CONSTRUCTION NOTES FOR THE

MINIMUS COMPOSTING TOILET

1st October, 2005

Congratulations on deciding to construct a composting toilet, or at least to investigate the possibility.

These notes and excerpts are intended to help anyone who wants to build a Minimus composting toilet. The basic design of this toilet appears in “Goodbye to the Flush Toilet” (by Carol Hupping Stoner: Rodale, 1977) on page 158.

This publication has been put together to assist those people who are interested in constructing their own Minimus Composting Toilet (MCT)

The original version was put together by Leigh Davison of Southern Cross University in Lismore, as a result of his experience and the interest shown by others. As a result of practical experience by a number of people over a number of years I have re-drawn both Leigh’s plans and the original plans from “Goodbye to the Flush Toilet”. Although there have been no major changes to the original plans, a number of possible options have been included in the notes. Further additions to the original document were made by Stuart Downs and Bob Fuller of the International Development Technologies Centre, Faculty of Engineering, University of Melbourne.

Significant numbers of the Minimus composting toilet have been built around Australia, but particularly in northern N.S.W. A number of these are situated on the multiple occupancy where Leigh and myself reside and have been operating successfully for up to 20 years.

It is my intention to continue to update these notes as further innovations and useful information become known to me. Anyone who uses these plans to construct their own toilet is invited and encouraged to make suggestions or comments. This way the design and ease of construction of the Minimus will be continually enhanced.

THESE PLANS ARE SUPPLIED ON THE UNDERSTANDING THAT THIS COMPOSTING TOILET SYSTEM HAS NOT BEEN APPROVED BY THE HEALTH DEPARTMENT OR ANY OTHER AUTHORITY IN N.S.W.

In N.S.W owner builders may be given conditional approval by local councils to build a composting toilet. The onus is then on the individual builder to prove that his/her unit is operating according to Health Dept. guidelines. It is recommended that you ask your local council for a copy of the state Health Department guidelines for waterless compost toilets, and any local regulations that may apply and familiarise yourself with them before submitting an application to build your toilet.

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LOCATION

Due to its odour free operation the Minimus can be located under the house (2m clearance needed). For an outhouse, the best location is on a well drained slope with the back of the chamber dug into the hill.

COST

The total materials cost of the chamber is roughly between $600 and $800 depending on how good you are at scrounging and recycling materials and which of the various options you choose (e.g. 100 or 150mm vent pipe). Cost of materials will also vary if you have to pay transport costs (e.g. delivery of blocks rather than collecting them in your trailer). Naturally there will be an extra cost involved in providing four walls and a roof.

CONSTRUCTION SEQUENCE

After selecting the toilet location, the procedure is roughly as follows:

- pour footings
- lay blocks according to arrangements in Figures 2-10, except for baffle wall
- after block layer # 5, backfill, shape and pour internal concrete floor(Fig.12)
- finish external block work including specially cut blocks and holed blocks
- fill in sloping edge of block work to smooth finish with mortar(Figs.15 & 19)
- make and install front access hatch/door (Fig.18)
- cast the slab, for the chamber top, in-situ (or separately, let cure well and install)
- render inside of composting chamber with water-proofing admix e.g. ”Silasec” (Fig.20)
- lay blocks for baffle wall
- install bypass air ducts(Fig.17)
- if required, paint and plastic external blockwork that will be buried by backfill
- backfill any areas
- construct dunny hut - design it yourself but ensure beautiful view from the throne!!
- prime composting chamber

ACTIVITIES TO BE UNDERTAKEN CONCURRENTLY WITH CONSTRUCTION WORK OR PRIOR TO STARTING:

- cut trench mesh and concrete slab reinforcing mesh
- cut holes in blocks to take ½ pipes (Figs 13 &14)
- cut air ducts from PVC pipe
- make front hatch/door (Fig 18)
- make cover for sloping face of unit

MATERIALS LIST

If you follow the course layout shown you will need the following (100 x 200 x 400mm) concrete blocks:-

	Full	Corner	¾	½	¼
Standard Chamber	**89**	**20**	**10**	**11**	
Stepped Footing	**78**	**14**	**10**	**13**	
Stepped top	**84**	**29**	**12**	**9**	**2**
Fibro Baffles	**78**	**28**	**10**	**11**	
Stepped Footing + Fibro	**68**	**22**	**12**	**15**	
Wide Chamber	**101**	**20**	**10**	**15**	

200 x 200 x 400mm blocks required :- first 3 options above = full x 6, ½ x 2,
wide chamber = full x 9, ½ x 2.

Brickies sand	¼ m3 (about 4 bags)
Blue metal (gravel) 10mm	½ m3 (order extra for drains)
Sand (sharp for cementing)	½ m3
Cement	6 bags
Trench mesh (3 bar F8)	16 metres (extra for step footing)
Slab reinforcing mesh (F72)	1m x 2.5m + 1m x 1m
Stormwater pipe (100mmPVC) (or 150mm)	1 x 6m (need 4.5m)
Stormwater pipe (90mm X heavy duty)	3.8m
Galvanised threaded rod (10mm)	1 x 3m length + nuts & washers x 20
Gal. hinges (75 or 100mm option)	2
Gal. steel angle (100 x 100mm)	980mm
Gal. steel angle (5 x 5cm)	980mm
Agricultural pipe (75mm)	Approx. 2.5m (if under slab) Extra may be needed for absorption trench
Building Plastic (optional)	Abt. 4sq.m for footings + extra to lap any sides to be backfilled
Duct tape (optional)	1 roll to join plastic
Silicone sealant	2 tubes
Concrete sealer	1 litre
Corrugated Iron	2 sheets x 1.9m +.8x.7m hatch cover
Formply (humus chamber door) or 9mm compressed fibro	600 x 800mm
Hardwood - 75 x 38mm) Or 30 x 30 gal. angle	2.1m (door frame)
Brick ties	10

The approximate concrete volumes are as follows :-

Footings and humus chamber floor	0.63 m3
Sloping floor	0.13 m3
Top slab	0.1 m3
Total	0.85 m3

It is usual to add 10% to the calculated volume if ordering Readymixed concrete.

Gravel fill under sloping floor 0.54 m3

CONSTRUCTION HINTS FOR THE MINIMUS

FOOTINGS

Footing dimensions shown are - 300mm wide x 300 deep (the official requirements vary for different soils), plan dimensions 2600 x 1200mm external, 2000 x 600mm internal.

In very wet situations , it is recommended to line the footing with heavy duty plastic and run a length of ag. drain under the floor of the humus chamber to ensure proper drainage of the soil below the sloping floor of the compost chamber.

On a flat site or when digging into a hillside with a backhoe the footings will be flat. If digging into a hillside by hand it will be easier to dig a stepped footing as illustrated in Fig. 2 and Fig. 18. I found, however, that the stepped footing was more time consuming and the footing itself required more concrete though you will need less concrete blocks and, of course, less fill material.

Option 1 When excavating for footings and sub-soil drainage you can excavate the whole area, not just the strips for footings. Backfill sub-soil drains with coarse, clean gravel. One length of 75mm ag.pipe can be installed under the centre of the toilet rather than sub-soil drains around the perimeter.

