CONSTRUCTION MANAGEMENT & SAFETY ENGINEERING

(SUBJECT CODE : 5012)

Department of Civil Engineering
Government Polytechnic College Manjeri

NISHMA M NAIR
Lecturer in Civil dept. GPTCM

SYLLABUS

Module 1: – Planning and Organizational aspects, Constructional planning, organizational structure

Module 2: – Execution of works, Contracts, Tender and tender notices, Measurement of works, Payment of bills

Module 3: – Introduction to Human Resource Management, Stores, Managing materials and machinery

Module 4: – Principles of safety in construction activity , Entrepreneurship and management, Introduction to small scale Industries, Introduction to quality control, T.Q.M and I.S.O 9000

CONTENTS

- Human resources management
- Different sources of human resource- Education institution campus –internal recruitment – open market – from opponents
- HR development - Recruitment – Selection –Appointment – Induction & training – In service training
- Increasing productivity –motivation -Incentives
- Labour welfare measures – Workmen compensation act
- Trade unions – Role of trade unions.

HUMAN RESOURCE MANAGEMENT

- Construction industry – Highly labour intensive
- 40% of total construction cost
- Increasing efficiency – highly important in increasing productivity and profitability
- Human resource – one with emotion and feeling

  Appropriate engineering to deal – HR department
- Thus most difficult among resource management

SOURCES OF HUMAN RESOURCE

- College campus (through campus recruitment)

  Young & Energetic –freshers - Easily trainable but extensive training
- Open market (through advertisement)

  Freshers as well as experienced , screening difficult
- Data banks (like employment exchange, private HR agencies)

  Screening process simple – complete details of the candidate available
- Opponent organisations

  Efficient candidates available
- Internal promotions

  Proven track record but personal egos may be there

HUMAN RESOURCE DEVELOPMENT

VARIOUS STAGES

- Recruitment – process of attracting eligible candidates for the job
- Selection – Based on knowledge, skill, personal qualities
- Appointment- posting of a person followed by a training
- Training
- Re-training (in-service training) – whenever there is a change in the system

INCREASING PRODUCTIVITY

- Productivity – yardstick of efficiency
- HR to be motivated - It is the self drive/enthusiasm that is created in a person to improve his performance
- Motivation factor vary according to the class of employees and other personal factors
- Measures adopted by the management to achieve motivation- INCENTIVES

  Monitory benefits ,tour package, membership in elite club
- Recognition ang honouring
- Providing unethical incentives – negative impact

LABOUR WELFARE MEASURES

- Primary responsibility of an organization
- Welfare measures include
  - Employees provident fund
  - Pension
  - Death cum retirement benefits
  - Gratuity
  - Soft loan
  - Provide safety gadgets
  - Medical/maternity leaves
  - Medical reimbursement
  - Insurance
  - Compensation for accidents
  - Education facilities for children
  - Food and household items at concessional rate
- Workmen compensation Act – protect welfare and compensation measures of employees

WORKMEN COMPENSATION ACT

- In the year 1923, the central government of India enacted a law called the Workmen's Compensation Act of 1923, to ensure the social safety of the workers
- The act was implemented in response to the increasing danger to the life of workers with the use of modern sophisticated machinery
- It was announced in the bill that if any discrepancy takes place by with any worker while working in the factories, as a result of employer's negligence, then he would only be responsible for the compensation
- The main aim of this act was to provide the workmen and their wards with the payment of compensation in case any injury and accident (including several industrial illnesses) takes place during the working hours

SALIENT FEATURES OF THE ACT

Provisions and applicability

The workmen's Compensation Act 1923 is one of the important social security legislations. It aims at providing financial protection to workmen and their dependants in case of accidental injury by means of payment of compensation by the employers. This act makes it obligatory for the employers brought within the ambit of the act to furnish to the state governments/Union Territory Administrations annual returns containing statistics relating to the average number of workers covered under the Act, number of compensated accidents and the amount of compensation paid

