Government of Tamil Nadu

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ESTIMATING AND COSTING - II

DIPLOMA IN CIVIL ENGINEERING

(SIXTH SEMESTER / THIRD YEAR)

(Syllabus M-Scheme)

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Untouchability is a sin

Untouchability is a crime

Untouchability is a inhuman

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PREFACE

We deem it a pleasure to present ESTIMATING AND COSTING - II book for Diploma in Civil Engineering under Directorate of Technical Education, Tamil Nadu. Efforts have been made for making this learning material to meet the requirements and standards of curriculum in ESTIMATING AND COSTING – II of sixth semester civil engineering prescribed by DOTE.

With the increase in construction of sky scrapers it is essential to forecast the cost with the inputs of architects and engineers to ensure the financial feasibility and scope requirements. Estimate is the process of calculating the quantities and cost of various items of the work, based on the dimensions in the drawings and the unit cost of the item.

This book deals with the importance of writing the specifications of materials, writing technical reports, preparing data for various items of work and detailed estimate of structures with latest rates. Two, three mark questions and problems for practice are also given at the end of each unit.

The convener, authors and reviewer are very much grateful to the Commissioner of Technical Education, Chennai for his dedication and encouragement in the preparation of this syllabus based learning material and to the officials of DOTE, Chennai.

CONVENER, AUTHORS and VALIDATOR

ESTIMATING AND COSTING – II

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Construction of bridge / Culvert across a river

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1. Septic tanks with dispersion trench / sock pit
2. Open Well with Masonry Steining
3. Rain water harvesting – Shallow Recharge Well
4. Square RCC Over Head Tank on Four columns with Staging

UNIT – V

Taking off Quantities of Road / Bridge Structures using Trade System

Preparing detailed estimate using Trade system and Take off quantities for all items of works in the following Road / Bridge Structures:

1. Water Bound Macadam Road
2. Cement Concrete Road with side drains
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4. Tee Beam Bridge.

1.1.1. General

The structural drawings show the shape and sizes of the various structural components. It is not possible to give details regarding the quality of materials and the workmanship of each and every item of the work on the drawing itself. The quality of materials and workmanship or the method of completing the works, tools and plants to be used etc., details are furnished in a separate contract document known as specifications of the work. Therefore the specifications along with detailed drawings completely define the structure and furnish the full details physically as well as technically.

1.1.2. Specification

Specification is an important document attached with a tender form or contract agreement, which are required to complete an engineering project in accordance with its drawing and details. Specification specifies the nature and the class of work, materials to be used in the work, workmanship etc., The cost of the work depends on the specifications of material and workmanship.

1.1.3. Necessity

The specification defines the quality of materials and workmanship. Hence the contractor who is filling the tender for the work will be able to put correct rates for the different items of the work.

- The information contained in the specification serves as a guide to the contractor as well as the supervising staff during execution of the work.
- Specifications help the owner to check and satisfy with the quality of works, during execution.
- In case of any disputes between the owner and contractor with respect to the method of construction, quality and quantity of materials used, equipments and machineries used etc., the specification plays the major role in solving the disputes and arriving at a settlement.

1.1.4. Importance of specifications

Drawings and specifications form two important contract documents. Informations (such as dimensions, types of constructions etc.,) which can be easily expressed graphically are put up on the drawings. On the other hand, instructions which can be easily expressed well in words are written in the specifications. But generally, the provisions in the specifications are given more legal strength and most of the contracts state that in case of discrepancy between the drawings and specifications, the provisions of the specifications shall govern. Thus the specifications play an important part in construction work and heavy responsibility is attached to the specification writer for his job.

1.1.5. Types of Specifications

The specifications are broadly divided into three types.

1 General specification
2 Detailed specification
3 Standard specification

1.1.6. General Specification

General specification gives the nature and class of work and materials in general term, to be used in the various parts of work, from the foundation to the super structure. It is a short description of different parts of the work specifying materials, proportion, qualities etc., They are used in the estimates by the person who prepares the estimates and give the general idea of the whole work. The general specification does not form a part of the contract document.

1.1.7. Detailed Specification

The detailed specification of an item specifies the quantity and quality of the materials, mortar proportion, and workmanship, method of preparation, method of execution and method of measurements. The detailed specification for different items of work is prepared separately, and describes what the works should be and how they shall be executed and constructed. Detailed specifications are written to express the requirements clearly in a concise form avoiding repetition and ambiguity. The detailed specifications are arranged as far as possible in the same sequence of order as the work is carried out. The detailed specifications if prepared properly are very helpful for the execution of work. The detailed specifications form an important part of contract document.

1.1.8. Standard Specification

Usually the specifications are standardized for most of the items of work occuring in the similar works, by the departments. These standard specifications are numbered. After standardizing the specifications, it is not necessary to write detailed specifications with all the contract bonds. While writing the contract bond only the serial numbers of the standard specifications are written. This saves lot of time, labour and stationary expenditure. Thus standard specifications save the lengthy process. This specification of C.P.W.D., P.W.D. of states is treated as standard specifications. All the specifications given in this chapter are based on the standard specifications. These standard specifications are also revised from time to time to include changes in technique while preparing contract bond, the details of standard specifications with date of issue, title etc., should be mentioned.

1.1.9. Essential requirements of specifications

Following are the some of the essential requirements of good specification writing.

1. Subject matter

The subject matter of the specification should relate to the information required after the

contract is given to a particular contractor. The requirements which are to be enforced should only be included in the specification.

2. Grammar

All the sentences of the specifications should follow the rules of grammer. The writing style and tense should remain the same throughout. Hyphens, commas and semi - colons should be used as and when required and the sentence should be framed in such a way that the addition, omission or misplacement of a comma does not alter the sense.

3. Selection of words

While writing specifications, only suitable words with desire meaning should be used. The unfamiliar words or words having more than one meaning, the use of unusual technical and trade expressions and semi – legal words should not be used.

4. Accuracy

The information should be complete and correct otherwise it may be misleading to the contractor. Also care should be taken to see that information is not repeated in the specifications.

5. Practical limits and commercial sizes

The specifications should be framed keeping in view the practical limitation of materials and workmanship and they should not specify practical impossibilities. Also, the specifications should specify use of commercial sizes and patterns of the materials, commonly available in the market / firm.

6. Clearness

The information should be clear. It should state what the contractor shall do or shall not do.

7. Brevity

The sentences of the specifications should be short, simple and concise. In this main purpose of the specifications is to give directions to the contractor and the supervising staff in carrying out the construction work.

1.1.10. General and technical provisions of detailed specifications

1 General Provisions

These are also known as conditions of contract and they apply to the work as a whole. In this document, the conditions governing the contract are written.

The following groups of contract are generally accommodated under the general provisions.

1. Conditions relating to documents.
   * Drawings
   * Bill Off Quantities (BOQ) and schedule of prices
   * Indian Standard specifications.
2. Conditions relating to labour and personal
   * Safety measures to workers
   * Contractors representative

* Accidents to workmen
* Accommodation to employees
* Removal of the employees of the contractor
* Contractors and Engineers representative.
* First aid.

3. Conditions relating to the general obligations of the contractor
   * Acts , bye - laws and regulations
   * Fencing, watching and lighting of the work spot.
   * Insurance.
   * Access to works
   * Site and setting out.

4. Conditions relating to the execution of the work
   * Workmanship
   * Damages
   * Defective work
   * Rates of extra items
   * Alterations, additions and omissions during the progress of work.
   * Work at night and on holidays etc.,
   * Water for construction

5. Conditions relating to measurements and payments
   * Method of measurement of completed works
   * Method / Mode of payment.
   * Payments to sub- contractors.

6. Conditions relating to the default and non-completion
   * Failure to compete the work in time.
   * Right to suspend the work by the owner
   * Engineer during construction
   * Time of completion of the work etc.,

7. Conditions relating to settlement of disputes.
   * Arbitration
   * Jurisdiction of court etc.,

2 Technical provisions

These specifications describe the technical requirements of each part of constructions. The technical provisions contain detail instructions regarding the desired quality of the final product. Technical provisions also describe regarding the inspections and tests, which shall be done during the construction to make sure regarding the quality of materials and workmanship.

(i) Specifications for materials and workmanship

These specifications are prepared to have a rigid control over the quality of materials and workmanship.

* Physical properties such as size, shape, grade, strength, hardness etc.,
* Chemical composition of the material.
* Appearance of the material
* Electrical, thermal and acoustical properties.
* A clear statement regarding the inspection and procedure of test of the material.

(ii) Specification for performance

These specifications are written for the overall performance of the finished product and hence, they are written for equipments and machinery such as pumps, motors etc.,

(iii) Specifications for proprietary commodities

It describe about the standardized items or patened items.

* Commercial products which are standardized or patented are called proprietary commodities.
* The specifications written for such materials should include the name of a particular brand or firm. (Eg. Sun brand , Everest brand etc.,)
* However, it is not desirable in case of public works to specify certain trade names or brands.

1.1.11. Specifications for various materials

1. Cement

Cement shall be Ordinary Portland Cement (OPC) or Rapid Hardening Portland cement confirming to IS: 269 - 1976. The cement to be used shall be fresh and shall comply with the standard requirements. The minimum compressive strength of ordinary Portland cement should be 175 Kg/cm² after 7 days of 1:3 cement mortar cubes.

2. Sand

The fine aggregate (sand) shall confirm to IS 383 - 1963. It shall be clean, sharp, heavy and gritty to touch. It should be free from clay, mica, vegetables and other organic matter.

3. Brick

The bricks shall be table moulded, well burnt in approved kiln, copper - coloured and free from cracks. It should be sharp and square edges. It should be uniform in shape and standard size. It should not be absorb water more than one - fifth of their weight after one hour of soaking in water. It should have maximum crushing strength of 10.5 N/mm².

4. Timber

The timber should be well seasoned. It should be of the best quality. It should be free from knots, flaws, shakes and cracks and other defects. Patching or plugging of any kind is not permitted.

5. Stone

It should be crushed or broken from hard stone obtained from approved quarry. It should be

tough and of uniform shapes. It should be hard, strong durable, thin flat and flakey. The size of the stones should not be less than 15cm in any direction.

6. Aggregate

The coarse aggregate should be in size from 20mm to 40mm. It should be clean and free from impurities for the concrete work. The unclean aggregates should be screened and washed before use.

7. Reinforcement (Steel)

The reinforcement shall be of high strength deformed steel bars confirming to IS: 1786. It should be bendable, weldable and have the modulus of elasticity not less than 200KN/mm². The yield strength of the steel used shall not be less than 415 N/mm². All reinforcement bars shall be free from loose mill scales, loose rust and coats of paints, oil, mud or other coatings which may destroy or reduce bond.

8. Tiles

They should be manufactured under hydraulic pressure of not less than 14 N/mm². The proportion of cement to sand in the backing of the tiles shall not be lesser than 1:3 by weight. The marble chips should be hard, dense, sound and homogeneous in texture. The size and shape of the tiles should be as per the detailed specification.

9. Bitumen

The BIS introduced paving grade bitumen specifications IS: 73- 1950. It is in brown blackish colour. The ductility value of bitumen should not be less than 50. The bitumen grade is specified in term of penetration value. The bitumen of grade 80/100 means that the range of penetration value of the material is between 80 and 100. As per IRC recommendation bitumen grades 30/40, 60/70 and 80/100 for bituminous macadam road. As per IRC recommendation the specific gravity of pure bitumen is usually in the range of 1.01 to 1.03.

10. Water

Potable water may be used for the construction work. It should be fresh, clear, colorless and odourless.The suspended solid matter in the water shall not exceed 200 mg/lit. The PH value of water shall be not less than 6. It shall be free from salts and organic impurities.

1.1.12. General Specification for a building

General specifications give the idea and class of work in general terms and are generally attached with the rough cost and detailed estimates.

1. General specification for Earthwork excavation for foundation

The excavation shall be carried out in accordance with the dimension. Sides are truly vertical and base shall be levelled.

2. Foundation concrete.

Cement concrete 1:4:8 using 40mm size blue granite broken stone shall be used.

3. Foundation and basement

Brick work in cement mortar 1:5 using 7.5 grade bricks shall be used.

4. Damp proof course

D.P.C shall be of 25mm thick cement concrete 1:1.5:3 with standard water proofing material.

5. Super structure

Brick work in cement mortar 1:6 using first class bricks shall be used.

6. Earth filling

Basement shall be filled by excavated earth.

7. Flooring

Mosaic flooring over a base of 100mm thick cement concrete 1:5:10 using 40mm size brick bats shall be used.

8. Roofing

Roofing shall be 120mm thick RCC roof in M20 grade concrete using 20mm size blue granite broken stone and Fe415 grade steel.

9. Finishing

Plastering the walls and ceilings with cement mortar 1:3, 12mm thick and finishing the same with three coats of white washing.

10. Doors and windows

Country wood doors and windows painted two coats with ready mixed paint over a primer coat. Windows shall be provided with iron gratings or grills.

General specifications are available for the following types of buildings.

(a) First Class building
(b) Second class building
(c) Third Class Building
(d) Fourth class building

(a) General Specifications of first class building

(i) Foundation and plinth

Foundation and plinth shall be of first class burnt bricks in the lime or cement mortar (1:6),over a bed of cement concrete.(1:6:12 or 1:8:16 or as per design).

(ii) Superstructure

Superstructure shall be of first class burnt brick work in lime or cement mortar (1:6).

(iii) Damp proof course (D.P.C)

D.P.C shall be of 8cm thick cement concrete (1:2:4) with one layer of bitumen laid hot or any other specified water proof material.

(iv) Roofing

Roofing shall be of R.C.C. slabs (1:2:4) covered with two coats of bitumen laid hot and a layer of lime or cement concrete 8cm, thick over it with a tile flooring with cement flush pointed on the top.

(v) Flooring

Flooring shall be of TERRAZO in drawing, dining, bath and W.C., 4cm thick plain conglomerate polished floors in bed rooms and in other rooms.

(vi) Doors and windows

Doors and windows shall be of teak wood, panelled or panelled and glazed with wire gauge shutters to outer doors and fixed wire gauge to windows and ventilators. Fittings shall be preferably of brass or good quality metal.

(vii) Finishing

The inside and outside walls shall have 1.25cm thick cement plaster (1:5),Drawing, dining and bed rooms inside of walls shall have 2 coats of distemper and other rooms shall have three coats of white washing. The outside of the walls shall have two coats of colour washing over one coat of white washing.

(viii) Painting

Doors and windows shall be given three coats of white lead where exposed and white zinc or cream or grey silicate paint elsewhere.

(ix) Miscellaneous

First class buildings shall be provided with first class sanitary and water supply fittings and electrical installations. A plinth protection 1.5m wide of bricks sloped away from the building shall be provided all round the building.

1.1.13. General specification for a culvert

1. Earthwork excavation

The excavation shall be measured as per exact length and width.

2. Foundation

The foundation shall be laid on the stratum having the required bearing capacity, but not less than 1.5m below the protected bed level.

3. Sub structure

RCC abutments and wing walls are to be provided in M20 grade concrete using Fe415 grade steel, as per design requirements.

4. Super structure

RCC work in deck slab should conform to the provision of formwork, steel reinforcement and structural concrete given in standard specifications of IRC.The whole slab shall be cast with reinforcements embedded for road kerb and railing, needle vibrators to be used for compaction.

5. Wearing coat

A bituminous wearing coat of 20mm thick premix carpet with seal coat has to be provided after the deck slab has been cast true to lines and levels.

6. White wash

The concrete surfaces are to be white washed 3 coats.

1.1.14. General specification for a concrete road project

1. Sub grade

Leveling and compacting the surface with a camber of 1:48 for 8 metre width, uniform along the full length, with watering.

2. Soling

Soling with 150mm size granite boulders, packed completely with gravel and compacted with hand roller, dry and wet rolling.

3. Spreading gravel

Red gravel spread over the base for 20mm thickness, watered and rolled.

4. Finish

Covered with a thin layer of sand.

1.1.15. General specification for a Tar road project

1. Preparation of base

Cleaning the surface with wire brushes and removing the dust completely patching all pot holes.

2. Application of bitumen binder

Applying heated bitumen uniformly at the rate of 0.9 kg/m².

3. Spreading of chips

Spreading 12mm size stone chips uniformly, 20mm thick.

4. Rolling

Rolling 6 to 8 trips with 8 ton power roller.

1.1.16. Detailed specification for works

1. Detailed specification for Earth work excavation for foundation

Starting of work – Workmanship – Excavated materials – Protection to the existing services – Measurement.

Starting of work

The excavation for the foundation trenches shall be carried out in all sorts of solis as per plan and lining approved at site.

Workmanship

The sides of the foundation trenches shall be truly vertical and bottom shall be uniformly levelled.

Excavated materials

The excavated material shall be stacked away from the sides of the trenches of the excavation by at least 2 metres. The excavated material shall be filled in the plinth in layers of 30cm and well – watered. The surplus excavated material shall be spread out uniformly up to a lead of 100 metres.

Protection to the existing services

All the existing services such as water pipes, sewers, electric cables, etc., Which are met with in foundation trenches shall be carefully supported and protected by the contractor as per instructions of the engineer.

Measurement

The excavation shall be measured as per exact length and width of the lowest step of footings according to drawing or the engineer's instructions. The depth of the trenches shall be measured vertically from the average ground level taken at site before starting the work.

2. Detailed specification for Foundation Concrete

Proportion – cement – Fine aggregate – Coarse aggregate - Water – mixing – laying and compacting – Curing – measurements.

Proportion

Cement: sand**:** broken stone ratio shall be 1:4:8 by weight or by volume. A water cement ratio of 0.5 may be adopted.

Cement

The cement to be used in this work shall comply with the standard requirements. It should be free from any organic.

Fine aggregate

The sand to be used shall be clean and washed. It shall be free from any organic.

Coarse aggregate

The coarse aggregate for the concrete work should be clean and free from impurities. The unclean aggregates should have to be screened and washed before use. The size of coarse aggregate varying from 20mm to 40mm for concrete work.

Water

The water to be used in concrete work shall be clean and fresh.

Mixing

The cement and sand in the required proportion 1:4 are mixed in dry condition thoroughly , by turning twice or thrice to get a uniform coloured mixture. This dry mixture of cement and sand is mixed with the specified quantity of stone aggregate till the stone aggregate is uniformly coated with the dry mix. Water is then added gradually to the required quantity and mixed thoroughly to have uniform plastic mix. All those mixing operations shall be done on a non – porous platform.

Laying and compacting

Concrete shall be laid gently in layers of thickness not exceeding 150mm and compacted well by pinning with rods and wooden tampers or using vibrators, until a dense concrete is obtained. The concrete shall be free from air holes, honey combs etc., on removal of side shutters.

Curing

The concrete has to be kept wet by flooding with water or by covering with wet gunny bags or with wet sand for at least 21days.

Measurements

Measurement shall be taken in cu.m for the finished concrete. The length and breadth shall be measured correct to 1cm and depth correct to 0.5cm. The rate shall be for the complete work including the cost of form work if required, and all tools and plants.

3.Detailed specification for Stone / Brick masonry

Properties of bricks – soaking in water – mortar – workmanship – measurement- scaffolding.

Properties of bricks

Bricks shall be table moulded, well burnt in approved kiln, copper colored, free from cracks and with sharp and square edges. Bricks shall be uniform in shape and shall be of standard size and shall give clear ringing sound when struck with each other.

Soaking in water

Bricks shall be well soaked in water for at least 12 hours before their use, preferably in a tank provided at site of work.

Mortar

The proportion of mortar shall be one part of cement to five parts of sand by volume and shall be prepared as per standard specifications for cement mortar. The cement and sand shall confirm to the standard specifications.

Workmanship

Broken bricks shall not be used except as closers. All corners shall be truly to plumb. Mortar joint shall break for bonding and shall not exceed 100 mm in thickness. Only masons shall be employed on the work and shall be kept well watered for at least 15 days. All brickwork shall be carried out in such a way that no portion is raised unduly above another.

Measurement

The length and height shall be measured as on at site. The thickness of walls shall be paid for as one brick, one and a half brick, and two bricks and as so on.

Scaffolding

The rate for brick work includes necessary scaffolding also, and no extra amount shall be paid for the same.

4. Detailed specification for Doors / Windows

Properties of timber – fabrication and fixing – design of shutters and frames – Workmanship – measurements.

Properties

- The timber to be used shall be of the best quality, well- seasoned.
- It should be free from cracks, knots, flows, shakes and other defects.

Fabrication and fixing

The rate of doors and windows includes fabricating and fixing in position of doors and windows.

Design of shutters and frames

The shutters shall be prepared from scantlings 40mm in thickness as per the design / detailed drawings. The thickness of panel shall be 40mm.The frames of doors and windows shall be of 100mm x 8mm size. Three numbers of hold fast shall be provided on each side of the door frame.

Workmanship

The workmanship of timber shall be of the best quality. Only skilled carpenters shall be employed on the work.

Paint

The rate for timber work includes three coats of oil paint.

Measurements

The measurements of the work shall be taken overall (including frames), and no extra amount shall be paid for any wastage of the materials.

5. Detailed specification for R.C.C in columns / beams / Slabs (1:1.5:3)

Proportion – cement – fine aggregate – coarse aggregate - water – reinforcement – Centering - mixing – placing and compaction – Curing – Finishing of exposed surface – Measurement.

Proportion

The proportion of cement concrete shall be of 1 part of cement, 1.5 parts of sand and 3 parts of coarse aggregates by volume.

Cement

The cement to be used in this work shall comply with the standard requirements.

Fine aggregate

The sand to be used shall be clean and washed. It shall be free from any organic**.**

Coarse aggregate

The size varies from 20mm to 6mm. The coarse aggregate for the concrete work shall be clean and free from impurities. The unclean aggregates shall have to be screened and washed before use.

Water

The water to be used in concrete work shall be clean and fresh.

Reinforcement

All reinforcement shall be of steel which shall comply with the standard requirements. All bars shall be placed as per design given by the Engineer. Before laying the concrete, the reinforcement shall be got approved by the Engineer.

Centering

The centering for the concrete work shall be sufficiently strong and rigid and in good condition. The material for formwork shall be of timber or steel plates. The centering shall be removed only after obtaining the written permission of the Engineer.

Mixing

The mixing of concrete shall be done in a mechanical mixer or by hand operations. The concrete from the drum shall be placed on a water – tight platform. The dry concrete shall be mixed at least three times and then required quantity of water shall be added to it. Incase of hand mixing, the mixing of concrete shall be done on water – tight platform.

Placing and Compaction

The concrete shall be transported and placed in position within 20 minutes after mixing the water. It shall be well compacted by mechanical vibrators to obtain a dense concrete. Vibration should be done as soon as the concrete is placed in position. All the above work should be completed before the concrete starts setting, normally 30 minutes from the time of mixing water . Over vibration shall be avoided, Which otherwise cause segregation of aggregates.

Curing

The concrete has to be kept wet for one day by covering with wet gunny bags or wet sand . From the next day it has to be provided with lean mortar bunds to enable flooding of water continuously for a minimum period of 14 days. In the case of columns, the surface of concrete has to be covered with gunny bags, and wetted by spraying water, for 14 days , without allowing the bags to dry.

Finishing of exposed surface

If specified the exposed surface shall be plastered with 1:3 cement mortar not exceeding 6mm thickness and the plastering shall be applied immediately after removal of the centering while the concrete is green. Immediately before applying the plaster the surface of concrete shall be wetted and neat cement wash shall be given.

Measurements

Measurement shall be taken in cum for the finished work and no deduction shall be made for the volume of steel. Steel reinforcement shall be measured under a separate item in quintal. Plastering, if any , shall not be included in the measurement. The rate of R.C.C. work shall be for the complete work excluding steel but including centering and shuttering and all tools and plants.

6. Detailed specification for Plastering

Materials – Thickness – mixing mortar – Application of mortar – Curing – Measurements.

Materials

Portland cement of initial setting time not less than 30 minutes and medium size clean sand, free from organic matters and salts are to be used for making mortar. The water to be used shall be clean and potable.

Thickness

Thickness Shall be 12mm , 15mm or 20mm thick as specified.

Mixing mortar

The sand and cement shall be first mixed dry in the required proportion thoroughly to get a uniform colour. The required amount of water shall be added slowly and gradually and the mortar mixed wet to give a uniform paste.

Application of mortar

The surface to be plastered shall be cleaned and wetted with water before the mortar is applied. Plastering shall be started from the top and proceeded towards the bottom. The plastered surface shall be made level and flush with wooden straight edges and rubbed thoroughly with wooden floats to ensure smooth and even surface.

Curing

Plastered surface shall be kept wet by sprinkling water for at least 7 days.

Measurements

If the plastering work shall be measured in sq.m. Then thickness of plastering work is not to be considered.

7. Detailed specification for Flooring

Base course – Mosaic tiles – Laying of tiles – Curing, polishing and finishing – Measurements.

Base course

The base shall be made rough and watered and given a cement wash and then the concrete shall be laid in 20mm thick. The top of flooring concrete shall be cleaned well and applied with a cement slurry before placing the chips concrete. After laying, the concrete shall be compacted by beating and tamping and level with wooden floats.

Mosaic tiles

Precast tiles of 200mm x 200mm x 20mm size are to be used. They shall be manufactured under hydraulic pressure of not less than 14N/mm^2.The proportion of cement to sand in the backing of tiles shall not be less than 1:3 by weight.

Laying of tiles

The bedding for the tiles shall be with cement mortar 1:3. The average thickness of the bedding mortar shall be 20mm and the thickness at any place shall not be less than 10mm. Cement mortar bedding shall be spread, tamped and corrected to proper levels and allowed to harden before the tiles are set. Tiles shall be washed clean and shall be fixed in this grout one after another. Each tile being gently tapped with a wooden mallet till it is properly bedded. The joints shall be kept as thin as possible not exceeding 1.5mm and in straight lines.

Curing, polishing and finishing

The surface should be kept wet curing all these days. After final rubbing the surface shall be thoroughly cleaned by washing with soap water and then with clean water. The floor shall then be kept wet for a minimum period of 7 days. After grinding , the surface shall be again cured and

polished with machine fitted with medium grade grit blocks. After the final polish, the surface shall be cleaned using diluted oxalic acid and wiped with a soft cloth.

Measurements

The payment shall be made for the actual work done on superficial area basis.

8. Detailed specification for Painting / varnishing

Cleaning – Paint – Application - Workmanship – Measurement – Rates.

Cleaning

The surface to be painted shall be cleaned and made smooth by rubbing sand – papers of different grades. In case of steel work, the dust and scales shall be thoroughly removed. All the holes and open joint shall be filled up with plaster of Paris and rubbed smooth.

Paint

The paint to be used shall be of approved tint and make. The pure turpentine shall be used as a thinning agent.

Application

Painting shall be carried out at the driest season of the year. Paint shall be applied with brushes, smoothly spread without any visible brush mark. The second coat shall be applied when the first coat is perfectly dried. The paint shall be stirred often with a stick, so that it does not settle down.

Workmanship

The paint shall be applied in the best workmanship manner. The brushes to be used shall be of the best quality.

Measurement

The doors and windows shall be measured flat on two sides.

Rates

The painting shall be paid in superficial contents.

9. Detailed specification for Damp proof course (DPC)

Proportion – Coarse aggregate – Fine aggregate – Cement – Water proofing compound – Mixing – Preparation of base – Curing.

Proportion

The proportion of Damp proof course shall be of plain cement concrete of 1:2:4 mix and the usual thickness of D.P.C. shall be 25mm to 40mm.

Coarse aggregate

12mm size hard and dense stone chips shall be used as coarse aggregate and free from earth, coal dust and other organic materials.

Fine aggregate

River sand of 5mm nominal size shall be used as fine aggregate. The aggregates shall be clean and free from dust, dirt, mud and organic matter etc.,

Cement

Fresh Portland cement of ISI approved brand of 43 grade shall be used as a binding material.

Water proofing compound

The water proofing compound to be used shall be of standard specifications. The water to be used shall be clean and fresh.

Mixing

Mixing shall be done in a masonry platform or in a sheet iron tray in the proportion of 1:1.5:3 by volume. The cement is first mixed thoroughly with the water proofing compound to the required quantity, and then mixed dry with the sand in the proportion of 1:1.5:3. The mix of cement and sand shall then be mixed dry with stone aggregate to have the proportion 1:1.5:3. Clean water shall then be added slowly and gradually while being mixed, to the required quantity to give a plastic mix of the required workable consistency. The mixing shall be done by turning at least three times to give a uniform and homogeneous concrete.

Preparation of base

The concrete , mixed as mentioned above shall be placed and compacted well by tamping rods to have a average thickness of 30mm.Damp proof course shall not have any joints, the whole concreting can be completed without any break and it need not be provided over door openings. The side planks shall be removed on the next day.

Curing

The concrete shall be cured for at least 7 days, by keeping the surface constantly wet.

10. Detailed specification for AC sheet roofing:

AC sheets – Purlins – Laying of sheets – Fixing – Pitch – Ridges – Measurements.

AC sheets

The sheets shall be of approved quality, free from cracks and damages.

Semi corrugated sheets of 1100mm width and 1750mm length are to be used. The thickness of the sheets shall not be less than 6mm.

Purlins

The sheets shall be laid on wooden or steel purlins as per drawings. Angle purlins of required size shall be used at spacing's not exceeding 1.4m.

Laying of sheets

The sheets shall be laid on wooden or steel purlins as per drawings. The sheets should be laid starting from the eaves, with the smooth side facing upwards and with a minimum of 150mm lap at the ends. The overhang of the sheets shall not exceed 300mm.

Fixing

Fastening of sheets shall be done with the best galvanized iron bolts. All such bolts shall be provided with lead washers. The bolts shall be placed 20cm apart on the sides and at every second

corrugation on the ends. The sheets when so fastened shall be secured with alternate wooden purlins by means of galvanized iron screws and washers about 15cm aprt. The holes for the bolts or screws shall always be drilled and not punched from the inside towards the outside.

Pitch

The slope of the roof shall be not flatter than 1 vertical to 5 horizontal and not steeper than 1 vertical to 1 horizontal.

Ridges

The ridges, hips and valleys shall be fastened securely on each side with a lap of 300mm.

Measurements

The payment shall be made for actual area covered by the asbestos sheets. The payment of ridges, hips and valleys shall be on running lengths.

11.Detailed specification for Rain water pipes:

Properties of pipes - Excavation - Laying - Testing of pipes - Refilling -Measurements.

Properties of pipes

The stone ware pipes are to be used in regular size and shape. The thickness of stoneware pipes shall not be less than one – twelfth of the internal diameter of the pipes. The internal and external surfaces of the pipes shall be smooth and properly glazed, free from cracks, flaws and glazing blow holes.

Excavation

The trench for laying the pipe shall be excavated as per the levels given.

Laying

The stoneware pipes shall be laid true to the invert level. The spigot of the pipe shall be carefully adjusted in the socket of the pipe previously laid. The joint shall be finished with the cement mortar of proportion 1:1.

Testing of pipes

The pipe line laid shall be tested for leakage by plugging one end and allowing water to flow from the other end under a head of 150cm.

Refilling

The refilling of the trench shall be started after getting written permission from the Engineer. The refilling of the trench shall be done in layers of 30cm and each layer shall be well – watered.

Measurements

The payment shall be made for the actual length of pipe laid and the rate shall include excavation of the trench, laying and joining the pipes.

12. Detailed specification for centering for roofing

Strutting – Form work – Centering – Measurements.

Strutting

Props used for strutting shall be of casuarina posts of 100mm to 130mm diameter. The props are to be vertical and rest on firm ground or wooden sole plates of thickness not less than 40mm. All props shall be provided with double wedges to facilitate tightening and loosening of shuttering. The horizontal spacing of props in both directions shall not exceed 750mm. When the height of shuttering exceeds 3.5m, suitable horizontal bracings should be provided. Splicing of props shall be as per the approved drawings.

Form work

The form work shall be of stiff and strong wood, easily workable with nails and light in weight. The form work shall be true to shape and size specified in the structural drawings and strong enough to withstand the forces caused by vibration of concrete and the incidental loads imposed on it during concreting. The unsupported length of the planks, particularly of the side plates shall not exceed 1.0m to avoid buckling. The levels of the form work are to be checked before placing the reinforcement bars in position.

Centering

Well seasoned wooden planks or steel sheets are to be used for the shuttering work. The joints shall be water tight to avoid leakage of cement slurry during compaction. The surfaces of planks and sheets which would come into contact with concrete shall be cleaned well and coated with oil of approved quality to prevent adhesion of concrete. The complete centering work shall be assembled so that it can be removed, on completion of the specified period, easily without causing any damage to the concrete surfaces and edges.

Measurements

Centering and shuttering shall be measured in sq.m, and the surface area in cement concrete shall be measured.

13. Detailed specification for weathering course

A weathering course of brick jelly concrete is to be laid over R.C slab, when there is a storey over it, to protect the slab against alternative shrinkage and expansion, after 15days of laying of the slab. A layer of 100mm thick brick concrete shall be laid over the slab and well beaten to 75mm thickness with wooden hand beaters.

Necessary slope to drain the rain water shall be given in the weathering course itself. The beating shall continue until the concrete is well consolidated and the breaker makes no impression and readily rebounds from the surface when struck on it, the whole shall be constantly wetted by sprinkling lime water. After 6 days the concrete laid has hardened, one course of pressed tiles of size 200mm x200mm x20mm shall be laid in oiled cement mortar 1:3 and rubbed smooth.

14. Detailed specification for under reamed piles

The under reamed piles are to be cast-in-situ, by drilling or boring deep holes of specified diameter and depth at appropriate locations marked in the drawing, inserting reinforcement cage into the bore and filling the bore with fresh concrete. Bore holes are to be made by earth augers manually or mechanically. In case of manual boring, an auger boring guide shall be used to keep the bores vertical. After the bore is made to the required depth, enlarging of the base shall be carried out by means of an under reaming tool. In ground with high water table or in sandy soil, boring and under reaming may be carried out using suitable drilling mud , made by mixing 5% bentonite in water, forming a highly colloidal and gel forming clay, which provides relatively impervious lining on the sides of bore holes. This slurry is to be pushed by a manually operated reciprocating type pump to the bottom of bore. In normal soil strata it can be poured from top while boring. The level of drilling mud should always be about one metre above water` table or the level at which caving occurs. To avoid irregular shape and widening of bore holes in very loose strata at top, a casing pipe of suitable length may be used temporarily during boring and concreting. For placing the concrete in bore holes full of drilling mud or subsoil water, tremie pipe of not less than 150 mm diameter with flap valve at the bottom should be used.

M20 grade concrete with minimum cement content of 400 kg per m^3 of concrete shall be used. When concreting is done under water or drilling mud, 10 percent extra cement shall be used. The materials used for making the concrete should satisfy the specifications prescribed in IS:456. The slump of concrete shall range between 100mm to 150 mm for concreting in water free, unlined bore holes.

The pipes shall be taken at least 500 mm into the stable zone of soil. The under reams shall rest within the firm soil strata. Reinforcement cage shall be lowered into the bore hole after pouring a small quantity of concrete to provided about 100 mm concrete cover to the reinforcement at bottom. Longitudinal bars should be provided for the full length of the pile with a cover of 40mm.

15. Detailed specification for Water-Bound Macadam Road

Selection of metal – preparation of sub grade – Placing of the road metal -Rolling – final coat – measurement.

Selection of the metal

The road metal shall be brought from the approved quarry. In direct compression test, the road metal shall give a strength of 145 N/mm². In impact test, the road metal shall withstand a height 180mm to 200mm and in cementation test, it shall withstand 100 blows.

Preparation of the sub grade

The sub grade shall be prepared to the camber of 1:36. The subgrade shall be well-dressed and a basecoat of sand of depth 100mm shall be placed.

Placing of the road metal

The road metal shall be placed on the finished subgrade and properly compacted in two layers.The thickness of each layer shall be 12cm.So that after consolidation, the thickness shall become 16cm.

Rolling

Each layer of the road metal shall be rolled dry so that a dense and properly inter-locked surface is obtained. The rolling shall be continued till the stones do not move under the weight of the roller. The roller shall start from the edges of the road and shall be taken to the crown.

Final Coat

The finishing coat shall consist of sand blindage and then, the required amount of water shall be spread over the surface. The roller shall then be started and continued till loaded cart goes over the finished surface without any mark. The road shall then be opened for traffic.

Measurements

The payment shall be made for the actual work done on superficial area basis.

16. Detailed specification for Surface dressing with bitumen

Preparation of surface – Application of binder – Covering materials – Rolling – Opening to traffic – Measurements.

Preparation of surface

The surface shall be free from dust, dirt or other deleterious matter. Depression or pot holes, if any shall be repaired as instructed. The surface shall be thoroughly dried before application of binder.

Application of binder

The binder, heated to a temperature as recommended by the manufacturer, shall be sprayed uniformly over the prepared surface by mechanical sprayers. Spraying shall be carried out parallel to the centre line of the road. 10 to 12kg bitumen shall be used for spraying 10sq.m area.

Covering Materials

The stone chips of nominal size 12mm, tough, clean and dry, shall be uniformly and evenly spread at the rate of 0.14 to 0.15m^3 per 10m^2 area with the required camber.

Rolling

The binded surface shall be rolled with a 8 to 10 tonne roller. The rolling shall begin from the edges of the road and shall be taken to the centre. When the centre is reached, the rolling shall then start at the opposite side and again proceed towards centre. Rolling shall be continued until the chipping are firmly embedded in the bituminous material and present a uniform closed surface.

Opening to traffic

The finished surface may be thrown open to traffic on the following day when straight run bitumen or road tar is used as binder.

Measurements

The payment shall be made for actual superficial area basis.

17. Detailed specifications for revetments/pitching

The sloping faces of road embankments are to be provided with revetments or pitching to avoid sliding of soil or erosion due to rain water. The thickness and shape of revetments shall be as given in the drawings. The stones used in revetment shall be sound, hard, durable and fairly regular in shape. Stones from approved quarry shall be used. Round boulders shall not be used in revetments.

The stones subject to marked deterioration by water or weather shall not be accepted for the work. The sizes of spalls shall be minimum of 25mm and shall be suitable to fill the voids in the pitching. The material for the filler shall consists of sand, gravel, stone or coarse sand. To prevent the escape of the embankment material through the voids of the stone revetment, as well as to allow free movement of water, one or more layers of fillers shall be provided underneath the pitching as directed by the engineer.

Before laying the revetment, the sides of embankment shall be trimmed to the required slope and profiles put up buy means of line and pegs of intervals of 3 metres to ensure regular straight work and a uniform slope throughout. Depressions shall be filled and thoroughly compacted. The filler granular material shall be laid over the prepared base and suitably compacted to the thickness specified on the drawings.

The lowest course of pitching shall be started from the toe wall and built up in courses upwards. The toe wall shall be in dry rubble masonry or plain cement concrete of M15 grade. Stones shall be placed to the required length, thickness and depth confirming to the drawings, by setting them normal to the shape. The pattern of laying shall be such that the joints are broken and voids are minimum by packing with spalls, wherever necessary and the top surface is a smooth as possible. The interstices between adjacent stones shall be filled in with spalls of proper size and wedged in with hammers to ensure tight packing.

1.1.17. Steps involved in writing standard specification

Standard specifications are written for usual works having uniform standards with no major changes in the materials used or method of construction. These are being written with reference to already established standards like National Building Code (NBC), National Building Organization Hand Book (NBO), Tamilnadu Building Practice, Indian Standards, Indian Road Congress (IRC), P.W.D. Manual etc., which are otherwise called Master Specifications.

- The master specifications are usually set in an easily recognizable pattern with logical and meaningful clause titles and a logical numbering system for all clauses while referring the master specifications in the standard specifications clause names rather than clause numbers shall be used.
- The issues covered in the conditions of contract shall not be repeated in the standard specifications. Matters of contract, tender and administration shall not be mingled with the technical specifications.

- Conditions for repairing or penalty in case failures shall not be mentioned in the standard specifications.
- Words with multiple meaning or whose meanings are unclear, subjective or even too precise should be avoided in the specifications.
- The matters clearly explained in the master specifications shall not be repeated again in the standard specifications. However, specific clauses may be modified, added or deleted from the master specification to suit the project condition since the standard specification will not provide the project specific document due to site constraints.
- It shall be carefully seen the descriptions or requirements specified exclusively for the project shall not clash with the provisions of referred standard.
- Considering the above mentioned points, the standard specifications are being written by referring the standards with their clause names and numbers wherever possible, not repeating or contradicting the matters of referred standards, and in a short form possible.

1.1.18. Advantages of Standard Specifications

- The standard specifications are based on well established standards, conditions and requirements which are acceptable to all parties concerned.
- The possibility of conflicts or misunderstanding between the clients and contractors with respect to quality of work is remote.
- The laborious work of writing detailed specifications for each and every item of work is much reduced.

- Use of standard specifications saves time and man power in the preparation of contract documents.
- It reduces the possibility of important clauses being left out in the specifications
- The standard specifications system is a nationally recognized system which provides uniformity in presentation and formulation. Using standardized terminology and definitions ensures that the specifications are widely accepted and understood.
- Having access to such a system allows specifiers and executers to keep up to date with changes in regulations , codes , standards , work practices and technology.
- Use of standard specifications leads to consistent, concise and easily understood clauses, minimizes ambiguities and offers clients greater certainty that their specifications will produce the quality required and expected.
- Standards have been written by most qualified and experienced persons, with care, spending considerable time on it which could be straight away used by the specifier for his project.

1.1.19 Examples of standard specifications

(1)Standard specification for surki mortar (Specification No.12 of Tamilnadu Building practice – Vol. 1)

(a) Surki mortar shall consist of lime, surki and sand each complying with its respective standard specification, mixed in the proportions noted below, or such other proportions as may be defined in the relevant schedule item for the various items of work.

Item of work (1)	Lime (2)	Surki (3)	Sand (4)
Concrete	1	½	1 ½
Masonry (Brick or stone)	1	½	1 ½
Plastering–First coat	1	½	1 ½
Plastering– second coat	1	½	1
Pointing	1	½	1

(b) Surki mortar is included in lime mortar specifications and relevant portions in IS: 1625 and IS: 2394 shall apply.

(2) Standard specification for cement concrete (Specification number 28 of Tamilnadu building practice vol-1)

(a) IS: 456, IS: 383, IS: 269 shall also apply

(b) **Mixing concrete** – cement and sand shall be measured in accurate proportions, and well mixed in a dry state, thrice turned over, on a clean dry platform of steel or wood or slabs with tight and even joints, so that there may be no wastage of mortar, or difficulty in mixing. As much quantity of the aggregate, washed and cleaned of dirt and allowed to dry shall then be laid on the dry platform and on it shall be spread the dry mixture of cement and sand in correct proportions. The cement is to be weighed, 50 kg being taken as 35 liters by volume of ($0.035m^3$) and measuring boxes are to be used to maintain the correct proportions of sand and broken stone. A convenient size of measuring box would be of inside dimensions of 40cm long, 35 cm wide and 25cm deep to have the volume of $0.035m^3$. The mixing platform should be large enough to enable the continuous procedure of two batches being mixed to avoid partial sets of the concrete between laying of successive batches. The whole mass shall then be thoroughly mixed with a shovel, turning over at least three times, and adding sufficient quantity of water with a sprinkling can , until the colour of the cement is uniformly distributed throughout the whole mass.

The whole operation shall be so arranged as to take the minimum time possible, so that the mixed concrete shall be placed in position before initial setting begins. Concrete which had begun to set, or which has been condemned by the executive engineer shall be rejected and removed from the work spot.

(c) **Water** – water for mixing, setting time, laying and machine mixing of concrete relevant clauses of IS: 456 and IS: 269 shall apply.

(d) **Rate** –The contract rates are to include the cost of mixing, conveying, placing, ramming, watering, barrows, tools and all appliances required to complete the concrete in position. They also include the cost of bailing and pumping for keeping excavation free of water, unless otherwise specified. Centering shall be measured and paid separately.

(e**) Quantities** –The standard data for the division is to be followed for the quantities of material and labour required for the various items of work. The relevant schedule item will define the proportions of cement to sand i.e.., whether 1:2 or 1:3 etc.,

(3)Standard specifications for reinforcement (Clause 4.6 of IS: 456.)

The reinforcement shall be any of the following:

(a) Mild steel and medium tensile steel bars confirming to IS: 432(Part I)

(b) High strength deformed steel bars confirming to IS: 1786.

(c) Hard drawn steel wire fabric confirming to IS: 1566.

(d) Structural steel confirming to grade A of IS: 2062.

All reinforcement shall be free from loose mill scales, loose rust and coats of paints, oil, mud or other coating which may destroy or reduce bond.

The modulus of elasticity of steel shall be taken as 200 KN/mm^2 The storage of steel shall be as described in IS: 4082.

Note: The examples given for general, detail and standard specifications are only few samples to explain the different types of specifications. All works cannot be covered in this book. Students should develop their ability to write the specification for any work from given hints regarding various requirements of the work.

(4) Standard Specification for repairing on existing bituminous surface:

The existing bituminous surface shall be prepared in accordance with clause 501.8.3.3 of section 500 of "Specifications for Road and Bridge works" (IRC). After applying a tack coat confirming to clause 503, the bituminous profile corrective course shall be laid and compacted to the requirements of the particular specification. Where local sags or depressions occur in the existing pavement a filling operation shall be carried out in accordance with fig 500.1. The maximum layer thickness at any point should not exceed 100mm. For correction of camber or super elevation of the existing carriage way, the method shown in fig. 500.2 shall be adopted depending on the profile of the existing carriageway. For surface finish and quality control, the relevant provisions of section 900 shall apply.

