A MANUAL FOR THE USE OF SCHOOLS AND COMMUNITIES IN THE RENOVATION OF PRIMARY SCHOOL BUILDINGS

Renovation Manual

FEEL FREE TO PUT IN ANY ADDITIONAL ILLUSTRATIONS THAT YOU THINK MIGHT HELP!

1: INTRODUCTION

In the past, the renovation of primary schools has been the responsibility of local government and has been carried out by local building contractors supervised by the Ministry of Works. This process has however resulted in many cases in poor quality construction.

A number of recent primary school construction projects have therefore used school committees and/or communities to manage or carry out the renovation of primary school buildings.

As government increasingly transfers the responsibility for managing primary schools to school committees and communities this method of renovating primary school buildings is becoming increasingly common and this manual has been designed to assist both schools and communities in managing and carrying out the work.

While neither school staff nor community members can be expected to replace completely the role of the building contractor, there are usually some members of the community who are either skilled artisans, building foremen, builders or engineers who will be able to assist the school committee or community in carrying out the work.

Many existing primary schools have had little or no maintenance since they were built and are now in varying states of disrepair.

This manual covers the more common areas of repair and renovation (rather than maintenance) required by buildings that have received little or no maintenance or those that have suffered damage by other factors.

The problems affecting existing primary school buildings can be divided into five main groups, affecting respectively:

- Walls, columns and beams
- Roofs and roof coverings
- Floors
- Doors and windows
- Finishes
- Site works

The extent of the damage to existing school buildings can range from that requiring only minor repairs to damage that is so extensive that the buildings are unsafe or are uneconomic to repair and require demolition.

Minor repairs are covered in the separate Maintenance Manual.

This Manual covers larger scale repairs and renovations and should be read in conjunction with the relevant sections of the Construction Manual (CM Sections 1 onwards).

The parts of the Construction Manual that deal with mixing screed, mixing concrete and choosing and using reinforcement are also included in this manual as they will need to be referred to quite often when carrying out any renovation works.

Remember: before starting any large-scale renovations of a building, always take advice from a properly qualified architect or engineer!

2: MIXING MORTAR

Before moving on to any renovation work for which mortar will be required, it is necessary to set out some guidelines on the mixing of mortar by hand, which will be the most common method at primary schools.

Mortar will be required for building foundations, building walls, for screed, for laying tiles and for plastering the walls.

There are some common problems associated with mixing mortar by hand: 1) the materials are not mixed enough dry before the water is added and 2) too much water is used in the mix.

Mortar for foundations and for laying bricks or blocks should be mixed in the ratio of 1 of cement to 4 of sand.

Mortar to be used for plastering walls should be mixed in the same ration or lime can be added which makes it easier to use. The ratio should then be 1 of cement, 1 of lime and 3 of sand.

Mortar for screed or laying tiles should be in the ratio of 1 of cement to 3 of sand.

The materials should be measured by volume preferably using a specially made box which should be big enough to take exactly one bag of cement or by using buckets. The measurements should be exact.

All sand should be clean and sand for mortar for laying bricks or blocks and for plastering should be and fine and soft and sand for mortar for laying tiles or for screeds should be coarse and sharp; sea sand should not be used unless it is thoroughly washed.

Mix the mortar on a clean platform and not on the ground. The platform should be made of cement/sand screed and should be big enough to take as much mortar as can easily be mixed by hand at one time.

Mix only enough mortar that can be mixed easily at one time by hand and can be used in less than one hour. Mix all materials thoroughly dry before any water is added until an even grey colour is achieved.

When an even colour is achieved, add water slowly and in small quantities mixing thoroughly all the time. To achieve maximum strength use as little water as necessary to achieve a workable mix. Very wet mortar will be very weak concrete! Never add more water later to improve the workability!

All materials containing cement require a curing period to reach their maximum strength and during this period (at least a week) they should be kept damp.

Remember:

- **Always mix materials on a clean platform**
- **Always measure materials accurately and by volume**
- **Always mix materials thoroughly dry before adding any water**
- **Use as little water as necessary to achieve a workable mix**

PUT IN ILLUSTRATIONS FROM CONSTRUCTION MANUAL

3: MIXING CONCRETE

Before moving on to any renovation work for which concrete will be required, it is necessary to set out some guidelines on the mixing of concrete by hand which will be the most common method at primary schools.

Two types of concrete will be required for primary school buildings: 1) mass concrete or concrete with no reinforcement and 2) reinforced concrete or concrete reinforced with steel bars.

There are some common problems associated with mixing concrete by hand: 1) the materials are usually not mixed enough dry before the water is added; 2) too much water is used in the mix; 3) the concrete is not very well compacted when it is put into the formwork because vibrators are not available.

Various measures have been taken in the designs used in this manual to counter-act these problems: 1) the strength of the mixes has been increased and 2) the size of columns and beams has been increased so that it is easier to pour and compact the concrete and get the required cover to the reinforcement.

Mass concrete should be mixed in the following ratio: 1 of cement, 2 of sand and 4 of aggregate.

Reinforced concrete should be mixed in the following ratio: 1 of cement, 1½ of sand and 3 of aggregate.

The materials should be measured by volume preferably using a specially made box that should be big enough to take exactly one bag of cement. If a wheel barrow is used for measuring, empty a bag of cement into it, level it and mark the top of the cement all round. Use this mark for measuring the sand and aggregate.

Cement should be fresh, Portland cement and should not be lumpy or hard. Any hard or lumpy cement should not be used. Cement should be stored off the ground and under cover.

Sand should be clean, coarse and sharp (not fine, soft sand) and sea sand should not be used unless it is thoroughly washed.

Aggregate should be either crushed rock ('split') or river stone. All aggregate should be clean and should be an average size of 20mm and a maximum size of 25mm.

Mix concrete by hand on a clean platform and not on the ground. The platform should be made of cement/sand screed and should be big enough to take as much concrete as can easily be mixed by hand at one time.

Mix only enough concrete that can be mixed easily at one time by hand and can be used in less than one hour. Mix all materials thoroughly dry before any water is added until an even grey colour is achieved. The materials should be completely turned over and mixed at least three times before any water is added.

When an even colour is achieved, add water slowly and in small quantities mixing thoroughly all the time and mix all materials with the water and do not leave any to mix later. Again the materials should be completely turned over and mixed at least three times before use.

To achieve maximum strength use only enough water as necessary to achieve a workable mix. Very wet concrete will be very weak concrete!

PUT IN ILLUSTRATIONS FROM CONSTRUCTION MANUAL

When the concrete is poured into the formwork, tamp it thoroughly using a length of 12mm reinforcing rod to make sure that no air pockets are left in the concrete that will reduce its strength.

Concrete becomes stronger as it gets older through a process of curing and it must be kept damp for as long as possible. Leave the shuttering on the beams and columns for at least 7 days to conserve moisture in the concrete and thus allow it to cure. Cover any exposed surfaces such as the top of beams with cement bags and keep them wet to assist the curing. Concrete that dries out quickly will not be very strong!

Remember:

- **Use only fresh cement that has no lumps**
- **Use only coarse, clean sand and clean aggregate**
- **Always mix the materials on a clean platform**
- **Always measure the materials accurately**
- **Make sure that all the materials are thoroughly mixed both dry and wet**
- **Never use too much water in the mix**
- **Keep the concrete protected and damp for at least 7 days in order to cure properly**

4: CHOOSING & USING REINFORCEMENT

Before moving on to any renovation work where reinforced concrete will be required, it is necessary to set out some guidelines for the size and type of reinforcement that will be used in all of the reinforced concrete in the building.

There are many sizes and types of reinforcement available in Indonesia. There are for instance a number of different sizes that are called '12mm Ø' bars available from building materials suppliers and these range in actual size from 8mm Ø to 12mm Ø.

To avoid any confusion and to ensure that the reinforcement is of an adequate size for the job it has to do, the same size of reinforcement has been specified for the main bars in all reinforced concrete columns and beams in the building. This is 10mm Ø reinforcement or what is quite often called 'local standard' 12mm Ø!

On no account should any reinforcement that is smaller than this be used and if any smaller sizes are delivered to site they should be rejected.

All column and beam sizes have been standardised at 20 x 20cm with 4No 10mm Ø bars and all the column and beam reinforcement 'cages' will be the same size: 15 x 15cm externally which will allow for 25mm of concrete cover to all sides of the reinforcement (see sketch).

The 4No reinforcing bars in the columns and beams are held together with 'links' and these links will all be of 6mm Ø bars set at 15cm centres.

Where lengths of reinforcement have to be joined, they must overlap for at least 40cm. Bend the ends of all bars back to assist bonding with the concrete (see sketch).

In order to achieve the 25mm concrete cover that is required over all reinforcement, make spacers of a mixture of sand and cement (1:3 mix) with wire ties cast in (see sketch) and cut up into 40 x 40mm squares. These spacers can then be wired to the outside of the reinforcing bars when they are put in the formwork and will hold the bars 25mm away from the formwork to give the required cover of concrete.

Remember:

- **Use only the correct size of reinforcement**
- **Put links at a maximum spacing of 15cm**
- **Where reinforcement has to be joined, it must be lapped for at least 40cm**
- **Hook the ends of all reinforcement to improve the bond**
- **Ensure that there is 25mm cover of concrete to all reinforcement**

PUT IN ILLUSTRATIONS FROM CONSTRUCTION MANUAL

5: LARGE SCALE RENOVATIONS: GENERAL

If the walls, columns, roof, etc of a building are all in such a bad state of repair that it is not economical to renovate the building but the foundations seem sound, it may be possible to demolish the superstructure and re-construct the building using the existing foundations. It would be wise however to get the advice of a properly qualified engineer on whether the foundations will be capable of supporting a new building.

