

Mining Machinery
Prof. Khanindra Pathak
Department of Mining Engineering
Indian Institute of Technology, Kharagpur

Module - 06
Lecture - 29
Underground Mining Machinery:
Road Header

We are discussing Underground Mining Machinery. So, we have talked about few loaders, then there are different type of machineries are used, particularly for how to start it. For example, for shaft sinking purposes we will be using different type of machines; and after this when you had to drive the galleries; that means, to making the roadways under underground for various operations, there will have to have different machines.

Also you may be knowing, what you know about tunneling while doing the tunneling that is tunnel boring machines are used, but there is one machine which is used both in tunnel making as well as for making the main driving the roads under the in underground operations. Those are called road headers.

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Underground Mining Machinery Road Header

Road header, used for driving gallery or tunnel making operations mainly consists of a cutting unit, a loading unit, a transportation department, a walking unit, a cooling and a dedusting system, electrical systems, and other components



OBJECTIVE
Explain the construction and operations of road header

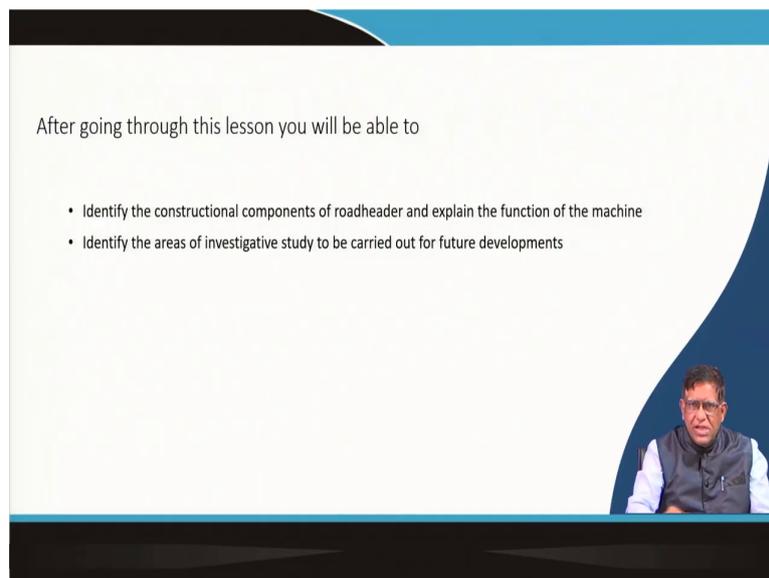
By Arpit Gupta - Rocker Shovel Loader info, CC BY 2.0,
<https://commons.wikimedia.org/w/index.php?curid=52456177>

So, this is a road header is basically a equipment which is used for driving the galleries. In coal mines, we say it is driving the galleries that means, that is how you go inside the deposits. So, as you can see in this figure, this is a machine which is a basically it has got a cutting head, and then it is a having the power is given to this cutting head to drive there is a your cutting boom which is mounting on a turret here.

And then there is a hydraulic system the cut material is collected just like a gathering arm loader, and at the backside there is a discharge conveyor belt. So, in between, this chain is giving the material to discharge boom conveyor, and then it is carrying out the material. So, that means, this is a machine to create the underground roads and that is why it is called road header – it is heading the road.

And there are different companies making these machines; like Sandvik and this Alpine Miner, they say this is a model name Alpine Miner it came and which has been used in Indian mining conditions in Indian mines in a number of that say Tata steels Jamadoba mines. You can see that Alpine Miner 50 was introduced long back in the early 70s. So, in this lecture, we will try to discuss the construction and operation of this machine.

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After going through this lesson you will be able to

- Identify the constructional components of roadheader and explain the function of the machine
- Identify the areas of investigative study to be carried out for future developments

So, that after studying this machine, you can identify that what are the constructional components of this machine, how it is machine is this designed and made. And also you will be able to identify that as a student what you should do that how you can improve these things and what are the modern studies can be carried out on these machines. And there are lot of people are working on this machine, and studying you should be able to read those articles after going through these lectures.

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The road header is a crawler mounted machine incorporating a universally mounted boom with a conical cutting head, gathering arms on a pivotable apron and a centrally disposed scraper chain conveyor.

The cutting head is driven by a water cooled electric motor through a two stage epicyclic gearbox and a power pack comprising three identical double sectioned gear pumps, is driven by an air cooled electric motor. The ancillaries are all hydraulically operated.



Alpine Miner

So, let us see this how this machine look like and under what condition it is work. As I said that there is a Alpine Miner this road header, which is having a two cutting heads here. And then you can see at the backside, there is a there is a discharge boom. And this is the front pan, which we are showing here in this front pan which is here in the operations you can see that.

And there is a there is your the inside is that there are two gathering arm is collecting the material which are cut from the here at the top, and this is falling on to this chain conveyor getting the material going to this chain conveyor to discharge it. At the back of it, there is the transporting machines. It could be wagon; it could be conveyor belt.

Normally a your stage loader can be there a particular feeder machines for a conveyor belt, so that this material cut from here can be directly put into a conveyor belt to take it out of the

mines. I can see these machines a better you can see here the cutter head which is there and is apron or that shovel plates some say hold this machine is mounted on a crawler. So, this is a crawler mounted machines. You can see the power cable that means, this is an electrically operated machines over here.

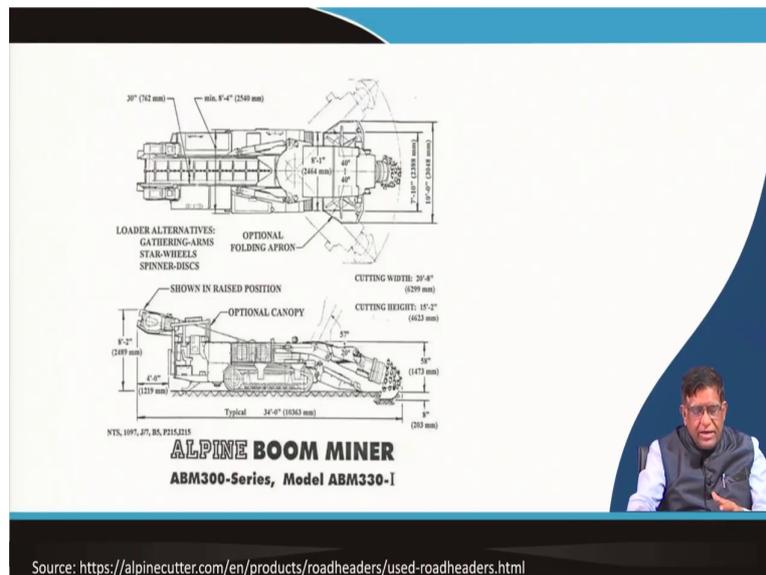
So, the road header is a crawler mounted machine incorporating a universally mounted boom with a conical cutting head, gathering arm on a pivotable apron and a centrally disposed scraper chain conveyor.