The top edge of the footing formwork was set to the finished footing level all around to ensure concrete is finished level. Two layers of three bar trench mesh is used in the footings, blocked up off the trench with pieces of broken concrete or rocks approx. 20mm thick. The concrete is finished to top of formwork and covered overnight. After stripping the formwork, fill in the central area to top of footing level, holding plastic to the sides of the footing while filling. I usually pour the flat section of floor, for humus chamber at the same time as the footing (Fig.11). A number of 10mm steel reinforcing starter bars, with about 200mm projecting from the slab, can be set into the footings to allow the blocks to be tied in to the concrete. Threaded starter bars can be used but are more expensive, however they can be fixed to the set slab using "Locksins". I usually place one near each corner to coincide with the holes in the blocks. Steer clear of the short end of the corner blocks as they are solid. Extra lengths can be added as you gain height. As the holes are fairly small I fill the blocks, as I finish each course or 2, with concrete. Use a small aggregate or use a mixture of "crusher dust "and cement about 6 parts to 1. I only use the steel bars if there is to be considerable backfill at the back of the chamber.

BLOCK ARRANGEMENT

Details of the most simple block arrangement that works are shown in figures 2 to 6 (narrow chamber), figures 2 and 7 (wide chamber),.Fig.8 (stepped top) and Fig.9 (baffles)

Lay all the blocks which don't need cutting, then either a) dry lay the blocks to be cut on 10mm spacers (mortar thickness) and draw a line on the blocks with a straight edge, or b) fill the remaining spaces with concrete when finishing the sloping top.

The current block arrangement requires all corner (1¼) blocks at the front of the chamber, up to course #4. This necessitates the cutting of these blocks on the 2nd and 4th courses (except for wide chamber). This is simple with a diamond tipped blade, but if you don't have the necessary equipment I suggest you stick with the old layout which has a chamber 100mm longer (see Figure 10).

For a stepped top version the front of the top step (course 9 & 10) can be filled in with compressed fibre cement or you can brick all the way around, in which case you will need to use gal. angle for support.

CUTTING CONCRETE BLOCKS

The best way to do this is with a diamond tipped disc on an angle grinder (see Figure 14). Cut along the line to depth of blade. You can use a masonry cutting disc but they wear out quickly. Cut the blocks, as deep.as your blade will allow, all around. Place the block on a bed of sand and using a bolster (wide ended masonry chisel) progressively strike along the line until fracturing occurs. Do not worry if some chipping occurs, as the sloping edge is rendered with mortar. This will cover many accidents. However, cutting the bricks is not an easy task, but you will get better at it the more you do, so persevere and order a few extra blocks to allow for breakage. If you are able to cut right through the blocks with a diamond tipped disc or masonry blade on a large circular saw or large grinder the off-cuts can be used to fill in the small triangular spaces otherwise filled with concrete.

AIR DUCTS

I recommend either 100mm PVC pipe or extra heavy duty 90mm PVC pipe for the bypass air ducts. Original units used 90mm stormwater pipe, however these have on occasions proved to have insufficient strength, when halved. It is necessary to make several holes in eight concrete blocks in the baffle and rear walls of the composting chamber to accommodate the air duct pipes. One way to do this is to drill a series of holes around the circumference of the required hole with a masonry bit in a heavy duty percussion drill (see Figure 13). Once sufficient holes have been drilled, then the centre of the hole could be removed by breaking through the concrete between the drilled holes. A pointed chisel and heavy hammer is useful for this. I use a combination of drilling and cutting with my 100mm angle grinder. I recommend making the holes a generous size to avoid having to enlarge them when they are in place. Remember that the vent pipes are inclined at an angle, and therefore the vent pipe holes in the face of each block are slightly offset. It is important that you don’t try to put the holes through the web of a block. This will not happen if you adhere to the block arrangement shown in the plans.

It is necessary to cut two x 1.9m lengths of the PVC pipe lengthwise to create half pipe channels. These are inserted in the holes in the blocks and span the length of the chamber. This can be done with a masonry or metal cutting disc on an angle grinder but a jigsaw does the job with minimal dust. Follow a marked line on both sides of the pipe and cut one side at a time. A handsaw or circular saw will also do the job.

VENT PIPE

You can use 100mm PVC storm-water pipe for the vent but I recommend 150mm pipe for more efficient venting. Painting the pipe with black paint will also increase efficiency. 4m is the recommended length but a longer pipe will draw better. The pipe is capped with either a “T” junction, or a 90° bend. Silicone a piece of fly wire to the hole/s. A purpose built “whirly bird” sewer vent is made by Edmonds (Tel. 1800674532) to fit into the flared end of the 150mm pipe or to a 100mm pipe with a reducer. They are not cheap, but an excellent addition unless in wind protected situations.

BLOCK LAYING

When setting out the wall lines on the footing, allow approx. 100mm between the blocks and footing edges to ensure blockwork will be centred on the footings. An easy and accurate method to mark out the corners of the chamber is to place one of the corner blocks on each corner at the correct distance apart then use a long straight edge to adjust the blocks so the sides are all square to each other. Details of a block arrangement that works are shown in Figures 2 to 6 (for narrow chamber) and Figures 2 and 7 (wide chamber. Note - side wall arrangement will be same as for narrow chamber). These narrow blocks can be quite tricky to lay at first. The blocks should be level and vertical within themselves and the wall straight and vertical overall. A string line along the outside wall for each new layer, can be very helpful. Remember at block course #2 to insert the 100mm x 100mm steel angle to support the baffle wall (see Figure 2, and 4) and again at course #7 include the 50mmx50mm steel angle to support the wider, 200mm blocks. I use galvanised angle for longevity. Cut out the back of the 100mm angle where it will sit over the walls and chip out the blocks above the angle so they sit down. I temporarily replace the mortar on the inside of the chamber, where the angle iron sits, with 10mm wooden spacers so that I can slide the angle iron into position after all the external blockwork is completed. From course 3 remember to embed brick ties in each course where the baffle wall joins. When placing the blocks with holes, ensure all holes line up and are oriented correctly for the slope of the air ducts. An alternative to the angle iron supporting the baffle wall would be a reinforced concrete beam replacing the first block course of the baffle. 10mm threaded rod can be set in the mortar between the 1st and 2nd and 3rd and 4th courses at the humus chamber door to take the timber frame. Alternatively the timber can be fixed later with Dyna bolts. A further option is to make up the door frame first and tie it in to the blocks with brick wire as you build up the blocks. You could also set bolts in the mortar, facing outwards so the door could attach directly to the outside wall. I like to avoid any timberwork inside the chamber, so my current preference is to use 30 x 30 x 2.5mm galvanised angle attached with hammer drive studs.

A mortar consisting of 1 part portland cement and 3½ parts brick layer's sand is my preference. A dash of household detergent added to the water acts as a plasticiser, making the mortar easier to work and extending it's working time. The blocks are made to a length that allows for a 10mm.thick mortar.

POURING THE INTERIOR FLOOR

The interior floor needs to be poured after block layer #4 otherwise access for placing and finishing concrete would be severely limited. You will need to have the back and at least one block at the top end of each side of the 5th course (the top of the sloping floor finishes on the 5th course – Fig.12). One approach involves the following steps:

- mark line of finished concrete floor level on inside faces of side walls, from bottom floor level underneath baffle wall to top of block layer #5 at back of unit.
- fill with good, dry material to approx. 75mm below level marked on side wall, ensure adequate compaction of fill material, fill in approx. 200mm layers and compact. I use rocks for fill, if available. Depending on fill quality you may want to provide a layer of gravel on the sloping face between the concrete and fill material. If so, leave sloping fill material lower by this amount (approx. 30mm) and place gravel layer prior to concreting. Compact gravel layer adequately. Care is needed not to disturb any of the block work while compacting fill material. Allow approx. 20mm between mesh and block walls on each side. Mesh should

be raised off sloping fill material prior to concreting as for trench mesh in footings.