SALIENT FEATURES OF THE ACT

Applicability of the ACT

The act extends to the whole of India except States/Union Territories of Arunachal Pradesh, Mizoram, Nagaland, Sikkim and Daman & Diu and Lakshadweep. The act applies to workers employed in any capacity specified in schedule II of the Act which includes Factories, Mines, Plantations, Mechanically propelled vehicles, Construction work and certain other Hazardous Occupations and specified categories of railway servants

SALIENT FEATURES OF THE ACT

Main provisions and scope of the Act

Under the Act, the state Governments are empowered to appoint Commissioners for Workmen's compensation for (i) settlement of dispute claims , (ii) disposal of cases of injuries involving death , and (iii) revision of periodical payments. Subsection (3) of section 2 of the Act, empowers the state government to extend the scope of the act to any class of persons whose occupations are considered hazardous after giving three month notice to be published in the official Gazette. Similarly , under section 3(3) of the Act, the state government are also empowered to add any other disease to the list mentioned in parts A and B of schedule-II and the central government in the case of employment specified in part C od schedule III of the Act

SALIENT FEATURES OF THE ACT

Compensation

In case of death the minimum amount of compensation fixed is Rs 80,000 and Rs 90,000 in case of permanent total disablement. The existing wage ceiling for computation of maximum amount of compensation is Rs 4000. The maximum amount of compensation payable is Rs 4.56 lakh in the case of death and Rs 5.48 lakh in case of permanent total disablement. The Indian workmen's compensation act 1923 provides for the payment of compensation by the employer to his employees (for their dependants in the event of fatal accidents) if personal injury is caused to them by the accidents arising out of and in the coarse of their employment. The maximum compensation payable is upon the following scale (as per W.C Amendment Act 2000)

SALIENT FEATURES OF THE ACT

Compensation

- Fatal injury – Rs 4,57,080
- Permanent Total disablement – Rs 5,48,496
- Permanent Partial disablement – According to incapacity caused
- Temporary disablement – Rs.2000 per month up to a period of 5 years

TRADE UNIONS & THEIR ROLE

- It is an association of Employees in an organization or similar organisations put together

- Major Role
  - To act as a watchdog in the industry to ensure the wellbeing of the employees
  - To negotiate with management for labour rights and privileges
  - To ensure the upkeep of discipline among the employees with regard to safety and working practices
  - To cooperate with the organisations for implementing positive changes in the organization and training of the employees
  - To advice and guide the govt. in formulating labour welfare measures and legislations
  - To develop brotherhood among the employees

- 1st trade Union in India - AITUC

CONTENTS

- Types of stores – T&P stores – material stores
- Material handling
- Store management – VED –ABC principles
- Shelf life of materials
- Issue of materials from stores
- Stock register - Intent – Invoice – USR – MAS
- Minimizing wastage
- Survey report & writing off unserviceable materials – Surplus stores& safe custody
- Stock verification - Procuring materials to stores
- Introduction to transportation problem – N-W corner method only - re-order level – EOQ – Taking delivery of goods from lorry parcel service or goods yard – LR/RR & Indemnity bond - Demurrage & wharfage.

STORE

- Provided to account for raw materials, spare parts, tools and plants
- Store keeper : person who keeps the account of items
- Store room : Building that houses a store
- Inventory
  - A non-performing asset in any organizations
  - It consumes a major chunk of capital investment
  - Includes raw materials in stock, semi finished goods in production process, finished goods in stock which are not sold, and machinery and equipment used in a factory or project
  - Hence on an economical ground , the inventory has to be brought to the lowest possible level
  - JIT philosophy

TYPES OF STORE

Classification based on items used:

- Material stores : In a project site, the material store further classified based on materials
  - General stores for storing hardware items
  - Cement stores
  - Oil-lubes and fuel stores
  - Stores for storing explosives
- T & P stores (Tools & plants)
  - In large organisations
    - T&P stores
    - Separate stores for vehicle spares