I did now the constructionally the machine is clear to you. This cutting head is driven by water cooled electric motor that means they you can understand this is a rock being cut, and there will be lot of heat will be generated. So, this machine peak can only need to be cooled at the same time, the dust which is generated need to be suppressed. So, that is why the water is sprayed. So, that it is cooling as well as suppressing the dust over there.

And then there is a epicyclic gearbox and the power pack which is comprising of three identical double section gear pumps, which are driven by air cooled electric motor. The electric motor which are there in that machines are cooled by the ventilated air whatever is available with their, and the all other functions are done by hydraulically.

So, the main electric motor which is there in this machine it drives those hydraulic power pack from where this is your hydraulic system is working in this machine.

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Source: <https://alpinecutter.com/en/products/roadheaders/used-roadheaders.html>

You can see that these the old machine a Alpine Miner, there you can see the top view of air you can this is the centrally loaded chain conveyor which you are seeing. This is the cutting boom which is the boom can be shrewd this is here within an angle of about your 30 to 40 degree, it can this make a stringing.

And then this can also move up and down that is just what is that exactly a mechanism called your turret, that means, it can slew and then it can move also just like in your cannon and all that you can aim at different directions that is the turret mechanism which is here.

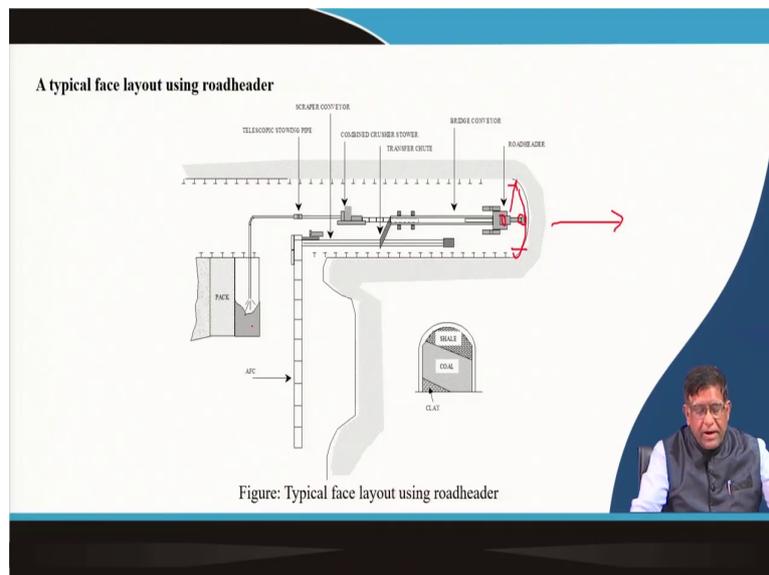
So, this is the discharge boom. It can be also need to be given a motion, it can be given raised and lowered depending on which it is going to discharge the material. You can see from here

that this is the crawler on which it is being mounted. And in front of it, you can see this a gathering arm just like or gathering arm loader is here this gathering.

So, material when this is exactly this is a the cutting head it rotates and then they picks which are attached to it, normally a conical pick or radial pick will be there. They will be cutting the material. The cut material will fall and that will be falling on this, and it will get loaded onto the apron as the machines will be moving forward.

So, that means, certain material will be definitely directly falling on it, it is getting collected. The rest of the things when this machine will be advancing, the other material will be collected over the your collecting that gathering arms will be the putting the things to the chain conveyor and taking them internally. I hope you have understood the constructionally this machine's component.

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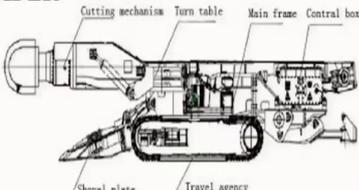
Let us a little bit more how that exactly the in the mines it will be working. You can see this is the gallery being driven, that means, towards these directions the machine is a advancing into this directions that your drive is there. So, this is your the gallery which is this is in this direction, it is going this is a gallery width. And we need that this machine is working it is the crawler mounted machines. This portion is that your cutter head, and then this is cut that this is the turret position on which this is there.

So, this machine can give a slewing from these two, it can slew up to here, and then the material cut is coming and on the stage loader and giving it to a conveyor belt, it can take out there. And this is the way how this machine there are different type of conditions can be there different layouts can be available.

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COMPONENTS OF A ROAD HEADER

1. Cutter Boom Assembly
2. Turret
3. Loading Assembly
4. Chain Conveyor
5. Crawler Track Assembly
6. Frame
7. Electrical System
8. Hydraulic System



Cutting arm is mounted on top of the turret, and is connected with the body by the rotating cylinder and lift cylinder. Rake located on shovel part hosed drop coal to scraper chain, and then scraper chain transports coal to reversed loader to complete coal carrying.

Cooling system consists of two parts, inside spray and outside spray. The water from tank flows directly to the outside spray system after the pump portion, and then the other part flows within the spray system after a spray pump pressure.

Wheel rotation is driven by a hydraulic motor unit gear, then driving wheel drives the track, and a tensioning cylinder controls track tension.



So, let us see the components of the road header now. Once again you can make the list of it, there is a cutter boom assembly which is the main cutting things, which will be cutting the material. And the turret on which this exactly the motions that different type of movement that is a slewing and luffing it is given to the cutter head of that is the that turret is that boom part which will be giving this rotary this slewing and luffing motions.

Then there is a loading assembly which is exactly having that the material which got cut it will have to be loaded to the chain conveyor. Chain conveyor is there on the this apron as well as on the there is also your the chain conveyor is here as well as it is there in the discharge sections.

Then the crawler truck assembly is there. Then it has got this main frame on which all the things are mounted. And definitely there will be your electric system and the hydraulic system.

So, constructional component wise, now we have understood what is this machine. And the cutting arm is mounted on the top of the turret, that is your this arm or the boom on which your this cutting mechanisms are there. So, this is there will be having the main motor, and then this drive will be given over there, so that this can rotate.

So, there is a for cooling of that is a heat dissipations is a very important thing in underground operations. You will have to put this as I said it could be by water sprinkling it can give a outside water as well as inside water, so that this things remain cooled. So, the other drives here for the chain and all this could be here by hydraulic systems. The mechanisms can be varying from make to model to model and then make to make.