- pour sloping floor and trowel to a smooth finish. Use a dryish mix to avoid slumping (Fig.12).
- Alternatively the floor could be 15mm compressed fibre cement. Support at the sides can be provided by fixing gal. angle iron to the blocks.
- A third option is to use 4.5mm standard fibre cement as a temporary support for the slab. You will need to fix some strips of gal. angle iron into the blockwork to help support the fibro. These will ultimately support the sides of the suspended slab. The fibro will need some extra temporary support so it doesn't collapse under the weight of the setting concrete. I use 2 lengths of 50 x 25mm timber with a prop under the middle of each one.
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UPPER SLAB

The lid of the chamber is usually poured in situ. Holes are formed by a plastic bucket approx. 300mm diameter or by a 100mm wide strip of flat iron bent into a circle. In the wide chambered unit two holes are included, located centrally over the gaps between the three layers of air ducts. By having two holes on this unit both a standard seat, thunderbox or throne, as well as a squatting hole (for those who prefer this more effective posture for evacuation) can be provided. When pouring the upper slab don't forget to insert a short length of 100 or 150mm PVC pipe in the back corner as a starter for the vent pipe. Pull this out before the concrete sets so the vent can slip straight in. The slab should be 10cm thick and reinforced with steel mesh. If casting the slab separately inserts can be placed around the edges of the slab to allow connections to the block wall - use PVC pipe of approx. 20mm. If casting the slab in situ temporary formwork is needed to support the weight until the concrete sets. You can use plywood, or old corrugated iron, supported with wooden props. The iron can be cut for a neat, inside, fit and propped in place or cut to overlap the top of the walls and simply left in situ. Don't forget to cut holes in the iron or ply for the drop hole and vent. Wooden boards can be used to form up the sides of the slab. I suggest 125 x 38mm boards with 25mm overlapping the blocks but 50mm thick would be more rigid. They are nailed together at the ends and propped to the correct height on each corner. Galvanised bolts (about 10mm) can be set into the edges of the slab to allow fixing of the hut frame. Alternatively the cured concrete can be drilled to take masonry fasteners such as "Dynabolts". If you intend making the room larger than a metre square the slab could be cantilevered the extra width, however, the overhang will probably need extra support, such as 100 x 100mm posts, if wider than about 300mm.

FINISHING THE SLOPING EDGES

After the fourth course the front block on each side is beveled as shown in figure 2. Where this bevel takes out more than half the block length on the side (e.g. on course 7) it is easiest to fill in with cement after all the blocks have been laid. A layer of concrete up to 2cm deep by 9cm wide (the full block width) is put down on the sloping edge of the side walls to provide a flat face for the lid of the chamber. A smooth face is required to ensure a good seal of the cover with the block walls so I use crusher dust and cement at 6:1 (see Fig.16). A couple of wide floorboards or 100 x 25 boards, clamped to the top of the wall makes a suitable form to pour the concrete into (Fig.19). Avoid doing this job before the mortar between the blocks has had a chance to set fully. Three or four 8 or 10mm anchor bolts should be set into the concrete as it starts to set. I usually bend the end of the bolts so that they don't turn when the nut is tightened. I clamp the bolt in a vise, slip a 400mm length of iron pipe over the bolt and bend it with minimal effort. If you finish the sloping edges before the last course of baffle blocks are laid, then a single form board can be used on the inside of the chamber wall.

<u>WATERPROOFING</u>

Before back filling any excavated area around the unit, paint blocks and joints that will be buried with bituminous paint and bring plastic from under footing up the outside face sticking it against the black paint. Join to plastic from under footing with good overlap, if necessary, to bring plastic to finished ground level. In very wet areas lay sub-soil drains around unit at top of footing level to drain water from behind unit. Lay ag. pipe (unless following *Option 1* from "Footings") and backfill with well draining gravel material and good soil. To waterproof the chamber and to cover any cracks and joins plaster internal surfaces with a cement render containing 6 parts fine sand*, 1 part lime and 1 part cement plus "Silasec" or similar waterproofing as per manufacturer's recommendations. Make the mix quite wet so it is easy to apply thinly You don't need to do the baffle. One of the main enemies of aerobic conditions is moisture, therefore, ingress of water is a potential problem to the unit operation that should be avoided (see Fig20).

**Brickie's or river sand can be used if sieved.*

<u>HUMUS CHAMBER DOOR</u>

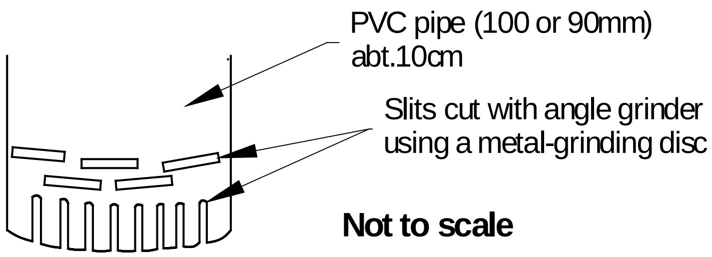
Make the door from either formply (used for concreting) or 9 or 12mm compressed fibro. Cover vent hole with fly wire and overlay with rat wire (see Fig.18). Fix frame to blockwork. The hatch can be either a lift off or hinged door. To seal the door I use 20mm strips of foam (as used in concrete expansion joints). I 'glue' it to the plywood using silicone sealant. Or run a bead of silicone around the edges of the door before bolting it to the frame. I smear a thin coat of grease to the doorframe so the silicone only adheres to the door. If using the gal. angle frame (see Block Laying) I attach the door using 8mm cup head bolts. Drill 2 x 8mm holes in both of the side angle irons, use a small 3 cornered file to shape holes into a square to accept the bolts. Next glue the bolt head into the hole using a strong glue such as Araldite

<u>LIQUID DRAIN</u>

The installation of an excess liquids drain from the humus chamber near the hatch/door is necessary. This excess liquid (leachate) can be directed to either a grey water system or an absorption trench*. The drain shown in Fig.1 exits horizontally at floor level. Some form of screen will be needed to prevent the humus from blocking this pipe. A slight fall towards the drain hole can be built into the humus chamber floor when floating the concrete. The drain could also exit vertically but would have to be set in place before pouring the floor. If you don't want to dig it under the footing it could be installed through (and at the same time as) the footing. A 50mm (or larger) bathroom waste drain suits this application. A simple filter (example below) will help prevent blockage of the drain.
(* A trench 2m x 300 wide x 400mm deep should suffice. Line the bottom of the trench with 100mm of course gravel, lay 75mm diameter agricultural drain or 90mm slotted PVC pipe in the trench. Seal off the ends of the ag. drain and cut a hole in it to

accept the PVC drain pipe. Fill the drain with gravel, to within 100mm of the ground level, cover with ‘geofabric’ and top up the trench with soil.)

WASTE WATER FILTER DETAIL



PRIMING THE UNIT

It is easiest to “prime” the composting chamber before the corrugated iron “lid” is fixed into place. A bale of straw is laid evenly on the sloping floor of the chamber. A bucket or so of compost is then added onto the top of the straw.

