HOW TO BUILD AN ACCESSIBLE ENVIRONMENT IN DEVELOPING COUNTRIES

Based on the Cambodia Program's experience

Manual #2 - Access to water and sanitation facilities

Part 1 – Toilets and closed showers

Handicap International

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Table of contents

Introduction

This booklet is part of a set called "How to build an accessible environment in developing countries" and represents the first technical manual. Because of its technical content, this manual aims to be used mainly by Ministries, NGOs, DPOs and more in particular technicians (engineers, architects, building companies, NGOs with technical background...). People without specific technical knowledge can use it for learning more about standards, general principles; drawings and pictures will enhance their general understanding.

In this part of the manual, we will focus on how to build accessible water and sanitation (or watsan) facilities, which comprise toilets, closed showers, washing areas and access to clear water. Such facilities are very important, not only to PwD but to everyone because they constitute a component of our everyday life. Several reasons support the fact that every watsan infrastructure should be constructed accessible to anyone:

- For dignity reasons: PwD should not rely on everyone (not even their family) for their intimate needs.
- For health reasons: being able to access clear water, toilets and washing areas easier, PwDs will need to spend less time to maintain or even increase their hygiene.
- For economic reasons: the time spent to have access to watsan facilities (by PwD and their families) is potentially some time that can be used to participate in social or economic life.

Moreover, access to water is a human right, as it underlined in the Article 25 of the UN Declaration of Human Rights and in the Article 27 of UN Convention on the Rights of the Child. As for the previously mentioned UN Convention on the Rights of People with Disabilities, access to clean water services is marked as a right in the article 28 (adequate standard of living and social protection).

In this booklet on water and sanitation facilities, we will

present various solutions for building accessible toilets and accessible closed showers. The next one will focus on accessible washing areas (either with a water pump or with a water tank) and accessible water points at lakes and rivers. Each time, the construction method and materials will be described using technical drawings and accompanied by key comments and remarks. Pictures of examples in Cambodia or 3-dimensional drawings showing the final buildings will also be presented. This will help to gain a better understanding of the different technical solutions on offer in this booklet. Sometimes, calculation tables are proposed in a 'ready-to-use' table format: the reader will have the necessary tool to estimate a specific cost for his/her attempted accessibility solution.

Accessible toilets

In this section, we will present some solutions for building accessible toilets - exterior (the building itself) and interior (layout of toilet, toilet seats, interior space). Making toilets accessible has numerous advantages for the disabled person and his/her family or community:

- For himself or herself: having an accessible toilet will allow him/her to be more independent. The independence, depending on context and individual personality may improve his/her feeling of dignity and self-reliance. The toilet also has the potential to improve his/her health condition as proposed toilets allow for easier handling of hygiene.

- For the wider family/community: it may also improve their health conditions; with accessible toilets being much easier to use also for kids and the eldery; and being less dangerous to use for everyone.

Before developing the technical part, the first thing to point out is: build them as close as possible to the house (or other buildings in case of a public building). Accessibility increases with less distances to be covered. The best case scenario is to build the toilets inside the house/ building.

IMPORTANT
The different solutions presented in this booklet use (if needed) always reinforced concrete by an **iron mesh**, which can be quite **expensive** considering the economic-al context nowadays. Some cheaper solu-tions can be used in order to reinforce the concrete. The best idea would be to rein-force it with **bamboo** (if available in the country). This solution, which is in use in China, is perfectly viable for such small constructions that do not have to support heavy loads.

Nota Bene:

For each technical solution, you will find a clue about its difficulty:

High difficulty

- "High difficulty" means that the construction requires special skills that must have been learnt, such as brickwork, or making reinforced concrete. The whole construction must be supervised by a technician.

Medium difficulty

- "Medium difficulty" means that a part of the construction process will require the intervention of a technician (most probably brickwork and/or concrete), but the remaining can be realized by beneficiaries themselves.

Easy

- "Easy" means that everyone can implement the design proposed. It does not require particular skills.

Constructing toilets – accessible exterior

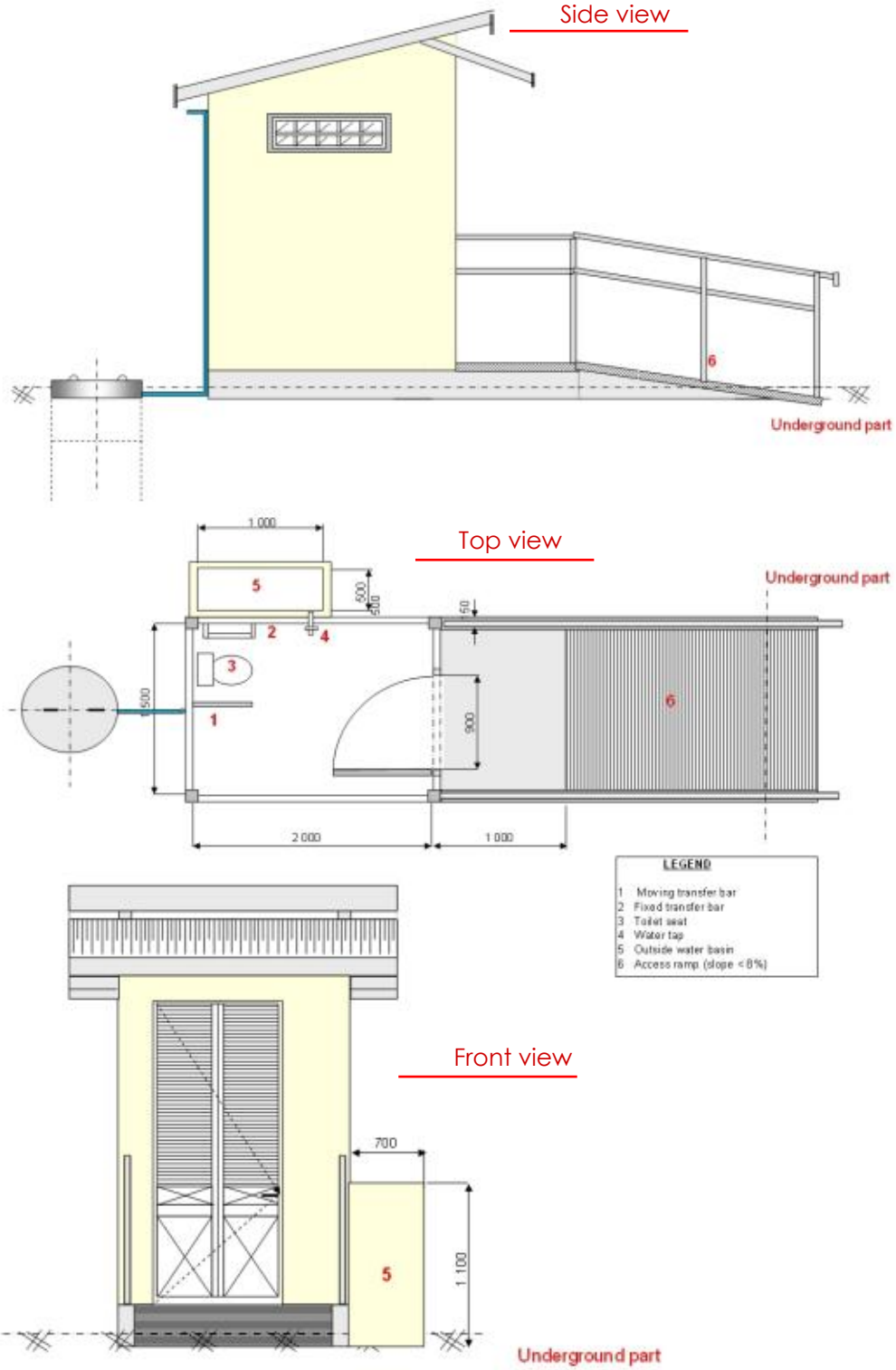
In this part, we will present various solutions for constructing the building itself. These solutions were mostly implemented in Cambodia, while being adapted to the context of various developing countries.

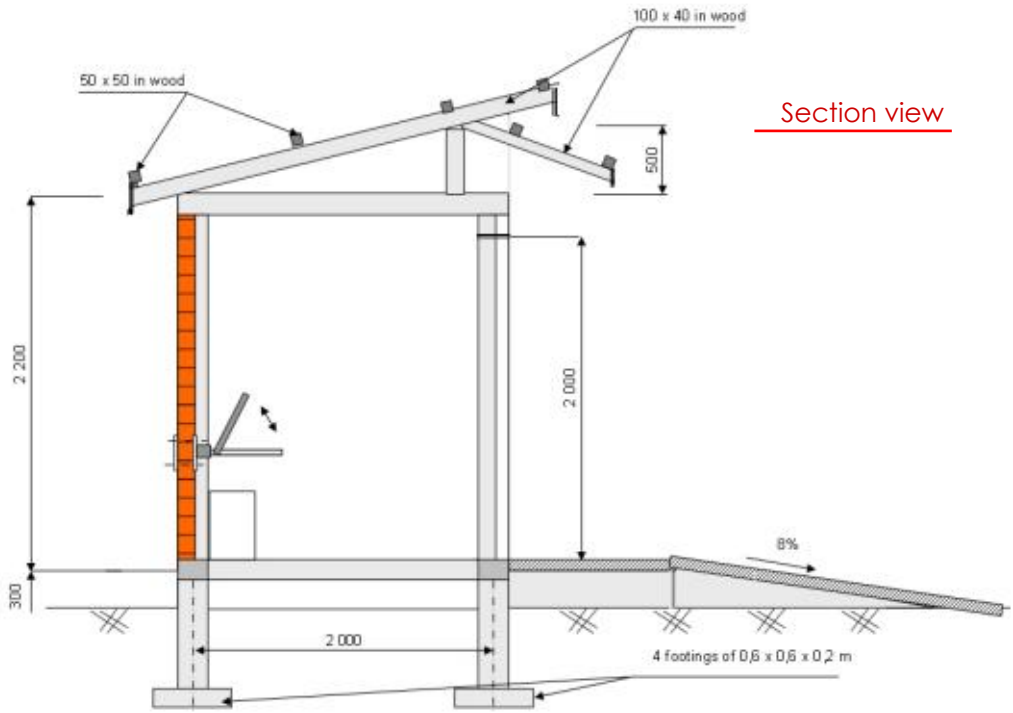
Toilets made of bricks

High difficulty

In terms of durability, the best solution is to construct toilets in concrete and brickwork. The drawback is that it can be quite expensive. Advantages to point out are that the maintenance necessary is reduced and that this type of building is best suited to resist climatic and/or human hazards. The access to the building is granted by a ramp (slope < 8%), equipped with handrails on both sides.

Technical drawings





As you can see on the technical drawings, the foundations of this type of toilets are made up of four columns. They are supported from four footings with dimensions of 0.6x0.6x0.2 m^3. These four columns are supporting a concrete slab constituting the ground of the toilets. Brick walls are built on this slab and hold on a wooden superstructure the roof of corrugated iron.

Construction of a toilets in brickwork, work in progress

Cost estimation

This table sums up all the materials for the building, coupled with the quantity needed. Provided that the reader knows the unit price of these materials in his/her country, he/she will be able to calculate a first cost estimation of this kind of construction (don't forget to add 5% for unexpected costs).

