
Disaster Resistant Rural House Design For Low Income People

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ABSTRACT

India has been facing natural disasters like drought, flood, cyclone, storm surge and earthquake every year in different parts of the country. These disasters cause large scale damages, destructions, death, injuries to human and animals. The non engineered houses constructed by the people are mostly damaged due to lack of technical guidance and affordability. Considering the growth of non engineered housing, and the damage level of housing due to disasters, it is essential to develop a appropriate housing model which resists the disaster forces. This paper describes the method of constructing rural housing using low cost techniques.

Keywords: Rural housing, earthquake resistant structures, disaster.

1. Introduction

India has been facing natural disasters like drought, flood, cyclone, storm surge and earthquake every year in different parts of the country. These disasters cause large scale damages, destructions, death, injuries to human and animals. The non engineered houses constructed by the people are mostly damaged due to lack of technical guidance and affordability. Considering the growth of non engineered housing, and the damage level of housing due to disasters, it is essential to develop a appropriate housing model which resists the disaster forces. This paper describes the method of constructing rural housing using low cost techniques.

2. Problems on Rural Housing

The rural houses are predominantly built with the locally available materials like mud, bamboo, tiles and thatches. These materials are not durable and get damaged due to heavy rain and wind blows. The projected eaves of the roof are also damaged due to heavy wind velocity. During cyclone the pyramidal shape roofs are damaged due to uplift forces developed by cyclone. The light roof structures having inadequate "J" bolts and absence of wind bracing and lack of ties, inadequate sheet thickness, fastening and insufficient frequency of the fasteners contribute to the damages, even the permanent houses constructed with RCC and brick walls are also affected due to the excessive corrosion of steel in the structures. The roof slab having inadequate thickness of roof concrete and low self weight which causes tension at the top due to the suction effect of the wind in where hair line cracks developed, These RC concrete exposed to the atmospheres are getting rusted and ultimately causes roof in to collapse. The unsymmetrical houses have shown heavy damages when it compared to symmetrical plan about its both axis. The effects of wind tunnel on the streets and housing plan arrangements are the factors to decide the damage level during disasters. The unreinforced masonry walls are also fails due to excessive tension. Some times the timber rafter are destroyed by the white ants and losses its section and leads to collapse at the time of disasters. The unscientific installation of roof tiles, the doors and windows latches, hinges and bolts are vulnerable hardware and fasteners

during the disaster. The cantilever parapets and the light weight verandah roof, improper connections of walls with footings are the most susceptible to high speed wind. The sitting of building on the terrain conditions like hills, valley, ridges in the windward side, leeward side are the factors influencing the damage level of structure.

1.3 Basic Requirement Of Cyclone Resistant Buildings

Based on the above facts the housing plan, design and executions should be carried out considering the following.

1. Avoid a low pitched roof
2. Use of Hip roof (or) High Pitched gable roof
3. Avoid over hanging roofs.
4. Cyclone shutters to be introduced in the opening places.
5. Minimize the projection of eaves.
6. Recommended steel reinforcement should be provided in the wall as seismic band in vertical and horizontal directions.
7. The foundation of the building should be designed by taking bearing capacity under the soil strata conditions and also checked the uplift pressure.
8. The wall should resist the horizontal forces developed by cyclone.
9. The joints are the vulnerable points should be properly designed and inter connection is essential.
10. The self weight of roof should be increased to counteract the uplift pressure developed by the cyclone, the structural components inter connected and anchored with the foundations so that the entire building should be act as one unit.
11. The over hanging roofs eaves projections are restricted.
12. The sloped roof is preferable rather than flat roof and low pitched roof are to be avoided
13. In the costal area the steel section should be protected from corrosion and use the anti corrosion reinforcement for the buildings. The cover for the reinforcement and quality of concrete are ensured for durability.

1.4 Design Of Model Rural House

While designing the socio economic status, present living pattern, traditional shape of existing the structures, type of labours and materials availability are considered for developing a house design,

Plan Form:

- Simple square / rectangle plan has been adopted in the design. A square symmetrical and compact plan form is more stable than a zig- zag plan, and is less prone to wind cyclone damages.
- The plan provides an inviting entrance verandah units a seat out, leading to the multipurpose living room which is also generally used for storing cloths, house hold utensil etc.
- The kitchen is attached to the rear side but do not have a door.
- A toilet at back yard has been proposed and separated form the main house.

Foundation:

Strip footing with RC band of 100mm thick to the width of brick masonry is to be provided all along the portion and connected to the RC Band.

Grade Beam 230mm x 75mm has been provided at the ground level and plinth beam has been provided at the plinth level in the design.

The vertical reinforcement (anchorage bars of 10mm rod) at the corners and jams of doors and windows has been provided from the ground level beam.

