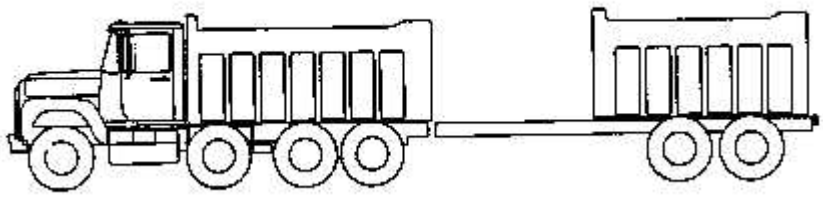


a. **Trucks**

> "**Truck, Dump, 10cy, t/a with drop axle**", describes a typical diesel powered truck, equipped with a dump box capable of transporting 10 cubic yards of material, having two powered rear axles, mounted in tandem, with another axle and pair of non-powered wheels which are deployed when loaded. The **Drop Axle** configuration allows significantly greater loads to be carried than on non-equipped trucks, however, when turning, these wheels tend to dig in, decreasing maneuverability and increasing the truck's turning radius.

A typical unladen weight, or **tare**, of a solo truck, t/a, with drop axle, is about 25,000# lb. A typical **maximum gross weight** is about 57,000lb, leaving a **payload** of about 32,000lb. Capacities are given in short tons of 2000 pounds. These figures may vary considerably between two trucks of similar configuration.

Dump boxes are available in various sizes and are constructed of either steel or aluminum. Trucks with aluminum boxes are lighter in construction and usually haul dirt, sand, gravel and smaller rock. Steel boxes are heavier and more durable than aluminum and able to withstand the repeated impacts of loading and transporting large rock. Wooden box linings are sometimes installed to reduce damage from loading. Sideboards, also constructed of wood, can be added to increase the capacity of a box when hauling light or bulky materials such as mulch, topsoil or oyster shells.

The **Rock Gate** consists of an inclined metal ramp attached to the rear of the Dump Box. This feature allows the transportation and dumping of large rock (riprap) which cannot pass through a tailgated opening.
The **Tailgate** is a metal door, hinged at the top, which can be set to varying opening widths with chains, allowing controlled passage of smaller material. This allows even spreading of materials such as small rock, quarry spalls, gravel or sand.

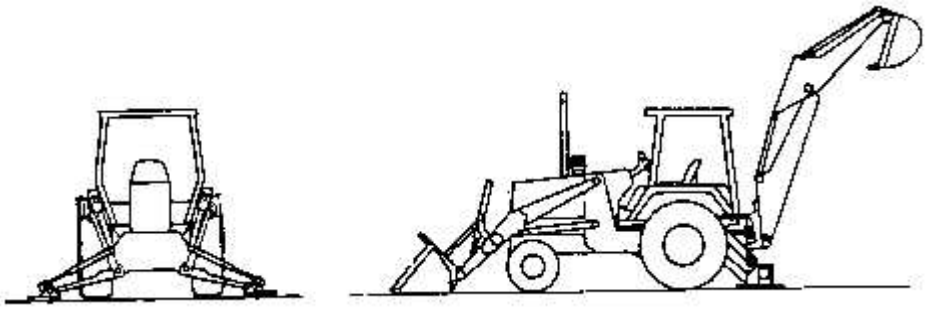
Trailers, often called " **pups** " can be pulled behind the dumptruck, adding another 7-10 cy capacity. These trailers are connected to the truck by an extendable boom, which allows the trailer to be dumped while still attached. In a variation, the payload may be carried in a removable box contained within the trailer. This box is also configured to fit within the truck's box. On site, the driver uncouples the trailer, unloads the truck's box and returns to load and dump the trailer's box. The length of dumptruck-trailer combinations reduces maneuverability, precluding the use of "**Truck & Pup**" combinations on some sites.

Dump trucks equipped with suitable hitches may also be used to pull towable equipment such as generators or **Tilt Trailers** which are capable of transporting smaller dozers, roller compactors or rubber-tired backhoes.

A formula has been developed by Contracting Division and OD-EM to address the selection of trucks with tandem and drop axles and tandem axle-only trucks. In summary, trucks with drop axles can carry more material per load than those without, therefore, fewer trips and less time are necessary to transport an equivalent amount of material. Haul distance and materials requirements may also determine truck selection criteria.

