

SPECIFICATIONS AND REPORT WRITING

SPECIFICATIONS

Specification is an important document attached with a tender form/contract agreement which in most cases controls the quality of materials and works. Sometimes, specifications may be used to describe matters which could not be explained clearly by drawings/sketches. This chapter explains the different types of specifications and their necessity.

Definition

For each proposed work, numbers of drawings are prepared to explain the details of foundations, basement, superstructure, roof and floors joinery etc., whatever attempt is made to furnish complete working drawings, it becomes necessary to describe the drawing in detail. This description in works without sketches and sometimes with line sketches giving details of standard materials, method of construction and the requirements of workmanship of construction etc., is called specification.

NECESSITY OF SPECIFICATION

1. The specifications define the quality of materials and workmanship. Hence this will help the contractor to quote correct rates for the different items of works.
2. The information contained in the specifications will serve as a guide to the contractor as well as to the supervising staff during execution of the work.
3. Specifications help the owner to check and satisfy with the works, during execution.
4. In case of 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 specifications play the major role in solving the disputes and arriving at a settlement.

Importance of Specifications

Drawings and Specifications form two important contract documents. Information such as dimensions, type of construction, etc. Which can be easily expressed graphically is put up on the drawings. On the other hand, instructions which can be easily expressed well in writing 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 be the final.

Types of Specifications

The specifications are broadly divided into three categories as

1. General or brief specifications,
2. Detailed specifications, and
3. Standard specifications.

1. General or Brief Specifications

General specification gives the nature and class of work and materials in general terms to be used in the various parts of the work, from the foundation to the superstructure. It is a short description of different parts of the work specifying materials, proportions, qualities etc. General specifications give general idea of the whole work or structure and are useful for preparing the estimate. These general specifications do not form part of the contract document. They are used in the estimates by the person who prepares the estimates.

2. Detailed Specifications

The detailed specifications form a part of the contract document. The detailed specification of an item of work specifies the qualities and quantities of materials, the proportion of mortar, workmanship, the method of preparation and execution and the method of measurement. The detailed specifications of different items of work are prepared separately which describe what the work should be and how they should be executed and constructed. Detailed specifications are written to express the requirements clearly in concise form avoiding repetition and ambiguity. The detailed specifications are arranged as far as possible in the same sequence or order as the work is carried out.

The following provisions are made in the detailed specifications.

- a. General provisions
- b. Technical provisions.

a. 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 conditions of contract are generally accommodated under the general provisions.

i. Conditions relating to documents

These pertain to

- Bill of quantities and schedule of prices
- Drawings
- Standard specifications

ii. Conditions relating to the general obligations of the contractor

These pertain to

- Acts, bye-laws and regulations

- Fencing, watching and lighting of the work spot
- Insurance

iii. Conditions a relating to labour and personnel

These pertain to

- Accidents to workmen
- Contractors representative
- Rates of wages paid to the employees
- Removal of the employees of the contractor

iv. Conditions a relating to the execution of the work

These provisions are related to

- Alterations, additions and omissions during the progress of work
- Amount of extra items
- Damages
- Defective work
- Work at night and on holidays
- Workmanship etc.

v. Conditions a relating to measurements and payments

These pertain to

- Method of measurement of completed works
- Method of payments etc.

vi. Conditions a relating to default and non-completion

These pertain to

- Failure to complete the work in time
- Right to suspend the work
- Time of completion etc.

vii. Conditions a relating to settlement of dispute

These pertain to

- arbitration
- Jurisdiction of court etc.

b. Technical Provisions

These specifications describe the technical requirements of each type of constructions. The technical provisions contain detailed instructions regarding the desired quality of the final product. The technical provisions are of three types.

i. Specifications for materials and workmanship

For materials the following properties should be included in the specifications.

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

For workmanship, the following important features should be included in the specifications.

- The results desired
- The tools and plants to be engaged
- Detailed description of the construction method for each item
- Instructions regarding the protection of the finished work as well as of the adjacent property.

ii. Specifications for performance

These specifications are written for the overall performance of the finished product and hence they are written if the contract is for the supply of equipment and machinery such as pumps, motors etc. In these specifications, general description, design and installation and guarantee etc., of the equipment are specified.

iii. Specifications for proprietary commodities

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. To avoid monopoly and favouritism, it is general practice to specify the selected brand and then it is followed by the phrase “or equal”.

