

Temporary Shelter For Tsunami Victims

Compiled by

**Centre for Housing Planning and Building
&
ITDG South Asia**

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Introduction

Significant amount of People displaced by Tsunami are still in refugee camps and it is likely that they would have to be accommodated for a longer time, until they are provided with permanent shelter. But it is not feasible to house them in refugee camps not geared to accommodate such a large population on a continuous basis. In order to give decent temporary shelter for them, the following is proposed.

The temporary solution proposed can be erected using a timber frame. GI sheets already available with NHDA would be used as the roofing material, while plastic sheet that is going to be provided by the UNHCR is suggested for wall cladding. The timber is used as the framework with the intention of using same timber element in permanent houses that is going to be followed.

Small individual fire place is also proposed for cooking within the house and toilets and wash rooms are provided for limited sharing outside the house (separate toilets for males and females).

House and Utility Design

The proposed temporary shelter is designed so that each family has

- a separate unit with a 200 sqft floor area, having two rooms
- shared toilet with three other families maximum (separate male and female toilets)
- shared washing place with three other families maximum (separate male and female washing places)
- All services are provided together to reduce the cost of infrastructure and the best use of land

Principles adopted

1. Privacy of family unit
2. Privacy within the family unit (internal partitioning)
3. Privacy between men and women
4. Responsible management of toilets and bathing places
5. Limited Privacy in toilets use
6. Manageable cost

ITDG South Asia which worked along with CHPB has made further deliberations on these in their concept paper which is attached (*Annexure 9*)

Materials

The proposed shelter is to be constructed out of GI sheets for roof and plastic sheets for wall cladding, with a timber structure (4"x 2" and 2" x 2").

Floor is made out of cement stabilized soil and rendered with cement-soil putty to a smooth finish.

Rationale

The GI sheets and timber could be used as roofing material in some of the permanent houses to be built later, once the temporary shelters are abandoned.

Once the temporary shelter is abandoned the material of the floor can be used as a filling material.

Hence the cost of labor would only be wasted.

Options

Option 1

Single temporary shelters

- a. Incorporating in the permanent house layout
This will enable the builder to construct part of the foundation of the permanent fixture and build the temporary shelter in that (selecting two parts of the house) so that duplicating the cost of floor in permanent and temporary arrangement is avoided
- b. In the same premises where the permanent house is to be built
This will enable the occupant to have more privacy and also facilitate early shifting to a permanent house
- c. Other
When small plots that can accommodate only one house are available for temporary settlements because of topography of the terrain this will enable to minimize land preparation costs

Details

- Cost of the house without GI sheets and wall cladding material (assuming that free GI sheets will be made available by the Government and plastic sheets for wall cladding is provided by UNHCR)- *Annexure 1*
- Material list – *Annexure 2*

Option 2

Twin houses

- d. Incorporating in the permanent house layout when a twin house is acceptable as a permanent solution

This will enable the builder to construct part of the foundation of the permanent fixture and build the temporary shelter in that so that duplicating the cost of floor in permanent and temporary arrangement is avoided

This will also enable to reduce the cost of one wall in both temporary and permanent shelter arrangements

- e. Other

When small plots that can accommodate two houses are available for temporary settlements because of topography of the terrain this will enable to minimize land preparation costs

Details

- Cost of the twin house without GI sheets (assuming that free GI sheets will be made available by the Government and charity organizations)- ***Annexure 3***
- Material list – ***Annexure 4***
- Lay out of the twin house – ***Annexure 5***

Option 3

Series of houses in a row (maximum of four)

When medium size lands are available

Details

- Cost of the four houses without GI and plastic sheets (assuming that free GI sheets will be made available by the Government and plastic sheets by UNHCR and other charity organizations) – ***Annexure 6***
- Material list – ***Annexure 7***
- Lay out of the houses – ***Annexure 8***

Option 4

Community housing consisting of series of houses in a row

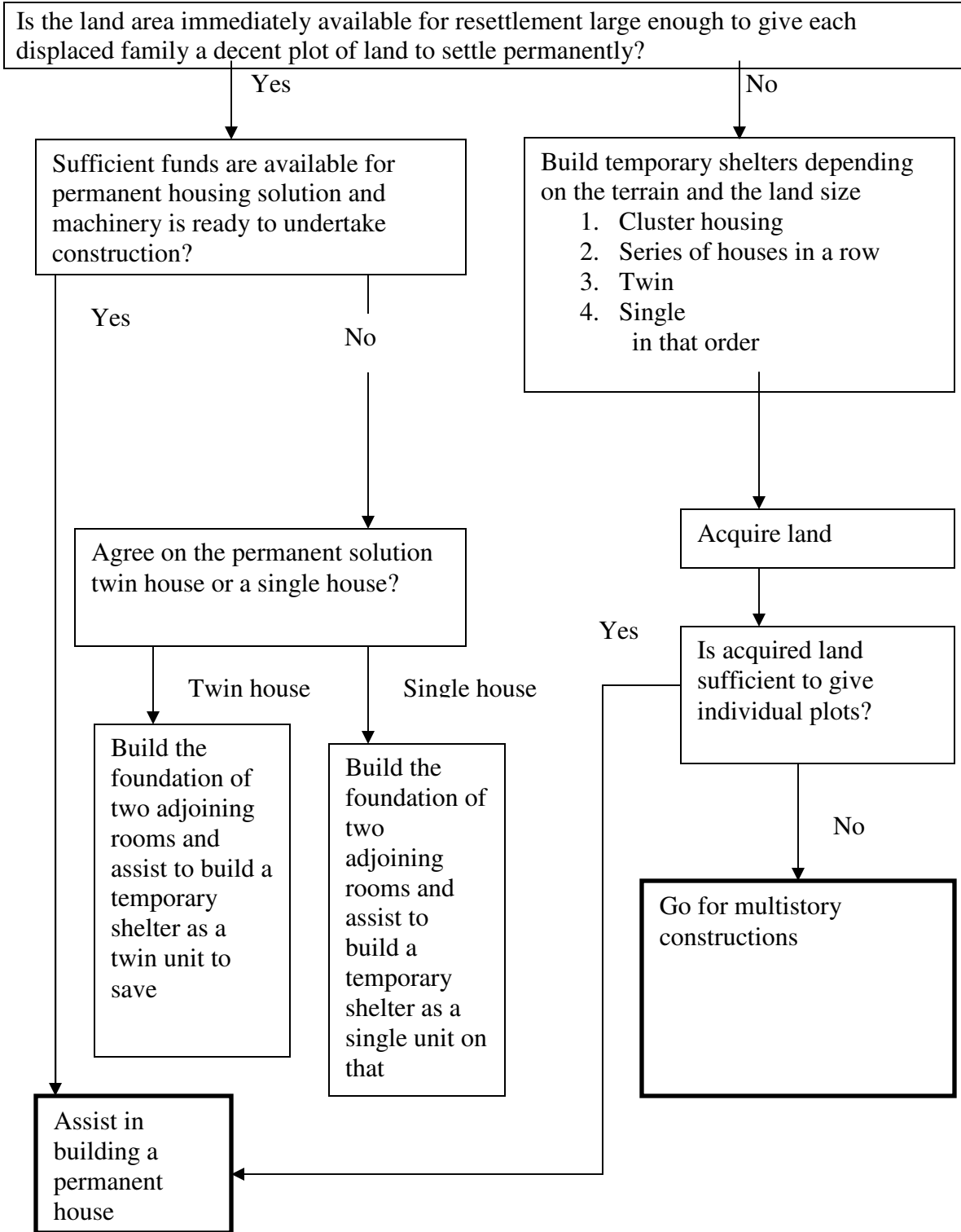
When large plots of lands are available for immediate occupancy but not large enough for distributing for permanent settlement among all who need houses

