



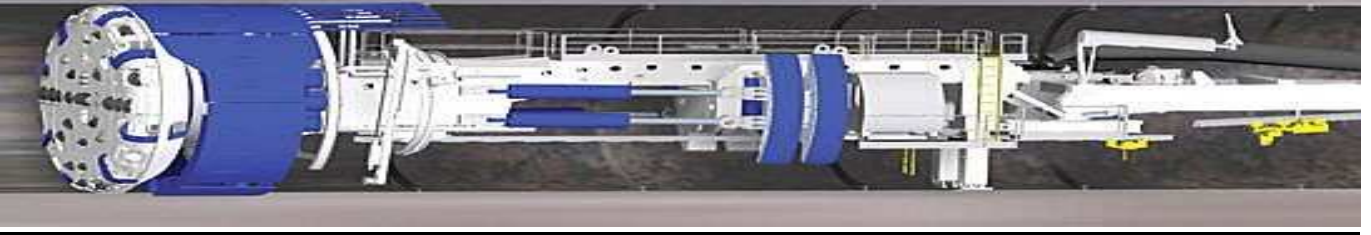
GOVERNMENT OF INDIA

भारत सरकार

MINISTRY OF RAILWAYS

रेल मंत्रालय

COMPENDIUM OF CONSTRUCTION EQUIPMENTS



Works Directorate

कार्य निदेशालय

Research Designs And Standards Organisation, Lucknow - 226011

अनुसंधान अभिकल्प और मानक संगठनए लखनऊ - 226011

अअमासं RDSO
रेल अग्रदूत Transforming Railways
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Foreword

The only constant in today's world, is Change.

Progression of technology, has redefined work methodology in most areas. Indian Railways, being a technology intensive organization, has been in the midst of sweeping technological advancements. The labor-intensive, construction activities have also witnessed technological upgradations, with most manual activities, being replaced with mechanized means. Mechanization, by adopting several tools, machines or equipment, has been achieved in the fields of excavation, concreting, element launching or transportation in the Construction domain.

Increased mechanization & technology deployment has resulted in a wide plethora of construction equipment of varying design, capacities or capabilities being employed. Owing to the wide spread of construction activities, the knowledge assimilation about the deployed technology-tools is thin & mostly missing. As a step towards this assimilation, I am glad that the Works directorate of RDSO has prepared a *Compendium of Construction Equipments*, used globally.

I am sure, the effort of RDSO in compiling the information, shall be of utmost use to Zonal Railways & professionals employing construction technology. Although all efforts have been put-in to ensure a thorough, professional compilation, we at RDSO, look forward to all suggestions for improvements, because, as they say:

Knowledge has its limit, learning is limitless.....

20th October'2010

(K.B.L. Mittal)
Director-General
RDSO, Lucknow

PREFACE

With the development of technologies and availability of various types of construction machineries, its use in construction industries is increasing day by day. All the Zonal Railways are using the machineries in different projects. Hence there is a need to share the experiences and availability of machineries so that other Zonal Railways can also use the same when ever required in a particular situation. This issue was discussed during CAO/PCE conference held at Delhi on 10/11.5.2010 and it was desired by Board that details of various type of machineries should be collected by Works Dte. of RDSO and circulate the same to all Zonal Railways.

This Compendium of Construction Equipments is based on literature survey & internet search and experience of engineers. Web addresses of construction equipments, wherever available have been provided to make this compendium more useful for field engineers.

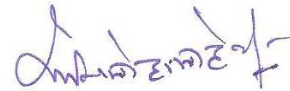
The compendium contains 16 chapters. The details in compendium will be helpful to field engineers in deciding the most appropriate choice of equipment and quick search of its availability from given web addresses.

Officers of RDSO associated with preparation of this compendium are:-

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A valuable assistance has been given by shri Phool Chand Meena, SE/D & Shri Pritam Kumar, SRE in preparing this compendium.

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(S.M. Maheshwari)
Executive Director/Works
RDSO, LUCKNOW

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1.0 SURVEYING EQUIPMENT

1.1 Theodolites

A theodolite is an instrument for measuring both horizontal and vertical angles, as used in triangulation networks. It is a key tool in surveying and engineering work, particularly on inaccessible ground. A modern theodolite consists of a movable telescope mounted within two perpendicular axes—the horizontal or turn-on axis and the vertical axis. When the telescope is pointed at a desired object, the angle of each of these axes can be measured with great precision, typically on the scale of arc seconds.



Fig.1 Theodolites

1.2 Total Stations

A total station is an electronic/optical instrument used in modern surveying. The total station is an electronic theodolite (transit) integrated with an electronic distance meter (EDM) to read distances from the instrument to a particular point where an assistant staff holds reflector. **Robotic total stations** allow the operator to control the instrument from a distance via remote control. This eliminates the need for an assistant staff member as the operator holds the reflector and controls the total station from the observed point.



Fig.2 Total Stations

1.3 Automatic level

It is an instrument to take levels of any surface. Good level instrument shall have property of automatic horizontal adjustment of the line of sight, an erect figure and a horizontal circle of 0 - 360° and large ribbed control buttons to simplify the adjustment of the instrument. The compensator shall be magnet damped, so that after the instrument has been set almost horizontal, the line of sight can be carefully leveled using the automatic compensation mechanism.



Fig.3 Automatic level

1.4 Abney Levels

A Topographic Abney Level is an instrument used in surveying which consists of a fixed sighting tube, a movable spirit level that is connected to a pointing arm and a protractor scale. The Topographic Abney Level is used to measure degrees, percent of grade, topographic elevation and

chainage correction. By using trigonometry the user of a Topographic Abney Level can determine height, volume and grade. The Topographic Abney Level is used at the eye height of the surveyor and is best employed when teamed with a second surveyor of the same eye height. This allows for easy sighting of the level and greater accuracy.



Fig.4 Abney Levels

1.5 Measuring wheel

A surveyor's wheel, also called a click wheel, odometer, way wiser, trundle wheel, measuring wheel or perambulator is a device for measuring distance. The meter can be calibrated and has a measuring range of 9999.99 m and can be read-out in cm. The tolerance is below 0.02%. The counting mechanism is driven without vibrations.



Fig.5 Measuring wheel

1.6 Ground plate

Available in the market are strikingly colored ground plates for stable positioning of the leveling staves.

1.7 Field umbrella

It is an umbrella for protecting of the level from obstructing light. Large diameter with carrying bag, dismountable poles and guy ropes.

1.8 Tri-partite aluminium ruler

The aluminium ruler is used for accurate measuring in mm of the planeness of bare surfaces such as asphalt, concrete, gravel, floors of sports accommodations, etc. The aluminium ruler comes in three parts and is supplied inclusive measuring wedges and carrying bag. The overall length measures 3 meter, the range is 1-20 mm and the accuracy is 0.3 mm.

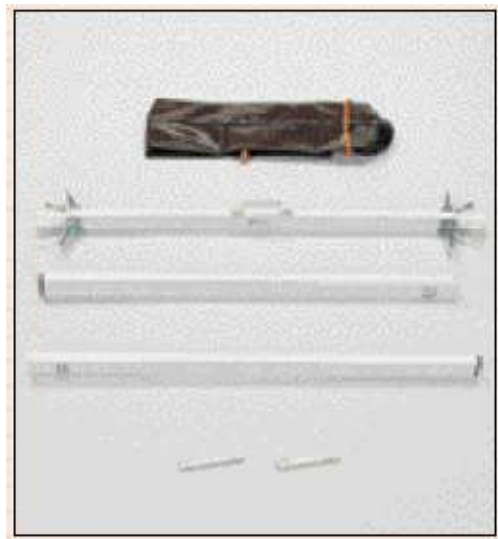


Fig.6 Tri-partite aluminium ruler

1.9 Clinometer

Clinometer is an instrument for measuring angles of slope (or tilt), elevation or inclination of an object with respect to gravity. It is also known as a tilt meter, tilt indicator, slope alert, slope gauge, gradient meter, gradiometer, level gauge, level meter, declinometer and pitch & roll indicator. Clinometers measure both inclines and declines.

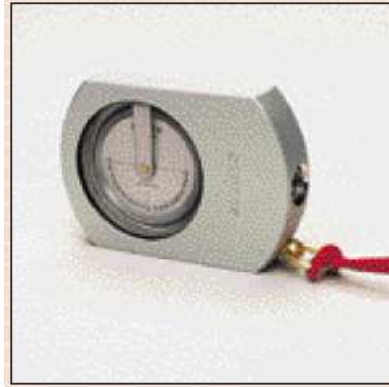


Fig.7 Clinometer

1.10 Global Positioning System

For accurate navigation in the field applying the Global Positioning System (GPS). Which uses satellite signals is used for navigation. GPS are available in market as a manageable, lightweight, waterproof (and floating) instrument with a clearly readable LCD-screen. These equipment works on principle of navigation.

Navigation using up to 12 satellites, WAAS enabled (Wide Area Augmentation System = System of satellites and ground stations that provide GPS signal corrections), memory for up to 500 landmarks and 50 routes. These equipments have built-in database showing the location of towns and cities and have large user friendly control buttons and menu controlled software. They have accuracy for position <15 meters. The accuracy of position can be increased to within 3 meters applying WAAS.



Fig.8 Global Positioning System

1.11 Planimeters

The planimeter is a drafting instrument used to measure the area of a graphically represented planar region. The region being measured may have any irregular shape, making this instrument remarkably versatile. Mechanical and Electrical (Digital) Planimeters are excellent area measuring tools to use measure irregular shaped areas on plans or drawings.



Fig.9 Planimeters

1.12 Compasses

A compass is a navigational instrument for determining direction relative to the Earth's magnetic poles. It consists of a magnetized pointer (usually marked on the North end) free to align itself with Earth's magnetic field. A compass is any magnetically sensitive device capable of indicating the direction of the magnetic north of a planet's magnetosphere. The face of the compass generally highlights the cardinal points of north, south, east and west.

Compass is used to measure horizontal angle from north-south direction. The equipment should have underlying mirror which allows very simple sighting with a high accuracy of 1degree. The needles shall be rotating on a sapphire bearings in antistatic fluid with adjustable declination scale.



Fig.10 Compasses

1.13 Flagging

Flagging (tape), a colored non-adhesive tape used in marking objects.



Fig.11 Flagging

1.14 Surveyors Measuring Rope

Surveyors Measuring Rope with strap makes for an ideal drag-chain for rough surveying measurements.



Fig.12 Surveyors Measuring Rope

1.15 Surveying Tripods

A surveyor's tripod is a device used to support any one of a number of surveying instruments, such as theodolites, total stations, levels or transits.



Fig.13 Surveying Tripods

1.16 Tribrachs

A tribrach is used to iteratively and simultaneously realize the dual requirements placed on a theodolite mounted for measurement over a benchmark: that it be centered and levelled. Usually the tribrach also contains a forced centering mechanism, allowing the theodolite to be replaced by a target, optical plummet or other instrument to the same position with sub-mm precision, by just loosening and re-tightening a locking screw.



Fig.14 Tribrachs

1.17 Hand Level

The Hand Level is a small, economical level for use with preliminary surveys to determine traveler way or cableway steel work elevations and other feasibility type site reconnaissance work.



Fig.15 Hand Level

1.18 Measuring tape

A tape measure or measuring tape is a flexible form of ruler. It consists of a ribbon of cloth, plastic, fiber glass or metal strip with linear-measurement markings. It is a common measuring tool. Its flexibility

allows for a measure of great length to be easily carried in pocket or toolkit and permits one to measure around curves or corners. Surveyors use tape measures in lengths of over 100 m (300+ ft).



Fig.16 Measuring tape

1.19 Plumb Bobs

A plumb-bob or a plummet is a weight, usually with a pointed tip on the bottom, that is suspended from a string and used as a vertical reference line or plumb-line. It is also used in surveying to establish the nadir with respect to gravity of a point in space. They are used with a variety of instruments (including levels, theodolites and steel tapes) to set the instrument exactly over a fixed survey marker or to transcribe positions onto the ground for placing a marker.



Fig.17 Plumb Bobs

Contacts:

1. <http://www.acquavirinternational.com/surveying-equipments.html>
(Mumbai)
2. <http://www.khukriwala.com/marine-instruments.html> (Dehradun)
3. <http://www.laboratory-testing-instruments.com/> (Delhi)

2.0 EARTH EXCAVATORS

Excavators are heavy equipment consisting of a boom, bucket and cab on a rotating platform (known as the "house"). The house sits atop an under carriage with tracks or wheels. All movement and functions of the excavator are accomplished through the use of hydraulic fluid, be it with rams or motors.



Fig. 1 A Typical Modern Excavator

TYPES OF EXCAVATOR:

- **COMPACT EXCAVATOR**
- **CRAWLER EXCAVATOR**
- **WHEELED EXCAVATORS**
- **BACKHOE LOADER**
- **DRAGLINE EXCAVATOR**
- **BUCKET WHEEL EXCAVATOR**
- **LONG REACH EXCAVATOR**

- **POWER SHOVEL**
- **SUCTION EXCAVATOR**

Excavators are used in many ways:

- Digging of trenches, holes and foundations
- Material handling
- Brush cutting with hydraulic attachments
- Forestry work
- Demolition
- General grading/landscaping
- Heavy lift, e.g. lifting and placing of pipes
- Mining, especially, but not only open-pit mining
- River dredging
- Driving piles, in conjunction with a Pile Driver

1. Compact Excavator

A **compact** or **mini excavator** is tracked or wheeled vehicle with an approximate operating weight from 0.7 to 7.5 tons. It generally includes a standard backfill blade and features independent boom swing.

Hydraulic Excavators are somewhat different from other construction equipment in that all movement and functions of the machine are accomplished through the transfer of hydraulic fluid. The compact excavator's work group and blade are activated by hydraulic fluid acting upon hydraulic cylinders. The excavator's slew (rotation) and travel functions are also activated by hydraulic fluid powering hydraulic motors.



Fig. 2 A Kubota compact excavator

2. Crawler Excavator

- **Mini-Crawler Excavator (2700kg - 5000kg)**

With a wide range of available sizes and features like Power Tech engines, zero-tail-swing, offset boom, multiple attachments and ultra-comfortable operator stations, there's excavator to fit every job. Hydraulic management system, which helps by balancing hydraulic pressure and flow and sensing when extra power is needed without draining other systems. Operating weights range from 1,730 kg–76,450 kg.



Fig. 3 Mini-Crawler Excavator

- **Heavy Crawler Excavator (Operating Weight 40,000kg – 80,000kg)**

Crawler excavator gets the job done with muscle, control and peerless productivity. Efficient, cool-running engines and enhanced hydraulics make these the most-reliable and hardest-working excavators yet. Climb into one of these best-in-class cabs and unleash a mighty workhorse to tackle toughest jobs.



Fig. 4 Heavy Crawler Excavator

3. Wheeled Excavators

Wheeled excavators easily navigate streets and hard surfaces to deliver powerful bucket forces in well-balanced, high-stability machines. Even with all that muscle outside, operators find quiet comfort inside spacious air-conditioned cabs. Low-effort levers deliver smooth boom and bucket control.



Fig.5 Wheeled Excavators

• **Compact Wheeled Excavator:**



Fig.6 Compact Wheeled Excavator

Features:

- Operating Weight 11-12t
- Engine Power 67kw(91hp)
- Bucket capacities 130-410l
- Dig Depth 4315mm with 2 piece articulated boom
- Total width with twin tyres 2500mm

• Mobile Wheeled Excavator

Fig.7 Mobile Wheeled Excavator

Features:

- Operating Weight: 18.5 - 20 t
- Engine Power: 134 kW (182 HP)
- Engine: Deutz BF6M2012C, 6-cylinder liquid-cooled turbocharged diesel engine, 2000 r.p.m. Bucket Capacity: 0.53 - 1.34m
- Max. Digging Depth: 5.85m
- Computer load limit control with AWE 5 system and 2 variable output pumps max. 420, max. 420l / min.

4. Backhoe loader

Backhoe loader, also called a loader backhoe and commonly shortened to backhoe, is a heavy equipment vehicle that consists of a tractor fitted with a shovel/bucket on the front and a small backhoe on the back. Due to its (relatively) small size and versatility, backhoe loaders are very common in urban engineering and small construction projects (such as building a small house, fixing urban roads, etc).



Fig.8 Backhoe loader

- **Other Backhoe Loader:**

Backhoe loaders deliver versatility and power in a cost-efficient package, whether placing pipe, busting up blacktop or digging deep. Each model features excavator-style boom, bucket and hydraulics. Crowd power, swing torque and boom and dipper stick lift are impressive and high-pressure hydraulics are powerful and quick. Easy-to-operate controls smoothly blend functions. Horsepower ranges from 41 to 118 (30.6 kW–88 kW), with digging depth from 14' 3" to 17'10" (4.34 m–5.44 m).



Fig.9 Backhoe Loader

5. Dragline Excavator

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 ever built on land, and weigh in the vicinity of 2000 metric tons, though specimens weighing up to 13,000 metric tons 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.