3. Standard Specifications

Specifications are seldom written completely for all items of the work. It is possible to standardize specifications for most of the items occurring in works of similar nature. Hence every engineering department prepares the detailed specifications of the various items of works and get them printed in book form under the name “Detailed Standard Specifications”. When the work, or a structure or project is taken up, instead of writing detailed specification every time, the printed standard specifications are referred in the contract document and other documents pertaining to the work. Tamilnadu Public Works Department following the “Tamilnadu Building Practice”. The clauses of Indian Standards (Code of Practice). National Building Code (NBC), Hand book by National Building Organisation (NBO) may be also referred while writing specifications.

Essential Requirements of Specifications

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

1. Subject matter

The subject matter of specifications 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 specifications.

2. Grammar

All sentences of the specifications should comply with the rules of grammar. The style and tense should remain the same throughout.

3. Selection of works

While writing specifications, only suitable works with desired meaning should be used. Unfamiliar works of works having more than one meaning should never be used in the specifications.

4. Accuracy

The information given in the specifications should be complete and correct, otherwise the contractor may claim for any extra cost due to damage occurred to him by the misleading information supplied by the specifications.

5. Practical limits and commercial sizes

The specifications should be framed keeping in view the practical limitations of materials and workmanship and they should not specify practical impossibilities. Also, the specifications should specify use of commercial sizes and patterns of the material.

6. Fairness

The specifications should be fair and they should not be framed in such a way as to throw all the risks on the shoulders of the contractor.

7. Brevity

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

Points to be Included in the Specifications

In the case of Civil Engineering Works, the specifications shall contain the following points.

- i. Quality of materials to be used with strength/size requirements,
- ii. Quantity of materials to be used and the methods of measurements to be followed.
- iii. Method of mixing when different materials are used.
- iv. Construction methods to be followed mentioning the equipment and machinery to be used.
- v. Dimensions of works such as breadth, thickness etc.,
- vi. Methods of measurements of works for payments.

The points to be included in the specifications of some of the civil engineering construction work are given below.

1. Specification for lime mortar concrete, surkimortar concrete and cement mortar concrete

Specifications for lime, cement, fine aggregate and coarse aggregate – quality and quantity of water – specification for lime mortar and surkimortar – volume batching or weigh batching and proportion of ingredients – method of mixing – hand mix ding or machine mixing – platform for mixing – transporting concrete – placing – ramming and compaction – curing – method of measurement and payment.

2. Specification for Cement Concrete for R.C.C. Work

Specifications for cement, fine aggregate and coarse aggregate – proportion of ingredients – quality of water – consistency – volume batching or weigh batching – mixing – haind mixing or machine mixing – mixing time – transporting and placing of concrete – thickness of each layer – compaction – use of vibrator – construction joints – specification of reinforcement – fabrication of reinforcement – centering and form work – curing removal of form work – finishing – method of measurement and payment.

3. Specification for Brick masonry in lime mortar, surki mortar or cement mortar

Quality and size of bricks – proportion and specification of mortar – soaking of bricks in water – setting of bricks in mortar – thickness of joints – bond – raking joints for plaster – uniform raising – maximum height for a day's work – scaffolding – throating corbelling and cornices – rounding off corners – plinth offsets – brick on edge coping – curing unit of measurement and payment.

4. Specification for Stone masonry in lime mortar, surki mortar or cement mortar

Requirements of building stone – size and dressing of stones – hammer dressing chisel dressing – bond stones – methods of laying stones – wetting of stones before placing – specification of mortar – thickness of mortar bed and thickness of joints of filling the voids – uniform raising – scaffolding – curing – methods of measurements and payment.

5. Specification for Plastering stone masonry or brick masonry with lime mortar, surki mortar or cement mortar

Preparation of surface – cleaning the surface – wetting and washing the surface – specification of mortar – mix ratio – thickness of plaster – number of coats – application of mortar on the surface – finishing – curing measurement and payment.

