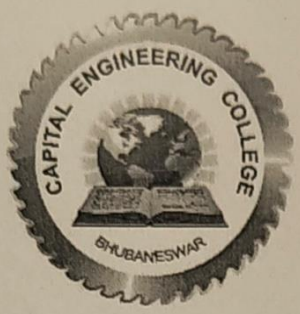


Department of Civil Engineering
Capital Engineering College
Khordha, Bhubaneswar Odisha-752060

LECTURE NOTES

Name of the Subject: Construction Management.

Semester: 6th **Year:** 3rd

Name of the Faculty: BISWABHARATI NAIK.

1 introductionToConstructionManagement

Aimsandobjectivesofconstruction management.

Functionsofconstructionmanagement.

Theconstructionteamcomponentsowner,engineer,architect,contractor-their functionsand interrelationship and jurisdiction.

Resourcesforconstructionmanagement-men,machines,materials,money

2 ConstructionalPlanning

ImportanceofConstructionPlanning

Developingworkbreakdownstructureforconstructionwork

ConstructionPlanningstages-Pre-tenderstage,Post-tender stage.

Construction scheduling by Bar charts-preparation of Bar Charts for simple construction works. 2.5 Preparation of schedules for labour materials,machinery, finance for small works

LimitationofBar charts

Construction scheduling by network techniques-defination of terms ,PERT and CPM techniques, advantages and disadvantages of two techniques, network analysis, estimation of time and critical path, application of PERT and CPM techniques in sample construction works.

3 MaterialsandStoresManagement

ClassificationofStores-storageofstock.

Issueofmaterials-indent,invoice,bincard

4 ConstructionSiteManagement

JobLayout-Objectives,Reviewplans,specifications,Layoutofequipments.

Locationofequipment,organizinglabouratsite.

Joblayoutfordifferentconstructionsites.

Principleofstoringmaterialatsite.

5 ConstructionOrganization:

Introduction–Characteristics,Structure,importance.

Organizationtypes-lineandstaff,functionsandtheir characteristics

Principlesoforganization-meaningandsignificanceofterms-control,authority, responsibility, job & task.

Leadership-necessity,stylesofleadership,roleofleader

Human relations-relations with subordinates, peers, Supervisors, characteristics of group behavior, mob psychology, handling of grievances, absenteeism, labour welfare.

Conflictsinorganization-genesisofconflicts,types-intrapersonal, interpersonal, intergroup, resolving conflicts.

6 Construction LabourandLabourManagement:

PreparingLabour schedule

Essentialsteps foroptimumlabouroutput

Labour characteristics

Wages&their payment

Labour incentives

Motivation-Classificationofmotives,differentapproachestomotivation.

7 EquipmentManagement

Preparingtheequipmentschedule

Identificationofdifferentalternativeequipment

Importance of Owning& operating costsin making decisionsfor hiring&purchase of equipment 7.4 Inspection and testing of equipment

7.5Equipmentmaintenance

8 QualityControl

Conceptofqualityinconstruction

Quality Standards- during construction, after construction, destructive &non destructive methods.

9 MonitoringProgress

Programmeandprogressofwork

Workstudy

Analysisandcontrolofphysicalandfinancialprogresscorrectivemeasures.

10 SafetyManagement InConstruction

Importanceofsafety

causesandeffectsofaccidents inconstructionworks

Safety measures in worksites for excavation, scaffolding, formwork, fabrication and erection, demolition.

Developmentofsafetyconsciousness

Safetylegislation-Workman'scompensationact,contractlabouract.

11 RoleofVulnerabilityAtlasofIndiain constructionprojects

Introduction to Vulnerability Atlas of India, Concepts of natural hazards and disasters and vulnerability profile of India. Definition of disaster related terms.

Earthquake hazard and vulnerability, Magnitude and intensity scales of earthquake, seismic zones, earthquake hazard maps, types ofstructures and damage classification, effects in housing and resistant measures.

Wind / Cyclone hazard and vulnerability, wind speed and pressures, wind hazard and cyclone occurrence maps, storm surveys and cyclone resistant measures.

Flood hazard and vulnerability, Flood hazard and Flood prone areas of the country, General protection of habitants and flood resistant construction.

Landslides, Tsunamis and Thunderstorm hazards and vulnerability, Landslide & Thunderstorm incidence maps, Measures against Tsunami hazards.

Housing vulnerability risk tables and usage of vulnerability atlas of India, Inclusion of vulnerability atlas in Tender documents.

CHAPTER-1INTRODUCTION

• Aimsand objective ofconstructionmanagement

• Functionsofconstructionmanagement

• Theconstructionteamcomponents

• Resourcesforconstructionmanagement

CONCEPTOFMANAGEMENT

• The term management has different senses of use. Sometimes it is used in the sense of an organisation in which different class of people work together to provide qualitative and economicalproduct bythe useofhumanbeingsandotherresources like machine, moneyand material.

• Or somtimes it may be defined as the process consisting ofplanning, organising, activiting and controlling the performance to determine and accomplish the objective by the use ofmen. machines, materials and money.

Aim&ObjectiveofconstructionManagment.

The followingarethemainobjectivesoftheconstructionmanagement.

- Theworkshouldbecompletedwithinestimatedbudgectandspecifiedtime
- Thereshouldbethemotivationtoworkingpeopletogivetheirlevelbesttheircapacities to complete the work.
- Thereshouldbequalifiedandtrainedstafftosuprevisethework properly.
- Theexecutionofworkshould be doneasperspecification.
- Theexecutionofworkshouldbedoneasmosteconomically.
- Theworkingqualityandworkmanshipshould begood.
- Thereshouldbeaproperplanofworkanditshouldbeorganisedproperly.
- Thereshouldbeanawarenessofcreating anorganisationthatworksasateam.
- Theworkersshouldhavebeenprovidedwithsafeandsatisfactory.

FUNCTIONSOFCONSTRUCTION MANAGEMENT

Thefollowingarethefunctionsofconstructionmanagement Planning

- Organising.
- Staffing.
- Directing
- Controlling
- Co-ordinating
- Communicating.

PLANNING

• Time neededtocompletethewholeconstructionproject

• Type,quantityandexacttimefor deliveryofmaterialsofcostruction.

• Type,numberandduration ofuseofdifferentmachinesandequipments.

• Categoryofstaffi.e.,Managers,skilledandunskilledworkers required.

• Type ofuncertainties likelyto cause delays such as weather conditions, shortage ofsupply, labour unrest and sub-judice land matter etc.

- WHATTODO

- WHENTODO
- HOWTODO
- WHOTODO

ORGANISING

• After the planning is in place, a manager be needs to organize her team and materials according to her plan.

• This process involves To identify the work to perform To classify or group the work To assign these group of activities to individuals To delegate authority and fix responsibility STAFFING

• Staffingisfillingthepositionintheorganisationstructurefordefining recruitments.

• It is a very important responsibility to select right person for right jobs in a construction organisation.

• Staffingisnotonlyabouttherecruitmentbutalsotheirtraininganddevelopingactivities.

• After the planning is in place, a manager be needs to organize her team and materials according to her plan.

• This process involves To identify the work to perform To classify or group the work To assign these group of activities to individuals To delegate authority and fix responsibility STAFFING

• Staffingisfillingthepositionintheorganisationstructurefordefining recruitments.

• It is a very important responsibility to select right person for right jobs in a construction organisation.

• Staffingisnotonlyabouttherecruitmentbutalsotheirtraininganddevelopingactivities.

• After the planning is in place, a manager be needs to organize her team and materials according to her plan.

• This process involves To identify the work to perform To classify or group the work To assign these group of activities to individuals To delegate authority and fix responsibility STAFFING

• Staffingisfillingthepositionintheorganisationstructurefordefining recruitments.

• Itisaveryimportantresponsibilitytoselectrightpersonforrightjobsinaconstruction organisation.

• Staffingisnotonlyabouttherecruitmentbutalsotheirtraininganddeveloping activities.

• Aftertheplanningisinplace,amanagerbeneedstoorganizeherteamandmaterials according to her plan.

• This process involves To identify the work to perform To classify or group the work To assign these group of activities to individuals To delegate authority and fix responsibility STAFFING

• Staffingisfillingthepositionintheorganisationstructure fordefining recruitments.

• It is a very important responsibility to select right person for right jobs in a construction organisation. • Staffing is not only about the recruitment but also their training and developing activities. DIRECTING

• Amanagerneedstodomorethanjustplan, organize, andstaffherteamtoachievea goal.

• Shemustalsolead.

• Leadinginvolvesmotivating,communicating,guiding,andencouraging.

• Itrequiresthemanagertocoach, assist,andproblemsolvewithemployees.

CONTROLLING

• After the other elements are in place, a manager's job is not finished. He needs to continuously check results against goals and take any corrective actions necessary to make sure that his area's plans remain on track.

• Controllingisanimportantactionforensuringeffectiveandefficientworking.

• Itreviewsthework plantocheck and rectifythedeviation.

• Amanagerneedstodomorethanjustplan, organize, andstaffherteamtoachievea goal.

• Shemustalsolead.

• Leadinginvolvesmotivating,communicating,guiding,andencouraging.

• Itrequiresthemanagertocoach, assist,andproblemsolvewithemployees.

CONTROLLING

• After the other elements are in place, a manager's job is not finished. He needs to continuously check results against goals and take any corrective actions necessary to make sure that his area's plans remain on track.

• Controllingisanimportantactionforensuringeffectiveandefficientworking.

• Itreviewstheworkplantocheck andrectifythe deviation.

• Amanagerneedstodomorethanjustplan, organize, andstaffherteamtoachievea goal.

• Shemustalsolead.

• Leadinginvolvesmotivating,communicating,guiding,andencouraging.

• Itrequiresthemanagertocoach, assist,andproblemsolvewithemployees.

CO-ORDINATING

• It means developing harmony between employees and group of employees for smooth and efficient functioning of construction work.

• Inlargeorganisationtheworkisdividedintodifferentdepartments.Sothereisagreat importance for good coordination. COMMUNICATING

• Communicationistheprocessoftransmittingreceivingandunderstandingtheideasby others for the purpose of effective desired results

• There are variousmethods of communication likeverbal return others reports instructionresult .

• Ineffectivecommunicationleadstoconfusionmisunderstanding Etc.

OWNER

- Theownerofaconstructionprojectmaybeanindividual,groupofindivdualsorpublic body. The owner finances the project and also recoginses the need for a project.
- in view of all aspects the owner has the power to take major decisions regarding managerial financial and administrative aspects

CONTRACTOR

- The contractor executes various types of works and also makes necessary arrangementsfor labour, machinery, materials, in order to complete the project in the limited scheduled time.

• In some projects, the contractor may appoint sub-contractor. There is a rate or bid between Contractor & owner before starting any project.

RESOURCESFORCONSTRUCTIONMANAGEMENTMoney

• Money the first and foremost recruitment for any project and it should be arranged before starting any construction project for smooth implementation of a project

• If the financial resources are insufficient than the project will not be completed within the limited scheduled time period Material

• Sufficient quantity of materials required for the completion of any project and should also be available at the site.

• Materialrequired forprojectrestmethodbeforestartingtheproject

• Forexample- bricks,cement,stones,Timber,watersupplyelectricalfittingetcMoney

• Money the first and foremost recruitment for any project and it should be arranged before starting any construction project for smooth implementation of a project

• If the financial resources are insufficient than the project will not be completed within the limited scheduled time period Material

• Sufficient quantity of materials required for the completion of any project and should also be available at the site.

• Materialrequired forprojectrestmethodbeforestartingtheproject

• Forexample-bricks,cement,stones,Timber,watersupplyelectricalfittingetc RESOURCES FOR CONSTRUCTION MANAGEMENT Money

• Money the first and foremost recruitment for any project and it should be arranged beforestarting any construction project for smooth implementation of a project

• If the financial resources are insufficient than the project will not be completed within the limited scheduled time period Material

• Sufficient quantity of materials required for the completion of any project and should also be available at the site.

• Materialrequired forprojectrestmethodbeforestartingtheproject

• Forexample- bricks,cement,stones,Timber,watersupplyelectricalfittingetcMoney

• Money the first and foremost recruitment for any project and it should be arranged before starting any construction project for smooth implementation of a project

• If the financial resources are insufficient than the project will not be completed within the limited scheduled time period Material

• Sufficient quantity of materials required for the completion of any project and should also be available at the site.

• Materialrequired forprojectrestmethodbeforestartingtheproject

• Forexample-bricks,cement,stones,Timber,watersupplyelectricalfittingetc

Machine

• Differenttypeofmachineriesandequipmentsrequiredforanyconstructionwork

• Althoughthecost ofmachinesarehighbutreducesthehighrequirementof manpower

• Forexamplemixers,tractors,cranes,pumps,generatorsexcavatorsetc.

Manpower

• Successfulcompletionofanyprojectmanpower isanimportantfactor

• Itmaybebahutskilledand unskilled.

• Manpowerdealswithengineersarchitectssupervisorsrepairtechniciansskilledor unskilled labour,etc.

Chapter2-CONSTRUCTION PLANNING

- ObjectiveofConstructionPlanning
- WorkBreakdownStructure
- ConstructionScheduling
- ClassificationofConstructionScheduling
- MethodsofConstruction Scheduling
- Bar Chart
- Bar ChartofaResidentialBuilding

IMPORTANCEOFCONSTRUCTIONPLANNING

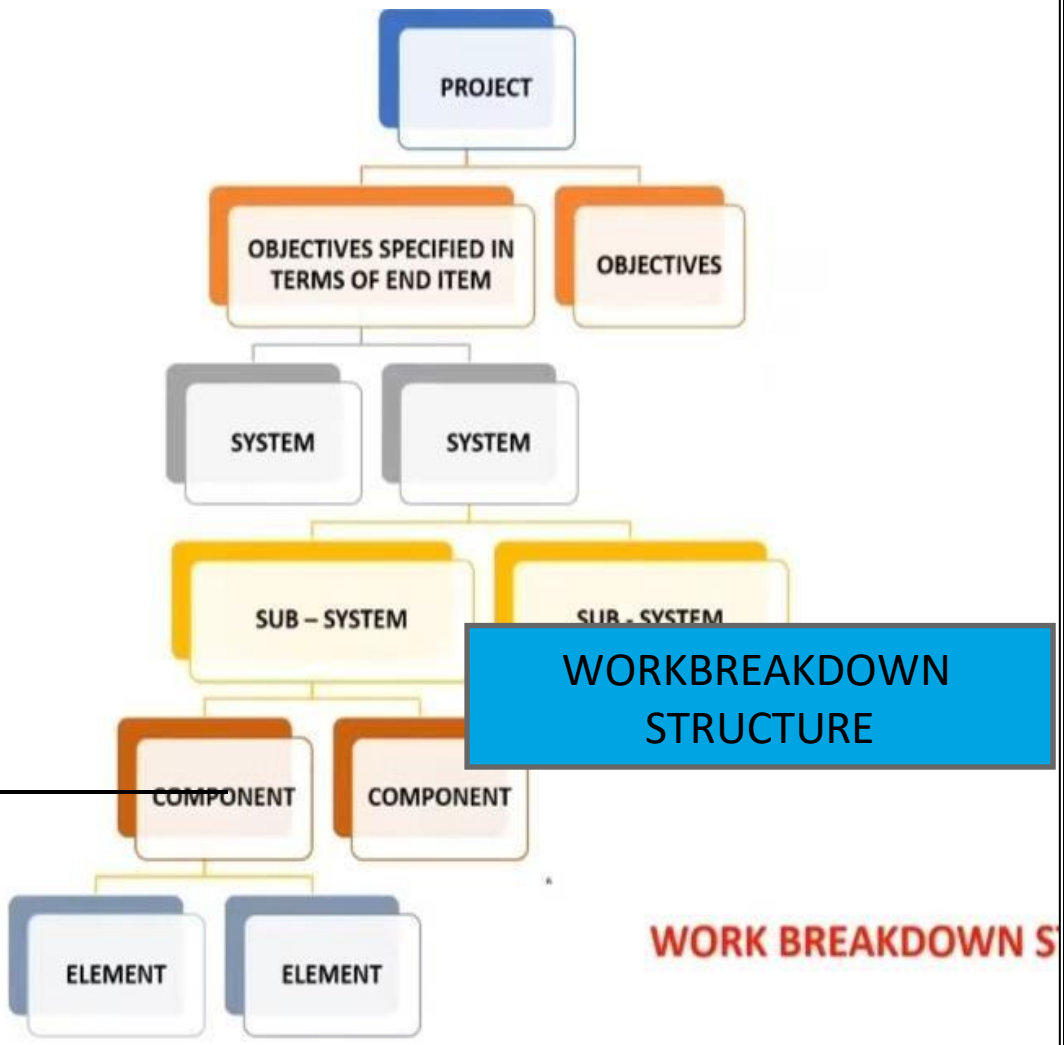
Importanceofconstructionplanning areasfollows.

