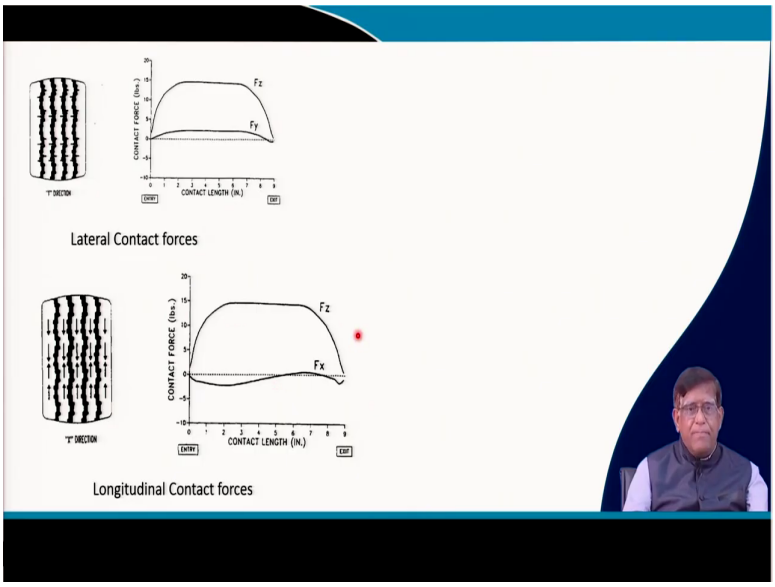

Exactly, there is a that is a lateral contract forces. As for example, here mainly there will be a vertical load and there will be an x direction and y direction, some forces are coming. How that forces are distributed over here, you can see on this that exactly that your lateral contact area, you can see there that F z is there, but F y it is moving like that, but F x it is coming over this.

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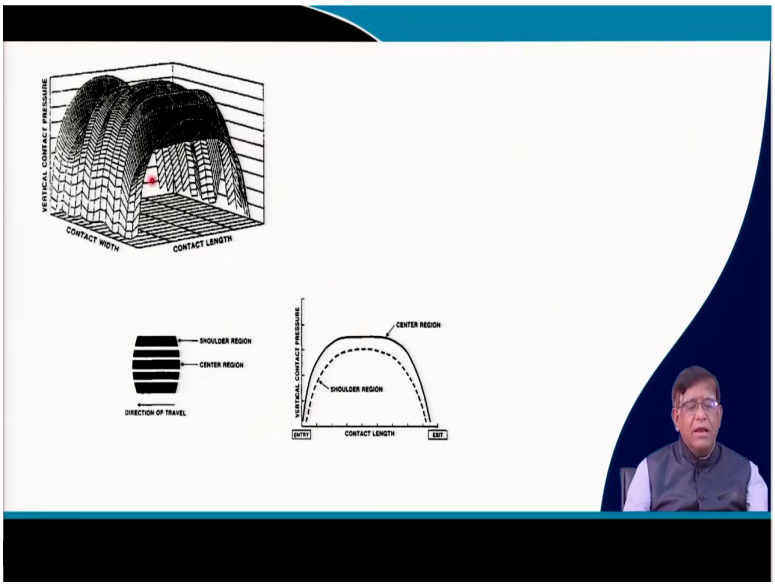

So, this total impact will be coming on your tire, where you can draw this stress diagrams over here.

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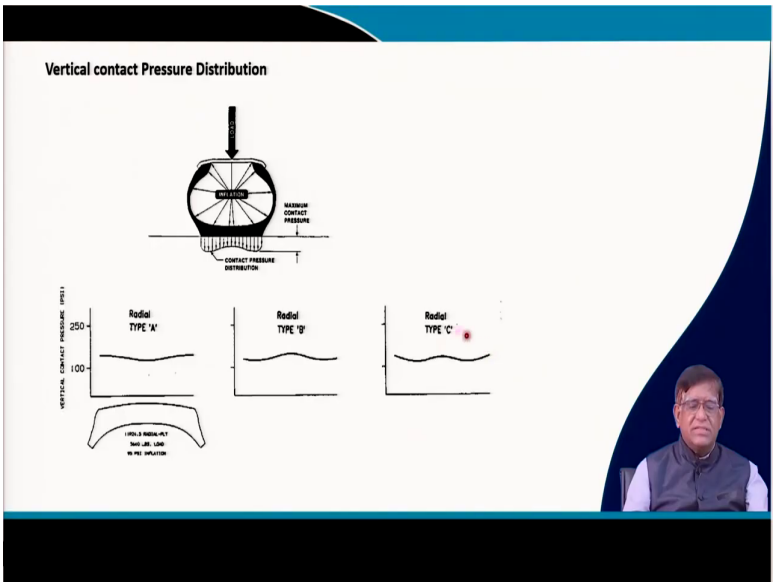

And then, in which region how much stresses are coming, you can find it out. Then, how exactly the pressure is getting distributed over the road; depending on that, you can find out.

