

Bulk Material Transport and Handling Systems
Prof. Khanindra Pathak
Department of Mining Engineering
Indian Institute of Technology, Kharagpur

Lecture – 1
Classification of Mining and Bulk Solid Handling Systems

Welcome students this time I first congratulate you for joining into this course on bulk solid handling and transportation.

(Video Start: 00:30)

Now you know that this bulk solid handling and transportation is one of the most important area of business in the varieties of industry out of which mining and mineral industry which is having a lot of bulk solid handling and transportation job. So, in this course you will be learning about the different aspects of this bulk solid handling.

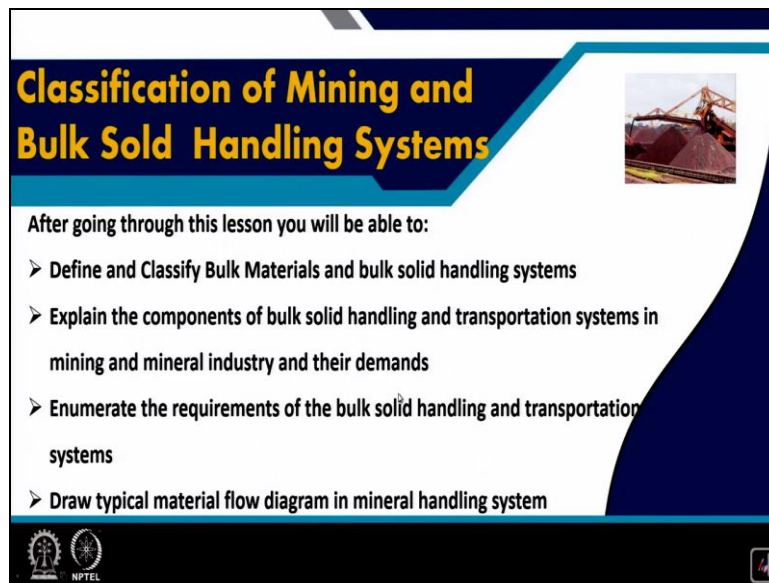
(Video End: 01:02)

And where you are having some scopes of getting into some innovative exercise product development as well as where you can do a your various project work and also you can think of having your career in this particular area. We will be as you have already seen that there is a the course has been structured into number of modules in these 8 to 9 modules you will be having number of lectures which will try to cover basically the construction operation and maintenance of various components or various machinery used in this particular area of our industrial activities.

At the same time we will be working with a system approach in which that whole work will be considered how we can optimize it how we can make it to perform well. And at the end of this course you will feel that you have got a sufficient background to take up a job in the industry whether it is in the mining sector in the thermal power stations in the port or in any of the food processing systems.

There are lot of bulk material handling almost in varieties of industry in fertilizer in wherever the raw materials are coming as a bulk solids you will be accepted there. So, before going to the whole detail about it today we will be giving an introduction of this bulk solid handling and transportation how it is there. Our today's objective is to do the classification of mining and bulk solid handling system.

(Refer Slide Time: 03:00)



Classification of Mining and Bulk Solid Handling Systems

After going through this lesson you will be able to:

- Define and Classify Bulk Materials and bulk solid handling systems
- Explain the components of bulk solid handling and transportation systems in mining and mineral industry and their demands
- Enumerate the requirements of the bulk solid handling and transportation systems
- Draw typical material flow diagram in mineral handling system

The slide features a blue and white color scheme. A small photograph in the top right corner shows a mining operation with a conveyor belt and a large pile of material. The NPTEL logo is visible in the bottom left corner.

Now how our this work we will be discussing in this particular class about the classification of mining and bulk solid handling system. Now after going to this lesson you should be able to define and classify bulk materials and bulk solid handling system. You should be able to explain the components of the bulk solids handling and transportation system in the mining and mineral industry.

And what are their demands how exactly will be there how the business is going to sustain in near future and in distant future. You also will be able to enumerate the requirements of the bulk solid handling and transportation systems what are the present requirement and where you should try to develop your competency. So, that you can serve the industry and you should be able to draw some typical material flow diagram in the mineral handling system where it is there.

So, in the figure here at the side you can see it is bulk material where you are having it is an iron or handling a sticker is making some dumb stock piles of this beneficiated ore. So, this type of figures will be very common to you once you will be going through this particular course.

(Refer Slide Time: 04:30)

Bulk Materials

- Bulk means Size, mass, or volume, especially when very large.
- Bulk material refers to those materials, which are produced, stored, transported, stored, distributed or consumed in large quantity or volume. Such materials can be solid, liquid or gas. For example, coal, iron ore, aggregates, cement, crude oil, Oxygen. Normally, bulk materials refer to bulk solids.

Handling of Bulk Solids

- Various handling operations include:
- Sizing
- Screening
- value adding
- short distance transferring and transporting,
- storages etc.

NPTEL

So, now coming to this what is the meaning of this bulk? Exactly whenever it is a big size or a mass or volume whenever there are large quantities at the big things which say it is a bulk you may be hearing that sometimes either bulk is very bulky that is he has got the volume is more we say like that. So, that is where the material which can come under this bulk material category it is exactly which are as a loose material we are having it.

So, which can be your transported stored or it can be distributed in a very large quantity. All of you have seen some of this material it comes in a large quantity whether it is the coal coming from a coal mine or you might have seen the trains carrying the iron ore from the say bearable area they are taking the iron ore to the port for exporting purposes or if you have seen if you are there at Visakhapathanam you might have seen how the that your our ore are getting exactly exported and imported there that bulk materials are collected and kept many of this you might have seen.

So, all this material like your coal, iron ore that aggregates the sands and this gettys and all these things are similarly cement is also a bulk material till it is packated. Once it is putting in the big cement bags they are just an unit material they will be transported and handled in a different way they will not no longer they will be till they are put into the bag that at a bag they are putting the materials that up to that it is a bulk material.

Crude oil again it is a liquid bulk if the sheep that are bringing the crude oils from the oil and exporting countries then from their ship how they are exactly transported to another

container and then to the tanker and how they are exactly stored in a oil storage tanks those are also handled in bulk. Similarly you may have seen gaseous things also when our oxygen cylinder oxygen tankers they are coming in a tank they are also handled in a big volume we can consider that as a gaseous bulk.

But a material which we will be discussing in this particular course is basically the bulk solids. Now what exactly the operations that will be there handling means what handling means you are operating it we are just it could be transferring from one place to another. It could be just transporting from one location to another distance locations when it is in a very small one location to another very near inside a plant we can say it transfer.

But when it is going from one it is a considerable distance we can tell it is a transport then what happens this when the material which are coming out of mine we say it is a runoff mine ore which can be a big lump. Sometimes that out of the blasting the material can come with a particular size of one meter. So, those need to be commuted that is they will have to go under a process of crushing a communication and then this crust material will have to be sized different sizes by screening.

Then we will have to find that this exactly if the ore there will be gangue material and there is the main valuable minerals. So, the gangue materials will have to be separated out there will be different processing with those bulk material and there we are exactly adding values to it similarly sometimes you may find in a pelletizing plant that some fines which cannot be loaded to the blast furnace need to be made small pellets.

So, for that also how you will do that pelletizing. So, that the fines I do not know fines which can be used or loaded into a blast furnace. So, those things these type of different operations and also when you are importing say coal the cooking coal being important from Indonesia or Australia when it comes over there they will have to be stored properly we know that.