Fig.10 Dragline Excavator

6. Bucket-Wheel Excavators

Bucket-wheel excavators (BWEs) are heavy equipment used in surface mining and civil engineering. The primary function of BWEs is to act as a continuous digging machine in large-scale open pit mining operations. What sets BWEs apart from other large-scale mining equipment, such as bucket chain excavators, is their use of a large wheel consisting of a continuous pattern of buckets used to scoop material as the wheel turns. They are among the largest vehicles ever constructed and the biggest bucket-wheel excavator ever built, Bagger 293, is the largest terrestrial (land) vehicle in human history according to the Guinness Book of World Records.



Fig.11 Bucket Wheel Excavator

7. Long Reach Excavator

The **long reach excavator** or **high reach excavator** is a development of the excavator with an especially long boom arm, that is primarily used for demolition. Instead of excavating ditches, the long reach excavator is designed to reach the upper stories of buildings that are being demolished and pull down the structure in a controlled fashion. Today it has largely replaced the wrecking ball as the primary tool for demolition.



Fig.12 Long Reach Excavator

8. Power Shovel

A **power shovel** (also **stripping shovel** or **front shovel** or **electric mining shovel**) is a bucket-equipped machine, usually electrically powered, used for digging and loading earth or fragmented rock and for mineral extraction.



Fig.13 Power Shovel

9. Suction Excavator

A **suction excavator** or **vacuum excavator** is a construction vehicle that removes earth from a hole on land or removes heavy debris on land, from various places, by powerful suction through a wide suction pipe which is up to a foot or so diameter. The suction inlet air speed may be up to 100 meters/second = over 200 mph.

The suction nozzle may have two handles for a man to hold it by; those handles may be on a collar which can be rotated to uncover suction-release openings (with grilles over) to release the suction to make the suction nozzle drop anything which it has picked up and is too big to go up the tube.

The end of the tube may be toothed. This helps to cut earth when use for excavating; but when it is used to suck up loose debris and litter, some types of debris items may snag on the teeth. The earth to be sucked out may be loosened first with a compressed-air lance or a powerful water jet.



Fig.14 Cleaning out a sewer manhole

Its construction is somewhat like a gully emptier but with a wider suction hose and a more powerful suction. Excavating with a suction excavator may be called "vacuum excavation" or "hydro excavation" if a water jet is used.

OTHER EXCAVATOR EQUIPMENTS

1. A) JCB Backhoe Loader (MIDI CX):-



JCB Backhoe Loader (MIDI CX)

- Purpose-built integrated chassis, designed to withstand construction cycles for a better longer-term investment than lighter weight tractor loaders.
- Fast travel speed (17.5mph/28kph) and compact size result in high machine utilisation around even the smallest sites
- 4-cylinder 50hp (37.3kW) engine, powerful breakout forces and anti-spill mechanism give superb loader performance
- Excavator design based on the 2CX provides excellent backfilling and grading performance
- Four wheel drive and rear limited slip differential provides maximum traction in arduous terrain

B) JCB ICX



Fig. JCB ICX

- The 1CX, at just 1.4 metres wide and with the ability to turn on its own axis, can be operated in virtually any environment.
- A low centre of gravity improves stability for safer operations.
- The 1CX backhoe comes with full side-shift capability and with a reach of over 3.38 metres.

C) JCB 4CX



Fig. JCB 4CX

- Ergonomic layout and smooth servo controls ensure easy operation and high productivity in a wide range of applications.
- JCB designed and built Power train for maximum reliability off-highway.
- Class-leading cab increases visibility, operator comfort and productivity.
- JCB Torque Lock results in up to 25% fuel saving and faster journey times.
- JCB Power slide hydraulically side-shifts the boom eliminating the need to manually move the backhoe during repositioning.

Contacts:

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 M: 0129-4299000
 delhi.marketing@jcb.com

2. Yanmar Construction (America)

Yanmar Co., Ltd. India Representative Office

Ocean Height K-4 Sector 18, Noida-210 301
 Uttar Pradesh, India
P 91.120.4313724
F 91.120.4313728

<http://www.transaxlemanufacturing.com>

ViO Series excavator

The "VIO" name means True Zero Tail Swing.

In 1993, YANMAR launched the world's first ZERO TAIL Swing excavator and is currently marketing the 4th generation model.

The "VIO" development objective of turning within the machine width has been successfully achieved, while still maintaining the stability and work performance of a conventional style units. Company have 7 models in the "VIO" ranging from 3,704 lbs through 17,530 lbs.

a) ViO17

Weight 3,836 lbs
Horsepower 13.5
Digging Depth 7'7"



(ViO17)

b) ViO20-3

**Weight 4,910 lbs
Horsepower 19.2
Digging Depth 8'7"**

c) ViO27-5

**Weight 6,460 lbs
Horsepower 21.6
Digging Depth 9'6"**

d) Vi035-5

Weight 7,850 lbs
Horsepower 28
Digging Depth 11'4"

e) Vi045-5B

Weight 10,121 lbs
Horsepower 38.7
Digging Depth 12'8

f) Vi055-5B

Weight 11,312 lbs
Horsepower 38.7
Digging Depth 13'8"

g) Vi075-C

Weight 17,530 lbs
Horsepower 58.2
Digging Depth 15'5



(ViO75-C)

3. Shandong Changlin Machinery Group Co., Ltd

- Fully insulated and sealed operator cabin
- Operator cabin is attached to the body with rubber viscous mounts to reduce noise and vibrations
- Sliding door window and opening glass skylight
- Highly effective airconditioning and heating system

Model Number	Bucket Capacity	Rated Power	Operating Weight
SC70.7	0.2m ³ ~0.37m ³	45kw	6800kg
SC80.7	0.2m ³ ~0.42m ³	45kw	7500kg
SC130.7	0.36m ³ ~0.64m ³	82kw	13000kg
SC200.8	0.8m ³	108kw	20600kg
SC210.7	0.4m ³ ~0.8m ³	117kw	21000kg

SC220.7	0.45m ³ ~1.2m ³	125kw/117kw	22180kg
SC230.8	0.45m ³ ~1.2m ³	133kw	22600kg
SC330.7	1.2m ³ ~1.6m ³	194kw	31600kg
SC360.7	1.6m ³	194kw	33600kg



Contacts:

1. <http://www.indiamart.com/company/1396333/> (Delhi)
2. <http://www.manodrill.com/piling-equipments.html> (Mumbai)
3. <http://www.indiamart.com/company/2071662/> (Barmer, Raj.)
4. <http://www.indiamart.com/company/1674967/> (Chennai)
5. <http://www.indiamart.com/company/153527/> (Kolkata)
6. <http://www.amrutgroup.com/>(Pune)

3.0 TIPPER (DUMPER TRUCK)

A **tipper** or **dump truck** (dumper truck) is a truck used for transporting loose material (such as sand, gravel or dirt) for construction. A typical dump truck is equipped with a hydraulically operated open-box bed hinged at the rear, the front of which can be lifted up to allow the contents to be deposited on the ground behind the truck at the site of delivery.



Types of dump trucks

- Standard dump truck
- Articulated dump truck
- Transfer dump truck
- Truck and pup
- Super dump truck
- Semi trailer end dump truck
- Semi trailer bottom dump truck
- Double and triple trailer bottom dump truck

- Side dump truck
- Off-road dump truck

1.0 Standard dump truck

A standard dump truck is a truck chassis with a dump body mounted to the frame. The bed is raised by a hydraulic ram mounted under the front of the dumper body between the frames and the back of the bed is hinged at the back to the truck. The tailgate can be configured to swing on hinges or it can be configured in the "High Lift Tailgate" format wherein pneumatic rams lift the gate open and up above the dump body.



Fig.1 Standard dump truck

(An Ashok Leyland Comet dump truck, is a good example of a basic 2 x 4 dump truck used for payloads of 10 tones or less).



Fig.2 Another kind of 8x4 dump truck: three rear axles (two powered, one lift)

2.0 Articulated dump truck

An articulated dump truck or "Yuke" has a hinge between the cab and the dump box, but is distinct from semi trailer trucks in that the cab is a permanent fixture, not a separable vehicle. Steering is accomplished via hydraulic rams that pivot the entire cab, rather than rack and pinion steering on the front axle. This vehicle is highly adaptable to rough terrain. In line with its use in rough terrain, longer distances and overly flat surfaces tend to cause driveline troubles and failures. Articulated trucks are often referred to as the modern scraper, in the sense that they carry a much higher maintenance burden than most trucks.



Fig.3 Articulated dump truck or dumper

3.0 Transfer dump truck

A transfer dump is a standard dump truck which pulls a separate trailer which can also be loaded with aggregate (gravel, sand, asphalt, klinkers, snow, wood chips, triple mix etc.)

The second aggregate container on the trailer is powered by either an electric, pneumatic motor or hydraulic line. It rolls on small wheels, riding on rails from the trailer's frame, into the empty main dump (A) box. This maximizes payload capacity without sacrificing the maneuverability of the standard dump truck.

Transfer dump trucks typically haul between 26 and 27 tons of aggregate per load.



Fig.4 transfer truck and trailer

4.0 Truck and pup

A truck and pup is very similar to a transfer dump. It consists of a standard dump truck pulling a dump trailer. The pup trailer, unlike the transfer, has its own hydraulic ram and is capable of self-unloading.



Fig.5 Tandem dump truck

5.0 Super dump truck

A Super dump truck is a straight dump truck equipped with a trailing axle, a liftable, load-bearing axle rated as high as 13,000 pounds. Trailing 11 to 13 feet (4.0 m) behind the rear tandem, the trailing axle stretches the outer "bridge" measurement the distance between the first and last axles to the maximum overall length allowed. This increases the gross weight allowed under the federal bridge formula, which sets standards for truck size and weight.



Fig.6 Super dump body and trailing axle

Depending on the vehicle length and axle configuration, Super dumps can be rated as high as 80,000 pounds GVW and carry 26 tons of payload or more. When the truck is empty or ready to offload, the trailing axle toggles up off the road surface on two hydraulic arms to clear the rear of the vehicle. Truck owners call their trailing axle equipped trucks Super dumps because they far exceed the payload, productivity and return on investment of a conventional dump truck.

6.0 Semi trailer end dump truck

A semi end dump truck is a tractor-trailer combination wherein the trailer itself contains the hydraulic hoist. A typical semi end dump has a 3-axle tractor pulling a 2-axle semi-trailer. The key advantage of a semi end dump is rapid unloading. A key disadvantage is that they are very unstable when raised in the dumping position limiting their use in many applications where the dumping location is uneven or off level.



Fig.7 End dump trailer

7.0 Semi trailer bottom dump truck

A semi trailer bottom dump truck (or "belly dump") is a 3-axle tractor pulling a 2-axle trailer with a clam shell type dump gate in the belly of the trailer. The key advantage of a semi bottom dump is its ability to lay material in a wind row (a linear heap). In addition, a semi bottom dump is maneuverable in reverse, unlike the double and triple trailer configurations. These do not work well with larger materials. Likewise they are not suitable for use where spreading is not desired such as when hot asphalt paving material is being dumped into a paving machine.



Fig.8 Bottom dump trailer

8.0 Double and triple trailer bottom dump truck

Double and triple bottom dumps consist of a 2-axle tractor pulling one single-axle semi-trailer and an additional full trailer (or two full trailers in the case of triples). These dump trucks allow the driver to lay material in windrows without leaving the cab or stopping the truck. The main disadvantage is the difficulty in backing double and triple units.

The specific type of dump truck used in any specific country is likely to be closely keyed to the weight and axle limitations of that jurisdiction. Rock, dirt and other types of materials commonly hauled in trucks of this type are quite heavy and almost any style of truck can be easily overloaded. Because of this, this type of truck is frequently configured to take advantage of local weight limitations to maximize the cargo. For example, the maximum weight limit of 40 tons throughout the country, except for specific bridges with lower limits. Individual states, in some instances, are allowed to authorize trucks up to 52.5 tons.

9.0 Side dump truck

A side dump truck consists of a 3-axle tractor pulling a 2-axle semi-trailer. It has hydraulic rams which tilt the dump body onto its side, spilling the material to either the left or right side of the trailer. The key advantages of the side dump are that it allows rapid unloading and can carry more weight. In addition, it is almost immune to upset (tipping)

over) while dumping unlike the semi end dumps which are very prone to tipping over. It is, however, highly likely that a side dump trailer will tip over if dumping is stopped prematurely. Also, when dumping loose materials or cobble sized stone, the side dump can become stuck if the pile becomes wide enough to cover too much of the trailer's wheels. Trailers that dump at the appropriate angle (50° for example) avoid the problem of the dumped load fouling the path of the trailer wheels by dumping their loads further to the side of the truck, in some cases leaving sufficient clearance to walk between the dumped load and the trailer.



Fig.9 Side Dump Truck

10.0 Off-road dump truck

Off-road dump trucks more closely resemble heavy construction equipment or engineering vehicles than they do highway dump trucks. Off-road dump trucks are used strictly off-road for mining and heavy dirt hauling jobs. There are two primary forms: rigid frame and articulating frame.

Bottom dump normally describes a trailer that discharges its load by opening two clam shell doors under the load space. In some instances, one tractor may pull several trailers (road train). This large capacity truck is used for the transportation of coal from a loading device (shovel) directly to a power station or bulk storage area. The current largest off road haul trucks are the Liebherr T 282B, the Bucyrus MT6300AC and the Caterpillar 797F, which each have payload capacities of up to 363 tons.



Fig.10 Liebherr T 282B haul truck



Fig.11 Hitachi haul truck

a) **"SINOTRUK HOWO 8X4 Tipper**

Model: ZZ3317N3867W

Engine: SINOTRUK 371HP Euro II

Drive Type: 8×4

Cabin: HW76

Transmission: HW18710 (10 F & 2R)

Steering: ZF8098 hydraulic steering with power assistance

Rear Axles: HC16

Tires: 12.00-20 (12.00R20 optional)

With: Safety belt

With: A/C

With: Single Sleeper

Body Inside Dimension (L×W×H)(mm): 7800×2300×1500(Front Lifting)

Thickness of bottom plate/side plate (mm): 10/8(Thickness can be changed)

Available 266HP, 290HP, 336HP, 371HP, 410HP engines



Fig.12 SINOTRUK HOWO 8X4 Tipper

b) Ashok Leyland Comet Tipper

Specifications

Engine	AL 6.65 naturally aspirated 6 cylinder Diesel Power 110 PS @ 2400 rpm Torque 38 kgm @1600 rpm
Clutch	Axial spring type
Gear box	5 speed synchromesh
Steering	Manual
Suspension	Slipper ended
Brakes	Full air - Dual line
Electricals	24 Volts
Gvw	15660 kgs
Capacity	15660 kgs

Capacity	6.5 cu.m.
Wheelbase	2997 mm



Fig.13 Ashok Leyland Comet Tipper

c) Ashok Leyland Hippo Tipper

Hippo Tipper is a 238 PS @ 2200 rpm powered vehicle with a AL 680 TCAC diesel engine. The vehicle comes with a synchromesh gearbox and a single plate dry type clutch. The vehicle is featured with nine forward and one reverse speed gear.