1.2. REPORT WRITING

The report should be written in such a manner that on the study of the report one can form an idea, about the whole work. The report of each work will differ from the other and shall have to be written according to the nature of the work. The report is usually is given at the beginning of the estimate followed by calculations, design general and detailed specifications analysis of rates materials statement and then the detailed estimate. The plans and drawings are enclosed at the end. In the last page of the abstract of the estimate there are space for signatures for the Assistant Engineer, the Executive Enginner and the Superintending Engineer and for the sanctioning authority. In the top of the title page the estimate number, name of work, name of division, head of accounts , total cost of the estimate etc., are written.

1.2.1.Definition of Report

The report is usually given at the beginning of the estimate followed by calculations, design and detailed specifications, analysis of rates, materials statement and then the detailed estimate.

1.2.2.Types of reports

While taking upto a construction project, the department which undertake the work, have to get necessary sanctionsand approvals from competent authorities, with respect to the feasibility, uasbility, finance, designgs, environmental impact etc.,

1. Feasibility report

The local people are there representatives demand a particular project for their area like buildings, bridges, roads etc., from the government. Now the government asks the public works department to make a feasibility study and submit a report. The officials go to the site, make some preliminary surveys, study the conditions of locality and submit the feasibility report to Government. This report says whether the project is feasible or not, with reasons mentioned for the decision and sometimes suggest suitable alternative.

2.Administrative report

The concerned department submit a detailed report on any proposed project with the detailed plans and estimates to Government. Normally the environment impact assessment report , if required for the project, is also enclosed with the report, the administrative officials of the Government, after careful examination of the report, give administrative approval to the project and permit the department to start the preliminary arrangements and allots necessary fund for the project. Now the report submitted to the government for obtaining the administrative sanction is called administrative report.

3.Technical report

On receipt of administrative sanction for a project, the engineers of concerned department (P.W.D) , make detailed structural designs, statements of material/labour/ equipment requirement, detailed drawings, schedules, charts etc., and submit a detailed report to the chief / superintending engineer for the technical sanction. A team of technical experts check the details and recommend for sanction.

4.Variance report

During the execution of a project, there is always the chance of changes in the project profile, method of construction, cost estimation etc., Now it becomes necessary to get the approval for the variations from the authorities concerned. In such cases , the department prepares a detailed report on variations, submit it to Government or concerned authority and get necessary approval as well as fund allocation.

5.Status report

In case of big projects which may extend for more than a year, the work may be split into different phases. On completion of each phase, a status report is send to the Government for obtaining the permission to start the next phase. In few important projects, the department sends periodical reports at a regular interval of a time, to the government for its appraisal. This status report gives particulars about the quantum of the work completed so far, and to be executed further. A comparative statement , comparing the statuswith the schedule is also provided with this report.

1.2.3. Necessity of reports

- Report to accompany a project proposal is necessary to describe the project profile in compact form and to help the authorities to select suitable project.
- Report to accompany a detailed estimate of a project is necessary to inform the authorities the mode of execution, men / material / machines / fund requirements, time schedule etc., briefly without forcing them to go into the entire estimate and search for informations.
- Periodical reports are necessary to update the informations regarding the progress of various works, to superior officials and Government.

1.2.4.Documents to accompany the report

The reportconsists of the following documents,

1. Report of the project
2. Detailed specification
3. Rates of materials and labour
4. Detailed estimate
5. Abstract estimate
6. Material statement
7. General specification

8. Design of structure
9. Calculation details
10. Total cost of estimate
11. Name of the work.

1.2.5. Points to be considered while writing technical reports

The following points are to be considered while writing a report.

1. Brief history with reference to the proposal.
2. Object, necessity and utility of the project with reasons.
3. Selection of site, with explanation why that particular site is selected.
4. Surveying, to define the topography of the site.
5. General specifications of works and basis of design and calculations.
6. Arrangements for supply of electricity, water etc., to the site.
7. Roads, transport facilities etc., available.
8. The estimated cost of the project.
9. Probable date of completion of the project.
10. Miscellaneous points such as labour amenities, temporary accommodation for staff etc.,
11. Method of execution of works, machineries to be used etc.,
12. Return of revenue if any.

(1) Report on the estimate for the construction of a residential building

The detailed estimate for construction of a residential building for the Executive Engineer at udaynagar has been prepared in compliance of S.E's letter no……. dated ……..There is no building for the residence of the Executive Engineer at Udaynagar and he has to live in a rented building with meagre accommodation at a very high rent. It has therefore, been proposed to construct a residential building for the Executive Engineer. The head of the accounts will be 50 civil original works, building.

The estimate provides for the following accommodation:

One drawing room , one dining room, three bed rooms, one guest room, and the necessary store, kitchen , baths, front and back verandahs and motor garage per plan enclosed.

A site has already been selected having a land of 60m x 30m (200' x 100') for the construction of the building having the good soil and proper drainage and this much of land has to be acquired. The building shall be oriented to face north direction.

The building shall have lime concrete foundation and first class brick masonry with lime mortar upto plinth level and the superstructure shall be of first class brick work in cement mortar, 1:6. Lintels shall be of R.B work and roof shall be R.C.C. with lime concrete terrace finishing . The drawing and dining rooms shall be 12mm cement lime plastered 1:1:6, and ceiling shall be 6mm cement plastered 1:3. Inside of drawing and dining rooms shall be colour washed and inside of remaining rooms shall be of white washed and outside wall shall be colour washed. Doors and

windows shall be of 4.5cm thick teak wood with chaukhat of sal wood and enamel painted. All work shall be strictly as per detailed P.W.D. specification.

The estimate has been prepared at P.W.D. schedule of rates, and for non schedule items on analysis of rates. The foundation has been designed for a safe load of 9 tonne per sq. m and the R.C.C roof has been designed for a safe load of 150 kg per sq.m with 1400kg per sq.m as safe tensile stress of steel and 50 kg per sq.cm. as safe compressive stress of concrete . All designs and calculations have been included in the estimate. Plans and drawings and site plans are also enclosed with the estimate.

Provision has been made for electrification and sanitary and water supply works and 20% of the estimated cost of the building works has been included for these works. As there is no sewer line in the area of septic tank shall have to be constructed for which lumpsum provision of Rs. 750 has been made in the estimate.

Provision for compound with a gate in the front and barbed wire fencing on the sides and back, and approach road have also been made in the estimate.

A statement of important materials as cement, steel, coal etc., which shall have to be arranged by the department is also enclosed with the estimate. A rent statement is also enclosed.

The work shall be carried on contract by inviting tenders. The work shall be completed within six months from the date of start.

The estimate work out as Rs. 15,00,000 and is submitted for sanction and allotment of fund.

(2) Report on the estimate for the construction of a primary health centre for a village.

This report is to accompany the detailed estimate for the construction of a building for the proposed primary health centre at Madhavaram village of VillivalkamTaluk., Chennai district. Due to the vast development of the Sub-urban areas of Chennai city ,this village and its surroundings now have a population of more than 25,000.Eventhough there are a few private clinics in then village, there is no Government hospital in the village to serve the poor. They have to go to Rajiv Gandhi government hospital which is at a distance of about 35k.m.

Based on the request of the local people and their representatives, the collector of Chennai has asked the public works department to prepare and submit an estimate for constructing a primary health centre in the village. Land to an extend of 1 acre has been allotted by the panchayat for this building, providing allowance for future expansion.

The building now proposed has two consulting rooms, one store room and one emergency wars with 2 beds. The plinth area of the building is 80m2. The anticipated cost of construction of the building is 9.45 lakhs.

The foundation of the building is of under reamed piles with a capping beam at the ground level. The basement and superstructure are of brick work in cement mortar,1:6,plastered with cement mortar 1;5.The roofing is of reinforcement cement concrete with necessary weathering course with pressed tiles. Cement flooring over brick jelly concrete is proposed. Grill gates and steel windows are to be provided. The duration of construction will be 6 to 7 months. Detailed drawings,

designs and estimates are enclosed.

This estimate is being submitted to the collector of Chennai district for financial sanction and fund allotment.

Sd/.....
Junior Engineer,P.W.D.
Chennai.

(3) Report for the construction of a school building

The estimate for the construction of primary school building in the village of Singanallur in the revenue district of Coimbatore has been prepared, with reference to S.E's letter no……Dt …….

At present to school is functioning in a thatched shed. The government of Tamilnadu in its G.O. MS. NO …….. Has banned the functioning of school in thatched sheds and hence a permanent building has been proposed.

Two halls of size 10m X 6m each with 2m wide verandah has been proposed for A student strength of 120. A site of 420 m^2 has been allotted by the local panchayat near the panchayat office.

A spread foundation consisting of 150 mm thick P.P.C. 1:5:10 foundation concrete with two masonry footing over it is proposed. The foundation and basement masonry consist of B.W in C.M. 1:5. The height of basement is 600mm, B.W. in C.M 1:6, 300mm thick is proposed for the super structure. Mangalore tiled roofing has been proposed. Country wood door and window are provided. Cement concrete flooring 100mm thick with C.C. 1:5:10 is proposed. Super structure will be plastered with C.M. 1:5, 12mm thick and white washed. All works shall be as per PWD specification. The duration of construction will be 10 month from the date of commencement of work.

The estimate has been prepared adopting the current schedule of rates and works out to Rs. 18,00,000 . Sanction may be accorded to estimate and necessary funds may be allotted for taking up the work on contract basis by inviting tenders.

(Countersigned)
Asst. Exclusive Engineer (PWD)
…….. Sub- division.

(Sd) Junior Engineer (PWD)
…… Section

(4) Report to accompany the estimate of the proposed construction of a community hall in a village

This estimate for the construction of a community hall , for the Arani village in Ponneritaluk of Thiruvallure district has been prepared , with reference to SE's letter no…….. dated…….

At present there is no community hall for the village people , they have to travel more than 7km to avail of community hall. Hence the community hall has been proposed.

A function hall of 20m x 8m with 2m wide verandah at the front side and 6mx 6m kitchen and 3m x 3m portico . A site of 250m² has been allotted by the local panchayat near the lake.

A spread foundation consisting 150mm thick P.C.C. 1:5:10 foundation concrete with R.C.C. footing over it is proposed. The foundation and basement consist of B.W. in C.M 1:5 The height of the basement is 1m, B.W in C.M 1:6 300 mm thick is proposed for the superstructure . R.C.C. flat roof has been proposed. Country wood doors and wooden framed glassed shutters in windows are provided. Glazed tile flooring is proposed. Superstructure will be plastered with C.M 1:5, 12 mm thick and white washed. All works shall be as per P.W.D. specifications.

The estimate has been prepared as per the correct schedule of rates and works out of Rs. 32,25,000. Sanction may be accorded to the estimate and necessary funds may be allotted for takingup the work on contract basis by inviting tenders.

(Countersigned) Sd/ Junior Engineer (PWD)

Assistant Executive Engineer (PWD) ……Section.

……Sub – Division.

(5) Report on the estimate for a village road construction

The estimate for the construction of Ananthan Nagar to parvathipuram road 15 km in length has been prepared in compliance with s.e's letter no---------dated ----------.

Ananthannagar is an important place. It has no widened road. The people of the locality have represented and demanded for the construction of a widened road.The alignment of road shall be straightened and avoiding conjested area as for as possible. Flat curves have been provided.

While selecting the alignment, the principles of shortest route, easy gradient serving maximum population. Minimum radius etc have been followed.Plane table survey has been made for the whole length of the road for 40 m. width on each side of centre line. L.S and C.S has been prepared every 30 m intervals. The formation width of the road shall be 10m and side slope 2:1 in banking and 1/2: 1 in cutting.

The road shall be water bound mecadam road and bituminouscoat on top surface. Proper gradient and carmbers are provided. Metals are complied by 20 tonne road roller.

The whole work of construction shall be spread in 3 years, earth work one year rest for 6 months, metally one year and painting 6 months. Second coat bituminous coat shall be done after one year.

All works shall be done strictly as per P.W.D. specifications. The estimate has been prepared at P.W.D. schedule of rates and local current rates. The works shall be done by inviting tenders.

The estimate amounting to Rs.50 lakhs has been submitted for sanction and allotment of fund.

(Countersigned).
Asst. Divisional Engineer,
…….. Sub division
……

(Signed)
Asst. Engineer,
Highways,
…….Section.

(6) Report on the estimate for the construction of a small bridge.

The estimate has been prepared for the construction of a small bridge of 6.5m span at 17 km – 350m on Karur – Dindugal road . The road at this point is flooded almost every year during rainy season, causing disruption of traffic. The jungle stream " Kalingarayanodai" crosses the road at this point and at present there is a flush causeway. The flush causeway itself has been eroded during the last flood.This estimate has been prepared with reference to the Divisional Engineers letter No…… dt……. Based on the appeals of local people.

The bridge has been designed for I.R.C. class A loading with four lanes. The waterway calculations and deck slab design are enclosed. L.S and C.S of stream taken for a length of 500m on upstream and downstream sides are also enclosed with the estimate.

The soil has been tested and found to be soft rock. Ordinary spread foundation is sufficient. The foundation shall be of C.C. 1:4:8, 600mm thick. Abutments, wing walls and parapets shall be of R.R. in C.M. 1:5, and deck slab of M25grade concrete is designed by limit state method.

The estimate has been prepared adopting the current P.W.D. schedule of rates. The work shall be executed on contract by inviting tenders and shall be started after the rainy season.

The estimate amounting to Rs. 10,25,000 is submitted for the sanction and allotment of fund.

Sd/……..
Assistant Engineer,
Highways and R.W. Dept.,

(7) Report to accompany the estimate for the construction of a foot over bridge across a city road.

This estimate for the construction of a R.C.C. foot over bridge at Madyakailash junction of Sardarpatel road, Chennai has been prepared and submitted with reference to letter No……dated……. Of the chief Engineer of Chennai corporation.

The large number of public transport buses are plying in S.P road through Madhyakailash junction in both directions. Number of educational institutions have been situated on either side of S.P road near to the junction. During peak hours , the employees , school and college students, local residents alight the buses coming from Guindy side on the northern side and cross the road, in danger amidst the heavy traffic to go to their places, either by walk or through other transport facilities available on the southern side of the road.

The pedestrians , mostly girls, women and elderly people, find it very difficult to cross the road during peak hours. Many major and minor accidents had taken place at this junction, in the past. More over the through traffic in S.P road is very much affected due to the pedestrian crossings, which often leads to traffic jam. The public are demanding a foot over bridge for a long time.

The Corporation of Chennai had gone through the feasibility report and decided to construct a R.C.C. foot over bridge across S.P road at 100m distance from Madyakailash temple on its western side.

The bridge is a double span, single T- beam bridge with double cantilever deck slab. The width of passage will be 3.2m. Total length of the bridge across the road will be 22m. Three R.C.C. columns of 600mm x 600mm size with pile foundation are provided to support the beam. 300mm thick deck slab is provided ,cantilevering equally on either side of the beam. R.C.C. steps are provided on either ends with necessary parapets as shown in the working drawing. M20 grade ready mixed concrete and Fe415 grade steel are to be used in the construction. The construction will be carried out without closing the regular traffic of the road.

The estimate cost towards the project is Rs.97 lakhs . This estimate is submitted to the Corporation of Chennai for sanction and fund allotment.

Sd/……
Assistant Engineer,
Adyar Division,
Corporation of Chennai.

(8) Report to accompany the estimate for providing drinking water supply for a village.

The estimate provides drinking water supply to the village…….. of ……..Panchayat Union of Coimbatore district. The estimate has been prepared with reference to the letter No…….dt……of Collector of Coimbatore.

At present three is no drinking water supply system to the village and the people used to get drinking water from the private irrigation wells. The population of the village is about 3,000 and they experience hardship in getting drinking water from the private wells. Very often this village is being affected by drought and the people suffer for drinking water during the drought. They have

been representing to the Collector for providing drinking water supply system to their village. The collector has ordered for it and hence this estimate.

In this estimate provisions have been made for the following.

(1) 150 mm. dia. And 60m deep borewell.

(2) Multistage turbine pump of 7.5 kW capacity.

(3) An overhead tank of 1,20,000liters capacity.

(4) Distribution system.

It is proposed to sink the bore well near a stream at a distance of 1 km from the village . The yield has been foreseen by water divining . The cost of multistage turbine pump will be Rs. 80,000. The R.C.C. overhead tank will be constructed near the borewell for a height of 15 m from ground level.

The distribution system consists of 75mm dia. G.I. main from the overhead tank and 20 m dia .G.I.distributors. It is proposed to distribute the water at selected points by 20 mm taps.

The estimate has been prepared adopting the current schedule of rates and works out to Rs.56,00,000. The expenditure can be met from the fund allotted for self sufficiency scheme. The estimate may be sanctioned and fund allotted.

(Sd) Union Engineer

……..Union.

(9) Report on the estimate for providing a small scale sewage treatment plant for a housing colony in a sub urban area.

This estimate is for providing an independent small scale sewage treatment plant for the housing board colony at Sholinganallur,a suburban town situated on old Mahabalipuram road, about 15 km from Chennai. Sholinganallur is a vast developing town on OMR, which accommodate number of I.T. companies and other commercial and industrial units. The Housing Board has planned to develop a small colony with 60 residential units for accommodating its employees working in and around the town. Since this town is not having any common sewage collection system, it is proposed to provide a STP with in the colony area itself ,to collect, treat and dispose the sewage and sullage water from the houses.

It is proposed to construct two septic tanks of 6m x 4m x3m size each with R.C.C. base slab, side walls, two baffle walls and cover slab, all of 150 mm thick using M20 grade concrete with necessary reinforcement as shown in the plan attached. Inlet and outlet chambers, manholes and vent pipes are provided as shown in the sketch. A tile field of 20 m length, 4m width and 1.2 m depth is provided with open jointed S.W.pipes of 150 mm diameter at 0.6 m depth. The tile filled with loose gravel and coarse sand mixture. Since no space is available in the premises for gardening or vegetation, the filtered water from the tile field is permitted to percolate into the ground to improve the ground water table. Since the G.W. level in this area will be normally . below 4.0 m during

mansoon and since the soil layer is of coarse sand upto 5m depth from ground level, any quantity of filtered effluent could be disposed of through percolation. The sludge accumulated in the septic tanks will be removed periodically by self sucking trucks.

The total cost of the work will be Rs.5.5 lakhs. The estimate is submitted to the Chairman , Housing Board for necessary approval.

Sd/……

Assistant Engineer, Housing Board,

Sholinganallur Division.

(10) Report on the estimate for the construction of a new bus terminus in a developing town

Thirunintravur is a fastly developing town on Chennai – Tirupathi Trunk Road, about 30 km distance from Chennai. Buses to Chennai, Thiruvallur , Arakonam, Tirupathi,Poonamallee, Kancheepuram, Red Hills etc., are plying from Thirunintravur. A number of Engineering collages and higher educational institutions are situated in and around the town. All express buses plying through this town stop here. It is boarding point for people of about twelve small villages situated around this town. The people from these village are coming to this town, by town buses for their regular marketing also. Number of hospitals and clinics are there in the town which are being used by the people of nearby villages.

At present there is no bus terminus available in the town and therefore all buses passing through this town are being stopped on the side of the road only. The public are in great discomfort while waiting on roads for hours, to board the buses. Even the buses having their terminals at this town are being parked on the road sides only , in the outskirts of the town.

The people of this town and surrounding village have appealed to Government for a bus terminus here, along the highway, near to the railway station for easy mobility. A feasibility survey had been already conducted and a report submitted to Government for it's a administrative approval. This estimate has been prepared as per the instructions of Superintending Engineer, P.W.D., Tiruvallur circle and submitted for the technical approval.

It is proposed to construct the bus terminus on the Poramboke land available along the Southern side of the trunk road , next to the railway station(site plan attached). The town Panchayat had taken a decision to handover about 2 acres of land for this purpose. It is proposed to construct a two storeyed administrative block of plinth area 100 sq.m with load bearing brick walls and R.C.C. floor slabs , two sheds of 15mmx6m size each with metal sheet roofing on steel trusses and concrete platforms. Two separate toilet blocks, for gents and ladies, 10 sq.m. area each are to be constructed, as shown in the layout plan.12 boys are to be provided for parking the buses. Water supply will be provided by the town panchayat. A small septic tank of 4mx2m size with a dispersion trench is to be provided.

The total anticipated expenditure towards the project is estimated as Rs.55 lakhs as per the present schedule of rates (2013). This estimated is submitted to the Superintending Engineer,PWD.Tiruvallur for technical approval.

(Counter-signed) (Signed)

Asst. Executive Engineer,P.W.D. Junior Engineer, P.W.D.

Tiruvallur.Avadi.

Review Questions

UNIT –I

1. What is specification?
2. State the different types of specification and their uses?
3. Differentiate brief specification and detailed specification?
4. What is the importance of specifications in a construction project?
5. Specify the essential requirements of a specification?
6. What are the important points to be included in a detailed specification?
7. Write general specifications for any five works involved in the formation of water bound macadam road?
8. Write general specifications for any five works involved in the construction of a culvert?
9. Write general specifications for any five works involved in the construction of a residential building?
10. Write detailed specification for (i) Sand for mortar and (ii)Bricks.
11. Write detailed specification for M20 grade cement concrete.
12. Write detailed specification for plastering with cement mortar 1:3 , 12mm thick?
13. Write detailed specification for any two construction materials?
14. Write detailed specification for surface dressing with bitumen?
15. What is the advantage of standard specification ? Specify any two standards which are usually referred in the specifications.
16. Write standard specification for R.C.C. in columns?
17. What is meant by report writing? What is the use of a report?
18. What are the important points to be included in a report?
19. It is proposed to upgrade a high school into a higher secondary school. A detailed estimate has been prepared for the construction of additional buildings for the classes and laboratories. Write a report to accompany the estimate.
20. Write a report to accompany the estimate for the construction of a R.C. culvert in a village road.
21. An estimate has been prepared to give water supply to a village. Write a report for this estimates.
22. What are the information you should include in a report of a project? State how they help in decision making?
23. A proposal has to be submitted to the collector for the construction of a primary health centre in a village. Write a report to accompany the proposal
24. Explain the various types of reports.
25. List out the documents to be attached with a report.
26. List out few points to be considered while writing technical reports.
27. What is meant by status report?
28. Differentiate administrative report and technical report.

UNIT - II

2.1 VALUATION

2.1.1 Definitions :

Value :

Value means the present saleable value of the property. It may be more or less than the cost of property or its original cost. The value of the property mainly depends of its structure, life of building, location of property, maintenance, rent if may fetch etc.,

Cost :

Cost means the original cost invested towards the purchase of property or construction of building. The cost of an old building becomes less due to its age and changes in fashion.

Price :

The amount of money expected, required, or given in payment to the owner for purchasing the property. For less demand the selling price may have to be fixed lower and vice-versa.

Difference between Cost and Value :

The difference between these terms are explained with an example :

For an example, suppose a person has constructed a cottage at the remote area according to his willingness at a cost of Rs. 20 lakhs. But just after some period he wants to sell the property which has less value to the others utility and he gets a maximum of Rs. 12 lakhs. The owner was about to sell his property, but just at that time there is a proposal to develop that area as Hi-tech city and subsequent growth of population starts. So due to the higher demand the cottage becomes valuable and he sells it a price of Rs.40 lakhs. So the value of the property varies from Rs. 12 lakhs to Rs. 40 lakhs, but the cost remains the same as Rs. 20 lakhs. Therefore, the value depends on demand and supply whereas cost is a constant amount.

Normally, the value of the land is increasing day by day whereas the building is decreasing due to depreciation.

Valuation :

Valuation is the art of assessing or estimating the present fair value of a property such as a building, a factory, other engineering structures of various types, land, etc., By valuation the present value of a property is determined. The present value of the property may be decided by its selling price, or income or rent it may fetch.

Purpose of Valuation :

The main purpose of valuation are as follows :

i. Buying and Selling of the properties.
ii. Taxation
iii. Rent fixation
iv. Security of loans or mortgage
v. Compulsory acquisition for public use
vi. Insurance purpose

2.1.2 Definition of terms :

Capital cost :

Capital cost is the total cost of construction including land, or the original total amount required to possess a property and does not change.

Gross income :

It is the total income or receipt from all sources without deducting the outgoings necessary for taxes, maintenance, replacement or loss of rent, etc., whatever it may be.

Outgoings :

Outgoings are the expenses which are required to be incurred to maintain the property.

The various types of outgoings are as follows :

i. Taxes (Municipal tax, Property tax, Wealth tax, Income tax, etc.,)
ii. Repairs (annual repairs 1% to 1.5% of total cost of construction may be taken)
iii. Sinking fund
iv. Management and Collection charges (5% to 10% may be taken for rent collector, watchman, liftman, Sweeper, etc.,)
v. Insurance
vi. Loss of rent (the property may not be fully occupied)
vii. Miscellaneous (running lift, electricity, pump, lighting in common places, etc.,)

Net income or Net return :

It is the income or amount left after deducting all outgoings from gross income.

i.e. Net income = Gross income - Out goings

Year's Purchase :

It is defined as the capital amount required to invest in order to receive an income of Rs.1.00 per annum at the rate of certain simple interest.

For 5% interest per annum (year), to get Rs.5.00 it requires Rs.100.00 to be deposited in a bank. To get Rs.1.00 per year it will be required to deposit 1/5 of Rs.100.00.

$$\text{i.e., } \frac{100}{5} = \text{Rs.20.00}$$

$$\text{Thus, Year's purchase} = \frac{100}{\textit{Rate of Interest}} = \frac{1}{i}$$

i = rate of interest in decimal

Also, Year's purchase = $\frac{Capital\ value}{Net\ income}$

Capitalized value or Capital value :

The capitalized value of the property is the amount of a money whose annual interest at the highest prevailing rate of interest will be equal to the net income from the property.

i.e., Capital value = Net income x Year's purchase

Sinking fund (S) :

At the end of its useful life of the property, a property is either to be replaced or a structure is reconstructed. For this purpose the fund is gradually accumulated by way of periodic payments on annual deposit is termed as sinking fund.

The total amount of sinking fund required is given as follows:

S = Capital cost (or Original cost) – Scrap value (or Salvage value)

The amount of annual instalment (I) of the Sinking fund may be found by the formula :

$$I = \frac{S\,i}{(1+i)^n - 1}$$

I = Annual instalment

S = Total amount of Sinking fund

i = rate of interest in decimal

n = number of years required to create the Sinking fund

Co-efficient of Sinking fund (I_c) :

It is defined as the annual instalment for the redemption of Re.1.00 at the end of given period, at the rate of prescribed interest, i.e., I when S = 1. Co-efficient of sinking fund I_c is given by,

$$I_c = \frac{i}{(1+i)^n - 1} \quad , \quad \therefore \ I = S\,I_c$$

Depreciation :

Depreciation is the gradual exhaustion of the usefulness of a property. This may be defined as the decrease or loss in the value of a property due to structural deterioration, use, life, wear and tear, decay and obsolescence. Usually a percentage on depreciation per

annum is allowed. The general annual decrease in the value of a property is known as annual depreciation.

Scrap value :

Scrap value is the value of dismantled materials of a property at the end of its life period. A certain amount can be fetched on sale of dismantled materials like bricks, steel, doors and windows, other wooden articles, etc., . In the case of machine the scrap value is the value of the metal only or the value of the dismantled parts. The scrap value of a building may be about 10% of its total cost of construction.

The scrap value is obtained by deducting the expenditure incurred for dismantling and removal of the rubbish material from the total amount received by sale of its materials.

Salvage value :

It is the value at the end of the life period without being dismantled. A machine after the completion of its usual span of life or when it become uneconomic, may be sold and one may purchase the same for use for some other purpose, the sale value of the machine is the salvage value. It does not include the cost of removal, sale, etc.,

Comparison between Scrap value and Salvage value

Sl. No.	Scrap Value	Salvage Value
1	It is the dismantled sale value of materials of an asset at the end of its useful life	This is the estimated value of an asset as a whole without dismantling at the end of its useful life
2	Scrap value is counted in the calculation of depreciation of the property	It is omitted in the calculation of depreciation
3	It is of an asset is merely sale of scrap and has limitation	Its deposition may take the form of a sale of the asset to a purchaser who will continue to use it for the function for which it was originally designed.
4	It is not counted as a minus quantity	There are times when it is a minus quantity

Obsolescence :

It is defined as the loss in the value of the property due to change in fashions, in designs, in structure, inadequacy in present needs, due to new inventions, poor original location, change in the character of the district, etc., .

Book value :

Book value is defined as the value of the property shown in the account book in that particular year. i.e., the original cost minus amount of total depreciation up to the previous year. Thus the book value of a property gradually reduces at a constant amount year after year up to the limit of scrap value, i.e., up to its life period. Book value is applicable on building and movable properties but not on land.

Market value :

It is the value of the property, which can be obtained at any time by selling the property in the open market. This value varies from time to time and depends on supply and demand, change in fashions, changes in industry, means of transport, cost of materials and labour, etc., in a particular place.

Difference between Market value and Book value

Sl. No.	Market Value	Book Value
1	The value is fixed by purchaser	The value is fixed by the rate of depreciation
2	The value may be constant for a period	The value cannot be constant , rather there is a gradual fall
3	This is applicable to any type of property	This is not applicable in case of land or metal article like steel, copper, gold etc.,
4	Market value is considered for valuation	It is considered for accounts book of a company
5	This depends on forces of demand and supply, development of the area etc.,	It is not variable due to its demand and supply or development of the area

Rateable value :

Rateable value is the net annual value of a property, which is obtained after deducting the amount of yearly repairs form the gross income. Municipal and other taxes are charged at a certain percentage on the rateable vaule of the property.

i.e., Rateable value = Gross income – Annual repair charges

Deferred value of land :

If a structure is standing on the land, the full value of the land alone can be realized only when the structure is demolished. For the purpose of valuation, the present cost of land is worked out and from the following formula, the deferred value of land upto the estimated life of the structure is obtained.

$$\text{Deferred value of land} = \frac{P}{(1 + i)^n}$$

where, P = present cost of land

i = rate of interest in decimal on sinking fund or for redemption of capital

n = future life of the structure in years.

If the income is estimated to continue in perpetuity, the problem of deferred land value does not arise.

Lease :

It is a form of contract by which a land or building is given by its owner to any other person to use it for a term of period is called as lease. The person who takes lease is known as lessee or leaseholder and the owner who grants lease is known as lessor.

Mortgage :

The owner of a property can barrow loan on interest against the security of his property. Such advancement of money against any form of security is called as Mortgage. The transactions, the security and the conditions of loan are entered in a document known as Mortgage deed. The person who takes the loans is known as Mortgagor, and the person who grants the loan is known as Mortgagee.

The amount of loan will depend on the valuation of the property, usually 50 to 70% of the valuation is granted as loan. The interest should be paid by regular instalments, and the loan also may be repaid by regular instalments over the specified period of the mortgage. When the loan is fully repaid together with interest, the mortgager has got the right to free his property from the mortgage and this is known as equity of redemption. 1 Factors causing reduction in market value :

Annuity :

Annuity is the annual periodic payments for repayments of the capital amount invested by a party. These annual payments are either paid at the end of the year or at the beginning of the year, usually for a specified number of years.

Though annuity means annual payment, the amount of annuity may be paid by twelve monthly instalments or quarterly or half-yearly instalments.

The following are the different types of annuities.

1 **Annuity certain :** If the amount of annuity is paid for a definite number of periods or years, it is known as Annuity certain.

2 **Annuity due :** If the amount of annuity is paid at the beginning of each period of year and payments continued for definite number of periods, it is known as annuity due.

3 **Deferred Annuity :** If the payment of annuity begins at some future date after a number of years, this is known as deferred annuity.

4 **Perpetual Annuity :** If the payments of annuity continue for indefinite period, it is known as perpetual annuity.

Amortization :

When the payment of a debt is made by a series of equal periodic payments, it is known as the amortization. Each periodic payment includes two provisions.

1 a certain portion of the principal, and

2 an account of interest on the outstanding debt.

2.1.3 Factors affecting the value of a property :

The following are the factors which affect the value of a property.

1 Factors causing reduction in market value :

i. Property is near hospital for health reasons.
ii. Property is near to factory, tanning industries, air port, etc.,
iii. Water, Sewer, electric lines are much away from the site of the property.
iv. It is situated on narrow lanes away from the main road.
v. It is situated in flood prone area.
vi. It is situated in low lying area.
vii. It is irregular in shape.
viii. It has block cotton soil in it.

2 Factors increasing the value of a property :

i. It is in vacant possession. i.e. without tenant.
ii. It is at the junction of roads or corner plot.
iii. It is on the main road.
iv. It has more width on the road.
v. It has hard soil for foundations.
vi. It is in the developed area with all facilities such as water, sewer and electricity.

vii. It has raised level, has no fear of flooding.

viii. Shopping centre, school, colleges, railway stations, bus stop, etc., are within reasonable short distances.

ix. The environment of the locality is good.

x. Building materials and labour are easily available.

2.1.4 Classification of properties :

For the purpose of classification, all the properties may broadly be divided into two categories, namely, land (immovable) and properties other than land (movable).

1 **Immovable property :** Land is an immovable property and it is also known as the real estate or real property or realty.

2 **Movable property :** A property other than land is known as movable property or personal property of personality or chattel.

The distinction between real estate and personal property is not very sharp. Everything firmly fixed to the soil is to be treated as land e.g. foundations, buildings, trees, etc., But the things which can easily be moved are to be treated as personality. Thus, the building materials are personality till they are not incorporated in the structures standing firmly on the soil. But they become realty when used in the construction of such structures. Similarly, coal, oil, etc., are realty till they are hidden in the earth. But they become personality when they are released or brought to the surface of the earth. The ornaments, furniture, etc., are other examples of the personal property.

According to the valuer, for the purpose of valuation the properties in land or land and buildings can be divided into two categories.

1 Freehold properties

2 Leasehold properties

1 **Freehold property :** A freehold property means that the owner is absolute possession of the property, and the owner can utilize the same in any manner, he likes, subject to the rules and regulations of government and local authorities. He may use the property by himself, he may grant leases, or tenancies for a short period or any period.

2 **Leasehold property :** It indicates the physical possession of the property and the use of it may be allowed by the original owner (lessor) as per lease document. The owner of a freehold property may give permission to any other person to use his freehold which is known as giving property on lease. The person who takes lease is known as lessee or leaseholder and the owner who grants lease is known as lessor.

2.1.5 Types of leases :

The main types of leases are :

1 Building lease

2 Occupation lease

3 Sub - lease

4 Life lease and

5 Perpetual lease

1 Building lease : The owner of a freehold land leases out his plot of land to somebody to construct a building, on payment of a yearly ground rent by the leaseholder. The leaseholder constructs the building and maintains it at his own expenses and earns some rent from the building. The net income to the leaseholder will be net rent minus the ground rent he pays to the lesser. As the leaseholder has to invest sufficient money in constructing the building, such lease is granted for long period for 99 or 999 years. At the end of the lease period the lesser has got the right on his land together with the structure on the land.

2 Occupation lease : In this type of lease the building or the structure is constructed by the owner (freeholder) and the constructed property is given to the lease for the purpose of occupation for a specified period on payment of certain amount of annual rent. The occupation lease may be for residential, office, factory, shop, etc.,. The lease period will depend on the purpose for which the building or structure has been constructed. If for a factory, the lease period should be 10 to 30 years, for other cases it may be less. In occupation lease the maintenance of the building or structure is usually done by the leaseholder which may be provided in the lease deed.

3 Sub - lease : A leaseholder may give the property as sub-lease to other persons subject to the terms and conditions in the original lease and be allowed by local regulations or court of law. The period of sub-lease shall be lesser than the original lease period. There may be more than one sub-leases of lease.

4 Life lease : When the duration of lease for a property is given until death of a person or persons, this is called “life lease”.

5 Perpetual lease : When the lease of a property is given for a number of years providing a condition that the lease is renewable time to time, according to the desire of the leaseholder, such type of lease is called as “perpetual lease”.

2.1.6 Problems on determination of sinking fund

Problem 1 : An old building has been purchased by a person at a cost of Rs.10 lakhs. Calculate the amount of annual sinking fund at 5% rate of interest assuming the future life of the building is 15 years and the scrap value of the building as 10% of the cost of purchase.

Solution :

Cost of purchase, C = Rs.10,00,000

Rate of interest, i = 5% = **0.05**

Future life of building, n = 15 years

Scrap value, = 10% of cost of purchase

= 0.01 x 1000000 = **Rs.1,00,000**

Total amount of sinking fund required, S = Capital cost – Scrap value

i.e., S = 1000000 – 100000 = **Rs.9,00,000**

Annual instalment of sinking fund, $I = \frac{S\,i}{(1+i)^n - 1}$

$$I = \frac{(900000\ X\ 0.05)}{[(1+0.05)^{15} - 1]}$$

\ Annual instalment of sinking fund, I = **Rs.41,708**

Problem 2 : A building owner sets aside a Rs.25000 as sinking fund in bank every year from the rent of the building. If the rate of interest of the bank is 9% , what will be the amount available with him after 20 years ?.

Solution :

Annual instalment as sinking fund, I = Rs.25000

Rate of interest, i = 9% = **0.09**

Number of years, n = 20 years

Now, amount of sinking fund, $S = I \times [\frac{(1+i)^n - 1}{i}]$

i.e., $S = 25000\ X\ [\frac{(1\ +\ 0.09)^{20}\quad 1}{0.09}]$

\ Amount of sinking fund, S = **Rs.12,79,003/-**

2.1.7 Methods of calculating depreciation

The various methods of calculating the depreciation are as follows :

1 Straight line method

2 Constant percentage method

3 Sinking fund method

4 Quantity survey method

1 **Straight line method :** In this method it is assumed that the property loses its value by the same amount every year. A fixed amount of the original cost is deducted every year, so that at the end of the utility period only the scrap value is left.

$$\text{Annual depreciation, } D = \frac{\text{Original cost} - \text{Scrap value}}{\text{Life of Property in year}} = \frac{(C - S_C)}{n}$$

Total depreciation, DT at the end of m^{th} year, $DT = m \times D$

The book value (B) after the number of years, say m^{th} years,

$$B = \text{original cost} - m \times D = C - (DT)_m$$

where, D - Annual depreciation C - Capital cost or original cost

S_c - Scrap value n - Life of the property in years

Note : Substitute Book value (B) or Salvage value in place of Scrap value (S_c) , if the number of year (n) is given.

2 **Constant percentage method :** In this method, it is assumed that the property will lose its value by a constant percentage of its value at the beginning of every year.

Mathematically, Constant percentage, $p = 1 - \left(\frac{B}{C}\right)^{1/n}$

Annual depreciation, D for the m^{th} year,

$$D = C\left[(1-p)^{m-1} - (1-p)^m\right]$$

Total depreciation, (DT) at the end of m^{th} year,

$$(DT)_m = C\left[1 - (1-p)^m\right]$$

The book value (B) after the number of years, say 'm' years,

$$B = C - (DT)_m = C(1-p)^m$$

where, D, B , C , and n have the same meaning as above.

3 **Sinking fund method :** In this method the depreciation of property is assumed to be equal to the annual sinking fund plus the interest on the fund for that year. The total amount of sinking fund is given by,

$$S = C - S_c$$

Annual instalment of sinking fund is given by,

$$I = \frac{S\,i}{(1+i)^n - 1}$$

Annual depreciation for the m^{th} year is given by,

$$D = I\ (1 + i)^{m-1}$$

Total depreciation, (DT) at the end of m^{th} year,

$$(DT)_m = \frac{I\left[(1+i)^m - 1\right]}{i}$$

where, i - is the rate of interest in decimal.

Scrape value / Salvage value / Book value at the end of the m^{th} year is given by,

$$B = C - (DT)_m$$

4 Quantity survey method : In this method, the property is studied in detail and loss in value due to obsolescence, decay, life, wear and tear, etc., worked out. Each and every step is based on some logical ground without any fixed percentage of the cost of the property. Only experienced valuer can work out the amount of depreciation and present value of property by this method.

2.1.8 Problems on calculation of depreciation

Problem 1 : A shopping complex was purchased for Rs.20,00,000. Assuming salvage value after 7 years as Rs.15,10,000, find the annual depreciation and also determine the total depreciation and book value at the end of 5^{th} year by (i) Straight line method (ii) Constant percentage method, and (iii) Sinking fund method assuming 6% interest.

Solution :

Original cost	C =	Rs.20,00,000
Salvage value	B =	Rs.15,10,000
Number of years	n =	7
Rate of interest	i =	6% = 0.06

(i) Straight line method :

Annual depreciation, $D = \frac{Original\ cost - Scrap\ value\ (salvage\ value)}{Life\ in\ year}$

i.e., $D = \frac{(C - B)}{n}$

$$\mathbf{D} = \frac{(2000000 - 1510000)}{7} = \mathbf{Rs.70,000}$$

Total depreciation, (DT) at the end of 5^{th} year,

$$\mathbf{(DT)_5} = 5 \times D = 5 \times 70000 = \mathbf{Rs.3,50,000}$$

Book value (B) after 5th year,

$B_5 = C - (DT)_5 = 2000000 - 350000 =$ **Rs.16,50,000**

(ii) Constant percentage method :

Constant percentage, $p = 1 - \left(\frac{B}{C}\right)^{1/n}$

$$p = 1 - \left(\frac{1510000}{2000000}\right)^{\frac{1}{7}} = 0.0394$$

Annual depreciation, D for the mth year,

$$D = C\left[(1-p)^{m-1} - (1-p)^{m}\right]$$

$$D = 2000000\left[(1-0.0394)^{5-1} - (1-0.0394)^{5}\right]$$

$$D = \text{Rs.67,096}$$

Total depreciation, (DT) at the end of mth year, (m = 5)

$$(DT)_m = C\left[1 - (1-p)^{m}\right]$$

$$(DT)_5 = 2000000\left[1 - (1-0.0394)^{5}\right]$$

$$(DT)_5 = Rs.3,64,152$$

Book value (B) after mth year,

$B = C - (DT)_m$

$B_5 = C - (DT)_5$

$B_5 = 2000000 - 364152 =$ **Rs.16,35,848**

(iii) Sinking fund method :

Total amount of sinking fund (S),

$$S = C - B$$

$$S = 2000000 - 1510000 = \text{Rs.4,90,000}$$

Annual instalment of sinking fund,

$$I = \frac{S\,i}{(1+i)^{n} - 1} = \frac{(490000\ X\ 0.06)}{(1+0.06)^{7} - 1}$$

$I =$ **Rs.58,376/-**

Annual depreciation for the mth year, (m = 5)

$$D_5 = I\,(1+i)^{m-1}$$

$D_5 = 58376 \times (1+0.06)^{5-1} =$ **Rs.73,698/-**

Total depreciation, (DT) at the end of m^{th} year, (m = 5)

$$(DT)_m = \frac{I\,(1+i)^m - 1}{i}$$

$$(DT)_5 = \frac{58376\,[\,(1+0.06)^5 - 1\,]}{0.06}$$

$$\mathbf{(DT)_5 = Rs.3,29,071}$$

Book value at the end of the m^{th} year , (m = 5)

$$B_m = C - (DT)_m$$

$$B_5 = 2000000 - 329071$$

$$\mathbf{B_5 = Rs.16,70,929\ /-}$$

Problem 2 : A construction machinery was purchased for Rs.2,50,000 in the year 2000. If the rate of depreciation is 3% , Calculate the annual depreciation, total depreciation and book value of the machinery during the year 2015.

Solution :

Capital or Original cost, C = Rs.2,50,000

Rate of depreciation , p = 3% = 0.03

Age of machinery, = 2015 – 2000 = 15 years

Since, the rate of depreciation is given in percentage,

Annual depreciation, D for the m^{th} year, (m = 15)

$$D = C\,[\,(1-p)^{m-1} - (1-p)^m\,]$$

$$D = 250000\,[\,(1-0.03)^{15-1} - (1-0.03)^{15}\,]$$

$$\mathbf{D = Rs.4896/-}$$

Total depreciation, (DT) at the end of m^{th} year, (m = 15)

$$(DT)_m = C\,[\,1 - (1-p)^m\,]$$

$$(DT)_{15} = 250000\,[\,1 - (1-0.03)^{15}\,]$$

$$(DT)_{15} = Rs.91,687/-$$

Book value (B) after m^{th} year,

$$B = C - (DT)_m$$

$$B_{15} = C - (DT)_{15}$$

$$B_{15} = 250000 - 91,687 = \mathbf{Rs.1,58,313/-}$$

Problem 3 : Calculate the depreciated replacement cost of a building having the following particulars by adopting straight line method:

Total plinth area of the building : 70 m^2

Age of the building : 30 yrs.

Life of the building : 100 yrs.

Scrap value at the end of useful life : 8% = 0.08

The present rate for the construction of building is Rs.32000/- per m^2 .

Solution : Straight line method.