- Theworkmaybecompletedwithinthescheduledtime.
- Theworkmaybeexecutedmosteconomically.
- Theworkwill bebothqualitative&quantitative.
- Thereshallbeminimumwastageduringconstructionwork.
- Theworkshould becompleted asperspecification.
- Therewillbeaminimumcostofmaintainanceofmechinery&equipment.
- There willbe optimumuse ofavailableresources.
- Controllingofconstructionactivitiescanbepossible.

WORK BREAKDOWN STRUCTURE

- It is the preliminary diagram which showing the breaking down a project into sub-systems and each sub-systems into major components and discrete activities.
- In WBS, top-down approach to planning is adopted. Such an approach ensures thatthe total project is fully planned and all derivative plan contribute directly to the desired end objectives.
- WBS aids in the identification of objectives and allows the planner to see the total picture of the project.

- WBSisdevelopedbyconsideringtheendobjectiveandbreakingitintosmaller manageable units on the basis of size, duration and responsibility.



C

- In other words scheduling is the time table for executing each and everyactivitywith its fixed starting and finishing date

CLASSIFICATIONOFSCHEDULING

Schedulescanbeclassifiedintovariousgroups.suchas;

- MaterialSchedule
- LabourSchedule
- EquipmentSchedule
- FinancialScedule

MATERIALSCEDULE

- thistype ofschedule isprepared for moving and storing ofmaterial inadvance before starting of construction schedule acts as a guide for preparing materials schedule.
- Thisscheduleisdonetoavoid delayintheexecutionofthe work
- Thematerialsshouldbedeliveredatsiteatleastoneweekbefore itsuse
- Thematerialsatsiteshouldnotremainonusedforlong
- The materialsstoredatsitelongbeforeitsuseitis likelytodeterioratedinquality.
- for example cement made its strengthby50% ifstored for 6months and steelmaybe attacked by corrosion due to long storage at site.

LABOURSCEDULE

- The labour schedule is prepared for deciding the actual number of skilled and unskilled labour which is required for the construction work
- Withthehelpofthisschedulerequiredlabour canbearrangedintime
- Ithelps inreducinglabourcost.
- Labour schedule is important as it is difficult and costly to arrange skilled labour as and when required.

EQUIPMENTSCHEDULE

- This type of schedule is prepared to decide the type and quantity of equipments asalso on which date the equipment will be needed.So that they can be arranged when requirement.
- The aimofthis schedule is to derive maximumadvantage ofthe equipment when it is required and remove it from the site when the job is over.

FINANCIALSCHEDULE

- Financial schedule is prepared to estimate the amount of money that owner or contractor has to spend as finance for the project work.
- In maximum construction project the owner will pay a stated percentage of the value tothe contractorforthe completionofworkineach month. it isabout 90%ofthe cost during each month.

METHOD OF SCHEDULING

Dependinguponthesizeoftheproject schedulingisdone bydifferent methods.

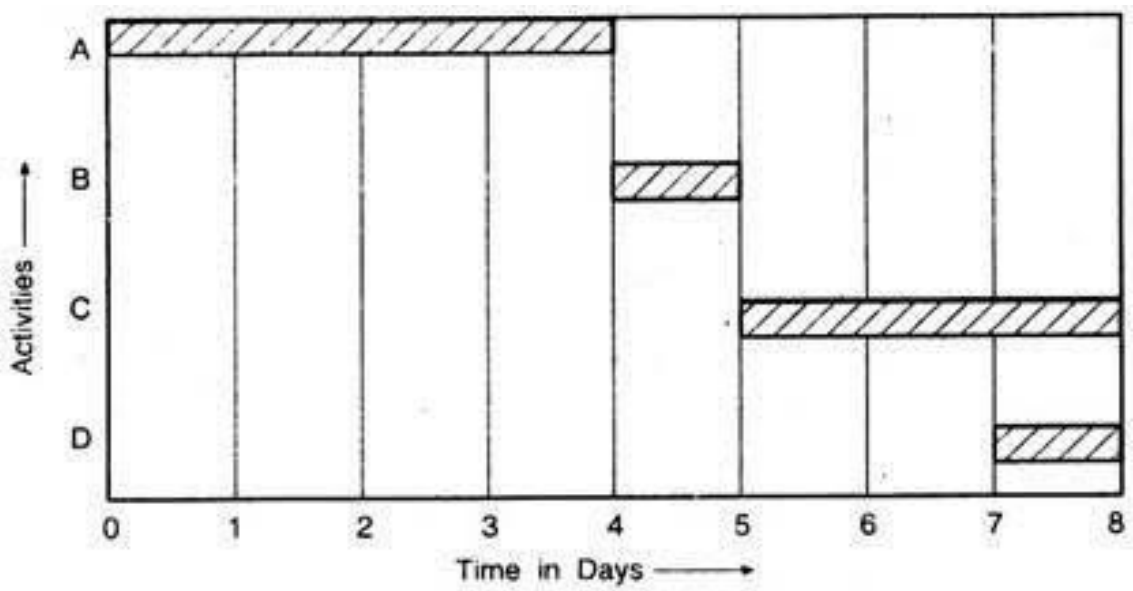
Following are the methods of scheduling.

1. **Barchartorganttcharts.**

2. **Networkanalysis(CPM,PERT)**

BAR CHARTS

- Bar chart is a graphical representation of various activities their duration start and period of a project.
- ThismethodwasdevelopedbyHenryGantt around 1900.
- Theyconsistsof2co-ordinateaxis,i.e.,horizontaland vertical.
- Horizontal axis is used to represent the time required for the completion of activity and vertical axis is used to represent the activities required for the completion of the project.
- The start and end point of bar represents the time of start and finished time of the activity hence the length of bar represents the duration of activity.
- The bar chart or gantt chart represents the schedule of a project also represent the actual progress
- We can also check the accuracyofwork and can compare the actualprogress ofwork with theschedule.

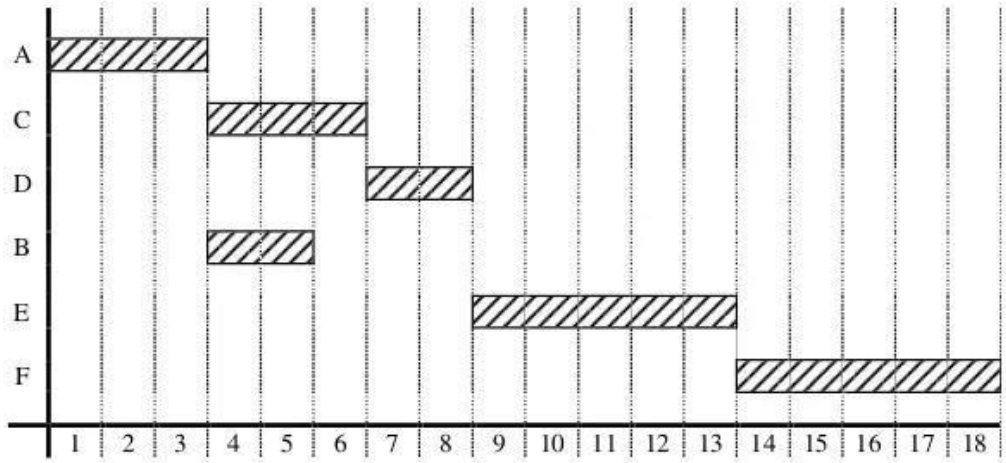


Barchartofaresidentialbuilding

- Example:

Activity ID	Activity Description	Dependency	Duration
A	Excavation	–	3
C	Foundation	A	3
D	Column	B, C	2
B	Moving the soil out	A	2
E	Wall	C, D	5
F	Roof	E, D	5

Solution



AdvantagesofBarChart

- VeryGraphical
- Easytounderstand
- Most widely used

DisadvantagesofBarChart

- DifficulttoUpdate.

- DifficulttofindtheCriticalPath
- Difficulttosetupandmaintainalargeprojectbecauseitisessentiallyamanual graphical procedure.

Chapter–3MaterialAndStore Management

Contents

- Introductionand Objective
- Classificationofstore-storageofstock
- Issueofmaterials(indent,invoice,bincard)
- Storesaccounting procedures
- Inspectionofstores
- Procedureofwriteoff

INTRODUCTION

For the execution of different kinds of works in public work department,different types of material and equipments required.

it is necessary to maintain a store of various types of construction material at one or more place in a division so that the execution of work will be efficient.

Beforestartofanyworkmaterialshould bearranged wellintime.

So store and material management is an integral function of different sections of the organisation.

It deals with the supply of material and other related activities and aims at minimum expenditure on materials.

Materialmanagementdealswiththeoverallactivitiesofmaterialssuchastype,amount ,movement,purchase ,location,timing ofvariousmaterialswhichare used inanorganisation. So store and material management is an integral function of different sections of the organisation.

Objectiveofmaterialmanagement

- Toselecttherightquality
- Tomeettheproductionrequirements
- Selectionofsuppliers
- Limit theWastages
- Productenhancement
- Forecasting
- StandardizationProcessObjectiveofmaterialmanagement

• Toselecttherightquality

• Tomeettheproductionrequirements

• Selectionofsuppliers

• Limit theWastages

• Productenhancement

• Forecasting

• StandardizationProcess

Classification of stores

Storescanbedividedintofourcategoriesaccordingtopublicwork department.

1. Stock

2. Tooland plants

3. Road metals

4. Materialchargeddirectlytoworks.

Stock

The stock is the store which is required for general work and kept under suspense head andfinally issued for the work.

The items which are in common use in the construction activity for the execution ofdifferent worksarekeptinstores.Suchmaterialsofgeneralusesuchascement,timber,bricks ,aggregates,steels, paintsetcarekeptinstorearecalledasstock.

Reservestocklimit

Themaximumamountofmaterialsthatcanbekeptinastockinadivisionisfixedandis known as the reserve stock limit.

The limit is fixed by the Government keeping into consideration the normal requirements of stock in the division.

Note

'Stock' is a suspense head of account. When an item of stock is purchased, its cost is debited to the suspense head 'Stock'.

Whentheitemisissuedforuseinawork,thecostoftheitemissuediscreditedtothe suspense, head 'Stock' and debited to the final head of the work concerned.

Subheadofstocks

The various materials of similar nature grouped under different heads to facilitate the proper maintenance of stock account are known as sub-head of stock .

Thefollowingaresomeofvarioussubheadsofstocks

1. Smallstores(likenails,screws,hinges,bolts,etc.).

2. Buildingmaterials(likecement,aggregates,bricks,lime,etc.).

3. Timber(likedeodar,chir,plywood,hardboard,etc.).

4. Metals(likemildsteelbars, rolledsteelsections etc)

5. Fuel(likekerosene,coal,etc.).

6. Painter'sstores(likepaints,varnishes,etc.).

7. Housefittings(likebathroomfittings,pelmets,etc.).

8. Miscellaneousstores(likecord,woodpreservatives,fertilisers, etc.)

9. Lands,kilns,etc.(likeroadmetalquarries),

10. Manufacture(i.e.manufactureinGovernmentworkshops).

11. Storage(i.e. charges incurred onthe storageofarticles, suchasrentofgodowns, payment to work charged store establishment **Issue of materials**

- Thestorekeepercanissuethematerialstodifferentdepartmentsuponthereceiptofa withdrawal form with proper authorityand it is called as material issue requisition form.
- Depending upon the nature and amount of material to be withdrawn from stores the material requisition is prepared in duplicate by the manager.
- Boththecopiesaresenttothestorekeeperwhoissuesandrecordsthematerials distributed.

IndentandInvoice

- Thematerialfromthe stores areprocuredbytheprocessofindenting.
- Materialsreceivedfromthestockondemandinaproperformcalledindentform.
- Indentformconsistintriplicateofcounterfoil,indentandinvoice.
- Thecounter foilandindentpartoftheindentformfilledbytheIndentofficer.
- Thenthisformwithblankinvoicesenttotheissuingofficerinchargeofthe stock.

• Invoice is anindent having list ofarticlesactuallyshouldandgivingpriceandparticularsof the articles.

• Then the issuing officer corrects the indent and fills up the invoice. • Then the issuing officer sends it back tothe indenting officer to signthe invoice and theyreturnit to himasan acknowledgement.

Rulesforpreparing indent andinvoice

• Thereshouldbedescriptionofunitofsupplyandquantityof material

• Thecostofmaterialsofthehead ofaccountshould be specified

• Thename ofworkshould be givenwhenthematerialisissued.

• Fulldetailsofdepartment ,divisionand anyother personfor whichthe metro Brijeshshould should be given.

BinCard

• BinCard isacard which maintainsthedetailsofquantitiesofeachtypeofmaterialreceived issued and on hand each day .

• The material and other items are kept in appropriate bins, drawers etc. The store keeper maintains the record on a Bin Card.

• Abinor shelf isattachedto eachbin card.

• Bincardsaremadeinduplicate

• Oneisattached tothebinandanother isforthestorekeeper.