If you do not store properly the quality of the material will go down if there will be a lot of if you are keeping iron ore a lot of moisture is taken then exactly the fuel consumptions in their processing will go high. So, that is why how you store that is also a handling operations.

(Refer Slide Time: 09:04)

MORE THAN 75% OF OPERATIONS IN MINING ARE BULK MATERIAL HANDLING AND TRANSPORTATION

- The World Steel Association (worldsteel) forecasted that global steel demand will climb 5.8% in 2021 to reach 1.874 billion metric ton (mt). Demand will further grow by 2.7% in 2022 to reach 1.925 billion mt.
- Notably, growing demand for steel has resulted in sky-high prices of iron ore, the most important input for steel industry.
- Also, worldsteel estimated that global steel demand declined a mere 0.2% in 2020 despite the outbreak of the deadly coronavirus across the world.
- This was mainly due to a 9.1% jump in steel demand for China in 2020 which offset a 10% contraction in the rest of the world. The earlier projection in October 2020 was for a 2.4% contraction in demand in 2020 and a 4.1% recovery in 2021 to 1.795 billion mt.

Mineral Business Growth should be compatible with facilities for Mineral Movements

Now if these are there that where exactly we are if you see in a mining industry or the mineral industry more than 75% of operations are only handling and transportation operation. So, whether you are a mechanical engineer whether you are an electrical engineer or a mining engineer if you are working in the mineral industry most of your operations your decision making your maintenance job will be related to this bulk material handling alone.

And if you see the projections towards in our different player in the steel industry how it is there. But steel industry is growing by 2030 will be having a huge demand on this steel and all across the world and of course after post covid certain things have happened you know but still for India it will be remaining if we just think of developing infrastructure in India and with our steel consumptions if you use that means in some time certain shield steel structures where exactly can be environmentally friendly because they will reduce the requirement of sands that need to be mined from the that is your river beds.

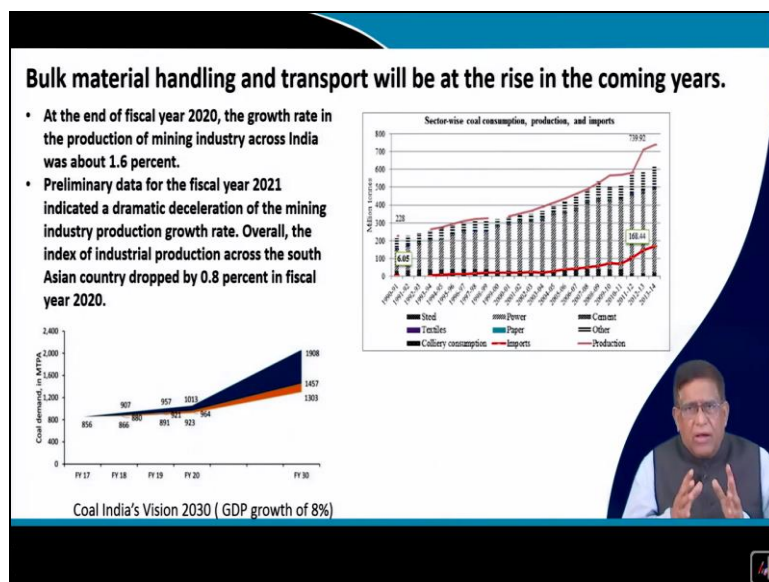
Sometimes there is a big crisis in sand it is going on in many places many towns today there is one of the thing which is having a crisis is for construction purposes is sand and in near future there will be more crisis people are. Now manufacturing sand. So, in that case some steel structures bridges and there your rope bridges and all that thing can come where the requirement for cement and brick and then your cement could be reduced.

So, then if all the hilly areas of our country are connected by they say the bridges and that culverts all are made of steel it can give a lasting for a life of another 200 to 300 years life can be done with a steel structure and for that the amount of steel could be produced India has got the iron ore. But that handling of those iron ore to the steel plant and there will be the one big problem India does not have the coking coal for that our production of steel that means we will have to import from other countries.

So, there how will you handle that if you as an Indian can go to country where there is a that coking coal and if a business can be taken over there will be a large things like that. So, what we can see is that the world steel association has already said that our steel demand will increase and it is still increasing and then you can see that according to the demand when supply is not there then the price goes high and it is happening and then the internally what is happening in china may again bring a different change.

Now that economics as a while you will be studying about the bulk material handling and transportations you will have to know about the mineral trades as well as a some of the supportive knowledge. So, that you can get your opportunity as a material handling expert.

(Refer Slide Time: 12:38)



Now if you see that our all products that is particularly the bulk materials for in the coal sector for your that our energy requirement where there will be more that scenario of our the coal consumptions production and import if we look into it then also it is clear that

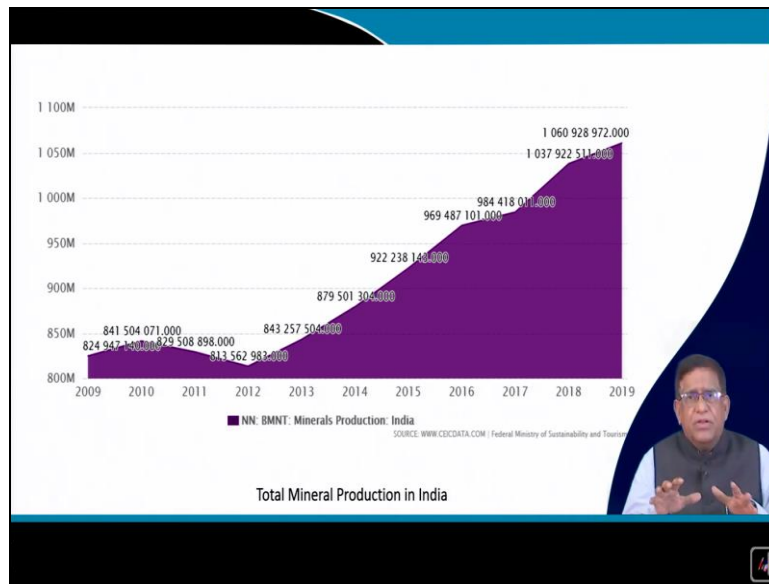
bulk material handling and transport business is going to be a critical business in this country.

So, that is why I first told you that I congratulate you for accepting this subject and this course because this can give you the required skill and competency by which you can grow. As it was that when in the say about five years back India we were thinking of that our GDP growth will be 8% unfortunately because of the covid 19 lot of things have changed but still this growth will be returning at present our GDP growth has gone very poor but it is expected it will go high but at that time the cold demand will be increasing.

But after the parish agreement what we are going for our renewable energies there we are going to have this if you are going to get wind energy solar energy and also when there will be electric car coming but at that time also for those goods you know exactly for our electric battery the electric car battery will be having a new business in the graphite mining already that in Arunachal the graphite deposits are being now of being producing.

So, that means there will be different type of material handling business but the coal business will not go down in our country because even if our other renewable energy sources go high the energy demand will also equally increase and for that our cheaper available of this energy will have to do and by the time a clean coal technology will be also developing. So, by which also there will be more business for material handling and transportation.

