

Department of Civil Engineering

Name of Subject: - **EMERGING TRENDS IN CIVIL ENGINEERING (ETC)**

Course Code: - **315315**

Scheme:- **CE-5K**

Semester:- **Fifth**

Unit No. 03

ADVANCED CONSTRUCTION EQUIPMENTS

CO1 - Propose the suitable advance construction equipments for the given work situation

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
I	Advance Construction Equipments	CO1	8	8	6	4	18

THEORY SYLLABUS CONTENT

Unit - I ~~Fundamental of Green Building and Energy Conservation~~ ~~Advanced construction Equipments~~

3.1 Survey equipments: LiDAR, Direct Reading Grade Rods, 3D Laser scanning, Robotic Markout, Google Earth.

3.2 Construction equipments: Earth moving equipment: Skid and crawler loaders, Trenchers, Scrappers, Wheeled loading shovels, Advanced plastering machine, Bridge girder launcher.

3.3 Material handling equipments: Types of cranes: Floating crane, Rough terrain crane, Bridge Over head crane, Conveyors, Hoists, Types of Forklifts: Telehandler forklift, Rough Terrain forklift, Types of paver: Tracked pavers, Hybrid offset paver, Side feeders, Road header, and Types of Tunnel boring machine: Horizontal boring, Vertical boring, Line boring

Subject Incharge

Mr. R. B. Patil

LIDAR:-

- It stands for Light Detection and Ranging.
- Used for distance measurement.
- it is a remote sensing technology.
- it emits laser radiation by accounting time to travel.

$$\text{Distance} = \frac{\text{speed of light} \times \text{time}}{2}$$

parts of Lidar →

1. Laser - emits laser pulses.
2. photodetector - it detect and reflect incident pulses.
3. GPS - provide sensor's position and direction on earth surface.

Applications:-

1. Land surveying.
2. urban planning.
3. Autonomous vehicle.
4. Agriculture.
5. Forest.
6. Disaster.

DIRECT READING GRADE RODS:-

It is a surveying staff and with levelling instrument to calculate/ measures the reduced level.

- usually 3m, 4m or 5m long.
- it can be folding or telescopic

Components of DRR:-

- sliding centre station.
- Laser detector
- Fixed Graduations.
- sliding graduations.
- lock mechanism.

Advantages:- Easy to use and read.

- More portable and light weight.
- High durable
- More accurate than others.

Applications:-

- used in major infrastructure projects.
- canal and irrigation projects.
- Topographic surveys.
- land development.

3D-Laser scanning:-

— it is an equipment used to collect spatial data at large volume.

— it captures 3D images of land.

— it also generate 3D-model without destruction.

— it scans and collect million of individual point measurements and plotted on single XYZ coordinate system to form a 'point cloud' of the objects external surface.



* Robotic markout :-

Objectives :- Transfer design coordinates from digital drawing to the construction site.

- It improves layout accuracy
- To reduce surveying time
- To increase productivity.
- To ensure precise positioning

Principle :-

Import the design coordinates
from CAD/BIM



set up instrument



orientation



measures angles/distances.



measured coordinates

Applications :-

- Building construction
- Road and highway projects.
- Tunnel construction
- Pipeline and utility installations.
- Railway construction

