QUALITY ASSURANCE CHECKLIST (2)

FOR HOUSE CONSTRUCTION IN DISASTER-PRONE AREAS FOR

BUILDING CONTRACTORS, SITE SUPERVISORS, BUILDING IMPLEMENTERS AND HOUSE OWNERS

CONTENTS

Contact: Resource Desk

Practical Action

No 5, Lionel Edirisinghe Mw, Colombo 5, Sri Lanka.

T +94 (11) 2829412 F +94 (11) 2856188

W www.practicalaction.org www.janathakshan.net E srilanka@practicalaction.org.lk

A : INTRODUCTION

WHY QUALITY ASSURANCE?

The need for a sustainable built structure calls for quality control throughout the entire process of its construction. This document pays attention to the following aspects:

1. Quality control in pre-planning
2. Quality control in site organization, construction process and supervision
3. Quality control in health and safety of personnel

The following information provides general guidelines for quality control when building one storey or two storey houses – not multistoreyed buildings that are higher than two storeys.

This document is intended mostly to help building contractors and site supervisors to maintain reliable standards in order to ensure that the final product would be of durable quality. It is hoped that users of this information will contribute to the construction of houses that will successfully withstand any adverse weather and even disasters such as cyclones, floods and earthquakes. By carefully implementing the guidelines provided in this document, users of this information who are engaged in the construction process will enhance their abilities and reputation in addition to ensuring that occupants of the buildings would be satisfied with the building's performance after occupation. This document has been prepared also to serve the interests of persons who would occupy the houses constructed and those financing the construction as stakeholders who must be concerned about achieving quality in the final product.

PLANNING AND SITE ORGANIZATION

Careful forethought and planning are required for sound site organization. Consideration must be given to the efficient use of available space at the site during building operations in order to ensure that all building activities move smoothly with minimal interference or delay. The proper choice of suppliers and subcontractors plays an important part in achieving desired quality and efficiency.

THE CONSTRUCTION PROCESS AND SUPERVISION

Reliable standards must be maintained throughout the whole construction process in order to ensure that the built work is durable, is functionally sound and aesthetically satisfying. Simple time-tested methods that have proved effective in ensuring quality can be employed to make sure that problems do not develop later, which can be expensive and difficult to rectify. Close supervision of craftsmen and workers employed by the main contractor on the site is essential to make certain that all the elements that make up the building conform to acceptable standards of quality. The work of sub contractors too requires planning and supervision to ensure quality is maintained in all aspects of construction, including services.

HEALTH AND SAFETY

Health and safety are factors that must be pursued with as much vigour as other management objectives. Ensuring the well-being and safety of all workers or visitors at construction sites will improve performance; minimize accidents and illness which in turn will reduce disruption of work as well as consequent expenses.

The following checklist is prepared so that building contractors and supervisors can make sure that essential steps are taken to ensure maintenance of quality control throughout the building process.

Note: In checking out the Yes/No response to each question, it is important that if the answer is No, follow-up corrective action is needed.

B: PRE-PLANNING

PRELIMINARY ASSESSMENT OF PROJECT

Have you?

- Carefully studied the architectural and structural drawings

  Yes __ No __

- Carefully studied the terms of the contract, the Specifications and Bill of Quantities BOQ* (* i.e. list of materials with corresponding quantities required for work items)

  Yes __ No __

- Noted any discrepancies or items that are not clear to you in the architectural and structural drawings, Specifications and BOQ

  Yes __ No __

- Requested clarification on items unclear to you in drawings and other documentation from the architect and engineer and client.

  Yes __ No __

- Made sure that information provided in the drawings and other documentation is adequate, also that the terms of the contract are acceptable for proceeding with preparatory work for construction at the proposed site

  Yes __ No __

- Prepared a Bar Chart (See specimen bar chart – annexed) that lists the sequence of building activities with corresponding time periods for completing each activity, taking into account holidays, inclement weather and other factors that are likely to cause delays.

  Yes __ No __

DETERMINE REQUIREMENTS – PLANT/EQUIPMENT, MATERIALS, AND PERSONNEL

To determine plant/equipment and materials requirements:

Have you?

- Studied the plans and specifications in relation to the phases of construction shown in the Bar Chart

  Yes __ No __

- Double checked the accuracy of the Bill of Quantities

  Yes __ No __

- Listed the materials required at each successive stage of construction (See specimen materials schedule – annexed)

  Yes __ No __

To determine personnel requirements:

Have you?

- Drawn up a schedule of personnel required for carrying out the project to completion (See specimen schedule of personnel – annexed)

  Yes __ No __

DETERMINE TIME FRAME FOR COMPLETING PROJECT

Have you?

- Checked the Bar Chart 's time periods for completing each activity in sequence, taking into account holidays, inclement weather and other common factors that cause delays and determined the feasibility of completing work on schedule

  Yes __ No __

CHOOSING SUPPLIERS AND PURCHASING MATERIALS

Quality and conformity to the specifications should be the primary consideration and not the cheapest price when choosing suppliers and materials.

Whenever and whatever the contractor aims to purchase, s/he should aim to buy:

- the right quality
- at the right time
- the right quantity
- from the right source
- at the right price

Have you?

- Made sure that an experienced and knowledgeable purchasing officer has personally visited the premises of the suppliers and has established the reliability of each supplier and the quantity of the materials that are to be purchased from them

  Yes __ No __

- Made sure that the supplier has reliable means of transporting materials to the site at the required time/s

  Yes __ No __

- Compared the rates given by at least two other reliable suppliers to determine whether the prices agreed upon are compatible and not excessive

CHOOSING SUBCONTRACTORS

Look for real value and not the cheapest cost when choosing subcontractors, the same as is needed with choosing suppliers. Also, it is important that certain installations, such as electrical and plumbing, require personnel who are qualified and experienced in their respective fields of activity if quality in installation is to be assured. In choosing suitable subcontractors

Have you?

- Investigated their financial standing and satisfied yourself that their financial status is satisfactory

  Yes __ No __

- Checked on whether the subcontractors and their staff of tradesmen are sufficiently experienced and skilled to carry out their respective tasks

  Yes __ No __

- Checked on who they worked for before and whether such persons can be approached for reference

  Yes __ No __

- Found out who in their labour force are permanently employed and who are casually recruited

  Yes __ No __

- Found out if the contractor or tradesmen have their own tools and specialist equipment

  Yes __ No __

- Found out if the contractor or tradesmen have their own transport that is dependable

  Yes __ No __

- Established whether the contractor is reasonably free from other current commitments in order to give adequate attention to the proposed work

  Yes __ No __

- Established if the contractor is able to complete the work assigned on time

  Yes __ No __

- Established clearly the terms and conditions of payment, including the contractor's commitment to correct substandard work (due to non conformity to given specifications/ drawings and prevailing standards) at his own cost

  Yes __ No __

OVERSIGHT OF SUBCONTRACTORS

In order to ensure that each subcontractor clearly understands his rights and responsibilities in carrying out the work assigned

Have you?

- Given a clear description of the work to be done, including the work of making good the work of previous trades* (*construction work items done by others earlier)

  Yes __ No __

- Arranged for access to the site for supplies, materials and equipment

  Yes __ No __

- Provided the specifications for work to be done, and clarified any queries for which the subcontractor may require clarification

  Yes __ No __

- Arranged for working area/s for subcontractor and storage of his tools and equipment

  Yes __ No __

- Clearly established whether, and in what circumstances, the subcontractor may use plant or equipment belonging to the main contractor

  Yes __ No __

- Agreed on the attendances (services) to be provided by the Main contractor to enable the subcontractor to carry out his work and informed the subcontractor accordingly

  Yes __ No __

- Established the time limits for commencing and completing the elements in the subcontract work, based on the general programme, and commitment to complete work on schedule, as well as the penalty to be imposed due to delay in completion

  Yes __ No __

- Arranged for supervisors by the client or client's representative

  Yes __ No __

- Made sure that worker safety and welfare arrangements are satisfactory

  Yes __ No __

- Obtained agreement on the subcontractor's liability for damages to third parties and insurance cover

  Yes __ No __

OVERSIGHT OF DIRECT LABOUR* (*Labour employed directly by the main contractor or house owner)

Have you?

- Given a clear description of the work to be done, including the work of making good the work of previous trades*(*construction work items done by others earlier) that have been affected by the work of the workmen

  Yes __ No __

- Made clear the terms and conditions of engagement

  Yes __ No __

- Established time/s to start work items and time limits for completion of work

  Yes __ No __

SITE SUPERVISION

Have you?

- Chosen and appointed an experienced and competent supervisor to oversee the work done by personnel who are to carry out all types of building activity on the site

  Yes __ No __

- Have you briefed the chosen supervisor thoroughly on all aspects of his/her responsibilities

  Yes __ No __

- Explained clearly the time frames set for each item and phase of work

  Yes __ No __

- Have you clearly explained the terms of engagement and obtained the supervisor's agreement to the stated terms

  Yes __ No __

C : HEALTH AND SAFETY AT THE WORK SITE

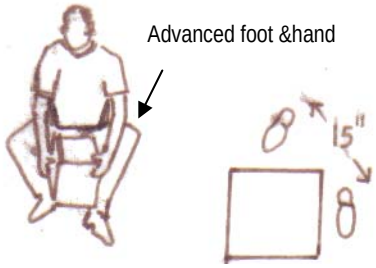
The physical well being and safety of workers on site as well as safety of visitors to the site should be of primary concern to the contractor and implementation of a project. An accident prevention programme should be established to minimize the number of accidents that can happen on a building site. All workers should be briefed on safety standards and measures to be taken to handle accidents. 'Good housekeeping' on a construction site is very important if accidents are to be avoided. Good housekeeping on a construction site includes the following:

1. Keeping the site tidy
2. Quickly clearing away debris that can be hazardous to persons moving around the site
3. Removing nails from used timbers
4. Making sure that nails, broken glass and other harmful objects are not left lying around
5. Making sure that each worker is personally responsible to clean-up as well as make good whenever needed after an item of work is completed.
6. Making sure that live power lines with unprotected joints and exposed wires are not allowed to be used or left exposed in a way that may cause harm to persons
7. Making sure that materials are stacked in a manner that would not cause harm to persons
8. Making sure that any live flames are not left untended if they are used at all for a purpose

9. Making sure that pits or excavations are clearly identified and protected so as not to cause injury to people by using marking tape, danger signs or red flags as appropriate
10. Making sure that plastic or polythene sheets are not used as temporary floor covering in locations especially where ladders are used because such coverings are too slippery and dangerous
11. Making sure edges of covering material on the floor are well tucked in so as not to cause persons to trip
12. Making sure that floor surfaces on which water has spilled are quickly mopped and made sufficiently dry to prevent injury due to persons slipping.
13. Making sure that animals and children are kept out of working areas and all materials and tools and paint are kept out of their reach
14. Making sure that workers at the building site tie back long hair or tuck their hair into a hat
15. Making sure when painting to keep the room well ventilated and not allow eating or smoking while painting or using equipment
16. Making sure that the right tools and equipment are used for the job at hand; never just improvising with whatever is on hand that is not suited to the work
17. Making sure that all workers who may have paint splashed on their skin, use only proprietary cleaners to remove it, never solvents or other chemicals
18. Making sure that rubbish is disposed of carefully, never throwing chemicals down drains, but follow pack instructions
19. Making sure that flammable items – gloss paint, undercoat, primer and white spirit – are stored well away from any source of ignition
20. Making sure that suitable measures are taken to ensure that the base of any ladder in use does not slip
21. Making sure that raised working platforms are stable and of adequate size and can hold the weight of persons and materials on them.

Other protective and preventive measures are:

- Make sure that protective gear and equipment are used – such as gloves, eye shields for welders, safety helmets, safety belts, face masks etc.
- Make certain that workers at site are given clear and specific instructions on proper posture when lifting heavy items and methods of moving and handling materials (See Manual Handling of Materials and Equipment 1 & 2).