6. Specification for pointing stone masonry, brick masonry with lime mortar, surkimortar, cement mortar

Raking out of joint – brushing and cleaning – washing with water – specification for mortar – application of mortar in the joints – finishing thickness of joints – curing measurements and payment.

Examples of General Specifications

1. General specifications of some works involved in the construction of a residential building

- i. **Foundation Concrete:** Cement concrete 1:4:8 using 40 mm size blue granite broken stone.
- ii. **Foundation and Basement:** Brickwork in cement mortar 1:5 using 7.5 grade bricks.
- iii. **Super Structure:** Brickwork in cement mortar 1:6 using 7.5 grade bricks.
- iv. **Flooring:** Mosaic flooring over a base of 100 mm thick cement concrete 1:5:10 using 40 mm size brick bats.
- v. **Roofing:** 120 mm thick R.C.C. roof in 1:2:4 concrete using 20 mm size blue granite broken stone.
- vi. **Finishing:** Plastering the walls and ceilings with cement mortar 1:3, 12 mm thick and finishing the same with three coats of white washing.
- vii. **Doors and Windows:** Country wood doors and windows painted two coats with ready mixed paint over a primer coat.

2. General specifications of few items of works involved in the laying of a village road

- i. **Sub grade:** Leveling and compacting the surface with a camber of 1:48 for 8 metre width, uniform along the full length, with watering.
- ii. **Soling:** Soling with 150 mm size granite boulders, packed completely with gravel and compacted with hand roller, dry and wet rolling.
- iii. **Spreading gravel:** Red gravel spread over the base for 20 mm thickness, watered and rolled.

iv. **Finish:** Covered with a thin layer of sand.

3. General (or) Brief specifications of few works involved in laying a bitumen road

- i. **Preparation of Base:** Clearing the surface with wire brushes and removing the dust completely patching all pot holes.
- ii. **Application of Bitumen binder:** Applying heated bitumen uniformly at the rate of 0.9 kg/m².
- iii. **Spreading of Chips:** Spreading 12 mm size stone chips uniformly, 20 mm thick.
- iv. **Rolling:** Rolling 6 to 8 trips with 8 ton power roller.

Examples of Detailed Specifications of Materials

1. Detailed Specification for sand for mortar

The Sand used for mortar shall be clean, sharp, heavy and gritty. It should be free from clay, salt, mica and organic impurities. It shall not contain harmful chemicals in any form. Medium and fine sand are to be used in mortars. Coarse sand shall be sifted through 600 micron sieve and used in mortars for plastering works.

2. Detailed Specification for first class bricks:

The earth used for molding the bricks shall be free from organic matters salts and chemicals. The size, weight and colour of the burnt bricks should be uniform. The adjacent faces of the bricks are to be right angles to each other. The bricks shall be free from cracks, flaws and lumps. They should not break where dropped, from 1 metre height, on the ground. They should not absorb water by more 15 % of their self weight when immersed in water for one hour. The average compressive strength of the bricks shall be not less than 7.5 N/mm². The dry weight of one brick shall not be less than 3 kg.

3. Detailed Specification for cement:

Ordinary Portland cement or rapid hardening Portland cement confirming to IS: 269 – 1989 and IS:8041 – 1990 shall be used. The fineness of the cement shall not be less than 30 minutes and the final setting time shall not be greater than 10 hours. The average compressive strength, after 7 days curing, of 1:3 cement mortar cubes shall be not less than 33 N/mm² (33 grade).

4. Detailed Specification for wood for doors and windows:

The wood shall be teak, well seasoned and dry. It should be free from cracks, knots, defects and disease. It should be sawn in the direction of grains so that the edges are perfectly straight and square. The dimensions of the frames/scantlings/planks shall be as prescribed in the drawings. Patching or plugging of any kind is not permitted.

5. Detailed Specification for water for concrete:

Water used for mixing and curing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water may be used for mixing concrete. The suspended organic solid matter in the water shall not exceed 200 mg/l and inorganic solid matter shall not exceed 3000 kg/l, the pH value of water shall be not less than 6. Water used for curing should not produce any objectionable stain or unsightly deposit on the concrete surface. The presence of tannic acid or iron compounds in the water is objectionable.