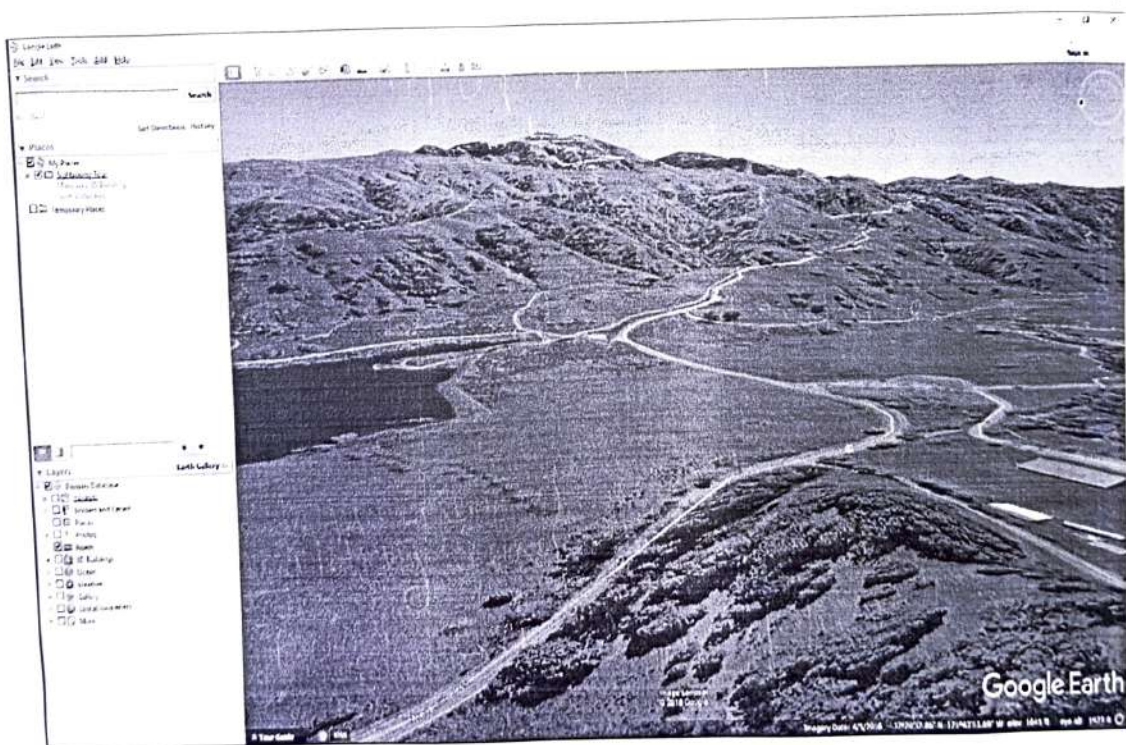
Google Earth:-

Objectives:- To obtained earth surface using satellite image.

- To measures distances, areas and elevations

- To support route planning and alignment studies.

- To Improve planning and decision making using topographic information



* construction equipments:-

① Earth moving equipments:- This instruments are heavy construction machines used for excavation, loading, hauling, grading, levelling, compaction and handling of soil and other earth materials.

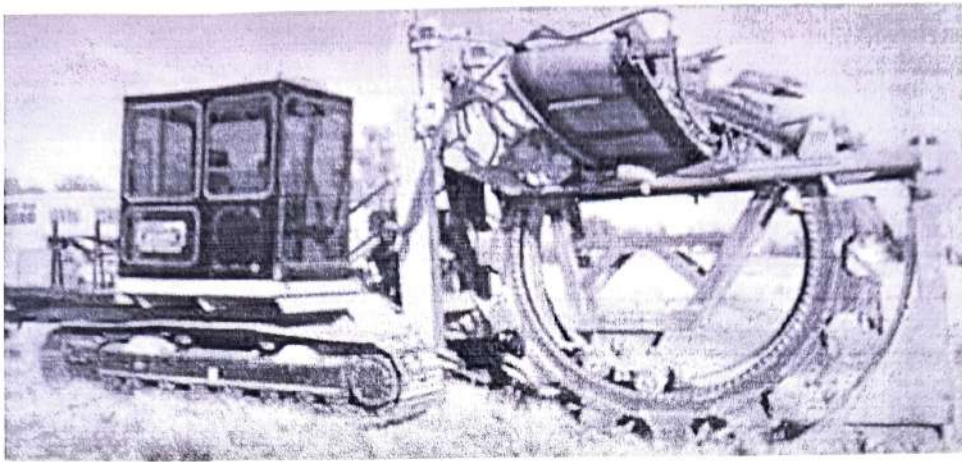
* skid and crawler loaders:-

It is a loaders used in construction for digging, lifting and moving materials.