STORE MANAGEMET STRATEGIES

- Store : a costly component in any industry
- So proper store management essential for optimising the project cost
- Main issues with stores
  - Wastage
  - Damage
  - Expiry of shelf life
  - Pilferage
  - Deadstock etc
- 2 main strategies adopted in store management
  - **VED (VITAL ESSENTIAL DESIRABLE) – control measures**
  - **ABC (ALWAYS BETTER CONTROL)**
- Key strategy : minimising wastage. starts with planning and extends to store management

SHELF LIFE OF MATERIAL

- Definition
  - The permissible storage period of materials after the manufacturing date
- For best performance – the material to be consumed within the shelf life
- Ex: Paint products and cement – limited shelf life
- Shelf life of cement : Three months under ideal conditions

ISSUES OF MATERIAL FROM THE STORE

- Issued based on Intent
- Intent : A document issued by the EE for the supply of items from the department store
- This is raised by the AE, recommended by the AEE and passed by EE
- Unstamped receipt (USR) : Receipt that a storekeeper seeks from the contractor for supply of materials from the store
- Delivery challan (Performa invoice) in duplicate also prepared while issuing materials from the store and send along with the transporting vehicle . On reaching the project site , one copy of the delivery challan will be signed and returned to store keeper as the acknowledgement
- Stock book: Records the issue and receipt of items from and to the store
- Bill : Document issued by a vendor on the supply of an items by sales
  - Shows the value of the item and GST or other taxes as applicable
  - Nowadays referred to as an invoice

TEO-TRANSFER ENTRY ORDER

- Definition
  - Order issued by a competent authority for the stock transfer of goods and equipment belonging to stock of one project site to another sitr being carried out under the same department or authority
- Necessary due to the sharing of resources according to priority

STOCK VERIFICATION

- Conducted by a person other than the custodian of stock at the end of each financial year
- Verifies and reports
  - Shortage of items
  - Surplus of items
  - Unserviceable items
- For unusable items
  - Name of the item
  - Quantity
  - Book value
  - Reason for becoming unusable , should be reported in specific form (KFC-form 15)

SURVEY REPORT

Survey report & writing off unserviceable materials

- Report prepared for removing unserviceable items from stock after annual stock verification
- Consist of :
  - Quantity of items that have become unserviceable
  - Its reason for becoming unserviceable
  - Book value
- Disposed by PUBLIC AUCTION and removed from store
- Example : Demolition of buildings, cutting and felling of trees, disposal of old vehicles

SURPLUS STORE & SAFE CUSTODY

- Surplus items found in the store (or if any unclaimed items found at the project site)- taken to custody and added to the stock
- Reason for surplus is investigated
- Example: Machinery, equipment, vehicles, that are abandoned by the contractor are taken to safe custody

MAS-MATERIAL ACCOUNTING STATEMENT

- Statement regarding the receipt and issue of materials at site
- Issue of materials are recorded according to the consumption of materials for various works as the work progresses
- Periodically prepared and sent to the higher office
- MAS should match the stock position in the store
- Prepared to ensure the consumption of a proper quantity of materials for actual quantity of work done

TRANSPORTATION PROBLEM

- Definition : Linear programming problem (LPP) solving technique adopted for optimising the supply cost of materials to the project site
- Objective : to minimise the cost of distributing a product from a number of sources to a number of destinations
- Gives the optimal number of quantities to be ordered from different sources based on the demand, stock (availability) and lowest price
- Various algorithm will optimise the cost of procuring materials
- The simplest one – North-West corner method (not the most optimal solution but the simplest method)

ASSUMPTIONS OF TRANSPORTATION PROBLEM

- Only a single type of commodity is being shipped from an origin to destination
- Total supply is equal to the total demand
- The unit transportation cost of the item from all sources to destinations is certainly and precisely known
- The objectives is to minimize the total cost

NORTH-WEST CORNER METHOD

- Allocation of demand done from the NORTH-WEST Corner (Top left) of the table based on the supply (availability)
- The values inside the cell indicate the unit cost of the item at that source
- This method my not give an accurate cost optimization , but it is simple to adopt

EXAMPLE

- A Company has three plants (P1, P2, P3) located throughout a state with production capacities 50, 75 and 25 units respectively (Supply capacity). Each day, the firm must furnish its four retail shops R1, R2, R3, & R4 with at least 20, 20, 50, and 60 units respectively (Demand). The transportation costs in Rs.) are given in the respective cell below. Give an optimal solution using the North West corner method.