ProcedureforstoreaccountingFinal

head

Thecostofacquisitionofstoresisdebitedtotheparticularworkforwhichtheyare required.This is known as final head of account. **Suspense head**

Suspense head includes the temporary booking of expenditure incurred for the purchasing of materials for theexecutionofworkisdebitedtothefinalheadoftheexpenditure isdebitedto the minor head i.e suspense expenditure.

a. The procedure for store accounting is done separately for various classes of stores suchas stock, tools and plants, road metals and other miscellaneous material.

b. When the stock is placed then the store is debited to suspense head .When the stock material is issued for the execution ofa particular workthen it is debited to the final head.

c. The supply of tools and plants in the division and its expenditure is debited to the minor head sometimes for general use special items of tools and plants are not required but for a specific work they are debited to that work.

d. For certain road the road metal is required for the construction its cost is debited to the estimate of that road construction and once the road metal is required for the maintenance of the road it is debited to the sub head under minor head.

e. Similarlyforother materials ifthe materialsarepurchasedfor generalrequirement thenthe cost is debited to the suspense head.

f. Theinitialaccountofallreceiptandissuesismaintainedbythesectionofficer.

g. Afterclosingthemonthlyaccountsectionofficerforwardsitstothesubdivisionaloffice.

PhysicalVerificationAndInspectionofstoresNecessity

Inspectionofstoresanditsphysicalverificationisessentialforfulfillmentoffollowing

(i) To ensure the correctness of stock held by comparing them with the balance shown in the store ledger or bin cards.

(ii) Toavoidshortageofmaterialsinthestock.

(iii) Tochecklossesininventoryduetopilferage,improperstorageormisplacement,deterioration etc.

(iv) Tocorrectandupdatestore records.

(v) Tocalculatethevaluesofthestockcarriedforthebalancesheetandprofitandloss account.

(vi) Tocalculatetherateofturn-over ofanitem.

(vii) Toensuremaximumeconomy instock carrying.

(viii) Toeffectinsurancecovers.

MethodofPhysicalStock Verification

• AnnualphysicalVerification

• PerpetualInventoryandContinuousStockTakingSystem.

Annualphysicalverification

The followingprocedureisadoptedfor carryingouttheannualphysicalverification.

(i) Bytheendofthe year, thestoresareclosed for a fewdays;no materialetc. is issuedto any project work/shopinthe plant.Incase it leadsto plant shut down,the activitiessuchasrepair and over hauling of equipment and machineries are resorted to.

(ii) A team of stores inspectors or stores verifying officers physically check and count each and every item lying in the entire store. It is tallied with the quantities marked on bin cards and store ledgers.

(iii) Step (ii) above may lead to the formation of a list of surplus and short items. Damaged and obsolete items may also be traced and recorded.

(iv) Inspectorschecka number ofitemseverydayasper apreplanned scheduleand finishthe complete work within a few days.

Advantages in the sense that all the items are checked at one time so there is no confusion about any item being left unchecked.

Perpetualinventoryand continuousstocktaking

Perpetual inventory and continuous stock taking system is a more appropriated method for large plant with huge inventories which records store balances after every receipt and issue and facilitates regular checking.

(i) Under this system, store items are checked continuouslythroughout the year; a number of items are counted daily or at frequent intervals and compared with the bin cards and stores ledger.

(ii) Discrepancies found if any, owing to in correct entries, breakage, pilferage, over issue, placing of items in the wrong bin etc. are investigated and corrected accordingly.

• Thismethod islesscostly

• In this method only few items are required to check every day as compared to annual physical verification.

Procedureforwriteoff

• The articles of tools and plants get worn out by continuous use and become unserviceable. Theycan be writtenoffonlywith the approvalofthe competent authority. A surveyreport of all the unserviceable articles is prepared on D.F.R. (P.W.)-15 giving full particulars of their value, date of purchase and reasons for their becoming unserviceable.

• The survey report is submitted to the competent authority for approval. As a general practice, the articles which are written off are destroyed in presence of a gazetteofficer.

• As regards the articles of stock, which get deteriorated, an estimate for the loss of stock is prepared. The tools and plants articles are written off after preparation of survey report.

• DFR-DocumentFilingandRetrievalForm

Example

PrepareaWriteoffinrespect offollowingArticlesoftoolsand plants.

• Name ofthesubdivision-Killamaidan

• Nameofthe DivisionandCircle-Cuttack

• 10 nos, of metallic tapes 30m purchased on 6.5.2004 for Rs. 5000/ • 04 nos. of brass pad locks 7.5cm size purchased on 2.6.1999 for Rs. 1200/

• 1 time piece (Ajanta Make) purchased for rest house OMP square on 3.10.2006 400/ These articles became unserviceable through fair wear and tear.

CH-4-CONSTRUCTIONSITEMANAGEMENT

CONTENTS

- JOBLAYOUT
- REVIEWPLAN
- FACTORSAFFECTINGSELECTION,DESIGN,LAYOUTOFCONSTRUCTIONSITE
- LAYOUTOFEQUIPMENT
- LOCATIONOFEQUIPMENT
- PRINCIPLESOFSTORINGMATERIALSATSITE
- ORGANISINGLABOURATSITE
- DIFFERENTJOBLAYOUTS

JOB LAYOUT

• Job layout isdrawing theprepared planofconstructionsite bythe siteengineer in-chargeof the project. The arrangements made at the construction site for different camps and the area around it, is known as job layout.

OR

• Job layout is a scaled diagram of the proposed construction site showing all the relevant features such as, Entry point , Exit point Storage areas of materials, Temporary services Contractor's site office Areas for keeping equipments such as mixers Bar bending area , Labour Housing etc.

Objectiveofpreparingjob layout

Followingaretheobjectiveofjoblayout.

- Itsavestimeindeliveringtheconstructionmaterialsatthe site.
- Thebestmethodofworkingmaybeadopted.
- Ithelpsto completethework withintheminimumuseofequipments.
- Themaximumoutputfromlabourandmachines canbetaken.
- Itprovidessafetytotheworkers.
- Ithelpsto avoiddamagetothenearbypropertiesdueto constructionwork.
- It plans fortheconstructionmaterialsto beplacedasnearaspossible totheworkFollowing are the objective of job layout.
- Itsavestimeindeliveringtheconstructionmaterialsatthe site.
- Thebestmethodofworkingmaybeadopted.
- Ithelpsto completethework withintheminimumuseofequipments.
- Themaximumoutputfromlabourandmachines canbetaken.
- It providessafetytothe workers.
- Ithelpsto avoiddamagetothenearbypropertiesdueto constructionwork.
- Itplansfortheconstructionmaterialstobeplacedasnear aspossibletothework

REVIEWPLAN

• Beforepreparingajoblayoutthedetailsofdifferentplansfortheexecutionofthework should be studied carefully.

- Siteplan
- Workingdrawing
- Specification

Siteplan

Thesiteplanshows

- Theboundariesofthesite
- Theadjacentareaofthe boundaryofthe constructionsite.
- Locationofanyexistingbuildingstandingnear site.
- Spaceleftaroundthebuildingtosecureverificationorfreeair condition.
- Spaceleftaroundthebuildingforcleaningandadmissionoflight.
- Positionofanynaturaldrains,rivers,Wellslocated nearthe site.
- AnyotherinformationwhichareconsideredtobenecessarySiteplanThesiteplanshows

Working drawing

- The working drawing consists ofthe building plans and other worksto be constructedatthe site. The working drawing include ;
- Floorplanofthebuildingwithcoveredarea,sizeoftheroom,openingofdoors&windows, structural members, staircase ,lifts Etc
- Elevationofallsidesareshown.
- IndicationofdirectionofNorthlineinthe planofbuildings.
- Indicationofrejectedpersonsbeyondthepermissiblebuildingline.
- LocatingexactlyoftheessentialserviceslikeWatercloset,sink,bath etc
- Showingsectionaldetailsdrawingoffootingthicknessofworldcurrentslabswiththeir material.

Specifications

Specification indicates the details of the types and grade of the material to be used in construction work which was signed duly the authority or engineer and shall be available at the working place before start of any work.

Specification is an important document in the construction industrywhich helps the designer to come and get It is thought and ideas to the other construction team members.

Factorsaffectingselection,design&layoutatconstructionsite

i. Nature of project
ii. Location of project
iii. Sevices
iv. Availabilityofmaterial&equipments
v. Availabilityofmanpower
vi. Medicalfacility
vii. Availabilityofspace
viii. Othermiscellaneousfactors

I) Nature ofthe project

The nature of the project plays an important role in its layout process. The camp layout depends on the nature and types of project. For example the layout of camp for a highway construction project will differ from that of a building.

II) Locationofproject

Location of the project also plays an important role in job layout plans the location project should be properly chosen such that there will be no difficulty for any type of climatic situation and transportation. So transportation facility to the construction site is an important factor for job layout.

IV) Services

Thereshould beproperserviceofwatersupply,sanitationandelectricity. Iftheseservicesare not available then it will be badly affect the job layout.

V) AvailablityofMaterial&Equipments

There should be sufficient availabilityofmaterials and equipments at the construction site. If the materials and equipments are not available locally then it will create problem in storage which will affect the shape of job layout.

VI) Medical facility

If the project is for a long time it is essential to have a field medical aid facility for the workers.

VI) Availabilityofmanpower

Man power is an important resource in any construction site. The arrangement of manpower at construction site should be made locally otherwise it will be a great difficulty for their shelter . So labour should be arranged locally.

VII) AvailabilityofSpace

If less space available at the construction site, then it will be difficult for job layout because the storage should have to be located nearest the regular supply of material & equipment. Urgent availabilityofmaterialmaynotpossibleas required.

VIII) Othermiscellaneousfactors

There should be availability of education facilities like schooling for the children of labours and staff ,daily necessities of life and other welfarefacilities for the workers. If these facilities are not available then it will also tend to change the layout ofthe project.

Principlesofstoringmaterialsat site

The materialsshouldbestoredinpropermanneratttheconstructionsite.The followingarethe important principles which are to be considered for storing materials.

- Materialsshouldbestoredattheconstructionsitesoastopreventmixingofforeignmatter.
- Materials should be stored in such a manner as to protect it fromany weathering agent like rain , sun and wind.
- Materialswhicharesuspectedto get fireeasilyshould bepreventedfromfirehazards i.ethe products like petrolium and explosives should be stored properly.
- Precastbeamspiecesoftimberandslabswhicharelikelytobeaffectedbythesoilor support should be stored with properly adopted measures.
- Materials like cement bagswhichare easilyaffectedbythe contactofthe moisture areto be stored with special precautions.
- Thematerialregularlyused areto beplaced relativelynearertotheplaceofuse.
- Thereshouldbeproperarrangementoffireextinguisherandfirebucketswherever necessary for the safety measure.

Locationandlayoutofequipments

Why equipments required?

As there is a increased cost of labour, the use of more & more mechanical equipments becomes necessary for construction work veryoften the available manpower is not sufficient for the completion of construction work with in stipulated time, so it is essential to use mechanical equipments along with the available manpower for the construction activity. So thereshouldbeacarefulconsiderationforcorrectchoosingatrightequipment.Fora

construction project to be completed with in the scheduled time economically, it is essentialto choose the correct and well-operated equipments.
Forthelocationofequipmentfollowingpointsaretobeconsidered.
(i) Equipmentsshould benearertotheconstructionwork.
(ii) Equipmementsshouldbeneartothematerials.
(iii) Theownedequipmentsmaybeprovidedneartheentrancesothattherewillbeno requirement of any aditional guard.
(iv) The hired equipments shouldbe placedin suitable places and thevacantplacemay be left where it can be accomodated.
(v) Themaintenance,repairingandfuelfillingofequipmentshouldbearrengedatthe construction site
(VI)Thereshould beadequatespaceavailable forparkingofthetransportvehicleslikетrucks tractors etc.
(VII) temporary sheds should be provided to safeguard the costly equipments from any type of weather condition.

Organisinglabouratsite

Organizinglabourproperlyattheworkingsiteisanimportantresponsibilityofthe supervisory staffs.
Thelaboursaredividedintodifferentgroupsbythesupervisorundertheguidanceof effective leader who has the quality to control the labours.
Proper wayoforganising of labours results the completionofwork withinthe stipulatedtime period.
Soitisveryessentialtoorganizethelaboursatthe constructionsite.
For example Suppose 10 labours and one supervisor are put for beam casting the division of the labour may be.
(i) Forbringingtheaggregates,threelabourersareput.
(ii) Formixingtheingredientsonelabouris put.
(iii) Fourlabourers areputonsomeotherwork.
(iv) For compactionpurposestwolaboursareput.
Therearesomepointswhicharetobeconsideredwhileorganisinglabouratconstruction
(i) Rehandlingofmaterialunnecessarilyshouldbeavoided.
(ii) Supplyofmaterialshouldbesufficientasperrequirementoflabour.
(iii) Laboursupplyshouldbeuninterrupted.
(iv) Thematerialsshouldbetakenonceforthewholedayfrom thegodown.Itreducethe frequent movement of labour.
(v) Thereshould besomepermanentlaboursasitiseconomical.
(vi) Increasinganddecreasingoflabour should bedoneaspernecessity.
(vii) Toavoidwastageoftimeoflabour, minimumfacilitiesshouldbemadeavailable
(viii) Alsotosavewastageoftimeoflabourers,drinkingwaterfacilityshouldbemade available at the site.
(ix) Arecordshould bemaintained abouttheprogressofthelabour.
(x) Record maintain once will help to compare the progress of work with the completion of work at right time at the site.

Preparation ofjob layout

• The construction plans, specifications, contract documents and other available material describing the jobshould be studied carefully in order to get the idea ofthe nature and extent of the work.
• A scaled drawing with a scale of 1 in 100 should be prepared showing the out line of the work or job to be constructed.
• Also the position of entry and exit points as well as the areas of temproray facilities should be marked on it.
• Injoblayoutplan
Moreoverfollowinginformationshouldbecollectedfromtheabovestudy.
• Area needed for accomodation: This area includes the area required for office. stores andresidential accomodation for officers, staff and labour.
• Arearequiredformachines,sheds,repairshopsandworkshopsetc.
• Areaforsecurityand fine fighting facilities.
• Arearequired forconstructionwork.
• Areaformiscellaneousamenitiessuchascanteen,toilets, dispensaryetc.
• Lengthofperiod forwhichareamaybeavailable.

Ch – 5ConstructionOrganisation

CONSTRUCTIONORGANISATION

CHARACTERISTICSANDSTRUCTUREOFORGANISATION IMPORTANCE

OF ORGANISATION

TYPES OF ORGANISATION

LEADERSHIPANDITSIMPORTANCE

STYLES OFLEADERSHIP

ORGANISATION

Foranysucessfulbusiness, asoundorganisationis highlyessential.

Bettertheorganisationthe more istheachievementofthecommonbusinessobjectives.

Organisation is the foundation upon which the business management is dependent.

Organisationisalargegrouphumanassociationunitedtogetherfortheattainmentof business objective.

Structureofan organisation

Organisation structure specifies the various job tasks and shows how job tasks are formallydevided ;grouped;and co-ordinated.

Organisationalstructurecoversthe overallarrangementofanorganisation.

It providesanappropriate framework for intra relationship and also indicatesthe hierarchyof authority and the reporting relationships.

So organisational structure coordinates the relationship between the various positions in the organisation.

There are some elements withwhich each member ofthe organisation should be similar with following are the main elements

Membersoftheorganisationshouldunderstandaboutthewelldefinedgoalofthe organisation.

Theyshouldbe familiarwiththerules,regulation,policies,proceduresoftheorganisation. They

should know with whom they have to work.

Theyshouldunderstandtheir dutiesandresponsibilitiestowardsthe organisation.