Place feet apart- one foot advanced in direction of travel advanced hand

Correct lifting posture

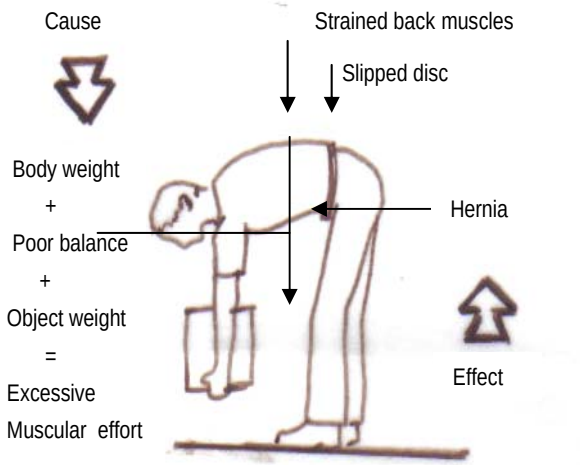
Back straight knees relaxed. Head up,chin in-Lifting done with leg muscles

Position of feet for pushing

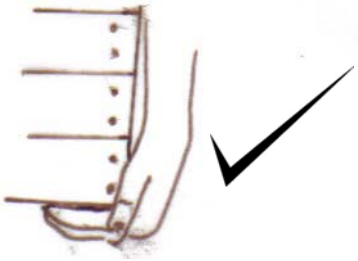
Front foot provides balance while rear foot gives thrust

Position of feet for pulling

Back foot safeguards balance, while front leg with knee bent to allow body to move back , does the thrusting

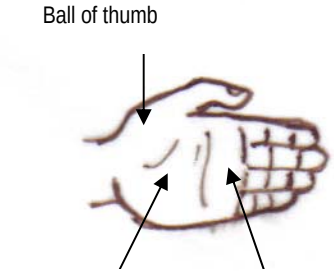


Manual Handling of Material & Equipment -1

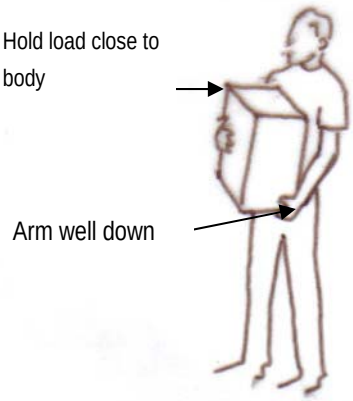


Position of hand for lifting

Avoid use of finger grip



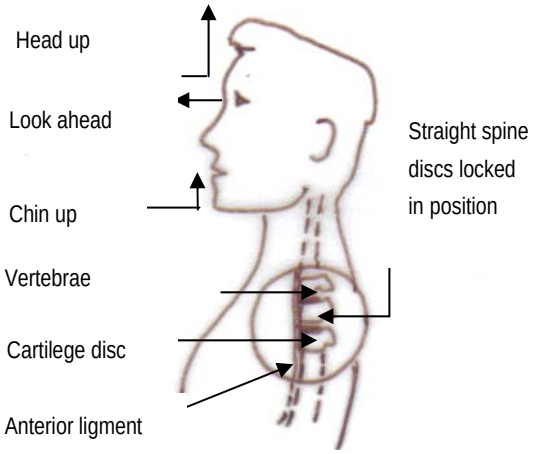
The palm of hand the ball of the thumb and roots of the fingers to obtain a broad, even contact with the object



Position of Arms when carrying object

Maximum leg thrust greater than 90°

Maximum leg thrust less than 90°



Position of head for lifting

Manual Handling of Material & Equipment -2

- Make sure that a well equipped first aid kit is made available on site and readily accessible to all persons on the site. Needed items for cuts, bruises, burns and other injuries that require first aid treatment should always be stocked in the kit and quickly replenished when used.
- Ensure that a stretcher is always on hand at the site and properly used when it is not advisable to lift and carry injured people without a stretcher. When the injured person is suspected to have severe fractures or broken bones stretchers have to be used.
- Ensure that all workers and persons who visit the site are not permitted to walk barefoot, because of the danger of being injured and the wound caused by the injury being infected.

Accidents

Accidents can and do happen and on such occasions it is important that these be handled properly and promptly because the first hour is critical. Special procedures should be outlined and explained to all who work on site. When accidents do happen, the following action should be taken:

1. Use items in the first aid kit that is on site as appropriate to the injury
2. Arrange for immediate transport of the injured person/s for needed medical attention
3. Site supervisor should fill out an accident report for each injured person – the form should provide for inclusion of the name of the injured person, the nature of the injury, the cause of the injury/accident, and what was done when the accident occurred.
4. The contractor must take follow-up action on the report, which includes arranging for the patient to be visited and next of kin informed speedily, and conducting an investigation into the accident that may warrant disciplinary action as well taking steps to prevent recurrence of the accident on site. It is important that the addresses of all workers on site are readily available as well as the name/s of next of kin and their addresses and telephone numbers.

Have you?

- Taken all the protective/preventive measures outlined in the Good Housekeeping list above

  Yes __ No __
- Made sure that workers on site have the necessary protective gear to ensure their health and safety

  Yes __ No __
- Arranged to brief all workers on the site regarding the importance of safety and the need for good housekeeping on the site

  Yes __ No __
- Clearly explained to all workers on the site the procedures that must be followed when accidents do happen

  Yes __ No __

MANUAL HANDLING AND LIFTING OF MATERIAL AND EQUIPMENT

Despite the availability of numerous mechanical aids for handling and lifting materials and equipment at construction sites, many operations call for manual handling and lifting. Records indicate that at least one third of all industrial accidents occur when workmen are lifting, lowering, pushing or pulling while handling material or equipment. A large number of these accidents are due to workmen using wrong methods or attempting to lift or carry weights beyond their physical capacity. They result in strained back muscles, or slipped or ruptured spinal discs, hernia and other painful injuries. Most of these injuries can be avoided by the

application of a scientific method of handling and lifting material known as human kinetics. Human kinetics makes the most efficient use of the body and limbs as levers and a source of power without the need for use of “brute force”. Efficient use of the body requires taking care to adjust and position the body before manually handling or lifting objects (See Manual Handling of Material & Equipment 1 & 2).

The Basic principles of manual handling

- Obtain a proper hold of the item being handled
- Maintain a straight back
- Position the feet correctly for balance
- Make powerful use of leg muscles and body weight

Responsibility of supervisors and training

Supervisors must ensure that safe handling practices are used by the staff at all times as well as making sure that the staff are coached or trained in adopting safe handling practices. When loads are too heavy for reasonable manual handling mechanical devices must be used. Workers should not be asked to handle items that are too heavy or to carry heavy loads over any distance.

Proper training can only be given by practical demonstration and supervised practice using material encountered on the job. All members of the staff must be given needed training.

D : SITE ORGANIZATION

PREPARATION OF THE SITE

Have you?

- Cleared the surface of grass and other vegetable matter as well as roofs of all, felled and fallen trees, plants etc. that come within the area of the proposed building/s.

  Yes __ No __
- Removed topsoil at the site and stockpiled (in a suitable place) the removed topsoil for later reuse in the garden surrounding the proposed building

  Yes __ No __
- Ensured that the area for the proposed building is properly drained of surface water so as to prevent the collection of water within or very near the proposed building area during and after construction is completed

  Yes __ No __

LOCATING OF SERVICES ON SITE

Have you located on site – the following?

- Area for storage of cement, aggregate, sand, timber, steel, bricks, stones

  Yes __ No __
- Concrete mixer and concrete mixing platform

  Yes __ No __
- Lock-up store for equipment and tools with necessary racks, bins etc.

  Yes __ No __
- Steel bending bench

  Yes __ No __
- Temporary toilet/s for workers (if no off site toilet is available)

  Yes __ No __
- A place where a First Aid kit can be accessible to all workers on site

  Yes __ No __
- A site office with racks for documents and basic furniture

  Yes __ No __

SETTING OUT THE BUILDING

The building is set out in relation to the building line (usually determined by the local authority). No part of the building should encroach upon this line (except overhead projections such as roof eaves, hoods or cantilevered floors up to 3' – 0" width). Initially, the setting out of any projections of the building's plan form should be ignored, and only the main rectangular, square or other basic form should be set out. The projections can then be added (See Fig.1).

Have You?

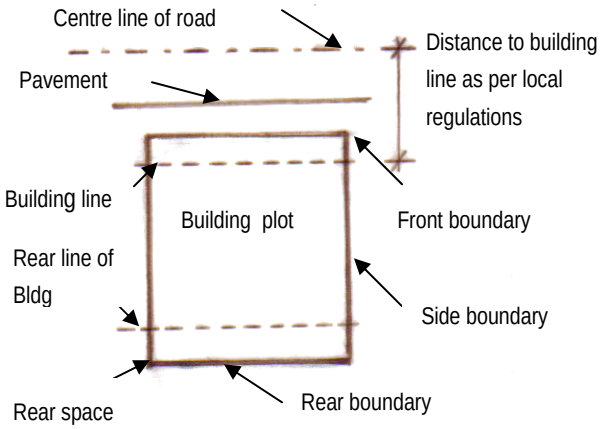


Fig 1- Plan of building plot

- Checked the site levels in relation to the access road levels and fixed the finished ground level at an elevation above the crown of the access road and at a height that will prevent entry of surface water from the road into the site (See Fig. 2).

  Yes __ No __

- Established the position of the building line from the local authority

  Yes __ No __

- Pegged out the frontage of the building in relation to the building line

  Yes __ No __

- Made sure that rear walls of the building do not encroach on the required rear space as per local building regulations

  Yes __ No __

Note: In flood-prone areas the finished floor level must be safely above known maximum flood level

* Finished floor level to be above level of crown of access road

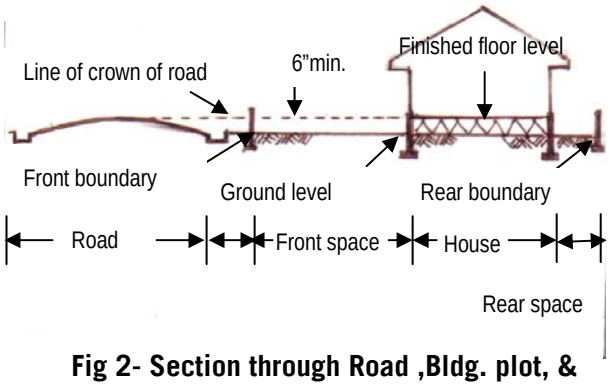
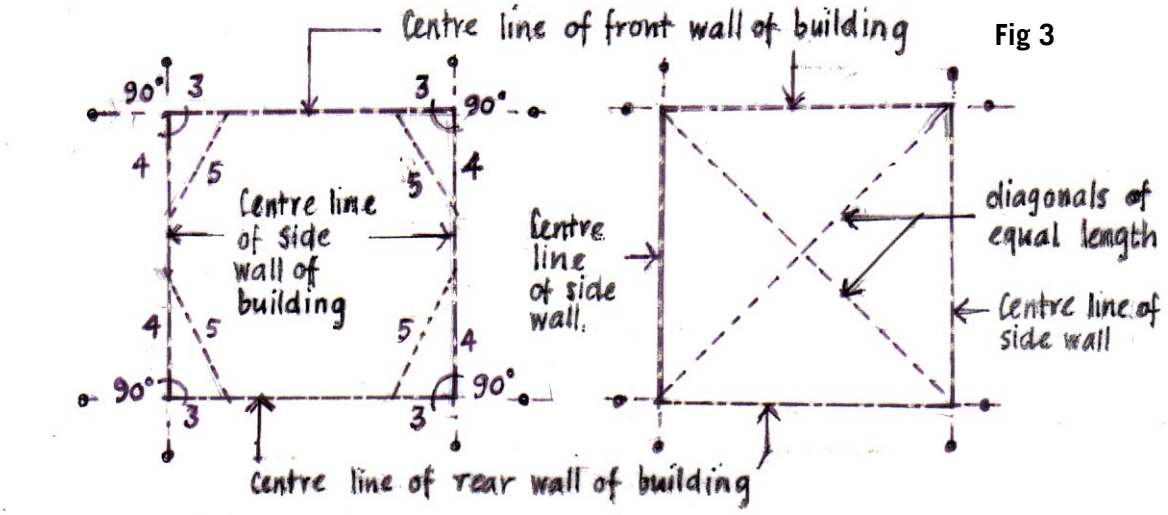


Fig 2- Section through Road ,Bldg. plot, & House

- Checked squareness of square or rectangular buildings by using the 3, 4, 5 method.
  - Establish centre line of one wall as primary axis (axis 1)
  - Mark off 3 feet (or 3 equal units of measure) from end of axis wall that meets adjacent side wall (axis 2)
  - From marked point on axis 1 measure 5 feet (or 5 equal units of measure) to coincide with the measurement of 4 feet (or 4 equal units of measure) starting from the end of the axis 1 wall. The point of coincidence indicates the line of the perpendicular adjacent wall (axis 2).
  - Repeat the above steps for the third wall (axis 3) and fourth wall (axis 4)
  - Double check accuracy by ensuing that the diagonals between opposite corners of the square or rectangle are of equal length (See fig. 3)

    Yes __ No __

Fig 3



■ 3-4-5 METHOD TO DETERMINE 90° ANGLES AT CORNERS OF SQUARE/RECTANGULAR BUILDINGS

■ METHOD TO CHECK THE SQUARENESS OF BUILDING (FOR SQUARE/RECTANGULAR FORMS)

POSITIONING EXCAVATIONS FOR FOUNDATIONS

Have you?