Company	Retailer				Supply
	R1	R2	R3	R4	
P1	3	5	7	6	50
P2	2	5	8	2	75
P3	3	6	9	2	25
Demand	20	20	50	60	

Solution :

The economic problem is to distribute the available products to different retail shops in such a way so that the total transportation cost is minimum. Starting from the North West corner, we allocate min (50,20) to P1R1, i.e., 20 units to cell P1R1. The demand for the first column is satisfied. The allocation is shown in the following table Allocations are shown in brackets in the respective cell, based on demand and available supply.

Step – 1

Company	Retailer				Supply
	R1	R2	R3	R4	
P1	3 (20)	5	7	6	30
P2	2	5	8	2	75
P3	3	6	9	2	25
Demand	0	20	50	60	

Step-2

Company	Retailer				Supply
	R1	R2	R3	R4	
P1	3 (20)	5 (20)	7	6	10
P2	2	5	8	2	75
P3	3	6	9	2	25
Demand	0	0	50	60	

Step-3

Company	Retailer				Supply
	R1	R2	R3	R4	
P1	3 (20)	5 (20)	7 (10)	6	0
P2	2	5	8	2	75
P3	3	6	9	2	25
Demand	0	0	40	60	

Step-4

Company	Retailer				Supply
	R1	R2	R3	R4	
P1	3 (20)	5 (20)	7 (10)	6	0
P2	2	5	8 (40)	2	35
P3	3	6	9	2	25
Demand	0	0	0	60	

Step-5

Company	Retailer				Supply
	R1	R2	R3	R4	
P1	3 (20)	5 (20)	7 (10)	6	0
P2	2	5	8 (40)	2 (35)	0
P3	3	6	9	2 (25)	0
Demand	0	0	0	0	

Thus the total cost as per this allocation is as follows

$20 \times 3 + 20 \times 5 + 10 \times 7 + 40 \times 8 + 35 \times 2 + 25 \times 2 =$ Rs. 670

RE-ORDER LEVEL

- The buffer stock level at which the re-order for a particular item is generated
- **Considered based** on the following
  - Periodic demand of the item
  - Its essentiality
  - Lead time required for supplying the item after placing the order
- The buffer stock will cater to its demand during the lead time for supplying the ordered item
- **Two-bin system**
  - The buffer stock kept in second bin of the storage system
  - When the stock in the first bin is exhausted, the item from the second bin will be taken and simultaneously the tag attached to the second bin indicating the name of the item and its part number is handed over to the purchase department for generating the order

EOQ-ECONOMIC ORDER QUANTITY

- Definition : Optimal quantity for which the unit cost at site is the minimum while procuring an item
- **Depends on the following**
  - Quantity of demand
  - Unit cost for different quantities ordered together with the transportation and handling charges
  - Vehicle capacity
  - Ordering cost discount allowed for various quantities of order etc

DELIVERY OF GOOD THROUGH PARCEL SERVICE

- Two copies of the receipt will be given (In railway it is known as railway receipt(RR), In lorry parcel service it is known as lorry receipt (LR))
  - **Consignor (despatcher) copy**
  - **Consignee (receiver) copy**
- Consignee copy will be sent to the consignee by post by the consignor. The consignee will claim the goods, producing RR or LR at the parcel office as proof of ownership, claim for the consignment
- If RR or LR is being lost, the consignee can claim the consignment by executing a bond with the parcel office authority , claiming that he the sole claimant for the consignment and will be responsible for any other claims raised by anyone else in the future. Such bond is known as **Indemnity bond**

DEMURRAGE & WHARFAGE

DEMURRAGE

Penalty imposed by the parcel service authority (railway) for the delay in unloading goods from the wagon beyond the time permissible for unloading and vacating the wagon

WHARFAGE

Penalty imposed for the delay beyond the time permissible for removing the goods from the railway platform or goods godown

CONTENTS

- Earth moving equipments –Dozer, grader, power shovel, back hoe, JCB, ripper, drag line, clam shell etc.
- Hoisting equipments –construction lift, tower crane, gantry crane, jib crane, winch & pulley, chain block etc.
- Transporting vehicles – Tractor trailer, dumpers, tippers, trucks etc.
- Miscellaneous equipments like water pump, concrete mixing machine, batching plant, concrete pump, vibrators, compressors, pneumatic/electric driller, Jack hammer, Hydraulic/screw jack etc.

