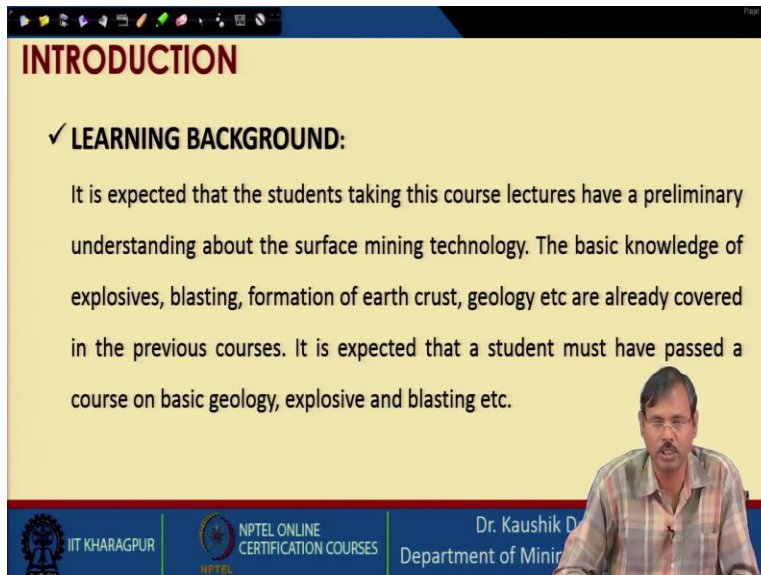


Surface Mining Technology
Professor Kaushik Dey
Department of Mining Engineering
Indian Institute of Technology, Kharagpur
Lecture Number 36
Excavation with Dragline-1

Let me welcome you to the 36th lecture of NPTEL online certification course: Surface Mining Technology. Before this lecture, we have covered the excavation using surface miner. So, from this class we will start excavation with dragline, this excavation with dragline; there will be three lectures on this. This is the first lecture on this series but as we do in every class let us see once again.

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INTRODUCTION

✓ **LEARNING BACKGROUND:**

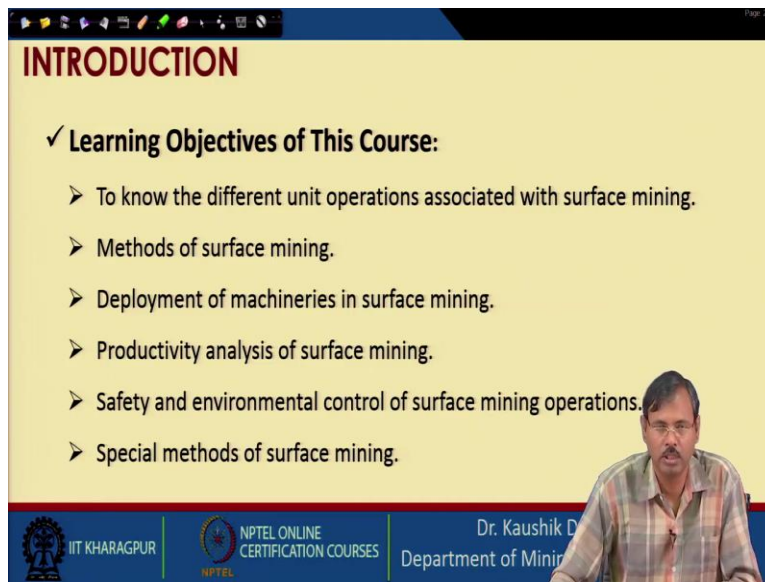
It is expected that the students taking this course lectures have a preliminary understanding about the surface mining technology. The basic knowledge of explosives, blasting, formation of earth crust, geology etc are already covered in the previous courses. It is expected that a student must have passed a course on basic geology, explosive and blasting etc.

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The learning background required for Surface Mining Technology course.

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INTRODUCTION

✓ **Learning Objectives of This Course:**

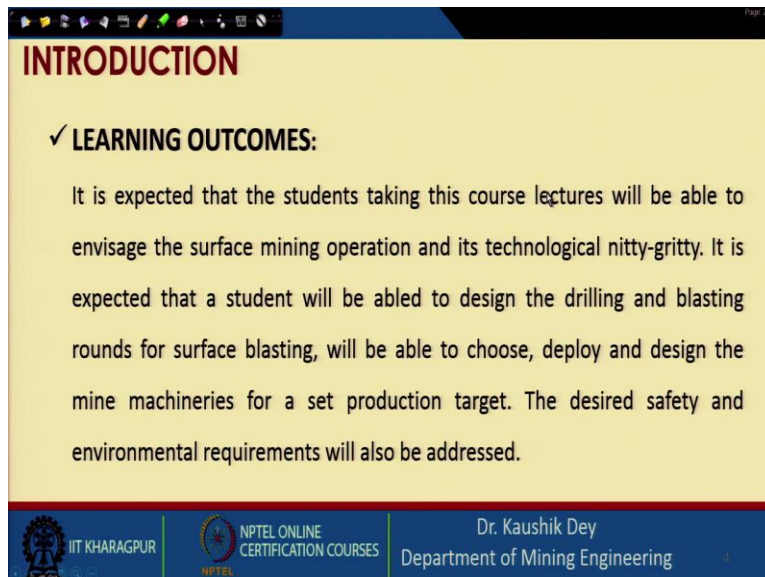
- To know the different unit operations associated with surface mining.
- Methods of surface mining.
- Deployment of machineries in surface mining.
- Productivity analysis of surface mining.
- Safety and environmental control of surface mining operations.
- Special methods of surface mining.

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And these are the learning objectives for Surface Mining technology course.

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INTRODUCTION

✓ **LEARNING OUTCOMES:**

It is expected that the students taking this course lectures will be able to envisage the surface mining operation and its technological nitty-gritty. It is expected that a student will be able to design the drilling and blasting rounds for surface blasting, will be able to choose, deploy and design the mine machineries for a set production target. The desired safety and environmental requirements will also be addressed.

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INTRODUCTION

✓ **LEARNING OUTCOMES:**

The student will also have an overall idea about the special methods of surface mining including sea bed mining, dimensional stone mining, highwall mining etc. The students will also be able to deliver the technological and managerial requirements to the special safety requirements like slope stability and sump management etc.

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Department of Mining Engineering

And these are the expected learning outcomes from the participant of surface mining technology course.

