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INTEGRATED WATER RESOURCES MANAGEMENT (IWRM)

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# *falevãtie manual*

**CONSTRUCTION; OPERATION & MAINTENANCE**

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Version 1

2013

**PUBLIC WORKS DEPARTMENT**

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## 1. INTRODUCTION

### 1.1. PURPOSE

Welcome to your *falevātie* building project! This is your guide to the construction, operation and maintenance process. Please read these instructions to familiarise yourself with the whole process. It is recommended that you keep this entire manual handy. It contains good tips for getting your entire crew involved in building your *falevātie*. This manual is design to help you progress step-by-step through the construction process and on how to use and maintain it.

This manual has been divided in two parts; part 1 focuses on the construction process and part 2 on the operation and maintenance. Please note information and dimensions outlined in the Construction Drawings (Appendix E) supersedes any other information specified in either the Sketches or Diagrams.

### 1.2. AUDIENCE

This manual has been developed specifically for builders, families and individuals who are willing to adopt the *falevātie* as part of their lives.

## 2. BEFORE YOU BEGIN

### 2.1. STEP 1: AT THE SITE

The homeowner has already determined where the home is to be built. They have taken into consideration their neighbours, existing structures, and their family's needs. Please make every effort to honour their requests. It's always helpful to cross check the floor plan, including the positioning of the door and windows in accordance with the family's wishes. Do not assume anything; ask where to place all items cleared from the work area.

### 2.2. STEP 2: MATERIAL INVENTORY

Using the material checklist provided in the Appendix D, locate and inventory everything necessary to complete the project.

## 3. PART 1: CONSTRUCTION PROCEDURE

### 3.1. STEP 1: UNLOADING MATERIAL

Check all items against the given Schedule of Materials (Appendix D). Arrange covered storage for materials in dry conditions clear of the ground (Note always store materials off the ground).

Components should be kept dry and under suitable covers during construction. Take special care of cement, ceramic tiles adhesive (CTA) and the like if provided. Stack materials into related component groups, ensuring access to all items is maintained. Timber linings and mouldings should be stacked carefully to prevent damage or warping.

Learn names of components and how and where they are to be used. At each stage of the project lay out materials in the proximity of their eventual position. This will save time and increase the speed of erection.

Extreme care should be exercised when handling glass. Window glasses should be supported and carried to the appropriate position according to the window schedule. Do not apply loads directly to glass.

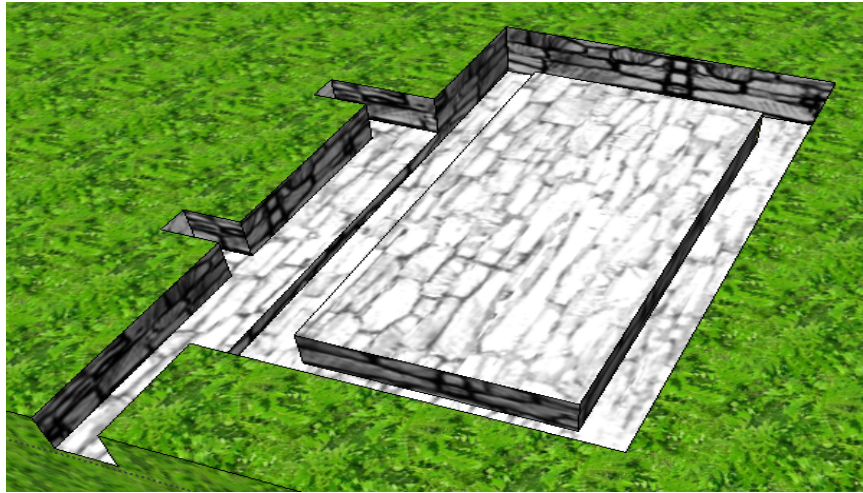
### 3.2. STEP 2: PREPARATION OF SITE

Check survey information and position of services. Remove topsoil and prepare site for excavation (foundation wall footings) or hard fill (slab-on-ground).

Ensure the finished ground surface immediately adjacent to the building is shaped adequately to facilitate surface drainage away from the building and the site and building floor levels meet the provisions of required standards.

Arrange for the excavation and placement of all buried services, e.g. water, electricity and sewer drains.

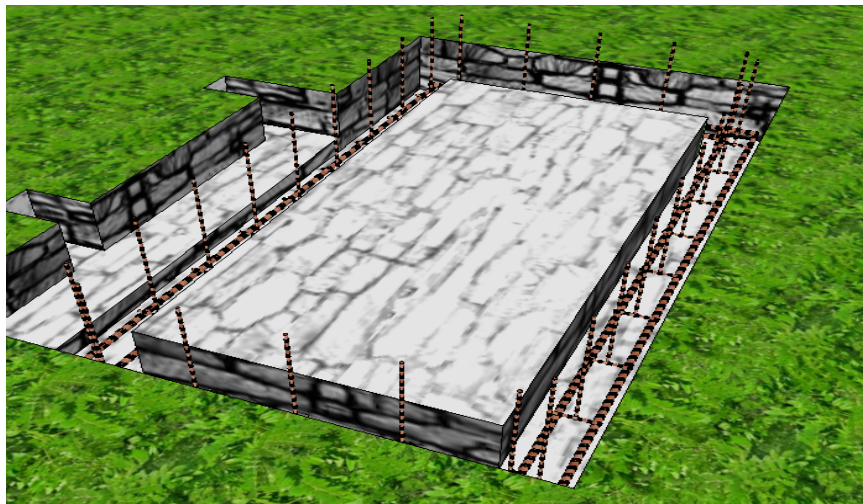
Check the specific design for foundation wall footing details in Appendix E. Excavate footings in accordance with the project requirements and clean out all holes carefully.



*Sketch 1: Illustrate the excavation of the footings*

### 3.3. STEP 3: FOUNDATION

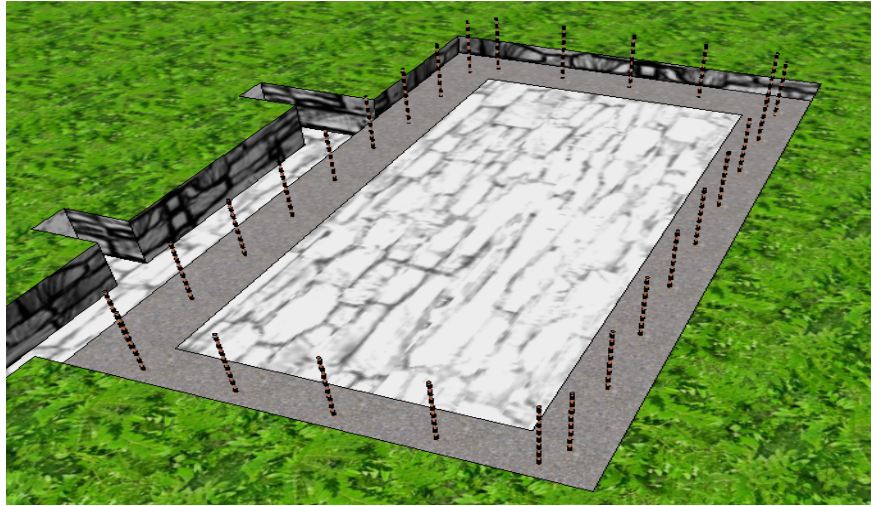
Erect profiles, place and compact hard-core fill. Excavate footings, place Damp Proof Membrane (DPM), install formwork and fix footing and slab mesh and reinforcing starter bars in place.



*Sketch 2: Illustrate the laying of reinforcement and starter bars*

Check the footings are both square and level. Subject to an inspection of the footing, concrete can be poured to all foundations. Formworks should be temporarily supported while pouring and compacting the concrete. Care should be taken not to disturb the footings during the pouring of concrete.

All concrete work should be carried out in accordance with the relevant standard and drawing specifications.

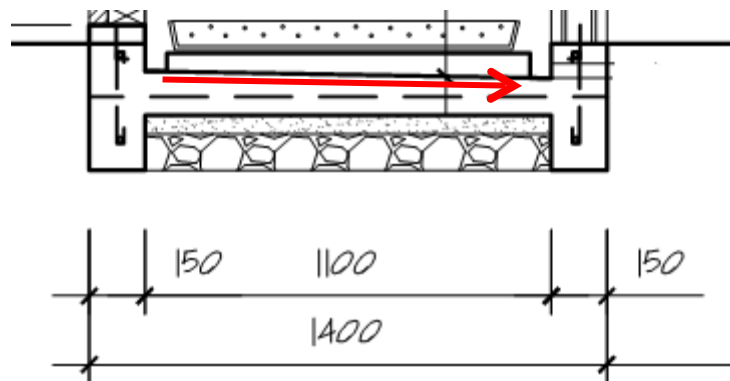


*Sketch 3: Concrete footing in place*

The concrete slab is a very important part of the construction and if it is not completed in a satisfactory manner then there will be trouble all the way through construction of the building.

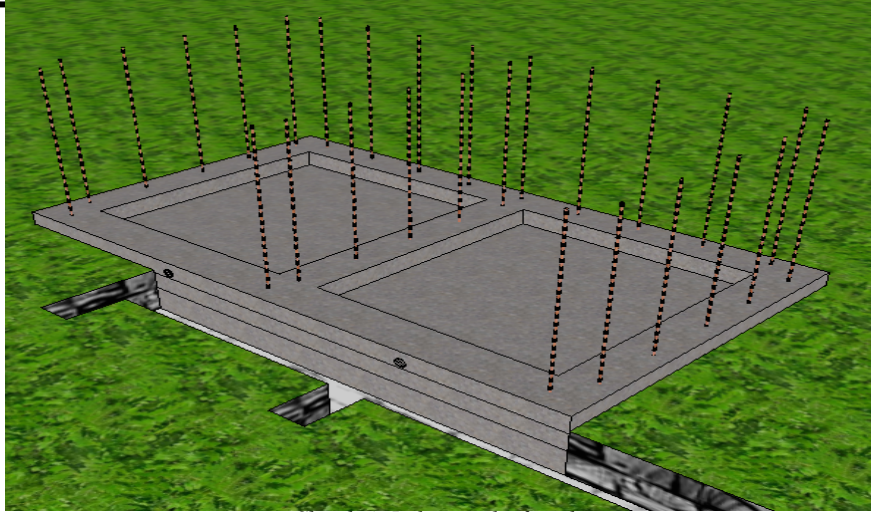
Concrete slab-on-ground foundation details will be in accordance with a specific design based on a soil investigation (A minimum of 20 MPa is the Design Strength).

Attention should be given to the direction of the fall as it might cause a major problem after the construction process is completed. Note the fall is directed toward the drainage outlets as shown below.



*Diagram 1: Indicates the fall of the slab-on-ground*

Specific designs in the Appendix E detailed all elements necessary, such as ground beams, slab-on-ground and also give the details for slab mesh, reinforcement and other foundation requirements.



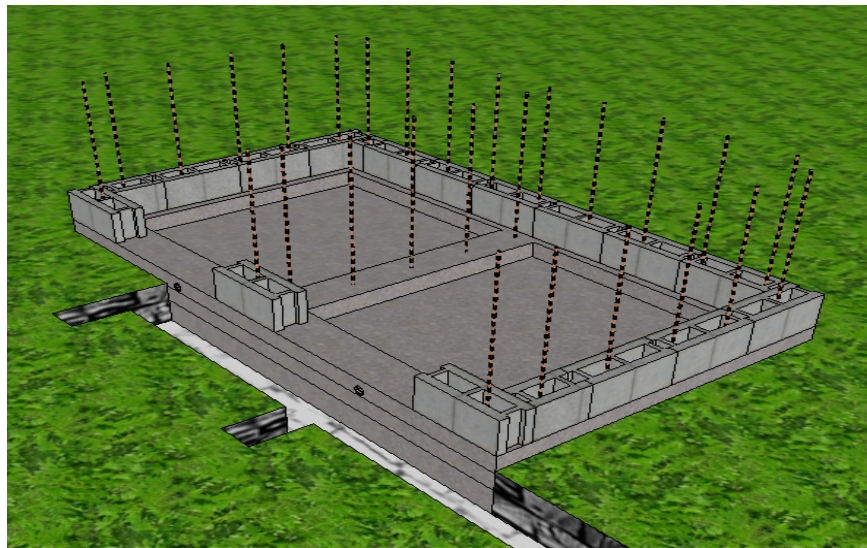
*Sketch 4: Indicates the foundation*

Items to check as work progresses on the slab are:

- The building has been cited in the correct position on the section of land
- The drainage has completed all under slab drainage and has granted approval
- Ground beams are constructed in accordance with the specific design
- When used the polythene damp proof membrane is in place and all joints are taped together
- All reinforcing steel is correct
- Accurate formwork dimensions

### 3.4. STEP 4: BLOCKWORK

Surfaces for the blocks to be laid upon must be level, clean but slightly rough. This roughness is necessary to create a good bond between the mortar and base. Usually the finish achieved with a wood float is adequate. Once an adequate surface has been prepared the first course of blocks can be laid.



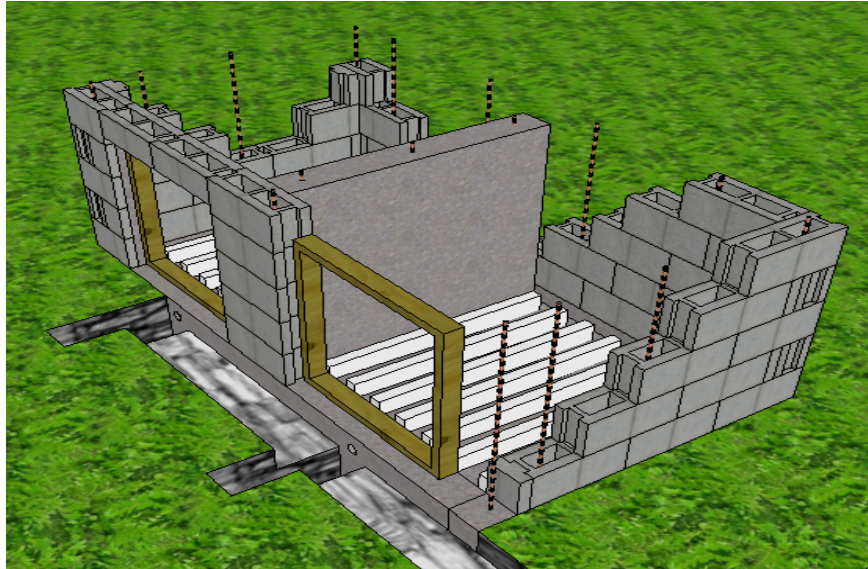
*Sketch 5: Illustrate the first course of blockwork*

Note a 50mm concrete nip/ plinth around both chambers is necessary to allow the installation of drainages as illustrated in *Sketch 4*. Drainage outlets should be kept clean at all times to minimise blockage when drainage are installed.

