

5.0 EARTHQUAKE DISASTER PREPAREDNESS (EDP)

Earthquakes are known to cause damage to both property and lives through structural and non-structural hazards. The shaking can result into collapse of structures and also destabilizing non-structural elements. The structure needs to be reinforced appropriately to enable it to resist the seismic forces, while the non-structural elements need to be properly braced to the structure, or removed or relocated to avert the danger of falling or moving uncontrollably to cause damage.

This section deals with earthquake disaster preparedness and response. EDP involves developing appropriate plans to mitigate the effects of earthquake disaster. Planning should be done at all levels of government (central and local government), the private sector, the community and individual families including institutions. All these should have earthquake disaster plans, which must be known by all the target members. EDP leads to the formulation of preparedness plan which may comprise several sub-plans such as: Warning Plan, Evacuation Plan, Search and Rescue Plan, Assessment Plan and an Emergency response plan.

5.1 Before Earthquake Disaster

<ul style="list-style-type: none"> Assess the potential of structural and non-structural hazards 	<ul style="list-style-type: none"> Conduct internal and external hazard assessments of the homestead or a given facility to find out the most dangerous areas that requires to be attended to.
<ul style="list-style-type: none"> Know the safest place 	<ul style="list-style-type: none"> Avoid most dangerous areas such as kitchen, near heavy furniture that is likely to slide or topple, near glass windows/ panels that can easily shatter etc. The safest places include corridors, under well-built table, outside in an open space away from buildings, trees, and electric transmission wires. Each person should know possible ways of escaping from the house.
<ul style="list-style-type: none"> Sensitize the family members about the earthquake risk. 	<ul style="list-style-type: none"> Everybody in the family should know how to respond during an earthquake: know the DOS and DON'TS

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<ul style="list-style-type: none"> • Make provision for people with special needs 	<ul style="list-style-type: none"> • Plan to have someone to attend to the elderly, disabled, the terminally ill, the pregnant and help them to evacuate if necessary during an earthquake.
<ul style="list-style-type: none"> • Know the resources and skills in your community 	<ul style="list-style-type: none"> • The Local leadership of the Community should have a plan of mobilizing the Disaster Response Teams, setting up an emergency relief centre preferably at a Health Centre, or Community Centre or School or Church or Mosque; people should be aware of all these arrangements.
<ul style="list-style-type: none"> • Plan responsibilities 	<ul style="list-style-type: none"> • The Disaster Committees should assign responsibilities to lower structures to ensure that at each level there is a Team of volunteers responsible for disaster response. At family level, members should know their responsibilities ranging from identification of damage, reporting, rescue, evacuation, emergence relief, etc.
<ul style="list-style-type: none"> • Stock some emergence supplies including medications for treatment of possible injuries. 	<ul style="list-style-type: none"> • Survival Kit: Safe water, First aid kit-freshly stocked, Food, Blankets, Portable radio, torch and spare batteries, whistle, Essential medication and Money • Sanitation Supplies: Soap, Toothpaste and toothbrushes, Feminine and infant supplies, Toilet paper, Household bleach/Jik, basins & Jerrycans. • Safety and Comfort: Gumboots, Heavy gloves for clearing debris, Candles and matches, spare clothing, sweaters, Knife or razor blades, Tent. • Cooking: Fuel for cooking (charcoal, camp stove fuel, etc.), Plastic knives, forks, spoons, plastic plates and cups, Saucepans and buckets. • Tools and Supplies: Shovel, broom, Screwdriver, pliers, hammer, 1/2" rope, Plastic tape and sheeting.

