ARBAMINCH UNIVERSITY
INSTITUTE OF TECHNOLOGY

Faculty Of Water Supply & Environmental Engineering

Contract, Specification and Quantity survey (WSEE-5252)

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Course outline

Objective:

* To provide students with basic knowledge on how to administer contract, prepare tender documents and carry out measurement of work.

Outcomes:

* After completion of this course students will be equipped with
  * Prepare tender documents ,
  * Prepare take-off sheets
  * Settle claims

Course contents

* Principles of contract law as applied to civil engineering;
* Types of construction contracts;
* Contents of construction and consultancy contract documents;
* Specification writing; subject matter of civil engineering specifications;
* National codes of standards and practices;
* Quantity surveying; areas; volumes and material taking-off;
* Preparation and writing of bill of quantities;
* Cost estimates

Lecture -1

Procurement and Contract

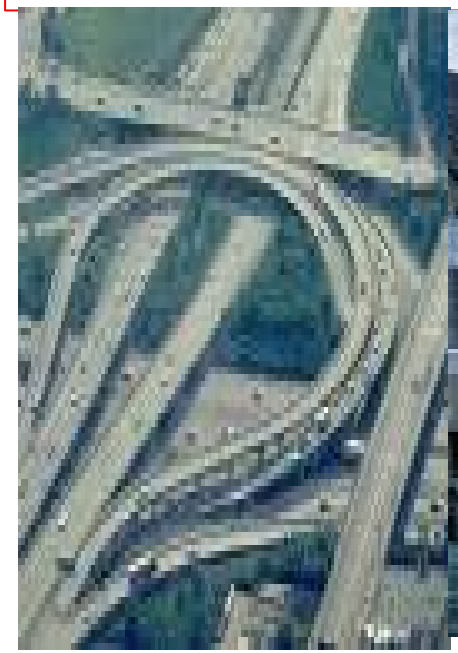
1.1 Introduction

- Construction is an important industry by which societies create most of new values.

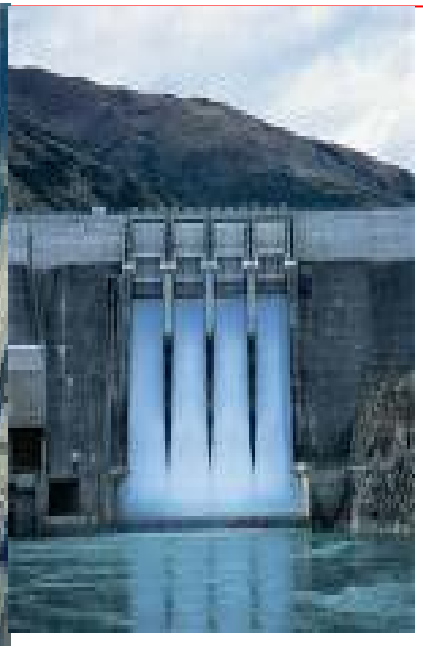
- Most of mankind's economic, social, political, environmental, public reforms and day-to-day activities are dependent on the infrastructure delivered by the Construction industry.

Cont'd…

The construction categories are



Transportation Infrastructure



Energy supply

Urban development

Water supply

Cont….

- Construction industry is the leading industry in producing employment.
- **It contributes to the overall national development of the country.**
- **It is the back bone for the development of developing countries like Ethiopia.**
- **It consumes much of the national budget. (railway)**

Major problems of Construction industry in Ethiopia

- cost over run
- Delay of projects
- Serious disputes and claims in projects
- Dissatisfaction of clients
- Terminations of projects
- Inefficient resources management

Cont'd…

- ✓ Incompetence of local contractors
- ✓ Inefficient contract administration
- ✓ High demand of infrastructures
  - -roads, bridges
  - -buildings
  - -dams

Participants in Construction Industry

- **The Client (Owner)**
  - person or organization who wants to build a structure.
  - Person or organization who pays the total cost of the project.
- **The Consultant**
  - Person or organization who designs the project based on the need and interest of the owner.
  - Person or organization who supervises the project.
- **The Contractor**
  - Person or organization who construct the project based on the designed drawing and contract document.

Cont'd…

- **Insurance Companies**
  - organizations who give guaranty for the damage's occurred on the project.
- **Banks**
  - organizations who give loans for the project.
- **Suppliers**
  - Person or organizations who supply the materials which is needed for the project. (cement, Asphalt bitumen, Reinforcement , equipment, Fuel and etc)
- **Public**
  - Peoples who has a direct involvement for the project

1.2 Stages in Construction

a. Pre design stage

- Selection of suitable site,
- Making topography of the site and preliminary soil investigations.
- Project appraisal and selection of designer.
- Selection of Consulting Firm
- Preparation of tentative cost estimate,
- Budget Request
- Bidding Documents preparation for Services

Cont'd…

b. design stage

- preparation of conceptual (sketch) design
- preparation of preliminary design
- preparation of final design
- project checking stages
- preparation of bid document
- preparations of detailed cost estimates

Cont'd…

C. Processing Construction Tenders Stage

- Methods of Procurement of Works
- Bid Documents and Related Issues
- Bid Processing and Award of Contract

Cont'd…

E. Construction Stage

- Pre-mobilization Stage
- post mobilization Stage
- Site Control
- Monthly and Quarterly Progress Evaluation Meetings

Cont'd…

F. Completion and Hand Over Stage

- Provisional Acceptance
- Final Acceptance

1.3 Introduction To Procurement

- It is the **purchasing**, **hiring** or **obtaining** by any other contractual means of goods, works and services.
- Is a process used to select the lowest competitive and qualified bidder
  - for acquiring service or
  - works
  - goods from potential competitors based on reasonable relevant criteria.
- *Finally, it* covers all activities that involve buying, contacting, purchasing, sourcing or tendering.

Cont'd..

1. It is the process by which we acquire
   - Goods
     - Computers, Vehicles, Books, Equipment etc.
   - Works
     - Buildings, Bridges, Roads etc.
   - Consultant Services
     - Design, Feasibility Study, Assessment, Review, Advisory Service
   - Non Consultant Service
     - Insurance, Transport, Repair work etc.

Cont'd…

- Construction Industry involves procurement and contract management systems.
- It is needed to have fair **competition** and **distributions** of obligations and rights among stakeholders.
- Computation is needed for
  - The Project Owner
  - The Project Financiers' & Regulators
  - The Project Providers

Cont'd…

- An effective and efficient procurement method ensures the following rights called the **"Five Rights".**
  - **The Right Quality,**
  - **The Right Quantity,**
  - **The Right Cost / Price /,**
  - **The Right Counterpart and**
  - **The Right Time.**

Cont'd…

The Right Quality

- it meant procuring of **qualified goods, works or services as per the requirement**; thus ensure the procurement is of the right quality.
- Right quality is always based on
  - technical expectation and
  - economical consideration.

The Right Quantity

- mistakes made either by increasing or decreasing the quantity provision will have an effect on project cost and site organization.

The Right Cost (price)

* tendering together with negotiation and market intelligence technique are the only way to approach the right cost.

The Right Counterpart

* procurement help to select right counter part by guarantying that the parties agreed to accomplish the task shall fit to the job.

The Right Time

* the provision of resources and accomplishments of obligation of each party shall be set and agreed, thus to avoid extra cost to be incurred.

1.3.1 Types of Procurement

- It can be classified based on the things to be procured and the way how they are procured.
- It depends on the Things to be Procured this are Goods, Services, or Works

1, Procurement of Goods

- Physical resources like Materials and Equipment's are made available using Procurement of Goods.
- **Raw materials, products, components, etc…**

2, Procurement of Services

- In CI they are procurements of consulting and non consulting services.
- **Consulting; it needs Professional skills required to carry out projects including *Design, Feasibility Study, Advisory Service etc…***
- **Non Consulting; Services that are not related to professional skills like *Transportation, Insurance, Repair work, Printing and duplicating books etc…***

3, Procurement of Works

- In the Construction Industry, procurement of works mean that
  - procurement of contractors to carry out the actual physical infrastructures.
  - ***Building, Transport and Water projects*** **and** ***related Infrastructures*** **which normally require construction at a specified site over a period of time**

Cont'd…

Participants/Actors:

A participant is one who takes a part or share in something.

Participants to a contract

There are only two parties to a contract.

For construction/works

- The client/Employer: who requires the project
- The contractor: who will carry out the work

For services

- The client/employer: who require the service
- The consultant: who will carry out the service

For goods

- Purchaser: who requires the goods
- Supplier: who will supply the goods

1.4 Procurement and contract management

- Involves three major processes.
- Contract Planning
  - Procurement and Contract Delivery system
- Procurement Management
  - Procurement preparation
  - Tendering
  - Tender evaluation and letter of acceptance
- Contract Management
  - Contract formulation
  - Contract administration
  - contract closing.

1.5 Procurement and Contract Delivery Systems

- Is the way project owners, regulators and financers determine the assignment of responsibilities.
- Procurement and Contract Delivery system is the way Project Owners together with Project Regulators and Financiers determine the assignment of responsibilities to Project Stakeholders along the Construction Process.
- There are different types of delivery systems

Cont'd…

- Generally, there are six types of Procurement and Contract Delivery systems. These are:

  1) Force Account,

  2)Design Bid Build (DBB),

  3)Design Build (DB) or Turnkey,

  4)Finance / Build Operate System (BOT),

  5)Construction/Facility Management Consultancy, &

  6)Alliances and Outsourcing.

1 Force Account

- When the Project Owners engage themselves to undertake the project
- Promoted if the Project Owners believe that there is a comparative advantage in Cost, Time and Quality issues.

- Eg. ERA rural road projects.(when projects are small and places are remote)

Cont'd…

- Used when
  - It provides a comparative advantage in cost, time and quality issues.
  - When there is a lack of capacity from the private sector to undertake very large and technologically new projects.
  - When projects are unattractive to bidders.

2. Design Bid Build (DBB)

- it is the most practiced type of delivery system in Ethiopia.
- The participants in this system are, client, consultant and contractor.
- Client- who coordinate different packages
- Consultant- who designs the project some times (supervise).
- Contractor- who construct the project.

Cont'd…

- Consultant will carry out the design together with the necessary tender documents which will be the bases for tendering to select contractors.
- Contractors are responsible to construct works with due care and diligence and complete them in accordance with the contract, but they are not held responsible for design deficiencies.

3. Design Build (DB) / Turnkey

- It is a response to the problems occurred on the above two types of delivery systems.
- The complete design and building of the project is carried out by a single contractor.
- Reduces fragmentations, adversarial relations and project owners risk.

Cont'd…

* Reduces numbers of procurement processes engaged in the fragmented process and employ only one procurement process and a single contractor to provide the entire Construction Implementation Process (Design and Construction Implementations).
* Typical advantages of this system include:
  - reducing fragmentation and adversarial relations between designers and constructors;

Cont'd…

- minimizing Project owners' risk transferable due to Designers' faults;
- accountability and entire responsibility for both design and construction which entitle the employer to receive completed project is onto a single contractor;

4 Finance / Build Operate Transfer (BOT)

- Build - Operate - Transfer is a form of procurement and contract delivery system that promotes Public Private Partnership (PPP) in which a private company is contracted to finance, design, construct, operate for a certain period (usually 10 years) and transfer.

1.6 Procurement Management

- The management of procurement includes the following phases
- **1.6.1 procurement preparation phase**
- First the procurement team will be established.
- In this team a minimum of five members shall be established.
- Necessary experts shall be included

Cont….

- Then the tender documents will be prepared.
- Tender documents are prepared to
  - Instruct bidders on the procedures for the preparation and submission of bids.
  - Inform prospective bidders about the nature of things to be procured
  - Inform bidders about the criteria for the evaluation and selection of a successful bidder.
  - Lay down the contract conditions, delivery system, procurement methods and contract types of the project.

Tender documents includes

- Form of invitation to tender or request for proposals.
- Instruction to tenderers
- Pre qualification documents if necessary.
- Form of tender
- Forms of contract agreement
- General and particular condition of contract.
- Bill of quantities and drawings
- Technical specification and method of measurement
- Other forms formats and schedules.

1.6.2 Tendering phase

- It includes the following
  - Invitation
  - Clarification
  - Submission and
  - Opening of tenders

Invitation

- It includes the following
  - The owner and his works.
  - Eligibility requirements.
  - Place to get further information.
  - Where to purchase and submit documents.
  - How long the tender will be floated.
  - How should the tender offer be packed.
  - When and where submission and opening of tender will take place.

Clarification

- Can either be requested by interested bidder or carried out using a pre tender clarification meeting.
- Issues clarified will be sent to all bidders participating for the intended services or works.
- The bidders shall submit their offer on or before the submission date and time including the issues clarified.
- Late bidders are automatically rejected.

Tender opening

- Bids shall be opened in public at a date and time mentioned in the invitation to bidders.
- In Ethiopia when the tender is opened two representatives should be there.
  - The project owner, consultant (if available)
  - Contractors who wish to attend by them selves or by their representatives shall attend during the tender opening ceremony

Cont.....

- The following procedures will be carried out during the tender opening
  - Tender attend members shall take their place and be registered.
  - Tender box opened and check for faulty things
  - Check the tender is the right one
  - Bids will be opened one after the other
  - All necessary data which is useful such as project name, name of bidder, bid bond amount, tender price etc.. will be read loudly for the tender attend members.
  - Bidders representative should sign a register to attest their presence during opening.
  - Tender committee members shall sign on the tender.

Tender evaluation phase

- It means to determine the winner based on
  - Technical qualification
  - Completion time
  - Commercial terms to the offer.
- Least bidder may not necessarily be the winner
- Based on the above three criteria's the following evaluations has been taken place.
  - **Preliminary evaluation.**
  - **Detailed Evaluation.**
  - **Award of Contract**
  - **Signing of Contracts**

A, Preliminary evaluations

- **The committee will examine the quotations to determine whether the quotations are complete.**

- **Eligibility**-the considerations in this requirements are
  - Valid and up to date trade and professional license
  - Valid and up-to-date membership to financier organizations.
  - Valid provisions of bid security or bond.
  - Completeness and submittals of all required documents.

cont….

- **Arithmetic**
  - Most tenders are often submitted hastily and it is common to have arithmetic error
  - Evaluation without arithmetic check will ultimately result in disputes therefor it is a formal evaluation process
- Errors should be corrected by the Engineer as follows
  - If there is error between amounts in figures and in words, the amount in words will govern; and
  - If there is error between the unit rate and the total amount derived from the multiplication of the unit rate and the quantity, **the unit rate as quoted will govern**

B, Detail evaluations

- Includes technical, commercial and financial qualification requirements.
- Critical evaluation of technical and financial offers will be carried out.
- Finally the financial offer will be updated using absolute results from commercial comparisons.

Cont'd…

- **Technical requirements-** it is carried out according to the pre qualification criteria.
- **Commercial evaluations-** includes
  - Benefit forgone due to completion time.
  - Additional costs due to
    - Foreign currency exchanges
    - Advance payment requirements
  - Provisions of domestic or regional preference margins.
    - Is to give preference to local companies even if their bid offer is not over by 7%-10% for construction works.

C, Award of contract

- When the Engineer has completed the evaluation of tenders, he will make a recommendation to the Employer on the award of the Contract.
- If the Employer agrees, a Letter of Acceptance to the successful bidder will be given from the employer.

D, **Signing of Contract**

- after the letter has been written, then the contract will be signed between the contractor and owner.

Thank you!!!

Lecture- 1.2

Construction Contract

Introduction

- A contract is a written or spoken agreement between two or more parties intended to be enforceable by law.
- Construction contracts are defined as, **the written agreements signed by the contracting parties**
- ECC says “a contract of work and labor is a contract whereby one party, the contractor, under takes to produce a given result, **under his own responsibility,** in consideration of a remuneration that the other party, the client, **under takes to pay him”(**Art.2610).

Cont'd…

- Construction contract documents are the essential guidelines for the **participants in construction industry(CI).**
- The documents states all the rights and responsibilities of all parties in construction.
- An agreement will be signed if they accept the document.
- ***The document will be prepared by consultancy services or the representatives of the owner.***

2.1 Principles Of Contract Law

- A Contract is
  - Agreement between two parties
    - In CI contractor and client
  - Legally enforceable for both parties
  - Obligations to be distinct from those required by law
- Contract can be between
  - Individuals
  - Businesses/public institutions
  - Businesses/public institutions to individual

Cont'd…

- *The contract between the parties requires **four basic elements.***
- **Mutual agreement**
  - It is offer and acceptance
    - Offers can be made to a person, group or institution.
    - Contract exists only when offer is accepted
- **Legal objective**
    - The thing contracted must be legal.
- **Consideration**
    - Price for promise, Money or some other benefit

Cont'd…

- **Legal capacity**.
  - In CI, parties must have
    - Legal authority to issue and execute contracts
    - Must have proper license to have legal capacity
  - Contract must be legally enforceable.
  - Contracts can be illegal by statute or law
  - Examples of illegal contracts
    - Agreement to commit crimes or civil wrong
    - Agreement which may injure the state
    - Promotion of corruption
    - Agreement limiting a person's ability to carry out trade

Cont'd…

- In construction contract documents, there are contents which should be included.
  - Identity of the parties
    - client,
    - consultant and
    - contractor
  - Promises and responsibilities (awards if the project will complete before the schedule)
  - Scope of work
  - Price and payment terms
  - Commercial terms and conditions
  - Project execution plan

2.2 Types Of Construction Contracts

- There are different types of contracts classified based on.
  - **Nature and Complexity of Works**
  - **Size and Duration of Contract**
  - **Previous Experiences of Employer**
  - **Standard Documents of Funding Agency**
  - Degree of Definition/risk/Uncertainty
  - Status of Design
  - Technical/Supervisory Resources of Employer
  - Budgetary/Financing/Borrowing Constraints

Types Of Construction Contracts

1, LUMP SUM CONTRACT

- **Such a contract might be used for the supply of a particular unit of process plant or material, or for a package deal in which the Contractor is responsible for both**
  - **detailed design and**
  - **construction.**
- This contract is typically used for buildings.
- Difficult to make adjustments.
- When the contractors has more experience the method of contract is suitable.
- Not suitable for unpredictable conditions.

2, unit price or bill of quantity(fixed price)

- Is also called **schedule contract**
- First the amount of work to be executed will be calculated and multiplied by the unit price.
- Used for work where it is not possible to calculate the exact quantity of materials that is required.
- Unit price contract are commonly used for heavy works.
- Items whose actual quantities varies **from 15%-20%** either above or below the estimated quantity are sometimes subjected to renegotiation.

3, lump sum plus scheduled/UP

- Combines the features of the lump sum plus scheduled contracts.
- Additional items are amounted as per the attached item rate.
- In this type of contract, some items may be taken as lump sum from the total jobs conducted.
- The jobs which needs a special consideration will taken as lump sum and the other one will be considered as scheduled.

4, cost plus contract

- Used when it is impossible to **predict their costs during the negotiation, bid and award process**.
- In this contract small projects like residential buildings will be used.
- It has advantagies when the client has an ability to prepare the materials.
- In this method the agreement will be taken as
  - cost plus fixed fee or
  - cost plus percentage

A, Cost plus fixed fee

- Is desirable when the scope and nature of the work can at least be broadly defined.
- The amount of fee is determined as a **lump sum** from a consideration of
  - The scope of the work
  - Its approximate cost
  - Nature of work
  - Estimated time of construction
  - Manpower and equipment availabilities
- The contractor **will not** be tempted to get more revenue.
- The contractor is selected on the basis of merit rather than fee.

B, Cost plus percentage of cost

- Simply the agreement will be based on the total cost of the project.
- The client will agree to pay some percent of the total cost of the project.
- In this case materials and man power are arranged by the client and contractor.
- ***DEMERITS ;***
- The tendency of the contractor **to increase the cost** of work to earn more profit by way of percentage will be the demerit of this method.

2.3 Contract Documents

- Contract documents are the basis on which a construction contract is carried out.
- The documents should explain **in detail of all the requirements of the project in a clear and unambiguous way.**
- The documents also identify all the rights and responsibilities of the main actors of contract.
  - **Employer (client)**
  - **Contractor and**
  - **Engineer (consultant)**

Cont'd…

- Contract documents contains the following which are mutually explanatory.
  - Form of agreement
  - Letter of acceptance
  - Form Tender (bid)and its appendix
  - Conditions of contract
  - Specification
  - Drawings
  - Bill of quantities
  - form of Guarantees (bond)
  - appendix

A, Form of agreement

- The form of agreement is specially prepared form which contains a legal undertaking between
  - the **employer and**
  - **contractor.**
- It is a part of contract document in which
  - The contractor promises to construct the works in accordance with **the contract documents** and
  - The employer covenants to pay the **contractor at the time** and in the manner stipulated by the contract agreement.

B, Form of tender (bid) and its appendix

- The Form of tender is the contractor's (tenderer's) written offer to carry the works in accordance with the contract document.
- It is a document which is summited to the client by the contractor.
- It is a promise by the tenderer to
  - carry the works with a specified tender sum
  - complying fully with the requirement of the contract document.

The Appendix to tender mainly defines the following

- Amount of performance bond which is normally **10% of the tender sum**
- Minimum Amount of **insurance**
- Time for issuing notice to commence
- Time for **completion**
- Limit of **liquidated damage**
- Period of maintenance
  - (defects liability period) normally 12 months.

Cont'd…

- Percentage for adjustment of **provisional sum**
- Percentage of the value of **goods and materials** to be included in payment certificates usually 70 – 80%
- Percentage of **retention**
- Limit of **retention**
- Minimum amount of **interim certificates** usually one half of the engineer's estimated average monthly value.
- Rate of interest upon **unpaid sums**

C, Letter of acceptance

- This is also a part of contract document.
- It is a confirmation of the acceptance by the employer.
- The letter of acceptance contains:
  - Acceptance of Contract price as corrected or modified in accordance with the **Instructions to Bidders.**
  - Instruction **to proceed** with the execution of the works in accordance with the contract document.

D, Conditions of contract

- **General Conditions (standard conditions)**
- are usually prepared to set out procedures of General application which can be used for different types of projects **without any modifications.**
- Construction contracts include a set of conditions which lay down **procedures of general applications.**
- It defines
  - The terms of the contract,
  - the rights and responsibilities of the parties to the contract (employer and contractor)
  - responsibilities and powers of the Engineer.

Cont'd…

- The standard contracts in use in Ethiopia are mostly
- **FIDIC** (for International contracts),
  - **FIDIC** is the international federation of national associations of independent consulting engineers.
  - Founded in 1913 by a natural associations of three countries (France, Belgium and Switzerland)
  - Now they are 74 countries in addition to **(Ethiopian consulting engineers and architects association).**
  - It Has involved into a leading body for the development of model standard forms of contract for use in the international construction industry.

Cont'd…

- **(MOWUD,1994)**
  - It is "Standard Conditions of Contract for Construction of Civil Works Project", of Ministry of Works and Urban Development **(MOWUD,1994),**
  - It is based on the FIDIC document because it is the first for all civil engineering works and the contract type is admeasurement type.
  - In (MOWUD,1994) price escalation was used only for fuel.
  - In (MOWUD,2004) cement, reinforcement and bitumen were added.

Cont'd…

- **National Competitive Bidding by the Ethiopian Roads Authority**

Some of the advantages of standard documents are:

- The parties will be familiar with their terms as result of common (frequent) usage.
- Avoids drafting contract for each project.
- Time for the preparation of contract conditions is saved.

Particular conditions of contract

- Since standard condition of contract doesn’t needs a modification and if Additional conditions, are required to adapt the standard conditions to the particular project another condition of contract will be added.
- These conditions are called **"special conditions"** or **"conditions of particular application".**
- Incase any conflict between the **special condition** of contract and the standard conditions of the contract arise the **special conditions** shall prevail.

E, Specifications

- Specification document describes the works in technical detail.
- It defines
  - the quality of material and
  - The quality of workmanship required and
  - any special responsibilities of the contractor which are not covered by **the conditions of contract**.
- There are two parts in the Technical Specification
  - General information and general **duties and obligations** of the contractor not covered by the conditions of contract
  - Description of materials and workmanship

Cont'd…

- Technical specification can be prepared by one of the following methods:
  - Make reference to existing standards specifications
  - Prepare detailed specification
- Describe performance and quality required and giving freedom to the contractor for the details.

F,DRAWINGS

- It is a model of the designer's idea

- Drawings may be a **new built** or **a record of what has been done i.e. as built drawings.**
- The problem which may arise in a large complex projects **(e.g. buildings)** are the coordination between the different disciplines of the design.
  - Example architectural with structural drawing
- In this case if drawings are not well coordinated it may give **rise to construction claims**.

G, Bill of Quantities

- Bill of quantities are list of items defining briefly the works to be done and quantities of the work.
- The bill of quantities consists of the following
  - day work schedule, if required
  - work items
  - grand summary
- Bill of quantities are used
  - during tendering contractors will have common basis for their pricing
  - assessment of interim payment certificates
  - standardization of the description of the works

2.4 Contract Management

- It is the management of contracts within a project.

Contract management includes

- **Negotiating** the terms and conditions in contracts
  - (tender preparation / tendering / contracting)
- **Ensuring compliance** with the terms and conditions (controlling)
- **Documenting and agreeing** any changes that may arise during its implementation or execution
  - (Change order Management)

2.4.1 Contract Administration and Closing

- It is identifying **contractual responsibilities** to stake holders.
  - Reviewing the terms of **contract documents.**
  - Extract monitoring activities.
  - Preparing monitoring responsibility summary sheets.
- Determining and understanding the construction components of the project
  - Reviewing the **contract drawings** and **technical specifications**
  - Extract the **construction methods** and **sequences**
  - Prepare construction methods and over all sequence sheets
  - Review **summited schedules** and break downs for operations.