Laying the first course should be done ensuring all blocks are level. The first course mortar joint can be up to 20mm to achieve levelling. Refer to the drawings (Appendix E) for all subsequent mortar joints but usually

10mm ± 3mm. All mortar either site mixed or premixed must meet a 28 day compressive strength of not less than 12.5MPa.

Often it is necessary to support lintels with timber framing (props) until the block-fill has gained sufficient strength. Refer to the sketch below.



*Sketch 6: Timber frames in place for chamber openings*

The need for temporary bracing of the masonry wall during construction is often overlooked. An unfilled wall is very susceptible to failure from strong winds. Typically walls over 1m in height are at significant risk. It is important to take some measures to brace the wall in order to prevent its premature failure.

Ensure ventilations outlets on both chambers are installed before suspended slab is poured.

### 3.5. STEP 5: SUSPENDED SLAB

There are two types of suspended concrete slabs. One is precast and the other being steel “tray”. Both of these are placed on the supporting walls and a topping slab of concrete is then poured.

Before erecting, props must be installed at the positions and pre-chamber levels as shown in the drawings. The props must be levelled to an accuracy of ± 3mm, must be adequate to safely carry the construction loads without settlement and must be well braced in each direction.

The perimeter boxing or formwork can be placed once the props are located accurately. This can be set to a height so that it can be used as screed railing.

Reinforcements are then placed as specified in the construction drawings before pouring concrete. It is essential to cure correctly to ensure it reaches the required strength. Insufficient curing of the floor may result in greater deflections than designed for.

Ensure that chutes for pan connectors on the suspended slab installed in the correct location before pouring concrete.



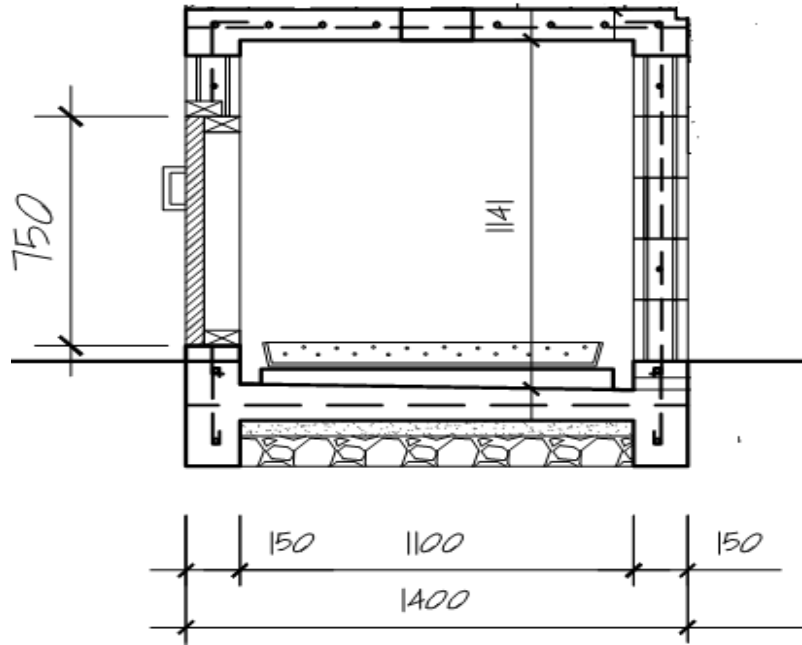
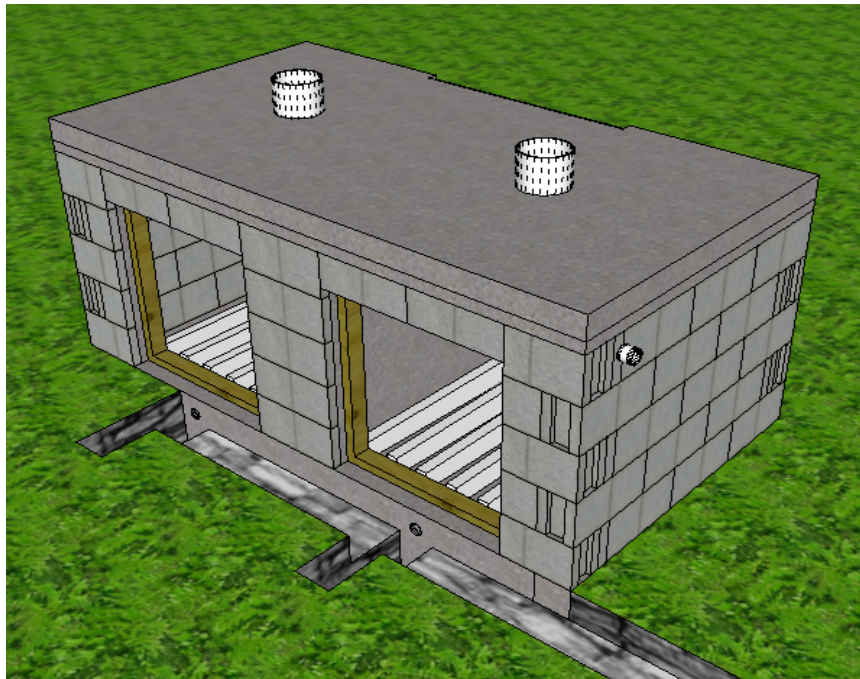


Diagram 2: Indicate a typical cross-section of the chamber

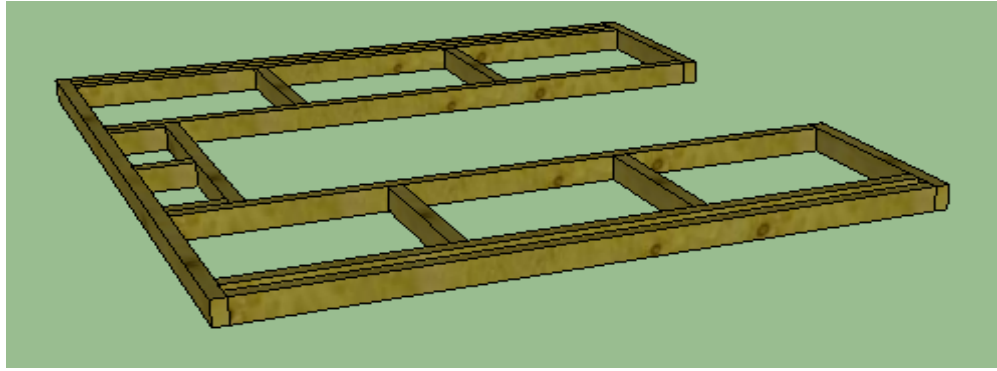
The props will be removed once the concrete topping has reached a compressive strength of 15MPa. This is usually around two weeks. An initial settlement may occur once the props are removed. The amount of initial and long term settlement depends on the overall depth and span of the floor system.



### 3.6. STEP 6: WALLS FRAMING

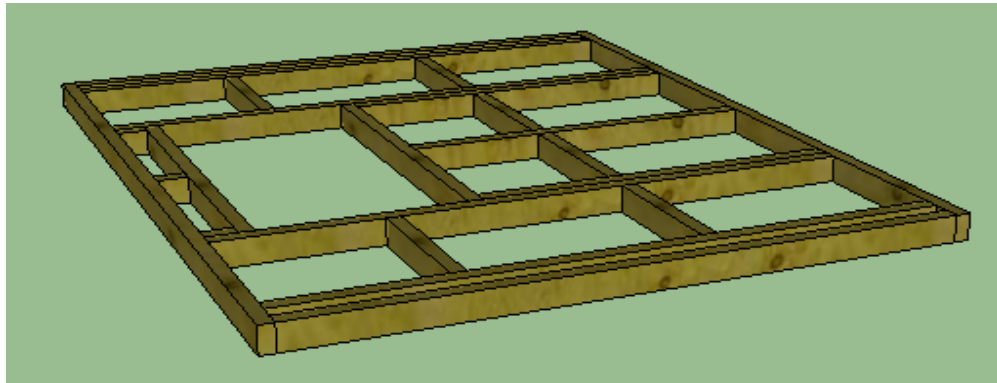
Wall framing must be of adequate size and strength to support the roof loads. Wall must also resist lateral wind loads. A single top plate will be used where roof rafters bear directly above wall studs. In such cases adequate corner ties are required, particularly where non-structural sheathing is used.

Refer to drawings for studs size and spacing. Where there are openings, a header of adequate size is required at windows and door openings to carry vertical loads across opening.

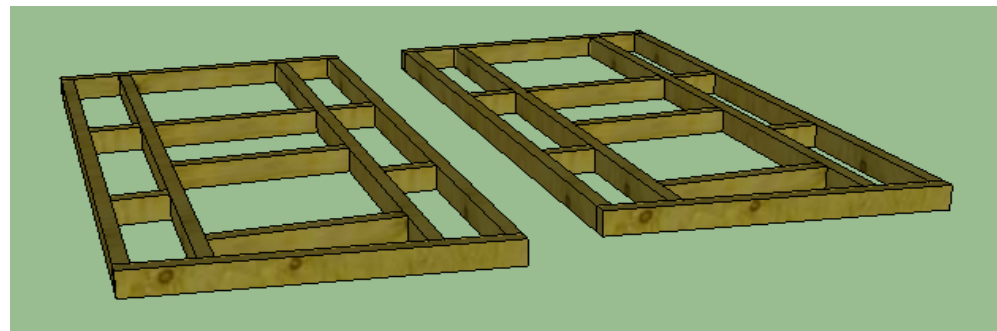


*Sketch 8: Wall frame to the front with door opening*

Wall panels are either solid or leave openings for windows and doors.



*Sketch 9: Wall frame to back of building with windows openings*

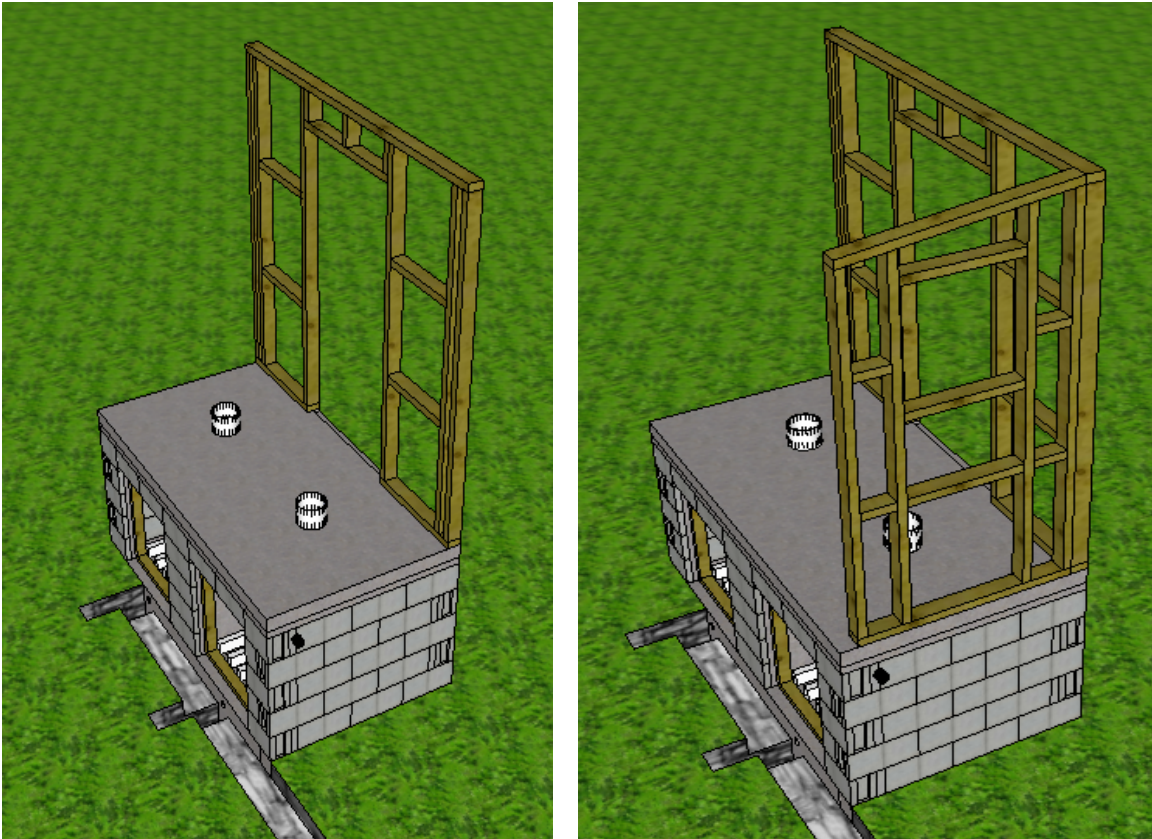


*Sketch 10: Wall frames to the sides of building with window openings*

### 3.7. STEP 7: ERECTING WALL FRAMES

Always start erecting wall panels at an external corner and work around it. At any external corner one panel will end on grid intersection and one panel will be off grid.

Specific attention should be paid in erecting panels for this particular building. Front and back panels end on grid whereas side panels ends off grid. Drill two adjacent 16mm holes through the flooring, directly through the “on-grid” panel, to match the holes in the end of the bottom plate. This method will be similar for a concrete slab; this will mean that “on-grid” panel will be fixed to the “cast-in” external M16 bolts.