Details

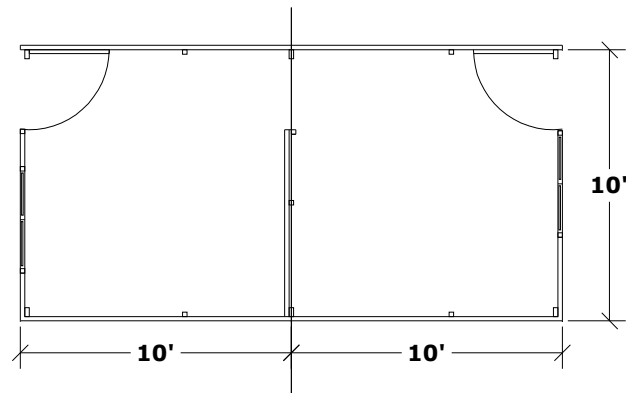
- Layout of the houses

This cluster housing layout had been done in conjunction with ITDG South Asia and proposal, as articulated by them is attached. – ***Annexure 9***

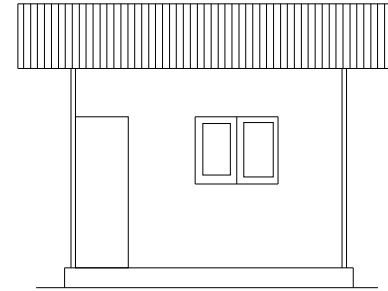
Decision Flow Chart for Selecting the Option



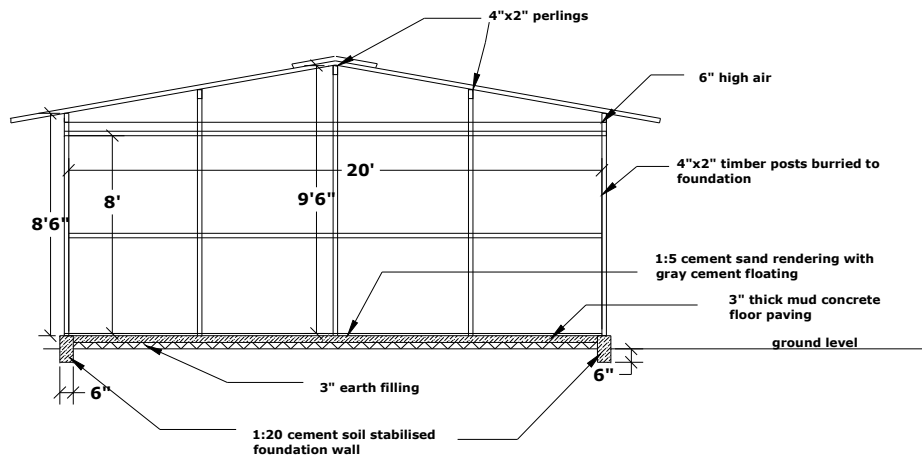
TEMPORARY SHELTER FOR DISPLACED FAMILIES



PLAN



ELEVATION



SECTION

**Estimate for Construction of one number Temporary Shelter
with available GI Sheets**

Floor Area - 200 Sq.Ft

Item No.	Description of work	Unit	Quantity	Rate Rs	Amount Rs.
1	Site Clearing	Lump Sum		-	300.00
2	Excavation for Foundation. Depth of excavation is approximately 6".	Cube	0.2	350.00	70.00
3	6" thick 1:20 Cement - Soil Stabilized wall for Foundation	Cube	0.36	9625.00	3465.00
4	3" thick earthfilling under Floors	Cube	0.46	1550.00	713.00
5	Gage 20 Corrugated GI Sheet Partitioning for Walls with 4"x2" timber verticals and 2"x2" reepers at 4" 0' intervals. GI Sheets available.	Sq.Ft.	504.0	17.00	8568.00
6	Corrugated GI Sheet roofing with 4"x2" purlins. GI Sheets available.	Sq.Ft.	300.0	14.00	4200.00
7	Ridging with GI plain sheets. GI sheets available.	L. Ft.	12.0	18.00	216.00
8	3" thick 1:10 Cement-Soil Stabilized Floor paving	Cube	0.45	9280.00	4176.00
9	1:5 Cement rendering with gray cement floating for floors	Sqrs	2.00	1000.00	2000.00
10	GI Sheet door with 2"x 2" timber frame and fixtures. GI Sheets available.	Nos	2.0	800.00	1600.00
11	4' 0" x 4' 0" Window with 2"x2" timber frame, 1" thick Albisiya timber plank sashes and fixtures.	Nos	2.0	1115.00	2230.00
	TOTAL				27538.00