Fig.14 hippo tipper

Specifications	
Features	For both on and off highway applications like mining, quarrying etc.
Engine	AL 680 TCAC Diesel
Max. Power	238 ps @ 2200 rpm
Max. Torque	95 kgm @ 1300 - 1500 rpm
Clutch	Single plate dry type clutch of 420 mm dia
Clutch	9 forward and 1 reverse Synchronesh Gearbox
Suspension	Semi elliptic leaf springs in front and rear
Brakes	Dual line full air
Wheelbase	4572 mm
Overall length	8233 mm
Tyres	11 x 20 - 16 PR
FES	Day cabin built over C45 FES, tilt angle 55 degrees
Max speed	67 kmph
Body Capacity	16 Cu.m
Tipping Type	4 Stage front end tipping
Tipping angle	55 degrees
Max Gradeability	25 %
GVW	25,000 kgs
Rear Axle	Fully floating, hub reduction, third differential lock
Steering	Integral Power steering

d) **Komatsu Dump Trucks**

Model	Flywheel Horsepower		Maximum Gross Vehicle Weight	Maximum Payload
	(kW)	(HP)	(kg)	(tones)
HD255-5	235	316	47525	25
HD325-6	364	488	65200	36.5
HD325-7	371	498	69280	36.5
HD325-7R	371	498	69280	36.5
HD405-6	364	488	73175	41
HD405-7	371	498	75080	41
HD405-7R	371	498	75080	41
HD465-7	533	715	98800	55
HD465-7E0	533	715	99680	55
HD465-7R	533	715	99680	55
HD605-7	533	715	109900	63
HD605-7E0	533	715	110180	63
HD605-7R	533	715	110180	63

HD785-5	753	1010	166000	91
HD785-7	879	1178	166000	91
HD1500-7	1048	1406	249480	144 *1
730E	1388	1860	324322	184 *1
830E	1761	2360	385852	223 *1
830E-AC	1761	2360	385848	222 *1
930E-4	1902	2550	501974	292 *1
930E-4SE	2558	3429	505755	290 *1
960E-1	2495	3346	576072	327 *1
Model	Flywheel Horsepower		Maximum Gross Vehicle Weight	Maximum Payload
	(kW)	(HP)	(kg)	(tonnes)
HM250-2	222	298	47680	24.0
HM300-1	242	324	49875	27.3
HM300-2	246	329	51420	27.3
HM300-2R	246	329	51420	27.3
HM350-1	290	389	60925	32.3
HM350-2	294	394	63440	32.3

HM350-2R	294	394	63440	32.3
HM400-1	321	430	66875	36.5
HM400-2	327	438	69040	36.5
HM400-2R	327	438	69040	36.5

Other Manufacturers

- Ashok Leyland
- BEML
- BelAZ
- Kenworth
- Case
- Caterpillar Inc.
- Daimler AG
- Doosan Moxy
- Euclid Trucks
- GHH Fahrzeuge
- Liebherr
- Hitachi Construction Machinery
- Hitachi Construction Machinery (Europe)
- Terex Corporation
- Komatsu
- MAN AG
- New Holland
- Peterbilt
- Henderson Products
- Raglan Industries
- ST Kinetics
- Tata
- Tata Daewoo
- Volvo
- Volvo Construction Equipment
- SAICO Tipping Bodies manufactory

Contacts:

1. <http://construck.tatamotors.com>
2. dir.indiamart.com/impeat/tipper-trucks.html
3. info@tippersindia.com(Bangalore)
4. www.tradeindia.com/manufacturers/.../tipper-trucks.html
5. <http://pslengg.tradeindia.com/> (New Delhi)
6. <http://pbcbuses.tradeindia.com/>
A.T. Road, Khutikhatia, N.H. 37, Haibargaon,

4.0 DOZER EQUIPMENT

Powerful machine for pushing earth or rocks, used in road building, farming, construction and wrecking; it consists of a heavy, broad steel blade or plate mounted on the front of a tractor. Sometimes it uses a four-wheel-drive tractor, but usually a track or crawler type, mounted on continuous metal treads, is employed. The blade may be lifted and forced down by hydraulic rams. For digging, the blade is held below surface level; for transporting, it is held at the surface level and for spreading, it is held above the surface level, as the tractor moves forward



1. CRAWLER DOZER

HORSEPOWER

32.4 kW 43.4 HP @ 2450 rpm

OPERATING WEIGHT

D21A-8E0: 3710 kg

D21P-8E0: 4100 kg

Responsive Operation:

A single joystick on the left controls all speed and directional changes including:

- Forward and reverse
- Right and left steering

A single joystick on the right controls all blade functions including:

- Lifting
- Angling
- Tilting

This left and right joystick system offers unparalleled control for shorter cycle times.



Fig.1 Crawler dozer

Dozers

Tag	Make	Model	Blade type	Other Features
<u>332</u>	<u>Case</u>	<u>850KWT Series II</u>	10' PAT blade	•Sweeps, rear and side screens
<u>375</u>	<u>Deere</u>	<u>650J LGP</u>	10' PAT blade	•99 hp Deere diesel •24 inch shoes
<u>391</u>	<u>Caterpillar</u>	<u>D3GXL</u>	8 foot PAT blade	• 16 inch pads
<u>408</u>	<u>Caterpillar</u>	<u>D6RLGP II</u>	13 foot blade	Sweeps and rear screen



Fig.2 Case crawler



Fig.3 Case crawler



Fig.4 Deere dozer



Fig.5 Deere dozer



Fig.6 391Caterpillar Dozer



Fig.7 Caterpillar D6RLGP Dozer

BULLDOZERS:

Bulldozer, which pushes earth and rocks with a blade installed at the machine's front end. Large- sized crawler dozers normally have a set of claws called a ripper that is installed at the machine's rear end and can crush a hard rock. Swamp bulldozers are equipped with an undercarriage that is configured to enable them to freely move around on a marshy land. As a fellow machine, there is a pipe- laying machine that lays down a large steel pipe in the construction of a pipeline and a dozer shovel (crawler loader) for loading.



Fig.8 Bulldozer

Type: SWD410Y Bulldozer

Main Specifications of Bulldozer

*ENGINE:

Model: Cummins KTA19-C525

Type: Turbocharged vertical four-stroke, PT pump injection

Flywheel power: 306Kw
 Rated speed (r/min): 2000rpm
 Number of cylinders-bore×stroke (mm) : 6-Φ159×159
 Starting method: Electric starting 9 kW /24V
 Battery : 24VOptimax
 Air cleaner : Dry horizontal type with pre-cleaner

Other type of Bulldozers & Dozers:

Model	Flywheel Horsepower		Operating Weight	Blade Type
	(kW)	(HP)	(kg)	
D21A-8E0	32.4	43.4	3710 *1	PAT
D31EX-22	58	78	7720 *1	PAT
D37EX-22	66	89	7890 *1	PAT
D39EX-22	79	105	9040 *1	PAT
D51EX-22	97	130	12600 *2	PAT
D61EX-15E0	125	168	16710 *1	PAT
D63E-12	125	168	14645 *2	Semi-U
D65E-12	135	180	19125 *2	Semi-U
D65EX-16	153	205	19510 *2	SIGMADOZER
D65WX-16	153	205	20370 *2	SIGMADOZER
D68ESS-12	116	155	19100 *3	PAT
D85ESS-2	161	215	21490 *3	Angle dozer
D85ESS-2A	149	200	20670 *4	Angle dozer

D85EX-15E0	197	264	28100 *4	Semi-U
D85EX-15R	197	264	28000 *4	Semi-U
D155A-2A	239	320	41380 *4	Semi-U
D155A-5	225	302	38700 *4	Semi-U
D155A-6	264	354	41700 *6	Semi-U
D155AX-6	264	354	39500 *6	SIGMADOZ ER
D275A-5	306	410	49850 *5	Semi-U
D275A-5R	335	449	50850 *5	Semi-U
D275AX-5E0	335	449	51530 *5	SIGMADOZ ER
D375A-5	391	525	66985 *5	Semi-U
D375A-5R	391	525	68370 *5	Semi-U
D375A-6	455	610	71640 *5	Semi-U
D475A-5E0	664	890	108390 *5	Semi-U
D475ASD-5E0	664	890	113200 *2	Super dozer
D575A-3	783	1050	131350 *5	Semi-U
D575A-3 SD	858	1150	152600 *2	Super dozer

Model	Flywheel Horsepower		Operating Weight	Blade Type
	(kW)	(HP)	(kg)	
D21P-8E0	32.4	43.4	4100	PAT

D31PX-22	58	78	8130 *1	PAT
D37PX-22	66	89	8240 *1	PAT
D39PX-22	79	105	9480 *1	PAT
D51PX-22	97	130	13100 *2	PAT
D61PX-15E0	125	168	18710 *1	PAT
D65P-12	142	190	20185 *2	Straight-tilt
D65PX-16	153	205	20990 *2	Straight-tilt
D85PX-15E0	197	264	27650 *2	Straight-tilt
D85PX-15R	197	264	27500 *2	Straight-tilt



Fig.9 Crawler bulldozer



Fig.10 Wheel bulldozer

Contacts:

1. <http://www.tradeindia.com>
2. <http://www.bellstonehitech.com> (New Delhi)
3. <http://www.bhavnagarsalt.com> (Bhavnagar, Gujrat)
4. BEML LIMITED (Bangalore)
Address: BEML SOUDHA, S.R. NAGAR, Bangalore - 560027,
Karnataka, India
Email: tradeindia.com

5.0 VIBRATORY ROLLER



Salient Feature

- Transported in standard normal vehicle dual to compact design
- 180° rotation of operator seat with controls & locking at 90°, 45° & 30° in both direction.
- Optimum configuration of drum axle load, dual amplitude & dual frequency.
- Hyd. kit for longer Life.
- Thick & rigid drum construction to ensure smooth & wobble free compaction.
- Articulated sturdy chassis design.
- Superb all-round view and improved front rear visibility.
- Uniform working pressure on front - rear drums.
- Higher gradeability due to higher capacity engine.

Technical Specifications

WEIGHTS

Standard operating weight

9500 Kgs.

Static weight at front drum	4750 Kgs.
Static weight at rear drum	4750 Kgs.
DIMENSIONS	
Overall length	4435 mm.
Overall width	1835 mm.
Overall height (top of canopy)	3000 mm.
Drum base	3050 mm.
Curb clearance	400 mm.
Drum diameter	1200 mm.
Drum width	1675 mm.
Drum shell thickness (machined)	18 mm.
Articulation angle (Steering Angle)	$\pm 40^\circ$
Oscillation angle	$\pm 10^\circ$
VIBRATORY SYSTEM	
Frequency (High) (3000 VPM)	50 Hz.
Frequency (Low) (2000 VPM)	33 Hz.

Amplitude (High)	0.67 mm.
Amplitude (Low)	0.4 mm.
Centrifugal force (High)	8000 Kgs.
Centrifugal force (Low)	5500 Kgs.
COMPACTION FORCE	
High amplitude/low frequency	20500 Kgs.
Low amplitude/high frequency	25500 Kgs.

1. Single Drum Vibratory Rollers

Single Drum Vibratory Rollers are used to compact all types of soil with the exception of rockfill. The rollers are suitable for most types of road construction, airfields, dam construction, harbour projects and industrial constructions. Heavy-size vibratory rollers are used for a very wide range of applications.



Fig.1 Single Drum Vibratory Rollers

2. 12 & 15 Ton Soil Compactors

12 & 15 ton soil compactors efficiently and effectively compact all types of soils ranging from granular to cohesive



Fig.2 12 & 15 Ton Soil Compactors

3. 4 Ton Tandem Roller

Compacting to specifications is critical for soil, landfill and paving applications.



Fig.3 4 Ton Tandem Roller

4. Earth Compactor

Earth compactors are designed for diverse application in compacting soil, sand and breaking stone. Therefore these earth compactors are ideal for construction purposes and road projects since these works require compaction. Earth compactors that are used for compaction of top layer of earth.

Earth Compactor	
Compaction capacity	4/5 ton
Impact Force (Appr.)	3000 KG.
Vibration Frequency (Appr.)	2000p/min.
Depth Effect Depending Upon Type of soil	12 Inch
Travel Speed	66 ft. p/min.
Gradiant Capacity	20%
Working Area (Per Hour)	5500 sq. ft.
Total gross Weight	180 Kg.
Direction of travel	Forward
Power Unit	5 HP Greaves Lombardini Diesel engine or 5 HP Electrical Motor



Fig.4 Earth Compactor

5. Plate Compactor

Plate Compactor is particularly suitable for application like compacting loose gravel and sand on footpaths, sub-grade for concrete floors, trenches, column footings & for small repair works like pot-hole repairs.

- Available in two versions. Diesel and Electric.
- Working speed 20m/min.
- Effective compaction depth 25cm. depending on material to be compacted.
- Permanently greased vibrator element.
- Heavy duty folding wheels for in-site movement.
- Centrifugal clutch allows easy start of engine on no-load condition.
- Conveniently located control
- 16mm thick heavy-duty bottom plate.
- Adjustable handle length.
- Heavy-duty coil springs and rubber dampers ensure minimum vibrations reaching engine and handle.

Technical Data

Diesel Engine	Greaves 1520 4.4 HP
---------------	---------------------

Electric Motor	3 HP, 3 Phase, 415V, 50 Hz.
Frequency	75 Hz. (4500 vibr. / min.)
Centrifugal Force	16 kN.(equivalent to 8 tons/m ²)
Width	440 mm.
Height	880 mm.
Length	1000 mm.
Working Surface Of Base Plate	450 x 440 mm.
Thickness Of Base Plate	16 mm.
Weight	160 Kg.
Area Coverage	125 sq. mtrs. / hour (with 4 passes)
Travel Speed	20 mtrs. / min.



Fig.5 Plate Compactor

6. Road roller

Road rollers use the weight of the vehicle to compress the surface being rolled. Initial compaction of the substrata is done using a pneumatic-tyred roller, with two rows (front and back) of pneumatic tyres. The flexibility of the tyres, with a certain amount of vertical movement of the wheels, enables the roller to operate effectively on uneven ground. The finish is done using metal-drum rollers to ensure a smooth, even result.

Roller Types



Manual walk-behind



Ride-on articulating-swivel



Vibratory Roller



Pneumatic-tyre



Tandem roller

Contacts:

1. Cosmos Construction Machineries And Equipments Private Limited
Website: <http://www.cosmos-machinery.net/compactors.html>
2. Accro-Tech Scientific Industries
Website: <http://www.accrotechscientific.com/>
3. Testwel Instruments Company
Website: <http://www.indiamart.com/ticom/>

4. Gubbi Enterprises
Website: <http://www.gubbienterprises.com/construction-equipments.html>
5. Jaypee India Limited
Website: <http://www.indiamart.com/jaypeeindia/compaction-equipments.html>
6. Surelia Engineering Works
Website: <http://www.indiamart.com/sureliaengineeringworks/>

6.0 GRADER EQUIPMENT

A grader, also known as a road grader, a blade, a maintainer or a motor grader. This is a construction machine with a long blade used to create a flat surface. Graders can produce inclined surfaces, to give cant (camber) to roads. In some countries they are used to produce drainage ditches with shallow V-shaped cross-sections on either side of highways.



Fig.1 Grader Machine

Graders are commonly used in the construction and maintenance of dirt roads and gravel roads. In the construction of paved roads they are used to prepare the base course to create a wide flat surface for the asphalt to be placed on. Similarly, graders are used for leveling the surface during earthwork is embankments and providing blanket surface before spreading ballast and laying track. Graders are also used to set native soil foundation pads to finish grade prior to the construction of large buildings and for underground mining.

Capacities range from a blade width of 2.50m to 7.30 m and engines from 93–373 kW (125–500 hp).



Fig.2 Grader Machine

Features Available in Graders are:

- Input of 3d design data to Grader system.
- On site support, surveys, and design adjustments.
- Measured GPS Site calibrations carried out.
- Trimble Machine Control.
- Terramodel Road Alignments.

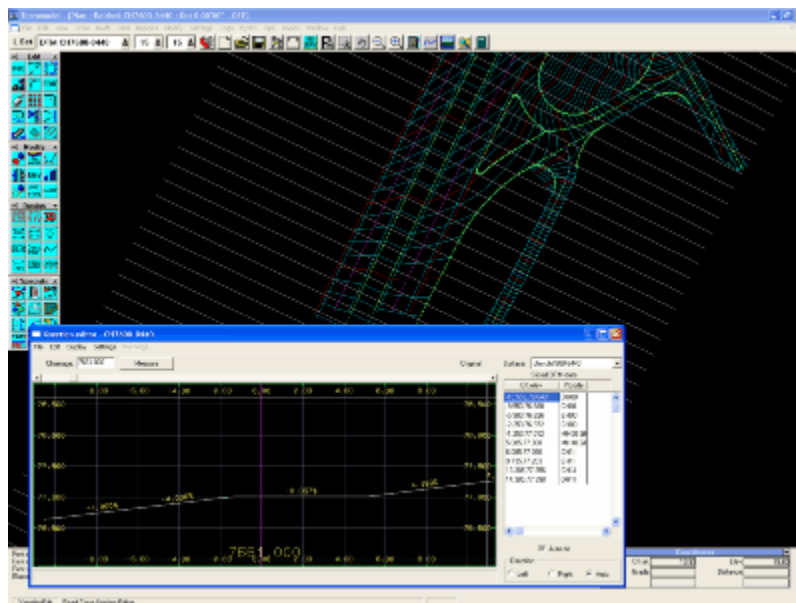




Fig.3 Grader Machine

Grader Machine Control Systems:

There are numerous economical machine control options for Grader. Such as a automated system or a indicate system and laser machine control systems. Using a laser control system grader is much more affordable than GPS equipment. In addition to being economical, laser machine control systems offer many capabilities that are similar to GPS equipment.