6. Detailed Specification for coarse aggregate:

The aggregate to be used in reinforced cement concrete shall be of blue granite stone, machine crushed and well graded with a nominal size of 20 mm. It shall be hard, dense, durable strong and free from flakes. The aggregate

shall not contain harmful materials such as coal, mica clay, shells, organic impurities etc. The compressive strength, crushing value etc of the aggregate shall be in accordance with the requirements of IS:383 – 1970.

7. Detailed Specification for reinforcement:

The reinforcement shall be of high strength deformed steel bars confirming to IS:1786 – 1985. It should be bendable, weldable and have the modulus of elasticity not less than 200 kN/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.

Examples of Detailed Specifications of Works

1. Detailed Specification for earth work excavation for foundation

Leveling the surface

The whole area of construction is to be cleared of trees, grass, roots of trees etc., complete and leveled horizontally to enable easy marking of centre line of the building.

Dimensions

The excavation shall be done in accordance with dimensions of trenches shown in the working drawings.

Shoring

The sides of the trenches should be vertical and the bottom of the trenches should be flat. In the case of loose soils the sides of the trenches should be shored with steel sheets.

Fencing

Suitable temporary fencing is to be provided around the site of excavation to avoid any accidental fall into the trenches.

Dumping the soil

The excavated soil is to be dumped and heaped at a minimum distance of 1.5 metre away from the trenches so that it does not slide again into the trenches.

Treatment of the bottom

The bottom of the trench shall be watered and compacted by ramming before the foundation concrete is laid. Excessive excavations should not be adjusted by filling with loose excavated soils. Sand or plain concrete may be used for the adjustment of levels, that too with proper compaction.

2. Detailed Specification for lime concrete in foundation

Lime

The lime used for the concrete shall be freshly burnt and slaked. It should be free from clayey particles and ashes. Unslaked stone particles should be removed by shifting.

Broken Bricks

The overburnt bricks and the pieces of well burnt bricks are to be broken to sizes ranging from 20 mm to 40 mm and stacked for easy measurement. The brick bats shall be free from dirt, dust, rubbish, leaf etc.

Fine aggregate

Surki made from well burnt brick bats is to be used as fine aggregate. It should pass through I.S. sieve no.48 and free from dust and dirt.

Proportioning

Lime, surki and broken bricks are to be mixed in the proportion of 1:2:5 by volume. The materials are to be measured loose without shaking or ramming.

Mixing

The mixing shall be done only by mechanical mixer. The broken bats are to be soaked in clean water for atleast 2 hours before mixing. The materials are first mixed to get uniform distribution and then water is gradually added. The mixing process is to be continued till all the brick bats are coated with mortar uniformly and a workable concrete is obtained.

Laying compacting

The concrete shall be laid to the required thickness, not more than 200 mm and a time, and compacted by ramming with rammers weighing 4.5 to 55 kg.

Curing

The lime concrete, so laid, is to be kept wet for atleast 7 days.

3. Detailed specification of random rubble masonry in foundation and basement

Stone

The stone shall be obtained from the approved queries. It shall be sound, free from cracks and decay and shall have a specific gravity of not less than 2.5.

Mortar

Cement mortar 1:6 to be used.

Method of Laying

The stones are to be laid on broadest face which gives better opportunity to fill the spaces between stones by the mortar. The stones are laid layer by layer with sufficient mortar in between them for better binding. The outer face of the basement should be vertical and the joints are to be staggered. There shall be no gap, between the stones, unfilled by mortar.

Curing

The masonry should be kept in wet condition by sprinkling water thrice daily for atleast 7 days after construction.

4. Detailed specification of for brickwork in cement mortar 1: using first class bricks in super structure

Bricks shall be table molded, well burnt in approved kiln, copper coloured, 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.

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

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

Broken bricks shall not be used except as closers. All corners shall be truly to plumb. Mortar joints shall break for bonding and shall not exceed 10 mm in thickness. Only skilled masons shall be employed on the work and the work 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.

The length and height shall be measured as on site. The thickness of walls shall be paid for as one brick, one and a half bricks, two bricks and so on. The rate for brickwork includes necessary scaffolding also.