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CUTTER BOOM ASSEMBLY

- The cutter boom assembly consists of cutter motor, the cutter, transmission with direct coupling and the cutter heads.
- The water cooled cutter motor is of special heavy duty design. For Alpine Miner 4.0 this motor is 100kW rated power delivering rated torque of 650 Nm. Breakdown torque is of 1625 Nm.
- A compact triple reduction bevel/spur gear assembly is flanged directly to the motor via a flexible pin type coupling. The reduction ratio is 16.56. The output speed is 88.7 rpm and output torque is 10764 Nm.
- The cutter head is secured at the top end on the output shaft by means of the compression tensioning spring. The round picks are held in pick holders with two retainer rings. The design helps in quick assembling and disassembling.



Sandvik MT 720



Now, coming to this cutting boom, cutter boom assembly, it can be having a two cutter, it can have one cutter there are different types of things. The assemblies, they are get changed depending on the, these type of rock you need to cut. Now, it is having a cutter motor, then a cutter, then the transmissions, and the coupling with the cutter head. So, that means, a mechanical arrangements are made there, and they mean that is a functional element. So, the power is given over there.

And then the water cooled cutter motor is a special duty design. For Alpine Miner 4.0 this motor is 100 kilowatt motor so, rated power delivered at a rated torque of 650 Newton meter, and they gives about 625 Newton meter torque.

So, that this selecting the machine will be depending on how much torque it can give that how much cutting force it can be applied. So, depending on the, this cutting resistance of the

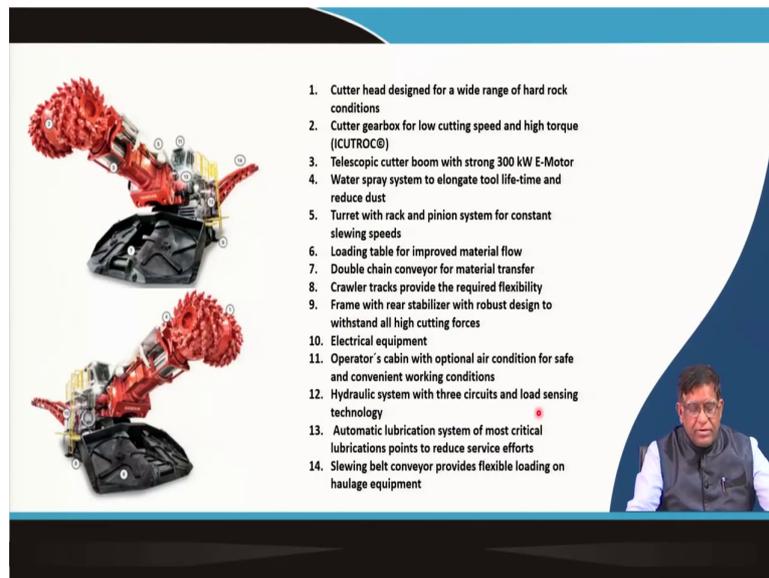
rock, you will have to select the power of the motor for turning there, and then giving the cutting force.

Now, there is a the mainly that your whole power transmission systems, there will have to be a gearbox and then the coupling to the motor. And this will have to be compatible with the amount of torque which is going to be available there. But the reduction ratio it is there 16.56 ratio is being maintained. The speed which is very very important; they maintain in this particular model of Alpine Miner.

They have this 88.7 rpm, and then that for a given torque. Exactly that at what speed it will be coming, and how much torque it is given that has got the relationship with the rock properties. So, that whenever will have we have to select a machine like this, first the characterization of rock mass is very very important.

Now, this is a the machine will have to be stable, it will have to be that all parts will have to be properly connected. So, that the what type of picks will be there. The pick will have to be put at the cutting pick will have to be in a pick holder. So, all these are to be assembled in the machines. And that whole this machine need to be assembled in underground there. So, all are given in a modular form taking out their piece by piece, and then do it.

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So, now, coming to this is a machine of Sandvik machines which they have been selling globally. They have got this type of cutter. And the cutter head is designed for a wide range of hard rock conditions. These are very much used in underground that your metal mining as well as in tunneling that these machines got maximum use. And there the design you can see over here that it is mounted on the frame of the machine.

So, there is a telescopic cutter boom that is a modern development that this boom can be made a telescopically moving forward and backward, so that by sitting in one position you can do a more advance. Because of that your this the energy required for movement that is for a total movement during cutting it is more and then your time operational, total operational time is increased. So, that to improve the productivity, this telescopic boom are use cutting boom are used.

Then you say there is this water system, which will have to you will have to provide supply the water, and then it will have to work. So, that the necessary design for that is life to be increased that is taken care of. So, the main problem with the water spraying system is the nozzle because the nozzle if it gets a that is a it will be it can get wear out, it can get corrosion, so that is why the proper metal materials should be selected.

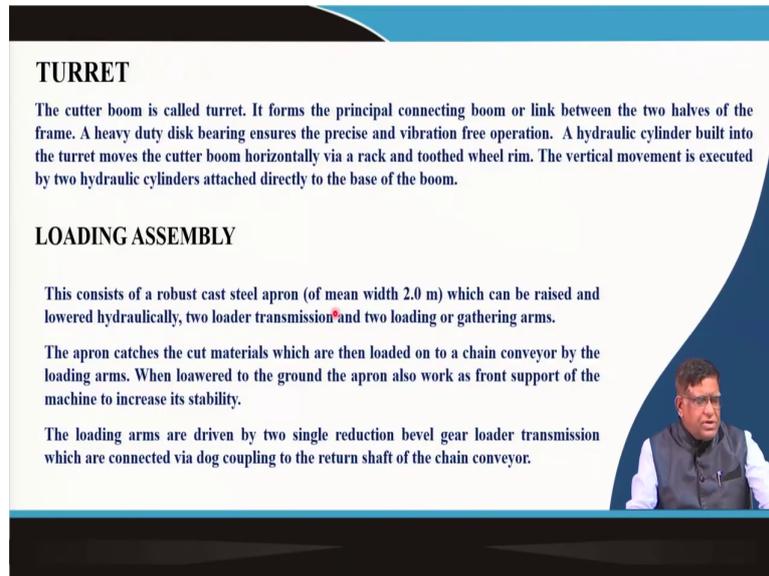
And the nozzles dimensions with that particular pressure to work, so that where it is intended to spray and that the type of the atomization's to take place that should be taken care of. So, then the loading table for improved material flow that this persons it is also designed in such a way that, while it is moving the material can be collected properly, and then there will be two arm which will be rotating in reverse direction, so that the material can be brought into the centrally located that your chain.