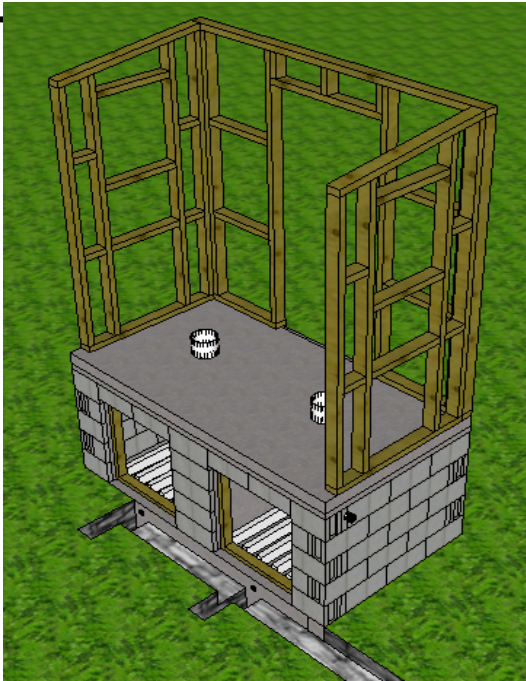


Always start walls by erecting both panels at an external corner and erect the first panel of each intersecting wall as work progresses. This will provide a stable and plumb wall that will resist damage which could be caused by a wind gust.

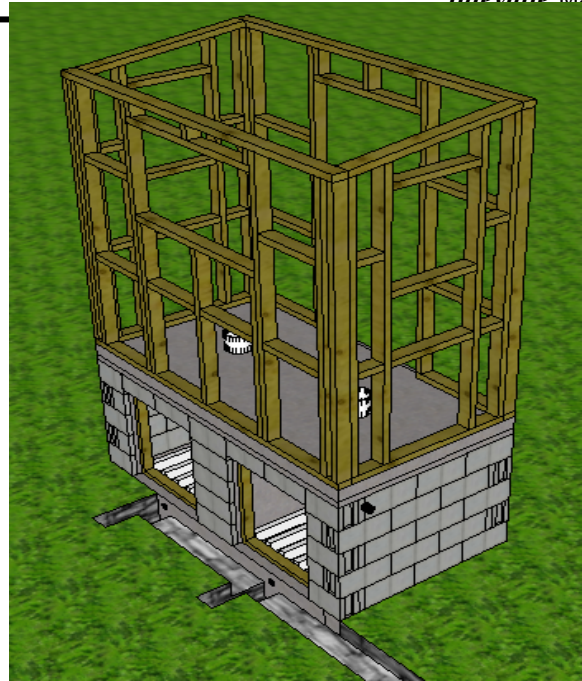
Working from a corner; check location of anchor bolts at next grid. Anchor bolts must be fixed between studs of all adjoining panels to ensure correct alignment of walls. Generally, single solid panels and single window panels require nailing from each panel or two panel alignment brackets each located about third from the top and bottom of panels.

Undo M16 anchor bolts at floor below, raise next panel into position ensuring the floor flashing engages at bottom and re-fasten the M16 bolt to fix the bottom studs of both panels to the floor.

Continue the process until all panels are fixed and in the correct location ready for the wall linings.



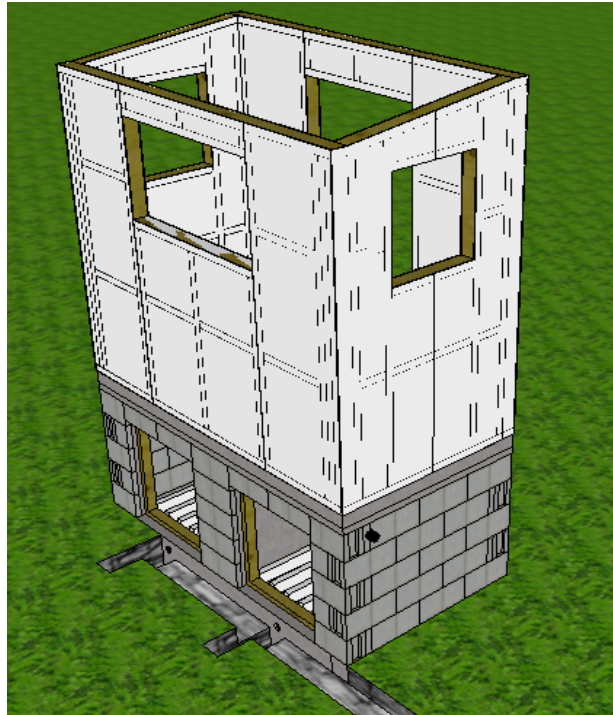
Sketch 13: front and two side panels in place



Sketch 14: complete wall panel in place

### 3.8. STEP 8: EXTERNAL WALL LININGS

The type of sheeting on wall panels is dependent upon the type of wall finish required. Generally, the outside sheeting of exterior panels is fiber cement (hardiflex) line board whilst the interior is hardboard to provide smooth finishing.



Specific attention should be paid to the different wall linings. This specific building exterior lining will be plywood whereas the interior will be hardiflex and hardboard. Refer to construction drawings (Appendix E) for details.

Before lining the external walls, the services must be placed within the cores of the walls especially electrical. Conduit wires and flush boxes must be placed and mount to the frames.

### 3.9. STEP 9: POSTS FOOTINGS

Excavate holes for footings in accordance with the requirements and clean out all holes carefully. Refer to the specific design for layout of braced and ordinary stumps /posts.

The length of posts will very dependent upon the slope of the land. Position posts beside the respective holes ready to be installed.

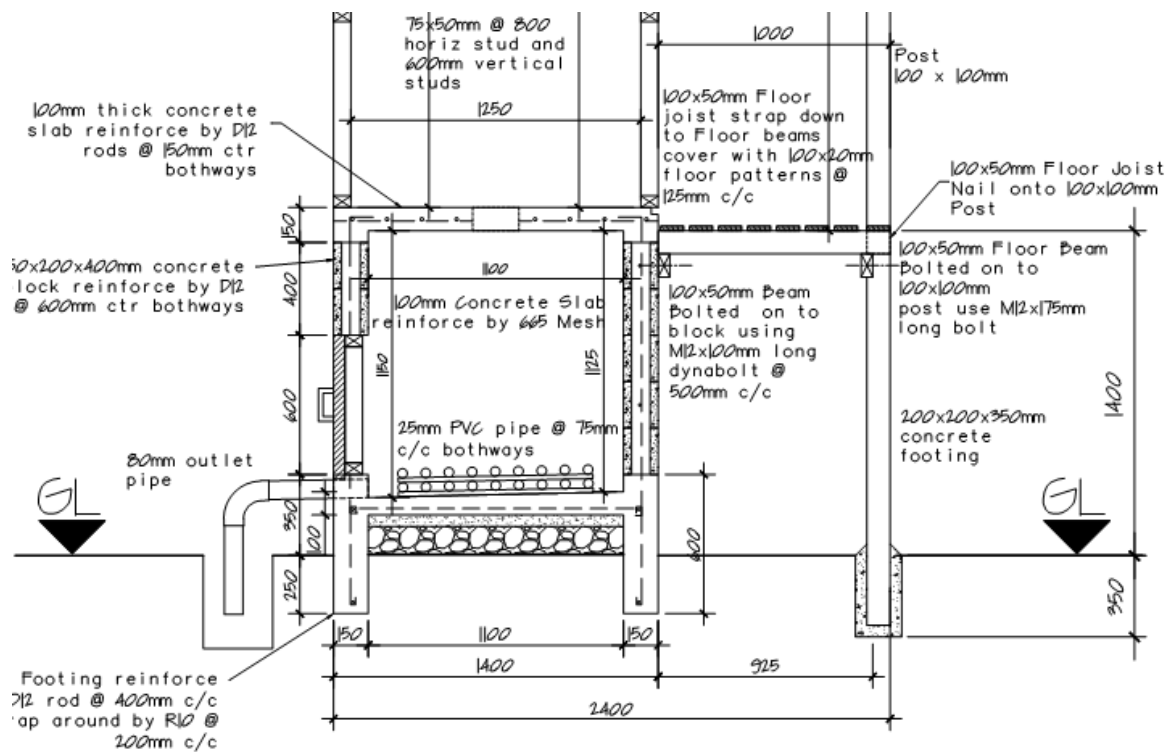


Diagram 4: Typical cross-section illustrate details of installing posts

Support the whole assembly over the excavation so that the posts are accurately located to the centre of the grid line and to the string lines strung from profiles. The bottom of the posts should be at least 150mm above the bottom of post hole.

Check that the structure is both square and level. Subject to an inspection of the footing concrete can be poured to all foundations. Posts should be temporarily supported while pouring and compacting the concrete. Care should be taken not to disturb the structure during the pouring of concrete.

Check the final position of the posts before the concrete sets. Adjust position as necessary and recompact the concrete ensuring the posts are plumb.

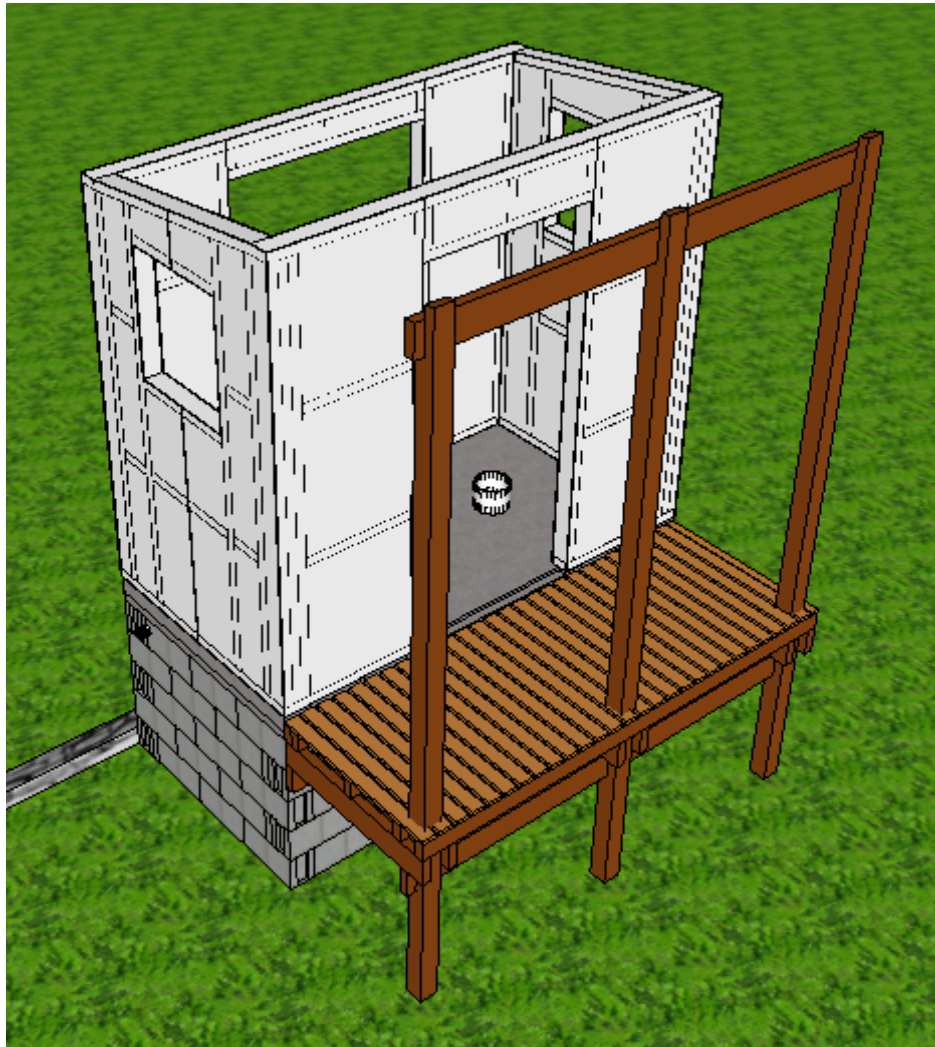
### 3.10. STEP 10: BEARERS AND FLOOR JOISTS

Check with the drawing the required height of the timber decking. Less the depth of the floor joists to give you the correct positions for your bearers. Use M12 bolts to fix your bearers to the concrete block wall and to the posts. If leveling is required, locate highest point, jack and support all other bearers to this level.

Distribute floor joists in accordance with the drawings or plans. Stack the floor joists into related module sizes, ensuring access is maintained.

Before fixing any floor joists, start from one end and set out the floor joists at the centres and strap down to bearers shown on the plan.

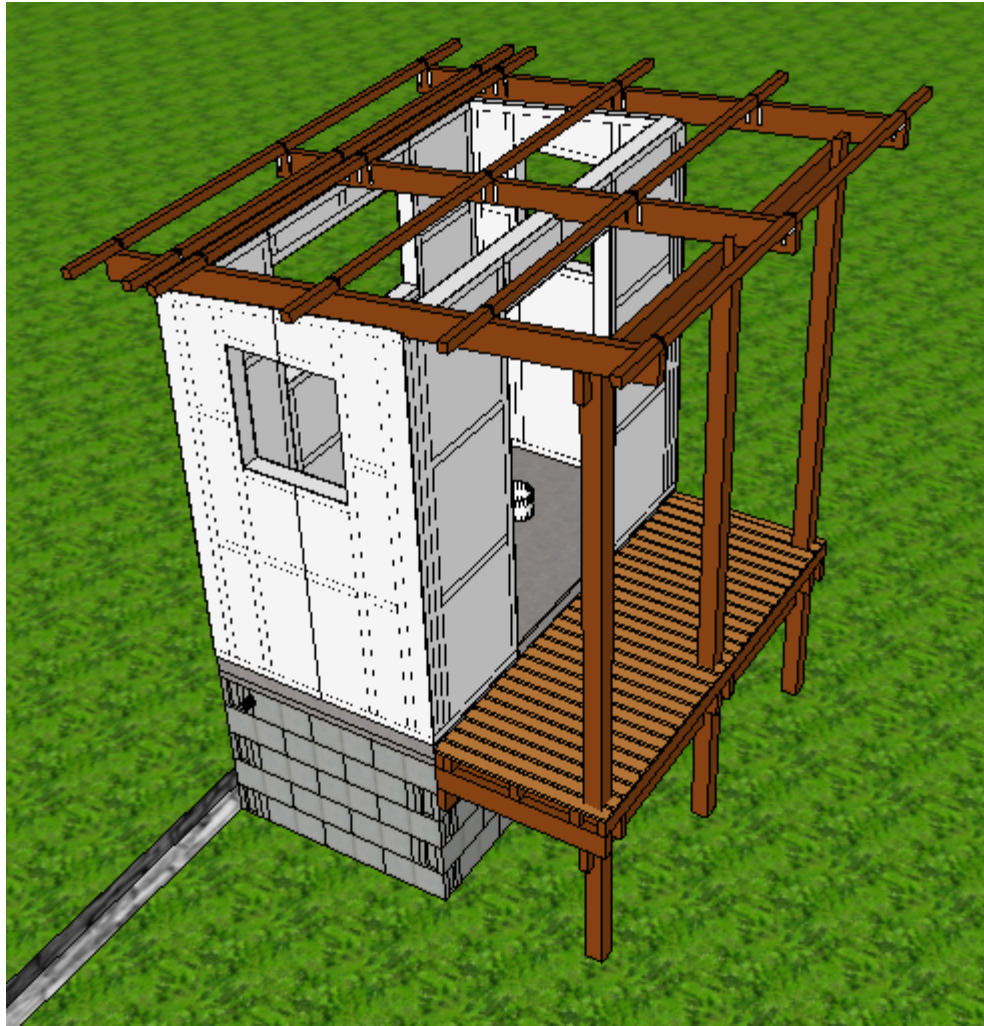
Fix tongue and groove (T&G) timber floor decking on to the joists with nails as specified in the drawings. Start from one end of the floor deck working toward the other end.