Capital or Original cost of building at present, C = (32000 x 70) = **Rs.22,40,000**

Scrap value at the end of useful life, S_c = 2240000 x 0.08 = **Rs.1,79,200**

Annual depreciation, $D = \frac{\text{Original cost} \quad \text{Scrap value (salvage value)}}{\text{Life in year}}$

i.e., $D = \frac{(C - S_c)}{n}$

$\mathbf{D = \frac{(2240000 \quad 179200)}{100}}$ = **Rs.20,608/-**

Total depreciation, (DT) at the end of 30th year,

$(DT)_{30}$ = 30 x D = 30 x 20608 = **Rs.6,18,240/-**

Depreciated replacement cost of building,

= C − $(DT)_{30}$ = 2240000 — 618240 = **Rs.16,21,760/-**

2.1.9 Valuation of Property

The valuation of the building is mainly depends on its type, materials used in construction, durability, site conditions, size and shape, present market rates of materials, labour and land, etc.,. The valuation may also depends on the height of building, type of roofs, wall thickness, type of foundations, plinth level, etc.,.

Buildings constructed in commercial areas or market have high value than those constructed in residential areas. Buildings constructed in approved lands or developed areas has high value as compared to buildings of unapproved lands or undeveloped areas. The buildings of the area with facilities like electricity, water supply and sanitary arrangements will have high value. The buildings constructed on free-hold lands will have high value than constructed on lease-hold lands. The value of the building mainly depends on the net income which it can fetch if rented. The valuation also depends on the demand for purchase, if purchasers are more the value will be increased.

2.1.10 Methods of valuation of buildings

The following are the various methods used to determine the valuation of buildings :

1 Rental method

2 Cost based method (Present value)

3 Profit based method

4 Capital value comparison method

1 Rental method :

In this method the net income fetched by the property is worked out deducting all the outgoing expenditures as described earlier. The valuation of the building on the basis of the rent is taken as about 200 times the rent per month of the building, and on this allowing cost of depreciation depending on life of the building.

If the building is rented one, then on its market value, its valuation can be calculated. But no hard and fast rules can be laid down for the market value of the building, as it will depend on the locality in which the building has been constructed, the purpose for which it was built, and the purpose for which it could be utilized in that locality.

2 Cost based method (Present value) :

In this method the actual cost of construction of the building or purchase cost is taken into account. After suitable depreciation and considering other points, the present valuation is determined.

i.e., Present value, $V = P\ (\ 1 - p\ )^n$

here, P - Original cost p – *rate of depreciation*]

3 Profit based method :

This method is used for the valuation of hotel, cinemas, theatres, buildings, etc., for which the capital value mainly depends on the profit. In these cases the annual net income is worked out after deducting all the expenditures, etc.,. The net profit per year is multiplied by Year's purchase to get the valuation of the building, where year's purchase is the capital amount required to be invested in order to receive an annuity of Re.1 at the market rate of interest.

4 Capital value comparison method :

This method is used for the valuation of the property, when the rental value of the property is not available, but sale records of similar buildings are available. In this method the capital value of the property is worked out by direct comparison with the capitalized value of the similar property in the same locality, whose sale records are available.

2.1.11 Methods of valuation of lands

The open lands can broadly be divided into two categories, namely, urban lands and farm lands. The urban open lands are classified in different ways such as residential, industrial, etc., and the value of such lands primarily depends on the potentially of their development by constructing appropriate structures over them. The farm lands are agricultural fields and they are capable of producing earnings themselves.

The following are the valuation methods of urban open lands.

1 Comparative method

2 Abstractive method

1 Comparative method :

In this method, the various transactions of nearby lands are properly studied and then a fair rate of land under consideration is decided. Thus, the comparative method will be useful only in case of an active market where there are large number of statistics available for comparison.

2 Abstractive method :

The abstractive method is useful when no information is available regarding land transaction in the nearby area or in other words, the value of land where sales are not occurring frequently can be worked out by the application of this method.

The following three distinct steps are involved in this method :

i. A nearby property fetching rent is considered and its capitalized value is worked out by multiplying its net income by year's purchase. Let us say this to be A.

ii. The estimated cost of the replacement of the above building is worked out and then, after making the allowance for the depreciation, a figure representing the cost of the building alone at present is obtained. Call this as B.

iii. The difference (A - B) gives the value of the land, and it should be divided by the area of land to determine the cost per unit area. This unit cost of land is then used to find out the value of open land under consideration.

2.1.12 Mathematics of Valuation

1 To find the amount of 1 Rupee of compound interest at the end of 'n' years :

$$A = (1 + i)^n = \text{Amount of 1 Rupee}$$

where 'A' is the amount and 'i' is the rate of interest in decimal (e.g. 4% as 0.04), when the principal is Re.1 .

When 'P' is the principal, instead of Re.1 then,

$$A = P(1 + i)^n$$

'P' is the present value of 'A' and is given by,

$$P = \frac{A}{(1 + i)^n}$$

We can say that an amount of 'A' at the end of 'n' years is equal to $A / (1 + i)^n$ today. If 'A' = 1, then,

$$P = \frac{1}{(1 + i)^n} = \text{present value of Re.1 receivable at the end of '}n\text{' years.}$$

Now, we can say that an amount of Re.1 at the end of 'n' years is equal to $1 / (1 + i)^n$ today.

2 To find the amount of an annuity of 1 Rupee (i.e., one rupee per annum with compound interest at the end of 'n' years) :

Annuity is the annual amount to be paid or to be received.

$$S = \frac{(1 + i)^n - 1}{i} = \text{amount of annuity of Re.1}$$

If you invest 1 Rupee per annum regularly it will accumulate to $\frac{(1 + i)^n - 1}{i}$ at the end of 'n' years.

If the annuity is I , then,

$$S = \frac{I[(1 + i)^n - 1]}{i} = \text{amount of annuity of '}I\text{'}$$

and $I = \frac{S\,i}{(1 + i)^n - 1}$ = amount of redeem a capital of S .

= annual amount of sinking fund, S .

If $S = 1$, $I = \frac{i}{(1 + i)^n - 1}$ = annuity for the redemption of capital of Re.1

= annual amount for a sinking fund of Re.1

$I = \frac{i}{(1+i)^n - 1}$ is also called co-efficient of sinking fund and is denoted by I_c.

3 To find the present value P of 1 Rupee receivable per annum for a period of 'n' years allowing interest 'i' on capital and interest (i') for redemption of capital.

$$P = \frac{1}{i + I_c}$$ = Present value of 1 Rupee per annum for 'n' years.

where, $I_c = \frac{i'}{(1+i')^n - 1}$

4 To find the present value of 1 Rupee per annum (i.e., present value of annuity of Re.1) receivable in perpetuity after a given number of years.

$P = \frac{1}{i} - \left[\frac{1}{i+1}\right]$ = present value of 1 Rupee receivable in perpetuity after 'n' years.

i.e., if you invest an amount of P today, after 'n' years it will fetch an income of Re.1, per year continuously for an infinite number of years.

2.1.13 Valuation Tables

Valuation tables have been prepared for quick determination of the valuation of the properties, in order to save time and labour and also to reduce chance of error in calculations.

Table 1 : The present value of Re.1 receivable at the end of 'n' years for different rates of interest are tabulated.

Number of Years 'n'	4 %	5 %	6 %	7 %	8 %
1	0.9615	0.9523	0.9433	0.9346	0.9259
2	0.9246	0.9070	0.8899	0.8734	0.8573
3	0.8890	0.8638	0.8396	0.8163	0.7938
4	0.8548	0.8227	0.7921	0.7629	0.7350
5	0.8219	0.7835	0.7473	0.7130	0.6806
10	0.6756	0.6139	0.5584	0.5083	0.4632
20	0.4564	0.3769	0.3118	0.2584	0.2145
50	0.1407	0.0872	0.0543	0.0339	0.0213
100	0.0198	0.0076	0.0029	0.0011	0.0005

Ex. : To receive Re.1 at the end of 5 yrs. Re.0.7473 is to be invested now with a compound interest of 6 %.

Table 2 : The value of Re.1 invested now, at the end of 'n' years for different compound interest rates are given in table.

Number of Years ' n '	4 %	5 %	6 %	7 %	8 %
1	1.0400	1.0500	1.0600	1.0700	1.0800
2	1.0816	1.1025	1.1236	1.1449	1.1664
3	1.1249	1.1576	1.1910	1.2250	1.2597
4	1.1699	1.2155	1.2625	1.3108	1.3605
5	1.2167	1.2763	1.3382	1.4026	1.4693
10	1.4802	1.6289	1.7908	1.9672	2.1589
20	2.1911	2.6533	3.2071	3.8697	4.6610
50	7.1069	11.4674	18.4202	29.4570	46.9016
100	50.5049	131.5013	339.3021	869.7163	2199.7613

Ex. : Re.1 invested now at 6% compound interest will fetch Re.1.3382 at the end of 5 yrs.

Table 3 : The annual instalment to be deposited to get a return of Re.1, at the end of 'n' years [Annuity for the redemption of capital of Re.1 (or) the annual instalment for a sinking fund] is given in table for different rates of interests.

Number of Years ' n '	4 %	5 %	6 %	7 %	8 %
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	0.4902	0.4878	0.4854	0.4831	0.4808
3	0.3203	0.3172	0.3141	0.3111	0.3080
4	0.2355	0.2320	0.2286	0.2252	0.2219
5	0.1846	0.1810	0.1774	0.1739	0.1705
10	0.0833	0.0795	0.0759	0.0724	0.0690
20	0.0336	0.0302	0.0272	0.0244	0.0219
50	0.0066	0.0048	0.0034	0.0025	0.0017
100	0.0008	0.0004	0.0002	0.0001	___

Ex. : To get Re.1 at the end of 5 yrs an annual instalment of Re.0.1774 is to be deposited at 6 % compound interest.

2.1.14 Problems on Valuation of Buildings / Properties

Problem 1 : A building was constructed 15 years back at a cost of Rs.10,00,000. As per the P.W.D schedule of rate, the present day rate of material and labour increased by 30 % over the original cost. Find the present value of the building if the rate of depreciation is 2 % .

Solution :

Original cost of construction C = Rs.10,00,000

Cost of present day rate P = 1.3 x 1000000 = **Rs.13,00,000/-**

Rate of depreciation p = 2 % = **0.02**

Age of the building n = 15 years

Now, Present value of the building, $V = P\,(1 - p)^n$

V = 1300000 x (1 − 0.02)^{15}

∴ **Present value of the building V = Rs.9,60,140/-**

Problem 2 : The cost of building constructed 20 years back was Rs.5,60,000. The standard rate of depreciation is 1 percent . Calculate the present value of the building when,

i. No allowance is made for appreciation value.

ii. When an allowance of 7 percent per annum is allowed for the increase of material cost.

Solution :

Original cost of the building C = Rs.5,60,000

Age of the building n = 20 years

Rate of depreciation p = 1 % = **0.01**

i. Present value of building (when, no allowance is made for appreciation value) :

Cost at present market rate $P = C$ = Rs.5,60,000

Depreciated present value $V = P\,(1 - p)^n$

= 560000 $(1 - 0.01)^{20}$

∴ **Depreciated present value V = Rs.4,58,028/-**

ii. Present value of building : (when, allowance of 7 % annum is allowed for increase of material cost)

Cost at present day rate $P = C(1 + p)^n$

(Use +ve for appreciation / increase in cost & −ve for depreciation)

Cost at present day rate $P = 560000\,(1 + 0.07)^{20}$

P = Rs.21,67,023/-

Depreciated present value $V = P\,(1 - p)^n$

$= 2167023\,(1 - 0.01)^{20}$

∴ **Depreciated present value V = Rs.17,72,423/-**

Problem 3 : An owner occupied property is required to be valued for the wealth tax purpose on land and buildings. The following particulars are available. Calculate the present value of the property.

Value of the land = Rs.4,50,000
Cost of building = Rs.27,00,000
Age of the building = 25 years
Estimated cost of repairs = Rs.2,25,000
Depreciation to be allowed for the building = 1 % per annum

Solution :

Cost of present day rate P = Rs.27,00,000
Rate of depreciation p = 1 % = **0.01**
Age of the building n = 25 years

Now, Depreciated Present value of the building, $V = P\ (\ 1 - p\ )^n$

V = 2700000 x (1 − 0.01)^{25}

V = **Rs.21,00,118/-**

Deduct cost of repairs = Rs.2,25,000

= **Rs.23,25,118/-**

Add value of land = Rs.4,50,000

\ **Present value of the property = Rs.27,75,118/-**

Problem 4 : The built up portion of a I Class building on 320 m^2 land, near city is 150 m^2, the plinth area rate in the neighbourhood including water supply, sanitary and electrification charges is Rs.14,500/- per m^2. The age of the building may be taken as 17 years. The cost of land in the locality is Rs.5,600/- per m^2. Assuming the rate of depreciation as 1.5 %, calculate the present value of the property.

Solution :

Plinth area of the building = 150 m^2
Cost of building at present day rate P = 150 x 14500 = **Rs.21,75,000/-**
Rate of depreciation p = 1.5 % = **0.015**
Age of the building n = 17 years

Now, Depreciated Present value of the building, $V = P\ (\ 1 - p\ )^n$

V = 2175000 x (1 − 0.015)^{17}

V = **Rs.16,82,191/-**

Add cost of land = 320 X 5600 = Rs.17,92,000

\ **Present value of the property = Rs.34,74,191/-**

Problem 5 : Find the value of a free hold property with the following particulars :

Area of land	= 700 m^2
Built up area	= 250 m^2
Gross annual rent	= Rs.84,000/-
Permissible built up area	= 50 % of area of plot
Estimated life of structure	= 70 years
Estimated rate of open land	= Rs.2000 / m^2
Interest on capital	= 6 % and interest on redemption of capital 4 %
Outgoings	= 25 % of gross rent

Solution :

Gross annual income = Rs.84,000 (+)

Deduct outgoings at 25 % = 84000 x 0.25 = Rs.21,000 (−)

Net income = 84000 − 21000 = **Rs.63,000**

Future life of the structure (n) = 70 years

Interest for redemption (i') = 4 % = **0.04**

Interest on capital (i) = 6 % = **0.06**

Now, Co-efficient , $I_c = \dfrac{i'}{(1 + i')^n - 1}$

i.e., $I_c = \dfrac{0.04}{(1 + 0.04)^{70} - 1} = 0.002745$

Years purchase (Y.P.) $= \dfrac{1}{i + I_c}$

$= \dfrac{1}{0.06 + 0.002745} = 15.94$

Capital value = Net income x Y.P.

= 63000 x 15.94 = **Rs.10,04,220 (+)**

Minimum land area required appurtenant to building = 50 % of area of plot

= built up area x 2 = 250 x 2 = **500 m^2**

Value of land deferred for 70 years at 4 % interest

$= \dfrac{500\ X\ 2000}{(1 + 0.04)^{70}}$ = **Rs.64,219 (+)**

Extra open land = 700 − 500 = **200 m^2**

Present value of open land = 200 x 2000 = **Rs.4,00,000 (+)**

Now, Total value of the property = 1004220 + 64219 + 400000

\ **Total value of the property = Rs.14,68,439 /-**

Problem 6 : A freehold plot of land measures 800 m^2. It is situated in middle class locality. A three-storeyed building stands on the plot. With the following particulars, find out the value of the property.

Built-up area on ground floor	= 210 m^2
Permissible built-up on ground floor	= 1/3 of plot area
Total carpet area of three floors	= 350 m^2
Average net rate of rent per m^2 of carpet area (Excluding local taxes)	= Rs.30/-
Estimated future life of building	= Perpetuity
Estimated rate of land	= Rs.1500 / m^2
Amount of usual outgoings	= 1/6 of gross rent
Rate of interest for capitalization	= 8 %

Solution :

Gross annual rent = (30 x 350 x 12) = Rs.1,26,000 (+)

Deduct outgoings = (1/6 x 126000) = Rs. 21,000 (–)

Net annual rent = 126000 – 21000 = **Rs.1,05,000/-**

Capitalized value = Net annual rent x Y.P.

Years purchase (Y.P.) = $\frac{1}{i} = \frac{1}{0.08}$ = **12.5**

\ **Capitalized value** = 105000 x 12.50 = **Rs.13,12,500 (+)**

Extra open land available for further construction, = (800 – 210 x 3) = 170 m^2

Present value of open land = 170 x 1500 = **Rs.2,55,000 (+)**

Now, Total value of the property = 1312500 + 255000

\ **Total value of the property = Rs.15,67,500 /-**

Problem 7 : Find the value of a leasehold property from the following particulars :

Replacement value of the building	= Rs.7,00,000
The ground rent per annum	= Rs.2000
Estimated life of the building	= 50 years
The rent of the building	= Rs.8000 per month
Taxes payable	= 12 % of gross rent
Insurance premium	= 0.7 % of gross rent
Repairs and management charges	= 15 % of gross rent
Interest on capital	= 6 %
Interest on sinking fund	= 1.5 %

Solution :

Gross income per annum = 8000 x 12 = **Rs.96,000 (+)**
(gross rent is the income)

Outgoings :

i. Ground rent = **Rs.2000 (–)**

ii. Taxes = 96000 x 0.12 = **Rs.11520 (–)**

iii. Insurance = 96000 x 0.007 = **Rs.672 (–)**

iv. Repairs and management charges = 96000 x 0.15 = **Rs.14400 (–)**

v. Annual instalment of sinking fund

$$I = \frac{S\,i}{(1+i)^n - 1}$$

$$I = \frac{(700000\ X\ 0.015)}{[\,(1+0.015\,)^{50} - 1\,]} = \textbf{Rs.9500 (–)}$$

Total outgoings = **Rs.38092 (–)**

Net income = Gross income – Total outgoings

= 96000 – 38092 = **Rs.57908/-**

Capital value = Net income x Year's Purchase

\ **Capital value at 6 %** = 57908 x $\frac{1}{0.06}$ = **Rs.9,65,133/-**

Problem 8 : A person intends to sell out his property for Rs.6,70,000. The details of the property are as follows :

Rent per month	=	Rs.5,000
Area of land	=	210 m^2
Estimated future life	=	40 years
Estimated value of land	=	Rs.2500 per m^2
Total outgoings	=	20 % of gross rent

Advice the client whether he can sell the property for the above price.

Solution :

Annual rent (Gross rent)	= 5000 x 12	= Rs.60,000	
Total outgoings (20% gross rent)	= 60000 x 0.2	= Rs.12,000	(–)
Net annual income		= **Rs.48,000/-**	

Assume 8 % interest on capital and 5 % for redemption of capital,

hence, i = 8 % = 0.08 and i' = 5 % = **0.05**

Years purchase (Y.P.) for 40 years $= \frac{1}{i + I_c}$

Co-efficient of sinking fund $I_c = \frac{i'}{(1 + i')^n - 1}$

$= \frac{0.05}{(1 + 0.05)^{40} - 1} = \mathbf{0.0083}$

Now, Y.P. $= \frac{1}{0.08 + 0.0083} = \mathbf{11.33}$

Capital value C = Net income x Y.P.

= 48000 x 11.33

\ C = **Rs.5,43,840/-**

Present cost of land = 210 x 2500 = **Rs.5,25,000/-**

Deferred value of land $= \frac{P}{(1 + i)^n}$

\ **Deferred value of land** $= \frac{525000}{(1 + 0.05)^{40}} =$ **Rs.74,574/-**

Now, Total value of the property = Capital value + Deferred value of land

= 543840 + 74574

\ **Total value of the property = Rs.6,18,414/-**

Hence, if an offer of Rs.6,70,000 received by the client, it will be in his interest to sell out the property.

Problem 9 : A city corporation has to acquire an area of 2,00,000 m^2 for the development of a new high tech residency. After developing the area it is proposed to be sold at Rs.300 per sq.m. Work out the maximum compensation which can be given to the owners, whose land is to be acquired for the development of the residency assuming the following :

i. The corporation's establishment charges - 17% on the sale price
ii. Residency improvement expenditure - Rs.60 per sq.m
iii. Architect's and supervising charges - 5 % of the sale price
iv. Area is to be provided for roads, parks and other public amenities - 30 %

Solution :

Total area proposed to be acquired = 200000 m^2

Area for roads, parks, etc., (0.30 x 200000) = 60000 m^2 (–)

\ Net area available for making plots for sale = **140000 m^2**

Now, Gross income from the sale of plots = 140000 x 300 = **Rs.4,20,00,000**

Outgoings :

Establishment charges	= 42000000 x 0.17	= Rs. 71,40,000	(–)
Residency improvement expenditure	= 200000 x 60	= Rs.1,20,00,000	(–)
Architect's and Supervising charges	= 42000000 x 0.05	= Rs. 21,00,000	(–)
Now, Maximum cost of undeveloped land		= **Rs.2,07,60,000/-**	

\ **Maximum possible compensation which can be given to the land owners (2,07,60,000 / 200000)** = **Rs. 103.80 per m^2**

Problem 10 : Workout the value of a cinema house with the following data:

Cost of land for life time period of the house = Rs.90,00,000/-
Capacity of the cinema house = 300 seats
Income per show on house full = Rs.36,000/-
Number of regular shows per day = 4
Take morning shows on Sundays and Holidays = 70 days
Take vacancies as 30 %
Share of theatre owner = 50 % of gross income (balance goes to distributor)
Income from advertisement per year = Rs.12,00,000/-
Staff salary, electric charges, municipal taxes, stationery and printing etc., = 30% of gross income
Repairs and maintenance of equipments, furnitures, etc., = 5 % of gross income
Insurance premium = Rs.4,50,000 / year
Assume year's purchase for 50 years @ 8% and redemption of capital @ 4% .

Solution :

Gross income :

Number of shows per year	= 4 x 365 + 70	= 1530	
Income per show on house full		= Rs. 36000	
Total income per year	= 1530 x 36000	= Rs. 55080000	(+)
Deduct for vacancies (30 %)	= 55080000 x 0.30	= Rs. 16524000	(–)
Gross income per year		= **Rs. 38556000/-**	
Owner's income (50 %)	= 38556000 / 2	= **Rs. 19278000**	(+)
Income from advertisements		= Rs. 1200000	(+)
Gross income to the owner		= **Rs. 20478000**	(+)

Outgoings :

Staff salary, electric charges, municipal taxes, stationeryand printing etc., = 20478000 x 0.30 = Rs. 6143400 (–)

Repairs and maintenance of equipments, furnitures, etc., = 20478000 x 0.05 = Rs. 1023900 (–)

Insurance premium = Rs. 450000 (–)

Total outgoings = **Rs. 7617300** (–)

Now, Net income to the owner = Gross income – Outgoings

= 20478000 – 7617300

\ **Net income to the owner** = **Rs. 1,28,60,700/-**

Capital value :

Year's purchase for 50 years @ 8% and redemption of capital @ 4% ,

hence, i = 8 % = 0.08 and i' = 4 % = **0.04**

Years purchase (Y.P.) for 50 years $= \frac{1}{i + I_C}$

Co-efficient of sinking fund $I_C = \frac{i'}{(1+i')^n - 1}$

$= \frac{0.04}{(1 + 0.04)^{50} - 1}$ = **0.00655**

Now, Y.P. $= \frac{1}{0.08 + 0.00655}$ = **11.55**

Capital value, C = Net income x Y.P.

= 12860700 x 11.55

\ C = **Rs.14,85,41,085 (+)**

Present cost of land for life time period of 50 years = **Rs. 90,00,000 (+)**

Now, Total value of the property = Capital value + Value of land

= 148541085 + 9000000

\ **Total value of the property** = **Rs.15,75,41,085 /-**

(Note : Value per seat = 157541085 / 300 = **Rs.5,25,137** per seat).

2.2 RENT CALCULATION

2.2.1 Fixation of Rent :Introduction (Logic)

The rent of a building is fixed on the basis of certain percentage of annual interest on the capital cost and all possible expenditures on outgoings. Allowing a certain prevalent percentage of interest on the capital, the return may be worked out. The capital cost divided by the year's purchase will give the return. The owner expects about 2 % higher interest than the prevalent interest to cover up the risk of his investment.

To this net return, all possible expenditures on outgoings are added to get gross rent.

Gross rent = Net rent + Outgoings

Dividing the gross rent by 12, rent per month can be calculated.

In resent day an interest of 12% may be a reasonable one for investment on building, but government allows only 6 % interest.

2.2.2 Definition of terms

1 Standard rent

It is the rent which can be lawfully charged from a tenant. It is the maximum permissible rent for a building of a state can be charged at the Court of law.

The rent controller of a state used to fix up the standard rent of a building considering the cost of construction, age, cost of land and its location. If the rent charged is higher than the standard rent, the Court can reduce it to the standard rent, if the tenant moves to the Court. But if the contract rent is less than the standard rent, the Court shall not increase it to the standard rent. All the states have framed their own acts for the fixation of the standard rent.

2 Fair rent (or) Reasonable rent (or) Equilibrium rent

Fair rent may be defined as the prevailing rent which is capable of being maintained for a long period. Also, When the net income by way of rent of a property is equal to the nominal interest of the capital invested on the property, the rent is called a fair rent (or) reasonable rent (or) equilibrium rent.

3 Economical rent

If the net income by way of rent of a property exceeds the nominal interest of the capital cost invested on the property, the rent is called an economical rent.

4 Market rent

Market rent of a building is the prevalent rent of a similar building with same facilities in the same locality. The market rent may be higher or lower than the standard rent or fair rent depending on the location, demand and facilities available / provided.

5 Nominal rent

If the owner due to some relationship with the tenant, charges a very small rent much below the standard rent, it is called nominal rent. Such rent is charged only to keep alive the relationship of owner and tenant.

6 Gross rent

It is the total rent received from a property during a year. It is most important and is the basis for determining the valuation of a property.

7 Net rent

It is equal to the gross rent minus all the outgoings. Mathematically,

Net rent = Gross rent – Outgoings

8 Rent certificate

When a private building is occupied by a government department, the rent demanded and negotiated will be paid only after obtaining a certificate for the reasonable of rent from the concerned P.W.D authority (Executive Engineer) . The concerned P.W.D authority, on application received from the occupying department, will inspect the building and calculate the reasonable rent of the building on the above basis and issue the certificate, if the rent fixed is equal to or less than the reasonable rent; otherwise the rent is restricted to the reasonable rent calculated as per rules.

2.2.3 Rent control

The practice of imposing a legal maximum ceiling upon the rent in a particular housing market is called rent control. This ceiling value is normally less than the market rent. If this ceiling is above the market rent, then the control becomes null and void. In a free market, rents would rise automatically filling the gap between the demand and the supply. But rent control prevents rents from rising automatically above the ceiling. Tamilnadu Government had enacted Tamilnadu Rent Control Act 1960 specifying terms and conditions for fixing and revising rent ceiling for buildings and properties.

Advantages of Rent Control System

i. Department of rent control make arrangement for renting the properties of owners, living in far away places.

ii. It protects the tenant from eviction from the house where he is living except for defined reasons.

iii. It protects the tenant from having to pay more than the standard rent fixed by the Rent Control Officer (the District Collector).

Disadvantages of Rent Control System

i. It gives very low return to the land lords / investors when compared to the return from other assets. This leads to rapid deterioration of existing housing stock, under this system.

ii. Land lord do not invest funds for upkeeping the property, leading to their poor maintenance and thereby causing discomfort to tenant.

iii. Difficult to vacate the tenant and sell the property.

2.2.4 Factors influencing the rent of a building

The following are the some of the factors which influence the rent of a building :

i. Type of building (whether RCC roof, Madras terraced roof, single storeyed or multistoreyed etc.,.

ii. Floor number (Ground floor, First floor, etc.,).

iii. Age of the building

iv. Type of flooring (Mosaic, Tiles, Marble, Granite, etc.,)

v. Architectural appearance of building

vi. Parking spaces available

vii. Amenities available (Lift, A.C., Electric heater, Garden, Play ground etc.,)

viii. Neighbourhood and environment

ix. Quality and Availability of drinking water

x. Number of rooms available

xi. Distance to main road, bus stop, hospitals, schools, market, etc.,

xii. Demand for housing and availability of buildings for rental

2.2.5 Problems on Rent Calculation

Problem 1 : A person has invested Rs.7,50,000 on a plot and Rs.22,30,000 on construction of a building over it expecting 7 % return. Assuming the cost of annual repairs to be Rs.2500 and other outgoings to be 30 % of the gross rent, calculate the reasonable rent, if the annual sinking fund co-efficient is 0.01 .

Solution :

Cost of building = Rs.22,30,000
Cost of land = Rs. 7,50,000
Total Capital cost = **Rs.29,80,000/-**

7 % interest on capital = 2980000 x 0.07 = **Rs.2,08,600**
Add cost of annual repairs = **Rs. 2,500**
(Assume no salvage value, Sinking fund S = 2230000 and $I = S I_c$)
Add annual instalment of sinking fund I = 2230000 x 0.01 = **Rs. 22,300**
Net rent required = **Rs.2,33,400/-**

Let, annual gross rent = x

Outgoings (30 % of gross rent) = **0.30** x

Now, Net rent = Gross rent − Outgoings

= x − 0.30 x = **0.70 x**

Now, 0.70 x = **Rs.2,33,400**

Gross rent, x = $\frac{233400}{0.70}$ = **Rs.3,33,429**

Monthly rent = 333429 / 12

\ **Monthly rent for the building = Rs.27,786/-**

Problem 2 : A private building constructed 15 years ago on a plot of land measuring 260 m^2 area is to be taken on lease for accomodating a Government Office. The following particulars are available for the building :

Plinth area of the building - 180 m^2 ; Plinth area rate at present day market rate - Rs.4200 / m^2 ; Cost of water supply, sanitary and electrical installations - 10 % of the cost of the building ; Length of compound wall - 60 m ; Cost of compound wall at present day rate - Rs.800 / m ; Cost of land in the locality - Rs.400 / m^2.

i. Calculate the present value of the property allowing a depreciation of 1.5 % per annum.

ii. Calculate the fair rent for the building allowing 10 % interest on capital.

Solution :

i. Present value of the property :

Cost of the building at present market rate	= 180 x 4200	= Rs.7,56,000
Add cost of water supply, sanitary and electrical installations (10 % of cost of building)	= 7,56,000 x 0.1	= Rs. 75,600
Add cost of compound wall	= 60 x 800	= Rs. 48,000
Total cost of building at present market rate	(P)	= **Rs.8,79,600**

Age of the building n = 15 years

Rate of depreciation p = 1.5 % = **0.015**

Now, Depreciated Present value of the building, $V = P\,(1 - p)^n$

= 8,79,000 (1 − 0.015)^{15}

V = **Rs.7,00,700**

Add cost of land = 260 x 400 = **Rs.1,04,000**

\ **Present value of the property = Rs.8,04,700/-**

ii. Fair and reasonable rent of the building :

Fair and reasonable rent of the building at 10 % (**0.10**) interest on capital,

Annual rent = 8,04,700 x 0.10 = **Rs.80,470**

Now, **Monthly rent** = 80,470 / 12 = **Rs.6,706/-**

Problem 3 : Calculate the standard rent of a Government residential building from the following data :

Cost of construction of building	:	Rs.25,63,000
Cost of construction of out house	:	Rs. 5,22,000
Cost of electrical arrangements	:	Rs. 91,000
Cost of establishment incurred	:	Rs. 28,000
Cost of compound wall	:	Rs. 2,45,000
Cost of site	:	Rs. 4,30,000

Solution :

Capital cost :

Cost of construction of building	=	Rs.25,63,000
Cost of construction of out house	=	Rs. 5,22,000
Cost of electrical arrangements	=	Rs. 91,000
Cost of establishment incurred	=	Rs. 28,000
Cost of compound wall	=	Rs. 2,45,000
Cost of site	=	Rs. 4,30,000
Total capital cost	=	**Rs.38,79,000/-**

Assume, annual standard rent at 7 % (0.07) of capital cost,

Annual standard rent = 38,79,000 x 0.07 = **Rs.2,71,530/-**

Now, **Monthly standard rent** = 2,71,530 / 12 = **Rs.22,628/-**

Problem 4 : Work out gross rent and net rent per month of a building which is constructed at a cost of Rs.4500000 /- on a free hold property. The area of the land is 300 m^2 and the cost of land is Rs.6000 / m^2. Assume the outgoings including sinking fund is Rs.57,000 /- per annum. Expected net rent is 6 % of land and 15 % of construction cost.

Solution :

Construction cost of building = Rs.4500000

Cost of land = 300 x 6000 = Rs.1800000

Net return on construction cost = 4500000 x 0.15 = Rs.675000

Net return on land cost = 1800000 x 0.06 = Rs.108000

\ **Expected net rent per year** = **Rs.783000**

Also, **Net rent per month** = 783000 / 12 = **Rs.65250 /-**

Now, **Gross rent per year** = Net rent per year + Outgoings

= 783000 + 57000 = **Rs.840000/-**

Also, **Gross rent per month** = 840000 / 12 = **Rs.70000 /-**

Problem 5 : Calculate the fair rent for a building to be used for residential purpose from the following data.

Cost of building at present market rate = Rs.32,00,000 /-

Age of the building = 25 years

Materials used = R.C.C and Teak wood

Area of the plot = 120 m^2

Cost of land in the locality = Rs.2100 / m^2

Sanitary, water supply amenities and electrical fittings = Rs.4,50,000 /-

Solution :

Cost of building at present market rate P = Rs.32,00,000 /-

Age of the building n = 25 years

Assume 1 % of depreciation (if not given) i.e., p = **0.01**

Depreciated present value of the building, $V = P\ (\ 1 - p\ )^n$

$= 3200000\ (\ 1 - 0.01\ )^{25}$

\ **Depreciated present value of the building,** V = **Rs.24,89,028**

Add present value of the sanitary, water supply and electrical fittings = Rs. 4,50,000

Add cost of land = 120 x 2100 = **Rs. 2,52,000**

\ **Capital value** = **Rs.31,91,028 /-**

Note : For residential building, the fair rent is fixed at 9 % on capital value.

Now, Annual rent at 9 % (0.09) = 3191028 x 0.09 = **Rs.2,87,193 /-**

\ **Monthly rent** = 287193 / 12 = **Rs.23,933 /-**

Problem 6 : A newly constructed building stands on a plot costing Rs.7 lakhs. The construction cost of the building is Rs.28 lakhs, and the estimated life of the building is 65 years. The investor desires to have 10 % return on the construction cost and 6 % return on the land cost. Assuming annual repairs to be at 0.3 % of the construction cost and other outgoings at 25 % of the gross rent. Calculate the monthly rent that will have to be charged for the building. Interest on sinking fund is 2 % .

Solution :

Step 1 :

Amount of return required on construction cost = 2800000 x 0.10 = Rs.2,80,000

Amount of return required on land cost = 700000 x 0.06 = Rs. 42,000

Net income per year = **Rs.3,22,000** ...(1)

Step 2 :

Let x = Gross rent per annum

Outgoings :

Annual repairs (0.3 % construction cost) = 2800000 x 0.003 = **Rs.8,400**

Other outgoings (25 % gross rent) = **0.25 x**

Assuming no salvage value, the total amount of sinking fund, S = Rs.2800000

Annual instalment of sinking fund,

$$I = \frac{S\,i}{(1+i)^n - 1} = \frac{2800000\ X\ 0.02}{(1+0.02)^{65} - 1} = \textbf{Rs.21,353/-}$$

Net income = Gross income − Out goings

Net income = x − 8400 − 0.25 x − 21353 = 0.75 x − 29753 ..... (**2**)

Equating (1) and (2),

0.75 x − 29753 = 322000

0.75 x = 351753

x = 351753 / 0.75 = 469004

\ **Annual Gross rent = Rs.4,69,004/-**

Monthly rent to be charged = 469004 / 12 = **Rs.39,084/-**

Problem 7 : On a plot of land costing Rs.18 lakhs, a building has been constructed at a total cost of Rs.56 lakhs. The building consists of 6 flats for six tenement. The owner expects a net return of 8 % over the investment amount. If the outgoings are Rs.2 lakhs find the reasonable rent for a flat.

Solution :

Cost of building = Rs.56,00,000
Cost of land = Rs.18,00,000
Total capital cost = **Rs.74,00,000/-**

The owner expects 8 % (**0.08**) return on capital investment,

= 7400000 x 0.08 = **Rs.5,92,000/-**

Add outgoings = Rs.2,00,000

Annual rent for 6 flats = **Rs.7,92,000/-**

Annual rent for one flat = 792000 / 6 = **Rs.1,32,000/-**

Monthly rent for one flat = 132000 / 12 = **Rs.11,000/-**

Problem 8 : A government employee having a pay of Rs.15,000 per month, occupies a quarters building having plinth area of 180 sq.m. The prevailing rate per square metre of plinth area is Rs.2000. Calculate and suggest the amount of monthly house rent payable by the employee.

Solution :

Cost of building = 180 x 2000 = **Rs.360000**

Assume, the above cost includes the cost of water supply, Sanitation and electrification.

The Chargeable rent for the employee is the minimum of the following : **Refer 2.2.7**

i. Rent per annum on overall percentage basis : 7 % interest on capital cost

ii. Rent per month on the basis of 10 % of his basic pay

Now, **i.** Rent per annum on overall percentage basis (7 %) = 360000 x 0.07 = Rs. 25200

i.e., Rent per month = 25200 / 12 = **Rs. 2100**

ii. Rent per month on the basis of basic pay (10 %) = 15000 x 0.10 = **Rs. 1500**

Chargeable rent from the employee = Rs. 1500 per month

Problem 9 : The rateable value of a building is Rs.40,000 /- p.a. when interest on capital be 12 % and on sinking fund 5 %. The owner of the building gets on offer from a Bank for a net rent Rs. 50,000 /- p.a. for a lease of 25 years, provided some alteration works costing to Rs. 75,000 /- are to be carried out by the owner. Suggest whether the offer is acceptable to the owner.

Solution :

Capital cost, C = Rs.75000 Lease period, n = 25 years

i = 12 % = 0.12 and i' = 5 % = **0.05**

Capital value, C = Net income x Y.P.

The investment Rs.75,000/- should be spread over the lease period with interest.

Years purchase (Y.P.) for 25 years $= \dfrac{1}{i + I_c}$

Co-efficient of sinking fund $I_c = \dfrac{i'}{(1 + i')^n - 1}$

$= \dfrac{0.05}{(1 + 0.05)^{25} - 1}$ = **0.021**

Now, Y.P. $= \dfrac{1}{0.12 + 0.021}$ = **7.09**

i.e., Capital value, C = Annuity x Y.P.

75000 = Annuity x 7.09

Annuity = Rs.10578 /-

\ Actual offer = Rs. 50000 — Rs. 10578 = Rs. 39422 < Rs. 40000

Hence, the offer from the Bank is not acceptable.

Problem 10 : A private building was rented for Government for residential purpose. The following particulars are available for the building :

Age of the building	:	15 years
Plinth area of the building	:	250 m^2
Cost of present market value	:	Rs.15000 per m^2
Rate of depreciation on the cost of building	:	2 % per annum
Cost of water supply, sanitary and electrical fittings at present market rate	:	Rs.350000

Rate of depreciation to be allowed on the cost of water supply, sanitary and electrical fittings : 1 % per annum

Area of plot : 400 m^2

Current market value of land : Rs. 3000 per m^2

The owner of the building demands a monthly rent of Rs. 25000/- .

Calculate the Fair rent or Reasonable rent for the residential building and suggest whether the monthly rent demanded by the owner can be paid.

Solution :

Cost of building at present day market rate, P = 250 x 15000 = **Rs.3750000**

Depreciated present value of the building, $V_1 = P\,(1 - p)^n$

$= 3750000\,(1 - 0.02)^{15}$

V_1 = **Rs.27,69,634** (+)

Cost of water supply, sanitary and electrical fittings at present market rate = Rs.3,50,000

Rate of depreciation to be allowed on the cost of water supply, sanitary and electrical fittings = 1 % per annum

Depreciated present value , $V_2 = P\,(1 - p)^n$

$= 350000\,(1 - 0.01)^{15}$

V_2 = **Rs.3,01,020** (+)

Add cost of land = 400 x 3000 = **Rs.12,00,000** (+)

\ Present value of the property = Rs.42,70,654/-

For residential purpose, rent is fixed at 9 % of capital **(Refer 2.2.6)** .

Annual rent = 4270654 x 0.09 = Rs. 3,84,359 /-

i.e., Monthly rent = 384359 / 12 = Rs. 32030 > Rs. 25000

Hence, the rent demanded by the owner is reasonable and can be paid.

2.2.6 Fixing rent of a Private Building used by Government

When Government buildings are not available it may be necessary to hire private buildings for Government purpose. The officers of the administrative department will locate

suitable buildings, get the consent from the owner and furnish a copy of same along with a certificate that no other private building at a lesser rate of rent is available shall be forwarded to the Assistant Executive Engineer, Buildings, Sub Division of the locality. The Assistant Executive Engineer will then issue a certificate that no Government building in his charge is available in the locality for the purpose. The administrative department will then decide to take the building on rent.

The rent of a private building taken on lease for Government purpose is calculated based on the P.W.D code incorporating the rules and provisions contained in the Tamilnadu Buildings Lease and Control Act 1960 .

Based on the above Code (D code), the Fair rent or Reasonable rent of a private building rented for Government purposes shall be calculated as follows:

1 The Fair rent or Reasonable rent of any residential building shall be **9 %** gross return per annum on the total cost of the building.

2 The Fair rent or Reasonable rent of any non-residential building shall be **12 %** gross returns per annum on the total cost of the building.

3 The Fair rent or Reasonable rent for any residential or non-residential building located in non-municipal or corporation areas shall be 7 % gross return on the total cost of such building.

4 The total cost referred above shall include the following :

a. Cost of construction b. Market value of land c. Cost of amenities

a. Cost of construction

The cost of construction of a building shall be the probable cost of reconstructing the building at the same condition and at the prevailing market rate. Along with the plinth area rate of the building, either the calculated market rate of sanitary, water supply and electrical fittings etc., or the maximum percentage limit of 22.5 % (each 7.5 %) whichever is less is added. Also the standard rate of depreciation between 1 % to 4 % per annum is adopted to calculate the cost of construction depending upon the type of building.

b. Market value of land

The maximum extent of land to be taken into consideration for this purpose should not exceed 1.5 times the actual built up area of the building.

c. Cost of amenities : The cost of amenities is restricted to 5 % for residential building and 25 % for non-residential building on cost of construction and the market value of land. The market value of land be fixed in consultation with the Revenue Department.

2.2.7 Fixing rent of a Government Building rented to its employees

The rent for the Government building to be rented for residential purpose to government employees is calculated at a certain percent of the capital cost of the building and is known as standard rent. The standard rent is fixed as per rule framed by the Government from time to time and which differs to some extent for state to state. Normally, the annual standard rent is about 7 % interest on the capital cost or rent per month on the basis of 10 % of his basic pay whichever is less.

The capital cost of the building are worked out by considering the following expenditures :

1 Cost of construction
2 Sanitary, water supply and electrical fittings
3 Approach roads and paths within the compound
4 Cost of land
5 Cost at direct establishment
6 Cost of compound wall, new well, lawns or gardens

For calculating the standard rent for Government buildings, the market value of land shall be the maximum extent of land to be taken into consideration should not exceed 1.5 times the actual built up area of the building or to the actual extent whichever is less. The market value of land be fixed in consultation with the Revenue Department or Registration Departments.

2.2.8 Fixing rent of a Government Building rented to private parties

1 If any government building is rented to private parties, rent should be collected regularly from them at the rates prevailing in the locality for similar building of private person (i.e. market rent) . The collected rent should not be less than standard rent based on 7 % interest on the capital cost of the building.

2 Nominal lease rent which would cover the maintenance charges of Government building be collected for the government buildings occupied by the following associations / Institutions.

   a. Recreation clubs run by government employees
   b. Social Welfare organizations
   c. Centres run by physically handicapped persons in government buildings

3 Market rent or lease rent be collected for the government buildings occupied by the following :

   a. Canteens run for the benefit of the government employees
   b. Canteens run for the benefit of students in college / school buildings
   c. Other organizations run on commercial lines.

2.2.8 Questions

Short Questions :

1. Define the terms : Cost and Value.
2. Write any two differences between cost and value.
3. Define the term valuation.
4. What are the purposes of valuation of a property ?
5. Mention the methods of valuation.
6. What are the different methods of valuation of buildings ? Explain.
7. What do you understand by the terms scrap value and salvage value? Give an examples.
8. Define : Market value. Mention any three factors which will affect the market value of the property.
9. Differentiate between book value and market value.
10. Define the terms : Gross income, Net income and Outgoings.
11. Mention the important outgoings of a property.
12. Define the term obsolescence. Mention the factors contributing to obsolescence .
13. Define the term depreciation. Mention the methods adopted for calculating depreciation.
14. Write a brief note about any two methods of calculating depreciation of building.
15. Define the term year's purchase.
16. What are the types of leases ?
17. Define the term deferred value of land. .
18. What is meant by sinking fund ? Mention the formula for annual instalment of sinking Fund .
19. Define the term annuity and mention the types of annuity.
20. What is amortization ?
21. Describe the use of valuation tables with examples.
22. What is the logic behind the process of rent fixing ?
23. Define : Standard rent and economical rent
24. Define the terms : Market rent and Nominal rent
25. Define the term fair rent or reasonable rent.
26. What is meant by rent certificate ? Who issues rent certificate ?
27. What is rent control ? Discuss the advantages and disadvantages of this system.
28. State the factors influencing the rent of a building.
29. Explain in detail how you will work out standard rent of a Government building ?
30. Explain the procedure to calculate the reasonable rent of a private building when it is taken on leases by Government.