Theyshouldunderstandthedelegationoftheauthorityandresponsibility. Importance of organization

- Forasuccessfulbusiness,asoundorganisationishighlyimportant.

- Organisationenblesalargegroupofpeopleworkingeffectivelytogetherfora common goal.
- Only a sound and well designed organisation can maintain the co-ordination between the managgment and administration.
- Organisational diversification or expansion of organisation can only be possible by a well-planned &welldesigned organisation.
- Effectiveuseofmanpowercanalsobepossiblebyasoundorganisation.
- Asound organisation makesanoptimumuseofrawmaterialsand resources.
- Wastageandexpenditureis lessinasound organisation.
- A sound organisation always stimulates the people for better, creative and innovative ideas.

Typesof organisations

There are different types oforganise structure have beendeveloped and the following are more common

- Lineormilitaryorganisation
- Functionalorganisation
- Lineandstafforganisation
- Matrixorganisation.

LineorMilitaryOrganisation

- Lineormilitaryorganisationisthesimplestandearliestformoforganisation.
- Thissystemoforganisationisbaseduponthescalarprinciple.
- According to this principal when the level of authorities arranged in the structure from the chief executive at the top to the workers at the bottom the system is known asscalarprinciple.
- In this line structure the authority and the responsibility flows directly from the manager to foremen and from foremen to workers.
- In other words authority and responsibility should flow directly in a line vertically from the highest level of the organisation to the lowest level of theorganisation.

- Lineorganisationisalso calledasmilitaryadministrationor militaryorganisation.

Advantages

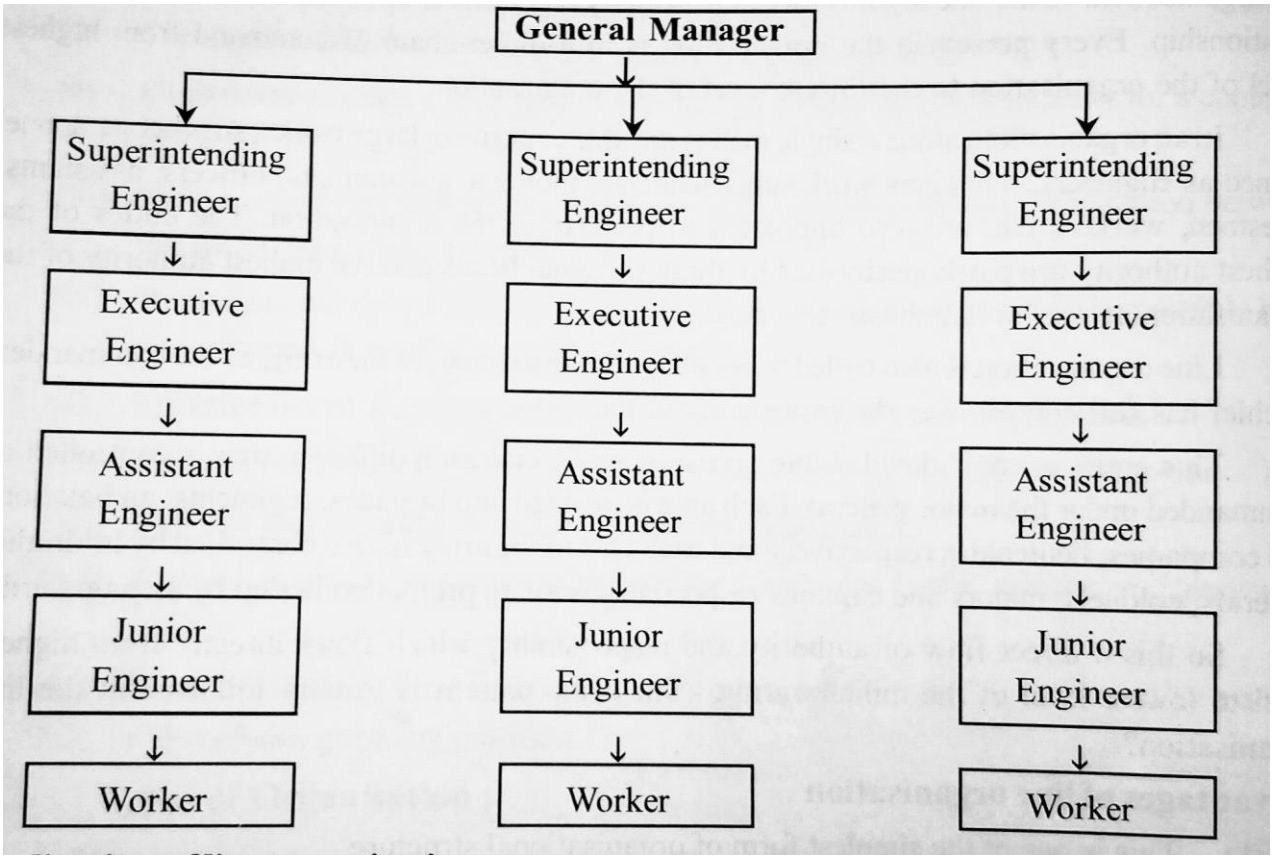
- Becauseofitssimple logicandcommonsenseappealthistypeoforganisationis most widely used.
- Itmakesuseofspecialistto giveexpertadvicetoworkers.
- Italso providesopportunitiesforpromotionandcareerdevelopment.

Disadvantages

- Itisdifficulttomaintaindiscipline intheorganisation
- Itmakesthecomplexindustrialrelationship
- Itisdifficulttoknowwhoisthe'boss'ofwhom.

LineandStaffOrganisation

- As thenamesuggestthis typeof organisationis thecombination of thelineandfunctional organisation.
- Herethelineofauthorityremainsthesameasitdoesinthelineorganisationi.eauthority



flowsfromtoptobottomandthelineexecutiveperformthemajorfunctionwhilestaff responsibilities carried out bythe functionalspecialist withtheir knowledge and experiences.

- Thestaffsareconstitutedbythespecialistsintheorganisationwhoareexpertwithlong experience.

- In this system staffs are are divided into functional staff and line staff as shown in the figure below.

Advantages

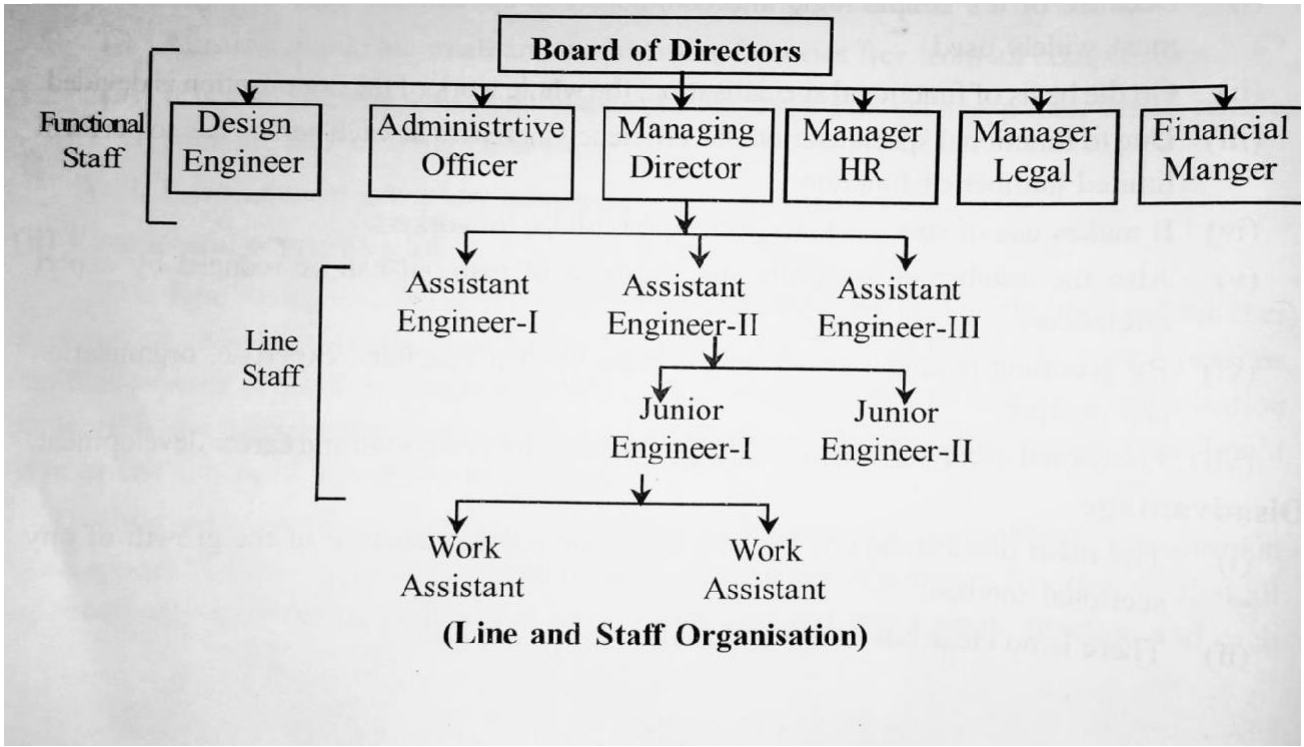
- Lineandstafforganisationpossessesalltheadvantagesofthelineandfunctional organisation
- Disciplineismaintainedbythe lineauthority.
- Itimprovesqualityofproduct.
- Itenablesavailabilityagreatervarietyofjobs.

Disadvantages

- Dueto highsalaryofthestaffexecutivetheproductcostwill increase.
- Theremaydevelopjealousybetweenstaffexecutives
- Linestaffsdonot havedirect authoritytoenforcetheirdecision andimplementtheir ideas

Matrix Organisation.

- Matrixstructureisthecombinationoftwodepartments.Oneisfunctionalandanotheris product responsibilities. Product manager is also known as project manager.
- In this system every group of employees have two bosses one is there functional department manager and another is there project manager.
- The matrixstructureallows foranefficient useofresourcesbecause teams include specialists from various departments.



(Line and Staff Organisation)

Advantages

- Itensuresthe effectiveutilisationoftheservicesofthe peoplewithhighlyspecialisedskills.
- Communicationimprovesbydirect contact withdifferent functionalspecialist.
- Employeescandevelopnew skills
- Disadvantages
- decisionmakingprocessmaybesloweddown.
- too muchworkcancause overload.
- Measuringemployeeperformancemightbecomedifficult

LEADERSHIP

- Leadership istheabilityofamanager tobuildupconfidenceamongthe subordinates
- Leadershipisaprocessofinfluenceinagroupinspecificsetupcircumstanceswhichencourages workers to work willingly to achieve organisation objective.
- whenagroupofemployeesinaprojecthaveacommongoalperformanceobjectivethen some sort of leadership is essentialthere to build up confidence among the employees. **Importance of Leadership**

➢ It leadsthe grouptoahigherlevelofperformance.
➢ Itimpliesamotivepowertogroupefforts.
➢ Leadershipactsasanwayofinfluencing,inspiring,taking actionsbytheauthority.
➢ Effectiveleadershipcreatesabetterunderstandingbetweenthesubordinatesandthe management.

StylesofLeadership

Accordingtotheattitudeandbehaviourpatterns,leadersareclassifiedasthe following

1. Autocraticorauthoritarianstyle
2. Laissez-faireorfree-reinstyle
3. Democraticorparticipativestyleleader
4. Paternalisticstyle leader.

Autocraticorauthoritarian style

- Thistypeofleaderistheabsolutepower withhimself.
- Here the subordinatesare completelyobedient to the leader and the leader also centralised all the powers decision making in himself
- Herethesubordinateshavetofollowtheleader'sorders,rulesandregulationblindlyor forcefully without any question.
- There isathreatofpenaltiesandpunishmenttothesubordinatesincaseofdeviation.
- Sothistypesofleaderisnotarealleader.
- Liassez-faireorfree-reinstyle.
- Thistypeofleadershipmaintainsagoodrelationshipbetweensinordinatesanditsleader because under these type of leadership the sinordinates allowed there maximum freedom.
- They aregiven thecapacity todecidetheirpoliciesandprogramswith theirownstyleand take their independent decisions.
- But this type of leadership rarely exists because in these type of leadership the subordinates must be required to be competent ,sincere and self disciplined.
- Democraticorparticipativestyle.
- Thistype ofleadership isthe exactlymiddlepositionbetweentwo extremesofthe autocratic and freerein style of leader.
- Bythisprocessofdecisionmakingthesubordinatesareencouragedtomakesuggestions while taking decisions.
- Subordinatesaregivenchancetoexploretheirpotentialinstrengthtocompletethe challenging responsibilities.
- Itcreatesafriendlyworkingatmosphereandreducesconflicts likestrikes,industrialunrest
- ,employeescomplaintsetc
- Peternalisticstyleorfunctionalstyle.
- Underthesestyleofleadershipthesubordinatesbecomedependentupontheleader.
- Herethesentimentsandemotionsaregivenmorepriority
- Andandtheleaderlooksafterissubordinateslikeafatherlooksafterhischildrenandfamily.
- Heissupposedtohelp, guideandprotecthissubordinates.

Chapter6

ConstructionLabour&labourIanagement

Introduction: Construction industry is one of the largest industry En india, where about four Crones of workers are employed and most of them are unskilled labourers. In general constructionLabourersareClassifiedasunskilled analskilleofandsemiskilledPersons. The labourers employed inconstruction industryare paid wages ondaily basis as the construction work is temporary. Hence the job in Construction industry is also temporary and Workers have no jobsecurity. There fore, construc -tionlabourerscaneasilybe shifted fromonePlace to another.

Labourscheduleміймит

A labour Schedule can be prepared from the construction Schedule and the objective of this Schedule istodecide,thenumberofskilledandunskilled labourrequired fortheexecutionof different operation on different dates.

*Withthehelpofthisschedulerequiredlabour canbearrangedwellintime.

Itisdifficult andcostlyto arrangeskilled labourasandwhenrequiredIt helpsinreducingthe labour cost.

Essential steps for Optimury labour output мини in in m + Labour output is a major concern for employers and it is desirable to have higher level of Productivity in any organization. For achieving this, a lot has to be done with the environmentat work Place and the work conditions along with a Series of factors that define the work couture. The employers have to implement wide spread changes in theire set up to improve the out put or

Productivityoftheir work

A few factoresthat help to improve the employee ProductivityonLabour out put at the work place ane!

1. Accountability.

Everyemployeeneedsto bewellawarethat he is accountability forthisactionsanddecisions and he can neither pass the bulk or pass the

blame to someone else. of This will help him to work more meticulously. Hake cautions rather than reckless decision, and not take advantage of his place, position or relationshipwith his superions

2. Followup

→ Every target on milestone set needs to be followed up as well to see if the progress is sufficient and if not, whether any interim measures can be taken before it is too late tosalvage a situation.

→It also keeps the employee on track ensuring no Fod consistent efford there time of the Project.

3. Management without micromanagement ofcourse, the poolof employees does need to be Managed, provided direction and given assistance.

But side by side.they must also be trusted, given freedom to operate in their own style and adopt measures which theythink are the best to deliver results4. Encourage Motivate reward and recognize

~w2

The employers Must ensure that on this part he always has the words of encouragement for his

It helps them move forward and do even better and Make the worker feel happy. Innovative way of motivating them spurs them even more. For EX: holidays or conferences paid

forbythecompanyhavebeenfoundtomotivate

employees immensely.