If the existing foundations are judged capable of supporting a new building, a new ground beam should be built on top of the foundations to ensure that the superstructure has adequate bearing on the foundations. See CM Section 11: Constructing the Ground Beam.

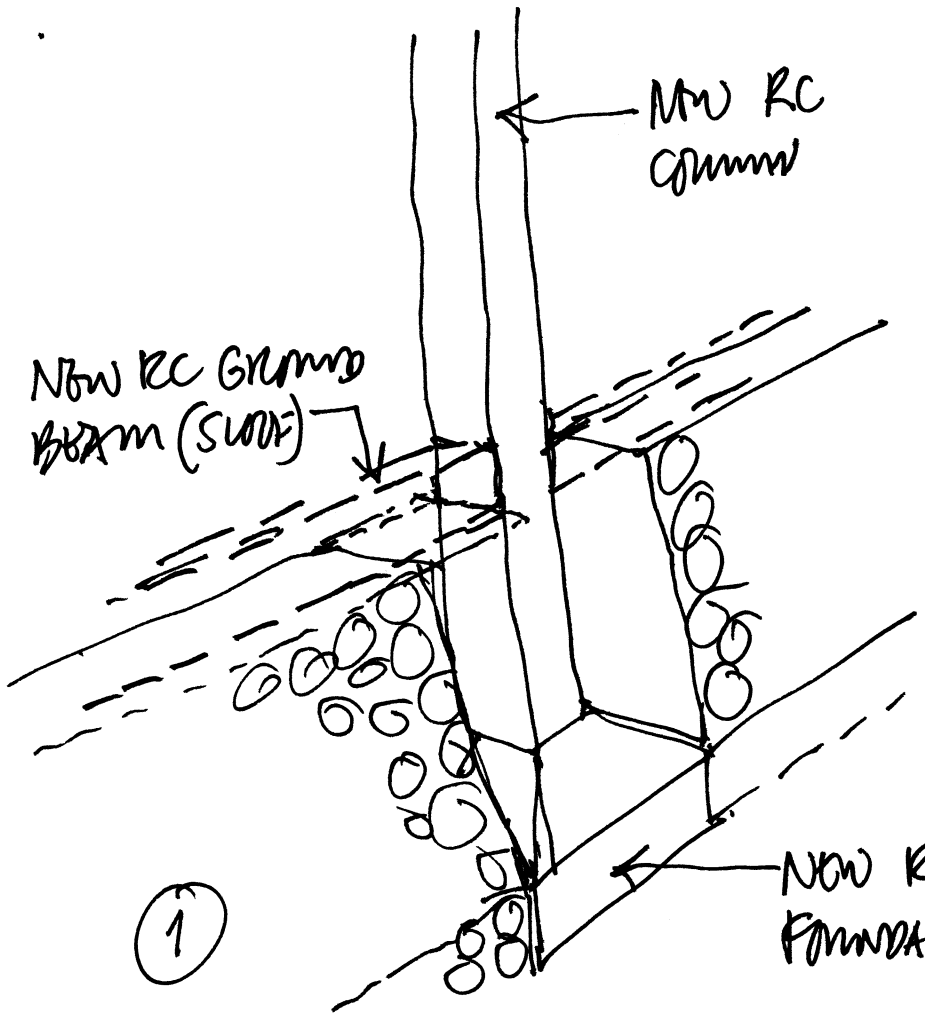
When the ground beam is complete, the following sections of the Construction Manual covering the construction of the rest of the building elements should be followed.

If the foundations below the new column positions do not appear to be adequate, then the existing foundations in these positions will have to be broken out and replaced, probably by reinforced concrete foundations (see sketch) and the advice of a properly qualified engineer should be sought on the design of the foundations.

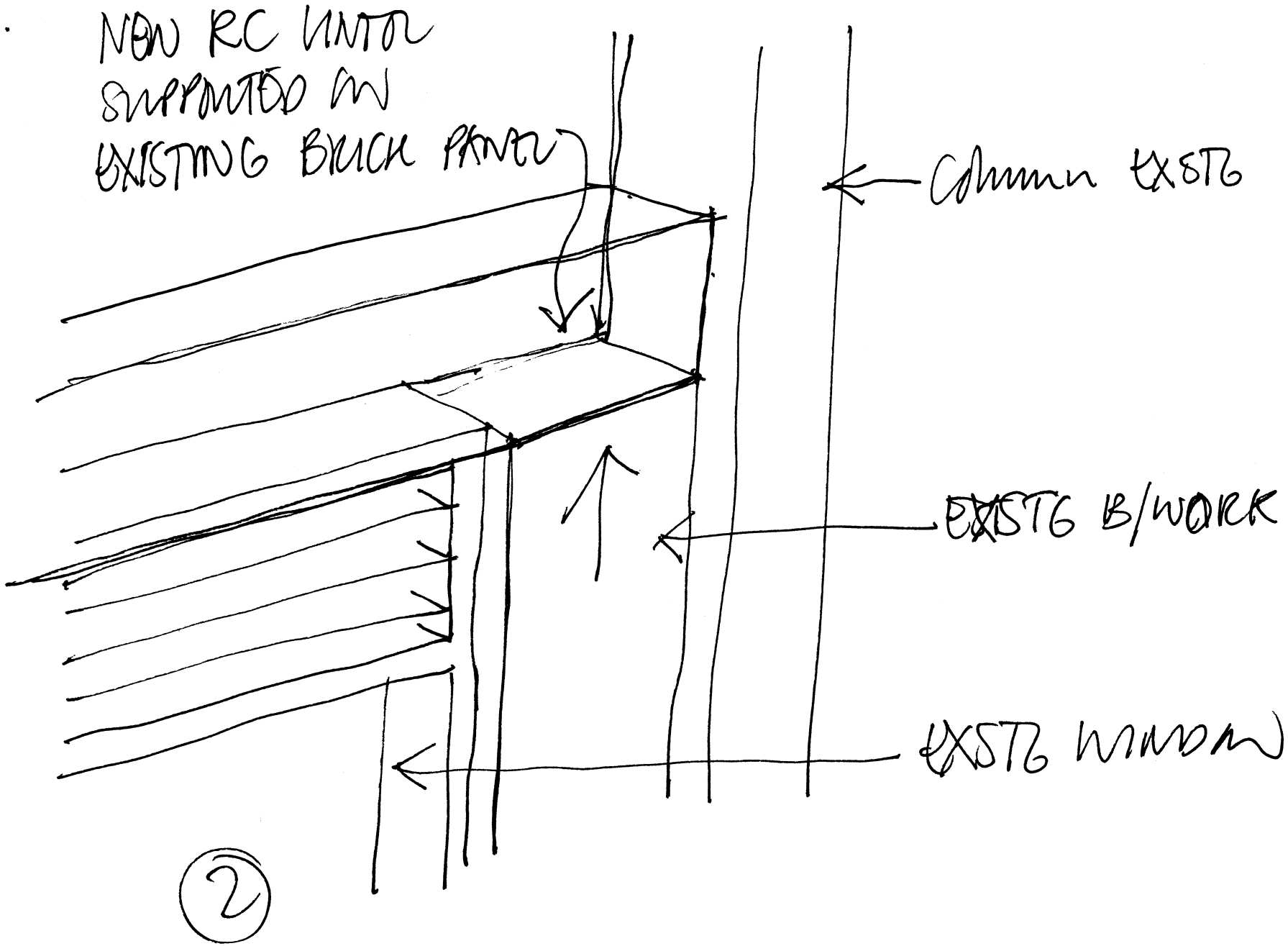
If the foundations and columns are sound but the walls are in poor repair, then the walls can be demolished and re-built between columns. It might be necessary to build new ground beams between the columns (see CM Section 11) and it would be advisable to build new lintels/ring beams over the window and door openings. This is fairly simple if there are brick or block panels at the sides of the windows. The new lintels can be constructed over the window openings supported on the brick or block panels. If there are no panels of brick or block work then it will be easier to construct a new ring beam at the top of the column (see CM Section 13: Constructing the Ring Beams/Lintels) and use a double timber lintel over the window. See Section 9: Renovations to Walls.

