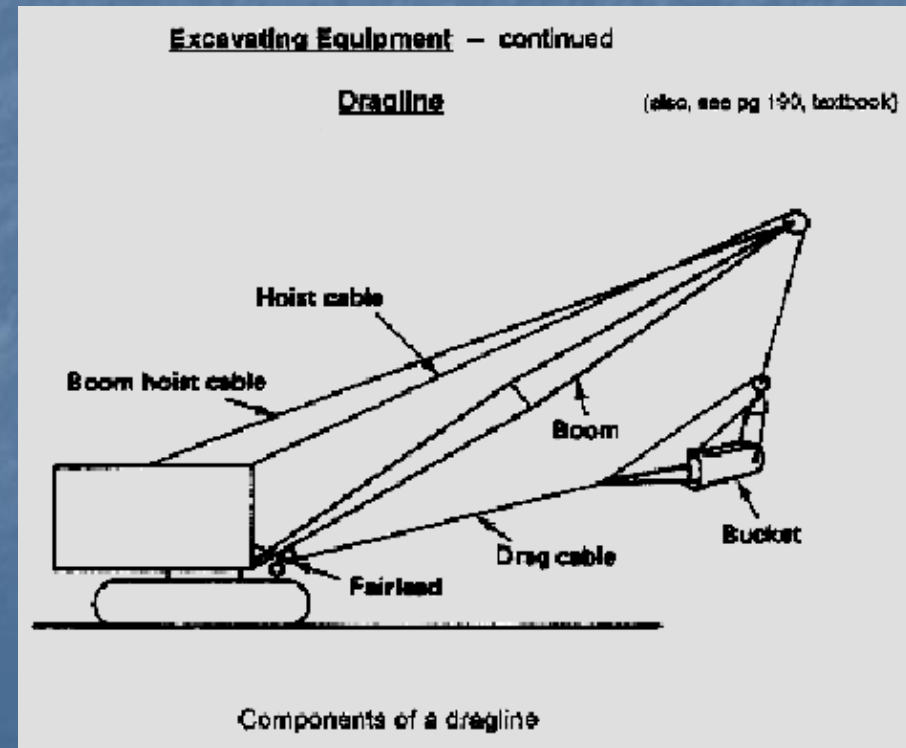
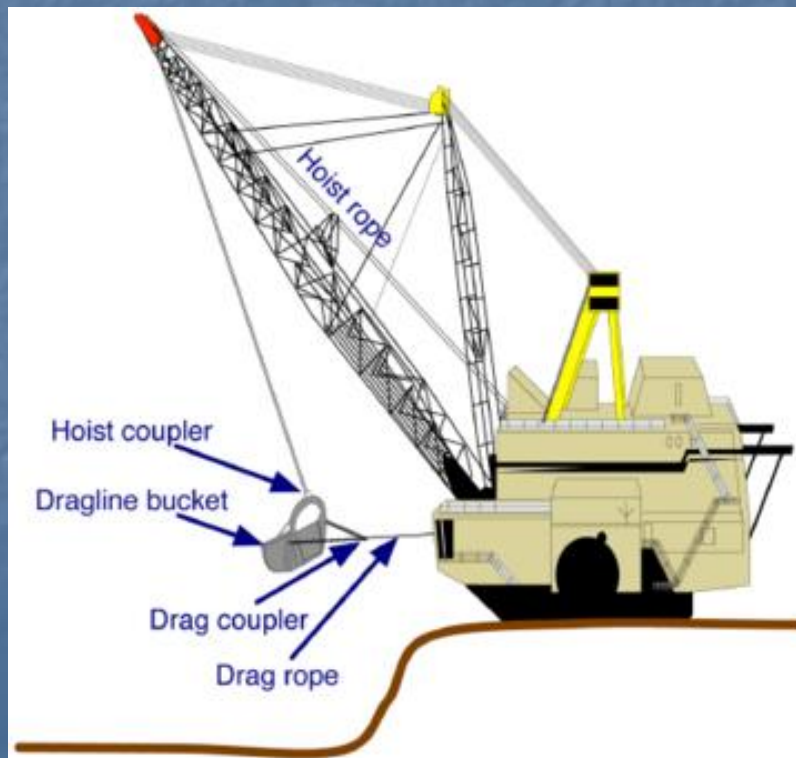