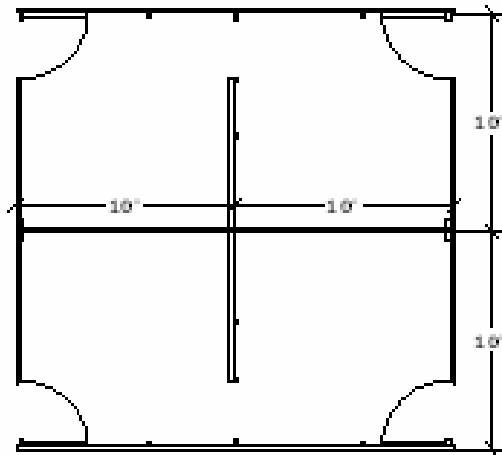
Materials List for Construction of one number Temporary Shelter

Floor Area - 200 Sq.Ft

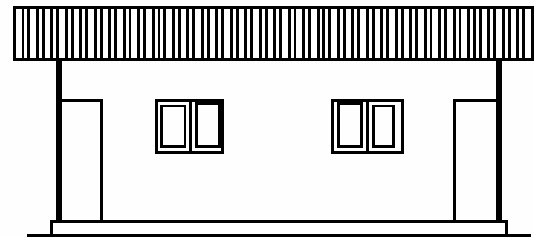
Materials requirement	Unit	Quantity
Soil	Cube	1 3/4
Cement	Bags	6 1/2
4" x 2" Timber members		
12' 0"	Nos	5
10' 6"	Nos	2
9' 6"	Nos	4
2" x 2" Timber members	L. Ft	290
1" thick Albisiya timber planks for window	Sq.Ft	28
1' 0" Barrel Bolts	Nos	2
4" Barrel Bolts	Nos	6
Hinges	Nos	12
Wire nails		

<u>Material requirement</u>	
Available in Ministry	
8' 0" x 3' 0" Plain GI Sheets for ridging	1 No.
10' 0" x 3' 0" Corrugated GI Sheets for roofs	11 Nos.
Available with UNHCR	
Plastic sheets for wall panels	504 Sq.Ft

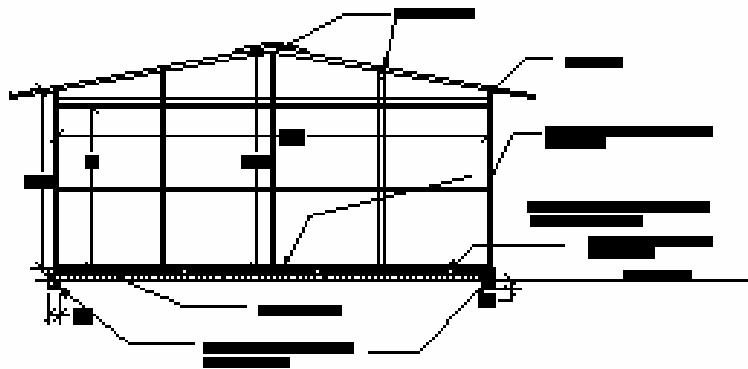
TEMPORARY SHELTER FOR DISPLACED FAMILIES



PLAN



SIDE ELEVATION



SECTION

**Estimate for Construction of one number Twin Temporary Shelter
with available GI Sheets**

Total Floor Area - 400 Sq.Ft

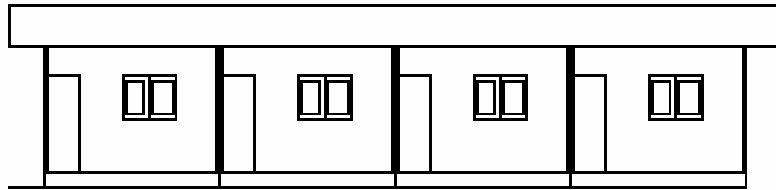
Item No.	Description of work	Unit	Quantity	Rate Rs	Amount Rs.
1	Site Clearing	Lump Sum			300.00
2	Excavation for Foundation. Depth of excavation is approximately 6".	Cube	0.31	350.00	108.50
3	6" thick 1:20 Cement - Soil Stabilized wall for Foundation	Cube	0.62	9625.00	5967.50
4	Earthfilling under Floors	Cube	0.90	1550.00	1395.00
5	Gage 20 Corrugated GI Sheet Partitioning for Walls with 4"x2" timber verticals and 2"x2" reepers at 4" 0' intervals. GI sheets available.	Sq.Ft.	828.0	17.00	14076.00
6	Corrugated GI Sheet roofing with 4"x2" purlins. GI sheets available.	Sq.Ft.	530.0	14.00	7420.00
7	Ridging with GI plain sheets. GI sheets available.	L. Ft.	21.5	18.00	387.00
8	3" thick 1:10 Cement-Soil Stabilized Floor paving	Cube	0.90	9280.00	8352.00
9	1:5 Cement rendering with gray cement floating for floors	Sqrs.	4.00	1000.00	4000.00
10	GI Sheet door with 2"x 2" timber frame and fixtures. GI sheets available.	Nos	4.0	800.00	3200.00
11	4' 0" x 4' 0" Window with 2"x2" timber frame and 1" thick Albisiya timber plank sashes	Nos	4.0	1115.00	4460.00
	TOTAL				49666.00

Materials List for Construction of one number Twin Temporary Shelter

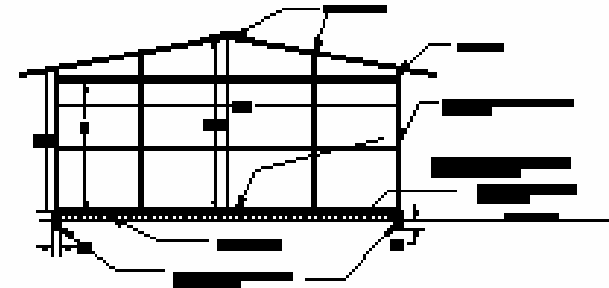
Total Floor Area - 400 Sq.Ft

Materials requirement	Unit	Quantity
Soil	Cube	3 1/2
Cement	Bags	12 1/2
4" x 2" Timber members		
	12' 0"	Nos 10
	10' 6"	Nos 3
	9' 6"	Nos 6
2" x 2" Timber members	L. Ft	570
1" thick Albisiya timber planks for window	Sq.Ft	56
1' 0" Barrel Bolts	Nos	4
4" Barrel Bolts	Nos	12
Hinges	Nos	24
Wire nails		