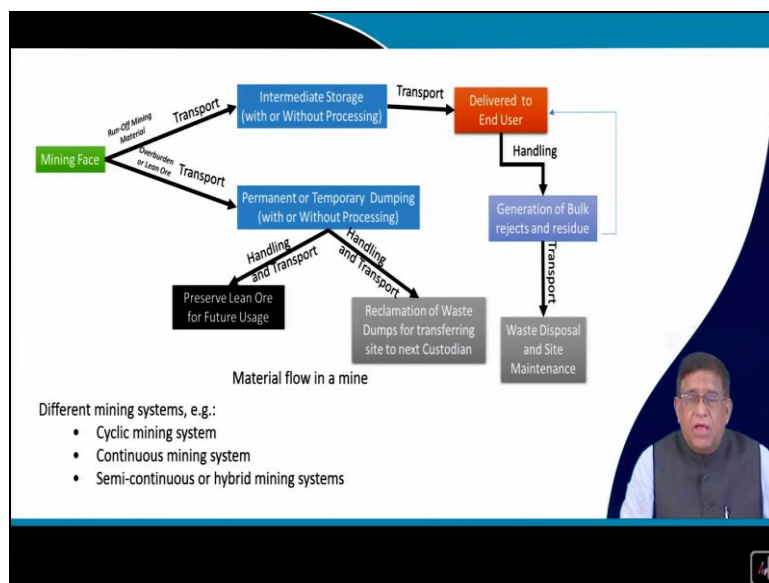
(Refer Slide Time: 14:53)



So, giving you this an idea you see that the total mineral production in India has increased and it is there you know there are 82 minerals are mined in India there are some of the things in a unorganized sector some are in the organized sector some as in the private sector some in the public sector. But overall there is a lot of mineral transportations and in mineral storage and where it is how it is going for that we have got the road network.

Now whether this road network is sufficient or not that is a different type of transportation planning are necessary.

(Refer Slide Time: 15:30)



But if you see that our mining face that is your from the mines where that exactly the extraction is taking place which can be by your drilling and blasting your breaking the

rock mass and collecting over there from that run of mine which can be of course sometimes a mechanical breaking of this coal we can have continuous surface miner can give us the there are some machines by mechanically loosening of the material from the site.

And then it will have to be transported to a intermediate storage that material will have to be stored and from there it will have to be reclaimed and then will have to be transferred to the where we will be using it. Say for coal will go to the thermal power stations or this iron ore will go to the steel plant but while doing in between there could be an handling and beneficiation and in which some of the things will be extracted which can be reused that will be going to the users other will be going as a reject.

Now I tell you that in a bulk material handling it is not the handling of coal alone you know that in India we are producing more than 600 million ton of coal per year and most of them more than 95% of them are now coming from surface mining and whenever we do surface mining for one ton of coal to be taken from the mines we need to produce about one meter 4 meter cube to 7 meter cube of that is your waste material the overlying rock mostly sandstone or steel which had to be dumped somewhere.

As a result what happens in mining when you are going doing about 600 million ton of coal it means that there are more than 25100 million meter cube of bulk material are handled to make some dump overburden dump or waste dump and by that those material when it is kept in the mining site near the mining site that means the environment is affected by this bulk material.

Now if you do not handle properly that can create lot of environmental damages at the same time for whole distinctions you say if in the country only in the coal sector I am telling 2500 meter cube of the 2500 million meter cube of overburden if it is handled and transported how much energy is consumed. So, that means our this transportation and handling will have to be taken in a very careful way.

And similarly that in the mining phase wherever your overburden or this waste rocks are coming that need to be permanent or temporarily dump somewhere and there also a lot of handling and transport there. So, these pictures has given you an overall but if you see in

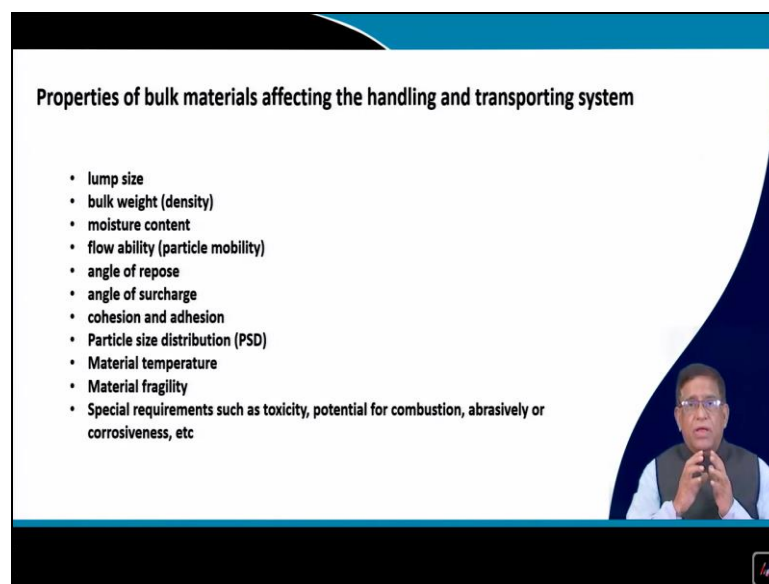
the mining system the mining works as a cyclic mining or intermittent mining and then it can be as a continuous mining or semi continuous mining.

What is a cyclic mining that means you are using a shovel which will be first crowding into the face collecting the material with the material it will go and dump on a truck and from that it will after that this bucket will be again coming and again it will be staying. So, these cyclic operations keep on repeating and the truck will go and then it will dump somewhere and again the truck will come again its loading will set. So, this is a cyclic.

And there is a continuous mining system in which just like a bucket wheel will be rotating all the time continuously it is cutting and when it cuts simultaneously the material is transferred to a conveyor belt and that conveyor belt will take the material out. So, that is a continuous. Now sometimes what happens you are cutting cyclically and transporting continuously that is called semi continuous.

So, this type of hybrid systems are also there in a detail you can see. Now there every system is nothing but a material handling and transportation.

(Refer Slide Time: 19:54)



Properties of bulk materials affecting the handling and transporting system

- lump size
- bulk weight (density)
- moisture content
- flow ability (particle mobility)
- angle of repose
- angle of surcharge
- cohesion and adhesion
- Particle size distribution (PSD)
- Material temperature
- Material fragility
- Special requirements such as toxicity, potential for combustion, abrasively or corrosiveness, etc

The slide features a blue header and footer. A small video inset in the bottom right corner shows a man with glasses speaking into a microphone.

Now how those operations are done there you will have to decide the equipment what you will be using how economically you will put them how will you optimize the system that will depend basically on the properties of the material. Now for handling your coal for handling your iron ore for handling your uranium or handling copper or handling bauxite or the process alumina or handling copper ore there will be different type of

equipment system handling system sometimes there is a there could be toxic materials coming.

Now sometimes your this over burden rock they may be having some sulphide or sulphate rock which if it is coming in connection with water it will be started giving your acid then your whole thing will be your water system may get polluted. So, that is why the properties of the material is very very important. Say if it is having a such type of acidic property you cannot make it a slurry and put it through a pipeline because then what will happen that whole pipeline will get corroded and in the within a very short time all problem will be coming.

You cannot pump the slurry by a slurry pump if that rock is having a acidic property and the slurry will be acidic and your impeller will go these things happen. So, for example in the northeast coal which has got high sulphur content. Now when the mining is there if the lot of water comes over there to handle that water if you whatever your pump you will be using that impeller life will be hardly one month or two months every time you will have to do it because that is the properties of the material will be affecting your what type of machines you will be selecting.

Now those properties which are more important in bulk material handling is the lump size that when it is blasted or that mechanically owned rockmass what are the size of that rock. The lump size is very very important whether you can transport it by conveyor belt whether we will have to load it to a truck or whether it can be handled by a front end loader or not those things will be coming at that, your the density is very very important.