- Subject: Advanced Building Construction & Services
- Topic: Excavation Tools
- Presented by: Balraj Marjara

DRAGLINE EXCAVATION SYSTEMS

Dragline excavation systems are [heavy equipment](#) used in [civil engineering](#) and surface [mining](#). In [civil engineering](#) the smaller types are used for [road](#) and port construction. The larger types are used in [strip-mining](#) operations to move [overburden](#) above [coal](#), and for tar-sand mining. Draglines are amongst the largest mobile equipment (not water-borne), and weigh in the vicinity of 2000 metric [tonnes](#), though specimens weighing up to 13,000 metric tonnes have also been constructed. A dragline bucket system consists of a large bucket which is suspended from a boom (a large [truss-like structure](#)) with [wire ropes](#). The bucket is maneuvered by means of a number of ropes and chains. The hoist rope, powered by large [diesel](#) or [electric motors](#), supports the bucket and hoist-coupler assembly from the boom. The dragrope is used to draw the bucket assembly horizontally. By skillful maneuver of the hoist and the dragropes the bucket is controlled for various operations. A schematic of a large dragline bucket system is shown below.



Operation

- In a typical cycle of excavation, the bucket is positioned above the material to be excavated. The bucket is then lowered and the dragrope is then drawn so that the bucket is dragged along the surface of the material. The bucket is then lifted by using the hoist rope. A swing operation is then performed to move the bucket to the place where the material is to be dumped. The dragrope is then released causing the bucket to tilt and empty. This is called a dump operation.
- The bucket can also be 'thrown' by winding up to the jib and then releasing a clutch on the drag cable. This would then swing the bucket like a pendulum. Once the bucket had passed the vertical, the hoist cable would be released thus throwing the bucket



Draglines in mining

- A large dragline system used in the [open pit mining](#) industry costs approximately [US\\$50-100 million](#). A typical bucket has a volume ranging from 30 to 60 cubic [metres](#), though extremely large buckets have ranged up to 168 cubic metres. [\[1\]](#) The length of the boom ranges from 45 to 100 metres. In a single cycle it can move up to 450 metric tonnes of material.
- Most mining draglines are not [fuel](#) powered like most other mining equipment. Their power consumption is so great that they have a direct connection to the [high-voltage](#) grid at voltages of between 6.6 to 22kV. A typical dragline, with a 55 cubic metre bucket, can use up to 6 Megawatts during normal digging operations



Limitations

- The primary limitations of draglines are their boom height and boom length, which limits where the dragline can dump the waste material. Another primary limitation is their dig depth, which is limited by the length of rope the dragline can utilize. Inherent with their construction, a dragline is most efficient excavating material below the level of their base. While a dragline can dig above itself, it does so inefficiently and is not suitable to load piled up material (like a [rope shovel](#) can).
- Despite their limitations, and their extremely high capital cost, draglines remain popular with many mines, due to their reliability, and extremely low waste removal cost.



- Designed for residential and short-run commercial service line work including gas, water, sewer, electric and communications lines, Ditch Witch pedestrian trenchers and plows are available for trenching two (0.6096 m) to four feet (1.2 m) deep or plowing one (0.3048) to two feet (0.6 m) deep.



- The compact line of Ditch Witch trenchers and plows are ideal for completing big jobs in small spaces. These small, maneuverable riding units are designed for residential utility installations and can trench to depths from 60 inches (1.5 m) to 80 inches (2 m) deep depending on boom length.