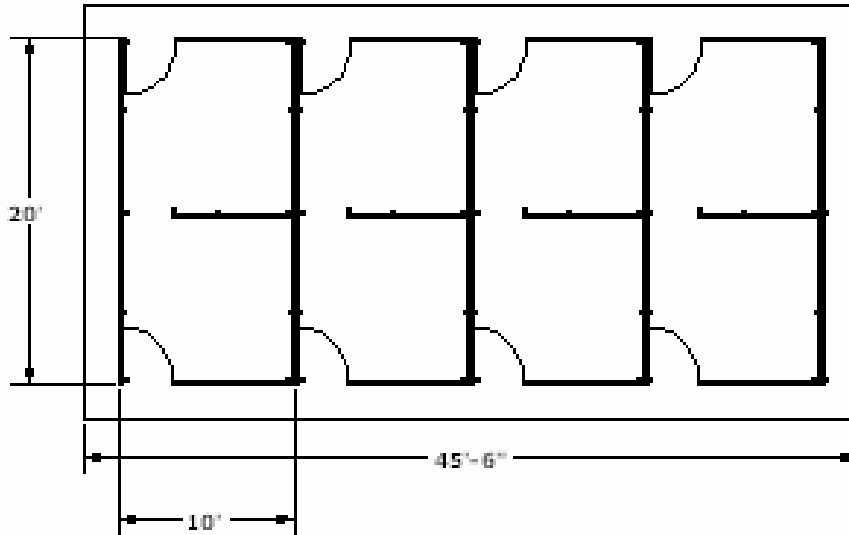
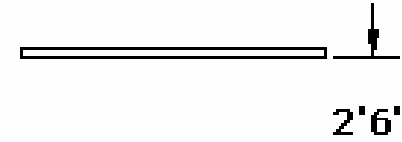
<u>Material requirement</u>	
Available in Ministry	
8' 0" x 3' 0" Plain GI Sheets for ridging	1 1/2 Nos.
10' 0" x 3' 0" Corrugated GI Sheets for roofs	22 Nos.
Available with UNHCR	
Plastic sheets for wall panels	828 Sq.Ft



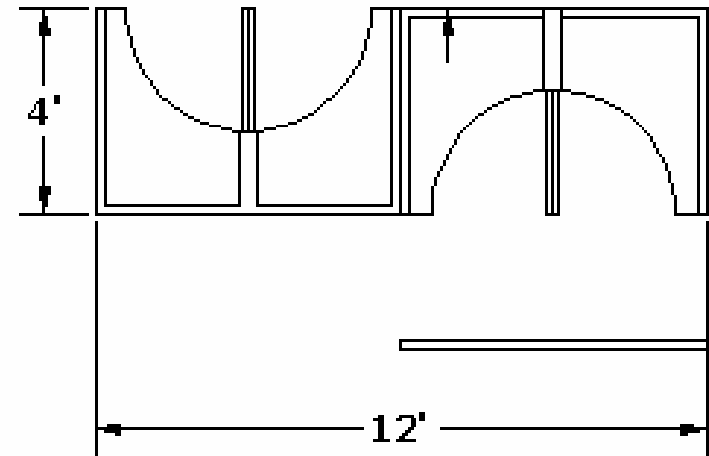
FRONT ELEVATION



SECTION



PLAN



PLAN OF COMMON TOILET

**Estimate for Construction of one unit Temporary Housing Cluster
of Four Houses with available GI Sheets**

Total Floor Area - 800 Sq.Ft

Item No.	Description of work	Unit	Quantity	Rate Rs	Amount Rs.
1	Site Clearing	Lump Sum			500.00
2	Excavation for Foundation. Depth of excavation is approximately 6".	Cube	0.56	350.00	196.00
3	6" thick 1:20 Cement - Soil Stabilized wall for Foundation	Cube	1.12	9625.00	10780.00
4	3" thick earthfilling under Floors	Cube	1.82	1550.00	2821.00
5	Gage 20 Corrugated GI Sheet Partitioning for Walls with 4"x2" timber verticals and 2"x2" reepers at 4' 0' intervals. GI Sheets available.	Sq.Ft.	1476.0	17.00	25092.00
6	Corrugated GI Sheet roofing with 4"x2" purlins. GI Sheets available.	Sq.Ft.	1060.00	14.00	14840.00
7	Ridging with GI plain sheets. GI sheets available.	L. Ft.	43.00	18.00	774.00
8	3" thick 1:10 Cement-Soil Stabilized Floor paving	Cube	1.85	9280.00	17168.00
9	1:5 Cement rendering with gray cement floating for floors	Sqrs	8.00	1000.00	8000.00
10	GI Sheet door with 2"x 2" timber frame and fixtures. GI Sheets available.	Nos	8.0	800.00	6400.00
11	4' 0" x 4' 0" Window with 2"x2" timber frame and 1" thick Albisiya timber plank sashes	Nos	8.0	1115.00	8920.00
	TOTAL				<u>95491.00</u>

Materials List for Construction of one unit Temporary Housing Cluster of Four Houses

Total Floor Area - 800 Sq.Ft

Materials requirement	Unit	Quantity
Soil	Cube	6 1/2
Cement	Bags	24 1/4
4" x 2" Timber members		
11' 6"	Nos	20
10' 6"	Nos	5
9' 6"	Nos	10
2" x 2" Timber members	L. Ft	1060
1" thick Albisiya timber planks for window	Sq.Ft	112
1' 0" Barrel Bolts	Nos	8
4" Barrel Bolts	Nos	24
Hinges	Nos	48
Wire nails		

<u>Material requirement</u>	
Available in Ministry	
8' 0" x 3' 0" Plain GI Sheets for ridging	3 Nos.
10' 0" x 3' 0" Corrugated GI Sheets for roofs	43 Nos.
Available with UNHCR	
Plastic sheets for wall panels	1476 Sq.Ft

RECOMMENDATIONS SUBMITTED TO CENTRE FOR HOUSING PLANNING & BUILDING (CHPB) REGARDING THE CONSTRUCTION OF SHELTERS FOR THE COMMUNITIES EFFECTED BY THE TSUNAMI

As per the request that came from CHPB, we submit these recommendations & suggestions for thoughts / discussions.

COMMON CRITERIA IN DESIGNING TEMPORARY SETTLEMENTS

1. Maintain at least 10' wide horizontal access paths at every two rows as shown in the diagrams. This space would help functioning of the 'day-to-day social interactions' among the residents.
2. The horizontal space between the back yards should be at least 7' between two rows. (The standard regulation to obtain light & ventilation for an arrangement like this is 15' between the two habitable areas, however it may not be feasible in a situation like this.)