Because the weight factor is dependent by them and that depending on the weight your exactly requirement of the energy that will be coming. So, then the moisture content this is another things that whether you need to dry them in the processing how it will affect the flowability with the material can be transferred from one place to another if it is having a very high of this adhesion on the container itself it will stick you are taking on a truck and you want to dump out from the truck but the material will not come out because it will be sticking over the dump truck. So, that type of material how you do it.

So, there will be this is the flow ability and sometimes some materials can be so flowing that it will be very difficult. So, angle of repose is another factor you will be knowing angle of repose when a sand is dropped over here you can see it forms a this conical shape. Now what is that the angle of that cone that is called your angle of repose. Sometimes you do not this angle of star search if this material your bulk material is on a conveyor belt when the conveyor belt will be moving at that time the repos angle will be changing.

Now when the conveyor belt is moving at that time whatever the angle it makes with the conveyor belt surface that is your angle of searchers during the motion. Similarly the particle size distributions may vary a blasted rock mass it may be having some very fine micro dust or also there could be 1 meter diameter one meter size of boulders. So, those particles which are very fine and all they may become airborne and they may create air pollution.

So, that is why the handling systems will be also changing depending on the if you are having very that say your PM20 PM10 or PM2.5 that which will be which can be inhaled at that time the persons also will have to be given a different care also the transportation system will have to be different. So, that is your the material temperatures that is also effect and sometimes the fragility sometimes if it is a during the handle the particles all break then it will become give a different type of problem.

So, there should be also sometimes the chemical properties like your toxicity whether it is an inflammable whether it and then physical properties like whether it will abrade and how your transporting machine will get wear and tear. So, now is it clear that when we will be discussing about the specific equipment and all that material bulk material properties will have to study.


So, this as you have already studied the material properties will have to look it into how it is required for our bulk material handling.

(Refer Slide Time: 24:49)

Examples of Some Bulk Material Handling Equipment & Systems

The equipment in the mineral handling system performs various activities, e.g.

1. Transportation of excavated ore/minerals from mine to the beneficiation plant.
2. Receiving of mineral at the beneficiation plant at a planned site in such a way that
 - a. It requires minimum time to receive the material. For doing that "keep the carrier moving: loaded towards the receiving point and the empty towards the mines".
 - b. Minimum loss of valuable material.
3. Transportation within the processing plant
4. Temporary storage within the processing plant and reclaiming as per demand schedule
5. Loading & dispatch of the beneficiated mineral
6. Rejection of waste products.




So, I will tell you here some of the examples that is your to perform different activities. So, what is the work we need to do you will have to first is the operation of transportation then sometimes that from the mine the material come you will have to receive them and then will have to separate them then within the processing plant you will have to move. And sometimes you will have to give a temporary storage and then loading and dispatch these are the different operations.

(Refer Slide Time: 25:22)

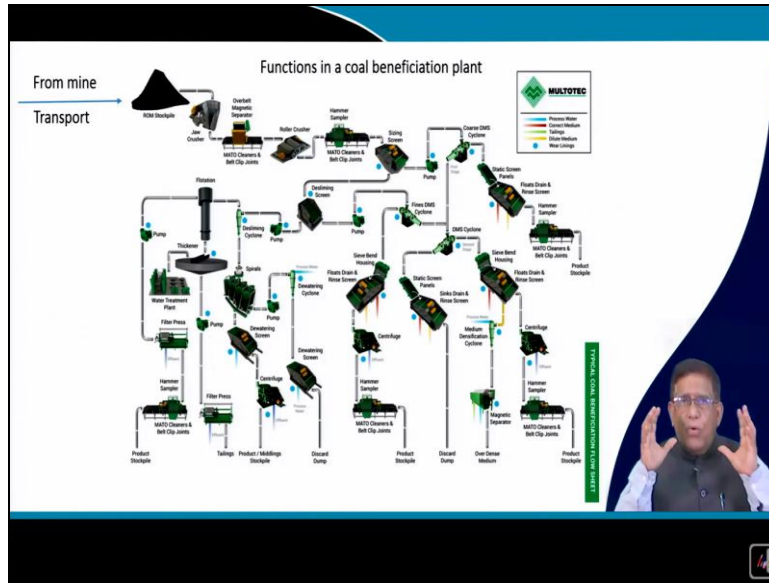
HANDLING OPERATIONS IN MINERAL INDUSTRY

- Transferring horizontally from one point to another
- Transferring vertically from one horizon to another horizon
- Transferring from one point at a horizon to another point at a distance at another horizon
- Processing operations in a mineral beneficiation plant
 - Washing
 - Crushing
 - Tabling
 - Jigging
 - Grinding
 - Screening
 - Classifiers
 - Magnetic separation
 - Floatation
 - Agglomeration



And for that in the handling operation in the mineral industry for different processing will take place your washing crushing, tabling, zigging these operations you will be learning how it is done for handling.

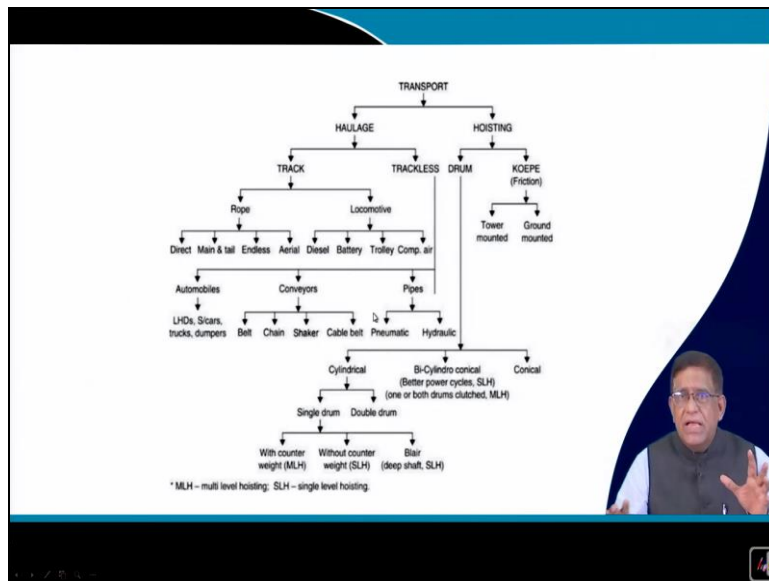
(Refer Slide Time: 25:33)



And you can see in a coal washing plant today just I am giving you as an introductions these things will be discussing that how from the mind the material when it is coming. What are the different processes it goes it is exactly that how a magnetic separator will be taking out the scrap iron materials and all that thing how the sampler from there you will be taking sampling for the maintaining the quality of it.

How exactly the particles will be separated out there that is your all the gang material will be taken that your ash will be reduced in the coal in a coal washing lot of operations goes.