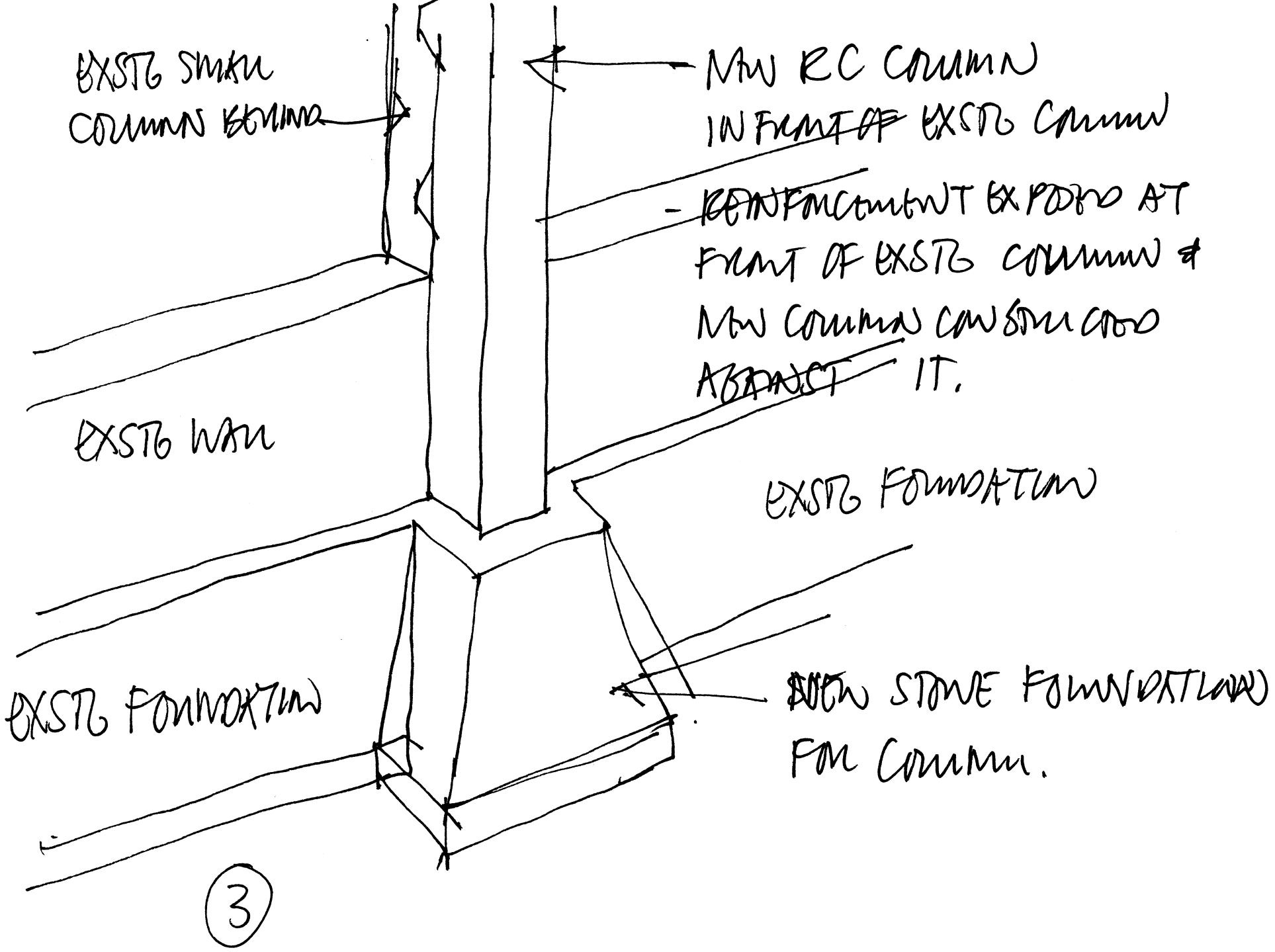
If there is doubt about the strength or stability of existing columns but the foundations and walls seem sound (in some cases the size of columns might have been reduced to the thickness of the walls and the columns are therefore under-sized) a more economic solution than demolition might be to build new columns (see CM Section 12: Constructing the Concrete Columns) sitting on new stone foundations built externally against the face of the existing columns. The existing columns should in this case be opened up so that the new columns can be bonded in to them (see sketch).

When the walls and columns have been re-built by whatever method, the roof, ceiling and floor can be constructed following the relevant sections in the Construction Manual (see CM Sections 15 to 27), the doors and windows can be made and fitted (see CM Section 22) and the building completed in the normal way.



- EXISTING FOUNDATION BROKEN OUT TO ALLOW CONSTRUCTION OF NEW RC COLUMN & FOUNDATION
  - FOUNDATION ROBUST ENOUGH COLUMN & FOUNDATION WHEN COMPLETE


NEW RC LINTOL
SUPPORTED ON
EXISTING BRICK PIER
EXISTG COLUMN
EXISTG B/WORK
EXISTG WINDOW
②


EXSTG SMALL COLUMN BEHIND
NEW RC COLUMN IN FRONT OF EXSTG COLUMN
- REINFORCEMENT EXPOSED AT FRONT OF EXSTG COLUMN & NEW COLUMN CONCRETED AGAINST IT.
EXSTG WALL
EXSTG FOUNDATION
EXSTG FOUNDATION
NEW STONE FOUNDATION FOR COLUMN.

3

6: PAINTING

Whatever renovations take place in the school, the school will probably have to be re-painted. The following are some simple rules to follow when painting which should help to give a better finish:

- Don't paint over a flaking or blistered surface: the paint will just come off!
- Don't paint over dirt or grease: the paint will take a long time to dry and the finish will not look good!
- Don't paint over an old coat of thick, soft paint: the new coat of paint will blister!
- Don't sweep the floors just before or during painting: the dust will ruin the new paint!
- Don't use an old or dirty paint brush: it will spoil the finish of the new paint!
- Always use the correct size of brush.
- Don't over-thin the paint!
- Don't forget to remove the skin from paint that has been used before!
- Don't forget to read the instructions on the paint tin!

Preparation is the key to good painting whatever the surface. It is necessary therefore to thoroughly prepare all surfaces before painting: they should be cleaned, washed down and sanded before painting. Wash off all dust and dirt with clean water and detergent or white spirit if necessary.

Rectify all defects before starting painting: fill any hollows or cracks in walls; punch in any nails in timber and fill the holes with wood-filler before painting. Prime all exposed or new surfaces to wood or metal with the appropriate primer before painting.

Always use the best quality paint and brushes that can be afforded and always clean brushes thoroughly after use. Use clean water for cleaning brushes used for emulsion and white spirit for brushes used for oil paint.

Take great care when using ladders: the ladder angle should be 1:4 i.e. if the ladder is 4 metres high then the bottom of the ladder should be 1 metre away from the wall.

Always secure the top or bottom of the ladder: if the ladder is positioned on soft ground, knock a long peg into the ground and tie the bottom of the ladder to the peg.

Always use a paint tin hook when painting off a ladder: a hook can be made from a piece of 'S' shaped 6mm rod which hooks onto a rung of the ladder and through the handle of the paint tin leaving both hands free for painting.

Always start painting at the right-hand side of the wall if right-handed (left-hand side if left handed) and move the ladder towards the left so that the ladder is never placed on the newly painted wall.

See CM Section 25: Painting the Building and the various elements of the building described below for details of painting roof timbers, walls, ceilings and doors and windows.

7: RENOVATIONS TO ROOFS

Roofs to primary school buildings are commonly constructed of clay tiles laid on battens on rafters on purlins or corrugated steel or fibre-cement roof sheets laid on purlins, with the purlins of both types of roof fixed to timber roof trusses.

Good timber and carpentry skills are available in most parts of the country and most roofs are therefore quite well built. There are however a number of common problems associated with primary school roofs and these include:

- Roof leaks.
- Rot to roof timbers caused by prolonged roof leaks.
- Insect damage to roof timbers.
- Rot to barge boards and fascias caused by lack of painting.
- Rusting of corrugated steel roof sheets or loose roof sheets, roofing screws or nails that are causing leaks.
- Loose, broken or poor quality clay roof tiles that are causing leaks.

If the roof timbers are badly damaged either by leaks or by insects (either wood borers or termites), the roof covering should be taken off over the affected area and the damaged roof timbers then removed and replaced.

Treat all the new roof timbers against insect damage before they are fixed (used engine oil is a cheap and effective treatment) and make sure that all roof timbers are properly tied down to the tops of columns or walls. See CM Section 15.

If corrugated steel roof sheets are leaking through roofing screw or nail holes, these can be sealed with silicone sealant.

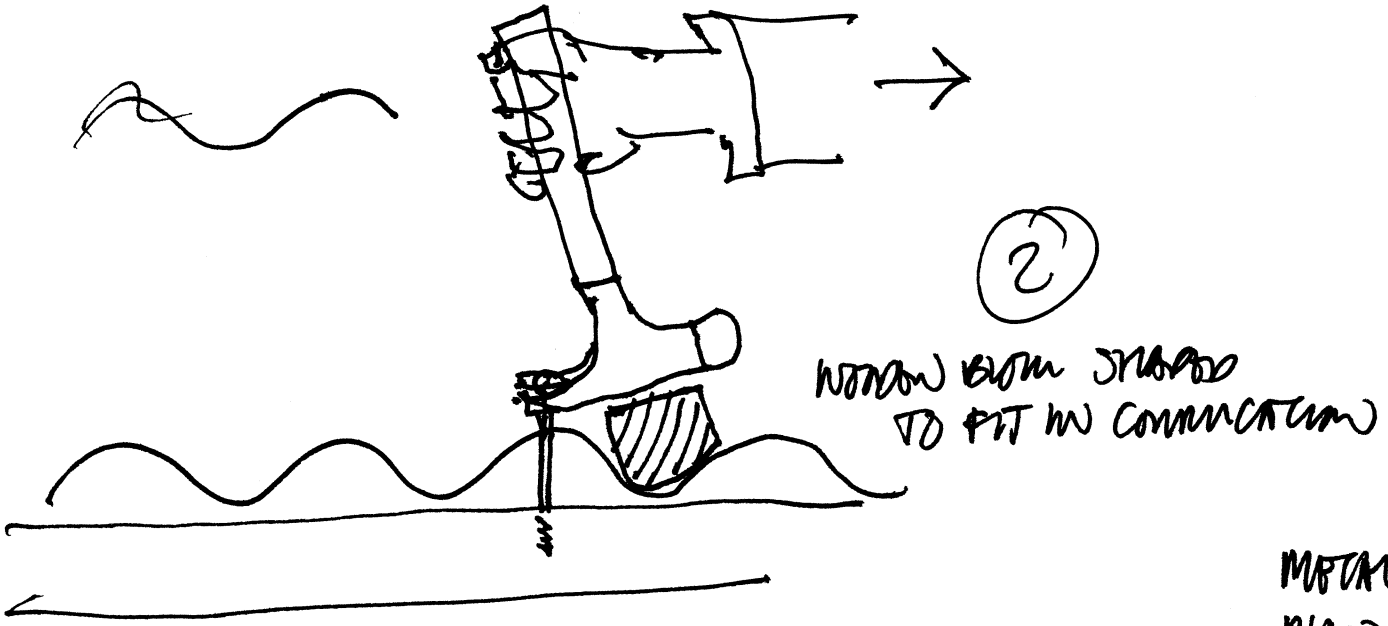
If the roof sheets are rusty but still serviceable they can be painted to prolong their life. Brush down the sheets very thoroughly with a steel brush, paint them with red-oxide metal primer and then finish them with two coats of oil paint. Use a light-coloured paint as this will reflect the heat better than a dark colour.