5. Detailed specification of mosaic flooring

Base Course

The basic course shall be of 25 mm thick cement concrete of a 1:2:4 mix using 12 mm size granite stone chips as coarse aggregate and sand as fine aggregate. The top of flooring concrete or R.C.C. slab shall be cleaned well and applied with cement slurry of 2 kg/m² before placing the chips concrete. The base course is to be compacted, leveled and smoothed by wooden floats.

Mosaic Tiles

Precast tiles of 200 mm x 200 mm x 20 mm size are to be used. They shall be manufactured under hydraulic pressure of not less than 14 N/mm² and given the first grinding with machine before laying. The proportion of cement to sand in the backing of the tiles shall not be leaner than 1:3 by weight. Similarly the proportion of cement to marble powder to marble chips in the wearing layer of the tiles shall be not leaner than 3:1:7. The marble chips shall be hard, dense sound and homogeneous in texture.

Laying of Tiles

The bedding for the tiles shall be with cement mortar 1:3. The average thickness of the bedding mortar shall be 20 mm and the thickness at any place shall be not less than 10 mm. Cement bedding shall be spread, tamped and corrected to proper levels and allowed to harden before the tiles are set. Neat cement slurry of honey like consistency shall be spread over the bedding at the rate of 4.4 kg/m². 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 is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible not exceeding 1.5 mm and in straight lines.

Curing, Polishing and Finishing

The day after the tiles are laid, all joints shall be cleared of the grey cement grout with a wire brush to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with white cement mixed with pigment to match the shade of tiles. The same cement slurry shall be applied to the entire surface of the tiles in a thin coat. The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be grouted evenly with the polishing machine fitted with coarse grade grit blocks, adding required water during the process. After grinding, the surface shall be washed clean and covered with thin coat of cement slurry with pigment. The surface shall be again cured and polished with machine fitted with medium grade grit blocks. Similarly a third grinding shall be done by fine grade grit blocks. After the final polish, the surface shall be cleaned using diluted oxalic acid and wiped with a soft cloth.

6. Detailed specification for plastering with cement mortar

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.

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.

7. Detailed specification for distempering

The distemper shall be of the approved colour and quality. Water shall be added as prescribed by the manufacture, stirred well often during use, to maintain uniform colour and consistency.

The plastered surface of the wall is scraped and cleaned with wire brushes and rubbed smooth with sand papers. Distemper shall not be applied in wet weather. It shall be applied with good brushes, first horizontally and

then immediately crossed off vertically which together shall constitute one coat. The second coat will be also applied in the same manner after the first coat has dried. The finished surface shall be even and uniform and shall show no brush marks.

8. Detailed specification for painting new wood work

Paint

Ready mixed paint of approved quality and colour shall be used.

Preparation of surface

The surface to be painted shall be rubbed down smooth with medium and fine sand papers and cleaned off any dust. Knots, cracks holes etc., shall be filled with putty made of 2 parts of whiting. 1 part of white lead mixed together in linseed oil and leveled to the surface. A primer coat is applied to the surface with ready mixed wood primer of best quality.

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 stick so that it does not settle down.

9. Detailed specification for A.C. Sheet roofing

A. C. Sheets

The sheets shall be approved quality, free from cracks and damages. Semi corrugated sheets of 1100 mm width and 1750 mm length are to be used. The thickness of the sheets shall not be less than 6 mm.

Purlins

Angle purlins of required size shall be used at spacing not exceeding 1.4 m.

Laying of Sheets

The sheets should be laid starting from the eaves, with the smooth side facing upwards and with a minimum of 150 mm lap at the ends. The overhang of the sheets shall not exceed 300 mm.

Pitch

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

Fixing

The sheets shall be fixed to the purlins from the top of corrugation by 8 mm dia G.I. hooks and nuts. The holes shall be drilled and not punched. Each hook shall have a bitumen washer and metal washer placed over the sheet before the nut is screwed.

Ridges and Hips

Ridges and hips shall be of the same brand of the sheets and have the same pattern of corrugations. They shall be free from cracks and damages. The ridge capping shall be screwed to the ridge purlins by same type of bolts used for fixing the sheets.