So, you understand there is a constructional components the operators cabin which is placed over here, he has got a good visibility and also the control he can do it. And there is all the safety devices as in any other machines also are available here. So, there is a the recent developments have gone on to the sensor technology different type of sensors are put, and then the whole operations can be monitored from the top.

There in a is a scope of improving these activities that by getting the whole information's collected that through a visual as well as with the audio well. So, it is that other parameters everything monitored and then that can be transmitted from underground to the top, and then you can do.

And here there could be in the near future the digital twins of this type of machines will be there when the machine is working exactly the same thing can be replicated onto the computer at the surface office, and you can know that how it is working. So that, those type of development may be within a recent years, it will be coming a digital twinning of such type of machines.

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TURRET

The cutter boom is called turret. It forms the principal connecting boom or link between the two halves of the frame. A heavy duty disk bearing ensures the precise and vibration free operation. A hydraulic cylinder built into the turret moves the cutter boom horizontally via a rack and toothed wheel rim. The vertical movement is executed by two hydraulic cylinders attached directly to the base of the boom.

LOADING ASSEMBLY

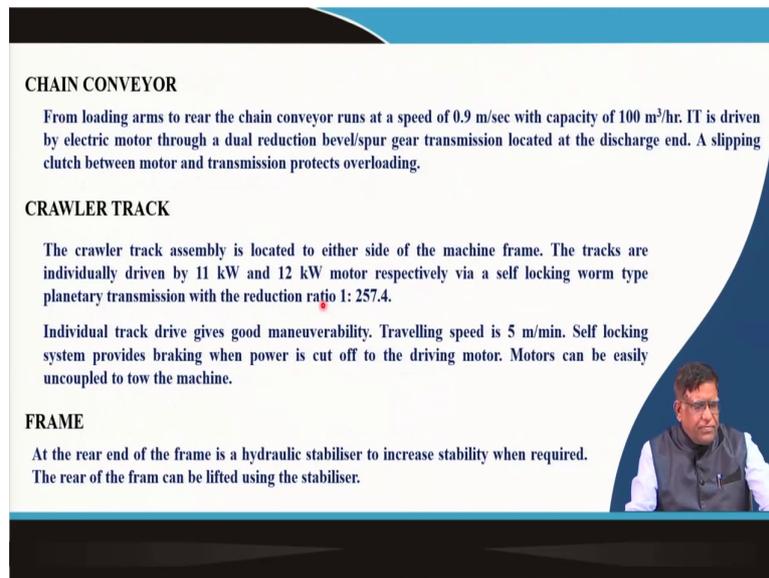
This consists of a robust cast steel apron (of mean width 2.0 m) which can be raised and lowered hydraulically, two loader transmission and two loading or gathering arms.

The apron catches the cut materials which are then loaded on to a chain conveyor by the loading arms. When lowered to the ground the apron also work as front support of the machine to increase its stability.

The loading arms are driven by two single reduction bevel gear loader transmission which are connected via dog coupling to the return shaft of the chain conveyor.

So, that as you say few components you should know that turret as I said it is having a mechanism by which exactly you will be imparting the that slewing and luffing machines over there. The loading assembly as we have said in the gathering arm loader, this is a gathering arm loader type of the machines, how the disc will be there, how the arm will be there, this will be affecting the productivity of it.

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CHAIN CONVEYOR

From loading arms to rear the chain conveyor runs at a speed of 0.9 m/sec with capacity of 100 m³/hr. It is driven by electric motor through a dual reduction bevel/spur gear transmission located at the discharge end. A slipping clutch between motor and transmission protects overloading.

CRAWLER TRACK

The crawler track assembly is located to either side of the machine frame. The tracks are individually driven by 11 kW and 12 kW motor respectively via a self locking worm type planetary transmission with the reduction ratio 1: 257.4.

Individual track drive gives good maneuverability. Travelling speed is 5 m/min. Self locking system provides braking when power is cut off to the driving motor. Motors can be easily uncoupled to tow the machine.

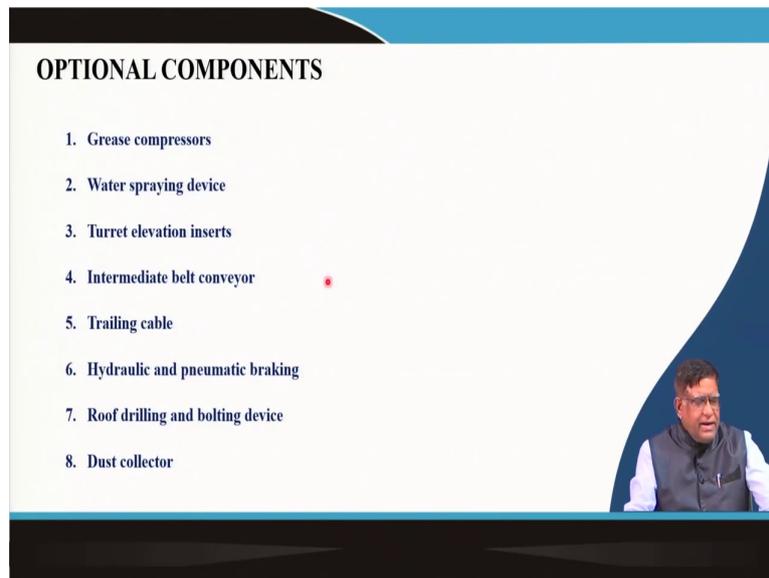
FRAME

At the rear end of the frame is a hydraulic stabiliser to increase stability when required. The rear of the frame can be lifted using the stabiliser.

The chain conveyor is a very important thing because there the chain conveyor will be having its drive at the discharge end, and it should be running on a sprocket. There will be a consumable things because the chain links if it get worn out at that time you will have to replace it. The flight bars of the chain need to be checked, so that it is operating over there.

And then the chain should not be too loose. And if it is loose, there will be lot of vibrations and heating actions will take place and the wear and tear will become more. The frame it is exactly the on which the other parts will be placed together, it is a structural strength need to be properly designed.

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Other than these main components, there are some auxiliary optional components like your how the lubrications will be done, how this their control, and then how you will be monitoring for that additional instrumentations things could be there. That your there could be intermediate belt conveyor, trailing cable, hydraulic pneumatic braking, roof drilling and bolting device can be incorporated along with that.