- Established centre lines of principle walls and identified these with pegs and chords (See fig. 4)

  Yes __ No __

- Used the centre lines to establish the side limits of excavations for wall foundations as per architectural/structural drawings (See fig. 4)

  Yes __ No __

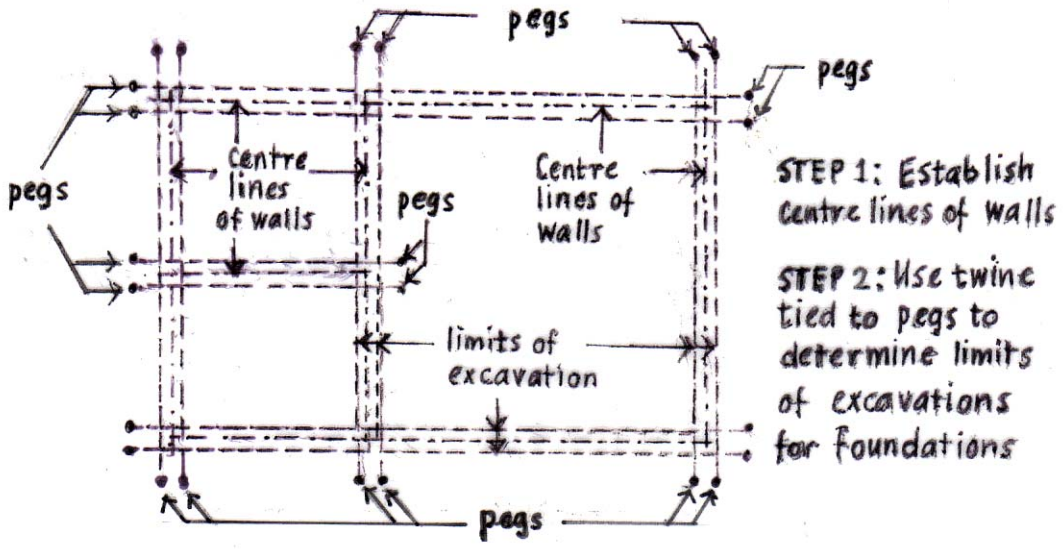


Fig 4 - Method of setting out foundations

EXCAVATION FOR FOUNDATIONS

Have you?

- Made sure that excavated soil is not stacked too close to excavations, to prevent sides of trenches from collapsing and excavated soil reentering the trench.

  Yes __ No __

- Used support work if necessary (in sandy or unstable soil) where side walls of trenches show evidence of collapsing readily (See Fig. 5)

  Yes __ No __

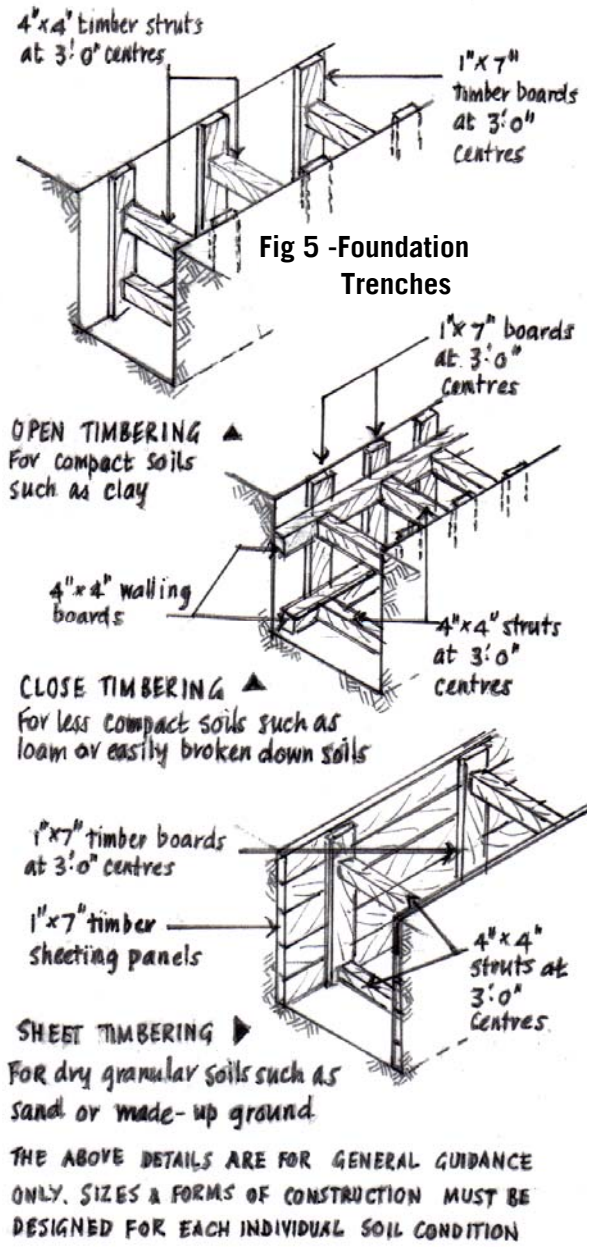


Fig 5 -Foundation Trenches

E : CONCRETE WORK AND MASONRY WORK

CONCRETE & REINFORCED CONCRET WORK (Refer also Quality Assurance Checklist – 1)

Have you?

- Made sure that the concreter has properly followed the guidelines listed in the above-named Quality Assurance Checklist – 1

  Yes __ No __

- Made sure that the reinforcement steel bars are properly hooked at the ends to facilitate anchoring (See fig. 6)

  Yes __ No __

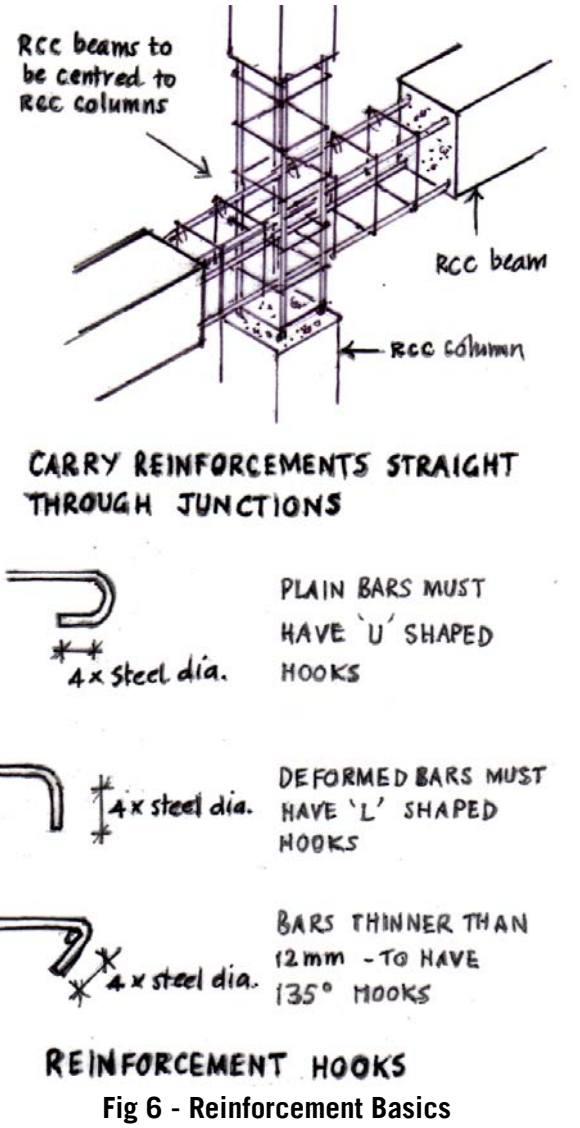


Fig 6 - Reinforcement Basics

- Made sure that reinforcements in intersecting columns and beams are carried straight through junctions (see fig 6)
- Made sure that when laying reinforcement steel in slabs – the main steel bars are laid under the distribution steel bars (See. Fig. 7)

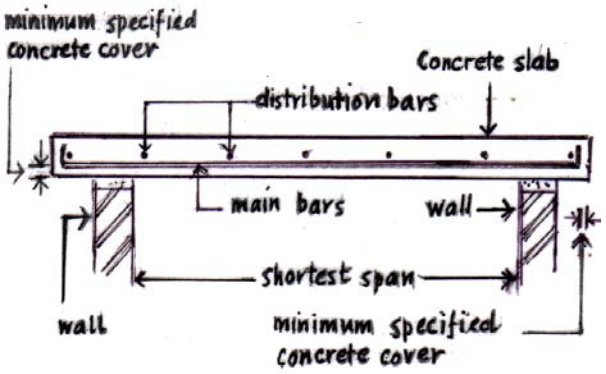


Fig 7-Typical section of simply supported rectangular RCC SLAB

Yes __ No __

- Made sure that sizes and spacing of all reinforcement steel and stirrups are placed strictly in conformity with the structural drawings

  Yes __ No __

- Made sure that the structural engineer has checked and approved the steel reinforcements laid for each of the following stages before concrete is poured:
  - Column footings and columns

    Yes __ No __
  - RCC foundations to walls

    Yes __ No __
  - Plinth beams

    Yes __ No __
  - Ring beams and other beams in superstructure

    Yes __ No __
  - Floor slabs

    Yes __ No __
  - Flat roof slabs

    Yes __ No __
  - Other RCC work not listed above

    Yes __ No __

MASONRY WORK (Refer Also Quality Assurance Checklist – 1)

- ade sure that the masons, working stone and brick work, have followed the guidelines listed in the above-named Quality Assurance Checklist – 1)

  Yes __ No __
- Made sure that plasterers and tilers have properly followed the guidelines listed in the above-named Quality Assurance Checklist – 1)

  Yes __ No __
- Made sure that intersecting masonry walls bond truly with each other by proper placement of cross walls (See fig. 8)

  Yes __ No __
- Made sure that openings for doors and windows have adequate allowance of masonry space on either side of the door/window for its framing (especially the head frame) to be securely fixed (See Fig. 9)

  Yes __ No __

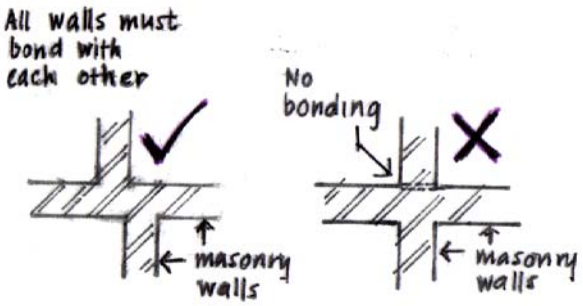


Fig 8 -Placement of cross walls

- Made sure that door and window or other openings on external walls are positioned at least 2' – 0"away from corners of walls or other adjacent openings. This requirement applies in all buildings located in disaster-prone areas (See Fig. 10)

  Yes __ No __

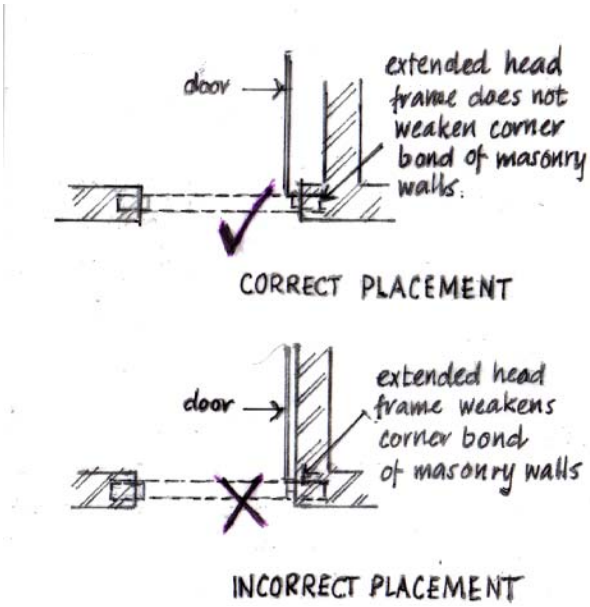


Fig 9- Positioning door openings

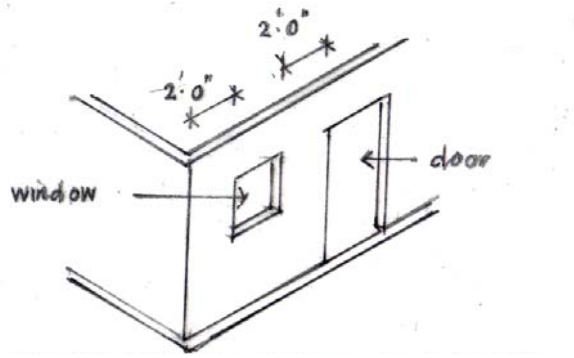


Fig 10- Positioning Door/Window opening

F : CARPENTRY AND TIMBER WORK

CARPENTRY WORK (Refer also Quality Assurance Checklist – 1)

Have you?