Women would mostly use this space as it is adjacent to the bedroom and functions such as clothes drying can take place here. This also would be a private access path to the toilets / water points etc.

3. There has to be a 10' wide vertical link road at least at every six housing blocks as shown in the diagram.

The residents should have access to their plots at least by a handcart.

4. The roads & paths have to be prepared in such a way that people with disabilities too have undisturbed access to their houses. Steep slopes have to be avoided as much as possible. It has to be ensured that the residents with disabilities are able to manage mobility on their own as much as possible, so that they too can interact socially according to their preference. In allocating the plots to them, their preferences & needs have to be carefully considered.
5. Maximum number of housing units that is recommended to be allocated in a row is 06 and the minimum could be 03 in specific situations described in PLAN 03. Otherwise the minimum number of units in row should be 04 in order to minimize the costs of services infrastructure.
6. The vertical space between housing blocks can be used to locate toilets, water storage points, electricity lines etc. This will enable to cut down the costs of services infrastructure and as well as easy provision of services. The minimum width of the space that can be allocated is 10'.
7. Having a toilet & a water point for every 04-06 houses in a close proximity will help proper maintenance of those by the users themselves.

As many of the residents, especially women would need more privacy or rather used to have private & clean toilets; allocation of toilets for housing blocks is the recommended arrangement.

Also this provides them an arrangement somewhat closer to their previous lifestyle, thus contributes to better psychological status.

Also such arrangement will reduce obvious problems associated with sanitation & hygiene in common toiletry arrangements.

This will further reduce maintenance & management inputs as this option enables to provide a ration of water to 04-06 households, which the residents would manage among themselves.

8. The water storage tanks should be built after calculating the water requirement of the number of families that would use the tank. Water requirement approximately would be per housing unit.
9. Try to create an 'air-escape' by not having any solid barriers at the edge of the common paths.
10. Demarcating barriers to access or boundaries around the settlement is another important measure that would contribute to make the residents mentally & physically secure.
11. Maximize the orientation of the housing blocks in a uniformed direction as much as possible in order to ensure maximum use of available space.
12. The ideal common space would have a rectangular / square / circular shape covering an area above 3000 sq.ft. Location is ideal when there is easy access by all the housing units and is close to the main entrance & the administration office.
13. The Community hall should have an extent of 800 sq.ft. at least for 100 housing units. This has to be decided according to the number of housing units in the compound. It is advisable to locate the community hall closer to the administration unit, if facilities such as Television, Radios & Newspapers are provided.

RECTANGULAR & SQUARE PLOTS

These are the ideal plots for layout of temporary housing settlements as the spaces within & around the compounds can be clearly defined in terms of use, privacy & ownership etc. Also the space can be utilized to the maximum and there will be no wastage or unusable areas.

Avoid locating the common space in the middle of the settlement. The noise from the common activities would be disturbing to those who prefer not to participate in such common activities. It is obvious that the residents will have very little freedom & privacy in such a settlement and, therefore, the common spaces should be located as much as possible away from the housing blocks, thus providing fast & easy access to these places by all the residents.

The ideal location for the common space therefore would be the front left or right corner of the settlement as shown in the diagram.

The main entrance to the settlement & the administrative office can be located close to the common space.

PLOTS WITH UNEVEN / SLOPING TERRAINS

It is always advisable to avoid these plots as those incur additional costs in preparing the land for housing.

If possible, try to locate few housing blocks both vertically & horizontally.

Make sure that the housing blocks at higher terrains would not be have a view to the interior of the housing blocks at lower terrains.

Location of the common space in these plots has to be situation specific. The factors such as the best possible evenness in an area and the common criteria mentioned above for common spaces needed to be considered in this regard.

PLOTS WITH TRIANGULAR SHAPE

It is recommended to lay the housing plots along the two shorter axes as much as possible to maximize the usage of the land.

The central triangle that is automatically created can be used as the common space. It is always recommended to minimize the number of houses facing the common space.

NARROW & LONG PLOTS

If the width of the plot is between 35' – 54', it is recommended to change the orientation of the housing block & design as shown in PLAN 03. This provides better utilization of land in such restricted conditions.

If the width is approximately 55' - 84' PLAN 01 or 02 can be adopted.

If the width of the plot is around 85' the orientation & design shown in PLAN 04 is recommended.

If the width is approximately 65' or 125' design shown in PLAN 05 can be adopted.

The number of units per housing block can be increased in this manner, but our recommendation is to provide multiplicities of even numbers (04 unit blocks, 06 unit blocks etc.) except for the situation shown in PLAN 04 & 05.

PLOTS WITH CIRCULAR / ROUND SHAPES

The orientation of the housing blocks should start along the periphery of the plot as shown in the Diagram. Access road/s should run across the central axis. Location of the common space can be central provided there is at least 15' buffer between the housing blocks & common space.

Generally, this type of arrangements consumes more space for circulation, needs technically skilled persons involvement for setting out of the units etc., therefore, does not seem feasible for short-term, fast & quick construction arrangements of this nature.

RECOMMENDATIONS FOR HOUSING UNITS

As per the information received from Centre for Housing Planning & Building (CHPB), UNHCR has recommended a minimum space of 200 sq.ft. per housing unit.

We support the designs provided for housing units by CHPB and, recommend the heights of the units to be decided according to the material to be used for wall cladding. If it is G.I. corrugated roofing sheets, the minimum length of a single sheet that can be used for wall cladding is 8'.

It is recommended to have a 6" gap between the roof & the top of the wall cladding as an air gap enabling release of hot air.

In the corner near to the window of the front room, a triangular shaped masonry or heat resistant base can be provided with a 2' high heat resistant back-guard to place the stove for cooking. This will provide a safe cooking facility inside the unit, allowing the residents to lead an independent lifestyle of their own faster.

Placing the stove near the window will enable escape of smoke to outside while reducing smoke inside the room.

This arrangement will further reduce the dependence of the residents on basic needs, while enabling a step towards a their way of lives.

If the G.I. corrugated sheets are used the heat generated due to warming of all the housing units can cause health hazards etc. Applying a paint over would be one immediate solution, but will add some additional costs.

OUR SUGGESTIONS FOR FUTURE....