After completing the timber decking, tie the top end of the posts by installing the timber beam to support the rafters for the roof. Extreme care should be taken in fixing the timber beam. Proper scaffolding is needed to erect to prevent accident in the building site.

### 3.11. STEP 11: ROOF CONNECTION

The two most popular methods of roof connection are by top plate and metal strap. Either one can be used in almost any circumstance. The top plate requires more material, but leaves greater flexibility for the roof members to be placed. It also leaves a nailing surface along the top of the wall, which is useful if a trim is to be installed. Metal straps can provide a stronger connection and for high-wind areas are often compulsory.



Roof construction must be of adequate strength to withstand anticipated wind loads. Framing members must be securely fastened to each other, to sheathing and to exterior walls to enable the roof system to serve as a structural unit.

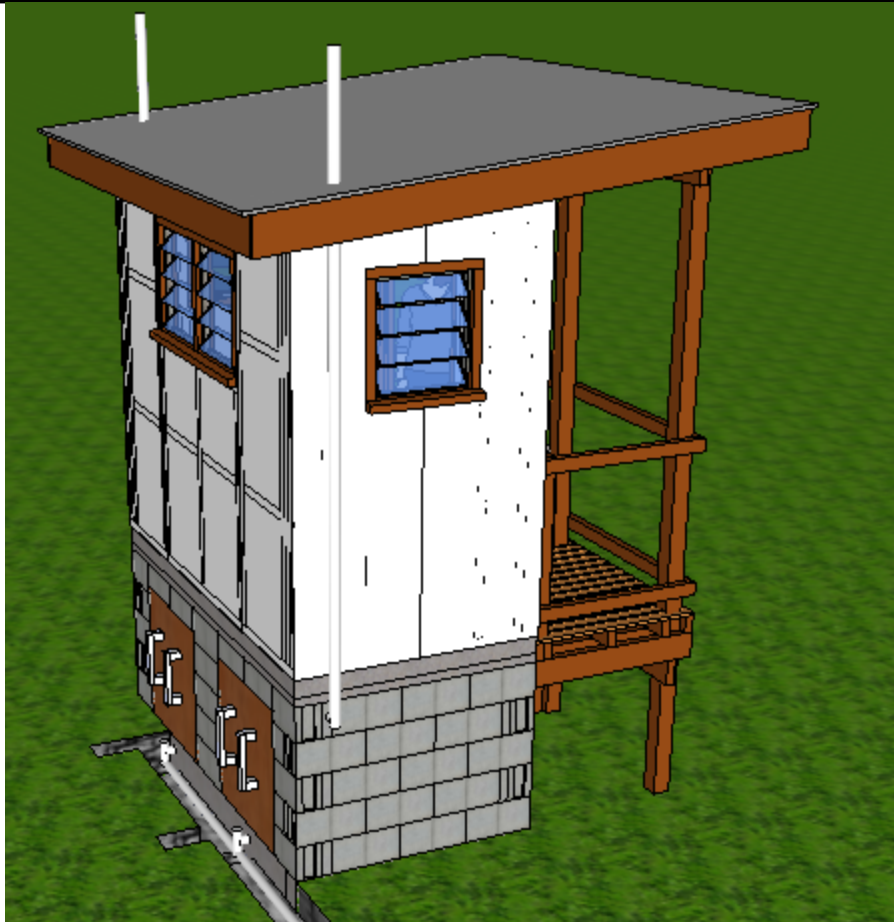
Rafters are placed directly on top of the wall frames top plate and the timber beam and secured to the wall plate by toe-nailing or use of special metal plate fastenings.

Maximum allowable spans for rafters and ceiling are provided in the Construction Drawings. Ceiling joists must be securely strapped to rafters as shown in the above sketch. This provides a structural tie across the building to withstand outward forces exerted by the rafters. Once all has been carried out, the roofing sheets can be installed.

### 3.12. STEP 12: ROOFING AND ROOF PLUMBING

Roofing and roof plumbing, including cladding, flashings and fixings shall be installed in accordance with clearly presented and adequate technical information provided in the construction drawings.

There are various fascia and gutter systems used and the appropriate information in the construction drawings and manufacturers specifications should be used. Always ensure that there is adequate fall in the gutter to allow water to drain from the roof area.



*Sketch 18: Illustrates the ventilation system from chambers in place*

Care should be taken in the installation of air vents from the chambers. Note that the vents are coming out from the sides of the chamber and goes through the roof. This is basically to prevent water leakages in the main building.

### 3.13. STEP 13: SERVICES

Methods of installing plumbing and electrical lines depend on whether they are run through, within or alongside the walls. Penetrations are necessary primarily to allow services to pass directly through the wall. Lines that run parallel to the wall can reside either within the wall panels themselves or be strapped and lined. Any openings required shall be formed with drills and saws.

All plumbing services should be brought up through the floor, inside cupboards or from directly below the unit, as is the case with conventional construction. Cutting chases in bracing wall panels for plumbing services will destroy the structural integrity of bracing wall panels. Wet walls (false walls) built out with surface mounted plumbing is a more acceptable practice. Fix all necessary plumbing fixtures and fittings including drainages, ventilations and manholes to chambers.

The location of all electrical fittings needs to be confirmed prior installation. Electrical cable is usually run through PVC conduit that has been placed inside the walls prior lining. It is not good practice to place more than one conduit within a single vertical core that is to be lined. The length of conduit and the number of bends should be kept to a minimum so as to not affect the installation of the cables within the conduit. With long, twisting conduits the friction can make it difficult to pull the wires/cables through.

The locations of the flush boxes should be installed prior the lining. The lining should be marked out then cut out or drilled on the wall at the location of the flush box. To install switches and power outlets, simply cut as required through the sheeting. A hole saw may be useful for this purpose. Fix switches, etc., in the same manner as required when fixing to any other sheeted walls. Meter boxes should be fixed directly into panel studs.



### 3.14. STEP 14: CEILING & INTERNAL LININGS

Once the roof is completed, ceiling lining can now be installed. Ceilings shall meet the provision given in the construction drawing. Ceiling lining shall be used and support is provided by ceiling battens at max 500 mm centres and fixed with panel pin nails.

Before the interior wall is lined, the services must be in placed within the cores of the walls, especially electrical. The builder will make cut-outs in the wall face where the electrical flush boxes and other service were mounted when lining the wall. The electrician will pull wires, install boxes and other fixtures. In partially good planning will see the services installed neatly.

### 3.15. STEP 15: DOORS & WINDOWS

Timber framed doors come to site sized, pre-hung and have solid jambs to provide simplicity in fixing. Select door frame to match panel opening. Check the type of door frame (external or internal), and its location. External doorframes have a thicker weatherproof door and a sill below the door.

Determine which way the homeowner would like the door to swing and pre-hang the door on hinge plates depending on your door opening. Centre the door in the opening and nail the stud directly to the adjacent stud. Check the full swing of the door and be sure there is clearance all the way around. If the door swings properly finish the installation by installing the lock set.

When fixing external doorframes, care should be taken to ensure that the bearer over/flashing engages correctly.

To install door frames:

- Fit the “frame” on which the door is hung, into the panel opening
- Screw fix jambs into the wall panel stud
- Fit handles and latches to complete installation. Refer to the hardware manufacturer’s instructions for details.

For windows, be sure to check and see that the window is placed right. Hence using aluminium louvre frame windows make sure that the frames are fixed correctly to window studs with screws. Make sure to the upper and bottom stoppers or jambs are nailed correctly before sliding louvre glasses into position. Check that the louvres glasses fit perfectly.

### 3.16. STEP 16: FINISHES

The finishing includes plastering, painting and tiling. Each trade varies considerably with each brand and type of finish chosen. Most of these trades require special tools and skills. Subcontractors should be used if you have had no previous experience. Refer to manufacturers’ specifications for instructions if you wish to do it yourself.

Lay mosaic floor tiles as specified in Appendix E using appropriate adhesive. Lay ceramic wall tiles as illustrated in construction drawings. Wall tiles should be laid on the hardiflex lining. Once tiles have been laid, grouting will then follow. Care should be taken when laying the wall tiles and grouting.

Painting will be the last of the finishes. Remove all dirt, dust and grease by thoroughly cleaning the surface. If mould or fungus present washes surface with bleaching agent and treat with anti-fungus agent. Fill cracks with suitable filler and spot primer. Brush or Roller can be used to carry out the work.

Stir the contents thoroughly before and during use with a broad flat stirrer using an upward lifting action. Apply uniformly, direct from the container. Apply one coat by the appropriate method of application. Brushing is best on timber as this works well into the grain of the timber. Apply direct from the container. For further ease of use add up to 5% thinner. One coat should be sufficient over suitably primed or previously painted surfaces.

Allow enough time for proper curing of the paint film. The quality of finish may depend on skill, and the type of brush or roller used. Please seek professional advice from suppliers of such equipment.



## 4. PART 2: OPERATION AND MAINTENANCE

Hygienic operation and maintenance of *falevātīe* is very important. As these are quite new concepts, users of these facilities have to be educated on how to use and maintain them properly. Although these are robust technologies compared to other sanitation systems, following proper maintenance procedures is very important for their effective functioning. Improper use and maintenance would lead to failure of the systems and create a negative impression among the users on the effectiveness of these technologies. Apart from conducting training on how to use and maintain these facilities, regular follow-up and maintenance support should also be planned.

*falevātīe* to be effective it is important for a correct balance of moisture, air and pulp to be considered. All compost toilets must have good ventilation, a pipe for excess moisture and an absorption trench (or effective evaporation process). Pulp must be added at every use to aid aerobic breakdown, ideally the waste should be periodically stirred for the same reason. Given this is a waterless (no water use for flushing) it is important to keep the toilet as minimum water as possible

### 4.1. SAFE USE OF FALEVĀTĪE

For defecation the chamber is used. One chamber shall be used for one year or until the chamber is full. A hand full of ash, sand or wood chip shall be added to the chamber after every usage. Care shall be taken not to add water into the faecal chamber. The chamber shall be closed with a lid after each use.

The other chamber shall be used for the next year and the cycle be continued. Soil or straw shall be spread to about 0.02 m (2 cm) at the bottom of the chamber before the first use. Soil or straw shall be added to the pile after 1 year of usage to cover the pile. The full chamber shall be let to rest for a period of 10- 12 months before

emptying. The emptied material shall be used as soil conditioner (compost) or shall be buried under the soil.

#### 4.1.1. Anal cleaning material:

People differ in their use of cleaning materials after defecation. Some use paper, some use vegetable material, stones, and others use water. The inappropriate disposal of cleaning material in a toilet can cause problems. Drainage system for water closet (WC) cannot cope with large amounts of toilet paper, so this has to be collected separately in a bin for later disposal by burning. Elsewhere WCs have rapidly been rendered useless by people trying to dispose of stones or maize cobs in the toilet.

Dry systems can take all kinds of paper and solid objects and still function well. As mentioned above a dry system can even be adapted to cope with the use of water for anal cleaning.

During the process in a composting toilet paper breaks down, but not in a dehydrating toilet – the paper does not decompose. This paper will, however, break down during secondary processing if the process used is composting or carbonization/ incineration.

Non-biodegradable materials, including tampons and sanitary pads, shall not be disposed in the faecal chamber in any case. Separate collection bins shall be provided in the toilet for this purpose.

#### 4.1.2. Absorbents and bulking agents:

Absorbents such as ash, lime, sawdust, husks, crushed dry leaves; peat moss and dry soil are used to reduce smells, absorb excess moisture, and make the pile less compact as well as less unsightly for the next user. Absorbents should be added immediately after defecation in order to cover the fresh faeces. They are used in both dehydrating and in composting toilets.

Bulking agents such as dry leaves, twigs, coconut fibre and wood shavings are used in composting toilets to make the pile less compact and allow air to enter and filter through the heap.

#### 4.1.3. How to use the *falevātīe*:

Users must be clearly explained about the steps involved in using the *falevātīe*. The concept and advantage of separation of faeces, urine and wash water must be explained in detail. In addition, functioning of every component of the *falevātīe* must be explained to the user in detail.

The following steps should be taken every time when using the *falevātīe*

- Defecate in the faeces hole/ toilet pan as provided
- Use toilet paper or the recommended materials
- Small quantity of additives such as ash, soil or dry leaves must be added to faeces chamber after every use of the toilet.
- Lid of faeces drop hole/ toilet pan must always be covered when not in use.
- Toilet seats must only be wiped with dry coconut husk or brush with minimal water.
- Doors of the toilets must be kept closed to prevent entry of rain water or any pet animals and insects.

If odour exists in your *falevātīe*, the only method to avoid this is to flush your toilet with half bag of dry bulk and then re used again.

## 4.2. MAINTENANCE

All sanitation technologies require maintenance to function properly. The amount of maintenance that users of *falevātīe* need to do varies a great deal and is influenced as much by the organisation of operation and maintenance as by the design of the *falevātīe* devices.

Good system design can minimize the need for intensive maintenance, and the tasks required need not be onerous. For example, systems that rely on composting often require the regular addition of bulking agents and periodic checking to ensure that vent pipes are not blocked by debris, spider webs or nesting insects. Some systems may require the transfer of partially processed solids to a secondary processing area. Many systems require that the toilet seat be closed-off when not in use.