FITTING THE SLOPING CHAMBER COVER

The lid can be screwed or nailed onto timber battens which are themselves secured to the block work by the anchor bolts (see Fig.16). I usually bolt the iron directly onto the cement. You may need to have some support for the iron at the top end of the chamber, such as a couple of right angle brackets fixed into the squat slab. I find if I cut the iron to be a snug fit and bend the valleys up with pliers it will be supported against the slab. Gaps and chinks around the lid can be filled in with mortar. A hole has to be cut in the iron for an inspection opening. I favour putting it to one side, but it can be centred. A hole about 600mm long and 300 to 400mm wide should allow sufficient access to rake the compost heap. A sheet of corrugated iron about 1m long is used as a cover. This can be attached to the fixed iron with stainless steel self-tapping screws. I fix a length of flashing about 250mm wide to the slab or upstairs cladding. This covers the top of the inspection cover and can be fixed down using the two upper fixing bolts for the iron roof.

OTHER STEPS

- ensure all joints are well sealed e.g. around access hatch, between hatch and cover, cover to block wall, cover to concrete slab - to ensure unit is insect-proof
- make dunny hut - design to suit yourself but ensure you have a beautiful view from the throne!

OTHER OPTIONS

- The hole in the squat slab can vary according to whether a squat plate or pedestal is planned. If a pedestal is favoured I suggest a larger chute, preferably sloping away from the seat. This will help avoid unnecessary soiling of the sides. The plans show a 30cm hole which would be too large for a comfortable squat hole. In fact a more elongated hole would be more suitable for squatting.
- The vent pipe can be centred on the squat plate rather than offset as in the plans.

- If the chamber is to be installed under an existing, dry, floor there is no necessity for a sloping lid to the chamber. In this case the top can be stepped so no cutting is required (see Fig.8 & 9). It is also wise in this case to have a metal (preferably stainless steel) or plastic chute to connect the chamber and floor. A direct connection between the blocks and a timber floor is an invitation to termites. The top could be sealed with moisture proof compressed cement sheeting with holes cut out for the chute and the vent pipe. Likewise the inspection cover and top of the humus chamber could also be compressed cement sheeting. The top cover can be bolted down or hinged for easy removal but the top of the humus chamber can be fixed more permanently. A bead of silicone sealant around the edge of each cover, before fixing, will ensure a fly proof seal. Depending on the thickness of 'fibro' used you may need to attach some strips of wood, on the outside, (say 20 x 75mm) for stiffening. You will need to install an extra length of steel angle to support the extra blocks above the doorway or, alternatively, make the door longer so that it still goes to the top of the humus chamber. You can close in the front of the top step with blocks, in which case you will need to insert another length of angle iron for support. The alternative is to simply attach a piece of compressed fibre cement sheeting. You will need to cut 1 or 2 holes (about 50 x 50mm) in the top course of the baffle wall (or in the inspection cover) to allow air to flow up over the top of the compost heap. N.B. Standard fibre cement should not be used as it will become brittle.
- You may also get away with shallower footings if the blocks are not supporting the 'throne room'.

MANAGEMENT OF YOUR MINIMUS COMPOSTING TOILET

ROUTINE MAINTENANCE

The chamber can receive excrement, household wastes and additional high carbon content organic matter. After a minimum of 9 months the first compost can be removed, via the door of the humus chamber and the compost used in the orchard or flower garden in accordance with health regulations. As an added factor of safety we recommend not using the compost directly in the vegetable garden. Should the composting pile become too close to the top of the chamber it will be necessary to knock the top off the pile with a suitable stick. This can be done by removing the inspection cover on the chamber lid or possibly through the drop chute.

The frequency of removal of composted matter will vary according to the volume of raw material entering the chamber, but is usually between 3 and 6 months. It is important to not let the humus build up too high as this can interfere with it's further downhill movement. If the humus is not feeding into the lower chamber it may be necessary to slide a small shovel or other suitable implement under the baffle wall to free up the pile.

THEORY AND PRACTICE OF OPERATION

Aeration:

Aerobic bacteria live only in the presence of oxygen. To ensure good aeration from the start, place at least 300mm of loose, dry straw or grass over the bottom of the chamber. Aeration is supplied by air flowing through the vents, over the pile and up the flue.

Adding worms:

Composting worms, such as Red Wrigglers or Tiger Worms, can be added to the chamber, however, this can make the compost very heavy and dense and therefore tend to restrict the down hill movement.

Moisture content:

The ideal aerobic compost pile is moist but not wet, fluffy and loose, not dense and matted. Since faeces are 65-80% moisture, light dry material such as dry leaves, wood shavings, sawdust, chopped dry grass, straw, wood chips or shredded or screwed-up newspaper must be added after each use to keep the pile from becoming too wet. If you live in a bush setting it may be possible to urinate outside the privy to avoid the pile becoming too wet. If you do urinate in the toilet, or when adding moist kitchen scraps, it is important to add some of the above mentioned dry bulking material. Use of fine sawdust tends to clog the system and prevents the composted material from feeding through to the humus chamber.

Nitrogen ratio

Organic material contains varying amounts of carbon and nitrogen. Faeces contain about 6% nitrogen, urine 15-18%. The optimum environment for the microorganisms decomposing the pile is 30 parts of Carbon to each part of Nitrogen. Too much nitrogen or other absorbent organic material slows or changes the process. Throw in a 500gm. coffee can of wood shavings, or equivalent amount of other bulking material, after each use of the privy.

CALCULATIONS

Faeces should constitute no more than 20-25% of the composting material. Human waste per person per day averages 225 gm faeces (moist weight) plus 3 litres urine. A yearly average equals about 145 kg faeces, 0.2 m3 urine. At 22 kg/litre and 1,100 litres/cubic metre, this equals 0.08 m3. faeces, 0.2 m3. urine. Decomposition reduces this raw wet volume to one twentieth its original volume**.** (We use 30,000 - 40,000 litres of water per person per year to flush

Excreta cannot be accessible to insects or animals or children.

The concrete design is impervious to penetration by pests. Insect screening at the vents prevents flies from entering. If the privy is freestanding from the house, it should be provided with a screen door. The main insect problem is flies, which can pass through a 3mm crack. Flies are attracted by smell and seek light. Sprinkling sawdust on fresh material, and of course, keeping the lid or cover down when the privy is not in use will prevent any fly nuisance. If you are adding kitchen scraps make sure you take all precautions to exclude insects from scraps prior to their addition to the toilet. Should fly infestation occur hydrated lime or wood ash can be sprinkled on the surface of the pile regularly, concentrating on areas where the larvae are most active, until the flies are eliminated. Alternatively, spray the flies and larvae with pyrethrum. Cockroaches can also be treated with pyrethrum but their entry to the chamber should not be possible if the chamber is properly sealed. Normal compost pile insects such as “slaters” are quite O.K. and shouldn’t pose a health problem

There should be no noticeable odour or unsightly conditions.

There will be no odour if the design and operating instructions are followed carefully. Make sure the cover fits tight and the vent is unobstructed. If odour becomes noticeable it is due to one or more of the following reasons:-

- Wrong proportions of materials, unable to maintain hot temperatures
- Too wet (add more dry sawdust or straw , check liquid drain hole for any blockage)
- Too high nitrogen (add more sawdust or straw, high C/N material - too much nitrogen smells like ammonia.)

Construction must be durable.

The concrete provides a tight, sealed chamber, impervious to weather, bacterial action and other conditions.

Finished material must be free from pathogens and safe to build the soil.