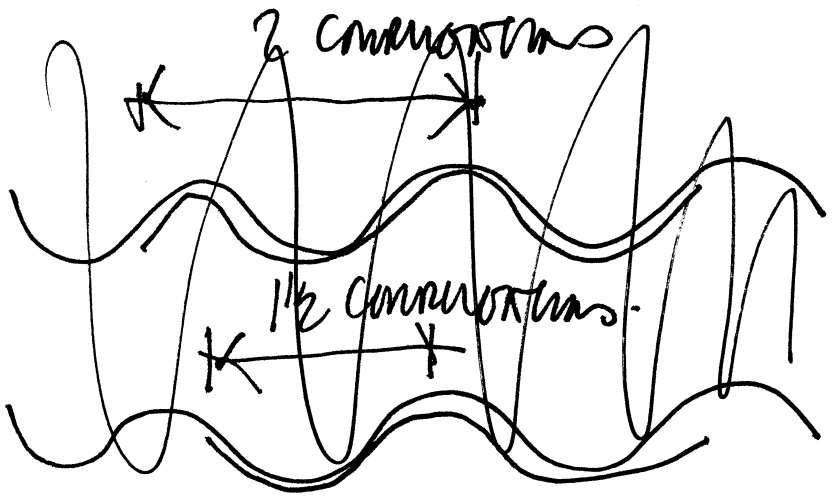
If the roof sheets are so badly rusted that they have to be replaced, they should be removed, the roof timbers checked and any damaged ones replaced and treated as above, and new roof sheets fitted. The roof sheets are laid as described in the new roof section of the Construction Manual. See CM Section 18.

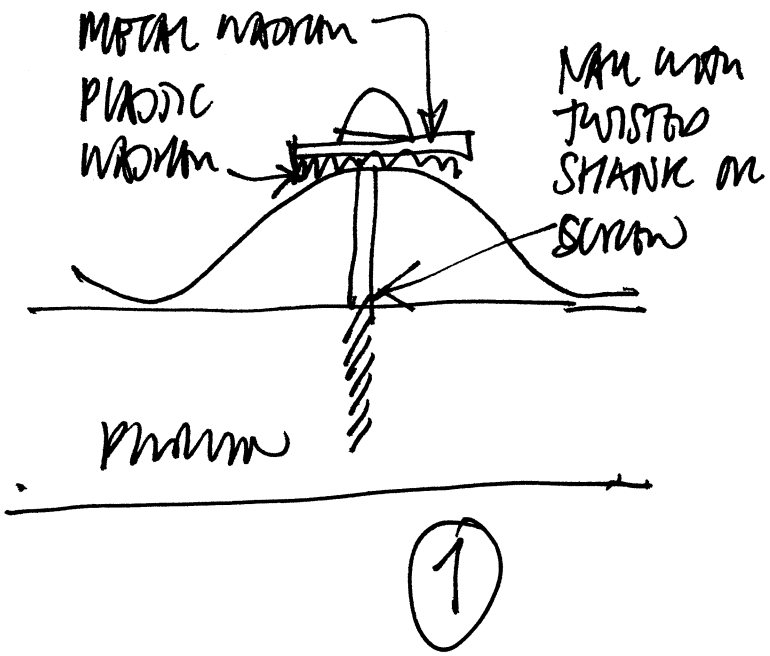
All fixings should be made through the top of the corrugations in the sheets and fixing screws with plastic washers and caps should be used if possible. They are more expensive than roofing nails but will provide a better fixing and are less liable to leaks. If roofing nails are used then use nails with twisted shanks and metal washers on top and plastic or felt washers below. (1)

If roofing nails have to be removed, use a claw hammer supported on a piece of timber shaped to fit into the sheet corrugations that will spread the load and stop damage to the sheet. (2) Remove roofing screws using a spanner of the correct size.

If clay roof tiles are loose or damaged, they should be fixed or replaced. If the roof timbers have been damaged, carefully remove the roof tiles, stack them for re-use later, replace the


2
NOTCH BEING SHAPED
TO FIT IN CONNECTION


2 CONNECTIONS
1½ CONNECTIONS


METAL WASHER
PLASTIC
WASHER
NAIL WITH
TWISTED
SHANK OR
SCREW
PANEL
1

damaged roof timbers and the re-tile the roof as described in the new roof section of the Construction Manual. See CM Section 19.

All roofing operations are dangerous and great care should always be taken. Always use a ladder to get access to the roof (with the top or bottom secured or someone holding it) and use crawl boards fixed over the roof to spread the weight of the tiler, especially after the roofing has been fixed. Roof tiles and fibre-cement and corrugated steel sheets are all very fragile and will not take the weight of a man without damage.

There are a number of external roof timbers that might require repair or replacement. These include fascias to the eaves at the bottom of the roof and bargeboards at the verges at the ends of the roof. See CM Sections 18 & 19.

These fascias and bargeboards protect the ends of rafters and purlins from the rain and sun and from damage by exposure to the weather. It is very important therefore to maintain them in good condition.

If any timbers are found to be rotten or have suffered insect damage, they should be removed and replaced. If only a short section of timber is affected, cut it out, replace it and strengthen it with additional timbers to the back or side as necessary. Punch in all nails to below the surface of the timber and fill the holes with wood filler before painting. Sand down all new timbers, prime them with good quality wood primer and paint them with two coats of gloss paint to match the existing timber.

Rub down all other existing roof timbers with sandpaper and paint them with at least one coat of gloss paint. Punch in any nails that are protruding from the timber and fill the holes filled with wood filler before painting. If any timber is exposed during sanding then it should be primed and re-painted with two coats of oil paint. For further details on painting see CM Section 25: Painting the Building.

8: RENOVATIONS TO CEILINGS

Ceilings to primary school buildings are usually constructed of timber battens suspended below the roof trusses with ceiling panels of 'tripleks' or fibre-cement with or without timber cover strips.

The damage associated with ceilings is usually caused by:

- Water from roof leaks.
- Insect damage to ceiling framing or plywood panels.
- Under-sized ceiling framing that has started sagging or has collapsed.

Before any repair work is started on the ceilings, any problems with the roof coverings or roof timbers must be resolved and any roof leaks repaired.

Once this is done the ceilings can be repaired or replaced. If ceiling panels are stained or damaged by roof leaks they will have to be re-painted or replaced depending upon the amount of damage. If the damage to the ceiling is extensive, then the whole ceiling including panels and framing should be removed and replaced. See CM Section 23.

It should be noted here that the use of local materials such as mats made bamboo or other local materials should be seriously considered for constructing ceiling panels. These can form a low-cost alternative ceiling that is as good if not better than Tripleks in terms of insulation and one that also looks very good.

When renovating ceilings, access panels should be provided to all roof spaces as described in CM Section 23.

The framing should be treated against insect damage before it is fixed (again used engine oil is a cheap way of doing this) and the panels can be of tripleks or fibre-cement.

Both types of materials should be nailed to the battens using panel pins for the tripleks or flat headed nails for the fibre-cement panels. Fix cover strips over the joints if these have been used on the existing ceiling.

If only a few panels are affected (with or without the framing) then they should be removed and new panels (and framing if necessary) fixed to match the existing ceiling.

If the panels are merely stained and can be re-painted, leave them until the panels have been completely dried out and then paint them with primer to cover the stains and then with two coats of emulsion paint to match the surrounding ceiling.

If new panels and cover strips have been fixed, punch in all fixing nails to Tripleks panels and cover strips and fill the holes with wood filler before painting. Prime the new ceiling panels and cover strips if used and paint the whole ceiling with two coats of emulsion to match the existing.

See the notes on ceilings in CM Section 23 for further details of fixings, etc.

9: RENOVATIONS TO WALLS

Most existing primary school buildings have walls constructed of a single skin of brick or block work built between concrete columns set at anything between 2 and 4 metre centres. These are large panels for a single skin of block or brick and many have cracks.

These cracks have three main causes: 1) shrinkage cracks caused by wall panels being too large; 2) cracks caused by settlement of foundations and 3) cracks over windows caused by lack of concrete lintels.

If wall panels are too large they will crack, usually in the centre of the wall. This cracking is mainly due to shrinkage when the wall is drying out. If there are no signs of the foundations subsiding (see below), these cracks are not dangerous but they are unsightly.