(Refer Slide Time: 26:13)

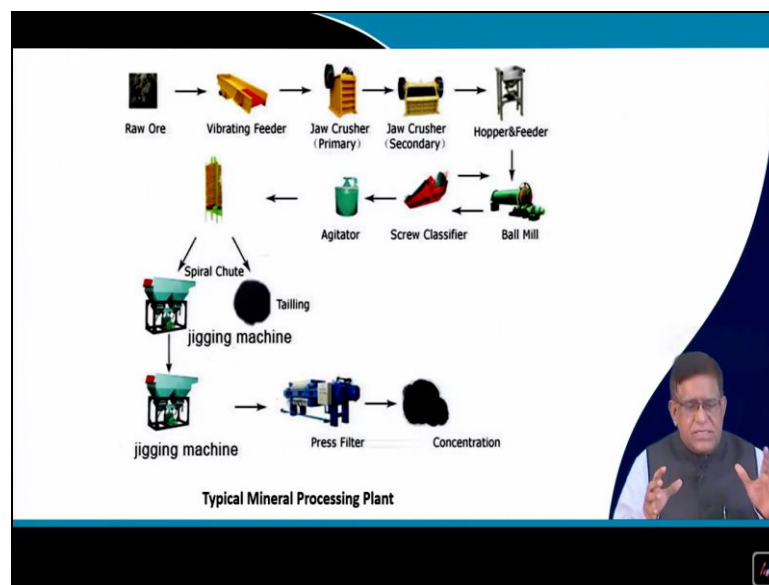


So, that means in a whole plant you will have to you will be learning about these things. Similarly the transport can be done by a different way it can be from an underground

mine it can be done winding or taking out by hoisting or it can be just transport on a track or track list there could be a locomotive there could be even your the row haulage. There could be built conveyor belt there could be a chain conveyor there could be a shaker conveyor there could be a cable built conveyor there could be a pneumatic conveying there could be hydraulic study conveying.

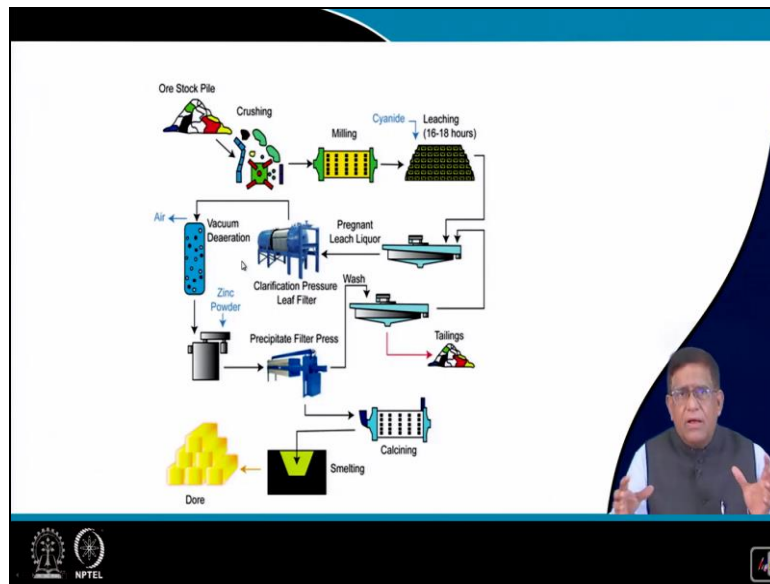
So, this transportation has got also a wide range. So, this is today you just have a note of it that there are wide range of the systems are there we will be studying few things over there in this particular course.

(Refer Slide Time: 26:57)



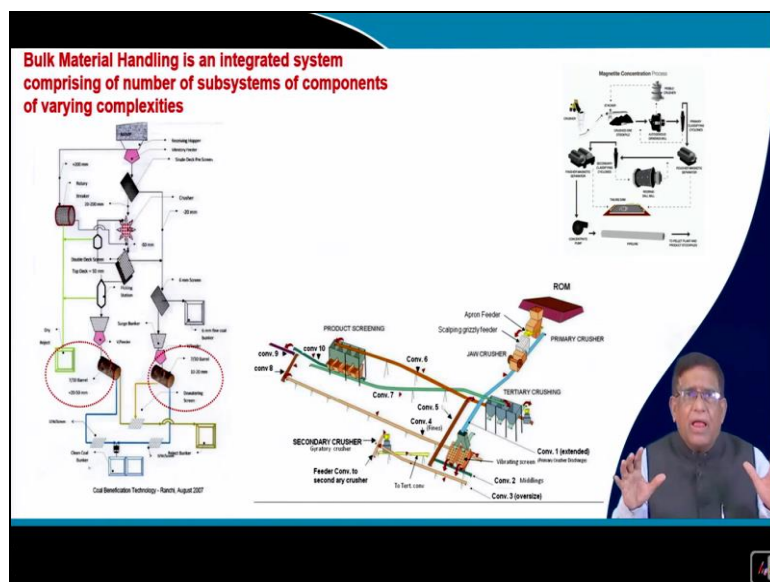
Similarly the ore they have also that is how we will be feeding it to the next system for that there will be feeder then how it will be crushed by jaw crusher different type of crushers and all you will be learning in this course like that that in your whole beneficiation to do that the handling operations you will be learning.

(Refer Slide Time: 27:16)



Similarly in a gold mine that where the gold is coming from there how exactly it is from because there will be hardly say few 1 gram or 0.35 gram of gold may be there in a tons of ore. So, from there how to take out the gold in a gold processing plant there also is a handling operations. So, if you can do it efficiently then only that is why when we say the most dirtiest material is gold or diamond because if you see that the how from the mining it comes it is there.

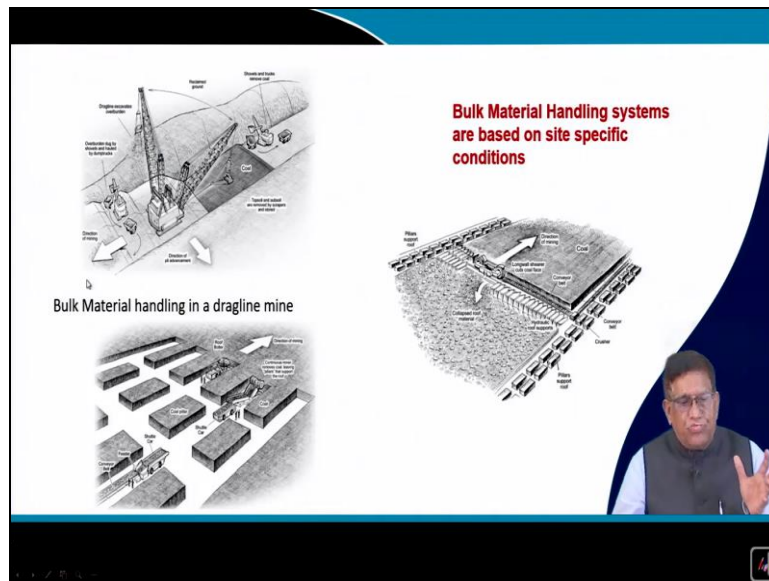
(Refer Slide Time: 27:50)



So, that bulk material handling is an integrated system where comprising of number of subsystems and components of variety of complexities. So, as an expert in your bulk material handling when you will be studying these things you will be, knowing this type of diagram or flow diagram will become is a part of your everyday discussions. So,

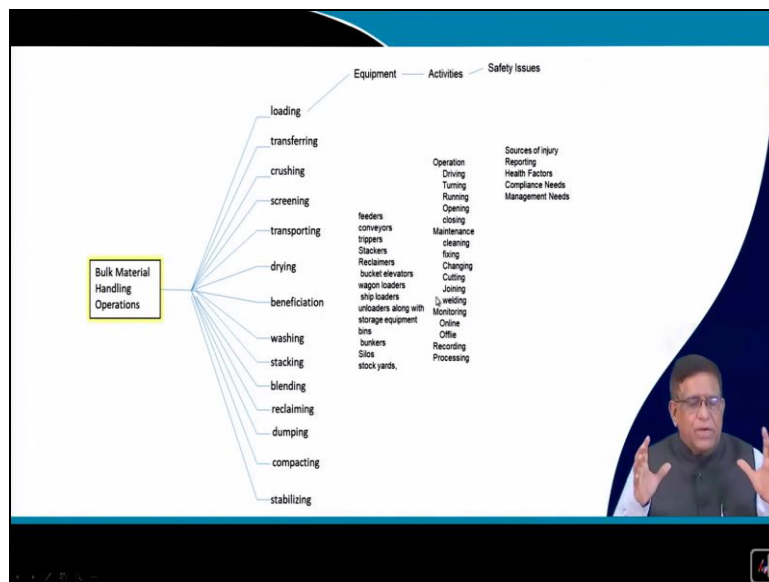
amongst you will be having an opportunity to discuss and see about identifying this different subsystems and developing your own interest into that.