NB: the cost of the access ramp is **not included.**

N°	WORK TYPE	Units	Dimensions				Quantity
			Lgth	Wdth	Ht	Nb.	
	PERMANENT FOUNDATIONS AND WATER BASIN						
1	Foundations excavation for footings	m3	1.00	1.00	0.80	4	3.200
2	Stones 4 x 6 for granular compacted fill under footings	m3	0.80	0.80	0.05	4	0.128
3	Concrete for foundations	m3	0.60	0.60	0.20	4	0.288
4	Beam supporting bricks	m2	9.00	0.50			4.500
5	Random fill	m3	3.00	1.50	0.05		0.225
6	Stones 4 x 6 for granular compacted fill under slab	m3	3.00	1.50	0.05		0.225
7	Blinding concrete	m3	2.00	1.50	0.05		0.150
8	Stones 4 x 6 for granular compacted fill	m2	1.20	0.60	0.05		0.036
9	Bricks 4 holes 100 x 100 x 200 for water basin	m2	3.00		1.00		3.000
10	Coating for water basin	m2	3.00		1.00	2	6.000
	SUPERSTRUCTURE IN REINFORCED CONCRETE						
1	Concrete for column	m3	2.00	0.18	0.18	2	0.130
2	Above beams	m3	7.00	0.20	0.18	1	0.252
3	Concrete on bricks	m3	7.00	0.20	0.18	1	0.252
4	Bricks 4 holes 100 x 100 x 200	m2	2.00	7.00			14.000
5	Bricks coating on both faces	m2	2.00	7.00		1	14.000
6	Brick walls	m2	2.00	0.50		1	1.000
7	Two faces coating	m2	2.00	0.50		2	2.000
8	Paint CaCO3	m2	2.00	0.50		1	1.000
9	Paint CaCO3	m2	2.00	7.00		1	14.000
	WOOD SUPERSTRUCTURE						
1	Wood for roof	m3	3.00	0.10	0.04	2	0.024
2	Wood for roof	m3	1.50	0.10	0.04	2	0.012
3	Wood for roof	m3	2.50	0.05	0.05	6	0.038
	SUPERSTRUCTURE IN CORRUGATED IRON						
2	Roof in corrugated iron	m2	3.00	0.60		5	9.000
2	Roof in corrugated iron	m2	2.00	0.60		5	6.000
3	Nails for corrugated iron	Box				3	3.000
	IRONMONGERY						
1	Anti-termites and fungicidal treatment	Kg				2	2.000
2	Doors hinges	Unit				3	3.000
3	Toilet seat	Unit				1	1.000
4	Septic tank for WC	Unit				1	1.000
5	Water tap and PVC pipes	F.F.					
6	Transfer bars	F.F.					
7	Door lock	F.F.				1	1.000
8	Wooden door	Unit	2.00	0.90		1	1.800
	UNEXPECTED						
	Unexpected 5.00%						
	GENERAL TOTAL						

Building in brickwork

Advantages: sustainable, easy to clean, reduced maintenance

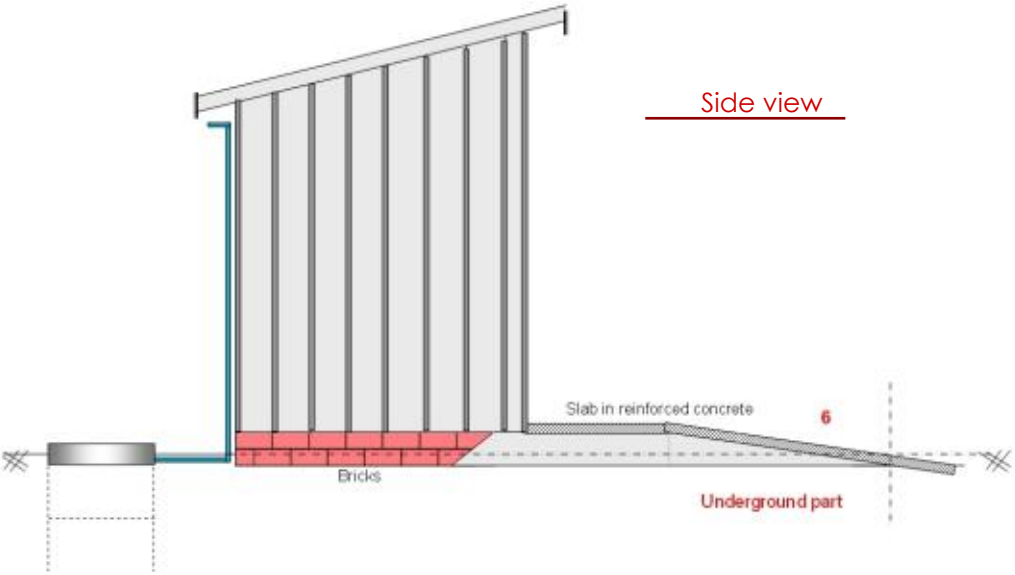
Drawbacks: very expensive, technician mandatory for the construction

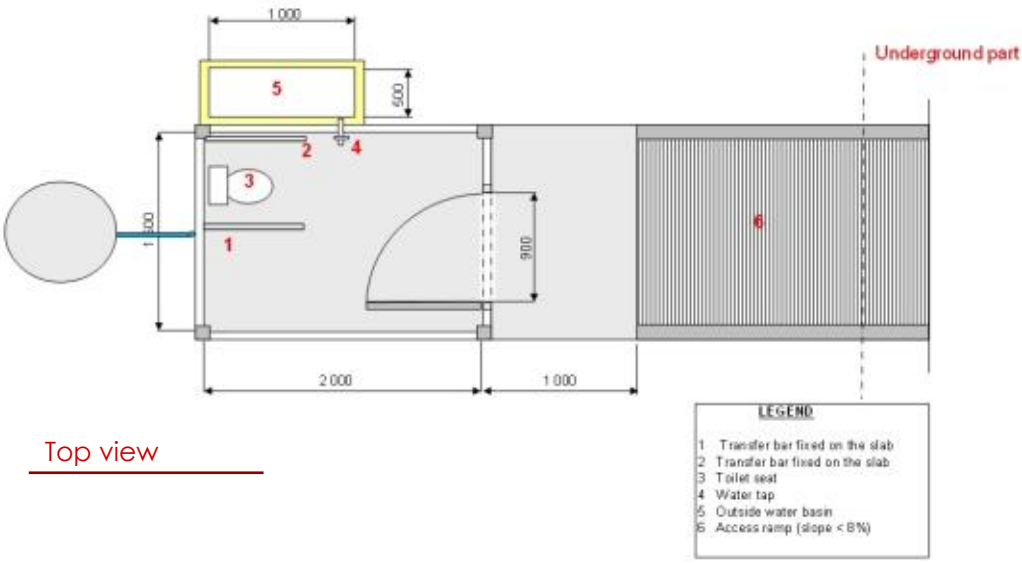
Medium difficulty

Toilets made of wood

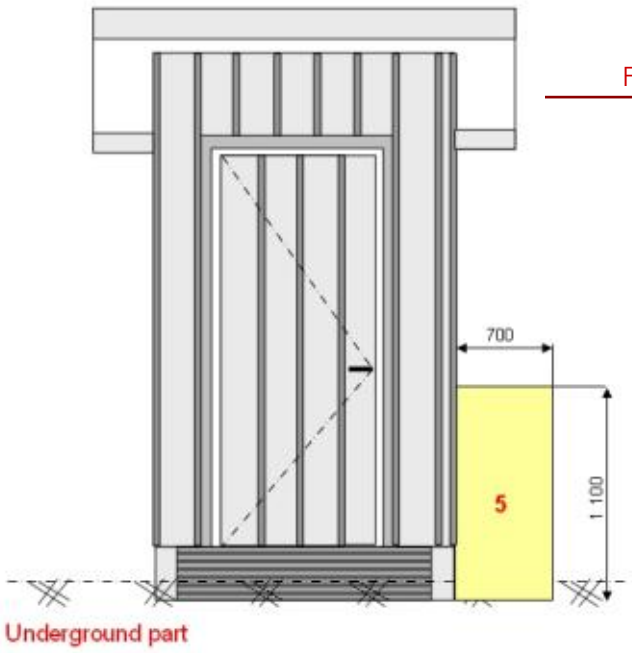
This kind of construction method is slightly different from the previous one, although the result is very similar. The difference is in terms of durability. If the wood is treated, and is well and regularly taken care of, there should be no problem of derogating material. The intervention of a technician will be necessary to build the slab (in brickwork or reinforced concrete), but the beneficiaries should be able to construct the walls and the roof.

Technical drawings





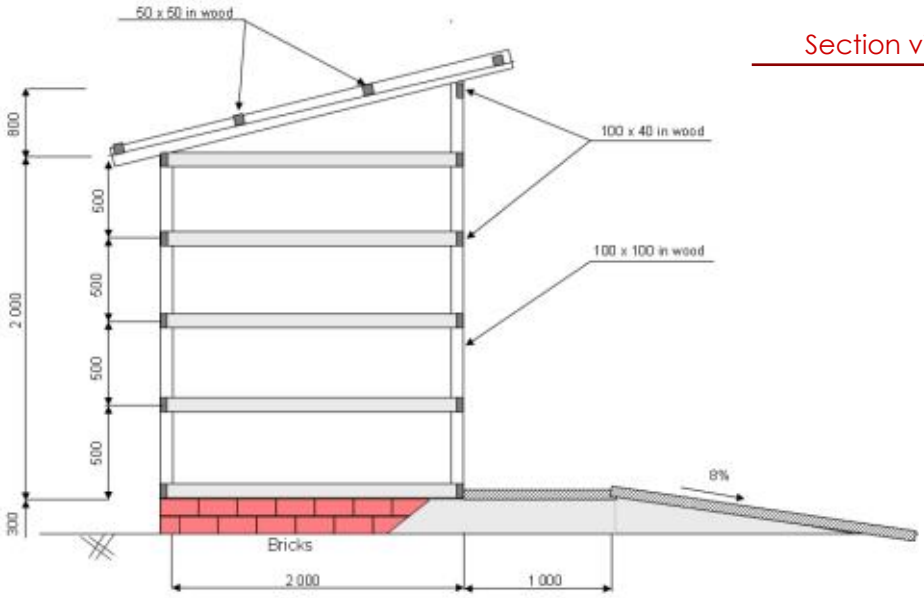
Top view



Front view

Be careful, for this type of construction, it is necessary to fix the transfer bars either on the ground or on a curb especially built for this purpose (see the picture below). It will also be mandatory to equip the access ramp with handrails on both sides if the user(s) needs them (in case of toilets for a person with hemiplegy for example).

Section view



Concerning the construction process, you can see that it is lighter than the one of the toilets in concrete. Indeed, in this case the walls are made of wood, which makes the superstructures lighter. Therefore the foundations do not need to be as strong. As you can see on the technical drawings: the foundation is made of a slab in bricks only, supported by a compacted granular fill and coated by blinding concrete.

Building in wood

Advantages: simpler than brickwork, usually more affordable (depends on the country)

Drawbacks: wooden structure suceptible to rot (especially in tropical countries), heavier maintenance

Cost estimation

As for the toilets in concrete, you will find below a table summarizing the different materials and their quantities needed for the construction process. With this you can calculate easily an estimation of the cost of such the construction.