**Fig.4 (a) Laser Machine Control
Indicate System Parts
Grader**

**Fig.4 (b) Laser Machine Control
Automated System Parts
Grader**

1.0 CATERPILLER MOTOR GRADER:



Fig.5 Caterpillar Motor Grader

TECHNICAL SPECIFICATIONS

Make / Model		CATERPILLER / 120 H	
Operating Weights:			
On Front Wheels	Kg	3164	
On Rear Wheels	Kg	8194	
Total Machine	Kg	11358	
Engine Data:			
Make / model		CAT / 3116	
Number of Cylinders	Nos	4	
Power Rating for			
(a) Gears 4-8 forward and 3-6 reverse	hp@rpm	151@2000	
(b) Gears 1-3 forward and 1-2 reverse	hp@rpm	136@2000	
Net Peak Torque for			
(a) Gears 4-8 forward and 3-6 reverse	N-m@rpm	650@1400	
(b) Gears 1-3 forward and 1-2 reverse	N-m@rpm	592@1400	
Moldboard Data:			
Blade Width	meters	3.658	
Moldboard Height	mm	610	
Scarifier Data :			
Scarifier Type	V – Type (Mid mounted)		
Working Width	mm	1184	
Maximum Scarifying Depth	mm	292	
Number of Scarifier Shank Holders	Nos.	11	
Spacing of Shank Holders	mm	116	

2.0 L&T KOMATSU MOTOR GRADER:



Fig.6 L&T Komatsu Motor Grader

Technical Specifications

Make / Model	L&T Komatsu / GD511A-1	
Operating Weights:		
On Front Wheels	Kg	3636
On Rear Wheels	Kg	8856
Total Machine	Kg	12492
Engine Data:		
Make / model	Komatsu / S6D95L	
Number of Cylinders	Nos	6
Flywheel Horsepower	hp@rpm	135@2900
Moldboard Data:		
Blade Width	meters	3.710

Moldboard Height	mm	645
Scarifier Data :		
Scarifier Type	V – Type	
Working Width	mm	1065
Maximum Lift Above Ground	mm	340
Number of teeth	Nos.	9
Scarifier Base	mm	970

Some grader-producing companies

- Caterpillar Inc.
- John Deere
- Case
- Grove
- Komatsu
- New Holland Machine Company
- Terex
- Volvo Construction Equipment
- Mitsubishi Heavy Industries
- Galion
- Champion Motor Graders
- Veekmas
- Sinoway Industrial (Shanghai) Co.,Ltd



Contacts:

1. <http://www.tradeindia.com>
2. <http://www.bellstonehitech.com> (New Delhi)
3. <http://www.bhavnagarsalt.com> (Bhavnagar, Gujrat)
4. <http://www.lowcostmachinecontrol.com/grader.php>
5. BEML LIMITED (Bangalore)
Address: BEML SOUDHA, S.R. NAGAR, Bangalore - 560027,
Karnataka, India
Email: tradeindia.com

7.0 TUNNELING EQUIPMENT:

Tunneling equipment is a machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata. There can bore through hard rock, sand and almost anything in between. Tunnel diameters can range from a meter (done with micro-TBMs) to almost 16 meters. Tunnels of less than a meter or so in diameter are typically done using trenchless construction methods or horizontal directional drilling.

Tunneling equipment has limiting disturbance to the surrounding ground and producing a smooth tunnel wall. This significantly reduces the cost of lining the tunnel and makes them suitable to use in heavy urbanized areas. The major disadvantage is the upfront cost. TBMs are expensive to construct and can be difficult to transport. However, as modern tunnels become longer, the cost of tunnel boring machines versus drill and blast is actually less-this is because tunneling with TBMs is much more efficient and results in a shorter project period.

Type of tunneling equipment:

- 1. Auger boring machine**
- 2. Gripper tunnel boring machine**
- 3. Double shield tunnel boring machine**
- 4. Single shield tunnel boring machine**
- 5. Earth pressure balance tunnel boring machine**
- 6. Microtunneling boring machine**
- 7. Slurry pressure balance tunnel boring machine**
- 8. Mixshield tunnel boring machine (TBM) Aker Wirth**

1. Auger Boring Machine

An Auger Boring Machine (ABM) is used to bore horizontally through soil or rock with a cutting head and auger. The majority of ABMs are used to install pipe casing under railroads, highways, airport runways, creeks or any area of ground that cannot be open cut or disturbed in any way.

There are many types of cutting attachments for this machine. They range from Backhoe Teeth cutters for cutting through soil to the Small Boring Unit for boring hard rock.

Initially the ABM is set up in the starting pit on a predetermined length of track. A backing plate, usually steel or reinforced concrete block, is installed in the wall opposite of the boring to withstand the thrust exerted by the boring machine. The machine bores through the earth with a cutting head and the jacking force is provided by the hydraulic thrust. The pipe casing and auger sections are added as the machine advances. Spoil is removed from the auger through the casing to a door located on the side of the machine.



Fig. 1 Auger Boring Machine

2. Gripper Tunnel Boring Machine (TBM)

Main Beam of TBM is complex in its design, yet relatively simple in concept. The front of the TBM is a rotating cutter head that matches the diameter of the tunnel. The cutter head holds disc cutters (ranging from 11" to 20" in diameter) which are positioned for optimal boring of the given rock type. As the cutter head turns, hydraulic propel cylinders push the cutters into the rock. The transfer of this high thrust through

the rolling disc cutters creates fractures in the rock causing chips to break away from the tunnel face. A unique floating gripper system pushes on the sidewalls and is locked in place while the propel cylinders extend, allowing the main beam to advance the TBM. The machine can be continuously steered while gripper shoes push on the sidewalls to react the machine's forward thrust. Buckets in the rotating cutter head scoop up and deposit the muck on to a belt conveyor inside the main beam. The muck is then transferred to the rear of the machine for removal from the tunnel. At the end of a stroke the rear legs of the machine are lowered, the grippers and propel cylinders are retracted. The retraction of the propel cylinders repositions the gripper assembly for the next boring cycle. The grippers are extended, the rear legs lifted, and boring begins again.

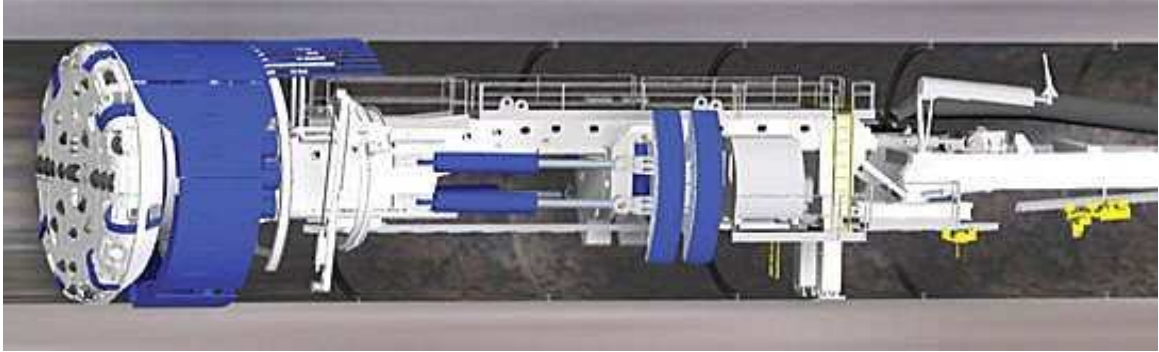


Fig. 2 Gripper Tunnel Boring Machine

3. Double Shield Tunnel Boring Machine (TBM)

A Double Shield TBM consists of a rotating cutter head mounted to the cutter head support followed by three shields: a telescopic shield (a smaller diameter inner shield which slides within the larger outer shield), a gripper shield and a tail shield.

In normal operation ("double shield mode"), the gripper shoes are energized, pushing against the tunnel walls to react the boring forces. The main propel cylinders are then extended to push the cutter head support and cutter head forward. The rotating cutter head cuts the rock. The telescopic shield extends as the machine advances keeping everything in the machine under cover and protected from the ground surrounding it.

The gripper shield remains stationary during boring. A segment erector is fixed to the gripper shield allowing pre-cast concrete tunnel lining segments to be erected while the machine is boring. The segments are erected within the safety of the tail shield. It is the Double Shield's ability to erect the tunnel lining simultaneously with boring that allows it to achieve such high performance rates. The completely enclosed shielded design provides the safe working environment.

If the ground becomes too weak to support the gripper shoe pressure, the machine thrust must be reacted another way. In this situation, the machine can be operated in "single shield mode". Auxiliary thrust cylinders are located in the gripper shield. In single shield mode they transfer the thrust from the gripper shield to the tunnel lining. Since the thrust is transferred to the tunnel lining, it is not possible to erect the lining simultaneously with boring. In the single shield mode, tunnel boring and tunnel lining erection are sequential operations.

Regardless of the operating mode, working crews remain protected within the shields. Double Shield TBMs are capable of safely excavating a wide range of geologic conditions on a project. Double Shield TBMs are manufactured to suit project requirements, in diameters from 1.6 m to 15 m (5 to 50 ft).

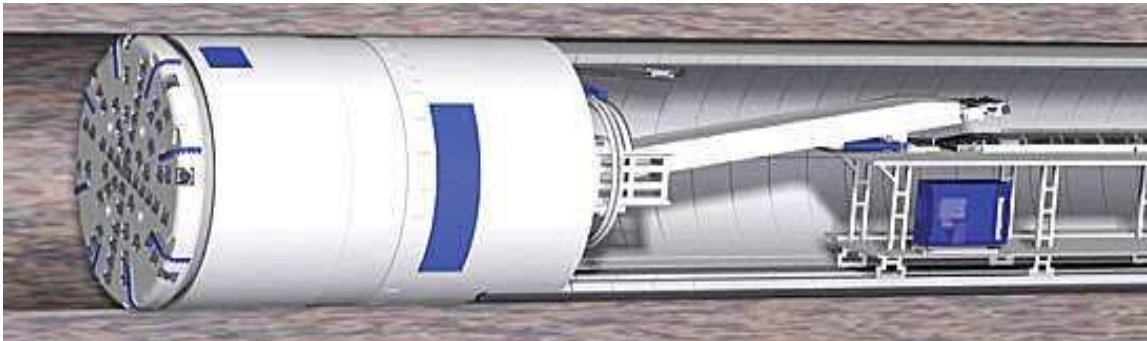


Fig. 3 Double Shield Tunnel Boring Machine

4. Single Shield Tunnel Boring Machine (TBM)

Single Shield TBMs protect workers from broken rock until the tunnel lining can be safely installed. The body of the machine is enclosed in a shield that is marginally smaller than the diameter of the tunnel. The flat, low-profile cutter head minimizes disturbance of the face as it bores and prevents large blocks from collapsing and causing excessive boring

stresses. The front of the TBM is a rotating cutter head that matches the diameter of the tunnel. As the cutter head turns, a ring of hydraulic cylinders provides forward thrust through shoes that push against the tunnel lining.

The cutter head holds disc cutters (ranging from 11" to 20" in diameter) positioned for optimal boring. The transfer of high thrust through the rolling disc cutters creates fractures in the rock, causing chips to break away from the face. Boring and lining installation are performed sequentially. To steer, cylinders orient the articulated cutter head in the required direction.

Single Shield TBMs are available in diameters from 1.6 to 15 m (5 to 50 ft). All Single Shields are equipped with high-speed segment erectors for rapid tunnel lining installation. To steer the machine, the cutter head is articulated. The short shield length enables a small turning radius and minimizes exposure to squeezing ground forces that could potentially trap the machine.

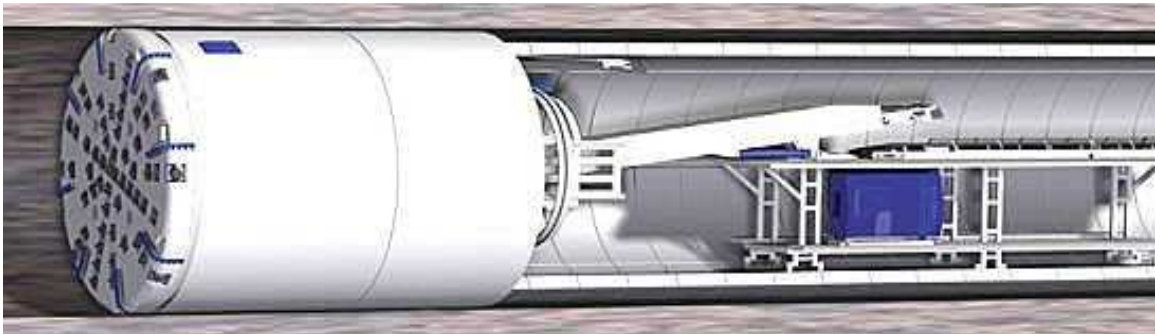


Fig. 4 Single Shield Tunnel Boring Machine

5. Earth Pressure Balance Tunnel Boring Machine (EPB TBM)

If the geology ranges from soft soils to weathered rock, then Earth Pressure Balance Machine (EPBM) is the correct technical solution for project. This is particularly true when project is located in an urban environment and ground surface subsidence cannot be tolerated.

EPBMs are utilized in the construction of rail tunnels, metropolitan subway systems, highway tunnels, and other projects where the tunnel will be constructed either partly or completely in soft soil beneath the water table.

From "Smooth Flow" cutter heads that reduce friction to super-reliable sealing systems and Variable Frequency Cutter head Drives, has taken the traditional EPB design to the next level.

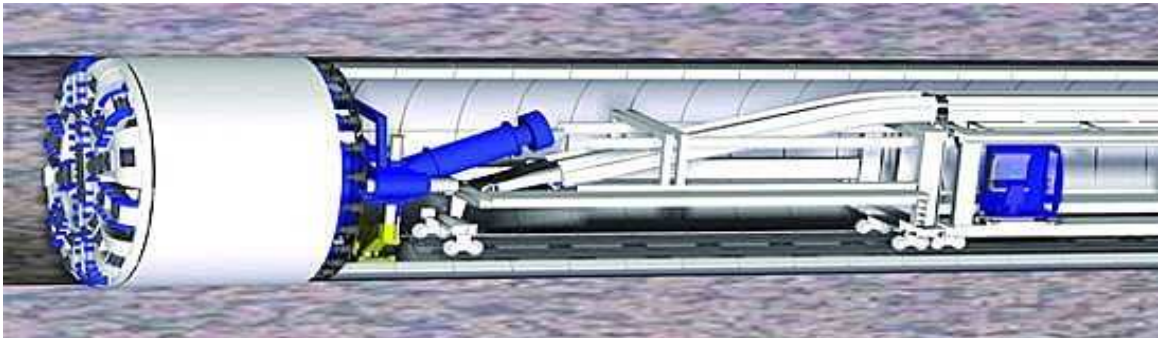


Fig. 5 Earth Pressure Balance Tunnel Boring Machine

6. Microtunneling Boring Machine (MTBM)

Small Boring Units (SBU-A) is a small diameter rock cutting head (from 24"/600 mm to 72"/1.8 m) that can be used with any Auger Boring Machine (ABM) to excavate hard rock on drives less than 500 ft (150 m). SBU-A has been proven on hundreds of jobs across the U.S. Over one hundred contractors in locations around the world have proven the SBU-A works better than any other method of excavating small diameter, hard rock bores.

Motorized Small Boring Units (SBU-Ms) is used to bore a small diameter tunnel in hard rock where line and grade are critical. These machines have been specifically designed for long bores (over 500 ft/150 m) with difficult ground conditions. They are offered in cutter head diameters from 48"/1.2 m to 78"/2.0 m.

Rock head (SBU-RHSS or SBU-RHDS)

If line and grade are critical and have a longer bore (over 1000 ft/300 m in length) for project, than Robbins Rock head is used. The diameter range is available between 54" (1.35 m) and 78" (2.0 m). The Robbins Rock head is a powerful mid-sized tunneling machine available in both Single Shield and Double Shield models.



Fig. 6 Microtunneling Boring Machine

7. Slurry Pressure Balance Tunnel Boring Machine (SPB TBM)

Bentonite slurry, consisting of a specific clay and water mixture is universally used in boring and digging operations. The slurry has numerous properties: sealing of the cutting face, reduced friction on the TBM's structure and transport of cuttings to the separation plant outside the tunnel.

The basic principle of this TBM is to maintain the tunnel's cutting face during the excavation phase by filling the working chamber, located behind the cutter head, with slurry.

Slurry pressure is carefully controlled by a large air bubble which is maintained by a separately-controlled air supply system. This air bubble acts as a damper by absorbing sudden variations in mucking output.



Fig. 7 Slurry Pressure Balance Tunnel Boring Machine

8. Mix shield Tunnel Boring Machine (TBM) Aker Wirth

Dual mode - two process technologies in one As the term 'dual mode' indicates, two process technologies are combined in these machines.

Shield machines:

These machines are externally similar to shield machines and combine the functional features of a hard-rock shield tunnel boring machine and optionally, of a slurry shield or a hydro shield machine. They are always used when tunnels have to be driven alternately in stable and unstable sections.

New style machines:

Dual-mode tunnel boring machines are still a new type of machines and have been developed to meet the requirements of complex projects in strongly varying geologies. Where conventional tunneling techniques had to be used formerly, these machines now open the way to lower-risk and lower-cost tunneling in difficult geological conditions



Fig. 8 Mix shield Tunnel Boring Machine

Contacts:

1. www.robbinstbm.com
2. www.csmbessac.com
3. www.akersolutions.com/akerwirth
4. www.bemlindia.com
5. www.hitachizosen.co.jp

8.0 LIFTING EQUIPMENTS

CRANE:-

A **crane** is a lifting machine, generally equipped with a winder (also called a wire rope drum), wire ropes or chains and sheaves that can be used both to lift and lower materials and to move them horizontally. It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a human. Cranes are commonly employed in the construction industry, lifting of heavy material, girders etc.