(Refer Slide Time: 28:19)



And as you see in a mining whether it is a drag line mining your shovel dumper mining you are handling the material and from there whether it is a board and pillar method of mining or a long wall mining ultimately the mining handles things.

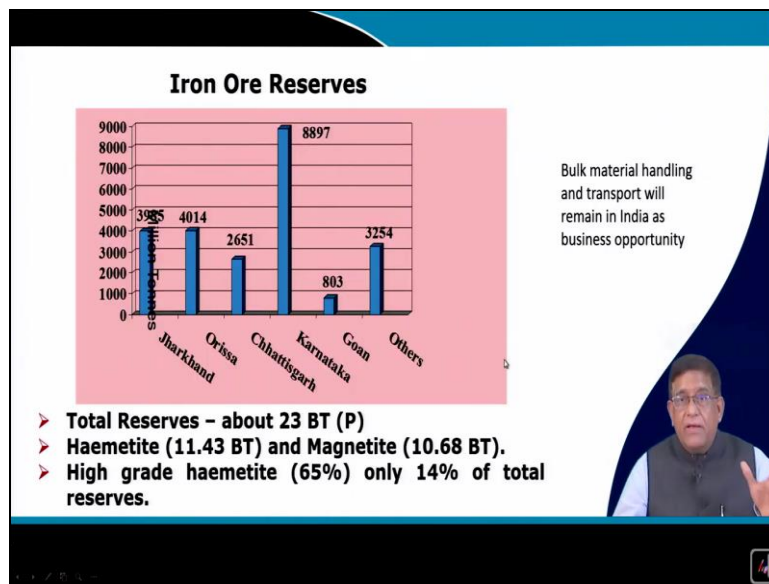
(Refer Slide Time: 28:32)



So, the bulk material handling operations as I have already told it will be loading transferring crushing screening transporting drying beneficiating washing staking blending reclaiming dumping compacting stabilizing all these jobs are with a bulk material handling and we have got number of different equipment. You can name some of this you can remember that these are the machines or systems equipment.

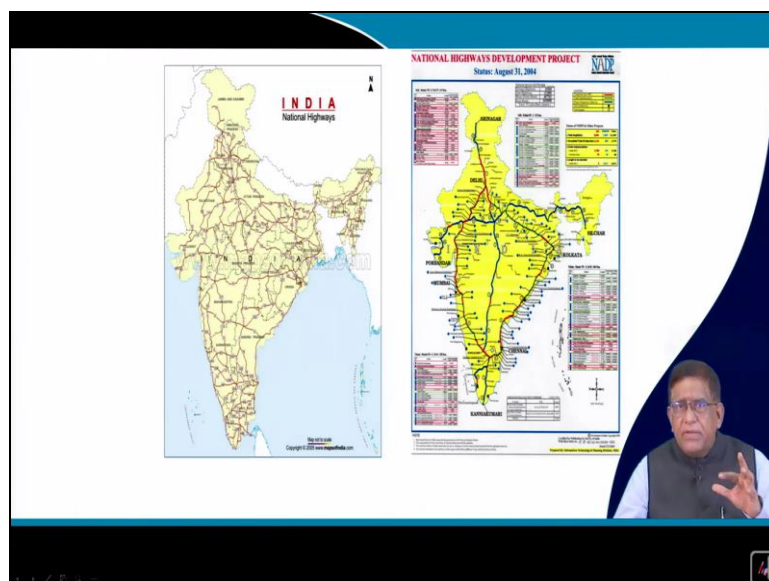
You will have to know their construction operation and maintenance which gets feeders conveyors trippers takers reclaimers bucket elevators wagon loaders ship loaders unloaders storage equipment bins bunker silos these are the things over there. And there will be different activities that is your driving turning running operating closing then there could be cleaning fixings changing like the number of activities will be there and then will have to maintain the safety and the environment.

(Refer Slide Time: 29:27)



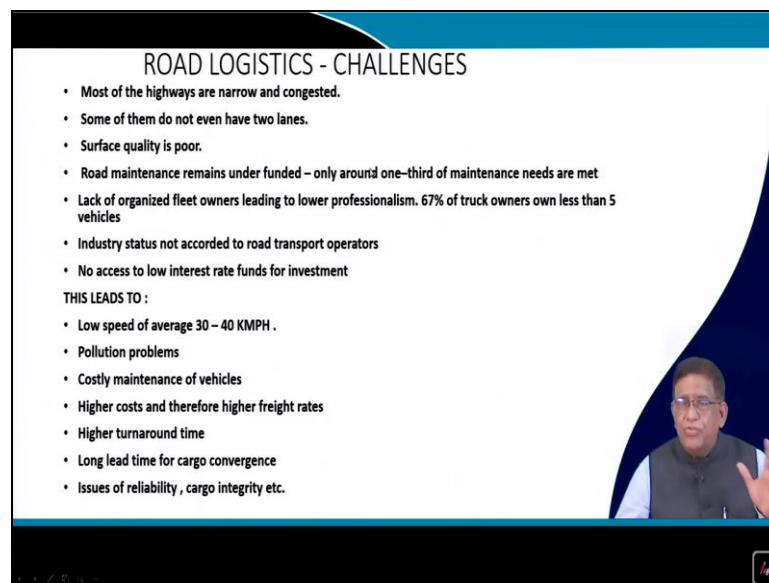
So, once you know that these things then you will find that our bulk material handling is going to exist because we have got a huge reserve of our iron ore and in our country how will you use our this railway network.

(Refer Slide Time: 29:47)



How will you use our road logistics? How will you use our the different national highways how they will be getting exactly that where there will be bottleneck whether have we decided our total beneficiation plans or the thermal power stations how they are located which road how it will be there how the overall development will be affecting. So, in a mega scale planning also you can give contribute.