Walling:

The exterior brick walls are provided with horizontal and vertical reinforcing bars connected with concrete band to resist the horizontal pressure and continuous lintel beam has been provided. The height of the building kept as 3000mm.

Roofing:

As per the discussion on the failure of buildings during the disasters, the suction on flat roof is much more than sloping roof and many of the roof structure are fail is due to their less weight and poor anchorage. The pyramidal or hipped roof having symmetrical slope on both areas are flat roof with more self weight are the appropriate solution for the roof. Therefore 100thick reinforced concrete slab with M20 grade are suggested.

Table1: Specification Details of model houses.

TYPE	FOUNDATION	WALLING	ROOFING
MODEL 1	Strip Foundation	English Bond wall	R.C.C. Slab
MODEL 2	Strip Foundation	Rat - Trap bond wall	Brick Panel
MODEL 3	Strip Foundation	Stabilized Mud Block	Ferro Cement Channel

MODEL 1

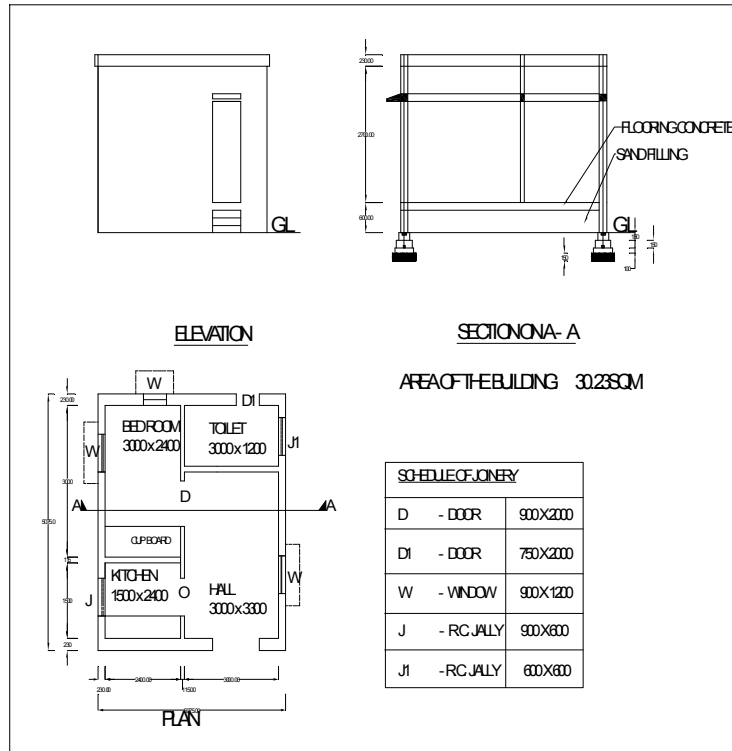


Figure 1: Plan showing the first type of proposed model

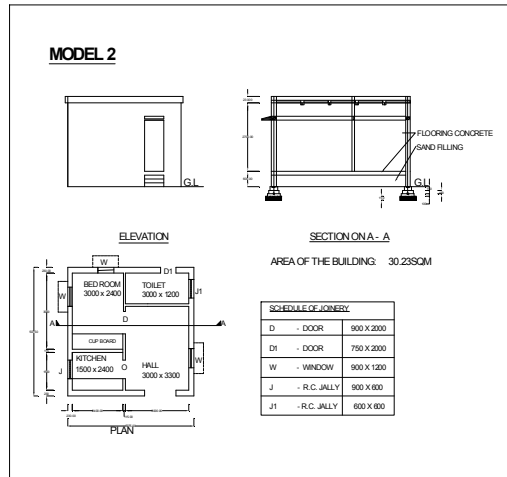


Figure 2: Plan showing the second type of proposed model

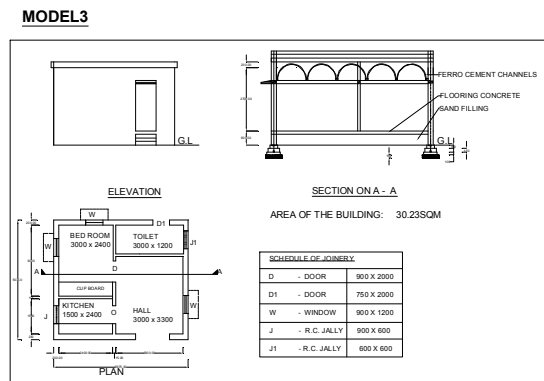


Figure 3: Plan showing the third type of proposed model

3. Results and Discussion

The above shown plan are some of the proposed plans that can be used while constructing houses in the areas of disaster prone zones. This will not only safeguard the structure but also will save lot of peoples lives. Rural technology Center of Gandhigram University is conducting lot of research works in the areas of rural construction, this type of model houses were constructed and tested in our campus.

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