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5.2 During Earthquake	
If you are outside:	<ul style="list-style-type: none"> • If you are outdoors when the shaking starts, get into an open area away from trees, buildings, walls and power lines.
If you are inside a house, stay there, drop, take cover, protect the head and hold on until the shaking stops.	<ul style="list-style-type: none"> • DROP down to the floor. • Take COVER under a strong desk, table, or other furniture; if that is not possible, seek COVER against an interior wall and protect your head and neck with your arms. Avoid the kitchen, near the windows, or hanging objects, or mirrors, or tall furniture, which might topple and overturn. • HOLD ON to the desk or table and be prepared to move with it. HOLD the position until the ground stops shaking and it is safe to move.
If you're in a storeyed building,	<ul style="list-style-type: none"> • And not near a desk or table, move against an interior wall, and protect your head with your arms. Do not use the elevators. Do not be surprised if the fire alarm or sprinkler systems come on.
If you're driving or in a vehicle	<ul style="list-style-type: none"> • Pull over to the side of the road and stop. Avoid overpasses, bridges, power lines, and other hazardous places. Stay inside the vehicle until the shaking is over. Should you resume driving, watch out for cracks in the roads, fallen buildings, stones or trees.
If you're in a crowded store or other public place	<ul style="list-style-type: none"> • Do not rush for exits. Move away from display shelves containing objects that could fall.
If you're in a Stadium or Theatre,	<ul style="list-style-type: none"> • Stay in your seat and protect your head with your arms. Do not try to leave until the shaking is over. Then leave in a calm, orderly manner.

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If you are in a mountainous or hilly area	<ul style="list-style-type: none"> • Watch out for falling rocks, landslides, trees and other debris that could be loosened by the earthquake.
5.3 After the Earthquake	
Be prepared for aftershocks,	<ul style="list-style-type: none"> • Lead your family to a previously identified safe place outdoors
Check for Hazards in your house	<ul style="list-style-type: none"> • Put out any fires immediately, switch off electricity, turn off water from the main source; clean up any spilled chemical including paraffin. Beware of items falling off shelves when you open doors of cupboards.
Check supply of emergency food and water.	<ul style="list-style-type: none"> • Check medication, first aid materials, for all members of the household including the children, handicapped and elderly. Replenish expired supplies of food, water, medicine, fire extinguishers, and batteries.
Help the injured or trapped	<ul style="list-style-type: none"> • Administer first-aid. Do not try to move seriously injured persons unless they are in further danger of injury. Get medical help for the seriously injured. Wear shoes to avoid injury from broken glass and debris.
Don'ts	
Avoid the following:	<ul style="list-style-type: none"> • Do not enter any building whose status you may not be sure of.
	<ul style="list-style-type: none"> • Eating and drinking anything from open containers near broken glass.
	<ul style="list-style-type: none"> • Leaving any child alone; talk and play with the children.
	<ul style="list-style-type: none"> • Driving when you are not certain whether or not the road is affected; walk or use a bicycle.
	<ul style="list-style-type: none"> • Do not criticize or pass judgment on rescue workers; join them and assist where possible.
	<ul style="list-style-type: none"> • If you are trapped inside a collapsed building, do not panic and shout for help. Breathe slowly and believe in your survival. Respond when you hear signal from outside. The best way to respond is to blow a whistle.

6.0 PROTO TYPE BUILDING PLANS

Prototype plans have been developed to give a guiding framework and explicitly exhibit basic design principles of earthquake resistant construction technologies. The following aspects are normally considered in designing building plans:

- The site location
- The shape and the volume of the structure
- The vertical and horizontal reinforcements
- The height of the structures
- The purpose or functionality of the structure
- The air circulation
- The locally available materials
- The culture, beliefs and traditions of target communities
- The length : Width : Height ratio
- Type of building materials preferred
- The openings
- Housing typologies and the form
- Building orientation
- Local climatic conditions
- Affordability factors
- Environmental friendliness
- The Weight of the roof
- The thickness of the wall
- Seismic safety aspects related to non-structural hazards