N°	WORK TYPE	Units	Dimensions				Quantity
			Lgth	Wdth	Ht	Nb.	
	PERMANENT FOUNDATIONS AND WATER BASIN						
1	Bricks 4 holes 100 x 10 x 200 for foundation		9.00	0.50			4.500
2	Stones 4 x 6 for compacted granular fill		3.00	1.50	0.05		0.225
3	Blinding concrete		3.00	1.50	0.05		0.225
4	Stones 4 X 6 for compacted granular fill		1.20	0.60	0.05		0.036
5	Bricks 4 holes 100 x 100 x 200 for water basin		3.00		1.00		3.000
6	Coating for water basin		3.00		1.00	2	6.000
	WOODEN SUPERSTRUCTURE						
1	Wooden columns 100 x 100	m3	2.00	0.10	0.10	2	0.040
	Idem	m3	2.80	0.10	0.10	2	0.056
2	Wooden beams 100 x 40	m3	2.00	0.10	0.04	2	0.016
	Idem	m3	1.50	0.10	0.04	3	0.018
3	Wood for roof	m3	3.50	0.10	0.04	2	0.028
	Idem	m3	2.50	0.05	0.05	4	0.025
4	Main wood	m3	2.00	0.05	0.05	8	0.040
5	Wooden walls	m3	1.50	0.05	0.05	6	0.023
6	Wooden joints	m3	2.80	0.20	0.02	35	0.392
7	Wood for door 50 x 50	m3	2.80	0.05	0.02	35	0.098
	Idem	m3	2.20	0.05	0.05	4	0.022
8	Wood misc 200 x 20	m3	0.80	0.05	0.05	6	0.012
	Idem	m3	3.50	0.20	0.02	2	0.028
	Idem	m3	2.50	0.20	0.02	2	0.020
	CORRUGATED IRON SUPERSTRUCTURE						
1	Roof in corrugated iron	m2	3.50	0.60		5	10.500
2	Nails for corrugated iron	Box				2	2.000
	IRONMONGERY						
1	Anti-termites and fungicidal treatment	Kg				2	2.000
2	Nails from 50 to 100 mm	Box				5	5.000
3	Doors hinges	Unit				3	3.000
4	Toilet seat	Unit				1	1.000
5	Septic tank for WC	Unit				1	1.000
6	Water tap and PVC pipes	F.F.					
7	Transfer bars	F.F.					
8	Door lock	F.F.				1	1.000
	UNEXPECTED						
	Unexpected 5.00%						
	GENERAL TOTAL						

Nota Bene
Cost of the access ramp **not included.**

Toilets made of straw or leafs

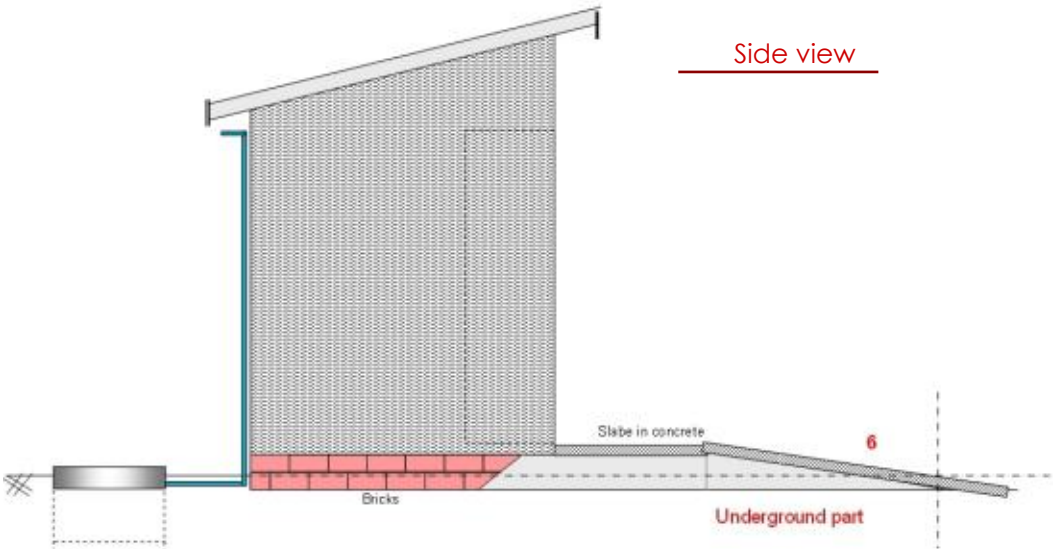
Medium difficulty

Compared to the two previous ways of constructing a toilet, this one is cheaper and more environmental friendly. Indeed, the proposed solution here is to build the WC with walls made of leafs or straw. As both are generally easily available in developing countries such as Cambodia, the cost is very affordable.

It has its own drawbacks. In term of maintenance, this kind of building technique will need closer attention, being notably less resistant to climatic hazards. Another drawback is that the risk of blaze is higher, which can cause some problems in some countries (in Cambodia, most of the families to whom this type of building had been proposed decided to invest a little bit more so that the toilets would be made of corrugated iron or plastic sheets).

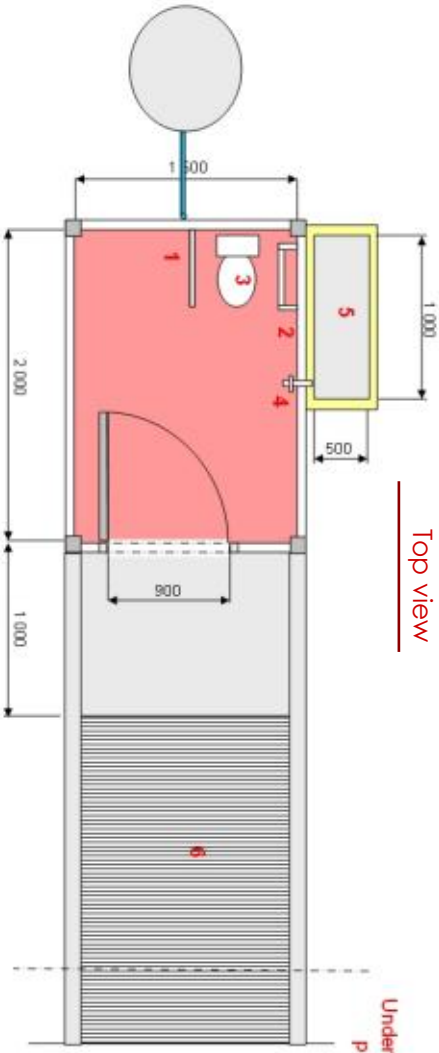
As for the building made of wood, the intervention of a technician is only necessary for the construction of the slab in bricks and/or concrete at the beginning. The walls and roof can normally be made by the beneficiaries themselves as long as they possess some minimum skills (which is usually the case in Cambodia in rural areas, people being used to building their own houses).

Technical drawings



Constructing toilets – Accessible exterior

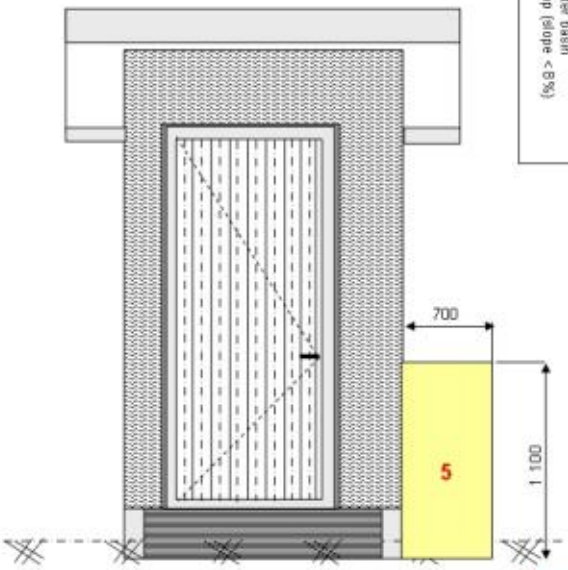
Toilet made of straw



Top view

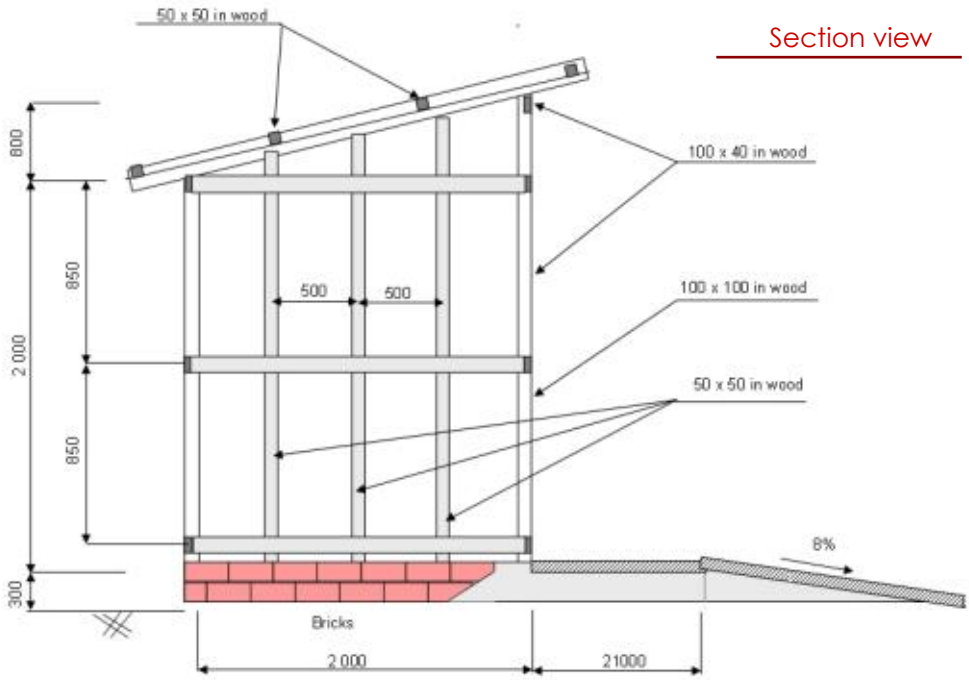
LEGEND

1 Transfer bar fixed on the slab
2 Transfer bar fixed on the slab
3 Toilet seat
4 Water tap
5 Outside water basin
6 Access ramp (slope < 8%)



Underground part

Front view



Here, the technique is very similar to the previous one for the toilets in wood: the slab is built using the same method, only the walls are done differently. They will be made by leafs or straw hold in position by a wooden superstructure (resulting in a higher risk of blaze). It is possible to replace this wooden superstructure by a metallic one, which should improve the lifetime of the building and reduce the fire hazard. Keep in mind: it will add some costs.

Accessing the toilets

Cost estimation

N°	WORK TYPE	Units	Dimensions Lgth	Wdth	Ht	Nb.	Quantity
	PERMANENT FOUNDATIONS AND WATER BASIN						
1	Bricks 4 holes 100 x 10 x 200 for foundation	m3	9.00	0.50			4.500
2	Stones 4 x 6 for compacted granular fill	m2	1.20	0.60	0.05		0.036
3	Bricks 4 holes 100 x 100 x 200 for water basin	m2	3.00		1.00		3.000
4	Coating for water basin	m2	3.00		1.00	2	6.000
	WOODEN SUPERSTRUCTURE						
1	Wooden columns 100 x 100	m3	2.00	0.10	0.10	2	0.040
	Idem	m3	2.80	0.10	0.10	2	0.056
2	Wooden beams 100 x 40	m3	2.00	0.10	0.04	2	0.016
	Idem	m3	1.50	0.10	0.04	3	0.018
3	Wood for roof	m3	3.50	0.10	0.04	2	0.028
	Idem	m3	2.50	0.05	0.05	4	0.025
4	Main wood	m3	2.00	0.05	0.05	6	0.030
	Idem	m3	1.50	0.05	0.05	6	0.023
5	Bamboo for straw	Piece				1	1.000
6	Main wood	m3	3.50	0.02	0.20	2	0.028
	Idem	m3	2.50	0.02	0.20	2	0.020
	SUPERSTRUCTURE IN LEAFS AND CORRUGATED IRON						
1	Door cover	m3	2.20	0.05	0.05	4	0.022
	Idem	m3	0.80	0.05	0.05	6	0.012
2	Corrugated iron for the door	m2	4.00	0.60		2	4.80
3	Corrugated iron for the roof	m2	3.50	0.60		5	10.50
4	Cover leafs	Unit	2.00			50	50.00
5	Thread	Kg				1	1.00
	IRONMONGERY						
1	Anti-termites and fungicidal treatment	Kg				2	2.000
2	Nails from 50 to 100 mm	Box				5	5.000
3	Doors hinges	Unit				3	3.000
4	Toilet seat	Unit				1	1.000
5	Septic tank for WC	Unit				1	1.000
6	Water tap and PVC pipes	F.F.					
7	Transfer bars	F.F.					
8	Door lock	F.F.				1	1.000
	UNEXPECTED						
	Unexpected 5.00%						
	GENERAL TOTAL						

Nota Bene

In this table, unlike what is shown on the technical drawings, the slab supporting the WC is not made of reinforced concrete but of bricks jointed and coated.