Problems :

31 The owner of a building sets aside in bank every year from the rent of the building which he gets Rs.25000 as sinking fund. He wishes to reconstruct another portion of the building after 20 years. If the rate of interest of the bank is 6 % , what will be the amount available with him at that time.

32 An old building has been purchased by a person at a cost of Rs.65,000 /- excluding the cost of land. Calculate the amount of annual sinking fund at 3 % interest assuming the future life of the building as 25 years and the scrap value of the building as 10 % of the cost of purchase.

33 Work out the value of year's purchase for an old building if its future life is 20 years and the rate of interest is 6 % on capital and 2 % for sinking fund.

34 Determine the present value of the building, which was constructed 25 years ago at Rs.5 lakhs. The estimated life of the building is 60 years, at the end of which it will have 12 % scrap value of its cost of construction.

35 The built up portion of a I class building on 700 m^2 land, near a city is 450 m^2. The plinth area rate including all charges is Rs.12500 per m^2. The age of building may be taken as 40 years. The cost of land in the locality is Rs.4200 per m^2. Calculate the present value of the property, assuming a suitable rate of depreciation.

36 The present value of a property is Rs.16 lakhs, out of which the cost of land is Rs.2 lakhs. The owner of the property expects 7 % return on the cost of construction and 6 % return on the cost of land. If the future life of the building is estimated as 70 years and at the end of its useful life, Rs.20 lakhs will be required for replacing the construction. Calculate the standard rent of the property assuming the following :

Rate of interest for sinking fund	= 5 %
Annual repairs cost	= 1 % of the cost of construction
All other outgoings	= 20 % of the net annual income

The scrap value of a building at the expiry of its useful life is 10% of its present value.

37 Total cost of construction of a newly constructed building with three floors is Rs.72 lakhs. The building is constructed on a plot measuring 500 sq.m purchased for Rs.20 lakhs. The prevailing rate of plots in the locality is Rs.5250 per sq.m. Work out the standard rent per floor per month assuming the following :

Municipal taxes at 30 % of rateable value (gross rent)

Collection and management charges at 3 % of the gross rent

Repairs at 1 % on $\frac{9}{10}$ th of cost of construction

Sinking fund at 4 % for 50 years on 80 % of cost of construction

Miscellaneous expenses at Rs.3000 per month

38 Calculate the fair rent of a residential building, the cost of building at present rate is Rs.6,50,000 . The age of building is 30 years. The building is constructed on a plot of land of 250 m^2. The cost of land in the locality is Rs.850 per m^2. The present value of sanitary and water supply works out to Rs.75,000. Allow a depreciation of 1.5 % .

39 Calculate the fair rent of a residential building with the following data :

The cost of the building at present market rate is Rs.4,50,000. The age of the building is 35 years. The building is of RCC with teak wood doors and windows. The building is constructed on a plot of land of 220 m^2. Cost of land in the locality is Rs.600 / m^2 . The present value of sanitary, water supply and electrical arrangement works out to Rs.42,000 . Allow a depreciation of 2 % on teakwood and RCC.

40 A building costing Rs.15,00,000 has been constructed on a freehold land measuring 200 Sq.m recently in a Bombay city. Prevailing rate of land in the neighbourhood is Rs.300 Per sq.m. Determine the net rent of the property, if the expected net return as 6.5 % on the cost of construction and 5 % on the cost of land. If the expenditure on an outgoing including sinking fund is Rs.36,280 per annum, work out the gross rent of the property per month.

3.1.1 Analysis of rates

In order to determine the rates of a particular item of works , the factor affecting the rate of that item are studied carefully and then finally , a rate is decided for that particular item. This process of determining the rate of an item is termed as analysis of rates or Rate analysis.

3.1.2 Importance of rate analysis

The process of rate analysis gives a clear picture of various factors acting behind the performance of a particular item. It should be remembered that the rate analysis of any item is never complete.

For example in the rate analysis of brickwork, a definite rate for bricks is assumed. But this rate for bricks derived by the manufacturer of bricks by is own rate analysis for preparing the bricks. Thus, theoretically the rate analysis of an item is incomplete, but in practice, it serves as a useful guide to arrive a reasonable rate for a particular item.

3.1.3 Essentials of rate analysis

For arriving at the correct rate analysis of a particular item the following essentials are necessary for the person carrying out the rate analysis.

a) Good knowledge of construction work and familiarity with the trade.

b) Information regarding costs of materials, labour and equipments.

c) Output of labourer i.e, task works per day for various traders.

3.1.4 Rates of materials and labour

The rates of all the material and labour as prevailing in standard schedule of rates 2017-2018 published by government of Tamilnadu public works department with effects from 01-06-2017.

3.1.5 a. Rates of material

1.Timber poling board 40mm thick	..... Rs.43000/m^3
2.country wood Wales 100mm X 75mm	..... Rs.94100/m^3
3.casurino struts100mm dia	..... Rs.21.00 /r m.
4. W.C. pan vitreous china ware	..... Rs.550/each
5. H.C.I. trap 100 for W.C. Indian type	..... Rs.95/each
6. Foot rests for Indian type W.C.	..... Rs.135/each
7. P.V.C. Flush pipe of 32mm telescopic	..... Rs.40/each
8. G.I pipe – 20mm to 25mm dia	..... Rs.259.70/r m.
9. P.V.C pipe – 65mm dia	..... Rs.125.30/r m.
10. Spun yarn	..... Rs.12.80/kg
11. CPVC pipe	..... Rs.283/r m.
12. Indian type water closet with flushing tank	..... Rs.1165/set

13. P.V.C. pipe 20mm dia …….Rs.23.20/ r m.
14. European type water closet with flushing tank …….. Rs.5500/set
15. Wash basin …….. Rs.1615/set
16. White low level P.V.C. flushing tank (10 lit) ……. Rs.991/set
17. Fine sand …….. Rs.456/m^3
18. Brick bats 50 to 80mm …….. Rs.645/m^3
    20mm …….. Rs.718/m^3
19. Shell line …….. Rs.1285/m^3
20. M.S. Bracket (for wash basin) ……. Rs.85/pair
21. M.S. bar 6mm dia …… Rs.43.50/kg
22. Binding wire …….. Rs.46.20/kg
23. Chicken mesh …….. Rs.33.50/kg
24. White glazed procelin low level 10 lit Capacity flushing system with fitting and bracket and 40 mm white C.P flush bend.....Rs.2070/set
25. M.S plate 200mm wide 12mm thick ……. Rs.43.50/kg
26. 15mm C.P. Brass pillar tap ……. Rs.375/each
27. 32mm dia C.P. Brass waste …….. Rs.95/each
28. Soling stone 230mm …….. Rs.401/m^3
29. Broken stone 80mm ……Rs.449/m^3
30. Stone aggregate 63mm …… Rs.518/m^3
    50mm …….. Rs.601/m^3
    40mm …….. Rs.934/m^3
    12.5mm …….. Rs.1206/m^3
31. Cement 1 bag (50 kg) …….. Rs.356/bag
32. Gravel …….. Rs.183/m^3
33. Shell lime …….. Rs.1285/m^3
34. Teak wood scantling for frame …….. Rs.108400/m^3
35. M.S. butt hinges
    (50 X 37 X 1.5mm) …….. Rs.33.30/each
    (100 X 58 X 1.9mm) …….. Rs.60.00/each
36. Teak wood scanting (frame ……. Rs.127200/m^3
37. Teak wood scanting (shutter) …… Rs.134300/m^3
38. Country wood scantling …….. Rs.39500/m^3
39. M.S Tower bolt …….. Rs.108.70/each
40. M.S Handles ……. Rs.33.20/each
41. P.V.C plugs …….. Rs.4.90/each
42. Aluminium section …… Rs.8.75/r m.
43. Lead …….. Rs.112/kg

44. Fire wood ……. Rs.3.00/kg

45. Kerosene …… Rs.15/litre

b. Rates of labour :

1. Mason-I-class …… Rs.545/each/day
2. Mason –II-class ……. Rs.488/each/day
3. Mazdoor category-I ……. Rs.341/each/day
4. Mazdoor category-II …… Rs.308/each/day
5. Plumber-I-class …..... Rs.474/each/day
6. Plumber-II-class …… Rs.440/each/day
7. Welder -I-class …….. Rs.353/each/day
8. Electrician ……. Rs.518/each/day
9. Electrician helper …….. Rs.338/each/day
10. Bitumen sprayer ……. Rs.319/each/day
11. Carpenter ……. Rs.545/each/day
12. Carpenter-I class ……. Rs.533/each /day
13. Carpenter-II class …… Rs.488/each/day
14. Fitter(pipe laying/bar bender)-I class …… Rs.474/each/day
15. Fitter(pipe laying/bar bender)-II class ……Rs.440/each/day
16. Concret mixer operator ……. Rs.371/each/day
17. Compressor operator …… Rs.371/each/day
18 Stone cutter …… Rs.419/each/day
19. Hire charges for circular mould 1.2m dia, 1m height and 50mm inner thick ……..Rs.250/day

In this book ,the cost of materials at site are taken based on PWD schedule of rates 2016-17 and market rates of Chennai. The rates arrived at for any item of work. In this book shall not be taken as it is for any practical purpose. These are only examples to explain the process of analysis of rates in general.

When the hire charges for tools and plants, mixer machines, lifts etc, expenses towards aminities to workers taxes, establishments, Supervision are not considered in detail, in the analysis lump sum provision of 10% to 20% of cost of materials and labour put together may be added as the over head expenses and profit of contractor in the rates of each item of work.

Tamil Nadu P.W.D allows 10% extra on the rates of materials and labor in Chennai corporation limit and 5% extra in other corporation limits.

Restricted Areas :

1. An extra 10% on rates of labour and work shall be allowed for the sewer works under unhygienic condition.
2. An extra 10% on rates of labour and works and conveyance charges shall be allowed for works in the campus of central jail and sub-jail.
3. An extra 20% works in Reserve Forest Areas
4. An extra 40%in rate of labour and 25% in extra cost of materials are allowed in Nilgiris district, Mudhamalai sanctuary.
5. 100% excess rates in dam construction, and 125% excess for works in islands are being allowed .

3.1.6 Problems in Earthwork excavation

Prepare data for Excavation for Trenches in Ordinary Soil including throwing excavated soil with in the lead of 30m and lift from trench upto 1.50m for $10m^3$

Earth Work excavation in trenches upto 1.5m depth - $1m^3$

As Per.NBO (National Building Organization)

Labours required

1 .Mazdoor-I … 3 Nos.

2. Mazdoor-II … 3 Nos.

Cost of Labour

1. Mazdoor-I …. Rs.341 each/day

2. Mazdoor-II … Rs.308 each/day

Preparation of data for E.W. Excavation – 10 m^3

Oty	Description	Rate Rs	Per	Amount Rs
3 Nos	Mazdoor-I	341.00	e/d	1023.00
3 Nos	Mazdoor-II	308.00	e/d	924.00
L.S	Sundries 10% for tools & plants	L.S		190.00
				2137.00

10% of contractor's profit …… Rs.213.70

Rate per $10m^3$ ……..... Rs. 2350.70

Rate per $1m^3$ ……... Rs. 235.07

Say……..Rs. 235.00

3.1.7 Sand filling in plinth

Preparation of data for sand filling in plinth - 10 m^3

Materials required

Sand…… $10m^3$ …. Rs. $456/m^3$

Labours required

Mazdoor category-I..... 1 No……..Rs. 341.00/e/d

Mazdoor category-II….. 1 No……..Rs. 308.00 e/d
Mason –I class……1/2……. Rs.545.00 e/d
Add 10% contractor's profit .

Preparation of data for sand filling in basement – 10m^3

Qty	Description	Rate Rs	Per	Amount Rs
10m^3	Sand	456.00	e/d	4560.00
1 No	Mason –II class	341.00	e/d	341.00
1 No	Mazdoor category –I	308.00	e/d	308.00
0.5No	Mazdoor category –II	545.00	e/d	273.00
10%	Contractor's profit	L.S	L.S	548.20

Rate per 10m^3 = 6030.20 /-
Rate per 1m^3 = say Rs.603 /-

3.1.8 Prepare Excavation of Trench with hydraulic excavator (JCB) with width and depth shoud not exceed 1.5m , includes sides dressing and compacting the bottom surface. Lift upto 1.5m which includes disposal of surplus soil with in a lead of 50m in ordinary soil - 10m^3

Materials and labours required:

Machineries required

Average output of Hydraulic Excavator ---30m^3 / hour
Dipper hours ---0.33hrs

Labours required:

Mazdoor I ---0.4 Nos
Mazdoor II ---2 Nos

Hire charges for machineries

Hire charges for Hydraulic Excavator with driver & fuel --- Rs. 700/hr
Hire charges for using dipper --- Rs. 900/hr

Cost of labours

Mazdoor I ---Rs.341 / e/ day
Mazdoor II ---Rs.308 / e /day

Solution:

Total quantity of soil to be excavated =10m^3
Average output of Hydraulic Excavator = 30m^3/hr
Hire charges for Hydraulic Excavator = 10 / 30 =0 .33hr
Hours to be worked by Hydraulic Excavator = Hours to be worked by Dipper

Mazdoor I - 0.4 Nos /10m^3 / Rs.341 / e/ day (10m^3 given data.)
Mazdoor II - 2 Nos / 10m^3 / Rs.308 / e /day.

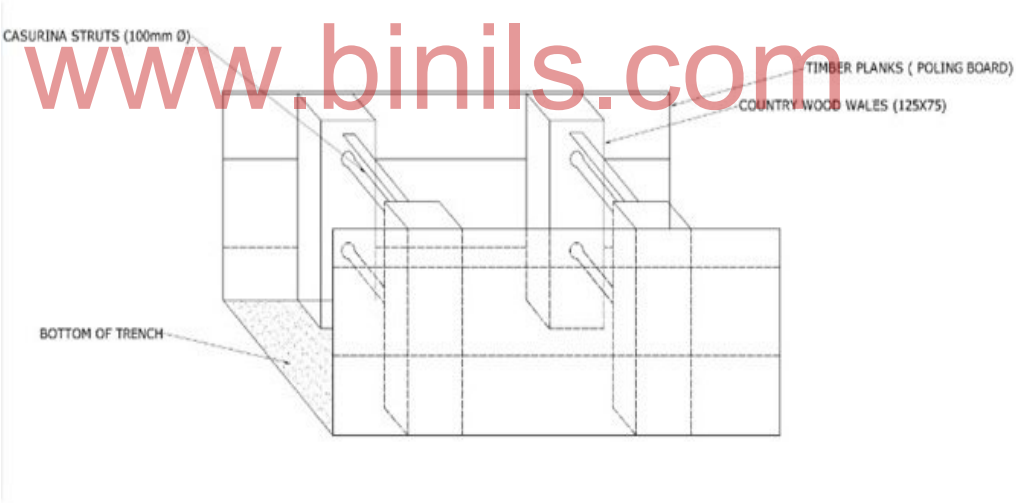
Preparation of data for excavation of trench- 10m^3

Quantity	Description	Rate Rs	Per	Amount Rs
0.33 hrs	Hire charges for Hydraulic Excavator	700.00	hr	231.00
0.33hrs	Dipper hours (to work)	900.00	hr	297.00
0.40hrs	Mazdoor I	341.00	e/d	136.40
2Nos	Mazdoor II	308.00	e/d	616.00
6%	Tools & Plants (6%)	L.S		75.00
10%	Contractor's profit over head expenses	L.S		135.54
		Rate for 10 m^3		**1490.94**

Rate for 1 m^3 Rs.149.09 /-

3.1.9 Timbering of Trenches

When the depth Trenches exceeds 1.5m it is considered as a deep excavation , moreover the sides of trenches contains loose soil it is necessary to protect sliding of soil by Timbering planks is known as Timbering of Trenches.



TIMBERING OF TRENCH

3.1.10 Prepare data for Timbering of trench upto 3m depth and width 1.2m, including removal after laying the sewer and length of trench is 30m -1m^2.

a) Materials requirements

Timbering of trenches 30m length and 3m depth area of timbering -90m^2 – 5 operations.

(i) Country wood for poling board – 7.20m^3

(ii) Sal wood water 125mm x 75mm – 1.60m^3
(iii) Sal ballies for struts 100mm dia at 1.5 C/C – 72m
(Deduct 25% salvage value of timber)

b) Labours required for fixing

i) Carpenter – 5 Nos
ii) Mazdoor II class – 10 Nos

Labours required for dismantling

i) Carpenter - 2.5 Nos
ii) Mazdoor II Class – 5 Nos
iii) Sundries – L.S (Rs.200)

Cost of Materials at site

Country wood - Rs. 43,000
Sal wood - Rs. 94,000
Sal ballies strut - Rs. 21.00 / r .m

Cost of Labour

Carpenter -Rs .533 each / day
Mazdoor II class -Rs .308 each / day

Solution :

Timbering of trench 30m length and 3m depth area of timbering - 90 m^2

Quantity	Description	Rate Rs	Per	Amount Rs
7.20 m^3	Country wood for poling board	43000.00	m^3	302400.00
1.60 m^3	Country wood wales 125x75mm	94000.00	m^3	150400.00
72m	Casurino struts 100mm dia 1.50m C/C	21.00	r.r.m	1512.00
				454312.00
	Deduct 25% for salvage value of timber			
	25/100 x 454312.00			(-) 113578.00
	Rate for 5 operation			340734.00
	Rate for 1 operation Rs.340734/5			**68146.80**
	Labour for fixing			
5 Nos	Carpenter - I - Class	533.00	e/d	2665.00
10 Nos	Mazdoor category - II	308.00	e/d	3080.00
	Labour for dismantling			
2.5 Nos	Carpenter - I - Class	533.00	e/d	1332.50
5 Nos	Mazdoor category - II	308.00	e/d	1540.00
L.S	Sundries	L.S		200.00
10%	Contractor 's profit	L.S		76964.30
	Rate for 90 m^2			**84660.73**
	Rate for 1 m^2			**940.67**

3.1.11 Laying stone ware / R.C.C. / G.I. Pipes

Preparation of data for Supplying and laying and jointing 100mm dia Glazed stone ware pipes with C.M. 1:1 including testing of joint etc, Rate for 1 m Length

Laying and joining stone ware pipe -30m

Material Required

1. 100mm dia glazed S.W. pipes (600mm length with 10% breakage) – as required
2. Portland cement -0.7 kg/joint
3. Fine sand for mortar -0.025m^3
4. Span yarn -9 kg

Labour required

1. Mason – I Class -1.5 Nos.
2. Mason – II Class -1.5 Nos
3. Mazdoor category – I -4.0 Nos
4. Mazdoor category – II -1.0 Nos

Cost of materials at site

1. 100mm dia glazed S.W. pipes (600mm length with 10% breakage) - Rs.220 /each
2. Portland cement - Rs.356 per bag
3. Fine sand for mortar - Rs.986 per m^3
4. Span yarn - 12.80 per Kg

Cost of Labuors

1. Mason – I Class …. Rs.545.00 e/d
2. Mason – II Class …. Rs.488.00 e/d
3. Mazdoor category – I ….. Rs.341.00 e/d
4. Mazdoor category – II ….. Rs.308.00 e/d.

Preparation of data for supplying and laying S.W. / R.C.C./G.I. Pipes for 30m length

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
55 Nos	100mm dia stone ware Pipes 0.6 m including breakage 10%	220.00	each	12100.00
35 kg	Portland cement(0.7x50=35kg)	356.00	Bag	249.20
0.025m^3	Fine sand for mortar	986.00	m^3	24.65
9 kg	Spam yarn	12.80	kg	115.20
	Labour			
1.5 Nos	Mason I class	545.00	e/d	617.50
1.5 Nos	Mason II class	488.00	e/d	732.00
4 Nos	Mazdoor category I	341.00	e/d	1364.00
1Nos	Mazdoor Category II	308.00	e/d	308.00
10 %	Over head expenses and contractor's profit	L.S		1571.06
	Rate for 30m length			**Rs.17281.61**

Rate for 1m length = Rs 576.05 /-

Note : No of joints = 30/0.6 =50 Nos

Add 10% breakage= 50+(50x10/100)= 55 Nos

Laying R.C.C pipe :

Problem

Prepare data for Supplying and laying without excavation of Trench of non-pressure class 2 R.C.C. pipe of 150mm dia with jointing collars, jointing with C.M. 1:2 includes testing of joints-Rate for 1m.

Preparation of data for Supplying and Laying of R.C.C. pipe without excavation of trench - 10m length

Materials required

1. 150mm dia R.C.C. pipe class 2 length 2m.each.
2. R.C.C. jointing collar 100mm dia -5nos.
3. Cement @1kg per joint.
4. Fine sand for mortar -0.007$m^{3.}$

Labours required

1. Mason I class ….0.32 No.
2. Mason II class ……..0.32 No.
3. Mazdoor category I ..0.63 No.
4. Mazdoor category II ..0.16 No.

Cost of Materials at site

1. 150mm dia R.C.C. pipe class - II -Rs.575.00 /each
2. R.C.C. jointing collar 100mm dia -Rs.105.00 / each
3. Cement @1kg per joint. -Rs.356.00 /bag
4. Fine sand for mortar -0.007m^3 -Rs.986.00 m^3

Cost of Labours

1. Mason I class …….. Rs.545.00 e/d
2. Mason II class …….. Rs .488.00 e/d
3. Mazdoor category I .. Rs.341.00 e/d
4. Mazdoor category II .. Rs.308.00 e/d

Preparation of data for Supplying & fixing R.C.C. pipe rate for 10m length.

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
5Nos.	R.C.C. pipe of 150mm dia.	575.00	each	2875.00
5Nos.	R.C.C. collar(150mm dia)	105.00	each	525.00
5kg.	Cement per joint(5joints)	356.00	bag	35.60
0.007	Fine sand for mortar	986.00	m^3	6.90
	Labours			
0.32Nos.	Mason-I-Class	545.00	e/d	174.40
0.32No	Mason-I-Class	488.00	e/d	156.16
0.63No	Mazdoor category-I	341.00	e/d	214.83
0.16No	Mazdoor category-II	308.00	e/d	49.28
10%	Contractor's profit	L.S	-	403.72
	Rate for 10 m length			**Rs.4440.89**

Rate for 1m length…….Rs.444.09 /-

Laying G.I.Pipes

Prepare data for Supplying and laying 20mm. dia G.I. pipes with all specials and fittings in trenches of size 1.20 width and 0.45 depth for water supply which includes cutting and necessary threading of pipes –Rate for 1m length.

Note: Excavation and fitting of trenches excluded.
Supplying, laying and fixing of 20mm dia G.I. pipe -30m

Materials required

1. G.I. pipe of 20mm dia ------ 30m.
2. Add 30% for fittings specials …….. L.S..
3. White lead, hamp oil…..etc ……L.S

Labour required

1. Plumber I Class ……0.5no.
2. Plumber II Class ……1.0 no.
3. Mazdoor category I ……1.0 no.
4. Testing, sundries …….L.S.

Cost of Materials at site

1. G.I. pipe of 20mm dia ……Rs.259.70 / m
2. Add 30% for fittings specials ……L.S..
3. White lead, hamp oil…..etc ….. L.S.

Cost of Labour

1. Plumber I Class ……..Rs.475 e/d
2. Plumber II Class ……..Rs.440 e/d
3. Mazdoor category I …… Rs.341 e/d
4. Testing, sundries ……..L.S

Preparation of data for supplying & laying 20mm dia G.I. pipe rate for 30m length.

Qty	Description	Rate Rs	Per	Amount Rs
	Materials			
30m	G.I. Pipe (20mm dia)	259.70	R.M.	7791.00
L.S	Add 30% for fittings & specials	-	-	2337.30
L.S	White lead, hemp oil	L.S.		708.96
	Labour			
0.5No	Plumber I Class.	475.00	e/d	237.00
1.0No	Plumber II Class.	440.00	e/d	440.00
1.0No	Mazdoor category I	341.00	e/d	341.00
L.S	Testing & sundries	L.S		203.60
10%	Contractor's profit	L.S		1205.89
	Rate for 30m length			**Rs.12058.86**

Rate for 1m length…….. Rs 401.90 /-

3.1.12 P.V.C Pipe works

Prepare data for Supplying and erecting of PVC pipes in the internal work of building on a exposed surface of wall ;of dia 20mm CPVC (chlorinated poly vinyl chloride)to withstand the heat and cold in the supply of water all fittings should be CPVC and brass threaded with special clamps of 0.8m c/c. use proper solvent to connect CPVC pipes and fittings-Rate for 1m length.

Supplying and erecting of PVC pipes – 10m

Materials required

1. CPVC pipe 20mm dia .....0.33nos.
2. Add 30% for fitting .....L.S.
3. Cement, sand etc .....L.S.

Labours required

1. Plumber –II- class .....0.82nos.
2. Mazdoor category –I 0.66no

Cost of Materials at site

1. CPVC pipe of 20mm dia .....Rs .283 /m
   (Add 30% for fittings .etc)
2. Cement, sand, grit etc .,.....L.S

Cost of Labours

1. Plumber-I-Class .....Rs.474.00 e/d
2. Plumber-II-Class .....Rs.440.00 e/d
3. Mazdoor category-I .....Rs.341.00 e/d

Preparation of data for supplying & laying of PVC pipe rate for 10m length

Qty	Description	Rate Rs	Per	Amount Rs
	Materials			
10m	CPVC pipe of 20mm dia.	283.00	RM.	2830.00
L.S.	Add 30% for fittings .etc.,	L.S.		849.00
L.S.	Cement, sand, grit etc.,	L.S		294.32
	Labour			
0.33No	Plumber-I-Class	474.00	e/d	156.42
0.82No	Plumber-II-Class	440.00	e/d	360.80
0.66No	Mazdoor category-I	341.00	e/d	225.06
10%	Contractor's profit			471.56
	Rate for 10m length			**Rs 5187.16**

Rate for 1m length..... Rs 518.72 /-

3.1.13. Prepare data for Supplying and fixing of 20mm dia CPVC pipe fixing as a concealed in wall ,cutting of walls, fixing of pipe , testing of joints and making the wall flush with other surface of wall , use CPVC fittings and solvents. Rate for 1m length.

Analysis of rates for 10m length

Materials and Labours required

Supplying and fixing of 20mm dia CPVC pipe - 10m length

1. C.P.V.C Pipe- Ist Quality 20mm dia ……10m
2. Add 40% for all fittings and wastage ……L.S.
3. C.M. 1:3 ……...L.S

Labours for cutting of wall ,fixing of pipe, Testing of joints and making flush with other walls after completing plumbing works.

1. Plumber I Class ---------0.33 no.
2. Plumber II Class ---------0.66 no
3. Mason I Class ---------0.25 nos
4. Stone cutter ---------0.25nos.
5. Mazdoor category I ---1.66nos

Cost of Materials at site

1. C.P.V.C Pipe- Ist Quality 20mm dia … Rs. 283
2. Add 40% for all fittings and wastage …L.S.
3. C.M. 1:3 ……..L.S

Cost of Labours

1. Plumber I Class --------- Rs.474.00e/d
2. Plumber II Class - ------- Rs.440.00 e/d.

Preparation of data for supplying and fixing of 20mm dia CPVC Pipe…Rate for 10m length

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
10m	CPVC-Ist Quality----20mm dia.	283.00	RM	2830.00
L.S.	Add 40% for fittings& wastage	L.S	…	1132.00
L.S.	C.M. 1:3 (for patch work)	L.S	….	198.10
	Labour			
0.33	Plumber-I-Class	474.00	e/d	156.42
0.66	Plumber-II-Class	440.00	e/d	290.40
0.25	Mason-I- Class	545.00	e/d	136.25
1.66	Mazdoor category-I	341.00	e/d	566.06
0.25	Stone cutter	419.00	e/d	104.75
10%	Contractor's profit	L.S		541.40
	Rate for 10m length			**Rs.5955.38**

Rate for 1m length……..…Rs 595.54 /-

3.1.14 Prepare data for Cutting and joining of C.I. pipes with spun yarn including testing of joints for leakage - Rate for 10 nos. of joints .

Materials and Labour required

1. Span yarn ……...2.0kg
2. Load at 2.5kg per joint …..25kg
3. Fire wood ……..….33kg
4. Kerosene ……0.5lit
5. Plumber I class ……..1 No
6. Plumber II class ……..1 No
7. Mazdoor category II ……..2 Nos

Cost of Materials at site

1. Span yarn…….... Rs.12.80 / kg
2. Lead at 2.5kg per joint ……Rs.112.00 / kg
3. Fire wood …….. . Rs.3.00 / kg
4. Kerosene …… .Rs. 8.00 /litre

Cost of Labour

1. Plumber I class……..... Rs.474.00 e/d
2. Plumber II class……..... Rs.440.00 e/d
3. Mazdoor category II …… Rs.308.00 e/d.

Preparation of data for cutting and joining of C.I. pipes – 10 joints

Qty	Description	Rate Rs	per	Amount Rs
2.0 kg	Spun yarn	12.80	kg	25.60
25kg	Lead	112.00	kg	2800.00
33kg	Firewood	3.00	kg	99.00
0.5 lit	Kerosene	8.00	Lit	4.00
1No	Plumber I Class	474.00	e/d	474.00
1No	Plumber II Class	440.00	e/d	440.00
2No	Mazdoor category II	38.00	e/d	616.00
10%	Contractor's Profit	L.S		445.86

Rate for 10 joints --- Rs.4904.46 /-
Rate for 1 joint -----Rs.490.45 /-

3.1.15 Prepare data for construction of man hole in the sewage line of a residential area – 1 No.

Materials and labours required.

Cement mortar : 1:4 - 1m^3

Cement	- 360 kg
Sand	- 1m^3
Mixing charges	-1m^3

Cement mortar : 1:5 - 1m^3

Cement	-288 kg
Sand	-1m^3
Mixing charges	-1m^3

P.C.C. 1:4:8 -10m^3

Broken stone 40mm size	– 9.5m^3
Cement mortar 1:4	– 3.8m^3
Mason II class	– 1.8 Nos
Mazdoor category I	– 17.7Nos
Mazdoor category II	- 14.1 Nos

Brick work in C.M. 1:5 using grade 7.5 bricks – 10m^3

Bricks – grade 7.5	– 5000 Nos
Cement mortar 1:5	– 2.2m^3
Mason I class	– 3.5 Nos
Mason II class	– 10.6 Nos
Mazdoor category I	– 17.1 Nos
Mazdoor category II	– 21.2 Nos

Plastering with cement mortar 1:4. 12mm thick – 10m^2

Cement mortar 1:4	– 0.14m^3
Mason I class	– 1.1 Nos
Mazdoor category I	– 0.5 No
Mazdoor category II	– 1.1 No

Cement concrete 1:2:4 for cover slab – 10m^3

Broken stone 20mm	– 9.0m^3
Sand	– 4.5m^3
Cement	– 3.24t
Mason II class	– 3.5 Nos
Mazdoor category I	- 21.2 Nos
Mazdoor category II	– 35.3 Nos

Construction of manhole in the sewage line – 1 No.

1. Earth work excavation ……0.22m^3
2. P.C.C. 1:4:8 in foundation …...0.56m^3
3. B.W. in C.M. 1:5. .....0.42m^3
4. Plastering with C.M. 1:4, 12mm thick…….0.28m^2
5. C.C. 1:2:4 Cover slab …..0.26m^3
6. Steel Quantity for reinforcement ……22.15kg
7. Cover in C.I. (455mm x 610mm) ……1No
8. Mason I class for fixing manhole cover…..0.08No
9. Mason II class for fixing manhole cover….0.08No

Cost of materials at site.

1. Cement .....Rs.7120.00 / tone
2. Bricks grade 7.5 .....Rs.6190.00/1000 Nos
3. Broken stone 40mm .....Rs.934.00/m^3
4. Broken stone 20mm ..... Rs.1110.00/m^3
5. Sand ..... Rs.456.00/ m^3
6. Reinforcement steel Rs.48.00/kg
7. Cover in C.I(455mmx610mm) Rs.1850.00/No
8. Earth work excavation ..... Rs.149.00/m^3

Cost of labours

1. Mason I class .....Rs.545.00 e/d
2. Mason II class ..... Rs. 488.00 e/d
3. Mazdoor category - I ..... Rs.341.00 e/d
4. Mazdoor category - II ..... Rs.308.00 e/d
5. Mixing charges ..... Rs.95.00 /m^3

Sub data
Cement mortar : 1:2 - 1m^3

Qty	Description	Rate Rs	Per	Amount Rs
1440/2= 720 kg	Cement	7120.00	Tonne	5126.40
1m^3	Sand	456.00	m^3	456.00
1m^3	Mixing charges	95.00	m^3	95.00
			Rate for 1m^3	**Rs.5677.40**

Sub data
Cement mortar : 1:3 - 1m^3

Qty	Description	Rate Rs	per	Amount Rs
480 kg	Cement	7120.00	Tonne	3417.60
1m^3	Sand	456.00	m^3	456.00
1m^3	Mixing charge	95.00	m^3	95.00
			Rate for 1m^3	**Rs.3968.60**

Sub data
Cement mortar : 1:4 - 1m^3

Qty	Description	Rate Rs	per	Amount Rs
360 kg	Cement	7120.00	Tonne	2563.20
1m^3	Sand	456.00	m^3	456.00
1m^3	Mixing charge	95.00	m^3	95.0
			Rate for 1m^3	**Rs.3114.20**

Sub data

Cement mortar : 1:5 - 1m^3

Qty	Description	Rate Rs	per	Amount Rs
288 kg	Cement	7120.00	Tonne	2050.56
1m^3	Sand	456.00	m^3	456.00
1m^3	Mixing charge	95.00	m^3	95.00
			Rate for 1m^3	**Rs.2601.50**

Sub data

P.C.C : 1:4:8 - 10m^3

Qty	Description	Rate Rs	per	Amount Rs
9.5m^3	Broken stone 40mm size	934.00	m^3	8873.00
3.8 m^3	Cement mortar 1:4	3114.20	m^3	11833.96
1.8 Nos	Mason II Class	488.00	each	878.40
17.7 Nos	Mazdoor category I	341.00	each	6035.70
14.1 Nos	Mazdoor category II	308.00	each	4342.80
				Rs.31964.06
			Rate for P.C.C 1:4:8 - 1 m^3	**Rs.3196.40**

Sub data

Brick work in C.M . 1:5 using grade 7.5 bricks - 10m^3

Qty	Description	Rate Rs	per	Amount Rs
5000 Nos	Bricks – grade 7.5	6190.00	1000 Nos	30950.00
2.2 m^3	Cement mortar 1:5	2601.00	m^3	5722.20
3.5 Nos	Mason II Class	545.00	each	1907.50
10.6 Nos	Mason II Class	488.00	each	5172.80
17.1 Nos	Mazdoor category I	341.00	each	2421.10
21.2 Nos	Mazdoor category II	308.00	each	6529.60
	Rate for brick work in C.M 1:5 - 10 m^3			**Rs.52703.20**

Sub data

Cement Concrete 1:2:4 for cover slab - 10m^3

Qty	Description	Rate Rs	per	Amount Rs
9.0 m^3	Broken stone 20mm	1110.00	m^3	9990.00
4.5 m^3	Sand	456.00	m^3	2052.00
3.24t	Cement	356.00	tonne	23068.80
3.5 Nos.	Mason II class	458.00	each	1708.00
21.2 Nos .	Mazdoor category I	341.00	each	7229.20
35.3 Nos.	Mazdoor category II	308.00	each	10872.40
				Rs.54920.40
			Rate for C.C 1:2:4 - 1 m^3	**Rs.5492.04**

Sub data

Plastering with cement mortar 1:4. 12mm thick - 10m^2

Qty	Description	Rate Rs	per	Amount Rs
0.14 m^3	Cement mortar 1:4	3114.20	m^3	435.99
1.1 Nos.	Mason I class	545.00	each	599.50
0.5 No	Mazdoor category I	341.00	each	170.50
1.1No	Mazdoor category II	308.00	each	338.80
				Rs.1544.79
			Rate for Plastering with cement mortar 1:4. 12mm thick - 1m^2	**Rs.154.48**

Main data

Preparation of data for construction of manhole for 1 No.

Qty	Description	Rate Rs	per	Amount Rs
0.22 m^3	Earth work excavation .	149.00	m^3	32.78
0.56 m^3	P.C.C 1.4.8 in foundation .	3196.40	m^3	1789.98
0.42 m^3	B.W. in C.M.1.4	5270.32	m^3	2213.53
0.28 m^3	plastering with C.M. 1.3,12mm tk	154.48	m^2	43.25
0.26 m^3	C.C1.2.4 for cover slab .	5492.04	m^3	1427.93
22.15kg	steel quantity for reinforcement	48.00	kg	1063.20
1 No	covers in C.I. (455mmx610mm)	1850.00	1No	1850.00
0.08 Nos	Mason I class	545.00	e/d	43.60
0.08Nos	Mason II class	488.00	e/d	39.04
10%	Contractor's profit	-	-	912.38
	Rate for 1 No of manhole			**Rs. 9415.69**

3.1.16 Providing a dispersion trench for septic tank of a residential flat

Prepare data for Providing a dispersion trench of 10mx1.2mx1.2m depth filling with brick bats of 20mm to 40mm size coarse sand and ordinary soil including 150mm dia stone ware pipe open jointed in 1 in 200 slope. Complete as per standard design - 1 No.

Materials required

1. Providing a dispersion trench for septic tank of a residential flat - 1No
2. Earth work excavation ---14.4 m^3
3. Broken brick bats 20mm ---14.4 m^3
4. Coarse sand ---1.8 m3
5. Stone ware pipe 600mm length and 150mm dia ---17Nos

Labours required

Mazdoor category I --- 2Nos

(For filling brick bats coarse sand laying pipe as open joint)

Preparation of data for providing a dispersion trench as per standard design for -1No

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
14.4 m^3	Earth work excavation	149.00	m^3	2145.60
14.4 m^3	Broken bricks 20mm to 40mm	645.00	m^3	9288.00
1.8 m^3	coarse sand	480.00	m^3	864.00
17Nos	stone ware pipe	145.00	each	2465.00
	Labour			
2nos	Mazdoor category …..I	341.00	each	682.00
10%	Contractor's profit	-		614.34
	Rate for 1No			**Rs. 16058.94**

3.1.17 Supplying a Ferro cement circular ring for well sinking

Prepare data for Casting and supplying Ferro cement circular ring of 1.2 m dia 1.0m height and 50mm thick well sinking…1 No

Casting and supplying Ferro cement circular ring for well sinking…1 No

Materials required

1. 6mm size crushed stone chips ---0.2m^3
2. Sand ---0.13m^3
3. Cement ---100kg
4. M.s bar 8mm dia ---10kg
5. Binding wire ---0.1kg
6. Chicken mesh ---4m^2

Labour required

1. Mason..I..Class ---0.5No
2. Fitter..II.Class ---0.33 Nos
3. Mazdoor category..I ---1.No

4. Hire charges for mould ---1 No
5. Curing charges ---.L.S
6. Overhead expenses and contractor's profit ---10%

Preparation of Data for casting and supplying Ferro cement circular rings for 1No

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
0.2 m^3	6mm size crushed stone chips	1206.00	m^3	241.20
0.13 m^3	Sand	456 .00	m^3	59.28
100 kg	Cement	356.00	bag	712.00
10kg	M.S reinforcement rod 8mm	46.00	kg	460.00
0.1kg	Binding wire	46.20	kg	4.62
4m^2	Chicken mesh	33.50	kg	107.20
	Labours			
0.5 No	Mason I class	545.00	e/d	272.50
0.33 No	Fitter II class	440.00	e/d	145.20
1 No	Mazdoor category..I	341.00	e/d	341.0
1 No	Hire charges for mould	250.00	e/d	250.00
L.S	Curing charges	L.S	L.S	40.00
10%	Waste oil over head charges and contractor' s profit	-	-	263.30
	Rate for 1 No			**Rs 2896.30**

Rate for Ferro cement circular ring of 1.2 m dia , 1.0m height and 50mm thick for 1 No. = Rs.2896.30.

3.1.18. Laying P.V.C Plumbing lines consealed in to brick masonry walls.

Prepare data for Supplying, laying and fixing 20mm diameter, PVC pipes including . Fitting , jointing with PVC solvent cement and cost of cutting B.W. in walls and making good the same including testing of joints complete – Rate for 1m length.

Supplying ,laying and fixing 20mm dia PVC pipe lines -10m Length.

Materials required

1. PVC pipe 20mm dia ---10m
2. Add 40% for fitting and wastage ---L.S
3. C.M. 1:3 ---L.S.

Labours for laying pipes

1. Plumber-I-class ---0.33Nos
2. Plumber-II-class ---0.66Nos
3. Mazdoor category-I ---0.66Nos

Labour for cutting the B.W up to 75x75mm size in B.W. wall including making good and finishing with matching B.W. surface after fixing and testing of pipe line.

1. Mason-I-class ---0.25No.
2. Stone cutter ---0.25No.
3. Mazdoor category-I ---1No.

Preparation of data for Supplying and fixing 20mm dia PVC pipes including fitting jointing with PVC solvent cement and cost of cutting B.W in walls and making good the same including testing of joints complete – 10m length

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
L.S.	PVC pipe (20mm dia)	23.20	R.M	2320.00
L.S.	Add 40% for fitting wastage	L.S	-	928.00
	C.M 1:3	L.S	-	100.00
	Labour for laying pipes			
0.33No	Plumber-I-class	414.00	e/d	156.42
0.66No	Plumber-II-class	440.00	e/d	290.40
0.66No	Mazdoor category-I	341.00	e/d	225.06
	Labour for cutting in B.W.			
0.25No	Mason-I-class	545.00	e/d	136.25
0.25No	Stone cutter	419.00	e/d	104.75
1No	Mazdoor category-I	341.00	e/d	341.10
10%	contractor's profits	-	-	437.65
	Rate for 10 m Length			**Rs 4814.13**

Rate for 1m Length = Rs. 481.41 /-

3.1.19.Supplying and fixing Indian type water closets with flushing tanks for 1 No.

Prepare the data for supplying and fixing Indian type water closets with flushing tanks for 5 Nos.

Materials required

1. W.C. pan vitreous chinaware ----5Nos
2. H.C.I trap 100mm ----5Nos
3. Pair of foot rests -----5pair
4. 10Liters capacity cistern ----5Nos
5. Flush pipe of 32mm telescopic P.V.C flush pipe ----5Nos
6. G.I pipe 20mm for over flow 150mm length ----5 Nos
7. Miscellaneous such as Cement, sand white lead, Red lead and cutting -----L.S.

Labour required

1. Plumber-I-class ----5Nos
2. Mason-II-class ----2.5Nos
3. Mazdoor category I ----5Nos.

Rate analysis for 5Nos of water closets with flushing tanks.

Qty	Description	Rate Rs	per	Amount Rs
5Nos	W.C pan vitreous china ware	550.00	1No	2750.00
5Nos	H.C.I. Trap 100mm	95.00	1No	475.00
5Nos	Pair of foot resets	135.00	Pair	675.00
5Nos	5 liters capacity cistern tank	991.00	Set	4955.00
5Nos	Flush pipe of32mm telescopic	40.00	1No	200.00
5Nos	P.V.C G.I. pipe 20mm for overflow 150mm length	39.00	1No	195.00
5Nos	Plumb bar-I-class	474.00	e/d	2370.00
2.5Nos	Mason-II-class	488.00	e/d	1220.00
5Nos	Mazdoor grade-I	341.00	e/d	1705.00
10%	Contractor's profit	-	-	1454.50
	Rate for 5 Nos of fixing of W.C with cistern tank			**Rs15999.50**

Rate for 1No. = Rs.3199.90 /-

3.1.20. Supplying and fixing European type water closet with flushing tank

Analysis of rate of providing and fixing white glazed vitreous procelin European type W.C. with pan and lid, CP, Brags hinge rubber butter, low level flushing cistern with fittings, brackets etc.,-1 No

Materials required

Providing and fixing white procelin pedestal type (European type) water closet -1No

1. White European Procelin Seat with Lid of PVC with Accessories including P.V.C low level flushing cistern & fittings ----1No.
2. 32mm PVC telescopic flush pipe with brass union ----1No.
3. White lead hemp etc ----L.S.
4. Cement sand and grit ----L.S.

Labour required

1. Plumber I class ----1.25 Nos
2. Mason I class ----0.5 No
3. Mazdoor category I -----1.00 No
4. Contractor's profit 10 -----L.S.

Supplying and fixing European W.C with flush tank for 1 No.

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
1No	European procelin seat with Lid in			
	PVC with all accessories including	5500.00	Set	5500.00
1No	tank.	40.00	each	40.00
L.S.	P.V.C Flush pipe Brass union32mm	L.S.	40.00	40.00
L.S.	White lead and hump pipe etc.,	L.S	150.00	150.00
	Cement, sand, and grit.			
	Labour			
1.25No	Plumber-I-class	474.00	e/d	592.50
0.5No	Mason-I-class	545.00	e/d	272.50
1.00No	Mazdoor category-I	341.00	e/d	341.10
10%	Contractor's profit	-	-	693.60
	Rate for 1No.			**Rs.7629.60**

3.1.21Supplying and fixing a wash basin with tap

Preparation of data for supplying and fixing in posision of white glazed earthen ware wash hand basin of size 550 x 400mm -1 set

Materials required

Providing and fixing white glazed earthen ware wash hand basin of size 550x400mm for 1 set

1. Colour wash basin 550mmx400mm (White) ----1No
2. 15mm Chromium plated brass pillar tap ----1No
3. 32mm Chromium plated brass waste ----1No
4. M.S. Bracket ----1 Pair
5. P.V.C waste pipe telescopic type ----1 No.
6. Lead, Gasket, Cement, Sand, grit ----L.S.