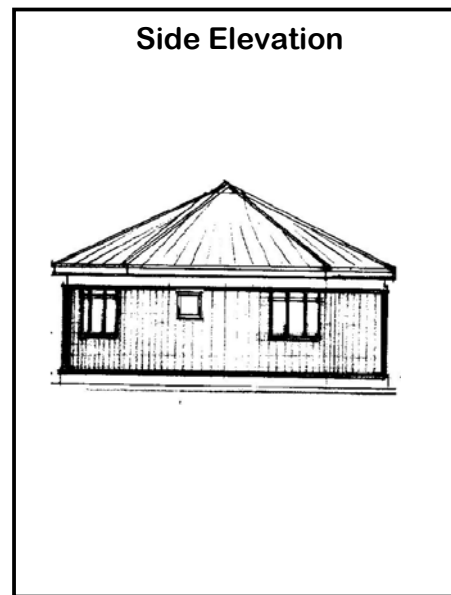
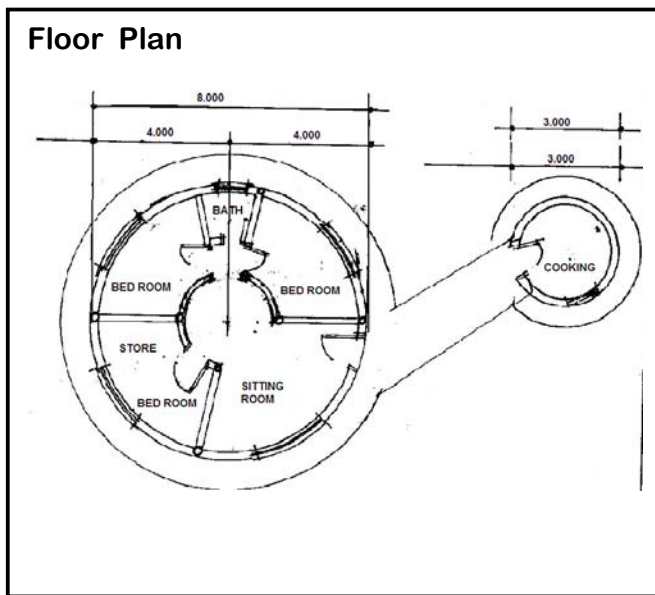
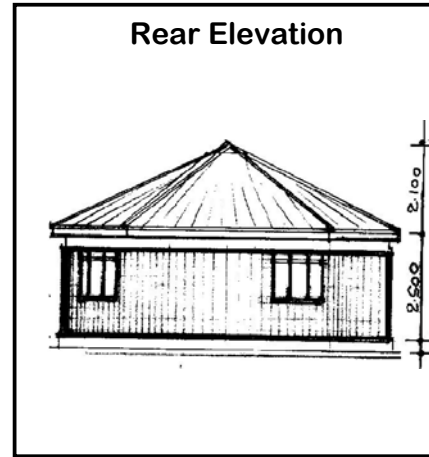
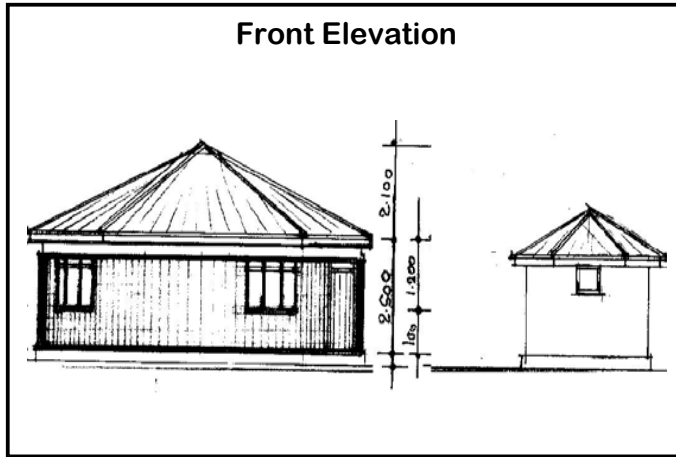
The National Task Force developed a few proto type house plans to be deposited with the District Engineers' Offices which will be responsible for making them available to the public at a nominal fee. It is however important that these plans are released to the applicant after a Building Inspector has visited the site and provided appropriate recommendation.

Other potential developers who may wish to modify the plans to suit their tastes are free to consult the District Engineers for advice. Workmanship and supervision are very crucial in ensuring compliancy to guidelines and seismic safety. The developers and contractors should endeavour to comply with recommended guidelines to safeguard against future seismic hazards.

Here below are examples of four prototype plans that have been designed to resist earthquake hazards.