(Refer Slide Time: 1:10)


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INTRODUCTION

✓ **SOME TEXT BOOKS AND REFERENCES**

1. Mishra G. B., 1978, Surface Mining, Dhanbad Publishers
2. Das S. K., 1998, Surface Mining Technology, Lovely Prakashan ✓
3. Deshmukh R. T., 1996, Opencast Mining, M. Publications, Nagpur.
4. De Amithosh, 1995, Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers ✓
5. Hartman H. L., 2002, Introductory Mining Engineering, Publisher John Willey and sons

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Department of Mining Engineering



INTRODUCTION

✓ **SOME TEXT BOOKS AND REFERENCES**

6. Peter Darling, 2011, SME Hand book, SME Publication
7. Rzhovsky, V. V., (1983), Opencast Mining Unit. Operation, Mir publications ✓
8. Rzhovsky, V. V., (1985), Opencast Mining Technology and Integrated Mechanisations, Mir publications

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And some of the textbook and references, these are available here, I would like to draw your attention related to the work of dragline in this book as well as this book, also you will get some good inputs. And these are two important books. These two books are important book particularly for the excavation of dragline. However, a number of web source are already available from which you can get good inputs pertaining to dragline.

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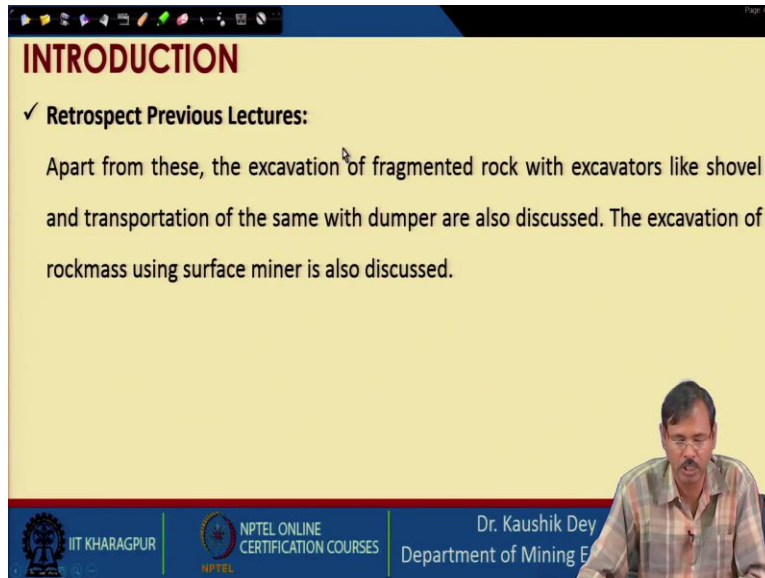
INTRODUCTION

✓ **Retrospect Previous Lectures:**

In previous lectures, the phases of mining a deposit are discussed. The unit operations associated in every phase is also explained. The commencement of mining excavation through opening of box cut is discussed. The unit operation, Drilling technology is discussed. The different drilling procedures, drilling patterns required and machine operations are also discussed. Blasting technology was also discussed in details. Blast – free excavation system i.e. excavation by rippers is also discussed.

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The image shows a presentation slide with a yellow background and a dark blue header. The header contains the word "INTRODUCTION" in red, bold, uppercase letters. Below the header, there is a section titled "✓ Retrospect Previous Lectures:" in black text. The main body of the slide contains a paragraph of text in black font. In the bottom right corner of the slide, there is a small video inset showing a man with glasses and a mustache, wearing a plaid shirt, speaking. At the bottom of the slide, there is a dark blue footer bar containing logos for IIT KHARAGPUR, NPTEL ONLINE CERTIFICATION COURSES, and the text "Dr. Kaushik Dey Department of Mining Engineering".

INTRODUCTION

✓ Retrospect Previous Lectures:

Apart from these, the excavation of fragmented rock with excavators like shovel and transportation of the same with dumper are also discussed. The excavation of rockmass using surface miner is also discussed.

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Let us retrospect so far whatever we have covered in this surface mining technology course. In this course we have started with the phases of mining a deposit, then we have seen what are the basic unit operations required in every phases. And we have also seen the commencement of surface mining through opening the box cut. Then different unit operations like drilling, in which we use the drill machine to drill the hole in the rock mass.

Then blasting is carried out utilizing the drill holes in which the explosives are placed and blasted. Then the fragmented rock mass is taken out by the shovel and transported through the different transporting system like dumper. And we have seen the blast free excavation systems like ripper and surface miner also. So, these are the main topics so far we have covered.

(Refer Slide Time: 3:15)

INTRODUCTION

✓ **Learning Objectives of This Lecture:**

- To understand the application of Dragline.
- To understand the operation of Dragline.
- To understand the cost and performance calculations for Dragline.

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And we have set our learning objectives from the lectures related to this excavation by dragline, our objectives are to understand the application of dragline, to understand the operation of dragline and to understand the cost and performance calculation for dragline. So, these are the basic objectives we have set. So, this is the first lecture on the introduction to dragline in which you will understand the dragline operation and applications.

(Refer Slide Time: 3:48)

DRAGLINE

- ✓ The dragline was invented in 1904 by John W. Page (Page & Schnable Contracting) for digging the Chicago Canal.
- ✓ Page built first crude walking dragline in 1923.
- ✓ Page developed the first diesel engines operated dragline in 1924.
- ✓ In 1988, Page was acquired by P&H.
- ✓ P&H, Bucyrus, Caterpillar, HEC are the pioneer dragline manufacturing companies.

15

Reach

(*Mining Dragline HS 8300 - Liebherr)

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So, at the very beginning, let us have some historical knowledge, dragline was invented in the year 1904 while Chicago Canal was carried out in that place for the first time, it was developed

by Page in 1904. And initially all the developments were carried out by the same company. Walking type dragline was introduced in 1923 and diesel engine operated dragline was also started in 1924.

And in 1988 the company was acquired by P & H and currently these are the major companies which are producing the dragline among which HEC is the Indian company who was also a prominent manufacturer of the dragline and around 15 draglines were manufactured by HEC. This company is the Indian company. This is one view of dragline in which basically mining engineers; they define a dragline in terms of its bucket capacity.

And bridge up the boom up to which the material can be transferred. So that is why it is dragline if it is called say 36 cubic meter and 90 meter means the bucket capacity is 36-meter cube and reach of the dragline means up to 90 meters that dragline can dump the material. So, that is the in general way we define a dragline in our process.

(Refer Slide Time: 5:50)

DRAGLINE

What is dragline?

- It is a machine used for direct transfer of material using a wirerope suspended bucket from the blasted muck to dump point.
- It eliminates loading, hauling and transporting material from one place to other on surface excavation.
- It normally deployed for side-casting the material.

Handwritten red annotations: A bracket groups the first two bullet points. A red box labeled 'Dumping' with an arrow points to the bucket in the 3D diagram.