Labour required

1. Plumber ----0.3 No.
2. Mason-I-class ----0.3 No.
3. Mazdoor category ----0.6.No.

Preparation of data for supplying and fixing of wash basin of size 550 x400 mm for 1 set.

Qty	Description	Rate Rs	per	Amount Rs
	Materials			
1No	White wash basin 550mmx400mm(White)	1615.00	Set	1615.00
1No	15mm C.P. Brass pillar tap	375.00	each	375.00
1No	32mm dia C.P. Brass waste	95.00	each	95. 00
1Pair	M.S. Bracket	85.00	Pair	85.00
1No	P.V.C waste pipe telescopic type	40.00	each	40.00
L.S.	Lead, gasket, cement, sand, grit	L.S	L.S	100.00
	Labour			
0.3No	Plumber	474.00	e/d	142.20
0.3No	Mason-I-class	545.00	e/d	163.50
0.6No	Mazdoor category-I	341.00	e/d	204.60
10%	Contractor's profit	-	-	282.03
	Rate for 1No of wash basin fixing			**Rs.3102.30**

3.2 ANALYSIS OF RATES FOR BRIDGE/ ROAD WORKS AND MISCELLENEOUS ITEMS

Introduction.

The pricing of stone masonry is similar to that of brickwork. In random rubble masonry, the quantity of stones required will be approximately 1.12m^3 and mortar 0.30m^3 for every m^3 of wall. 12% (percent) increase in the quantity of stone is due to irregular size of stones available and the wastes due to brining the stones to a reasonable shape. The increase in quantity of mortar is due to excessive voids in stone work of this nature. In case of ashlar masonry where dressed stones are used and joints are not more than 8mm thick, the mortar required approximately 0.20$m^{3.}$

3.2.1 .Random rubble stone masonry in Abutment and Pier 10m^3

1. Random Rubble masonry in C.M. 1:6 - 1m^3
2. Coursed Rubble masonry in C.M. 1:5 - 1m^3
3. Cut stone masonry in C.M. 1:4 - 1m^3

Materials and Labours required:

Cement mortar 1:4 -1m^3

Cement	-360kg
Sand	-1m^3
Mixing charges	- m^3

Cement mortar 1:5 - 1m^3

Cement	-288kg
Sand	-1 m^3
Mixing charges	-1 m^3

Cement mortar 1:6 - 1m^3

Cement	-240kg
Sand	-1 m^3
Mixing charges	-1 m^3

1) Random Rubble masonry in C.M. 1:6 - 10m^3

Rough stone	-10 m^3
Bond stone	-1 m^3
Cement mortar 1:6	-3.4m^3
Masons I class	-7.1 Nos
Masons II class	-10.6 Nos
Mazdoor category –I	-14.1 Nos
Mazdoor category –II	-14.1 Nos

2) Coursed Rubble masonry in C.M. 1:5 - 10m^3

Course rubble stone	-11 m^3
Cement mortar 1:5	-3.2m^3
Masons I class	-7.1 Nos
Masons II class	-17.6 Nos

Mazdoor category –I	-14.1 Nos
Mazdoor category –II	-14.1 Nos

3) Cut stone masonry in C.M. 1:4 - 10m^3

Cut stone	-10.5 m^3
Cement mortar 1:4	-1.6m^3
Stone cutter I class	-10.6 Nos
Stone cutter II class	-24.7 Nos
Mazdoor category –I	-35.3 Nos
Mazdoor category –II	-28.2 Nos

Materials Supplied at site

Cement	-Rs.7120.00/t
Sand	-Rs.176.40/m^3
Rough stone	-Rs.300.00/ m^3
Bond stone	-Rs.567.00/ m^3
Course rubble stone	-Rs.330.00/ m^3
Cut stone	-Rs.4060.00/m^3

Cost of Labours

Mason-I-class	-Rs.545/each/day
Mass –II-class	-Rs.488/each/day
Mazdoor category-I	-Rs.341/each/day
Mazdoor category-II	-Rs.308/each/day
Mixing charges	-Rs.95/ m^3
Stone cutter I class	-Rs.419/each/day
Stone cutter II class	-Rs.350/each/day

Solution:

Sub data:1

Cement mortar : 1:4 - 1m^3

Qty	Description	Rate Rs	Per	Amount Rs
360 kg	Cement	7120.00	Tonne	2563.20
1m^3	Sand	176.40	m^3	176.40
1m^3	Mixing charge	95.00	m^3	95.00
				Rs.2834.60

Sub data:2
Cement mortar : 1:5 - 1m^3

Qty	Description	Rate Rs	Per	Amount Rs
288 kg	Cement	7120.00	Tonne	2050.56
1m^3	Sand	176.40	m^3	176.40
1m^3	Mixing charge	95.00	m^3	95.00
				Rs.2321.96

Sub data:3
Cement mortar : 1:6 - 1m^3

Qty	Description	Rate Rs	Per	Amount Rs
240 kg	Cement	7120.00	Tonne	1708.80
1m^3	Sand	176.40	m^3	176.40
1m^3	Mixing charges	95.00	m^3	95.00
				Rs.1980.20

1) Random Rubble masonry in C.M. 1:6 - 10m^3

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
10m^3	Rough stone	300.00	m^3	3000.00
1 m^3	Bond stone	567.00	m^3	567.00
3.4 m^3	C.M 1:6(vide sub data:3)	1980.20	m^3	6732.68
7.1Nos	Mason-I-class	545.00	each	3869.50
10.6Nos	Mason-II-class	488.00	each	5172.80
14.1Nos	Mazdoor category-I	341.00	each	4808.10
14.1Nos	Mazdoor category-II	308.00	each	4342.80
	Rate for 10m^3			**Rs.28492.88**

Rate for 1m^3 Rs. 2849.29/-

2) Coursed Rubble masonry in C.M. 1:5 - 10m^3

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
11m^3	Course rubble stone	330.00	m^3	3630.00
3.2 m^3	C.M 1:5(vide sub data:2)	2321.95	m^3	7430.27
7.1Nos	Mason-I-class	545.00	each	3869.50
17.6Nos	Mason-II-class	488.00	each	8588.80
14.1Nos	Mazdoor category-I	341.00	each	4808.10
14.1Nos	Mazdoor category-II	308.00	each	4342.80
	Rate for 10m^3			**Rs.32669.47**

Rate for 1m^3 Rs.3266.95/-

3) Cut stone masonry in C.M. 1:4 - 10m^3

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
10.5m^3	Cut stone	4060.00	m^3	42630.00
1.60 m^3	C.M 1:4(vide sub data:1)	2834.60	m^3	4535.36
10.6Nos	Stone cutter I class	419.00	each	4441.40
24.7Nos	Stone cutter II class	350.00	each	8645.00
35.3Nos	Mazdoor category-I	341.00	each	12037.30
28.2Nos	Mazdoor category-II	308.00	each	8685.60
	Rate for 10m^3			**Rs.80974.66**

Rate for 1m^3 Rs.8097.47/-

Result

1. Rs.2849.29/m^3
2. Rs.3266.95 /m^3
3. Rs.8097.47 /m^3

3.2.2 Providing form work for deck slab

Steel centering and shuttering at 4 m to 5m height for deck slab of bridges including all vertical and horizontal supports and shuttering plate of size 1.524m x 0.94m (provide “L” angle 50mmx50mmx6mm – 3 Nos in lengthwise and 5 Nos in widthwise), costs, conveyance, hire charges of

materials , including cost of conveyance, dismantling and removal of wastes complete to receive reinforcements and concrete as required- 1m^2.

Materials and Labours required:

1.Sub data for steel shuttering plate-1m^2.

steel shuttering plate of size 1.524 m x 0.914m @ 31.4kg/m^2 ----1.393m^2.

' L' angle 50mm x 50mm x 6mm @ 4.5 kg/m ----As required

Welding rods ----1 Packet

Fabrication charges ----Extra

2. Sub data for Telescopic props –1 m^2

65mm dia steel pipe as prop of 5m length @ 8 kg /m ----As required

One prop covers an area 2.0m^2 (40 uses)

3. Sub data for Horizontal support - 1m^2.

Length of I section @ 37.8 kg /m ----As required

(Considering 40 uses of sections)

4. Sub data for wooden scantling –1m^2.

Country wood scantling size of 100mm x 75mm ----As required

Wooden planks 38mm thick -----As required

(Considering 15 uses of scantling and planks)

5. Steel centering and shuttering at 4m to 5m height deck slab - 1m^2.

Hire charges for steel shuttering plate	----1m^2.
Hire charges for prop (65mm)	----1m^2.
Hire charges for I- section	----1m^2.
Hire charges for wood scantling & planks	----1m^2.
Fitter I class	----0.3No
Mazdoor category-II	---0.3No
Scaffolding ,nuts , bolts , oil ,etc (5%)	---L.S
10% of over head expenses	---Extra

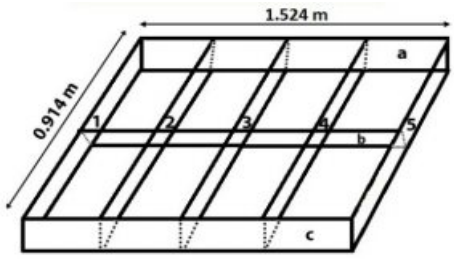
Cost of Materials at site:

Steel	---Rs. 43.50/Kg
Props dia 65mm	---Rs.63.00/kg
I-Section	---Rs.72.00/kg
Welding rod	---Rs. 300.00/Packet
Cost of scantling & planks	---Rs. 466.67/ m^2

Cost of Labours:

Labour for fabrication ..... Rs. 17.50/Kg
Fitter Rs.481.00/e/d
Mazdoor category – II Rs.308.00/e/d
Rate for welding Rs.300.00/packet

1.Sub data :- Calculation of hire charges of steel shuttering plate- 1m^2.



Hire charges for steel shuttering plate of size 1.524 m x 0.914m Area of plate

Area of plate = 1.524 x 0.914m

A = 1.393m^2

Length of angle for sides and centre 50mm x50 mm x 6mm ' L' angle

= 3 x 1.524 + 5 x 0.914

= 9.142m

Standard wt of angle 50 x50 x 6 mm = 4.5 kg/m

Weight of angle =9.142 x 4.5

= 41.14kg

Area of plate = 1.524 x 0.914

=1.39m^2

Weight of steel plate per m^2 = 31.4kg

Total weight of plate = 1.39m^2 x 31.4kg/ m^2

=43.65kg

Total weight of centering sheet = wt of angle + wt of sheet

= 41.14 + 43.65

Total weight of centering sheet = 84.79kg

Cost of steel =Rs 43.50 /kg

Total cost of steel = 84.79 x 43.50 = Rs 3688.37

Cost of welding rods =Rs 300/packet

Labour for fabrication (Rs 17.50/kg) = 84.79 x 17.50

= Rs 1483.83/-

Cost of 1 centering sheet = 3688.37+ 300+ 1483.83

= Rs5472.20/-

Cost per m^2 = cost / Area = 5472.20 / 1.39 = Rs 3936.83

Considering 40 uses of sheet = Rs 3936.83/-

For single use of sheet =Rs3936.83/40

Hire charges for sheet per m^2 = Rs 98.42/-

2) Sub data :- Calculation of hire charges for Telescopic props per m^2

Weight of 65mm dia pipe as prop of 5m length at 8 kg /m

5 x 8 = 40 kg /prop

Cost of one prop..... = Rs 63.00/kg =40x63 =Rs 2520/-

One prop covers 2.0m^2

Cost of prop per m^2 2520 /2.0 =Rs1260

Considering 40 uses of props

Hire charges for one use of prop per m^2 =1260 / 40 = Rs31.50.

3) Sub data:- Calculation of hire charges for horizontal support per m^2

Considering 6m x 6m Area = 6x6 =36m^2

Length of I- section = 4x 6 =24m

Weight of I- Section = 37.8 kg /m =37.8 x24 =907.2 kg

Cost of I-section is Rs 72.00 per kg =72 x907.2

= Rs.65, 318.40/-

Cost of I-Section per m^2 ..... = Rs 1814.39

Considering 40 uses of sections

Hire charges for one use per m^2 = 1814.39 / 40 = Rs 45.36

4) Sub data :- Calculation of hire charges for wooden scantling and planks –1 m^2

Let the area be 6m x 1.5m = 9m^2

Size of country wood scantling = 100 x 75mm

Length of country wood scantling = 2 (6+ 1.5) =15m

Volume of scantling = 15m x 0.1 x 0.075 = 0.112 m^3

Volume of planks (1x 1 x 0.0380) = 0.038m^3

(Thickness of plank 38mm)

Total volume = 0.112 + 0.038= 0.150m^3

Cost of scantling and planks per m^2 = 466.67

Consider 15 uses of scantling and planks,

Hire charges for 1 use per m^2 = 466.67 / 15 = Rs.31.10

Preparation of data for steel centering & shuttering plate- 1m^2.

Main data :

Qty	Description	Rate Rs	Per	Amount Rs
1m^2	Hire charges for steel sheet.	98.42	m^2	98.42
1m^2	Hire charges for props (65mm dia)	31.50	m^2	31.50
1m^2	Hire charges for I sections	45.36	m^2	45.36
1m^2	Hire charges for wooden scantling and planks	31.10	m^2	31.10
0.3No	Fitter I Class	481.00	e /d	149.11
0.3No	Mazdoor category II	308.00	e /d	92.40
L.S	Sundress for bolts , nuts ,oiling the plates (5%)			22.00
10%	Contractors profit		L.S	46.98
				Rs.516.87

Rate per m^2 = Rs. 516.87/-

Say Rs .517.00/-

3.2.3 Timbering of trenches

a)Timbering of trench upto 3m depth including removal after laying sewer -1m^2.

Materials required

Timbering of trenches 30m length and 3m depth, area of timbering-90m^2

5 operations.

(i) Country wood for poling board –7.20m^3

(ii) Sal wood wales 125mm x 75mm –1.60m^3

(iii) Sal ballies for struts 100mm dia at 1.5 C/C –72m

(Deduct 25% salvage value of timber)

Labour required for fixing

(i) Carpenter -5 Nos

(ii) Mazdoor II class -10 Nos

Labour required for dismantling

(i) Carpenter –2.5 Nos

(ii) Mazdoor II Class –5.0 Nos

(iii) Sundries –L.S (Rs.200.00)

Cost of materials

(i) Country wood -Rs. 43000.00/ m^3.

(ii) Sal wood -Rs. 94000/ m^3.

(iii) Sal ballies strut -Rs. 21.00 / r .m.

Cost of labours

(i)Carpenter -Rs .533.00 each / day

(ii)Mazdoor II class -Rs .308.00 each / day

Solution :

Timbering of trench 30m length and 3m depth, area of timbering - 90 m^2 .

Main data:

Qty	Description	Rate Rs	per	Amount Rs
7.20 m^3	Country wood for poling board	43000 .00	m^3	302400.00
1.60 m^3	Country wood wales 125x75mm	94000.00	m^3	150400.00
72m	Sal ballies for struts 100mm dia 1.50m C/C	21.00	m	1512.00
				454312.00
	Deduct 25% for salvage value of timber			(-) 1,13,578.00
	Rate for 5 operation Rs .340734.00			340734.00
	Rate for 1 operation Rs.340734/5 = Rs.68,146.80			
	Rate for 1 operation			68146.80
	Labour for fixing			
5 Nos	Carpenter - I - Class	533.00	e/d	2665.00
10 Nos	Mazdoor category - II	308.00	e/d	3080.00
	Labour for dismantling			
2.5 Nos	Carpenter - I - Class	533.00	e/d	1332.50
5 Nos	Mazdoor category - II	308.00	e/d	1540.00
L.S	Sundries	L.S		200.00
10%	Contractor 's profit	L.S		7696.43
	Rate for 90 m^2 = Rs.84660.73			**84660.73**
	Rate for 1 m^2			**940.67**

3.2.4. Supplying of materials and placing of reinforcement and concrete in solid slabs of bridges as per drawing and technical specification, including cost of formwork complete - 1m^3

1. R.C.C. roof slab 120mm thick of mix 1:1.5:3 using 20mm broken jelly with suitable reinforcement including centering , curing etc. Complete ---- 1$m^{2.}$
2. R.C.C. 1:2:4 sunshade of 600mm projection and 80mm average thickness Rate for 10m run.
3. R.C.C. 1:2:4 beam 300 x 500 mm using 20mm broken stone jelly with suitable reinforcements including centering, shuttering etc. Complete….1$m^{3.}$
4. R.C.C. columns with mix 1:2:4 of size 200 x 200 mm with suitable reinforcement including centering, curing etc. Complete….1$m^{3.}$

Materials and Labours required:

a) C.C. 1:1.5:3 ----10m^3

Broken stone 20mm size	--9m^3
Sand	--4.5 m^3
Cement	--4308kg
Mason-II-class	--3.50Nos
Mazdoor category-I	--21.20Nos
Mazdoor category-II	--35.30Nos

b)R.C.C. roof slab of mix 1:1.5:3 , 120mm thick ---- 1m^3

Concrete 1:1.5:3	--As required
Steel	--90kg/m^3
Binding wire	--1% of reinforcement
Centering	--As required add 20% extra for sides
Bar bending	--As required

c)Cement Concrete 1:2:4 -10m^3

Broken stone 20mm size	--9m^3
Sand	--4.5 m^3
Cement	--3231kg
Mason-II-class	--3.50Nos
Mazdoor category-I	--21.20Nos
Mazdoor category-II	--35.30Nos

d) R.C.C. 1:2:4, sunshade 600mm wide ------ 1m run

Concrete 1:2:4	---As required
Steel	---75kg/m^3 of concrete
Binding wire	---1% of reinforcement
Centering	---As required add 20% extra for sides
Bar bending	---As required

e).R.C.C. beam of mix 1:2:4---1m^3

Concrete1:2:4 -1m^3	
Steel	---150kg/m^3 of concrete
Binding wire	---1% of reinforcement
Centering	---As required
Bar bending	---As required

f).R.C.C. 1:2:4 for column of size 200mm x 200mm

Concrete	---As required
Steel	---90kg/m^3 of concrete
Binding wire	---1% of reinforcement
Centering	---As required
Bar bending	---As required

Cost of materials at site

Cement	---7120/tonne
Steel	---46000/tonne
Binding wire	---50/kg
Broken stone	---1300/m^3 (20mm size)
Sand	---176/m^3

Cost of Labours

Mason-I-class	---Rs.545.00 each/day
Mason-II-class	---Rs.488.00 each/day
Mazdoor category-I	---Rs.341.00 each/day
Mazdoor category-II	---Rs.308.00 each/day
Bar bending charges	---Rs.400.00 /100kg
Centering charges	---Rs.160/m^2
Mixing charges	---Rs.95/m^3

Solution:

First we calculate the quantity of cement, steel ,binding wire , bar bending and centering area for slab.

Concrete

Slab area	= 1m x 1m	=1m^2
Thickness of slab	= 120mm	=0.12m
Volume of concrete	= 1 m^2 x 0.12m	= 0.12m^3

Steel

= 90kg/m^3 of concrete

= 90 x 0.12 = **10.8kg**

Binding wire

1% of steel = $\frac{1}{100}$ x 10.8kg = 0.108kg

Centering area

Area = 1m^2

20% add extra $= 1 + \frac{20}{100} \times 1 = 1.2\ m^2$

(or)

$1m^2 \times 1.2 = 1.2m^2$

Sub data:1

C.C. 1:1.5:3 ----10m^3

Qty	Description	Rate Rs	Per	Amount Rs
9m^3	Broken stone 20mm size	1300.00	m^3	11700.00
4.5m^3	Sand	176.00	m^3	792.00
4308kg	Cement	7120.00	tonne	30672.96
3.50Nos	Mason-II-class	488.00	each	1708.00
21.20Nos	Mazdoor category-I	341.00	each	7229.20
35.30Nos	Mazdoor category-II	308.00	each	10872.40
	Rate for 10m3			**Rs.62974.56**

Rate for 10m^3 = Rs.6297.45/-

a). Preparation of data for R.C.C. roof slab of mix 1:1.5:3 , 120mm thick – 1m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
0.12m^3	Concrete 1:1.5:3, 120mm thick (0.12mx1m2=0.12m3)	6297.45	m^3	755.69
10.8kg	Steel (90 x 0.12 = 10.8kg)	46000.00	tonne	496.80
0.108kg	Binding wire(10.8 x 1/100 = 0.108)	50.00	kg	5.40
1.2m^2	Centering 20% extra for sides	160.00	m^2	192.00
10.8kg	Bar bending same as steel quantity	400.00	100kg	43.20
	Rate for 1m^2 area of slab			**Rs.1493.09**

b) Sub data: 2

C.C. 1:2:4 ----10m^3

Qty	Description	Rate Rs	Per	Amount Rs
9m^3	Broken stone 20mm size	1300.00	m^3	11700.00
4.5m^3	Sand	176.00	m^3	792.00
3231kg	Cement	7120.00	tonne	23004.72
3.50Nos	Mason-II-class	488.00	each	1708.00
21.20Nos	Mazdoor category-I	341.00	each	7229.20
35.30Nos	Mazdoor category-II	308.00	each	10872.40
	Rate for 10m^3			**Rs.55306.32**

Rate for 1m^3 = Rs.5530.63/-

Calculation for R.C.C. 1:2:4, sunshade -10m run

Quantity of concrete = 10 x 0.6 x 0.08 = 0.48m^3

Steel 75/m^3 0.48 x 75 = 36kg

Binding wire 1% of steel = $\frac{1}{100}$ x 36 = 0.36kg

Bar bending = 36kg

Centering = 10 x 0.60 x 1.2 = 7.2m^2

Preparation of data for R.C.C. 1:2:4, sunshade 600mm wide ------ 10m run

Main data

Qty	Description	Rate Rs	Per	Amount Rs
0.48m^3	Concrete 1:2:4	5530.63	m^3	2654.70
36kg	Steel 75kg/m3 of concrete	46000.00	tonne	1656.00
0.36kg	Binding wire 1% of steel	50.00	kg	18.00
7.2m^2	Centering 20% extra for sides	160.00	m^2	1152.00
36kg	Bar bending	400.00	100kg	144.00
		Rate for 10m run		**Rs.5624.70**

Rate for 1m run = Rs. 562.47/-

C) Calculation for Beam of size 300mm x 500mm

Area of centering = Lx B

Length, L = $\frac{\text{Volume of beam}}{\text{C/S area of beam}} = \frac{1\ m^3}{(0.5x0.3)}$

= 6.67m

Breadth, B = 0.5+0.3+0.5 = 1.3m

Area of centering = 6.67m x 1.3m = 8.67m^2

Preparation of data for R.C.C. 1:2:4 beam 300mm x 500 mm using 20mm broken jelly --- 1m^3

Main data :

Qty	Description	Rate Rs	Per	Amount Rs
1m^3	Concrete 1:2:4	5530.63	m^3	5530.63
150kg	Steel	46000.00	tonne	6900.00
1.5kg	Binding wire 1% of reinforcement 1 x 150 = 1.5 kg	50.00	kg	75.00
8.67m^2	Centering	160.00	m^2	1387.20
150kg	Bar bending	400.00	100kg	600.00
	Rate for 1m^3			**Rs.14492.83**

d) Quantity of concrete for column (200mm x 200mm)

Size of column = 0.2 x 0.2 m

Volume of concrete = 0.2 x 0.2 x1 = 0.04m^3

Steel 90 kg/m^3 = 90 x 0.04 = 3.60kg

Binding wire 1% = $\frac{1}{100}$ x 3.6 = 0.036kg

Bar bending = 3.60kg

Breadth of Centering = 0.2 x 4 = 0.8m^2 ; Length – 1m

Area (l x h) = 0.8 x 1 = 0.8m^2

Preparation of data for R.C.C. column of size 200mm x 200mm with C.C. 1:2:4- 1m Run.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
0.04m^3	Concrete 1:2:4	5530.63	m^3	221.23
3.60kg	Steel	46000.00	tonne	165.60
0.036kg	Binding wire	50.00	kg	1.80
0.8m^2	Centering	160.00	m^2	128.00
3.60kg	Bar bending	400.00	100kg	14.40
			Rate for 1m^3	**Rs.531.03**

Rate for 1m^3 = $\frac{531.03}{0.04}$ = Rs.13275.75/-

Result :

a) Rate for 1m^3 = Rs. 12442.42
b) Rate for 1m^3 = Rs. 562.47
c) Rate for 1m^3 = Rs. 13313.63
d) Rate for 1m^3 = Rs. 13275.75

3.2.5.Supplying and placing M20 grade cement concrete in beams and slab of bridges excluding cost of steel and including cost of form work –m^3

Materials required

20mm stone aggregate	---5.4 m^3
10 mm stone aggregate	---3.6 m^3
Sand	---4.5m^3
Cement	---3.41t
Concrete mixer	---4 hrs
Needle vibrator	---4hrs

Labours required

Mason I class	---0.57No
Mason II class	---1No
Mazdoor category I	---13.3Nos

Cost of materials and machinery at site

Cement	--7120/tonne
Sand	--176.40/m^3
20mm stone aggregate	--1206.00/m^3
10 mm stone aggregate	--1206.00/m^3
Concrete mixer	--220.00/hr
Needle vibrator	--65.00/hr

Labour charges

Mason-I-class	-- Rs.545.00 each/day
Mason-II-class	-- Rs.488.00 each/day
Mazdoor category-I	--Rs.341.00 each/day

Solution:

Preparation of data for M20 grade concrete using concrete mixer -10 m^3

Qty	Description	Rate Rs	Per	Amount Rs
	a)Materials			
3.41t	Cement	7120.00	tonne	24279.20
4.5m^3	Coarse sand	176.40	m^3	793.80
5.4m^3	20mm stone aggregate	1206.00	m^3	6512.40
3.6m^3	10 mm stone aggregate	1206.00	m^3	43416.00

	b)Labour			
0.57No	Mason I class	545.00	e /d	310.65
1No	Mason II class	488.00	e /d	488.00
13.3No	Mazdoor category-I	341.00	e /d	4535.30
	c)Machinery			
4hrs	Concrete mixer	220.00	hr	880.00
4hrs	Needle vibrator	65.00	hr	260.00
	d)Form work			
	Add 30% of (a+b+c) formwork and staging of Beams and slabs at 5 to 10 m height above bed level			24443.21
	e)Contractors profit 10%			10592.06
	Rate for 10 m^3			**Rs.116512.62**
	Rate for 1m^3			**Rs.11651.26**

3.2.6.Brick work in parapet 200 mm thick for the culvert in cement mortar 1:3 including plastering both sides with c.m 1:4 , 12mm thick and white washing two coats -10 m^2

Materials and Labours required:

a) B.W. in C.M. 1:3 – 1m^3

Bricks	----500Nos
Sand	----0.14m^3
Cement	----67.2kg
Mason I class	----0.7No
Mason II class	----0.71No
Mazdoor category I	----10.71No
Mazdoor category II	----2.12Nos

b) Plastering with C.M. 1:4 ,12mm thick – 10m^2

Sand	----0.12m^3
Cement	----43.2kg
Mason I class	----1.1Nos
Mazdoor category I	----0.5No
Mazdoor category II	----1.1Nos

c) White washing two coats - 100 m^2

Shell lime	-----0.07m^3
Gum, conjee, water, brushes et	-----L.S
Mason II class	-----1.6Nos
Mazdoor category I	-----0.5No
Mazdoor category II	-----2.7Nos

d)B.W in Parapet 200mm thick in CM1:3 for 10m

i). B.W. in C.M. 1:3 ----As required

ii) . Plastering with C.M. 1:4 ,12mm thick ----As required

iii). White washing two coats ----As required

iv). Contractor's profit ----10%

Cost of materials at site

Bricks ----Rs.7190/1000

Cement ----Rs.7120/ tonne

Sand ----Rs.176.40/m^3

Shell lime ----Rs.1285/m^3

Labour charges

Mason-I-class ----Rs.545.00 each/day

Mason-II-class ----Rs.488.00 each/day

Mazdoor category-I ----Rs.341.00 each/day

Mazdoor category-II ----Rs.308.00 each/day

Solution:

Preparation of data for BW in CM1: 3 -1m^3

Sub data:

Qty	Description	Rate Rs	Per	Amount Rs
500Nos	Bricks	7190.00	1000	3595.00
0.14m^3	sand	176.40	1m^3	24.70
67.2kg	Cement	356.00	1bag	478.46
0.7No	Mason I class	545.00	e /d	381.50
0.71No	Mason II class	488.00	e /d	346.48
0.71No	Mazdoor category I	341.00	e /d	242.11
2.12Nos	Mazdoor category II	308.00	e /d	36.96
	Rate for 1 m3			**Rs.5105.21**

1) Preparation of data for Plastering with C.M. 1:4 ,12mm thick – 10m^2
Sub data:

Qty	Description	Rate Rs	Per	Amount Rs
0.12m^3	sand	176.40	1m^3	21.17
43.2kg	Cement	356.00	1bag	307.58
1.1Nos	Mason I class	545.00	e /d	599.50
0.5Nos	Mazdoor category I	341.00	e /d	170.50
1.1Nos	Mazdoor category II	308.00	e /d	338.80
	Rate for 10 m^2			**Rs.1437.55**
	Rate for 1 m^2			**Rs.143.76**

2) Preparation of data for White washing two coats 100 m^2
Sub data:

Qty	Description	Rate Rs	Per	Amount Rs
0.07 m^3	Shell lime	1285.00	m^3	89.95
L.S	Gum, conjee, water, brushes etc	L.S	--	50.00
1.6Nos	Mason II class	488.00	e /d	780.80
0.5Nos	Mazdoor category I	341.00	e /d	170.50
2.7Nos	Mazdoor category II	308.00	e /d	831.60
	Rate for 100m^2			**Rs 1922.85**
	Rate for 1 m^2			**Rs 19.23**

Preparation of data for B.W in Parapet 200mm thick in CM1:3 for 10m^2
Main data :

Qty	Description	Rate Rs	Per	Amount Rs
2m^3	Brick work in C.M 1:3			
	(Volume of bricks = 10m2 x 0.2 =2m^3)	5105.25	m^3	10210.42
20m^2	Plastering in C.M 1:5 12mm thick			
	(Area of plastering = 10m2 x 2sides =20m^2)	143.76	m^2	2875.20
20m^2	White washing two coats	19.22	m^2	384.40
10%	Contractor's profit			1347.00
	Rate for 10m^2			**Rs.14817.02**
	Rate for 1 m^2			**Rs.1481.70**

3.2.7.Hand Rails

Construction of 175mm x 175mm size precast R.C.C. railing of M30 grade concrete in three tiers with 1m high twin vertical posts of 250mm x 250mm size at centre distance not exceeding 2m complete for a 24m long bridge – 1 Rm.

Materials and Labours required:

Construction of 175mmx175mm precast RCC Railing for 24m long bridge.

M30 grade concrete	-As required
Steel including fabrication	-As required
Formwork 5% of cost of concrete	-L.S
Labour 20% of concrete,steel,formwork	-L.S
Contractor's profit	-10%

Cost of materials at site

Cost of M30 concrete	- Rs. 4600/m^3

Cost of Labour

Steel including fabrication	- Rs .48000 /1000kg

Solution:

Calculation for Hand rails -24m length

(Cost of M30 grade concrete = Rs.4600/m^3
Add for Formwork a lumpsum of 5% of cost of concrete
Assume 150kg steel per m^3 of concrete in rails and posts
Add for labour a lumpsum of 20% of cost of concrete plus steel plus formwork
Cost of Steel including fabrication = Rs .48000 /1000kg)
Length of bridge = 24 m
Concrete Hand rail 175mm x 175mm – 24 No of 3 Layer
Vertical posts 13 Nos (Single post 2 + Twin post 11)

Calculation of concrete Quantity

Hand rail	= 0.175 x0.175 x24 x3 =2.205m^3
Vertical post	= (2+ 2x 11)
	= 24Nos 1 m height of 250 mm x 250mm
24 x 1 x 0.25 x 0.25 =1.5m^3	
Total quantity of concrete	= 2.205 + 1.5
	= 3.705m^3
Quantity of steel	=150kg /m^3
Total steel quantity	= 150 x 3.705
	= 555kg
Cost of M20 concrete	= Rs 10938.53 / m^3
Formwork ----------	5% of cost of concrete= 40527.25 x 5/100 = 2026.36
Steel including fabrication	= Rs .48000 /1000kg

Preparation of data for Hand rails 24m length
Main data:

Qty	Description	Rate Rs	Per	Amount Rs
3.705m^3	1 .M30 concrete	10938.53	m^3	40,527.25
555kg	2 . steel 150kg /m^3 of concrete	48000.00	1000kg	26,640.00
L.S	3 . formwork 5% of cost of concrete	L.S		2026.36
L.S	4 .Labour 20% (1+2+3)	L.S		13,838.72
	5 . Contractor's profit 10%	L.S		8303.23
	Rate for 24 m Length			**Rs.91335.56**

Cost for 1 m Length =Rs.3805.65/-

3.2.8. Earth filling in Embankments.

Filling of embankment with tested soil with all lifts , leads ,and transporting 5 km by mechanical machinery means and spreading with a necessary gradient and compacting to the all requirements - 100m^3

Materials, Machineries&Labours required:

Hydraulic excavator capacity 60 m^3 /hr	--As required
Tipper lorry of 10 t capacity	--As required
Costing of loading & unloading	--L.S. (10% cost of Tipper lorry)
Dozzer for spreading the soil capacity 150 m^3 /hr	--As required
Motor grader for grading capacity 100 m^3 /hr	--As required
Water tanker 6000 lit capacity	--4hr
Water	---24000lit
Roller vibratory capacity 100 m^3 /hr	--1hr
Mazdoor category II	--0.50No
Contractor's profit including tools & plants	---10%
Cost of material and Labour	
Hydraulic excavator capacity 60 m^3 /hr	--Rs.750.00/hr
Tipper lorry of 10 t capacity	--Rs.5.00km/t
Dozzer for spreading the soil capacity 150 m^3 /hr	--Rs.600.00/hr
Motar grader for grading capacity 100 m^3 /hr	--Rs. 950.00/hr
Water tanker 6000lit	--Rs.450.00/hr
Roller vibratory capacity 100 m^3 /hr	--Rs.1200.00/hr
Cost of water 80.00per 1000 liters.	--Rs.80.00 ; 1000/lit
Mazdoor category II	--Rs.308.00 e/d

Solution:

Preparation of data for Earth filling in embankment for -100 m^3

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
1.67hrs	Hydraulic excavator (100 m^3/60m^3per hr)	750.00	hr	1252.50
144t/5km	Tipper lorry of 10 t capacity (144x5x5=3600)	5.00	Km/t	3600.00
L.S	Costing of loading & unloading 10%	-	-	360.00
0.67hrs	Spreading charges by Dozzer (capacity150 m^3/hr 100/150=0.67hrs)	600.00	hr	402.00
1hr	Motar grader (100m^3/hr)	950.00	hr	950.00
4hrs	Tanker (Water) Lorry 6000litre	450.00	hr	1800.00
1hrs	Roller vibratory capacity 100 m^3 /hr	1200.00	hr	1200.00
24000lit	Cost of water	80.00	1000/lit	1920.00
0.5	Mazdoor category II	308.00	e/d	154.00
10%	Contractor's profit Includes tools& plants.	L.S.		1068.85
	Rate for 100m^3			**Rs.12707.35**

Rate for 1m^3--------- = Rs. 127.07/-

3.2.9.Analysis of Rate of Earthwork in cutting or in embankment in ordinary soil excavation is to be done in the form of regular pits not exceeding 500mm in depth and earthwork in embankment to be done 200 mm layers including ramming and dressing the surface to the required levels and slopes including 1.5m lift and 30m lead for Rate for 100 m^3

Labours required

Mason II class -0.3Nos

Mazdoor category I -7.0Nos

Mazdoor category II -33.0Nos

Cost of labours

Mason II class - Rs.488.00 each/day

Mazdoor category-I - Rs.341.00 each/day

Mazdoor category-I - Rs.308.00 each/day

Solution:

Preparation of data for E.W. in cutting / embankment – m^3.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
0.3Nos	Mason II class	488.00	e/d	146.40
7.0Nos	Mazdoor category I	341.00	e/d	2387.00
33.0Nos	Mazdoor category II	308.00	e/d	10164 .00
L.S	For tools & plants with Contractors profit 10%	L.S		1264.74
	Rate for 100m^3			**Rs.13967.14**

Rate for 1m^3 = Rs. 139.67 /-

3.2.10. Soling for WBM Road

Supplying and laying of soling stones of 230mm thick and packing with 80 mm size HBG (Hard broken granite) in joints of soling with providing necessary camber -10m^2

Materials and Labours required:

Soling stone 230 mm	--2.3m^3
Broken stone 80mm	--0.7 m^3
Sand	--0.3 m^3
Labour for laying	--10 m^2
Labour for packing	--10 m^2

Cost of Materials and Labour

Soling stone 230mm	--Rs.358.00/m^3
Broken stone 80mm	--Rs.449.00/ m^3
Sand	--Rs.176.40/ m^3
Labour for laying	--Rs.45.00/ m^2
Labour for packing	--Rs.20.00/ m^2

Solution:

Preparation of data for supplying of soling stone for -10 m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
2.3 m^3	Soling stone 230 mm	358.00	m^3	823.40
0.7 m^3	Broken stone 80mm	449 .00	m^3	314.30
0.3 m^3	Sand	176.40	m^3	52.92
10 m^2	Labour for laying	45.00	m^2	450.00
10 m^2	Labour for packing	20.00	m^2	200.00
LS	Contractor's profit and over head expenses		L.S	184.06
	Rate for 10m^2			Rs.2024.68

Rate for 1m^2 = Rs 202.47/-

3.2.11. Laying WBM Road over existing soling :

Laying of WBM Road by spreading metal (IRC 50mm and IRC 40mm size broken stones in equal proportion) to required camber to an average thickness of 80mm and blindage with25mm thick gravel including watering and consolidation with power roller and surface dressing over the W.B.M. road with pre coated chips using 2.7m^3 of IRC 12mm size stone chips per 100m^2 and 56kg of bitumen per m^3 of chips for premixing and 100kg of bitumen for tack coat per 100m^2 including consolidation with power roller, the rate inclusive of hire charges for tools and plants – Rate for 10m^2.

Laying of WBM Road by spreading metal an average thickness of 80mm and blindage with25mm thick gravel and surface dressing over W.B.M. road with pre coated chips – For 100m^2

Materials and Labour required For water bound macadam

Broken stone IRC 50mm size	--- 4 m^3
Broken stone IRC 40mm size	--- 4 m^3
Gravel	-- 2.5m^3
Labour	-- L.S . Rs.350.00
Hire charges for roller	-- 1/5 day
Water	-- L.S. Rs.100.00

For surface dressing

IRC 12mm size stone chips	--- As required
Bitumen 80/100 grade	--- As required
Labour	-- L.S . Rs.200.00
Hire charges for roller	-- 1/5 day
Water	-- L.S. Rs.200.00
Kerosene	-- 1/8 day

Cost of materials at site

Gravel	--Rs.183.00/ m^3
Broken stone IRC 50mm size	--Rs.601.00/ m^3
Broken stone IRC 40mm size	--Rs.934.00/ m^3
IRC 12mm size stone chips	--Rs.1206/ m^3
Bitumen 80/100 grade	--Rs.30680/tonne
Hire charges	--Rs.2500 per/day

Solution:

Preparation the data for Laying of WBM Road by spreading metal (IRC 50mm and IRC 40mm size broken stones in equal proportion) to required camber to an average thickness of 80mm and blindage with25mm thick gravel including watering and consolidation with power roller and surface dressing over the W.B.M. road with pre coated chips using 2.7m^3 of IRC 12mm size stone chips per 100m^2 and 56kg of bitumen for take coat per 100m^2 including consolidation with power roller –For 100m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	For water bound macadam			
4.00m^3	Stone aggregate 50mm	601.00	m^3	2404.00
4.00m^3	Stone aggregate 40mm	934.00	m^3	3736.00
2.5m^3	Gravel	183.00	m^3	457.50
L.S	Labour	350.00	L.S	350.00
1/5 day	Hire charges for roller	2500.00	day	500.00
L.S	Water	100.00	L.S	100.00
	For surface dressing			
2.7m^3	IRC 12mm size stone chips	1206.00	m^3	3256.20
251.2kg	Bitumen 80/100 grade (2.7x56+100=251.2kg)	30680.00	tonne	7706.82
L.S	Labour	200.00	L.S	200.00
1/8 day	Hire charges for roller	2500.00	Day	312.50
L.S	Kerosene	200.00	L.S	200.00
	Rate for 100m^2			**Rs.19223.00**
			Rate for 10m^2	**Rs.1922.30**

3.2.12. Laying WBM Road over the existing soling

Laying WBM Road over the existing soling spreading metal (IRC 50mm size and IRC 40mm size in equal proportion) with required camber to an average thickness of 100 mm and blindage with 25mm thick gravel including dry rolling and wet rolling using power roller as per specifications – Rate for 10m^2 .

Materials and Labour required:

Laying WBM Road over the existing soling spreading metal (IRC 50mm size and IRC 40mm size in equal proportion) –For 10 m^2.

Broken stone IRC 50mm size --- As required

Broken stone IRC 40mm size --- As required

Gravel -- As required

Labour -- Rs.400.00

Roller --1150 day

Water L.S. -- Rs.100.00

Cost of material at site

Gravel	--Rs.183.00/ m^3
Broken stone IRC 50mm size	--Rs.601.00/ m^3
Broken stone IRC 40mm size	--Rs.934.00/ m^3
Hire charges for road roller	--Rs.2500.00/day

Solution:

Preparation of data for Laying WBM Road over the existing soling by spreading(IRC 50mm size and IRC 40mm size in equal proportion) to average thickness of 100mm and blindage with 25mm thick gravel –For 10 m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
0.5m^3	Broken Stone IRC 50mm size (10x0.1)/2 =0.5 m3	601.00	m^3	300.50
0.5m^3	Broken Stone IRC 40mm size (10x0.1)/2 =0.5 m3	934.00	m^3	467.00
0.25m^3	Gravel (10x0.025=0.25 m3)	183.00	m^3	45.80
L.S	Labour	200.00	L.S	200.00
1/50 day	Hire charges for road roller	2500.00	day	50.00
L.S	Water	100.00	L.S	100.00
		Rate for	**10m^2**	**Rs.1163.30**

3.2.13 .Surface dressing

Surface dressing with pre coated chips using 2.7m^3 of chips per 100m^2 and 56kg of bitumen 80/100 grade per m^3 of chips for premixing and 100kg of bitumen per100m^2 for tack coat including consolidation – Rate for 10m^2.

Materials and labours required:

Surface dressing with pre-coated chips using 2.7m^3 of chips per 100m^2 and 56kg of Bitumen 80/100 grade per m^3 of chips for premixing- 100 m^2

IRC 12mm size stone chips	---As required
Bitumen 80/100 grade	---As required
Labour L.S.	---Rs.150.00
Kerosene ,Fuel ect L.S.	---Rs.500.00

Cost of Materials at site

IRC 12mm size stone chips	--Rs.1206.00/ m^3
Bitumen 80/100 grade	--Rs.30680.00/ tonne

Solution:

Preparation of data for Surface dressing with precoated chips using 2.7m^3 of chips per 100m^2 and 56kg of bitumen per m^3 of chips for premixing and 100kg of bitumen per100m^2 for tack coat – For 100m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
2.7m^3	IRC 12mm size stone chips	1206.00	m^3	3256.20
251.2kg	Bitumen 80/100 grade			
	(2.7x56=151.2+100=251.2kg)	30680.00	tonne	7706.82
LS	Labour	150.00	L.S	150.00
L.S	Kerosene	500.00	L.S	500.00
	Rate for 100m^2			**Rs.11613.00**
	Rate for 10m^2			**Rs.1161.30**

3.2.14. Bituminous painting (or) surface dressing second coat -100m^2

Materials and Labours required:

Stone chips 12mm at 0.75m^3 for 100m^2

Asphalt 80/100 at 120kg for 100m^2 (Including wastage)

Mazdoor I class for heating and cleaning for road surface…… 2.0 Nos

Mazdoor I class for brushing and spraying…….. 1.5 Nos

Mazdoor I class for rolling and brushing chips …… 0.5 Nos

Mazdoor I class for spreading stone chips…… 1.5 Nos

Tools & plants:

Tar boiler at 800m^2 per day ……..1/8day

Fuel, fire wood at 400kg per 1000kg of asphalt…… 48kg

Hire charges of road roller at 800m^2 per day……,,,, 1/8 day

Sundries , Tools ,Plants and Brushes.

Cost of Materials at site

Stone chips 12mm - Rs.1206.00/ m^3.