All systems require periodic inspection and removal of the end products. The following reminders should be taken seriously;

- Careful and judicious use of water in the *falevātīe* is recommended.
- It is advisable not to have provision of running water in the *falevātīe*.
- Vent pipe should be periodically checked for blockage and cleared.
- Access vents of faeces chambers must be sealed properly and no leakage from it or into it should be allowed.
- Water should never be allowed to enter faeces collection chamber.
- If accidentally or by mistake water is added to faeces chamber, sufficient quantity of additive must be added to soak the excess water.
- Rainwater should not be allowed to enter the toilet or faeces chambers. Check whether doors or ventilators are installed properly to prevent entry of rainwater into the toilet.
- Wash water beds/soak pit must be maintained properly to dispose of the wash water generated.
- In case insects like cockroaches are found in faeces chamber, dry powdered neem leaves and turmeric powder may be used to control the same. No chemicals should be used for such operations.
- Regular inspection of the systems installed is a must for identifying the problems before they get worse.
- Periodic maintenance of *falevātīe* pan and wash water disposal pipes is required to prevent clogging of the systems.
- Repairs can occur to the systems installed due to wear and tear over a period of use. Therefore, assistance of technicians who are trained to repair these must be made available.

---

## Appendix A: Construction Manual Approval

The undersigned acknowledge they have reviewed the *falevātīe* **Construction Manual** and agree with the approach it presents. Changes to this **Construction Manual** will be coordinated with and approved by the undersigned or their designated representatives.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Print Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Role: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Print Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Role: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Print Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Role: \_\_\_\_\_

## APPENDIX B: REFERENCES

The following table summarises the documents referenced in this document.

Document Name	Description and Version	Location
<i>Basic Construction Training Manual for Trainers</i>	Skat Foundation – Version 1, 2004	<a href="http://www.skat.ch">http://www.skat.ch</a>
<i>Building System for Modular Housing</i>	Force 10 Engineered Building Systems for the World – Version 2, 2003	<a href="http://www.force10.com.au">http://www.force10.com.au</a>
<i>Construction of Ecological Sanitation latrines</i>	WaterAid Nepal – Version 1, 2011	<a href="http://www.nepal.wateraid.org">http://www.nepal.wateraid.org</a>
<i>Construction Manual for Australia</i>	TRIBOARD – Version 5, 2002	<a href="http://www.triboard.com">http://www.triboard.com</a>
<i>Details for Conventional Wood Frame Construction</i>	America Wood Council – Version 1, 2001	<a href="http://www.awc.org">http://www.awc.org</a>
<i>Ecological Sanitation – Practitioner’s Handbook</i>	UNICEF India – Version 1, 2011	<a href="http://ddws.nic.in">http://ddws.nic.in</a>
<i>Home Building Manual Tuvalu</i>	AUSTIN Pacific Building Standards – Version 1, 1990	Public Works Department, Funafuti
<i>Masonry Home Construction Manual</i>	Firth – Version 1, 2008	<a href="http://www.firth.co.nz">http://www.firth.co.nz</a>

## APPENDIX C: KEY TERMS

The following table provides definitions for terms relevant to this document.

<b>Term</b>	<b>Definition</b>
<b>Building</b>	<i>A building provides shelter against natural elements such as rain, sunshine and wind. It also provides security and privacy.</i>
<b>Foundation</b>	<i>A foundation is necessary to evenly distribute the entire building load on the soil in such a manner that no damaging settlements take place. Hence, the foundations need to be constructed on good/solid ground</i>
<b>Plinth</b>	<i>A plinth is normally constructed just above the ground level and immediately after the foundation. It raises the floor above the ground level and herewith prevents surface water from entering the building.</i>
<b>Polythene Membrane</b>	<i>A plastic sheet lay before reinforcement and concrete is poured. The polythene membrane prevents ground water from rising into the floor.</i>
<b>Floor</b>	<i>This is the surface on which we do most of our activities. Flooring is laid over the filling of the plinth and on subsequent floors.</i>
<b>Walls</b>	<i>Walls are the vertical elements on which the roof finally rests. They can be made of different materials like bricks, stones, concrete blocks, timbers etc. Walls provide privacy and enclosure. Walls also provide security and protection against natural elements such as wind, rain and sunshine.</i>
<b>Openings</b>	<i>Openings are normally provided in the walls as door, windows and ventilators. Doors provide access; windows and ventilators provide light and ventilation.</i>
<b>Stairs</b>	<i>A stair is a sequence of steps and it is provided to afford the means of ascent and descent between the floors and landings.</i>
<b>Roof</b>	<i>The roof provides protection for the building and the people living in it. The roof rests on the walls and requires proper anchoring so that wind and other mechanical impact cannot destroy it. A roof can have different shapes but it is always either flat or sloping.</i>
<b>Surfaces/ Finishes</b>	<i>External finishes are the outer most layer of protection, which protect the structure from weathering. Internal finishes are the layers given on internal faces. They give durability and pleasing appearance to the inside.</i>
<b>Drainage &amp; Sewerage</b>	<i>This is provided to collect and carry the wastewater away from the building.</i>
<b>Concrete</b>	<i>In its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of portland cement and water, coats the surface of the fine and coarse aggregates. Through a chemical reaction called hydration, the paste hardens and gains strength to form the rock-like mass known as concrete.</i>
<b>Reinforced Concrete</b>	<i>Concrete with steel bars embedded in it to improve the load carrying capacity of the structure. The steel is placed in the concrete that is subjected to tension but also to avoid cracks due to shrinking.</i>
<b>Mortar</b>	<i>Mortar may be defined as a material composed of fine aggregate and cement, which forms a hardened mass after mixing with water. It is used in the beds and side joints of masonry work, in order to bind the stones, bricks or blocks together and distribute the pressure throughout the block-work.</i>

## APPENDIX D: SCHEDULE OF MATERIALS

<i>item</i>	<i>description</i>	<i>unit</i>	<i>quantity</i>
<b>1</b>	<b>concrete works</b>		
1.1	40kg cement bags	bags	20
1.2	sisulation foil	mtrs	4
<b>2</b>	<b>reinforcement</b>		
2.1	D16 reinforcing rods @ 6mtrs long	lgths	6
2.2	D10 reinforcing rods @ 6mtrs long	lgths	10
2.3	F665 mesh wire	sht	1
2.4	Dyna bolt M6 4"	pcs	8
<b>3</b>	<b>blockworks</b>		
3.1	400 x 200 x 150mm thick standard concrete blocks	pcs	115
<b>4</b>	<b>timber works</b>		
4.1	220 x 20 dressed timber (fascia boards) @ 6mtrs long	lgths	3
4.2	200 x 50 dressed timber stairs bearers and treads @ ditto	lgths	2
4.3	100 x 100 dressed timber post @ 6mtrs long	lgths	2
4.4	150 x 50 dressed timber window sill @ 6mtrs long	lgths	2.5
4.5	100 x 50 dressed timber framings @ 6mtrs long	lgths	4
4.6	75 x 50 dressed timber purlins @ 6mtrs long	lgths	21
4.7	50 x 50 dressed timber door frames @ 6mtrs long	lgths	8
4.8	2400 x 1200 x 18mm marine plywood	sht	1
4.9	90 x 20 T&G timber @ 6mtrs long	lgths	8
4.10	2400 x 1200 x 6mm thick hardiflex	shts	3
4.11	2400 x 1200 x 3mm thick Hardboard	shts	3
4.12	2400 x 1200 x 3mm thick exterior plywood	shts	9
4.13	2400 x 1200 x 3mm door ply	shts	2
<b>5</b>	<b>fixings and ironmongery</b>		
5.1	4' galv nails	kg	1
5.2	3' ditto	kg	1
5.3	hardiflex nails	kg	1
5.4	4 blades louvre frames	pairs	6
5.5	clear louvre glass @ 600mm long	pcs	16
5.6	M16 bolts @ 250mm long	pcs	6
5.7	M12 bolts @ 150mm long	pcs	8
5.8	purlin straps	pcs	6
5.9	door lockset - entrance lock	pcs	1
5.10	3" padlocks complete with screws	pcs	2
5.11	door hinges - brass 4" with screws	pairs	2
5.12	Mosaic tiles - 300 x 300mm sheets - blue	pcs	40
5.13	Ceramic wall tiles -150 x 150mm	pcs	270
5.14	Waterproof adhesive for floor and wall ceramic tiles - 20kg bags	bags	1
5.15	Waterproof grout for ceramic tiles - white - 10kg bags	bags	1

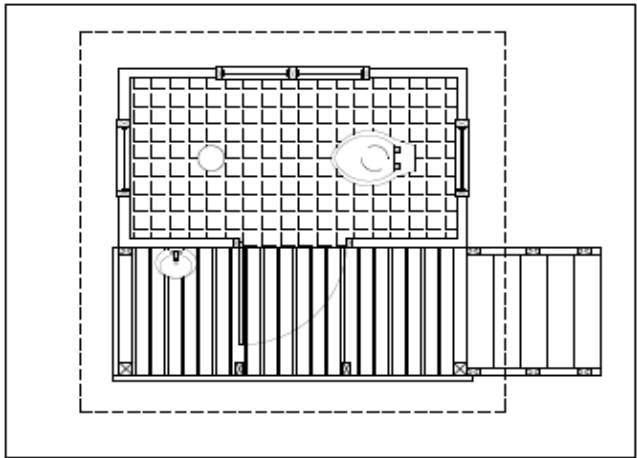


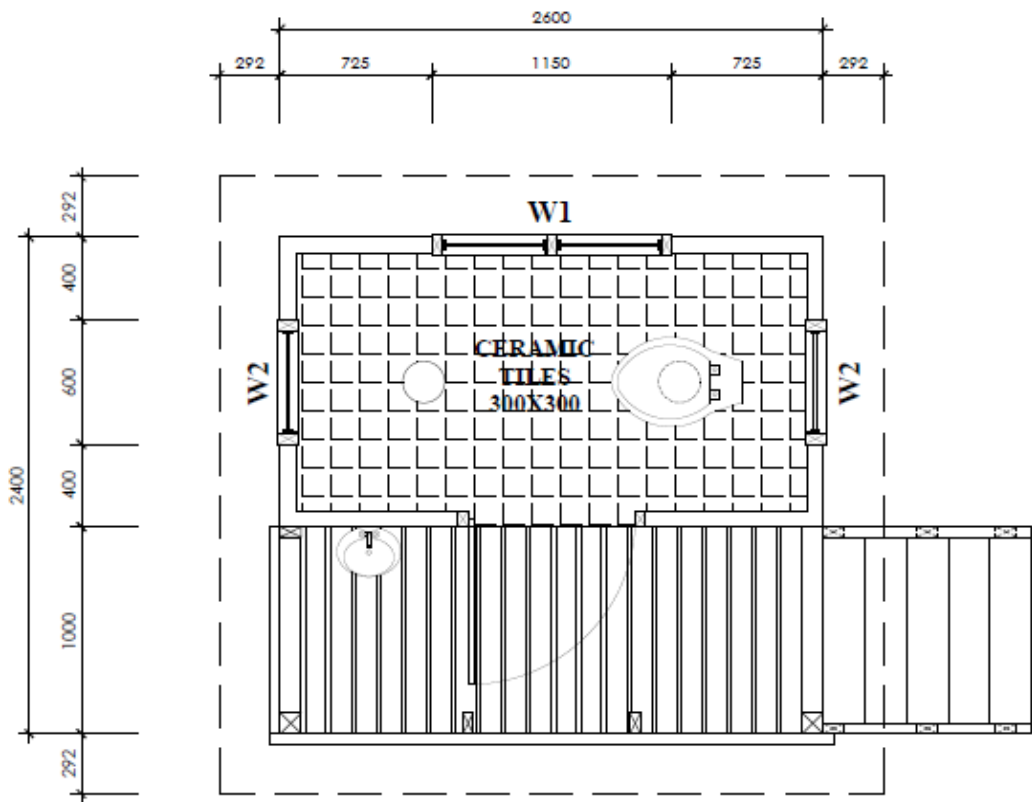
<b>6 roofing works</b>			
<b>6.1</b>	10' roofing irons	shts	5
<b>6.2</b>	standard end flashings - 2.4m long	lgths	3
<b>6.3</b>	roofing nails	pcs	40
<b>6.4</b>	washers for roofing nails	pcs	40
<b>6.5</b>	quadrant gutters - 6mtrs long	lgths	1
<b>6.6</b>	gutter brackets	pcs	7
<b>6.7</b>	gutter outlets	pcs	1
<b>6.8</b>	stop end - left	pcs	1
<b>6.9</b>	stop end - right	pcs	1
<b>6.10</b>	flat head nails	pcs	20
<b>6.11</b>	80mm down pipe - 6mtrs long	pcs	1
<b>6.12</b>	elbow - 80mm	pcs	2
<b>7 painting works</b>			
<b>7.1</b>	paradise blue ( Water paint)	cans	1
<b>7.2</b>	coconut brown (Water paint)	cans	1
<b>7.3</b>	coconut black ( Water paint)	cans	1
<b>7.4</b>	sealer paint	cans	3
<b>8 plumbing</b>			
<b>8.1</b>	pedestal	pcs	1
<b>8.2</b>	50mm ventilation pvc pipe	length	2
<b>8.3</b>	ventilation cap	pcs	2
<b>8.4</b>	Hand basin ( Blastic type) complete set 40mm	pcs	1
<b>8.5</b>	100mm pvc tee	pcs	4
<b>8.6</b>	100mm pvc bend	pcs	4
<b>8.7</b>	Inspection opening caps 100mm	pcs	4
<b>8.8</b>	pallet pvc tray	pcs	2
<b>8.9</b>	40mm pvc drainage	length	20
<b>8.10</b>	15mm pvc pipe	length	15
<b>9 electrical</b>			
<b>9.1</b>	TPS wire 1.5"	metres	5
<b>9.2</b>	conduit elbow 20mm	pcs	2
<b>9.3</b>	WP double switch (one gang light switch. water proof)	pcs	1
<b>9.4</b>	battern holder water proof	pcs	2
<b>9.5</b>	bulb 20W energy saver	pcs	2
<b>9.6</b>	wall box	pcs	1
<b>9.7</b>	20mm conduit pipe	length	1
<b>9.8</b>	conduit saddle 20mm	pcs	8
<b>9.9</b>	conduit tee 20mm	pcs	1
<b>9.10</b>	adaptor lock ring 20mm conduit	pcs	1