(Refer Slide Time: 30:11)



ROAD LOGISTICS - CHALLENGES

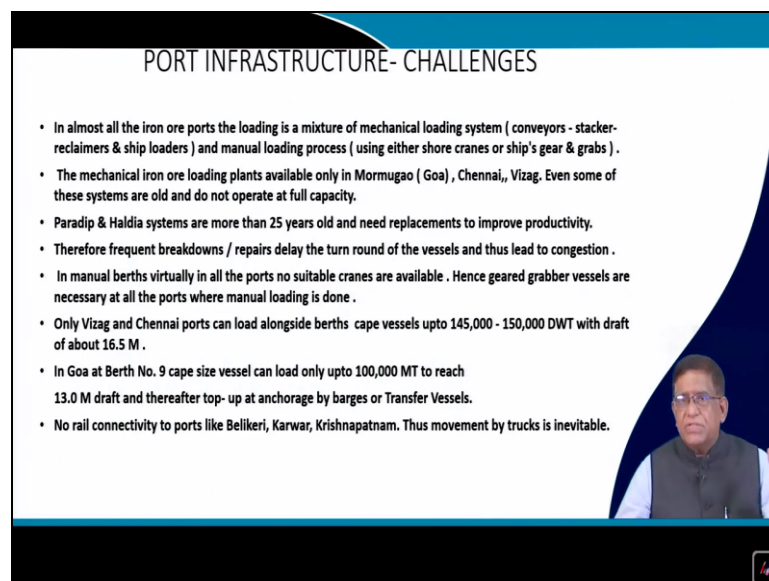
- Most of the highways are narrow and congested.
- Some of them do not even have two lanes.
- Surface quality is poor.
- Road maintenance remains under funded – only around one-third of maintenance needs are met
- Lack of organized fleet owners leading to lower professionalism. 67% of truck owners own less than 5 vehicles
- Industry status not accorded to road transport operators
- No access to low interest rate funds for investment

THIS LEADS TO :

- Low speed of average 30 – 40 KMPH .
- Pollution problems
- Costly maintenance of vehicles
- Higher costs and therefore higher freight rates
- Higher turnaround time
- Long lead time for cargo convergence
- Issues of reliability , cargo integrity etc.

And then the whole road logistics and challenges you can study you can in future you can get a job in the Nityayog where they do the planning of the whole country that what exactly our this road system can contribute to our pollution how they will be exactly that contribute to the energy how it will be contributing to our automobile business lot of things are there.

(Refer Slide Time: 30:32)

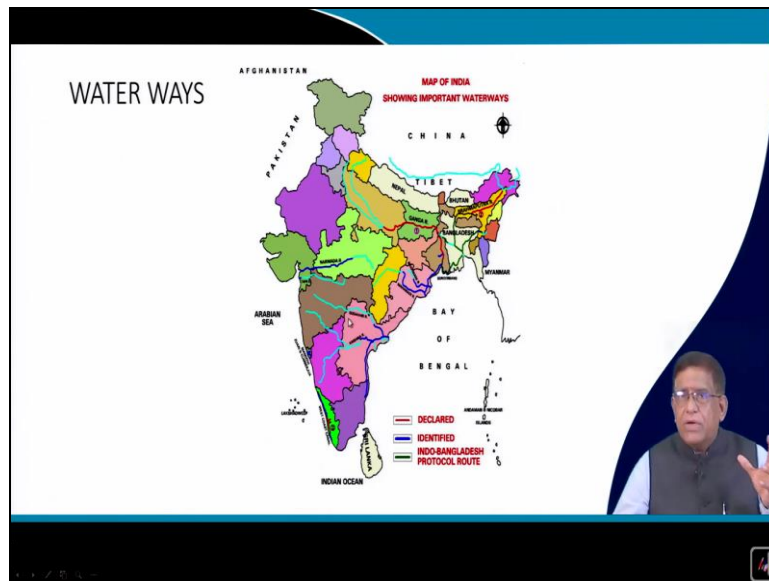


PORT INFRASTRUCTURE- CHALLENGES

- In almost all the iron ore ports the loading is a mixture of mechanical loading system (conveyors - stacker-reclaimers & ship loaders) and manual loading process (using either shore cranes or ship's gear & grabs) .
- The mechanical iron ore loading plants available only in Mormugao (Goa) , Chennai,, Vizag. Even some of these systems are old and do not operate at full capacity.
- Paradip & Haldia systems are more than 25 years old and need replacements to improve productivity.
- Therefore frequent breakdowns / repairs delay the turn round of the vessels and thus lead to congestion .
- In manual berths virtually in all the ports no suitable cranes are available . Hence geared grabber vessels are necessary at all the ports where manual loading is done .
- Only Vizag and Chennai ports can load alongside berths cape vessels upto 145,000 - 150,000 DWT with draft of about 16.5 M .
- In Goa at Berth No. 9 cape size vessel can load only upto 100,000 MT to reach 13.0 M draft and thereafter top- up at anchorage by barges or Transfer Vessels.
- No rail connectivity to ports like Belikeri, Karwar, Krishnapatnam. Thus movement by trucks is inevitable.

At the same time in the ports also you can see the port infrastructure has got a lot of challenges to cater the huge quantity of bulk material which will be moving.

(Refer Slide Time: 30:46)



And then we have not used our water waste properly and that water river network that is another area if you get interest you can have a lot of research and lot of development and innovative technology can be developed in this that how our water waste can be used for our bulk material handling.

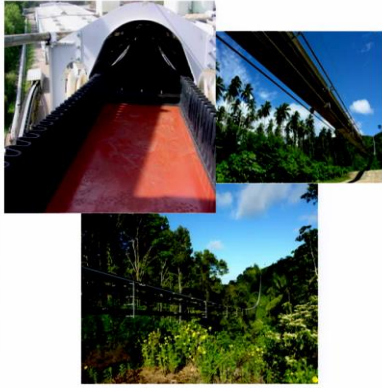
(Refer Slide Time: 31:04)



And then in a bind that when it is a for a specific purposes for a pacific bind how you design a bulk material handling system that will be a part.

(Refer Slide Time: 31:15)


RopeCon Conveyor:
The Latest Innovation in Bulk Material and Unit Load Handling- a combination of conveyor belt and aerial ropeway



RopeCon is a long-distance continuous conveyor system suitable for the transportation of bulk materials and unit loads of any kind. This product is the result of well-proven transport technology combined with Doppelmayr's decades of experience in the ropeway industry.

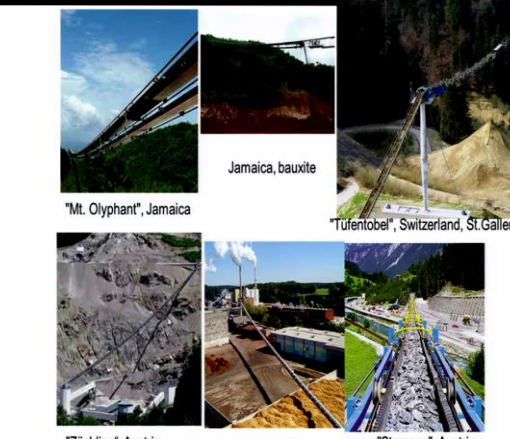
Application areas:

- Single conveyor lengths up to 20,000 m
- Capacity up to 10,000 tonnes/hour
- Easy traversing of streets, railways, tracks, rivers and other obstacles
- Tower spacing up to 2,000 m



And there lot of new things have come like this your RopeCon is a things which is a conveyor belt on a ropeways is a very innovative design.

(Refer Slide Time: 31:30)



"Mt. Olyphant", Jamaica


Jamaica, bauxite

"Tufentobel", Switzerland, St.Gallen

"Zöchling", Austria


"Lenzing", Austria (for wood chips)

"Strengen", Austria



You know in the world about six seven places these are there in Jamaica they have been using in Austria they have been using this rope con it has not come to in India yet.

