

# Guidance for House Builders

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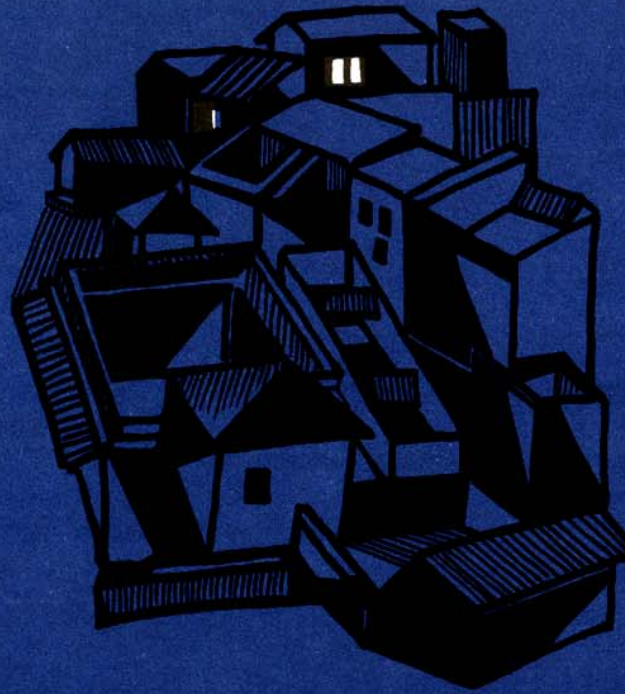
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## Useful Tips for House Builders

**H**ouse builders who are going to construct their houses have many misconceptions and doubts about various steps to be taken in getting their houses constructed economically and efficiently. Written in simple non-technical language, this booklet is intended to help all those who are going to engage themselves in construction activities. The following points should be taken into consideration by the owner or house builders while constructing a house. These useful tips will help them in reducing the cost of construction and maintenance, minimising risk of defects and wastage of materials, besides getting better performance over a period of time.

### 1. LOCATION OF PLOT

It should be ensured that the location of plot to be purchased is in approved layout. As far as possible the plot should not be in a filled up area or at a low level where water may stagnate.

### 2. SIZE OF PLOT

The size of plot should be selected keeping in view the requirements of family and financial position to acquire land and to construct a house.

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### 3. PLANS

Before construction is started, proper planning is very important. After getting the land registered in your name it is necessary to get the plan prepared from a competent and experienced architect.

### 4. STRUCTURAL DESIGN

After the preparation of plans, the structural design should be got done, preferably from a structural engineer. This will provide the numbers, details and position of columns, beams, lintels, roof slabs, including sizes, spacing and position of steel reinforcement.

### 5. ESTIMATES

The estimates of construction cost should be prepared on the basis of details of quantities of different building items. This will be required for obtaining loans from concerned authorities.

### 6. LOANS

Loans should be obtained from agencies where these are available at the lowest rate of interest. One must apply for loan well in advance. Loans can be obtained from Life Insurance Corporation (LIC), Employee Provident Fund, Housing Development Finance Corporation (HDFC), Commercial Banks, Housing Boards, Central and State Governments (for their employees). Loans can be obtained only when land is registered in your name.

### 7. MATERIAL REQUIREMENT

Before starting the construction, estimate of materials such as cement, steel, bricks, lime, sand and stone aggregates etc. should be prepared. The owner should purchase building materials in bulk directly from the source or from wholesale dealers to effect purchase economy. Preferences should be given to ISI marked products.

### 8. MODE OF CONSTRUCTION

It is necessary to decide the mode of carrying out construction work before starting the construction. The different methods of construction are:

#### a) Self-supervised Construction:

In this system, the house builder himself purchases the estimated quantity of materials, properly stores them and issues the same to labourers under his own control. The labourers are engaged on daily wages and the work may be executed in consultation with the architect.

#### b) Labour contract system:

In this system the materials are purchased and supplied to the labour contractor, who would be responsible for supplying labour. A separate note on construction by labour contract is available later in this booklet.

#### c) Complete contract system:

In this system, the contractor is made

responsible for supply of materials and labourers. The work is executed at predetermined and negotiated rates of different items. The payment to contractor is made on measurements of work done.

#### d) Subwork construction:

In this method the work is divided into small contracts on item basis and given on contract basis to experienced mistrys.

#### e) Lumpsum contract:

In this method, the whole job is given to a good contractor, on a fixed amount of money.

### 9. SPECIFICATIONS

The economic specification may be prepared through a competent and experienced engineer. Economic specifications have been prepared by BMTPC and given later in this booklet..