Parameter	Skid Loader	Crawler Loader
Bucket capacity	Generally 0.25–1.0 m ³	Generally 1.0–4.0 m ³
Loading capacity	Low to medium	Medium to high
Machine size	Compact	Medium to large
Carrying/working capacity	Suitable for small quantities of material	Suitable for large quantities of material
Ground condition	Best on firm and relatively stable ground	Excellent on soft, muddy, loose and uneven ground
Mobility	Very high; easy to maneuver in confined spaces	Lower speed, but excellent traction
Working distance	Short-distance material movement	Short to moderate-distance material movement
Excavation capability	Light excavation	Heavy excavation and earthmoving
Site clearing	Small-scale clearing	Large-scale clearing
Road construction	Minor grading, shoulder work and material handling	Heavy earthwork and site preparation
Building construction	Excellent for confined sites, trenches and landscaping	Suitable for large construction sites
Material handling	Soil, sand, gravel and debris in smaller quantities	Soil, rock, aggregates and large quantities of earth
Best suited for	Small/medium projects and restricted areas	Large-scale and difficult-terrain projects

• Trenchers! – are used to excavate trenches in soil. These trenchers are generally used for pipeline laying, cable laying, drainage purposes etc. These are of two types namely chain trenchers and wheeled trenchers.



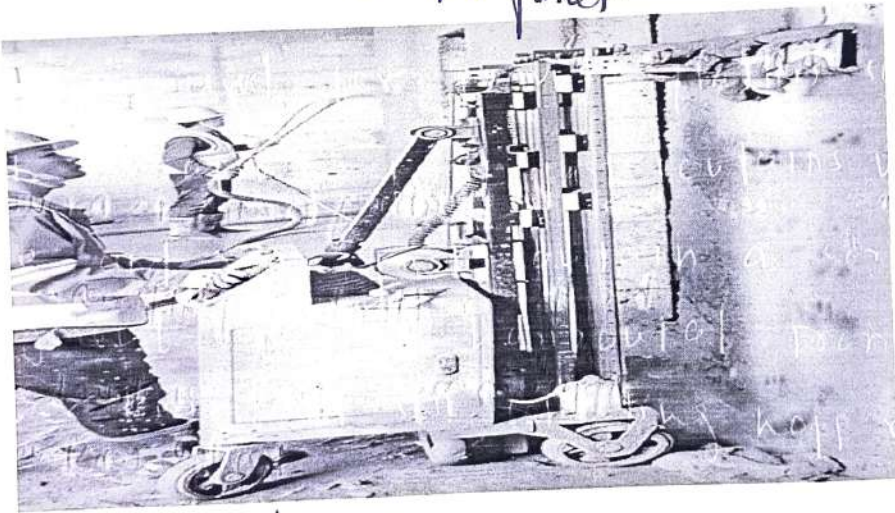
* scrapers! - used for provide flatten soil surface through scraping. front part contains wheeled tractor vehicle and rear part contain a scrapping arrangement such as horizontal front blade, conveyor belt and soil collecting hopper.



* Advanced plastering machine:-

It is mechanized construction machine used to mix, pump, spray, level and finish plaster.

components:-
 material hopper
 mixing unit
 pump
 delivery hose
 spray gun
 levelling
 control panel.

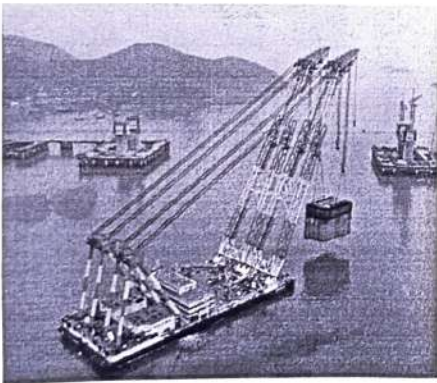


* Bridge girder launcher:- It is specialized heavy construction equipment used to lift, transport, position and place precast concrete or steel bridge girders.



types of cranes! —

① Floating crane :— A floating crane is mounted on a barge or floating platform.