1. It would be an immediate solution for the victims to regain their lives if the intended residents are involved as much as possible in all the work starting from setting out to allocation of units. This will ease the workload of the government in its task of organizing work groups.
2. Involve NGOs, CBOs & Social Networks in the process of designing, identification & categorization of the beneficiaries & execution, as they have experience of similar work and have a network of human resources that can be utilized. Also they have skills, capacity & experience in mobilizing people for such activities.
3. Such an exercise can be extended towards the development of permanent settlements easily as we all become a part of the process from the beginning itself. This develops ownership & commitment of the parties involved and reduces the heavy workload on the Government.
Also the expertise that are available within the organizations can be used for the benefit of many, while allowing uniformity, integration and creating a means of control with regard to quality of the outcome.
4. Inclusion of representatives of all the sectors that have expressed commitments towards building shelters into one forum. This would enable easy coordination & communication of the action to all the sectors. It also binds all the interested parties to abide by the national level program. So that the government will find it easy to manage the tasks as many of organizational work can be handled by this forum. Also the multi-disciplinary nature of the stakeholders of this forum would create lot of knowledge that would make the process faster & fruitful.
5. Consolidation & synthesis of many skills, technologies, and knowledge available in & outside the country to this forum will provide access & well-defined directions to all the interested parties.
6. Monitoring & quality maintenance of the work can also be effectively handled through a forum of this nature, as the knowledge & financial providers will be keen to ensure that their inputs have been used in the right manner.

7. If the expertise organizations on livelihood options development & capacity building can be incorporated into this forum, the victims who have lost their livelihoods can be incorporated to provide ways & means of livelihood options within the program.
8. Management of funds too will become easy through such a forum as all the contributions get concentrated / channeled through it. Therefore, the national level fund allocation too can be adjusted accordingly.
9. Dissemination of the forum's functions to grass-root level will eventually create a mechanism that works as coordinated groups at local level, which can be gradually formalized as a local body for housing development recommendations which can be adopted as a concept to other parts of the country as well, with the experience of this effort. This not only facilitates the enactment of the regulations & systems of proper housing practices in an effective manner, but also provides the country with a mechanism of integrated development.
10. Also, the scattered information on housing & related areas also gets consolidated through this effort, so that the country will ultimately have a valuable resource hub with regard to housing, which will be immensely useful for our people.

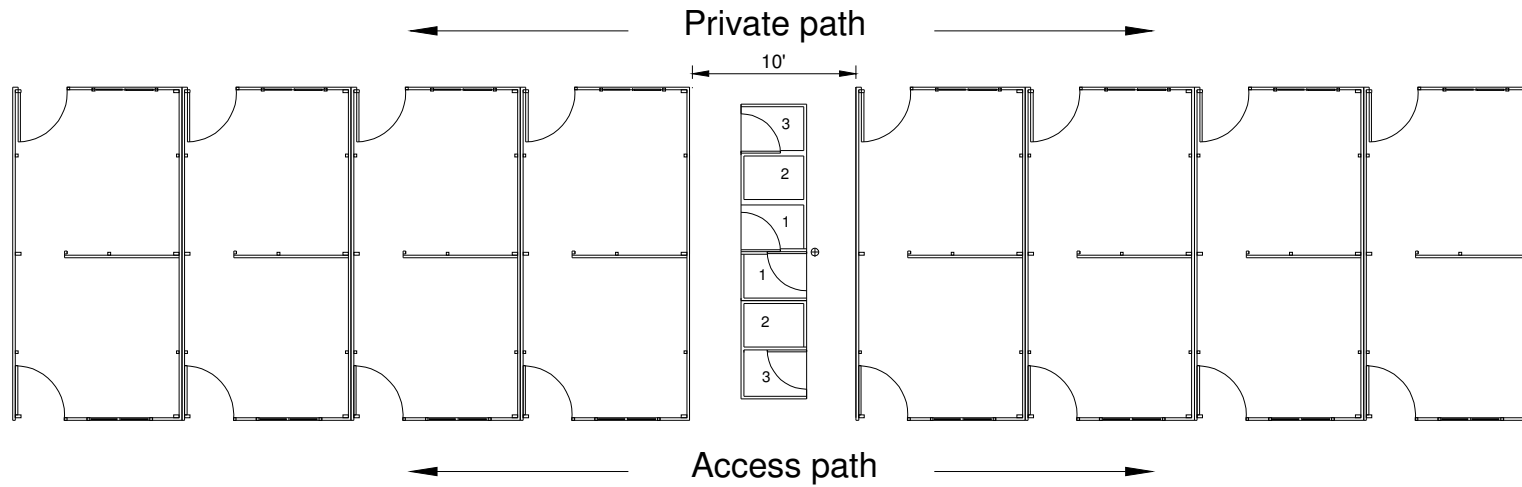
SOME FINAL THOUGHTS.....

In conclusion, we would like to mention that the costs that incur in temporary shelters too can be avoided & if we can think of a way to accelerate allocation of permanent plots to the victims, so that the materials, labour & time spent on building the temporary shelters can be constructively used to initiate building of permanent houses.

WHAT WE CAN OFFER.....

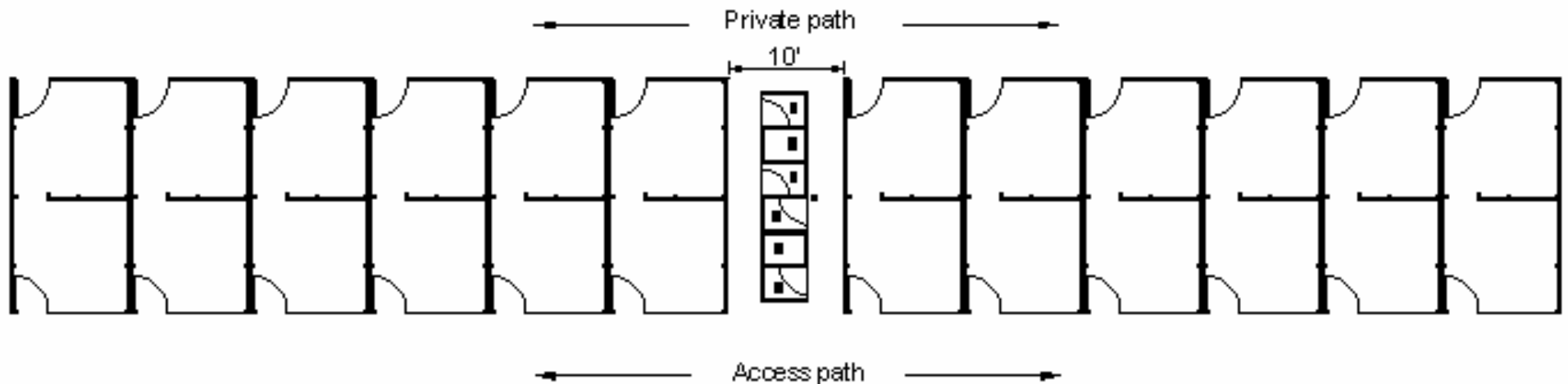
We, ITDG having in & outside the country & many links with many appropriate technology expertise among which cost-effective, disaster-resistant housing & related services such as water & sanitation, transport & infrastructure, working with people with disabilities, community oriented development processes and development / innovation of locally affordable technologies as a means of addressing poverty, would like share many of our knowledge, skills & capacities to help the government at this point of time. More information on our work & us is available at our website on <http://www.itdg.org/>.