### 10. ANTI-TERMITE TREATMENT

It is necessary to carry out anti termite treatment in the building during the course of construction to prevent the attack of termites. For this purpose any one of the following chemicals can be used by mixing with water to make a solution which may be sprayed at the rate of 5 litres per sq.mtr.

- a) Heptachlor 0.5%
- b) Chlordane 1.0%
- c) Chloropyrifos 1.0%

### 11. DAILY DIARY

A daily diary should be maintained with dates of execution of work. This will help in proper curing and knowing the dates of removal of supports or shuttering etc. Daily expenditure record may also be kept to keep tab on the expenditure and financial requirements. A record of receipt and consumption of materials may also be kept.

### 12. GODOWN

A godown with lock and key may be constructed at site for safe keeping of costly items and cement etc., before starting construction. Copies of drawings with cloth pasted on the back may be kept at site for ready reference.

### 13. AGREEMENT WITH THE CONTRACTOR

A written agreement should be entered into with the contractor keeping in view the following points:

- a) The contractor will provide and furnish all labour, tools, plants and equipment necessary to complete all work required for construction.
- b) Time of completion should be fixed in advance. In case of non completion of work within stipulated time a predetermined/negotiated sum should

be deducted from the contractors bill.

- c) The mode of payment should be mentioned.
- d) A defects liability period, which is generally 12 months, should be included in the agreement.
- e) The contractor shall not appoint subcontractor without consulting the house builder.
- f) Sub-standard work shall be demolished and reconstructed at contractors cost.
- g) Rates of extra items should be included in the agreement.

#### 14. CENTERING & SHUTTERING

Sufficient supports should be provided to beams, slabs, columns, canopies, balconies etc. so that there is no sagging. The planks should have minimum space between them. Water should be sprinkled over them before concreting to clean and to close gaps. Paper may be spread on the planks over gaps to prevent leakage of cement slurry.

#### 15. CURING (SPRINKLING OF WATER)

Curing should be carried out for minimum 7 days for all cement and concrete works. Better curing gives extra strength without any extra cost.

#### 16. PAYMENTS TO LABOUR

The owner must see that the contractor is making payment to labour regularly as otherwise the owner may be made responsible for payment.

#### 17. EXTRA ITEMS

Before executing any extra items, rate should be decided in advance on current market rates with the contractor to prevent any dispute later on.

#### 18. REDUCTION IN BUILDING COST

The various aspects governing the reduction in building cost are:

##### 18.1 DESIGN ASPECTS

###### a) Load Bearing Walls:

As far as possible, the building should have load bearing walls made of bricks or stone. Reinforced cement concrete (RCC) columns and beams make construction costly. 4.5" thick i.e. half brick thick wall with hoop iron reinforcement may be used as partition wall.

###### b) Doors and Window Openings:

For construction of an economical house, large openings for doors and windows should be avoided as the lintel, chajja, frame, grills for windows, shutters, fittings, glass, jalli for doors, painting and polishing make them costly.

###### c) Lofts, Canopies and Sunshades:

These should be provided only where necessary and permitted under building byelaws. Their necessity may be considered from functional point of view as these add to the cost of construction.

###### d) Bye Laws:

The house should be constructed as per the building byelaws of the areas and as per sanctioned plan. Any deviation from sanctioned plan and area not only increases the cost of construction but attracts penalties from sanctioning authority.

###### e) Structural Design:

Structural design should be got prepared by qualified engineer. It should be such that number of columns and beams are minimum. Good and safe structural design saves steel and cement and make construction cheap.

##### 18.2 MATERIAL ASPECTS

###### a) Bricks:

Bricks should be purchased through civil supplies department, if available at controlled rates. These should not be half burnt or over burnt. The bricks available around Delhi/New Delhi are generally good for 2 to 3 storey house. Good quality bricks have regular shape, perfect corners and reddish colour. They should give metallic sound when struck with each other. Bricks should be properly soaked in water before use.

###### b) Cement:

Cement should also be purchased through civil supplies department, if available at controlled rate. Cement in drums reduces wastage. Cement

should be consumed as early as possible. More than 6 months old cement should not be used for construction.

###### c) Steel Bars:

Steel for reinforcement should be clean, free from scales of rust, oil or grease. Instead of plain mild steel bars, it would be advantageous to use ribbed steel bars, which do not require end hooks and need less over lapping.

###### d) Hydrated Lime and Clay Pozzolana:

It may be used for all masonry mortars and plasters for economy. 20 to 30% cement can be saved by use of pozzolana. Lime pozzolana mortars are cheaper compared to cement sand mortar and give improved workability.

###### e) Flyash:

The quantity of cement can be saved to the extent of 20% if flyash is used in conjunction with cement in mortars and plasters.

###### f) Pipes and Fittings:

Plastic pipes and fittings including electrical conduit may be used instead of G.I. or C.I. or steel pipes as these are cheaper.