- Made sure that the carpenters, roofers, and joiners have properly followed the guidelines for fabrication and fitting doors and windows and timber framed roofs listed and illustrated in the above-mentioned Quality Assurance Checklist – 1.

  Yes __ No __

- Checked that good quality timber is used for all timber work as per the guidelines detailed in the above-named checklist.

  Yes __ No __

- Made sure that timber that is stored at site has been stacked correctly and protected as described in the above-named checklist.

  Yes __ No __

- Made sure that all timber elements are first treated before fixing at site.

  Yes __ No __

GUIDELINES FOR PRESERVING AND FINISHING TIMBER

The reason for preserving and finishing timber

Timber is sensitive to changes in temperature and moisture, therefore requiring special attention in tropical Sri Lanka with its high humidity. Timber is also subject to deterioration by wood-destroying fungi, insect attack, weathering, mechanical wear as well as chemical action. It is therefore prudent to take measures to retard the deterioration of timber as far as possible. In view of the questionable quality of available timber, it is vital that some form of preservative be used prior to using the timber in a building.

Types of preservatives that are used

There are three basic types: Insecticide, fungicide, and a combination of the two.

1. T. O. (Tar oils) of which the best known is creosote
2. O. S. (Organic Solvent), with dissolved chemicals
3. W. B. (Water Borne), which consists of salts dissolved in water, giving it a toxic solution free of deposit.

Organic solvent types are very effective for the treatment of decay and insect attack, having good penetrating properties. Water borne types are often used for pressure treatment of timber and this type can be used internally and externally, although some tend to leach away when soaked with water.

The application of preservatives to timber in conditions where highly complex pressure and vacuum treatments are not easily available, Steeping is the best practice for practical purposes; this involves submerging the timber in cold preservative for periods varying from a few days to a few weeks. Small section timber will require only a few hours, but the longer the treatment the – greater the penetration. Dipping consists of submerging the timber in a bath of preservative – small items for a period of 10 seconds, to a minimum of 3 minutes for structural timber.

Brushing-on or using a coarse spray is the least effective method. It is the only way of treating timber after it has been installed or fitted. Understandably not all surfaces of the timber would be exposed to receive the preservative. However, a good measure of protection can be given to the timber if the application of preservative is carried out carefully using plenty of preservative.

Any timber that is cut after the preservative has been applied should have all the new exposed surfaces liberally treated before the timber is covered or installed.

Even when timber is to be painted, it is important that the timber be treated prior to painting.

The preparation of timber for finishing

Any sand papering should be done in the direction of the grain. The grade of paper should be varied from medium to fine as the surface is gradually cut down to become shiny and clean (totally clear of dust)

The normal method of painting timber

The painting process, whether it is to be a gloss or matt finish, can be divided into six stages:

1. Lightly sand any rough edges or surfaces on new wood. Remove dust by wiping the sanded areas with a lint-free cloth dampened in white spirit. Knots in wood can be sealed with shellac or knotting.
2. When the knotting is completely dry, apply a wood primer. Brush the primer well into the wood and allow to dry.
3. Smooth the surface by rubbing lightly with fine sandpaper.
4. Paint on one or two layers of undercoat. Apply the undercoat evenly to the surfaces, brushing out the paint to avoid any runs.
5. When the undercoat is dry, rub down the surface with fine-grade sandpaper.
6. Wipe clean the sanded surface and brush on the top coat. Allow the paint to dry in as dust-free conditions as possible.

Varnishing and Staining wood

Varnishes give coatings as durable as oil-based paints, and are available in matt, satin, and gloss finishes. Pigmentation changes the colour of wood. Staining produces a more effective tone than varnishing. The procedure for varnishing and staining wood is as follows:

1. Prepare the wood for vanishing (See preparation of timber for finishing)
2. Sand and fill to create a smooth surface.
3. Brush away the dust and wipe the surface with a lint-free cloth dampened with white spirit.
4. Rub in the varnish with a lint-free cloth by dabbing the varnish into the surface of the wood, working in the direction of the grain.
5. Allow the first coat of varnish to dry for up to 12 hours, depending on the temperature and the type of coating.
6. Lightly rub the surface with sandpaper.
7. Remove the dust by cleaning the surface with a dusting brush and remove any remaining dust with a lint-free cloth dampened in white spirit.
8. Follow the manufacturer's instructions; apply each coat with a clean brush. Rub the surface lightly after each coat of varnish has dried.

Linseed oil finish

1. Lightly sand the surface of timber using No. 100 sand paper, thereafter with 120 sand paper
2. Dip a rag (folded into a small compact bundle) in linseed oil and apply evenly on the timber surface (a brush may be used instead of a rag). A suitable stain can be mixed

in with the linseed oil to obtain the desired colour. This may be repeated to obtain the desired colour

3. Allow time for the linseed oil to dry in a dust-free environment

Timber approved by the State Timber Corporation for construction

Timber that has the density of above 45 lb per cubic foot is most suitable for construction Timber presently (as of 2006) locally available for construction:

- Eucalyptus Microcorys

Weight: 50-65 lb. per cubic ft.

Qualities: Very durable even in contact with the ground

Uses: Construction work and buildings

- Kumbuk

Weight: 45-50 lb. per cubic ft.

Qualities: Has a tendency to warp. Heartwood is durable in exposed conditions, but sapwood is very perishable and should not be used.

- Palu

Weight: 70 lb. per cubic ft.

Qualities: Extremely hard, heavy and rough. Difficult to saw, especially if logs are not fresh. Very durable even in contact with the ground

Uses: Heavy construction, sleepers, and in any use in which hardness and roughness are important.

- Wewarana

Weight: 50 lb. per cubic ft.

Qualities: The converted timber is not attacked by borers and is resistant to termite attack. Works to a smooth finish and takes affine polish.

Uses: All building purposes, sleepers, bridge work and furniture.

- Mee

Weight: 60 lb. per cubic ft.

Qualities: Difficult to saw when fresh. Seasons well if converted green. Logs tend to split at ends if left unconverted. Very durable especially in contact with water.

- Hora

Weight: 50-55lb. per cubic ft.

Qualities: Stronger and harder than Teak. Not durable in exposed conditions, but durable under cover. Is easily treated with preservatives

Uses: Railway sleepers and transmission poles (treated), piles, building construction, underwater work.

The above list shows that the densities of all timbers named above are suited for construction. However it must be noted that some timbers are not suited to exposed conditions, and some timbers are suited for use below ground and are durable when in contact with water. Therefore the use of these approved timbers must be used judiciously and in keeping with the qualities of each type.

There are many types of imported, treated timber that are available locally for use in construction. It is important to ensure that timbers specified and used have performed well over the years before they are considered to be suited for local use.

Note that timbers approved for furniture work are not included in the above list which names only local timbers that are approved for construction work.

G : PAINTING WORK

Have you made sure that the painter has?

- Thoroughly cleaned the surface to be painted before applying paint

  Yes __ No __

- Mixed the recommended proportions of paint and water (As specified by the manufacturer) for water-based paints such as emulsion and cement paint

  Yes __ No __

- Mixed the recommended proportions of paint for thinner (As specified by the manufacturer) for oil-based Enamel paints

  Yes __ No __

- Ensured that manufacturer's instructions are followed when applying overcoats on undercoats

  Yes __ No __

- Ensured that good quality brushes have been used for applying paint

  Yes __ No __

- Ensured the stability of working platform for painters (See Fig. 11)

  Yes __ No __

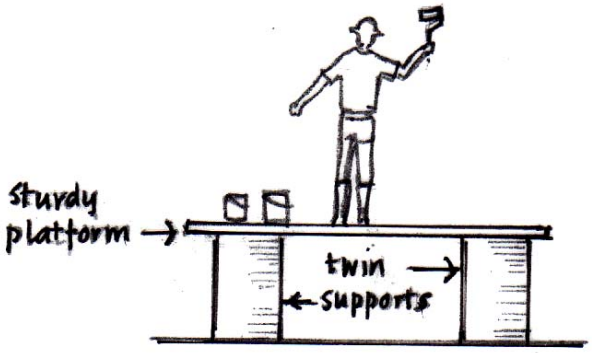


Fig 11-Typical safe work platform

- Ensured that all paint drippings are cleaned off while the paint is fresh

  Yes __ No __

GENERAL GUIDELINES FOR PAINTING

Preliminaries: Working environment, working gear and protection of surroundings Make sure there is plenty of air circulation while painting – good ventilation is important to prevent respiratory problems. Make sure that the area around the proposed work area for painting is clear of debris or furniture. Depending on the job to be done, wear goggles, face mask, old clothes or disposable overalls, a cap or hat for ceiling work and suitable gloves.

Use masking tape, polythene dustsheets or newspaper to cover woodwork and window panes when painting walls. Place cover sheets, which do not slip, over the floor areas that are likely to be spotted by dripping paint. If paint inadvertently falls on the floor, ensure that drippings are quickly cleaned off while the paint is yet fresh.

Preparation of surfaces to be painted

Iron and steel surfaces: Remove all rust using emery cloth, wire wool or wire brush according to the extent of rust that is observed. Fill any holes with suitable filler and apply primer soon after.

Plastered wall surfaces: make sure that the wall surface is quite dry before painting begins. If damp patches are observed – establish the cause/s and rectify the problems first before painting begins. Failure to do so will allow damp patches to recur causing new paint to flake off. A possible common cause is leaking water pipes embedded in walls. When the causes of dampness are rectified and the wall surface is well dried, prime it with a damp seal to prevent watermarks from showing through.

When previously painted walls are to be repainted, the surfaces have to be washed down with soapy water or mild detergent using a large sponge or lint-free cloth. Rinse thoroughly but do not soak the sponge/cloth. Ensure that streaky stains are not permitted to remain on the surface. Be careful to protect electrical fixtures from water. If a chalky coating is seen to come of the wall surface when it is washed, stabilize the surface before painting is done otherwise the new paint will not stick. To stabilize the surface, properly seal the surface with two coats of a suitable stabilizing solution recommended for porous surfaces.

Surfaces for painting should be smooth for the paintwork to be successful. If there are some small, superficial cracks on an otherwise sound wall, use a fine surface preparatory filler. Where there are small holes and cracks in the plaster, first rake out loose bits, to help the filler stick. Then fill with an interior filler, pressing it in with a flexible filling knife. Leave the filling slightly above the wall surface. Let it dry and sand it with sandpaper wrapped around a wooden block.

For larger holes, use deep-repair filler, or plaster filler, knocking off loose plaster first. For larger cracks, work in several layers, letting each dry before the next is laid.

Avoid painting on rainy days when there is high humidity. The best is to paint on hot, dry days. Never paint over damp or dirty surfaces.

Do not use varnish on surfaces of woodwork that are expose to the sun as varnish soon burns and fades in sunlight.

Always use good quality paints and brushes to obtain a quality finish.

Choosing a painting tool :The use of brush or roller for painting is optional for water based paints. A good roller will usually cut the time it takes to paint a room, giving it a more finished result with less effort than a brush. The use of a roller to paint is a recommended alternative. A roller tray (metallic preferred to plastic) is needed for use with a roller, also a roller pole that can be extended for painting ceilings. Brushes of smaller sizes are needed for painting recessed surfaces and rebates that cannot be painted easily with a roller. Never use rollers for oil-based paints.