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Now, what is the dragline? Dragline is basically a machine which directly transfer the material using a wire rope suspended bucket from the blasted muck to the dump point. So, dragline is essentially utilized to take the blasted muck and transfer the material or dump the material at a height. One point must be remembered in this case the dragline bucket is suspended with the wire.

So, this bucket cannot be used for loading purpose because it is always oscillating with the wire just like pendulums. So that is why it is not judicial to use that as a loading machine. So, this can be only used in dumping and in dumping it is basically spreading the material over an area and it is not basically dumping at a particular point. So that is why this machine is eliminating, loading, hauling and transporting of the material from one place to the dump site. And this can be directly carried out by the dragline.

So, that is why dragline is very popular and very cost effective excavation technique that can be utilized for the overburden material which can be dumped especially in the backfilling condition.

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DRAGLINE

What is dragline?

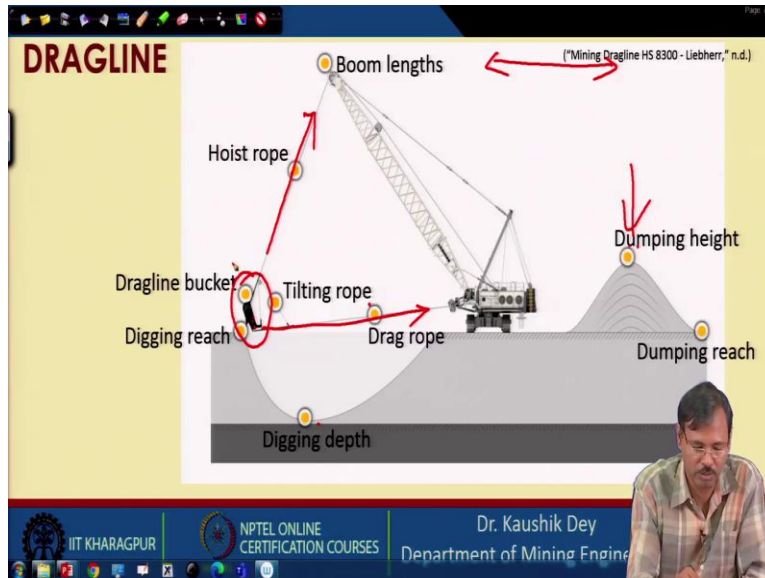
- Dragline falls in heavy equipment's category. Dragline excavator is used for civil engineering projects and surface mining. **boom** ↑
- It has the ability to excavate very deep down the earth. **30m**
- Word drag is used because it has the ability to drag material at far distance from the machine.
- Dragline consists of drag rope, large bucket, boom, hoist rope and motors.

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Dragline itself is a very heavy equipment because to having a long boom essentially the machine weight, self-weight has to be increased significantly. So that is why dragline is a heavy equipment and this can have the ability to deep down the earth and that can take the material from a very high bench, so dragline can operate a bench height of 30 meter also. And that is allowing the keeping the bench height is significantly more and that is why the number of benches requirement can be reduced if we are using dragline.

The word drag is used. So that its ability to drag the material from a distance towards the machine and it is costing a drag rope, a large bucket, boom, hoisting rope, and driving motors, those arrangements are the essential components of a dragline.

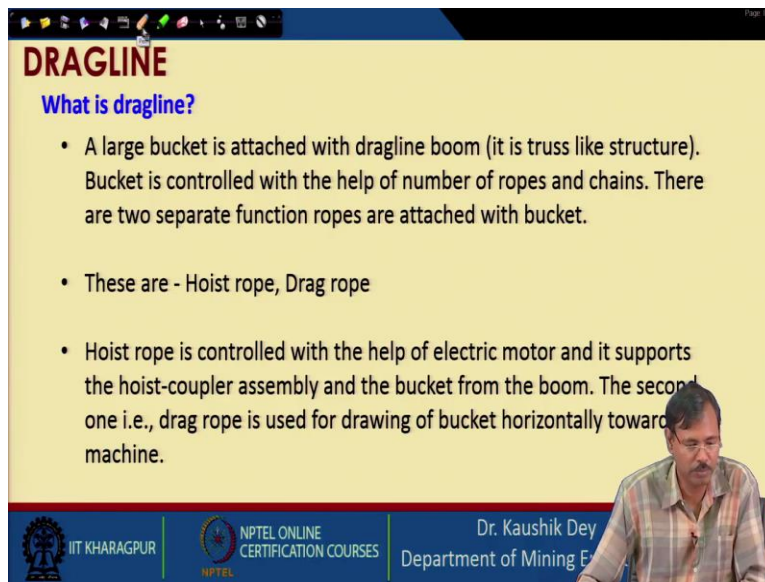
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Now, a dragline can be specified like this, it is having this rope is called drag rope. This rope is called hoisting rope. So, the bucket is basically suspended with this hoist rope and it is dragged towards the machine by the drag rope. So that the bucket can be filled and after filling the bucket the boom is rotating and moving towards this direction and this is the reach because of this boom height. This up to this the material can be dumped at this position.

So, this is the digging depth up to which this drag rope can work efficiently and this is the dump height from up to this the dumping can be carried out depending on the stability purpose et cetera. And by the way, the dragline is basically defined with the bucket capacity and the boom reach of the dragline.

(Refer Slide Time: 10:02)



DRAGLINE

What is dragline?

- A large bucket is attached with dragline boom (it is truss like structure). Bucket is controlled with the help of number of ropes and chains. There are two separate function ropes are attached with bucket.
- These are - Hoist rope, Drag rope
- Hoist rope is controlled with the help of electric motor and it supports the hoist-coupler assembly and the bucket from the boom. The second one i.e., drag rope is used for drawing of bucket horizontally toward machine.

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So, these are the basic components of the dragline.

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DRAGLINE



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Now, let us look how the dragline is working, this is a video from the NCL. This is also available in YouTube. So, this is the hoist rope, the drag rope is now dragging the bucket towards the machine and the way the bucket is being filled with the blasted muck. Now the bucket is filled and now the hoisting rope is taking the material, lifting the bucket, and along with that the dragline is rotating and simultaneously the bucket is being hoisted and rotation of this one now, the bucket is basically released. Now, we can see basically the dumping is carried out over an area and that is why the material is dumped in the dump pile only; it cannot be used for filling of the machines.