In general, these needs can be addressed by including the requirement to transport a **16 ton, or 32,000 lb net payload**.

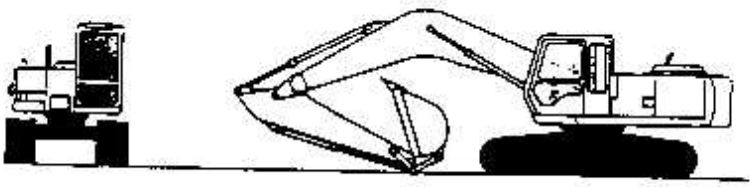
Late model-year (no more than 5 years old) trucks are generally preferred due to the increased overall performance and reliability of newer vehicles.



b. **Backhoe/Loaders**

> "**Backhoe, r/t, with loading and digging buckets**" refers to a small, multipurpose tractor with rubber tires (may be either 2 or 4 wheel drive) a **forward mounted general purpose bucket** of about 1 to 2 cy capacity and a **rear mounted, articulated boom and digging bucket** of about 0.3cy, suitable for excavating small holes and trenches. A typical rubber-tired backhoe used for small earthmoving and minor excavations would be a Case 580 series, however equivalent capabilities may be obtained with a John Deere 510 or machines of similar size and power manufactured by Kubota, Caterpillar, Ford and others.

Depending upon the location and application, a variety of options, such as an Extend-a-boom, which allows a greater reach than the standard 14' 4", vibratory compactor head, hammer or 4-wheel drive, may be specified. A **groundsman** may also be required on some sites to locate hazards and otherwise assist the excavator operator.



c. **Hydraulic Excavators**.

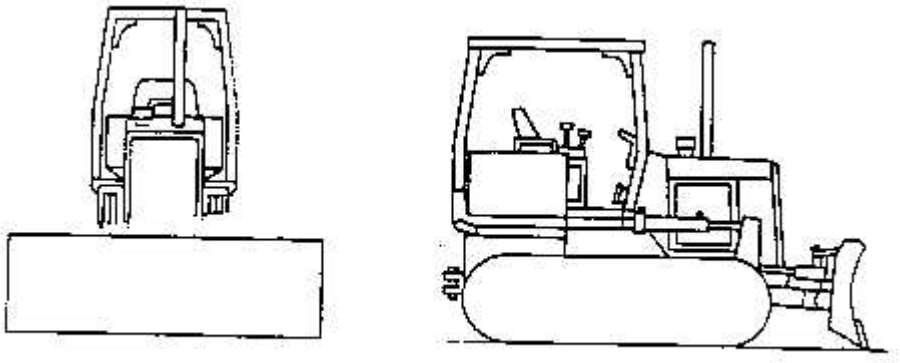
> "**Hyd Exc, John Deere Model 892**" describes a typical, medium-large sized, 220hp diesel-powered, track-mounted hydraulic excavator, weighing about 75,000lbs. An equivalent machine, the Caterpillar 235, has 250hp and weighs about 93,000lb. These machines, sometimes referred to as "**Trackhoes**" are often used for excavation and placement of rock. Smaller and larger excavators are available, ranging from 3250 lbs for a small compact 13.5hp unit such as a "Bobcat" with a 0.05 cy bucket to the John Deere 992E-LC, with 285hp, weighing 97,600 lb, which may carry up to a 4.18 cy bucket.

Hydraulic excavators are used to remove and load overburden or debris and excavate areas which are too large or too deep for the rubber-tired backhoe. Materials placement with this equipment can be extremely accurate, with the capability to place and adjust individual rocks around vegetation or other features.

Attachments. A principal selection factor for hydraulic excavators is **Boom** length and reach, which determines the ability of the machine to perform work from available access.

Buckets vary in size and configuration, i.e. with or without teeth and range from 1/4cy up to about 4cy capacity. Use of a "**Thumb**" allows the excavator operator to grasp and carry objects such as individual rocks, tree trunks and debris up to several thousand lbs. **Hydraulic compactors, Hammers, Drills** and numerous other attachments including **Wrists and Brusher heads** may also be fitted.

Late-model hydraulic excavators, (less than five years old), generally provide greater reliability, speed and efficiency than older, less sophisticated models.