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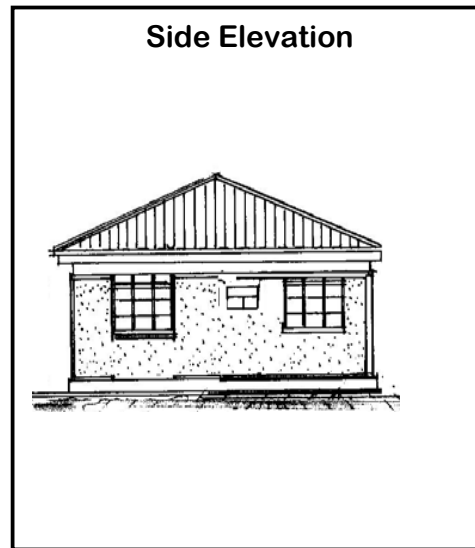
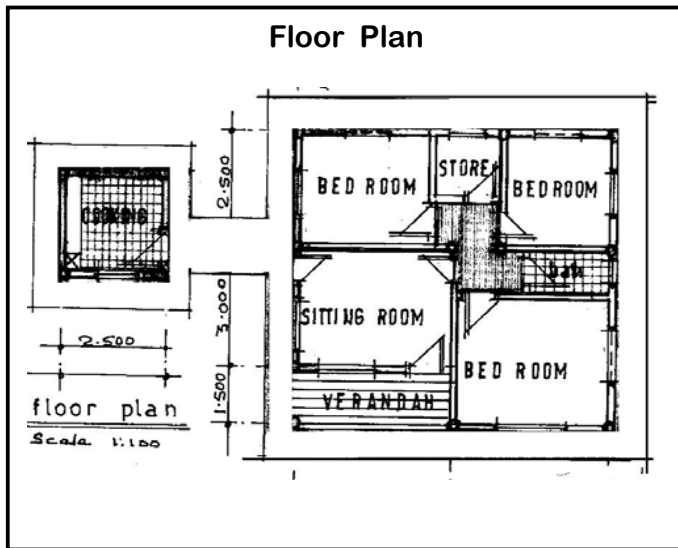
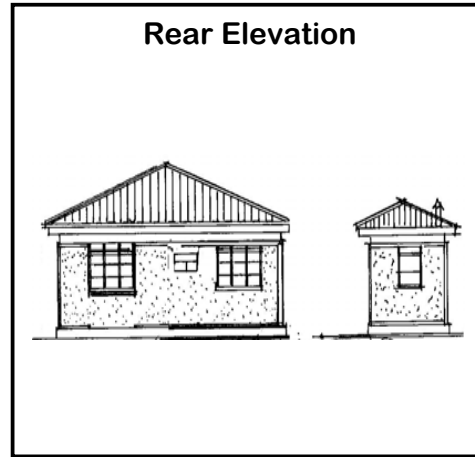
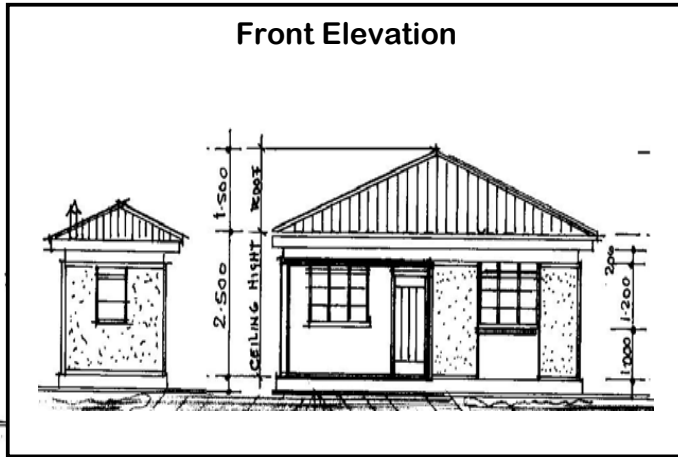
PROTO TYPE PLAN 1 - ROUND SHAPE