(Refer Slide Time: 11:42)

BIG MUSKIE - LARGEST DRAGLINE

1974

Specifications	
Manufacturer:	Bucyrus-Erie
Model:	4250 "Big Muskie"
Weight:	21,000,000 pounds (9,500 t; 12,000 short tons)
Bucket Capacity:	220 cubic yards (170 m ³); 525 short tons (295 t)
Height:	222 feet 6 inches (67.82 m)
Boom length:	310 feet (94 m)
Machine length (boom down):	487 feet 6 inches (148.59 m)
Bucket weight (empty):	230 short tons (210 t)
Width:	151 feet 6 inches (46.18 m)—comparable to an eight-lane highway
Cable diameter:	5 inches (130 mm)
Electrical power:	13,800 volts
Mobility:	Hydraulically driven walker feet

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This is the world largest dragline Big Muskie; it was commissioned in the year 1969 and work up to 2004. This is a photograph of 1974, this is a photograph of 1999, and you can see the bucket capacity is 170-meter cube and its boom length is 94 meters. So, this is a huge machine its self-weight is 12,000 ton. So, 12,000 ton is the machine and its power requirement is 4200, 4000 I think this is, let me see, yeah 4250-watt machine.

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DRAGLINE

Auxiliary Bench Surface

Minimum Bench Width

Maximum Bench Width

Bench Crest

Primary Bench Surface

Bench Face Angle

Bench Toe

Reach Limit Feature

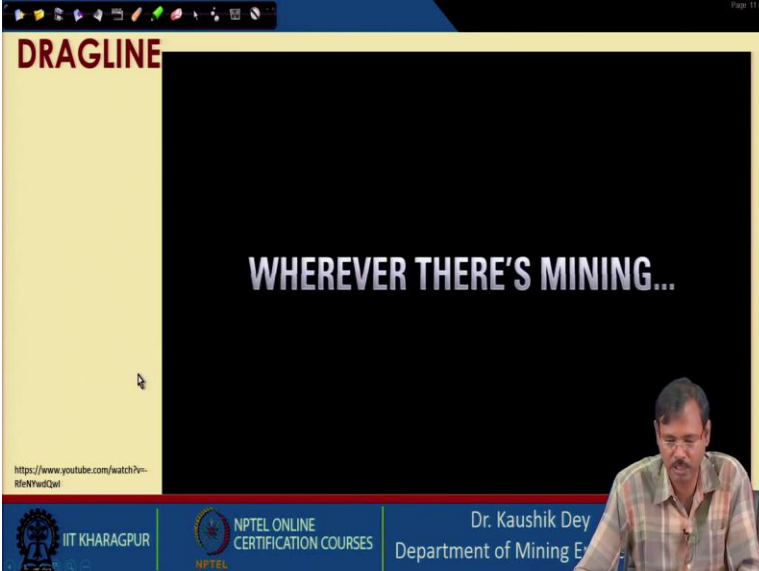
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Now, you can see the specification of a dragline bench. This is the coal seam and this is the overburden rock material and this is already blasted and dragline is working standing on the

blasted muck pile. And it is shifting the material from this point to this point. And this is the minimum bench width required for the operation of the dragline. This is the maximum bench width from this point, the material can be transferred up to this otherwise it cannot be transferred.

And this is the bridge and the bucket capacity is not shown here. It must be remembered that every time as a blasted muck pile is there, slope angle must be there for the bench in the bench face for the stability of this bench that is mandatory requirement whereas in the operating bench, we can have a steeper slope but in a dragline bench we should have a significant slope for this there is a problem in this actually the dump has to be made not on the coal. That is a little mistake in this one but this is taken from this photograph. Otherwise, this one is good.

(Refer Slide Time: 14:36)



The image is a screenshot of a video lecture. The main content area is a slide with a yellow background on the left and a black background on the right. The word "DRAGLINE" is written in red at the top left. The text "WHEREVER THERE'S MINING..." is centered in white on the black background. A URL is visible at the bottom left of the slide: <https://www.youtube.com/watch?v=Rf6N7w0Qaf>. In the bottom right corner, there is a small video feed of a man, Dr. Kaushik Dey, wearing a plaid shirt. The bottom of the slide features a blue banner with the IIT Kharagpur logo, the NPTEL logo, and the text "NPTEL ONLINE CERTIFICATION COURSES" and "Dr. Kaushik Dey, Department of Mining Engineering".

DRAGLINE

REGION: India
LOCATION: Madhya Pradesh, India
APPLICATION: Coal
EQUIPMENT: Overburden removal too

<https://www.youtube.com/watch?v=RfENYwUQwI>

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Now this is a caterpillar video. Available in this. This is showing the different parts of a dragline, this is also for the Northern coal field of Coal India.

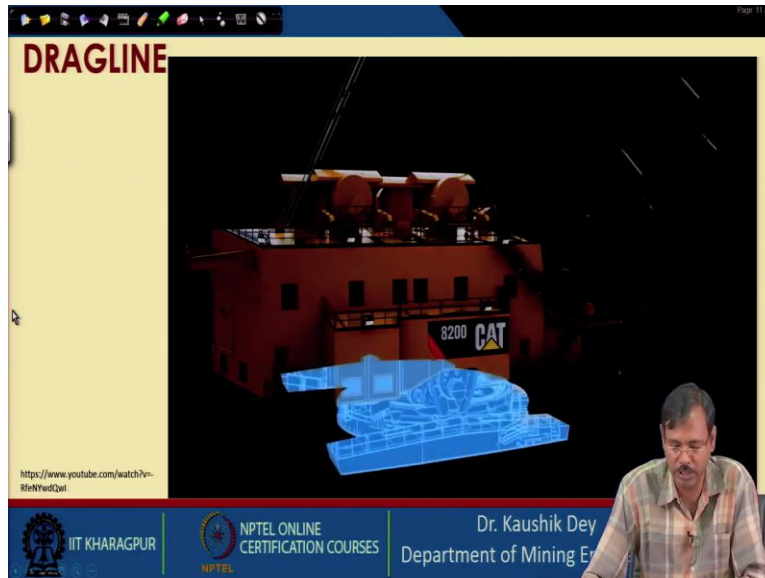
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DRAGLINE

CAT 8200
BOOM LENGTH: 200 FT / 61 M
BUCKET CAPACITIES: 90-90 TD / 46-61 M
RATED SUSPENDED LOAD: 300,000-400,000 / 136,777-181,437 KG
ELECTRICAL SYSTEM: AC IGBT DRIVE SYSTEM