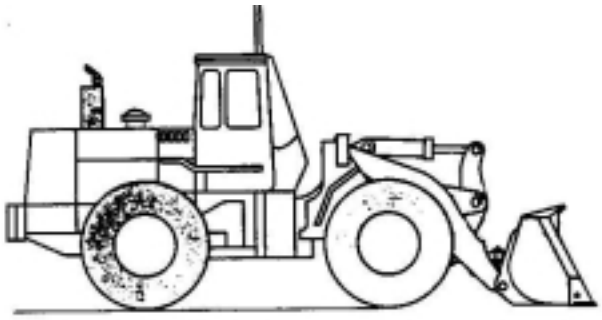


d. **Crawler Tractors/Dozers.**

This category of equipment includes "**Bulldozers**", "**Cats**", or similar tracked vehicles that are usually equipped with a front mounted blade and accessories including a rear mounted winch and/or several digging teeth (rippers).

Horsepower requirements for most dozers used by EM usually range between 74 and 105 hp. Given equivalent horsepower and equipment, a D4D Caterpillar may be interchanged with a Model 550 John Deere or Case Model 880.

Attachments. Dozer requirements typically include a 8' wide, **6-way Blade**. A six-way blade, capable of hydraulically adjusting tilt, angle and lift, is often used for removing overburden, spreading materials, and grading surfaces; a **Winch**, consisting of a powered reel with a length of steel cable, can be used for the extraction and towing of trucks and other equipment.

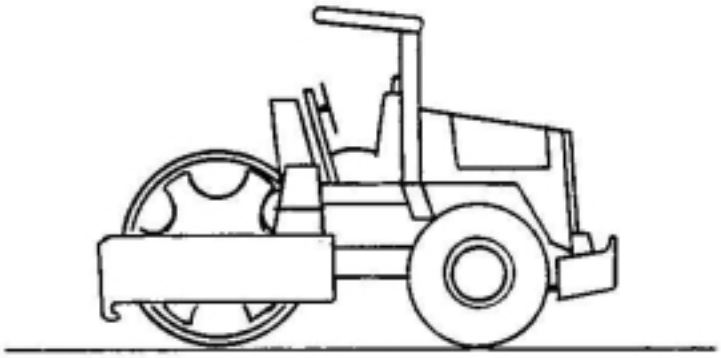


e. **Frontend Loaders**

Frontend Loaders are highly maneuverable, rubber-tired vehicles used to dig, transport and load materials onto trucks, barges or within a limited area such as a quarry, wharf or jobsite.

A typical **Frontend Loader**, the Caterpillar 966, is rated at about 125hp, weighs about 30,000lb and is most often equipped with a straight-edged **bucket** with a capacity of about 3cy. Larger machines may use a tooth-edged bucket up to 5cy which could be specified to break up materials or exclude smaller materials from a load.

Numerous accessories such as Forks, booms, sweepers and snowplows may also be attached. Frontend loaders are usually four-wheel drive, ranging between 125 and 250hp and articulated, or hinged amidships, which increases manuverability in confined work areas. Frontend loaders usually work at materials transshipment points, loading trucks from stockpiles or transporting and stockpiling material for rehandling by a **hydraulic excavator.**

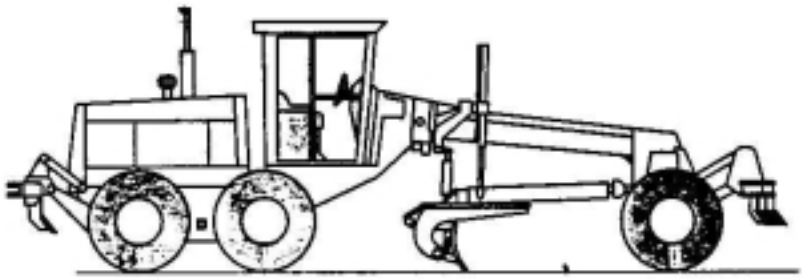


f. **Compactors.**

> Generally self-propelled, diesel-powered machines which mount one or two large metal drums. Compactors smooth and increase the density and stability of a structure utilizing the weight of the machine and an **integral hydraulic vibrator** to compress multiple lifts of materials such as silt, sand, clay, gravel and asphalt into a solid cohesive structure.

Dry conditions may require the use of a **Water Truck** (a truck with large water tank, fill connections and nozzles) to provide suitable compaction for some materials. Wet conditions may require that the vibratory feature be disconnected in order to reduce "pumping" of moisture to the surface.