Building in straw or leaf

Advantages: cheap (except for the slab), superstructure easy to (re)build (even by the beneficiaries)

Drawbacks: intervention of a technician still necessary for the slab, reduced lifespan, fire hazard

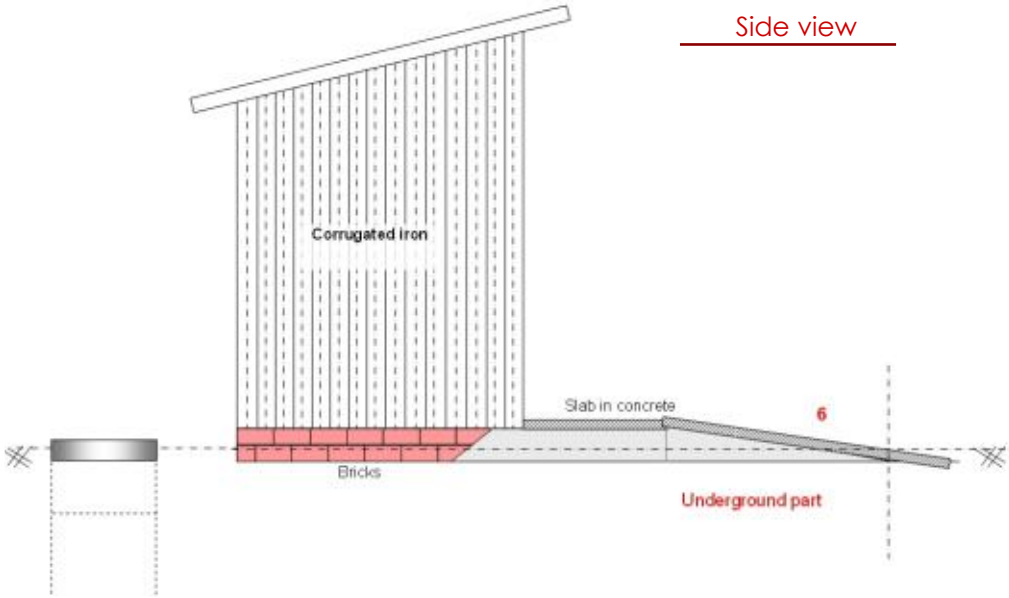
Toilets made of corrugated iron

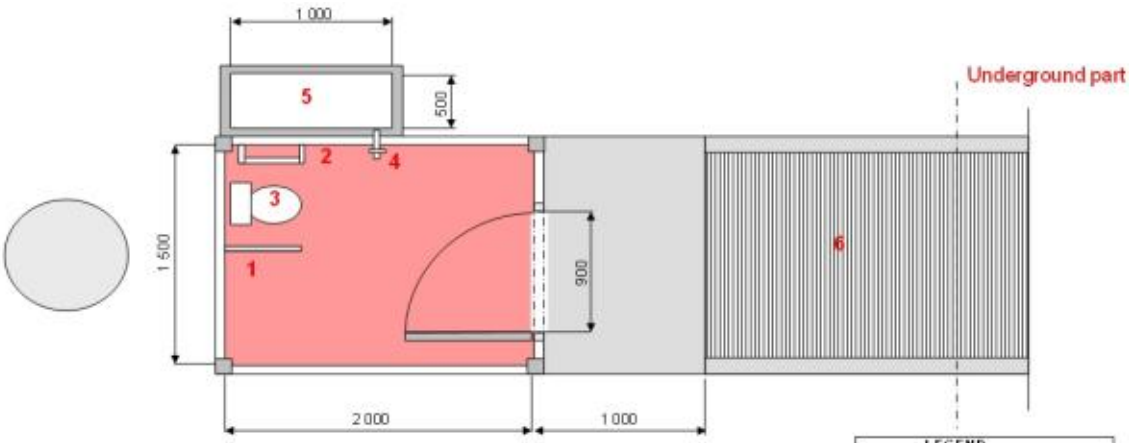
Medium difficulty

Last of the proposed construction methods for toilets, we will develop hereafter how to build with corrugated iron walls. The method does not differ much from the two previous ones. The only variation is that we are now considering walls made of corrugated iron (and not from wood or straw).

Technical drawings

Side view

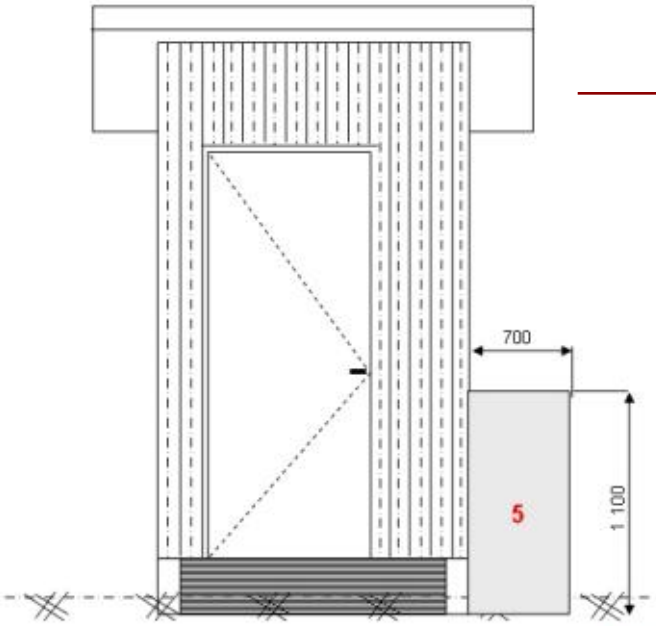




Top view

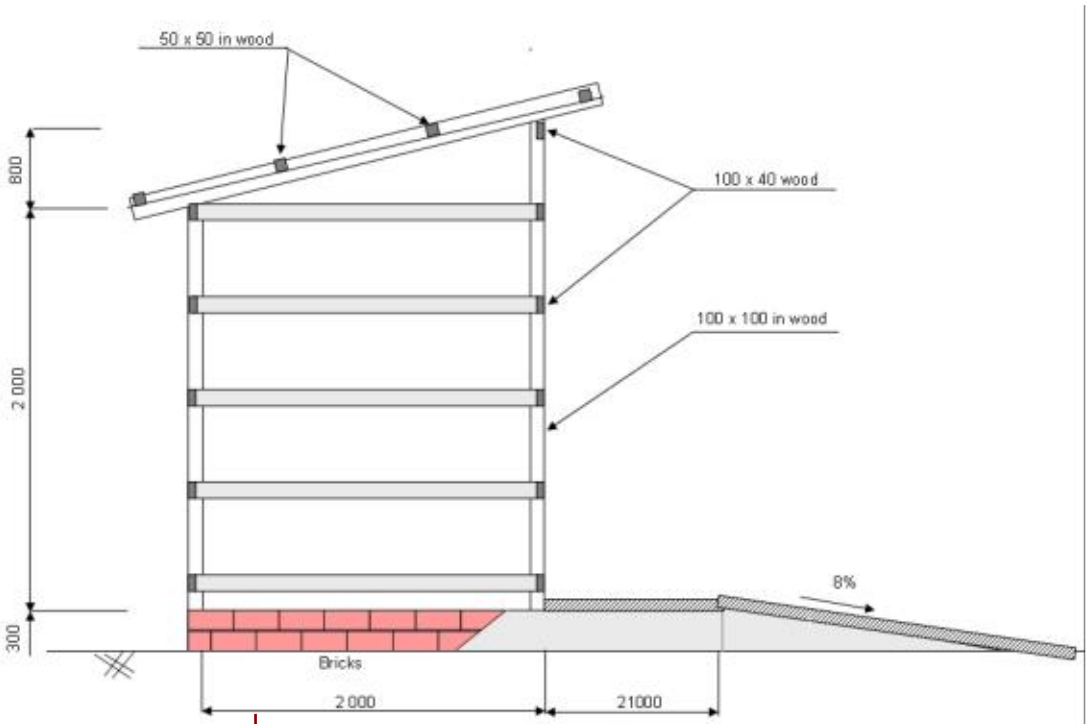
LEGEND

1 Transfer bar fixed on the slab
2 Transfer bar fixed on the slab
3 Toilet seat
4 Water tap
5 Outside water basin
6 Access ramp (slope < 8%)



Front view

Underground part



Section view

Cost estimation

N°	WORK TYPE	Units	Dimensions Lgth	Wdth	Ht	Nb.	Quantity
	PERMANENT FOUNDATIONS AND WATER BASIN						
1	Bricks 4 holes 100 x 10 x 200 for foundation	m2	9.00	0.50			4.500
2	Stones 4 x 6 for compacted granular fill	m3	3.00	1.50	0.05		0.225
3	Blinding concrete	m3	3.00	1.50	0.05		0.225
4	Stones 4 X 6 for compacted granular fill	m3	1.20	0.60	0.05		0.036
5	Bricks 4 holes 100 x 100 x 200 for water basin	m2	3.00		1.00		3.000
6	Coating for water basin	m2	3.00		1.00	2	6.000
	WOODEN SUPERSTRUCTURE						
1	Wooden columns 100 x 100	m3	2.00	0.10	0.10	2	0.040
	Idem	m3	2.80	0.10	0.10	2	0.056
2	Wooden beams 100 x 40	m3	2.00	0.10	0.04	2	0.016
	Idem	m3	1.50	0.10	0.04	2	0.012
3	Wood for roof	m3	3.50	0.10	0.04	2	0.028
	Idem	m3	2.50	0.05	0.05	4	0.025
4	Main wood 50 x 50	m3	2.00	0.05	0.05	8	0.040
	Idem	m3	1.50	0.05	0.05	6	0.023
5	Wood misc 200 x20	m3	3.50	0.20	0.02	2	0.028
	Idem	m3	2.50	0.20	0.02	2	0.020
6	Wood for door 50 x 50	m3	2.20	0.05	0.05	4	0.022
	Idem	m3	0.80	0.05	0.05	6	0.012
	CORRUGATED IRON SUPERSTRUCTURE						
1	Corrugated iron walls	m2	2.50	0.60		13	19.500
2	Corrugated iron for door	m2	3.50	0.60		5	10.50
3	Corrugated iron for roof	m2	2.00	0.60		2	2.40
	IRONMONGERY						
1	Anti-termites and fungicidal treatment	Kg				2	2.000
2	Nails from 50 to 100 mm	Box				5	5.000
3	Doors hinges	Unit				3	3.000
4	Toilet seat	Unit				1	1.000
5	Septic tank for WC	Unit				1	1.000
6	Water tap and PVC pipes	F.F.					
7	Transfer bars	F.F.					
8	Door lock	F.F.				1	1.000
	UNEXPECTED						
	Unexpected 5.00%						
	GENERAL TOTAL						

Building in corrugated iron

Advantages: quite cheap, superstructure easy to build

Drawbacks: reduced lifespan, technician intervention necessay

Constructing toilets – accessible interior

In this section, we will consider various ways of adjusting the interior design of a toilet in order to make it accessible (in addition to the one already presented on the technical drawings of the first part of this manual). Indeed, in case of individual housing for example, you have the opportunity of laying out the built environment in order to fit perfectly the needs of the person living with disability. It is by discussing with that person, trying to find out what are her/his problems, her/his needs, what does she/he want... that you will succeed in building an adapted toilet.