5. Reachouttoemployeesbyseekingthem

→ Every employee loves to feel he has the ears of the management who will recognize him and Listen to what he says. of me

Displayof interpersonal skills in which the boss appears humane and one ofthemrather than a larger than life, distant figure, helps to have employees warm up to him and feel happy working of him.

6. Demandrealistictargets

→ •Employers need to set realistic goals that are within the limits of achievement. → while an aggressive employer may want his people

tooutstreetchthemselvestoachievefarefatchedgoals,itmayalsoburnthemout."

7. TearyWork

→ Teamwork always helps in increasing workplace Productivitysince there is more input in the from of More ideas and minds at work.→ working alone is not always the happiest situation

eitherespeciallyinthefields.

8. Ensurethat people enjoytheir workThe best performing employee, isthe happyemployee and the employer has to find ways of Making his people happy.

→ Besides working conditions and the work culture Implemented, he has to devise way of making the work seem challenging and interesting rather than mundane and boring.

9. Breakthemonotony

and

rotate

→ while employers assign tasks according to an employee's core competence, even with the task they are best at, can make an employee bored and

thisworkSeerymonotonous.

This Monotony can be broken with rotation and giving people new tasks and exposure to other divisions.

10. CoursesandEmprovementoptions.

→ Employees are delighted when they can enhance their skills and get additional larning opportunities Sponsored by the employer. om

This help them learn feel indebted for the? money being spent on them, which also adds to their resume and are obliged to performbetter by applying all the knowledge gained in these Courses11. Spend less time on meetings and more an action →The current trend to havemore meetings and discussion more time in rather than spending more time in working to achieve results leads to Precious Productive time loss.

→ Meetings for reviews and Sharing of ideas can be Limited and kept short. Employees should have more time to show results.

12. Toolandequipmentstoraise Productivity.

Theworkplaceshouldhavethebestof Machinery devicesandequipmentsthatyielderror free results in the minimum possible time

→ Efficient electronic equipment with no connectivity ssues and breakdowns will in saving Precious time. help

→ Theyshouldtakethe placeofpaperwork

andyieldfastresultswasane6.3Labour Characteristics!

1. Labour is original and indispensable factor of Production. 2. Labour is an active factor of Production

3.LabourisPerishablethananyotherARTHCommodity4.Labourcannotbeseparated from the labourer

5. Labourisless

6. Laboursupplyis inelastic

7. ALaboursellhaslabourandnothimself.8.Labourehasweakbarganizing power.

9.Labour isboththebeginning andtheendofProduction.10.Efficiencyoflabourdiffers.

1.Labourcannotbeengaged continuoslyinproductionLikeMachine

19. Labour Createscapital: labour is more important inthe processofproductionthancapital because Capital is the result of the working of labour.

13. Ttisdifficulttocalculatethecostofproduction of

labour

14. Labour has not tangible form: Labour has not reserve price. Labourer can be seen, can be touched but labour can not be seen.

WagesPaymentToLabour:

→Paymentmadetolabourisgenerally referredtoaswages.Itcan betime-rated on piece rated. It can be nate per hour, per day, per week, per Month Or per year.

This isthe renumerationpaidto toworkersforthe actitalworktheydo.

The wages can be paid to ordinary skilled, unskilled Or semi-skilled workers as daily basis, on week weekly basis.

The wages arebothmonetaryandnon-monetary.

→The monetarywagesare moneypaidto workersaswage. But non-Monetarypayment may are known as

fringebenefits.

Typesofwages

wagesaregenerallyoftwotypes. iy

Time wages.

howtodesig

iyRealwagesHosat 40cortom Py
Time wages:

Whenpaymentof wagesmadetolabourisintheform ofmoneyfortheworkdoneon the basis ofPer hour, Per day, per week, per month ore per year it is often called as time wages.

iiyReat wages:

After Satisfying the basic needs of a worker and for improving the standard or uving of a worker wages given in the form of lawny and comfort On extra security, is often known as real wage.

Therealwagessepeifytheamountofgoodsand.Servicesthatthemoneywageswillbuy.
Methodofwage

Wages can be calculated on the basis of the Out Put Errespective of the time taken in completing

14.→Efficiencymaybeafactorwhichvaries fromindividualtoindividual.

The efficient worker may creat more out put than Other so wages can be calculated on the basis of the work irrespective of the time.

Also a good wage payment system establishes a good relationship between worker and employeer. The payment of wages can be classified into two method.

iyTimeondayratesystem to

iiypieceworkonpiece ratesystem.Вран1.Timeondayratesystems

In this Method of wage payment, the worker is Paid a fixed renumeration as per his unit of time which can be rate per hour, perday, per week, Pear month or per year.This is one of the oldest method of wage. payment adopted in india.

As in this method, workers don't get extra benefits except their weekly leave, they have no special intrest to work hard for the Optimum Profit of the organization. Merits!

iyThisMethodissuitableworkcannot be.Masured directly.

iiy By this method of wage payment, worker f ensures regular employment and greater security. of service.

yHereSkilled,unskilledand semi.Skilled allTheworkersgetthesamewagesofoneclass.

The calculation of wage can be done easily by Method. where measurement of output is not feasible, this

Methodisspeciallyuseful.

viyAsworkershavenotendencytoshow increased OutPutthe qualityofworkisgood.قانون

vii) Also this methodcanbeunderstoodbyallclass ofworkerseasily. conofvigane Demerits!

iyAstheworkersdon'tgetentrabenefitsencepttheirweeklyleave,theyhavenosuch interest to work hand for the organization.

iiyThere is no inspirationofcompetition among the workers and hence there is no chance of extra Profet.

ilyBythis method, a skillemployee becomes intrest -lessto Produce more thanthe unskilled workers.ivy A regular Supervision is required for this the"" work to extract work from the labour. vy The workers are assured of their wages to theire

outputislow.

vixcostcontrol can'tbeensuredeffectively duetovaryingProduction.27Piecework one piece rate system.

→ In this system according to the worker's output

theirpayment isdecided.Ofcoursepayment ismade

at the agreed rate.→ In thismethod,an efficientworker can earn Money by increasinghis out put.

→HerePayment &&Purelybasedonproductiononoutputofworkers→Payment isdecided at the actual quantur of work

donebythework. Advantages

to

1223bon

ixSuitableincentivesaregiventoefficientworkersinproportionoftheiroutputor production.

iiyThereexistsahealthy. atmosphereamongtheemployerandemployees.

ii) Higher wagesaregiventoworkerwithhigher OutputonProductionnaRProk200000 ivy less

supervision is required. 14, 2

vyInthissystem,agoodworkercanmakemore202.00money byincreasinghisout Put.

vix By this Method, unefficient and unskilled yees are pointed out. employeesviiy As effortof workers increases, the over all Production of the organization increases similarly there are some demerits of piece-work system of wage payment as given below.

Disadvantage:

by workers are not careful about the quality of work. They have to any how increase the out put of the Organization.

ily over time work causes sickness to health. iiiy Sometimes no work no pay situation arises 107 because during the period of sickness or absence there will be no payment as the output will be there.

ivyIt causesacompetitive fjealous atmosphere.amongtheworkersoforganization. 65

Motivation

6.5

Labourincentives

→ Labour incentives refer to those incentives that Supplement a salary and are given to theemployees of a company fore their excellent Performance

Most often that not incentives are what attract the employees to keep working Company and go an extra mile to achieve something they are set to do.

Motivation:

→Motivationisanimportantfactorwhich encouragespersons togivestheirperformance and helptheminreachingtheenterprisegoals. Motivationisoneofthemostimportantfactor

affectinghumanbehaviour.→Ithelpsthe individualtowardsthefulfilmentof

durableobjectives.14Exocompleneforcethatisresponsibleforstartingandkeepinga person at work in an it

Organization.

→Motivationissomethingthat mobilisesapersontotowork. Defination

Motivation is an inspiration that simplers and Person to expand energy to achieve a goal onAreward.

→Motivationis acts as a drivingforceby conich 1000521 thehuman beingachievetheir goal.

→ In other words Motivation is the stimulation of emotion or desire and an inner state thatactivates On directs the behaviour towards achiveing the goals.

ClassificationofMotivernemasque

WhenaManagerwantstogetmorethisSub-OrdinatesMotivatethemfor230workfrom then he will have to improving their mance.

ThisMotivationmaybeintheformofananyalimonincentiveorbonusno13thBmo? NS150 OF

Therearetwotypesof motivations.

EyInternalMotivation201

ExternalMotivation.AntofiInternalMotivation

Internal Motivation Motivates peopleinternally and 24 meters tomotivation by intereston enjoyment.in doing the task itself.

Internal Motivation emists within the individual rather than any external intuence. ANTS → Need to get an accomplishment of good job, and

theillusionofself-determinationandfreedom are

the examples of the internal Motivation. ify

External Motivation.

EnternalMotivationcomesfromoutsideoftheindividual.

CommonexternalMotivationsarerewardsLikemoney.grades,pay,incentives,threatof punishmement or praise, in

ALSOMotivationcanbroadlybeclassifiedintotwobroadtypesasfollows:ayPositive Motivation.

whentheemployeesareofferedtheincentivestheytrytoimprovetheirperformancewil willingly.

PositiveMotivationorincentivemotivationis, wwbaskbasedonreword.-مهلوان

TheincentivesmaybeintheformofMorepay,Promotion,recognitionofJobetcropget born work, more responsible

Positive Motivation is achieved by the Co-operation of the employees to do andain and they have a feeling of happiness. avit of an nomepinnalby Negative Motivation.

Negativemotivationisbasedonforceorfear.→Feancausestheemployeestodocertain job.

→It theydonot do accordinglythentheymay bePunished withdemotionson lay-offs.

This types of motivation causes anger and funestration because the employees do notworkwillingly rather they want to avoid the Punishment. 40

Different Approachestomotivation

The Motivation differ from time to time, place, to place, situation to situation and person to Person.

→soitisdifficulttosetaspecifictheorywhichwillbeuniversallyaccepted. WHOM OLIA

,

w'sNeedHierachytheoryishbondf

Maslow's

olayHerzberg'stwo-factortheory.ByAlden for'sERGTtheoryhemaltotry

1. Maslow's Need Hierachy theory This theory includes the hie Abraham Maslow. hierarchy of need by

+Maslow'stheoryisoneofthemostwidlydiscursed theoriesofmotivation.

→MotivationisinfluencedbytheneedsofaPersonA.H.MaslowanAmericansocial scientists has developed the hierarchy of needs consisting of five hierachic Classes

Maslowcategoriedhumanneedsintofivecategories 97
tyBasic Physiological Needs

TheseneedsaremostessentialforthesurvivalandMaintenanceofhumanlife,

These needs include satisfactionofthe needsofhunger, and shelter, drinking water, clothing, rest," etc. اده

Selfactualisation

Top(self-fulfilment)Esteemneed/Egoneeds(Prestige,status,self-respect Socialneeds.

(Affection, friendship, belongings

Safetyandsecurity needs

(Protection,onder,stability)BasicPhysiologicalneeds.(food,water,air,Shelter) iix

Safety Needs:

Once Physiologicalneedsare staistied, the human being want the assurance ofmaintaining a given economic level. 197

These are the needs to be free from Physical dangers, and fear of jobs Property, Sheller, etc. 10

→Everypersonwould liketo befree fromworries like lossofjob, sickness, oldagepension, physical safety like accident and fire.

Social Needs: Once the individual esSatisfid with social needs, they are concerned about the next level.

Beingasocialbeingpeoplebelongtobeacceptedall

by othersvoskedalTherefore themanisintrested in conversation.Sociability,exchangeof feelings and grievances,

Companionshipandbelongingness.

ivyEsteemonEgoNeeds!7863→These needsare concernedwith

self-respect.self-confidence,feelingofbeinguniquerecognitionetc.Satisfactionof these needs bring confidence, power,

controlandprestigeachievment,independence

competence, knowledge & → The individual have to learn on acquire these only through his intelligence and hard work.

etc.

&Hanxberg'sTwofactorTheory:

vyself-actualisationself-actualisationneedistheneedforselffulfillmentofwantsofa person considered to be mission of his life.

+self-fulfillmentisthehighestneedin Maslow's

hierarchyand thento Theseneedswhich help anindividualtodevlophispotentialities.

self-fulfillment needs gives satisfaction to the person concerned and gives a tendency of capability of doing of self-development

2. Herzbergtwo-factore

or Theory

→ This theory was devloped by frederick in 1959. y's two factor theory is also known as → Herzberg's Motivation-hygien theory of Motivation.

→ Herzberg and his associates concluded a of need satisfaction of 200 engineers and accountants inanOrganisation. StudyThesepersonwereaskedto describea fewPrevious job experiances in which they felt exceptionally good or enceptionally bad about the jobs.

The satisfaction of some need may not have Positive effect on motivation but their non-satisfac -tion on may act as a negative factor.

These factors operate to build strong motivation and high job satisfaction and their absence affects both satisfaction and Motivation.

ix Hygiene factor: These factor are responsible for reasonable level of satisfaction and are called Maintenance or hygiene factor.

→ The hygiene factorEx just like hygiene; the Presence will not make the employee healthy but its absence causes a deterioration of health.

There are factors concerned with the company Policy and administration, teennical supervision, winter personal relations with Supervisor, inter personal relations with peers, inter-personalrelations with Subordinates, Salary, Job security, PersonalLife, work relations with subordinates and status.

These are the maintenance factor conich are necessary to maintain a reasonable level of Satisfaction.

→ These factor are not responsible for growth of motivation in workers but the absence of these factors Creates problem ostaliy Motivation factor

These factorscreatehighmotivationand jobSatisfactionintheirPresence. The

absence of these factors do not cause.

dissatisfaction.→AccordingtoHerzbeng,therearesixfactor

whichgivepositivesatisfaction.→Thesesixfactorsarerecognition,advancement.work itself. possibilites of personal growth,

achievmentandresponsibility.

Itisessentialtoincreasethesefactorforincreasingthemotivationofemployees.

3. ERGTheory:

→Thistheorywas introducedbyAldenter. TAldenten'sERGtheoryistheexpanded form of

Maslow's hierarchy of need theory and

Herzbery'stwo factortheoryofmotivation. He foundsomeover- lapping betweenPhysiollo - gical need security need and social needs.

HeclassifiedthevariousneedsintothreemaincategoriesittenyourattoTomogr iy

Existence needs.

yRelatednessneedsatomallwa Growth

needs.

iyExistenceneeds:

infotemofgove

Thisneed ofERGTheoryincludesbothPhysiologicalandsafelyneedsofanindividual

in Maslow's Model.These needs include the basic Servival needs of human beings like food, clothing, Shelter and drinking water.

ThesearethePrimarytofulfillthis.trytoneeds,human being

ilyRelatednessNeedsThisneedofERGtheoryisthecombinationofthesocialneedand esteem need of Maslow's

Model.

Theseneedsaretheemotionalneedsofthehumanbeingfor Love,affection,warmthand friendship. These needs give human being ego sats faction

so combining these two needsofmaslow relatedness need isderived. iliGrothNeeds;plus no 29t

TheseneedsaresameastheMaslow'sself actualisation

needs.