**g) Timber:**

Timber to be used for construction purposes should be free from defects such as knots, wraps, splits, fungus etc. Treated and properly seasoned secondary species of timber may be used for wood-work. Exact sizes should be obtained from the market to curtail wastage. Various other alternatives to timber are cement bound chip boards, rice husk boards, fibre reinforced plastics, bagasse boards, gypsum boards, ferrocement products, MDF boards, aluminium, red mud products, poplar wood, rubber wood etc.

**h) Stone Dust:**

Stone dust can be used where good quantity is available at cheap rates, compared to Badarpur Sand. The silt content in Badarpur and stone dust should not be more than 6 to 10%.

**i) Stone Aggregates:**

Stone aggregates can be replaced by brick aggregates in foundation concrete or filling purpose with lime where water table is not high. Stone aggregates should be clean, free from cow dung, organic and inorganic impurities. Aggregates may be round, angular or irregular in shape. It is advantageous to use various sizes for good strength.

**j) Composite mortar:**

Composite mortar 1:2:9 (1 cement:2 hydrated lime:9 sand) can be used for all mortars and plaster to minimise the

use of cement. Coarse sand like Badarpur or stone dust for masonry mortar and fine sand like Yamuna sand for plasters should be used. 1:2:9 is equivalent to 1:6 cement sand mortar.

**k) Pozzolana Cement:**

It is cheaper as compared to ordinary portland cement and can be used with reliability. Flyash should not be mixed with pozzolana cement as it already contains pozzolana.

### 18.3 NEW TECHNIQUES

New techniques developed by various research institutions to evolve low cost housing are given below. These should be adopted, preferably for mass housing under the guidance of good engineers. (Please refer BMTPC Specifications).

**a) Foundation:**

- i) Underreamed piles
- ii) Hyperbolic paraboloid footing
- iii) Lean concrete (1:8:16)
- iv) Pocket connections

**b) Superstructure:**

- i) Brick cavity walls
- ii) 4.5" thick brick walls
- iii) Modular bricks
- iv) Lime flyash gypsum bricks for masonry
- v) Precast stone blocks
- vi) 19 cm thick load bearing masonry walls
- vii) Sand lime bricks
- viii) Light weight bricks

- ix) Cellular concrete blocks
- x) Laterite blocks
- xi) Solid / hollow concrete blocks
- xii) Red mud bricks and blocks
- xiii) Clay flyash bricks

**c) Arches/lintels:**

- i) Precast RCC thin lintels in 1:2:4
- ii) Ferrocement lintels cum chajja
- iii) Stone patties of suitable sizes
- iv) Flat or segmental arch in brick work

**d) Doors and Windows:**

- i) Precast RCC frames
- ii) Particle boards for shutters
- iii) Steel frames or pressed steel frames
- iv) Magnesium oxychloride saw dust frames
- v) Ferrocement door shutters
- vi) Red mud sisal fibre board shutters
- vii) Flyash polymer board shutters
- viii) MDF board shutters
- ix) Door shutters from plantation timbers like rubber wood or poplar wood.

**e) Roofing/Flooring:**

- i) Precast channel units
- ii) Precast waffle shells
- iii) Precast batten and hollow block construction
- iv) Reinforced concrete folded plate roof
- v) Precast hyperbolic shell for roofing
- vi) L-panel roofing
- vii) Reinforced brick/brick concrete slab

- viii) Precast R.C. planks and joists
- ix) Ribbed slab flooring
- x) Arch brick panels
- xi) Precast cored units
- xii) Doubly curved tiles

**f) Flooring:**

- i) Stabilised soil cement base for floors
- ii) Magnesium oxychloride flooring
- iii) Cement concrete flooring
- iv) Floor base of 1:20:40 (Cement : Flyash : Sand)
- v) Thin clay tile flooring
- vi) Brick/brick tile flooring in cement/ lime mortar

**g) Structural Members:**

- i) Hollow Beams
- ii) Precast RCC columns and bases
- iii) Precast concrete staircases elements

**h) Services:**

- i) PVC pipes for water, electric supply
- ii) Single stack system of plumbing
- iii) PVC fittings for sanitary purposes

### 18.4. TIME AND CONTINUITY OF CONSTRUCTION

Well planned time schedule and continuity of construction would reduce the building cost to a good extent.



## Guidelines for Execution of Construction Work by Labour Contract Only

**T**he most commonly used method for construction of houses in and around Delhi, which is adopted by the house builders, is the labour contract method. In this method after the plans are approved, the materials required for construction are purchased and supplied by owner to a labour contractor, who would be responsible for supplying labour and getting the work done for smooth construction. The owner should purchase building materials in bulk directly from the source or wholesale dealers, to effect purchase economy. Preferences should given to ISI marked products.