Care of tools

Rollers: Always thoroughly wash roller and roller trays after use with water based paints. Flick the roller sharply out-of-doors until no more water sprays from the surface. Then peg the roller on a line and leave to dry for a few hours. Keep the roller in a bag that will prevent it from getting dusty.

Brushes: When using oil based paints, such as gloss or undercoat, wash the brush in a suitable cleaning liquid (turpentine or thinner). Do not allow paint to dry on a brush after it is used. Clean it soon after it is used. This practice will ensure longer use of the brush. Flick the brush sharply out-of-doors until no water sprays off the bristles. Dry the brush with waste cloth or rag. Store brushes by hanging them upside down from a hook with the bristles effectively kept free from dust.

Use of tools

Before using a new brush soak it thoroughly in cold water. With the brush still wet take it to a dry, rough wall surface or corner of a wall and flick the brush back and forth until the brush is quite dry. Repeat this process of wetting and drying the brush to shed any loose bristles.

Load the brush by dipping the tips of the bristles into the paint. Do not allow the paint to reach the upper part of the brush. Dab off excess paint by pushing the bristles against the inside of the paint container to prevent dripping when applying.

The painting process

- Paint one room at a time
- Smooth and dry all surfaces to be painted and clean the room of all debris and dust
- Start first with the ceiling. Time it so one whole surface can be finished in one operation. Start from the light source and work away from it in order to clearly see what is and what is not painted.
- Next paint the walls.
- Finally paint the woodwork.
- If painting over an existing dark coloured surface, two undercoats may be needed before applying the top coat.

Painting walls

- When painting walls with a roller or brush – paint in blocks. Work from right to left if you are right handed or vice versa if left handed. When using a brush, work in horizontal strips beginning parallel with the ceiling and moving downwards.
- Start the first bay (top corner) moving horizontally towards the opposite corner, applying paint as in the previous bay.
- Blend each new section with the previous one by lightly working back towards it when laying-off. Always work new into old to avoid marking the drying paint.
- Continue in this manner across the surface to the end, and then begin a new ‘row of bays’ below the first. Continue this process for succeeding rows of bays.
- Don’t go back to areas that have been completed, as the drying paint will no longer be workable and will be easily damaged.

Painting exterior surfaces

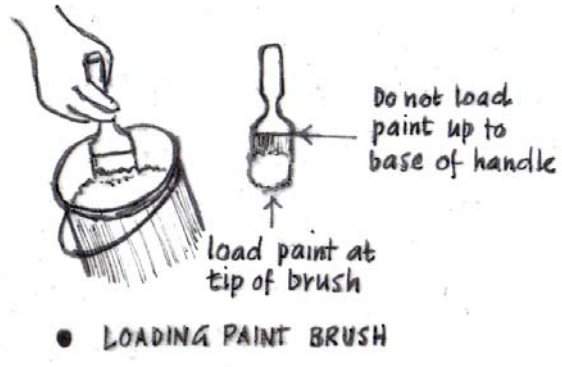
- When painting exteriors, follow the sun. Allow it to dry and warm the surface and then proceed to paint in the shade.

Painting with a brush (See Painting Basics 1 & 2)

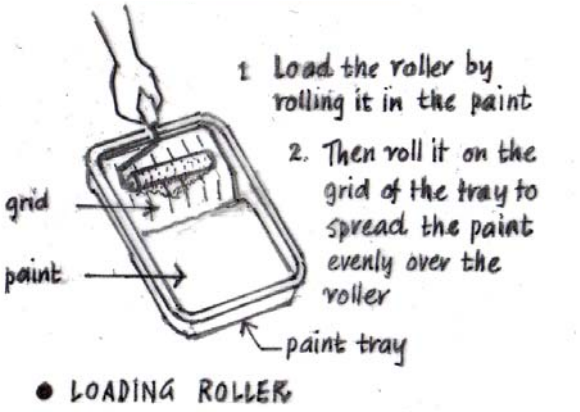
- Ensure that brushing of paint is always done in a consistent direction, usually up and down on walls and back and forth on ceilings. (see painting basics)
- Work in bays of 1'-6" x 1'-6" at a time.
- Spread the paint by brushing at right angles. This will create an even film. Then lay off (finish with light strokes) in the direction of the longest side you are painting.

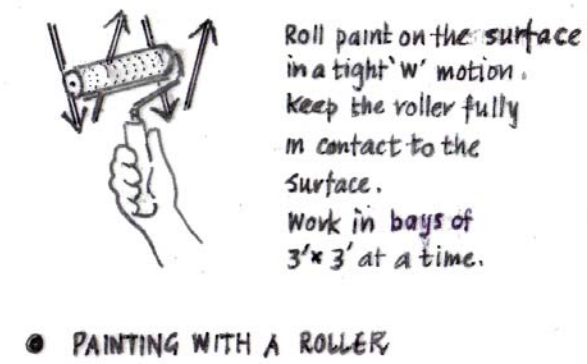
Painting with a roller (See Painting Basics 1 & 2)

- To load paint, soak the roller in paint then roll it out in the ridged area of the roller tray to remove the excess paint.
- Work in bays of 3' x 3'
- Roll on the paint with a tight 'W' motion, keeping the roller fully in contact with the surface to avoid skipping or skidding.
- Without reloading, repeat the process in a diagonal direction to spread the paint in an even film. Finally roll out again with an almost straight back and forth motion in the first direction. Keep the same final direction on the whole surface – walls vertically, ceiling parallel to the window wall.
- Reload and move to the next bay. As with all painting, work with the paint onto unpainted areas. Always work with new paint into old. Usually each full roller enables the painting of about 8 square feet.
- Start at the window edge and work away from it, as this will make it possible to see painted and unpainted surfaces by viewing them at an angle to the light.
- Apply the paint on the roller to spread evenly and then as a final measure with each swatch roll the dry roller sleeve over the edge of the swatch to smooth out the bead of paint that has built up there. Repeat the process in the adjacent area.
- For narrow and awkward areas, recesses and rebates use a brush.



Painting Basics 1





Painting basics 2

H : PLUMBING AND SEWERAGE WORK

PLUMBING AND SEWERAGE (See Section – Standard Requirements for Plumbing and Sewerage Works)

Have you?

- Chosen a qualified and experienced plumber to carry out the plumbing work needed for the building

  Yes __ No __

- Issued the needed drawings and specifications to the plumber and clearly explained what is required for carrying out the plumbing work

  Yes __ No __

- Made sure that the PVC pipes used for plumbing and sewerage are new, of good quality, without defects or deformities and manufactured by reputed manufacturers.

  Yes __ No __

- Made sure that PVC pipes are stored and stacked in a manner that will protect them from damage and exposure to sunlight.

  Yes __ No __

- Made sure that toilet fixtures are positioned to allow space for movement around and between them (See Plumbing Basics 1)

  Yes __ No __

- Made sure toilet fixtures such as wash basins, showers, sinks, taps, water closets etc. are fitted at the specified heights (See Plumbing Basics 2). Where provision is required for disabled users; have the positions and heights for such items been adjusted accordingly – (See Basic Dimensional Information for Wheelchair Users 2)

- Made sure that the flushing systems in water closets operate efficiently

  Yes __ No __

- Made sure that valves, meters and taps used are new and of good quality

  Yes __ No __

- Made sure that all pipe joints are fitted as per manufacturer's instructions so as to be leak-free

  Yes __ No __

- Made that ends of PVC pipe surfaces for joining are free from grease and dust before application of solvent prior to joining pipes.

  Yes __ No __

- Made sure that a period of two hours is allowed before pressure testing is done on non-threaded PVC pipes that have been joined by solvent

  Yes __ No __

- Made sure, when joining threaded PVC pipes that a thin layer of thread-sealing tape is wrapped around the external thread and screwed completely (not excessively) into the internally threaded pipe.

  Yes __ No __

- Made sure that rodding eyes have been provided at bends and branches according to standard plumbing requirements.

  Yes __ No __

- Made sure that standards for connecting waste lines to stacks are followed (See Plumbing Basics 1 & 3)

  Yes __ No __

- Made sure that wash basins, showers/baths and sinks or other fixtures are fitted with correctly sized waste lines and depths of water seal traps (See Plumbing basics 3)

  Yes __ No __

- Made sure that PVC pipes that penetrate masonry or concrete external walls are placed within a steel pipe with two rubber sealing rings to prevent entry of water into the building (See Plumbing Basics 2)

  Yes __ No __

- Made sure that joints for pipes (plumbing and sewerage) are not made within walls – all joints are fitted externally

  Yes __ No __

- Made sure that all the above-ground pipes are secured against axial thrust by using correctly sized fixing clamps where pipes change direction

  Yes __ No __

- Made sure that pipe clamps are used as supports at a distance of ten (10) times the pipe diameter.

  Yes __ No __

- Made sure that water seal traps are provided in drainage systems and water seals retain a minimum seal under test and working conditions for each appliance (See Plumbing Basics 3)

  Yes __ No __

- Made sure that ventilation is provided where needed to effectively maintain water seal of traps installed in the building

  Yes __ No __

- Made sure that branch pipes to the stack are positioned to prevent backpressure and blocks from occurring (See Plumbing Basics 1 & 3)

  Yes __ No __

- Made sure that branch discharge pipes are fully accessible for clearing blockages

  Yes __ No __

- Made sure that below-ground plumbing and sewerage pipes are laid at the required depth as per standard regulations.

  Yes __ No __

- Made sure that the drain invert depth and radius conforms to plumbing standards (See Plumbing Basics 3)

  Yes __ No __

- Made sure that below-ground soil and drainage pipes are not positioned too close to water supply pipelines

  Yes __ No __

- Made sure that water pipelines are laid as remote as possible from electrical cables, gas, waste water and sewerage lines in conformity with local regulations

  Yes __ No __

- Made sure that the standard gradients for below-ground pipes are strictly followed when they are laid

  Yes __ No __

- Made sure that proper bedding method is used for below-ground pipes especially in soft soils, and standard lean concrete bedding in stable soils as specified (See Plumbing basics 4)

  Yes __ No __

- Made sure that below ground pipes are well supported at joints, bends and junctions by providing suitable supports and abutments (See Plumbing basics 4)

  Yes __ No __

- Made sure, when laying pipes in steep terrain, that pipes be secured against sliding off by providing correctly positioned supports and that pipes are laid with the sockets facing upwards (See Plumbing Basics 4)

  Yes __ No __

- Made sure that soil that surrounds buried pipes are free of stones or other material that may cause damage to the pipes

  Yes __ No __

- Tested all sections of below-ground pipes for water tightness by pressure testing before these are covered

  Yes __ No __

- Made sure, before pressure testing of pipes, that buried pipes are covered with backfill to approximately 2' – 9" leaving uncovered space of 6" around joints and junctions in order to load the pipes sufficiently

  Yes __ No __

- Made sure that invert levels of manholes are as specified in order to make sure that the sewerage disposal works efficiently

  Yes __ No __

- Made sure that the spacing of manholes are according to standard regulations and drawings and specifications

  Yes __ No __

- Made sure that the septic tank is constructed strictly in accordance with the given drawings and specifications (sizes and depths) of chambers

Yes __ No __

- Made sure that the septic tank on the premises of the building is located not less than 50 feet away from the nearest drinking water well or waterway with potable water

  Yes __ No __

- Made sure that the septic tank will not be inundated by ground water during rainy seasons

  Yes __ No __

- Provided a suitably sized soakage pit independent from the Septic tank soakage pit within the site to take waste water form the kitchen, bath and laundry

  Yes __ No __

- Ensured that run off water from roofs are handled properly by use of adequately sized gutters, down pipes, down pipe spout heads and in single storey buildings the use of a system of chains instead of down pipes as an option if specified

  Yes __ No __

- Made sure that gutters and down pipes are adequately secured by use of needed support brackets

  Yes __ No __

- Made sure that rainwater from roofs and surface water within the site are properly handled by the use of an appropriate surface water drainage system

  Yes __ No __

- Made sure that approval has been obtained from the local authority when work has been completed, before handing over to the client/occupant

  Yes __ No __

- Made sure that all items listed in the document – Standard Requirements for Plumbing and Sewerage Works included in this document – have been satisfactorily acted on