Theseneedssatisfythehumanbeingfornispersonaldevelopmentandachivement.

When the individual wants to do something Challenging, the samse ofachivement gives him a satisfaction.

Thisneed satisfiesalldesiresoftheindividu-altoincreaseand develophis potential."

CHAPTER–7EQUIPMENTMANAGEMENT

(The cost of equipment in a project varies from 10 to 3% of the total cost on ne project, depending upon the extent of mechanization. In modern fully mechanized projects, the costof equipment may vary in the range of 25% to 30%.) However, proper planning, selection, procurement, installation, operation, maintenance andequipment replacement policyplays an important role in equipment management for the successful completion of the project. With the growing use of the machinery, it has become necessary for the construction engineers to be thoroughly familiar with the construction application and up keep ofthe wide range ofthe modern equipment.

(The aimofthe equipment management is to reduce downtime, achieve optimumequipment utilization and increase production at minimum cost. There is a need for a rational planning, proper selection and judicious deployment of equipments so as to achieve optimum utilization. Of course, the equipment management integrates and continuously interacts with human, technical, financialand production system in orderto achieve top efficiency and cost effectiveness.

PREPARINGEQUIPMENTSCHEDULE

The equipment use schedule has to be prepared before the start of the project in order to decidethetype, numberanddatesonwhichaparticularequipment willbe neededso that it is arranged well in advance and brought to the site as and when required. The aim of this schedule is to derive maximum advantage ofthe equipment when at site and remove it from the site when its job is over. This is most likelyto result in economy.

After the purchase of the equipmentfor a particular project, the owner gets a mark punchedorpaintedontheequipment ormachineto identify it fromothers. Theownershould have full knowledge of the equipment purchased by him. Usually following information is sent to the owner:

1. Costoftheequipments.
2. Efficiencyofeachequipmentormachine.
3. Recordoftheirrepair.
4. Detailsofexpenditureonrepairs.Durationofeffective useofthe equipment.
5. Detailsoffuelconsumptionbythe equipment.
6. Details ofservicingoftheequipment.

With the above information, the efficiency and working capacity of the equipment can be compared with the figures supplied by its manufacturers. This schedule is very useful at the use of purchase of new equipments.

SELECTIONOFEQUIPMENTS

Identification and selection of proper equipment is of paramount importance for the speedy and economicalcompletion ofa construction project.The problemofselection ofa particular equipment or identification of different alternative equipments is a difficult task because of availability of variety of equipments in the market by different manufacturers. For proper selection of equipments considerable field experience in their operation and maintenance is required. Previous records of operation, maintenance and actual output under comparable conditions of similar projects comes to great help in deciding the choice of equipments.

Basically, following two aspects are considered for the selection of construction equipments in a project. While the first aspect deals with the type, size and other particulars of the equipment, the second aspect decides wheather it is to be purchased, hired or to be procured under hire-cum-purchase arrangement. But in all cases, the following factors must be taken into account before having a final choice.

(i) **Suitabilityforjobcondition**

The equipment selected or identified must satisfy the requirements of work, climatic and working conditions

(ii) **Size oftheequipment**

The size of the equipment should be such as to be compatible with other matching units. Ifthe chosen equipment is of larger size, it is likely to remain idle for most ofthe time or shall work on part loads leading to rise in the cost of production / work. On the other hand, if the equipment selected is of smaller size than that is required, it may not be compatible for matching equipments, in which case, the other equipments will have to either remain idle orto be allowed to work on part loads, which will again be uneconomical.

(iii) **Standardisation**

It is desirable to have the same type and size ofthe equipment in a project which will ensure lesser spare parts reserve, better interchangeability of parts, easy understanding of operators and efficient maintenance and repair as the mechanics become adept by handling the same type of equipment.

(iv) **Easeofavailabilityinthemarket**

The equipment selected should be easily available in the market but side by side it is also to be ensured that the equipment is of reputed company and likely to be continued to be manufactured in future also. This is essential for future standardization and ensuring spare parts supply as well as for disposing off such equipment after completion of the project.

(v) **Availabilityofspareparts**

The availability of spare parts at reasonable price throughout the working life of the equipment is all the more important while selecting a particular type or make of the equipment. It is desirable that the downtime of the equipment for want of spare parts should not be more. This is very important in case of imported equipments.

(vi) **Versatility of equipments**

There are certain type of equipments that are not fully utilized for a particular function. Inthat case, they should be capable of performing more than one function so that it is not layedidle and has multi-purpose use.

(vii) **Availabilityofknowhow**

The equipment selected should be capable of being handled satisfactorily by the available operators and mechanics. Therefore, a sophisticated equipment that gives excellent performance but difficult to handle and maintain should be avoided.

(viii) **Possibilityofuseinfuture projects**

When selecting an equipment that completes only a part of their useful life in a project, itsuse in future projects should be kept in view before it becomes obsolate.

(ix) **Economicaspect**

While selecting any equipment, it should be ensured that the cost of unit production is minimum.

(x) **Reliabilityandsupportservice**

The equipment selected for the project must be reliable one. In addition, support service should be available in the area of project where the equipment is to be used. After sales service should be a major criteria for the selection of equipments.

(xi) **Operatingequipment**

The equipment selected should be easy for operation and maintenance, user friendly to the and should have lesser fuel consumption.

Satisfactory past performance While procuring an equipment of new make and model, it is desirable to enquire about its coryperformance fromother users, who areusing the make and model for quite some

Besides these, the other points that are to be taken care of are reputation of the acturer, warranty or guarantee offered, use of standard components in the equipment adequacy of drive mechanism or power of the prime mover. use of However, versatility of the equipment should be given due priority. Multipurpose achine promises extra profit due to following reasons. Allows one machine to do the job of several machines and thus cutting into ownershipandoperatingcostsassociatedwithadditionalplantandlabour. It increases the utilization enabling a machine to earn money when it might otherwise beidle.(increases the utilization enabling a machine to earn money when it might otherwisehe idle. Generally, there are provisionsoffitting and changing the attachmentsofsuch machines with the help of couplers. Thus, a balance between reliability, investment cost and operating

cost should be worked out, since a policy of selecting only the lowest priced equipment may lead to overall higher costs.

OWNINGANDOPERATINGCOSTS

The principles of engineering economics are made use of while selecting and planning of finances for the procurement of construction equipments. Economics of construction equipment mainly deals with the study of working of the equipment and computation of the unit cost of production, which comprises of the following components:

a) **OwningcostbyOperatingcost**

The costofpossessionofanequipment is called the costofowning while the costof faeland lubricants for running the equipment is known as operating cost. These two combined so gather when estimated on hourly basis represent the amount by which an equipment shouldbe hired. Of course, it is exclusive of labour cost. There are several methods of determining the probable cost of owning and operating of a construction equipment but there is no guarantee that similar equipment will have similar cost if used under different conditions.Past recordsofuseofequipment mayoftenserve as a guide but it must be adjusted as perthe prevailing situation to arrive at the realistic value.

The followingfactorsaffecttheowningandoperating cost.

1. Initialcostoftheequipmentanditsdelivery.

2. Severityoftheconditionsunderwhichitisused.

3. Noofhoursitisusedperyear.

4. Thecarewithwhichitismaintainedandrepaired.

5. Thesalvagevalueoftheequipmentafteritsusefulperiod.

6. Usefullifeorserviceperiodoftheequipmentinyears.

When detailed cost records based on past performance of an equipment is not available, it is analyzed from the first principles. The following costs constitute the cost of owning and operating.

1. Investmentcost(includinginterest,insuranceandstorage)

2. Maintenanceandrepair cost

3. Depreciationcost

4. Fuelorenergyconsumption cost

5. Costof lubrication

1. **Investmentcost**

Theowner hasto invest moneyinorder toownanequipment. This is akindoffixedcost and is incurred, wheather the equipment is used or not. Investment cost comprises of the following:

a) Interestonthemoneyinvested intheprocurement ofthe equipment

b) Various taxes ontheequipment

c) Insuranceexpenses

d) Thecostofstorage

The chance ofearning the interest onthe amount spent onthe purchase ofequipment isa loss to the owner. In addition to this, all type of taxes assessed against the equipment, insurance premium and storage charges have to be paid. Therefore, it is desirable that these costs must be realized during the life of the equipment. Sometimes, a fixed percentage of the original cost of the equipment is charged towards the cost of investment each year equally which is much higher than the actual, because the insurance, taxes etc. are usually paid on the depreciated value of the equipment and the amount of interest charged also should be based on the book value of the equipment instead of its original cost. So, the owner must deduct from its earnings an amount equal to the annual cost of depreciation to get the book value of the equipment and the realistic value of investment cost of a particular year will be some percentage of the book value of that year. But, this process being cumbersome, the average value of the equipment is used in determining the annual cost of the investment. Generally, annual investment cost 10 to 15% of the average annual cost of the equipment.

Maintenanceandrepaircost

The annual cost of maintenance and repair is based on the experience obtained from the operation of the equipment under average conditions. The actual cost varies with the conditions under which it is used and the care with which it is handled. Of course, it varies with the type and quality of equipment. The annual cost of maintenance and repair may be expressed as a percentage of the annual cost of depreciation or it may be expressed independent of depreciation. But in any case, it should be sufficient to meet all maintenance work including cleaning. washing, checking of component units, instruments, ropes, adjustment of component units as well as routine and major repairs. Normally, annual repair and maintenance cost- 50 to 100% of annual depreciation but 100% of the fair value.

Depreciation cost

Depreciation is the loss in value of the equipment resulting from wear and tear or obsolescence. The owner of the equipment must recover the loss in value of the equipment during its useful life by way of depreciation. There are different methods of determining the cost of depreciation.

Generally, standard equipments are preferred in construction industries. However, special equipmentsalso may be considered provided the economic analysis justifies itsselection. So, forallequipmentsused intheconstruction, iftheequipmentsdonot suffer fromthedangerof obsolescence, theannualdepreciationcost oftheequipment may beobtained byInitialvalue-Salvage value

AnnualdepreciationUsefullife ofthe equipment (in years) Thus, atthe endofthe usefullife, thevalueobtained becauseofthedisposedoftheequipment maybe intermsofsalvage value or scarp value. 4. Fuel or energy consumption cost

Construction equipments require fuel in the form ofgasoline oil, diesel, electrical energy and lubricating oil, which is considered as operating cost. Although, the amounts consumed depends upon the type of equipment, its rated horse power, location, temperature 615erie pressure and the conditions under which it is used as well as other factors but the working condition is the most significant to estimate the realistic consumption of the fuel per hour. These working conditions of the engine are defined by engine factor i.e. extent to which the engine will operate at full power all the time and the time factor i.e. that the actual time that the engine will operate in one hour.

ThenoperatingfactorEnginefactorxTimefactor.

A common value of operating factor for an engine during a construction equipment may be taken as 0.6 if detailed information regarding its engine factor and time factor are not available.

Costof lubrication

An engine requires lubricating oil for its smooth functioning and getting more output minimum loss on account of frictional force in the machine. The quantity depends upon the size ofthe engine, the capacityofthe crank case, the conditionofpistonringsand the number of hours between oilchanges. However, it is common practice to change the oilevery100 to 200hrs. The empirical formulae may be used to estimate the quantity of lubricating oil andthe factor of 0.6 may be assumed in those formulae when sufficient data is not available for the purpose.

7.4**INSPECTIONANDTESTINGOFEQUIPMENT**

Inspection is taken to mean observation of work environment, work practices, equipment used, work posture or reported hazard which may be generic or it may be specific to assess a particular risk, task or part of occupational health and safety management systems. Testing means use ofstandardised tests to check the equipment, plant operation, process control, and effectiveness.

The purpose of inspection of an equipment is to identify whether the equipment can be operated,adjusted and maintained safelywithanydeteriorationdetected and remedied before it results in the health and safety risk. Not all work equipments need formal inspection to ensuresafetyand,inmanycases,aquickvisualcheckbeforeusemaybesufficient.

However, timely inspection is necessary for any equipment where significant risks to health and safety may arise from incorrect installation, reinstallation, deteroration or any other circumstances. Usually, the need for inspection and inspection frequencies are determined through risk assessment.

theneedforinspectionandinspectionfrequencies aredeterminedthroughrisk assessment.

The equipment should be inspected if the risk assesment identifies any significant risk (for example, of major injury) to operators and others from the equipment's installation use. The result of the inspection should be recorded and such records must be preserved untilthe next inspectionoftheequipment. Therecordsneed notbe necessarilyinwritting but ifkept inany other from(e.g. on a computer), these should be held securelyand made available on request by any enforcing authority.

Equipment that demands inspection should not be used, unless required inspection has taken place. When equipment is transfered or returned, it should be accompanied by the physical evidence of last inspection such as an inspection report or for small equipments, some fromof tagging, colour coding or lebelling system.

Where the safety of the equipment depends on the installation conditions, it should be invariably inspected after installation and before the first use and after reassemblyat the new site or location at suitable internals, where the equipment may be exposed to conditions causing deterioration liable to result in dangerous situations.

The scope of inspection will depend on the type of equipment, its use and conditions to this exposed. This should be determined through the risk assessment and take full account manufactures recommendation. The inspection should concentrate on those parts which ecessary for the safe operation of the equipment and, in some cases, this may require stingand dismantling. However, not all safety critical features on a particular equipment may pre important same intervals. Rather, an inspection may vary in its extent such as quick chess before use. weekly cheeks and more extensive examinations under taken every few ths or longer, Recordsneed not be maintained forthe simple pre-use cheeks. The frequency nection may vary depending on environmental conditions and your own experience, Intervals the inspection may be increased if the inspection history shows negligible deterioration a shortened where experience shows this is necessary to prevent danger.

The equipments should be inspected by competent persons who has sufficient knowledge d experience of it. Of course, the necessary level of competence will vary for inspections, cording to the type of equipment and how/where it is used.

Agencies who conduct the testing of equipments must have required competency and tification in this regard. They may inspect and test an equpment following a report ofancident and check ifcorrective action has been taken on factors contributing to the incident. Thus, testing and inspection may consist either of a scheduled programme to meet the requirements oflegislationandstandardsor onanadhocbasiswhichisinitiatedbecauseof

an sue that arises requiring testing to diagnonise the cause or source and resolve the safety problem.

Persons responsible for coordinating inspection and testing of equipments are generally sponsible for maintainance and securityof such records. Inspection and test results should be made available to the manager of the area concerned. It is also important that the inspection and testing results are discussed with the safety committee to ensure all possible solutions. Procedures must be reviewed to ensure relevance, currency and corrective action on nonconformance found during inspection or testing procedures.

EQUIPMENTMAINTENANCE

Maintenance of an equipment is the operation of keeping its various components in their original form as far as possible with a view to ensure that safety as well as production in operationdo not deteriorate. It includesservicing, inspectionand adjustment, smallrepairs in field, major repairs and over hauls in main workshops and proper case of laid up machine. The objectives of maintenance are:

i) Tomaximizetheavailabilityofmachineryneeded forsmoothproduction.

ii) Tominimize downtimedue tobreakdownof machinery

iii) Toensurelongevityofthemachinerytoavoidhighrateofdepreciationofcapital.