Cont'd…

- Record **monitor** and **evaluate** progress of mobilizations, works and completions.
- Report **project status** daily/ periodically.
- Qualify **quality of materials** samples, **workmanships**
- Measure works, record site potentials and certify payments and completions.
  - Take off sheet and bar schedules are used for measurement of works.
  - Method of measurement is based on standard practices.

Cont'd…

- Site potentials such as material, equipment and manpower on site together with appropriate site organization is recorded.
- Advance intern and final payments will be certified.

- Mediate disputes.
- Closing of contract looks into issues related to
  - maintenance period,
  - remedial works,
  - left over claims and disputes,
  - closing of accounts and completion certificates.

2.4.2 Claims and Dispute Management

- Dispute is the difference in **a line of thought**.
- Claim is mostly concerned with **entitlements** and **liabilities** arising under a legally valid contract.
- The main causes of claims are
  - Extra work/variations
  - Design change
  - Differing soil/site conditions
  - Untimely payment
  - Limited access to the site
  - Defects in plans & specifications
  - Failure to approve drawings
  - Changes in cost

Cont'd…

- A construction claim is a demand for
  - **Payment** of additional compensation
  - **Adjustment** of the parties respective contractual obligation.
  - **Extension** of time
  - **Compensating** delay damages
  - Any other change with regard to the contractual conditions.

Types Of Claims

- **TIME RELATED CLAIMS**
- When this type of claims are raised the following entitlements or penalties will be taken
  - Time extension only
  - Liquidated damages only
  - Time extension and cost compensation
  - Bonus
  - Reliving of obligations.
- **COST RELATED CLAIMS**
- In this type the following entitlements or penalties will be taken
  - Additions requiring rate adjustment
  - Price changes
  - Provisional sum adjustments

Alternative Dispute Resolution System

- **PREVANTIVE DISPUTE RESOLUTION SYSTEM**
  - It is partnering, use of dispute resolution advisors and use of facilitators.
- **AMICABLE DISPUTE RESOLUTION SYSTEM**
- Includes
  - **Negotiations;** agreements
  - **mediations;** using additional third party for negotiation.
  - **conciliation**; it is almost similar to mediation but the **conciliator** may make more specific suggestions to resolve the dispute.
    - Conciliator has a powerful and forceful roles in the varies meetings.

Judgmental dispute resolution system

- Includes
  - **Adjunction**; it is use of dispute review board.
  - **Arbitration**; is a method of adding the third party for negotiation.
    - The arbitrator will be chosen and paid by disputants.
  - **Litigation**; is going to court and being judged by a public appointed jury.
    - This process is quite expensive.

Thank you!!!

Cont'd... Lecture-1.3

Termination of contract

Cont'd…

- Ordinarily termination means to bring something to an end .And the same meaning is applicable as far as termination of contract is concerned.
- A contract may be terminated under the following situations.

1. Termination by Performance

- A contract is automatically terminated when both the parties have performed their obligations un-satisfactorily under the agreement.
- A contract may be terminated if *specific performance* mentioned in the agreement has been completed and paid the contract price against the specific performance.
- A contract may also be terminated by *substantial performance* when due to conditions beyond the control of either party, specific performance is impossible but one party has performed his obligations to substantial completion and is entitled to receive payment in full or with minor deductions, provided that no damage has been suffered by the other party.

2. Termination by Agreement

- The parties under contract may agree to the termination of a contract at any time in its life time if it is based on payment in lieu of performance.
- Much government provides a clause in the contract that the contract shall be terminated at any time it appears to be in the interest of the government.

Continued…

- This constitute termination by agreement (in advance of actual termination) in which an incomplete portion of the work under the contract is accepted in lieu of complete performance.
- The work completed at the time of such terminated is paid for on the basis of a negotiated price satisfactory to both parties or on the basis of a pre- arranged method of settlement set forth in the contract.

3. Termination by Breach

- A breach of contract occurs under the following conditions;

(1) Where a party fails to perform one or more obligations of contract. This is **an Actual breach**.

(2) Where a party shows an intention not to perform one or more obligations of the contract. This is **an anticipatory breach**, where the contract is due to be performed but the party shows an intention not to perform the obligations under the contract.

Cont'd...

- Actual breach of contract may take three forms;

(a) One form is **non- performance**, where a contractor fails to carry out the contract work.

(b) The second form is that of defective performance, when the party undertakes the contract work but fails to performance it as the contract requires, such as not constructing a building in accordance with the specifications.

(c) The third form is where a party has contracted as to the existence of something, such as suitability, and if that thing is not so suited it is breach of contract.

Cont'd…

- **Anticipatory breach** of contract is where the breach occurs before the date for performance of the contract; it may come about **by express repudiation** or by **implied repudiation**.
- **Express repudiation** is where a party under a contractual obligation informs the other party that they have no intention of proceeding with the contract.
- **Implied repudiation** is where a party does not inform the other party that they do not intend to fulfill the contract. An example of this would be someone who accepted an offer of employment but, the day before the agreed date to start work, took up employment with another contractor.

4. Termination by Impossibility of Performance

- A contract may be terminated if conditions unforeseen when the agreement was made preclude performance. For example, subsoil characteristics previously assumed to be satisfactory for a bridge pier foundation may be determined unsuitable after the signing of the contract, making the construction of the pier impossible , and such a contract could not be enforced.

Cont'd…

- **Remedies for Termination of Contract by Breach**
- Whenever a breach of contract occurs a right of action exists in the courts to remedy the matter. The remedies generally available are as follows;

1. Damages
2. Order of payment of a debt
3. Specific performance
4. Rescission

Cont'd…

- These remedies are described in brief as follows:
- **Damages**- In most cases a breach of contract gives rise to a right of action for damages. The 'damages' consist of a sum of money, which will, as far as is practicable, place the aggrieved party in the same position as if the contract has been performed.
- Damages: **legal money that a court orders you to pay someone because you have harmed them or their property.**
- The parties to the contract, when entering into agreement, may agree that a certain sum shall be payable if a breach occurs.

Cont'd…

- This sum is usually known as liquidated damages/clause 47, where it represents a genuine estimate of the loss that is likely to result from the breach of contract. Where, however, the agreed sum is in the nature of a punishment for the breach of contract, then the term ‘penalty’ is applied to it, and the penalties are not normally recoverable in full.

Cont,d...

- For instance, in civil engineering contracts it is often stipulated that a fixed sum shall be paid per day or per week, if the contract extends beyond the agreed contract period. If this sum is reasonable it constitute liquidated damages and unlike a penalty, is recoverable in full.

Cont'd…

- **Order of Payment of a Debt –** A debt is a liquidated or ascertained sum of money due from the debtor to the creditor and is recoverable by an 'action of debt'.
- **Specific Performance-** The term 'specific performance' refers to an order of the court directing a party to a contract to perform his part of the contract agreement. It is now only applied by the courts on rare occasions when damages would be an inadequate remedy, but specific performance constitutes a fair and reasonable remedy and is capable of effective supervision by the court.
- **Injection-** An injection is an order of court directing a person not to perform a specified act.
- **Rescission-** Rescission consists of an order of court concelling or setting the non-breaching parties back in the position that they were before the contract was made.

Thank you!!!

Lecture-2

Specifications

Introduction

- It is defined as the **designation** or **statement** by which written instructions are given.
- Used to **distinguish** and/or **limit** and describe the particular trade of work to be executed.
- *In short specification is a statement of particular instructions of how to execute some task.*
- Specification is one of the contract documents.

Cont'd…

- Specifications are written based on
  - The prepared design,
  - Drawings,
  - General and scientific trends of workmanship,
  - Quality expected,
  - Equipment involved and
  - Materials to be used for the particular trade of work.
- Specifications should be ***clear***, ***concise***, and ***brief descriptions*** of what is required to execute the proposed trade of work.

Cont'd…

- The specifications should clearly specify: -
  - Design and drawing
  - Labor employment
  - Materials to be used
  - Construction method
  - Equipment's used
- The information that is needed for building construction is usually conveyed by two basic communication lines.
  - The drawings (pictorial)
  - The specifications (written)

Drawings and specifications

Drawings contains

- Dimensions, extents, size, shape, and location of component parts.
- Location of materials, machineries, and fixtures
- Interaction of furniture, equipment's and space
- Schedules of finishes, windows and doors.

Specifications contains

- Type and quality of materials, equipment's, labor or workmanship
- Methods of fabrication, installation and erection
- Standards, codes and tests
- Allowance, submittals and substitutions
- Cost included, insurance and bonds
- Project records and site facilities.

3.2 Purposes of specifications

- ***Guide the bidder*** at the time of tendering to arrive at a reasonable cost for the work.
- Provide guidance ***for execution*** and ***supervision of works.***
- ***Guide the contractor for the purchase of materials***
- Serve as ***a part of contract document to limit*** and describe ***the rights and obligations of each contracting parties.***
- ***Guide the bidder*** to identify his capacity to execute the work.

Cont'd…

- ***Serve as fabrication*** and ***installation guide*** for temporary and permanent works.
- ***Guide the contractor*** for the purchase and/or hiring of equipment's.
- ***Serve for the owner*** to know what he/she is entitled to receive
- ***Serve for the manufacturers*** of construction materials, equipment's, tools etc… to grade, classify, and improve qualities of their produces.

Cont'd…

- The specifications are very much related to
  - The legal considerations,
  - Insurance considerations,
  - Bidding requirements,
  - Alternates and options,
  - Rights, obligations and remedial measures for the contracting parties.
- In the events of conflicts between specification and drawings, ***the specification governs***.

3.3 Types of Specifications

- In general, specifications can be broadly classified into ***four*** categories as follows
  - **Manufacturer's specification**
  - **Guide Specification**
  - **Standard Specification**:
  - **Contract (Project) Specification**:

3.3.1 Manufacturer's specification

- Manufacturers prepare ***specifications*** of their product for the guidance of their users,
  - which includes ***property description*** and ***installation guide lines.***

3.3.2 Guide Specification

- This type of Specifications prepared by ***an individual*** or ***group of individuals*** based on
  - Manufacturer's specifications,
  - Established ***trends of workmanship***,
  - ***Service*** and ***laboratory tests*** and
  - Research findings to be used as ***guide lines*** for preparation of contract specifications.

3.3.3 Standard Specification

- Specifications which are intended to be used as ***a reference standard*** in the construction of a project.
- ***The guide specification which has been standardized by a recognized authority is considered as standard specification***.

3.3.4 Contract (Project) Specification

- It is the specification which is prepared ***for a particular project*** to accompany ***the drawings*** and ***other contract documents.***
- This type of specification can be prepared following the format which ***has general and specific parts.***
  - General specification and
  - Specific specification

Cont'd…

- In the ***general part of the standard specifications*** the following items are included:-
  - ***Administrative and Procedural Requirements***
  - ***Scope, definitions***
  - ***Reference organizations and Standards***
  - ***Project description, site facilities***
  - Submittals and quality assurance
  - Delivery, storage and handling
  - Project records
  - Insurances
  - Other general requirements

Cont'd…

- In the specific part of the standard specifications, ***detailed description of the quality of items to be used is given.***
- In addition to this, ***preparatory actions and methods of incorporating the items into the project are indicated.***
- Specifications could be written in several ways, with the prime emphasis given to either the producer company's brand or the performance capacity of the material and so on.

Cont'd…

- Accordingly, there are the following types of technical specifications.
  - **Proprietary Specifications**:
  - **Performance Specifications**
  - **Reference Specifications**
  - **Descriptive Specifications**
  - **Cash Allowance Specifications**

Cont'd…

- ***Proprietary Specifications***
  - This specifications call for ***desired materials***, ***producers***, ***systems,*** and equipment's by their trade names and model numbers.
  - Detailed descriptions reference should be made to manufacturer's specifications.
- ***Performance Specifications***:
- Specifications which define products based on ***desired end results*** which are performance oriented;
- ***Most appropriate when new or unusual products or systems are required or when innovation is necessary***.

- It Describes the problems or conditions under which the products or systems must operate.
- the parameters for the acceptable solutions is difficult and challenging.
- Testing methods and evaluation procedures for defining the required performances ***must be explicitly specified.***
- ***Reference Specifications:***
- Specifications which refer to levels of quality established by recognized testing authority or standards set by quality control authorities.
- These specifications are also used in conjunction with other types of specifications.

Descriptive Specifications

- Specifications which describe
  - all components of products,
  - their arrangements and methods of assembly,
  - physical and chemical properties,
  - arrangement and relationship of parts and numerous other details.
- The specifier shall take total **responsibility** for the function and performance of the product.
- **Cash Allowance Specifications:**
- Specifications meant **to direct bidders to set aside a specified amount of money** to be applied to the construction work at the direction of the specifier.

3.4 Specification writing

- Basically specifications **are not to be created**.
- specifications are prepared based on
  - existing standards,
  - codes,
  - guidelines, and
  - laws.
- Specification writing embodies certain methods of presenting information and instructions.
- When specifications are to be written, the following shall be taken into consideration:-

Cont'd…

- Specification writing require
  - **Visualization** (having clear picture of the system)
  - **Research** (to know the legal impact correctly)
  - **Clear thinking** (understanding things directly without misleading)
  - **Organizing** (organizing what we know to write the specification)
- Specification writing require professional ability to read drawings.

Cont'd…

- Specification writing require wide knowledge of the
  - construction materials,
  - various levels of workmanship,
  - different construction equipment's and
  - method of construction to be employed
- Specifications use simple and clear language such that it can readily be understood.
- Specifications shall be brief and short as much as possible (avoid long sentences without punctuations)
- Specifications shall include all items affecting the cost of the work

Cont'd…

- Specifications shall be fair and do not attempt to throw **all risks and responsibilities** on one of the parties signing the contract, the employer or the contractor.
- Specifications shall avoid repetition of information shown on drawings to avoid mistakes and duplications within the specifications and drawings
- Specifications shall not include inapplicable text and do not specify the impossible or anything not intended to be enforced.

Cont'd…

- **What are the useful references in specification writing?**
  - Codes and ordinances of governments, cities, or municipalities. For example, EBCSs
  - Standards prepared by distinct societies and government agents. For example, ACI standards, ASTM standards, BS, ES.
  - Standards or model specifications prepared by manufacturers, professional societies, and government bodies.
  - Master specifications and previously written specifications.
  - Information or experience acquired by personal observation and contact with trained or experienced people in the construction industry.

Cont'd…

- The specification writer should present his instructions regarding the particular work under consideration in such a manner that: -
  - The drawings are more clearly interpreted, not duplicated.
  - Rights, obligations, and remedial measures shall be designated without ambiguity or prejudice.
  - Clearly express the extent of works under consideration; therefore, the phraseology used in this regard shall be: -
    - i) Judged by its quality not its length
    - ii) Should be concise and short and written with commonly used words

Cont'd…

- iii) Punctuations are important but their usage shall be limited to few
- iv) Capitalizing the first letters is mandatory for the following expressions: -
  - Parties to the contract; eg Employer/Client /Contractor/ Engineer /Architect
  - Space within the building; eg Bed Room, Toilet, Living Room
  - Contract documents; eg Bill of Quantity, Working Drawing, Specification

Cont'd…

- v) Minimize pronouns, better to repeat nouns
- Vi) Minimize the use of symbols
- Vii) Do not use foot notes, do not underline within a sentence for emphasis
- viii) Words shall be used as follows:-
  - shall in place of must; **use "shall"** for the duties of the contractor or the consultant to represent the **word "must"**
  - **"will" is** used for the duties of the employer to represent the word **"must"**
  - "must" –avoid the use of the word "must" and substitute by the word shall to prevent the inference of different degrees of obligation
  - Avoid the use of words which have indefinite meanings or limitless and ambiguous in their meanings.
    - For example, any, either, same, similar, etc.

Thank you!!!

Introduction

- Before starting any construction one has to have a thorough knowledge about the volume of the work and the probable cost that may be required for the completion of the project.
- Otherwise, the construction will be stopped before its completion due to shortage of money or materials.

Types of estimates

a. Approximate/Rough estimate

- To get an idea for the probable expenditure in a short time.
- To prepare a preliminary estimate before drawing up a detailed estimate for a Project.
- This is made after knowing the costs of similar projects.

b) A detailed estimate

- This is the best method and includes the quantities and cost of everything required for the Work Requirements
  - Drawings
  - Specification
- Therefore, quantity surveying may be defined as the process of calculating the quantities and cost of various works required in connection with the project.

Purposes of quantity surveying

- To know the amount of money required.
- To know the quantities of materials required.
- To know the tools and equipment required for the construction.
- To know the different workers to be employed
- To draw up the construction schedule and program.
- To fix up the completion period.
- To invite tenders.
- To obtain sanction of necessary funds from the concerned authority
- For Evaluation of an existing structure

Bill preparation

- There are three processes in the preparation of the completed bill of quantities.

a) Taking-off quantities
b) Abstracting or ‘working-up’
c) Billing

Taking –off quantities

- In the first instance quantities need to be extracted from drawings, together with an appropriate description.
- This process - known as booking dimensions or taking-off quantities - involves the measure in either reading or scaling dimensions from the drawings.
- There are two distinct parts.
  - the first involves the recording of quantities,
  - the second required a written description to accompany the quantity

Cont'd…

* The sequence adopted by measurers in this initial stage bears little relation to the eventual order of the finished bill of quantities. This is because 'taking-off' has been devised in order to assist the measurer with both the speed and accuracy of recording dimensions.
* Dimensions are taken from a drawing and recorded on specially lined paper known as dimension paper.

The format of standard dimension paper

	1	2	3	4	1	2	3	4

Cont'd...

- The A4 page is divided vertically into two identical halves each comprising a set of four columns. These are labeled for the purpose of identifications. The extra column on the extreme left is called the binding margin and would not normally be used for recording dimensions.

The purpose of each column

* ***Column 1*** *is called the 'timesing column' in which multiplying figures are entered when* there is more than one of the particular items being measured.
* ***Column 2*** *is called the 'dimension column' in which the actual dimensions, as scaled or* taken direct from the drawings, are entered. There may be one, two or three lines of dimensions in an item depending on whether it is linear, square or cubic.

Cont'd…

* ***Column 3*** *is called the 'squaring column' in which the length, area or volume obtained by* multiplying together the figures in columns 1 and 2 is recorded, ready for transfer to the abstract or bill.
* ***Column 4*** *is called the 'description column' in which the written description of each item is* entered. This column is frequently used to accommodate preliminary calculations and other basic information.

General principles of taking-off

1. Entering dimensions

* Dimensions are entered in the dimension column in meters to two places of decimals.
* The four principal units of measurement are length (m), area (m2), volume (m3) and enumeration (no or pcs).
* For enumerated items whole numbers are entered in the dimension column, with a line drawn horizontally beneath each single entry.

Cont'd…

The order of recording dimensions is:

* Length
* Width/breadth
* Vertical height/depth

2 Abbreviations

* Many of the words entered in the description column are abbreviated in order to save space and time in entering the item by highly skilled technical staff. Many abbreviations have become almost standard and are of general application; for this reason there is a list of the more common abbreviations (refer Appendix I).

3.Grouping of dimensions

* Where more than one set of dimensions relate to the same description, the dimensions should be suitably bracketed so that this shall be made clear.
* Where the same dimensions apply to more than one item, the best procedure is to separate each of the descriptions by an ampersand ‘&’ sign and to bracket the descriptions.

4 Adjustment of openings and voids

* When measuring areas with openings or voids, the most convenient practice is usually to measure the full area in the first instance, and to subsequently adjust for any voids or openings

5.Order of taking off

- The order of taking off largely follows the order of construction to simplify the work and to reduce the risk of items being missed.

Abstracting or 'Working up' bill of quantities

* The sequence adopted by measurers follows construction operations as they occur on site.
* However, once the take-off is complete, these measured items need to be collated, like items must be merged and deduction adjustments made. This process, known as abstracting or working-up quantities, is carried out on specially lined A3 size paper.

Cont'd…

* At the head of each abstract a work section heading is recorded. Each measured item is copied from the dimension column and transferred to the abstract. In an effect to avoid double transfer, or the omission of an item, each description is lined through on the dimension sheet as it is transferred.

Billing

- This is the final stage in the preparation of the completed bill of quantities.
- The effort of assembling and ordering was completed at the abstracting stage and all that remains is for the descriptions and quantities to be presented in a structured and consistent fashion.

Cont'd...

Item	Description	Unit	Qty	Rate	Amount
	A. SUB-STRUCTURE				
	1. Earthwork				
1.1					
1.2					
1.3					
1.4					
	Total carried to summary				
	2. Concrete Work				
2.1					
2.2					
2.3					
	Total carried to summary				

Mensuration in Quantities

- Measurement is the term used by mathematicians to describe the measurement of lengths, areas and volumes of different figures.
- It is necessary to understand the principles of mensuration before dimensions can be correctly presented and recorded on dimension paper.

Technical Specification & Methods of Measurements for the different Trade of Works

3.1. Building Project

* A typical building project will have the following work items.

Typical building Project

	A-SUB STRUCTURE
1	Excavation and earth work
2	Concrete Works
3	Masonry work
	B. SUPER STRUCTURE
1	Concrete Works
2	Masonry Works
3	Roofing
4	Carpentry and Joinery
5	Metal Works
6	Finishing
7	Glazing
8	Painting
9	Sanitary installation
10	Electrical installation
11	Fence Work

3.2 Methods for finding Quantities for Building Project

* There are three methods:

1 *Out – to - Out and In – to – In Method*

* Long Wall (Out – to - Out) = Inner Length + 2 Times Thickness of the Wall
* Short Wall (In – to – In) = Inner Length - 2 Times Thickness of the Wall

2. *Center Line Method*

* All dimensions are taken center to center

3. *Crossing Method*

* Long Wall (Out – to - Out) = Inner Length + 2 Times Thickness of the Wall
* Short Wall (In – to – In) = Inner Length

Thank you!!

Lecture-3.1

COST ESTIMATION

Introduction

- It is the process of valuing on monetary expression, including
  - the cost of all ***possible entrants*** necessary for the ***planning***, ***implementing*** and ***monitoring*** stages of the proposed project under consideration.
- The possible entrants of project cost are:
  - Preliminary investigation (project appraisal costs)
  - design and supervision (consultancy cost)
  - construction works (contractor's cost)
  - land owning cost
  - monitoring costs

Cont'd…

Purposes of Estimation

- Know the volume of work in reference to the fund available
- Determine actual cost per unit of item
- Identifying engineering estimate of the work for bidding purpose
- Work out economical use of materials, labor and equipment's
- In cases of variations to determine the extra cost to be incurred
- When changes in cost due to legislation happens, to work out ***the escalation in cost.***

Cont'd…

- **Factors affecting cost estimation**
  - Type and documentation of the project
  - Construction scheduling
  - Bidding environment
  - Quality and availability of material and labor
  - Strength or grade required. Eg. C15, C20, C25 concrete
  - Construction facilities /tools and method of construction
  - Location of the site
  - Transportation charges
  - Proper management
  - Land charges (lease)
  - Nature of subsurface condition

Information's required to define cost per unit of work

- Correct information of the market price of the materials
- Correct information of the rates of various categories of skilled and unskilled laborers
- Output of laborers per day for various types of items ***(productivity)***
- Correct information of the rates of various categories of equipment's and tools as rental rates to be used for major items of rates
- Up-to-date knowledge of the construction methods.

5.2 Types of costing or estimation

- Estimation can be broadly classified as
  - **preliminary (approximate) and**
  - **detailed (refined)**.
- **5.2.1 Preliminary /approximate costing**
- It is required to know the financial position of the client before costly detailed designs are carried out.
- Such estimates are based on practical knowledge and cost of similar previous works.

❑ *Cost per functional unit*

- ***Hospital =cost per bed***,
- Dormitory = cost per student,
- Cinema or theatre = cost per seat,
- road works = cost per kilometer length, etc

■ *Plinth area method – cost per m^2*

- ***Social Buildings*** – not aesthetic but functional, 1000 – 1500 Br/m^2
- ***Industrial Buildings*** – Profitable but aesthetics is not the main quality, 1300 – 2000Br/m^2
- ***Monumental Building*** – Aesthetics is the main quality, eg. Palaces, museums 2000 – 3000Br/m^2

Cont'd…

- ***Cubical Content method*** – cost per m^3 of the building
- ***Elemental/parametric Estimate***
  - Roughly grouped quantities or elemental bill
  - The elemental costs are the summation of grouped quantities.

5.2.2 Detailed estimate or item rate method

- This is the most reliable and accurate type of estimate.
- The quantities of items are carefully prepared from the drawings and the total cost worked out from up to date market rates.
- Detailed estimate is accompanied by a detailed report, detailed specification for the execution of the work, and detailed drawings, etc.

5.2.3 Revised Estimate

- A detailed estimate prepared afresh when the original detailed estimate is ***beyond an acceptable range***.
- It should be accompanied by all the papers as in the case of the ***detailed estimate*** and also should include the comparative statements of variations in each item of works.

5.2.4 Supplementary Estimate

- When additional works are there, a fresh detailed estimate is prepared to supplement the original work.

Rate Analysis

- It is the process of fixing cost per unit of measurement for the different item of works.
- Cost due to construction (contractor's cost) is given special ***attention here.***
- Total cost per unit of work ***(TC)*** may be grouped into two components; ***direct cost and indirect cost***.

TC= DC + IC

- In order to facilitate the estimation material break down is essential
- We may use the excel or software's to calculate the material break down (COMNISS)

Cont'd….