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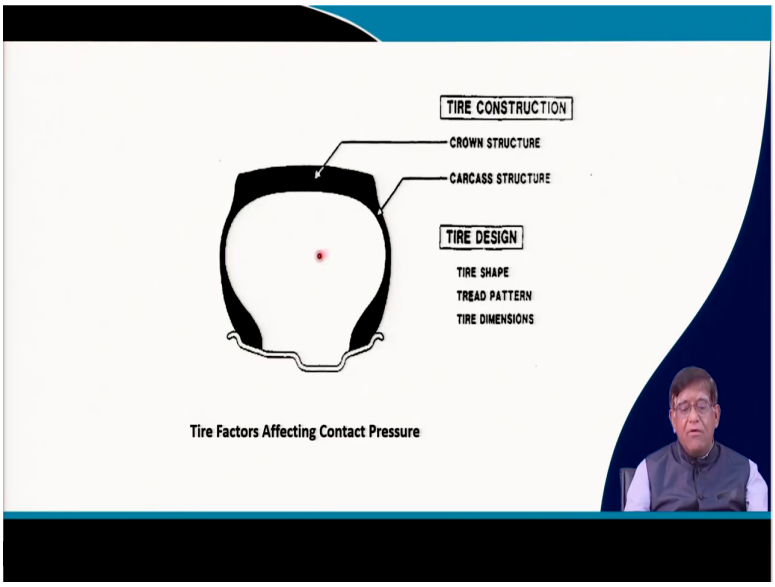

So, that means, this behavior will be changing with a different type of a road. So, whether it is in iron ore mine, in coal mine or in a bauxite mine or in a limestone mine. How that will be behaving, if you compare it, it could be a very good study and from there, you can give the input to the mining industry that how they should select tires and how they should maintain tire.

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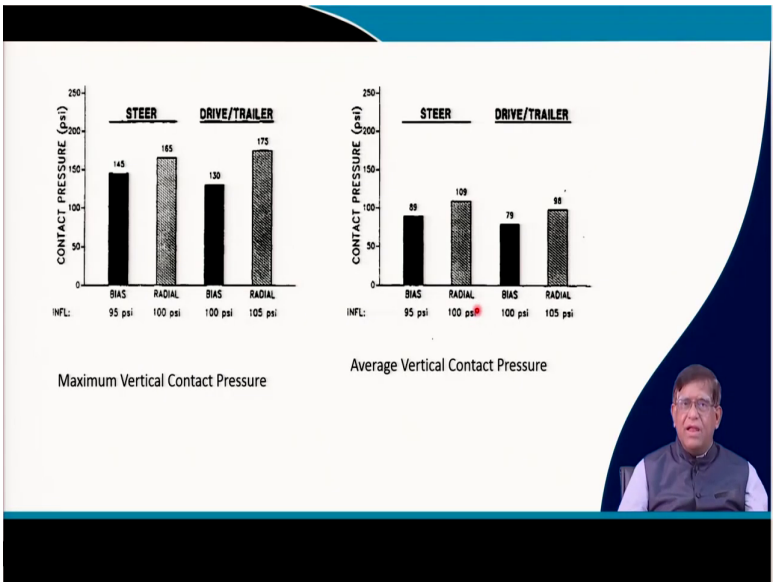

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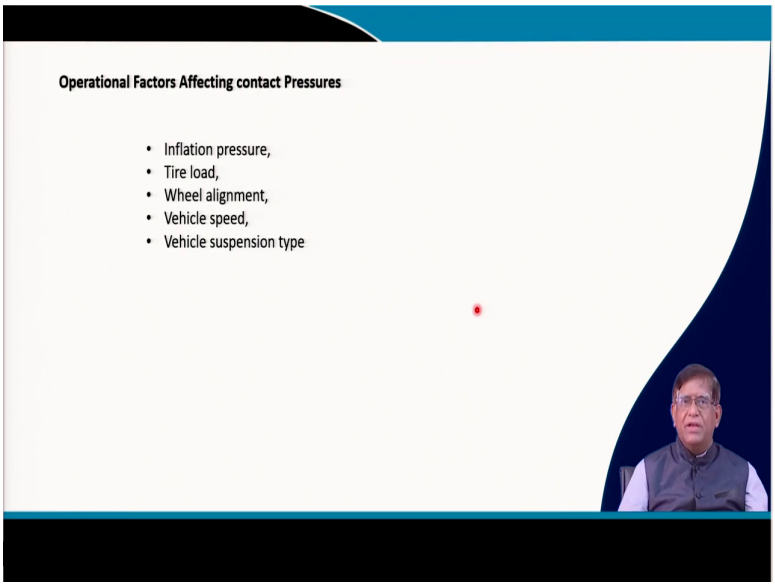

So, mainly your that you should know that the inflation pressure, tire load, wheel alignment, vehicle speed and vehicle suspension type, these things to be much properly to get the proper your tire that is your tire life and better tire that is tire performance.

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So, in a nutshell what we have said here today that you can refer to the books, you can refer to number of this manufacturers catalogue. From there, you will find that to be to manage a mine, technology management, transportation you will have to pay a lot of attention towards the tire life. If you can increase the tire life, if you can maintain tire properly, your productivity of the mine will be increasing.

If you are not maintaining the tire properly, if you are not maintaining the road and tire interactions with the particular truck selected, you may lead to a over consumption of fuel, you may lead to a lot of other trouble. So, that is why while learning the machinery, you need to prepare yourself also to be an effective mine manager as a proper mining engineer.

So, with this, we may stop here. That only you have got some queries., we can discuss it in our offline mode at different places; but we will become going to the next machinery

transport machinery in our next class, we will be introducing conveyor belt and if required, you can discuss on these issues and take up some work and then, based on the work, we can do number of activities need to be created on this.

Thank you very much.