Particularly now, when that is your weak strata depending on the strata conditions you can these machines can be having additional features should at the root bolting for the strata support can be done. As the same time dust collection and dust the separation systems also could be incorporated over here.

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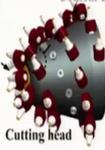
CONSTRUCTION

The main assemblies of a roadheader are:

1. Fabricated main frame incorporating slewing turret for the cutting boom
2. Left and right hand side frame assemblies incorporating crawler tracks and drive units
3. Cutting boom with telescopic action driven by electric motor through a two speed epicyclic gearbox.
4. Cutter head fitted with radial picks or conical picks.



Roadheader



Cutting head



CONICAL PICKS



RADIAL PICKS



RADIAL PICKS



So, these constructions are clear now, that is a cutter head. On the cutter head, we have the two types of cutting bits can be there either a conical bit, it will be placed on this bit holder or the pick holder this there. Now, most important thing is there you can see how these picks are allocated on this. If you develop this surface that conical surface, on that there will be a particular matrix on which this will be there.

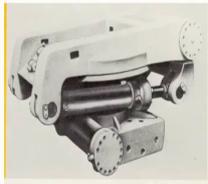
Now, and they have got the how the how these picks are placed that will determine how the material will be falling onto this loader. And then in which way it will be cutting the rock. So, these part of the design is a very very important design in this. Now, that conical pick depending on it can have got various alternatives can be there to put the picks on the cutter head.

That the other type of is as a radial bit you can see a tungsten carbide tip is inserted over there. And this bit is given as a radial bit it is connected and mounted on this. So, they, this is a the way they will be cutting, and then the way they will be wearing out, and then they because this pick are the your consumables.

So, and then when they get worn out, you need to replace and there is a time consumption for the maintenance and all. So, there had been a lot of studies people do on how to optimize the design and so that we can increase the life of the pick. So, this is one area where a lot of studies are still required.

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Turret: The turret provides the vertical and horizontal positioning of the cutter boom.



TURRET

It forms the link between divided frame. The turret consists of the following main components: the bridge girder with slewing appliance, and the disc bearing with flange, disk, base of cutter boom and appliance for the vertical swing.

The boom is slewed horizontally by hydraulic jack driving a spur rack and gear rim. The vertical swing is effected by two hydraulic jacks acting on the base of the cutter boom.



And then this is a turret which we said that exactly the boom it is mounted, at the bottom it is here it has got a horizontal movement as well as there will be a the this particularly this the

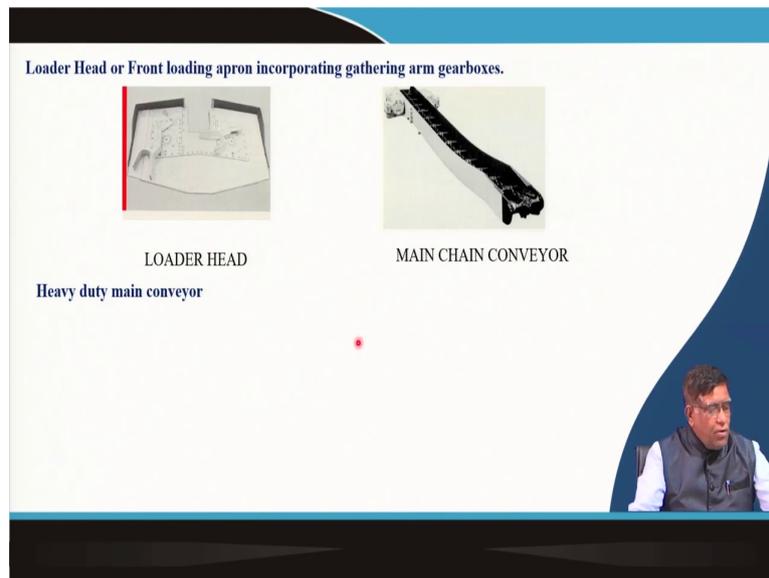
turret it is consisting of mainly a bridge girder and a slewing appliance, and the disc bearing with a flange, a disc, and the base cutter and appliances.

Basically, the performance is when it will be moving that is exactly on that swing motions of this part will be there on which the boom is mounted. It will have to give the swinging motions, and also it can give the raising and lowering motions, so that is executed by a design of a turret.

So, there is a there is also hydraulic operation, these all things are carried out by a hydraulic jack which will be driving that a rack and pinion system is there by which you can make the thing to move a slewing motion.

It is unlike your the surface mining machinery, you have seen the slewing we are having a turntable on which your the say they the on a sun gears and then this type of swing, but those type of systems are not here because of the space restrictions this particular design is maintained.

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You can see the chain conveyor which is there centrally located. It is a just a main chain conveyor is there, you can see this. The loading pan it is similar to a gathering arm loader, it is working over there.

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Electrical control unit to supply main motors and assemblies.

Rear clamp unit: Individually or in conjunction with the lowered loader head this unit can lift the total weight of the machine. The unit is specially useful when changes of gradient occur.

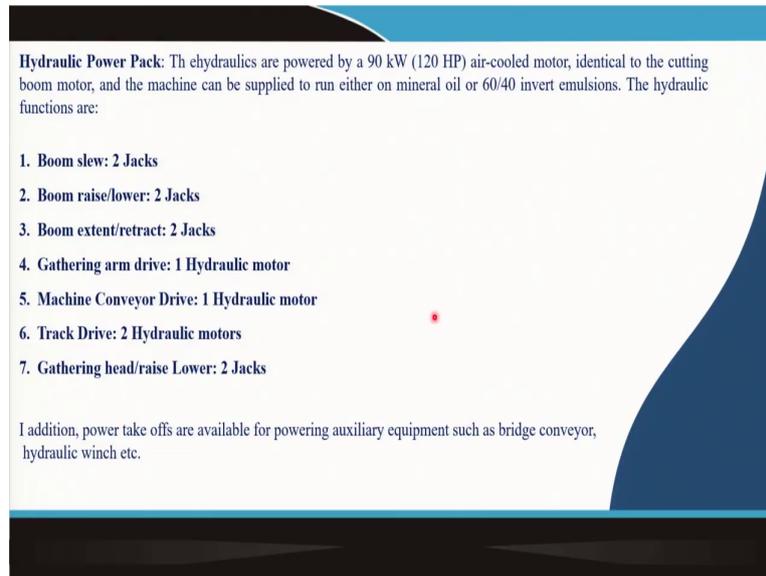


REAR CLAMP UNIT



So, sometimes there is also a rear clamp unit. This, rear clamp is exactly there is a if the machine is to be lifted that is when the machine is moving sometime for the maintenance jobs and all, a rear clamp unit is provided which is required in certain maintenance jobs on these machines.

