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SCHOOL OF ENGINEERING & TECHNOLOGY
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Construction Equipments & Techniques –Trucks, Wagons & Dumpers

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Subject: Advanced Construction Equipments

Construction Equipments & Techniques

Trucks

Wagons

Dumpers

Trucks

Hauling units

- Low cost –owning as well as operating
- High travel speed
- Most of them can be hauled on road

Classification of Trucks

- Type of frame : Rigid, Articulated.
- Method of dump : Rear, bottom or side
- Kind of drive : 2,4,6 wheeled drive.
- Capacity (in tonnes or in volume).
- Highway & Off-Highway Trucks

Types of frame

Rigid

Dumping unit & tractor acts as a single unit.

Articulated

Has an articulated joint & oscillating ring between tractor & dumper which permitts all wheels to maintain contact with ground at all times.

Types of trucks

Rigid frame truck

Articulated frame truck

Additional features of an Articulated truck

- High Clearance.
- Low pressure, wide & extra-rib tyres – capability to move through soft or sticky ground.
- Can navigate on grades upto 35 %.
- Dump angle upto 72 deg within 15 seconds.
- Ejector may be attached sometimes for unloading sticky material.

Articulated truck

Articulated truck

Method of dump

- Rear dump

  Used when material to be hauled is free-flowing or has bulky components.

- Side Dump

  Used when some side banking work is to be done.

Method of dump

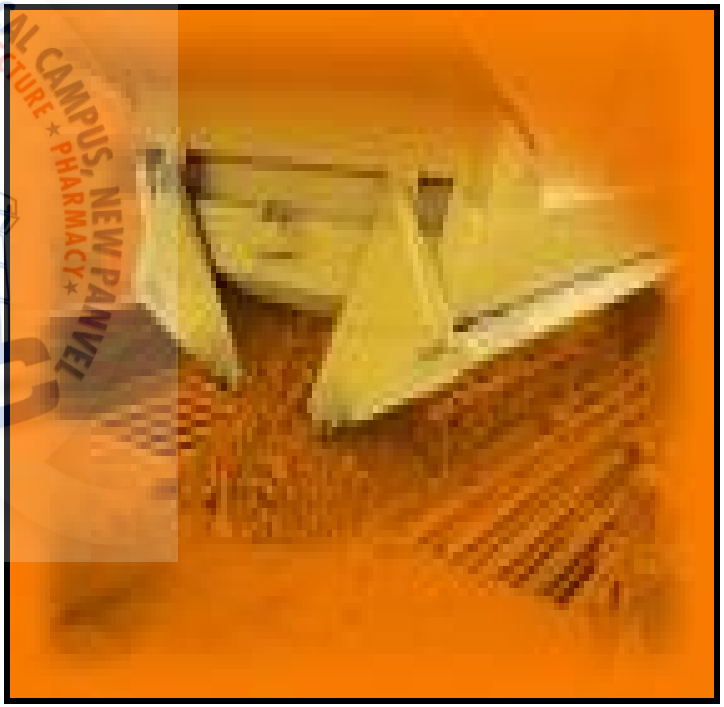
- Bottom Dump

  used when:

  - material is free-flowing.
  - Loading & dumping sites are unrestricted.

- Door arrangement is similar to clamshell.
- Reduce unloading time.
- Cannot be used on grades steeper than 5 %

Bottom dump trucks



Rear dump truck

Side Dump truck

Capacity of a truck

Expressed in 3 ways :

- Gravimetric – Load carried (kgs)
- Struck volume – Volume it can enclose when filled with water.
- Heaped volume – volume it can enclose when heaped on a 2H:1V slope above the body.

Capacity of a truck

- Volume that can be carried depends upon :

i) Type of Material. (Permissible slope & unit weight of material)

ii) Quality of roads/Tyres.

Rear dup truck failure due to overload during dumping

Capacity of a truck

- Sideboards may be added to increase volumetric capacity.But,the increment should’nt exceed the safe carrying capacity of the truck.
- Proper maintenance of tyres increases capacity of trucks. (Tyres are about 35 % of a truck’s operating cost).

Productivity of a truck

It depends on :

- Size of load.
- Number of trips per hour (which further depends upon cycle time).
- CYCLE involves

Load-Haul-Dump-Return.

Productivity of a truck

- Load Time – Relative Size of Excavator Bucket & Truck.

Dump time – Function of Type of Equipment & conditions in Dump Area.

Productivity of a truck

- Haul Time & Return Time

  Both Depend upon the Weight of Filled Vehicle, Engine Capacity, Haul & Return Distance, Type of Terrain & Condition of Road.

Truck should have a minimum capacity of 4 to 5 times the capacity of excavator Bucket.

Calculating Truck Production

i) Number of Bucket Loads = $\frac{\text{Truck Capacity}}{\text{Bucket Capacity}}$

ii) Load Time = No of Buckets * Bucket C.T

iii) Volumetric Truck Load (VTL)

= No of Bucket Swings * Volume of Bucket.

(VTL * Unit weight of material excavated) should always be less than the gravimetric truck load.

Calculating Truck Production

- Haul time = (Haul Distance/Haul Speed[#])

#Haul speed depends on type of Truck, its specifications, road resistance, Type of material, total load, type & slope of terrain, Weight of Vehicle & load.

Calculating Truck Production

- Return time[#] = (Return Distance/Ret. Speed)

#This is less than haul time as the machine is empty.It may be more if during return, the journey is uphill.

Calculating Truck Production

- No of Trucks required

$$= \frac{\text{Truck cycle time (min)}}{\text{Loader cycle time (min)}}$$

- Production (m^3/hr)

$$= \text{Truck load } (m^3) * \text{No of Trucks} * \frac{60 \text{ minutes}}{\text{(Truck cycle time (min)}}$$

Variations required on site

- Grade of Haul Road
  - While hauling downhill, sideboards may be added to increase hauling capacity.
  - While hauling uphill, Size of load or travel speed may be reduced, which may increase the cost of hauling.

Variations required on site

- Quality of road & Tyres
  - On Earthern roads sprinkling of water will not only compact the road but also reduces rolling resistance & improves visibility.
  - Life of tyres is increased due to the cooling effect of moisture.

Variations required on site

- Grade of Haul Road
  - While hauling downhill, sideboards may be added to increase hauling capacity.
  - While hauling uphill, Size of load or travel speed may be reduced, which may increase the cost of hauling.

Variations required on site

- Idle time should be reduced.
- Proper tyre pressure should be maintained. Reduction in air pressure increases the contact area producing additional deformation of the tyre.