- Criterion for selection of equipment - Methods of procuring equipments – rental basis – Hire purchase – Outright purchase – Factors to be considered while selecting equipment.

HAULING/TRANSPOTATION EQUIPMENTS

TRUCKS/TIPPERS

Transporting materials/machineries etc
(for long haulage)

Dumpers

For Transporting and self unloading of materials
(for long haulage)

Tractor tailor

For Transporting materials within an around the project area

EARTH MOVING EQUIPMENTS

- DOZERS
- GRADER
- RIPPER
- POWER SHOVEL
- BACK HOE
- JCB
- DRAG LINE
- CLAM SHELL

DOZERS

For dozing/cutting hard soil/soft rock, mainly used in hilly areas

GRADER

For levelling soil fills

RIPPER

For breaking soft rocks and other hard strata

POWER SHOVEL

For loading loose material

BACK HOE

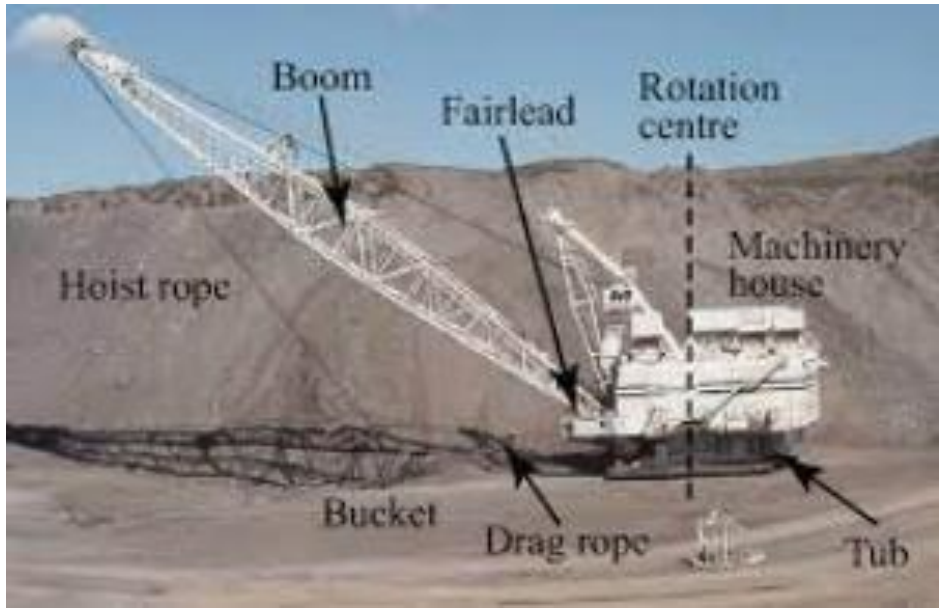
For excavating soil

JCB

JCB (Combination of power shovel and back hoe, named after its designer Joseph Cyril Bamford)

DRAG LINE

For digging in marshy area and canal dredging



CLAM SHELL

For well sinking and excavation in marshy areas

COMPACTING EQUIPMENTS

- SMOOTH WHEELED ROLLER
- SHEEP FOOT ROLLER
- PNEUMATIC WHEELED ROLLER
- VIBRATORS

SMOOTH WHEELED ROLLER

For compacting earth fill and bituminous work

Sheep foot roller

For heavy compaction of soil for earth dams, air port runways, express ways etc.