Schedule of Materials		
Hardcore filling	11	Tons
Murram filling	11	Tons
cement (50Kg)	117	Bags
Lime (25Kg)	12	Bags
Sand	29	Tons
Aggregates	22	Tons
12mm Diameter Twisted reinforcement bars	204	LM
8mm Round bars	156	LM
No. 142 Fabric mesh reinforcement	2	Rolls
225 x 113 x 75mm Burnt clay bricks	7183	NO
DPC material(bituminous felt)	2	Rolls
1000Gauge polythene sheet DPM	2	Rolls
200 x 50mm Hard wood timber frames	37	LM
100 x 50mm Sawn treated timber	172	LM
230 x 25mm Fascia board	30	LM
28Gauge iron sheets cover	35	NO
Oil gloss paint	5	LTRS
Emulsion paint	17	LTRS
1000 x 1000mm high windows	5	NO
500 x 600mm high windows	1	NO
Window stay/fasteners (each)	11	NO
Clear sheet glass 4mm thick	6	SM
Flush doors size 800 x 2000mm high	1	NO
Batten doors 900 x 2100mm high	5	NO
Hinges	9	PRS
3Lever union door locks	6	NO

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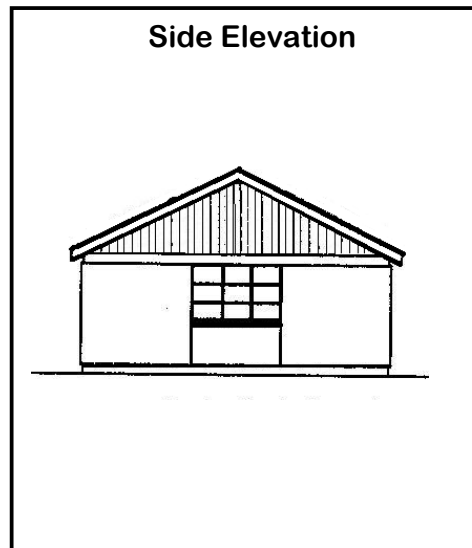
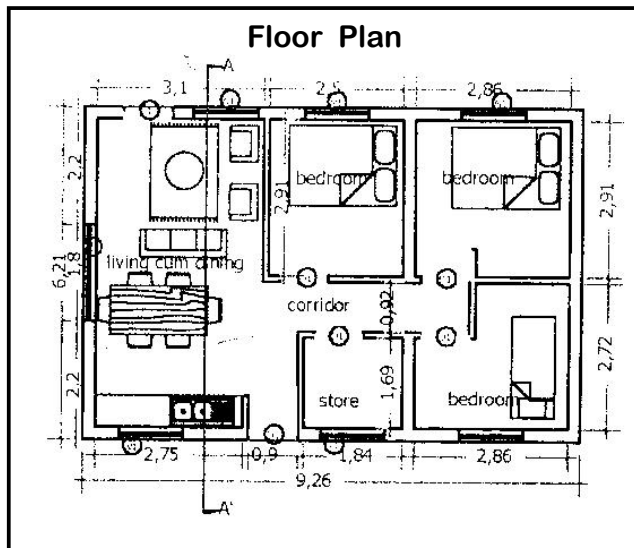
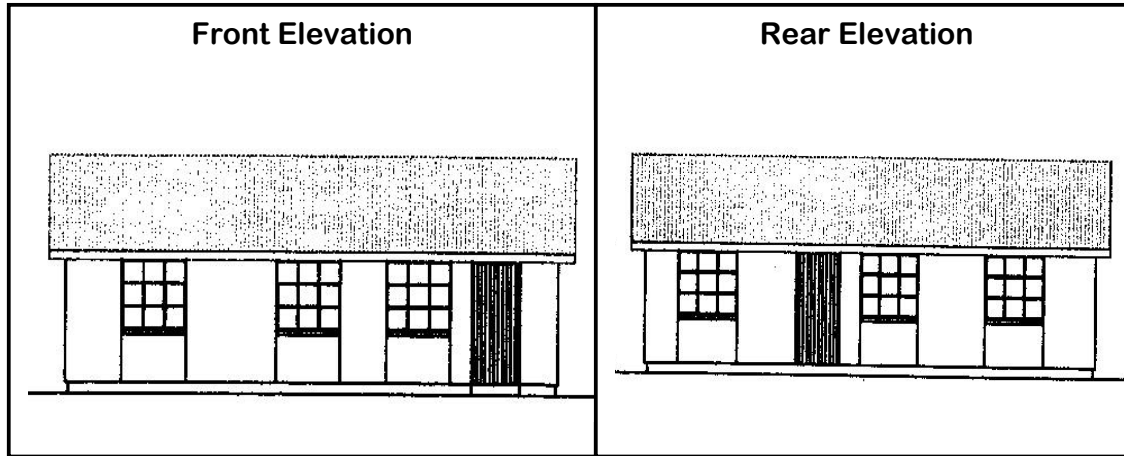
PROTO TYPE PLAN 2 - SQUARE SHAPE