7.5.1.Typesofmaintenance

There are mainly four types of maintenance: a) Reactive maintenance / Break down maintenance / Corrective based maintenance)

b) Predictive maintenance and Reliability centered maintenance (condition based maintenance)

c) Preventivemaintenance/Schedulemaintenance(Timebased maintenance)

d) Pro-activemaintenance(Advancemaintenancetechnique)

7.5.1.17**Reactivemaintenance**

Reactive maintenance is based onthe principle of "run it till it breaks" mode of maintenance. No efforts are mode or no actions are taken to maintain the equipment as intended by the designer, either to prevent failure or to ensure that the designed life of the equipment is attained. Ofcourse, reactive maintenance is stillthe predominant modeofmaintenance inthe Indianconstructionscenario, accounting for about 65to 70%ofthe maintenance programme.

Theadvantagesofreactivemaintenanceare:

(1)Ithaslowerinitialcosts

(ii)Itrequiresfewer maintenancestaff

However,thedisadvantagesofthisapproachtomaintenance are

(i) Costescalationdueto unplanned downtimeofthe equipment.

(ii) Increasedlabour cost,especiallytowardsovertimefor untimelyrepairsand replacement.

(iii) Increaseincostassociatedwithsuddenrequirementofrepairorreplacementof equipments.

(iv) Mayresultinpossiblesecondaryequipmentorprocessdamagefromequipmentfailures.

(v) Leadsto inefficientuseofstaffresources.

7.5.1.2**Predictivemaintenance**

The predictive maintenance approach aims at detecting the onset of equipment degradation and addressing the problem as soon as they are identified. This allows stressors to be eliminated or controlled, prior to any significant deterioration in the physical state of the component orequipment.It leadsto bothcurrent and futurefunctionalcapabilities. Ofcourse, predictive maintenance techniques provide data that define required servicing and inspection periods so that maintenance departments candetermine in advance whenthe equipment must beshut downforoverhaul. Statisticalevidenceprovesthat theseprogrammes, whenproperly minimize equipment and system breakdowns resulting in a major reduction in tenance and operating costs. It accounts for about 2% of the maintenance programme for diagnostic tools in predictive maintenance programme .

Thefollowing are the six majordiagnostic toolsin the predictivemaintenance programme cularly scheduled basis.

wearparticleanalysisVibrationanalysis

Infrared thermographyElectricaltesting

Ultrasonic/acousticProcessvariables/inspections/non-destructiveTheadvantagesofpredictive maintenance are:

1. Increasedcomponentoperationallifeandavailability.
2. Allowanceforpre-emptivecorrectiveactions
3. Decrease inequipmentand/orprocessdowntime
4. Loweringofcostfor partsandlabour
5. Betterproductquality
6. Improvementofworkerandenvironmentalsafety
7. Risein moraleoftheworkers
8. Increaseinenergysaving

Thedisadvantagesassociatedwithitare:

1) Increaseofinvestmentindiagnosticequipment.
2) Increaseininvestmentofstafftraining.
3) Non-availabilityofimmediatesavingspotentialbythemanagement.

15.1.3**Preventive maintenance**

Itrefersto aseriesofactionsthat areperformedoneitheratime-basedscheduleoraschedule based on that of machine-run time. These actions are designed to detect, preclude or stigate degradation ofa system(or its components). The goalofpreventive maintenance proach is to minimize systemand component degradation and thus sustain or extend the riodic inspection of equipment to uncover conditions leading to production break downs or seful life of the equipment. The basic activities involved in the preventive maintenance are i) mful depreciationand ii) Upkeep ofequipment to minimize downtime and break down conditions while they are still in a major stage. It accounts for 30% maintenance programme in India. Application of preventive maintenance technology

Thepreventivemaintenancetechnologyisappliedinrespectofthefollowing:

a) Lubrication

b) Cleaning

c) Replacement

d) Inspection

Theadvantagesofpreventivemaintenanceareasfollows

i) Costeffectivenessincapitalintensiveprocessesandequipment

ii) Flexibilityintheadjustmentofmaintenanceperiodicity.

iii) Increaseincomponentlifecycle.

iv) Generationofenergy savings.

v) Reductioninequipmentandorprocess failures.

vi) Costsaving(around15%)overthatfoundinareactivemaintenanceprogremme.

The disadvantagesofthis approachare

i) Inabilitytoeliminatecatastrophicfailures.

ii) Morelabourintensive.

7.5.1.4**Pro-active maintenance**

Although predictive maintenance uses online condition monitoring to help predict the occurrence of failure, it often fails to identify the root cause of failure. That is where the proactive maintenance is called for. Of course, proactive maintenance relies on information provided by predictive methods to identify problems and isolate the source of failure.

Now a days, the old ideas on the machine maintenance being discarded in major industries throughouttheworld.Moreover,thecostsavingtrendistowardsamaintenanceprogramme

that targets the root causes of machine wear and failure. Thus, proactive maintenancemethods have been able to save quite sizable amount on machine maintenance every year in various industriesand constructionorganizations. Intact, in manycompanies, it oftenexceeds annual net profit.

Thus, equipment maintenance is not simply either preventive maintenance or lubrication which is an important aspect or function of maintenance. Also, itis not a hastyrush to repairabrokenmachinepart orreplacea faltering bearing, althoughtheseareessentialmaintenance activities. Rather equipment maintenance is a science, an exercise in economics and an art as 11/15 philosophy. Broadly maintenance encompasses all these aspects and too many wholly as are of its components.

maintenanceplanEquipments

The maintenance plan necessarily embodies the quality of maintenance work. An aspect of maintenance activity is the difficulty in accessing the quality of work ip executedmaintenance work may lead to a breakdown. Because of the intervening becomes very difficult to judge wheather the breakdown was attributable to errors or defective parts. In other words, the quality of maintenance must ensure work itself. In order to accomplish this, each individualmember ofthe maintenance possess a sense ofresponsibilityand consider the methods for preparing, executing ading his or her own work. From efficiency point of view, the works planned in advance can be accomplished compared to the work done in case of abrupt failure. With a view to raise the ading his or her efficiency point of view, the works planned inadvance canbeaccomplished comparedtotheworkdone incaseofabrupt failure. With a view to raise the tenance, quality and efficiency, it is imperative to create a maintenance plan and cpus preparation before it execution. The work ethics of the maintenance staff mat curbing the breakdown. However, the following are the benefits of adoptingplan.

The number of operational steps can be repeatedly utilized. Advance planning of human resources can be made for availability of required personnel.

Prevention of errors in procurement of materials, spare parts and sub contractingwork is possible.

Facilitateschekingofqualityandprocurement ofbetter material.

Schedules can be set so that work detail plans are coordinated with production plans. Repair cycles can be identified to take measures in a timely fashion Standardization pattern ofrepair work can be adopted enabling the work to be done efficiently Makes possible simultaneous devising of repair plans.

- Peoplessenseofresponsibilityareencouraged.
- Largevolumeofwork canbehandledmore efficiently.
- Precautionarymeasures formaintenance
- Beforecarryingoutmaintenance

- Failurenotificationshouldbegiventoappropriateauthorityhavingthorough knowledge of the equipment.

Equipmentsmaintenanceplan

The maintenance plan necessarily embodies the quality of maintenance work. An important aspect of maintenance activity is the difficulty in accessing the quality of work de. A poorly executed maintenance work may lead to a breakdown. Because ofthe intervening time lag, it becomes very difficult to judge wheather the breakdown was attributable to maintenance errors or defective parts. In other words, the quality of maintenance mustensure the qualityof work itself. In order to accomplish this, each individual member of the maintenance crew must possess a sense ofresponsibilityand consider the methods for preparing, executing and validating his or her own work.

From efficiency point of view, the works planned in advance can be accomplished more quicklycompared to the workdone incase ofabrupt failure. Witha view to raise the levelof maintenance, quality and efficiency, it is imperative to create a maintenance plan and make tenacious preparation before it execution. The work ethics of the maintenance staff should aim at curbing the breakdown. However, the following are the benefits of adopting maintenance plan.

(i) Thenumberofoperationalstepscan berepeatedlyutilized.

(ii) Advanceplanning ofhumanresourcescanbemadeforavailabilityofrequiredpersonnel.

(iii) Prevention oferrors in procurement of materials, spare parts and sub contracting work is possible.

(iv) Facilitateschecking ofqualityandprocurement ofbettermaterial.

(v) Schedulescanbesetsothatworkdetailplansarecoordinatedwithproductionplans.

(vi) Repaircyclescanbeidentifiedtotakemeasuresinatimelyfashion.

(vii) Standardizationpatternofrepairworkcanbeadoptedenablingtheworktobedone efficiently.

(viii) Makespossiblesimultaneousdevisingofrepair plans.

(ix) Peoplessenseofresponsibilityareencouraged.

(x) Largevolumeofwork canbehandledmoreefficiently.

Precautionarymeasuresformaintenance

(A) **Beforecarrying outmaintenance**

(i) Failure notification should be given to appropriate authority having thorough knowledge of the equipment.

(ii) Warning tags indicating not to operate must be tied to the equipment to avoid inadvertent use.

(iii) Itmustbecleanedbeforeinspectionandmaintenance.

(iv) Theworkplacemustbekeptcleanandtidy.

(v) Caremustbetakentostoptheenginebeforecarryingoutinspectionandmaintenance.

(vi) Establishmentoffivefightingarrangementandpreventionofsmokingmustbeensured.

(vii) Presence of proper rigging tools and repair tools are to be ascertained before taking upmaintenance work.

(B) **Duringmaintenance**

(i) Onlyauthorized personsshouldcarryoutthemaintenance ofequipments.

(ii) Attachments are to be stored in safe custody andaccess of unauthorized persons are to be restricted.

(iii) Theequipmentmustbeplacedonthefirmlevelgroundwhileworkingunderthemachine.

(iv) When maintenance work is to be carried out with engine in running condition, operator must be seated to stop the machine in case of emergency.

(v) Caremustbetakentoseethatnotoolsareleftasitisinsidethemachinebymistake.

(vi) Itistobeensuredthatthemachinesareprovidedwithpersonalprotectiveequipments.

(vii) Repairshouldbeunder takenimmediatelyassoonasabnormalityis reported.

(viii) Highlevelofalertness must be maintainedwhile handling fuelhighpressure hoses, high pressure oils and working at high temperature.

<u>Generalguidelinesformaintenance</u>Do's

(i) Keeptheequipmentcleananddry.

(ii) Befamiliarwith operation andmaintenancemanual of theequipmentandbethorough with manufacturer's instruction.

(iii) Payparticularattentionto

(iv) Keep allthenutsand boltstight.

(v) Useonlygenuinespares.

(vi) Checkthelevelofengineoilandradiatorwaterregularly/dailybeforestartingthe equipment.

(vii) Attendperiodicpreventivemaintenance.

(viii) Takestepstokeep allmeterandsafetydevicesfunctional.

Donot's

(i) Avoidoverloadingtheengineand equipment.

(ii) Don'trunthe engineincase black smokeiscoming outofthe exhaust.

(iii) Whilecleaningengine partsavoidusingcottonwaste.

(iv) Don'tmixdifferentbrandsofoils.

(v) Avoidstoringfuel,oilingalvanizedcontainers.

(vi) Don'tobserve economyonlyinthe costofmaintenance.

CHAPTER-8(QUALITYCONTROL)

INTRODUCTION: Quality control in its simplest term, is ensuring quality aspect during manufacturing or production process. The aim of quality control is to ensure construction or production of items for their intended use without defects and variations from prescribed standards within allowable tolerance limits.

In the current concept of quality control, the meaning of quality is closely associated withcost and customer needs or performance standards. So, quality may simply be defined as fitness of purpose at lowest cost and highest performance level.

After all, the quality of a product depends upon the application of materials, men, machine and manufacturing conditions.

Thus, quality control may be broadly defined as a industrial management technique by of which a product of uniform acceptable quality are manufactured.

CONCEPT OFQUALITYINCONSTRUCTION:

Thebasic elementsofqualityin constructionare asfollows:

(1) Qualitycharacteristics–

Thepropertiesthatdefinethenatureofaproductforqualitycontrolviz.strength,colour, Amensionandtemperatureetc.arecalledqualitycharacteristic.Eg-Cementconcretewhich 82verycommonconstructionmaterialnow-a-days,thecompressivestrength,sizeof aggregate, sater-cement ratio, slump, surface finish etc.

(2) Designquality–

It is afact thatno design can produce absolutely perfectresults,whatsoevergood design it may be. Thus, the desired standards for characteristics such as strength, dimension etc.

(3) Qualityofconformance–

The degree of quality of work found in actual construction work is known as quality of conformance. As in the case of design quality, the degree to which the quality is to be enforced in the field has to be considered along with the cost necessary for qualitycontrol.

- Factorsaffecting thequalityofconformance:

Thequalityofconformanceisaffectedbythefollowingfactors:

1. Construction methodinthefield:

The quality of materials used, skill of the workers and efficiency of machinery and equipments affect the quality of conformance.

2. Fieldsupervisionlevel :

The managerial control exercised in directing the workers to conform to the plans and specifications and the level of supervision enforced affects the quality of conformance.

3. Inspectionandqualitycontrolprocedure:

The inspectionand the qualitycontrolprocedure adopted also greatly influence the qualityof conformance.

Quality Standards- during construction, after Construction, destructive &non destructiveMethods :-

Inconstructionwork,thefollowingactivities/worksneedeffectivequalitycontrol.

1. Concreteworks

Concrete is a very important construction material possessing high compressive strength, whose quality is influenced to a great extent by its constituent materials, water-cement ratio, sizeofaggregateandtheirgrading,rateofloadingandcuringconditionsetc.Thesupervisor

should be well versed with the properties of concrete. So, to obtain a good quality concrete, the engineer-in-charge is required to be present throughout the operation of mixing, placing, compacting and finishing etc.

2. Steelworks

Steel is a costly item and constitutes a majoritem of expenditurein most of the civil works. In RCC structures, it is used as reinforcement to take up tensile stress. Hence its tensile strength, proper binding, binding and placing etc. should be checked carefullywhile using it. The reinforcing bars should be free fromrust, scales, oil, grease and other harmfulcoatings.

3. Formwork

Theshapeand finishedsurfaceofconcretedependsuponthe formwork.Theformworkmust have smoothsurface sothatthe finishedconcretemayrequire minimumamount ofrendering. When the finished surface is not required to be plastered.

4. Masonrywork

The bricks/stones to be used in masonry work should be of specified quality and grade, having requisite strength and water absorption capacity within permissible limits. The dimensions and verticality of masonry works are very important and care should be taken to maintain it.

5. Water proofing

Provision of damp proof coarses at plinth level and water proofing of roof and expansion joints etc. Hence proper care should be taken to have them properly installed.

6. JoineryandTimber work

For wood work, timber of specified quality should be used. The workmanship of wood work should be properlychecked and maintained asperspecifications. These are important aspects from the quality control point of view.

7. Servicesworks

Watersupply, electric fittings, sanitaryairconditioningetc.areclassifiedunderthiscategory. Therefore, these works need special attention of quality control.