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Hydraulic Power Pack: The hydraulics are powered by a 90 kW (120 HP) air-cooled motor, identical to the cutting boom motor, and the machine can be supplied to run either on mineral oil or 60/40 invert emulsions. The hydraulic functions are:

1. Boom slew: 2 Jacks
2. Boom raise/lower: 2 Jacks
3. Boom extent/retract: 2 Jacks
4. Gathering arm drive: 1 Hydraulic motor
5. Machine Conveyor Drive: 1 Hydraulic motor
6. Track Drive: 2 Hydraulic motors
7. Gathering head/raise Lower: 2 Jacks

In addition, power take offs are available for powering auxiliary equipment such as bridge conveyor, hydraulic winch etc.

So, there are the main hydraulic components. There will be different type of power packs are necessary, the hydraulic power depending on the size of the machines. We have got a different type of hydraulic systems, because the main hydraulic functions are for the slewing of the boom as it is said on the turret operations.

There are two jacks for the boom slew that the boom rising and lowering, another two jacks are there, then your boom extend and retract, there are two jacks there, gathering arm it has got one hydraulic motor is there. For the machine conveyor drive, there is a hydraulic motor. These are all hydraulically driven motor.

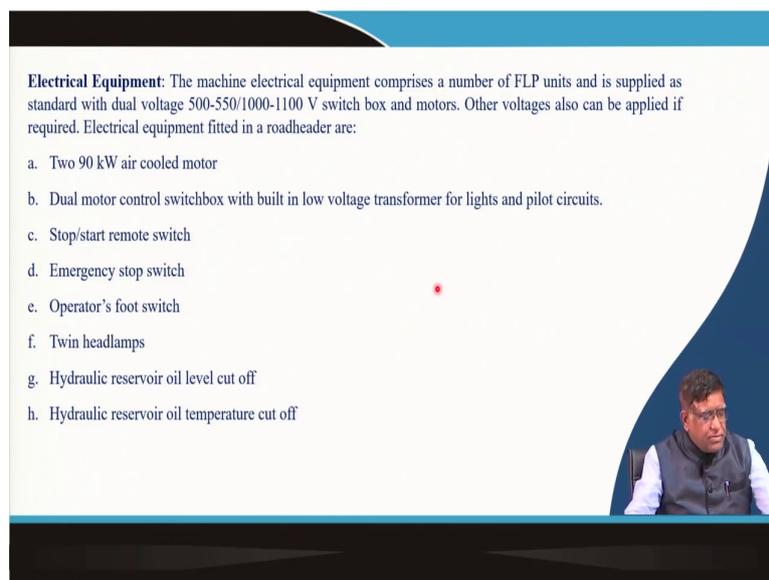
Then for the crawler movement, there are two hydraulic motors. And for the gathering arm that head because the shovel that is your the main collecting plate it is can be also raised and

lowered. So, when it is lowered to collect the material over there that is also done by two jacks. So, this machine has got a lot of hydraulic units.

So, what is most important over there, wherever the hydraulic unit is there you are having the hydraulic pump and also you are having the your the hose pipes that will be it will be working it is certain pressure. So, to get the pressure generated, it should not burst out.

So, there many a times this problem takes place. This hose pipe if it is not properly fitted or if it is a worn out and sometimes it leak, then the whole oil may get spill over to those type of problems maintenance problems need to be taken care of while operating it.

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Electrical Equipment: The machine electrical equipment comprises a number of FLP units and is supplied as standard with dual voltage 500-550/1000-1100 V switch box and motors. Other voltages also can be applied if required. Electrical equipment fitted in a roadheader are:

- Two 90 kW air cooled motor
- Dual motor control switchbox with built in low voltage transformer for lights and pilot circuits.
- Stop/start remote switch
- Emergency stop switch
- Operator's foot switch
- Twin headlamps
- Hydraulic reservoir oil level cut off
- Hydraulic reservoir oil temperature cut off

The slide features a blue header and footer, a white central content area, and a small video inset in the bottom right corner showing a man in a dark vest and white shirt speaking.

Now, that in the electrical equipment is also there in this machine, because this is an electro hydraulically operated machines. Electrical energy is very important there. Depending on the

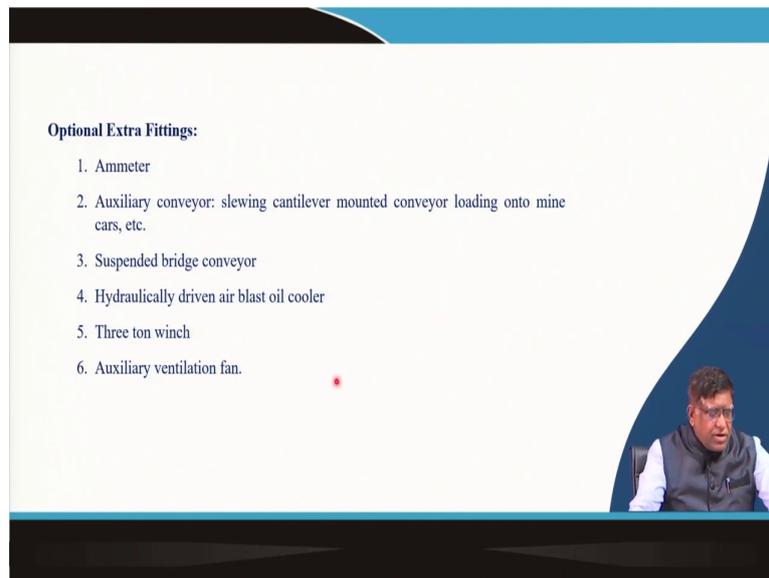
size your the input voltage can be 550 to 1100 volt. And then this will have to be brought to the as a underground electrical supply system the in the machine there will be a 90 kilowatt air cooled motor is there that motor will be driving your whole this power packs.

Then dual motor control switch boxes are there. And there will be a transformer on it. For this your, you will have to get for the light and other things. Then stop and start can be a remote switch, remotely control switches are there.

Emergency stop switch is there by which it can be the anybody if the bystander sees that something is going wrong, then anybody can stop the machines from anywhere that they are by when they are with a particular location of the emergency stop switches are there.