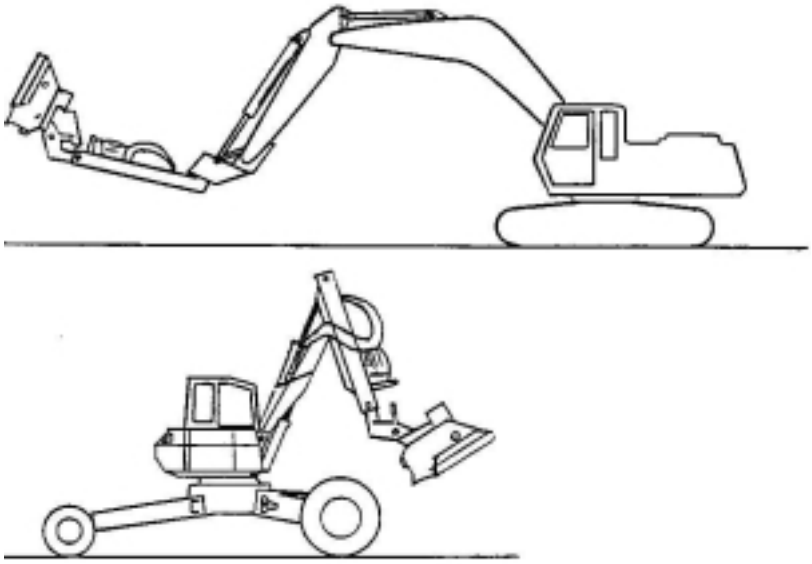
Compactors are usually sized by tonnage and drum characteristics, from less than 5-tons, with a drum 39 to 52 inches wide to a "10-ton, single-drum, Vibratory Compactor, 72-inches in width " commonly specified for use in levee rehabilitation, bank protection, small road construction and similar projects. Compactors may range up over 11 tons with single or double drums and up to 84 inches in width, the widest commonly available size.



g. **Graders**.

Roadgraders, or Grader, Motor Patrol, range from small, parking lot sized "Athey" machines to the large land-leveling graders used to construct airport runways and shopping malls. Equipment selection is usually determined by the size of the work area and distances involved. **Horsepower** and/or **Blade size** requirements will usually be specified.

Following placement and spreading of materials by truck and dozer, a compactor prepares a smooth, solid surface slightly higher than the finished elevation. The **Grader** then scrapes a thin layer of material from the surface, sloped to direct water runoff, to the final elevation.



h. **Brushers.**

Vegetation maintenance often requires use of specialized equipment. The Stillaguamish and Puyallup River authorized projects for example, have been maintained for several years (by D&M Construction, Montesano, WA) using a proprietary, **hydraulic brusher-head attachment** which mounts on both rubber-tired and track-mounted hydraulic excavator chassis. The brusher

head consists of a 400lb metal disc, with rows of replaceable carbon steel teeth, which spins at several hundred rpm at the end of the boom and arm. The **Boom** may be extended over the bank to a distance of about 39' and may be tilted and angled with great accuracy and speed, making this type of equipment the preferred choice for areas requiring selective vegetation maintenance.

A **Groundsman** is usually specified to accompany this equipment. This person may operate the truck and trailer to transport the machine, assist the operator by cutting and choking larger trees, spot for the machine operator in close quarters, sharpen teeth and provide other machine support functions.

Mobilization and Demobilization.

The transportation of equipment to the jobsite often requires specialized hauling equipment and procedures. The costs are usually reflected in requisitions as "**Mob and De-Mob**".

Equipment is often transported on "**Low Boys**", specialized trailers constructed with a lowered center section to carry large construction equipment such as backhoes, dozers and hydraulic excavators.

When loaded, the trailer and equipment must be less than 10' wide to travel unescorted, otherwise marker cars are required.

The equipment contractor usually hires transporters, however, for large projects requiring multiple equipment movements, one or more tractor/trailer combinations may be hired by the COE for use by contractors.

Mobilization and Demobilization may be addressed as one or two separate item costs, which vary with time and haul distance. Such costs are usually written into requisitions as lump sum (l.s.) charges, which are usually authorized for payment upon 1) delivery to the site, "Mob", and 2) on the final invoice, "Demob"), although both may sometimes appear on a single billing.

Mobilization/demobilization costs for the abovementioned equipment vary, depending on times and distances involved.