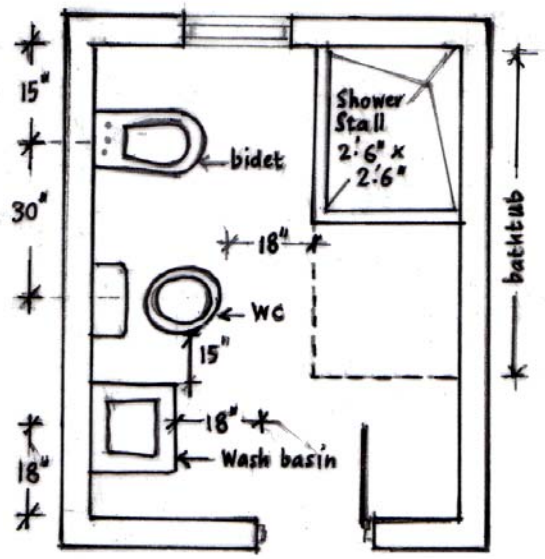
  Yes __ No __

- Made sure that plumbing and sanitation installation can be maintained in a trouble-free manner when the building is occupied

  Yes __ No __

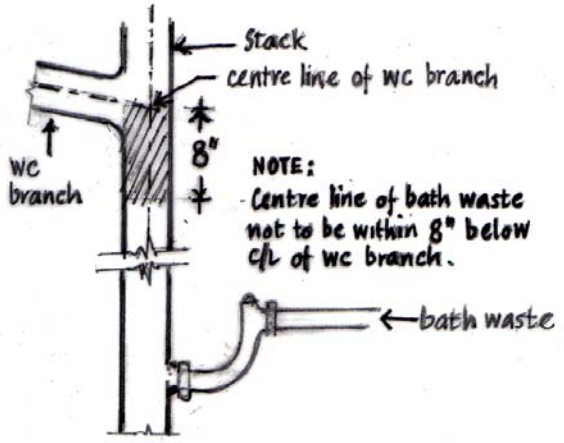
- Made sure that as-built drawings are prepared and a copy of each handed to the house owner and architect/designer when work is completed

  Yes __ No __

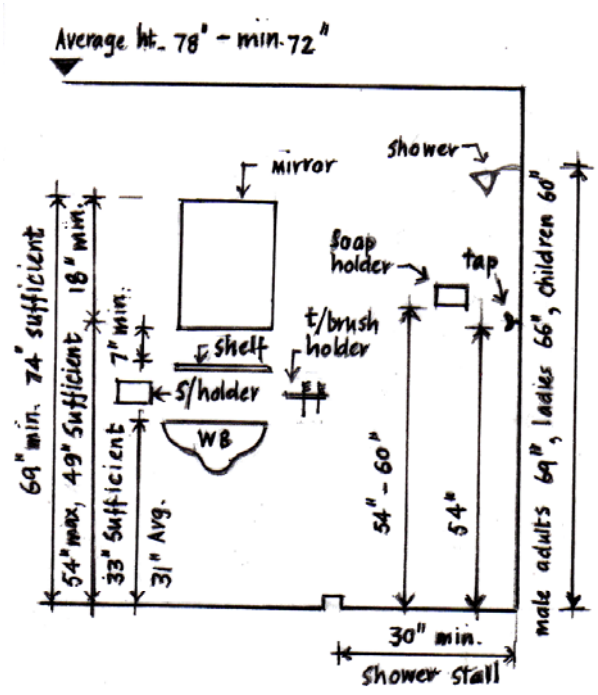


● MINIMUM FIXTURE CLEARANCES

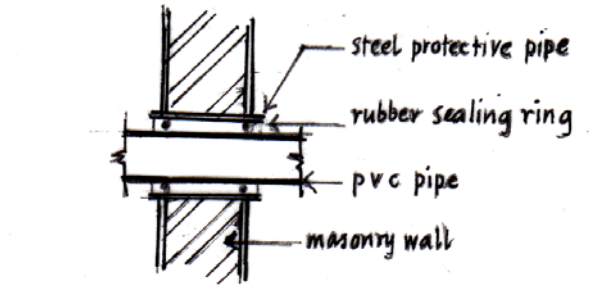
Plumbing Basics 1



● CONNECTION OF BATH WASTE TO STACK



FIXTURE INSTALLATION AT BATHROOMS

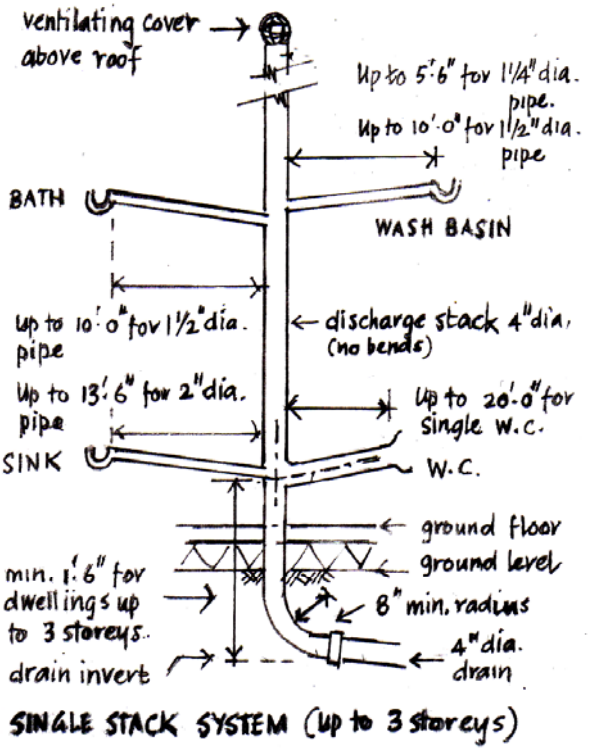


DETAIL SECTION-LAYING PIPES THRU WALL

Plumbing Basics 2

STANDARD REQUIREMENTS FOR PLUMBING AND SEWERAGE WORKS

- All pipes and sanitary fittings and accessories used for the building shall be new, without defects and deformity and of reputed make.
- All pipelines, fittings and fixtures shall be installed leak-proof and all connected works, when completed, should not cause splashing, spilling or emission of foul odour and gases.
- Gradients for soil and drainage pipes shall be in accordance with established practice as per requirements of the local authority.



SINGLE STACK SYSTEM (up to 3 storeys)

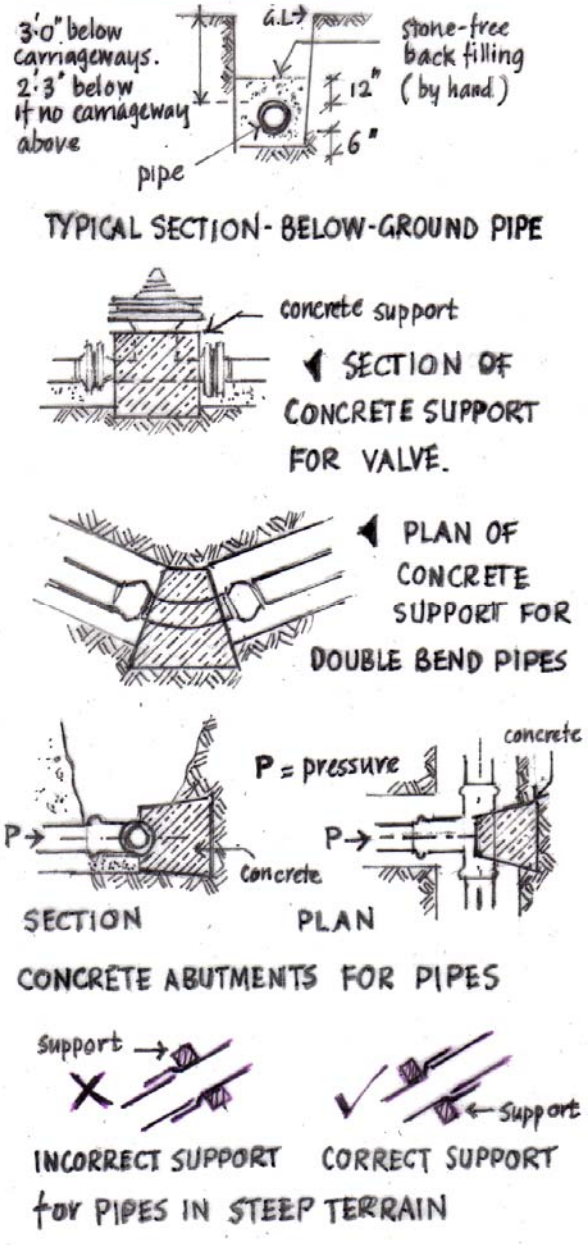
Plumbing Basics 3

APPLIANCE	MIN. DIA. OF PIPE & TRAP	DEPTH OF TRAP SEAL
SINK	1½" (40 mm)	3" (75 mm)
BATH	1½" (40 mm)	3" (75 mm)
W. C.	3" (75 mm)	2" (50 mm)
WASH BASIN	1½" (40 mm)	3" (75 mm)

DESIGN LIMITS - SINGLE STACK SYSTEM

- Under no circumstances, unless clearance is officially received from the local authority, shall soil and drainage pipes be allowed to come too close to water supply pipelines.
- For water pipelines, care should be taken to avoid chances of airlock and water hammer. The layout and positioning of pipe work shall be such that there is no possibility of back flow towards the source from any cistern appliances by any means. Clamps and fittings used shall be as per standard practice and approved by the local authority.

Plumbing Basics 4



- Plumbing and sewerage pipelines shall be supported and protected as per the manufacturer's instructions as approved by the local authority.
- Pipes carrying off waste from water closets and waste water from baths, wash basins and sinks to drains shall be trapped immediately beneath such fixtures. Traps shall have a minimum water seal of 2" (See Plumbing basics 3) and shall be ventilated wherever such ventilation is necessary to maintain water seal of the trap. Ventilating pipes shall be carried up vertically from the drain to a height of 2' – 0" above the outer covering (roof) of the rest of the building or as shown in the drawings issued by the engineer. All vertical ventilating and anti-siphonage and similar pipes shall be covered on top with a cowl (protective weather cover)
- All pipe work hall be fitted with cleaning eyes at required locations to facilitate removal of blockages and maintenance.
- All joints between pipes, pipes and fittings and manholes shall be gastight when above ground and water tight when underground. Method of jointing shall be as per manufacturer's instructions and requirements of the local authority.
- Water supply connections to the mains supply shall be in accordance with prevailing regulatory requirements.
- The depth of a pipe trench (water or sewerage) shall not be less than 3' – 0" measured from the top of the pipe to the surface of the ground under carriageways (where vehicles pass over) and not less than 2' – 3" elsewhere to safeguard it from superimposed loads (See Plumbing basics 4)
- Water pipes shall be as remote as possible from electrical cables, gas, and waste water and sewerage lines and should be installed after receiving approval from the relevant authorities.
- The pipe work shall be subjected to a Water Test, Smoke Test and Air Test and corrective steps shall be taken prior to back filling or closing over the pipes.
- For short branch drains, the following falls are usually adhered to in practice:
  - 110 mm pipes – 1 in 40
  - 160 mm pipes – 1 in 60

HELPFUL RULES OF THUMB IN PLUMBING DESIGN AND PLANNING

- At planning stage locate the appropriate manhole or sewer outfall on the site plan in locations where there is a public sewerage system
- Where sewerage has to be handled within the site, determine invert levels of manholes and septic tanks.
- Septic tanks should be installed at depths that are clear of ground water table levels

- Sewer lines between manholes are usually run with a 1' – 100' pitch
- Aim at grouping toilets and bathrooms as close to each other as possible to facilitate efficient operation of the plumbing/sewerage system and reduce investment cost
- Drain, waste and vent pipes not less than 2" and water supply pipes not less than ½" usually are safe sizes to use
- Provide several cut-off valves on water supply lines to sections of the building instead of using only a single cut-off valve, in order to facilitate repair and modifications without disrupting water supply in other sections

I : ELECTRICAL WORK

ELECTRICAL (See list of Standard Requirements for Electrical Works listed below)

Have you?