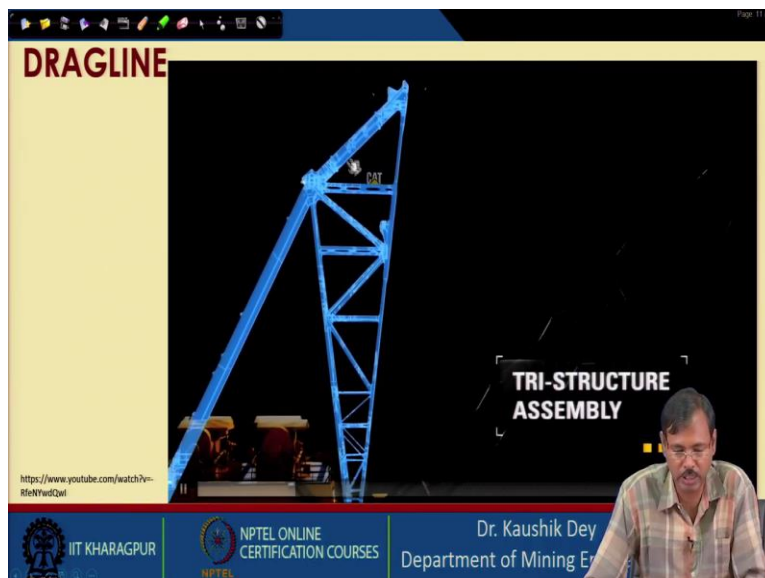
<https://www.youtube.com/watch?v=RfENYwUQwI>

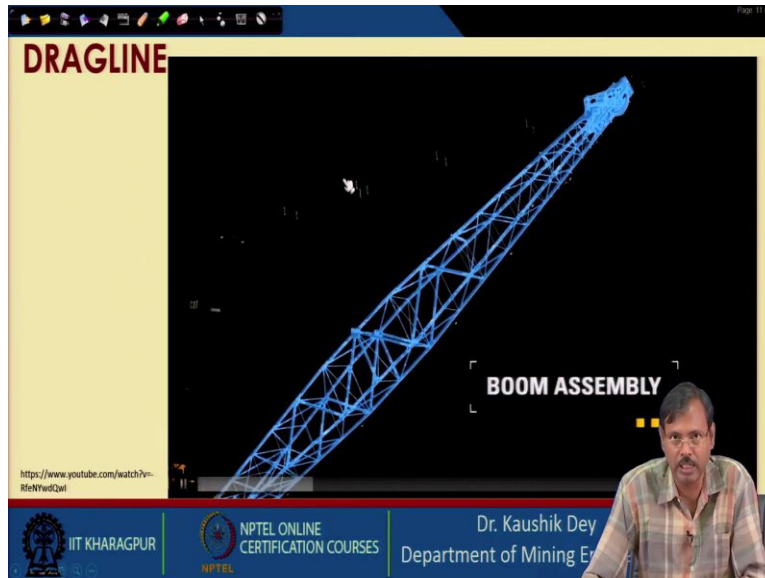
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So, this is the dragline CAT 8200 dragline of boom length 100-meter, bucket capacity is 46-to-61-meter cube. So, it is eliminating the most of the diesel operated equipment like shovel, dumpers, so that is why it is better environment friendly, this is skid mounted walking dragline we will see the walking principle in the next slide. So, these are the skid and this is having the revolving frame. So, skid is moving the machine in general stands on a circular base.

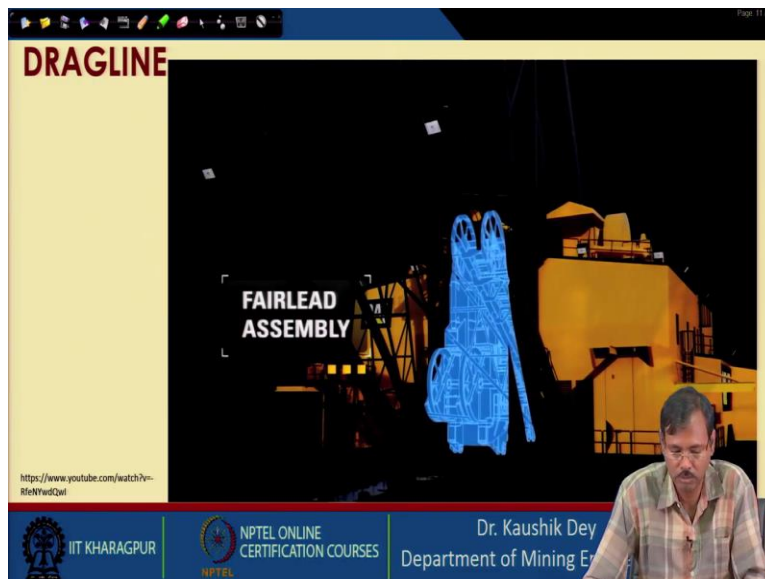
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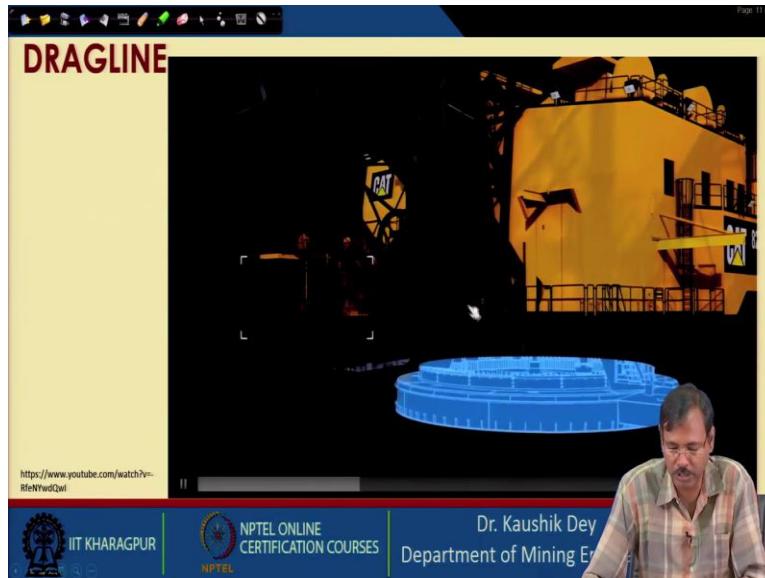




So, this is the tri-structure assemble, basically, these are inspected time to time, this frame is taking the load of this boom, nondestructive tests are carried out to find out any cracks in the structure as well as in the wires of the dragline. And for inspection, these are accessible for detection of cracks, often the pressurized gases are used.