Applications —

- port construction
- Bridge construction
- off shore construction

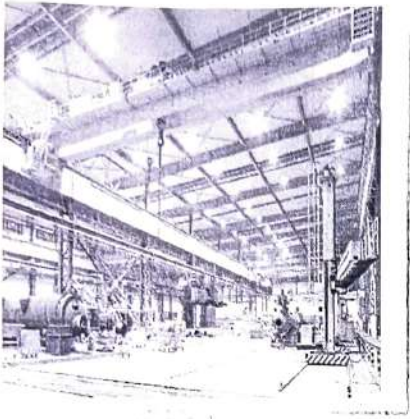
② Rough terrain crane :— it is specially designed for off-road construction site.



Applications :—

- Building construction
- Industrial site
- Infrastructure projects
- uneven construction site

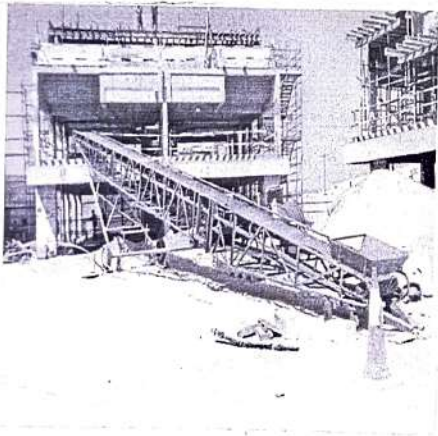
③ Overhead crane :- An overhead crane runs along parallel elevated rails inside a building.



Applications :-

- Manufacturing plants.
- Workshops
- Ware houses.
- Steel plants.

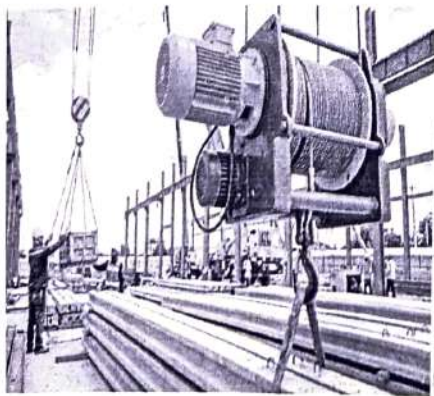
* Conveyers :- It is material handling equipment used to transport material continuously from one location to another location.



Applications -

- construction sites.
- mining sector
- manufacturing sector
- ware houses.
- RMC plant.

* Hoist :- used in rigging to support hanging loads such as cargo, construction equipment and vehicle engines as well as to raise or transport heavy things.



Applications :-

- manufacturing facilities.
- logging camps.
- construction sites.
- auto repair shops.

* Forklifts! - It is powered industrial vehicle used for loading and unloading of materials such as lifting, carrying, moving and stacking materials.

Types of forklifts! -

① Telehandler forklift! - It has telescopic boom that can extend forward and upward. It can lift materials to considerable heights and reach over station.

Applications! -

- Material handling
- To lift bricks at certain height.
- Roof construction
- To place materials on upper floor.

Types of Pavers – Components, Features and Applications

Paver – A construction machine used for placing and spreading materials such as asphalt, concrete or paving blocks to form roads, pavements and other surfaces in a uniform and controlled manner.

Tracked Pavers



A tracked paver is an asphalt paving machine that moves on continuous tracks instead of rubber tyres. It provides stability and traction, especially on uneven or soft ground.

Components

1. Hopper – Stores and supplies hot mix asphalt
2. Conveyor (Feeders) – Transfers material from hopper to screed
3. Screed – Ensures uniform flow of material
4. Spreaders – Spreads and levels the mix
5. Traction System (Tracks) – Movement and stability
6. Operator's Cabin – Controls the machine

Features

• Moves on continuous tracks – better stability and traction
• Uniform and smooth paving of asphalt
• High load-carrying capacity
• Suitable for large-scale and heavy-duty projects
• Works on uneven or weak subgrade

Applications

• Construction of highways and expressways
• Airport runways
• City and rural roads
• Large parking areas and industrial yards
• Road construction on soft or uneven ground

Hybrid Offset Paver



A hybrid offset paver is a versatile paving machine that can place concrete in different shapes and widths using an offset mould or paving arrangement. It combines features of conventional and offset paving.