Laboratory and field experiments confirm that pathogens cannot survive the normally high temperatures of aerobic composting, nor do they survive very long in material that is allowed to age. Proper composting and lengthy exposure to the elements are the cornerstones to purification. Beyond this, only sterilizing all finished material with heat to kill all microorganisms, good and bad, can guarantee complete safety.

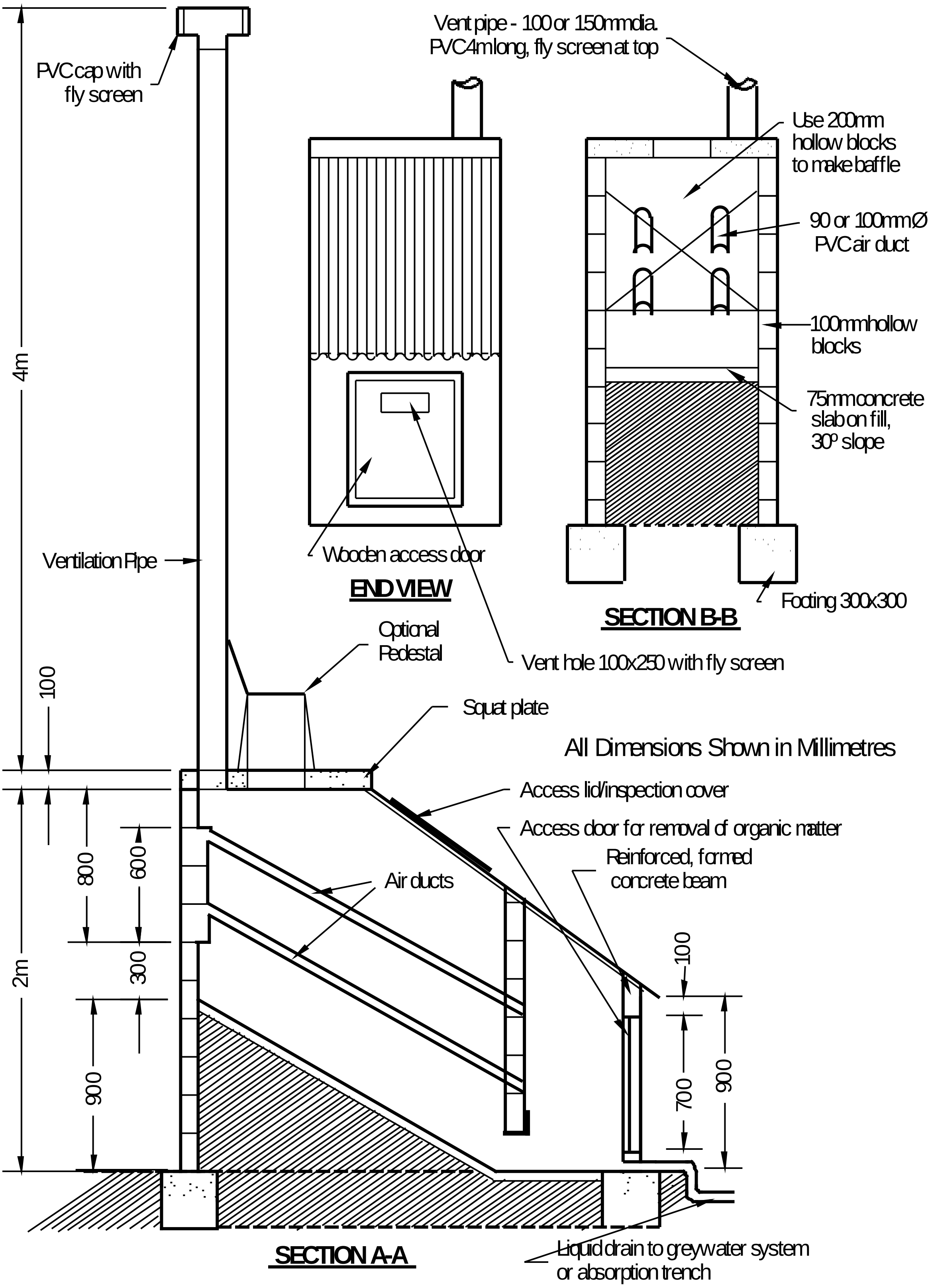
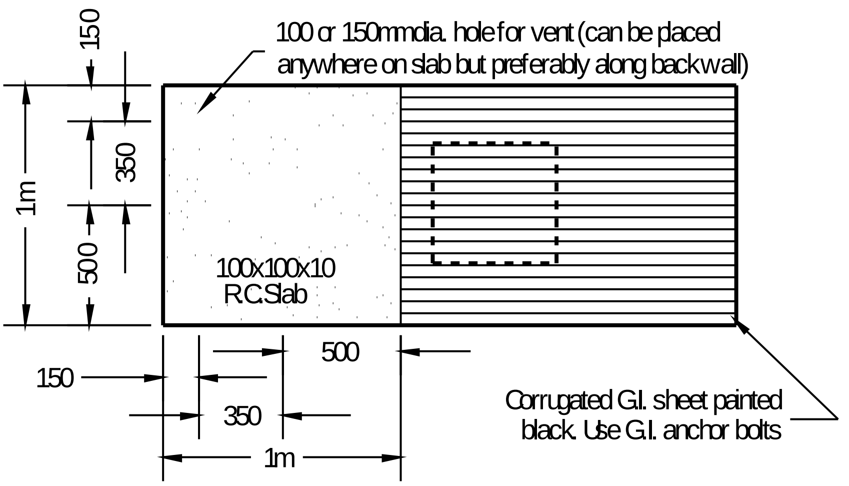


FIG. 1 Clivus Plans Adapted From Rybczynski's Variation on the Clivus Multrum
(Page 158 of "Goodbye to the Flush Toilet")

FIG. 1a

PLAN VIEW "A"



PLAN VIEW "B"