Designed for heavy-duty trenching, vibratory plowing and pavement cutting, the large line of Ditch Witch trenchers feature up to 185 hp (138kW) and can dig to 99 inches (2.5 m) and plow to 48-inch (1.2 m) depths for installation of mainline utilities.

CLAMSHELLS

- Clamshells. To achieve deeper digging depth, clamshell equipment must be used. A clamshell bucket is attached to a crane by cables. A clamshell excavator can reach digging depths of 15 m (50 ft) or more.
- **Excavation with a Clamshell**
- A clamshell bucket can be used for excavation to around 200 ft bgs. A cable-suspended mechanical clamshell is a crane-operated grabbing tool that depends on gravity for accurate excavation and closure of the grab (Figure 7-3). Therefore, a heavier tool is beneficial.

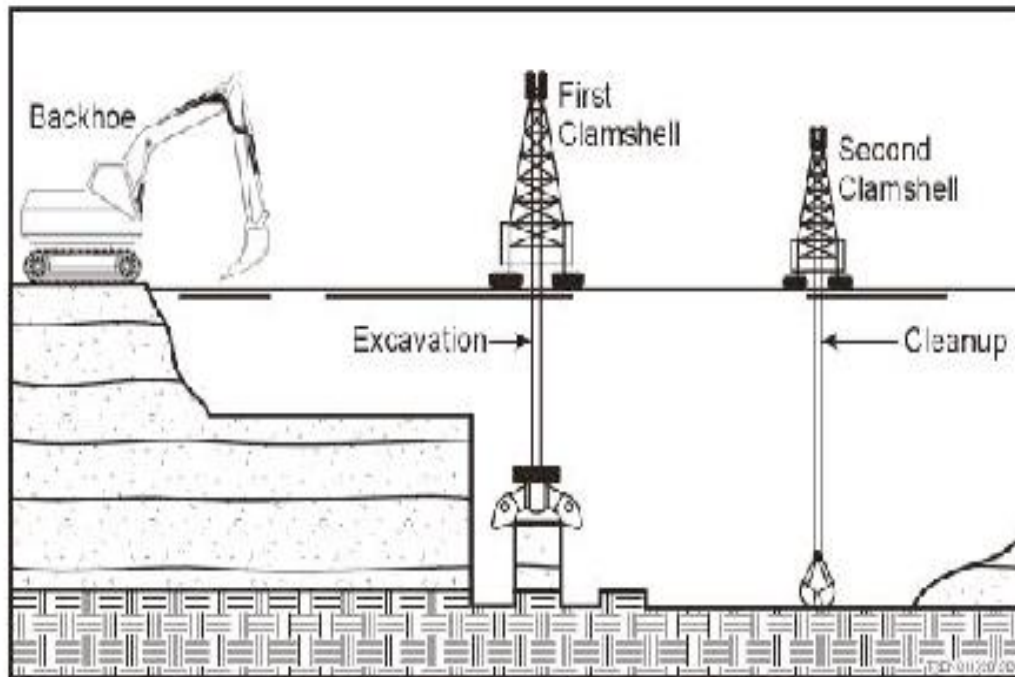


Figure 7-3. Trench Excavation Using a Clamshell and Backhoe



- Hydraulic clamshells can be equipped with a Kelly bar to help guide and control the vertical line in addition to providing weight.
- The verticality of the excavation is controlled by the repeated cyclic lifting and lowering of the bucket under gravity.
- Mechanical clamshells are preferred over their hydraulic counterparts because they are more flexible in soils with boulders, can reach greater depths, and involve fewer maintenance costs.
- Clamshell excavation is popular because it is efficient for bulk excavations of almost any type of material except highly consolidated sediment and solid rock.
- It also can be controlled and operated in small and very confined areas as long as the boom can reach over the trench. Clamshell excavation, however, has a relatively low production rate compared to a backhoe. Also, worker safety can become an issue during clamshell excavation.