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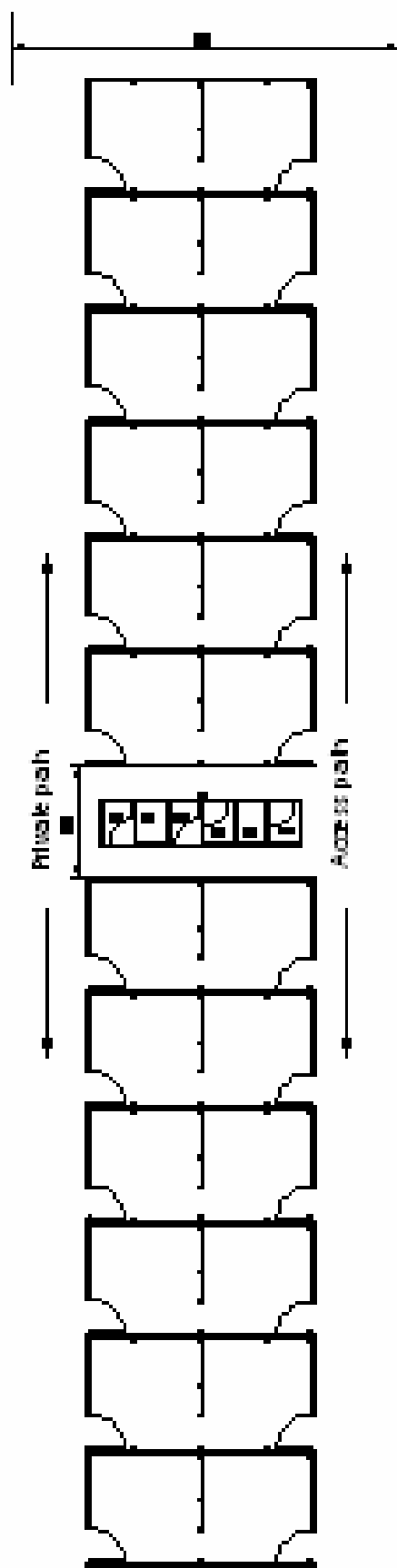
PLAN 01

- 1 - Toilet
- 2 - Water Storage Tank
- 3 - Washing Bay
- ⊕ - Electricity post fixed to toilet roof



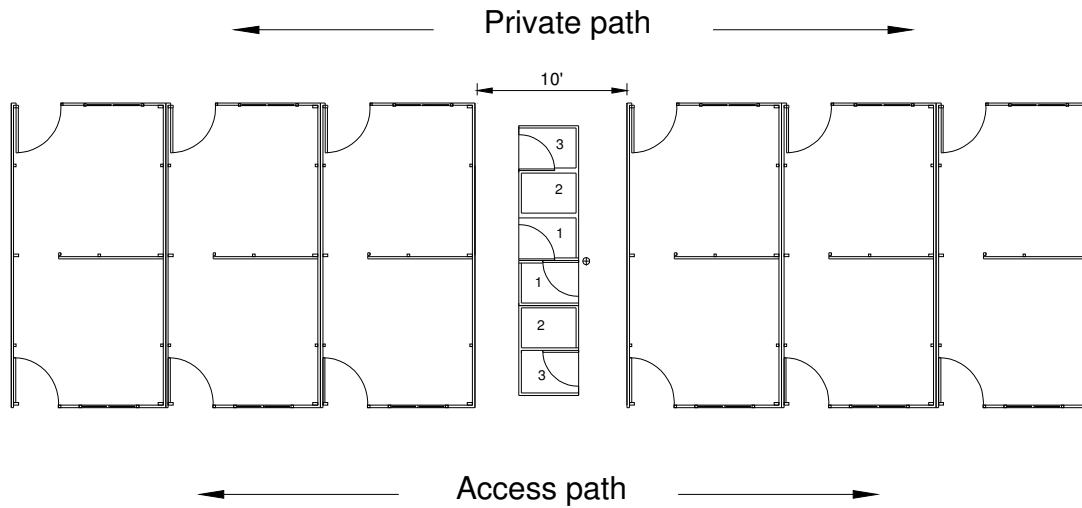
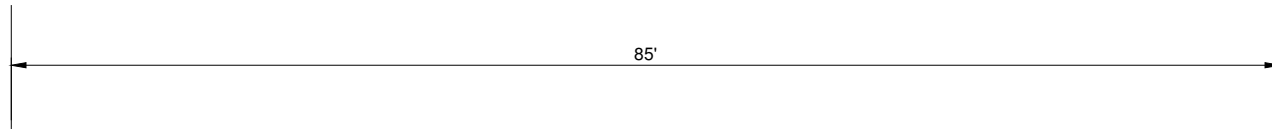
PLAN 02

- 1 - Toilet
- 2 - Water Storage Tank
- 3 - Washing Bay
- ◆ - Electricity post fixed to toilet roof