Unfortunately once a wall is cracked it is very difficult to close the crack permanently. One method that could be used is as follows: 1) hack the plaster off the wall for 30cms on either side of the crack on both sides of the wall; 2) open out the crack on both sides of the wall and fill with mortar (1 cement to 4 sand mix); fix chicken wire with masonry nails over the crack on both sides of the wall and re-plaster the wall to match the surround (see sketch). (1)

If a wall has been cracked due to settlement of foundations in the centre of a building the cracks will usually be wider at the bottom than the top (see sketch (2)). However if the foundation to an end wall has settled, there will be 45° cracks in the front and back walls showing that the end wall has dropped (see sketch) or cracks that are wider at the top than the bottom. (3)

If a foundation has settled, it is highly likely that the surrounding floor will have dropped and will be cracked and damaged and this is another sign to look for.

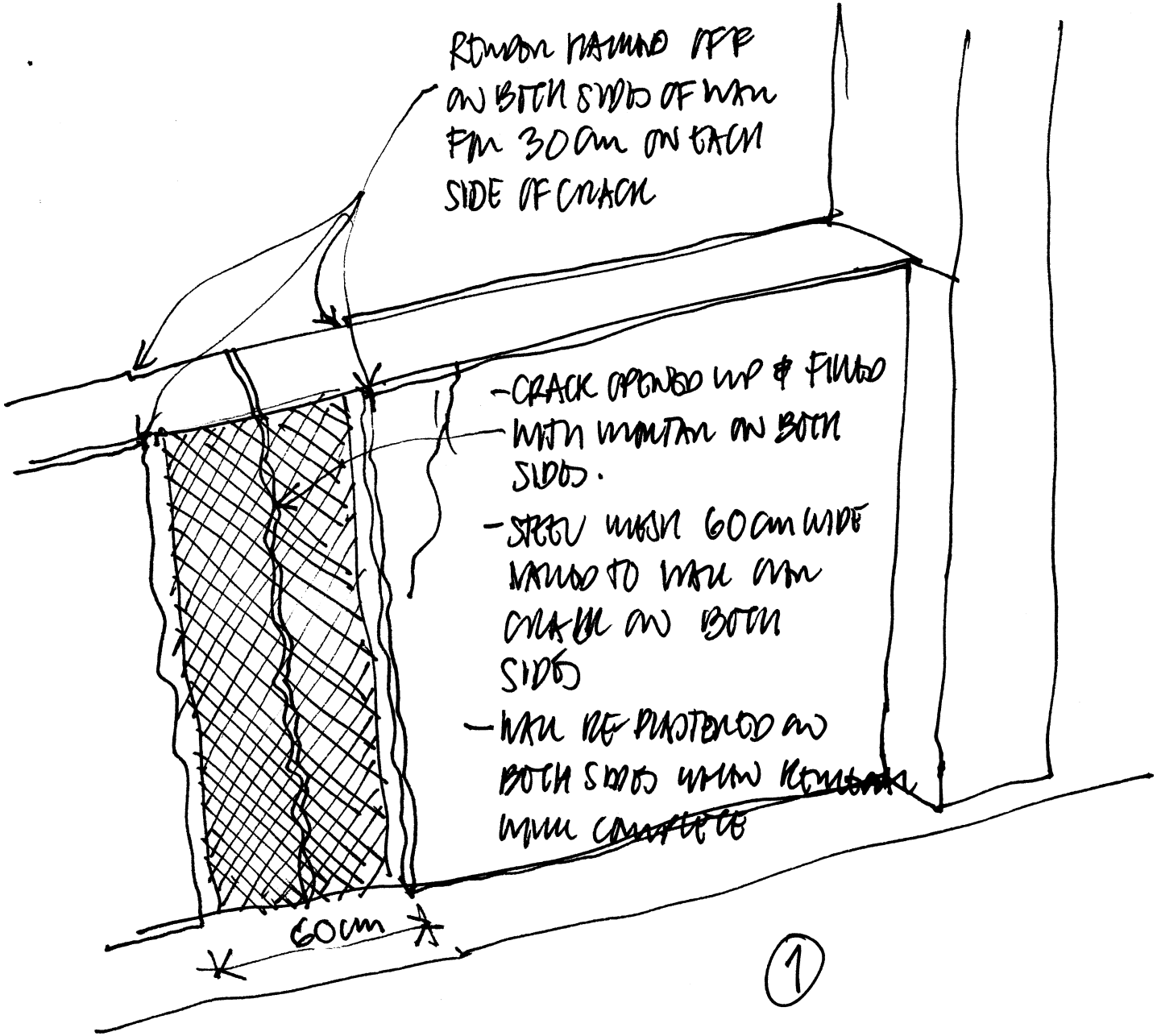
The main cause of settlement is the inadequate bearing capacity of the soil below the foundation. Traditional stone foundations should always be taken down to firm soil but, if there is no firm soil available in a particular location or it is very deep, then this is not always done and this will cause settlement of the foundation at a later date.

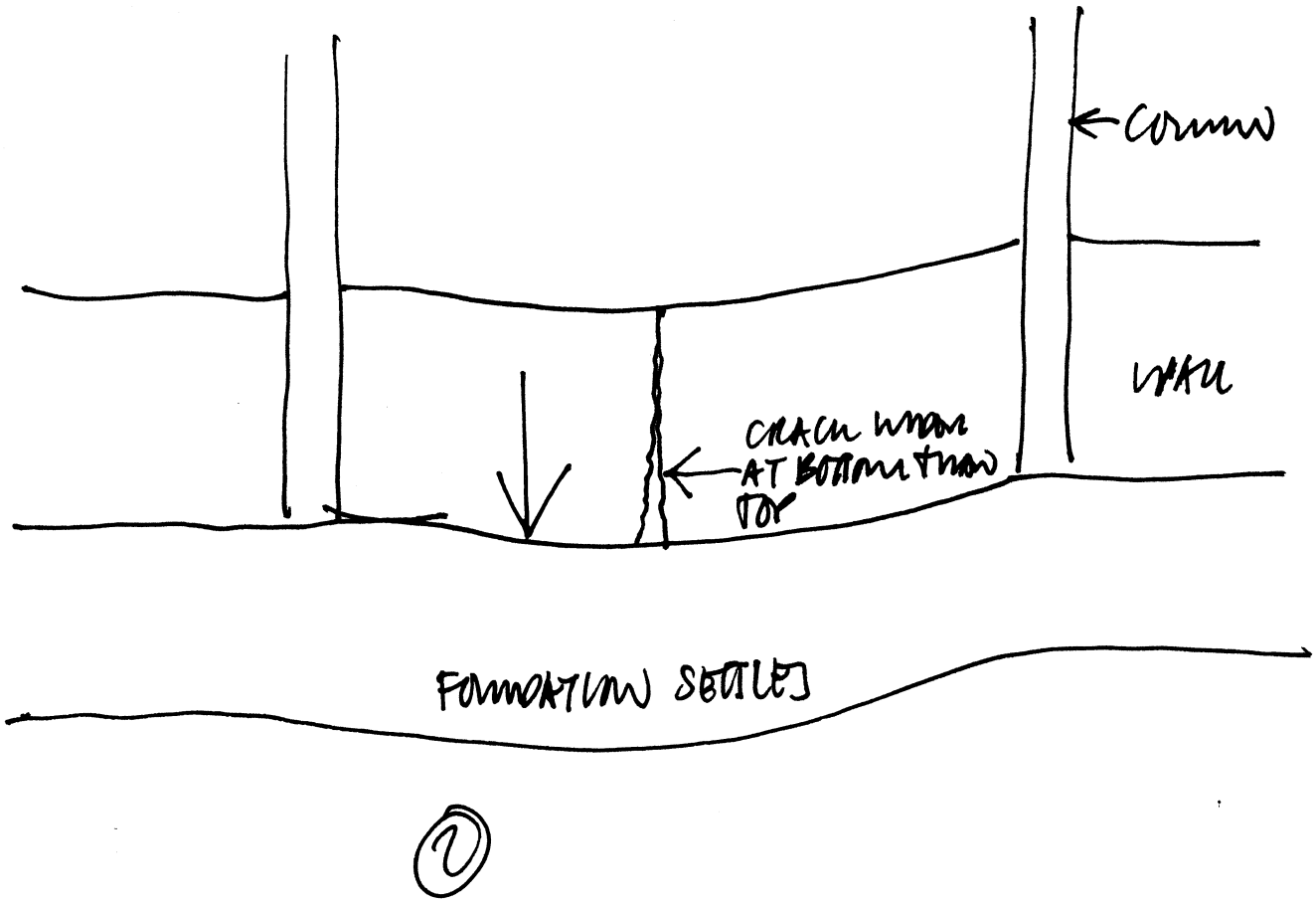
In some cases there are pockets of soft soil where in the past a latrine or a rubbish pit has been excavated for instance and this can cause localised settlement.

Settlement cracks are also often seen where part of a building is raised above existing ground level on one or more sides. It is quite common in this situation for the foundation on the high side not to be taken down to firm soil and the foundation then settles.