Components

1. Power Unit – Engine and hydraulic system
2. Operator's Cabin – Controls the machine
3. Main Frame – Supports all components
4. Offset Mould / Paving Arrangement – Forms kerb, gutter, drain or other profiles
5. Material Supply System – Feeds concrete / mix
6. Vibrator / Compaction Unit – Ensures density and proper profile

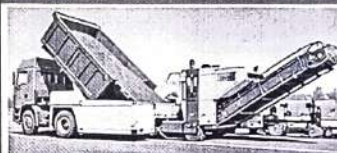
Features

• Can place concrete in multiple profiles (kerb, drain, barrier, etc.)
• Offset construction – works on one side
• Suitable for narrow spaces and constrained areas
• Provides continuous and uniform construction
• Reduces manual labour and time

Applications

• Kerb and gutter construction
• Road shoulders and median barriers
• Drainage channels
• Concrete barriers
• Sidewalks and narrow pavements

Side Feeders



A side feeder is a material-transfer machine used to receive asphalt from trucks and continuously feed it to an asphalt paver. It maintains a steady supply of material to the paving machine.

Components

1. Receiving Hopper – Accepts hot mix from trucks
2. Conveyor Belt – Transfers material to paver
3. Transfer Conveyor – Lifts and feeds material
4. Hydraulic System – Controls movement
5. Operator's Cabin – For monitoring and control
6. Tracks / Wheels – Mobility and positioning

Features

• Provides continuous and uninterrupted supply of asphalt to paver
• Reduces truck-to-paver contact
• Maintains uniform temperature of material
• Improves paving quality and productivity
• Minimizes delays in construction

Applications

• Highway construction
• Airport pavement construction
• Large asphalt paving projects
• Long-distance paving operations
• Projects requiring continuous material feeding

Road Header



A road header is a mechanically operated excavation machine used mainly for tunnelling and underground excavation. It has a rotating cutting head that cuts rock or soil.

Components

1. Boom – Supports and moves the cutting head
2. Cutting Head (Drum) – Rotating cutter with cutting tools
3. Conveyor System – Removes excavated material
4. Power Unit – Engine and hydraulic system
5. Operator's Cabin – Controls and monitoring
6. Tracks – Movement in underground space

Features

• Rotating cutting head for efficient excavation
• Suitable for hard to medium rock/soil
• Can work in confined underground spaces
• Provides accurate tunnel profile
• Safe and controlled excavation

Applications

• Road tunnels
• Railway and metro tunnels
• Mining operations
• Underground utility tunnels
• Caverns and underground structures

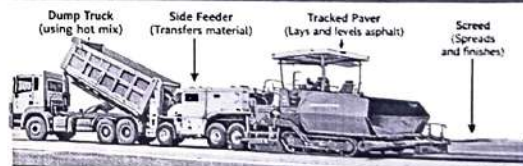
Key Differences

Type	Main Function	Key Use
Tracked Paver	Laying asphalt	Highways, airports, large roads
Hybrid Offset Paver	Placing concrete in special profiles	Kerbs, drains, barriers, shoulders
Side Feeder	Feeding asphalt continuously	Highway and large paving projects
Road Header	Underground excavation	Road, metro and railway tunnels

Summary

- Pavers are used for road and pavement construction to place and level material uniformly.
- Tracked pavers, hybrid offset pavers and side feeders are mainly used in asphalt and concrete paving works.
- Road header is an excavation machine used for tunnel and underground construction.
- Side feeders ensure continuous supply of material to the paver, improving efficiency and quality.
- Road header machines help in safe and accurate tunnel excavation.

Typical Road Paving Arrangement



Continuous Material Supply → Uniform Paving