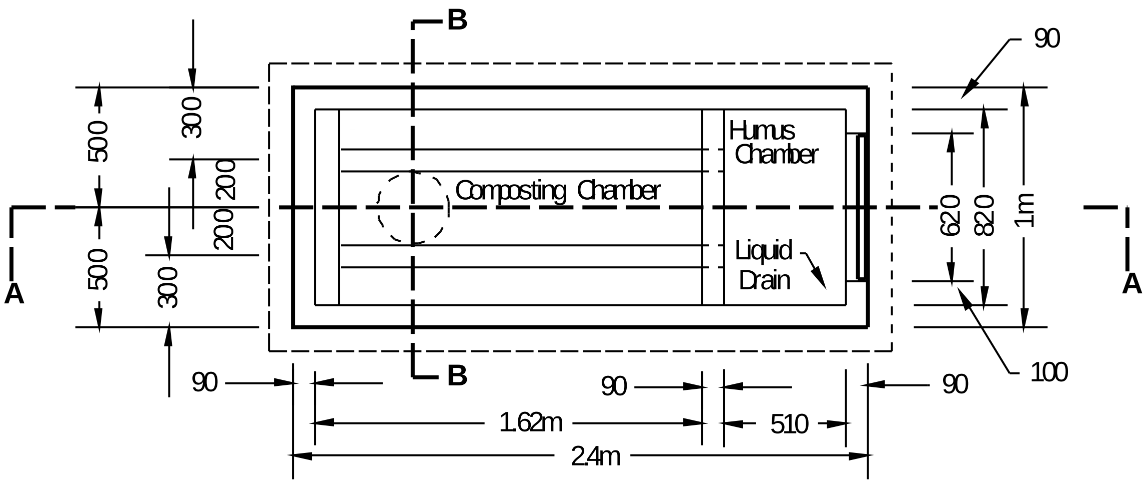


FIG. 2 STANDARD BLOCK ARRANGEMENT

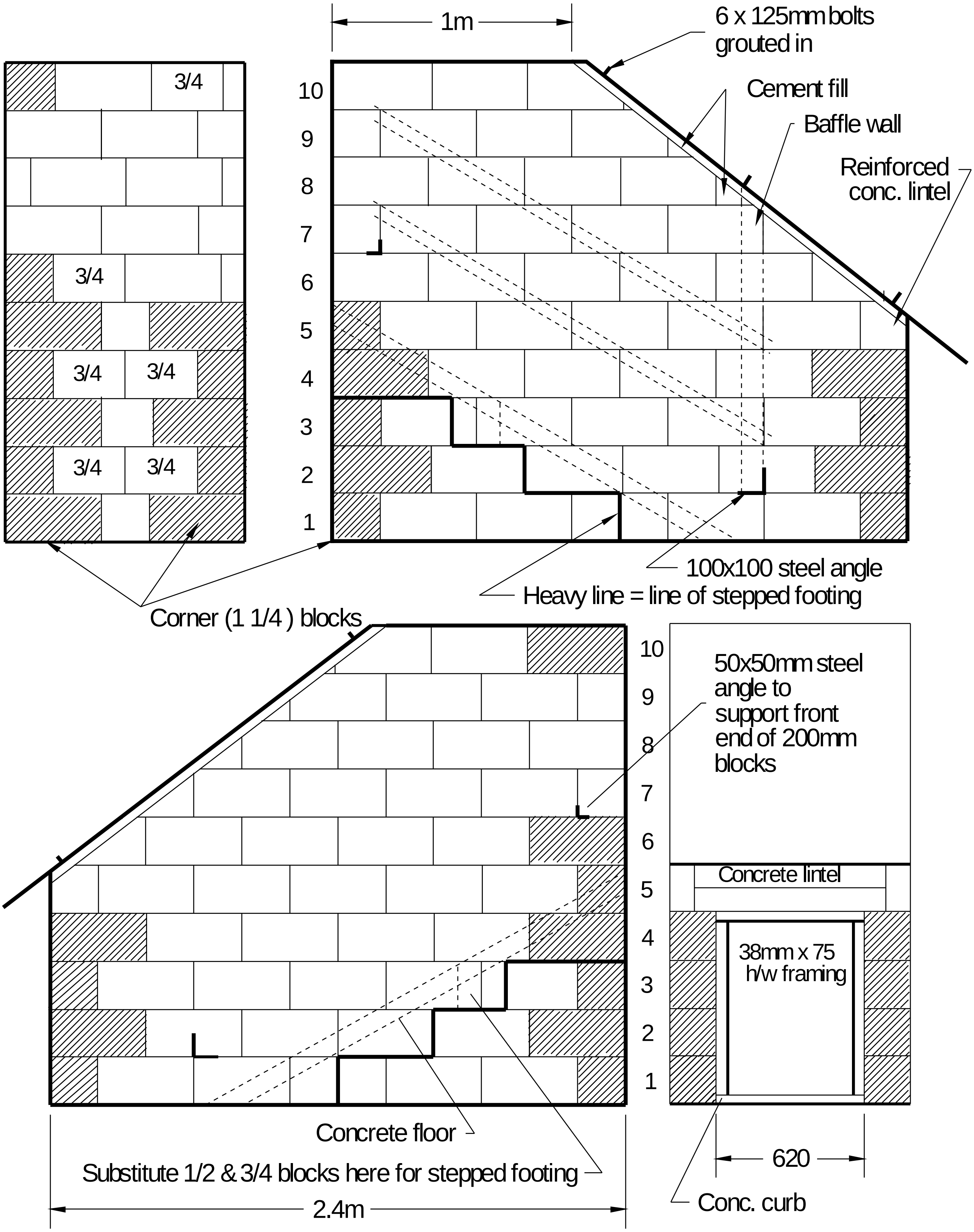


FIG. 3 COURSE 1 & 3, NARROW CHAMBER

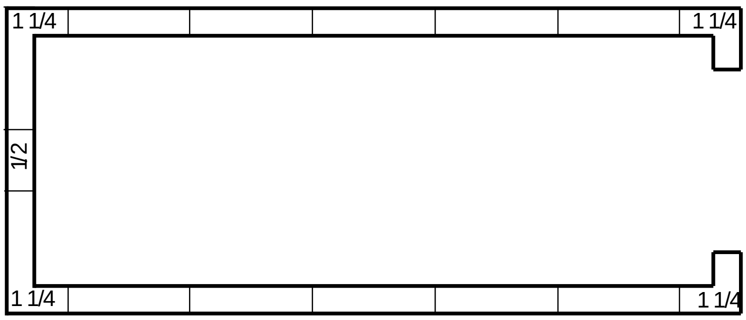


FIG. 4 COURSES 2 & 4, NARROW CHAMBER

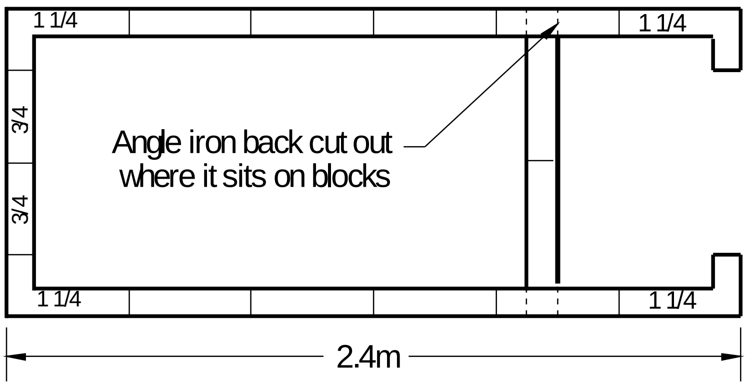


FIG. 5 COURSE 5 FOR NARROW CHAMBER (2 1/2 blocks wide)