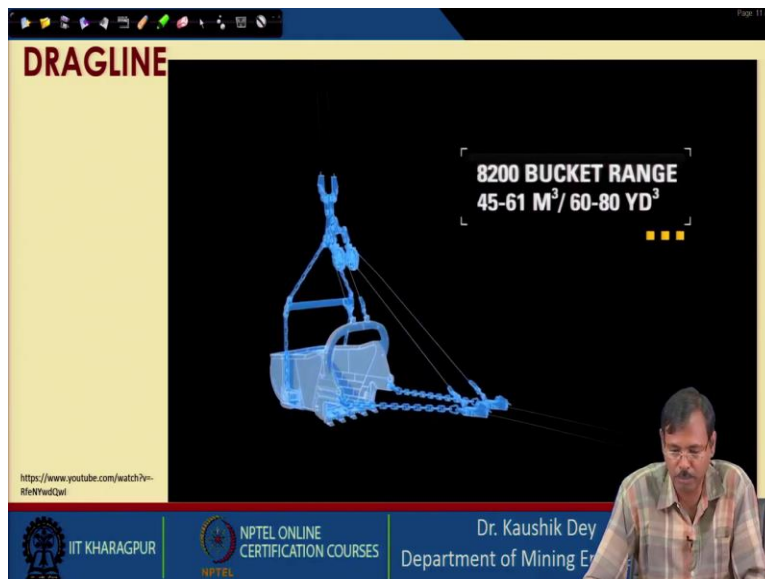
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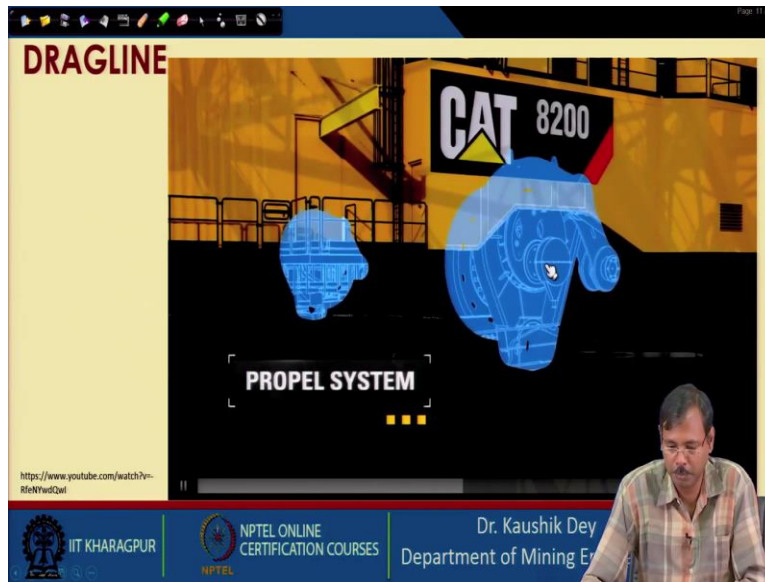
These are the, how the wire ropes are being basically carried out here, this is the best frame on which the dragline in general stands. And dragline can rotate on these also in 360 degrees.

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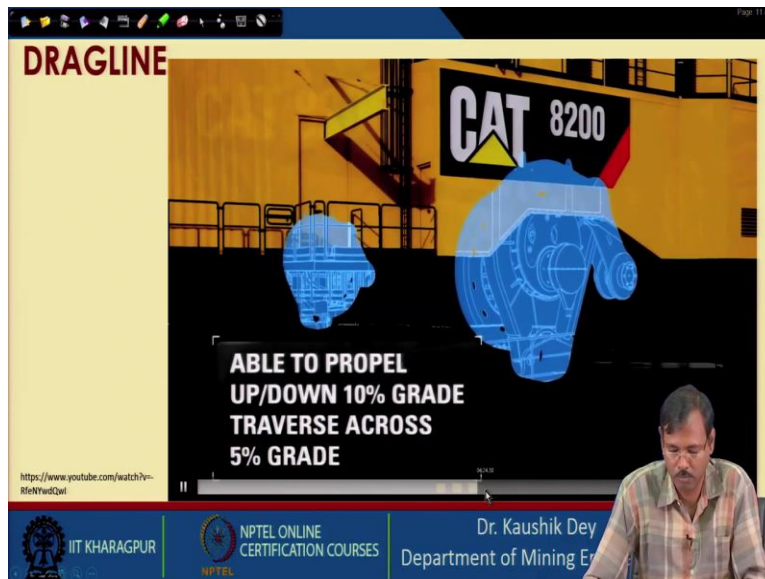
This is the bucket and this is the hoist rope, this is the drag rope and these are the attachment of the bucket. And generally, as this bucket is allowed to fill on dragging it towards the dragline over a slope. So basically, drag filling factor of the bucket is in general low for the dragline. So, the wear and tear onto the rope is also required to be inspected, swinging is carried out in the planetary system.

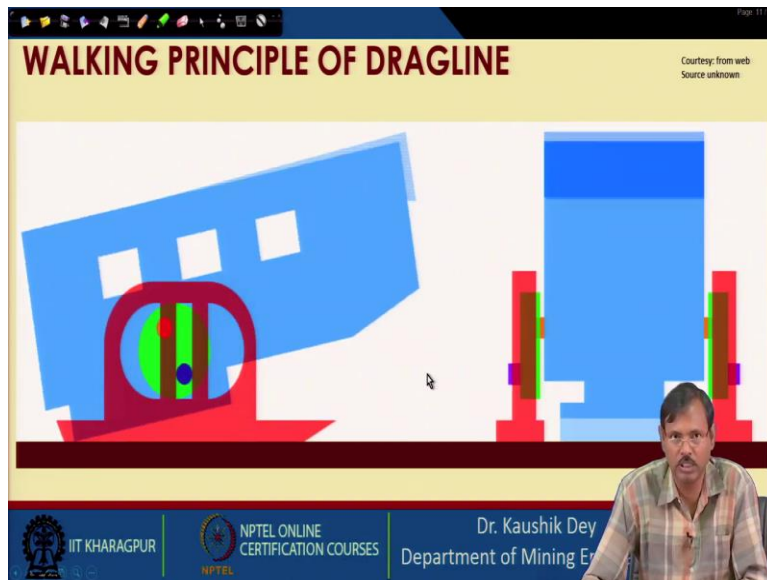
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And this is the walking arrangements for the walking draglines.