The labour contractor should quote his rate on per sq. foot or per sq. mtr. basis. At present the rate in and around Delhi is Rs.30/- to Rs.35/- per sq. foot or Rs.300 to Rs.350/- per sq.mtr. depending upon the area where the plot is located and the quality of work involved. The rates are lower in areas where cheap labour is available, and near the residence of workers.

The contractors are mostly good mistries with good experience of job. Some of these are semi-educated and can do the job properly. However, before assigning the work, enquiries regarding their earlier jobs should be made and the quality of work assessed.

### MODE OF PAYMENT

The payments may be in instalments as mentioned below to meet periodical money requirement of the labour

contractor. But in no case should excess payment be made.

Execution of work upto	Payment
1) DPC level	15%
2) Door level	10%
3) Roof level	25%
4) External plastering	10%
5) Internal plastering	10%
6) Laying of floors	10%
7) Grinding and polishing of floors	15%
8) Final, after fixing gates etc.	5%

For example if the covered area of the house is 500 sq.ft. and the rate quoted by labour contractor is Rs.30 per sq.ft. The charges for providing labour will be Rs.15,000/-. This can be divided in eight instalments as mentioned above.

### EXTRA ITEMS

An agreement should be made indicating charges, if any, for open spaces, courtyards, balconies, chajjas, canopy, mumty, godown for keeping cement, chowkidar huts, water tank for storing water for construction, water tank at top of roof for water supply to the house, fixing of glazed tiles, marble or stone slabs, and fixing of gates, railings, boundary walls, etc.

### RATES OF EXTRA ITEMS

The contractors may not agree to some of

the items mentioned above as included in the rate per sq.ft. given by him. In that case the rate which will be chargeable should be negotiated and decided in advance to prevent disputes later on.

The contractor will provide all tools, scaffolding, shuttering and labour and execute work within a time limit fixed in advance.

The owner will pay for bar binder, rental charges for concrete mixer, vibrators etc., provide hand pump or water connection for execution of work. He will also provide electricity connection and pay the electrical & water bills.

### WOOD WORK

There is a separate contractor for wood work, i.e. for frames, doors, windows, show cases etc.

### SERVICES

A separate labour contractor is required for the following services:

- i) Sanitary and water supply work.
- ii) Electrical wiring and fixing of fittings etc.
- iii) Painting, white washing etc.

### A. LABOUR AND MATERIALS WISE BREAK UP

For the general guidance of house builders the rough break-up of the cost of labour and materials is as under:

<b>Cost of Materials</b>		<b>73%</b>
Cement	18%	
Iron & Steel	10%	
Bricks	17%	
Timber	13%	
Sand	7%	
Aggregates	8%	
<b>Cost of Labour</b>		<b>27%</b>
Masons	12%	
Carpenters	10%	
Unskilled Labour	5%	

### B. ELEMENTS WISE BREAK-UP

The above break-up was for labour and material. The element wise rough break-up may be as indicated below:

Foundation	10%
Walls	30%
Roofs	25%
Doors & Windows	15%
Flooring	10%
Finishing	10%

### C. SERVICE BREAKUP

A further 25 to 30% on the above is required for following services:

Sanitary services	12 to 18%
Water supply	10 to 15%
Electric	6 to 8%
Painting, White washing etc.	2 to 5%

### BREAK-UP OF COST

This table lists the cost break ups for the various components from three different parameters, as a ready reckoner for calculating funds required for a particular component. This table will also help in determining where optimum economy can be achieved



## Typical Specifications for Cost-Effective House Construction in Urban Areas

**B**uildings are expected to be structurally safe, functionally efficient and durable. In cost-effective housing, however, where economy in cost of construction is an important consideration, it becomes necessary to follow somewhat lower standards, by choosing such specifications which would result in reduction in cost. Maximum possible use of locally available materials may be made for cost effective housing. Typical specifications for cost effective house construction in urban areas are given here, with various suggested alternatives.