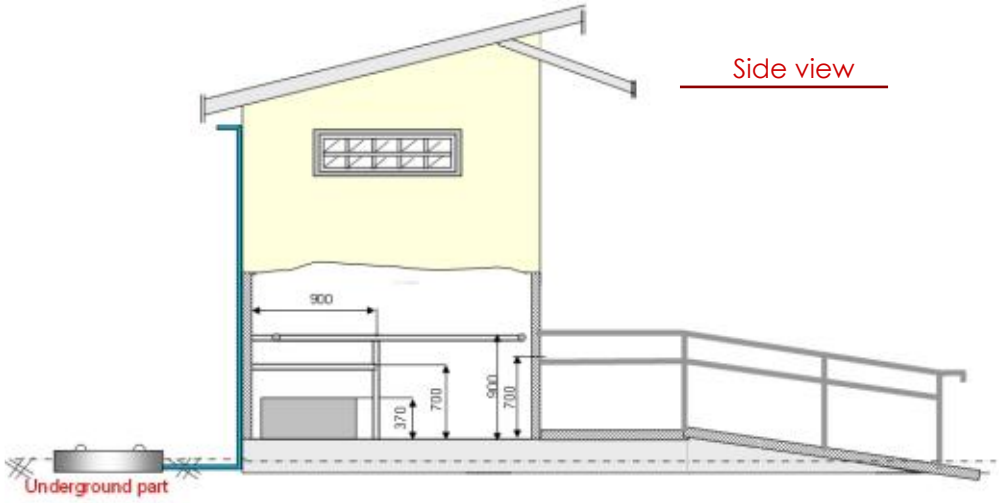
But before starting to develop the technical side, it is necessary to underline the fact that the most important need is in most of the cases (if not all) to provide support to squat or sit. This is done by building systems made of handles or support rails so that the user could use cleanly and comfortably the toilets. The advantages of such support systems are numerous: they can be used of course to sit and/or squat, but also as support for dressing or undressing, as guiding systems for visually impaired people, or as aids for the transfer from a wheelchair. But be careful, rails and handles must be strong enough to bear the weight of the various users. You cannot afford to take the risk that the support system could break.

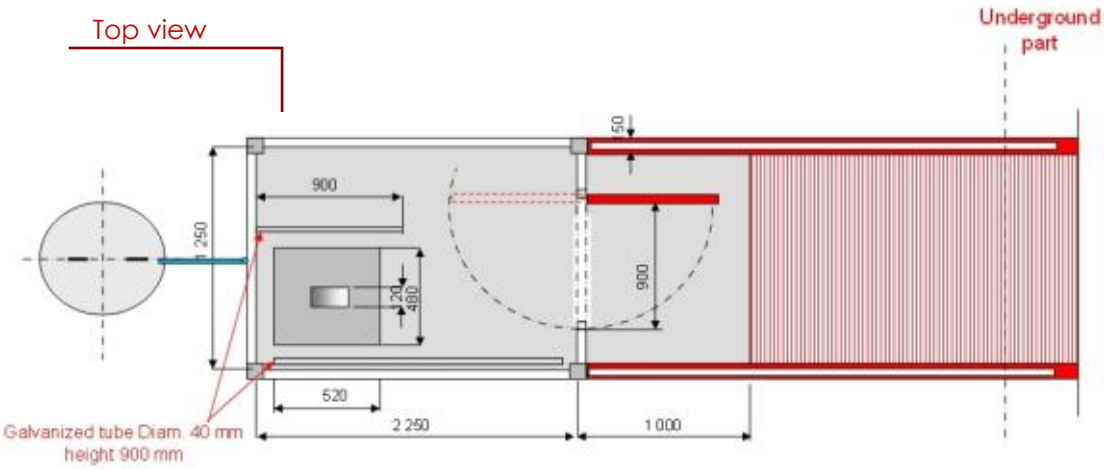
Layout for a toilet in brickwork

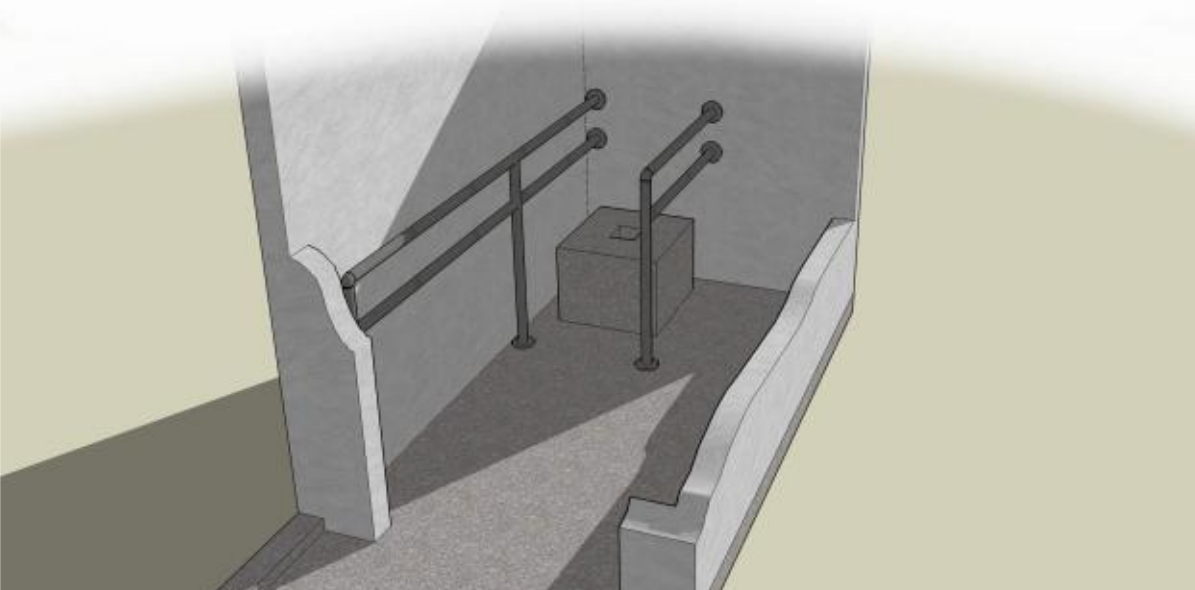
High difficulty

The layout presented here is best suited for a toilet made of brickwork. You can see on the technical drawings below that the seat is made in brickwork, which is best fitted to the context of developing countries. The addition of strong and long support rails makes this toilet well adapted to people with reduced mobility. Moreover, the door being able to be opened towards inside and outside, it will be more convenient to use than a single-side door.

Technical drawings







Cost estimation

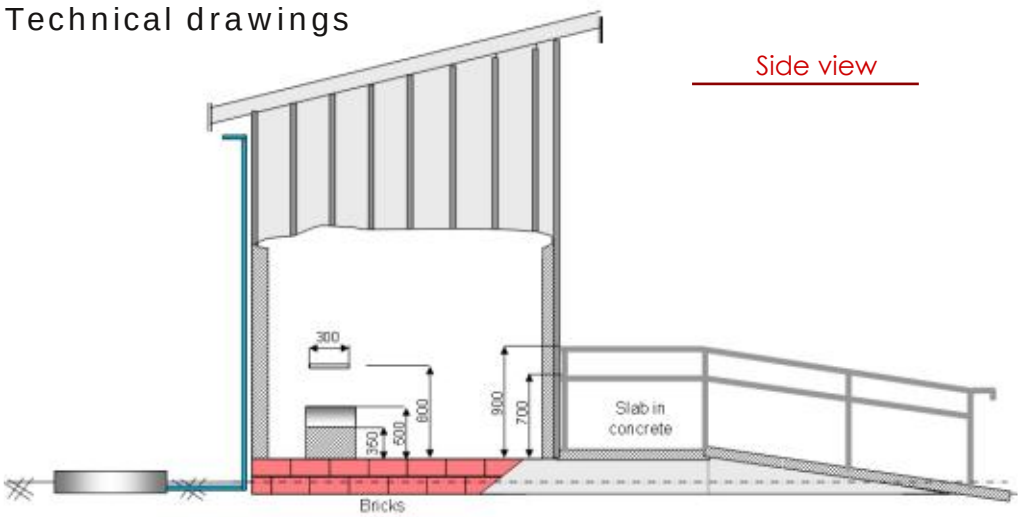
The support rails, will add around 10% to the total cost, for the case of the brick construction of the building.(see the table page 12 to calculate it).

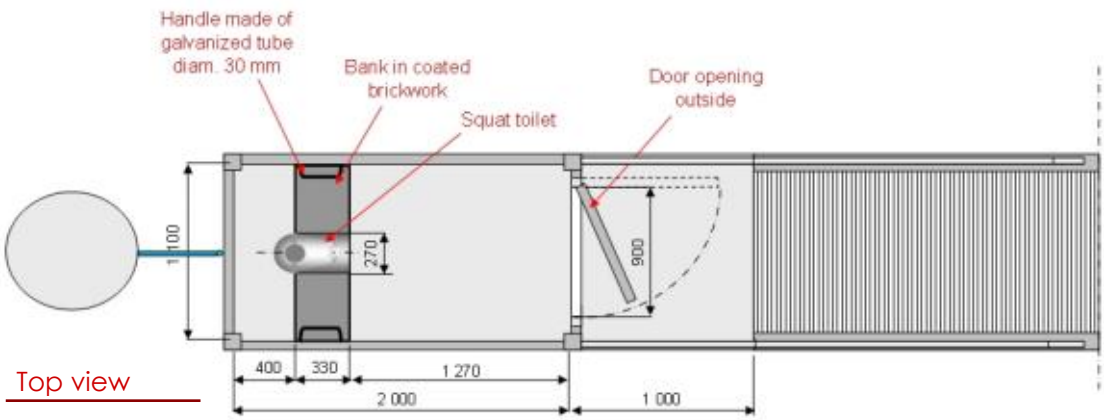
Layout for a toilet in wood

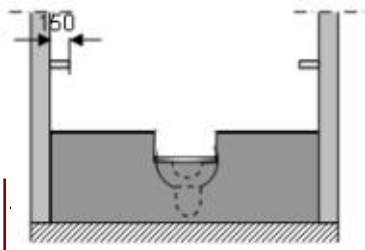
High difficulty

Unlike the previous layout for brickwork, this one has been thought to be adapted for toilets made of wood. It has been designed to answer more the needs of a person with reduced mobility than a wheelchair user or a visually impaired person.

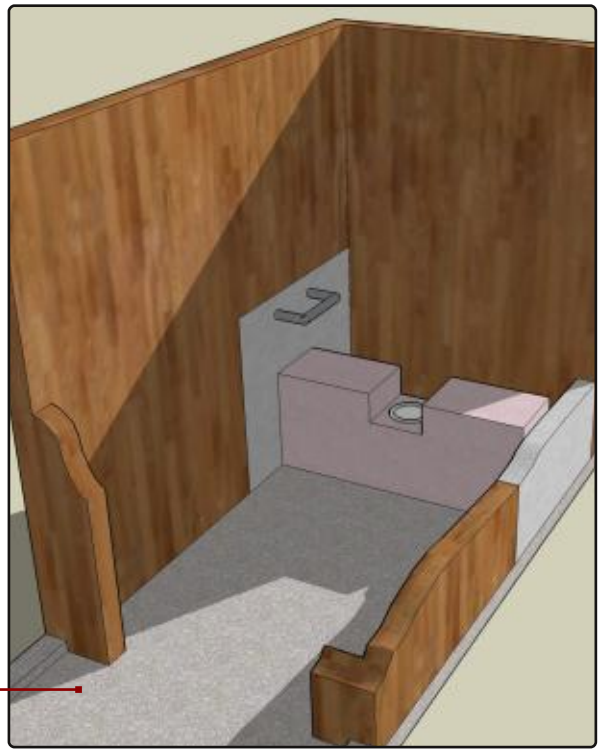
Technical drawings







Constructional Detail



A 3D sketching of the proposed layout

Cost estimation

This lay out with rails will add around 10% to the general cost of a toilets building in wood.