Mobile cranes

The most basic type of mobile crane consists of a truss or telescopic boom mounted on a mobile platform - be it on road, rail or water.

1. Truck-Mounted Crane



Fig.1 Truck-Mounted Crane

Description:

Crane mounted on a truck carrier provides the mobility for this type of crane.

These cranes are able to travel on highways, eliminating the need for special equipment to transport the crane. When working on the jobsite, outriggers are extended horizontally from the chassis then vertically to

level and stabilize the crane while stationary and hoisting. Many truck cranes have slow-travelling capability (a few miles per hour) while suspending a load. Great care must be taken not to swing the load sideways from the direction of travel, as most anti-tipping stability then lies in the stiffness of the chassis suspension.

Most cranes of this type also have moving counterweights for stabilization beyond that provided by the outriggers. Loads suspended directly aft are the most stable, since most of the weight of the crane acts as a counterweight. Factory-calculated charts (or electronic safeguards) are used by crane operators to determine the maximum safe loads for stationary work as well as (on-rubber) loads and travelling speeds.

Truck cranes range in lifting capacity from about 12900kg to 13155kg.

2. Rough Terrain Crane



Fig.2 Rough Terrain Crane

A crane mounted on an undercarriage with four rubber tires that is designed for pick-and-carry operations and for off-road and "rough terrain" applications. Outriggers are used to level and stabilize the crane for hoisting.

These telescopic cranes are single-engine machines, with the same engine powering the undercarriage and the crane, similar to a crawler crane. In a rough terrain crane, the engine is usually mounted in the undercarriage rather than in the upper, as with crawler crane.

3. Side lift Crane

A side lifter crane is a road-going truck or semi-trailer, able to hoist and transport containers. Container lift is done with parallel crane-like hoists, which can lift a container from the ground or from a railway vehicle.



Fig.3 Side lift Crane

4. All Terrain Crane

A mobile crane with the necessary equipment to travel at speed on public roads and on rough terrain at the job site using all-wheel and crab steering. AT's combine the road ability of Truck-mounted Cranes and the maneuverability of Rough Terrain Cranes.

AT's have 2-9 axles and are designed for lifting loads up to 1,200 tons



Fig.4 All Terrain Crane

5. Crawler Crane

A crawler is a crane mounted on an undercarriage with a set of tracks (also called crawlers) that provide stability and mobility. Crawler cranes range in lifting capacity from about (35.7 to 3,125.0 tons).

Crawler cranes have both advantages and disadvantages depending on their use. Their main advantage is that they can move around on site and perform each lift with little set-up, since the crane is stable on its tracks with no outriggers. In addition, a crawler crane is capable of traveling with a load. The main disadvantage is that they are very heavy, and cannot easily be moved from one job site to another without significant expense. Typically a large crawler must be disassembled and moved by trucks, rail cars or ships to its next location.



Fig.5 Crawler Crane

6. Floating Crane

Floating cranes are used mainly in bridge building and port construction, but they are also used for occasional loading and unloading of especially heavy or awkward loads on and off ships. Some floating cranes are mounted on a pontoon, others are specialized crane barges with a lifting capacity exceeding 9,072 tons and have been used to transport entire bridge sections. Floating cranes have also been used to salvage sunken ships.

Crane vessels are often used in offshore construction. The largest revolving cranes can be found on SSCV Thialf, which has two cranes with a capacity of 7,100 tons.



Fig.6 Floating Crane

7. Tower Cranes

Tower cranes are a modern form of balance crane that consist of the same basic parts. Fixed to the ground on a concrete slab (and sometimes attached to the sides of structures as well), tower cranes often give the best combination of height and lifting capacity and are used in the construction of tall buildings. The base is then attached to the mast which gives the crane its height. Further the mast is attached to the slewing unit (gear and motor) that allows the crane to rotate. On top of the slewing unit there are three main parts which are: the long horizontal jib (working arm), shorter counter-jib, and the operators cab.

The long horizontal jib is the part of the crane that carries the load. The counter-jib carries a counterweight, usually of concrete blocks, while the jib suspends the load to and from the center of the crane. The crane operator either sits in a cab at the top of the tower or controls the crane by radio remote control from the ground. In the first case the operator's cab is most usually located at the top of the tower attached to the turntable, but can be mounted on the jib or partway down the tower. The

lifting hook is operated by the crane operator using electric motors to manipulate wire rope cables through a system of sheaves. The hook is located on the long horizontal arm to lift the load which also contains its motor.

In order to hook and unhook the loads, the operator usually works in conjunction with a signaller (known as a 'dogger', 'rigger' or 'swamper'). They are most often in radio contact and always use hand signals. The rigger or dogger directs the schedule of lifts for the crane and is responsible for the safety of the rigging and loads. A tower crane is usually assembled by a telescopic jib (mobile) crane of greater reach and in the case of tower cranes that have risen while constructing very tall skyscrapers, a smaller crane (or derrick) will often be lifted to the roof of the completed tower to dismantle the tower crane afterwards.



Fig.7 Tower Crane Rotates on its axis

8. Level Luffing Crane

Normally a crane with a hinged jib will tend to have its hook also move up and down as the jib moves (or luffs). A level luffing crane is a crane of this common design, but with an extra mechanism to keep the hook level when luffing.



Fig.8 Level Luffing crane

9. Loader Crane

A loader crane (also called a *knuckle-boom crane* or *articulating crane*) is a hydraulically-powered articulated arm fitted to a truck or trailer and is used for loading/unloading the vehicle. The numerous jointed sections can be folded into a small space when the crane is not in use. One or more of the sections may be telescopic. Often the crane will have a degree of automation and be able to unload or stow itself without an operator's instruction.

Unlike most cranes, the operator must move around the vehicle to be able to view his load; hence modern cranes may be fitted with a portable cabled or radio-linked control system to supplement the crane-mounted hydraulic control levers.

A *roll-loader* crane is a loader crane mounted on a chassis with wheels. This chassis can ride on the trailer. Because the crane can move on the trailer, it can be a light crane, so the trailer is allowed to transport more goods.



Fig.9 Loader Crane

10. Wire Rope Hoists :-

RANGE :-

Capacity : 0.5 Tons to 45 Tons

Lift : 0.5 Mtr to 18 Mtr.

DESIGN: Compact dimensions, low weight, easy to operate and easy to maintain, modular design with direct fits between components.

MOTORS: Uses sturdy cylindrical rotor pole-changing motors with elegant continuous cast aluminium sections, integrated safety brakes. Insulation class - F, Protection- IP54. Specifically designed for high starting torque hoisting service, half-hour rated with permanently lubricated bearings suitable for frequent reversals as well as braking.

GEAR BOXES: Precision flat helical/ spur gear units with case-hardened gears, high-grade surface treatment and permanent oil/grease lubrication. Newer designs are lighter in weight because of improved material strength & manufacturing techniques.

BRAKES: Single/ Dual-disc electromagnetic DC brakes featuring automatic braking on power failure. Environmentally sound brake linings designed for approx. 1 million braking operations allow long maintenance intervals.

ELECTRICAL PANEL: Modular design, covering a very wide operating range. The panels are designed for ease of installation, maintenance and reliable operation, with fuseless circuitry. Each drive group is equipped with a motor overload protection device to provide effective protection against inadmissible overloading. Control circuit provides reduced voltage at the Push Button station, with 110 volts being standard. Also, a relay to prevent phase failure and phase sequence change at the incoming. Modular soft starts for cross and long travel motors, ensures, operation is much more gentle on components, lowering shock loads and heat buildup.

SUPPORTING STRUCTURE, TROLLEYS AND DRIVE SYSTEMS: The trolley types are the result of integrating standard hoists in chassis designed for different applications and combining them with various types of travelling gear

In addition articulated joints ensure that all four wheels are always firmly positioned on the tracks and that the wheel loads are properly distributed in accordance with the structural design of the system.

SPECIAL FEATURES :-

- **LIMIT SWITCHES (PROXIMITY) :** To prevent over Hoisting & over lowering of hook. Positive action limit switch will prevent over travel beyond set limits in either direction.

- **PUSH BUTTON STATIONS:** Extra light, handy, easy to operate, aluminium, fabricated from extruded section. Weather proof as standard, giving sure grip, one handed control, Station has built in steel strain relief, permits pulling of unloaded hoist along track. **ROCKER** switches in certain designs.

11. Heavy Duty Cranes

i) PK 42502 Performance

This exceptional heavy-duty crane impresses with a series of technical highlights and due to its perfect movement geometry. Fitted as standard with PALTRONIC 50 overload protection, E-HPLS, radio remote control showing the percentage of capacity utilisation and the overload situation, the PK 42502 Performance sets new standards for the loading of containers and heavy machinery.

Technical data

Max. lifting moment	415,0 kNm
Max. lifting capacity	14340 kg
Slewing angle	400 °
Max. hydraulic outreach	16,80 m
Max. mechanical outreach	21,2 m

Standard crane

Slewing torque	49,0 kNm
Outreach	8,0 m
Stabilizer spread standard	6,6 m
Stabilizer spread max.	6,6 m
Fitting space required (min.)	1,21 m
Fitting space required (max.)	1,21 m
Width folded	2,5 m
Operating pressure	330 bar

Recommended pump capacity	100 l/min
Dead weight standard crane	3970 kg



FIG. 10 Heavy Duty Cranes

ii) PK 150002 Performance

Right at the top of the heavy-duty crane class, the PK 150002 Performance sets completely new standards of quality, outreach and lifting capacity. This high-tech heavy-duty crane masters extreme jobs and maximum loadings just as easily as it handles difficult precision work. Manufactured with first grade class high-strength fine-grained structural steel this crane also impresses with its low dead weight and extraordinary performance. PK 150002 Performance - a new milestone in crane engineering from the PALFINGER Company.



FIG. 11 Heavy Duty Cranes

Technical data

Max. lifting moment	1 146,0 kNm
Max. lifting capacity	40000 kg
Slewing angle	endless
Max. hydraulic outreach	21,5 m
Max. mechanical outreach	26,9 m
Max. outreach (with fly jib)	36,0 m

Standard crane

Slewing torque	1 18,0 kNm
Outreach	8,9 m
Stabilizer spread standard	9,8 m
Stabilizer spread max.	9,8 m
Fitting space required (min.)	2,52 m
Fitting space required (max.)	2,76 m
Width folded	2,55 m

Operating pressure	330 bar
Recommended pump capacity	2 x 100 l/min
Dead weight standard crane	11520 kg

Contacts:

1. www.vncranes.com (Delhi)
2. www.jagdambacranes.com/ (Ghaziabad, U.P.)
3. www.expresscranes.com/(Mumbai)
4. www.hotfrog.in/Products/Cranes (Hyderabad)
5. <http://www.tadanocrane.com.cn> (China)

9.0 SAND WASHING EQUIPMENT

Sand Washing Machine Application

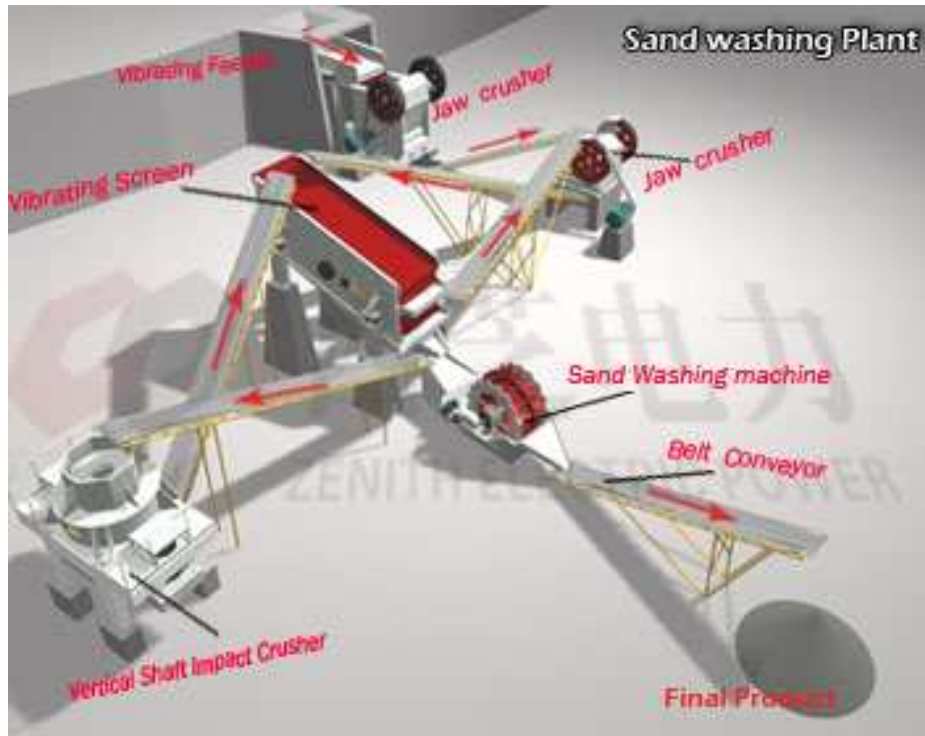
Sand washer is used to remove the dust in sand. It aims at improving the quality of sand. It is widely used for cleaning materials in the following industries: quarry, minerals, building materials, transportation, chemical industry, water conservancy and hydropower, cement mixture station and so on.



(Sand Washing Machine)

Sand Washing Machine Principle

Sand washing machinery drives the impeller in the water groove to move like a circle transmitted by electric motor and decelerator and then mixes, overturns, cleans and discharges the sand or slag pellets in the water groove.



SAND WASHING MACHINES:

- **XSD2610**
- **XSD3016**
- **XSD3620**
- **LSX-920**
- **2LSX-920**
- **LSX-1120**
- **2LSX-1120**
- **LSX SPIRAL SAND-WASHING MACHINE**
- **SCREW CONVEYOR TYPE MACHINE**

1. XSD Sand Washing Machine

XSD series sand washing machine is a kind of wheeled washing equipment, and can clean and separate the dust and powder from the sand. Its new seal-structure and reliable driving device can make sure the cleaning effect and a kind of high efficiency sand washing equipment matched with the sand making machine.

Sand washing machine are mainly used in building site, gravel plant, concrete dam building site of hydropower station, etc.



Fig.1 XSD Sand Washing Machine

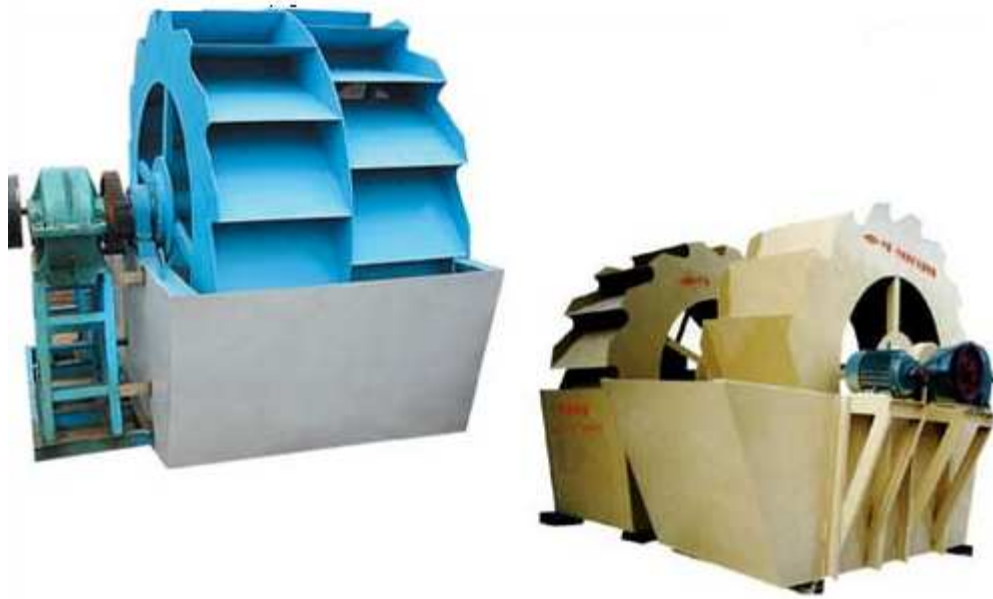


Fig.2 XSD Sand Washing Machine

XSD Machine Specification:

Models	XSD2610	XSD3016	XSD3620
Diameter of Impeller (mm)	2600	3000	3600
Feed Size (mm)	≤10	≤10	≤10
Capacity (t/h)	50	80	150
Power (KW)	7.5	15	18.5
Weight (t)	2.68	3.26	4.3
Overall Dimensions (L×W×H)	3320×2125×2670	3810x2686x3085	4500x3206x3480

2. LSX/SXL Washing Machine

2SXL-920 is especially used in washing, classification and dehydration for gravel and quartz sand and so on. It is available to be used in grit company, construction building site, water and electricity station, concrete dam building site, glass manufacturing, foundry, oil well development site and such so on.