- ***The direct cost (DC)*** includes
  - cost due to ***material***,
  - ***cost due*** to ***labor***,
  - ***cost due to equipment***,
- ***(IC) cost covers***
  - ***Overhead costs*** are expenses for general office facility, rents, taxes, electrical light, water, and other miscellaneous items.
  - ***contractor's profit*** it is a cost which is assumed for the profit of the contractor.
    - It is almost 30% of the above costs.

5.3 Project Valuation

- It is the art of determining the present value of a property such as buildings, factories, halls….
- It is determined or decided by its selling price
- Valuation of a building depends upon
  - The type of a building
  - Its structure
  - Shape of the structure
  - Quality of materials used
  - Present day prices of the materials
  - Plinth area
- It can also be calculated on its cost of construction at the present day rate after deducting a suitable depreciation.

Methods Of Valuations

- ***Rent return method***; it is based on the net rent value, capitalized for the future life of the building.
- ***Valuation on land and building bases***; it considers the cost of land + building cost.
- ***Valuation on profit basis***; suitable for commercial buildings like hotels, cinemas, etc
  - It is by multiplying the net profit by future life of the building.
- ***Valuation on cost basis***; by deducting the depreciation from the actual cost incureed in construction.

Cont'd….

- ***Development method of valuation***
  - *In this method it needs renovation by alteration*
  - *Anticipated future net income is renovated and multiplied by the future life of the property to get the value*
- ***Depreciation method of valuation***
  - *The property value is determined based on the book value for the year by deducting the depreciation*

Examples. . .

Thank you!!!

ITEM	WORK ITEM	UNIT	MATERIAL COST	LABOUR COST	EQUIPMENT COST	DIRECT COST	OVERHEAD & PROFIT 30%	SUMMARIZED UNIT PRICE	
1	REMOVE TOP SOIL	m^3	-	0.27	5.25	5.52	1.66	7.20	
2	BLUK EXCAVATION TO A DEPTH 1.50m	m^3	-	5.15	0.8	5.95	1.80	7.80	
3	DITTO BUT FROM DEPTH 1.5 to 3m	m^3	-	6.87	1.07	7.94	2.36	10.30	
4	DITTO BUT EXCEDING 3:00	m^3	-	10.84	1.68	12.52	3.78	16.30	
5	EXCAVATION FOR SOFT ROCK	m^3	-	15.85	2.46	18.31	5.49	23.80	
6	EXCAVATION ON HARD ROCK	m^3	-	47.50	8.00	55.50	16.70	72.20	
7	BACK FILL FROM SITE	m^3	-	9.07	1.49	10.56	3.14	13.70	
8	BACK FILL WITH SELECTED MATERIAL	m^3	26.25	9.07	1.49	36.81	11.09	47.90	
9	CART AWAY 500m FROM SITE	m^3	-	0.30	7.63	7.93	2.37	10.30	
10	HARD CORE	m^2	15.63	2.51	0.19	18.33	5.57	23.90	
11	LEAN CONCRETE	m^3	210.50	11.94	12.93	235.37	70.63	306.00	
12	C 15 CONCRETE	m^3	261.30	12.79	15.74	289.83	86.97	376.80	
13	C 25 CONCRETE SUB STRUC.	m^3	293.85	28.60	25.82	348.27	104.53	452.80	
14	C 25 CONCRET G.TIE BEAM	m^3	293.85	28.60	28.35	350.80	105.20	456.00	
15	C 25 ELEVATION COLUM	m^3	293.85	45.57	47.16	386.58	116.02	502.60	
16	FORM WORK FOR FOUNDATION	m^2	63.67	8.76	0.36	72.79	21.81	94.60	
17	FORM WORK COLUMN SLAB & BEAM	m^2	61.00	9.84	0.4	71.24	21.36	92.60	
18	FORM WORK FOR STAIR & PARAPET SHEAR WALL	m^2	61.00	11.26	0.46	72.72	21.88	94.60	
19	REINFORCEMENT BAR	KG	6.04	0.54	0.1	6.68	2.12	8.80	
20	MASONARY FDN. WALL	m^3	178.40	15.04	1.28	194.72	58.44	253.20	

ITEM	WORK ITEM	UNIT	MATERIAL COST	LABOUR COST	EQUIPMENT COST	DIRECT COST	OVERHEAD & PROFIT 30%	SUMMARIZED UNIT PRICE	
21	DRESED STONE	m^3	180.94	42.56	1.28	224.78	67.42	292.20	
22	20 CM THICK H.C.B.	m^2	38.57	6.40	0.36	45.33	13.67	59.00	
23	15 CM THICK H.C.B.	m^2	32.75	5.76	0.32	38.83	11.67	50.50	
24	10 CM H.C.B	m^2	28.23	4.80	0.27	33.33	10.00	43.30	
25	25 CM BRICK	m^2	83.77	12.20	0.80	96.77	29.03	125.80	
26	12 CM THICK BRICK	m^2	41.56	6.51	0.43	48.50	14.60	63.10	
27	G 28 C.I.S COVER	m^2	30.15	1.99	0.05	32.19	9.81	42.00	
28	G 30 ROOF COVER	m^2	28.65	1.99	0.05	30.69	9.21	39.90	
29	TRUSS	ML	13.57	1.71	0.09	15.37	4.63	20.00	
30	PURLIN (15X7)CM)	ML	18.20	2.17	0.08	20.45	6.15	26.60	
31	FASHIA BOARD	ML	29.40	1.01	0.04	30.45	9.15	39.60	
32	EGA SHEET	m^2	71.00	1.70	0.08	72.78	21.82	94.60	
33	FLASHING	m^2	34.34	2.88	0.11	37.33	11.17	48.50	
34	STEEL STRUCTURE	KG	15.00	0.73	0.62	15.69	4.71	20.40	
35	GUTTER & WATER PIPE	ML	33.20	1.48	0.06	34.74	10.46	45.20	
36	CHIP WOOD (8 mmTHICK)	m^2	61.38	13.56	0.96	75.9	22.80	98.70	
37	PLASTERING	m^2	9.66	9.63	0.40	19.69	5.91	25.60	
38	POINTING	m^2	0.97	6.13	0.32	7.42	2.28	9.70	
39	WOODEN DOOR/WINDOWS	m^2	516.00	9.9	0.48	526.38	157.92	684.30	
40	FLASH DOOR	m^2	536.00	9.9	0.48	546.38	163.92	710.30	
41	SCREEDING	m^2	16.10	5.3	0.21	21.61	6.49	28.10	
42	PVC TILE	m^2	96.00	3.00	0.16	99.16	29.84	129.00	
43	CEMENT TILE	m^2	43.74	4.78	0.26	48.78	14.62	63.40	
44	TERRAZO TILE FLOORING	m^2	67.24	5.32	0.32	72.88	21.92	94.80	
45	CERAMIC TILE(NON SLIPPERY)	m^2	108.99	5.32	0.32	114.63	34.37	149.00	

ITEM	WORK ITEM	UNIT	MATERIAL COST	LABOUR COST	EQUIPMENT COST	DIRECT COST	OVERHEAD & PROFIT 30%	SUMMARIZED UNIT pRICE	
46	GRANULAR FLOOR TILE	m^2	48.99	4.61	0.26	53.86	16.14	70.00	
47	TREAD(TERRAZZO) 30X3 CM)	m^2	46.83	5.33	0.21	52.37	15.73	68.10	
48	RISER 15 X 2 CM	ML	27.86	3.25	0.21	31.32	9.38	40.70	
49	MARBLE FLOORING(GOJAM)	m^2	273.77	16.90	0.08	291.47	87.43	378.90	
50	MARBLE FLOORING(HARAR)	m^2	221.27	16.90	0.8	238.97	71.73	310.70	
51	MARBLE TREAD(GOJAM)	ML	81.97	4.33	0.16	86.46	25.94	112.40	
52	MARBLE RISER(GOJAM)	ML	40.99	3.46	0.13	44.58	13.42	58.00	
53	CERAMIC WALL TILE	m^2	121.79	9.76	0.64	132.19	39.71	171.90	
54	WINDOW CILL(MARBLE) 27 CM	ML	73.46	5.41	0.26	79.13	23.77	102.90	
55	" " (TERRAZZO) 27cm	ML	43.53	5.41	0.26	49.20	14.80	64.00	
56	" " CONCRETE	ML	8.88	5.41	0.26	14.55	4.45	19.00	
57	METAL DOORS & WINDOWS	m^2	468.37	13.20	0.43	482.00	145.00	627.00	
58	3mm CLEAR GLASS	m^2	135.00	5.84	0.18	141.02	42.38	183.40	
59	3 mm " "	m^2	124.00	5.26	0.16	129.42	38.88	168.30	
60	4 " FROSTED GLASS	m^2	168.00	5.84	0.18	174.02	52.88	226.30	
61	PLASTIC PAINT	m^2	8.50	2.71	0.10	11.31	3.39	14.70	
62	DRESSED STONE PAVEMENT	m^2	31.79	4.88	0.32	36.99	11.11	48.10	
63	CURB STONE	ML	14.21	1.40	0.1	15.71	4.69	20.40	
64	HAND WASH BASIN	N^O	460.00	100.00	0	560.00	168.00	728.00	
65	LOW FLUSH W.C	N^O	980.00	100.00	0	1,080.00	324.00	1,404.00	
66	WATER HEATER 80 FT.	N^O	930.00	100.00	0	1,030.00	309.00	1,339.00	
67	SHOWER PLATE	N^O	515.00	100.00	0	615.00	184.50	799.50	
68	FLOOR DRAIN	N^O	57.00	10.00	0	67.00	20.10	87.10	
69	KITCHEN SINK SINGLE BOWL	N^O	610.00	100.00	0	710.00	213.00	923.00	

EFFICIENCY OF LABOUR PER DAY (8hrs/day)

Item	Description	Labour Efficiencies	
		Gang	Out Put Per Day
	I. Excavation		
1.1	Site clearing to remove top soil to an average depth of 20cm.	1D.L.(Daily Laboer)	10M²
1.2.	Trench excavation inordinary soil		
	a) to a depth of 1.2 M	1D.L	1.25M³
	b) " " " " 2.2 M	"	1.00M³
	c) " " " " 3.0 M	"	0.75M³
1.3	Bulk excavation in ordinary soil to depth of 1.5M	"	1.5M³
1.4	Cartaway		
	a) to 500M away from site	"	1.5M³
	b) " one km." " "	"	1.0M³
1.5	Hard coring 25cm. thick	1 mason + 4D.L	18M²
1.6	Back fill around foundation		
	a) Loosesoil	1D.L.	2M³
	b) Agregate	1D.L	1.5M³
	II. Concrete Work		
2.1	Lean concrete		
	a) 5cm. thick	1 mason + 6D.L	20M²
	b) 8cm. "	"	15M²
2.2	Floor slab		
	a) 8cm. thick	"	15M²
	b) 10cm. "	"	12.5M²
	c) 15cm. "	"	10.0M²
2.3	Grade beam	"	1.5M³
2.4	Footing	"	1.5M³
2.5	Foundation column	"	1.25M³
2.6	Upper tie beam	"	1.0M³
2.7	Lintel	"	1.0M³
2.8	Column upto 2m	"	1.25M³
2.9	" above 2m	"	1.0M³
	III. Masonary Work		
3.1	Stone masonary sub-structure		
	a. 40cm.thick	2 mason + 6D.L	5M³
	b. 50cm. "	"	6M³
	c. 60cm. "	"	7M³
3.2	Stone masanary super-structure		
	a. 40cm. thick	"	3M³
	b. 50cm. "	"	4M³
	c. 60cm. "	"	5M³

Item	Description	Labour Efficiencies	
		Gang	Out Put/Day
3.3	Brick wall for plastering		
	a) 25cm. thick up to 2m	1mason + 3D.L	7M²
	b) 12 " " " " "	"	9M²
	c) 25 " " from 2-4m	"	5M²
	d) 12 " " " "	"	7M²
3.4	Hollow block wall for plastering		
	a) 20cm. thick upto 2m	1mason + 2D.L	10M²
	b) 15cm. " " "	"	10M²
	c) 10cm. " " "	"	8M²
	d) 20cm. " from 2-4m	"	8M²
	e) 15cm. " " "	"	8M²
	f) 10cm. " " "	"	6M²
	IV. Roof Work		
4.1	Roof covering (CIS)	1carpenter + 2D.L	40M²
4.2	Ridge cover	"	70ML
4.3	Valley cover	"	70ML
4.4	Gutter fixing	"	30ML
4.5	Joining eucalyptius truss upto 10mt. spans on ground	"	4truss
4.6	Down pipe	"	40ML
4.7	Truss erecting	1carpenter + 8D.L	15truss
4.8	Fixing corrigated asbestos	1carpenter + 2D.L	25M²
4.9	Fixing EGA	"	30M²
4.10	Joining zigba truss upto 10m span on ground	"	3truss
4.11	Zigba truss erecting	1carpenter + 8D.L	15 "
4.12	Fixing fascia boord	1carpenter + 2D.L	70ML
	V. Joinery Work		
5.1	Wooden door fixing	1carpenter + 2D.L	3pcs.
5.2	" window "	"	4 "
5.3	Chipwood ceiling fixing	"	10M²
5.4	Hardboard " "	"	10M²
5.5	Abujedi " "	"	13M²
	VI. Metal Work		
6.1	Metal door fixing	"	3pcs.
6.2	" window "	"	4 "
6.3	French " "	"	2 "

Item	Description	Labour Efficiencies	
		Gang	Out Put/Day
	VII. Plastering & Painting		
7.1	1st coat plastering	1plasterer + 2D.L	35M²
7.2	2nd " "	"	10M²
7.3	3rd " "	"	14M²
7.4	Pointing on stone wall	"	
7.5	" " brick "	"	8M²
7.6	" " HCB "	"	14M²
7.7	" " dressed stone wall	"	12M²
7.8	Rendering	"	20M²
	VIII. Flooring		
8.1	Cement screed	1mason + 2D.L	14M²
8.2	" tile fixing	"	10M²
8.3	Plastic tile	"	17M²
8.4	Par-quet flooring	"	15M²
8.5	Woodenn flooring	"	8M²
8.6	Ceramic wall tile	"	7M²
8.7	Plastic tile skirting	1mason + 1D.L	40ML
8.8	Cement tile skirting	1mason + 2D.L	12ML
8.9	Marble slate flooring	"	12M²
8.10	" " skirting	"	16ML
8.11	Fixing pre-cast window cill	"	10ML
8.12	" unpre-cast " "	"	6ML
	IX. Glazzing		
9.1	Cutting	1glazzer + 2D.L	50M²
9.2	Fixing	"	20M²
	X. Painting		
	a) Plastic Paint		
10.1	Painting plastered wall surface 3coats	1painter + 1D.L	30M²
10.2	" rendered " " "	"	25M²
10.3	" Abujedi ceiling " "	"	20M²
10.4	" hard board " " "	"	20M²
10.5	" chipwood " " "	"	20M²

Item	Description	Labour Efficiencies	
		Gang	Out Put/Day
	b) Synthetic Paint		
10.6	Plastered wall surface in 3 coats	1painter + 1D.1	25M²
10.7	Wooden surface	"	25M²
10.8	Metal "	"	27M²
	XI. Sanitary Work		
11.1	G.I.pipe laying in ground $\phi\frac{1}{2}"-1\frac{1}{4}"$	1plumber + 2D.L	120ML
11.2	Fixing - bathtub,shower complete, wash basin,water closet, bidet	1plumber + 1D.L	1pc.
	XII. Electrical Installation		
12.1	Fixing conduts	1electrician + 1D.L	40ML
12.2	Pulling wires	"	50ML
12.3	Fixing switch & outlets	"	20pcs.
12.4	" fittings	"	10 "
12.5	" distribution boards	"	10 "
	XIII. Site Work		
13.1	Drain laying		
	a) Ø10-30cm. concrete pipe	1mason + 3D.L	30ML
	b) Ø40-60cm. " "	"	20ML
	c) Ø80-100cm. " "	"	10ML
13.2	Curb-stone	"	30ML
13.3	0.60x0.60x0.60 manhole out of brick	"	2pcs.
13.4	0.60x0.60x0.60 " " " H.C.B.	"	3 "
13.5	Fancing with galvanized fencing net	1carpenter + 2D.L	50M²

GENERAL FORMULA

A. Assumed concrete mix ratio 1:2:4

Volume of concrete = xm^3 kg/m^3

a) Cement = 1/7 X xm^3 X 1400 kg/m^3 X 1.30 shrinkage x1.50 (Waste) waste.

b) Sand = 2/7 X xm^3 X 1.30 shrinkage X 1.15 wastage

c) Gravel = 4/7 X xm^3 X 1.30 shrinkage X 1.15 wastage

B. Mix ratio ==1=2

Volume of lime mortar = Ym^3

a) Lime = 2/3 X ym^3 X 1.20 Shrinkage X 1100 kg/m^3 X 1/50 Wastage.

b) Sand = 1/3 X 1.20 Shrinkage X 1.20 Wastage.

C. Mix Ratio = = 1 = 2 = 9

Volume of cement lime mortar = zm^3

a) Cement = 1/12 X zm3 X 1.20 Shrinkage X 1400 kg/m3 X 1.05 Wastage.

b) Lime = 2/12 X zm3 X 1.20 Shrinkage X 1100 kg/m3 X 1.05 Wastage.

c) Sand = 9/12 X zm3 X Shrinkage X 1.20 Wastage.

D. Mix ratio = 1 - 3

Volume of cement mortar = ym^3

a) Cement = 1/4 X ym^3 X 1.20 shrinkage X 1400 kg/m^3 X 1.05 Wastage.

b) Sand = 3/4 X ym^3 X 12.0 Shrinkage X 1.20 Wastage.

ITEM	TYPE OF WORK		QUANTITIES
1	Curt away (with 25% Bulkoge)		1.25m^3/m^3
2	Back fill (with 15% decrease after consolidation)		1.15/m^3
	CONCRETE WORK		
3	Concrete C-7	Cement	1.82qt/m^3
	Mechanical mix	Sand	0.50m^3/m^3
	Mix ration =1==3.5:6	Gravel	0.85/m^3
4	Concrete C-15	Cement	2.73qt/m^3
	Mechanical mix	Sand	0.53m^3/m^3
	Mix ratio = 1=2.5=3.5	Gravel	0.75/m^3
5	Concrete C-20	Cement	3.10qt/m^3
	Mechanical mix	Sand	0.05m^3/m^3
	Mix ratio =1=2=3	Gravel	0.75/m^3
6	Concrete C-15	Cement	3.10qt/m^3
	Hand Mix	Sand	0.05m^3/m^3
	Mix ratio = 1=2=3.5	Gravel	0.75/m^3
7	Concrete C-20	Cement	2.94qt/m^3
	Hand Mix	Sand	0.45m^3/m^3
	Mix ratio=1=1.5=3	Gravel	0.82/m^3
8	Concrete C-30	Cement	3.47qt/m^3
	Mix ratio=1=1.5=2.5	Sand	0.45m^3/m^3
		Gravel	0.75/m^3
9	Concrete C-10	Cement	2.40qt/m^3
	Total agg=1800kg.	Sand	35.50%
		Gravel	-
10	Concrete C-15	Cement	2.80qt/m^3
	Total agg=1800kg.	Sand	35.50%
11	Concrete C-20	Cement	3.20qt/m^3

ITEM	TYPE OF WORK		QUANTITIES
	Total agg=1800kg.	Sand	30.40%
		Gravel	-
12	Concrete C-25	Cement	3.60qt/m^3
	Total agg-1700kg	Sand	30.40%
		Gravel	-
13	Concrete C-30	Cement	4.0qt/m^3
	Total agg-1700kg	Sand	30.40%
		Gravel	-
14	Steel reinforcement (with 5% wastage 1/05kg/1qs		

1. Form Work For Sides of The Wall

a)	2.5 cm. thick boards (with 5% wastage	0.53 m^2/m^2
b)	50 X 75mm battens (with 5% wastage) (5 usages	0.84m/m^2
c)	50 X 125 mm (with 5% wastage) (10 usages)	0.105m/m^2
d)	Strut (6mm euclayptus)(10 usages	0.10m/m^2
e)	Nails claps etc	0.30 kg/m^3
f)	Mould oil	0.60 lit/m^2

2. **Soffit for work for slab props height not exceeding 800 mm**

a)	2.5cm thick boards (with 5% wastage) (4 usages)		0.17m^2/m^2
b)	30 X 100 mm battens (10 usages)	4.0m/m^2	0.42m/m^2
c)	75 X 125 mm beams (10 usages)	1.0m/m^2	0.105/m^2
d)	Props 60mm(20 usages)	3m/m^2	0.15/m^2
e)	20 X 100 mm Bracing (20 usages)	2m/m^2	0.15/m^2
f)	Nails		0.20 kg/m^2
g)	Mould oil		0.061lit/m^2

ITEM	TYPE OF WORK	QUANTITIES
3	Form work for edges of the slab width not exceeding 200mm	
	a) 2.5mm thick bards (4 usages)	0.53m/m^2
	b) 50 x 50 mm battens (10 Usages) 2m/m	0.25/m
	c) Nails	0.05 kg/m
4	Form work for face of the steps and edges of the slab width over 200mm but not exceeding 250 mm	
	a) 25 x 2.50mm boards (5 usages)	0.21m/m
	b) 50 x 50 battens (10 usages) 1.0m/m	0.11m/m
	c) Nails	0.05kg/m
	d) Mould oil	o.05 lit/m
5	Form work for sides of the footing width not exceeding 250 mm	
	a) 25mm thick boards (4 usages)	0.07m^2/m
	b) 50 x 50mm battens (10 usages)	0.32m/m
	c) Nails	0.05kg/m
	d) Mould oil	0.015 lit/m
6	Ditto, but width over 250 mm but not exceeding 350 mm	
	a) 25 mm thick board (usages)	0.10m^2/m
	b) 50 x 50 mm battens (10 usages)	0.38m/m
	c) Nails	0.07kg/m
	d) Mould oil	0.021 lit/m
7	Form work for sides of the ground beams & footing width over 450 mm	
	a) 25 mm thick boards (4 usages	0.27m^2/m^2
	b) 50 x 100 mm battens (10 usages) 3.0m/m^2	0.32m^2/m^2
	c) Struts 60mm(10 usages) 2.0m/m	0.21m/m^2
	d) Nails	0.20kg/m^2
	e) Mould oil	0.061 lit/m^2

ITEM	TYPE OF WORK	QUANTITIES
8	Form work for sides of foundation wall	
	a) 25 mm thick boards (4 usages)	0.27 m^2/m^2
	b) 50 x 70mm battens (10 usages) 5.5 m/m	0.47m/m^2
	c) 50 X 125 MM BEAMS (10 USAGES) 1.05 m/m^2	0.11m/m^2
	d) Strut 60 mm eucalyptus (10 usages) 1.0m/m^2	0.10m/m^2
	e) Nails	0.25kg/m^2
	f) Mould oil	0.06 lit/m^2
9	Form work for sides of the Foundation column	
	a) 25 mm thick board (4 usages)	0.27m^2/m^2
	b) 50 x 100 mm beams (10 usages 4.6m/m^2	0.49/m^2
	c) Struts 60mm Eucalyptus (10 usages)	0.10m/m^2
	d) Nails	0.20kg/m^2
	e) Mould oil	0.60lit/m^2
10	Form work for sides of the columns	
	a) 25 mm thick boards (4 usages)	0.27m^2/m^2
	b) 50 x 75mm battens (10 usages) 4.6 m/m^2	0.46m/m
	c) Struts 60 mm Eucalyptus (10 usages) 3m/m^2	0.20m/m
	d) Nails	0.30 kg/m^2
	e) Mould oil	0.6 lit/m^2
11	Form work for sides of the walls	
	a) 25 mm thick boards (4 usages)	0.27m^2/m^2
	b) 50 x 75 mm battens (10 usages) 4.2m/m^2	0.46m/m^2
	c) Beams 50 x 100mm (10 usages) 2.1m/m	0.20m/m^2
	d) Nails	0.30kg/m^2

ITEM	TYPE OF WORK	QUANTITIES
	e) Mould oil	0.06 lit/m^2
12	Form work for sides of the Walls	
	a) 25 mm thick boards (4 usages)	0.27m^2/m^2
	b) 50 x 45 mm battens (100 usages) 4.2m/m^2	04.2m/m^2
	c) 50 x 125 mm beams (10 usages) 1.05 m/m^2	0.105m/m^2
	d) Struts 60 mm eucalyptus (10 usages) 1m/m^2	0.10m/m^2
	e) Nails	0.30kg/m^2
	e) Mould oil	0.06 lit/m^2
	BLOCK WORKS CONCRETE BLOCK WORKS FOR FOUNDATION	
1	150 mm thick concrete hollow block foundation wall be added in cement mortar 1=4	
	a) Concrete hollow block	12.5pes/m^2
	b) Mortar (10 mm joints + 5% waste)	0.0138m^3/m^2
	c) Cement	0.04qts/m^2
	d) Sand	0.01m^3/m^2
	e) Hollows filled with concrete mortar 1=5	0.08m^3/m^2
	f) Cement	0.19 qts/m^2
	g(Sand	0.07m^3/m^2
2	Ditto but 200 mm thick	12.5 Pcs/m^2
	a) Concrete hollow block	12.5pcs/m^2
	b) Mortar	0.0184ml^3/m^2
	c) Cement	0.05qts/m^2
	d) Sand	0.01m^3/m^2
	e) Hollows filled with concrete mortar 1=5	0.11m^3/m^2
	f) Cement	0.26qt/m^2
	g) Sand	0.09m^3/m^2
3	Ditto but 250mm thick	