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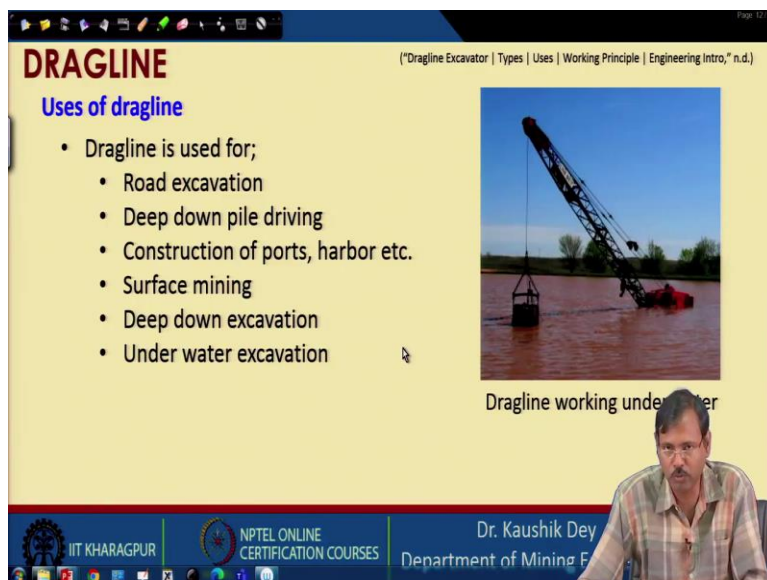




So, this is the walking principle, say this walking pads come down, then this one is rotated and machine is moved in the front side. Again, the machine is allowed to stand on base platform then the walking pads are allowed to move in front and then again it is taking the load, lifting the base and then it is rotating moving the base in the front direction. So as the walking pads are also rotating when the machine is swinging with the base.

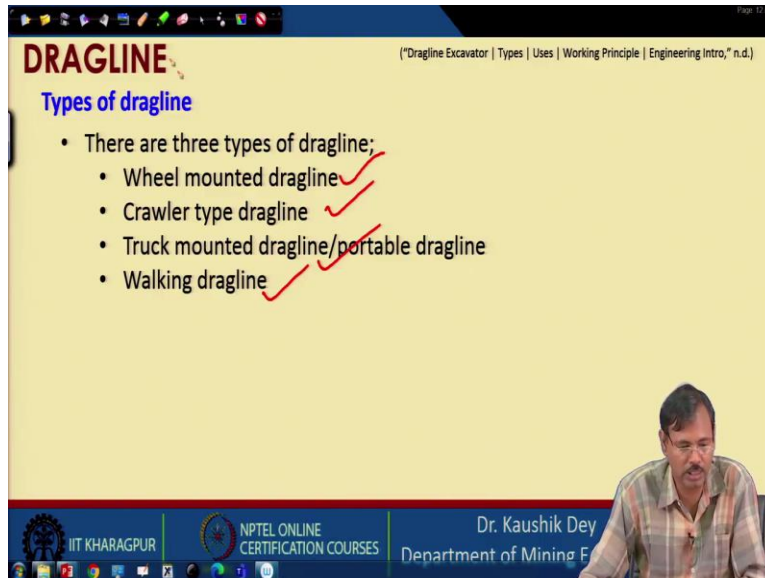
So, that is why the turning is very easy, it can turn in any direction from any point, from where the circular base is placed. From there it can turn to any direction by rotating the machine on the platform itself. So that is the way basically a dragline can walk.

(Refer Slide Time: 19:39)



The dragline can be deployed for road excavation, surface mining excavation, deep down pile driving, construction of ports harbors, surface mining we are talking about, deep down excavation, underwater excavations also for dredging purpose etcetera for different places we can use dragline. This is one photograph where the dragline is being deployed for underwater excavation.

(Refer Slide Time: 20:09)



DRAGLINE
Types of dragline

- There are three types of dragline;
 - Wheel mounted dragline ✓
 - Crawler type dragline ✓
 - Truck mounted dragline/portable dragline ✓
 - Walking dragline ✓

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In general, dragline can be classified as wheel mounted dragline, crawler type dragline, or truck mounted dragline, and walking dragline. So, these are the different types of draglines, in many places truck mounted draglines are used as it can give more mobility but these are having small applications like digging ponds, et cetera.

Crawler type dragline are often used in the surface mine also, even up to 1950s, 1960s it was very popular equipment. And currently the walking dragline is very popular and most of the bedded deposit walking dragline is found to be uncommon equipment to be deployed for direct crushing of the material.

(Refer Slide Time: 21:01)


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DRAGLINE

("Dragline Excavator | Types | Uses | Working Principle | Engineering Intro," n.d.)

Working principle of dragline

- Dragline drops the bucket on the source and then drag it horizontally. bucket start tilting as it came closer to the machine.



Animation can be slow & jerky! until your computer loads all the images! then it will work just fine.

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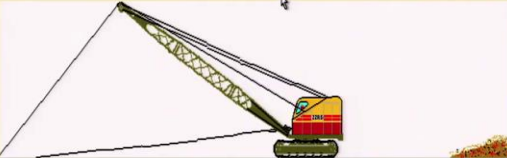
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DRAGLINE

("Dragline Excavator | Types | Uses | Working Principle | Engineering Intro," n.d.)

Working principle of dragline

- Dragline drops the bucket on the source and then drag it horizontally. bucket start tilting as it came closer to the machine.



Animation can be slow & jerky! until your computer loads all the images! then it will work just fine.

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DRAGLINE


(“Dragline Excavator | Types | Uses | Working Principle | Engineering Intro,” n.d.)

Working principle of dragline

- Dragline drops the bucket on the source and then drag it horizontally. bucket start tilting as it came closer to the machine.



Animation can be slow & jerky! until your computer loads all the images! then it will work just fine.

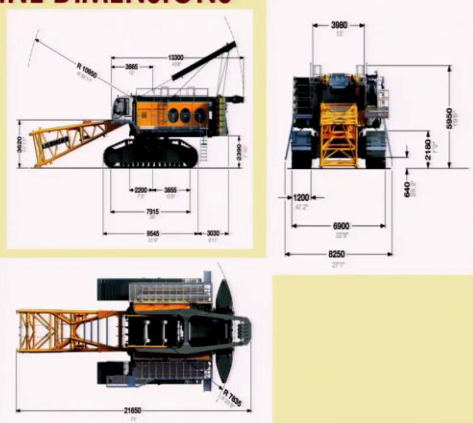

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DRAGLINE DIMENSIONS

(“Mining Dragline HS 8300 - Liebherr,” n.d.)



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Department of Mining E

This is the way how a dragline operates. So, it is basically filling the bucket then discharge the bucket and again return back and again drag the material in the drag wire towards it, these are the different components of the dragline you see, in this case dragline is mounted on a crawler.

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TECHNICAL DESCRIPTIONS

("Mining Dragline HS 8300 - Liebherr," n.d.)