(Refer Slide Time: 31:34)



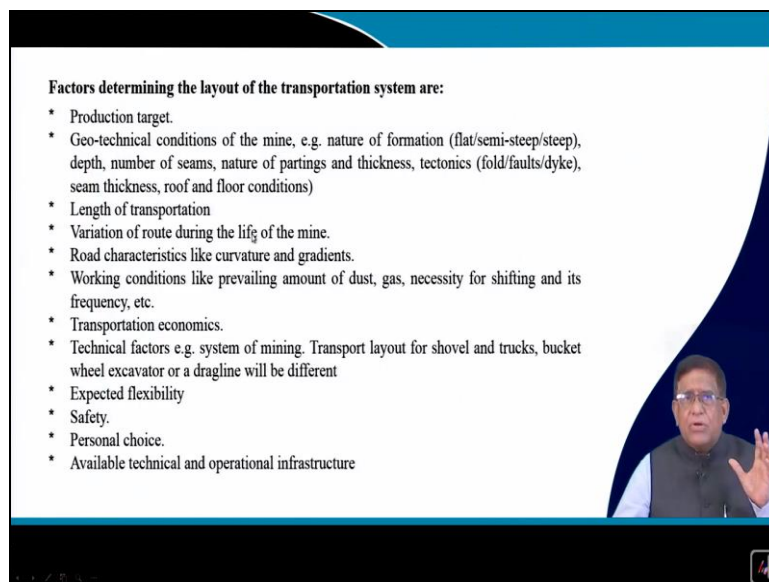
Railveyor

Railveyor is a remote controlled, electrically powered light-rail haulage solution for surface and underground applications in the mining and aggregate industries.

The slide features four images: a yellow railveyor structure, an underground tunnel with a railveyor, a surface railveyor system, and a schematic diagram of the railveyor structure. A speaker is visible in the bottom right corner.

There is another in Brazil that whale company they have used a railveyor that is exactly you can see this is a rail but it is a very specific special device of it. Exactly the drive is given on a horizontal motor in the outside the whole thing it is just pushing and then there is a totally different type of drive system the unloading is done by such a huge will this type of unloading of the hole that is your rail mounted your cars which are carrying over that is a development with a new system. So, what I am telling you there is a scope of lot of innovations.

(Refer Slide Time: 32:09)



Factors determining the layout of the transportation system are:

- * Production target.
- * Geo-technical conditions of the mine, e.g. nature of formation (flat/semi-steep/steep), depth, number of seams, nature of partings and thickness, tectonics (fold/faults/dyke), seam thickness, roof and floor conditions)
- * Length of transportation
- * Variation of route during the life of the mine.
- * Road characteristics like curvature and gradients.
- * Working conditions like prevailing amount of dust, gas, necessity for shifting and its frequency, etc.
- * Transportation economics.
- * Technical factors e.g. system of mining. Transport layout for shovel and trucks, bucket wheel excavator or a dragline will be different
- * Expected flexibility
- * Safety.
- * Personal choice.
- * Available technical and operational infrastructure

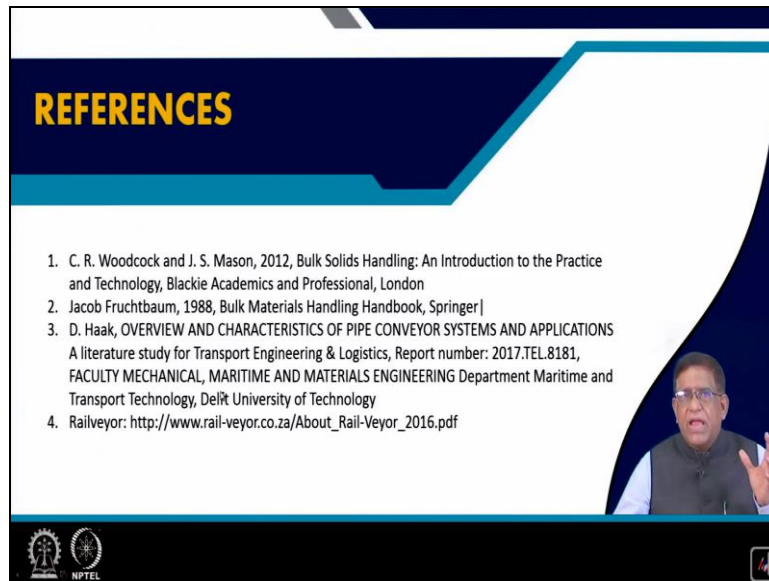
A speaker is visible in the bottom right corner.

And then there will be manufacturer in the Chinese and Indian manufacturers many a time they combine together to give different type of instruments for our industry. So, that how they will be put it will be depending on number of factors in our subsequent classes we will be discussing that what are these factors they will determine the layout of a

transportation system whether it is in a thermal power stations whether it is in a steel plant.

How the iron ore will be coming and then what type of layout will be there how it will be received and that will be depending on the total transportation economics that how that operational is can be incorporated over there.

(Refer Slide Time: 32:50)




REFERENCES

1. C. R. Woodcock and J. S. Mason, 2012, Bulk Solids Handling: An Introduction to the Practice and Technology, Blackie Academics and Professional, London
2. Jacob Fruchtbau, 1988, Bulk Materials Handling Handbook, Springer]
3. D. Haak, OVERVIEW AND CHARACTERISTICS OF PIPE CONVEYOR SYSTEMS AND APPLICATIONS
A literature study for Transport Engineering & Logistics, Report number: 2017.TEL.8181,
FACULTY MECHANICAL, MARITIME AND MATERIALS ENGINEERING Department Maritime and
Transport Technology, Delft University of Technology
4. Railveyor: http://www.rail-veyor.co.za/About_Rail-Veyor_2016.pdf

The slide features a dark blue header with the word 'REFERENCES' in yellow. Below the header is a white area containing the reference list. In the bottom right corner, there is a small video inset showing a man in a blue shirt and glasses speaking. At the bottom left, there are logos for NPTEL and a small square icon.

So, there are lot of things about these things you can read some of this book that is your bulk solid handling and introduction to the practice and technology this book gives a all details you will find is a very fascinating book. There is a some of the mathematical analysis some of the engineering analysis are very good there are lot of materials available in the nowadays in the world wide web you can search over there.

(Refer Slide Time: 33:15)




CONCLUSION

- Classification of Mining systems and bulk solid handling and transportation systems in the mining industry is discussed in this lesson. There are scopes of improvement and development of new technology and system in this sector.
- A systematic study of bulk material handling and transportation is necessary for future disruptive innovations necessary for optimization of energy consumption and control of environmental stressors generated from this sector.

Test yourself

1. Draw a schematic diagram of flow of materials in a coal beneficiation plant
2. What are the operations in an iron ore beneficiation plant? Discuss the machines used for such operation.
3. Classify the various transportation system in surface mining.
4. Explain the properties of bulk materials that affect its transportation.



But overall the classification of mining system and bulk solid handling I have just in a nutshell I told you and then we have given that say if you do a systematic study of bulk material handling and transportation that our tier could be a future disruptive innovation are necessary for the optimization of energy consumption and control of environment and to that you can contribute.

If you study this course understand that what is it and for that after this lesson you try to draw some schematic diagram of flow of materials in a coal beneficiation plant you can study from the net what are the operations or in an iron ore beneficiation plan you can find it out and you can discuss that what are the machines used in such operations and you can classify various transportation system in surface mining.

I have already told you about three systems and explain the properties of bulk materials that affect its transportations. We will be coming back to our subsequent class on these transportations how it can be done. But that is where exactly I will be ending it today thank you very much.