Fig.3 2SXL-920 Washing Machine

Technical Parameter Of The Sand Washing Machine:

Model: 2SXL-920

Screw number: 2

Screw diameter: 920mm

Flume length: 7585mm

Capacity: 200t/h

Max. Input size: 10mm

Electromotor power: 11 KW

Screw rotate speed: 21r/min

Water rate: 20-160t/h

Weight: 11.5kg

Exterior dimension: 8420*3970*3960 mm (L*W*H)

Specifications:

Model	LSX-920	2LSX-920	LSX-1120	2LSX-1120
Number of Screw	1	2	1	2
Screw Diameter (mm)	920	920	1120	1120
Tub Length (mm)	7585	7585	9750	9750
Feeding Size (mm)	≤10	≤10	≤10	≤10
Capacity (t/h)	100	200	175	350
Screw Speed (r/min)	21	21	17	17
Required Moter (kw)	11	11×2	18.5	18.5×2
Water Requirement (t/h)	10-80	20-160	20-150	40-300
Weight (t)	6.2	11.5	10.9	17.8

3. LSX Spiral Sand-Washing Machine

Spiral sand-Stone-Washing Machine is widely used for washing separation, classification and removal of extraneous materials and so on in such industry as metallurgy, building materials, water resources and hydropower etc and it is applicable for washing separation of fine and coarse materials, especially of sand for building and road construction.

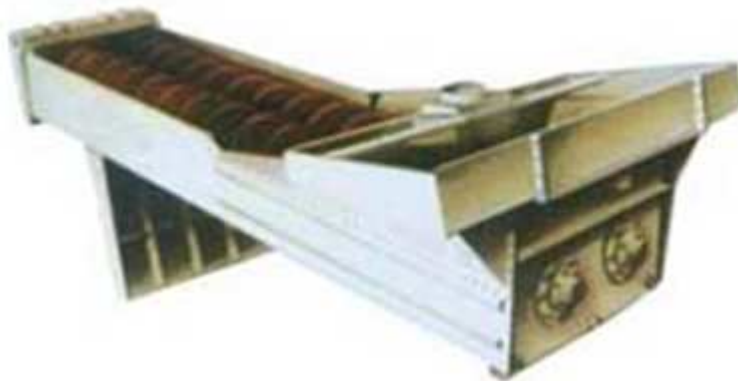


Fig.4 LSX Spiral Washing Machine

Specification and Technical Parameter of Spiral Sand-washing Machine				
Type and Specification	Diameter of Screw (mm)	Output t/h	Power kw	Weight kg
FG-60	600	20	3	2550
FG-75	750	50	5.5	3820
FG-100	1000	75	7.5	4870
FG-120	1200	95	11	6900
FG-150	1500	130	18.5	8800

4. Screw Conveyor Type Machine

Technical Specification :

- Screw conveyor type machine
- 8ft length with 2 HP single phase motor connection with yield
- 2.5 to 3 brass in 8 hrs with sufficient water.



Fig.5 Screw Conveyor Type Machine

5. Sand Washer

Sand washer is generally used to clear up and remove the dirt and contaminate mixed in sandstones matched with the sand making machine.



Fig.6 Sand Washer

Contacts:

1. <http://www.gubbienterprises.com/construction-equipments.html> (Thane)
2. <http://www.cometengineers.com/screw-type-sand-gravel-washer.html> (Mumbai)
3. <http://www.indiamart.com/company/940653/> (Pune)
4. <http://www.indiamart.com/foundryequipments/> (Ahmedabad)
5. <http://www.indiamart.com/company/1405306/> (Bahadurgarh)

10.0 CONCRETE MIXER

A concrete mixer (also commonly called a cement mixer) is a device that homogeneously mixes cement, aggregate such as sand & gravel and water to form concrete. A typical concrete mixer uses a revolving drum to mix the components. For smaller volume works portable concrete mixers are often used so that the concrete can be made at the construction site, giving the workers ample time to use the concrete before it hardens.

Different type of concrete mixer available in the market:-

1. 10/7 Cft Concrete Mixer without hopper (1 Bag capacity)

When small concrete is to be executed without much quality control and with volumetric mix then this can be used.



Fig. 10/7 Cft Concrete Mixer without hopper (1 Bag capacity)

This machinery has following technical specifications:

- Capacity (unmixed) :10 CFT
- Capacity (mixed) : 7 CFT
- Drum Speed : 18 / 20 RPM
- Type : Tilting
- Power : 6 HP Diesel Engine / 5HP Motor
- Loading : Hand Loading

2. 7/5 Cft concrete mixer (3/4 bag capacity)

For small Concrete, with volumetric mix this can be used.



Fig. 7/5 Cft concrete mixer (3/4 bag capacity)

The special technical attributes of portable concrete mixers are mentioned below:

- Capacity (unmixed) : 5 to 10 CFT
- Capacity (mixed) : 3.5 to 7 CFT
- Drum Speed : 18 / 20 RPM
- Type : Tilting
- Power : 6 HP Diesel Engine / 3 HP Motor
- Loading : Hand Loading

3. 1 Bag Hydraulic Concrete Mixer / 10/7 Cft Concrete Mixer with hydraulic operated hopper

This can be used for Design mix concrete with weigh batching as well as for volumetric mix concrete. Hopper attached to the mixer is hydraulically operated.



Fig.3 1Bag Hydraulic Concrete Mixer

This machinery has unique technical specifications as follows:

- Capacity (unmixed) : 10 CFT
- Capacity (mixed) : 7 CFT
- Drum speed : 18 / 20 RPM
- Power : 6 HP Diesel engine / 5 HP Motor
- Type : Tilting
- Loading : Hopper loading
- Hopper Function: Hydraulically operated.

4. 1 Bag Clutch Type / Mechanical Mixture

This can be used for Design mix concrete with weigh batching as well as for volumetric mix concrete. Hopper attached to the mixer is mechanically operated.



Fig.4 1 Bag Clutch Type / Mechanical Mixture

Some of the major technical citations for hopper concrete mixer are :

- Capacity (unmixed) : 10 CFT
- Capacity (mixed) : 7 CFT
- Drum Speed : 18 / 20 RPM
- Type : Tilting
- Power : 6 HP Diesel Engine / 5 HP Motor
- Loading : Hopper Loading
- Hopper Function : Operated by Clutch System

5. 3 CFT Hand Mixtures

Suitable for very small scattered quantity of concrete where otherwise hand mixing is done.



Fig. 5 3 CFT Hand Mixtures

6. Concrete Pan Mixers

Concrete pan mixers are specially designed for thorough mixing of the ingredients with the other coarse and granular materials in the powder form. Available in the market with easy unloading mechanism, motorized operated and with pneumatic wheels for easy transportation.



Fig.6 Concrete Pan Mixers

Specification:	
Capacity	½ bag or 170 Kgs
Type	Stirrer type
Transmission	Mechanical gear box
Power	3 HP single phase
Blade	Four blades with different functions
Dimensions	L - 1800 X W - 900 X H - 1150

7. Laboratory Concrete Mixer (Motorised)

These are generally electrically operated & designed to eliminate the hand mixing in laboratory work.

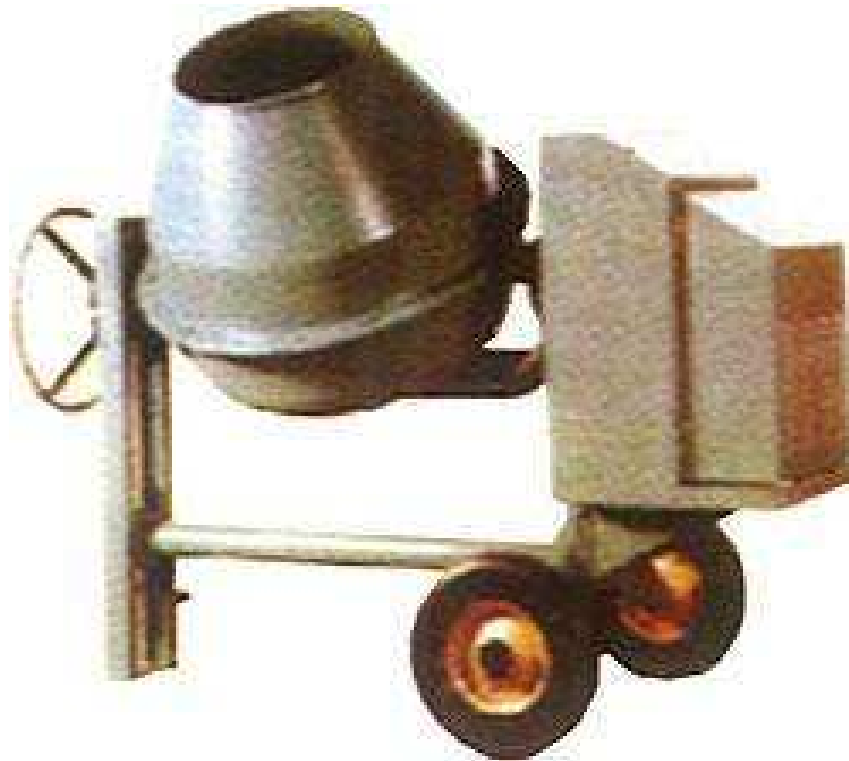


Fig.7 Laboratory Concrete Mixer (Motorised)

Specification:	
Capacity	1.5 to 2 cft
Type	Stirrer type
Power	0.5 HP single phase , 220/230 volts AC single phase
Drum Volume	3 cft

8. Laboratory Concrete Mixer (Hand Operated)

This is a Hand Operated Concrete Mixer and is suitable to mix 1 cft to 1.5 cft material.

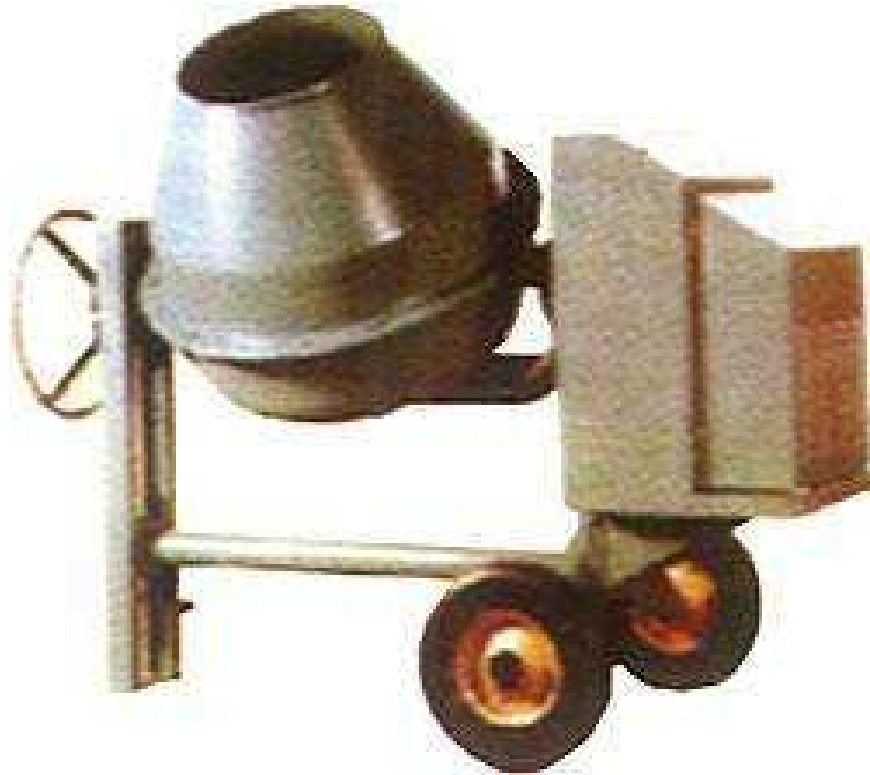


Fig.8 Laboratory Concrete Mixer (Hand Operated)

Contacts:

1. B & R Engineering Works
Website: <http://www.indiamart.com/krs/construction-machines.html>
2. Cosmos Construction Machineries And Equipments Private Limited
Website: <http://www.cosmos-machinery.net/mixers.html>
3. Machines and Engineering Company, Coimbatore
Website: <http://www.mecbbe.com/concrete-block-making-machine.html>
4. Macons Equipments
Website: <http://www.indiamart.com/maconengineers/construction-machines.html>
5. Shambhavi Impex
Website: <http://www.shambhaviimpex.com/laboratory-concrete-mixer.html>
6. Vinayak Road Equipment, Gujarat
Website: <http://www.hotmixplantindia.com/bitumen-sprayer.html>

11.0 CONCRETE BATCHING AND MIXING PLANT

1. Horizontal Plant

Salient Features:-Concrete Batching / Mixing plant are available in 45/60/90/120 m³/hr. capacity.

- Aggregate stored in Inline Bins.
- Aggregate weigh is suspended on Four “S” type load cells, gives higher accuracy.
- Independent weighing system for Aggregate/Cement/Water & Additive.
- Fully Automatic-Electronic operation with PLC/PC Control.
- Available with Single Shaft / Twin Shaft / PAN / Planetary type Mixers.
- Reliable, Fast and Accurate Electronic Weighing System for major inputs.
- Cement / fly ash storage & conveying system from 20 to 200 MT capacities.
- Microwave Moisture Meter.
- Computer SCADA System with software.
- Radial Conveyor Belt for Agg. Feeding



Fig. 1 Horizontal concrete batching and mixing plant

2. Compact Concrete Batching/Mixing Plant. (Scrapper Type)

Silent Features:-

- Specially designed fabricated sections used for sturdy Construction.
- Fully Automatic – Electronic operation with PLC/PC control.
- Sturdy (16mm thk.) skip hoist track.
- Replaceable Hard Liner tiles in the Mixer.
- Reliable, Fast and individual electronic weighing system for major inputs.
- Available With Pan type Mixer & Pocket Aggregate Storage Bin
- Simple and economical foundation.



Fig. 2 Compact Concrete Batching/Mixing Plant (Scrapper Type)

3. Compact Concrete Batching/Mixing Plant. (Inline Bin)

Silent Features:

- Specially designed fabricated sections used for sturdy Construction.
- Fully Automatic – Electronic operation with PLC/PC control.
- Sturdy (16mm thk.) skip hoist track.

- Reliable, Fast and individual electronic weighing system for major inputs.
- Available With Pan type Mixer & Pocket Aggregate Storage Bin



Fig. 3 Compact Concrete Batching/Mixing Plant. (Inline Bin)

4. Compact Concrete Batching/Mixing Plant. (Pocket Type)

Silent Features :-

- Fully Automatic – Electronic operation with PLC/PC control.
- Sturdy (16mm thk.) skip hoist track.
- Reliable, Fast and individual electronic weighing system for major inputs.
- Available With Pan type Mixer & Pocket Aggregate Storage Bin



Fig. 4 Compact Concrete Batching/Mixing Plant(Pocket Type)

5. Compact Plant MAC Series

Four types of mixer models can be selected with a broad range of models: Single Shaft Mixer, Twin Shaft Mixer, PAN type Mixer and Planetary Mixer.

The main advantage of this plant is that it doesn't require large foundations and others civil constructions. The time and money can be saved by easy transportation, assemble and disassemble when plant is shifting from one site to another site. The constitution of the plant is made in welded construction of steel profiles.

It is easy to disassemble, transport and assemble again. In one week plant can be assembled at new site producing concrete.

Salient Features:-

- Available in 30 / 45 / 60- / 75 / 90 m³/hr. capacity.
- Compact and economically designed.
- Heavy duty structure.
- Plug-on & Operate” concrete batching plant.
- Less space required because of its compactness.
- Civil Foundation work is very fewer as compact design.
- Negligible owning & operating cost.
- Longer life of wear & tear parts.
- In-built control cabin.
- Especially quick erection & commissioning.
- Inbuilt pipeline of water, additive and pneumatic.
- Tilting type control cabin for easy transportation.
- One operator can run the plant.
- Single Shaft and Planetary Mixer Available on request.

Optional-

- Cement / fly ash storage & conveying system from 20 to 200 MT capacity.
- Microwave Moisture Meter.
- Computer SCADA System with software.
- Radial Conveyor Belt for Agg. Feeding



Fig. 5 Compact Plant MAC Series

6. Mobile Concrete Batching Mixing Plant

Salient Features

- Available in 15 m³ / 20 m³ / 125 m³ / h - Capacity
- Compact Design for easy to Transportation and Shifting by Towing Also
- Loading of Aggregate / Sand Hoppers by Wheel Loader / JCB
- Microprocessor Based Control Panel with integral Computerized Batch Controller accommodates Different Mix Receipes
- Fully Automatic Plant with Electronic Weighing of Agg. / Sand / Water / Cement
- Plant can be Erected & Commissioned withing One Day
- Complete Plant can be Transported in One 40 foot Trailer
- Plant Only requires Electric power Supply, Water Piping / Agg., Sand Feeding
- With Discharge Belt Conveyor
- High Pressure Cleaner

Optional

- Chemical Additive System
- Printout System
- Cement Silo.