10. Detailed specification for form work and centering to R.C.C. Roofing

Strutting

Props used for strutting shall be of casuarinas posts of 100 to 130 mm diameter. The props are to be vertical and rest on firm ground or on wooden sole plates of thickness not less than 40 mm. 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 750 mm. When the height of strutting exceeds 3.5 m, suitable horizontal bracings should be provided. Splicing of props shall be as per the approved drawings. The props shall be constantly watched, by a carpenter, during the process of concreting and immediate remedial measures are to be taken in any of them get loosened.

Form Work

The formwork 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 with stand 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 1.0 m 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 the 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 demand to the concrete surfaces and edges.

11. Detailed specification for damp proof course (D.P.C.)

Damp Proof Course will be of plain cement concrete of 1:2:4 mix and 30 mm thickness. 12 mm size hard and dense stone chips shall be used as coarse aggregate and river sand of 5 mm nominal size shall be used as fine aggregate. The aggregate shall be clean and free from dust, dirt, mud, organic matter etc. The coarse aggregate is to be washed well before mixing. Fresh port land cement of I.S.I. approved brand of 43 grades is to be used as the binding material. Potable water, free from harmful salts, shall be only used for mixing the concrete. The coarse aggregate and sand are to be measured separately by volume and mixed dry in a clean and stable platform to get a mixture of uniform colour. This mixture is stacked to a uniform height and the cement of required quantity is spread over the stack, turned over in dry state first, and with water twice to get a workable and uniform concrete. The brickwork in basement is stopped at plinth level, cured will for 7 days, top surface cleaned well for dust by wire brushes. Form work is provided along the two sides of wall by wooden planks, to the required height. Gauge plates are to be provided at one metre interval, connecting the two side planks by nails, keeping at a clear distance equal to the width of wall at plinth level. The concrete, mixed as mentioned above, shall be placed and compacted well by tamping rods to have a net thickness of 30 mm. Damp proof course shall not have any joints, the whole concreting be completed without any break, and it need not be provided over door openings. The top surface of concrete, when starts to dry shall be roughened to provided over door openings. The top surface of concrete, when starts to dry, shall be roughened to provide bondage with the super structure. The side planks shall be removed on the next day and the concrete shall be cured for 7 days by keeping the surface constantly wet.

12. Detailed specification for cement concrete flooring

Bottom Layer

The base shall be of cement concrete of 1:2:4 mix, 25 mm thick. The coarse aggregate, 12 mm size stone chipping, shall be hard, durable strong and free from dust and organic matters. The fine aggregate, 5 mm size river sand, shall be also free from dirt, clay, mud etc. Fresh Portland cement having initial setting time not less than 30 minutes and of grade 33 shall be used. Portable water, free from harmful substances shall be used for mixing and curing. (For method of mixing refer item number 11). The concrete mixed as mentioned above shall be spread over the well prepared base, to a uniform thickness of 25 mm, compacted and leveled using wooden floats. The top surface shall be roughened with 2 mm deep lines at 100 mm intervals, with scratching sticks, to provide bond to the top layer. The bottom layer shall be cured for at least 3 days before the top layer being laid over it.

Top Layer

The top layer is of 1:3 cement mortar, 12 mm thick finished with a floating coat of neat cement. Fine sand, sifted through 5 mm size mesh and free from clay and dust shall be used. To have a red coloured finish, 3 kg of red oxide of approved quality may be mixed with 50 kg of cement and is used in preparing the mortar. The cement with red oxide is mixed with sand in the ratio 1:3 by volume in dry state to obtain a uniform colour. Water is then added slowly, a paste of uniform consistency is prepared and laid over the base layer to a uniform thickness of 12 mm. It is leveled and smoothed by wooden floats. In the process of finishing cement slurry mixed with enough red oxide is sprayed on top of cement mortar layer. The surface should be covered with a thin layer of water constantly from next day for at least seven days for better curing.

13. Detailed specification for providing and fixing A.C. Rain Water pipes

The asbestos cement pipes shall be of 100 mm internal diameter, 2.0 m length, weighing 12 kg each and free from cracks, flaws etc. The wall thickness is to be uniform and the surfaces shall be smooth. Galvanized iron bat

clamps are to be provided at 1.0 m interval to fix the pipe with the wall in vertical position. The clamps are to be rigidly fixed to the wooden plugs by 75 mm long screws. The spigot end of the upper pipe shall be centrally placed into the socket end of the lower pipe, with uniform gap around which shall be filled with spun yarn soaked in bitumen to one-third depth and with cement – mortar 1:2 to the remaining two – third depth, the top being finished smooth with 450 slopes. The joints shall be cured for at least seven days by tying pieces of gunnies around them and keeping them wet. A.C. Shoes are to be fitted at the bottom end of each pipe with a clear gap of 150 mm above the ground.