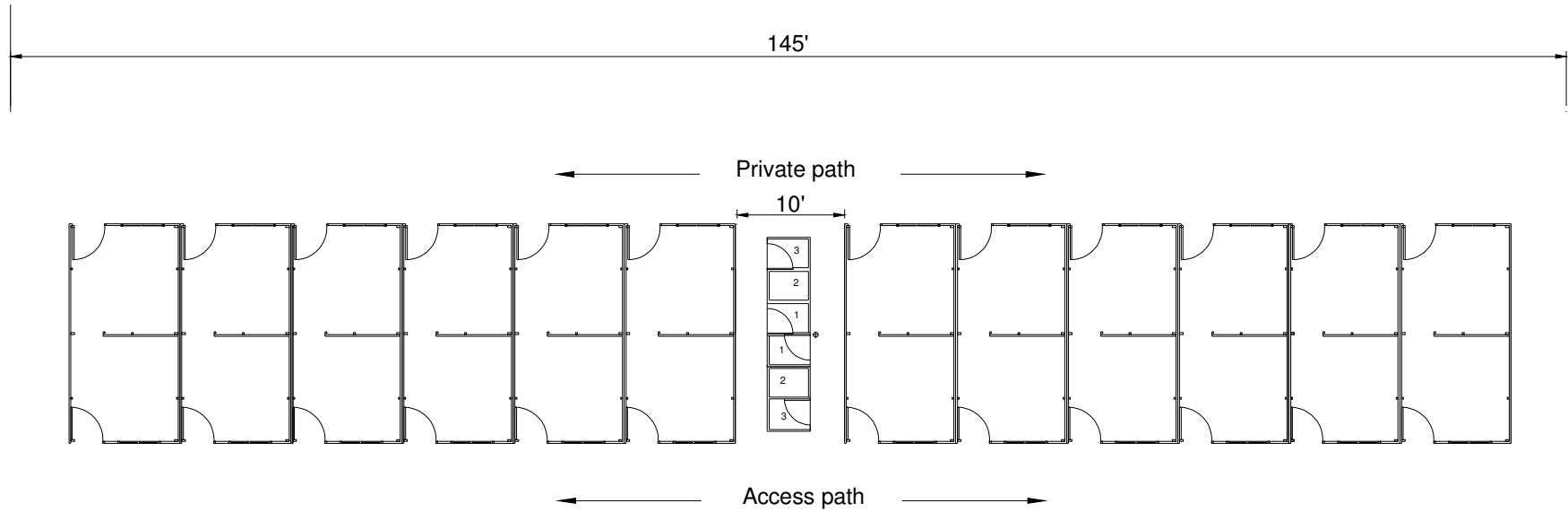
PLAN 03

- 1 - Toilet
- 2 - Water Storage Tank
- 3 - Washing Bay
- - Bench (typical) positioned to toilet roof



PLAN 04

- 1 - Toilet
- 2 - Water Storage Tank
- 3 - Washing Bay
- ⊕ - Electricity post fixed to toilet roof

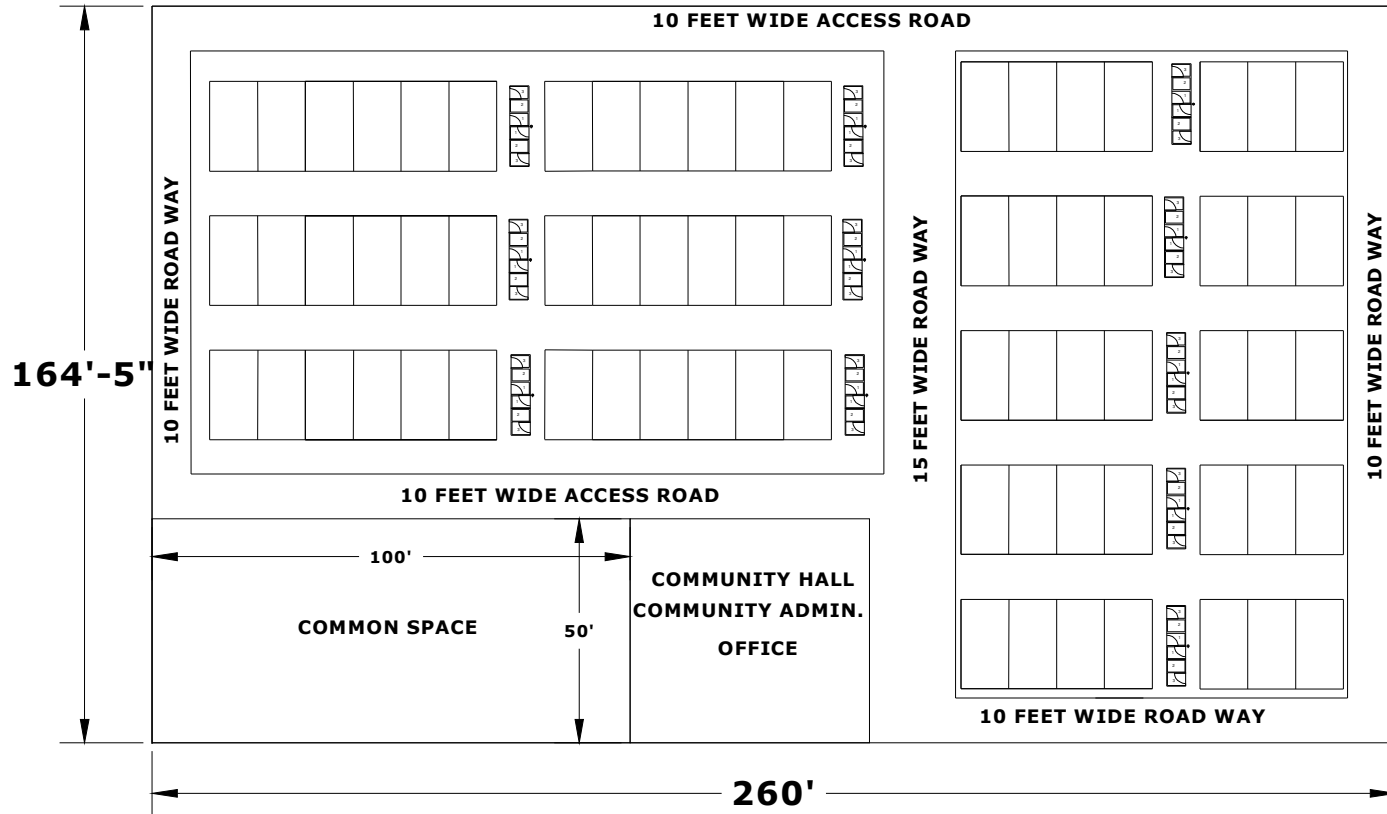


PLAN 05

- 1 - Toilet
- 2 - Water Storage Tank
- 3 - Washing Bay
- ⊕ - Electricity post fixed to toilet roof

LAYOUT PLAN

LAND AREA - ONE ACRE



TOTAL NO OF HOUSES - 71 Nos