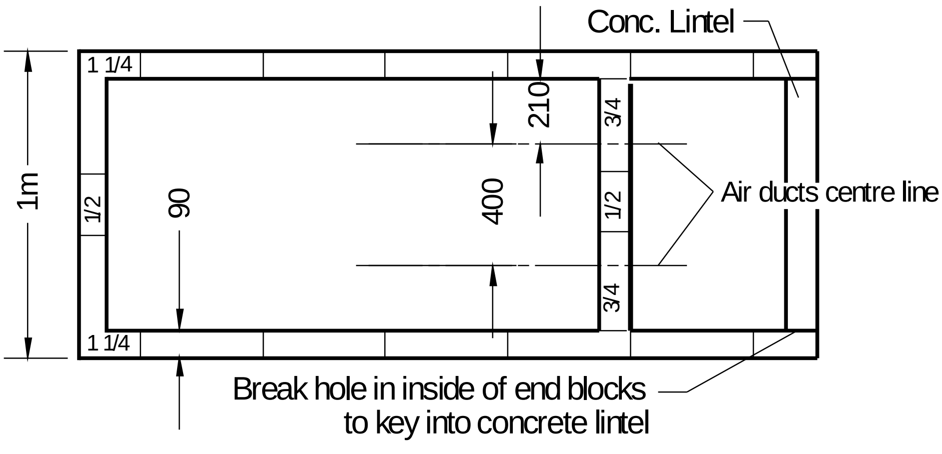


FIG. 6 BLOCK ARRANGEMENT FOR COURSE 7, NARROW CHAMBER

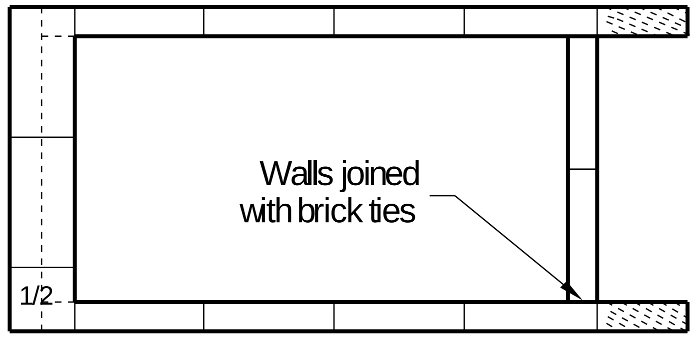


FIG. 7 COURSE 1 FOR WIDE CHAMBER

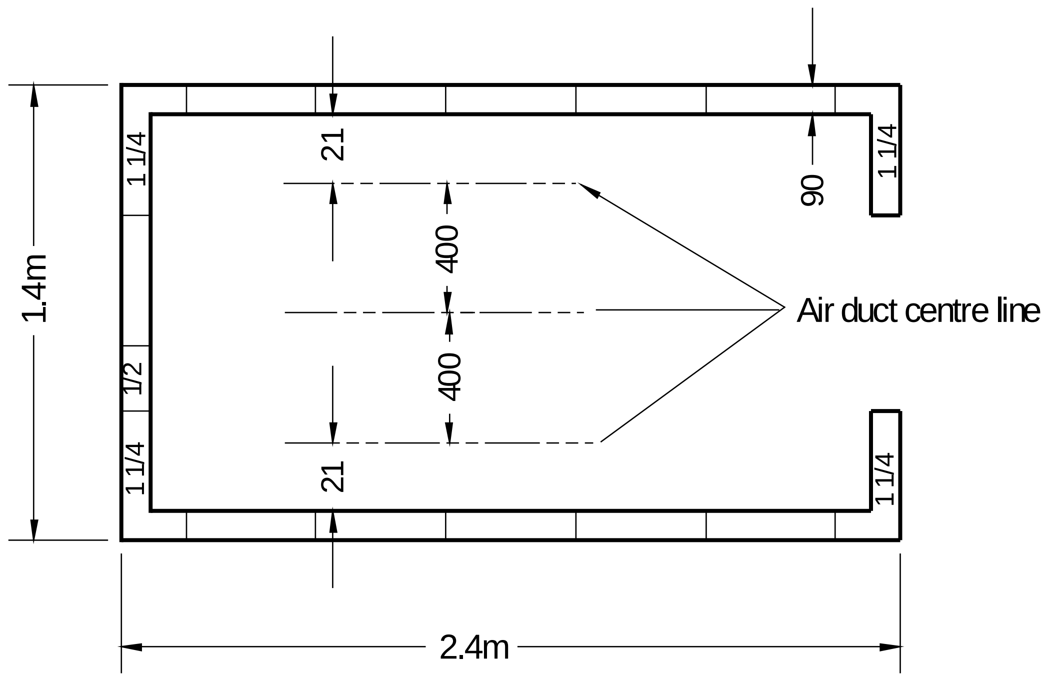


FIG.8 BLOCK ARRANGEMENT FOR STEPPED TOP

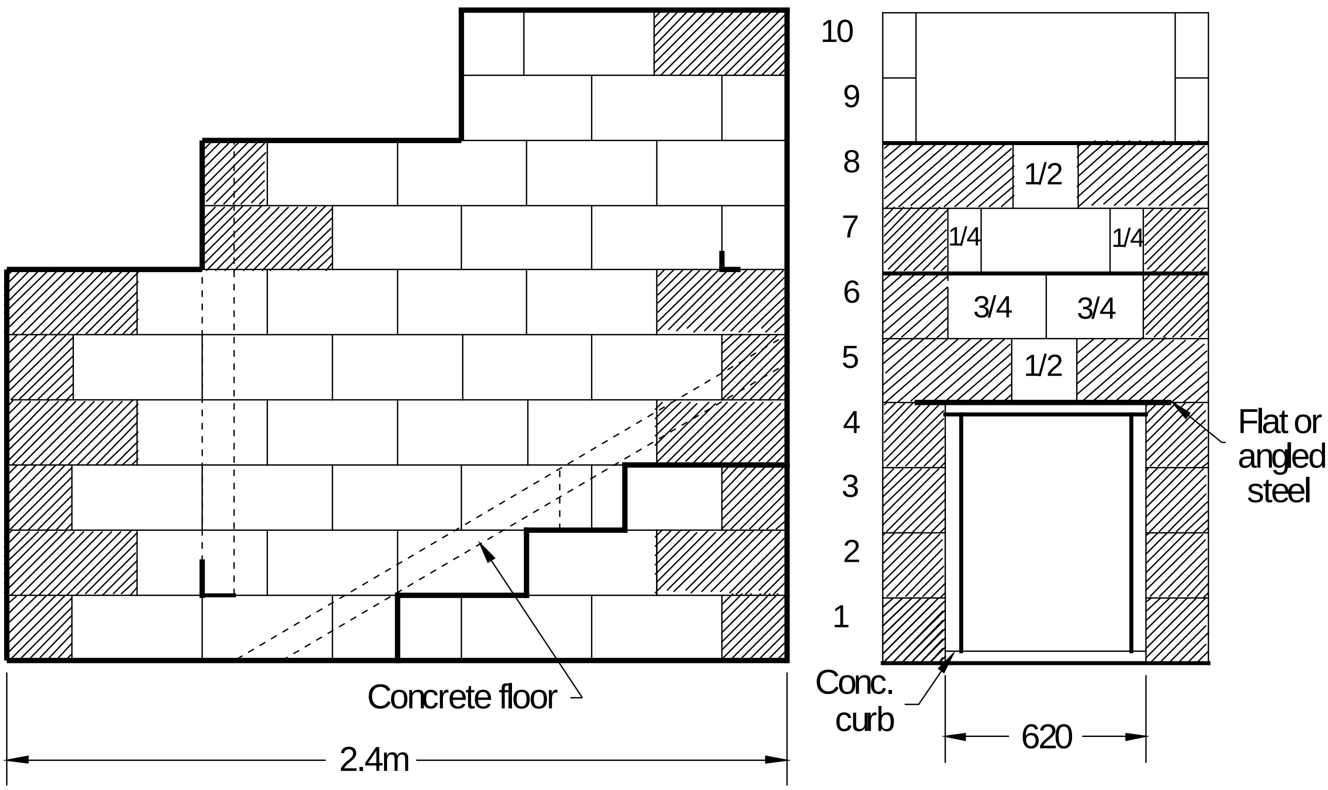
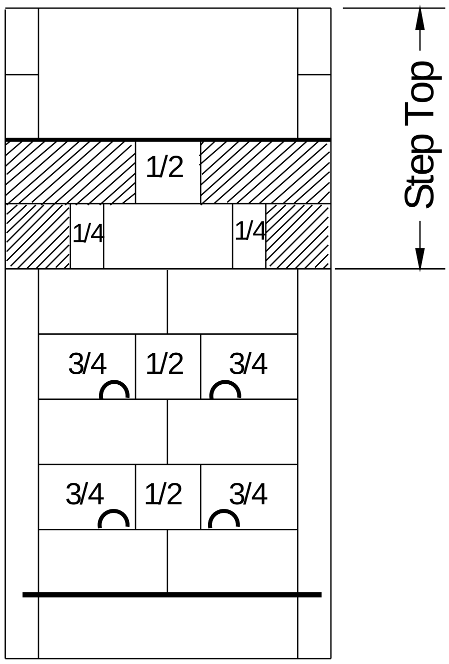