ITEM	TYPE OF WORK	QUANTITIES
	a) Concrete hollow block	12.5pcs/m^2
	b) Mortar	0.023m^3/m^2
	c) Cement	0.06qt/m^2
	d) Sand	0.02m^3/m^2
	e) Hollows filled with concrete mortar 1=5	0./14m^3/m^2
	f) Cement	0.33qts/m^2
	g) Sand	0.12m^3/m^2
	NATURAL STONE MASONRY FOR FOUNDATION	
4	400mm thick hard basaltic stone masonry foundation wall bedded in cement mortar 1-4 in full joints	
	a) Basaltic stone	
	1.25m^3/m^3 xx0.40m x 1.05 waste	0.53m^3/m^3
	b) Mortar	
	0.34m^3/m^3 x 0.40m x 1.05 waste	0.14m^3/m^2
	c) Cement	0.39qts/m^2
	d) Sand	0.112m^3/m^2
5	Ditto but one side roughly dressed and left for pointion.	
	a) Basaltic stone	
	1.35m3/m3 x 0.40m x 1.05 waste	0.56m^3/m^2
	b) Mortar	
	0.34m3/m3 x 0.040m x 1/05 waste	0.14m^3/m^2
	c) Cement	0.392qts/m^2
	d) Sand	0.11m^2/m^2
	BURNT BRICK WALLS FOR SUPER STRUCTURE	
6	120mm thick burnt brick wall bedded in cement lime mortar 1=2=9 both sides left for plastering	
	a) Brick	57.7pcs/m^2
	b) Mortar (with 15% Waste)	0.26m^3/m^2

ITEM	TYPE OF WORK	QUANTITIES
	c) Cement	0.31qts/m^2
	d) Lime	0.048qts/m^2
	e) Sand	0.02m^3/m^2
7	Ditto, bot 250mm thick	
	a) Brick	115.4pcs/m^2
	b) Mortar (with 15% waste)	0.06m^3/$m^2$1
	c) Cement	0.07qt/m^2
	d) Lime	0.11qt/m^2
	e) Sand	0.05m^3/m^2
	CONCRETE BLOCK WALLS FOR SUPER STRUCTURE	
8	100mm thick hollow concrete block wall bedded in cement lime mortar 1-2-9 both side left for plastering	
	a) Hollow concrete block	12.5pcs/m^2
	b) Mortar (with 15% waste)	0.0092m^3/m^2
	c) Cement	0.011qts/m^2
	d) Lime	0.02qts/m^2
	e) Sand	0.01m^3/m^2
9	Ditto but 150mm thick	
	a) Hollow concrete block	12.5pcs/m^2
	b) Mortar (with 15% waste)	0.0128m^3/m^2
	c) Cement	0.016qts/m^2
	d) Lime	0.2qt/m^2
	e) Sand	0.01m^3/m^2
10	Ditto, but 200mm thick	
	a) Hollow concrete block	12.5pcs/m^2
	b) Mortar with 15% waste	0.0184m^3/m^2
	c) Cement	0.021qt/m^2
	d) Lime	0.034qt/m^2
	e) Sand	0.014m^3/m^2

ITEM	TYPE OF WORK	QUANTITIES
11	Ditto but 250 thick	
	a) Hallow concrete block	12.5pcs/m^2
	b) Mortar (with 15% waste)	0.023m^3
	c) Cement	0.27qts/m^2
	d) Lime	0.042qts/m^2
	e) Sand	0.17m^3/m^2
12	NATURAL STONE MASONRY FOR SUPER STRUCTURE	
	350mm thick trachytic stone wall bedded in cement mortar 1=4 one side left for plastering and one side dressed and left for pointing,	
	a) Trachytic stone	
	1.33m^3/m^3 x 0.35 x 1.05 waste	0.49m^3/m^3
	b) Cement mortar	
	0.264m^3/m^3 x 0.35 x 1.05 waste	0.10m^3/m^2
	c) Cement	0.28qt/m^3
	d) Sand	0.08m^3/m^3
13	Ditto, but both sides dressed and left for pointing	
	a) Trachytic Stone	
	1.33m3/m3 x 0.35m x 1.10 waste	0.52m^3/m^3
	b) Cement Mortar	
	0.246m^3/m^3 x 0.35 x 1.05 waste	0.10m^3/m^2
	c) Cement	0.28qts/m^3
	d) Sand	0.08m^3/m^3
1	Lime Mortar 1=2	
	a) Lime	4.62qts/m^3
	b) Sand	0.96m^3/m^3
2	Cement Lime mortar 1=1=6	
	a) Cement	2.21qts/m^3

ITEM	TYPE OF WORK	QUANTITIES
	b) Lime	1.73qts/m^3
	c) Sand	1.08m^3/m^3
3	Cement Mortar 1=2=9	
	a) Cement	1.47qt/m^3
	c) Lime	2.31qt/m^3
	c) Sand	1.08m^3/m^3
4	Cement Mortar	
	a) Cement	0.82qt/m^3
	b) Sand	0.96m^3/m^3
5	Cement Mortar 1-2	
	a) Cement	5.88qt/m^3
	b) Sand	0.96m^3/m^3
6	Cement Mortar 1=3	
	a) Cement	4.41qts/m^3
	b) Sand	1.08m^3/m^3
7	Cement Mortar 1=4	
	a) Cement	3.53qt/m^3
	b) Sand	1.15m^3/m^3
8	Cement Mortar 1=5	
	a) Cement	2.94qts/m^3
	b) Sand	1.20m^3/m^3
9	Cement Mortar 1=6	
	a) Cement	2.52qt/m^3
	b) Sand	1.23m^3/m^3
10	Cement Pumice Light Weight Scred 1=6	
	a) Cement	2.52qt/m^3
	b) Pumice	1.23m^3/m^3
11	Ditto, but 1=8	
	a) Cement	1.96qt/m^3
	b) Pumice	1.28m^3/m^3

ITEM	TYPE OF WORK	QUANTITIES
12	(13mm thick plastor 1=2=9+6mm thickness for erregularition in wall + 10% waste)	
	a) Mortar (with 10% waste)	0.021m^3/m^2
	b) Cement	0.02qt/m^2
	c) Lime	0/05qts/m^2
	d) Sand	0.02m^3/m^3
13	Two coats of plastor, first coat in cement mortar 1=3 10mm thick + 6mm irregularities in wall + 10% waste	
	a) Mortar (with 10% Waste)	0.176m^3/m^3
	b) Cement	0.08qts/m^2
	c) Sand	0.02m^3/m^2
	Second in cement lime mortar 1=1=6	
	a) Mortar	0.0066m^3/m^2
	b) Cement	0.01qts/m^2
	c) Sand	0.01m^3/m^2
14	Three coats of plaster in cement lime mortar 1=2=9	
	13mm thick plaster in 1=2=9 + 6mm thickness for irregularities in wall + 10% waste	
	a) Mortar	0.021m^3/m^2
	b) Cement	0.03qts/m^2
	c) Lime	0.05qts/m^2
	d) Sand	0.02m^3/m^2
	3mm Thick fine lime mortar 1=2 + 10% Waste	
	a) Mortar	0.00
	b) Lime	0.92qts/m^2
	c) Sand	0.003$m^3/m^2$1
15	30mm thick cement sand 1=3 + 6mm	
	THICKNESS FOR IRREGULARITIES + 5% WASTE	
	a) Mortar	0.038m^3/m^2

ITEM	TYPE OF WORK	QUANTITIES
	b) Cement	0/168qts/m^2
	c) Sand	0.041m^3/m^2
	d) Cement Grout	1.5lit/m^2
16	Ditto, but 400mm thick	
	a) Mortar	0.048m^3/m^2
	b) Cement	0.212qts/m^2
	c) Sand	0.052m^3/m^2
	d) Cement grout 1=1	1/5lit/m^2
17	Ditto,bot 50mm thick 1=4	
	a) Mortar	0.059m^3/m^2
	b) Cement	0.208qts/m^2
	c) Sand	0.068m^3/m^2
	d) Cement Grout 1=1	1.5lit/m^2
19	Average 50mm thick light weight screeding in cement pumice screed 1=6 to roof slab (45 mm thick cement pumice screed 1=6+6mm thickness for irregularities in slab+5% waste)	
	a) Mortar	0.054m^3/m^2
	b) Cement	0.136ats/m^2
	c) Pumice	0/067m^3/m^2
	(5mm thick cement screeding for smoothing surface 15% waste)	
	a) Mortar	0/0053m^3/m^2
	b) Cement	0/013ats/m^2
	c) Sand	0/007m^3/m^2
	d) Cement Grout	1.5 lit/m^2
20	Ditto, bot 100mm thick	
	(96mm thick 81=6)	
	a) Mortar	0.106m^3/m^2
	b) Cement	0.267qts/m^2
	c) Pumice	0.131m^3/m^2

ITEM	TYPE OF WORK	QUANTITIES
	5mm thick cement screed	
	a) Mortar	0.0053m^3/m^2
	b) Cement	0.13qts/m^2
	c) Pumice	0.007m^3/m^2
	d) Cement Grout 1=1	1.5 lit/m^2
21	One coat of tyrdean type rendering in cement lime mortar 1=1=6 with cement colour +5%waste	
	a) Mortar	0.008m^3/m^2
	b) Cement	0.18qts/m^2
	c) Lime	0.014qts/m^2
	d) Sand	0.009m^3/m^2
22	Pointing of burne brick wall with Cement Mortar 1=3	
	a) Mortar	0.003m^3/m^2
	b) Cement	0.013qts/m^2
	c) Sand	0.003m^3/m^2
23	Pointing of fair faced concrete blook wall with cement mortar 1=3	
	a) Cement Mortar 1=3 + 15% waste	0.002m^3/m^2
	b) Cement	0.009qts/m^2
	c) Sand	0.002m^3/m^2
24	Pointing of dresses stone masonry wall with cement mortar 1=3	
	a) Cement Mortar + 15% waste	0.0055m^3/m^2
	b) Cement	0.024qts/m^2
	c) Sand	0.006m^3/m^2
25	15 x 57 Cement sand 1=3 skirting finished smooth with steel trowt	
	a) Cement sand screed 1=3 +6mm thickness for irregularities in beds +5% waste	0.0017m^3/m/
	b) Cement	0.007qts/m/
	c) Sand	0.002m^3/m/

ITEM	TYPE OF WORK	QUANTITIES
26	20mm thick terrazzo flooring in cement marble chipping screed 1=3	
	a) Cement sand screed 1=3 +6mm thickness for irregularities in floor beds + 5%waste	0.027m^3/m^2
	b) Cement	0.119ats/m^2
	c) Sand	0.029m^3/m^2
1	6 x 150mm x glassed ceramic wall tiles bedded in cement mortar 1=3	
	a) Ceramic tile (with 2% waste)	45.3pcs/m^2
	b) Mortar for bedding (with 10 waste)	0.011m^3/m^2
	c) Cement	0.49qts/m^2
	d) Sand	0.012m^3/m^2
	e) Cement grout for pointing with 20% waste	0.001m^3/m^2
2	Ditto but 7 x 73 x 145mm ceramic wall tiles	
	a) Geramic tiles (with 20% waste)	96.4pcs/m^2
	b) Mortar for bedding (with 105 waste)	0.011m^3/m^2
	c) cement	0.049qts/m^2
	d) Sand	0.012m^3/m^2
	e) Sand as above	0.012m^3/m^2
3	Ditto, but 7 x 50 x 100mm cement wall tiles	
	a) Cement tiles (with 2% waste)	204.0pcs/m^2
	b-e) Some above	
4	Ceramic tile skirting in 7 x 73 x 145mm tiles bedded incement sand screed 1=3	
	a) Garamic tiles (with 5% waste)	7.24pcs/m/
	b) Mortar 1=3 for bedding + 10%waste	0.001m^3/m
	c) Cement	0.004qts/m/
	d) Sand	0.001m^3/m/

ITEM	TYPE OF WORK	QUANTITIES
5	20 x 200 x 000 terrazzo tile (Cement tile) flooring bedded in cement screed 1=3	
	a) Terrazzo tile (Cement tile) with 2% waste)	15.5pcs/m^2
	b) 20mm thick bedding (with 10% waste)	0.022m^3/m^2
	c) Cement	0.097qts/m^2
	d) Sand	0.024m^3/m^2
	e) Cement grout for pointing (with 20% waste)	0.001m^3/m^2
	f) Polish	0.04gk/m^2
6	20 x 20 x 200mm terrazzo tile (cement tile) skirting bedded in cement screed 1=3	
	a) Terrazzo tile (cement tile skirting (with 5% waste)	5.3pcs/m/
	b) Mortar for bedding (with 10% waste)	0.0011m^3/m^2
	c) cement	0.lith/m/
	e) Sand	0.001m^3/m/
7	20mm thick marble slate flooring bedded in cement sand screed 1=3	
	a) Marble slate with 20 waste	1.02m^2/m^2
	b) 20mm thick bedding screed 1=3 + 10% waste	
	c) Cement	0.097qts/m^2
	d) Sand	0.024m^3/m^2
	e) Cement grout for pointing with 20% waste	0.001m^3/m^2
	f) Polish	0.04kg/m^2
8	15 x 75mm Marble skirting bedded in cement mortar 1=3	
	a) Marble state (with 50% waste	1.05m/m
	b) Mortar for bedding 9 with 10% waste)	0.001m^3/m^2
	c) Cement	0.004qts/m/

ITEM	TYPE OF WORK	QUANTITIES
	d) Sand	0.001m^3/m/
	e) Polish	0.01kg/m/
9	2 x 200 x 200mm plastic tile	
	a) Plastic tile (with 2; wastage)	25.5pcs/m^2
	b) Adhesine including waste	0.40lit/m^2
	c) polishing	0.04k/m^2
	d)	
10	8mm thick panel woira wood proguest	
	a) Wooden carpet with 3% waste)	1.03m^2/m^2
	b) Adhesiue including waste	0.40lit/m^2
11	15 x 100mm terrazzo skirting in while cement marble chipping screed 1=3	
	a) Terrazzo screed + 6mm thickness for irregularities in base + 5% waste	0.0022m^3/m/
	b) Cement grout 1=1	0.11 lit/m/
	c) polish	0.01 kg/m/
12	Wooden shirting intid wood fixed on the walls	
	a) 15 x 60mm tid wood +10% waste	1.10m/m
	b) Fixers + 5% waste	2.10pcs/m/
	Wooden Flooring	
	a) Boarding	1.10m^2/m^2
	b) Nails	0.6kg/m^2
	c) Floor Joint (c/c 30cm)	2.20 m/m^2
	d) Nails for floor joint	0.14kg/m^2
1	2 coats of plastic emulsion paint to masted surface	
	a) Priming Coat	0.10 lit/m^2
	b) Finishing coat	0.08 lit/m^2
2	Ditto , bot 3 coats	
	a) Priming coat	0.10 lit/m^2
	b) under coat	0.08 lit/m2

ITEM	TYPE OF WORK	QUANTITIES
	c) Finishes coat	0.07 lit/m2
3	2 Coats of plastic emulsion paint to wooden wall surface	
	a) Priming coat	0.01 lit/m^2
	b) Finishes coat	0.08 lit/m^2
4	Ditto bot 3 coats	
	a) Priming coat	0.01 lit/m^2
	b) Under coat	0.08 lit/m^2
	c) Finishing coat	0.07 lit/m^2
5	2 coats of oil paint (enamel) to wooden surface	
	a) Priming coat	0.100 lit/m^2
	b) Finishing coat	0.08 lit/m^2
6	3 Coats of varnish paint to wooden surface	
	a) First coat	0.08 lit/m^2
	b) Second coat	0.08 lit/m^2
	c) Finishing coat	0.07 lit/m^2
	d) Knotting	0.006 lit/m^2
7	One coat of cement paint to smooth plastered surface	
	a) Cement point with fine sand	6k/m^2
8	3 Coats of plastic emulsion paint to wooden (chip wood)ext. surface	
	a) Priming coat	0.08 lit/m^2
	b) Under Coat	0.08 lit/m^2
	c) Finishing Coat	0.07 lit/m^2
9	2 Coats of oil paint to wooden shirting girth not exceeding 100mm	
	a) Priming and finishing coat	0.032 lit/m^2
10	2 Coats of varnish paint to wooden surface	
	a) Priming Coat	0.08 lit/m^2

ITEM	TYPE OF WORK	QUANTITIES
	b) Finishing Coat	0.08 lit/m^2
	c) Knotting	0.006 lit/m^2
11	2 Coats of varnish paint to wooden shirting girth not exceeding 100mm	
	a) Knotting	0.08 lit/m2
	b) Priming coat	0.012 lit/m2
	c) Finishing	0.012 lit/m2
12	3 Coats of plastic emulsion paint to plaster Ceiling surface	
	a) Priming coat	0.01 Lit/m^2
	b) Under Coat	0.08 Lit/m^2
	c) Finishing Coat	0.012 Lit/m^2
13	3 Coats of hard glass oil paint (enamel) to wooden door surface	
	a) Priming coat	0.15 Lit/m^2
	b) Under Coat	0.13 Lit/m^2
14	3 Coat of hard glass oil paint(enamel) to wooden part of the windows	
	a) Priming Coat	0.02 lit/m^2
	b) Under Coat	0.06 lit/m^2
	c) Finishing Coat	0.06 lit/m^2
	d) Knotting	0.01 lit/m^2
	e) Putty	0.03 lit/m^2
15	3 Coats of Hard Glass Oil Paint(enamel) to Steel Door surface	
	a) Priming Coat	0.15 lit/m^2
	b) Under Coat	0.13 lit/m^2
	c) Finishing	0.12 lit/m^2
16	3 Coats of Hard Glass Oil Paint to Steel parts of the windows(Window areas Measured one Side)	
	a) Priming Coat	0.07 lit/m^2
	b) Under Coat	0.06 lit/m^2

ITEM	TYPE OF WORK	QUANTITIES
	c) Finishing coat	0.06 lit/m^2
17	3 Coats of Varnish paint to wooden door surface	
	a) Knotting	0.013 lit/m^2
	b) Priming Coat	0.13 lit/m^2
	c) Under Coat	0.12 lit/m^2
	d) Finishing Coat	0.12 lit/m^2
18	3 Coats of Varnish paint to wooden part of window(Window areas measured in one side)	
	a) Knotting	0.01 lit/m^2
	b) Priming Coat	0.13 lit/m^2
	c) Under Coat	0.12 lit/m^2
	d) Finishing	0.12 lit/m^2
19	2 Coats of plastic emulsion paint to wooden barge board and seffit boarding	
	a) Priming Coat	0.11 lit/m^2
	b) Finishing Coat	0.09 lit/m^2
20	3 Coats of oil paint (enamel) to galvanized Steel sheet down pipe size 100 x 100mm (girth 400mm)	
	a) Priming	0.03 lit/m^2
	b) Under Coat	0.04 lit/m^2
	c) Finishing	0.03 lit/m^2
21	3 Coats of oil paing (enamel) to galvanizal steel down pipe size 100x200	
	a) priming	0.03 lit/m^2
	b) under Coat	0.04 lit/m^2
	c) Finishing	0.03 lit/m^2
22	3 Coats of oil paint (enamel) to galvanized steel sheet flashing	
	a) Priming	0.07 lit/m^2
	b) Under Coat	0.08 lit/m^2
	c) Finishing	0.07 lit/m^2

ITEM	TYPE OF WORK	QUANTITIES
	1. Flat asbestos sheet, chip wood, and so on +5% wastage per m^2 area for wall causing	
	2. Chip wood, hard board, safe board, flat asbestos sheet and so on 5% wastage per m^2 area for ceiling covering	
	3. a) mm thick glass + 10% wastage for m^2 area.	
	b) Putty 0.50 kg/m^2 area.	
1	50 x 150mm zigba wood floor joint on peates + 10% waste	1.10m/m
	b) Nails	0.07kg/m
2	50 x 100mm zigba wood stud (ples) +10% waste	1.10m/m
3	25 x 150mm zigba wood lower and upper cord Intrusses + 10% waste	1.10m/m
	b) Nails	1.10kg/m/
	50 x 100mm zigba wood diagonals and vertical intrusses + 10% waste	1.10m/m
	b) Nails	0.10kg/m/
4	50 x 100mm zigba wood raffers + 10% waste	1.10m/m
	b) Nails	0.07kg/m/
5	50 x 100 mm zigba wood purlins + 10% waste	1.10m/m
	b) Nails	0.07kg/m/
	80mm eucalyptus wood lower and upper cord intrusses x 15% waste	1.15m/m
	b) Nails	0.04kg/m
	c) Fixing bands	0.12kg/m/
	60mm eucalyptus wood diagonals and verticalsin trusses + 15% waste	1.15m/m
	b) Nails	0.04kg/m/
	c) Fixing bands	0.12kg/m/
	100mm eucalyptus wood ruffers + 15% waste	0.15m/m

ITEM	TYPE OF WORK	QUANTITIES
	b) Nails	0.07kg/m
	c) Fixing bands	0.06kg/m
	70mm eucalyptus wood ruffers + 15% waste	0.15m/m
	b) Nails	0.04kg/m
	c) Fixing bands	0.06kg/m
	30 x 70mm zigba wood battens for wooden wall frames + 10% waste	1.10m/m
	b) Nails	0.07kg/m
	Planed 1 swan tid wood fascial board, barge board + 10% waste	10.10m/m
	b) Gal, Nails	0.03kg/m
13	50 x 50mm Zigba battens for chip wood ceiling + 10% waste	1.10m/m
	b) Nails	0.05kg/m/
14	15 x 14mm plened wood fillets + 10% waste	1.10ml
	b) Gal, Nails	0.01kg/m1
	BITUMINOUS DAMP PROOFING FOR WALLS:	
1	Bituminous damp proofing for plastered wall surface	
	a) One coat bituminous emulsion for primes + 5% waste	0.42kg/m^2
	b) One coat of hot bitumen + 5% waste	1.58kg/m^2
	c) Heating gas	0.05kg/m^2
2	Ditto, but 2 coats of hot bitumen	
	a) Same as above	0.42kg/m^2
	b) Two coats of hot bitumen +5% waste	3.15kg/m^2
	c) Heating gas	0.10kg/m^2
3	Damp proofing course under walls, width not exceeding 25cm	
	a) One coat of bitumen for primer +5% waste	0.11kg/m
	b) One Coat of bitumen + 5% waste	0.40kg/m

ITEM	TYPE OF WORK	QUANTITIES
	c) Heating gas	0.013kg/m
5	Ditto, but two coats of bitumen emulsion	
	a) Same as above	
	b) Two coats of bitumen emulsion +5% waste	1.58kg/m^2
	BITUMINOUS WATER PROOFING FOR WALLS	
1	BITUMINOUS WATER PROOFING FOR PLASTERED CONCRETE WALLS	
	a) One coat of bitumen emulsion for primer +5% waste	0.32kg/m^2
	b) One ply of glass fiber membrane +5% waste and over lap	1.15m^2/m^2
	c) Sealing coat +5% waste	0.79kg/m^2
	d) Bitumen emulsion for embedding (2x 0.75kg/m^2)+5% waste	1.58kg/m^2
2	Ditto, but two plies of glasses fiber membrane	
	a) Same as above	
	b) Two plies of glasses fiber membrane +5% our leep and waste	2.30m^2/m^2
	c) Bitumen emulsion for embedding (4 X 0.75kg/m^2) + 5% waste	3.15kg/m^2
	d) Sealing coats +5% waste	0.79kg/m^2
	BITUMINOUS DAMP-PROOFING FOR FLOORS	
1	Damp Proofing for ground slab (screeded base)	
	a) One coat of bitumen emulsion for primes coat +5% waste	0.42kg/m^2
	b) One coat of hot bitumen ontto ground slab +5% waste	1.58kg/m^2
	c) Heating gas	0.05kg/m^2
2	Ditto but 2 coats of hot bitumen	0.42kg/m^2
	a) Same as above	
	b) Hot Bitumen (2 coats x 1.50kg/m^2)+5% waste	3.15kg/m^2

ITEM	TYPE OF WORK	QUANTITIES
	c) Heating gas	0.10kg/m^2
3	Damp proofing one screeded base	0.42kg/m^2
	a) One coat of bitumen emulsion for primer +5% waste	0.42kg/m^2
	b) One coat of bitumen emulsion layer +5% waste	0.79kg/m^2
4	Ditto, bot two coat of bitumen emulsion	
	a) Same as above	
	b) Bitumen emulsion (2 coats x 0.75kg/m2)+5% waste	1.58kg/m^2
	BITUMINOUS WATER-PROOFING FOR FLOORS	
1	Bituminous water proofing for screeded base	
	a) One coat of bituminous emulsion for primes + 5% waste	0.32kg/m^2
	b One ply of glass fiber members +15% out lap & waste	1.15m^3/m^2
	c) Bitumen emulsion embedding (2x0.75kg/m^2)+5% waste	1.58kg/m^2
	d) Sealin coat + 5% waste	0.79kg/m^2
2	Ditto, bot two place of glass fiber membrane	
	a) Same as above	
	b) Tow plies glass fiber membrane + 15%our lap and waste	2.30m^2/m^2
	c) Bitumen emulsion for embedding (4 x 0.75kg/m^2)+5% waste	3.16kg/m^2
	d) Sealing coat +5% waste	0.79kg/m^2
	BITUMINOUS ROOFING	
1	a) One coat of bitumen emulsion primer +5% waste	0.32kg/m^2
	b) One ply of glass fiber membrane + 15% for our laping & waste	1.15m^2/m^2
	c) Bitumen emulsion for embedding (4 layers x 0.75kg/m2) +5% waste	0.32kg/m^2