Schedule of Materials		
Hardcore filling	12	Tons
Murram filling	12	Tons
cement (50Kg)	143	Bags
Lime (25Kg)	17	Bags
Sand	28	Tons
Aggregates	20	Tons
12mm Dia. Twisted reinforcement bars	303	LM
8mm Round round bars	462	LM
No. 142 Fabric mesh reinforcement	3	Rolls
225 x 113 x 75mm Burnt clay bricks	12700	NO
DPC material(bituminous felt)	2	Rolls
1000Gauge polythene sheet DPM	3	Rolls
200 x 50mm Hard wood timber- frames	49	LM
100 x 50mm Sawn treated timber	445	LM
230 x 25mm Fascia board	51	LM
28Gauge iron sheets cover	30	NO
450mm Ridge cover	17	NO
Oil gloss paint	15	LTRS
Emulsion paint	20	LTRS
Precast concrete units 1.2m, 1m & 0.5m	38	NO
1200 x 1200mm high window	3	NO
1000 x 1200mm high window	5	NO
500 x 600mm high window	4	NO
Window stay/fasteners (each)	20	NO
Clear sheet glass 4mm thick	11	SM
Flush doors size 800 x 2000mm high	6	NO
Batten doors 900 x 2100mm high	3	NO
Hinges	11	PRS
3Lever union door locks	9	NO
13mm Celotex ceiling softboard	20	NO

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PROTO TYPE PLAN 3 - RECTANGULAR SHAPE

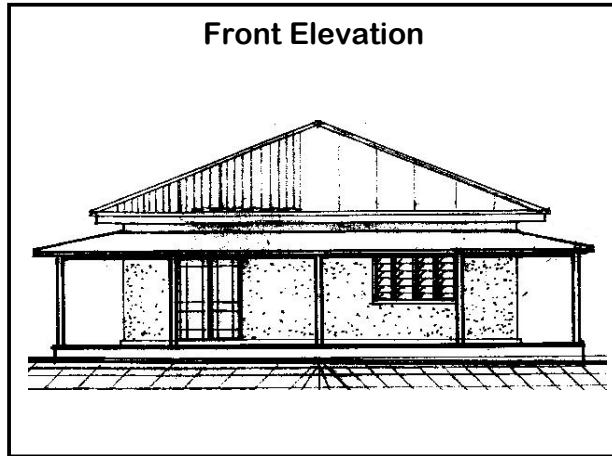


Schedule of Materials

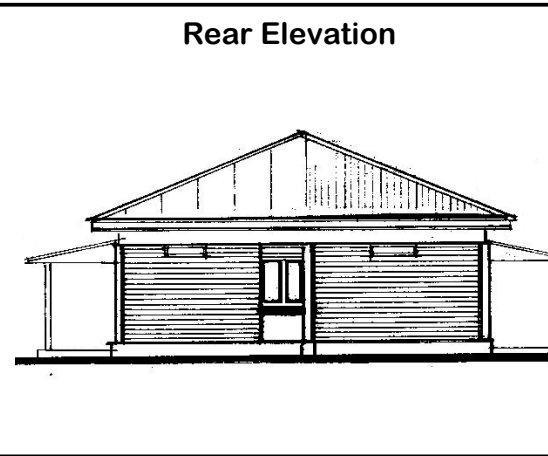
Hardcore filling	16	Tons
Murram filling	16	Tons
cement (50Kg)	162	Bags
Lime (25Kg)	21	Bags
Sand	32	Tons
Aggregates	25	Tons
12mm Diameter Twisted reinforcement bars	355	LM
8mm Round round bars	500	LM
No. 142 Fabric mesh reinforcement	04	Rolls
225 x 113 x 75mm Burnt clay bricks	14904	NO
DPC material(bituminous felt)	03	Rolls
1000Gauge polythene sheet DPM	04	Rolls
200 x 50mm Hard wood timber for frames	33	LM
100 x 50mm Sawn treated timber	522	LM
230 x 25mm Fascia board	36	LM
28Gauge iron sheets cover	32	NO
450mm Ridge cover	09	NO
Oil gloss paint	28	LTRS
Emulsion paint	33	LTRS
Precast concrete units 1.2m, 1m and 0.5m	06	NO
1200 x 1200mm high window	01	NO
1000 x 1200mm high window	06	NO
500 x 600mm high window	-	NO
Window stay/fasteners (each)	14	NO
Clear sheet glass 4mm thick	09	SM
Flush doors size 800 x 2000mm high	04	NO
Batten doors 900 x 2100mm high	02	NO
Hinges	07	PRS
3Lever union door locks	06	NO
13mm Celotex ceiling softboard	18	NO