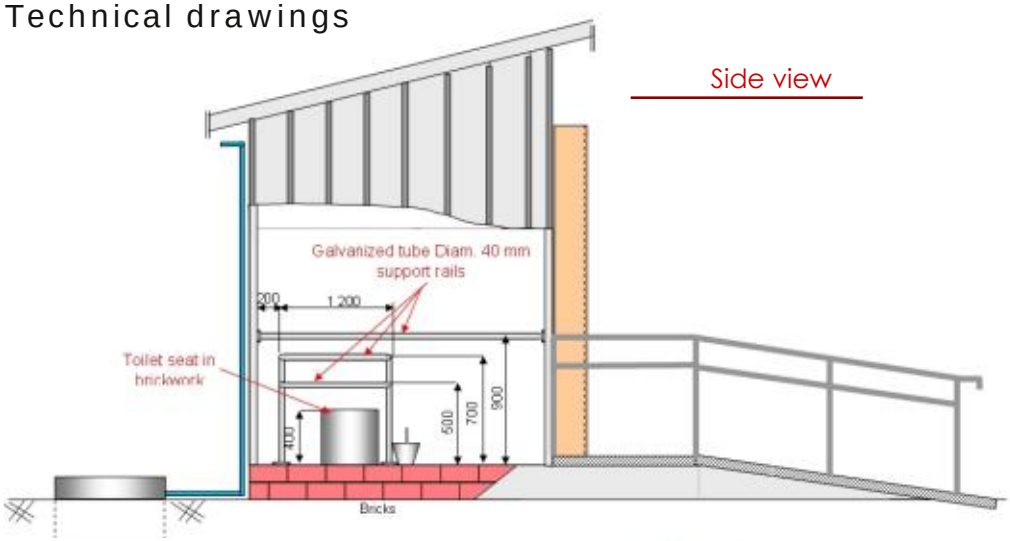
Layout with rails

High difficulty

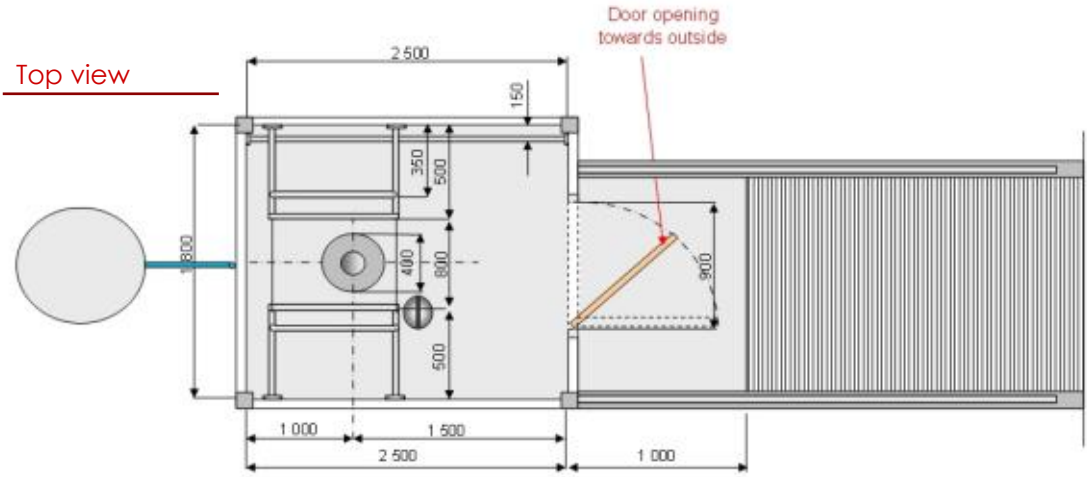
You will find here a last example on how to fix support rails in order to design an accessible toilets cubicle. As being particularly complex, we advise to fix these rails on an adequate support, id est a wall in brickwork able to support the weight of a regular user.

Technical drawings

Side view



Top view



Cost estimation

You will find below a table summing up all the components (including manpower) needed to build this kind of rail system fitted for accessible toilets.

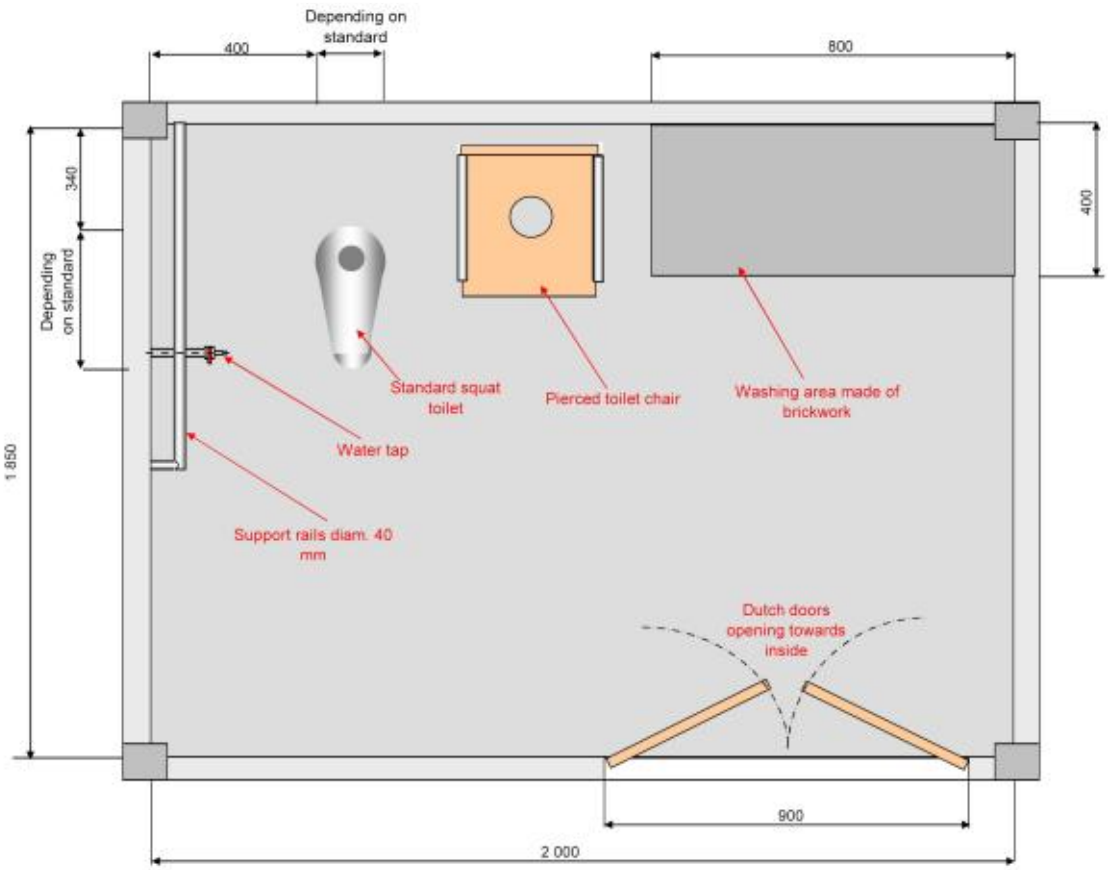
NAME	Unit	Qty	Unit price	Total price
Galvanized tubes diam. 40 mm	m	7.00		
Manpower	Day	1.50		
Misc	Unit	0.10		
Fixations	Unit	8.00		
TOTAL				

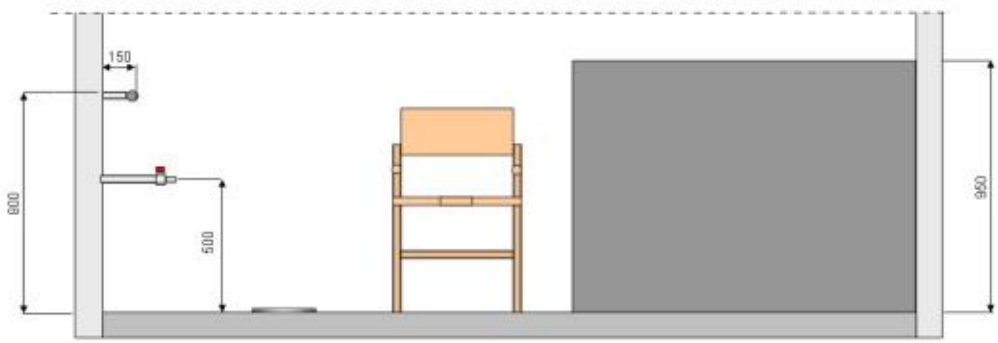
Toilet chairs

Medium difficulty

This example introduces another kind of adapted feature for a person with disability. Indeed, sometimes support rails are not the best solution, especially if the grasping capacity of the person is low. Here we present the solution consisting of a pierced toilet seat made of wood. This solution offers two advantages: first, it allows the user to sit down, which is mandatory for some persons who can't stand up or support their weight on rails for long; and second it is cheaper and technically easier than having to fix support rails on the walls.

Technical drawings



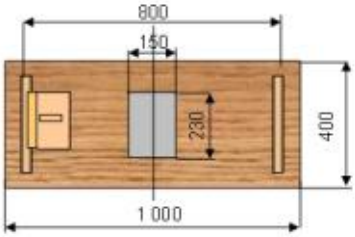


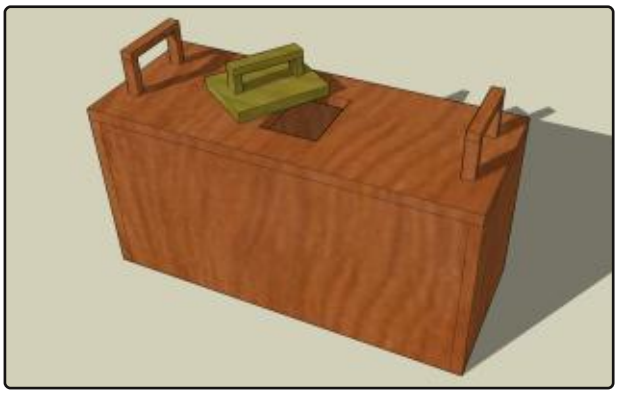
Toilet seat examples

This kind of toilet seat presents side-rails that can be raised in order to facilitate the movements that the user has to make. As it is made of treated wood, it is quite cheap, but does require some skill to make the moveable side-rails.

You will find two simple yet different designs for building toilet seats made of treated wood. They can be made without particular skill at rather minimum cost, provided that you can find appropriate wood.