Pneumatic wheeled roller

For light compaction of soil, bituminous surface etc

vibrators

- Types
  - Table vibrator
  - Platform vibrator
  - Needle vibrator
  - Formwork vibrator
- For compacting of concrete
- Table vibrator – In labs and precast manufacturing units
- Platform vibrator – For compacting mass concrete in flat areas such as concrete roads , yard paving etc
- Needle vibrator – For compacting equipment for in situ beam and column and slab casting
- Form vibrators
  - Vibrating unit in contact with the steel form work
  - Commonly adopted for long pre-cast members like pole casting of electricity post

CONCRETING EQUIPMENTS

- MIXER MACHINE
- BATCHING PLANT
- TRANSIT MIXERS
- CONCRETE PUMPS
- TREMIE PIPES
- BOOM PUMP

MIXER MACHINE

For mixing small quantities of concrete

BATCHING PLANT

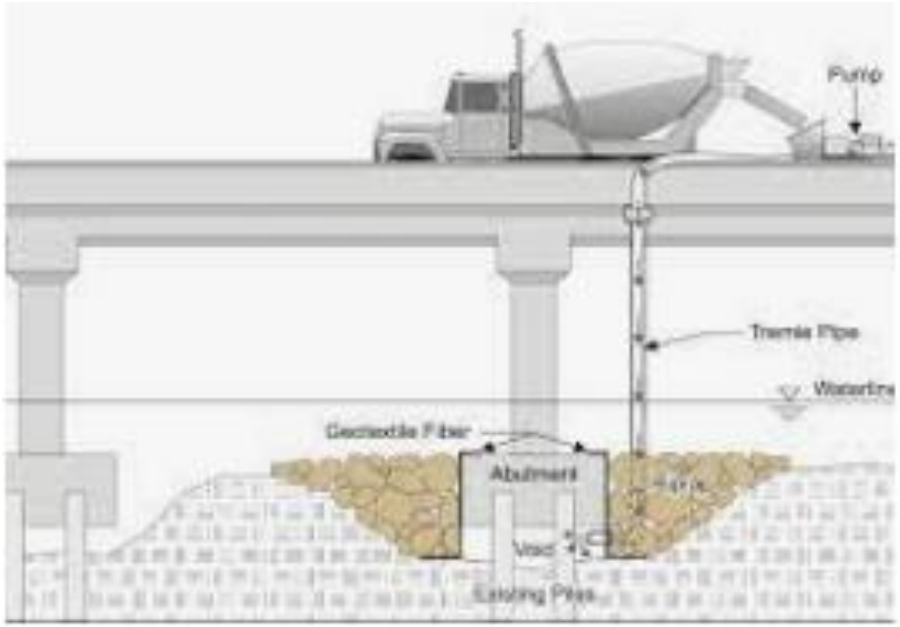
For bulk proportioning of concrete

Transit mixer

For mixing and transporting concrete from batching plant to project site

Tremie pipe

For concreting under water



Boom pump

For concreting under water and overhead

HOISTING/LIFTING EQUIPMENT

- FORK LIFT – For local shifting of bag , box and small items
- CONSTRUCTION LIFT – For lifting construction materials in multi-storeyed building construction
- GANTRY CRANE – For lifting, shifting and placing of materials in god owns, yard and fabrication shops
- TOWER CRANE-For lifting and placing of material within its radius, usually used in tall buildings under construction
- CHAIN BLOCK & PULLEY-For easing lifting operations
- HYDRAULIC LIFT & JACK-Fir lifting equipment, vehicles etc and for general purpose lifting operations
- SCREW JACK-For lifting Equipment, vehicles etc. and for general purpose lifting such as under pinning

GENERAL EQUIPMENTS

- TRACTORS
- AIR COMPRESSORS
- ELECTRIC GENERATORS
- JACK HAMMER
- CUTTING MACHINE
- GRINDING MACHINE
- POLISHING MACHINE
- WELDING MACHINE
- DRILLING MACHINE
- QUARRYING EQUIPMENT
- PLANER MACHINE
- THREAD MAKING EQUIPMENT
- ROAD PAVER
- HOT MIX PLANT101