Earthquake Resistant Construction Handbook

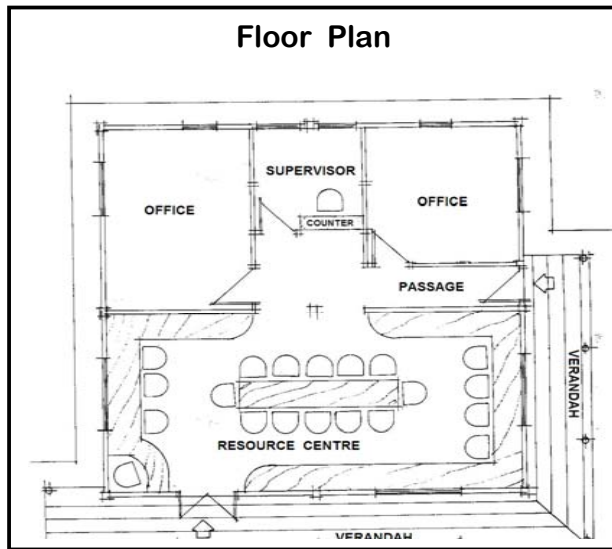
PROTO TYPE PLAN 4 - THE PROPOSED EARTHQUAKE RESISTANCE DEMONSTRATION RESOURCE CENTRE



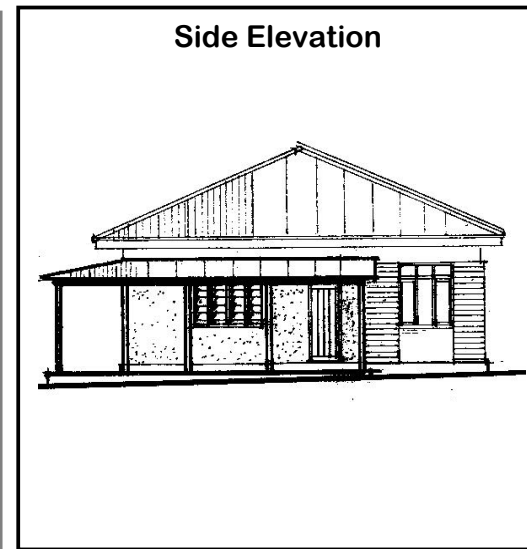
Front Elevation



Rear Elevation



Floor Plan



Side Elevation

Schedule of Materials

Hardcore filling	15	Tons
Murram filling	15	Tons
cement (50Kg)	160	Bags
Lime (25Kg)	19	Bags
Sand	30	Tons
Aggregates	24	Tons
12mm Diameter Twisted reinforcement bars	325	LM
8mm Round round bars	480	LM
No. 142 Fabric mesh reinforcement	04	Rolls
225 x 113 x 75mm Burnt clay bricks	13600	NO
DPC material(bituminous felt)	02	Rolls
1000Gauge polythene sheet DPM	03	Rolls
200 x 50mm Hard wood timber for frames	28	LM
100 x 50mm Sawn treated timber	520	LM
230 x 25mm Fascia board	58	LM
28Gauge iron sheets cover	42	NO
450mm Ridge cover	21	NO
Oil gloss paint	25	LTRS
Emulsion paint	30	LTRS
Precast concrete units 1.2m, 1m and 0.5m	07	NO
1200 x 1200mm high window	03	NO
1000 x 1200mm high window	06	NO
500 x 600mm high window	-	NO
Window stay/fasteners (each)	18	NO
Clear sheet glass 4mm thick	11	SM
Flush doors size 800 x 2000mm high	03	NO
Batten doors 900 x 2100mm high	02	NO
Hinges	06	PRS
3Lever union door locks	05	NO
13mm Celotex ceiling softboard	16	NO