Asphalt 80/100 - Rs.30680.00/ tonne

Cost of Labour

Mazdoor I class - Rs.341.00/ e/d

Solution:

Preparation of data for Bituminous painting (or) surface dressing second coat –For 100m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Material			
0.75m^3	Stone chips -12mm	1206.00	m^3	904.50
0.12 t	Asphalt 80/100 (120kg = 0.12t)	30680.00	tonne	3681.60
	Labour			
2 No	Mazdoor I class for heating & cleaning road surface.	341.00	e/d	682.00
1.5Nos	Mazdoor I class for brushing and spraying	341.00	e/d	511.50
0.5No	Mazdoor I class rolling &brushing chips	341.00	e/d	170.50
1.5Nos	Mazdoor I class spreading stone chips	341.00	e/d	511.50
	Tools &Plants			
1/8day	Tar boiler	2200.00	day	275.00
48kg	Fuel, fire wood	6.00	kg	288.00
1/8day	Road roller	2500.00	Day	312.50
L.S	Sundries, tools &plants ,brushes etc	L.S		88.00
10%	Contractor‘s profit	L.S		742.51
		Rate for 100m^2		**Rs. 8167.61**

3.2.15. providing premixed carpet

Supplying and laying pre-mixed carpet over an existing bituminous surface with pre-coated chips using 2.7m^3 of chips per 100m^2 and 56kg of bitumen per m^3 of chips for premixing and 100kg of bitumen per 100m^2 for finishing coat-100m^2.

Materials and Labours required:

Stone chips 12mm	---- 2.7m^3
Bitumen for premixing	---- As required
Bitumen for finishing coat	---- 100kg
Tar boiler	---- 0.05day
Hire charges for Hot bitumen mixer	---- 0.01day
Hire charges for Road roller	---- 0.06day
Mazdoor category-I	---- 3Nos

Cost of Materials and Machinery at site

Stone chips 12mm	--- Rs.1206.00/ m^3.
Asphalt 80/100	--- Rs.30680.00/ tonne
Tar boiler hire charges	--- Rs.2200.00/day

Hot bitumen mixer hire charges --- Rs.2200.00/day

Road roller hire charges --- Rs.2500.00/day

Cost of Labour

Mazdoor I ---Rs.341.00/ e/d

Solution:

Preparation of data for premix carpet -100m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
2.7m^3	Stone chips 12mm	1206.00	m^3	3256.20
151.2kg	Bitumen for premixing (2.7m^3 x 56 =151.2kg)	30680.00	1000kg	4638.82
100kg	Bitumen for finishing coat	30680.00	1000kg	3068.00
0.05day	Hire charges Tar boiler	2200.00	day	110.00
0.01day	Hire charges Hot bitumen mixer	2200.00	day	22.00
0.06day	Hire charges for Road roller	2500.00	day	150.00
3Nos	Mazdoor category-1	341.00	e/d	1023.00
10%	Contractor's profit	L.S		Rs 1226.80

Rate for 100m^2 = Rs.13494.82/-

Rate for 1m^2= RS.134.94/-

3.2.16. Laying of concrete roads

Analysis of rate of laying cement concrete road of 100mm thick consisting 1:2:4 gauge stone ballest over prepared sub grade to proper camber including supplying of all material and labour tools and plants required for proper completion of work finished but excluding cost of metal required for rectification of the sub grade.(for 10mx4m road surface)-40m^2.

Materials and Labour required:

cement ---312.6kg

Sand ---1.75m^3

40mm broken stone ---3.5m^3

Labour for laying & C.C Compacting

Mason-I class ---0.17Nos

Mason-II class ---2Nos

Mazdoor category-I ---13Nos

Mazdoor category-II ---2Nos

Sub grade Rectification ---0.5No

Mason-I Class ---1No

Mazdoor category-I ---1No

Mazdoor category-II ---9Nos

For curing ---8Nos

Mazdoor category-II

Mixer machine

Cost of Materials at site

cement ---Rs.356.00/bag

Sand ---Rs.176.40/m^3

40mm broken stone ---Rs.934.00/m^3

Cost of Labour

Mason-I class ---Rs.545.00 e/d

Mason-II class ---Rs.488.00 e/d

Mazdoor category-I ---Rs.341.00 e/d

Mazdoor category-II ---Rs.308.00 e/d

Labour charges for concrete Mixer machine ---Rs.220.00 e/d

Solution:

Main data: Laying of C.C. road 100mm thick --- 40m^2

Qty	Description	Rate Rs	Per	Amount Rs
	Material			
312.6kg	cement	356.00	1 bag	9345.71
1.75 m^3	Sand	176.40	m^3	308.70
	40mm broken stone	934.00	m^3	3269.00
	Labour for laying c.c & Compacting			
3.5m^3	Mason-I class	545.00	e/d	92.65
0.17Nos	Mason-II class	488.00	e/d	976.00
2Nos	Mazdoor category-I	341.00	e/d	4433.00
13Nos	Mazdoor category-II	308.00	e/d	616.00
	Sub grade Rectification			
2Nos	Mason-I Class	545.00	e/d	272.50
0.5No	Mazdoor category-I	341.00	e/d	341.00
1No	Mazdoor category-II	308.00	e/d	308.00
	For curing			
1No	Mazdoor category-II	308.00	e/d	2772.00
9Nos	Labour for concrete Mixer machine	220.00	e/d	1760.00
	Rate for 40 m^2			**Rs.24494.56**
	Rate for 1m^2			**Rs.612.36**

3.2.17. Apron and revetment work in canals

Prepare the data for Rough stone dry packing in revetment and apron of canals with 150mm to 300mm size Hard granite stones-1m^3.

Materials required:

Rough stone 150mm to 300mm ---1m^3.

Labours required:

Mason-1-class ---0.17N0s
Stone packer ---0.35Nos
Mazdoor category-I ---0.52Nos
Mazdoor category-II ---0.52Nos

Cost of Materials at site:

Rough stone 150mm to 300mm ---Rs.172.50m^3

Cost of Labours:

Mason-1-class ---Rs.545.00 e/d
Stone packer ---Rs.545.00 e/d
Mazdoor category-I ---Rs.341.00 e/d
Mazdoor category-II ---Rs.308.00 e/d

Solution:

Preparation of data for Rough stone dry packing in revetment and apron of canals with 150mm to 300mm size Hard granite stones-1m^3.

Main data:

Qty	Description	Rate Rs	per	Amount Rs
1m^3	Rough stone 150mm to 300mm	172.50	m^3	172.50
0.17Nos	Mason-1-class	545.00	e/d	92.65
0.35Nos	Stone packer	545.00	e/d	190.75
0.52Nos	Mazdoor category-I	341.00	e/d	177.32
0.52N0s	Mazdoor category-II	308.00	e/d	160.16
10%	Contractor profit 10%	L.S		79.34
			Rate in 1m^3	**Rs. 872.72**

3.2.18. wooden frames for doors

Supplying and fixing wooden frames for main door 1.2x2.1m using teak wood with sill-1No

Material required

T.W Frame (125mmx100mm)	---As required
cutting grooves & nosing	---6.6m
steel clamps	---6Nos
Brass screws (50mm)	---12Nos
C.M. with chips	---L.S(Rs.100.00)

Labour required

Carpenter I class	---0.7Nos
Mason II class	---0.3Nos
Mazdoor category I	---0.3Nos

Cost of Material at site

T.W Frame	---Rs.121800.00/ m^3
cutting grooves & nosing	---Rs.40.00/ m
steel clamps	---Rs.15.00/ each
Brass screws (50mm)	---Rs.0.65/ each
C.M. with chips	---Rs.100.00(L.S)

Cost of Labour

Carpenter I class	---Rs.545.00/ e/d
Mason II class	---Rs.488.00/ e/d
Mazdoor category I	---Rs.341.00/ e/d

Solution:

Calculation of Materials

Frames size	= 125mmx100mm
Post 2Nox2.1m	=4.2m
Head 1Nox1.2m	=1.2m
Bottom 1Nox1.2m	=1.2m
Total Length of frame(4.2+1.2+1.2)	=6.6m
6.6m of 125mmx100mm	=6.6mx0.125mx0.1m = 0.0825m^3

preparation of data for 1 No of Main door1.2 x2.1 m

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
0.0825m^3	T.W Frame	121800.00	m^3	10048.50
6.6m	Charge for cutting grooves & nosing	40.00	m	264.00
6Nos	Cost of steel clamps	15.00	each	90.00
12Nos	Brass screws (50mm)	0.65.00	each	7.80
L.S	C.M. with chips	L.S		100.00
0.7Nos	Carpenter I class	545.00	e/d	381.50
0.3Nos	Mason II class	488.00	e/d	146.40
0.3Nos	Mazdoor category I	341.00	e/d	102.30
10%	Contractor's profit		L.S	565.95
	Rate for 1No			**Rs.11706.45**

3.2.19. Wooden frames for panelled door

Panelled door of Indian Teak wood of 40 mm thick wood for 1No.

Take a door 1.064m x 2.13m (shutter only)

Area of shutter = 0.94m x 2.0 m =1.88 m^2

Materials required

Sal wood ,planks for shutters with 36mm thick	---As required
Steel Hinges	---3Nos

Labours required

Carpenter I class	---2 Nos
Carpenter II class	---1 No
Helper	---2 Nos

Cost of Materials

Sal wood ,planks for shutters	---Rs.43000/ m^3
Steel Hinges	---Rs.30.00/ each

Cost of Labours

Carpenter I class	---Rs.545.00/ e/d
Carpenter II class	---Rs.488.00/ e/d
Helper	---Rs.348.00/ e/d

Solution:

Calculation:

Size of door =1.064mx2.13m

Shutter 0.94m x2.0m =1.88m^2

Thickness of shutter = 36mm = 0.036m

Planks for shutter =1.88 x0.036 =0.067 m^3

Preparation of data for Panelled door of Indian Teak wood of 40 mm thick wood -1m^2

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
0.067m^3	Sal wood ,planks for shutters (Area= 1.88 x0.036 =0.067 m^3)	43000	m^3	2881.00
3Nos	Steel Hinges	30.00	each	90.00
2 Nos	Carpenter I class	545.00	e/d	1090.00
1 No	Carpenter II class	488.00	e/d	488.00
2 Nos	Helper	348.00	e/d	696.00
LS	Tools & Plants 5%		L.S	262.25
10%	Contractor's profit		L.S	550.73
	Rate for 1.88m^2			**Rs.6225.45**
	Rate for 1 m^2			**Rs. 3222.32**

3.2.20 Supplying and fixing of 35mm thick Factory laminated door shutter including M.S Hinges - 1m^2

Analysis for one shutter 1.08 x2.2 =(2.38m^2)

Materials required

Factory made laminated door shutter of 35 mm thick	---As required
M.S Hinges (100 x58 x1.9mm)	---6Nos
M.S Screws (40mm)	---48Nos

Labours required

Carpenter II class	---0.5No
Helper	---0.6 No

Cost of Materials at site

Factory made laminated door shutter of 35 mm thick	---Rs. 2100.00 / m^2
M.S Hinges (100 x58 x1.9mm)	---Rs.40.00/ each
M.S Screws (40mm)	---Rs.0.50/ each

Cost of Labour

Carpenter II class	---Rs.488.00/ e/d
Helper	---Rs.348.00/ e/d

Solution:

Analysis for one shutter 1.08 x2.2 =(2.38m^2)

Preparation of data for Supplying and fixing of 35mm thick Factory laminated door shutter including M.S Hinges - 1m^2

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
2.38m^2	Factory made laminated door shutter of 35 mm thick	2100.00	m^2	4998.00
6Nos	M.S Hinges (100 x58 x1.9mm)	40.00	each	240.00
48 Nos	M.S Screws (40mm)	0.50	each	24.00
0.5 No	Carpenter II Class	545.00	each	283.40
0.6 No	Helper	348.00	each	208.80
LS	Contractor's profit 10%			575.42
	Rate for 2.38 m^2			**Rs 6329.62**
	Rate for 1 m^2			**Rs 2659.50**

3.2.21. Glazed windows

Supplying and fixing of Glazed window of size 1.2m x 1.4m ,4mm thick glass windows in Indian Teakwood – 1m^2

Frame Indian Teak wood. 100mm x 80mm

Shutter : Indian Teakwood size of styles & Rail =90mm x40mm

Indian Teak wood rails 90mm x40mm

15 mm Insertion

Indian Teak wood slash bar 40 x 40 mm (beading)

Glaze of 4mm thick 6 Nos

Material required

T. W frames	---As required
T.W Shutters	---As required
Float glass 4mm thick	---As required
Hinges M.S(100X 58 X1.9mm)	---6Nos
Screw M.S	---48Nos

Labours required

Carpenter I Class	---1.42 Nos
Carpenter II class	---0.17 Nos
Helper	---0.60 Nos

Cost of Material

T. W frames	---Rs.121800.00/ m^3
T.W Shutters	---Rs.43000.00/ m^3
Float glass 4mm thick	---Rs.450.00/ m^3
Hinges M.S(100X 58 X1.9mm)	---Rs.30.00/each
Screw M.S	---Rs.0.50/each

Cost of Labours

Carpenter I Class	---Rs.545.00 /e/d
Carpenter II class	---Rs.488.00/ e/d
Helper	---Rs.348.00/ e/d

Calculation of material:

Window of size 1.2 x1.4m (1.68m^2)

1.Frame Indian Teak wood. 100mm x 80mm

= (3 x1.4 + 2x1.2)x 0.1 x0.08 = 0.0528m^3

Consider wastage 10% = 0.053 m^3

Total wood qty = 0.0581 m^3

2. Shutter : Indian Teakwood for styles & Rails of size 90mm x40mm

=(1.4 – 2x0.08 +2x 0.015) x4Nos x0.09 x0.04 =0.0183m^3

3. Indian Teak wood for rails 90mm x40mm

15 mm Insertion (1.2 - 3 x0.08 +4 x0.015) /2 x4 x 0.09 x0.04 = 0.0073m^3

Indian Teak wood slash bar 40mm x 40 mm (beeding)

(0.51 - 2 x0.09 +2x 0.025) x4 x0.04x 0.04 =0.0024m^3

Total qty of wood =0.0183 +0.0073 +0.0024 =0.0280 m^3

Add wastage 10 % =0.0028

Total =0.0308m^3

4. Float Glaze of 4mm thick

0.357 x 0.350 x6Nos = 0.75 m^2

Solution:

Preparation of data for Glazed windows of size 1.2m x 1.4m.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Material			
0.0581m^3	T. W frames 100mm x 80mm	121800.00	m^3	7076.58
0.0308m^3	T.W Shutters 90mm x40mm	43000.00	m^3	1324.40
0.75 m^3	Float glass 4mm thick	450.00	m^3	337.50
6 Nos	Hinges M.S(100X 58 X1.9mm)	30.00	each	180.00
48 Nos	Screw M.S	0.50	each	24.00
	Labour			
1.42 Nos	Carpenter I Class	545.00	e/d	773.90
0.17 Nos	Carpenter II Class	488.00	e/d	82.96
0.60 Nos	Helper	348.00	e/d	208.80
10%	Contractor's profit	L.S		1000.80
	Rate for 1.68m^2			**Rs.11008.95**

Rate for 1 m^2 = Rs 6552.95/-

3.2.22. Steel grill for windows

Providing and fixing of M.S Grills of required pattern , fixed to frames of window with M.S flats of square or round bars including priming coat etc., complete.

Analysis of Rates for a grill of size 0.90m x 1.2m (1.08 m^2)

Materials and Labours required:

M.S Square bar (12mmx 12mm) @ 1.13 kg/m	---As required
M.S Flat (20mm x5mm) @ 0.79 kg/m	---As required
Primer paint	---0.2lit
Electricity charges for welding	---L.S (Rs.100.00)
Black smith	---0.86No
Helper / painter	---1.10 Nos

Cost of Materials at site

M.S Square bar (12mmx 12mm)	---Rs.58.00/kg
M.S Flat (20mm x5mm)	---Rs.56.00/kg
Primer pain	---Rs.150.00/lit

Cost of Labours

Black smith ---Rs.425.00/e/d

Helper / painter ---Rs.348.00/e/d

Calculation:

Analysis of Rates of a grill of size 0.90m x 1.2m =1.08 m^2

Material requirement:

M.S Square bars (12mm x12mm)

11Nos x 0.86 = 9.46m

8Nos x 1.16 = 9.28m

Wastage 10 % = 1.87m

20.614m x 1.13 kg/m =23.29kg

M.S Flat (20 mm x 5 mm)

2 x 0.9+ 2 x 1.2 = 4.20m

Wastage 10% = 0.42m

4.62 x 0.79 kg/m =3.65kg

Solution:

Preparation of data for M.S.Grill of size 0.90m x1.2m =1.08m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Material			
23.29kg	M.S Square bar (12mmx 12mm)	58.00	Kg	1350.82
3.65kg	M.S Flat (20mm x5mm)	56.00	Kg	204.40
L.S	Electricity charges & Welding	L.S		100.00
0.4lit	consumables	150.00	Lit	30.00
	Primer paint			
	Labour			
0.86No	Black smith	425.00	e/d	365.50
1.10Nos	Helper/ Painter	348.00	e/d	382.80
10%	Contractor's profit	L.S		243.35
	Rate for 1.08m^2			**Rs.2676.87**

3.2.23. Providing and fixing of 1mm thick M.S. Sheet gate with 40x40x6 mm size frame angles 3mm thick gusset plates at functions and corners, 30x6 mm size flats for central horizontal tie and diagonal braces with all necessary fittings complete, including applying a priming coat -1m^2.

Analysis of rates for a Double leaf Gate of size 2.4m x 2.4m (5.76m^2.)

Material required

M.S.Sheet(1mm)	---As required
M.S.Sheet(3mm)	---As required
Angle Iron (40mmx40mmx6mm)	---As required
M.s.flats(30x6mm)	---As required
M.s.Hooks,Bolts,Nuts,Rivets etc..	---L.S
Locking arrangement & handles	---L.S
Priming coat	---14.7m^2

Labours required

Fitter I class	---2 Nos
Blank smith	---6Nos
Mason I class	---0.1No
Mazdoor category-I	---3Nos

Cost of Material at site

M.S.Sheet(1mm) @ 7.85 kg/ m^2	---Rs.55.00/kg
M.S.Sheet(3mm) @ 23.55 kg/ m^2	---Rs.53.00/kg
Angle Iron (40x40X6mm) @ 3/5 kg/m	---Rs.51.50/kg
M.s.flats(30x6mm) @ 1.4 kg /m	---Rs.50.00/kg
M.s.Hooks,Bolts,Nuts,Rivets etc..	---Rs.530.00
Locking arrangement & handles	---Rs.300.00(L.S)
Priming coat	---Rs.25.00m^2

Cost of Labours

Fitter I class	---Rs.545.00/e/d
Black smith	---Rs.425.00/e/d
Mason I class	---Rs.545.00/e/d
Mazdoor category I	---Rs.341.00/e/d

Calculation of Materials requirement:

(i). M.S. Sheet (1mm thick) = 5.76m^2
10% Wastage =0.58m^2
= 6.34 m^2 @ 7.85 kg/ m^2 = 49.769kg

(ii) M.S. Sheet (3mm thick) for gussets(300mm x 300mm x 40mm)

Area of one gusset T & L shape = 0.3 x 0.3 – ½ x 0.26 x 0.26
= 0.0562 m^2

Area of 300mm dia circular gusset= $\frac{\pi \times 0.3^2}{4}$ = 0.0707 m^2

Corner gusset: 8Nos x 0.0562 = 0.4496 m^2
Mid height gussets:4Nos x 0.0562 =0.2248 m^2
Centre gussets 2Nos x 0.0707 =0.1414 m^2
Total =0.8158 m^2
10% wastage = 0.0816 m^2
=0.8974 m^2 @ 23.55 kg/ m^2 = 21.14kg

(iii) Angle Iron 40 x 40 x 6 mm)

Sides 4 x 2.4 = 9.60m
Top & Bottom 4 x 1.2 =4.80m
Total =14.40m
10% wastage = 1.44m
= 15.84 m @ 3/5 kg/m = 55.44kg

(iv)Flats 30 x 6 mm

4 Diagonals 4 x 2.45 = 9.80m
2 Horizontals 2 x 1.20 = 2.40m
Total = 12.20m
10% wastage = 1.22m
= 13.42m @ 1.4 kg /m = 18.79 kg

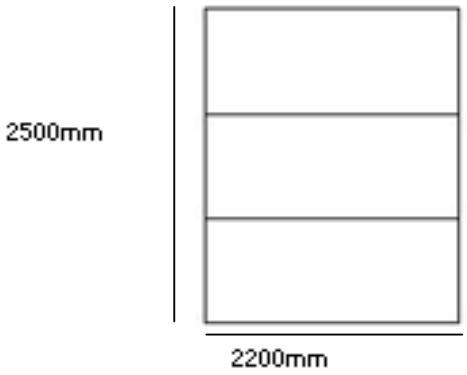
Preparation of data for Providing and fixing of 1mm thick M.S. Sheet gate 2.4m x 2.4m and frame of flat 30mm x 6mm – 5.76 m².

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Materials			
49.78kg	M.S.Sheet(1mm)	55.00	Kg	2737.90
21.14kg	M.S.Sheet(3mm)	53.00	Kg	1120.00
55.44kg	Angle Iron 40x40X6mm)	51.50	Kg	2855.20
18.79 kg	M.s.flats(30x6mm)	50.00	Kg	939.50
L.S	M.s. Hooks, Bolts ,Nuts, Rivets etc..	L.S	-	530.00
L.S	Locking arrangements & handling	L.S	-	300.00
	Priming coat	25.00	m^2	367.50
14.7 m^2	**Labour**			
2 Nos	Fitter I class	545.00	e/d	1090.00
6Nos	Blank smith	425.00	e/d	2550.00
0.1No	Mason I class	545.00	e/d	54.50
3Nos	Mazdoor category I	341.00	e/d	1023.00
10%	Contractor's profit	L.S		1356.76
	Rate for 5.76 m^2			**Rs. 14924.36**
	Rate for 1 m^2			**Rs.2591.03**

3.2.24. Supplying and fixing of aluminum partitions with pre laminated boards .

Analysis of rate for partition 2.20mx2.50m=5.5m^2



Materials and Labours required:

a). Materials required for Aluminum section

i) Single groove Aluminum section(No 9210) @1.377 kg /m	---As required
ii) Double groove aluminum section (No 9207) @1.424 kg/m	---As required
iii) Tapered clip section	---As required
iv) Angle section @ 0.518 kg/m	---4.8m

b)Fixing aluminum partition with pre laminated board for 2.20 x2.50m size -5.5m^2

Aluminum section	---As required
U- rubber beading 12mm thick pre laminated	---As required
Nova pan board including 10% wastage	---As required
PVC Plug	---10Nos
Screws (75mm)	---10Nos
50mmx8mm screws	---15Nos
Drilling machine	---2days
Carpenter/fitter	---4Nos
Helper	---4 Nos

Cost of Materials at site

Aluminum section	---Rs.210.00/kg
U- rubber beading 12mm thick pre laminated	---Rs. 25.00/m
Nova pan board including 10% wastage	---Rs.610.00/m^2
PVC Plug	---Rs.10.00/each
Screws (75mm)	---Rs.0.50/each
50mmx8mm screws	---Rs.0.50/each
Hire charges for Drilling machine	---Rs.150.00/day

Cost of Labours

Carpenter/fitter	---Rs.545.00/e/d
Helper	---Rs.348.00/e/d

Calculation:

Materials Required for Aluminum section

Single groove aluminum section (No 9210)

2.20x4=8.80mx1.377 kg /m=12.12kg

Double groove aluminum section (No 9207)

2.50x2=5.00mx1.424 kg/m=7.12 kg

Tapered clip section 2.20x6x2+2.5x2x2=36.4m

=36.4mx0.169 kg/m=6.15 kg

Angle section 4.8m @ 0.518 kg/m =2.49 kg

Aluminum section =12.12+7.12+6.15+2.49

=27.88 kg

wastage 10%=2.79kg

Angle section 4.8m @ 0.518 kg/m =30.67 kg

Preparation of data for fixing aluminum partition with pre laminated board for 5.5m^2 (2.20 x2.50m) =5.5m^2

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Material			
30.67kg	Aluminum section	210.00	Kg	6440.70
36.4m	u- rubber beading 12mm thick pre laminated	25.00	m	910.00
6.05m^2	Nova pan board including 10% wastage (5.5+10/100x5.5)=6.05m^2	610.00	m^2	3690.50
10 Nos	PVC Plug	10.00	each	100.00
10 Nos	Screws (75mm)	0.50	each	5.00
15 Nos	50mmx8mm screws	0.50	each	7.50
2days	Hire charges for drilling machine	150.00	days	300.00
	Labour			
4 Nos	Carpenter/fitter	545.00	e/d	2180.00
4 Nos	Helper	348.00	e/d	1392.00
	Contractor's profit 10%			1502.57
			Rate for 5.5m^2	**Rs.16528.27/-**
			Rate for 1 m^2	**Rs. 3005.14/-**

3.2.25. providing ply wood shutters with teak wood scantling to R.C.Loft at lintel level -1m^2.

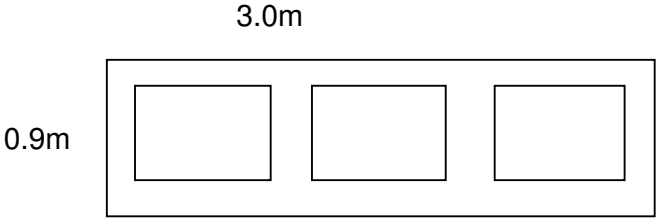
Materials for a loft of size 3.0m x 0.9m

Size of loft =3.0mx0.9m Area = 2.7m^2

T.W. Scantling 75mmx40mm

(Horizontal :2Nos, Vertical: 4Nos)

18mm thick laminated ply wood



Analysis of rates for a loft of size 3.0m x 0.9m

Materials required

T.W scantling	---As required
Laminated plywood (18mm thick)	---As required
M.S. Hinges	---18Nos
M.S. Handles	---6Nos
M.S. tower bolt	---3Nos
Screws	---132Nos

Labours required

Carpenter II class	---6Nos
Helper	---6 Nos

Cost of Materials at site

T.W scantling	--Rs.121800.00/m^3
Laminated plywood (18mm thick)	---Rs. 1250.00/m^2
M.S. Hinges	---Rs.30.00/each
M.S. Handles	---Rs.25.00/each
M.S. tower bolt	---Rs.27.50/each
Screws	---Rs.0.50/each

Cost of Labour

Carpenter II class	---Rs.488.00/e/d
Helper	---Rs.348.00/e/d

Calculation:

Size of loft =3.0mx0.9m Area = 2.7m^2

T.W. Scantling 75mmx40mm = (2x3.0+4x0.9) x 0.075x0.040 = 0.0289m^3

18mm thick laminated ply wood =(3-4x0.075) x (0.9-2x0.075) = 2.28m^2

Preparation of data for Providing ply wood shutters with teak wood scantling to R.C.Loft at lintel level -2.7m^2.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Materials			
0.0289m^3	T.W scantling	121800.00	m^3	3520.00
2.28m^2	Laminated plywood (18mm thick)	1250.00	m^2	2850.00
18Nos	M.S. Hinges	30.00	each	540.00
6 Nos	M.S. Handles	25.00	each	150.00
3 Nos	M.S. tower bolt	27.50	each	82.50
132 Nos	Screws	0.50	each	66.00
	Labour			
6 Nos	Carpenter II Class	488.00	e/d	2928.00
6 Nos	Helper	348.00	e/d	2088.00
10%	Contractor's profit wastage tools and plants	L.S		1222.45
	Rate for 2.7m^2			**Rs. 13446.95**

Rate for 1 m^2 = Rs. 4980.35/-

3.2.26. Supplying and laying a expansion joint, expansion gap of 20 mm covered with 12mm thick , 200mm wide G.I Plate as per IS -2062 Placed at the centre of joint. welding of 8mm dia,100mm long of G.I nails placed at 300mm c/c along centre line of plate -1m length.

Material required

G.I Plate 200mm wide 12mm thick94.2kg/m^2 Including 5% of wastage	---197.9 kg
Add 10% for cutting , welding, and Nails	---L.S

Labour required

Mason II class	---0.17No
Mazdoor category I	---0.17No
Mazdoor category II	---0.34No

Cost of Material at site

G.I Plate 200mm wide 12mm thick	---Rs.48/ kg

Cost of Labour

Mason II class	---Rs.488.00/e/d
Mazdoor category I	---Rs.488.00/e/d
Mazdoor category II	---Rs.341.00/e/d

Preparation of data for Supplying and laying a expansion joint, expansion gap of 20 mm covered with 12mm thick , 200mm wide G.I Plate as per IS -2062 Placed at the centre of joint. welding of 8mm dia,100mm long of G.I nails placed at 300mm c/c along centre line of plate of -Rate for 10 m length.

Main data:

Qty	Description	Rate Rs	Per	Amount Rs
	Materials			
197.9kg	G.I Plate 200mm wide 12mm thick94.2kg/m2 Including 5% of wastage	48.00	Kg	9495.20
LS	Add 10% for cutting , welding, and Nails	--	--	94.95
	Labours			
0.17	Mason II class	545.00	e/d	92.65
0.17	Mazdoor category I	488.00	e/d	82.96
0.34	Mazdoor category II	308.00	e/d	104.72
10%	Contractor's profit	L.S	--	987.05
	Rate for 10m length			**Rs. 10857.53**

Rate for 1m length = Rs.1085.753/-

EXERCISES

1).A trench has to be excavated on ordinary soil for laying a sewer line, along the side of a road for 1.0m widthand 1.2m depth using hydraulic escavator. Analyse and determine the rate for earthwork excavation per matre run of trench with the following given data.

Average output of hydraulic escavator : 240 m^3 /day

Hire charge for hydraulic escavator including driver and fuel : Rs.4500.00 per day

Mazdoor category – I : 5 Nos @ Rs.400.00 e/day

Mazdoor category – II : 5 Nos @ Rs.300.00 e/day

An extra 20% on labour charges may be allowed for over head expenses and contractor's profit.

2).20mm dia CPVC pipes are to be provided and fixed on walls of a building externally with clamps at 1.2m interval for water supply. Determine the rate for supplying and fixing the pipe per metre length with the following given data:

Cost of 6m length 20mm dia CPVC pipes : Rs.306.00

Cost of fittings : 30% of cost of pipes.

Cost of clamps including fixing : Rs. 5.00 Each

Out turn of fitter grade –I : 30m per day @ Rs. 500.00 / day

Out turn of fitter grade –II : 30m per day @ Rs. 400.00 / day

Out turn of fitter grade –II : 40m per day @ Rs. 400.00 / day

Add 15% of cost of material and labour as over head expenses and contractor's profit.

3).An Indian water closet has to be provided and fixed with S-Trap and a 10 litre capacity P.V.C. flushing cistern with all fittings and fixtures. The cost of materials at shop are given below:

White W.C. Pan : Rs.1200.00/ Each

White P.V.C. Cistern with all fittings : Rs.950.00/ Each

S-Trap with vent : Rs.340.00/ Each

The work site is at a distance of 12 km from the shop. The cost of conveyance for the above three items will be Rs.480.00 per day, one mason at the cost of Rs.450.00 per day and one mazdoor at the cost of Rs.400.00 per day are required for half-a-day to complete the work. An allowance of 12% has to be made for expenses towards overhead and profit to contractor's etc.., Find the unit cost of the work.

4).150mm dia R.C.C. pipes with collars are to be supplied to laid in the excavated trenches, jointed with cement mortar 1:2 and tested. Analyse the cost per metre length, excluding cost of excavation and refilling the trench.

Material required for 10m length

150mm dia R.C.C. pipes : 10m @ Rs.350.00 per m
150mm dia R.C.C. collars : 5 Nos @ Rs.60.00 each
C.M. 1:2 : 0.005 m^3 per joint @ Rs.3200.00/m^3.
The Out turn of workers are as given below :
Mason II class : 30 m per day
Mazdoor category- I : 60 m per day
Mazdoor category- II : 60 m per day

Cost of Labour:

Mason II class : Rs.480.00 each per day
Mazdoor category- I : Rs.390.00 each per day
Mazdoor category- II : Rs.300.00 each per day

Add 10% of cost of material and labour as overhead expenses and contractor's profit.

5.Determine the cost of surface dressing one coat with bitumen of approved quality with the following data:

Material requirement:

Bitumen Emulsion : 2 kg/m^2 of surface area.
Stone chipping (13.2 mm) : 1.6 m^3/100 m^2 of surface area.

Machinery requirement:

8 to 10 capacity Roller : 1 day for 1000 m^2 of surface area.
Tar sprayer : 1 day for 1000 m^2 of surface area.

Labour requirement:

Mazdoor category- I : 1 No of every 200 m^2
Mazdoor category- II : 1 No of every 15 m^2
Sprayer : 1 No of every 1000 m^2

Cost of materials and labours

Bitumen Emulsion : Rs.44.00/kg (including conveyance).
Stone chipping (13.2 mm) : Rs.1100.00/m^3 + Rs.100.00/m^3 for conveyance.
Hire charge for Road Roller : Rs.1800.00 per day
Hire charge for Tar sprayer : Rs.400.00 per day

Add Rs. 240.00 per 100m2 of surface area towards cost of brushes, brooms, diesel etc.,

Mazdoor category- I : Rs.400.00/Each/ day
Mazdoor category- II : Rs.300.00/Each/ day
Sprayer : Rs.450.00/Each/ day

Add 10% of all the above cost as over head expenses and contractor's profit.

6.Analyse and findout the unit rate for providing and fixing fully glazed aluminium window with openable glass shutters with the following data:

Material and labour required for 1.22m x 1.22 m size window.

Aluminium Sections : 4.88 m @ 0.594 kg /m

Aluminium Sections : 2.44 m @ 0.890kg /m

Aluminium Sections : 4.88 m @ 0.520 kg /m

Clip Sections : 7.32 m @ 0.197 kg /m

Angle Sections : 0.91 m @ 0.518 kg /m

Add 10% extra in the above requirement for wastage.

Cost of Aluminium section : Rs.210.00 per kg (Including cost of conveyance)

Rubber beading : 7.32 m @ Rs.7.00 /m

Handled with locks : 2 Nos @ Rs.40.00 each

Friction stayes : 2 Nos @ Rs.110.00 each

Gray glass : 1.64 m^2 @ Rs.400.00/m^2.

Add Rs.30.00 for plugs and screws.

Carpenter II class : 2 Nos @ Rs.450.00 each

Helpers : 2 Nos @ Rs.300.00 each

Add 10% extra in cost of material and labour towards the overhead expenses and contractor's profit.

4.1. SEPTIC TANK WITH DISPERSION TRENCH / SOAK PIT

4.1.A. Septic Tank with dispersion trench

Introduction :

Works involved in the detailed estimate of a septic tank with dispersion trench.

I. Septic Tank

(i) Earth work excavation

(ii) Foundation concrete in C.C 1:4:8

(iii) B.W. in C.M 1:4 for walls of septic Tank

(iv) Roof Cover slab and baffled wall of septic tank in R.C.C 1:2:4.

(v) Inside plastering of septic tank walls inside & outside

II. Dispersion Trench

(i) Filling of dispersion trench with Broken stone of uniform size 20 to 40 mm.

(ii) Filling with ordinary soil (or) coarse sand

(iii) Laying and jointing of stone ware apipe or PVC pipe with c. m. 1:3 in inlet & outlet ends

(iv) Laying with open jointed stone ware pipe of 150mm size in dispersion Trench

(v) Fixing of stone ware Tee of 150mm size.

(vi) Fixing of cast Iron manhole cover (500 mm dia)

(vii) Contingencies charges and petty supervision charged.

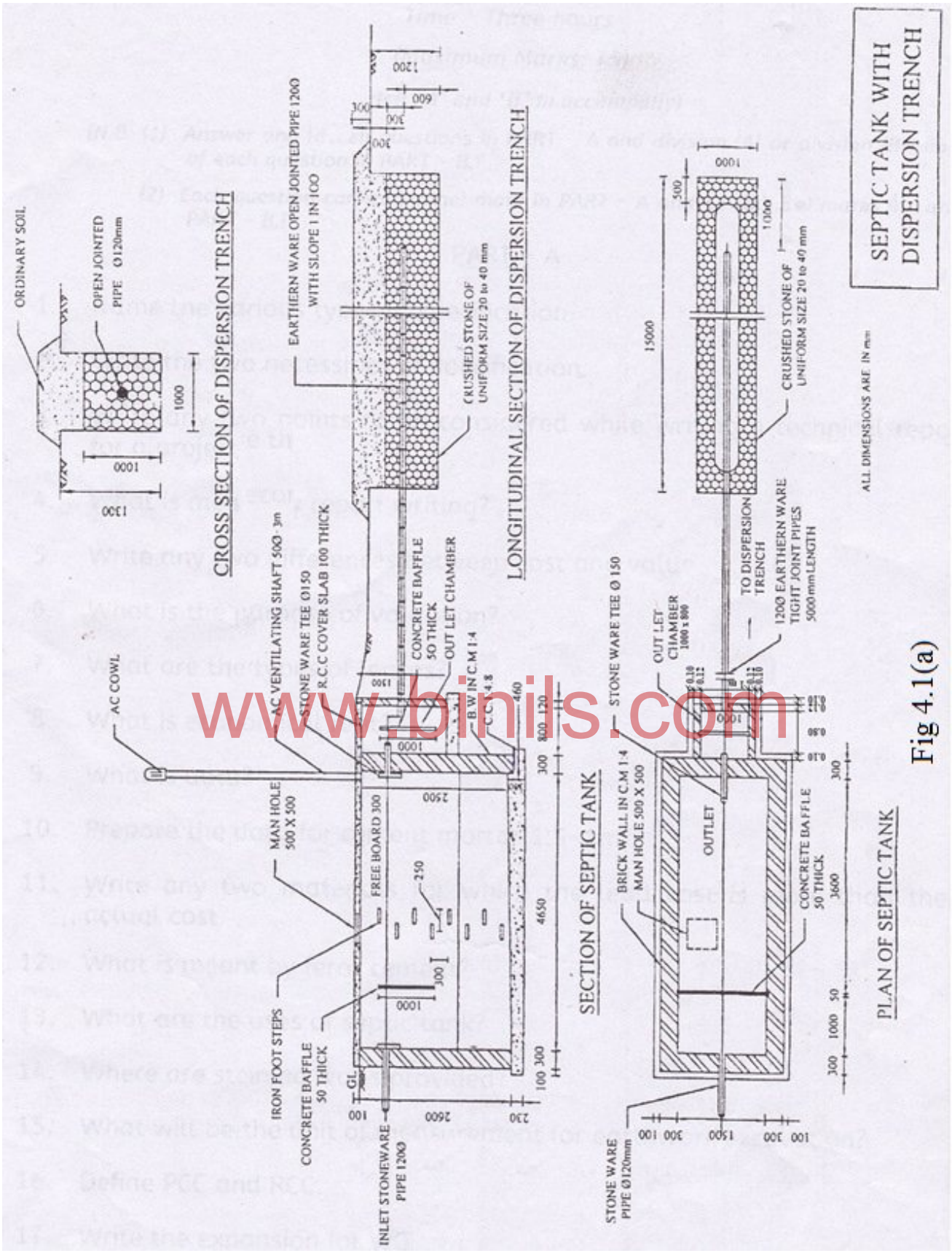
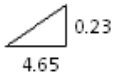


Fig 4.1(a)

DETAILED ESTIMATE OF A SEPTIC TANK WITH DISPERSION TRENCH

Preparation of detailed estimate for the septic tank with dispersion trench as shown in fig 4.1(a)

S. No	Description	No	Dimensions L(m)	B(m)	D(m)	Qty	Total Qty	Remarks
1.	**Earthwork excavation**							L=0.3+1+0.05+3.6+ 0.3+0.1=5.45m
	(a)Septic tank	1	5.45	2.30	2.83	35.47		L=0.8+0.12-0.01+0.10 =0.92m
	(b)Outlet chamber	1	0.92	1.44	1.73	2.13		B=1.0+2(0.12)+2(0.1) = 1.44m
							37.16 m^3	
2.	**Foundation & Flooring concrete in CC 1:4:8**							Ave tk = $\frac{0+0.23}{2}$ =0.12m
	(a) Foundation concrete in C.C 1:4:8	1	5.45	2.30	0.23	2.88		= 0.115 (Say 0.12)
	(b) Flooring concrete in C.C 1:4:8	1	4.65	1.50	0.12	0.84		$= \frac{0.23}{4.65} = \frac{1}{x}$ x=1 in 20
	(c) Outlet chamber	1	0.92	1.50	0.23	0.32		
							4.04 m^3	
3.	**Brick work in C.M 1:6**							
	(a) Brick work of walls of septic tank in B.W in C.M 1:6 (Centre line method)	1	13.50	0.30	2.60	10.53		L=(4.95+1.8)2=13.5m L=0.8+0.06+0.06+1.0+ 0.06+0.06+0.8 =2.84m
	(b) Outlet chamber walls in B.W in C.M1:6	1	2.84	0.12	1.40	0.48		
							11.01 m^3	
4.	**Roof Cover slab of R.C.C. 1:2:4**							
	(a) Septic tank	1	5.25	2.10	0.10	1.10		L=0.3+4.65+0.3 =5.25m
	(b) Outlet chamber	1	1.24	0.92	0.10	0.11		B=0.3+1.5+0.3 =2.1m
	(c) Baffle wall in septic tank	1	1.60	0.05	1.00	0.08		L=0.12+1+0.12 =1.24m
	(d) Baffle wall in outlet chamber	1	1.10	0.05	1.00	0.06		B=0.8+0.12=0.92m
			Gross quantity			(+)1.35		L=0.05+1.5+0.05 =1.6m
	Deduction of manhole	1	0.50	0.50	0.10	(-)0.025		(0.05 = insertion) L=0.05+1.0+0.05 =1.1m
			Net quantity			1.325		
							1.33 m^3	

5.	**Plastering with C.M. 1:3, 12mm thick** Inside walls of septic tank (a) Short wall (b) Long wall Top of the floor Outside of walls above ground level	 2 2 1 1	 1.50 4.65 4.65 14.70	 -- -- -- --	 2.50 2.50 1.50 0.20	 7.50 23.25 7.00 2.94	 **40.69m^2**	L=(0.3+1+0.05+3.6 +0.3+0.3+1.5+0.3)2 = 14.7m
6.	**Laying of Inlet & outlet stoneware pipe 120 Φ . jointing with CM 1: 3** (a) Inlet (b) Outlet end pipe (from septic tank to dispersion trench) (c) Inlet & outlet 150mm Φ stoneware Tee (d) C.I. man hole cover 500mm x 500mm (e) A.C ventilating pipe 50Φ (f) Cowl 50Φ	 1 1 2 1 1 1	 3.00 5.00 -- -- 3.00 --	 -- -- -- -- -- --	 -- -- -- -- -- --	 3.00 5.00 2No 1 No 3.00m 1 No	 3.00m 5.00m 2Nos 1No 3.00m 1No	
1.	DISPERSION TRENCH a) Earth work excavation for 120Ø earthen ware tight joint pipe b)Dispersion Trench	 1 1	 5.00 15.00	 0.30 1.00	 0.75 1.30	 1.13 19.50	 **20.63m^3**	(Assume) Width = 0.30m Depth =0.75m
2.	Filling crushed stone uniform size 20 to 40mm.	1	15.00	1.00	0.90	13.50	**13.50 m^3**	Depth = 0.6+0.3 =0.90m
3.	Filling of ordinary soil over crushed stone	1	15.00	1.00	0.60	9.00	**9.00 m^3**	Depth = 0.3+0.3 = 0.60m
4.	Laying of earthen ware open joined pipe 120Ø with slope 1 in 100	1	14.00	--	--	14.00	**14.00m**	Length =15.00-1.00 =14.00m
5.	Contingencies of petty supervision charges	--	--	--	--	--	L.S	