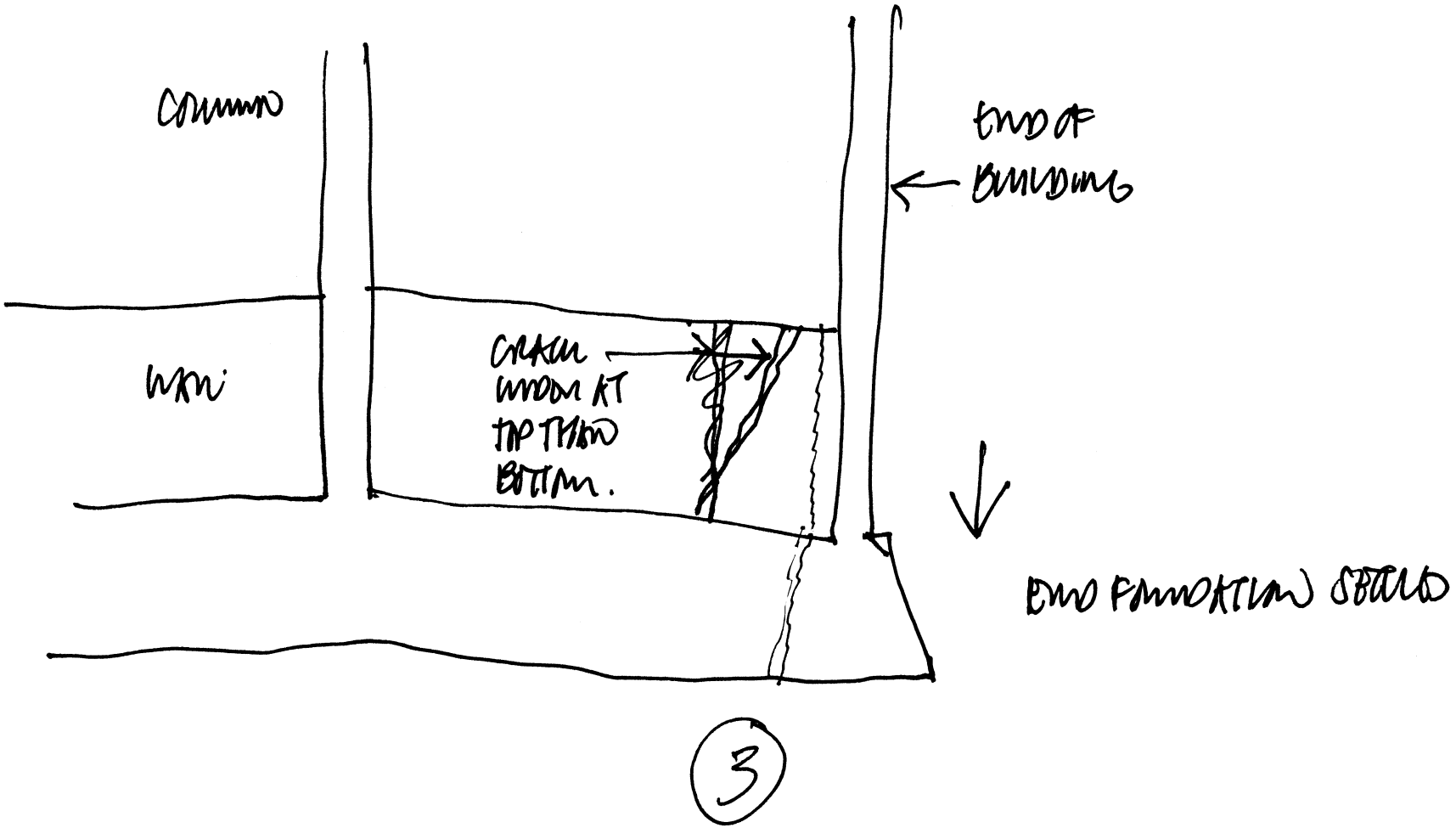
If settlement of foundations is suspected, then this can be very serious and can cause a building to collapse and an engineer should be consulted to give advice on remedial action.

This remedial action could entail a section of the wall being taken down, the foundation dug out, the bottom of the foundation being taken down to firm soil and the foundation and wall being reconstructed. See CM Section 8: Constructing the Foundation and CM Section 20: Constructing the Brickwork or Blockwork.


REMOVE PLASTER OFF ON BOTH SIDES OF WALL FOR 30cm ON EACH SIDE OF CRACK
- CRACK OPENED UP & FILLED WITH MORTAR ON BOTH SIDES.
- STEEL MESH 60cm WIDE NAILED TO WALL OVER CRACK ON BOTH SIDES
- WALL RE-PLASTERED ON BOTH SIDES WHEN REMOVED WHEN COMPLETED
60cm
1


CASING
CRACK WHERE AT BOTTOM THEN TOP
WALL
FORMATION SETTLES

(2)


COLUMN
WALL
CRACK WIDENS AT TOP THEN BOTTOM.
END OF BUILDING
END FOUNDATION SHOULD

3

Another solution could be for the soil under the foundation to be excavated in short sections down to firm soil and the excavated area filled with mass concrete. This is called under-pinning.

If an end wall has settled then the whole of the wall will have to be taken down, the foundation dug out, the bottom of the foundation lowered and the foundation and wall re-built. During this work the roof will have to be propped up.

Every situation will therefore be different and it is very important that the advice of a qualified engineer is taken on what remedial action is required.

Where there are cracks over doors and windows this is usually the result of the common practice of building the brick or block work above the doors and windows directly on top of the frames. The frame is quite often not large enough to support the load of the brick or block work above and therefore deflects causing cracking or there is differential movement between the timber of the frames and the brick or block work and this also causes cracking.

The cracks are usually not dangerous but they are unsightly. There is very little that can be done about them however after construction is completed apart from making repairs and re-rendering the walls as described above.

If the cracks are particularly bad another solution would be to take down the panel of brick or block work above the window and insert a timber or concrete lintel. If a concrete lintel is used and there are brick or block panels on either side of the window or door, then these can be used to support the lintel.

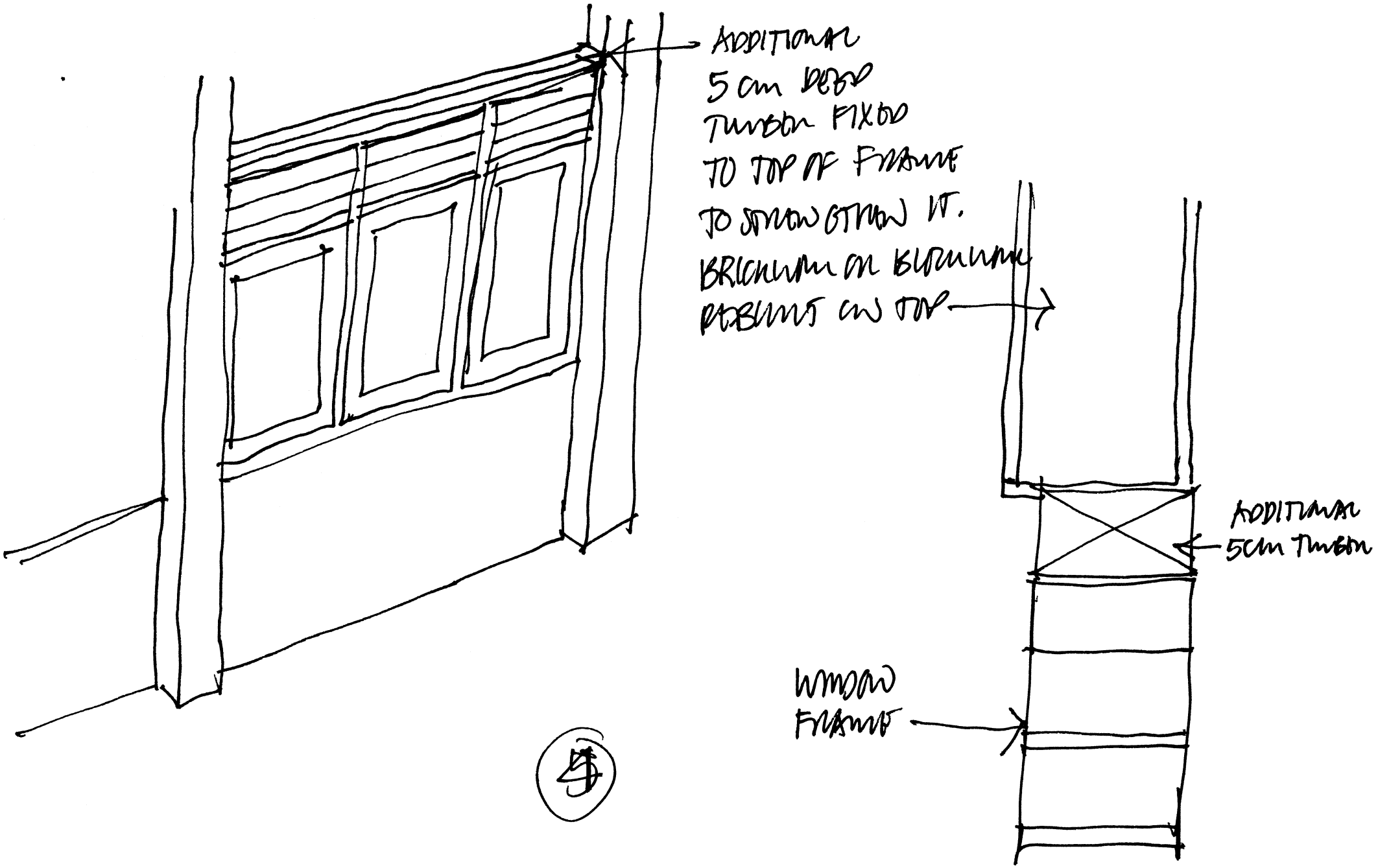
If a concrete lintel is not possible, then a lintel can be formed using timber. An extra piece of timber 50mm deep by the width of the existing frame should be fixed to the top of the existing window frame and the brick or block work panel above re-built (see sketch).

If there are no structural problems but the plaster is loose and coming off the wall (probably because it has been poorly mixed or has too little cement), hack off the whole area of plaster that is loose and re-plaster the wall to match the surrounding. Before re-plastering the wall, hack the surface to make it rough (another reason for the plaster coming off is if the surface is very smooth) and wet it thoroughly (for further details see CM Section 24: Plastering the Building).