Engine

Power rating according to ISO 9249, 750 kW (1005 hp) at 1700 rpm
 Engine type — Liebherr D 9512 A7-00 or Liebherr D 9512 A7-04
 Fuel tank — 1170 l capacity with continuous level indicator and reserve warning

Main Winches

Winch options:
 Line pull (nom. load) — **500 kN** / 112,405 lbf
 Rope diameter — **46 mm**
 Drum diameter — **1100 mm** / 43.3 inch
 Rope speed — **0-125 m/min** / 0-410 ft/min
 Rope capacity 1st layer — **69.1 m** / 226.7 ft

Swing

Swing speed from 0-3.6 rpm continuously variable,

Boom Winch

Line pull — max. **150 kN** / max. 33,725 lbf
 Rope diameter — 24 mm
 Boom up — 130 sec. from 15° to 84°

Hydraulic System

Working pressure — max. 400 bar
 Oil tank capacity — 2800 l

Crawlers

Track pads — **1200 mm**
 Track pads (option) — **1500 mm**
 Drive speed —

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TECHNICAL DESCRIPTIONS

("Mining Dragline HS 8300 - Liebherr," n.d.)

Machine Characteristics

Operating weight	approx. 364 t *	802,483 lbs
Drive technology	Liebherr V12 (induction motor available)	
System power with Pactronic®	1250 kW	1676.3 hp
Boom	up to 50 m	3,281 ft
Bucket	up to 11.5 m³	15 yd³
Design	according to EN 474-1 and EN 474-12	

* The operating weight includes the basic machine with Pactronic®, HD undercarriage and crawlers with 1200 mm tracks, a 41 m boom, a 11 yd³ dragline bucket and 78,7 t of counterweight.

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DIGGING RANGE

("Mining Dragline HS 8300 - Liebherr," n.d.)

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DIGGING RANGE

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DIGGING RANGE

("Mining Dragline HS 8300 - Liebherr," n.d.)

Digging Range at 40° boom angle – At an assumed density of 1.6 t/m³ and a fill factor of 100 %

Digging range / dumping range		1	2	3	4	5	6
Boom length	[m / ft]	35 / 115	38 / 125	41 / 135	44 / 144	47 / 154	50 / 164
GP	[m ³ / yd ³]	11.5 / 15.0	9.9 / 13.0	8.4 / 11.0	7.6 / 10.0	6.5 / 8.5	4.6 / 6.0
HD	[m ³ / yd ³]	11.1 / 14.5	9.5 / 12.5	8.0 / 10.5	7.3 / 9.5	6.1 / 8.0	4.2 / 5.5
XHD	[m ³ / yd ³]	10.7 / 14.0	9.2 / 12.0	7.6 / 10.0	6.9 / 9.0	5.7 / 7.5	3.8 / 5.0
Digging and dumping reach *	[m / ft]	29.8 / 97.8	32.1 / 102.0	34.4 / 112.9	36.7 / 120.4	39.0 / 128.0	41.3 / 135.5
Digging depth	[m / ft]	14.9 / 48.9	16.0 / 52.5	17.2 / 56.4	18.4 / 60.4	19.5 / 64.0	20.6 / 67.6
Dumping height	[m / ft]	16.1 / 52.8	18.8 / 61.7	21.4 / 70.2	24.0 / 78.7	26.7 / 87.6	28.6 / 93.8

GP: General Purpose Dragline Bucket
HD: Heavy Duty Dragline Bucket
XHD: Extra Heavy Duty Dragline Bucket

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These are engines, etcetera. And this is the general performance curve provided in most of the cases by the manufacturer which can show the digging depth, reach and the allowable dump height. So, these are the dumping height, these are the digging height and these are the reach. So, these are in general given and based on that the performance can be observed in the dragline. So, these are the charts in general, the dragline manufacturers used to provide.

And these are some of the specifications of the same, where the boom length, then the volume, then digging reach, digging depth or dumping height all these are specified. This is for assuming the density of this one and fill factor: they have considered 100 percent but in general as the bucket is filled by dragging it with the drag wire and by that way the bucket is basically rubbed with the face of the crushed face of the face.

So, that is why the bucket is filled but obviously 100 percent filling is not observed because it is not guided by a solid boom. In case of shovel where the bucket is basically guided or the more digging forces applied, here the natural digging force by the drag force given by the wire that is coming but in case of a boom mounted shovel that digging force is much higher.

So, the bucket fill factor with 100 percent is very difficult in case of dragline, in fact filling factors are in general very poor for dragline operations. So, that has to be considered and based on that this performance are considered in this case.

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DIGGING RANGE

(*Mining Dragline HS 8300 - Liebherr,* n.d.)

Digging Range at 45° boom angle – At an assumed density of 1.6 t/m³ and a fill factor of 100 %

Digging range / dumping range		1	2	3	4	5	6
Boom length	[m / ft]	35 / 115	38 / 125	41 / 135	44 / 144	47 / 154	50 / 164
GP	[m ³ / yd ³]	13.0 / 17.0	11.5 / 15.0	10 / 13.0	9.2 / 12.0	7.3 / 9.5	6.1 / 8.0
HD	[m ³ / yd ³]	12.6 / 16.5	11.1 / 14.5	9.6 / 12.5	8.8 / 11.5	6.9 / 9.0	5.7 / 7.5
XHD	[m ³ / yd ³]	12.2 / 16.0	10.7 / 14.0	9.2 / 12.0	8.4 / 11.0	6.5 / 8.5	5.4 / 7.0
Digging and dumping reach *	[m / ft]	27.7 / 90.9	29.9 / 98.1	32.0 / 105.0	34.1 / 111.9	36.2 / 118.8	38.3 / 125.7
Digging depth	[m / ft]	13.9 / 45.6	14.9 / 48.9	16.0 / 52.5	17.1 / 56.1	18.1 / 59.4	19.2 / 63.0
Dumping height [m]	[m / ft]	18.4 / 60.4	20.8 / 68.2	23.2 / 76.1	25.7 / 84.3	28.3 / 92.9	31.5 / 103.4

* the reach is calculated from rotation center of the machine

GP: General Purpose Dragline Bucket
HD: Heavy Duty Dragline Bucket
XHD: Extra Heavy Duty Dragline Bucket

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Department of Mining Engineering

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These are some more chapters where the 45-degree angle is considered and that is more or less about the introduction of the dragline, it has been found that the dragline is basically a wire suspended bucket which is allowed to operate at a digging depth. So, the dragline bucket is allowed to dig from the level below to the level at which the dragline is standing. And then the bucket is hoisted using the hoisting rope and it is discharged over a dump.

So, in dragline the main advantage is that it can operate at a greater depth, the depth is significantly high almost 30-meter 40 meters depth can be well adjusted with the dragline digging. And it is very fast movement of the material so only as because it is having a very long

boom range. It can take the material and dump the material at a distance. So direct casting is very easy with the dragline. So, this gives the very high productivity of the dragline and that is why it is very popular. Thank you.