### 1. FOUNDATION & PLINTH

#### 1.1 Base concrete

The base concrete may be 100 to 150 mm thick consisting of:

- a) Lime concrete 1:2:6 (1 lime: 2 fine aggregate like surkhi, sand: 6 coarse aggregate like stone or brick aggregate)  
*Note: If water table is high and rainfall is heavy use of fat lime for lime concrete should be avoided.*
- b) Cement concrete 1:5:10 (1 cement:5 fine aggregate:10 coarse aggregate like stone or brick aggregate)  
*Note i) A cement concrete mix leaner than above can be used if sand is granular, coarse and well graded.*  
*Note ii) Flyash may be used in lean cement concrete.*

#### 1.2 Masonry

Under average conditions, the following mortar are adequate for masonry in foundation and plinth:

- a) Brick masonry in cement mortar 1:6 (1 cement : 6 fine aggregate)  
Cement lime mortar 1:1:8 (1 cement : 1 lime : 8 fine aggregate)  
Lime mortar 1:3 (1 lime : 3 fine aggregate)

*Note i) Leaner mix cement mortar may be used for single and double storeyed construction if sand used is well graded and granular.*

*Note ii) Rice husk pozzolana lime mortar 1:3 may be used instead of cement mortar.*

- b) Coursed rubble stone masonry/precast stone masonry blocks/random rubble masonry in :  
cement mortar 1:6  
Cement lime mortar 1:1:8  
Lime mortar 1:3

*Note i) Stone and stone aggregate may be used where available at reasonable cost*

*Note ii) Flyash of proper quality may be used in the areas where it is available.*

### 2. DAMP PROOF COURSE (DPC)

The Damp Proof Course may consist of:

- a) 2 cms thick cement lime plaster 1:1:5 (1 cement:1 lime:5 coarse sand) with one or two coats of bitumen.  
*Note: Suitable for scanty rainfall areas with low water table.*

- b) 2.5 to 4 cms thick coat of cement concrete 1:2:4 (1 cement:2 fine aggregate:4 coarse aggregate) with two coats of bitumen.

*Note: Suitable for moderate rainfall areas with low water table level and scanty rainfall areas with high water table.*

- c) 4 cms thick coat of cement concrete 1:1.5:3 with integral water proofing compound.

*Note: Suitable for heavy rainfall areas with low or high water table level and moderate rainfall areas with high water table level.*

### 3. WALLS

The walls as super structure may consist of the following:

- a) Brick Masonry  
b) Coursed stone masonry/precast stone masonry blocks/random rubble stone masonry in:

Cement mortar 1:6

Cement lime mortar 1:1:6-9/1:2:9-12/1:3:12-15

Lime mortar 1:2-3

Mud mortar with 2% lime

*Note i) Where soil is not good for making bricks, stone may be used for walling.*

*Note ii) Leaner mix of mortars may be employed if well graded, granular, coarse and good quality sand is available. Use of fat lime should be avoided in heavy rainfall areas.*

*Note iii) Mud mortar may be used in brick masonry for single storey structure when economy in cost is a major consideration. Jambs of door and windows openings and*

*two courses below roof level should however be in cement mortar 1:6. Mud mortar could be improved by adding 2% lime if soil is sandy.*

*Note iv) Lime flyash gypsum bricks, precast stone blocks, flyash bricks, redmud bricks and blocks, 19 cm thick load bearing wall, sand lime bricks, cellular concrete blocks, laterite blocks, hollow concrete blocks etc. may also be used for walls for cost effective housing.*

### 4. ARCHES/LINTELS

The following types of arches/lintels may be provided:

- a) Flat or segmental arch in brick work up to 1.20 mt. span.  
b) Precast RCC thin lintel in 1:2:4. Concrete upto 1.8 mt. span ensuring composite action between lintel and the brick work above.  
c) Ferrocement lintels cum chajja.  
d) Stone patties of suitable size for small spans.  
e) RCC lintels suitably designed for any span length.

### 5. STRUCTURAL FLOOR/ROOF

Structural floor/roof may consist of any of the followings:

- a) Brick tiles on precast RCC or timber battens/floor.  
b) Jack arch roof with precast RCC joists.  
c) Madras terrace floor/roof.  
d) Timber joists and planking.  
e) Trusses in RCC/steel with AC/CGI sheets/corrugated asphaltic sheets/red mud roofing sheets/fibre reinforced

plastic roofing sheets/tiles/slates/shingles.

- f) Reinforced brick or reinforced brick concrete slabs.  
g) Stone patties of required thickness for span upto 3.2 mts.  
h) Precast units like channel units, cored units, waffle shells, L-panel, cellular units, doubly curved tiles, solid RCC planks, reinforced brick panels on precast RCC joists, arch brick panels, precast hyperbolic shell, ribbed slab flooring.  
i) Reinforced cement concrete slab.

*Note i) Madras terracing may be used where special terrace bricks and clay tiles are available at reasonable rates.*

*Note ii) For reinforced brick work, bricks should have a minimum crushing strength of 105 kg/cm<sup>2</sup>. It should not be used in coastal areas where incidence of corrosion is high.*

*Note iii) Before adopting the precast units, a detailed comparative study of cost is essential.*

*Note iv) Refer to BMTPC Standards & Specifications for technical details of pre-cast units.*

### 6. DOORS AND WINDOWS

The doors and windows may consists of :

#### 6.1 Frames

- a) Secondary species of timbers locally available after proper seasoning and chemical treatment.  
b) Angle iron, tee iron or pressed steel frames.