14. 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 15 days of laying of the slab. A layer of 100 mm thick brick concrete (0.96 m³ broken brick of 20 mm gauge and 0.375 m³ slaked lime for every 1 m³ of weathering course) shall be laid over the slab and well beaten to 75 mm thickness with wooden hand beaters.

15. Detailed specification for laying water bound macadam road, over existing soling

The road metal shall be brought from the approved quarry. In direct compression test, the road metal shall give a strength of 14.5 N/mm². The abrasion number of the road metal shall not be less than 17 and the attrition number shall be between 7 and 8. In impact test, the road metal shall withstand a height of 180 to 200 mm and in cementation test, it shall withstand 100 blows.

The road metal shall be placed on the existing soling in two layers, each layer being consolidated so that the final thickness of two layers will be 10 mm IRC 50 mm size and IRC 40 mm size stones are used in equal proportions.

Each layer of the road metal shall be rolled dry so that a dense and properly interlocked surface is obtained. Rolling shall be continued till the stones do not move under the weight of the roller.

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

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

16. Detailed specification for single coat surface dressing with bitumen

Preparation of road surface

The surface shall be prepared by sweeping clean and removing all dust, dirt and other deleterious matter by hand brushing with wire brushes, base brooms and finally by fanning the cleaned surface with gunny bags to remove all loose dirt. 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 manufacture, 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 12 kg bitumen shall be used for spraying 10 sqm area.

Application of covering materials

The stone chips of nominal size 12 mm, tough, clean and dry shall be uniformly and evenly spread at the rate of 0.14 to 0.15 m³ per 10 m² area with the required camber. The surface shall be checked by a camber board laid across the road and a three metre straight edge laid parallel to the centre line of the road and the irregularities, if any shall be corrected.

Rolling

The blinded surface shall be rolled with a 8 to 10 tonne roller. The rolling shall begin at the edge and proceed lengthwise over the area to be rolled sapping not less than one third of the roller tread and proceed towards the centre. When the centre is reached; the rolling shall then start at the opposite side and again proceed towards center. Tolling shall be continued until the chipping are firmly embedded in the bituminous material and present a uniform closed surface. Excessive rolling which results in the crushing of the aggregate shall be avoided.

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.

Examples of Standard Specification

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

1. 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	Lime	Surki	Sand
i. Concrete	1	½	1 ½
ii. Masonry (Brick or Stone)	1	½	1 ½
iii. Plastering – First Coat	1	½	1 ½
Plastering – Second Coat	1	½	1
iv. Pointing	1	½	1

2. Surki mortar is included in lime mortar specifications and relevant portions in I.S.1625/1971 and I.S.2394/1965 shall apply.

2. Standard specification for cement concrete (Specification number 28 of Tamilnadu Building Practice – Vol.1)

1. I.S. 456-1978, I.S. 383-1970 and I.S. 269-1989 shall also apply.
2. Mixing concrete – Cement and sand shall be measured in accurate proportions, and well mixed in a dry state, thrice over, on a clean dry platform of 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, as can be mixed and laid with in 15 to 20 minutes after water is added to the mixture, 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, 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 40 cm long, 35 cm wide and 25 cm deep. The mixing platform should be large enough to enable the continuous procedure of two batches being mixed avoid partial sets of the concrete between laying of successive batches. The whole mass shall then be thoroughly mixed with a shovel, turning over atleast 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 executing engineer shall be rejected and removed from the work spot.