Dimensions	4 Bins	4 Bins
Total Length	8705 mm	8705 mm
Total Width	2135 mm	2135 mm
Total Height	2750 mm	2750 mm
net Weight	7 Ton	9 Ton
Pan Mixer		
Output Rate	12-15	18-20 m ³ /hr.
Volume	m ³ /hr.	1200 Lt.
Output / Mix	1200 Lt.	750 Lt.
Mixer Motor	750 Lt. 20 HP	30 HP
Sand / Aggregate	2/4 Hopper	2/4 Hopper
Hopper Cap. Each	2.5 m ³	2.5 m ³
Water Pump	2 Nos.	2 Nos.

Connected Power	50 HP	60 HP
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Fig. 6 Mobile Concrete Batching Mixing Plant

7. Mobile Concrete Placer

- This Machine can be used for Bridges, Culverts, mass Concreting Purpose and Canal Works.

Mobile Concrete Placer - MCP - 56, can place concrete of any mix at the rate of 25 cum/hr up to 8.5 Mtrs. height and underground up to 5 Mtrs.

Mobile Concrete Placer - MCP - 56/650, can place concrete of any mix at the rate of 50 cum/hr and can handle upto 80 mm aggregate up to 6 Mtrs. height and underground up to 5 Mtrs.

- Mobile Concrete Placer is available in 56 Feet length, pouring at the height of 27 feet and ability to fold for Twing without removing discharge hopper.

Mechanical power for the conveyor is provided by 25 HP (19 Kw) Kirloskar Engine, which drives a Hydraulic Double Pump. Hydraulic steering which pivots the two under carriage wheels 90 degree to the

Right and 45 Degree to the Left and the steering wheel at the charging end rotates the towing hitch wheel 360 degree about its yoke. So the conveyor can be moved in a straight line and vertical too.

Capacity

Model - MCP - 56	25 cm/hr. maximum
Model - MCP - 56/650	50 cm/hr. maximum (Handle up to 80 mm Aggregate size)
Charging Hopper	0.2 cm/hr.
Hydraulic Oil Tank	80 Liters
Fuel Tank	25 Liters
Water Tank	95 Liters



Fig. 7(i) Mobile Concrete Placer-56/650



Fig. 7(ii) Mobile Concrete Placer-56

8. Ready Mix Concrete Mix Plant

In-Line Bin Type Concrete Batching Plant

Capacity: 30 Cubic Meter / Hour with Pan Type Mixer
Above 30 that is 45, 60 & 120 Cubic Meter with BHS Twin Shaft Mixer

Four Bin System

4 Bin aggregate. Feeder unit with a storage capacity of 7.5 M³, Feeder bins are provided with pneumatically operated, radial gates for coarse / fine discharge. Sand Bin is provided with vibrator.

Gathering / Weighing Conveyor

Aggregates are discharged sequentially according to predefined set values on to the Gathering Conveyor. The Gathering Conveyor assembly is suspended on 4 load cells. As soon as desired recipe of aggregates accumulates gathering conveyor discharges the mix on the the Slinger conveyor. The Gathering Conveyor and Slinger Conveyor are provided with idlers roller guides and return roller.

Slinger Conveyor

Slinger Conveyor discharges aggregate to the retention hopper.
Weighing System for Cement, Water & Additives: -

Cement

Cement will be fed from cement storage silo to cement weighing hopper which is normally mounted on 3 load cell with butterfly valve for discharge.

Water Weighing Tank (Capacity 250 Ltrs.)

Water will be pumped by water pump from reservoir (Byers's Scope), Water tank is supported on load cells and it has a gate with rubber gasket at the bottom, which is actuated by pneumatic cylinder. Water will be directly discharged into the mixer.

Additives

Comprises of admixture flask tank of capacity 10 Liters with feeding pump.

Retention Hopper

Temporary Storage Hopper is provided with vibrator and it is utilized for holding the batch of 4 aggregates before feeding to the pan type mixer.

Pan Type Mixer

Pan Type Mixer of capacity 1m³ is fixed on the basic structure of the plant. Mixer having 7 arms and shell is reinforced with replaceable high wear resistant NI Hard Liners. The aggregates, cement, water and additives are discharged to Pan Mixer. After homogeneous mixing the batch is discharged to the Transit Mixer by hydraulic system.

Computerized Control Cabin:

Control Panel Comprises of:

- SCADA" Based Controller
- Proxy switch for each control point (Gates)
- Display Monitor
- Storage for 99 different type of mix proportions
- Preset batch controls the no. of batches for a transit mixer.
- Provision for printing operating data like - Mix Proportion, Batch weight, total no. of Batches, Subtotal, Gross Total etc.

- Automatic & Manual control
- 12' x 7' cabin size.

Pneumatic System

30 CFM / Air Compressor with built in pressure switch with necessary valves, fittings pneumatic piping.

Power Required

S. No.	Description	HP
1	Sand Hopper Vibrator	0.5 HP
2	Gathering / Weighing Conveyor Belt Drive	12.5 HP
3	Slinger Conveyor Belt Drive	15.0 HP
4	Pan Type Mixer	40.0 HP
5	Cement Screw Conveyor 1 Nos.	10.0 HP
6	Water Pump	03.0 HP
7	Air Compressor	10.0 HP
8	Hydraulic Power Pack	03.0 HP
Total		94.0 HP



Fig. 8 In-Line Bin Type Concrete Batching Plant

Contact:

1. Cosmos Construction Machineries And Equipments Private Limited
Website: <http://www.cosmos-machinery.net/>
2. Macons Equipments
Website: <http://www.indiamart.com/maconengineers/>
3. Gamzen Plast Private Limited
Website: <http://www.gamzenmachines.com/mobile-batching-plants.html>
4. Vinayak Road Equipment, Gujarat
Website: <http://www.hotmixplantindia.com/concrete-batching-plant.html>
5. Aquarius Engineers Private Limited
Website: <http://www.indiamart.com/aquariusengineers/>

12.0 CONCRETE MIXER TRUCK

Concrete Mixer Truck- The hydrostatic truck mixer transports concrete /mortar directly from plant to the place where it is to be poured. Concrete mixer with various capacities like 3, 4 and 6 cum is mounted on truck. It has a wide range of applications specially for mass concreting works like Multi-storeyed buildings, Bridge works etc.

The basic function of transit mixer is to maintain the concrete's liquid state, through the turning of the drum till the point of delivering at construction site.



Fig.6 Concrete Mixer Truck

Contacts:

1. Maxmech Equipments Pvt. Ltd.
Ref: http://www.maxmechgroup.net/transit_Mixer.htm
2. Apollo Infratech Pvt. Ltd.
Ref: http://www.apolloinfratech.com/transit_mixers_atm2_atm4.html
3. Jamshedji Construction Machinery Co.
Ref: <http://www.jcmcindia.com/mixers.html#transit-mixer>
4. Conmat Systems Private Limited
Ref: <http://www.indiamart.com/conmat/concrete-pump-transit-mixer.html#concrete-transit-mixer>

13. CONCRETE PUMP

A concrete pump is a tool used for transferring liquid/flowable concrete by pumping. There are two types of concrete pumps.

The first type of concrete pump is attached to a truck. This is known as a trailer-mounted boom concrete pump because it uses a remote-controlled articulating robotic arm (called a boom) to place concrete with pinpoint accuracy. Boom pumps are used on most of the larger construction projects as they are capable of pumping at very high volumes and because of the labour saving nature of the placing boom.

The second main type of concrete pump is either mounted on a truck and known as a truck-mounted concrete pump or placed on a trailer, and it is commonly referred to as a line pump or trailer-mounted concrete pump. This pump requires steel or rubber concrete placing hoses to be manually attached to the outlet of the machine. Those hoses are linked together and lead to wherever the concrete needs to be placed. Line pumps normally pump concrete at lower volumes than boom pumps and are used for smaller volume concrete placing applications such as swimming pools, sidewalks and single family home concrete slabs and most ground slabs.

There are also skid-mounted and rail mounted concrete pumps, but these are uncommon and only used on specialized jobsites such as mines and tunnels.

Type of concrete pump:

1. Concrete boom pump
2. Truck Mounted Concrete Pumps
3. Trailer Mounted Concrete Pumps
4. Concrete Distributor
5. Stationary Boom
6. Concrete pump
7. High Pressure Pump/ Material Handling Pumps
8. Concrete Buckets
9. Material Lift
10. Double Drum Winch

1. Concrete boom pump

Concrete Boom Pumps are an indigenous solution that ensures faster completion of job and reduced down time. These boom pumps are available in 32 m and 36 m lengths. The boom allows quick setting-up by overcoming the necessity of cumbersome pipeline laying.

Some of the major features available in such pumps are mentioned below:

- Effective reverse pumping and reverse cleaning
- Digital hour meter
- Digital temperature display
- Suitable for two axle chassis
- Less ground space required
- Anti Stalling Device (ASD) to save engine overloading
- Remote control for boom operations
- Pump unloading valve to shut-off oil flow of hydraulic pump during blockages
- Maintenance friendly
- RPM and output regulation
- Water separator with display
- High pressure cleaning pump with large water tank



Fig.1 Concrete boom pump

2. Truck Mounted Concrete Pumps

Truck Mounted Concrete Pump is a complete solution for Ready Mix. and equipped with the highly wear resistant transfer tube and can pump the most difficult concrete. It carries its own pipelines and accessories and consists of a water tank and a flushing water pump.

The highlighting features of such pumps are listed below

- Highly wear-resistant S-transfer tube system
- Less wear parts
- Powerful agitator from both sides
- State-of-art 'easy clean' hopper
- Maintenance friendly
- Integrated water tank with high pressure pump
- Storage capacity for 100 m pipeline with all accessories
- Air compressor with tank (capacity 160 liters)
- Hydraulic out riggers



Fig.2 Truck Mounted Concrete Pumps

3. Trailer Mounted Concrete Pumps

Trailer Mounted Concrete Pumps are ideal for wide range applications and the high-pressure models are extensively used for high-rise and long distance conveying.

Some of the salient features of our range are mentioned below:

- Highly wear-resistant S-transfer tube system
- Less wear parts
- Powerful agitator
- State-of-art 'easy clean' hopper
- Maintenance friendly
- Leaf spring suspension for the demanding Indian roads



Fig.3 Trailer Mounted Concrete Pumps

4. Concrete Distributor

The Hydro Mechanical Concrete Distributors provide an inexpensive solution, as a practical complement to stationary concrete pumps, when separate concrete placing booms cannot be used to their full value. The reach of a placing boom on a truck mounted pump can also be increased with the help of concrete distributor. Available in various models such as CD-HM 08, CD-HM 12 etc.



Fig.5 Concrete Distributor

5. Stationary Boom

The SB has a 3-section hydraulic boom mounted on a 4-legged chasis. Use of Stationary Booms makes it possible to avoid the cumbersome process of laying pipelines. This means faster pours in less manpower and increased site safety.



Fig.6 Stationary Boom

6. Concrete Pump

Concrete Pump M15 finds application in grouting, plastering and concrete placing @ 15m³/hr. The multi purposes pump with number of advantages is featured with high pressure. Another model M45 is available with a capacity of 45M³/hr and can place the concrete at a distance of height 80 Mtrs and horizontal distance of 300 Mtrs. The pump is mounted on a framed chassis with air tyres for easy mobility at 25 Km/hr on site.

Technical Specifications:

JAMSHEDJI CONCRETE PUMPS MODEL					
S N o	Description	Unit	Model M15	Model M45	Model M60
1	Maximum theoretical output	M ³ /h	15	45	60
2	Maximum	(mp)a/	9/90	6/60	10/100

	Concrete Pressure				
3	Strokes / Minute	No	20	25	23
4	Pump Cylinder * Strokes	Mm	114 x826	180 x 1200	200/1600
5	Hopper Capacity	M3	0.4	0.6	0.8
6	Max Horizontal Placing Distance	Mtrs	150	300	1000
7	Max Vertical placing distance	Mtrs	45	80	80
8	Engine Diesel	Kw	40	75	75
9	Driving Speed	Rpm	2300	2300	2300
10	Hopper Height	mm	1400	1400	1400
11	Oleo tank Capacity	L	400	400	500
12	Total Weight	Kg	3500	5700	6200
13	Max Aggreg rate	Mm	20	40	40

Other additional Features

Sr	Features	M15	M45	M60
1	Double Walled Tail Pipe hsg	N/A	N/A	√
2	Enclosed agitator hsg	N/A	N/A	√
3	Choke up hooter/warning	N/A	N/A	√

4	Self lubricating	N/A	N/A	√
5	Stroke controller	√	√	√
6	high pressure/ Low pressure pumping	N/A	N/A	√
7	Pressure control main pump	N/A	N/A	√
8	Electronic control pannel	√	√	√
9	Remote control	√	Optional	√
10	Hydraulic Pump	2	2	3



Fig.7 Concrete Pump

Other additional models of Concrete Pump

Name of Parameter	M60 A	M60 B	M80 A	M80 B	M80 C	M80 D	M80 E	M70 A	M70 B
Max Theoretic al output m3/hr.	60	60	80	80	80	80	80	70	70
Theoretic al Max Horizontal	1600	1300	1600	1600	1600	1600	1800	2100	2100

l Distance (m)									
Theoretic al Max Vertical Distance (m)	350	270	350	350	350	400	400	450	450
Model of Distributi on valves	S Valve	S Valve	S Valve	S Valve	S Valve	S Valve	S Valve	S Valve	S Valve
Power (Kw)	156	156	181	174	156,187	181	187,224	181	187,224
Rotating Speed(RP M)	2200	2200	2300	2300	2200	2200	2200	2200	2200

7. High pressure pump or Material Handling Pumps

The pumps are appreciated by global clients for their operation efficiency in every climatic condition. High pressure pumps are available with wide collections as categorized:

- Solid handling pumps
- Semi liquid handling pump
- Pump for highly viscous liquid

It is featured with automatic operation and high efficiency, excellent resistance to abrasion and corrosion. High pressure pumps provide maximum design flexibility especially in plant retrofits and saves space during the pipeline transfer over long distance. Some of the other features of such pump include following:

- Pump and pipeline afford maximum design flexibility especially in plant retrofits
- Completely enclosed pipeline transfer eliminates odor and hygienic problems
- Long service life
- Expendables for minimum maintenance
- Self priming high suction capability
- Space saving pipeline transfer over long distance

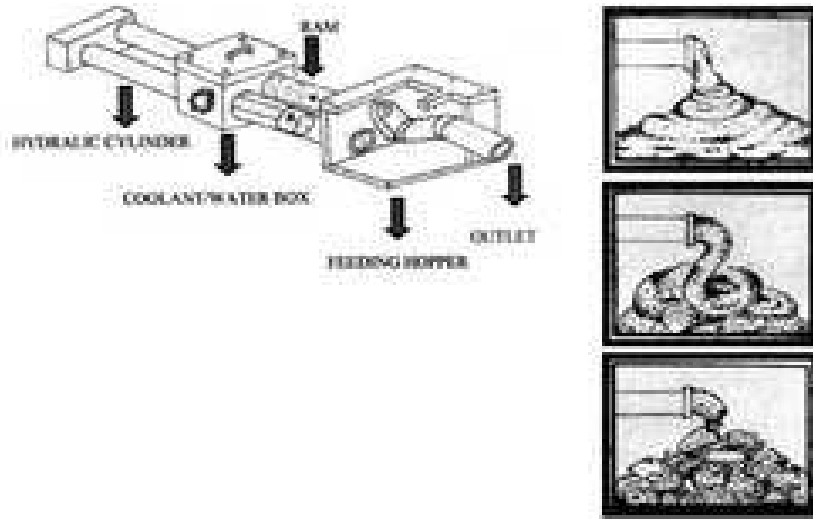


Fig.7 High Pressure Pump

8. Concrete Buckets

Concrete Buckets that are available in market are made from 3mm or 4 mm M.S sheet and are used to carry ready concrete mix from one place to another place within the construction premises. The bucket is available in two types of 0.6 cum capacity.

Conical Bucket	It can be used for concreting of slab, wide beam
Cow mouth or Shoe Type Bucket	It can be suitable for concreting of slab, narrow beam, column



Fig.8 Concrete Buckets

9. Material Lift

Material Lift that is fitted with a rope hoist for lowering and raising the cage in a precise manner. It can also be used in a efficient manner in the absence of a RCC inside the building. Mounted on a supported I-beam, the rope hoist is fitted with guide wheels. These wheels run in the C-Guides and are fitted with the collapsible gates that add a safety feature to these lifts. Material Lifts available are of two types such as One and Two Bag Capacity Material Lift.

It is also fitted with single/double drum winch and stair case/bar lifting arrangement. There are available in a height range of 9 meters to 13 meters and fitted with clutch & brake type sturdy & stable winch that is operated by electric motor or diesel engine.