It will be disengage the whole machines from power and machine will stop. Then these are operator's foot switches are there, twin headlamps are there, hydraulic reservoir oil cut off that also electrically operated. And then this temperature cut off these type of systems are there in your machine.

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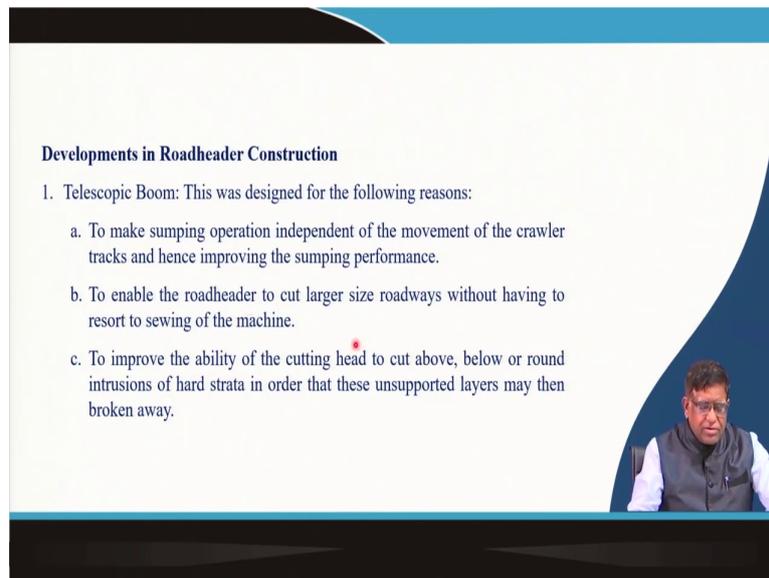


Optional Extra Fittings:

1. Ammeter
2. Auxiliary conveyor: slewing cantilever mounted conveyor loading onto mine cars, etc.
3. Suspended bridge conveyor
4. Hydraulically driven air blast oil cooler
5. Three ton winch
6. Auxiliary ventilation fan.

So, the in along with that some instrumentations are there like ammeter, then receiver also there could be a your auxiliary conveyor belt can be given, then there is a the bridge conveyor from one conveyor this is given to the next conveyor to carry the material from the face to the where this main conveyor or the your loading machine is connected.

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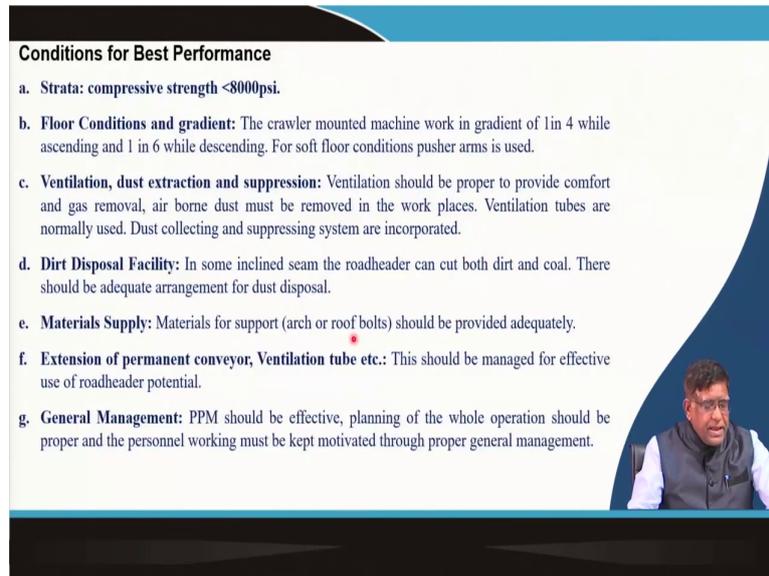


Developments in Roadheader Construction

1. Telescopic Boom: This was designed for the following reasons:
 - a. To make sumping operation independent of the movement of the crawler tracks and hence improving the sumping performance.
 - b. To enable the roadheader to cut larger size roadways without having to resort to sewing of the machine.
 - c. To improve the ability of the cutting head to cut above, below or round intrusions of hard strata in order that these unsupported layers may then be broken away.

So, there could be winch and other things to get the machines properly maintained, certain facilities are provided by different designs provide different facilities, so that it can give a good operational ease. So, this exactly to summarize that new developments are coming to get this telescopic boom, and then this telescopic boom can give a better sumping in. And from one positions, it can give a movements and they can cut the material.

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Conditions for Best Performance

- a. **Strata: compressive strength <8000psi.**
- b. **Floor Conditions and gradient:** The crawler mounted machine work in gradient of 1 in 4 while ascending and 1 in 6 while descending. For soft floor conditions pusher arms is used.
- c. **Ventilation, dust extraction and suppression:** Ventilation should be proper to provide comfort and gas removal, air borne dust must be removed in the work places. Ventilation tubes are normally used. Dust collecting and suppressing system are incorporated.
- d. **Dirt Disposal Facility:** In some inclined seam the roadheader can cut both dirt and coal. There should be adequate arrangement for dust disposal.
- e. **Materials Supply:** Materials for support (arch or roof bolts) should be provided adequately.
- f. **Extension of permanent conveyor, Ventilation tube etc.:** This should be managed for effective use of roadheader potential.
- g. **General Management:** PPM should be effective, planning of the whole operation should be proper and the personnel working must be kept motivated through proper general management.

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Then you have got for the best performance, how it will do? If their compressive strength is 8000 psi, so that type of the different rock properties it can work. Then the floor conditions under gradient should be properly looked into. The ventilation and dust extraction and separation systems should be proper; that your dirt disposal facility whatever the material getting collected, it should be disposed properly.

The material supply, whatever the required for your the roof bolt and grease and oil lubricants this should be properly brought there and timely supply should be there. Then there should be where from the main conveyor belt that will have to be extended as your gallery in that as your the road increases that advances, then the conveyor belt also will have to be extended.

The debt logistics should be made compatible, so that the system performance become better. So, overall by giving this plan, preventive maintenance, and then general the cleanliness of the machines, up keepment, housekeeping of the at the underground is very very important.