**APPENDIX E: CONSTRUCTION DRAWINGS**

**COMPOST TOILET**

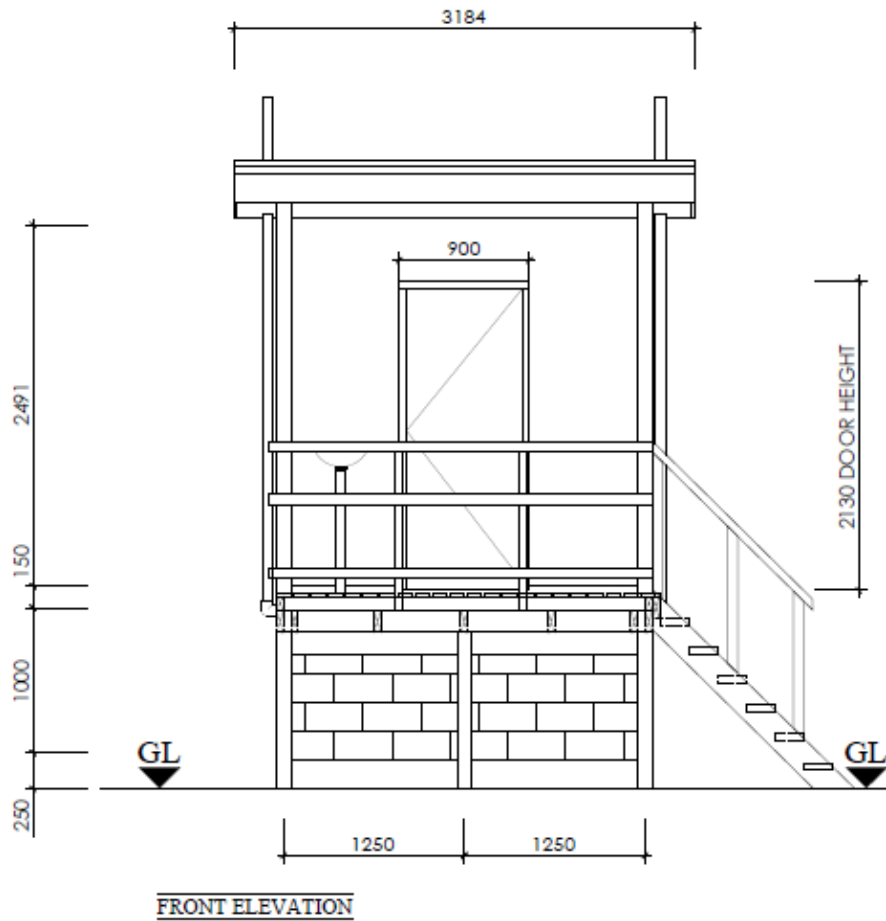
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- L02 FRONT ELEVATION
- L03 REAR ELEVATION
- L04 SIDE ELEVATION
- L05 SIDE ELEVATION 1
- L06 CROSS SECTION
- L07 ROOF LAYOUT
  