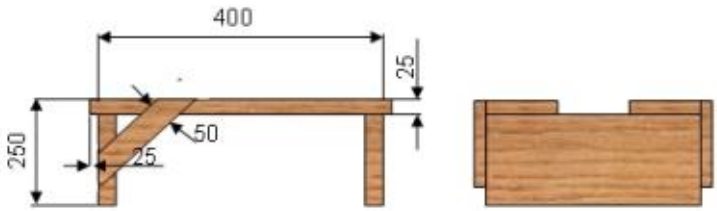
First design

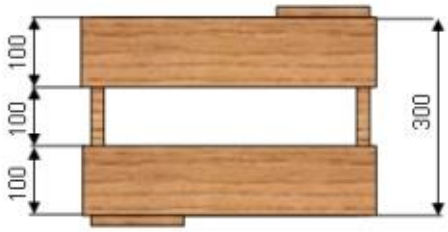


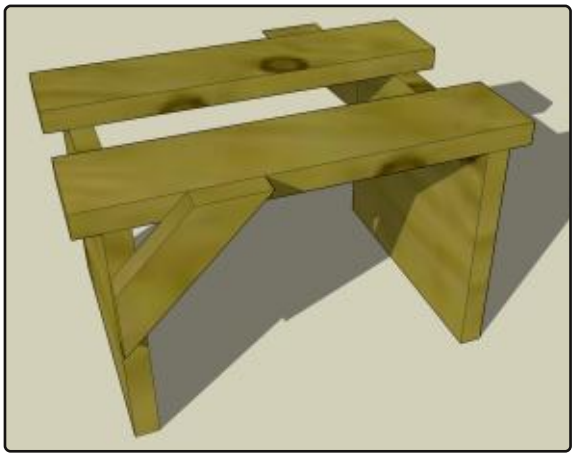


NAME	Unit	Qty	Unit price	Total price
Large sides	m3	0.020		
Small sides	m3	0.008		
Top	m3	0.008		
Handles	m3	0.003		
Cover	m3	0.001		
Corner reinforcements	m3	0.003		
Manpower	Day	1.300		
Ironmongery	Unit	1.000		
Wood treatment	kg	0.250		
TOTAL				

Second design







NAME	Unit	Qty	Unit price	Total price
Sides	m3	0.003		
Top	m3	0.002		
Corner reinforcements	m3	0.002		
Joist bridging	m3	0.001		
Manpower	Day	0.750		
Ironmongery	Unit	0.500		
Wood treatment	kg	0.180		
TOTAL				

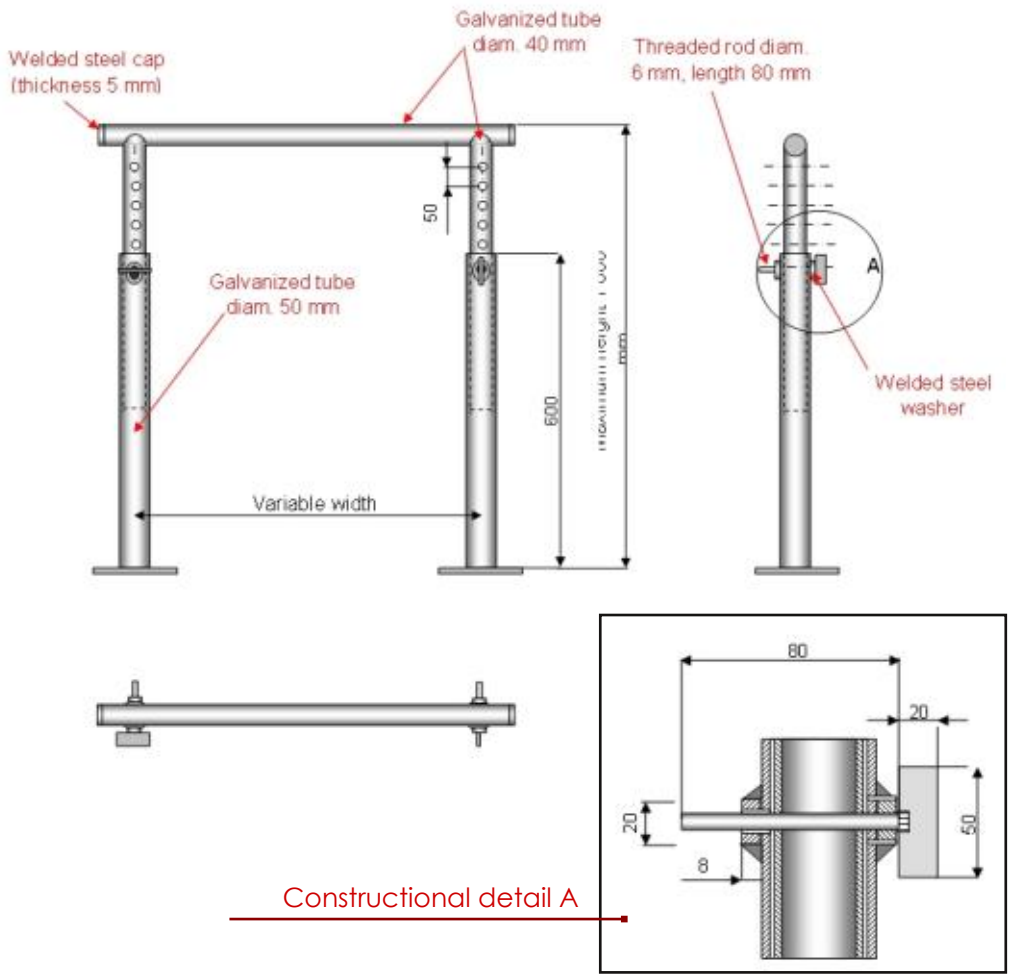
Adjustable support rails

High difficulty

In some cases, it can be pretty useful to have support rails that can be adjustable in height (for instance, the case of a child growing up). But you must be very careful when constructing it, because they will have to sustain the weight of various users.

The solution presented here consists of exterior tubes of diameter 50 mm. The inner tubes are of diameter 40 mm. Both exterior and interior tubes are pierced at the same height with holes of diameter 7 mm, in which the threaded rods (diam. 6 mm and length 80 mm) slips into.

Technical drawings



Constructional detail A

Cost estimation

Cost for one-meter length

NAME	Unit	Qty	Unit price	Total price
Galvanized tubes diam. 40 mm	m	6.00		
Galvanized tubes diam. 40 mm	m	2.40		
Manpower	Day	2.00		
Ground bindings	unit	4.00		
Miscallenous	unit	4.00		
Unexpected 5%				
TOTAL				

Accessible closed showers

To construct the building of a closed shower, the solutions are pretty much the same as the ones presented for the construction of a toilet. So we invite you to referr to the above part (page 8 and following). You will need to follow simply the same technical drawings and comments. The only main difference between toilets and showers is that you have to provide **more space** inside a shower i**n order for the user to move around more easily.**

The interiour layout is of course quite different. You will find below two examples of shower layouts, one with a water basin and the other one with a jar used as a water tank (which is very common in Cambodia).

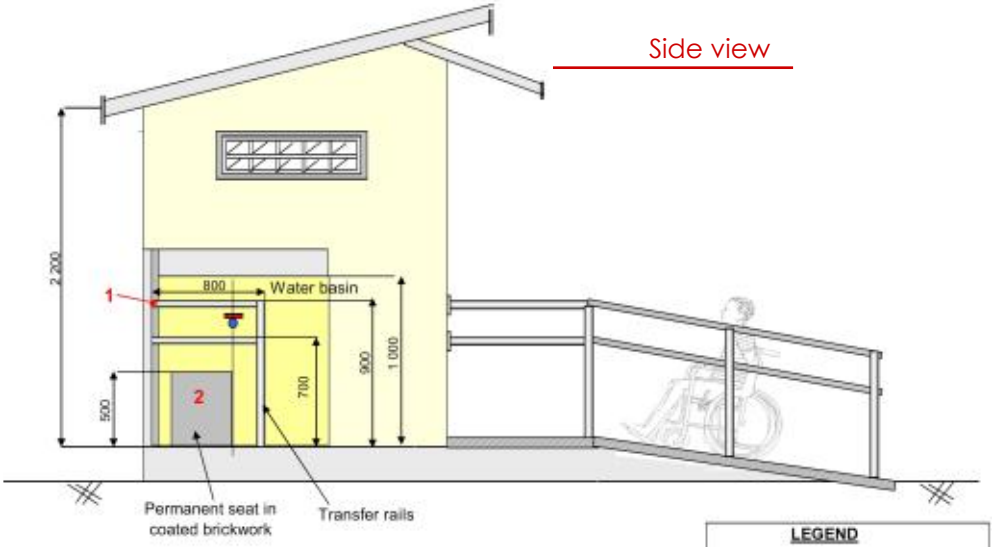
Closed shower with a water basin

High difficulty

As you can see on the technical drawings below, this first layout is designed to be adapted to a building in concrete and brickwork, but can be easily transferred to other buildings. Concerning the building in itself, this is the most difficult one to build and the more expensive type of construction. However keep in mind that the investment will pay back over time! Since it is also the one which is best suited to resist time and climatic aggressions (if properly maintained, of course). While you will have to replace the others again and again, this one is made to last!