FIG. 9 BLOCK ARRANGEMENT FOR BAFFLES

Standard Chamber



Wide Chamber

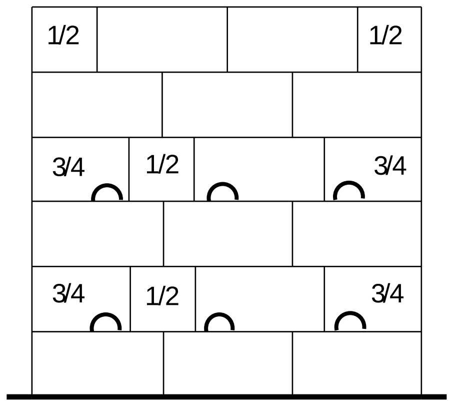
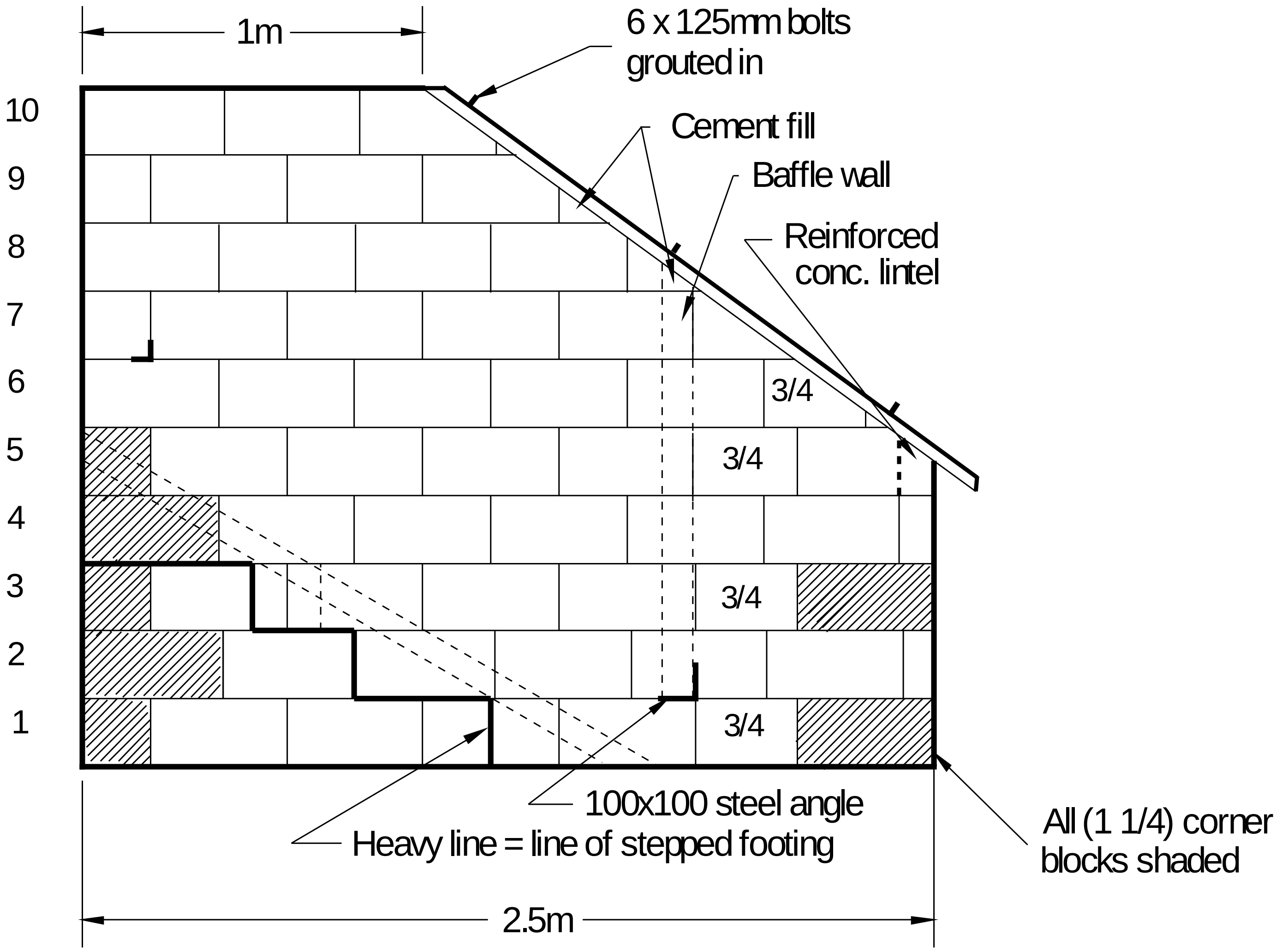


FIG.10 OLD BLOCK ARRANGEMENT

(use when you don't want to cut front corner blocks)



For rear wall layout see FIG.2

FIG.11
Stepped footing & humus chamber floor

FIG.12
Sloping floor - for compressed fibro baffle
(hence no angle iron)

FIG. 13 *Drilling holes in blocks*

FIG. 14 *Cutting blocks*

FIG. 15 *Vent pipes, finishing sloping top (wide chamber)*

FIG. 16 *Top ready for fixing iron*

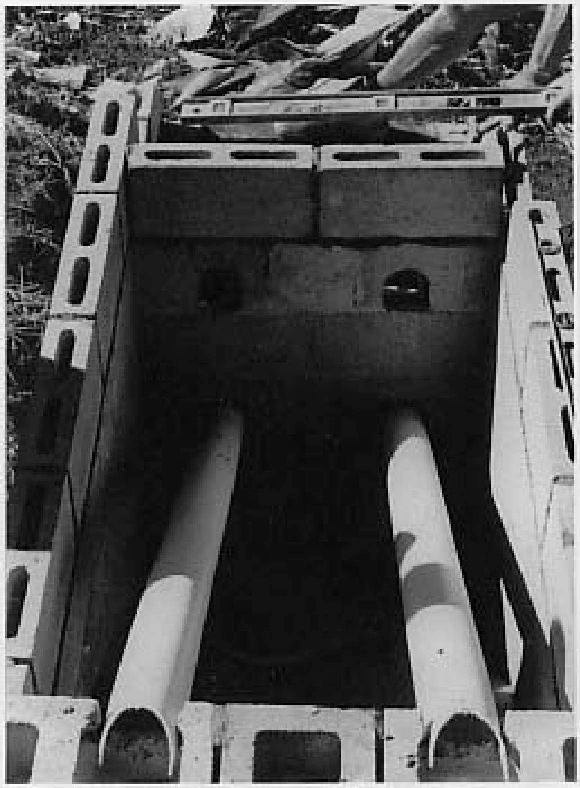


FIG. 17
Vent pipe installation

FIG. 18
Stepped footing option

FIG. 19
Finishing sloping walls

FIG. 20
Rendering inside of chamber