- Made sure that all items used in the installation are new and reliable and that no second hand material is used

  Yes __ No __
- Obtained architect or owner approval of all items proposed to be used for the electrical work

  Yes __ No __
- Made sure that the electricians make good the work of previous trades* (*construction work items done by others earlier) after installation of any and all items of electrical work

  Yes __ No __
- Made sure that all power cables installed are properly protected and will not endanger the lives of persons

  Yes __ No __
- Made sure that installation of conduits and trunking for cables are in conformity with standard regulations

  Yes __ No __
- Made sure that all cables that connect the control switch or main switch and any outlet point, light fixture, fan, etc. are unbroken

  Yes __ No __
- Made sure that all electrical fittings and accessories have been installed in conformity with standard regulations

  Yes __ No __
- Checked that no diagonal runs of conduits carrying power are used when placing them within walls and floor slabs (See Placement of Electrical Conduits – illustrations)

  Yes __ No __
- Ensured that all below-ground power lines are installed according to prevailing regulations and excavations identified with buried marker tape laid at appropriate levels to prevent later damage to the underground lines if and when subsequent excavations are done

  Yes __ No __
- Obtained from the electrical sub contractor all operating manuals and warranties that are required under the terms of the contract and given these documents to the owner of the building.

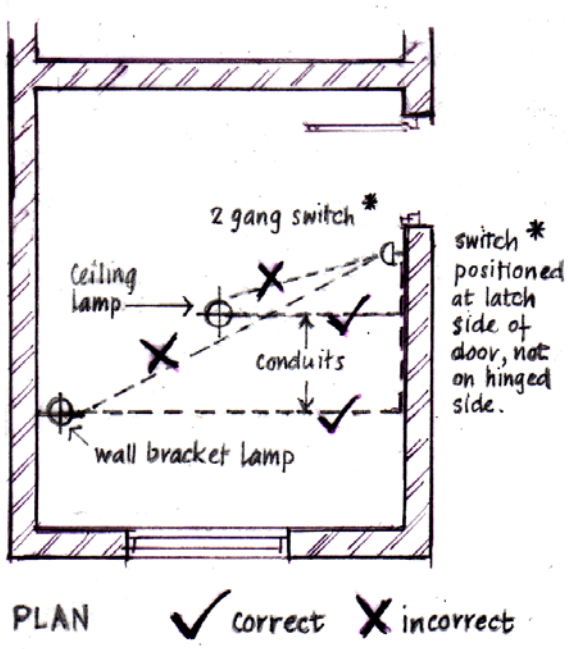
  Yes __ No __
- Obtained from the electrical sub contractor all needed maintenance instructions and given these to the owner of the building

  Yes __ No __
- Arranged for the relevant authorities and a qualified electrical engineer to carry out needed inspections and tests and obtained required certification of approval in order to commission the installation

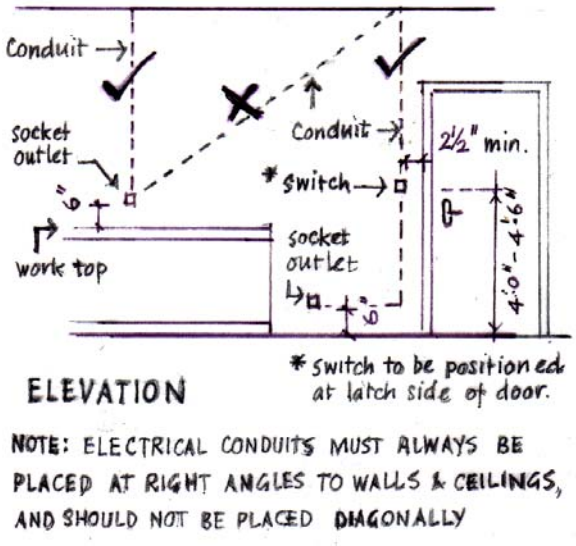
  Yes __ No __
- Checked if electrical fixtures have been clearly identified so that occupants are aware of the functions of the electrical items fitted in the building

  Yes __ No __
- Arranged for suitably qualified stand-by staff from all trades to be on hand when the Electrical Engineer is present for the final commissioning test demonstration

  Yes __ No __



Placement of Electrical conduits



- Prepared as built drawings of the electrical installation in the house and handed the drawings to the house owner.

  Yes __ No __

- Checked if the following tests have been done satisfactorily:
  - Insulation Resistance Test Yes __ No __
  - Earth Continuity Test Yes __ No __
  - Earth Resistance Test Yes __ No __
  - Polarity Test Yes __ No __
  - Working Test Yes __ No __

Placement of Electrical Conduits

STANDARD REQUIREMENTS FOR ELECTRICALWORKS

GENERAL

- All electrical works shall be carried out by adequately skilled and licensed supervisors and trained technicians
- Primary attention shall be given to safety of the installation and conformity to prevailing regulations
- Particular attention shall be given to the neatness in the appearance of the installation which is to be achieved by judicious planning of runs and cables, the locations of light fittings, fans, switches, socket outlets etc. and making good any surfaces, framework or other elements in the building in the process of execution of electrical installation

INSPECTIONS & TESTS

- The contractor shall arrange with relevant statutory authorities and a qualified Electrical Engineer to carry out inspections and tests and obtain required certification of approval for the electrical installation
- The following tests shall be carried out: 1) Insulation Resistance Test, 2) Earth Continuity test, 3) Earth Resistance test, 4) Polarity Test 5) Working Test
- During the final commissioning of the plant suitably qualified stand-by staff shall be provided from all trades so that all related services are available during commissioning

CIRCUIT PLAN

- The circuit plan shall have branch circuits that serve easily defined areas or purposes. Each branch circuit should not be overloaded. Some heavy voltage appliances may need dedicated circuits for themselves.

PROTECTION OF CABLES

- Cables shall be encased in conduits (PVC or metal) and shall be surface mounted or embedded in walls and

floor slabs and shall be mechanically continuous and watertight so that cables are fully protected. No conduit smaller than ¾" (19mm)shall be used.

- Cables buried in concrete shall have at least 1 3/8" (35mm) depth of cover over its entire length.
- Conduits buried in plaster shall have at least 3/16" (5mm) depth of cover throughout its entire length.
- Below ground cables have to be laid at depths designated by the local authority and excavations for buried cables should be identified with marker tapes at require depths.

INSTALLATION OF CONDUITS AND CABLES

- The conduits shall be fitted and completed before any cables are drawn in. Surface mounted conduits shall be securely fitted to wall and ceiling surfaces.
- No conduit smaller than ¾" (20mm) in diameter shall be used as per standard regulations
- Conduits in floor slabs or columns shall be inspected and approved before pouring of concrete or otherwise covering up.
- All cables and conductors used as fixed wiring shall be supported so that they are not exposed to undue stress.
- Unbroken runs of conductors shall be used. Joints shall not be permitted in wiring between power control sources (Control switch or main switch) and any outlet point, light fixture, fan, etc.
- Diagonal runs of power cables shall not be permitted. All branches shall be taken at right angles. Cables shall be kept clear of hot water or steam pipes etc.
- During construction, where conduit is buried in the carcass of a building or in the ground, all open ends shall be temporarily plugged to prevent ingress of foreign matter, moisture or water

INSTALLATION OF CEILING FANS

- The terminal block on the fan as well as the capacities shall be provided with removable covers
- The fan hook shall be of adequate mechanical strength and the internal diameter shall not be less than 5/8" (16mm).
- The fan shall be positioned at a height that is in accordance with local regulations
- The down rod shall be of adequate mechanical strength and the internal diameter shall not be less than 5/8" (16 mm).

INSTALLATION OF ACCESSORIES

- All switches, bell pushes and fan regulators shall be fitted at a minimum height of 4' – 0" (1200mm) above finished floor level, unless otherwise specified in the design (Provision for disabled persons to access switches etc. would require height adjustments)
- Switches for toilets and bathrooms shall be installed outside the room and immediately adjacent to the normal access door of the room, or a switch can be of a type operated by an insulated chord.
- All socket outlets except in a toilet, or kitchen shall be mounted at a minimum height of 6" (150mm) above finished floor level. Socket outlets in kitchens shall be mounted at a minimum height of 6"(150mm) above kitchen counter level unless otherwise specified.
- All socket outlets shall be of the shuttered type.
- In a room where a shower or fixed bath is installed, only a shaver socket is permitted to be installed.
- All ceiling fans shall be fitted at a height where an average person with raised hands will not be able to touch the blades of the fan.
- All lamps with metal parts shall be earthed.
- All cables should be PVC/PVC/Cu except earth wire which could be PVC/Cu
- Cable description:
  - PVC/PVC = PVC sheathed cables with copper conductor
  - PVC/Cu = PVC insulated copper conductor. E.g. Earth cables
- Lamps with fan circuits and 5 Amp socket outlets shall be with 1/1.13 cables and 7/0 67

SUB CIRCUIT ARRANGEMENT

Circuit Type	Number of points per circuit	MCB rating
Lamp, fan, bell/s	08	06 A
5 Amp socket outlet	02	10 A
15 Amp socket outlet	01	16 A
Ring circuit (with 13 Amp socket outlet)	Any number	16/20 A

J : PROVISIONS FOR PERSONS WITH DISABILITIES (See Dimensional information for wheelchair user access 1 & 2)

The expression persons with disabilities in this document includes persons with impaired vision, or handicapped due to non functioning or impaired function of limbs and persons who use crutches or wheelchairs.

Have you?

- Made sure that adequately sized access ramps have been provided to enable disabled users to enter and access all sections of the building

  Yes __ No __
- Made sure that sizes and slope of access ramps conform to standard specifications

  Yes __ No __
- Made sure that handrails are provided on both sides of stairs

  Yes __ No __
- Made sure that stairs do not have open risers

  Yes __ No __
- Made sure that handrails at stairs and ramps extend beyond the top and bottom ends.

  Yes __ No __
- Made sure that risers and treads in stairs are consistently sized

  Yes __ No __
- Made sure that stairs and ramps have adequate lighting

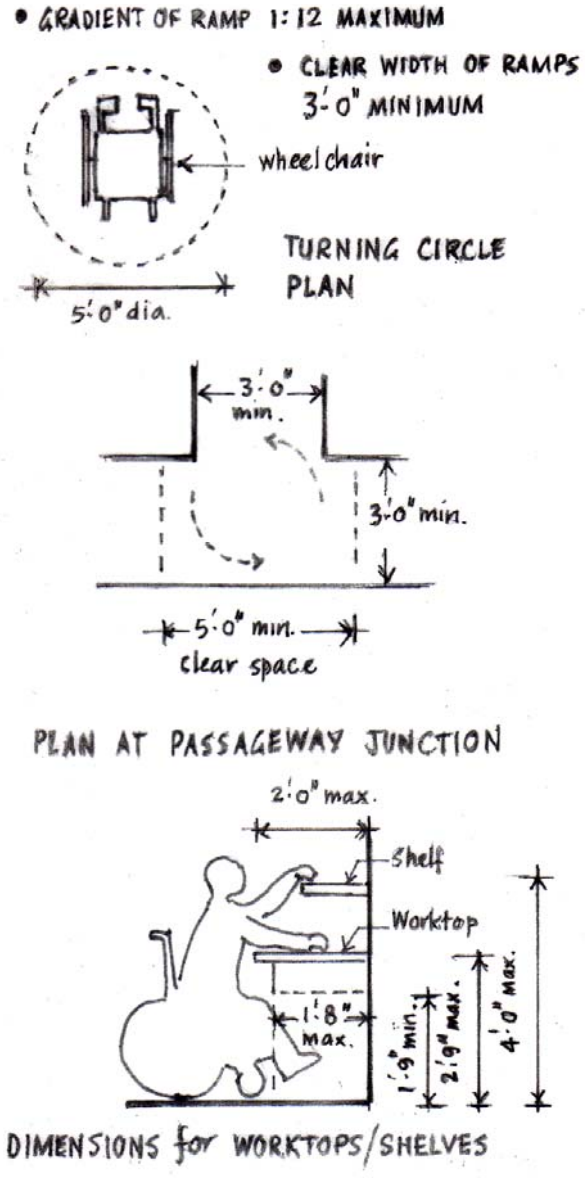
  Yes __ No __
- Made sure that the treads of stairs are not less than 12" (300 mm) wide