Technical drawings

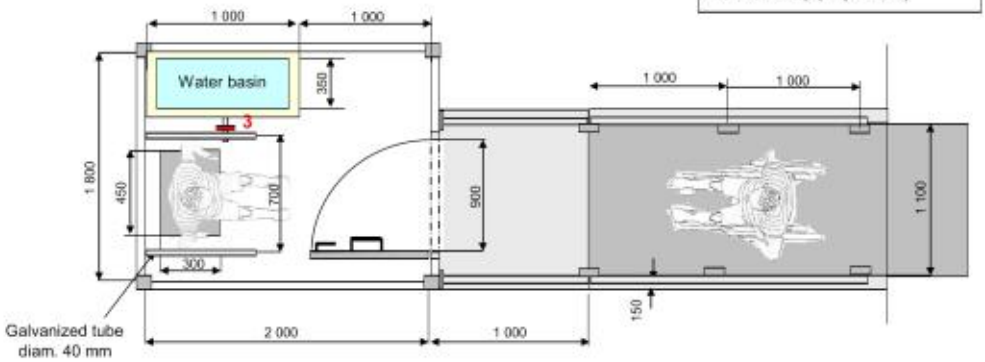
Side view

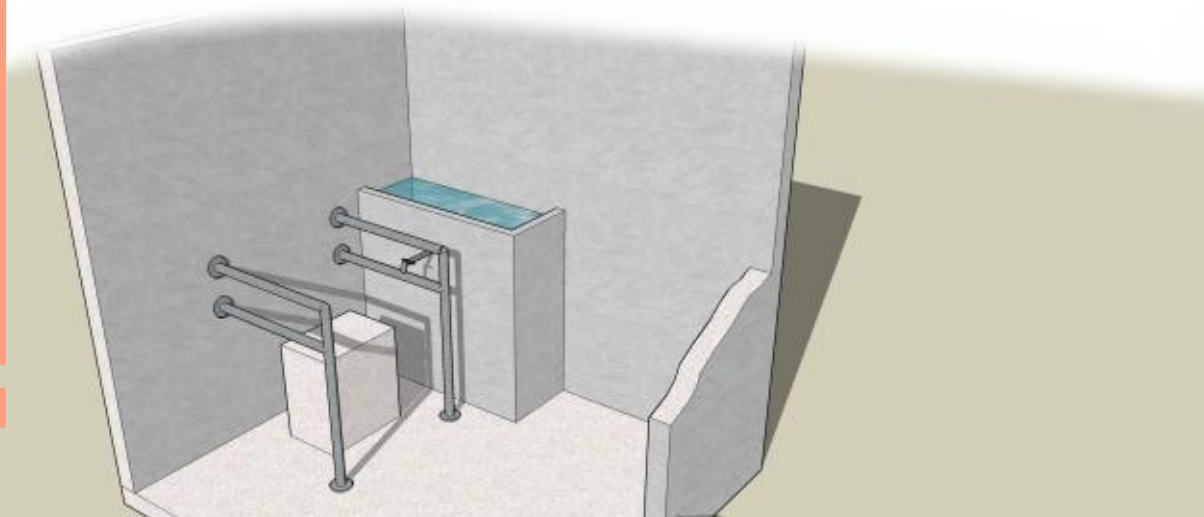


LEGEND

1 Fixed transfer rails
2 Seat in brickwork
3 Water tap
4 Water basin
5 Access ramp (slope < 8%)

Top view





Cost estimation

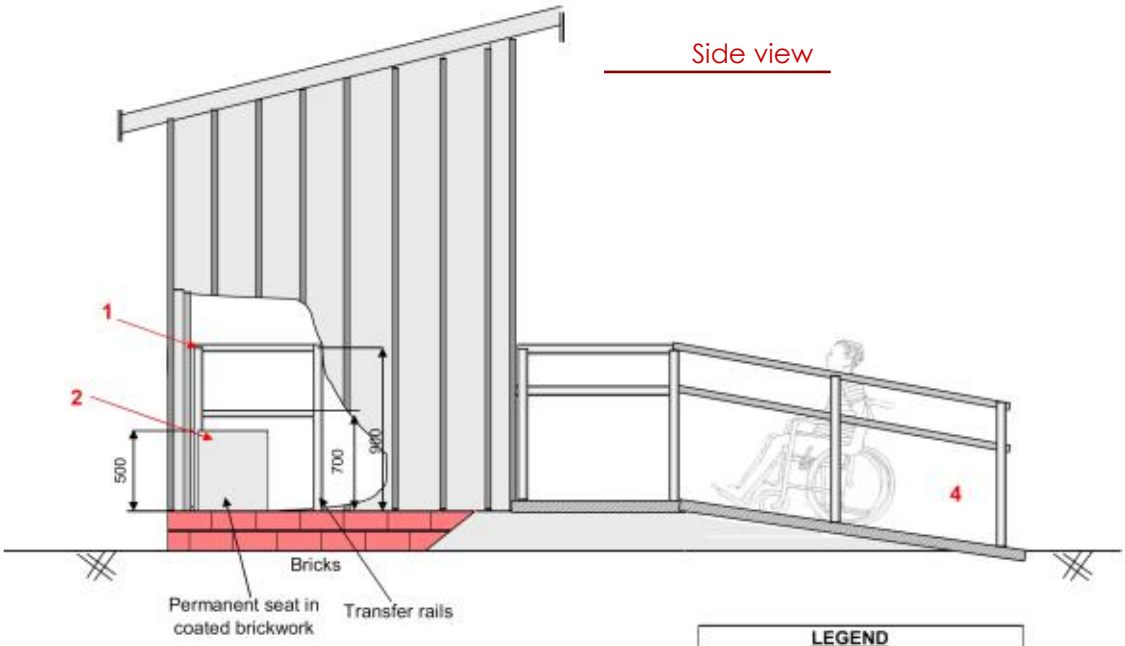
N°	WORK TYPE	Units	Dimensions Lgth	Wdth	Ht	Nb.	Quantity
	PERMANENT FOUNDATIONS AND WATER BASIN						
1	Foundations excavation for footings	m3	1.00	1.00	0.80	4	3.200
2	Stones 4 x 6 for granular compacted fill under footings	m3	0.80	0.80	0.05	4	0.128
3	Concrete for foundations	m3	0.60	0.60	0.20	4	0.288
4	Beam supporting bricks	m2	10.00	0.50			4.500
5	Random fill	m3	3.00	2.00	0.05		0.300
6	Stones 4 x 6 for granular compacted fill under slab	m3	3.00	2.00	0.05		0.300
7	Blinding concrete	m3	2.00	2.00	0.05		0.200
8	Bricks 4 holes 100 x 100 x 200 for water basin	m2	3.00		1.00		3.000
9	Coating for water basin	m2	3.00		1.00	2	6.000
	SUPERSTRUCTURE IN REINFORCED CONCRETE						
1	Concrete for column	m3	2.00	0.18	0.18	2	0.130
2	Above beams	m3	8.00	0.20	0.18	1	0.288
3	Concrete on bricks	m3	8.00	0.20	0.18	1	0.288
4	Bricks 4 holes 100 x 100 x 200	m2	2.00	8.00			16.000
5	Bricks coating on both faces	m2	2.00	8.00		1	16.000
6	Brick walls	m2	2.00	0.50		1	1.000
7	Two faces coating	m2	2.00	0.50		1	1.000
8	Paint CaCO3	m2	2.00	0.50		1	1.000
9	Paint CaCO3	m2	2.00	8.00		1	16.000
	WOOD SUPERSTRUCTURE						
1	Bois pour toit	m3	3.00	0.10	0.04	2	0.024
2	Bois pour toit	m3	2.00	0.10	0.04	2	0.016
3	Bois pour toit	m3	2.50	0.05	0.05	6	0.038
	SUPERSTRUCTURE TÔLES ONDULEES						
2	Wood for roof	m2	3.00	0.60		6	9.000
2	Wood for roof	m2	2.00	0.60		6	7.200
3	Wood for roof	kg				4	4.000
	IRONMONGERY						
1	Anti-termites and fungicidal treatment	Kg				2	2.000
2	Doors hinges	Unité				3	3.000
3	Shower seat	Unité				1	1.000
4	Water tap and PVC pipes	F.F.					
5	Transfer bars	F.F.					
6	Door lock	F.F.				1	1.000
7	Wooden door	Unité	2.00	0.90		1	1.800
	ACCESS RAMP						
	Report yourself to the manual #4						
	UNEXPECTED 5%						
	GENERAL TOTAL						

Closed shower with a water jar

High difficulty

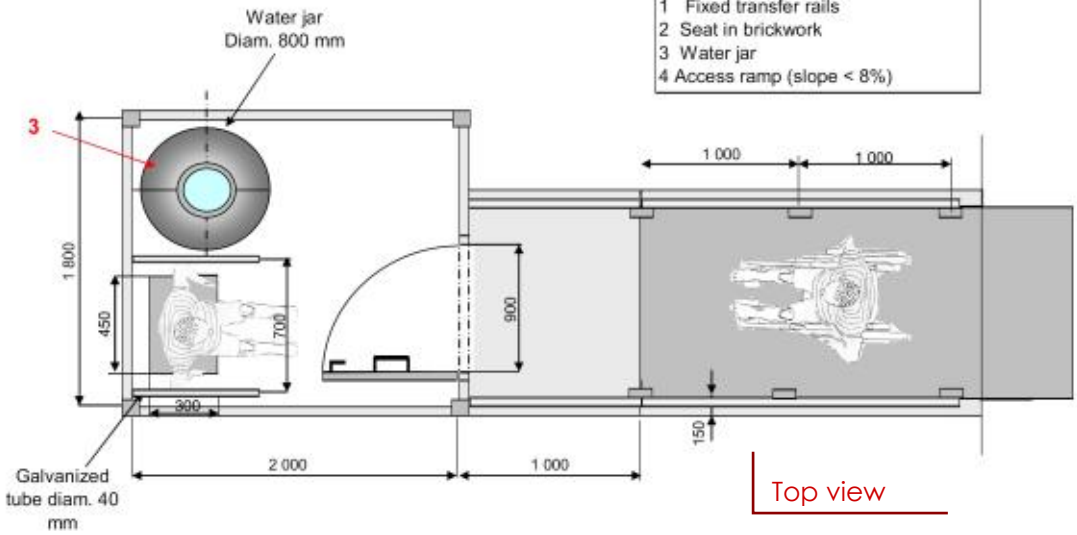
This second layout was first designed for a shower building in wood. Like the first layout it can be easily adapted to other types of materials.

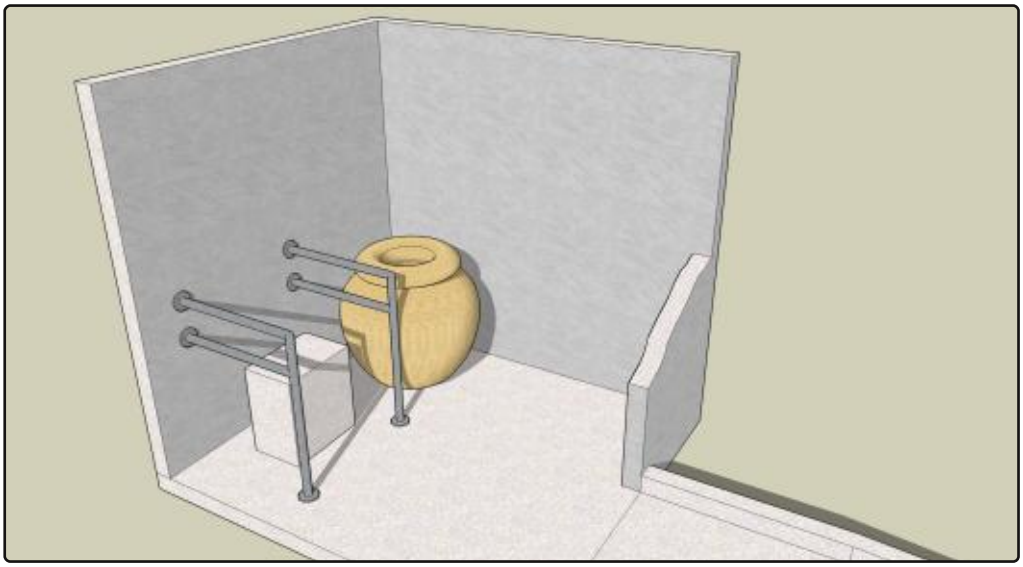
Technical drawings



LEGEND

1 Fixed transfer rails
2 Seat in brickwork
3 Water jar
4 Access ramp (slope < 8%)





Cost estimation

N°	WORK TYPE	Units	Dimensions Lgth	Wdth	Ht	Nb.	Quantity
	PERMANENT FOUNDATIONS AND WATER BASIN						
1	Bricks 4 holes 100 x 10 x 200 for foundation	m3	10.00	0.50			5.000
2	Stones 4 x 6 for compacted granular fill	m3	3.00	2.00	0.05		0.300
3	Blinding concrete	m3	3.00	2.00	0.05		0.300
	SUPERSTRUCTURE EN BOIS						
1	Wooden columns 100 x 100	m3	2.00	0.10	0.10	2	0.040
	Idem	m3	2.80	0.10	0.10	2	0.056
2	Wooden beams 100 x 40	m3	2.10	0.10	0.04	2	0.017
	Idem	m3	2.00	0.10	0.04	3	0.024
3	Wood for roof	m3	3.50	0.10	0.04	2	0.028
	Idem	m3	2.80	0.05	0.05	4	0.028
4	Main wood	m3	2.50	0.05	0.05	8	0.050
5	Wooden walls	m3	2.00	0.05	0.05	6	0.030
6	Wooden joints	m3	2.80	0.20	0.02	42	0.470
7	Wood for door 50 x 50	m3	2.80	0.05	0.02	35	0.098
	Idem	m3	2.20	0.05	0.05	4	0.022
8	Wood misc 200 x 20	m3	0.80	0.05	0.05	6	0.012
	Idem	m3	3.50	0.20	0.02	2	0.028
	Idem	m3	2.50	0.20	0.02	2	0.020
	CORRUGATED IRON SUPERSTRUCTURE						
1	Roof in corrugated iron	m2	3.50	0.60		6	12.600
2	Nails for corrugated iron	kg				2	2.000
	IRONMONGERY						
1	Anti-termites and fungicidal treatment	Kg				3	3.000
2	Nails from 50 to 100 mm	Box				6	5.000
3	Doors hinges	Unit				3	3.000
4	Shower seat	Unit				1	1.000
5	Water jar	Unit				1	1.000
6	Water tap and PVC pipes	F.F.					
7	Transfer bars	F.F.					
8	Door lock	F.F.				1	1.000
	ACCESS RAMP						
	Report yourself to the manual #4						
	UNEXPECTED 5%						
	GENERAL TOTAL						

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