- c) Precast RCC frames.  
d) Magnesium oxy-chloride saw dust frames.

#### 6.2 Shutters

- a) Secondary species of locally available timbers after proper seasoning and chemical treatment of thickness around 3.5 cms.  
b) Ferrocement door shutters.  
c) Red mud sisal fibre board shutters.  
d) Flyash polymer jute board shutters.  
e) MDF board shutters  
f) Shutters from plantation timbers like rubber wood or poplar wood.

#### 6.3 Fittings

Mild steel black Japan painted fittings, anodised aluminium fittings may be used.  
*Note: When economy in cost is a major consideration, frames for internal doors can be omitted and shutters hung on pivot arrangements.*

### 7. FLOORING

The flooring may consist of as indicated:

#### 7.1 Base for Ground Floor

Rammed earth followed by 10 to 15 cm of sand filling and 10 cm of lean cement concrete or lime concrete.

#### 7.2 Wearing Course

- a) 2.5 to 3.5 cm thick cement concrete 1:2:4.



- b) Brick/brick tile flooring laid in cement/ lime mortar.
- c) Stone slabs
- d) Clay tiles flooring with 25 mm width terrazzo strips.
- e) Magnesium oxy-chloride flooring

## 8. FINISHING

The finishing may consist of:

### 8.1 External rendering on walls

Cement lime mortar 1:1:7

Cement mortar 1:6

Rough cast cement plaster in two coats

*Note i): For external rendering, the fineness modulus of sand used should be 2 to 2.5 i.e. coarse sand.*

*Note ii) In areas of moderate and heavy rainfall, the external rendering should not be omitted in case of one brick walls. Stone masonry, however, could be finished by pointing instead of rendering.*

### 8.2 Internal rendering on walls

Cement lime mortar 1:1:8

Lime surkhi mortar 1:1:2 ( 1 lime : 1 surkhi : 2 sand)

Cement mortar 1:6

*Note i) For internal rendering the fineness modulus of sand should be 1 to 1.5 i.e. fine sand.*

*Note ii) When economy in cost is a major factor, joints of brick work can be finished flush while the mortar is still green and thus internal plastering could be avoided.*

### 8.3 Finish on walls

Internal - white wash

External - colour wash

### 8.4 Finish on wood work and iron work

One coat of primer plus two coats of synthetic paint may be used.

## 9. WATER-PROOFING

**9.1 Bitumen** coating at the rate of 12 kg per 10 sq.mts. impregnated with a coat of coarse sand at 60 dm per 10 sq.mts with following:

- a) Residual type petroleum bitumen of penetration 80/100 or
- b) with hot cutback bitumen.

The above is followed by:

- 1) Mudphuska with tiles if the terrace is to be used.
- 2) Mudphuska finished with mud plaster and gobri leaping if the terrace is not to be used.
- 3) Lime concrete.

*Note i) Lime concrete covered with cement concrete tiles on four to six course tarfelt treatment may be used in heavy rainfall areas.*

*Note ii) Please ensure proper slope with adequate pipes to drain off water.*

**9.2 Ferrocement** may be used for water proofing.

## 10. PLUMBING AND DRAINAGE

**10.1 External plumbing** - G.I. pipes, plastic pipes and fittings.

**Internal plumbing** - Plastic pipes for cold water supply.

### 10.2 Drainage

Single stack system of plumbing should be used subject to municipal bye-laws.

## 11. ELECTRICAL INSTALLATIONS

Wiring on wooden battens with PVC insulated, PVC sheathed aluminium conductor cable may be used for electrical work.



## Superior Specifications for Residential Buildings

The following specifications lay down the guidelines for superior quality construction for residential buildings which are not greater than two storey in height.

### 1. FOUNDATION

- 1.1 CEMENT CONCRETE in foundation bed 1:5:10 (1 cement:5 sand(fine sand):10 stone ballast 40 mm down gauge). The thickness of the foundation bed varies from 15 cm to 30 cm depending upon the structural design. It is laid directly after excavation of the bed of trenches. Concrete is to distribute the load and level the foundation bed.
- 1.2 MASONRY in foundation with first class brick work in cement mortar 1:6 (1 cement:6 sand)
- 1.3 DAMP PROOF COURSE (DPC) 40 mm thick DPC in cement concrete 1:2:4 (1 cement:2 coarse sand:4 crushed stone aggregates 12 mm and down gauge).
- 1.4 HOT BITUMEN COATING using 1.7 kg per square meter shall be applied over the dried up surface of cement concrete (over DPC surface) after properly cleaning it with brush and finally with a piece of cloth soaked in kerosene oil. The bitumen shall be applied uniformly all over, so that no blank spaces are left.