  Yes __ No __
- Made sure that floor finishes in toilets are slip resistant

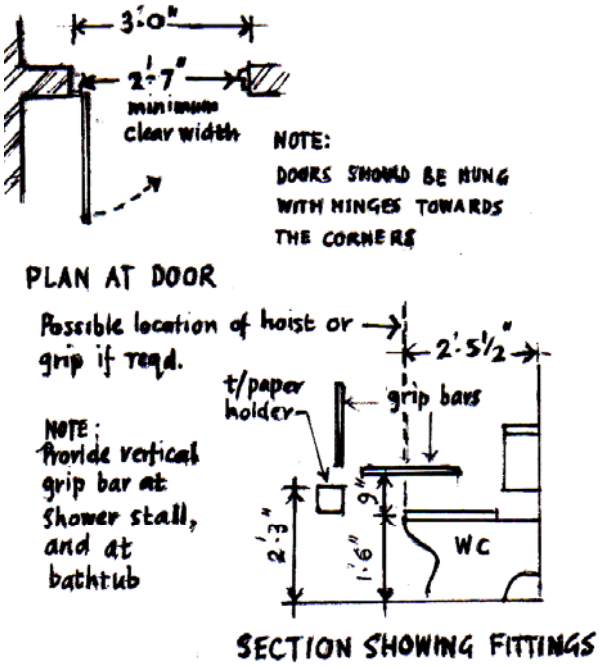
  Yes __ No __
- Made sure that handrails and grab bars are of adequate strength for users

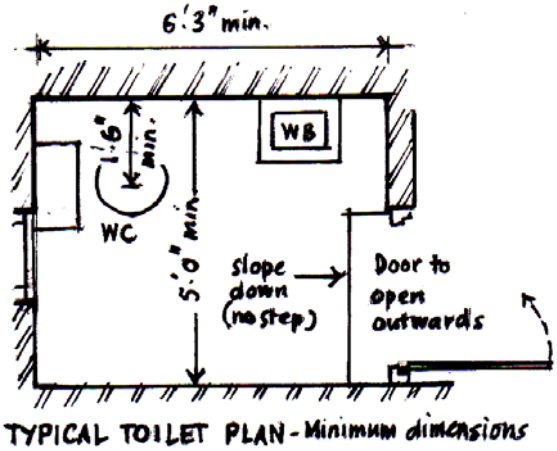
  Yes __ No __

Basic Dimensional information for Wheelchair User Access 1



Basic Dimensional Information For Wheelchair User Access 2





- Made sure that adequate clearance is allowed around beds in bedrooms used by wheelchair users

  Yes __ No __

- Made sure that adequate clearance is allowed around toilet fixtures for wheelchair users

  Yes __ No __

- Made sure that all doorways and passageways are of adequate width to enable disabled persons using wheelchairs to pass through comfortably

  Yes __ No __

- Made sure that heights of electrical switches and socket outlets have been positioned for easy access by wheelchair users

  Yes __ No __

- Made sure that grip bars have been provided in toilets and bathrooms to enable disabled persons to use facilities with ease

  Yes __ No __

- Provided handrails at the approved height along ramps that are unprotected

  Yes __ No __

- Made sure that ramp and landing surfaces are slip-resistant

  Yes __ No __

- Provided suitable barriers under stairways or other protruding obstructions that persons with impaired vision may not be aware of

  Yes __ No __

This checklist must be referred to before and throughout the building work. Some items related to preparatory action and others relate to action that must be taken during construction operations.

Please note that the above checklist provides only general guidelines for users, and is not comprehensive. It is important to be guided by the specifications and drawings that are provided for the specific construction work and the instructions given in commercial products such as paints that are used in the construction.

Information sources:

Building and Social Housing Foundation (B+SHF) – A Practical Guide to the Construction of Low Cost Typhoon-Resistant Housing. Building and Social Housing Foundation, UK, 1983

Coburn A. Hughes R, Pomonis A, Spence R, - Technical Principles of Building for Safety – Intermediate technology Publications, UK, 1995

Fullerton R. L. – Building Construction in Warm Climates – Volume 1. Oxford Tropical Handbooks. Oxford University Press, London. 1967

Institute for Construction Training and Development – Specifications for Electrical & Mechanical Works Associated with Building & Civil Engineering – Sri Lanka, Second Edition, Published by Ministry of Local Government, Housing and Construction (Sri Lanka). November 1987.

Khanna P. N. – Indian Practical Civil Engineer's handbook – Eleventh Edition 1989. Published by P. N. Khanna for Engineer's Publishers, New Delhi. 1989

Ministry of Social Services (Sri Lanka) Steering committee.– Promotion of Accessibility to Built Environment For persons With Disabilities – Addendum to report Book Four – Planning and Design Guide. Ministry of Social Services. December 1998

National Housing Department Authority (Ministry of Housing and Construction) – Guidelines for Housing Development in the Coastal Belt of Sri Lanka – 2005. Colombo Sri Lanka.

Neufert – Architects' Data – Second Edition 1960. Published by Blackwell Science Ltd. 1960

Sri Lanka Urban Multi-Hazard Disaster Mitigation Project (SLUMCP) – Guidelines for Construction in Disaster Prone Areas – Ministry of Urban Development and Construction. Sri Lanka. 1999.

St. Anthony's Industries Group (Pvt.) Ltd. – Technical & Instruction manual – Revision 03. 2003. Sri Lanka. 2003

Vazirini V. N. & Chandola S. P. – Civil Engineering & Costing. Khanna Publishers, New Delhi 1988.

Urban Development Authority – Ministry of Urban Development & Construction – City of Colombo Development Plan 1999 – Volume 2. SriLanka 1999.

Whiltide A. R. – Carpentry and Joinery – Questions and Answers. Butterworth & C0., Ltd. UK.1982

Annex 1

PROJECT REFERENCE

MATERIAL BREAKDOWN

	Materials	Nos.	Bags	Cubes	Bars	Kgs.	L/ft	Unit rate	Total cost	Due date
FOUNDATION	Rubble			8						
	Sand			3						
	Metal 3/4"			2						
	Cement		41							
	10mm bars				22					
	6mm bars				25					
	Bricks	400								
	Binding Wire					2				
PLINTH - ROOF SOFFIT	Bricks	1300								
	Cement		35							
	Sand			3						
	Metal 3/4"			0						
	10mm bars				30					
	6mm bars				15					
	Binding Wire					1				
	1/2' Conduit pipes	15								
FILLER SLAB ROOF	Cement		50							
	Sand			2.5						
	Metal 3/4"			3						
	12mm bars				2					
	10mm bars				65					
	8mm bars				40					
	6mm bars				5					
	Binding Wire					3				
	Rejcted calicut tiles	750								
CALICUT TILE ROOF	4"x 2" hard wood									
	2"x 1" hard wood									
	2"x 5" hard wood									
	3"x 4" hard wood									
	8"x 1" hard wood									
	Roof tiles									
	Ridge tiles									
	Nails									
FLOORING	Cement		30							
	Metal - 1 1/2"			1.5						
	Sand			2						
	Bricks	1000								
	Coloured cement					2				

FINISHES	Cement		20							
	Sand			1						
	White cement					5				
	Red cement					0.5				
	Yellow cement					1				
	Lime					10				
	2"x 2" weld mesh									

* Emulsion paint/gloss paint/varnish quantities & sundry items are not shown in this schedule
The above materail breakdown is based on a 500 sq. ft. building using concrte filler slab roof.
The alternative tiled roof would require quantities (not shown) specific to the roof design

TYPICAL BAR CHART

ITEM	WEEK NUMBER																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Clearing site																		
2. Excavate top soil																		
3. Exc. Foundation																		
4. Steel to fdns.																		
5. Formwork to fdns.																		
6. Concrete to fdns.																		
7. Steel to columns																		
8. Formwk. To columns																		
9. Conc. to columns																		
10. Masonry to g/floor																		
11.Formwk.- plinth beam																		
12. Steel to plinth beam																		
13. Conc. To plith beam																		
14. Return fill & Ram																		
15. Hardcore fill																		
16. DPC & DPM																		
17. Bk. Wk.to floor																		
18. Masonry above floor																		
19. Formwk. to ring beam																		
20. Steel to ring beam																		
21. Concrete to ring beam																		
22. Fabricate roof trusses																		
23. Fix roof truss																		
24. Fix roof timber frame																		
25. Place roof tiles/sheets																		
26. Timber to gable ends																		
27. Form eaves																		
28. Fix ceiling boards																		
29. Floor finish																		
30. Fix door frames *																		

TYPICAL BAR CHART																		
WEEK NUMBER																		
ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
31. Fix window frames *																		
32. Fix doors *																		
33. Fix window sashes *																		
34. Paint exterior walls																		
35. Paint interior walls																		
36. Paint ceiling																		
36. Spread top soil																		
37. Build fence/wall																		

* Note that fabrication of doors and windows can begin well ahead of fixing at site

MATERIAL BREAKDOWN

Description	Materials	Nos.	Bags	Cubes	Bars	Kgs.	Meters.	Unit Rate	Total Cost	Due date
FOUNDATION TO PLINTH	rubble			0				0	0	
	sand			0				0	0	
	metal - 3/4"			0				0	0	
	cement		0					0	0	
	10mm	0						0	0	
	6mm	0						0	0	
	bricks	0						0	0	
	binding wire					0		0	0	
FROM PLINTH	bricks	0						0	0	
TO ROOF SOFFIT	cement		0					0	0	
	sand			0				0	0	
	metal - 3/4"			0				0	0	
	10mm steel	0						0	0	
	6mm steel	0						0	0	
	binding wire					0		0	0	
	conduit	0						0	0	
FILLER SLAB	cement		0					0	0	
ROOF	sand			0				0	0	
	metal- 3/4"			0				0	0	
	12mm steel	0						0	0	
	10mm steel	0						0	0	
	8mm steel	0						0	0	
	6mm steel	0						0	0	
	binding wire					0		0	0	
CALICUT TILE	4"x2" hard wood						0	0	0	
ROOF (alternative)	2"x1" hard wood						0	0	0	
	2"x5" hard wood						0	0	0	

MATERIAL BREAKDOWN										
Description	Materials	Nos.	Bags	Cubes	Bars	Kgs.	Meters.	Unit Rate	Total Cost	Due date
	3"x4" hard wood						0	0	0	
	8"x1" hard wood						0	0	0	
	roof tiles	0						0	0	
	ridge tiles	0						0	0	
	nails					0		0	0	
FLOORING	cement		0					0	0	
	metal - 1 1/2"			0				0	0	
	sand			0				0	0	
	bricks	0						0	0	
	black cement					0		0	0	
FINISHING	cement		0					0	0	
	sand			0				0	0	
	white cement					0		0	0	
	red cement					0		0	0	
	yellow cement					0		0	0	
	lime		0					0	0	
	2"x2"weld mesh						0	0	0	

WEEKLY SCHEDULE OF LABOUR

WORK ITEM	Week number																				Workmen
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1. Clear site/remove topsoil	3																				labourers
2. Excavate foundations	3	4																			labourers
3. Steel to foundations		2	2																		steel fixers
4. Formwork to foundations			2	2																	carpenters
5. Concrete to foundations				3	3																mixer operator, labourers
6. Steel to columns					2	2															steel fixers
7. Formwork to columns						2	2														carpenters
8. Concrete to columns							2	2													mixer operator, labourers
9. masonry to DPC								3	3												masons
10. Return fill & ram									1	1											labourer
11. Hardcore fill									1	1											skilled labourer
12. Masonry above floor										2	2										masons
13. Formwork to ringbeam											2	2									carpenters
14. Steel to ringbeam												2	2								steel fixers
15. Concrete to ringbeam													3	3							mixer operator, labourers
16. Fabricate roof members												2	2	2	2						carpenters
17. Fix roof members															3	3					2 carpenters, 1 labourer
18. Place roofing tiles																2	2				skilled labourers
19. Fabricate doors/windows									2	2	2		2	2							carpenters
20. Fix door/window frames																2	2				carpenters
21. Fix doors & windows																	2	2			carpenters
22. Plaster walls																		2	2		plasterers
23. Paint external walls																			2	2	Painters
24. Paint internal walls																			2	2	Painters
25. External clearing																				2	labourers

WEEKLY SCHEDULE OF LABOUR																					
WORKMEN																					
Steel fixers		*2*	*2*		*2*	*2*						*2*	*2*								
Concrete gang				*3*	*3*		*2*	*2*					*3*	*3*							
Carpenters			***2***	***2***		***2***	***2***		***2***	***2***	***4***	***4***	***4***	***4***	***4***	***4***	***4***	***2***			
Masons								***3***	***3***	***2***	***2***										
Plasterer																		***2***	***2***		
Painters																			***4***	***4***	
Labourers	***6***	***4***							***2***	***2***					***1***	***3***	***2***			***2***	***1 Supervsor - 20 weeks***
Week Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	