ITEM	TYPE OF WORK	QUANTITIES
2	Ditto, bot two plies of glass fiber membrane	
	a) Same as above	
	b) Two plies glass fiber membrane +5% for our lapping & waste	2.30m^2/m^2
	c) Bitumen emulsion for embedding (4 layers x 0.75kg/m2)+5% waste	4.73kg/m^2
	d) Reflecting finish) 2 coat x 0.15kg/m2) +5% waste	0.32kg/m^2

ITEM	TYPE OF WORK	QUANTITIES
ITEM	DESCRIPTION	QUANTITIES
1	Supply and install 100mm concrete pipe layed on leveled base and joints comere in 100mm wide bituminous felt strip	
	a) 100m c.p. +5% waste	1.05m/m
	b) Bituminous felt strip 100mm wide +5%waste	0.45m/m
2	300mm concrete ring pit on a levelled ground with joints filled in cement mortar 1=2 including R/.C/ cover and con ection for in let and let pipes	
	a) 300mm Concrete ring (1=100mm)+5% waste	1.05pcs/no
	b) Concrete for cover 1=4	0.020m/no
	c) Mortar for joints	0.005m3/no
	d) Reinforcement	1kg ino
3	Ditto, bot 400mm	
	a) Same as above	
	b) Concrete for cover 1=4	0.03m^3/no
	c) Same as above	
	d) Same as above	
4	Supply and install 100mm concrete pipe in trenches layed on a sand bed with joints filled in cement mortar 1=2	
	a) 100mm c.p. + 5% waste	1.03m/m
	b) Mortar 1=2 for joints	0.002m^3/m
5	Ditto, bot 150mm	
	a) 150mm c.p.+5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.003m^3/m
6	Ditto, bot 200mm	
	a) 200mm c.p. + 5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.004m^3/m
7	Ditto, bot 300mm	
	a) 300mm c.p. + 5% waste	1.05m/m

ITEM	TYPE OF WORK	QUANTITIES
	b) Mortar 1=2 for joints	0.006m^3/m
8	Ditto, bot 400mm	
	a) 400mm c.p. +5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.009m^3/m
9	Ditto, bot 500mm	
	a) 500mm c.p. +5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.010m^3/m
10	Ditto, bot 600mm	
	a) 800mm c.p. + 5% waste	1.05 m/m
	b) Mortar 1=2 for joints	0.017m^3/m
11	Ditto, bot 800mm	
	a) 800mm c.p. + 5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.18m^3/m
12	Ditto, bot 100mm	
	a) 1000mm c.p. + 5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.18m^3/m
13	Supply and install 100mm concrete pipe surrounded with sand layer under ground slab with joins filled in cement mortar 1=2	
	a) 100mm c.p. + 5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.002m^3/m
	c) Sand surroundings	0.10m^3/m
14	Ditto, bot 150mm	
	a) 150mm c.p. +5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.003/m/m
	c) Sand surroundings	0.14m^3/m
15	Ditto, bot 200mm	
	a) 200mm c.p. +5% waste	1.05m/m
	b) Mortar 1=2 for joints	0.004m^3/m
	c) Sand surroundings	0.18m^3/m

COVERING CAPACITY OF PAINT ETC. ON VARIES SURFACES (APPLIED BY HAD)

ITEM	D E S C R I P T I O N S	SQUARE METERS COVERED BY LITERS
1	Special aluminum priming coat on planed	20
2	Lead priming wat coat on planed timber	12
3	First a coat of oil painted after priming	16
4	Second coat	18
5	Third coat	22
6	First coat of oil paint on previously paintor timber	18
7	Second coat	20
8	Oil glass paint applied as finishing coat	24
9	Under coat for enamel	20
10	Enamel on prepared surface-first coat	14
11	Enamel on prepared surface-Second coat	18
12	Flat finish for varnish	22
13	Finish on prepared surface-first coat	16
14	Finish on prepared surface-Second coat	20
15	Stain applied to planed timber	16
16	Stain applied to un wrought timber	10
17	Priming coat on brick or stucco	8
18	Priming coat on concrete, compo or stone	10
19	Priming coat on plaster	14

ITEM	D E S C R I P T I O N S	SQUARE METERS COVERED BY LITERS
20	First coat oil paint after priming	12
21	Oil glass paint applied as a finishing coat	18
22	Priming coat on smooth iron	20
23	Priming coat on slightly rusted iron	14
24	Priming coat on rust-pitted iron	10
25	First coat after priming	20
26	Second after priming	24

ITEM	D E S C R I P T I O N	PAIN REQUIRED IN KGS
1	Aluminum priming coat on planed timber	m^2---0.10
2	Lead priming coat on planed timber	m^2 -0.22
3	First coat of paint on priming	m^2 -0.15
4	Second coat	m^2 -0.14
5	Third coat	m^2 0.11
6	Oil glass finishing coat as third coat	m^2 -0.11
7	First coat of paint on previously coated timber	m^2 -0.10
8	Second coat	m^2 -0.14
9	Oil glass finishing coat as third coat	m^2 -0.13
10	Margins of floors -first coat	m^2 -0.11
11	Margins of floors -Second coat	0.16
12	Margins of floors -third coat	0.14
13	Margins to read and risers -first coat	0.11
14	Margins to read and risers -Second coat	0.16

ITEM	D E S C R I P T I O N	PAIN REQUIRED IN KGS
15	Margins to read and risers -third coat	0.14
16	Narrow moulding silirting, etc, 75mm girth	100 meter - 1.1
17	Narrow moulding silirting, etc, 150mm girth	100 meter -2.2
18	Narrow moulding silirting, etc, 225mm girth	100 meter -3.3
19	Priming coat on brick or stucco	M^2 - meter 0.35
20	Priming coat on concrete, stone, or conpo	M^2 - meter 0.20
21	Priming coat on brick or stucco	M_2 - meter 0.35
22	First coat of paint after priming	M_2 - meter 0.21
23	Oil glass paint as finishing coat	M_2 - meter 0.21
24	Rafter end per 300mm length or less	Each - 0.02
25	Sash frames	100 meter-0.35
26	Small sash squares	m^2 - 0.18
27	Sash squares	m^2 - 0.11
28	Large sash squares	m^2 - 0.08
29	Extra large sash squares	m^2 - 0.06
30	Sash edges	M - 0.02
31	Shelf edges	M _ 0.01

ITEM	TYPE OF PAINT	WEIGHT IN KGS PER LITER
1	While lead paint with out colour	3.00
2	Lead based paints of light colour-cream grey, stone, etc.	2.75
3	Lead based paints of dark colour-re, brown	2.60
4	Lead based paint of green colours	2.50
5	Block paint	2.20
6	Oil glass paint	3.00
7	Lead priming coat for wrought timber	3.00
8	Special aluminum priming for wrought timber	2.00
9	Priming coat for brick, stucco and plaster	2.60
10	Priming coat for concrete, campo & stone	3.00
11	Priming coat for iron coxide paint	2.00
12	Enamel	3.00
13	Stain	1.30
14	Varnish	1.40

1. The absolute volume material, is the minimum volume of the material with all voids remove, is given by the equations.

$$\text{Absolute Volume} = \frac{\text{Weight of material in kilograms}}{\text{Specific gravity x weight of } 1m^3 \text{ of water}}$$

$$= \frac{\text{Weight of material in KGS.}}{5.E \times 1000kg}$$

NAILS	PCS	KGS
1cm	950	1
2cm	815	1
4cm	546	1
6cm	275	1
7cm	180	1
8cm	127	1
10cm	63	1
12cm	44	1
15cm	29	1

Roofing nails = 1kg = 105pcs

Roofing nails = 1PKTS = 3kgs = 315 pcs

Assumption

A: Roofing Work

- Roofing nails = 14pcs per C.I.S
- Purlin = 8cm nails
- Truss = 10 or 12cm nails - 20 - 35pcs/truss

B: Ceiling Work

- Battens = 8cm nail - 16per m^2
- Chip wood = rcm nail - 80pcs per pcs of chip wood or 25pcs per m^2

C: Beams

6cm nails - 60pcs 1m1
12cm nails - 6-8 pcs 1m1 (stiffenins)
1 gallon of paint = 4kg
7 meter band iron = 1kg

ITEM	TYPE OF WORK	QUANTITY
	FENCE WORK	
1	100 x 100mm our all length 2400mm fence post with	1.05pcs/no3
	a) Wood sanic in to concrete base + 5% waste	1.05pcs/no3
	b) Start 50 2400mm fence post	1.02 m/m
	c) barbed. wire fencing +2% waste	0.52pcs/m/
	d) Fixing clips 45% waste	
	HARD CORING	
1	20cm thick basaltic stone hard coring	
	a) Basaltic stone	
	0.20m x 1.15 decrease and waste	$0.23m^3/m^2$
2	Coarse gravel filling for hard core to a finished thickness of 15cm	
	a) Coarse gravel	
	0.15m x 1.15 decrease and waste	$0.17m^3/m^2$
	ROOF WORK	
1	28 Gage roofing sheet	
	b) Fixers with plastic washers + 5% waste	$4.2pcs/m^2$
2	400mm wide 28 gage roof ridge	$0.46m^2/m$
	b) Fixers +5% waste	4.30pcs/m/
3	500mm wide roof valley covers in 28 gage sheet + 5% waste	$0.27m^2/m$
	b) Fixers + 5% waste	4.30 pcs/m/
4	Eaves gutter 100 x 100mm (girth not exceeding 400mm)	
	a) 0.5mm gal. steel sheet + 5% waste	
	($0.42m^2$/m1 x $4.12kg/m^2$)	1.73kg/m1
	b) 3 x 20mm L= 400mm steel brake to +5% waste	0.20kg/m1
	c) Fixer	0.02kg/m1

10. Form Work

Material cost

Boarrd 0.013(1200)=15.60
Botten 0.006(1200)=7.20
Eucal 1.50x1.50= 2.25
Nail 0.30x3.41 =1.03
26.35

Labour cost

Carpenter 1x30=30
Helper 1x20=20
Labour 1x6= 6
56

Production/day =7m^2
cost/m^2=56/7=8Birr
Small tools 1%(26.35+8)=0.34
Total=26.35+8+0.34=34.69
Over head= 30%(34.69)=10.4
Total=34.69+10.41=45.10
=45 Birr/m^2

11. Reim for cement Ø 6mm

Material cost

Ø- 1.05x327=3.43
Tyipwrirs-0.02x5=0.10
3.53

Labour sost

Bar Bender 1x30=30
Labour 2x6 =12
42

Performance/day=60kg
cost/kg=42/60=0.70

Small tools cost=5%(3.53+0.70)=0.21

Sub Total = 3.53+0.70+0.21)=444
Over head=3%(444)=1.33
Total=444+1.33=5.77=5.80 Birr/kg

b.Ø 8mm

Material cost

Ø8mm=1.05x3.27=3.43
Tbingwires=0.02x5=0.10
3.53

Labour cost

Bar Bender 1x30=30
Labour 2x6=12
42

Production/day=70kg

cost/kg=42/70=0.60

Small tools cost=5%(3.53+0.6)=0.21
sub total=3.53+0.60+0.21=4.34

Over head =30%(4.34)=1.30
Total=4.34+1.30=5.64=5.65Birr/

12. Stone Wall

Material cost

Stone 1.30x15=19.50
Cement 1.01x33.75=34.09
Sand 0.29x70=20.30
73.89

Labour cost

Mosan 1x30=30
Labour 2x6 =12
42

Production/day=2m^3
cost/m^3=42/2=21

Small tools cost=2%(73.89+21)=1.96
Sub total =73.89+21+1.90=96.79

Over head=3%(96.79)=29.04

Total=96.79+29.04=125.82=126Birr/

13. Bkg Block 20cm think

Material cost

Block 16x1.65=24.80
Cement 0.021x33.75=0.71
Lime 0.36x30= 1.05
Sand 0.013x70=0.91
27.50

Labour cost

Masum 4x30=30
Labouer 2x6=12
42

7. Lean Concerte cs

Material cost

Cement	1.50x33.75=50.63	= 60
Sand	0.55x70 =38.50	= 55
Ags	0.95x50 =47.50	= 44
Water	0.30x0.50 =.0.15	
	136.78	259

Labour Cost

PLastere	2x30=60	2x35 = 70
Labouer	30x6=180	180
	240	250

Production/day=20m^3 =

Cost/m^3=240/20=12 = 12.5

Eqlipment Cost

Mixer	1x25=25
Vibrator	1x5 = 5
	30

performance/hr=2.5m^3

Cost/m^3=30/2.5m=12

Small tools cost=2%(136.75+12+12)=3.22

Total=136.78+12+12+3.22=164

Over head=30%(164)=49.70

Total=164+49.20=213.20=213 Birr/m^3

8. Concrete C.15

Material Cost

Coment	2.80x33.75	=94.50
Sand	0.55x70	=38.50
Ags	0.95x50	=47.50
Water	0.50x0.30	= 0.15
		180.65

Labour Cost

Plasterer	2x30	=60
Laboure	30x6	=180
Carpenter	1x30	=30
Fore man	1x35	=35
		305

Performance/day=18m^2

Cost/m^2=305/18=16.94

Small toola Cost=2%(180.65+16.94+13.33)=4.22

Total=180.65+16.94+13.33+4.22=215.14

Over head=30%(215.14)=64.54

Total=215.94+64.54

=279.65

=280Birrm^3

9. Concrete C.20

Material Cost

Cement	3.20x33.75=108	
Sand	0.50x70	=35
Ags	0.90x50	=45
Water	0.50x0.30	=0.15
		188.15

Labour Cost

Plasterer	2x30=60
Labour	45x6=270
carpenter	1x30=30
Barbender	1x30=30
Forman	1x35=35
	425

Performance/day=15

Cost/m^3=425/15=28.33 Birr

Equipment Cost

MIxer	1x25=25
Vibretar	2x5 =10
	35

Performance/hr=1.90

Cost/m^3=35/1.90=18.42

Small tools cost=

2%(188.15+28.33+18.42)=4.70 Birr

Total=188.15+28.33+18.42+4.70=239.60

Over head=30%(239.60)=71.88

Total=311 Birr/m^3

1, Site Clearance,200 mm thick

Labaur cost

labourer 1x6=6

per formance day= $4m^2$

cost/m^2=6/4= 1.50 Birr

Small tools cost =10/0(1.50)=0.02

Total=1.5+0.02=1.52

Overhead=30%(1.52)=0.46

Total=1.52+0.46=1.98=2.00Birr/m^2

2.Excavation up to 1.5m

Labour cost

Labourer 1x6=6

performance/ day=$1m^3$

cost/m^3= 6/1=6Birr

Small tools cost=1%(6)=0.06

Total=6.06

Over head=30%(6.06)=1.82

Total=6.06+1.82=7.87=785 Birr/m^2

3. Excavation,over 1.5m

Labour cost

Labouere=1x6=6

Performance/day=0.83m^2

cost/m^3=6/0.83=7.23Birr

Small tools cost=1%(7.23)=0.07

Total=7.23+0.07=7.30

Over head=30%(7.30)=2.19

Total=7.30+2.19=9.50 Birr/m^3

Reinforcement penalty Prescription

4. Back fill fromsite

Labour cost

Labourer=1x6=6

Performance/day=1.12m^3

cost/m^3=6/1.12=5.36

Small tools cost=1%(5.36)=0.05

Total=5.36+0.05=541

Over hrad=30%(5.41)=1/62

Total=5.41+1.62=7.00 Birr/m^3

5. Cart away

Labour cost

looder 1x150=150

truck 1x100=100

252

performance/hr=42m^3

cost/m^3=252/42=6

Over head=30%(6)=1.80

Total=641.80=7.80 Birr/m^3

6. Hard core 25cm

Material cost

Stone 0.26x15=390= 390

crushed stone 0.03x30=0.90

4.80

Labour cost

Mason 1x30=30

Labouere 6x6=36

66

performance/day=16m^2

cost/m^2=66/16=4.13

Equipment Cost

Roller 1x30=30

performance/hr 50m^2

Cost/m^2=30/50 =0.6

Small tools Cost=1%(4.80+4.13+0.60)=0.

Total=4.80+4.13+0.6+0.10=9.63

Over head=30%(9.63)=289

Total=9.63+289=12.52=12.55 Birr/m^2

18. 5x7cm zigba Wood puriln

Matatal cost

Zigba	0.004(1200)=4.83	
Nail	0.07 (6.95)=0.49	
Preservetive	0.07x4	=0.28
		5.60

Labour cost

Carpenter	1x30=30
Helper	1x20=20
Lsbour	1x6 = 6
	56

Production/day=80m
cost/m=56/80=0.70
Small tools cost =2%(5.60+0.70)=0.13
Sub total =5.60+0.70+0.13=6.43
Over head =30%(6.43)=1.93
Total=6.43+1.93=8.35Birrm

19. Fascia Board 25x3cm

Material cost

Kerrero fascia	=	1.05x12=12.60
Oil paint	=	0.06x11.10=0.66
Nail	=	0.10x341=0.34
		13.60

Labour cost

Carpenter	= 1x30=30
Helper	= 1x20=20
Labour	= 1x6 = 6
	56

Per formance/day=25m
cost/m=56/25=2.24
Small tools cost 2%(13.60+2.24)0.32
Sub total =13.60+2.24+0.32=16.16
Over head =(16.16)=4.85
Total =16.16+4.35=21.01=21 Birr/m

20. Flush door 88x208 cm

Material cost

Door Co mplete	2.27x350=794.50
Rarnish	1.13x13=14.69
	809.19

Labour cost

Carpenter cost	1x30=30
Helper	1x20=20
Labouer	1x 6= 6
	56

Perfatmance/day =2 door
cost/per= 56/2=28 Birr
Transport/ =20 Birr/pes
Small tools cost=10%(809.19+28.20(
=8.57
Sub total =809.19+28+20+8.57-
865.76
Over head=30%(865.46)=259.73
Total=865.46+259.73 =1125.4

Cost/m^2= 1125.49 / 0.88x2.59 = 495.89 Birr/

21. Window 198x158c

Material cost

Window	3.13x330	=1032.90
Transport		= 15
		1047.90

Wi Transport

Labour cost

Carpentor	1x30	=30
Helper	1x20	=20
Chisler	1x18	=18
Labourer	1x 6	= 6
		74

Prouduction/day=2.5 Psc
Cost/pcs =74/2.5=29.60
Samal tools cost=1%(1047.90+29.60
=1074

Production/day=7m^2

cost/m^2=42/7=6

Small tools cost=2%(27.50+60=0.67

Sub Total= 34.17

OOver head=30/(34.17)=10.25

Total=34.17+10.25=44.42

=44.50 Birr/m^2

B.15cm think

BLock	12.30x1.55	=19.07
Cement	0.016x33.75	=0.54
Lime	0.03x30	=0.90
Sand	0.01x70	=0.70
		21.21

Labour cost

same as a b:-

Small total cost=2%(21.21+6)=0.54

Sub total =21.21+6+0.54=27.75

Over head=30%(27.75)8.32

Total=27.75+8.32=36 Birr/m^2

14. Garge Roof/over

Material cost

garage 30 (b.)	=1.25x17.24	=21.55
Nail	=0.07x6.95	= 0.49
Ridge cover	=0.20x10	=2.00
		24.04

Labour cost

Carpenter	1x30	=30
Halper	1x20	=20
Labouer	1x6	= 6
		56

Proudaction/day=15m^2

cost/m^2=56/15=3.73

Samll tools cost=1%(24.04+3.730=0.28

Sub total=24.04+3.73+0.28=28.05

Over head=30%(28.050=8.42

Total=28.05+8.42=36.47

36.50 birr/m^2

15.Gatter G 30,der 33

Material cost

flat sheet	0.35x21	=7.00
Nail	0.07x6.95	=0.49
		7.49

Labour cost

Carpenter	1x30	=30
Labour	1x6	= 6
		36

Production/day=6m

cost/mt=36/6=6

Folding cost= 12Birr/m

Samll tools cost=2%(749+6+12)=0.51

Over head =30%(260=4.80

Total=26+7.50=33.80

=34Birr/mk

Dawn

16. Dalon pipe 6x10=32 davolopment

Based on item 15

$\frac{0.34x34}{0.35}$= 33 Birr/m

17.Eucalyptus truss Ø 10-12cm

Material cost

Eucalyptus ECudyptus	=1.30x1.50	=1.95
Metal Bard	=0.15x3	=0.45
Nail	=0.06x6.95	=0.48
Centi Termite	=0.12x4	=3.30

Lab our cost

Carpenter	=1x30	=30
Helper	=1x20	=20
Labour	=1x6	6
		56

Production/day=30m

cost/m=36/30=1.87

Small tools cost=2%(3.3+1.87)=0.10

Sub/m total=3.3+1.87+0.10=5.27

Over head = 30%(5.27)=1.58

Total=5.27+1.58=7.00Birr/m

Sub Total = 1047.90+29.60+10.74
= 1088.24
Over head = 30% (1088.24) = 326.47
Total = 1088.24 + 326.47 = 1414.71
Cost/ml = 1 x 1414.71/3.13 = 451.98 Birr

22. Metal Dorr 1 16 x 2.58cm

Material Cost

Door 2.99 x 3.80 = 1136.20
Transport = 20.-
1156.20

Labouf Cost

Performance/day = 1.70 pes
Cost/pes = 74/1.70 = 43.58
Small tools cost = 1% (1156.20+43.53) = 12
Sub total = 1156.20+43.50+12 = 1211.73
Over head = 30% (1211.73) = 363.52
Total = 1211.73+363.52 = 1575.25
Cost/m^2 = 1575.25/2.99 = 526.84 Birr/ml

23. Plaster 3 Coats

Material Cost

Cement 0.06x33.75 = 2.03
Lime 0.08x30 = 2.40
Sand 0.03x70 = 2.50

Labour Cost

Plaster 1 x 30 = 30
Labourer 1 x 6 = 6
36
Production/day = 6m
Cost/m = 36/6 = 6 Birr

Small tools cost = 2% (6.53+6) = 0.26
= 6.53+6+0.25 = 12.78
Over head = 30% (12.78) = 3.83
Total = 12.78+3.83 = 16.61 = 16.65 Birr

.../

24. Tyrolen render

Material Cost

Cement = 0.07x33.75 = 2.36
Lime = 0.15x 30 = 1.50
Sand = 0.04x 70 = 2.30
6.66

Labour cost

see item 23 = 36 birr
Production/day = 45m
Cost/m^2 = 36/45 = 8 Birr
Small tools cost = 2% (6.66=8) = 0.29
Sub total = 6.66+8+0.29 = 14.95
Over head = 35% (14.05) = 4.49
Total = 14.06+4.49 = 19.45 Birr/m

Labour Cost

Pavior 1 x 35 = 35
Labour 1 x 6 = 6
41
Performance/day 4m^2
Cost/m^2 $4\frac{1}{4}$ = 10.25
Small tools cost = 1%(1226

25. Screed 1:3

Material Cost

Cement = 4.41x33.75 = 147.74
Sand = 1.08x70 = 75.60
223.34

Labour Cost

Plaster 1x30 = 30
Helper 1x20 = 20
Labourer 1x6 = 6
56

Production/day = 0.30m^3
Cost/m^3 = 56/0.3 = 186.66
Small tools cost 2% (223.34+186.66)=3.20
Sub total = 223.34+186.66+3.20 = 418.20
Over head = 30% (418.20) = 125.46
Total = 418.20+125.46 = 543.66 Birr/m^3

26. Ceramie wall tile

Material Cost

Tile = 0.47x250 = 117.50
Ceramie mortal = 0.012x418.20 = 5.01
122.51

.../

Labour Cost

Pavior 1x35 = 35

Labourer 1 x 6= 6

41

Performance/day $4m^2$

Cost/m^2 41/4 = 10.25

Small tools cost = 1% (122.00+10.25)1.35

Sub Total = 122.50+10.25+1.33 = 134.08

Over head = 30% (134.08) = 40.22

Total = 134.08+40.22 = 174.30

= 174. Birr/m^2

27. PVC flooring

Material Cost

Tile 4.05x41 = 43.05

Adhe .40x100 = 40.-

83.05

Labour Cost

Pavior 1x30 = 30

Labourer 1x6 = 6

36

Production/day = $6m^2$

Cost/m^2 = 36/6 = 6 Birr

Small tools cost = 1% (83.05+6)=0.89

Sub total = 89.94

Over head = 30% (89.94)+26.98

Total = 89.94+26.98

117 Birr/m^2

28. Granite Flooring

Material Cost

Tile 1005x17 = 17.85

Grouting 0.0001x418.2 = 0.17

18.02

Labour Cost

Pavior 1x30 = 30

Labour 1x6 = 6

36

Performance/day = $15m^2$

29. 10cm concrete pipe

Material Cost

Pipe 1.10x14.15 = 15.56
Masn 0.025x20 = 0.50
16.06

Labour Cost

Mason 1x30 = 30
Labour 2x6 = 12
42

Production/day = 20m
Cost/m = 42/20 = 2.10
Small tools cost = 2% (16.06+2.10)=0.36
Sub total = 16.06+2.10+0.36 = 18.52
Over head = 30% (18.52) = 5.56
Total = 18.52+5.56 = 24.08
Excavation + Cartawy = 24.08+3.71=27.79
28 Birr

30. Terrazyo Window cill

Material cost

Tile 1.05x22.5 = 23.63
Groting 0.0002x418.20=0.08
23.71

Labour Cost

Mason 1x30 = 30
Labour 2x6 = 12
42

Performance/day = 15m 4
small tools cost = 1% (23.71+2.30)=0.27
sub total = 26.78
over head = 30% (26.78) = 8.03
Total = 26.78+8.03 = 34.81
= 35 Birr/m

31. Chip wood cutting, 8mm thick

material cost

chip wood 1.66x8 = 8.70
betten 3.15x3.20 = 10.08
eucalyptes 2.20x1.25 = 2.75
24.83

.../

GENERAL FORMULA

1. Concrete Mix ratio = 1:2:4

Let Volume of concrete = Z m^3 \

Then a) Cement = 1/7 x Zm^3 x 1400 kg/m^3 x 1.30
Shrinkage x 1.05 wastage
= 273 kgs Z
= 0.19 m^3 Z

b) Sand =2/7 x Zm^3 x 1840kg/m^3 x 1.30
Shrinkage x 1.05 wastage
= 718 kgs Z
= 0.39m^3 Z

c) Gravel = 4/7x Zm^3 x 2250 kg/m^3 x 1.30
Shrinkage x 1.05 wastage
= 1755 kgs Z
= 0.95 m^3 Z

2. Lime Mortar Mix Ratio = 1:4

Let Volume of Lime Mortar = Ym^3

Then - a) Lime = 1/5 x Ym^3 x 1900 kg/m^3 x 1.20
Shrinkage x 1.05 wastage
= 479 kgs Y
= 0.25 m^3 Y

b) Sand = 4/5 x ym^3 x 1840 kg/m^3 x 1.20
Shrinkage x 1.50 wastage
= 1855 kgs Y
= 1.01 m^3 Y

3. Cement Mortar Mix ratio = 1:4

Let volume of cement mortar = W

Then a) Cement = 1/5 x Wm^3 x 1400kg – m^3 x 1.25
Shrinkage x 1.05 wastage
= 368 kgs W
= 0.26 m^3W

b) Sand = 4/5 x Wm^3 x 1840 kg/ m^3 x 1.25
Shrinkage x 1.05 wastage
= 1932 kgs W

4. Compo-mortar mix ratio = 1:2:9

Let volume of Compo-mortar = X

Then a) Cement = 1/12 x Xm^3 x 1400 kg/m^3 x 1.20
Shrinkage x 1.05 wastage
= 147 kgs X
= 0.015 m^3 X

b) Lime = 2/12 x Xm^3 x 1900 kg/m^3 x 1.20
Shrinkage x 1.05 wastage
= 399 kgl X
= 0.21 m^3 X

c) Sand = 9/12 x Xm^3 x 1840 kg/m^3 x 1.20
Shrinkage x 1.05 wastage
= 1739 kgs X
= 0.95 m^3 X

Material List Calculation

I. Concrete

Assuming 30% shrinkage

5% wastage

For Mechanical mix $\frac{\text{water}}{\text{Cement}}$ =0.4 – 0.5

Hand mix $\frac{\text{water}}{\text{Cement}}$ = 0.4 – 0.65

Note: Hand mix shall only be allowed for class II concrete, and shall not be allowed for concrete of class C-20 and above.