### 2. WALLS

Walls shall be with first class brick in cement mortar 1:6. Brickwork shall be

9" thick (22.5 cms) for load bearing walls. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical.

### 3. REINFORCED CEMENT CONCRETE

- 3.1 RCC work in slab (Roof), lintel, beams, chajjas and columns shall be with cement concrete in ratio of 1:2:4.
- 3.2 STEEL  
Mild steel deformed bars shall be used as reinforcement in all RCC work. The diameter of bars shall be provided according to structural design. All steel shall be free from rust, oil or dust.
- 3.3 COVER  
Minimum thickness of concrete cover (exclusive of plaster or other decorative finish) for various elements are:
  - a) SLAB  
For tensile, compressive, shear or other reinforcement at least 15 mm or diameter of bar whichever is greater.
  - b) BEAM  
For longitudinal reinforcement at least 25 mm or diameter of bar whichever is greater.
  - c) COLUMN  
For longitudinal reinforcement at least 40 mm or diameter of bar whichever is greater. For column of minimum

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dimension of 20 cm, 25 mm cover may be used.

- d) Ends at each end of reinforcing bar at least 25 mm or twice the diameter of such rod or bar.

**3.4 SHUTTERING** at least 30 mm thick wooden planks or steel plates stiffened by steel angles may be used. It shall be supported on battens and beams and props of vertical ballies properly cross braced together, so as to make the form work rigid.

#### **Surface Treatment for Shuttering**

The surface of timber shuttering coming in contact with concrete shall be properly cleaned, well wetted and coated with soap solution applied before concreting is done. Alternatively, a coat of raw linseed oil or form oil of approved quality may be applied on.

#### **Removal Time for Shuttering**

In normal conditions (generally where temperature is above 20°C) and where ordinary cement is used, time for removal of form work for different members should be as under:

- a) Walls, columns and vertical sides of beams - 48 hours  
b) Undersides of slabs upto 4.5 meters span - 7 days  
c) Undersides of slabs upto 4.5 mtr span and undersides of beams upto 6 mtr span - 14 days  
d) Undersides of beams and arches over

6 meters span and upto 9 meters span - 21 days

#### **3.5 CURING**

Generally curing shall be done for 7 to 10 days. In winters it should be continued for 14 days. The curing may be done by following methods:

- i) Covering the concrete surface with moist sand, earth, gunny bags etc. and sprinkling water at intervals to keep the covering wet.  
ii) Floors or other horizontal surfaces may be cured by holding water in earthen or sandy bunds in square over the entire area  
iii) Columns, walls or other such vertical surfaces are covered by wrapping gunny bags over the surface and keeping the same wet by sprinkling water.

#### **4. FLOORING**

**4.1** The flooring is generally done in the following layers:

- i) After DPC, earth shall be filled in layers not exceeding 20 cm upto plinth level. This should be properly watered and consolidated by ramming with iron rammers and with butt ends of crowbars when filling reaches the finish level. The surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and consolidated, in order to avoid any settlement at a later stage. The finishing level of the filling shall be kept to slope intended to be given to the floor.

- ii) Over the earth filling, about 15 cms thick fine sand layer shall be filled, properly sloped, well rammed and watered.  
iii) 7.5 cm thick layer of 1:5:10 (1 cement:5 fine sand:10 brick ballast) shall be laid in proper slope and rammed properly  
iv) 28 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 crushed aggregates) shall be provided. Glass, Plastic or Aluminium strips are laid in floors. These strips divide the floors in smaller areas (ideal bay is about 1.2 sqm) in order to prevent cracking due to temperature variations. They are also useful for providing designs and patterns in the flooring.  
v) 12 mm thick marble chips concrete in 1:2 (1 cement:2 marble chips) is laid. White cement with light shade pigments shall be used for colouring. For dark colours ordinary grey cement with colouring pigment is used.

#### **4.2 GRINDING, CURING AND FINISHING**

Grinding shall be done by machine except near corners and skirting etc. It shall be done in three layers:

- i) First Grinding is done after 36 hours of laying of floor top layer with machine using rapid cutting grit blocks of course grade (No.60). After the first grinding the surface shall be thoroughly washed and covered with grout of cement to fill any pin holes that appear and left

for curing for 5 to 7 days.

- ii) Second Grinding shall be after 5 to 7 days with machine using fine grit block (No.120) and again cleared and repaired as before and allowed to cure for 3 to 5 days.  
iii) Third Grinding shall be done after 3 to 5 days with grit blocks (No.320) to get even and smooth surface. The floors may be cleaned and polished with wax polish.