7.0 UNIT COST ANALYSIS OF VARIOUS HOUSE OPTIONS

This section gives a rough guide on the unit cost of different house options to facilitate a developer to make an estimation of how much it would cost to construct a house of an area of one's choice. These unit costs are applicable to single-storey building structures that are built on a firm-rock ground. An allowance of up to 10% may have to be made to cater for sites with peculiar features such as sites located along a slope or on weak or loose soils, proximity to the seismic source zone, etc. These costs cover all building materials including the cost of the ground beam with exception of all houses built of mud and wattle walls.

7.1 Comparative Unit Cost* Analysis of various house options Shs'000

	Foundation Type											
	Reinforced Concrete			Concrete			Brick/Block			Others		
Roof Type →	Thatch	CGI Sheets	Tiles	Thatch	CGI Sheets	Tiles	Thatch	CGI Sheets	Tiles	Thatch	CGI Sheets	Tiles
Wall Type												
Mud + Wattle ↓	44.3	53.2	0.0	44.3	53.2	0.0	44.3	53.2	0.0	44.3	53.2	0.0
Timber	246.7	257.3	310.5	236.5	247.1	300.3	230.9	241.5	294.7	237.6	248.2	301.4
Burnt "Kifufu" Bricks	227.1	237.7	290.9	216.7	227.3	280.5	211.2	221.8	275.0	217.9	228.5	281.7
Stabilized Interlocking Blocks	239.1	249.7	302.9	228.9	239.5	292.7	223.3	233.9	287.1	230.0	240.6	293.8
Burnt Clay Bricks	232.9	243.5	296.7	222.6	233.2	286.4	217.1	227.7	280.9	223.8	234.4	287.6
Concrete Blocks	249.0	259.6	312.8	238.7	249.3	302.5	233.2	243.8	297.0	239.9	250.5	303.7

* These unit costs are derived from prices as of December, 2003 obtaining in Fort Portal

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7.2 Recommended options for minimum seismic safety in areas with different seismic risks

Category	Conventional Structure	Earthquake Resistant Component		
		0.11g - 0.20g	0.21g - 0.30g	0.31g and above
Peak Ground Acceleration (PGA)	Below 0.10g	0.11g - 0.20g	0.21g - 0.30g	0.31g and above
Foundation	Concrete	Concrete	Concrete	Concrete
Ground Beam	Optional	Optional*	RC Ground Beam	RC Ground Beam
DPC	DPC	DPC	DPC	DPC
Floor Slab	Cement screed	Cement Screed	Mass Concrete slab	Reinforced Concrete slab
Wall	Conventional	Conventional	Reinforced	Reinforced
Horizontal Reinforcement metal strips	After every 3 courses	After every 3 courses	After every 3 courses	After every other course
Ring Beam	Reinforced Concrete Ring Beam	Reinforced Concrete (RC) Ring Beam at 4 courses below wall plate	RC Ring Beam at wall plate	RC Ring Beam at wall plate
Columns	Optional	Optional	Columns are obligatory	Columns are obligatory
Wall Plate	Obligatory	Obligatory	Obligatory	Obligatory
Roof Structure	Timber well-inter-connected	Timber well-inter-connected	Timber well-inter-connected	Timber well-inter-connected
Water Tank	Outside the roof	Outside the roof	Outside the roof	Outside the roof
Fittings	Securely fixed on walls and ground		Securely fixed on walls and ground	
Electricals	Designed	Designed	Designed	Designed

* - Ground beam is required in soft/weak soils