- A01 RAFTER DETAIL
- A02 WASTER CHAMBER DOOR & STAIRS
- A03 WALL FRAMES
  
- ST01 CHAMBER REINF. BARS
- ST02 CHAMBER DETAIL
- ST03 CONCRETE BLITH AND CHUTE DETAIL
  
- SH01 DOOR & WINDOW SCHEDULE



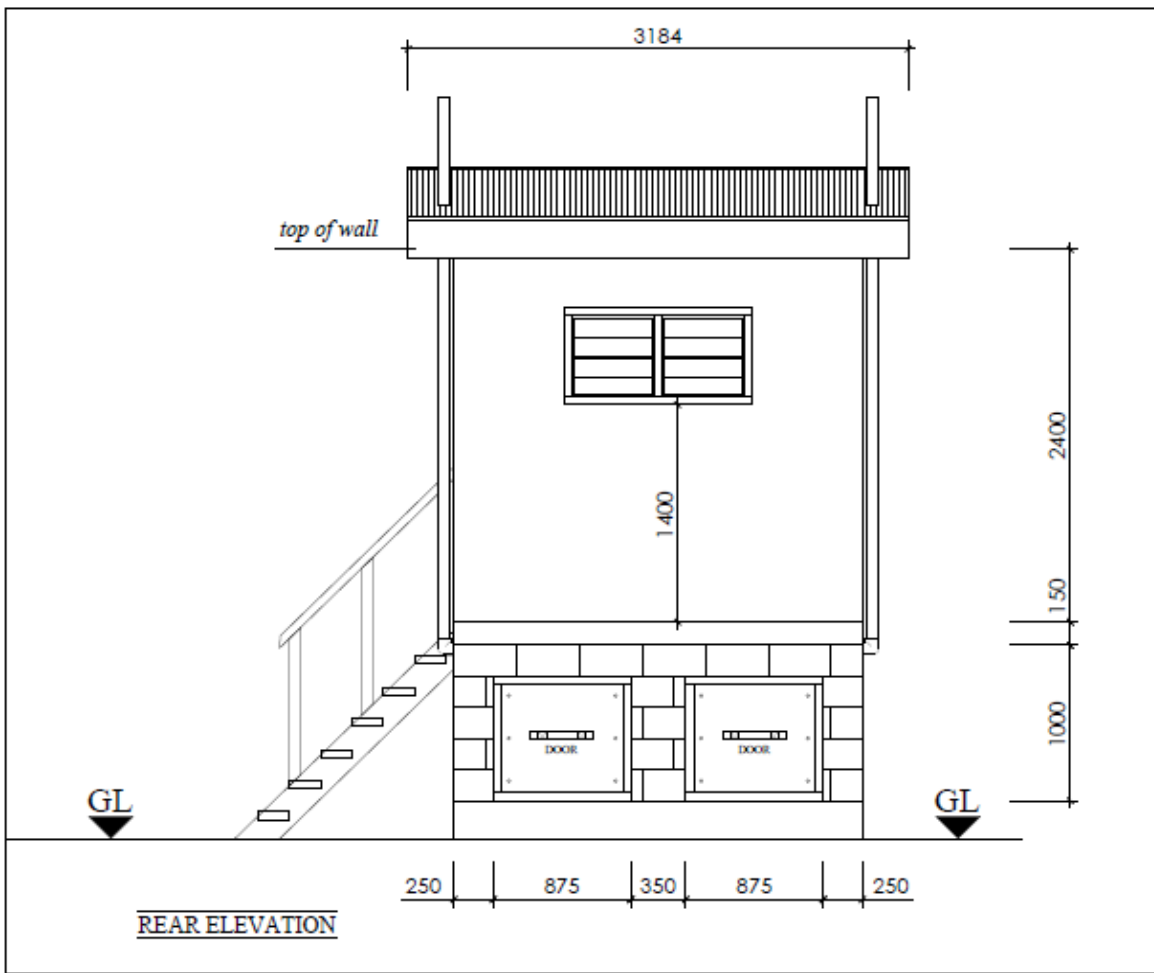


**FLOOR PLAN**

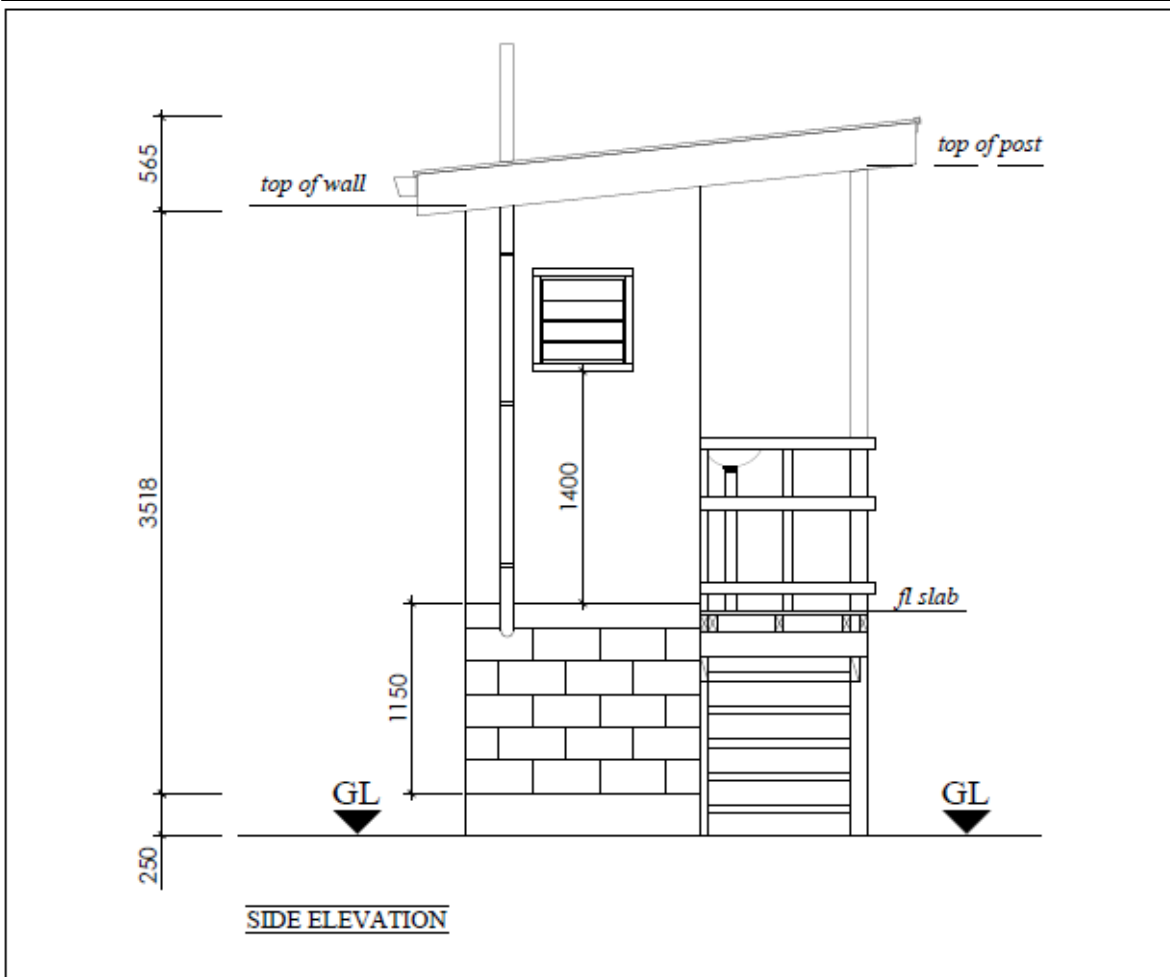
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Sheet No:	Block:	Sheet No:
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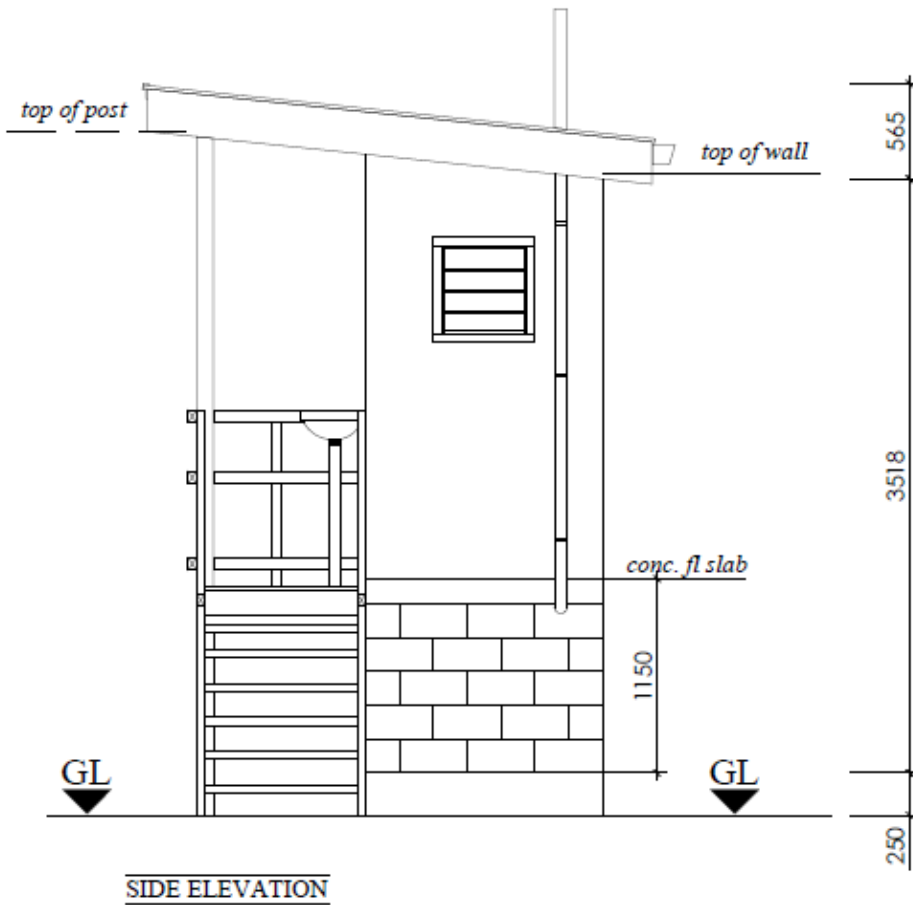
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Project Title: COMPOSTING TOILET		
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Scale:	Author:	DSU
Nts	Checker:	KM
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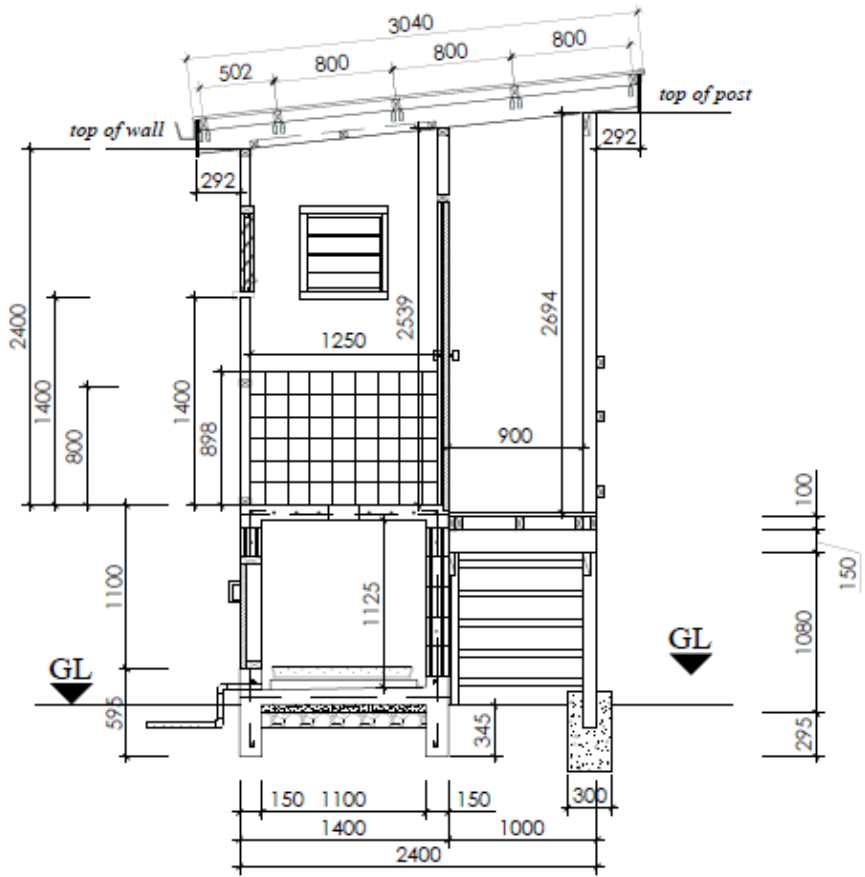
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Project Title: COMPOSTING TOILET		
Drawing Title: REAR ELEVATION		
Scale:	Author:	DSU
Nts:	Checker:	KM
Approval for construction:		
Date:	Division:	DSU
06/04/10		
Project No.:		
Sheet No.	Revision	Sheet No.
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<i>Client</i>		
IWRM PROJECT		
<i>Project Title</i>		
COMPOSTING TOILET		
<i>Drawing Title</i>		
SIDE ELEVATION		
<i>Scale</i>	<i>Author</i>	<i>Division</i>
Nts	DSU	DSU
	<i>Checker</i>	EM
<i>Approved for construction</i>		
<i>Date</i>	<i>Division</i>	
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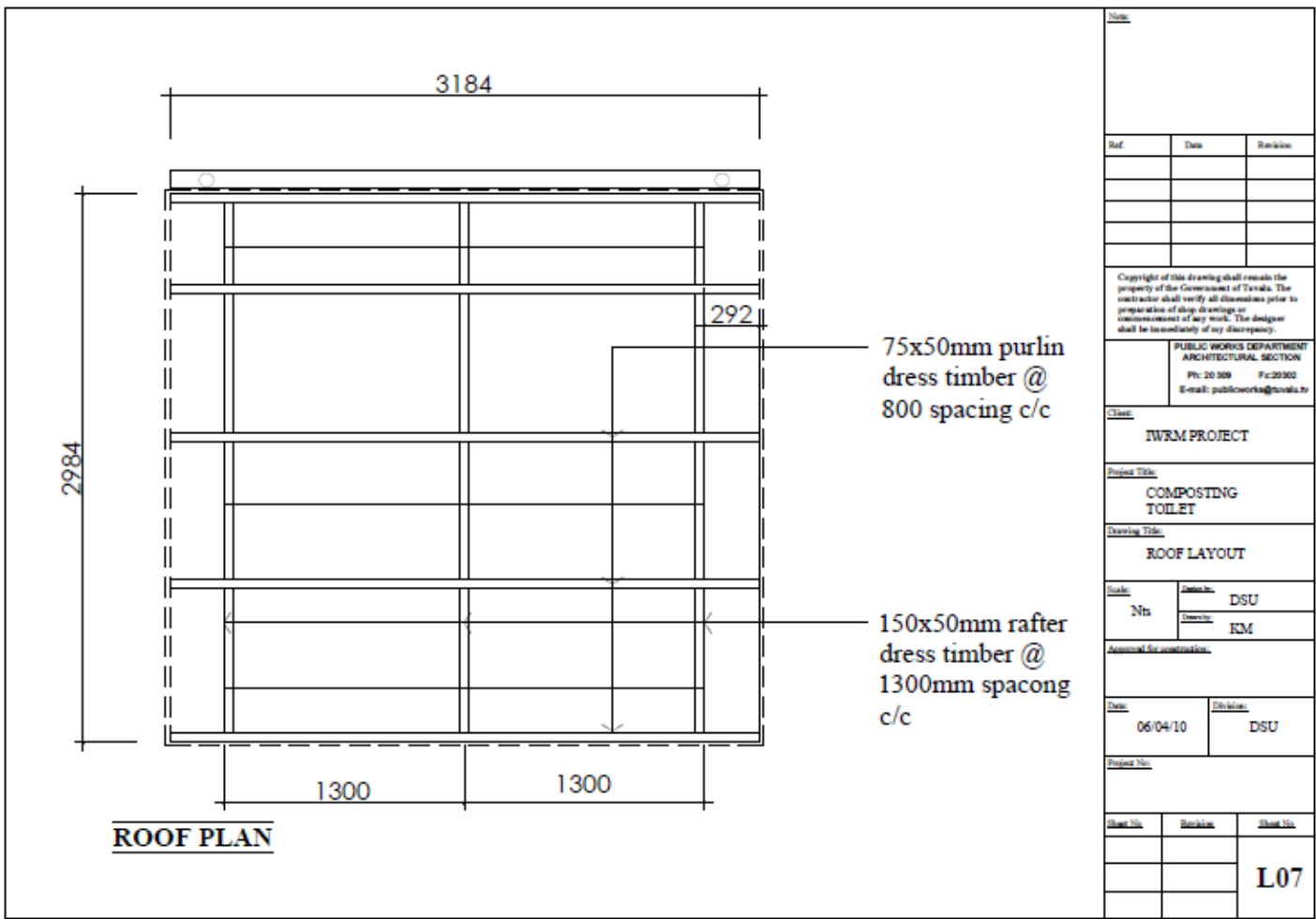
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Project Title:		
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Drawing Title:		
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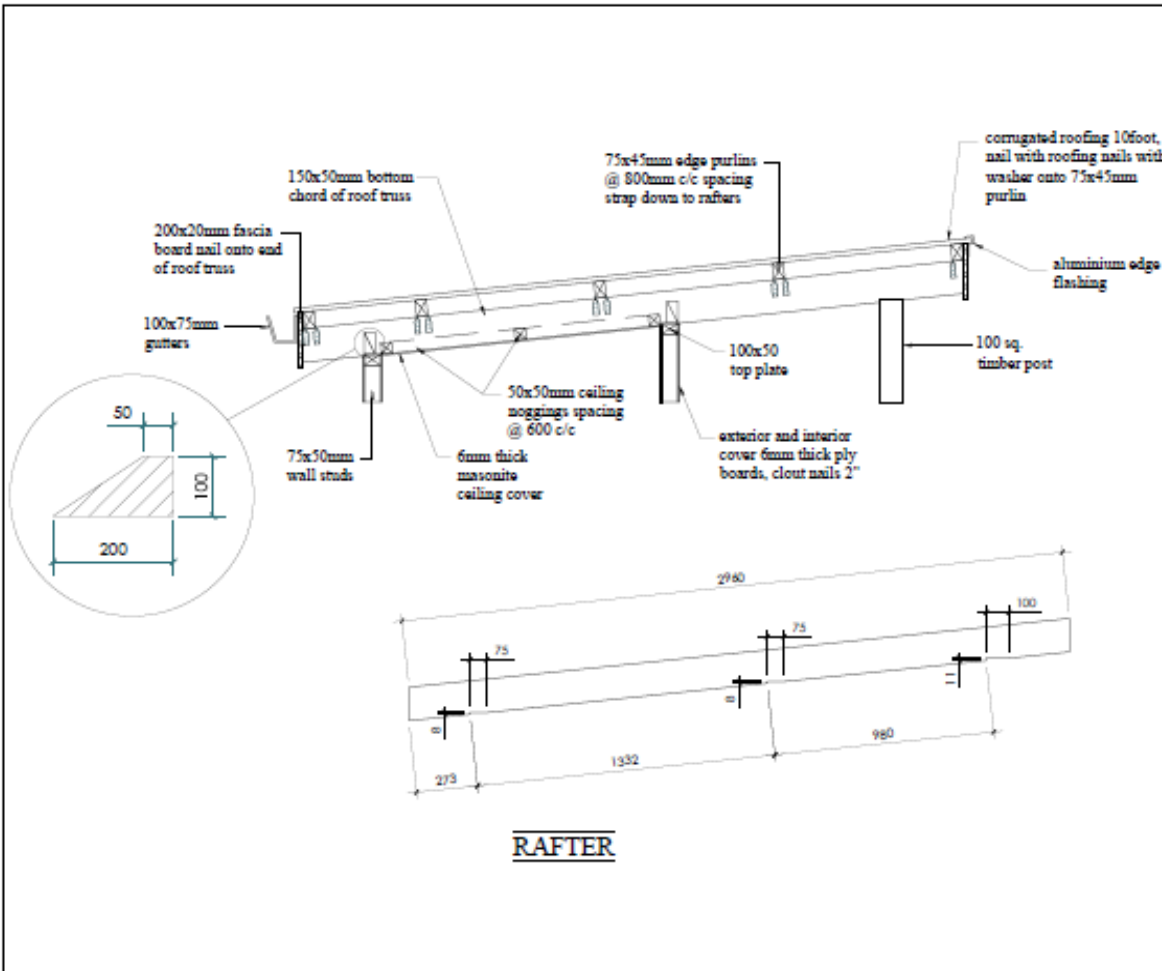
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Project Title		
COMPOSTING TOILET		
Drawing Title		
CROSS SECTION		
Scale	Drawn by	DSU
Nts	Checked by	KM
Approved for construction		
Date	Division	DSU
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Project No.		
Sheet No.	Revision	Sheet No.
		L06





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<p><b>Class:</b> IWRM PROJECT</p>		
<p><b>Project Title:</b> COMPOSTING TOILET</p>		
<p><b>Drawing Title:</b> ROOF LAYOUT</p>		
<p><b>Scale:</b> Nts</p>	<p><b>Author:</b> DSU</p>	<p><b>Checker:</b> EM</p>
<p><b>Approved for construction:</b></p>		
<p><b>Date:</b> 06/04/10</p>	<p><b>Division:</b> DSU</p>	
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<p><b>Sheet No.:</b></p>	<p><b>Revision:</b></p>	<p><b>Sheet No.:</b> <b>L07</b></p>



Revisions		
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 Email: publicworks@ps.gov.su