Item	Type of Work	Material Required to Produce 1m³ concrete
1	Concrete C- 7 Mechanical Mix Mix ratio 1:4:8	Cement = 150 kgs (3 bags) Sand = 773 kgs (0.42 m³) Gravel = 1890 kgs (0.84 m³) Water = 60 liters
2	Concrete C-15 Mechanical mix Mix ratio 1:3:6	Cement = 200 kgs (4 bags) Sand = 754 kgs (0.41 m³) Gravel = 1843 kgs (0.82 m³) Water = 80 liters
3	Concrete C- 20 Mechanical mix Mix ratio 1:2:4	Cement = 275 kgs (5.5 bags) Sand = 718 kgs (0.39 m³) Gravel = 1755 kgs (0.78m³) Water = 110 liters
4	Concrete C- 30 Mechanical mix Mix ratio 1:2:3	Cement = 325 kgs (6.5 bags) Sand = 837 kgs (0.45 m³) Gravel = 1536 kgs (0.68m³) Water = 130 liters
5	Concrete C- 7 Hand mix Mix ratio 1:3.5:8	Cement = 153 kgs (3.06bags) Sand = 704 kgs (0.38 m³) Gravel = 1966 kgs (0.87 m³) Water = 92 liters
6	Concrete C- 15 Hand mix Mix ratio 1:2:5:6	Cement = 202 kgs (4.04 bags) Sand = 661 kgs (0.36 m³) Gravel = 1940 kgs (0.868 m³) Water = 121 liters

Calculating Material for Masonry

Basic Data

For one meter cube masonry work

- Sub Structure (foundation wall) =1m^3 of stone/m^3
- Super structure (semi-dressed) =1.25m^3 of stone/m^3
- Super structure (dressed) =1.5m^3 of stone/m^3

A. Stone Masonry

a) 50cm thick basaltic or equivalent foundation wall bedded in cement mortar 1:4

1. Stone = 1m^3/m^3
2. Mortar = 0.4 m^3/m^3
   2.1 Cement = 150 kgs/m^3
   2.2 Sand = 0.42m^3 /m^3

b) 50cm thick roughly dressed super-structure stone wall bedded in cement mortar 1:4

1. Stone = 1.25 m^3/m^3
2. Mortar = 0.4m^3/m^3
   2.1 Cement = 150 kgs/m^3
   2.2 Sand = 0.42m^3/m^3

c) 40cm thick dressed super structure stone wall bedded in cement mortar 1:4

1. Stone = 1.50m^3/m^3
2. Mortar = 0.40m^3/m^3
   2.1 Cement = 150kgs/m^3
   2.2 Sand = 0.42m^3/m^3

B. Brick Masonry for Super-structure

a. ½ brick wall bedded in compo- mortar 1:2:9 both sides left for plastering

1. Brick with 5% wastage = 58 pcs/m^2
2. Compo-mortar (10mm joints) = 0.0353m^3/m^2

15% wastage

2.1 Cement = 5kgs/m^2
2.2 Lime = 14kgs/m^2
2.3 Sand = 0.034m^3/m^2

b. One brick wall bedded in compo-mortar 1:2:9 both sides left for plastering.

1. Brick with 5% wastage = 115pcs/m^2
2. Compo-mortar with 15% wastage =0.085m^3/m^2 (10mm joints)

2.1 Cement = 12.5kgs/m^2
2.2 Lime =34kg/m^2
2.3 Sand =0.081m^3/m^2

C. Hollow Block Masonry for Super-Structure

a) 10cm thick hollow concrete block wall bedded in cement mortar 1:4

1. Hollow block with 5% wastage = 13 pcs/m^2
2. Mortar 10mm joints 20% wastage = 0.0135m^3/m^2
   2.2 Cement = 5 kgs/m^2
   2.2 Sand = 0.014m^3/m^2

b) 15cm thick hollow concrete block wall bedded in cement mortar 1:4.

1.Hollow block with 5% wastage = 13 pcs/m^2
2.Mortar 10mm joints 20% wastage = 0.020m^3/m^2
   2.1 Cement =7.5kgs/m^2
   2.2 Sand = 0.022m^3/m^2

c) 20cm thick Hollow concrete block wall bedded in cement mortar 1:4

1. Hollow block with 5% wastage = 13pcs/m^2
2. Mortar 10mm joints 20% wastage = 0.027m^3/m^2
   2.1 Cement =10kgs/m^2
   2.1 Sand = 0.028m^3/m^2

III. Mortar

Assuming 25% Shrinkage
5% Wastage

a) Cement Mortar

Item	Type of Work	Material required to produce 1m³ mortar
1	Cement Mortar 1:3	Cement = 460kgs Sand = 0.99m³
2	Cement Mortar 1:4	Cement = 308kgs Sand = 1.05m³
3	Cement Mortar 1:5	Cement = 306kgs Sand = 1.10m³
4	Cement Mortar 1:6	Cement = 263kgs Sand = 1.13m³

b) Compo-Mortar

Assuming 20% Shrinkage
5% Wastage

Item	Type of Work	Material Required to produce 1m³ Compo-Mortar
1	Compo-mortar1:1:6	Cement = 221 kgs Lime = 300 kgs Sand = 0.95m³
2	Compo-mortar 1:2:9	Cement = 147 kgs Lime = 399 kgs Sand = 0.95m³
3	Compo-mortar ½: 1:3	Cement = 195 kgs Lime = 528 kgs Sand = 0.89m³

Light Weight Screed

Assuming - 25% Shrinkage
5% Wastage

Item	Type of Work	Material required to produce 1m³ mortar
1	Cement Pumice 1:6	Cement = 263 kgs Pumice = 1.13m3
2	Cement Pumice 1:8	Cement = 205 kgs Pumice = 1.17m³

IV. Roofing

A. Roofing out of corrugated Iron sheet Nailed on wooden truss

a) Roof covering upto 15^0 Slope

1. Roofing Sheet =1.38m^2/corrugated Iron Sheet
2. Washer = 10pcs/Iron Sheet
3. Dome Headed nail = 10pcs/Iron Sheet

b) Roof ridge 33cm wide

1. Covering of 2m length= 5pcs/9ml
2. Dome headed nail = 0.05 kgs/ml

c) Valley covers

1. Covering of 2m length= 5 pcs/9ml
2. Nails 6cm = 0.006kgs/ml

d) Gutter

1. Gutter with 2% wastage = 1.02mts/ml
2. Lead
3. Acid
4. Screws (fixers) = 3pcs/ml
5. Metal Brackets = 3pcs/ml

e) Down pipe

1. Down pipe = 9pcs/10ml
2. Metal Brackets = 2pcs/ml
3. Nut & Belt for metal brakes (fixers) = 4pcs/ml

f) Fascia board

1. Fascia board with 10% wastage = 1.10mt/ml
2. Nails = 0.007kgs/ml

B) Roofing out of corrugated Asbestos on wooden Truss

a) Roof Covering for up to 20^0 slope

1. Roof covering = 2.25m/Asbestos Sheet
2. "J" hooks = 12pcs/Asbestos Sheet

3. Washer = 12pcs/ Asbestos Sheet

b) Roof ridge up to 20^0 slope

1. Covering = $2.25m^2$/ Asbestos Sheet
2. "J" hooks = 12pcs/ Asbestos Sheet
3. Washer = 12pcs/ Asbestos Sheet

c) Gutter
   1. Gutter
   2. "J" hooks
   3. Washer

C) Roofing out of EGA Sheet on Steel truss

a) Roof Covering

"J" hooks

b) Roof ridge

1. Covering
2. "J" hooks

c) Valley Covers
   1. Covering
   2. "J" hooks

d) Gutter with 2% wastage

1. Gutter = 1.02pcs/ml
2. Metal Brackets = 2pcs/ml
3. Fixers = 4pcs/ml

e) Down pipe

1. Down pipe = 9pcs/10ml
2. Metal Brackets =2pcs/ml
3. Fixers =4pcs/ml

f) Roofing nails

1kg=105 pcs

1pkg 3kgs 315pcs

V. Carpentry & Joinery

a) Eucalyptus truss for span upto 10m

1. 10-12 cmΦ Upper and Lower Eucalyptus wood truss members with 50% wastage = 1.5mt/ml

2. Nails = 0.04kgs/ml
3. Band/Iron = 0.12kgs/ml
4. 8-10 cmΦ vertical & diagonal truss members
   With 60% wastage = 1.6m/ml
5. Nails = 0.06kgs/ml
6. Band Iron = 0.17kgs/ml

b) Truss out of 5x10cm & 15cm wood upto 10m span

1. 5x10cm Zigba wood upper member in truss
   with 15% wastage = 1.15mt/ml
2. Nails = 0.03 kgs/ml
3. Band Iron = 0.10kgs/ml
2. 5x10cm Zigba wood diagonal & Vertical
   member with 20% wastage = 1.20mt/ml
2. 2x2.5x15cm zigba wood = 2.30mts/ml
   Lower member with 15% wastage
4. Nails = 0.04kgs/ml
5. Band Iron = 0.20kgs/ml

c) Truss out of 2.5 x 15cm zigba wood

1. 2(2.5 x 15cm) Zigba wood upper & lower
   member with 15% wastage = 2.30mts/ml
2. Nails = 0.03kgs/ml
3. Band Iron = 0.10kgs/ml
2. 2 x 2.5 x 15cm diagonal & vertical
   member with 20% wastage = 2.40mts/ml
3. Nails = 0.04kgs/ml
5. Band Iron = 0.20kgs/ml

d) Purlin

1. 06 – 8cm eucalyptus wood purlin with
   40% wastage =1.40mts/ml
2. Nails = 0.025 kgs/ml
2. 5 x 7 zigba wood purlin with 20%
   wastage = 1.20mts/ml
3. Nails = 0.15kgs/ml

e) Fascia Board

1. Zigba or Tid wood with 15%
   Wastage = 1.15mts/ml

2. Nails = 0.10kgs/ml

f) Door & window frame

1. Wood with 15% wastage = 1.15mts/ml
2. Nails = 0.05kgs/ml

g) Cheap wood ceiling nailed on 4 x 5 zigba wood battens placed at c/c 41 cm.

1. 4 x 5 cm zigba wood battens with 15% wastage = 4.6mts/m^2
2. Cheap wood 10% wastage = 1.10m2/m^2
3. Nails of 6cm = 0.07kgs/m^2
4. Corner list = 1.75mts/m^2
5. Middle list of necessary with 1 5% wastage = 2.85mts/m^2

h) Cheap wood ceiling nailed on 4 x 5 cm Zigba wood battens placed at c/c 41cm.

1. 4 x 5 cm zigba wood battens with 10% wastage = 6.30mts/ml
2. Cheap wood 10% wastage = 1.10cm^2/m^2
3. Nails = 0.08kgs/m^2
4. Corner list = 1.75mts/m^2
5. Middle list if necessary = 4.55mts/ml

Nails

1cm nails = 950 pcs =1kg

2cm nails = 826 pcs = 1kg

4cm nails = 546 pcs = 1kg

6cm nails = 235 pcs = 1kg

7cm nails = 180 pcs = 1kg

8cm nails = 127 pcs = 1kg

10cm nails = 63 pcs = 1kg

12cm nails = 44 pcs = 1kg

15cm nails = 29 pcs = 1kg

Roofing Nails = 105 pcs = 1kg

Band Iron 16mm = 15m = 1kg

Zigba truss 4m long = 13pcs/truss

Plastic washer 1 pkt = 300pc

I) Hard board ceiling Nailed on 4 x 5 cm Zigba wood battens placed at c/c 61cm

1. 4 x 5 cm zigba wood battens with 15% wastage = 4.6mts/m^2
2. Cheap wood 10% wastage = 1.10m^2/m^2
3. Nails = 0.07kgs/m^2
4. Corner list = 1.75 mts/m^2
5. Middle list = 2.85mts/m^2

J) Abujedid- ceiling nailed on 4 x 5 cm zigba wood battens placed at c/c 50cm

1. 4 x 5 cm zigba wood battens with 10% wastage = 5.28ml/m^2
2. Abujedid with 10% wastage = 1.10m2/m^2
3. Nailed = 0.05kgs/m^2
4. Corner list = 1.75ml/m^2
5. Middle list = 3.53ml/m^2

K) Doors & windows

Note- By writing the size of doors & windows the number's can be given in pcs.

<u>Door Type</u>

a. Ledged & battened door
b. Ledged, braced & battened door
c. Framed, ledged, braced on battened door
d. Framed, ledged & battened door
e. Flush door
f. Paneled door

L) Size of Doors (standards)

For Bed Rooms =80 x 210 cm
90 x 210 cm

For Living Rooms = 90 x 210 cm
= 120 x 210 cm
= 150 x 210 cm

For W.C. = 70 x 210 cm
80 x 210 cm

For Kitchen = 80 x 210 cm
90 x 210 cm

V. Metal Work

a) For single leaf 0.90 x 2.10m door made out of Tubular profile black Iron steel, 1.00 meter of its height covered with sheet metal material required.

a) L Tubular with 5% wastage = 6.30ml/pcs
b) Z Tubular with 5% wastage = 3.26ml/pcs
c) T Tubular with 5% wastage = 0.95ml/pcs
d) O Tubular with 5% wastage = 4.00ml/pcs
e) Sheet metal with 5% wastage =1.00m/pcs
f) Lock = 1 pcs/pcs
g) Hinge = 2 pcs/pcs
h) Parker screw with 10% wastage = 14 pcs/pcs
i) Electrode =
j) Flat Iron = 3.80ml/pcs

b) Ditto but for Double leaf door size 120 x 2.10m

a) L with 5% wastage = 6.93ml/pcs
b) Z with 5% wastage = 7.88ml/pcs
c) T with 5% wastage = 3.14ml/pcs
d) O with 5% wastage = 7.46ml/pcs
e) Sheet metal = 1.32m/pcs
f) Lock = 1 pcs/pcs
g) Hinge = 4pcs/pcs
h) Stopper = 2 pcs/pcs
l) Parker screw with 10% wastage = 33 pcs/pcs
j) Electrode =
k) Flat Iron = 5.46m^2/pcs

c) Ditto but for Door size 80 x 2.10m single leaf.

a) L – Tabular
b) Z = 5.25ml/pcs
c) T = 0.84ml/pcs
d) O = 3.99ml/pcs
e) Sheet metal = 0.84m^2/pcs
f) Lock = 1 pcs/pcs

g) Hinge = 2 pcs/pcs
h) Parker screw with 10% wastage = 14 pcs/pcs
i) Electrode
j) Flat Iron = 3.78ml/pcs

d) French window size 2.00 x 2.10m with two opening size 0.70 x 0.70m Made out of Tubular profile black Iron steel & 0.30m of its height covered with sheet metal dividers placed at c/c 70cm.

a) L Tubular with 5% wastage = 8.41ml/pcs
b) Z Tubular with 5% wastage = 5.88ml/pcs
c) T Tubular with 5% wastage = 10.71ml/pcs
d) O Tubular with 5% wastage = 24ml/pcs
e) Sheet metal = 0.63m^2/pcs
f) Handle = 2pcs/pcs
h) Hinge = 4pcs/pcs
l) Stopper = 2pcs/pcs
j) Parker screw with 10% wastage = 80pcs/pcs
k) Electrode =
l) Flat Iron = 6.10ml/pcs

e) French window size 3.00 x 2.10m with single leaf door size 0.70 x 2.10m & window 0.60 x 0.60m opening made out of tubular profile black iron 0.30m of its height covered with sheet metal & dividers placed at c/c 60cm.

a) L with 5% wastage = 10.71ml/pcs
b) Z with 5% wastage = 10.92ml/pcs
c) T with 5% wastage = 9.45ml/pcs
d) O with 5% wastage = 37.80ml/pcs
e) Sheet metal = 0.945m^2/pcs
f) Lock = 1 pcs/pcs
g) Hinge = 6 pcs/pcs
h) Handle = 2 pcs/pcs
l) Stopper = 2 pcs/pcs
j) Parker screw with 10% wastage = 132 pcs/pcs
k) Electrode =
l) Flat Iron with 5% wastage = 9.45ml/pcs

f) Window size 1.00 x 1.20 made out of tubular profile black iron sheet which has one opening.

a) L with 5% Wastage = 4.63ml/pcs

b) Z with 5% Wastage = 3.57ml/pcs

c) T with 5% Wastage = 1.26ml/pcs

d) O with 5% Wastage = 7.14ml/pcs

e) Handle = 1 pcs/pcs

f) Stopper = 1 pcs/pcs

g) Hinge = 2pcs/pcs

h) Parker screw with 10% wastage = 22pcs

I) Electrode =

g) Ditto but for size 1.20 x 1.20m

a) L with 5% wastage = 5.04ml/pcs

b) Z with 5% wastage = 3.78ml/pcs

c) T with 5% wastage = 1.26ml/pcs

d) O with 5% wastage = 7.56ml/pcs

e) Handle = 1 pcs/pcs

f) Stopper = 1 pcs/pcs

g) Hinge = 2 pcs/pcs

h) Parker screw with 10% wastage = 22 pcs/pcs

I) Electrode

h) Ditto for size 1.50 x 1.20m but two opening

a) L with 5% wastage = 5.67ml/pcs

b) Z with 5% wastage = 7.14ml/pcs

c) T with 5% wastage = 2.52ml/pcs

d) O with 5% wastage = 10.71ml/pcs

e) Handle = 2pcs/pcs

f) Stopper = 2pcs/pcs

g) Hinge = 4pcs/pcs

h) Parker screw = 38pcs/pcs

I) Electrode =

i) 1000 lit water capacity tank with manhole on top.

a) Sheet metal = 3pcs/pcs

b) Angle Iron = 4ml/pcs

c) Hinge = 2pcs/pcs

d) Electrode = 1 packet/pcs

e) Manicotti = 2pcs/pcs

f) Paint antirust = 0.24lit/pcs

g) Enamel paint = 0.72lit/pcs

h) Φ12 reinforcement = 3ml/pcs

j) Ditto but 2000 lit capacity

a) Sheet metal = 5pcs/pcs

b) Angle Iron = 4ml/pcs

c) Hinge = 2pcs/pcs

d) Electrode = 1 ¾ packet/pcs

e) Manicotti = 2pcs/pcs

f) Paint antirust = 0.4lit/pcs

g) Enamel paint = 1.2lit/pcs

h) Φ14 reinforcement = 4ml/pcs

VII Pointing

a) Brick wall pointed with cement mortar 1:3 with 15% wastage Per 10 square meters.

1. Mortar	= $0.03m^3/10m^2$	= $0.003m^3/m^2$
1.1 Cement	= 3.78kgs	= $0.378m^2$
1.2 Sand	= $0.03m^3$	= $0.003m^3$

b) Stone wall pointed with cement mortar 1:3 with 12% wastage Per10 square meters.

1. Mortar	= $0.06m^3/10m^2$	= $0.006m^3/m^2$
1.1 Cement	= 27.56kgs	= 2.756 kg
1.2 Sand	= $0.06m^3$	= $0.006m^3$

c) Hollow block wall pointed with cement mortar 1:3 with 10% Wastage per 10 square meters.

1. Mortar	= $0.02m^3/10m^2$	= $0.002m^3/m^2$
1.1 Cement	= 9.19kgs	= 0.919 kg
1.2 Sand	= $0.02m^3$	= $0.002\ m^3$

d) Brick wall

1 Mortar	= $0.03m^3/10m^2$	= $0.003m^3/m^2$
1.1 Cement	= 11.04kgs	= 1.104 kgs
1.2 Sand	= $0.03m^3$	= $0.003m^3$

e) Stone wall pointed with cement mortar 1:4 with 12% wastage
Per 10 square meters.

1. Mortar = $0.06m^3/10m^2$ = $0.006m^3/m^2$

1.1 Cement = 22.08kgs = 2.208 kgs

1.2 Sand = $0.06m^3$ = $0.006m^3$

f) Hollow block wall pointed with mortar 1:4 with 10% wastage
Per 10 square meters.

1 Mortar = $0.02m^3/10m^2$ = $0.002m^3/m^2$

1.1 Cement = 7.36kgs = 0.736 kg

1.2 Sand = $0.02m^3$ = $0.002m^2$

VII.Plastering

a) Cement Mortar plaster on walls per 10 square meters.

Proportion of cement mortar	12mm thick with 20% wastage Mortar= $0.144m^3$		15mm thick 15% wastage mortar = $0.172m^3$		20mm thick 12% wastage Mortar= $0.22m^3$		25mm thick 10% wastage mortar=$0.25m^3$	
	Cement (kgs)	Sand (m^3)	Cement (kgs)	Sand (m^3)	Cement (kgs)	Sand (m^3)	Cement (kgs)	Sand (m^3)
1:3	66.15	0.14	79.10	0.17	102.90	0.22	114.84	0.25
1:4	53.00	0.15	63.80	0.18	82.43	0.24	92.00	0.26
1:5	44.10	0.16	52.68	0.19	68.60	0.25	76.56	0.27
1:6	37.80	0.16	45.15	0.19	58.80	0.25	65.62	0.28

IX. Rendering

a) Cement Mortar rendering on walls per 10square meters with 20% wastage mix proportion 1:3.

1. Mortar = $0.06m^3/10\ m^2$

1.1 Cement = 27.56kgs

1.2 Sand = $0.06m^3$

b) Cement mortar rendering on walls per 10square meters with 20% wastage mix proportion 1:4

1. Mortar = $0.06m^3/10\ m^2$

1.1 Cement = 22.08kgs

1.2 Sand = $0.06m^3$

X.A. Flooring

a) Terrazzo tile (Cement tile)
Flooring bedded in cement mortar 1:4

1. Terraze tile (cement tile) with
20% wastage size 20 x 20=26pcs/m^2

2. 2.5cm thick mortar with 10% wastage for laying.

2.1 Sand = $0.0275m^3/m^2$

2.2 Cement = $10.12kgs/m^2$

3. Mortar 1:3 for grouting with
20% wastage. = $0.001m^3/m^2$

3.1 Cement = $0.46kgs/m^2$

3.2 Sand = $0.001m^3/m^2$

b) Cement screed flooring with an average thickness 2.5 cm.