#### **5. ROOFING OR TERRACE**

##### **5.1 LIME CONCRETE TERRACING**

Lime mortars used shall be in 1:2 (1 lime putty:2 surkhi). The volume of wet mortar to be used will be 50% of laid (and not thrown) in a single layer and spread and rammed with wooden rammers of weight not exceeding 2 kg to the specified averaged thickness sloped and levelled.

While the beating is in progress, the surface should be liberally sprinkled with a mixture of gur and boiled solution of bael fruit in the proportion of 1.75 kg of gur to 1 kg bael fruit boiled in 60 litres of water. As soon as the beating is completed the mortar that has come on top shall be softened by adding the solution of gur and bael.

The lime concrete treatment shall be done over hot bitumen at the rate of 1.7 kg per sqm. and blended with 0.06 cubic meter of coarse sand

## 6. WOOD WORK

### 6.1 WOOD FOR FRAMES

All timber shall be of good quality teak and well seasoned. It should be hard, dark coloured, uniformly coloured, sweet smelling, reasonably straight grain and shall be free from knots, cracks and shakes etc.

### 6.2 DOOR AND WINDOW SHUTTERS (FLUSH DOOR SHUTTERS)

Door shutters shall be decorative plywood faced flush doors. These shall consist of a solid core covered on each face with cross bands and face veneers and lipped on all the edges.

A wooden frame prepared from styles and rails shall be of well seasoned and treated wood. Good quality wood shall be provided for holding the core. The width of members shall not be less than 50 mm and not more than 100mm.

Alternatives to timber such as Medium Density Fibre Boards, Glass Reinforced Gypsum Boards and Cement Bonded Particle Boards may also be used instead of timber. These products are fireproof, termite free, and act as alternatives to timber.

### 6.3 PANELLED, GLAZED OR PANELLED AND GLAZED SHUTTERS FOR DOORS, WINDOWS

- i) Joinery work shall be started immediately after the commencement of the building work.
- ii) The thickness of styles and rails shall be as specified for the shutters. The thickness of panels shall be 16mm upto a width of 400 mm and 19mm for a greater width.
- iii) Shutters shall not be painted, oiled or otherwise treated, before these are fixed in position.

### 6.4 GLAZING

Glazing shall be of good glass not less than 2 mm thick for panes upto 0.09 sq.mtr and 3mm thick for panes bigger than 0.09 sq.m. Glasses shall be free from flaws, specks or bubbles. In doors, windows and clerestories of bath, WC and lavatories frosted glass panes shall be used. Superior glass panes such as sheet glass, plate glass, pin head glass shall be used where required. Glass panes shall be fixed by wooden beading having mitred joints. A thin layer of putty shall be applied between glass panes and sash bars and also between glass panes and the beading. Fixing of glass panes with simple putty and brads shall not be permitted. Putty shall be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding boiled linseed oil to the mixture to form into a stiff paste.

## 7. STAIRS

RCC stairs with a maximum rise of 150 mm and minimum tread of 250mm shall be provided.

## 8. FINISHING

The finishing may consist of the following:

- i) 15mm thick cement plaster 1:2:4 (1 cement:2 coarse sand:4 fine sand) on rough side.
- ii) 12mm thick cement plaster 1:2:4 (1 cement:2 coarse sand:4 fine sand) smooth side (outside).
- iii) Distemping with washable oil bound distemper in verandah, kitchen and passage.
- iv) Synthetic enamel paint of approved quality in rooms.
- v) Finishing external walls with two or more coats of decorative water proof cement paint.
- vi) Polish on all wood work on doors and windows.
- vii) Ceramic tiles pasted on cement mortar 1:3 (1 cement:3 coarse sand) in latrine, W.C. and kitchen, toilet, bathroom.

## 9. SOME GENERAL PRECAUTIONS AND SUGGESTIONS:

The following precautions and suggestions should be considered while constructing a house:

- i) Water: Water shall be clean and reasonably free from deleterious matter such as oils, acids, alkalies, salts and vegetable growth.

- ii) Fine sand (Jamuna sand)- This shall be natural river sand, clean, sharp and free from excessive deleterious matter. It shall not contain more than 8 percent of silt.
- iii) Coarse sand- This shall be natural, pit sand, clean, sharp and strong. Stone dust can also be used in place of coarse sand.
- iv) All scaffolding, props or support shuttering should be good and be able to take weight of slabs without sagging.
- v) Bricks required for masonry in cement shall be thoroughly soaked in clean water for at least one hour in brick lined tank of sufficient size immediately before use.
- vi) Before construction is taken up please check whether the location lies in an area prone to disasters like earthquake, floods, cyclones etc. Consult experts for adopting disaster resistant construction features.