These towers are available in two types that are as follows:

Channel Type:	<ul style="list-style-type: none"> Vertical tower / structure is made of channel angle & flat of different sizes
Kadamb type(Scaffolding Type)	<ul style="list-style-type: none"> Kadamb is a small square or rectangular structure made from angle which is used as guide for trolley, which is used with or without suitable H frame/Scaffolding



Fig.9 Material Lift

10 Double Drum Winch

Five tones capacity. Heavy in weight with sturdy & stable base for engine or motor. Wire rope, Diesel engine, Pulley etc. are also available for its operations.



Fig.11 Double Drum Winch

Contacts:

1. Aquarius Engineers Private Limited
Website: <http://www.trademart.in/aquarius.htm>
2. Jamshedji Construction Machinery Co.
Website:
<http://www.trademart.in/jamshedjiconstructionmachinerycopune1.htm>
3. S. N. Thakkar Construction Private Limited
Website:
<http://www.trademart.in/snthakkarconstructionprivatelimited.htm>
4. Spag Industries
Website: <http://www.trademart.in/spagindustries.htm>
5. Schwing Stetter India Private Limited
Website:[http://www.trademart.in/schwingstetterindiaprivatelimited.h](http://www.trademart.in/schwingstetterindiaprivatelimited.htm)
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14.0 SLIPFORM

Slipform - concrete is placed continuously in side form which moves at a set rate. Forms are not removed; they slip over the concrete which can support itself by the time it is out of the form.

Slipform System (Electro-Hydraulic self climbing system) may be defined as a method of continuously moulding or forming concrete, with the use of a moving formwork. The rate of movement or slipping, is controlled by the setting or curing rate of the concrete, which must be capable of supporting at least its own weight when exposed by the moving formwork. This is undoubtedly the most unique aspect of slipforming, the ability of concrete to stand safely and unsupported within 2 to 4 hours after being placed into the formwork in a plastic state. An evolution of the method has been taking place gradually over the years by fabquip Construction Systems.

Uses:

Construction of reinforced concrete wall structures such as silo complexes, chimneys, reservoirs, medium to high-rise housing, office buildings, hotels, hospitals, bridge piers, in ground shafts, caissons, dam structures, power stations etc.

The following are the major components of slip form System:

- Shuttering/form panels.
- Walers
- Yokes
- Working decks
- Hanging scaffolds
- Truss system
- Hydraulic jacks
- Jack rods
- Pumping units for jacks
- Bracings
- Operation screws
- Extraction jacks
- Miscellaneous equipment.

The Working system of Slipform

Concrete is placed inside the forms in shallow and regular layers of around 150 - 200mm. Each layer is vibrated with high frequency immersion type vibrators.

In commencing any slipform project, the forms must first be filled by layering in the concrete as described above.

Within 2½ - 3 hours of initial placement of the concrete, the vertical slipping of the formwork can commence. The formwork, at all times, must be kept as full of concrete as possible to allow the concrete the maximum period of time in the forms to gain strength before being exposed beneath the sliding forms. As the forms are slid or jacked upward, concrete continues to be layered into the top of the forms.

The speed of jacking is determined by the setting characteristics of the concrete rather than by the speed of the jacking system. If jacking is too fast, plastic concrete will fall out as it is exposed from the bottom of the forms. Conversely if jacking is too slow, the concrete surface will become dry, generating considerable friction between the sliding faces of the formwork.

Jacks are used to lift the formwork. They climb on jack rods, which are located centrally in the wall and cast into the concrete, the concrete providing lateral restraint against buckling of the jack rods.

Additional jack rods are added with the aid of screwed end couplings as the formwork rises.

Vertical reinforcement is located by reinforcement guides which are fixed to the slipform. The horizontal reinforcement has to be threaded beneath yoke heads as the slipform rises.

Slipforming is normally undertaken on repetitive work where speed or economy through the maximum reuse of the same formwork is possible.

Slipforming can be carried out continuously, 24 hours a day until the structure is completed; alternatively slipforming can be done on a discontinuous basis during daylight hours only; i.e. high-rise core construction.

Continuous Slip forming is normal for the construction of silos or water retaining structures where monolithic walls are required. On such projects, slipforming can be carried out at an average speed of 300 to 400mm in height per hour.

Discontinuous slip forming

Discontinuous slip forming is preferred for multi-story structures such as apartment building and commercial offices. For projects of this type, it is normal to use slipform for one full floor height per day (i.e. 3 to 4 meters). The following day is used to install window, door and floor blackouts, fix all vertical reinforcement, install stairs and generally make ready for the next floor height pour which would be completed the following day. This arrangement gives a repetitive 2 day cycle per floor.

There are many factors which will influence the decision to slipform continuously or discontinuously. For instance, where a slender or complicated structure is to be slipped, the rate of strength gain of the concrete and stability considerations, particularly where strong wind conditions are encountered, will dictate that a discontinuous or intermittent slipform approach be adopted.

Custom assembled to designed specifications

It is possible to slipform quite complex shapes. Almost any rectangular, cellular, curved or convolute d shape can be slipped.

Generally, for economic reasons, the plan shape of a structure to be slipformed should remain constant throughout its full height.

Whilst this is a desired requirement, it should not be taken as a limiting factor as it is quite possible to change wall thicknesses and to add to or remove walls from a Slip form during construction.

Since the formwork must slide past the face of the concrete wall it is essential that any horizontal projections from this face be eliminated or at least minimized. This requirement calls for special attention to floor slab and beam connections to Slip formed walls.

Where projections from the wall face have to be provided as an essential part of the structural design, such as corbels or haunches to provide

seating for precast beams or panels, then these can be formed integrally with the slipformed wall by the use of static formwork panels. These remain stationary in place as the slipform rises. This type of detail tends to complicate a slipform and as such should only be used where no alternatives are structurally or economically possible.

slipform construction is a method for building large towers or bridges from concrete. The name refers to the moving form the concrete is poured into, which moves along the project as the previously poured concrete hardens behind it.

Vertical slipform relies on the quick-setting properties of concrete requiring a balance between early strength gain and workability. Concrete needs to be workable enough to be placed to the formwork and strong enough to develop early strength so that the form can slip upwards without any disturbance to the freshly placed concrete.

Contacts:

1. www.gomaco.com (USA)
2. www.huronmanufacturing.com (USA)
3. www.mcepl.com (Haryana, India) (mani construction equipments(p) ltd.
4. www.macromarvel.com (Chennai, India)
5. www.fabquip.com

15.0 CONCRETE VIBRATOR

Concrete Vibrator- Consolidation of concrete should proceed immediately after placing the concrete to make impermeable/dense enough to gain desired strength. The concrete mass should be consolidated or compacted till the cream of concrete starts appearing on the surface. This may be done by hand or by mechanical device. Mechanical compaction is done by use of vibrators. Compaction of concrete by vibration is considered essential for all important work specially in situations where reinforcement are congested or the member is required to have exposed concrete surface finish.

Type of vibrator:

1. Plate Vibrator:

Plate vibrators are used to compact concrete to avoid blowholes on concrete slabs. The compaction level can be adjusted as per the thickness of the slab.



Fig 1 Plate vibrator

2. Screed Board or Surface Vibrator:

Screen board vibrators are used while pouring the concrete floors to level the faces and making the concrete free of porosity.



Fig 2 Screed Board or Surface Vibrator

3. Needle/ Internal/ Immersion Vibrator:

Internal concrete vibrators are used to consolidate the concrete surface so that it becomes more sturdy and gets free of any risk of voids. Based on operation this is either electrically operated or diesel operated.

Needle vibrator is mounted on a round plate which dampens the vibrations generated in the engine/motor. The vibrators' needles work on the pendulum principle showing both high frequency and amplitude, distributing vibration equally over the whole needle

Needle Vibrators specifics:

Needle Size	Dia 60/40/25 mm
Flexible Shaft	6 meters (L)
Vibrations	12000 /min
Power	2 H. P. Petrol/ Kerosene Enigne/ 2 H. P. single Ph Mortor



Fig 3 Needle vibrator

4. Table Vibrator:

Table vibrators are used extensively for precasting. Its main function is to compact the granules for which the controlled vibrations are required.



Fig 4 Table vibrator

- 5. Shutter Vibrator:** This type of vibrator is attached with formwork with nut and bolt attachment where concreting is to be done. After concreting this machine is started and vibration is produced which helps in expelling voids from concrete.



Fig 5 Shutter Vibrator

Contacts:

1. Cosmos Construction Machineries And Equipments Private Limited
Ref: <http://www.cosmos-machinery.net/vibrators.html>
2. Shree Sahjanand Engineering
Ref:
<http://www.indiamart.com/shreesahjanandengineering/industrial-vibrators.html>
3. Gubbi Enterprises
Ref: <http://www.constructionbazar.com/construction-equipments.html#concrete-vibrator>
4. Bhaskar Construction Equipments
Ref: <http://www.indiamart.com/bhaskarmachines/lab-testing-equipment.html#vibrator>
5. SONA SALES AGENCIES
Ref: <http://www.sonavibrators.in/search.html?ss=shutter+vibrator>

ROAD CONSTRUCTION EQUIPMENT

16.0 HOT MIX PLANT/ASPHALT DRUM MIX PLANT

Hot Mix Plant or Asphalt Drum Mix Plant is equipment for producing good quality of hot mix for flexible pavement construction.

The ingredients of the hot mix in required proportion are continuously fed to the rotating drum in drying & mixing zones and the discharge end of the drum delivers continuous output of the hot mix. The main ingredients of hot mix are virgin cold aggregates of different grades, asphalt (bitumen) and mineral fillers. The output capacity of this plant varies from 30 TPH to 120 TPH (Tone per hour).

1. Asphalt drum mix plant generally consists of :

- » Cold Aggregate Four Bin Feeder
- » Single Deck Vibratory Screen For Oversized Material Removal
- » Slinger (Cold) Conveyor
- » Drying Cum Mixing Thermo drum
- » Load out conveyor with Gob hopper
- » Asphalt Tank
- » Mineral Filler Unit
- » Centralized Control Panel With Insulated Cabin
- » Dryer Auto Burner
- » Fuel Storage Tank
- » Pollution Control Unit (Optional)

In this the cold aggregates of different grades which are stored in the multiple feeder bins are transferred in required proportion to the primary section of the rotary drum through slinger conveyor. The burner fitted on the in feed side of the drum produce appropriate flame to remove the moisture from the aggregates and heat the dried aggregates to the desired temperature in the primary section of the drum.

The hot aggregates then travel down the secondary section where they are mixed & coated with the asphalt & filler material. The asphalt and filler material are pumped in the secondary section in predetermined proportion from asphalt tank and mineral filler unit respectively. These

hotmix from the drum is then transferred to truck through load out conveyor. The heavy dust is collected by the multi cone type dust collector and the exhaust is passed through wet scrubber type pollution control unit before letting it to the atmosphere.



Fig.1 Asphalt drum mix plant

Asphalt Drum Mix Plants offer advantages of higher production rates, less moving parts, lower maintenance, simple to operate, lower fuel consumption & better economy.

2. Wet Mix Macadam Plant / Wet mix plant Soil Stabilizing Plant

Wet Mix Macadam Plant is also Wet mix plant /Soil Stabilizing Plant. This equipment is employed for producing homogenous mixture of aggregates, sand, cement and water which is laid in base or sub base preparation of rigid or flexible pavements. The output capacity of Wet Mix Macadam is 60 TPH, 100 TPH, 160 TPH and 200 TPH. The aggregates and sand stored in multiple feeder bins discharged by each bin feeder belt in desired proportion to gathering belt. This mixed material is then conveyed by gathering belt to Pug mill where it is mixed with water and cement in order to produce the homogenous mixture. The homogenous mixture is further on conveyed to storage silo or trucks for lying at site.

Wet Mix Plant generally consists of:

- » Multiple Feeder Bins
- » Pugmill Mixture
- » Collecting Conveyor
- » Load out conveyor

- » Water storage tank
- » Cement silo
- » Storage Silo
- » Control Panel.



Fig.2 Wet Mix Macadam Plant

3. Road cleaning Machine

Road cleaning machine are used to sweep roads quickly. This machine cleans the road completely and removes the dirt and dust from it in order to assist in road construction. This machine is provided with a rotary brush which mechanically operates and cleans the dust particles settled on the road



Fig.3 Road cleaning Machine

This machines is extensively used to clean the sand of the road with a powerful high pressure air blower within a short time there by it saves labour, time and also bitumen.



Fig.3(a) Road cleaning Machine

4. Road Kerbing Machine

A curb/kerb is the edge where a raised pavement/sidewalk/footpath, road median or road shoulder meets an unraised street or other roadway. Typically made from concrete, asphalt or long stones (often granite), the purpose is twofold: first as a gutter for proper drainage of the roadway and second for safety, to prevent motorists from driving onto the shoulder, median, sidewalk or pavement.

Road kerbing equipment is widely used in various road projects. These concrete kerbing machine are built under strict guidelines as per international quality standards.



Fig.4 Road Kerbing Machine

5. Asphalt Paver Finisher

Mechanical Asphalt Paver Finisher is a unique paver with combination of features designed and engineered to give maximum output with comforts and efficiency. The hydraulically extendable screed allows step less and hassle free width adjustment. The higher H.P. engine ensures smooth paving in gradients. The paver can be employed for both asphalt as well as wet mix paving with slight modifications.

Paver Finisher is used in road construction industry for paving or laying hot mix material on constructed surface. This is simple to operate and require negligible maintenance.



Fig.4 Road Kerbing Machine

6. Wet mix Paver

Highly efficient and long lasting in nature. Wet Mix Pavers serve as an economical solution for laying wet mix Macadam and dry lean concrete in line with M.O.R.T.H. specifications.



Fig.6 Wet mix Paver

7. Chips Spreader

Chip Spreaders is used for surface dressing works. It is used to lay 10mm to 65mm thick material. Chip Spreaders is available in two sizes as per given below:

Up to 2 meters spreading width

Up to 3.5 meters spreading width



Fig.7 Road Kerbing Machine

8. Fog Seals

Fog Seals are using polymer modified asphalt surface sealer (PASS). These seals find application to maintaining the quality of road ways there by extending its lifetime.



Fig.8 Fog Seals

9. Bitumen Sprayer

Bitumen pressure distributor is developed for tack coat and between spraying application. This equipment is capable of applying a uniform coating of hot & emulsion bitumen on specified surface in prescribed quality. Its capacity is up to 3000 litres.

PRIMAX Hot Bitumen Pressure distributor consisting of insulated Bitumen tank of 1200 Ltr. capacity with heating arrangement and other standard accessories such as Spray Bar, Gear Pump. It is mounted on fabricated chassis with four pneumatic tyres wheels and air Cooled Diesel Engine.



Fig.9 Bitumen Sprayer

10. Concrete Lining Paver

Concrete lining paver is widely used for pavement of canal, Airport Apron & Runway roads, Flooring, Reservoir, Bridges etc. It consists of sturdy frame structure made from plates, pipes & angles etc. The frames are normally made in length of 1220mm, 1830, 2440mm & 3660mm for easy handling. It consists of two hydraulic power pack units, one is at fix console from where the operator operates the machine & another is traveling unit i.e. undercarriage. Each unit is equipped with electric motor.

The complete frame (according to the required length) is mounted on 4 Nos. heavy duty mechanical jacks which used for leveling of the machine. The four jacks are fitted on structure which carried 2 set of rollers i.e. 4 bogies runs on rail.

The fix console is fitted at one end from where the operator controls long travel speed & drum bogie operation. It is equipped with 10 H.P. electric motor and power pack. The undercarriage also consists of power pack unit equipped with 15 H.P. electric motor which operates drum, groove cutter, drum vibration.

The function of concrete lining paver is to finish the laid concrete in desired thickness & prepare a level finished concrete layer.

Expansion joint in concrete is prepared by two method, In first method

transverse & longitudinal groove cutter (driven by hydraulic motor) are provided & in second method PVC inserter is provided longitudinally & in transverse direction.

Optional:Sturdy, heavy duty design built for canal, Road and airport projects. Speedy, compacted and finished concrete laying



Fig.10 Concrete Lining Paver

Contacts:

1. Vijay Road Equipment
Ref: <http://www.indiamart.com/vijayroadequipment/road-construction-equipment.html#asphalt-mixing-plants>
2. Quality Engineers, Ahmedabad
Ref: <http://www.indiamart.com/qualityengineers/road-construction-equipment.html>
3. Capious Roadtech Private Limited
Ref: <http://www.capious.in>
4. Primax Equipment Pvt. Ltd.
Ref: <http://www.indiamart.com/primaxequipment/road-machinery-equipments.html>
5. Alka Earth Tech Equipment
Ref: <http://www.indiamart.com/alka-earth-equipment/paving-equipment.html>

6. Universal Engineers – Ahmedabad
Ref: <http://www.indiamart.com/universaleng/road-construction-equipment.html>
7. Maxmech Group
Ref: www.maxmechgroup.net