If the plaster has a lot of hair-line cracks, these can be filled with proprietary filler (external quality should be used) or with a neat cement/water mix. Larger cracks can be filled with a mix of 1 cement to 1 fine sand to which some PVA glue has been added.

Once the cracks have been repaired and filled or areas of walls have been re-rendered, rub down the walls with sandpaper to get rid of any rough patches and prime the areas of fill or new render with watered down emulsion paint. Then re-paint the walls with two coats of emulsion to match the existing paint colour (see CM Section 25: Painting the Building).

See further notes on wall construction in CM Section 20: Constructing the Brickwork or Blockwork).


ADDITIONAL
5 cm DEEP
TIMBER FIXED
TO TOP OF FRAME
TO STRENGTHEN IT.
BRICKWORK OR BLOCKWORK
RESTING ON TOP
ADDITIONAL
5cm TIMBER
WINDOW
FRAME

10: RENOVATIONS TO COLUMNS & BEAMS

Cracks to columns and beams are potentially very serious. However, as most concrete columns and beams are usually finished with a layer of plaster, the cracks can sometimes be only in the plaster, caused by shrinkage, etc. The plaster should therefore be hacked off around the crack to see if the concrete itself is cracked.

If the concrete is cracked, this can be caused by a number of factors including:

- Settlement of the foundations
- Inadequate size or number of reinforcing bars
- Inadequate cover to the reinforcement
- Poor quality concrete caused by the use of too little cement, too much water, dirty sand, etc.

The advice of a properly qualified engineer should be sought on any serious cracking to columns and beams.

Particular attention should be paid to any settlement of columns, columns that are leaning, columns that are cracked and to cracks in roof beams and particularly in cantilevered roof beams that can be very dangerous.

It is possible to demolish individual columns or beams and provide temporary supports to walls and roofs while they are re-built. This can be complicated and difficult however and the advice of a properly qualified engineer should be sought before any such work is undertaken.

See the notes on constructing columns and beams in the CM Sections 12 to 14.

11: RENOVATIONS TO FLOORS

Floors in primary schools are usually constructed of floor tiles (concrete or ceramic) laid on screed on sand on consolidated back-fill. Sometimes the tile finish is omitted and the floor consists only of a layer of sand/cement screed on sand on fill.

There are two common problems with floors:

- The floors collapse because of inadequate consolidation of the back-fill below the screed and tiles or because roots and other vegetable matter have been left under the floor and these have rotted and has caused subsidence.
- The tiles if used become loose or broken.

If floors have collapsed (but the walls and foundations are not affected ie there is no subsidence of the foundations) they will have to be broken up and the sand and fill below dug out until firm ground is reached. Any vegetable matter, roots, etc that are found must also be removed.

The floor area should then be back-filled in layers with suitable materials, properly compacted and finished with a layer of sand. The new tiles if used should then be laid on a bed of screed.

If tiles become loose or broken, they should be removed and new tiles to match the existing should be laid using tile adhesive. If large numbers of tiles are loose or broken, it might be better to break up the whole floor and re-lay it.

If new tiles are required then plain concrete tiles are cheaper, more hard wearing, have a non-slip surface and are therefore safer and more cost-effective than the white glazed floor tiles that are commonly used.

If the floor finish is screed and is cracked, then the cracked area should be broken up and replaced using a screed mix of 1 cement to 4 sharp sand finished with a steel float. Consolidate the fill under the area of screed being replaced before the screed is laid. Cure the screed for at least a week by covering it with a plastic sheet or sand and keep damp.

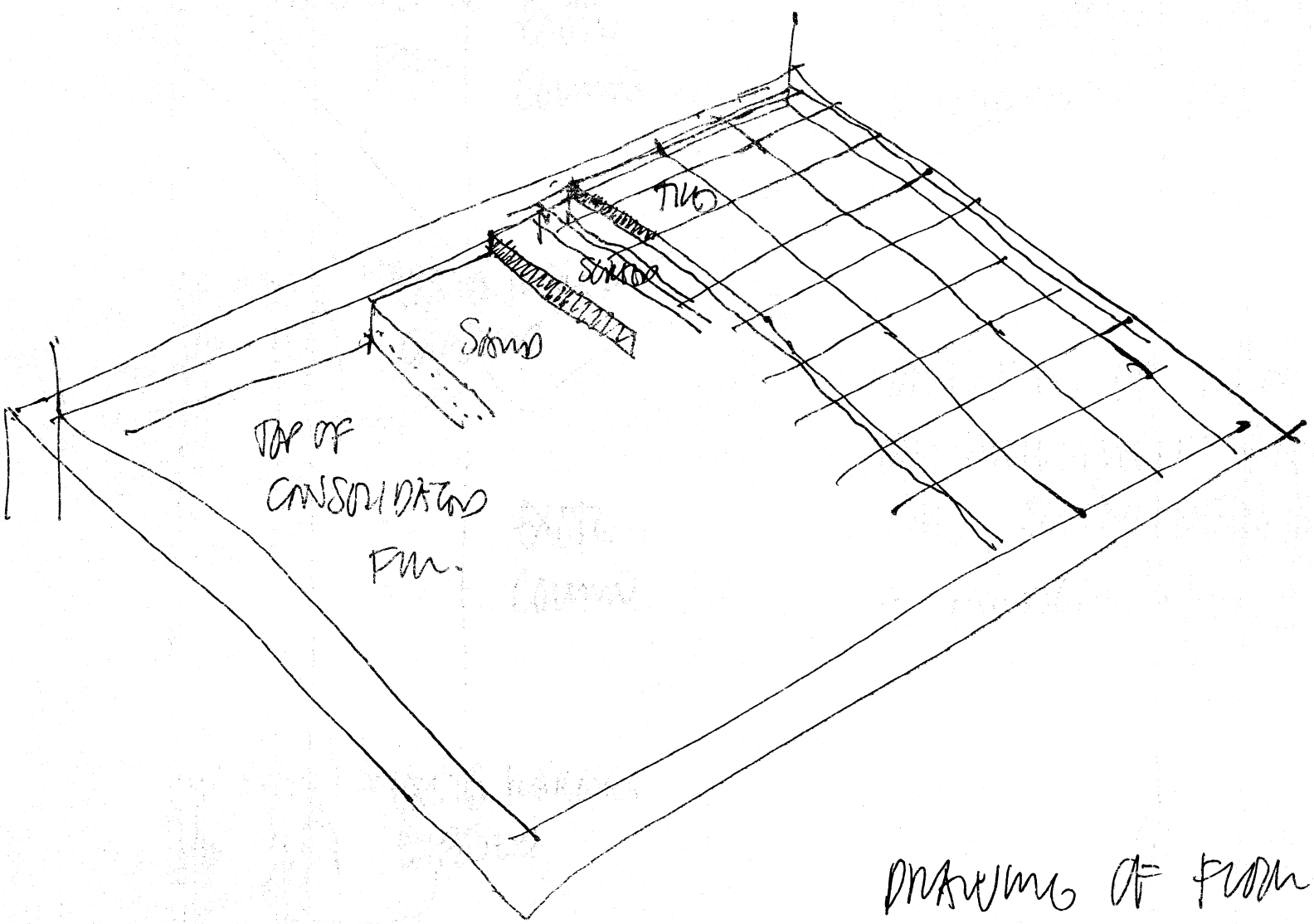
An alternative floor finish which is inexpensive and hard wearing which should be considered if floors are being replaced is a 10cm thick bed of concrete finished with a steel trowel to give a smooth finish (mix: 1 cement to 2 sand to 4 aggregate).

Lay the concrete on thick plastic sheet (to stop too much water being absorbed by the sand bed) and the sand bed should be laid lower than for floor tiles, the top being 50mm below the top of the ground beams. The concrete slab can be reinforced with steel mesh to make it stronger. In this case, the mesh should be laid on 50mm thick spacers to position it in the middle of the slab.