QUALITYCONTROLMETHODS(DESTRUCTIVE)

The followingaretheimportantqualitycontrolmethods

1. Inspection

Inspection is the function to judge the quality of a product. To be more precise, it is the process of measuring the quality of a product or service in terms of established standards. Any defect noticed must be got notified before proceeding to the next stage ofconstruction.

2. Testing

Testing is the examination of the material or product to check its conformance to thespecified standards. The testing may be either destructive or non-destructive and can be performed at site or in the laboratory.

3. Sampling

The process ofdetermining the qualityofa large group byexamining a part ofthe group that willbe statisticallyrepresentative tothe whole group is called sampling. The reliabilityofthe test results of the sample is determined by the reliability number. The reliability of the information obtained increases with the size of the sample used.

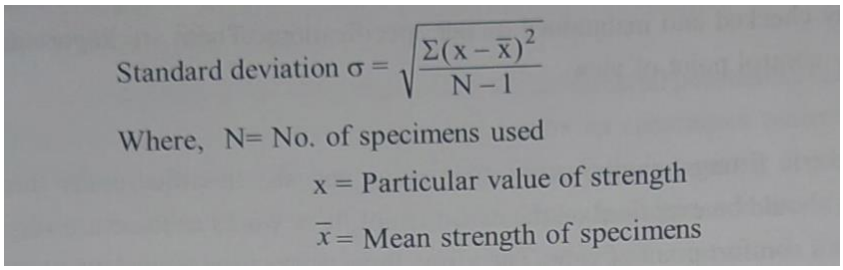
(a) ReliabilityNumber-Thereliabilitynumberistakenasthereliabilityofthetest results of the sample. It is expressed as

ReliabilitynumberR=100–[(No.ofdefectiveunits)/(no.Ofunitstested)×100]

(b) Deviation

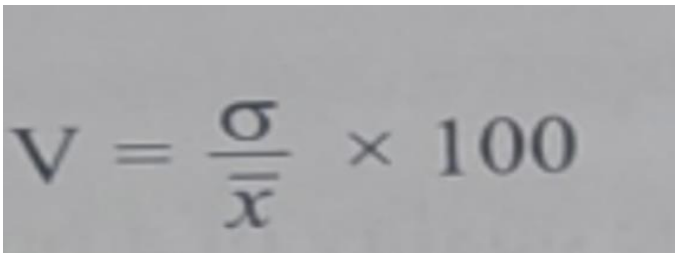
It is the root mean square of the deviation of all the results and is calculated as follows: Standard deviation σ =

(C) Coefficientofvariation



This is an alternative method of expressing variation of results and is a non-dimensional measure ofvariation. It is obtained bydividing the standard deviationbythe arithmetic mean value.

Co-efficientofvariation=



However, in India, the standard deviation is taken as the most reliable method of quality control. Standard deviation is an absolute measure of dispersion,where as the coefficient of variation is a relative measure of dispersion.

NON-DESTRUCTIVEMETHODSOFQUALITYCONTROL:

The quality control tests or exercises conducted on a structure without causing slightest damage to whole or part of it are known as non-destructive methods. As per ISO-13822, the existing structuremaybe assessed for load bearing capacityand other structuralproperties by non- destructive testing and continuous monitoring process. The various stages oftesting and monitoring are as under:

1. Loadtesting

It is done to test the structure or part thereof by external loading to evaluate its behavior or properties or to certain its load bearing capacity.

2. Inspection

On site non-destructive examination may be done to establish the present conditions of The structures.

3. Monitoring

It is an act of acquiring, processing and communicating information about a structure under operational conditions over a period of time with a high level of automation. Monitoring of structures is done continuously or frequently for observing or measurement of structural conditions.

Of course, non-destructive methods have been in use for about four decades and during this period, considerable development has taken place to such an extent that it has become a powerfulmethod for evaluatingexisting structureswithregardtotheir strengthanddurability apart from assessment and control of quality. In certain cases, the investigation of crack depth, existence of micro cracks and progressive deterioration are also studied by thismethod. For example, taking concrete as the material under consideration, some such properties are hardness, resistance to penetration, rebound number, resonant frequency and ability to allow ultrasonic pulse velocity to propagate through it. Further, certain electrical properties of concrete,

(I)Surfacehardnesstest-

These are of indentation type, include the William's testing pistol and impact hammers andare

used only forestimationofconcrete strength.

(ii) test-

The rebound hammer test measures the elastic rebound of concrete and is primarily used for the estimation of concrete strength as well as for comparative investigations.

(iii) Penetrationandpullouttests-

These include the use of Simbi hammer, spit pins, the Windsor probe and the pull out test. They measure the penetration and pull out resistance of concrete and are primarily used for strength estimations. However, they can also be used for comparative studies.

(iv) Dynamicorvibrationtests-

These include resonant frequency and mechanical sonic and ultrasonic pulse velocity methods. These are mainly used to evaluate the durability and uniformity of concrete including estimation of strength and elastic properties.

(v) Combinedmethods-

The combined methods involving ultrasonic pulse velocity and rebound hammer may be effectively used to estimate the strength of concrete.

(vi) Radioactiveandnuclear methods-

These include the X-Ray and Gamma-Ray penetration tests for measurement of density and thickness of concrete. Also the neutron scattering and neutron activation method are useFor moisture and cement content determination.

(vii) Magneticandelectrical methods-

The magnetic methods are primarily concerned with determining the cover thickness of reinforcement in concrete, where as the electrical methods, including, the micro wake absorption technique, have been used to measure moisture content and thickness ofconcrete.

(viii) Acousticemissiontechnique-

Thesetechniquesaremostlyused tostudytheinitiationand growthofcracksinconcrete.

Chapter-10

SAFETYMANAGEMENTINCONSTRUCTIONWORK

IMPORTANCEOFSAFETY:-

Thus social concern and efforts are being made to adopt safety measures by creating safety conciousness among the wokers. Forma surveyofoccupationalinjuryand illness accident, it is found that upto 14.5% workers suffer from these injuries. So sufficent care & though preventive measures should be taken for it, so that, accidents of any sort during the constructionperiod canbe avoided to some extent.Accident preventionshould be considered isanessentialactivityinallconstructionsites.Inindia, constructionindustrycoversthe largest labour force after agriculture. With the advance of construction industry, the number accidents also is increasing and accident happens all of a sudden enexpectedly.

From economic reasons, the injured worker faces difficulty owing to medical expenses For the injury. It also causes the slow down in progress of work and decrease in productivity. Loss of confidence, and loss of administrative work due to accident.

CAUSESANDEFFECTSOFACCIDENT-

Therearemanycausesofaccidentinconstructionindustry.Theseareclassifiedbroadly.

1. Physical

Physiological

Psychological

PHYSICALCAUSE:

The following factors may be grouped under physical cause. 1.Causes relating to machines:

(I)Duetoobstructionfreemovementofman&machineisnotpossible&theremaybe inadequate working space for the machines.

(ii) toimproperplacingoradjustingofmachines.

(iii) Accidentmaybecausedduetounsuitablemachinesbeingusedforthejob.

(iv) Accident maybecausedduetoimproperlyguarded machines

(v) Accidentmaybecausedduetoimproperlyinsulatedelectricmotoronthe machine.

2. **CausesRelating totools&equipments**

1) Accidentmaybecausedduetoconstantuseoftools,whichhasbeenbluntandwornout.

2) Toolsusedforthejobis beingtoosmall.

3) Sometimesduetobrittlenatureoftools,itbreakssuddenly,accidentmaybecaused.

4) Thetools having handletoo shortor loose5. Useofunsuitabletools for theworkmay be a cause for accident.

3. Causesrelatingtomaterials

1) Accidentmay be caused due to careless handling of explosives,petrolium products&Brittle materials.

2) Atthetimeofuseofroadmaterials,thereshouldbecarefulhandlingoftoohot materials like tar or bitumen.

3) Accident may be caused due to use ofmaterials being poisonous &dangerous as acid and some salts.

4) Duetonotadoptingproperprecautionswhilehandlingmaterialsemittingfoul gases.Eg sewage in the maintenance of sewers.

4. **Causesrelatingto uniform**

1) uniformshouldnotbeloose.

2) The slipperyand loose shoes may be used during the work time. 3)While working on welding job, no protective devices are being used. 4)Sleeves ofthe shirt being out ofbottons.

5. CausesRelatingtoEnvironment

1) Poorlightingarrangementattheworking site.
2) Poorventilation&unhygienicconditinsattheworkingplace.
3) Looseelectriccables &liveconductorscarelessly.
4) Obstaclesintheworking area.
5) Floorsbeingslippery.
6) Useofunstable&unsafeladder.

SAFETYMEASURESATWORKSITES

Prevention of accidents is the prime concern at any construction site both from human lifeand financial considerations. Irrespective of the natureof construction projects, accidents are likely to take place resulting in physical injury, loss of property or even casualties.

(a) Excavation
(b) scaffolding
(C)Formwork(d)Fabrication(e)Errection(f)Demolition

Safetymeasuresofexcavation:

ThefollowingsafetymeasuresarerequiredtobeadoptedatExcavationsites.

(i) The excavation work should be carried out under the supervision of experienced and competent supervisor having responsibility for enforcement ofsafetyrules and prevention of the use of defective and unsafe appliances.

(ii) It is essential to have a complete knowledge of under ground structures (such as sewers,Pipe lines, electrical conduits, gas mains etc) before commencement of the excavationWork and proper precautions should be takento ensure safetyofworkmenas well as Public.

(iii) The workers should be advised to make use of safety appliances whenever required and safety helmet must be invariably used by the workers where hazards from falling stores, timber and other materials exist.

Safetymeasuresforscaffolding:

The necessity of scaffolding/staging arises for all types of construction works carried out above ground levelviz brick or stone masonryinsuper structurepainting, repair mentainance of structures etc.

(I) ensure safety and stability, every scaffold should be securely supported or suspended and properly strutted or braced. Thus, all scaffolds and working platforms should be securely fastened to the building or structure. They should be braced or guyed properbly. If independent of a building.

(ii) The vertical standards of scaffolds should be embedded into the ground sufficiently deep so that these are capable of withstanding loads. On pucca floors or on black topped pavaments/streets, the standards could be supported in empty tar drums and packed with sand/stone bricks etc.

(iii) member of scaffolds should be free from defects and particularly the wooden Members should be free from dry rot & wet rot etc. The members should be thoroughly Tested for their strength and inspected before these are put to use for the second time or For any subsequent use.

(iv) Also the sizes of different members are properly designed for the loads that are intended to be carried. Lacings should be done securely for connecting the ledgers to standards and putlogs to ledgers. The rope used for tieing should be stout and thick.

Safetymeasuresforformwork:

(i) The material of the formwork should be carefully selected as per relevant Indian standard. The members should be properly designed for adequate strength and the sectionsare generallyworked out in consideration of the loads that are likely to be Taken up.

(ii) The formwork should be sufficiently strong and stiff to resist bending anddeformation deflection after concrete is placed. Also, it should be capable of taking up all dead Load, live load and the impact to which it may be subjected to.

(iii) Partially seasoned timber should be used for formwork to minimize the effect of shrinkage,warping, bendingorbulging under loadswhenever,greentimber istobeused,due allowance for bulging and shrinkage should be made while preparing the Surface.

Safetyinfabricationanderection:

Thefollowingsafetymeasuresareadoptedduringfabricationanderectionworks.

(I) Periodical checking of all equipments required for fabrication such as gas cutter and welding sets, power hacksaws, drills, grinders etc. should be done to ensure their safe working.

(II) All workers engaged in gas cutting or welding operations should wear safety gloves And aprons and use proper welding.

(III) Moving parts of machineries or equipments should be invariablyprovided withsafety guards.

(IV) Powercablesofallequipments/machineriesshould be properly insulted and protected from damage and cuts against any mishap.

Safetymeasuresfordemolition :

The following are the various safety measures to be adopted at the time of any demolition work.

(I)Before the start of demolition process, the manner in which various parts of the structure are supported and the extent of demolition effect on the adjoining structures should be thoroughly studied.

(ii) Asitespecificsystematicplanforthestepbystepdemolitionworkshouldbeprepared And strictly followed under the guidance of experienced foreman.

(iii) Thedemolitionworkshouldnotbetakenupatnightorduringstormyweatheror heavy rains especially when the structure to be demolished is situated in an inhabited area.

DEVELOPMETOFSAFETYCONSCIOUSNESS:

Safety programme on each construction project is highly important so as to reduce the total number of accidents. So safety consciousness should be developed in the construction work. Also safety programme should be made an integral part of each construction company.Someimprotant aspectsofsafetyprogramme ofconstructionprojectsare asfollows.

(I)A sefety committee should be set up to guide the operation of safety programme. Both worker and management should paticipate in it to give their opinion on safety measures.

(ii) The employees should secure full support ofthe top management, because the employers are not to be expected to maintain an intrest in the safety programme.

(iv) Beforestartingconstructiononaproject,thesafetydirectorshouldanalysewith foreman and superintendent about the safety programme.

SafetyEquipments:

The workers while performing their duties, particularly while proforming difficult or hazardousor dangerousoperations, there aresome safetyaccessorieswhichthe workersmust use. By using these accessories the accident hazards can be reduced to a great extent.

Theseaccessoryitemsaresuch as:

1. Safetyshoes.
2. Goggles
3. Apron
4. Handgloves
5. Helmets
6. Dresses
7. Gunboot
8. Safetybelts.
9. Portablelight &lantern
10. Fireextinguisheretc.

SAFETYLEGISLATION:

Therearesomelawsorlegislationsinconnectionwithsafety&wellbeingoftheworkers.

Among

themtheWorkman'sCompensationAct&ContractLabourActare important.

Workman'sCompensationAct:

InIndiatheworkmencompensationact waspassedforthefirst time in1923.But it came into force in 1924, and it was amended in 1958, 1976. This act regulates the payment of compensation to a worker who had injured in the course of employment. But before this act the payment of compensation to the injured worker was a lengthy & costly process. In case any accident occurring at the site of work, this act provides the payment of compensation to the workers.

OBJECTIVES:

The mainobjective ofthis act is to payment ofcompensationto the workers who had injured in the couse of employment. Another aim of this act is protect the worker & his family from hardly caused by the accident. Also by result of accident, the worker losses his earning capacity.Thisact forcestheworkertoworkcarefullywhiledangeroussituationsandalsothis act forces the employer to take all the safety measures which are to be provided to the workers.

Contract LabourAct:-

AimofthisAct

In order to provide all the facilities and to protect the contract labourers fromthe contractors engaged in the government and private works, the Government of India passed contract labour act.Asthisact wasenacted in1970,thereforeit isalso knownas1970 contract labour act.

10.5.2.3 Contractlabourers:

As the know that in India construction industry is the second largest industry. Construction industry plays on important role not only in the development of infrastructure of our country but also it affects our economy. About five crores of labourers are employed under the construction industry. Most of the labourers employed in construction industryare unskilled. They are employed on daily wage basis.They are for carrying the constructional activities. The contractor who engages the labourers for construction ofthe government and the private works, decide the wages and other facilities to the labourers: When the construction work is over, then they are terminated. In order to seek employment, they are to shift to new construction sites. Thus, these labourers move fromone site to another. Theyare paid wages and have to also work for long hours