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The Dosco TB3000
TWIN BOOM MINING MACHINE

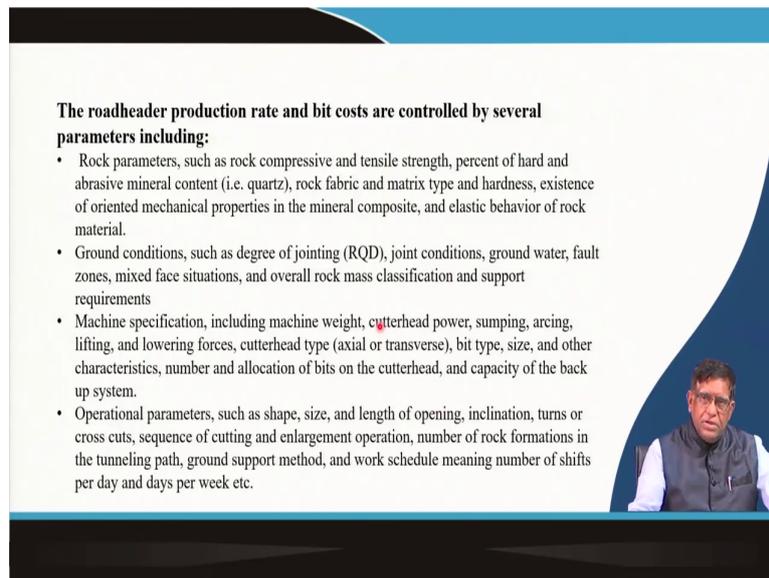
TB 3000 as a surface rock excavator

Specification TB 3000 Outline Data Typical Specification

- Machine Weight (Base Machine) 125 tonnes
- Total Power (Standard Machine) 742 kW
- Power on Cutting Boom (Standard Machine) From 250 kW each
- Hydraulic System Working Pressure 170 bar
- Tracking Speeds - Sumping/Flitting 0.04/0.2m/sec
- Ground Pressure 2.2kg/cm²

So, there are different type of designs with a twin boom type of designs of Dosco be manufactured. There are this your these machines are also used that can be cut any type of material even you can use in surface sometimes.

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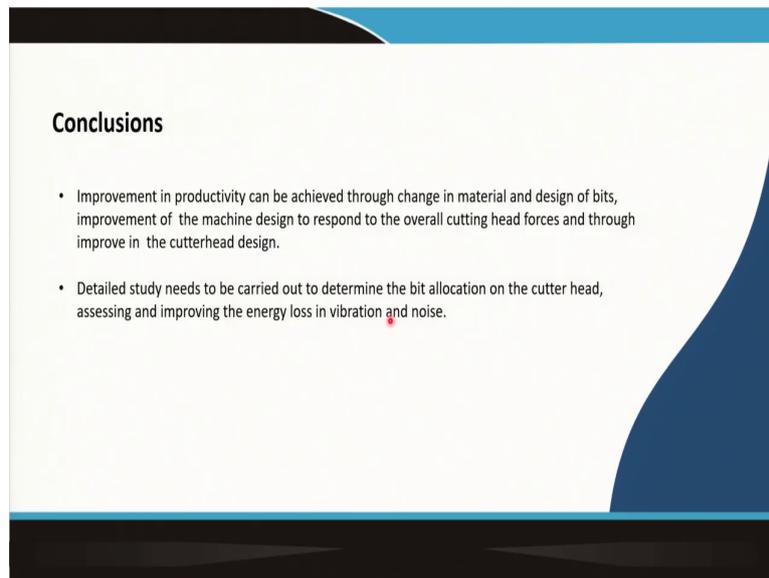


The roadheader production rate and bit costs are controlled by several parameters including:

- Rock parameters, such as rock compressive and tensile strength, percent of hard and abrasive mineral content (i.e. quartz), rock fabric and matrix type and hardness, existence of oriented mechanical properties in the mineral composite, and elastic behavior of rock material.
- Ground conditions, such as degree of jointing (RQD), joint conditions, ground water, fault zones, mixed face situations, and overall rock mass classification and support requirements
- Machine specification, including machine weight, cutterhead power, sumping, arcing, lifting, and lowering forces, cutterhead type (axial or transverse), bit type, size, and other characteristics, number and allocation of bits on the cutterhead, and capacity of the back up system.
- Operational parameters, such as shape, size, and length of opening, inclination, turns or cross cuts, sequence of cutting and enlargement operation, number of rock formations in the tunneling path, ground support method, and work schedule meaning number of shifts per day and days per week etc.

There are lot of possibilities of this, but only thing is they will have to be designed as per the rock properties depending on their the rock quality designations there jointing, then all the parameters of the need to be taken care of then only these machines will be giving you the desired performance.

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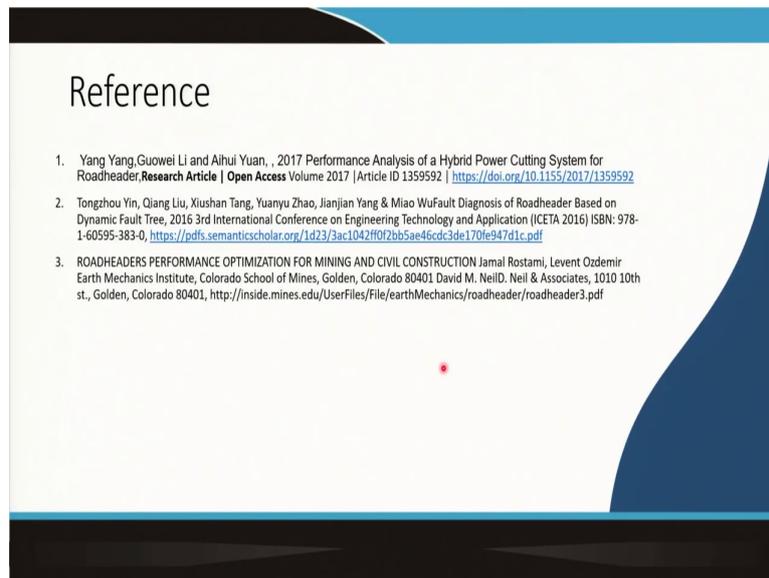


Conclusions

- Improvement in productivity can be achieved through change in material and design of bits, improvement of the machine design to respond to the overall cutting head forces and through improve in the cutterhead design.
- Detailed study needs to be carried out to determine the bit allocation on the cutter head, assessing and improving the energy loss in vibration and noise.

So, in a nutshell, you have learned that this is a machine which is used in underground mine only thing is that you will can learn it while you are working with it. So, improvement in productivity can be achieved through change in the material design in the bits, improvement in the machine design and to respond the overall cutting head forces through improve in the cutter head designed. Now, detailed study needs to be carried out to determine the bit allocations on the cutter head that this is a part of things.

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A lot of references are there. Please go through that. And I hope you will be able to take up some study work on these machines.

Thank you very much.