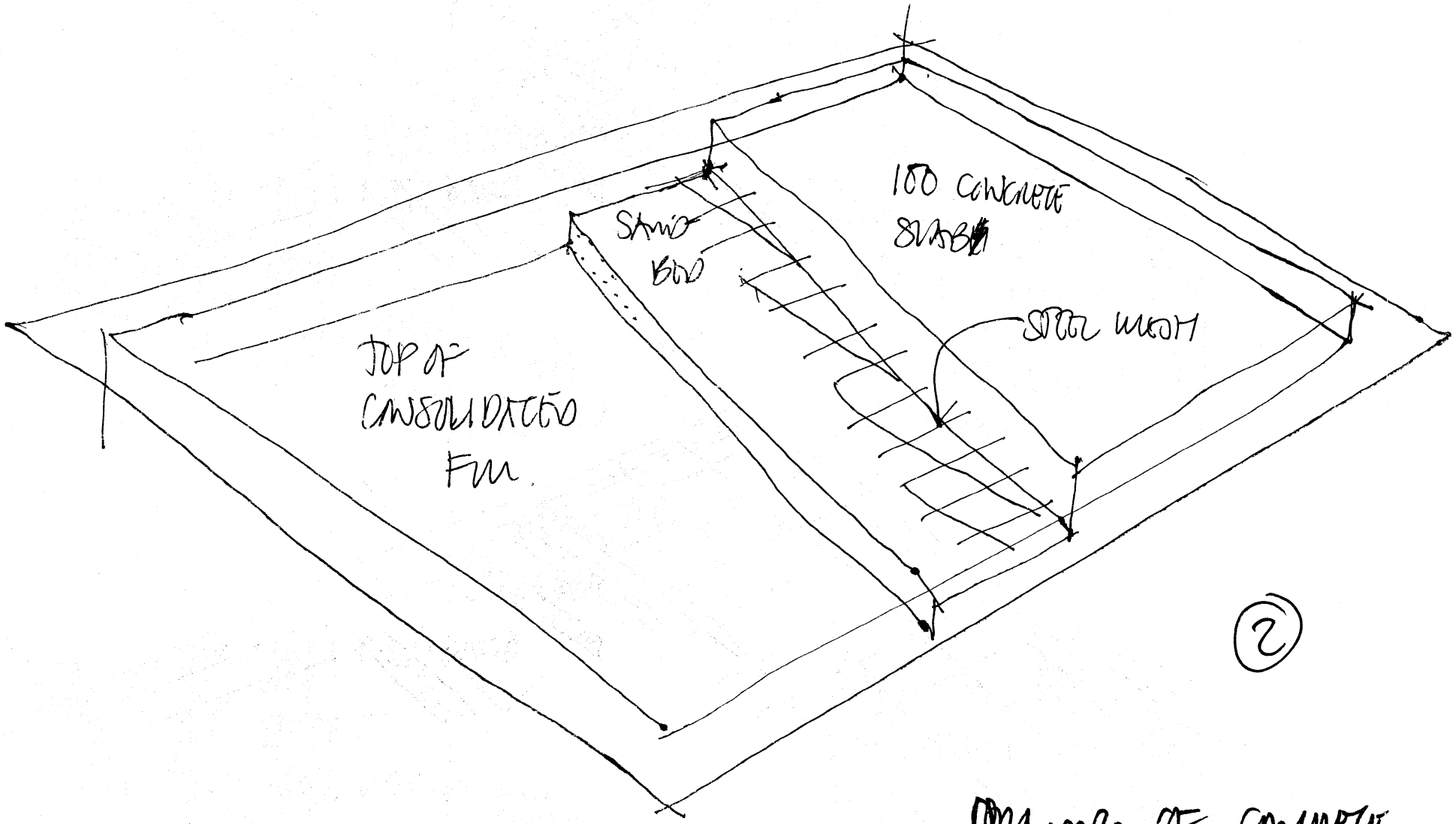
The concrete should be laid in two bays to a classroom and in similar bays along the veranda to prevent cracking. Form a 'V' joint between the panels of concrete.

If concrete is used for flooring, it needs to be properly cured in order that it reaches its full strength. Cover it with a layer of plastic, cement bags or sand and keep it damp by watering at least once a day for 2 weeks. If it dries out too quickly this will reduce its strength and increase the likelihood of cracking.

For further details of floor construction see CM Section 21: Constructing the Floor.



DRAWING OF FROM CONSTRUCTION SHOWING TMD., SCMDD BED, SAND * HANDCORE FM.



(2)

DRAWING OF CONCRETE
FILL

12: RENOVATIONS TO DOORS & WINDOWS

Door and window frames often suffer termite or other insect damage or they rot if they are exposed to the weather and they then require replacement.

This can be a problem if, as has noted above, there is no lintel over the door or window opening. In this case the brick or block work over the opening must be carefully removed and the door or window frame removed. A concrete or timber lintel can then be fixed as described in the 'Renovations to Walls' section above and the brick or block work panel re-built.

Doors are very vulnerable to damage particularly if they are flush doors or poorly made panel doors and double doors to classrooms are particularly vulnerable.

Doors can however be easily replaced. Make new panel doors of the best quality hardwood and replace double doors with one large single door with a fixed panel to one side; this will last longer than double doors.

If poor quality steel-framed louvre windows have been used, they will probably be in-operable and should be replaced with timber top-hung glazed windows. Replace any broken timber top-hung glazed windows together with any broken glass, hinges or fittings. Always use 4mm glass for re-glazing the windows.

Always use the best quality hardware (locks, handles, bolts, window stays, catches, etc) that can be afforded for doors and windows and only use wood screws for fixings, never nails. The School Committee will be responsible for maintenance of the school and these fittings, though more expensive initially, will reduce the cost of maintenance. Cheap hardware will quickly break and will then need replacement!

If the doors, windows and frames are well made of good quality timber, they can be finished with a clear polyurethane lacquer.

They should be first sanded with fine sandpaper to remove any rough grain and splinters and primed with lacquer diluted with 10% white spirit. Finish with two full coats of lacquer, the timber being sanded down with fine sandpaper between coats.

If the quality of the timber is not so good, paint the doors, windows and frames with good quality gloss paint. Sand them first with fine sandpaper to remove any rough grain and splinters and prime them with wood primer. Then paint them with two full coats of oil paint, the timber being sanded down with fine sandpaper between coats.

For further information on doors and windows see CM Section 22: Doors and windows. For further information on painting doors and windows see CM Section 25: Painting the Building.

13: RENOVATIONS TO PLUMBING INSTALLATIONS

The plumbing installation includes the water supply, soil and waste- pipes, sanitary appliances such as toilets, water tanks and basins and fittings such as taps, stop-cocks and stop valves.

At some point during the life of the school the various components of the plumbing installation will require renovation. If rigid plastic water pipes are used for instance, they will eventually become brittle and crack; galvanised steel pipes will rust and block up or leak; sanitary fittings will get cracked or broken, etc.

When this happens the component that has failed should be replaced and for details of the procedures to be followed see the notes on toilets and plumbing in the Construction Manual Section 26: Toilets and Plumbing.

14: RENOVATIONS TO ELECTRICAL INSTALLATIONS

Electrical installations can give rise to serious and even life-threatening problems if they are not inspected regularly and promptly and competently repaired if any faults are found. Faulty electrical circuits can kill!

Electrical wiring diagrams should be provided to the school when the school is built and these should be kept available in the school office for use if there are faults in the system.

Electrical wiring deteriorates with age due to the ageing of the insulating material and mechanical damage. All electrical installations must therefore be inspected and tested regularly, preferably every 5 years, by a qualified electrical engineer.

See the notes on electrical installations in the Construction Manual Section 27: Electrical Installations for further details and note that all renovations should be carried out by a qualified electrical engineer who should be consulted before any work is started.

15: RENOVATIONS TO SITE WORKS

At some point during the life of the school, parts or all of the site works will require renovation. This will include:

- Site drainage.
- Paving and site paths.
- Retaining walls.
- Septic tanks and soakaways.
- Water supplies and wells.
- Refuse disposal

Other site works that might require renovation but are not covered here include fences, gates, etc and these are left to the school committee to renovate if they feel they are still needed.

For detailed information on site works see the Construction Manual, Section D: Site Works.

SITE DRAINAGE

Drainage around the site and particularly around buildings is very important to stop flooding of the site and buildings during the rainy season and to stop erosion of the soil around the buildings.

The drains around buildings and around the site will require re-construction at some point and the notes under site drainage in CM Section D.2 should then be followed.

The drains should be built around all buildings and any paved areas such as play grounds and then collected in a main drain that will drain the water off the site to a main drain in a nearby road or to a stream or swamp.

PAVING & SITE PATHS

Paving around the buildings between the external walls and the storm drains will help to stop soil erosion and paths around the site can be very useful particularly on very wet or sloping sites. On wet or muddy sites, paths can reduce the amount of soil trodden into classrooms or verandas and help keep them clean.

Steps will also be required on many sites particularly on those that slope steeply.

Paving, paths and steps will eventually require renovation and when this happens, the notes in CM Section D.3 (Paving and Site Paths) should be followed in reconstructing them.

RETAINING WALLS

If the site is sloping it will probably have retaining walls constructed around the site to retain the ground at higher levels.

If these walls collapse either because they were badly built or because large amounts of water have got behind them, they will have to be re-built to ensure the safety of the school. See CM Section D.4 for details.

A properly qualified engineer should always be consulted before any reconstruction work is carried out and his/her advice and the notes on retaining walls in the construction section above should be followed in the reconstruction.

SOIL PIPES, SEPTIC TANKS & SOAKAWAYS

Septic tanks and soakaways will both eventually require replacement, the soakaway probably before the septic tank and soil pipes will also probably crack, block up etc and require replacement.

When any of these require replacement, follow the notes on septic tanks, soakaways and soil pipes in CM Section D.5.

WATER SUPPLIES

All primary schools whether in rural or urban situations should have a dependable drinking water supply.

Some primary schools, especially those in towns and large villages will have access either to a main town water supply or to a village supply, usually from a spring.

If the main water pipe ever requires replacement, follow the notes on water supplies in CM Section D.6.

WATER TANKS

If the school has a piped water supply but the supply is intermittent, it might be necessary to install one or more water storage tanks.

If it is ever necessary to replace the water tank, follow the notes on water tanks in CM Section D.7.

WELLS

Many primary schools, especially those in the rural areas, will depend on a well as their source of drinking water.

Traditionally, wells in Indonesia are not lined and are not covered. This means that they are open to contamination from the top and from the sides and that they sometimes collapse.

If a well constructed in this way ever requires replacement, follow the notes on the construction of wells in CM Section D.8.

REFUSE DISPOSAL

The school grounds should always be kept clean and tidy both to improve the appearance of the school and to stop any disease that might be spread by decaying rubbish, etc.

Rubbish bins should be positioned around the site and these should be replaced when necessary. The incinerator will also require replacement at intervals and the notes on making a simple incinerator in the rubbish disposal section in CM Section D.9 should be followed.