1. Mortar 1:3 with 20% wastage = $0.03m^3/m^2$

1.1 Cement = $13.78kgs/m^2$

1.2 Sand = $0.03m^3/m^2$

c) 2cm thick marble slate flooring bedded in cement sand screed 1:4

1. Marble slate with 2% wastage = 1.02m^2/m^2
2. 2.5cm thick mortar with 10% wastage = 0.0275m^3/m^2

2.1 Cement = 10.12kgs/m^2

2.2 Sand = 0.029m^3/m^2

3. Polish = 0.03kg/m^2

d) 2cm thick marble chips flooring bedded in cement mortar 1:4

1. Marble chips with 20% wastage = 1.20m^2/m^2
2. Mortar with 10% wastage = 0.0275m^3/m^2

2.1 Cement = 10.12kgs/m^2

2.2 Sand = 0.029m^3/m^2

2.3 polish = 0.03kg/m^2

e) 1.5mm, 2mm or 2.5mm thick plastic tile flooring.

1. Plastic with 5% wastage size 25x25 = 17pcs/m^2

Plastic with 5% wastage size 30x30 = 12pcs/m^2

2. Adhesive including wastage = 0.3 kgs/m^2
3. Polish = 0.3 kgs/m^2

f) Woira Wood para-quet flooring

1. Woira wood with 3% wastage = 1.03m^2/m^2
2. Adhesive glue including wastage = 0.4kgs/m^2
3. Polish = 0.6kgs/m^2

g) Wooden Flooring

1. Boarding wastage 2% = 1.02m^2/m^2
2. Nails: 4 - 6cm length
3. Floor joist at 50cm apart with 5% wastage size 5 x 7cm = 2.05ml/m^2
4. Nails for floor joint

h) Carpet Flooring

1. Carpet with 5% wastage = 1.05m^2/m^2

XI Wall tiles

A) <u>Ceramic wall tile</u>

1. Ceramic tile with 5% wastage size 15 x 15cm = 47pcs/m^2

71/2 x 15cm = 94pcs/m^2

5 x 10cm = 210pcs/m^2

10 x 10cm = 105pcs/m^2

2. Mortar 1:4 for bedding with 10% wastage = 0.001m^3/m^2

2.1 Cement = 0.37kgs/m^2

2.2 Sand = 0.001m^3/m^2

3. Cement for grouting the joints = 0.01kgs/m^2

B) Mosaic wall tile

1. Mosaic tile with 2% wastage = 1.02m^2/m^2

2. Mortar 1:4 for bedding with 10% wastage = 0.001m^3/m^2

2.1 Cement = 0.37kgs/m^2

2.2 Sand = 0.001m^3/m^2

3. Cement for grouting the joints = 0.02kgs/m^2

C) Skirting

a) Terrazzo tile (cement tile' for skirting
Bedded in cement mortar 1:4

1. Tile with 10% wastage size 10 x 20cm = 11pcs/ml

2. Mortar 1:4 for bedding with 10% wastage = 0.0006m^3/pcs

2.1 Cement = 0.22kgs/pcs

2.2 Sand = 0.006m^3/pcs

b) Plastic tile skirting

1. Plastic tile with 2% wastage = 1.02m/ml

2. Adhesive including wastage = 0.01kgs/ml

c) Marble slate skirting

1. Marble slate with 10% wastage = 1.10m/ml

2. Mortar with 10% wastage = 0.003m^3/ml

2.1 Cement = 1.10kgs/ml

2.2 Sand = 0.003m^3/ml

d) Wooden Skirting

1. Wooden with 10% wastage = 1.10m/ml
2. Fisher = 5 pcs/ml
3. Screw = 5 pcs/ml

D. Window sill

a) Marble slate windowsill width 27cm

1. Marble 2 or 3cm thick = 1m/ml
2. Mortar with 10% wastage = 0.007m^3/ml

2.1 Cement = 2.6kgs/ml
2.2 Sand = 0.007m^3/ml

b) Ganglia window sill width 27cm

1. Ganglia 3cm thick = 1m/ml
2. Mortar with 10% wastage = 0.007m^3/ml
   2.1 Cement = 2.6kgs/ml
   2.2 Sand = 0.007m^3/ml

c) Pre-cast concrete window sill 5cm thick 27cm wide.

1. Concrete with 10% wastage = 0.015m^3/ml
2. Mortar with 10% wastage = 0.007m^3/ml

XI. Glazing

a) 3mm thick glass fixed on tubular profile black iron steel

1. 3mm glass with 10% wastage =1.1m^2/m^2
2. Putty = 0.20kg/m^2

b) 4mm thick glass fixed on tubular profile block iron steel

1. Glass with 10% wastage = 1.10m^2/m^2
2. Putty = 0.20kg/m^2

c) 5mm thick glass fixed on tubular profile black iron steel

1. Glass with 10% wastage =1.10m^2/m^2
2. Putty = 0.15kg/m^2

d) 3mm thick glass fixed on seco profile (galvanized iron steel)

1. 3mm thick glass with 10% wastage = 1.10m^2/m^2
2. Putty = 0.25kg/m^2

e) 4mm thick glass fixed on seco profile (galvanized iron steel)

1. 4mm thick glass with 10% wastage = 1.10m/m^2
2. Putty = 0.20kg/m^2

f) 5mm thick glass fixed on seco profile (galvanized iron steel)

1. 5mm thick glass with 10% wastage = 1.10m^2/m^2
2. Putty = 0.15kg/m^2

XXI. Painting

a) 2 coats of plastic emulsion paint to internal newly plastered surface.

1. Priming coat to fill the props of the surface prepare smooth base

for the 1st paint coat. = 62.5grams/m^2

1.1 Stucco =50.0"/m^2

1.2 Animal Glue before vinavil = 12.5"/m^2

2. 1st coat = 0.07 ilt/m^2

2nd coat = 0.06 lit/m^2

3. Brusher for plastic paint = 1pcs/500m^2

40 x 140mm

4. Sand paper = 0.01m^2/m^2

5. Gypsum = 0.03kg/m^2

b. 3 coats of plastic emulsion paint to internal newly plastered surface.

1. Priming coat to fill the process of the surface to prepare smooth base for 1st paint coat.

1.1 Stucco =50.0 grams/m^2

1.2 Animal or vinavil glue =12.5grams/m^2

2. 1st coat = 0.07 lit/m2

3. 2nd coat = 0.06 lit/m^2

4. 3rd coat final coat = 0.05 lit/m^2

5. Gypsum = 0.03 kgs/m^2

6. Sand paper = 0.01 m^2/m^2

7. Brush 140 x 40mm = 1pcs/500m^2

c) 2 coat of plastic emulsion paint to external newly plastered surface.

1. Priming coat = 62.5gram/m^2

1.1 stucco = 0.50grams/m^2

1.2 Animal or vinavil glue = 12.5grams/m^2

2. 1st coat = 0.08lit/m^2

3. 2nd coat = 0.07lit/m^2

4. Sand paper = 0.01m^2/m^2

5. Brush 140 x 40mn = 1pcs/500m^2

6. Cement mortar = 0.02kgs/m^2

d) 3 coats of plastic emulsion paint to external newly plastered surface

1. Priming coat = 62.5 gram/m^2
   1.1 stucco = 50grams/m^2
   1.2 Animal or vinavil glue = 12.5 grams/m^2
2. 1st coat = 0.08 lit/m^2
3. 2md coat = 0.07 lit/m^2
4. 3rd coat = 0.06 lit/m^2
5. Sand paper = 0.01m^2/m^2
6. Brush 140 x 40 mm = 1pcs/500m^2
7. Cement mortar = 0.02kgs/m^2

e) 2 coats of plastic emulsion to external rendered surface.
   1. 1st coat = 0.13lit/m^2
   2. 2nd coat = 0.11 lit/m^2
   3. Brush 140 x 40m = 1pcs/m^2

f) 3 coats plastic emulsion paint to external rendered surface
   1. 1st coat = 0.13 lit/m^2
   2. 2nd coat = 0.11 lit/m^2
   3. 3rd coat = 0.01lit/m^2
   4. Brush 140 x 40m = 1pcs/500m^2

g) 2 coats of synthetic enamel paint to wooden surface.
   1. 1st coat =0.06lit/m^2
   2. 2nd coat =0.05litm^2
   3. Solvent (thinner) for 1st and 2nd coat =0.5 lit/gall
   4. Brush 4" or 5" =1pcs/200m^2
   5. Stucco =0.05kgs/m^2
   6. Sand paper =0.007m^2/m^2

h) 3 coats of synthetic enamel point to wooden surface.
   1. 1st coat = 0.06lit/m^2
   2. 2nd coat = 0.05lit/m^2
   3. 3rd coat = 0.04lit/m^2
   4. Solvent (thinner) for 1st and 2nd coat = 0.5lit/gall
   5. Brush = 1pcs /200m^2
   6. (Stucco) Knotting = 0.05kgs/m^2
   7. Sand paper =0.007m^2/m^2

i) 2 coats of varnish or lurker paint to wooden surface
   1. 1st coat =0.06lit/m^2
   2. 2nd coat =0.05lit/m^2
   3. Brush =1pcs/200m^2
   4. Stucco (Knotting) = 0.05kgs/m^2

5. Sand paper =0.007m^2/m^2

j) Cement paint to porous smooth surface

1. Cement paint =0.5lit/m^2
2. Brush =1pcs/200m^2

k) Cement paint to porous rough surface

1. Cement Paint =1.25lit/m^2
2. Brush =1pcs/200m^2

l) 3 coats of plastic emulsion paint to chip wood ceiling.

1. Priming coat = 62.5grams/m^2
   - 1.1 Stucco = 50.0grams/m^2
   - 1.2 Vinavil or animal glue = 12.5grams/m^2
2. 1st coat plastic emulsion paint = 0.5lit/gall
3. Knotting
   - 3.1 Stucco =0.05kgs/m^2
   - 3.2 Gypsum =0.04kgs/m^2
4. 2nd coat =0.08lit/m^2
5. 3rd coat = 0.07lit/m^2
6. Sand paper = 0.007m^2/m^2
7. Brush 140 x 40mm = 1pcs/400m^2

m) 3 coats of synthetic enamel paint to steel surface.

1. Priming coat (anti-rust) = 0.04lit/m^2
2. Thinner for Anti-rust = 0.5lit/gall
3. 1st coat = 0.04lit/m2
4. 2nd coat = 0.04lit/m^2
5. 3rd coat = 0.04lit/m^2
6. Thinner for the paint = 0.5lit/gall
7. Sand paper = 0.007m^2/m^2
8. Brush 4" or 5" = 1 pcs/300m^2

n)3 coats of synthetic enamel paint to galvanized steel surface.

XIII Damp – Proofing and Water Proofing

A-a) One coat of bitumen for plastered wall surface.

1. Bitumen emulsion for primer coat with 5% wastage =0.42kgs/m^2

2. One coat of bitumen emulsion
with 5% wastage. =0.79kgs/m^2

b) Ditto but two coats

1. Bitumen emulsion for primer coat with 5% wastage = 0.42kgs/m^2
2. Two coats of bitumen emulsion with 5% wastage = 1.58kgs/m^2

B-a) One coat of bitumen for ground slab.

1. Bitumen emulsion for primer coat with 5% wastage =0.42kgs/m^2
2. One coats of bitumen emulsion with 5% wastage = 0.79kgs/m^2

b) Ditto but two coats

1. Bitumen emulsion for primer coat with 5% wastage = 0.42kgs/m^2
2. Two coats of bitumen with 5% wastage =1.58kgs/m^2

C – a) One coat of bitumen for roofing

1. Bitumen emulsion for primer coat with 5% wastage = 0.32kgs/m^2
2. One ply of glass fiber with 10% wastage and overlap = 1.20 m^2/m^2
3. One coat of bitumen emulsion with 5% wastage = 2.5kgs/m^2

Note: - Galvanized iron should not be painted until it has been exposed to the weather For half a year as paint adheres badly to new galvanized iron. It is necessary to paint sooner a coat mordant solution can be used. This solution turns the galvanized iron black.

1. 1st coat = 0.04lit/m^2
2. 2nd coat = 0.04lit/m^2
3. 3rd coat = 0.04lit/m^2
4. Thinner for the paint = 0.5lit/gallon
5. Sand paper = 0.007m^2/m^2
6. Brush 4” or 5” = 1pcs/300m^2

d) Ditto but two coats.

1. Bitumen emulsion for primer coat with 5%wastage =0.32kgs/m^2

2. Two plies of glass fiber with
   with 10% wastage & overlap = 2.41 m^2/m^2
3. Two coat of bitumen emulsion
   with 5% wastage. = 4.5kgs/m2
4. Two coat of reflecting emulsion
   with 5% wastage =0.32kgs/m^2

XIV. Sanitary Work

a. 1. In Villa Houses for water supply
   ½ " & ¾ " Galvanized Water pipes are laid
   & those are found in pcs. = 6ml
   2. For sewerage in Villa houses
   11/4" & 11 –2" pipes are laid & those
   are found in pcs. = 6ml

b. Sanitary Equipment
   3. Enamel bath tubs size 170 x 70 cm = = pcs
   4. Shower plate size 70 x 70cm, 80 x 80cm = pcs
   5. Wash basin 60 x 50cm, 55 x 45cm, 40 x 40cm & 40 x 30cm = pcs
   6. Bottle trap = pcs
   7. Water closet low flush or high flush = pcs
   8. Turkish water closet = pcs
   9. Bidet = pcs
   10. Urinal = pcs

11. Sink
    100 x 50cm, 120 x 50cm
    140 x 50cm, 150 x 50cm
    180 x 50 cm, single bowel
    200 x 50 cm
    Soap Holder
    Paper roll holder
    Mirror Size

XV. Electrical Installation Electrical Materials

a. Conduits

a-1)Semi Rigid Electrical Conduits

1. Conduits 11mm = ml
2. Conduits 13mm = ml
3. Conduits 14mm = ml

a-2) Rigid Electrical Conduits

1. Conduits 11mm = ml
2. Conduits 13mm = ml
3. Conduits 14mm = ml
4. Conduits 19mm = ml
5. Conduits 20mm = ml
6. Conduits 23mm = ml
7. Conduits 25mm = ml
8. Conduits 29mm = ml
9. Conduits 35mm = ml
10. Conduits 42mm = ml
11. Conduits 50mm = ml

b) Electrical Junction Boxes

1. Switch boxes 0.65 mm = pcs
2. Junction boxes 0.85 mm = pcs
   Junction boxes 100 x 100mm = pcs
   Junction boxes 100 x 150mm = pcs
   Junction boxes 100 x 300mm = pcs
3. Water proof junction boxes 70mm = pcs

c.) Wires & cables

c-1 Electrical Wires Rigid

1. Single rigid Wire 1 x 1mm^2 = ml
2. Single rigid Wire 1 x 1.5mm^2 = ml
3. Single rigid Wire 1 x 2mm^2 = ml
4. Single rigid Wire 1 x 2.5mm^2 = ml
5. Single rigid Wire 1 x 4mm^2 = ml
6. Single rigid Wire 1 x 6.3mm^2 = ml
7. Single rigid Wire 1 x 8mm^2 = ml

c-2. Electrical Wires Flexible.

1. Single Flexible Wire 1 x 1mm^2 = ml

2. Single Flexible Wire	1 x 1.5mm^2	= ml
3. Single Flexible Wire	1 x 2mm^2	= ml
4. Single Flexible Wire	1 x 2.5mm^2	= ml
5. Single Flexible Wire	1 x 4mm^2	= ml
6. Single Flexible Wire	1 x 8 mm^2	= ml
7. Single Flexible Wire	1 x 10mm^2	= ml
8. Single Flexible Wire	1 x 16mm^2	= ml
9. Single Flexible Wire	1 x 25mm^2	= ml

c-3. Flat Wire

1. Twin Wire	2 x 0.25mm^2	= ml
2. Twin Wire	2 x 0.35mm^2	= ml
3. Twin Wire	2 x 0.50mm^2	= ml
4. Twin Wire	2 x 0.80mm^2	= ml
5. Twin Wire	2 x 2.00mm^2	= ml
6. Twin Wire	2 x 2.5mm^2	= ml

c-4. Telephone Wire

1.Telephone Wire	2 x 0.50mm^2	= ml
2. Telephone Wire	2 x 0.80mm^2	= ml
3. Telephone Wire	2 x 1.00mm^2	= ml

c-5. Round flexible rubber cables

1.Rubber 2 cores cable	2 x 0.50mm^2	= ml
2. Rubber 2 cores cable	2 x 0.80mm^2	= ml
3. Rubber 2 cores cable	2 x 1.00mm^2	= ml
4. Rubber 2 cores cable	2 x 1.5mm^2	= ml
5. Rubber 2 cores cable	2 x 2.0mm^2	= ml
6. Rubber 2 cores cable	2 x 2.5mm^2	= ml
7. Rubber 2 cores cable	2 x 6.0mm^2	= ml
8. Rubber 2 cores cable	3 x 0.8mm^2	= ml
9. Rubber 2 cores cable	3 x 1.0mm^2	= ml
10. Rubber 2 cores cable	3 x 1.5mm^2	= ml
11. Rubber 2 cores cable	3 x 2.00mm^2	= ml
12. Rubber 2 cores cable	3 x 2.5mm^2	= ml
13. Rubber 2 cores cable	3 x 4mm^2	= ml
14. Rubber 2 cores cable	3 x 6.3mm^2	= ml
15. Rubber 2 cores cable	4 x 1.5mm^2	= ml
16. Rubber 2 cores cable	4 x 2.0mm^2	= ml
17. Rubber 2 cores cable	4 x 2.5mm^2	= ml

18. Rubber 2 cores cable 4 x 4.0mm^2 = ml

19. Rubber 2 cores cable 4 x 6.3mm^2 = ml

c-6. Flat Rigid Cable

1. Rigid 2 cores cable 2 x 0.50mm^2 = ml
2. Rigid 2 cores cable 2 x 0.80mm^2 = ml
3. Rigid 2 cores cable 2 x 1.0mm^2 = ml
4. Rigid 2 cores cable 2 x 1.60mm^2 = ml
5. Rigid 2 cores cable 2x 2.0mm^2 = ml
6. Rigid 2 cores cable 2 x 2.5mm^2 = ml
7. Rigid 2 cores cable 2 x 4 mm^2 = ml
8. Rigid 2 cores cable 2 x 6.3mm^2 = ml
9. Rigid 2 cores cable 2 x 8mm^2 = ml
10. Rigid 2 cores cable 2x 10mm^2 = ml

c-7. Round Rigid Cable

1 Round Cable 3 cores 3 x 0.50mm^2 = ml
2. Round Cable 3 cores 3 x 0.80mm^2 = ml
3. Round Cable 3 cores 3 x 1.00mm^2 = ml
4. Round Cable 3 cores 3 x 1.60mm^2 = ml
5. Round Cable 3 cores 3 x 2.0mm^2 = ml
6. Round Cable 3 cores 3 x 2.5mm^2 = ml
7.Round Cable 3 cores 3 x 4mm^2 = ml
8. Round Cable 3 cores 3 x 6.3mm^2 = ml
9. Round Cable 3 cores 4 x 1.6mm^2 = ml
10. Round Cable 3 cores 4 x 2.5mm^2 = ml
11. Round Cable 3 cores 4 x 4mm^2 = ml
12. Round Cable 3 cores 4 x 6mm^2 = ml

d) Line terminal

1. Line terminal 05mm = pcs
2. Line terminal 06.5mm = pcs
3. Line terminal 08mm = pcs
4. Line terminal 09mm = pcs

e) Switch

e-1) Flush Mounted

1. Flush mounting normal switches = pcs
2. Flush mounting two way switches = pcs

3. Flush mounting double two way = pcs

4. Flush mounting two way + two way + tow switches = pcs

5. Flush mounting two way switches + boll push = pcs

e-2) Surface mounted

1. Surface mounted switches = pcs

2. Surface mounting two switches = pcs

3. Surface mounting double switches = pcs

e-3) Main Switch

1. Main Switch single pole = pcs

2. Main Switch double pole = pcs

3. Main Switch three pole = pcs

f) Sockets

f.1) Surface Mounting socket

1. Surface mounting socket 10A + ground
2. Surface mounting socket 2x15A + ground
3. Surface mounting socket 2x15A

f.2) Flush mounting socket

1. Flush mounting normal socket 10A = pcs

2. Flush mounting normal socket 10A + ground = pcs

3. Flush mounting normal socket 15A + ground = pcs

f.3) Heavy duty rubber socket

1. Heavy duty rubber socket 2 x 10A+G = pcs

2. Heavy duty rubber socket 2 x 15A+G = pcs

3. Heavy duty rubber socket 3x 15A+G = pcs

g) Bell Push

g-1) Surface mounted

1. Surface mounting bell push 10Amp = pcs

g-2) Flush mounted

1. Flush mounting bell push 10Amp = pcs

2. Flush mounting bell push + socket = pcs

h) Electrical Bells

1. Round bell 8 - 12 volts = pcs
2. Round bell 220 volts = pcs
3. Din Don bells 8 - 12 volts = pcs
4. Din Don bells 220 volts = pcs

i) Bell indicators

Surface mounted and flush mounted

1. Bell Indicates No. 6 = pcs
2. Bell Indicates No 8 = pcs
3. Bell Indicates No 10 = pcs
4. Bell Indicates No 12 = pcs

j) Electrical Lamps

1. Normal lamp
2. Globe ceiling lamp
3. Globe straight base for walls
   Globe slanting base for walls
4. Fluorescent lamp 1 x 10, 1 x 20, 1 x 10,
   2x20 & 2x 40 = pcs

k) Insulating tapes

1. Insulating tapes = roll

l) Insulating staples

1. Insulating staples ¾ , 5/8, 5/8 = packets

m) Water heater

1. Water heater 30 lit = pcs
2. Water heater 50 lit = pcs
3. Water heater 80 lit = pcs
4. Water heater 100 lit = pcs
5. Water heater 120 lit = pcs
6. Water heater 150 lit = pcs

XVI. Site work

a) Drains

1. Φ10 cm concrete pipe installation in trench laid on 5cm thick Red ash bed joints filled in cement mortar 1:4 per 20ml

1.1 Concrete pipe Φ10 with 5% wastage =21 pcs/20ml

1.2 Mortar with 5% wastage = $0.06m^3$/20ml

1.2.1 Cement = 22kgs/20ml

1.2.2 Sand = $0.06m^3$/20ml

2.3 Red Ash = $0.13m^3$/20ml

2. Ditto but Φ 15cm

2.1 Concrete pipe Φ15 cm with 5% wastage = 21pcs/20ml

2.2 Mortar with 5% wastage = 0.08m^3/20ml

2.2.1 Cement = 29.44kgs/20ml

2.2.2 Sand = 0.08m^3/20ml

2.3 Red Ash with 5% wastage = 0.21m^3/20ml

3. Ditto but Φ20cm

3.1 Concrete pipe Φ20cm with 5% wastage = 21pcs/20ml

3.2 Mortar with 5% wastage = 0.1m^3/20ml

3.2.1 Cement = 36.8kgs/ml

3.2.2 Sand = 01m^3/20ml

3.3 Red Ash with 5% wastage = 0.26m^3/20ml

4. Ditto but Φ30cm

4.1 Concrete pipe Φ30cm with 5% wastage = 21pcs/20ml

4.2 Mortar with 5% wastage = 0.14 m^3/20ml

4.2.1 Cement = 51.52kgs/20ml

4.2.2 Sand = 0.15m^3/20ml

4.3 Red Ash = 0.37m^3/20ml

5. Ditto but 0.40cm

5.1 Concrete pipe 0.40cm with 5% wastage =21pcs/20ml

5.2 Mortar with 5% wastage = 0.18m^3/20ml

5.2.1 Cement = 66.24 kgs/20ml

5.2.2 Sand = 0.20m^3/30ml

5.3 Red Ash = 0.47m^3/20ml

6. Ditto but 0.50 cm

6.1 Concrete pipe 0.50cm with 5% wastage = 21pcs/20ml

6.2 Mortar with 5% wastage = 0.22m^3/20ml

6.2.1 Cement = 73.64kgs/20ml

6.2.2 Sand = 0.21m^3/20ml

6.3 Red Ash = 0.58m^3/20ml

7. Ditto but 0.60cm

7.1 Concrete pipe 0.60cm with 10% wastage = 22pcs/20ml

7.2 Mortar with 5% wastage = 0.28m^3/20ml

7.2.1 Cement

7.2.2 Sand

7.3 Red Ash

8. Ditto but 0.80 cm

8.1 Concrete pipe 0.80cm with 10% wastage

8.2 Mortar with 5% wastage = 0.36m^3/20ml

8.2.1 Cement = 132.48kgs/20ml

8.2.2 Sand =0.38m^3/20ml

9. Ditto but Φ100cm

9.1 Concrete pipe 0 100cm with 10% wastage = 22pcs/20ml

9.2 Mortar with 5% wastage = 0.38m^3/20ml

9.2.1 Cement = 139.84kgs/20ml

9.2.2 Sand = 0.4m^3/20ml

b. Road constructed out of flexible asphalt.