3. For water for mixing, setting time, laying and machine mixing of concrete I.S.456-1978 and I.S.269-1989 shall apply.
4. 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 shall also include the cost of bailing pumping for keeping the excavation free of water, unless otherwise specified. Centering shall be measured and paid separately.
5. 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 ie., whether 1:2 or 1:3 etc.,

3. Standard specification for reinforcement (Clause 4.6 of IS:456-1978)

The reinforcement shall be any of the following:

- a. Mild steel and medium tensile steel bars confirming to IS:432(Part 1) 1982.
- b. High strength deformed steel bars confirming to IS 1786 – 1985.
- c. Hard drawn steel wire fabric confirming to IS 1566 – 1982.
- d. Structural steel confirming grade A of IS 2062 – 1992.

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:4082-1972.

The examples given for general, detail and standard specifications are only few samples to explain the different types of specifications. A model list of specifications, which is used for a common building is given below with method of measurement.

DRAFT MODEL FOR THE SPECIFICATIONS OF DETAILED ESTIMATE

1. Earth work excavation in all soils for foundation with initial lead of 10 m and initial lift of 2 m including refilling the foundation with excavated earth and spreading the excess earth within the premises, etc complete.
2. Supplying and filling with clean river sand for foundation including consolidation in layers of not more than 15 cm thick, etc. complete.

3. Cement Concrete 1:5:10 (One part of Cement, five parts of sand and 10 parts of coarse aggregates) using 40 mm HBG stone jelly for leveling coarse and foundation, etc. complete.
4. Cement concrete 1:2:4 (one part of cement, 2 parts of sand and 4 parts of aggregates) using 20 mm HBG stone jelly for reinforced cement concrete works including cost of centering, shuttering the sides and soffits, laying, finishing, curing etc. complete.
 - a) For Foundation
 - b) For Grade Beams
 - c) For Lintel
 - d) For Roof Slabs
 - e) For Sun Shades
 - f) For Columns
 - g) For Vertical Facia Slabs, etc.
5. Brick work in cement mortar 1:5 (One cement and five sand) using best quality chamber burnt country bricks including laying, finishing, curing, etc. complete.
 - a) For Foundation and Basement
 - b) For Ground Floor
 - c) For First Floor
 - d) For Second Floor
 - e) For Third Floor
6. Supplying and fabrication of steel rods including cutting, bending, tying and fixing in position including cost of binding wire, etc. complete.
 - a) For Foundation
 - b) For Grade Beam
 - c) For Lintel
 - d) For Roof Slabs
 - e) For Sun Shades
 - f) For Columns
 - g) For Vertical Facia Slabs etc.

7. Brick partition walls of 4½” thick using best quality chamber burnt country bricks in cement mortar 1:4 (one cement and four sand) with hoop iron reinforcement including laying, finishing, etc. complete.
8. Supplying and manufacturing of country wood joineries for doors, windows and ventilators using 4” x 3” scantlings for frames and 40 mm thick Planks for shutters are including cost of wood, manufacturing charges, clamps and other furniture fittings etc. complete.
9. Supplying of M.S. grills including cost of flats and angle sections welding charges, etc. (design as approved by the engineering authorities) complete.
10. Weathering coarse concrete over roof slab using 20 mm gauge broken brick jelly and lime, the proportion between the brick jelly and lime is 32:12:5 including cost of laying to proper gradient etc. complete.

11. Finishing the top of roof with one coarse of flat tiles of 25 x 25 x 2 cm size laid in cm 1:4 mixed with 2 percent of water proofing compound and the joints pointed with same coloured mortar including coat of laying, finishing, curing etc. complete.
12. Plastering with cement mortar 1:3 (one cement three sand) for exposed surface of RCC items – 12 mm thick.
13. Plastering with cement mortar 1:5 (one cement and five sand) for sides of wall structures 12 mm thick.
14. Finishing the flooring with cement mortar 1:3 (one cement three sand) – 19 mm thick.
15. Finishing the flooring with 1 coarse of ceramic tiles of 25 mm thick including cost of laying finishing and polishing the floors, etc. complete.
16. White washing three coats with best quality shell lime for ceilings.
17. White washing one coat and colour washing two coats best quality cement paint including curing for wall structures.
18. Painting two coats with synthetic enamel paint over a priming coat for wooden joineries including cost of paints labour charges etc., complete.
19. Painting of two coats with synthetic enamel paint over a priming coat for steel work including cost of paints labour charges etc., complete.
20. Provision for internal and external sanitary arrangements.
21. Provision for internal and external water supply arrangements.