4.1.B.DETAILED ESTIMATE OF A SEPTIC TANK WITH SOAK PIT

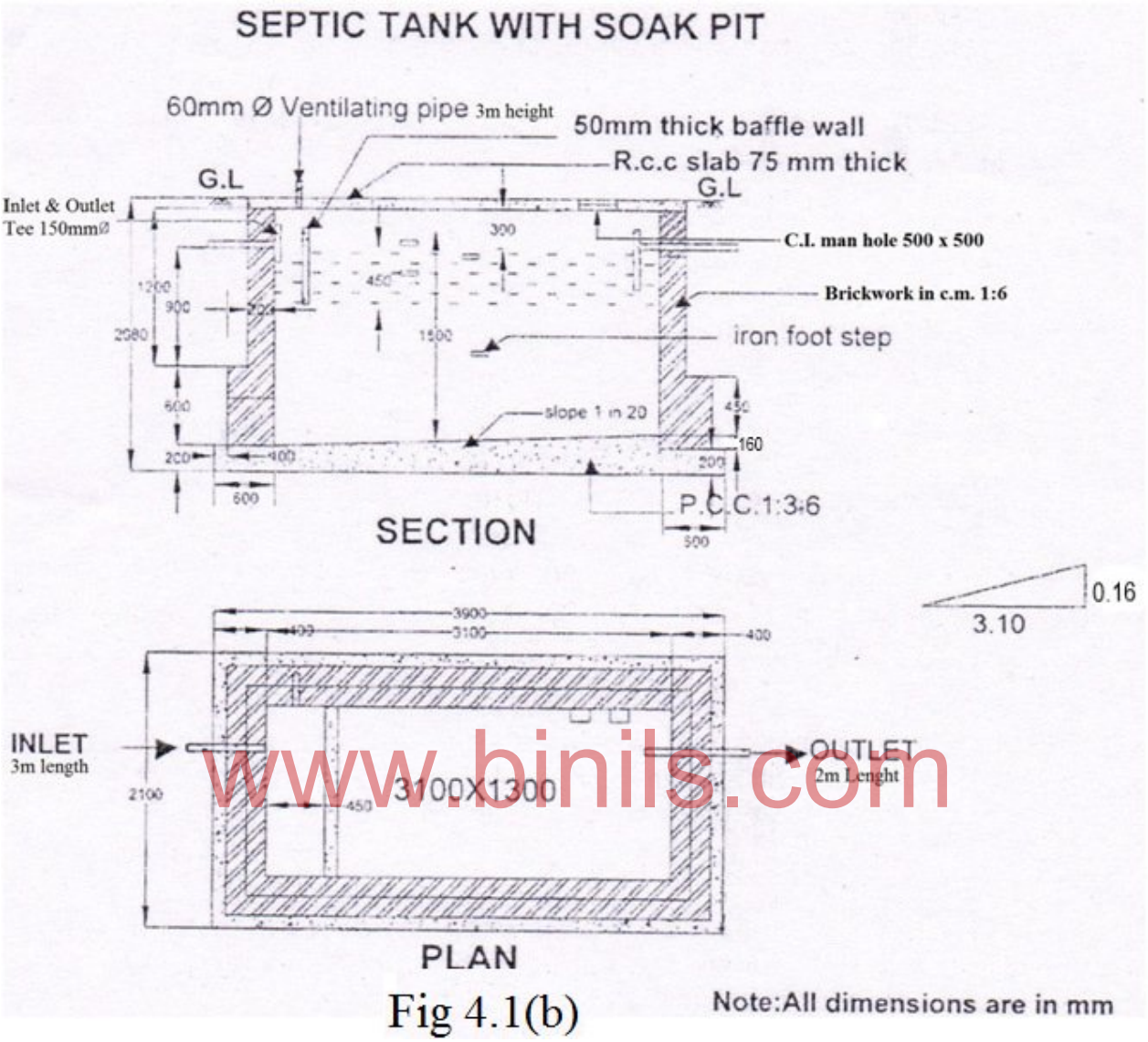
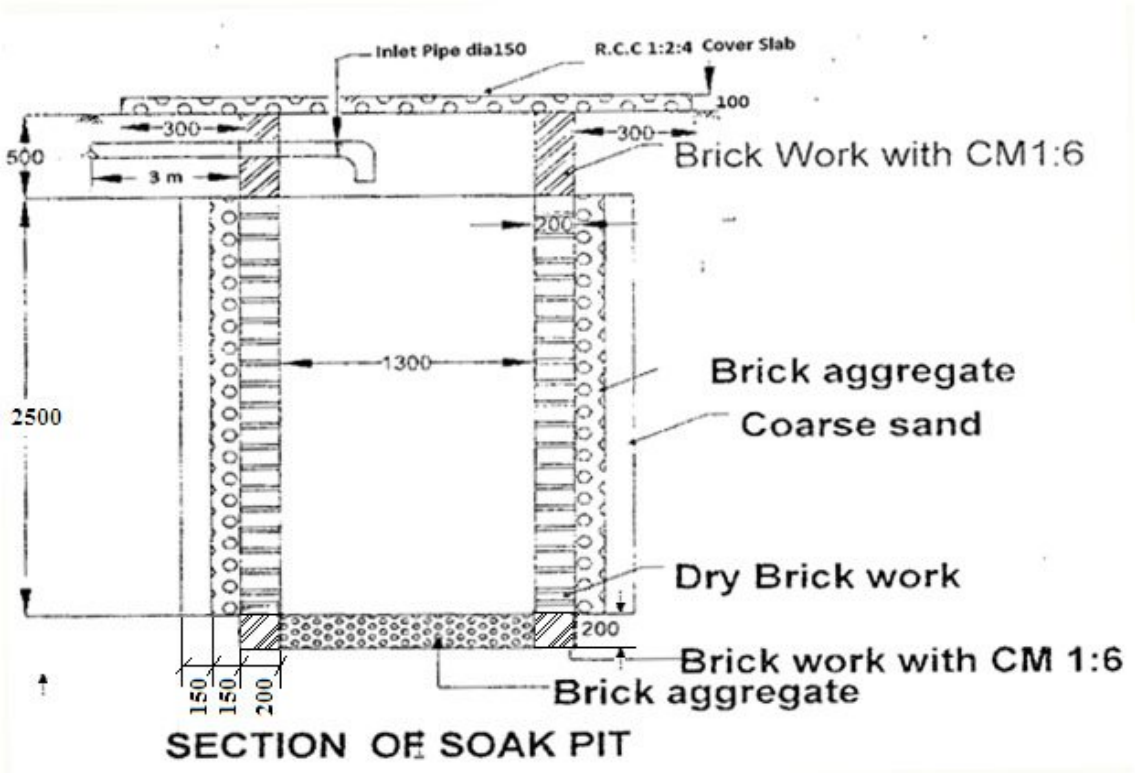
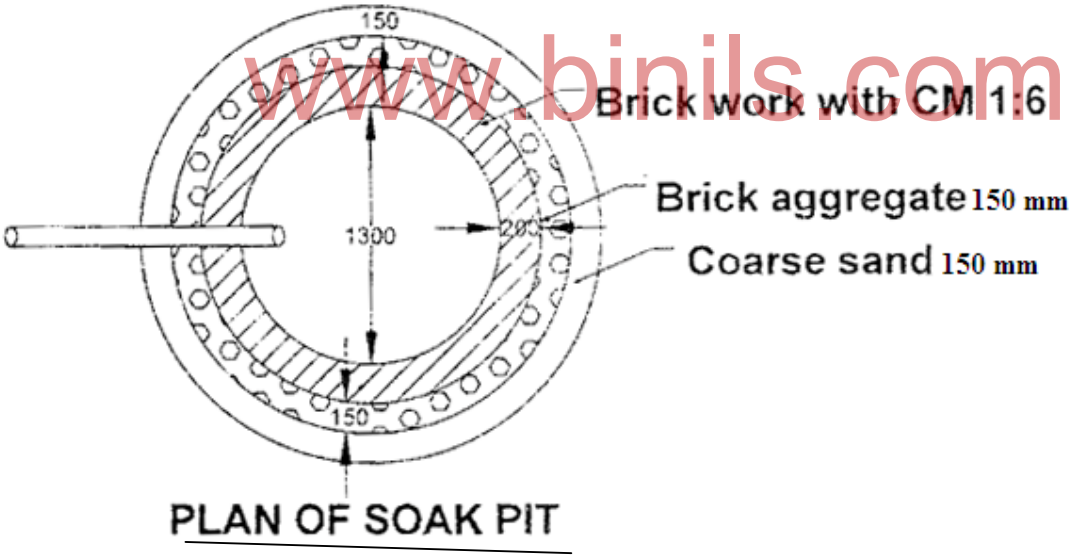


Fig 4.1(b)



SECTION OF SOAK PIT



PLAN OF SOAK PIT

Note:All dimensions are in mm

DETAILED ESTIMATE OF A SEPTIC TANK WITH SOAK PIT

Preparation of detailed estimate for the septic tank with Soak pit as shown in fig 4.1.(b)

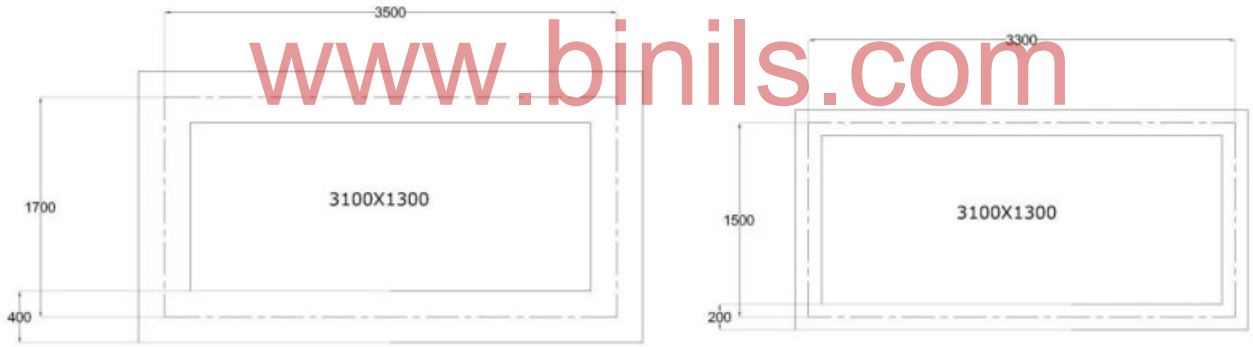
S. No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	**SEPTIC TANK**							
	Earth work excavation	1	3.90	2.10	2.08	17.03	**17.03m ^{3}**	
2.	Foundation Concrete P.C.C 1:3:6	1	3.90	2.10	0.20	1.64	**1.64m^3**	
3.	Flooring Concrete P.C.C 1:3:6	1	3.10	1.30	0.08	0.32	**0.32 m^3**	0+0.16 / 2 = 0.08m
4.	**Brick work in C.M1:6**							
	a) Bottom portion400 mm thick wall	1	10.40	0.40	0.60	2.50		
	b) Top portion 200 mm thick wall	1	9.60	0.20	1.20	2.30	**4.80m^3**	
5.	**R.C.C 1:2:4Cover slab and baffle wall**.							
	a)Septic tank cover slab	1	3.50	1.70	0.075	0.45		
	b)Baffle wall.(Insertion 50 mm on both sides)	1	1.40	0.45	0.05	0.03		
	Deduction Manhole							
	Net Quantity of R.C.C 1:2;4	1	0.50	0.50	0.05	(-)0.01	**0.47m^3**	
6.	**Plastering of septic tank inside in C.M 1:3, 12 mm thick.**							
	a) Inside plastering	1	8.80	--	1.81	15.93		L=(3.1+1.3)2 = 8.8m D=(2.08 –0.2 - 0.075 = 1.81m
	b) Top of floor	1	3.10	1.30	--	4.03		L=(3.5 + 1.7) 2 =10.4m
	c) Plastering out side 0.1 m below G.L.	1	10.40	--	0.10	1.04	**21.00 m^2.**	

7.	**Laying of inlet and outlet stoneware 120mm dia pipe, jointing with C.M.1:3** Inlet pipe Outlet pipe	 1 1	 3.00 2.00	 --- ---	 --- ---	 3.00 2.00	5.00m	
8.	Laying of inlet and outlet Tee 150 mm dia	2	---	----	---	2Nos	2Nos	
9.	C.I manhole 500 x500 mm	1	----	----	----	1No	1No	
10.	Ventilating pipe 60 mm dia	3 m	----	-----	----	3.00 m	3.00m	
11.	Cowl 60 mm dia	1	----	----	---	1No	1 No	
1.	**SOAK PIT** **Earth work excavation** a)Soak pit upto 3m b)Soak pit lower portion	 1 1	 $\frac{\Pi x 2.3^2}{4}$ $\frac{\Pi x 1.7^2}{4}$	 	 3.00 0.20	 12.48 0.45	 **12.93m^3**	Dia of soak pit 1.3+2(0.2)+ 2(0.15)+2(0.15) =2 .3m
2.	**Brick work in C.M. 1: 6** a)At bottom portion b)At top portion	 1 1	 Πx1.5 Πx1.5	 0.20 0.20	 0.20 0.50	 0.19 0.47	 **0.66 m^3**	L= ΠD D=1.3+0.1+0.1 =1.5m
3.	**Dry Brick work at middle portion**	1	4.71	0.20	2.50	2.36	**2.36 m^2**	
4.	**Filling with Brick aggregate** at **bottam of soak pit**	1	$\frac{\Pi x 1.3^2}{4}$		0.20	0.27	**0.27 m^3**	
5.	**Filling of Brick aggregate at outside of soak pit**	1	Πx1.85	0.15	2.50	2.18	**2.18m^3**	L=Π XD D=1.3+2(0.2+0.15/2) =1.85m

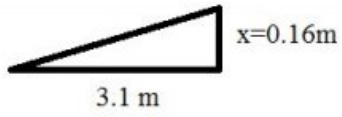
6.	**Filling of coarse sand**	1	Πx2.15	0.15	2.50	2.53	**2.53m^3**	L=Π XD D=1.3+2(0.2+ 0.15 + 0.15/2) =2.15m
7.	**Casting and fixing of cover slab in R.C.C1:2:4**	1	$\frac{\Pi x 2.3^2}{4}$		0.10	0.42	**0.42m^3**	D=1.3+0.2+0.2 +0.3 +0.3 =2.3m
8.	**Fixing of Inlet pipe** 150 mm Φ pipe 'L' Bow	 1 1	 3.00 --	 -- --	 -- --	 3.00 m 1No	 **3.00m** **1No**	
9.	Contingencies of petty item & supervision charges	---	--	---	---	---	**L.S**	

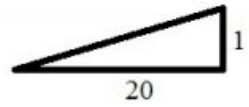
Remarks:

Item No: 1

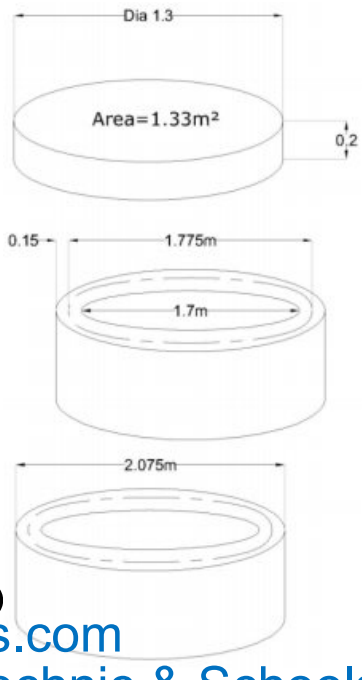


If slope is given (1 in 20)





$\frac{V}{H} = \frac{X}{31} = \frac{1}{20} = 0.155$say 0.16



4.2.OPEN WELL WITH MASONRY STEINING

Taking of quantities for the following items of works involved in the construction of open well with masonry steining.

1. Earth work excavation
   (i)Earth work excavation upto 4500 mm below GL.
   (ii)Earth work excavation below 4500mm depth
2. Balasting and removal of hard rock at 8500mm below GL.
3. Bed concrete 1:3:6 to steining.
4. Brick work in CM 1:4 in steining and parapet wall.
5. Plastering in CM 1:3 in steining and parapet wall
6. Earth work in platform
7. Foundation in cement concrete 1:4:8 in the retaining wall of platform.
8. Brickwork in retaining wall.
9. Plastering of platform.

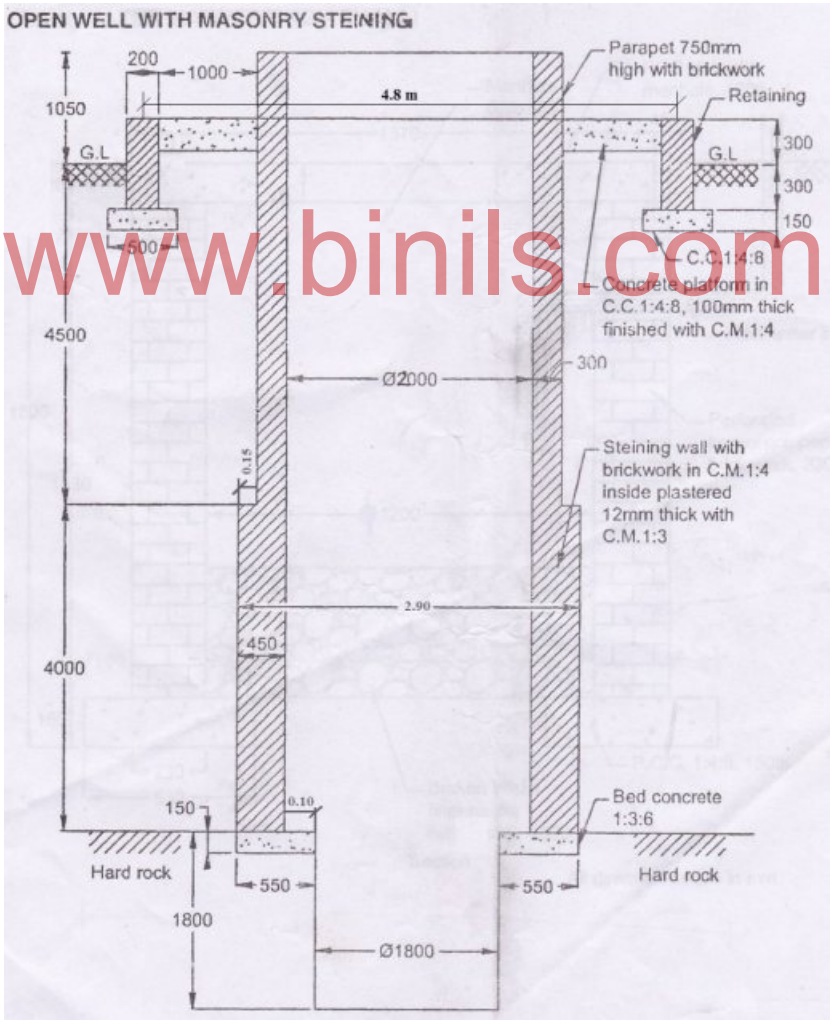


Fig 4.2

DETAILED ESTIMATE OF A OPEN WELL WITH MASONRY STEINING

Preparation of detailed estimate for Open well with masonry steining as shown in fig 4.2

S. No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	**Earthwork excavation**							
	a)Earthwork upto 4.5m	1	$\frac{\Pi x 2.9^2}{4}$		4.50	29.75	**29.75 m^3**	D=2.0+2(0.45) =2.9m
	b)Excavation below 4.5m	1	$\frac{\Pi x 2.9^2}{4}$		4.00	26.44	**26.44 m^3**	
2.	Blasting and removal of hardrock	1	$\frac{\Pi x 2.9^2}{4}$		0.15	0.99	**0.99m^3**	
3.	Blasting and removal of hardrock below 8.65m for bed concrete.	1	$\frac{\Pi x 1.8^2}{4}$		1.65	4.21	**4.21m^3**	D=1.8-.015=1.65m
4.	Bed concrete 1:3:6	1	Πx2.35	0.45	0.15	0.50	**0.50m^3**	D=1.8+0.55/2+0.55/2 =2.35m
5.	**Brick work in CM 1:4 in steining and parapet wall.**							D= $\frac{0.45}{2}$ + 2.0 + $\frac{0.45}{2}$ =2.45m
	a) Bottom step 450mm thick wall.	1	Π x2.45	0.45	4.00	13.86		
	b) Top step 300mm thick wall	1	Πx 2.30	0.30	4.50	9.76		D=1.05-0.75=0.3m
	c) B.W . above G.L.	1	Πx 2.30	0.30	0.30	0.65		
	d) B.W. in parapet	1	Πx 2.30	0.30	0.75	1.63		D=1.05-0.3=0.75m
							25.9m^3	

6.	**Plastering in C.M 1:3 for steining and parapet**							D=4+4.5+1.05 =9.55m
	a) Inside the well	1	Πx2.00	--	9.55	60.03		D= 0.3/2 + 2.0+ 0.3/2 =2.3m
	b) Top of the parapet	1	Πx2.30	0.30	--	2.17		
	c)Outside of parapet	1	Πx2.60	--	0.75	6.13		
							68.33 m^2	
7.	**Platform works**							L=ΠD
	a) Earthwork excavation	1	Πx4.80	0.50	0.45	3.39		D=2.0+0.3+0.3+1.0+ 1.0+ 0.2/2 + 0.2/2 =4.8m
	b) Foundation in cement concrete 1:4:8							
	(i) Retaining wall	1	Πx4.80	0.50	0.15	1.13		D=2.0+0.3+0.3+ 1.0/2 +1.0/2 = 3.6m
	(ii)Concrete pavement	1	Πx3.60	1.00	0.10	1.13		
	c) Brickwork in retaining wall.	1	Πx4.80	0.20	0.60	1.81		
	e)Plastering of flooring of platform	1	Πx4.80	1.0	--	15.08		D= 2.0+0.3+0.3+1.0 +1.0+0.2+0.2 = 5.0m
	f) Plastering of vertical face of platform & 0.1 below G.L.	1	Πx5.00	---	0.40	6.28		
							28.82 m^3	

4.3.TAKING OFF QUANTITIES OF RAIN WATER HARVESTING (RECHARGE WELL METHOD) – SHALLOW RECHARGE WELL

WORKS INVOLED IN TAKING OFF QUANTITIES OF RAINWATER HARVESTING – SHALLOW RECHARGE WELL

1. Earth work excavation.
2. Foundation concrete.
3. Perforated Honey comb brickwork.
4. Filter media with broken brick.
5. Cover slab.
6. Supplying and fixing of man hole
7. Fixing inlet P.V.C. pipe and bends.

RAIN WATER HARVESTING – SHALLOW RECHARGE WELL

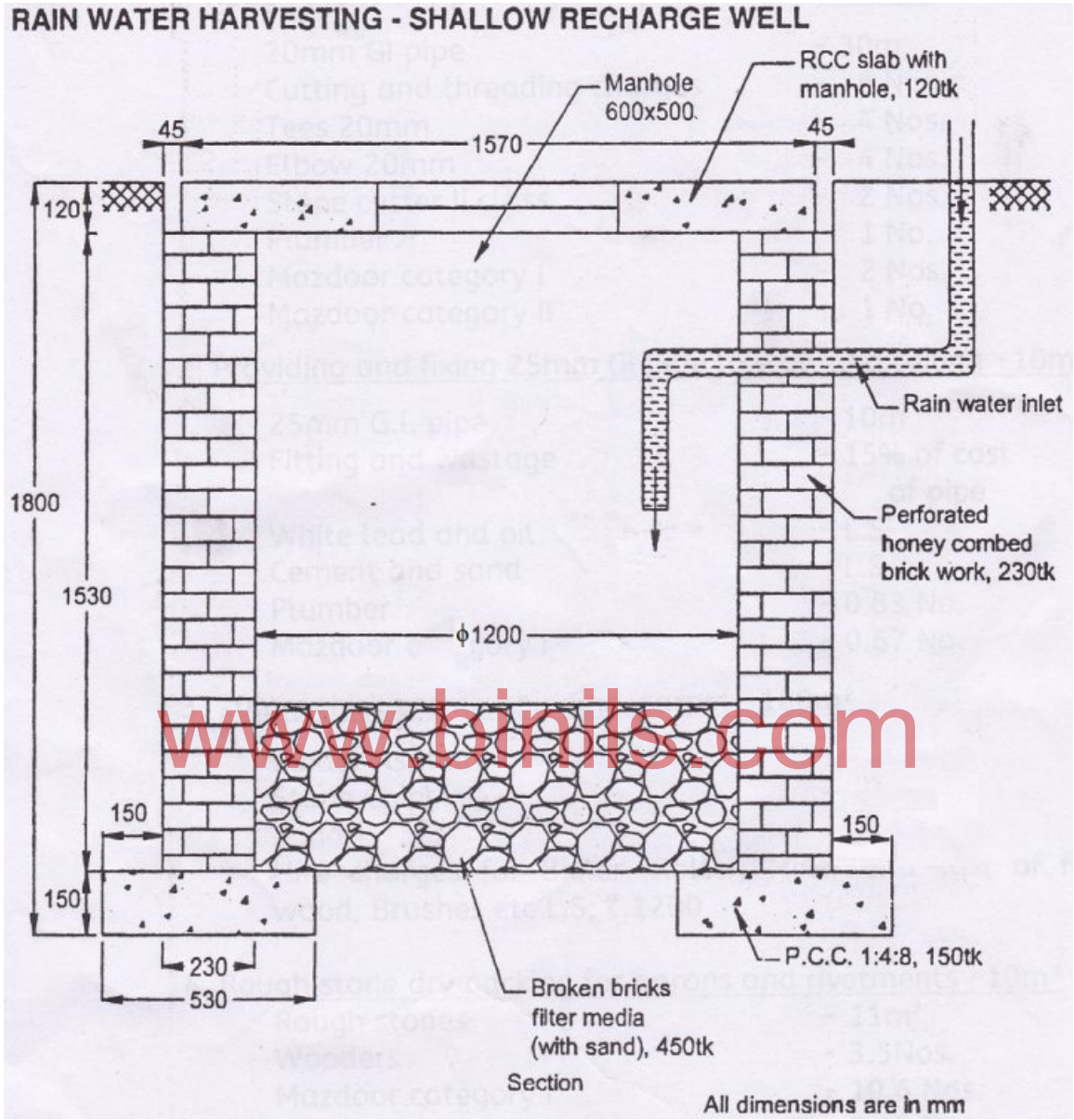


Fig 4.3

DETAILED ESTIMATE OF RAIN WATER HARVESTING

(RECHARGE WELL METHOD) SHALLOW RECHARGE WELL

Preparation of detailed estimate for the Rainwater Harvesting as shown in figure.4.3

S.No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	Earthwork excavation	1	$\frac{\Pi}{4}$ X 1.96^2		1.80	5.44	**5.44m^3**	Dia , D=1.2+0.23+0.23+ 0.15+0.15=1.96m
2.	Foundation concrete in P.C.C 1:4:8	1	Πx1.43	0.53	0.15	0.36	**0.36m^3**	D=1.2+$\frac{0.23}{2}$+$\frac{0.23}{2}$ =1.43m
3.	Perforated honey combed B.W	1	Πx1.43	0.23	1.53	1.58	**1.58m^3**	
4.	Filling of Broken bricks filter media (with sand)	1	$\frac{\Pi}{4}$ X 1.2^2		0.45	0.51	**0.51m^3**	
5.	Cover slab in R.C.C 1:2:4	1	$\frac{\Pi}{4}$ X 1.57^2		0.12	0.230		
	DEDUCTION Manhole Net quantity of R.C.C 1:2:4 cover slab.	1	0.60	0.50	0.12	-0.036	**0.20m^3**	
6.	Supplying and fixing of manhole in C.I	1	---	--	---	---	**1No**	
7.	Fixing of P.V.C. pipe of dia 120mm with 2' L' bow	1	1.45	---	---	1.45	**1.45m**	L=0.5+0.5+0.45 =0.45m

4.4. SQUARE R.C.C. OVER HEAD TANK ON FOUR COLUMNS WITH STAGING

Take off Quantities of square R.C.C. over head tank on four columns with staging as shown in fig.

SQUARE R.C.C. OVER HEAD TANK

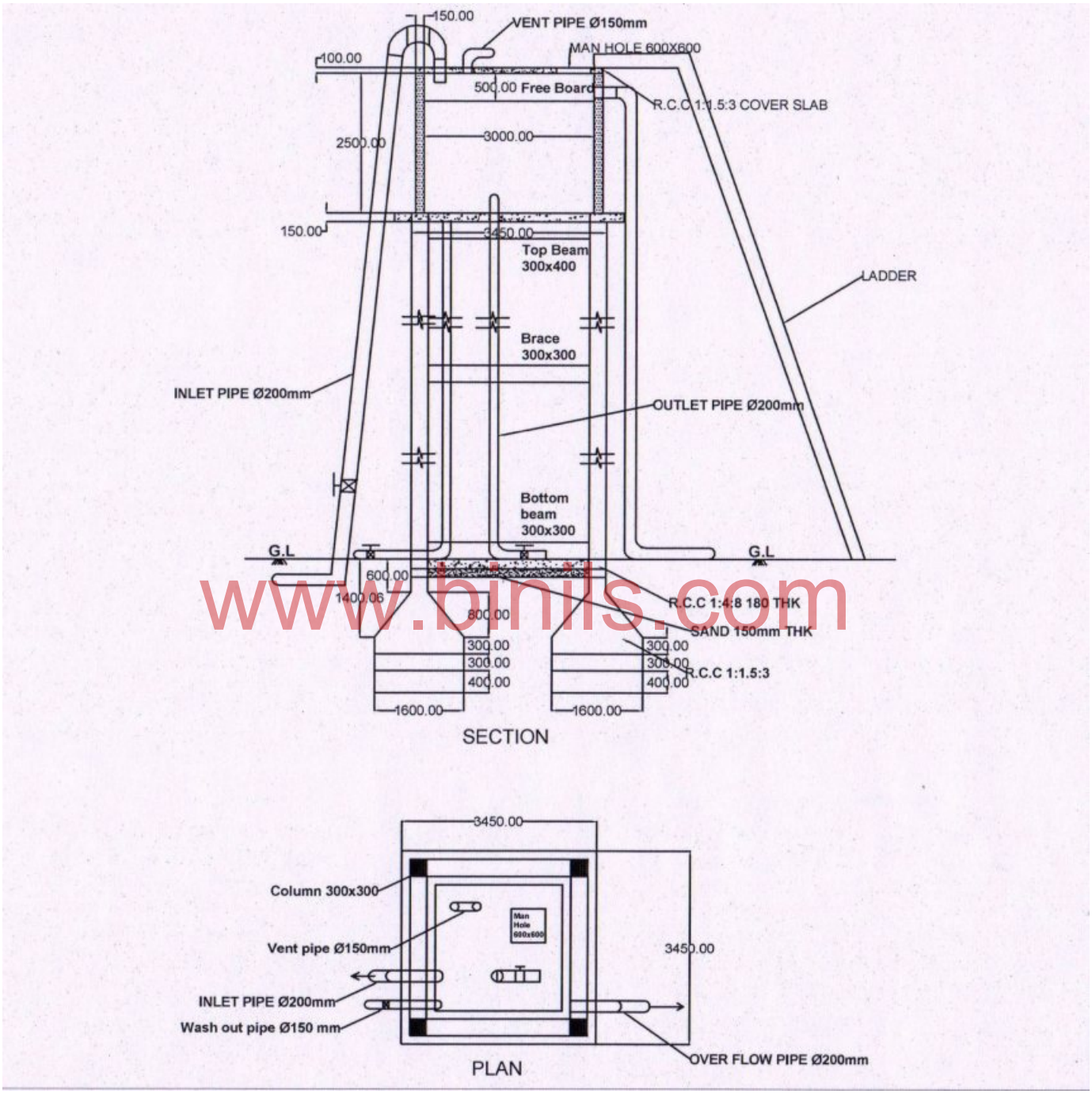


Fig 4.4

DETAILED ESTIMATE OF SQUARE R.C.C. OVER HEAD TANK ON FOUR COLUMNS WITH STAGING

Preparation of detailed estimate for The R.C.C. Over head tank as shown in fig 4.4

S. No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	**Earthwork excavation**							
	a) Columns	4	1.60	1.60	2.40	24.58		3.45-2(0.3) =2.85m
	b) Bottom beam	4	1.55	0.30	0.30	0.56		L=2.85-(0.65) =1.55m
							25.14m^3	
2.	**Sand Cushion**							
	a)columns	4	1.60	1.60	0.40	4.10		
	b)Bottom beam	4	2.85	0.30	0.15	0.51		L=3.45-2(0.3) =2.85m
							4.16m^3	
3.	**Foundation concrete in P.C.C. 1:4:8.**							
	columns	4	1.60	1.60	0.30	3.07		
	Bottom beam	4	2.85	0.30	0.15	0.51		
							3.58m^3	
4.	**Foundation in R.C.C. 1:1.5:3 for footing**							
	a)Footing bottom square portion	4	1.60	1.60	0.30	3.07		Length for Trapezoidal portion $\frac{0.3^2 + 1.6^2}{2}$ =1.33m
	Trapezoidal portion	4	1.33	--	0.80	4.16		
	b)Columns in R.C.C. 1:1.5:3 below GL	4	0.30	0.30	0.60	0.22		3+3+$\frac{0.3}{2}$ +$\frac{0.4}{2}$ =6.35m
	c)Columns in R.C.C. 1:1.5:3 above GL	4	0.30	0.30	6.35	2.29		
							9.74m^3	
5.	**Beams in R.C.C.1 :1.5:3**							
	Ground beam,Brace beam	2x4	2.85	0.3	0.3	2.05		
	Top beam	1x4	2.85	0.3	0.4	1.37		
							3.42m^3	

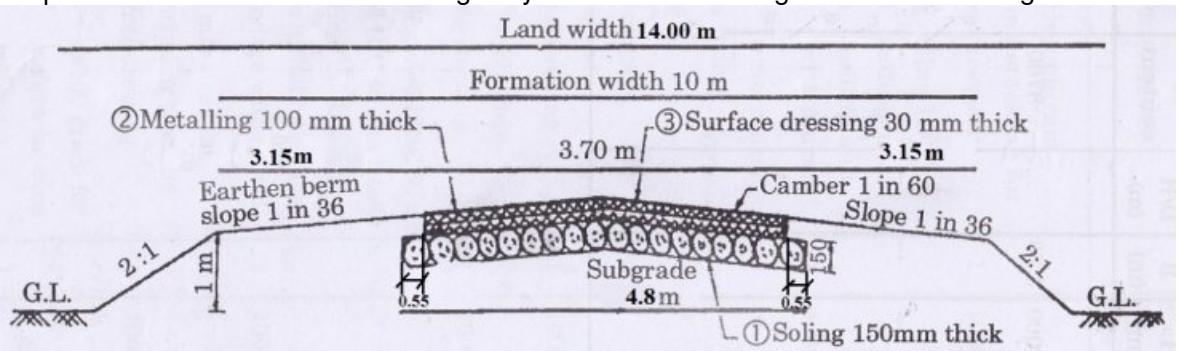
6.	**Vertical walls of a Tank in R.C.C 1:1.5:3**	1x1	12.6	0.15	2.50	4.73	**4.73m^3**	L=2(3.15+3.15) =12.6m
7.	**Floor & Roof slab of a tank in R.C.C 1:1.5:3**							L=3.15+2(0.15) =3.45m
	Floor slab	1	3.45	3.45	0.15	1.79		
	Roof slab	1	3.30	3.30	0.10	1.09	**19.1m^3**	
8.	**Centering works for column**							L=4x1.6=6.40m L=4x0.3=1.20m L=4x(0.3)=1.2m
	(i).Centering area for Column footing	1x4	6.40	---	0.30	7.68		
	(ii)Centering area for column Below GL	1x4	1.20	--	0.60	2.88		D=3- $\frac{0.3}{2}$ - $\frac{0.3}{2}$ =2.7m
	(iii)Above bottom beam	1x4	1.20	---	2.70	12.96		D= 3- $\frac{0.3}{2}$ - $\frac{0.4}{2}$ =2.65 m
	(iv)Above brace beam	1x4	1.20	---	2.65	12.72	**13.24m^2**	
9.	**Centering work for Beams and brace beam**							
	(i). Bottom beam							L= 0.075+ 0.15+ 3 +0.15+0.075 =3.45m
	Inner side	1x4	2.85	---	0.30	3.42		
	Outer side	1x4	3.45	---	0.30	4.14		
	(ii)Brace beam							
	Bottom	1x4	2.85	0.30	---	3.42		
	Inner side	1x4	2.85	---	0.30	3.42		
	Outer side	1x4	3.45	---	0.30	4.14		
	(iii)Top beam							
	Bottom	1x4	2.85	0.30	---	3.42		
	Inner side	1x4	2.85	---	0.40	4.56		
	Outer side	1x4	3.45	---	0.40	5.52	**32.04m^2**	
10.	Centering for floor slab	1x4	2.85	2.85	---	8.12		
	sides	1x4	3.45	---	0.15	2.07	**10.19m^2**	

11.	Centering for Roof slab	1x4	3.3	3.3	---	10.89		
	sides	1x4	3.3	---	0.1	1.32		
							12.21m^2	
12.	**Centering work for tank vertical walls**							
	Inside	1x4	3.00	---	2.50	30.00		
	Out side	1x4	3.30	---	2.50	33.00		
							63.00m^2	
13.	**Plastering outer side of Tank in C.M 1:4 ,18 mm thick.**							D=0.075+2.5+0.1 = 2.68m
	Outer face of Tank walls.	1x4	3.30	---	2.68	35.38		L=3.0-0.075-.075 =2.85m
	Bottom of floor slab (outside)	1x1	2.85	2.85	---	8.12		
	Top of Roof slab	1x1	3.30	3.30	---	10.89		
							54.39m^2	
14.	**Inside plastering with water proof C.M 1:4 , 12mm thick.**							
	Tank vertical wall	1x4	3.00	---	2.50	30.00		
	Bottom of floor slab	1x4	3.00	3.00	---	36.00		
	Top of roof slab	1x4	3.00	3.00	---	36.00		
							102.00m^2	
15.	**Plastering of beams & columns. Beams**							
	(i).Bottom beam sides	4x2	2.85	--	0.30	6.84		
	Top	4x1	2.85	--	0.30	3.42		
	(ii).Brace beam,sides	4x2	2.85	--	0.30	6.84		
	Top&Bottom	4x2	2.85	--	0.30	6.84		
	(iii) Top beam , sides	4x2	2.85	--	0.40	9.12		
	Top&Bottom	4x2	2.85	0.30	--	6.84		
	(iv)Column Plastering	4x4	0.30	--	6.45	30.69		
							(+)70.59m^2	
	Deductions joint of column & Beam							
	Bottom beam	4x2	0.30	0.30	--	-0.72		
	Brace beam	4x2	0.30	0.30	--			

	Top beam	4x2	0.30	0.40	--	-0.72 -0.96	(-) 2.40 m^2 **68.19 m^2**	
		Net plastering Area						
16.	**White washing three coats** As per Item no :13 As per Item no :14 As per Item no :15					 54.39 102.00 68.19	 **224.58m^2**	
17.	Miscellaneous items like Inlet pipe , Outlet pipe ,Over flow , Vent pipe , washout pipe, manhole C.I , M.S. Ladder , Level indicators	L.S	-----	-----	-----	-----	L.S	

5.1. DETAILED ESTIMATE OF WATER BOUND MACADAM ROAD

Prepare detailed estimate of a new highway road as shown in figure 5.1 for 5km length



CROSS SECTION

SPECIFICATIONS :

1. Soling with laterite soling stones 150 mm size and bindage with murum 20 mm thick.
2. Metalling with IRC 40 mm size and 50 mm size stones in equal proportion to an average thickness of 100 mm and blindage with 400 mm thick gravel.
3. Surface dressing with precoated chips using 2.7 m^3 of IRC 12 mm size stone chips per 100 m^2 and 56 kg of bitumen 80/100 grade per m^3 of chips for premixing and 100 kg of bitumen for tack coat per 100 m^2.

Fig.5.1 Road (State highway)

DETAILED ESTIMATE OF WATER BOUND MACADAM ROAD

S.No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	Clearing of bushes surveying and fixing of centre line of a proposed road	----	----	L.S	----	----	----	
2.	Land acquisition	1	5000	14.00	----	70000	**70000 m^2**	
3.	Earth filling for embankment,Volume	1	5000	12.00 m^2	----	60000	**60000 m^3**	A=bd+sd^2 = (10x1+ 2x1^2) =12m^2
4.	Sub grade preparation	----	----	L.S	----	----	----	
5.	Supplying HBG soling stone 150 mm size including Stocking for pre-measurement	1	5000	4.8	0.15	3600	**3600 m^3**	
6.	Supplying and stocking of red gravel for pre-measurement.	1	5000	4.8	0.02	480	**480m^3**	

7.	laying of HBG soling stone 150mm packing, dry rolling and blindage with red gravel.	1	5000	4.8	----	24000	**24000 m^2**	
8.	Supplying and stocking for pre measurement of IRC 50mm size broken stone.	1	5000	3.70	0.05	925	**925m^3**	Depth: 0.1/2=0.05m
9.	Supplying and stocking for pre measurement of IRC 40	1	5000	3.70	0.05	925	**925m^3**	
10.	supplying and stocking for pre measurement of gravel for blindage	1	5000	3.70	0.04	740	**740m^3**	
11.	Mixing evenly IRC 50mm And IRC40mm & spreading metal of coverage thickness of 100mm including rolling and blind age with gravel.	1	5000	3.70	----	18700	**18700 m^2**	
12.	Supplying, stocking for Pre-measurement spreading of IRC 12mm size stone chips for surface dressing.	1	5000	3.70	2.7 / 100	499.50	**499.50m^3**	
13.	**Surface dressing with bitumens 80/100 grade** For pre-mixing For tack coat	 1 1	 100 100	 56 3.70	 --- 1	 5600 3700	 **9300 kg**	
14.	Surface dressing work pre coated chips	1	5000	3.70	---	18500	**18500 m^2**	
15.	Fixing km stones and boundary stones etc,	---	----	L.S	----	----	----	
16.	Fixing sign boards direction sign board and posts.	---	----	L.S	----	----	----	
17.	Arboriculture arrangement	----	----	L.S	----	----	----	
18.	Petty supervision contingencies and enforces charges.	----	----	L.S	----	----	----	

5.2. TAKING OFF QUANTITIES OF CEMENT CONCRETE ROAD WITH SIDE DRAINS

Preparation of detailed estimate of a Cement concrete Road with side drains as shown in figure 5.2.

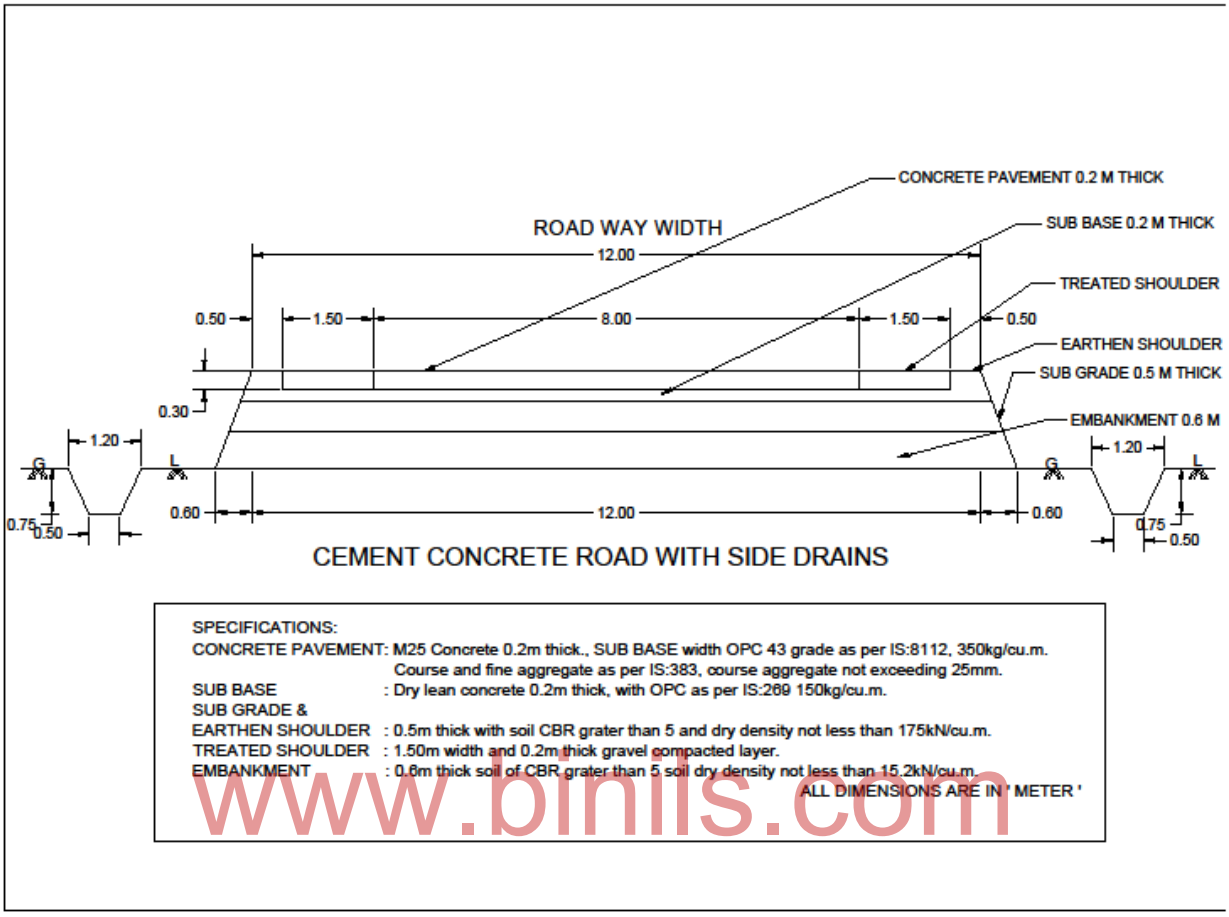


Fig 5.2.

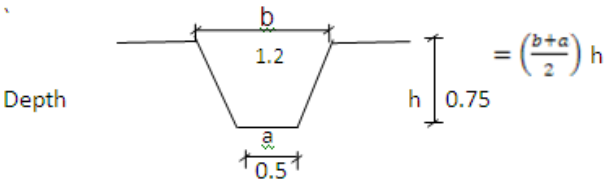
DETAILED ESTIMATE OF A CEMENT CONCRETE ROAD WITH SIDE DRAINS

Preparation of detailed estimate for the Cement concrete Road as shown in Fig 5.2.