**Client:**  
IWRM PROJECT

**Project Title:**  
COMPOSTING TOILET

**Drawing Title:**  
RAFTER DETAIL

<b>Scale:</b> Nts	<b>Contract:</b> DSU
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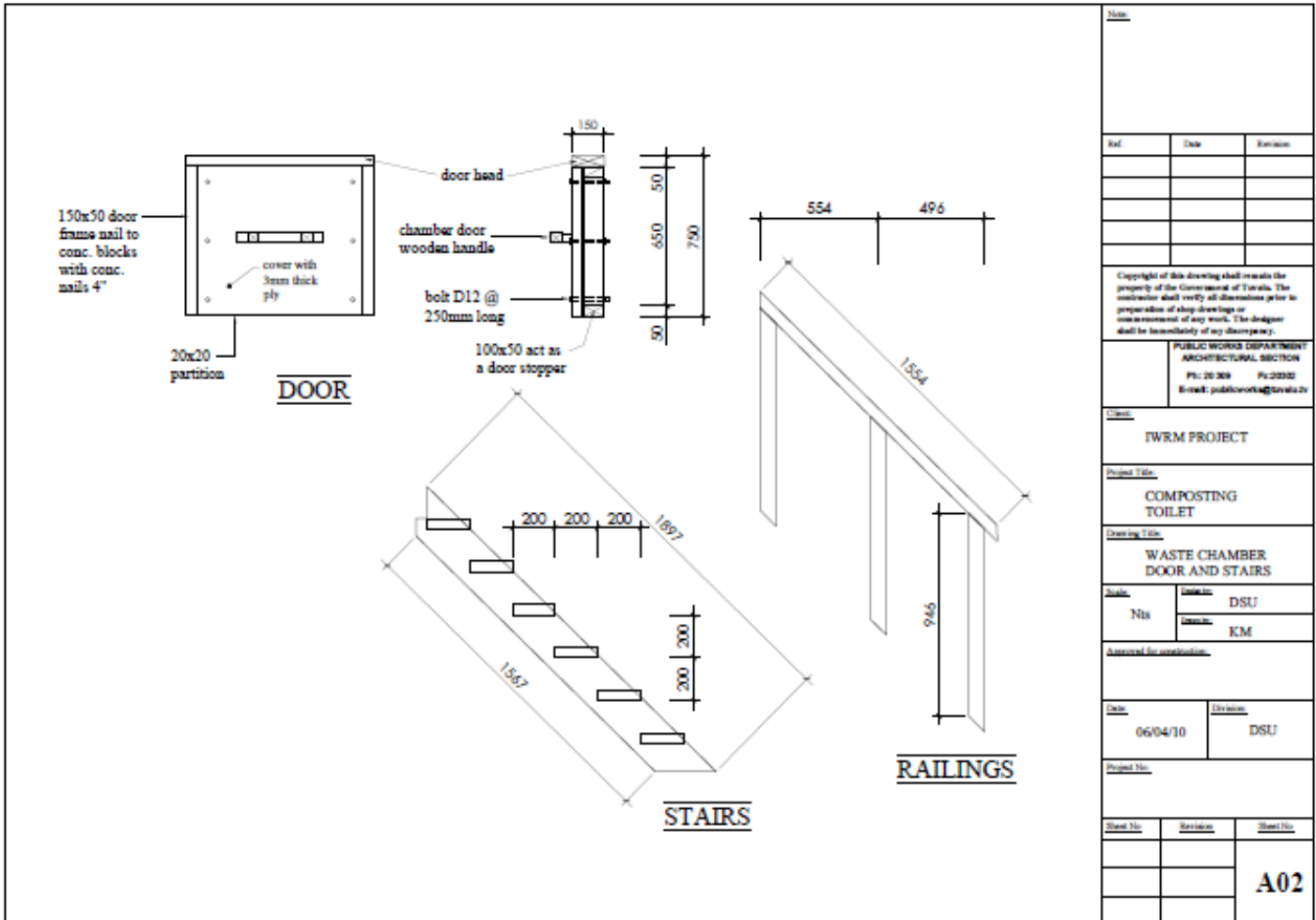
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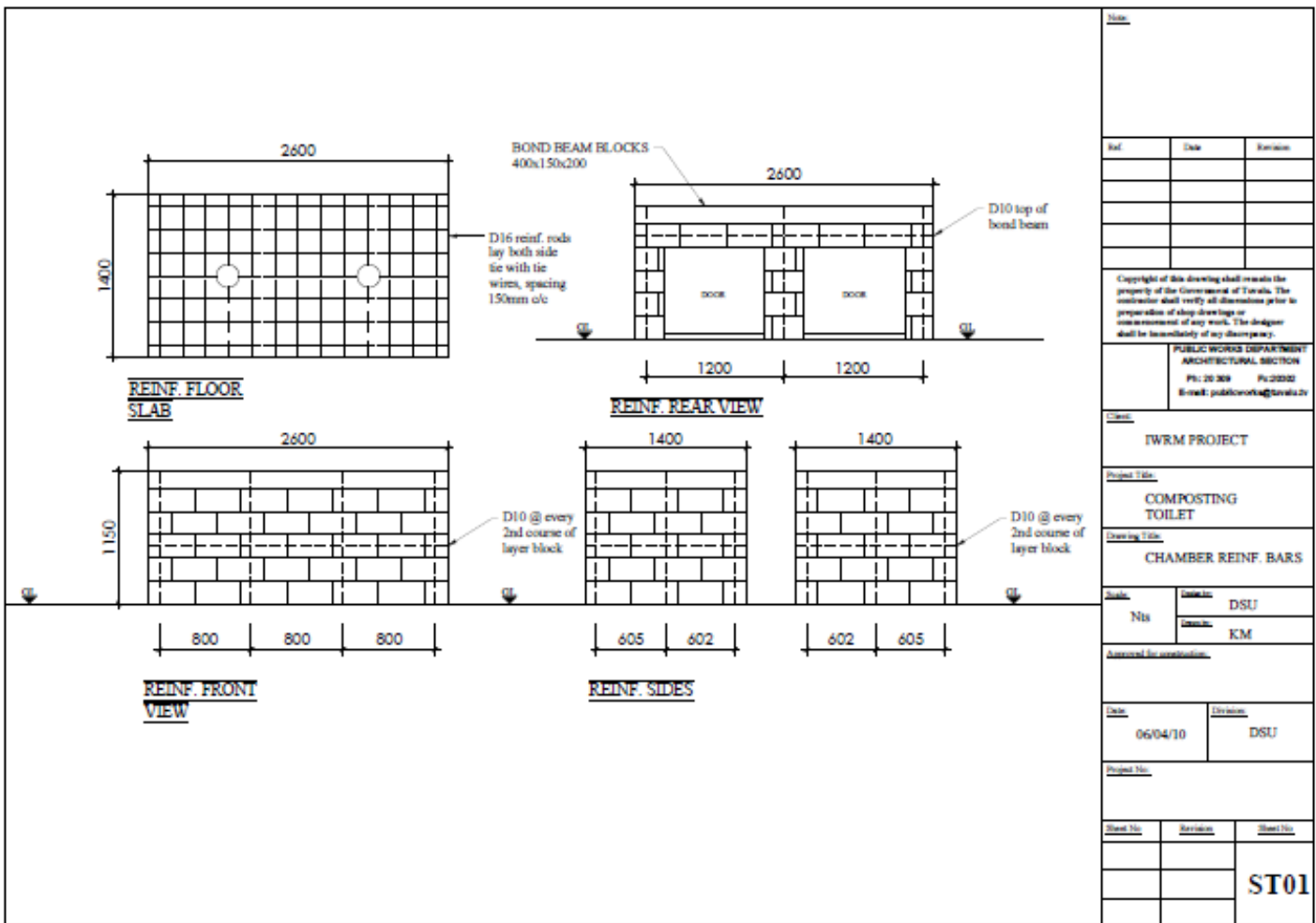
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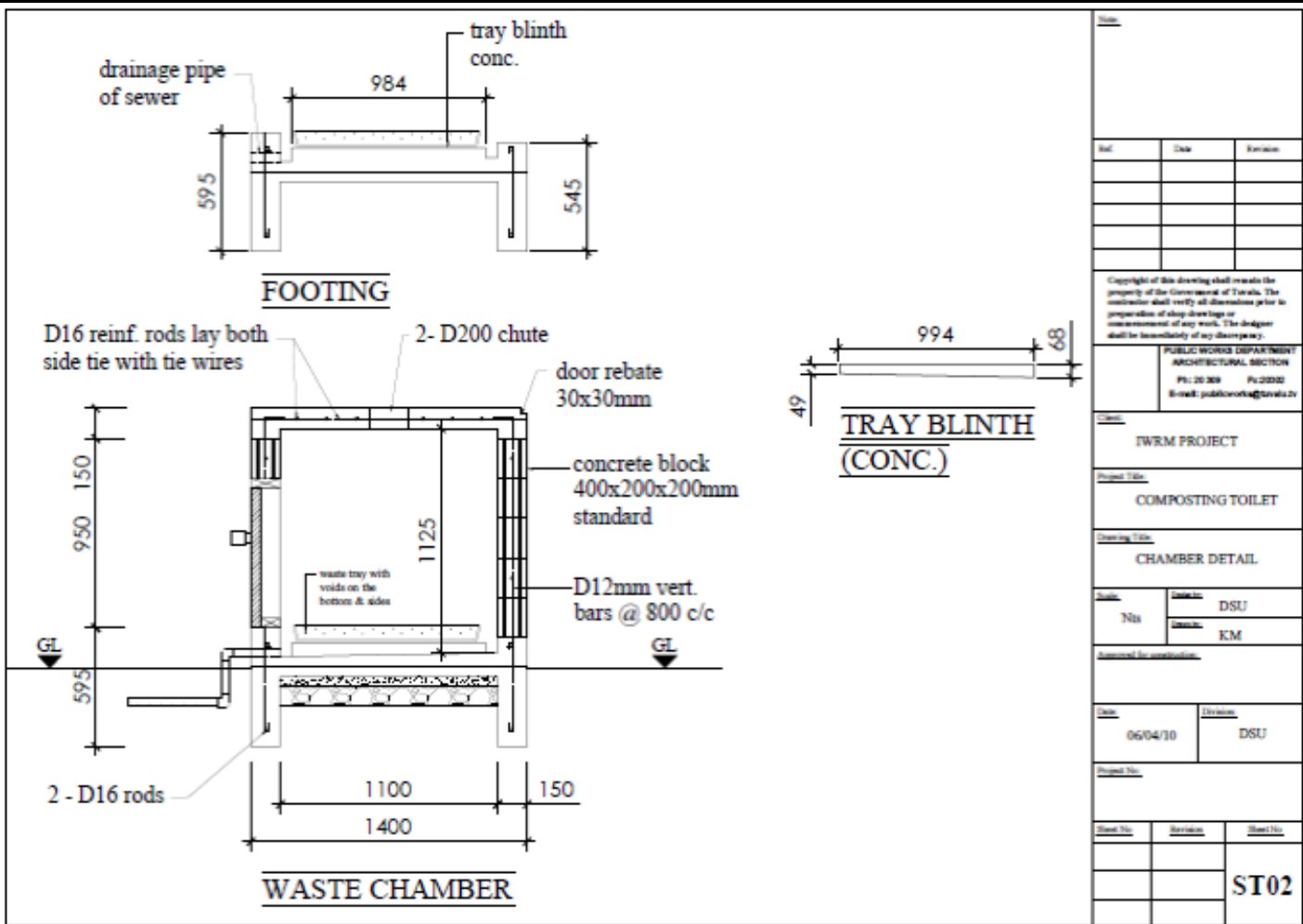
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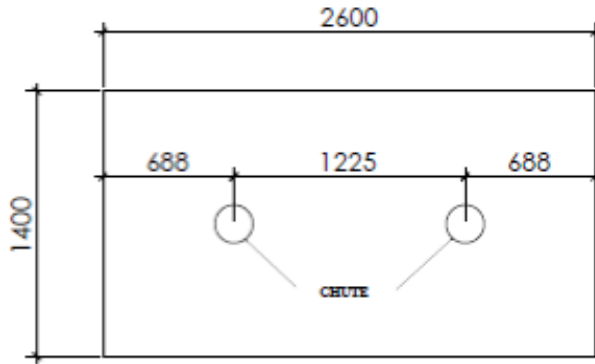




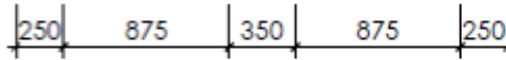
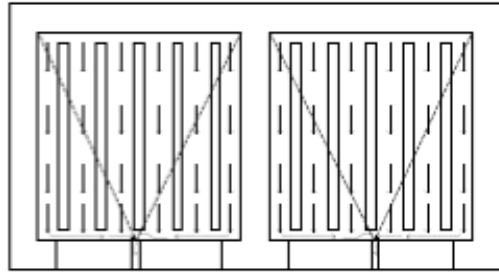




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Client		
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Project Title		
COMPOSTING TOILET		
Drawing Title		
CHAMBER DETAIL		
Scale		DSU
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Approved for construction		
Date		Division
06/04/10		DSU
Sheet No.		
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**CONC. SLAB**

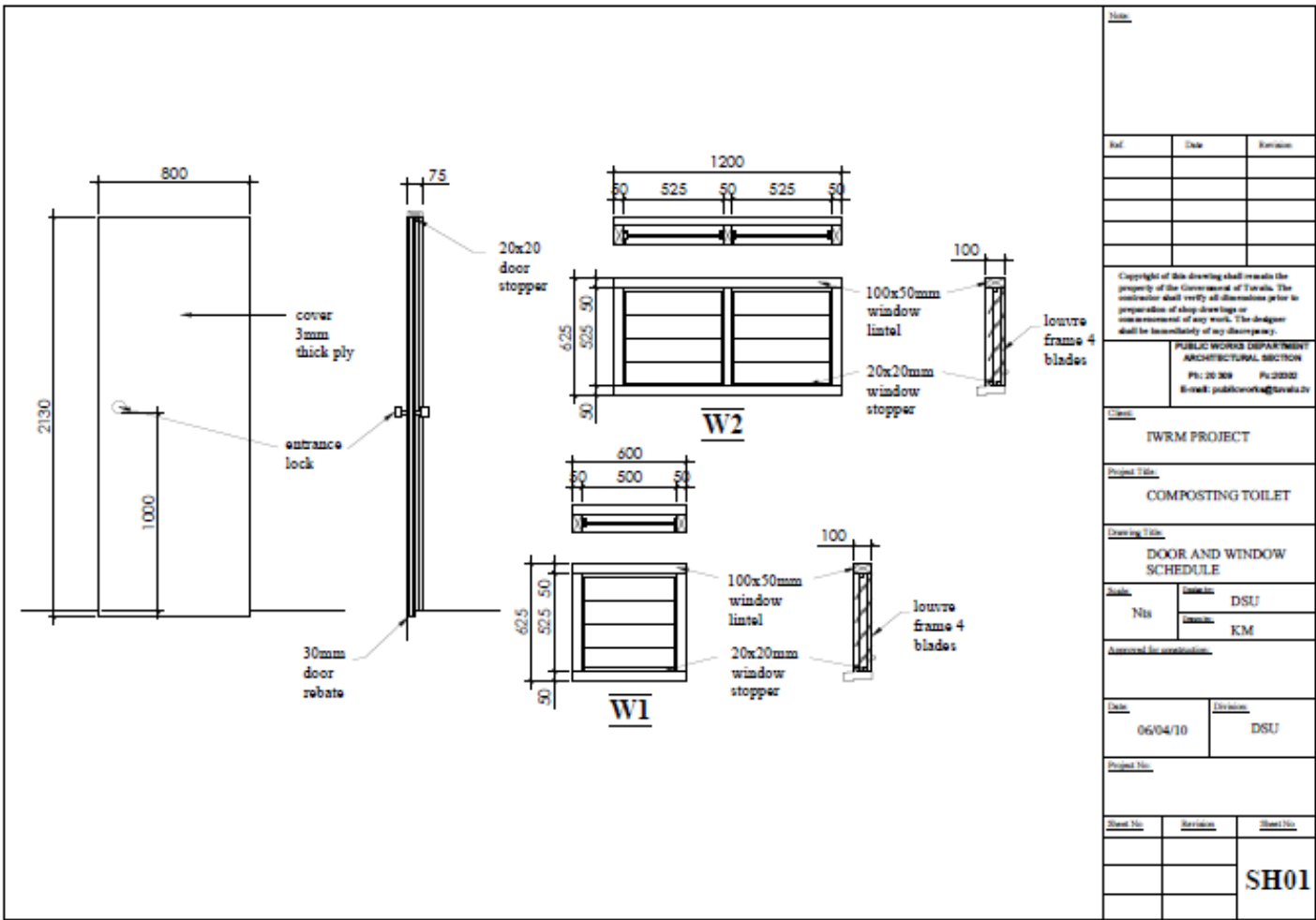


**CONC. BLINTH**

**NOTE:**

- THE ARROWS INDICATE THE FLOW OF WATER TO THE DRAINAGE PIPE
- THE WASTE WATER IS THEN DRAIN INTO A SOAK PIT

Title		
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Project Title: COMPOSTING TOILET		
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Nbs		DSU
		KM
Approved by construction:		
Date:		Division:
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Project No:		
Sheet No:	Revision:	Sheet No:
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Client		
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Project Title		
COMPOSTING TOILET		
Drawing Title		
DOOR AND WINDOW SCHEDULE		
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N/A	DSU	KM
Approved for construction		
Date	Division	
06/04/10	DSU	
Project No.		
Sheet No.	Revision	Sheet No.
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