1. Sub-base of basaltic or equivalent 25cm thick with 10% wastage = 0.28m^3/m^2
2. Base coarse 04 - 05 gravel 10cm thick with 20% wastage = 0.12m^3/m^2
3. Prime coat of MC - 70 = 1.41ts/m^2
4. Second layer base coarse of 02 gravel 5cm thick with 15% wastage = 0.058m^3/m^2
5. Second prime coat type 180 - 200 M.C = 1.5lts/m^2
6. Wearing surface out of 01 gravel 2cm thick with 15% wastage = 0.023m^3/m^2
7. Final coat asphalt = 1.6lts/m^2
8. Fino crushed aggregate and dust 1cm thick with 20% wastage. = 0.012m^3/m^2

c) Man - hole

1. 60 x 60 x 60cm made out of half brick wall bedded in cement Mortar 1:4

1 brick with 5% wastage = 111 pcs/pcs

2. Mortar with 15% wastage = 0.13m^3/pcs

2.1 Cement = 47.84kgs/pcs

2.2 Sand = 0.14m^3pcs

2. 60 x 60 x 60cm made out of 15cm thick hollow block bedded in cement mortar 1:4

1. Hollow block with 5% wastage = 23pcs/pcs
2. Mortar with 20% wastage = 0.037m^3/pcs

2.1 Cement = 13.45kgs/pcs

2.2 Sand = 0.037m^3/pcs

XVII. Fence work

Materials for Fence work are:-

1. Barbed wire in roll =200ml
2. U Nails in packet = 5kgs

3. Galv. Fencing net in roll 1-3m with = 25ml
4. Black sl fencing net in roll = 13ml
5. Black wire in roll = 25kgs
6. Angle iron in pcs = 6 or 12ml
7. Angle T iron in pcs = 6 or 12 ml
8. Eucalyptus posts in pcs = 2.00, 2.50 or 3.00 ml
9. Gabion in pcs = 1.00m

Calculating Labour Requirement

Item	Description	Labor Efficiencies			Labour Requirement
		Gang	Time	work to be excuted	
	1. Excavation & Earth Work				
1.1	Site clearing to remove topsoil to an average depth of 20cm	1D.L	8hr	$10m^2$	$48min/m^2$
1.2	Trench Excavation in ordinary oil				
	a. To a depth of 1.2m	1D.L	8hr	$1.25m^3$	$6.40hr/m^3$
	b. To a depth of 2.20m	1D.L	8hr	$1.00m^3$	$8.00hr/m^3$
	c. To a depth of 3.00m	1D.L	8hr	$0.75m^3$	$10.66hr/m^3$
1.3	Bulk excavation in ordinary soil				
	a. To a depth of 1.5m	1D.L	8hr	$1.5m^3$	$5.33hr/m^3$
1.4	Cart Away				
	a. To 500m away from the site	1D.L	8hr	$1.5m^3$	$5.33hr/m^3$
	b. To 1 km away from the site	1D.L	8hr	$1.m^3$	$8hr/m^3$
1.5	Hard-coring 25cm thick	1M+4D.L	8hr	$18m^2$	$26min/m^2$
1.6	Back fill around foundation:				
	a. Loose soil	1D.L	8hr	$2m^3$	$4hr/m^3$

	b. Aggregate	1D.L	8hr	11/2m^3	5.33hr/m^3
2.	**<u>Concrete Work</u>**				
	2.1 Lean concrete				
	a. 5cm thick	1M+6D.L	8hr	20m^2	24min/m^2
	b. 8cm thick	1M+6D.L	8hr	15m^2	32min/m^2
2.2	Floor Slab				
	a. 8cm thick	1M+6D.L	8 hr	15m^2	32min/m^2
	b. 10cm thick	1M+6D.L	8hr	12.5m^2	38min/m^2
	c. 15cm thick	1M+6D.L	8hr	10m^2	48min/m^2
2.3	Ground beam	1M+6D.L	8hr	11/2m^3	5.33hr/m^3
2.4	Footing	1M+6D.L	8hr	11/2m^3	5.33hr/m^3
2.5	Foundation column	1M+6D.L	8hr	11/4m^3	6.40hr/m^3
2.6	Upper tie beam	1M+6D.L	8hr	11/2m^3	8.00hr/m^3
2.7	Lintel	1M+6D.L	8hr	1m^3	8.00 hr/m^3
2.8	Column up to 2m	1M+6D.L	8hr	1m^3	6.40hrr/m^3
2.9	Column above 2m	1M+6D.L	8hr	11/4m^3	8.00hrr/m^3
3.	**<u>Masonry Work</u>**				
3.1	Stone Masonry sub-structure.				
	a. 40cm thick	2M+6D.L	8hr	5m^3	1.66hr/m^3
	b. 50cm thick	2M+6D.L	8hr	6m^3	1.33hr/m^3
	c. 60cm thick	2M+6D.L	8hr	7m^3	1.15hr/m^3
3.2	Stone Masonry super structure				
	a. 40cm thick	2M+6D.L	8hr	3m^3	2.66hr/m^3
	b. 50cm thick	2M+6D.L	8hr	4m^3	2hr/m^3
	c. 60cm thick	2M+6D.L	8hr	5m^3	1.6hr/m^3
3.3	Brick Masonry Wall for plastering.				
	a. 25cm thick upto 2m	1M+3D.L	8hr	7m^2	1.14hr/m^2
	b. 12cm thick upto 2m	1M+3D.L	8hr	9m^2	53min/m^2
	c. 25cm thick from 2-4m	1M+3D.L	8hr	5m^2	1.60hr/m^2
	d. 12cm thick from 2-4m	1M+3D.L	8hr	7m^2	1.13hr/m^2

3.4	**Hollow Block Masonry Wall for plastering**				
	a. 20cm thick upto 2m	1M+2D.L	8hr	$10m^2$	$48min/m^2$
	b. 15cm thick upto 2m	1M+2D.L	8hr	$10m^2$	$48min/m^2$
	c. 10cm thick upto 2m	1M+2D.L	8hr	$8m^2$	$1hr/m^2$
	d. 20cm thick form 2-4m	1M+2D.L	8hr	$8m^2$	$1hr/m^2$
	e. 15cm thick from 2-4m	1M+2D.L	8hr	$8m^2$	$1hr/m^2$
	f. 10cm thick from 2-4m	1M+2D.L	8hr	$6m^2$	$1.33hr/m^2$
4.	**Roofing Work**				
4.1	Leaf covering (G.C.I)	1C+2D.L	8hr	$40m^2$	$12min/m^2$
4.2	Ridge cover	1C+2D.L	8hr	70ml	7min/ml
4.3	Valley cover	1C+2D.L	8hr	70ml	7min/ml
4.4	Gutter fixing	1C+2D.L	8hr	30ml	16min/ml
Joining eucalyptus truss					
	upto 10m span on ground	1C+2D.L	8hr	4truss	2hr/truss
4.6	Down pipe fixing	1C+2D.L	8hr	40ml	12min/ml
4.7	Truss erecting	1C+2D.L	8hr	15tress	32min/tress
4.8	Fixing corrugated asbestos	1C+2D.L	8hr	$25m^2$	$19min/m^2$
4.9	Fixing EGA sheet joining	1C+2D.L	8hr	$30m^2$	$16min/m^2$
4.10	Joining Zigba Truss upto 10m span on ground	1C+2D.L	8hr	3tress	2.66hr/tr
4.11	Zigba truss erecting	1C+8D.L	8hr	15tress	32min/tru
4.12	Fdcid board fixing	1C+2D.L	8hr	70ml	7min/ml
5.	**Joinery - Work**				
5.1	Leaf covering (G.C.I)	1C+2D.L	8hr	3pcs	2.66hr/pos
5.2	Ridge cover	1C+2D.L	8hr	4pcs	2hr/pos
5.3	Valley cover	1C+2D.L	8hr	$10m^2$	$48min/m^2$
5.4	Gutter fixing	1C+2D.L	8hr	$10m^2$	$48min/m^2$
5.5	Joining eucalyptus truss				

	upto 10m span on ground	1C+2D.L	8hr	$13m^2$	$48min/m^2$
6.	**Metal Work**				
6.1	Metal door fixing	1W+2D.L	8hr	3pcs	2.66hr/pcs
6.2	Metal Window fixing	1W+2D.L	8hr	4pcs	2hr/pcs
6.3	French Window fixing	1W+2D.L	8hr	2pcs	4hr/pcs
7.	**Plastering & Pointing**				
7.1	1^{st} cost plastering	1P+2D.L	8hr	$35m^2$	$14min/m^2$
7.2	2^{nd} cost plastering	1P+2D.L	8hr	$10m^2$	$48min/m^2$
7.3	3^{rd} cost plastering	1P+2D.L	8hr	$14m^2$	$34min/m^2$
7.4	Pointing on stone Wall				
7.5	Pointing on brick wall	1P+2D.L	8hr	$8m^2$	$4hr/m^2$
7.6	Pointing on Hollow block	1P+2D.L	8hr	$14m^2$	$34min/m^2$
7.7	Pointing on dressed stone	1P+2D.L	8hr	$12m^2$	$40min/m^2$
7.8	Rendering	1P+2D.L	8hr	$20m^2$	$24min/m^2$
8.	**Flooring**				
8.1	Cement Screed	1M+2D.L	8hr	$14m^2$	$34min/m^2$
8.2	Cement tile fixing	1M+2D.L	8hr	$10m^2$	$48min/m^2$
8.3	Plastic tile fixing	1M+2D.L	8hr	$17m^2$	$48min/m^2$
8.4	Par - quet flooring	1M+2D.L	8hr	$15m^2$	$32min/m^2$
8.5	Wooden flooring	1C+2D.L	8hr	$8m^2$	$1hr/m^2$
8.6	Ceramic wall tile	1M+2D.L	8hr	7m2	$1.14hrn/m^2$
8.7	Plastic tile skirting	1M+2D.L	8hr	40ml	12min/ml
8.8	Cement tile skirting	1M+2D.L	8hr	12ml	$40min/m^2$
8.9	Marble slate flooring	1M+2D.L	8hr	12ml	$40min/m^2$
8.10	Marble slate skirting	1M+2D.L	8hr	16ml	$30min/m^2$
8.11	Fixing pre-cat window sill	1M+2D.L	8hr	10ml	48min/ml
8.12	Fixing un pre-cast window sill	1M+2D.L	8hr	6ml	1.33min/ml

9. Glazing

9.1	Cutting	1G+2D.L	8hr	$50m^2$	$10min/m^2$
9.2	Fixing	1G+2D.L	8hr	$20m^2$	$24min/m^2$

10. Painting

a) **Plastic paint**

10.1	Painting plastered wall Surface 3ocats	1P + 1DL	8hr	$30m^2$	$16min/m^2$
10.2	Painting Rendered wall surface	1P + 1DL	8hr	$25m^2$	$19min/m^2$
10.3	Painting Abujedid wall	1P + 1DL	8hr	$20m^2$	$24min/m^2$
10.4	Painting Hard board obi	1P + 1DL	8hr	$20m^2$	$24min/m^2$
10.4	Painting Cheap board ceiling	1P + 1DL	8hr	$20m^2$	$24ming/m^2$

b) **Synthetic paint**

10.6	Plastered wall surface in 3 coats	1p + ID1	8hr	$25m^2$	$19min/m^2$
10.7	Wooden surface	1p + ID1	8hr	$25m^2$	$19min/m^2$
10.8	Metal surface	1p + ID1	8hr	$25m^2$	$19min/m^2$

11. Sanitary work

11.1	G.1. pipe laying in Ground ½ - 11/4	1P+2DL	8hr	$120m^2$	4min/ml
11.2	Fixing – Bath tube Shower complete, wash Basin, water closest, bidet Sink, urinal	1p+1DL	8hr	1pcs	8hr/pcs

12 Electrical installation

2.	Fixing conduits	1E+1DL	8hr	40ml	12min/ml
12.2.	Pulling wires	1E+1DL	8hr	50ml	10min/ml
12.3.	Fixing switch & out-lets	1E+1DL	8hr	20pcs	24min/pcs
12.4.	Fixing fittings	1E+1DL	8hr	10pcs	48min/pcs

12.5.	Fitting distribution board	1E+1DL	8hr	10pcs	8min/pcs

13. **<u>Site Work</u>**

13.1	Drain laying				
	0.10 - 0.30m	1M +3 1DL	8hr	30ml	16min/ml
	0.40 - 0.60 m		8hr	20ml	24min/ml
	0.80 - 1.00 m		8hr	10ml	48min/ml
13.2	Curb Stone	1m+3DL	8hr	30ml	16min/ml
13.3	0.60 x 0.60 x 0.60m				
	manhole out of brick	1m+3DL	8hr	3pcs	4hr/pcs
13.4	0.60 x 0.60 x 0.60m				
	manhole out of hollow block	1m+3DL	8hr	2pcs	4hr/pcs
13.5	Feneing with Galv.				
	Feneing net	1C+2DL	8hr	$50m^2$	$10min/m^2$

<u>Calculating Unit Prices (Analysis of Rates)</u>

In ordinary type of building the cost of materials is about 60% & labor 40% of the total cost of the whole building.

Materials:- Walling material 25% cement 13% steel 10% timber 12%

Labor:- Excavation 1% mason 25% carpenters 12% smith 2%

The cost of separate items of works may be roughly as follows as percentage of the total cost of the building for a single storey building.

Excavation ……	1%
Concrete in Foundation ……	2%
Foundation wall up to plinth ……	5%
Walling (super structure ……	25%
Roofing……	20%
Flooring……..	6%
Joinery……	15%
Internal Finishes……..	6%
External……	3%
Water Supply & Sanitary work……	12%
Electrification……..	5%
	100%

For the purpose of calculating unit prices the details about all the operations involved in carrying out the work should be available, the quantities of materials required and their costs should be known and the number of different categories of laborers required and the capacity doing work per laborer and their wages per day should be known.

The rates of particular item of work depends on the following:-

- Specifications of work and materials, quality of materials proportion of mortar method of constructional operation.
- Quantities of materials and their rates, number of different types of labourer and their rates.
- Location of the site of work and its distance from the sources of materials and their rates.
- Profits overhead expenses & miscellaneous of contractor.

Material Cost – include

- The first cost (cost of origin)
- Cost of transport
- Taxes etc.

Labor Cost

Varies form place to place. In bigger cities where standard of living is high & specialized and experienced labor is higher than small towns and country sides.

Transportation

In the country if transportation of material is to be done the rate is on highway (as 0.02049 cents/kg/km on rural road (0.04 cent/kg/km).

Profit - Contractors are allowed to get a net profit of 6 - 8%

Overhead cost & Miscellaneous

These include general office expenses, rents taxes, Supervision and other costs, which are indirect expenses and not productive expenses on the job. And this is about 5 - 10%

The analysis of rates of different items of work is the summation of cost of material, cost of labour, transportation, profit & overhead cost and miscellaneous.

PRODUCTION RATE FOR BUILDING CONSTRUCTION

Item No	Type of activity	Unit	CREW FORMATION		Hourly Output
			Labour	Equipment	
1	5cm thick lean concrete (c-7)	m^3	1 Forman 2 mason 45 D/L	1 mixer	$2.25m^3$
2	Concrete C-15	m^3	1 Forman 2 mason 45 D/L	1Mixer 1 Vibrator	$2.25m^3$
3	C-25 concrete for footing	m^3	1 Forman 2 mason 45 D/L	1 Mixer 1 Vibrator	$2.25m^3$
4	C-25 concrete for column	m^3	1 Forman 2 mason 25 D/L	1 Mixer 2 Vibrator	$0.75m^3$
5	C-25 concrete for Grade Beam	m^3	1Forman 2 mason	1 Mixer 2 Vibrator	$1.75m^3$

			45 D/L		
6	C-25 Concrete for slab	m^3	1 Forman 2 Mason 45 D/L	1 Mixer 2 Vibrator	$2.50m^3$
7	C-25 top beam and Lintel	m^3	1 Forman 2 Mason 45 D/L	1 Mixer 2 Vibrator	$1.50m^3$
8	30 cm Ribbed slab	m^2	1/6 Forman 1Mason 2 D/L	-	$2.00m^2$
9	Wooden form work (Footing)	m^2	1/6 Forman 1 carpenter 1 Helper 1 D/L	-	$0.60m^2$
10	Wooden form work (Column)	m^2	1/6 Forman 1 carpenter 1 Helper 1 D/L	-	$0.50m^2$

TRANSPORT COST

To transport cement from Addis Ababa - Kebridehar

Type of Vehicle - Truck (N3) with trailer

Capacity of truck - 200 qtl/trip

Average speed of truck - 40km/hr

Total distance to cover - 1035 kms

Time taken to arrive - $\frac{1035}{40}$ = 25.8 = 26 hr = 3.25 days

7 days round trip

Rental rate of truck with feul and wage (Rental rate x day) hour/ day = (86 x 7) 8 = 4816 birr/trip

Feul Expense = $\frac{1035 \times 2}{1.5}$ (it covers 1.5 km/liter)

= 1389

= 1380 x 1.46 - Feul cost/liter (1.46 Birr/liter)

= 2014.80 birr

Driver wage.

a. Driver salary = $\frac{420 \times 7}{}$ = 113 birr

26

Benefit = 20 birr x 7 = 140 birr

?á= 253 birr

b. Assistant salary = $\frac{180}{26}$ x 7 = 63 birr

Benefit = 18 x 7 = 126 birr

?á= 189 birr

Grand total = 253 + 189 = 442 bir

Loading and unloading = (20 cents/qtl)

= 2(200 x 0.20) = 80 birr/qtl

Storage cost = (0.02 x 200) 10 days = 40 birr

Total transport cost = 4816 + 2014 .80 + 442 + 80 + 40 = 7392.80 /round trip

= $\frac{7392.80 \text{ birr}}{200 \text{ qtl}}$ = 36.96 birr ≈37 birr/qtl/tri

cost of cement = 41 birr/qt

Material + Transport cost

= 41 birr + 37 birr

= 78 birr/qtl

ITEM	TYPE OF WORKS	QUANTITIE

1. **Natural stone masonry for foundation 400mm thick hard basaltic stone masonry foundation wall bedded in cement mortar 1:4 in full joints**

   a. Basaltic stone =0.53m^3/m^2

a. 25 m^3/m^3 x 0.40m x 1.05 waste

b. Mortar 0.34m^3/m^3 x 0.40 x 1.05 waste = 0.14m^3/m^2

c. Cement = 0.392 qts/m^2

2. Ditto but one side roughly dressed and left for pointing

a. Basaltic stone :-

1.35m^3/m^3 x 0.40m x 1.05 waste = 0.56 m^3/m^2

b. Mortar

34m^3/m^3 x 0.40m x 1.05 waste = 0.14m^3/m^2

c. Cement = 0.392 qts/m^2

d. Sand = 0.11 m^3/m^2

12 cm thick brick wall (1:2:9)

3. Burnt brick walls for super structures

1120mm thick burnt brick wall bedded in cement lime mortar 1:2:9 both sides left for plastering

a. Brick = 57.7 pcs/m^2

b. Mortar (with 15% waste) = 0.0263 m^3/m^2

c. Cement = 0.031 qts/m^2

d. Lime = 0.048 qts/m^2

e. Sand = 0.02m^3/m^2

4. Ditto but 250mm thick

a. Brick = 115.4 pcs/m^2

b. Mortar (with 15% waste) = 0.062 m^3/m^2

c. Cement = 0.07 qts/m^2

d. Lime = 0.11 qts/m^2

e. Sand = 0.05 m^3/m^2

5. Coats of oil paint (enamel) to galvanized steel sheet fishing: -

a. Priming = 0.10 lit/m^2

b. Under coat = 0.08 lit/m^2

c. Finishing coat = 0.07 lit/m^2

Covering capacity of paint etc on various applied hand	**m^2 covered by 1 lit**
Special aluminum priming coat on planed timber	20
Lead Priming wat coat on planed timber	12

First a coat of all paint after priming	16
Second coat	18
Third coat	22
First coat of oil paint on previously painter timber	18
Second coat	20
Oil glass paint applied as a finishing coat	24
Under coat for enamel	20
Enamel on prepared surface – first coat	14
Enamel on prepared surface – second coat	18
Flat finish for varnish	22
Varnish on prepared surface – first coat	16
Varnish on prepared surface – second coat	20
Stain applied to planed timber	10
Stain applied to unwrought timber	10
Priming coat on brick or stucco	8
Priming coat 1 concrete, compo or stone	10
Priming coat on plastor	18
First coat oil paint after priming	12
Oil glass pait applied as a finishing coat	18
Priming coat on smooth iron	20
Priming coat 1 concrete, compo or stone	10
Priming coat on plastor	18
First coat oil paint after priming	12
Oil glass pait applied as a finishing coat	18
Priming coat on smooth iron	20
Priming coat on slightly rusted iron	14
Priming coat rust – pitted iron	10
First coat often priming	20
Second coat after priming	24

Description	**Paint required in KGS**	
1. Aluminium priming coat on planed timber	m^2	0.10
2. Lead priming coat on planed timber	m^2	0.22

3. First coat of paint on priming	m^2	0.15
4. Second coat	m^2	0.14
5. Third coat	m^2	0.10
6. oil galss finishing coat as third coat	m^2	0.11
7. First coat of paint on previously coat of timber	m^2	0.10
8. Second coat	m^2	0.16
9. Oil glass finishing coat as third coat	m^2	0.16
10. Margins to floors – first coat	m^2	0.14
11. Margins to floors second coat	m^2	0.13
12. Margins to floors third coat	m^2	0.11
13. Margins to reads and riscrs – first coat	m^2	0.16
14. Margins to reads and riscrs second coat	m^2	0.16
15. Margins to reads and riscrs third coat	m^2	0.14
16. Narrow molding slitting, etc, 75mm girth	100 meter 1.1	
17. Narrow molding slitting, etc, 150mm girth	100 meter 2.2	
18. Narrow molding slitting, etc, 75mm girth	100 meter 3.3	
19. Priming coat on brick or stucco	m^2	0.35
20. Priming coat on concrete, stone, cromp	m^2	0.28
21. Priming coat to brick or stucco	m^2	0.35
22. First coat of paint after priming	m^2	0.21
23. Oil glass paint as finishing coat	m^2	0.14
24. Rafter ends per 300 mm length of less	each	0.02
25. sash frmes	100 meter	0.35
26. Small sash squares	m^2	0.18
27. Sash	m^2	0.18
28. Large sash squares	m^2	0.08
29. Extra large sash squares	m^2	0.06
30. Sash edges	m^2	0.02
31. Shelf edges	m^2	0.01

TYPE OF PAINT	**WEIGHT IN KILO GRAMS PER LITTER**

With the lead paint without colcut	3.00
Lead based paints of light colour-cream grey, stone etc.	2.75
Lead based paint of dark colur-red brown	2.60
Lead based paint of green colurs	2.50
Black paint	2.20
Oil gloss paint	3.00
Lead priming coat for wrought timber	3.00
Special alumining coat for wrought timber	2.00
Priming coat for brick, sturcqu and plaster	2.60
Priming coat for concrete, compo, and stone	3.00
Priming coat for iron(oxide paint)	2.00
Stain	1.30
Varnish	1.40

Item	**Type of work**	**Quantities**
	FENCE WORK	
	100 x 100 mm over all length 2400 mm fence post with wood sank into concret base + 5% waste	
	a. Strut to 2400 mm fence post	= 1.05 pcs/m^3
	b. Barbed wire fencing + 2% waste	= 1.02 m/ml
	c. Fixing clips + 5% waste	= 0.52 pcs/ml

Ridgecover

Ridge sheet = 1.10ml/ml

Dome headed nails = 0.05 kg/ml

The absolute volume of material, is the minimum volume of the material with all voids removed, is given by the equations.

$$\text{Absolute volumes} \quad \frac{\text{weight of material in kilogram's}}{\text{Specific gravity x weight of } 1m^3 \text{ of water}}$$

$$\frac{\text{Wt of material in kgs.}}{\text{S. B x 100 kg.}}$$

1.	Nails	Pcs	Kilograms
	1 cm	950	1
	2 cm	815	1
	4 cm	546	1
	6 cm	275	1
	7 cm	180	1
	8 cm	127	1
	10 cm	63	1
	12 cm	44	1
	15 cm	29	1

Glazing

3mm thick clear sheet glass

a. 1 + 10% waste.

c. Putty with leased oil

4mm thick clear sheet glass

a. 1 + 10% waste

b. Putty with leased oil

Wire mesh 1 roll = 25ml

Barbed wire 1 roll = 200 ml

Roofing nails = 1 kg = 105pcs

Roofing nails = 1pkts = 315pcs = 3kg

Plastic washers = 1pkts = 300pcs

Jhooks for asbestos sheet (EGA Sheet) = 9 – 10pcs/sheet 16mm iron bond = 15 ml/kg.

Assumption: -

a Roof work:-

- Roofing nails = 14 pcs /C.I.S/
- Purlin = 8 cm nails
- Truss = 10 or 12 cm Nails – 20 – 35 pcs per

10 Eucaly puts truss = nails 20-25 pcs/truss

P. reservation oil = 0.2 gallon/truss

b. **Ceiling work:-**

- Battens = 8 cm nails - 16pe/m^2
- Chip wood = 4 cm nails - 80 pcs per chip wood of –25 pecs per m^2

Area of caling = 192.54m^2

$\frac{192.54}{1.25 \times 2.50}$ x 1.05 = 65 pcs of 8mm chip wood

c. **Beams:-**

4cm Nails per chip wood =65 x $\frac{80pc}{546\ pcs}$ = 9.52kg

- 6 cm nails = 50 pcs 1 ml
- 12 cm nails = 6 – 8 pcs ml (stiffening)

1 gallon of paint = 4 kilograms = 4 liters

7 meters band iron = 1 kilogram

1 gallon of plant covers = $15m^2$

EGA sheet max length 400cm x 80.6cm

- side over laping 1.5 3cm

Front and rear

400 – 0.20 = 380 cm

806 – 0.3 = 776 ½ cm

3.8 x 0.776 - $\left[\underline{\underline{2.95m^2}}\right]$

EGA sheet + 9 400 x 8.6cm

Cover an area $\left[\frac{2.95m^2}{1.80}\right]$

200 – 20

1.80 x .776

Ega 500/0.6m width - ≥ 0.63m

Length ≤ 5m