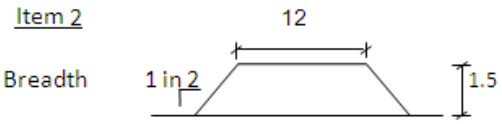
S. No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	Earthwork excavation for side drain in ordinary soil	2	1000	---	0.64	1280	**1280 m^2**	Depth = $\frac{(a+b)}{2}$ h D=$\frac{(1.2+0.5)}{2}$ 0.75 D= 0.64m
2	Filling and compaction of embankment with soil having CBR>5 and dry density not less than 15.2 kN /cu m.	1	1000	16.80	0.60	10080	**10080 m^3**	B= 12+ (2x1.5)x2 = 18.0m B=12+(2X0.9)X2 =15.6m Ave,B=$\frac{18+15.6}{2}$ = 16.8m
3.	Construction of subgrade of soil having CBR>5 and dry density not less than 17.5 KN/cu.m	1	1000	14.80	0.50	7400	**7400 m^3**	To find breadth of subgrade 12+(2x0.5)x2 =14.0m 12+(2x0.9)x2 =15.6m Average B= $\frac{14.0+15.6}{2}$ =14.8m
4.	Formation & compaction of earthen shoulder with soil having CBR>5 and dry density not less than 17.5 kN / cu.m a)Trapezoidal portion b)Rectangular portion	 2 2	 1000 1000	 0.90 1.20	 0.40 0.20	 720 480	 **1200 m^3**	Breadth : Trapezoidal portion B= $\frac{0.5+0.5+(2x0.4)}{2}$ =0.9m Rectangular portion B= 1.50-0.30=1.20m
5.	Treated shoulder with gravel compaction construction	2	1000	1.50	0.20	600	**600m^3**	
6.	Sub base with dry lean concrete with OP Cement confirming to IS: 269, 150 kg / cu.m of concrete coarse and fine aggregate confirming IS: 383 size of course not exceeding 25mm.	1	1000	12.00	0.20	2400	**2400 m^3**	

7.	Construction of concrete surface with M25 concrete coarse and fine aggregate size not exceeding 25mm in coarse aggregate.	1	1000	8.00	0.20	1600	**1600 m^3**	

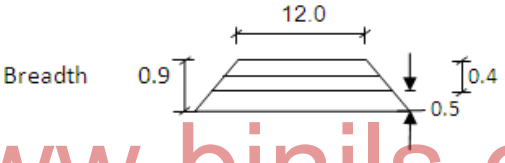
Item 1



Item 2



Item 3



5.3. R.C.C SINGLE SPAN SLAB CULVERT.

Determine the quantities of works for the single span slab culvert.

5.3.1. WORKS INVOLVED IN SINGLE SPAN SLAB CULVERT.

1. Earth work excavation for foundation.
2. Foundation concrete 1:3:6 in foundation.
3. B.W.in C.M. 1:4 in abutment, wingwall, parapet kerb, coping, etc….
4. R.C.C work in 1:2:4 in slab.
5. Wearing coat in C.C . 1:2:4.
6. Pointing work in C.M 1:2 in Brick walls.
7. Painting and fixing of sign boards .
8. Fixing and painting of km stones
9. Fixing and painting of guard stones.

5.3. R.C.C. SLAB CULVERTS - 1.5 METRE SPAN

Example 1. — Prepare a detailed estimate of a slab culvert of 1.50 metre span and 4.00 metre roadway from the given drawing (Fig. 5.3). The general specifications are as follows :—

Foundation concrete shall be of cement concrete 1 : 3 : 6 with stone ballast and coarse sand. Masonry shall be of first class brickwork in 1 : 4 cement coarse sand mortar. Slab shall be of R.C.C. 1 : 2 : 4 with reinforcement as per drawing. Exposed surface of brick masonry shall be cement pointed 1 : 2. Road shall be provided with 10 cm thick wearing coat of 1 : 2 : 4 cement concrete. Assume suitable rates.

R.C.C. SLAB CULVERT 1.50 m SPAN with standard modular bricks

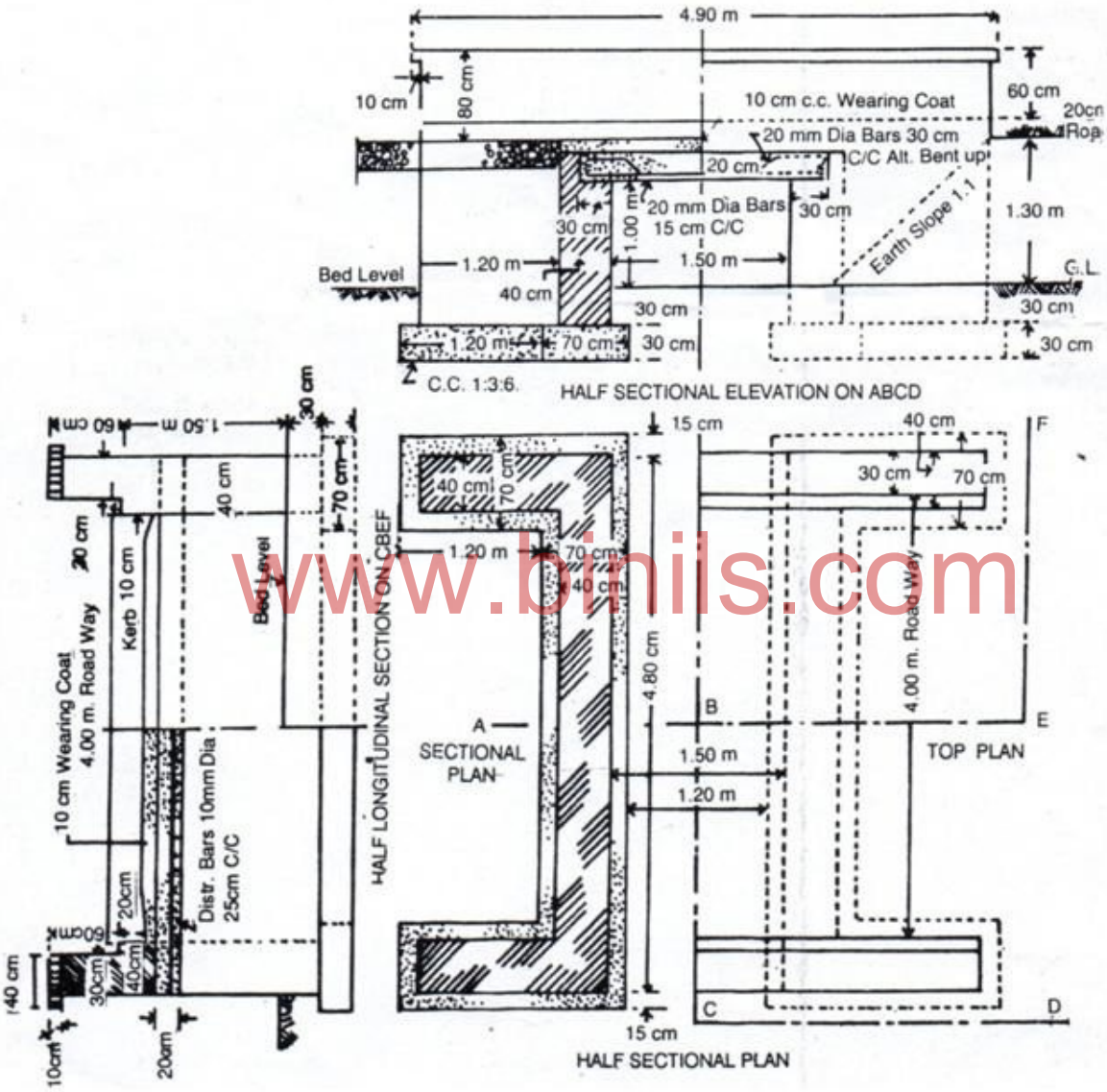


Fig 5.3

R.C.C SLAB – SINGLE SPAN SLAB CULVERT

DETAILED ESTIMATE OF R.C.C SINGLE SPAN SLAB CULVERT

Preparation of detailed estimate for R.C.C .Single span slab culvert as shown in fig. 5.3

S. No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	**Earth work excavation for foundation.**							
	1. Abutment	1x2	5.1	0.70	0.60	4.28		
	2. Wing wall	2x2	1.2	0.70	0.60	2.02		
							6.30 m^3	
2.	**Foundation concrete in C.C 1:3:6**							
	1. Abutment	1x2	5.1	0.70	0.30	2.14		
	2. Wing wall	2x2	1.2	0.70	0.30	1.01		
							3.15 m^3	
3.	**I- class brick masonry in C.M 1:**4							
	a)Abutment	1x2	4.80	0.40	1.50	5.76		
	b)Wing wall	2x2	1.20	0.40	1.50	2.88		
	(up to top of the slab)							D=0.30+1.0+0.2 =1.5m
	c)Parapet wall up to kerb	1x2	4.70	0.40	0.30	1.13		
	d)Parapet above kerb	1x2	4.70	0.30	0.50	1.41		
	(Excluding coping)							
	e)Coping	1x2	4.90	0.40	0.10	0.39		
							11.57m^3	
	Deduction Bearing of R.C.C. slab	1x2	4.80	0.30	0.20	0.58	-0.58m^3	
		Net volume of I class brick masonry in CM 1:4.					**10.99m^3**	
4.	Deck slab in R.C.C.1:2:4	1	4.80	2.10	0.20	2.016	**2.016 m^3**	B=1.5+2(0.30) =2.1m
5.	Wearing coat in C.C.1:2:4	1	4.00	2.30	0.10	9.20	**9.20 m^3**	B=1.5+2(0.40) =2.3m

6.	**Pointing with C.M.1:2 in Brick walls (exposed faces only)**							
	a)From 0.1m below G.L to bottam of copping	1x2	4.70	---	2.10	19.74		D=0.5+0.2+1.3 +0.10 =2.1m
	b)Inner side of parapet except coping..	1x2	4.70	---	0.80	7.52		B=0.1+0.4+0.1 +0.1 =0.70m
	c) Coping (Inner edge, top, outer edge and outer) Inner edge	1x2	4.90	0.70	---	6.86		
	d) Ends of parapet in kerb	2x2	---	0.40	0.20	0.32		
	e)Ends of parapet above kerb	2x2	---	0.30	0.50	0.60		R.C.C. Slab =0.2m
	f)Ends of coping & bottom side	2x2	0.40	---	0.20	0.32		Below G.L =0.1m
							$35.36m^2$	
	DEDUCTION							
	Water opening (Rectangular)	1x2	1.50	---	1.30	3.90		B=1.0+0.2+0.1 =1.3m
	Triangular portion below earth slope	1x2	$\frac{1}{2}$ x bh = $\frac{1}{2}$ x 1.3 x1.3 = $0.845m^2$			1.69		
		Total deduction				(-) 5.59		
		Net Pointing Area					**29.77 m^2**	
7.	Painting and fixing of sign boards	..... L.S.....				...	...	
8.	Fixing and painting of km stones	..... L.S.....				...	...	
9.	Fixing and painting of guard stones	..... L.S.....				...	...	

DETAILED ESTIMTE FOR TWO SPAN TEE BEAM BRIDGE WITH SQUARE RETURNS

Preparation of detailed estimate for The Two span Tee beam bridge with square returns as shown in Fig5.4.

5.4. WORKS INVOLVED IN THE ESTIMATION OF TEE BEAM BRIDGE

1. Earth work excavation for abutments ,wing walls and pier
2. Foundation concrete for abutments, wing walls and pier
3. Course rubble masonry II sort in C.M 1:5
4. Cement concrete bed blocks in C.C 1:2:4
5. Wearing coat
6. Casting of RCC T-beam ,slab, kerb , post and pillar in RCC 1:2:4 mix
7. Rough stone packing for rivetments
8. Writing km details in the facing of parapet
9. Kerb painting,parapet painting
10. Fixing of guard stones and km stones.

5.4. Detailed estimate for Two span Tee beam bridge with square returns.

S. No	Description	No	Dimensions			Qty	Total Qty	Remarks
			L (m)	B(m)	D(m)			
1.	**Earth work excavation**							
	a)Abutments	1x2	4.60	1.80	0.60	9.94		L=4.4+0.1+0.1 =4.6m
	b)Wing walls (Returns)	2x2	1.80	1.00	0.60	4.32		D=(+13.00) – (+12.40)
	c)Piers	1x2	4.60	1.20	0.60	3.31		D = 0.60m
							17.57m^3	
2.	**Foundation Concrete**							
	a)Abutments	1x2	4.60	1.80	0.30	5.00		D=(+12.70) – (+12.40)
	b)Wing walls (Returns)	2x2	1.80	1.00	0.30	2.16		D = 0.30m.
	c)Piers	1x2	4.60	1.20	0.30	1.66		
							8.82 m^3	

TWO SPAN TEE BEAM BRIDGE WITH SQUARE RETURNS

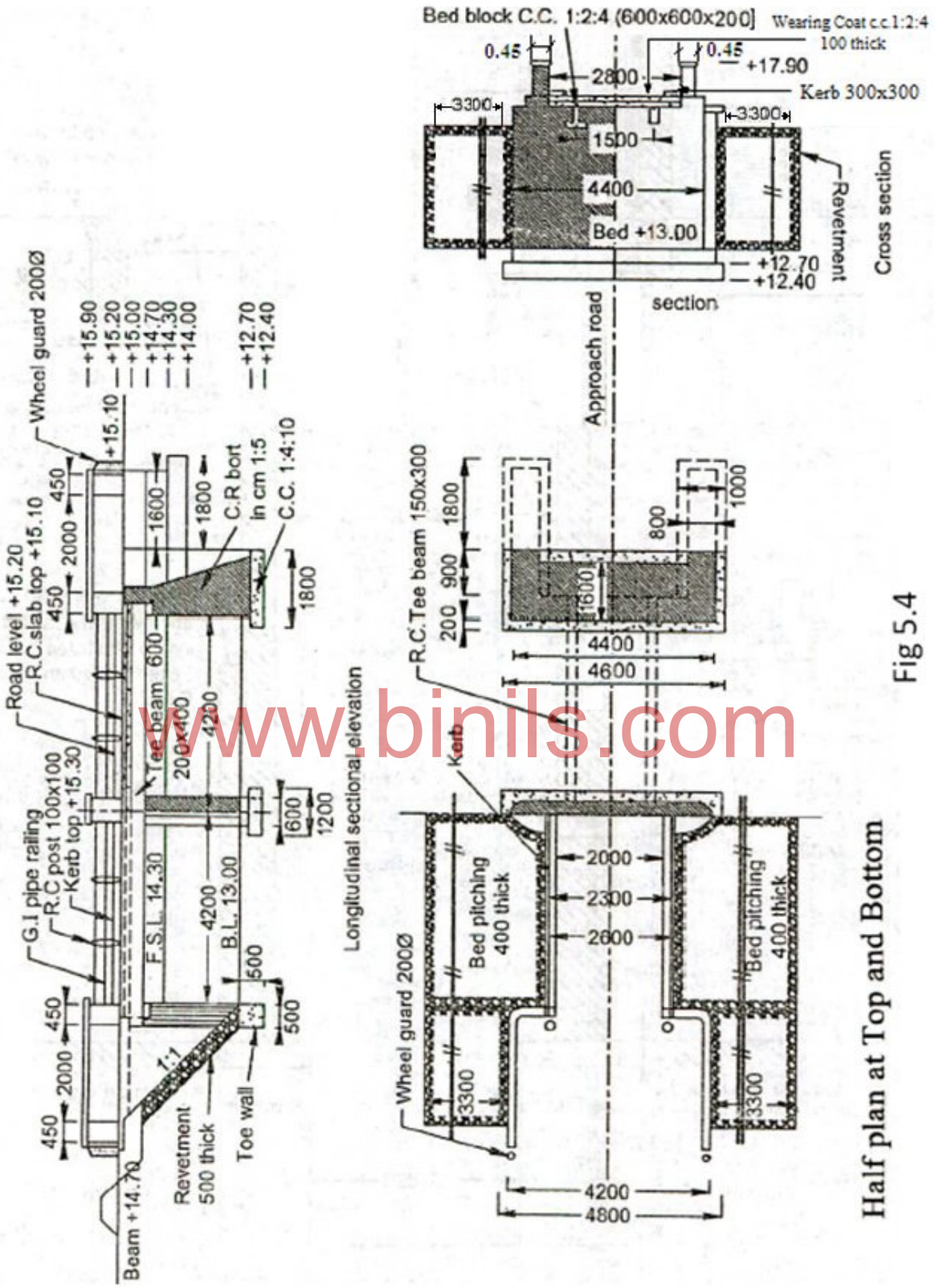


Fig 5.4

Half plan at Top and Bottom

3.	**Coursed Rubble masonry in C.M. 1:5.**							Abutments B= $\frac{1.6+0.6}{2}$ =1.10m D= (+14.70)-(+12.70) = 2.00m Abutment top portion D=(+15.10)-(+14.70) =0.40m Wing walls returns L=1.8-0.1+.90 =2.60m (+ 15.0) – (+12.70) = 2.3m (+ 15.9) – (+15.20) = 0.7 m
	a)Abutments	1x2	4.40	1.10	2.00	19.36		
	b)Abutment at top portion	1x2	4.40	0.60	0.40	2.11		
	c)Wing walls (Returns)	2x2	2.60	0.60	0.50	3.12		
	d)Pier	1x1	3.80	0.60	2.30	5.24		
	e)Cut and ease water	2	$\frac{\Pi x\ 0.6^2}{4}$ x $\frac{1}{2}$		2.30	0.65		
	f)Pillars	1x10	0.45	0.45	0.70	1.42		
	g)Parapet	2x2	2.00	0.45	0.70	2.52		
							34.42m^3	
4.	**Casting of bed blocks and wearing coat in R.C.C. 1:2:4**							Take bearing150mm on each side) L=4.2+4.2+0.6+ 0.15 +0.15 = 9.3m
	a)Wearing coat	1	9.30	2.80	0.10	2.60		
	b)Bed blocks	3x2	0.60	0.60	0.20	0.432		
							3.03m^3	
5	**Casting of T-beam, slab, kerb and railing post in R.C.C. 1:2:4**							T-Beam depth D=(+15.10)-(+14.70) =0.40m Railing post depth D=(+15.90)-(+15.30) =0.60m
	Slab	1	9.30	2.80	1.00	26.04		
	T-beam	1x2	9.30	0.20	0.40	1.49		
	Kerb	1x2	9.30	0.30	0.30	1.67		
	Railing post	2x4	0.10	0.10	0.60	0.048		
							29.25m^3	
6.	**Rough stone dry packing for rivetments**							
	Toe wall	2x2	3.30	0.50	0.50	3.32		Rivetment B=(+14.70)-(+13.00) = 1.7m
	Rivetments	2x2	3.30	1.7√2	0.50	15.86		
							19.28m^3	
7.	Fixing of wheel guard Dia 200.	2x2	0.70	---	---	2.80 m	**2.80 m**	
8.	Painting of centre line of road	----	----	L.S	----	----	----	
9.	Fixing of guard stones	----	----	L.S	----	----	----	
10.	Fixing of Km stone Sign boards	----	----	L.S	----	----	----	

Model Question Paper - 1

Time-Three hours

(Maximum Marks:75)

[N.B: (1)Answer any five questions in each PART-A and PART-B.
Q.No.8 in PART-A and Q.No.16 in PART-B are compulsory.
(2)Answer division (a) or division (b) of each question in PART-C.
(3)Each question carries 2 marks in PAR-A,3 marks in PART-B and 10 marks in PAR-C.]

PART A :

1. Differentitate general specification and detailed specification.
2. What particulars are to be incorporated in a detailed specification of materials.
3. Define the term salvage value.
4. Write the formula used to calculate the annual installment of sinking fund.
5. What particulars you need to arrive at a reasonable rate for earth work in trenches.
6. What do you mean by observed data.
7. What will be the unit of measurement for the wearing coat of a bridge.
8. Where steining walls are provided.

PART B :

9. What are the points to be considered while writing a technical report on a project.
10. Write detailed specifications for (i)sand for mortar and (ii) Bricks.
11. What are the factors which govern the rent of a building.
12. Write any three items of works involved in the construction of a manhole.
13. How you estimate the quantity of steel reinforcement for various RCC elements.
14. What are the items of works involved in the laying of a water bound macadam road.
15. Mention any five item of works in single span R.C.C culvert
16. What are the items of works involved in the construction of side drains for a Road.

PART C :

17.A.(i).Write a detailed specification for the coarse aggregate to be used in reinforced cement concrete.
(ii).Write general specification for any six items of works involved in the construction of a slab culvert.

(OR)

B.(i).Write a detailed report about the proposed new bus terminus for a developing town.
(ii).List out the documents and sketches to be enclosed with the above report.

18.A.(i).Write a small note on valuation.
(ii).A building was constructed in the year 2011 for a total cost of Rs.40 lakhs. Its salvage value in year 2030 is expected to be Rs.15 lakhs. Find the book value of the building in the year 2020 by sinking fund method , and also determine the annual installment of sinking fund, assuming the rate of interest as 8%.

(OR)

B.(i).How the nominal lease rent are fixed for Government buildings when they are rented to service associations of the department employees.
(ii).A person is having a house building worth Rs.1200000 at present market value,

constructed 10 years back in a plot area of 240m^2 . The present market value of land in the locality is Rs.3000 per m^2. The cost of amenities provided to the building is Rs.120000. Allowing a rate of depreciation of 2% and taking the nominal interest on investment as 9%, fix a fair monthly rent to the building.

19.A. Analyze and determine the rates for the following items of work with the given data:

(i).Supplying and laying of stone ware glazed pipes and specials for sewers 100mm dia lowering in trenches upto a depth of 1.5m, jointing with cement mortar 1:1 including testing but excluding earth work excavation- 1m.

(ii).Casting and supplying 1200mm dia, 300mm high. 25mm thick ferrocement ring for well sinking -1No.

(OR)

B.(i).20 mm thick Premix chipping carpet – 1m^2.

(ii).Rough stone dry packing for aprons and rivetments - 1m^3.

Materials and labour requirement:

1) Supplying and laying of stone ware glazed pipes-30m.

600mm length 100mm dia pipes	-- 50 No.
Cement	--18 Kg
Sand (medium)	--0.11 m^3.
Spun yarn	--2.0 Kg
Bitumen, Tools & Plants, Testing etc	--Rs.400.00 (LS)
Mason I class	--1.0 No.
Mason II class	--4.0 No
Mazdoor category I	--5.0 No.
Mazdoor category II	--3.0 No

3) Casting and supplying 25mm thick ferro cement ring for well sinking-10 Nos.

Stone chips	--0.30m^3.
Sand (medium)	--0.15 m^3.
Cement	--107 kg
3mm gauge wire mesh	--12 m^3.
Chicken mesh	--24 m^2.
Mason I class	--2.4 No.
Mazdoor category I	--4.0 No.
Mazdoor category II	--4.0 No.
Labour for shifting and curing	--Rs.200 per 10 Nos
Mason II class	--1.6 No.
Mazdoor category I	--0.5 No.
Mazdoor category II	--1.1 No.

4) 20 mm thick Premix chipping carpet – 100m^2.

Binder Asphalt	--255 kg
Stone chips	--2.7m^3.
Sand	--0.3 m^3.

Hire charges for Boiler, Roller, Mixer and cost of fire wood, brushes etc LS :Rs.950.00.

5) Rough stone dry packing for aprons and rivetments - 10m^3.

Rough stones	--11 m^3.
Wooders	--3.5 No
Mazdoor category I	--10.6 No.
Mazdoor category II	--7.1 No.

Cost of materials and lead particulars:

Materials	Unit (Rs)	Cost (Rs)	Lead	Rate for lead / km(Rs)	Handling charges(Rs)
Cement	50 kg	280.00	4	2.00	5.00
Sand	m^3	250.00	30	20.00	60.00
Rough stone	m^3	800.00	20	20.00	80.00
Stone chips	m^3	520.00	18	40.00	0.50
SW pipe 100mm dia	0.6m	60.00	4	0.50	0.50
Spurn yarn	1kg	16.00	--	--	--
Binder Asphalt	1kg	21.00	--	--	--
3 mm gauge wire mesh	m^3	150.00	--	--	--
Chicken mesh	m^3	40.00	--	--	--

Cost of Labour:

Mason I class	--Rs.550.00 per day
Mason II class	--Rs.500.00 per day
Mazdoor category I	--Rs.400.00 per day
Mazdoor category II	--Rs.275.00 per day
Wooder	--Rs.450.00 per day

20 (A) Tack the quantity of R.C.C. in column footing for the over head tank shown in sketch 1. Using Trade system

(OR)

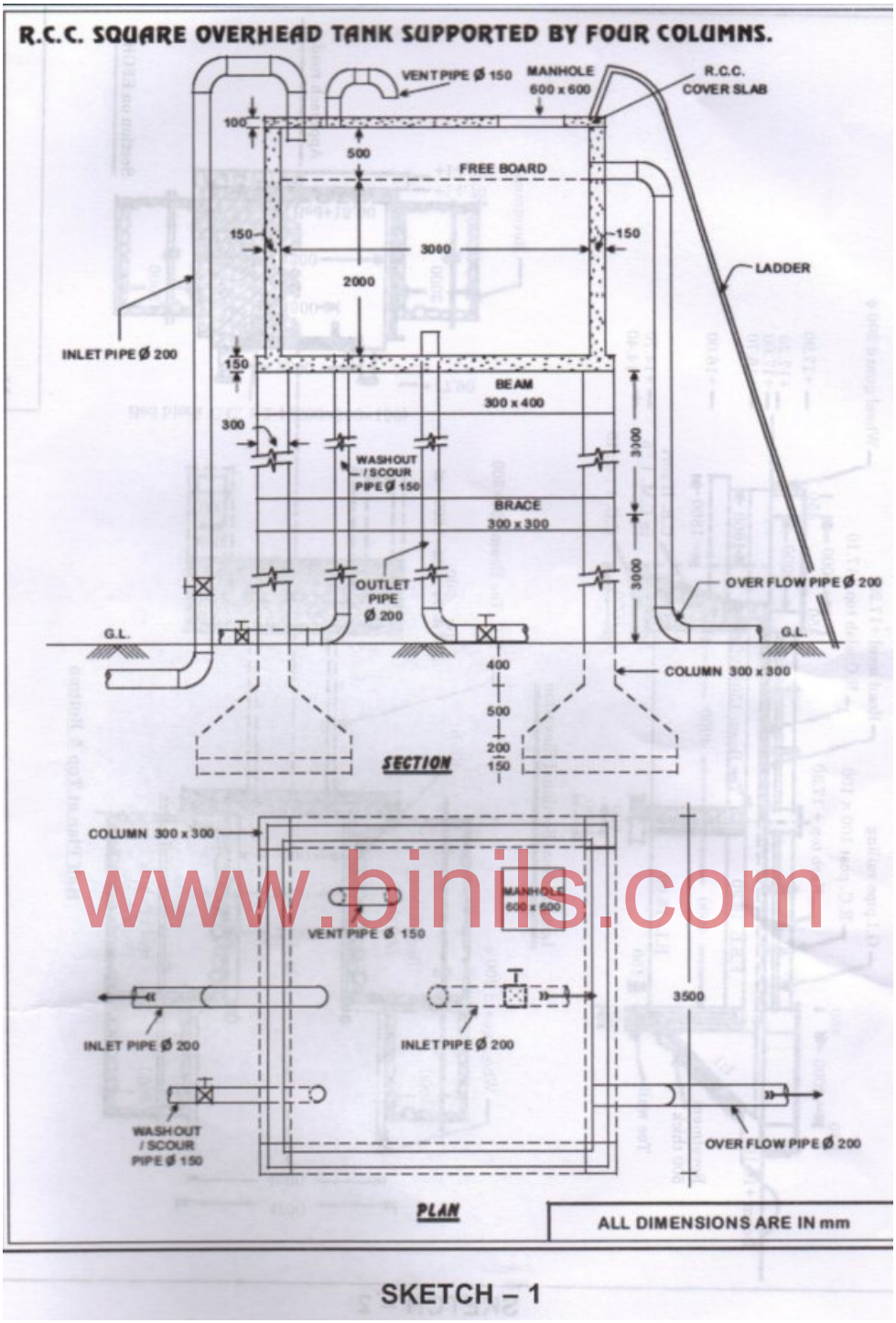
(B) Tack the area of plastering of the side walls (inner and outer) of the over head tank shown in sketch 1. Using Trade system

21. Tacking the quantity of the following items for Detailed estimate of A TEE BEAM BRIDGE shown in sketch 2.

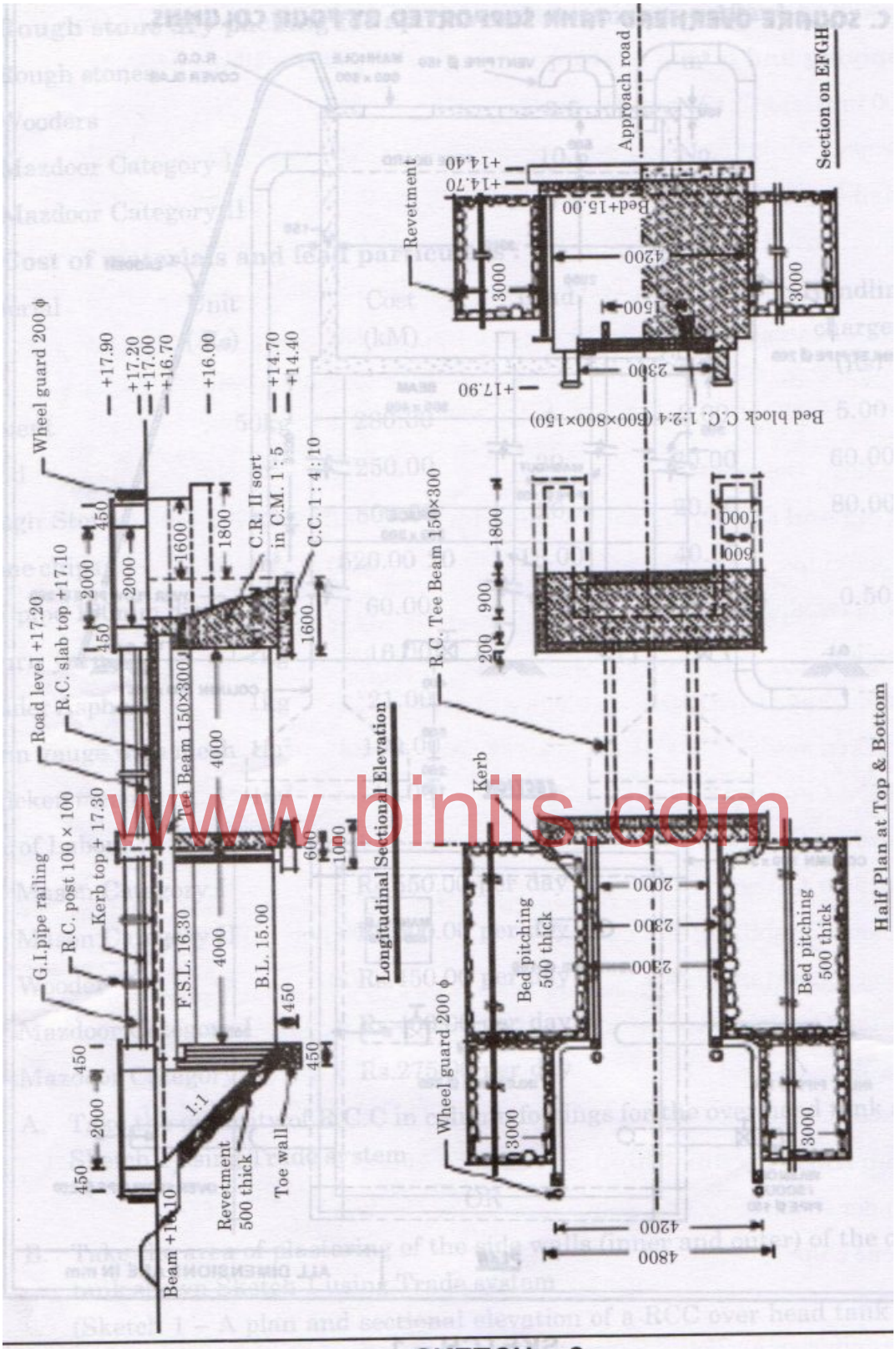
A (i) Tack the quantity of C.C. 1:4:10 in foundations
(ii) R.C.C. 1:2:4

(OR)

B (i) C.R masonry II sort in C.M. 1:5.
(ii) Rough stone dry packing for rivetments



SKETCH – 1



SKETCH – 2

Model Question Paper - 2

Time-Three hours

(Maximum Marks:75)

[N.B: (1)Answer any five questions in each PART-A and PART-B.
Q.No.8 in PART-A and Q.No.16 in PART-B are compulsory.
(2)Answer division (a) or division (b) of each question in PART-C.
(3)Each question carries 2 marks in PAR-A,3 marks in PART-B and 10 marks in PAR-C.]

PART A :

1. Differentiate general specification and detailed specification.
2. What are the particulars are to be incorporated in a detailed specification of materiel?
3. Define valuation?
4. Define depreciation?
5. What do you meant by observed data?
6. Write any three items of work involved in laying WBM road.
7. State the unit of measurement for the fabrication of steel for the deck slab of a culvert.
8. Write any three items of work involved in the construction of manhole.

PART B :

9. What are the types of specification?
10. Write the general specification for curing?
11. Write any three factors affecting value of the property?
12. Explain methods for calculating depreciation?
13. What is schedule of rates
14. What is lead statement
15. Mention any five item of works in single span R.C.C culvert
16. Define steining wall and state the uses of steining wall .

PART C :

17. A (i) Write a detailed specification for plastering with CM 1:3, 12mm thick
(ii) List out the documents that is to be attached to the report?

(OR)

B (i) Write the detailed specification for form work and centering to RCC roofing.
(ii) Write a detailed report for the construction of the hospital in your locality.

18. A (i) Write a small note on valuation.
(ii)The cost of building constructed 10 years back was Rs.1,20,000. The standard rate of depreciation is 2 %. Calculate the present value of the building when (1) no allowance is made for the appreciation value (2) when allowance of 5% per annum is allowed for the increase of material cost.

(OR)

B (i) Mention any five important outgoings of a property.
(ii) Differentiate between scrap value and salvage value. Give atleast one example for each of the above

19. A. Analyse and determine the rates for the following items of work with the given data
(i) Rough stone dry packing in aprons and revetments in canals with 150mm to 300 mm size hard granite stones-1m^3
(ii) Providing premixed carpet over an existing bitumen surface, with precoated chips, using 2.7m^3

of chips per 100m^2 and 56kg of bitumen per m^3 of chips for premixing and 100kg of bitumen per 100m^2 for finishing coat- 100m^2.

(OR)

B. (i) 20mm dia CPVC pipes are to be provided and fixed on the walls of the building externally with clamps at 1.2m interval for water supply. Determine the rate for supplying and fixing the pipe per metre length with following given data

Cost of 6m length 20mm CPVC pipes	--Rs.306.00
Cost of fittings	--30% of cost of pipes
Cost of clamps including fixing:	--Rs.5.00 each
Fitter grade-I	--Rs.500/day
Fitter grade-II	--Rs.400/day
Mazdoor grade-II	--Rs.300/day

(ii) Providing and laying 25mm dia GI pipes and specials with fittings on trenches of 0.45m depth for water supply, including cutting and threading of pipes , but excluding digging and refilling of trenches- rate for 1m length

Material And Labour Requirement

A. Rough stone dry packing

Rough stone granite including spalls for filling and wedging-1m^3

0.17 Nos	–Mason I class,
0.35 Nos	–Sone packer,
0.52 Nos	–Mazdoor category I ,
0.52 Nos	–Mazdoor category II

Pre-mixed carpet over an existing bitumen surface.

Stone chips(12mm)	–2.7m^3
Bitumen for premixing	–need to calculate.
Bitumen for finishing coat	–100 kgs
0.05 day	–Tar boiler,
0.01 day	–Hot bitumen mixer,
0.06 day	–Road roller,
3Nos	–Mazdoor category I

B. Providing And Laying 25mm dia GI Pipes

25mm GI pipes-30m,

Add 30% cost from pipes for specials and fittings

Whit lead and hemp oil(L.S)	–Rs.320.00,
Testing and sundries(L.S)	–Rs.200.00
0.5Nos	–Fitter I class,
1.0Nos	–Fitter II class,
1.0 Nos	–Mazdoor category I

Cost of materiels

Rough stone granite(1m^3)	–Rs.650.00
Stone chips(1m^3)	–Rs.1050.00
Bitumen for premixing(kg)	–Rs.40.00
Bitumen for finishing coat(kg)	–Rs.40.00
G.I pipes 25mm dia (m)	–Rs.125.00

Cost of labour

Mason I class	–Rs.500/each
Mazdoor I category	–Rs.400/each
Mazdoor II category	–Rs.300/each
Fitter I class	–Rs.500/each

Fitter II class –Rs.450/each
Stone packer –Rs.450/each

Hiring charges

Tar boiler –Rs.900/day
Hot bitumen mixer –Rs.4000/day
Road roller –Rs.1500/day

20. Take out the quantities of the following items of work for the "septic tank with dispersion trench" shown in sketch-1.

A. i. C.C 1:4:8 for foundation.
ii. B.W in C.M 1:4 for septic tank.
iii. Earthwork excavation for septic tank and dispersion trench.

(OR)

B. i. Plastering with C.M. 1:3 ;12mm thick.
ii. R.C.C. 1:2:4 for covering slab, manhole and baffle wall.

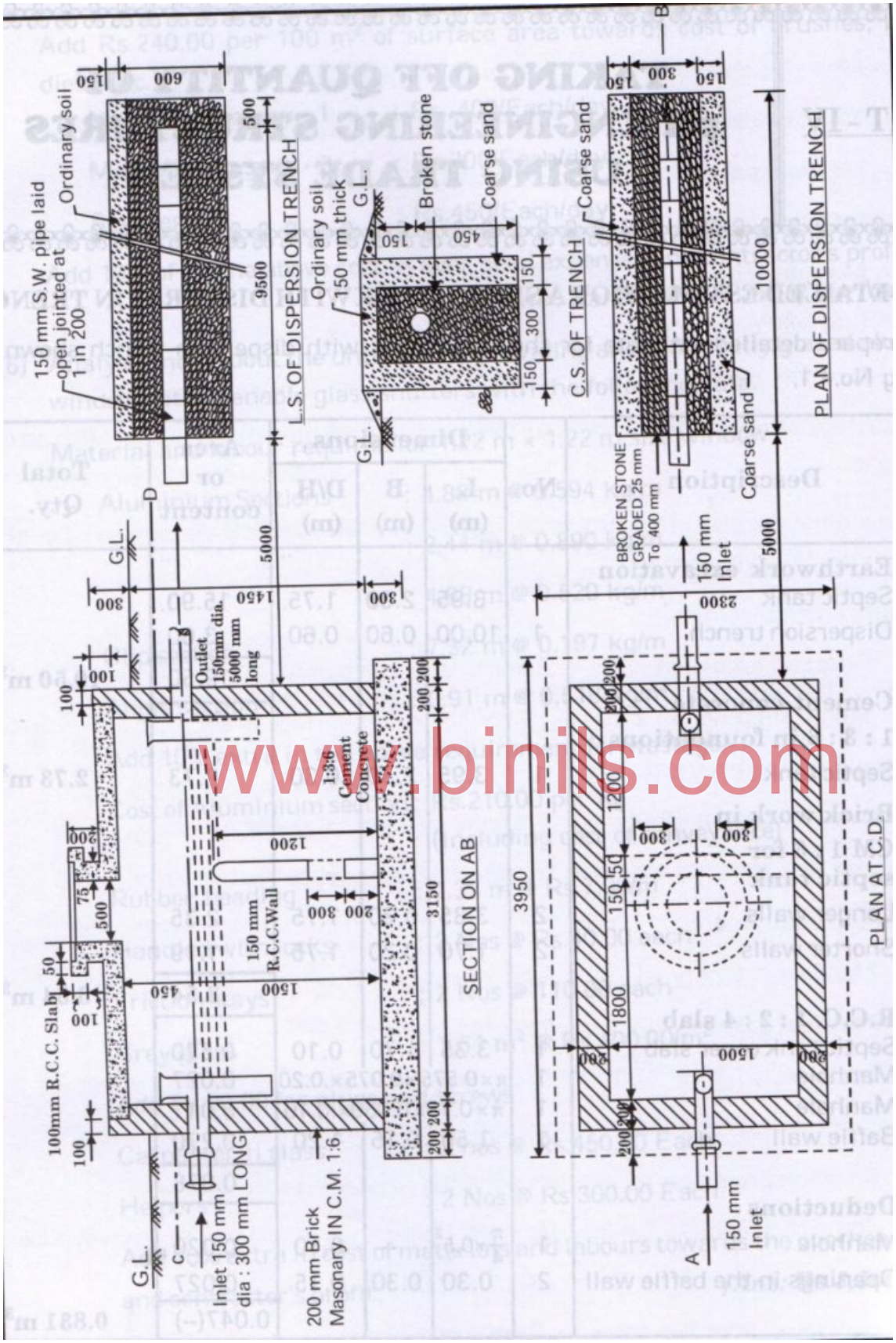
21. Prepare detailed estimate of quantities for the following items of work for R.C.C slab culvert shown in Sketch -2.

A. i.C.C 1:3:6 in foundations.
ii.R.C.C. 1:2:4 for slab.

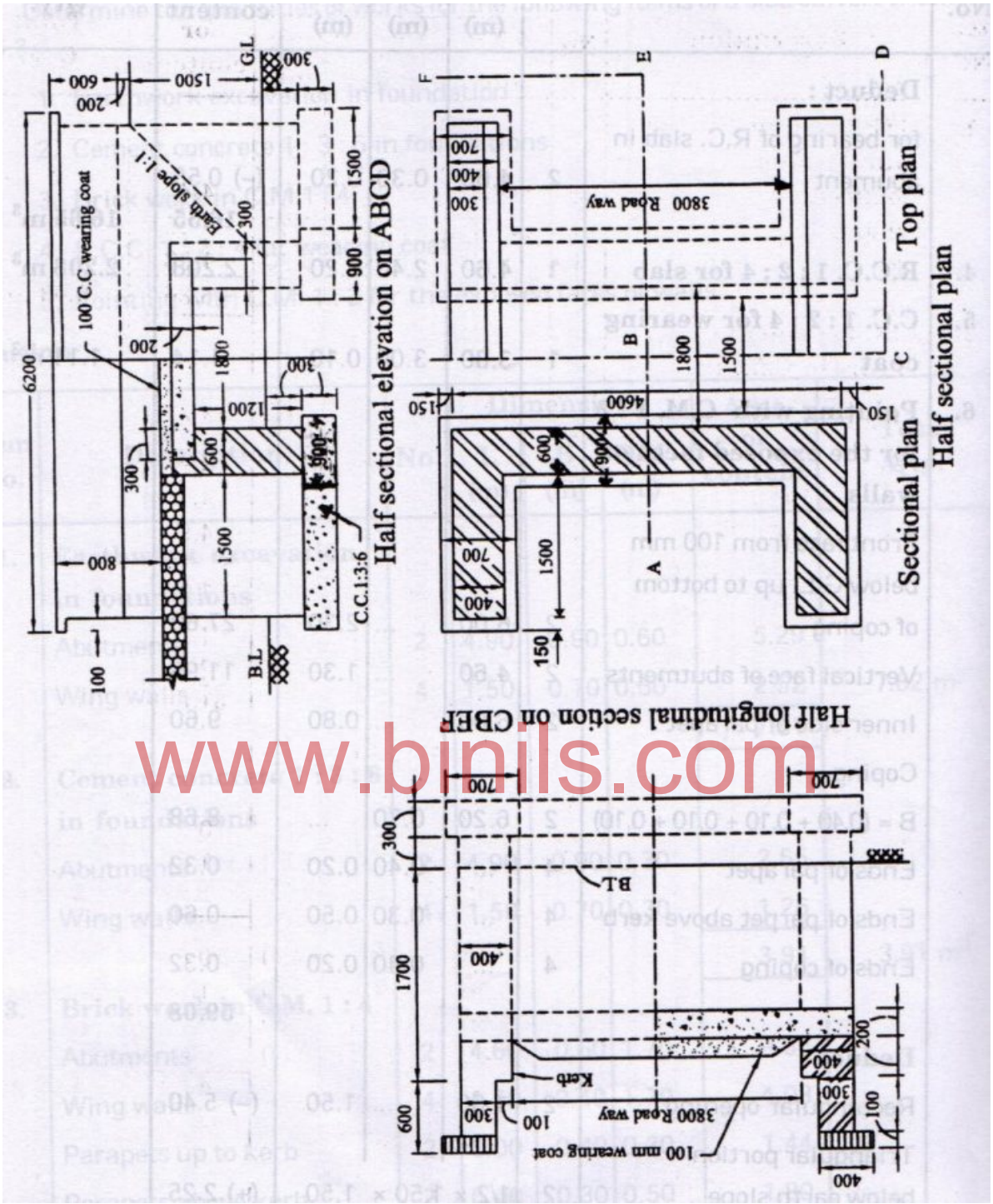
(OR)

B.i.Pointing with C.M 1:3 for the exposed faces of walls

ii.B.W in C.M. 1:4.



Septic Tank with Dispersion Trench
sketch-1.



R.C.C slab culvert
Sketch -2.

DISCLAIMER

These course materials are not exhaustive. For in depth information students may please refer standard text books / reference books)