

# Analysis of Bamboo Reinforced Horizontal Bands in Flood Resilient house

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**Abstract** - As the demand for masonry buildings is still a prominent method existing for building construction, it is necessary to bring up with additional innovations to make them perform more resistant towards the flood damages. One of the most important methods of increasing the crack resistance of masonry buildings is by the incorporation of horizontal bands. The horizontal band can be defined as a method of reinforcing the masonry buildings by providing bands with higher tension strength. This is enabled in areas where two structural elements of a building meet, so that a connection is formed all together and they would behave like a single unit. In this study performance analysis of horizontal bands with bamboo reinforcement at different levels of a building has been carried out. This paper aims to analyze the structural behavior of a building under flood conditions with and without horizontal bands using ETABS software.

**Key Words:** Horizontal bands, Flood, ETABS, Masonry building, crack resistance, etc...

## 1. INTRODUCTION

Flood resilient construction has become an essential component of the integrated approach to flood risk management, now widely accepted through the concepts of making space for water and living with floods. Resilient construction has been in place for centuries, but only fairly recently has it been recognized as part of this wider strategy to manage flood risk. Buildings and the wider built environment are known to play a key role in flood risk management, and when buildings are constructed on or near to flood plains there is an obvious need to protect these.

One of the most important methods of increasing the flood resistance of masonry buildings is by the incorporation of horizontal bands. The use of horizontal bands will help all the elements to be confined together as a single unit. This would have a

total resistance from the whole building, other than having an individual contribution.

### 1.1 Positions of Horizontal Bands

Horizontal bands are implemented at the following levels:

- At the plinth level of the building
- At the levels of lintels (i.e. at door and windows)
- At the ceiling levels
- At sill levels

### 1.2 Objectives

The main objectives of this paper are:

- To compare the performance of steel and bamboo as reinforcement in horizontal bands.
- To compare the behavior of a masonry building with and without horizontal bands at different levels under the effect of floodwater

## 2. MODELLING AND ANALYSIS

ETABS Software is used for the modeling and analysis of the masonry walls.

Two models have to be analysed

- Masonry building with steel reinforced cement concrete bands provided above openings (door and window) only.
- Masonry building with steel reinforced cement concrete bands provided above openings (door and window) and bamboo reinforced concrete bands are provided at lintel level other than openings as well as the sill level

The following are the various loads to be considered for analysis wherever they are applicable.

- Dead load
- Live load
- Floodwater pressure

According to Federal emergency management agency (FEMA) flood water pressure,  $P = Y_w g H$  where

H = height of water above bottom of wall(m).

$Y_w$  = unit weight of water.

g = acceleration due to gravity.

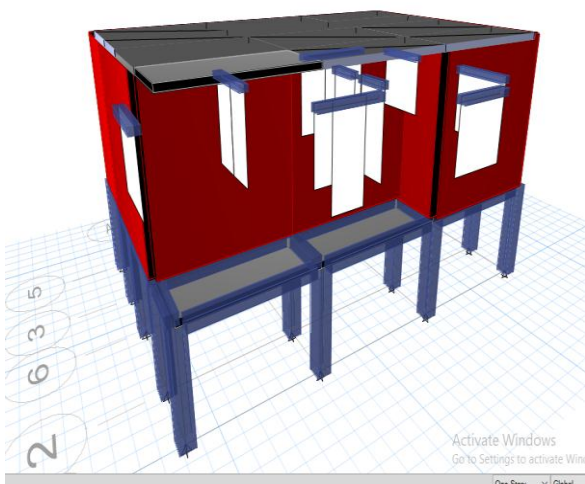
**Table -1: Reinforcement Details**

Reinforcement Type	Steel	Bamboo
Main bar (dia)	10mm	12.7mm
Stirrups	6mm	6.35mm
Spacing	125mm	75mm

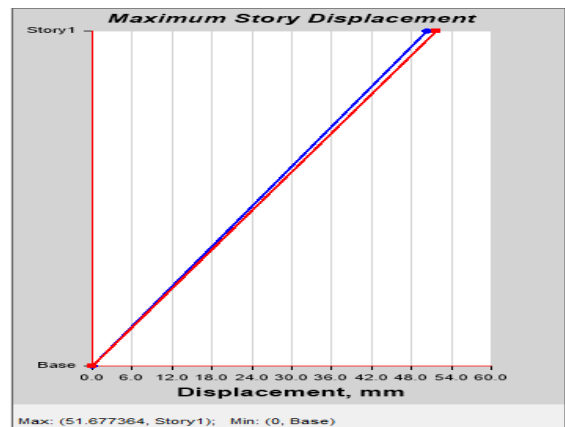
**2.1 Masonry building with steel reinforced cement concrete bands provided above openings (door and window) only.**

Specifications:

- Wall
  - Material used -Brick
  - Length = 4m
  - Thickness = 0.23m
- Horizontal bands
  - Position - Above the openings only
  - Material used - RCC
  - Thickness =15mm



**Fig -1:** Building with steel reinforced horizontal bands above the openings only



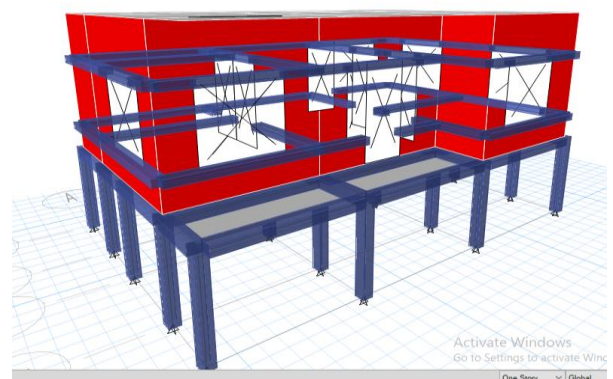
**Chart -1:** Displacement of building with steel reinforced horizontal bands above the openings only.

The maximum displacement was observed as 51.677mm.

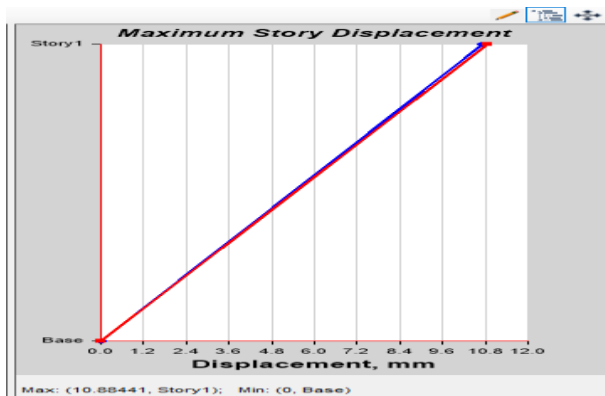
**2.2 Masonry building with reinforced cement concrete bands are provided at lintel level other than openings as well as the sill level.**

Specifications:

- Wall
  - Material used - Brick
  - Length = 4m
  - Thickness = 0.23m
- Horizontal bands
  - Position -Lintel level and Sill level
  - Material used - RCC on above openings and bamboo reinforced concrete at sill level and lintel level.



**Fig -2:** Building with bamboo reinforced horizontal bands at sill and lintel levels.



**Chart -2:** Displacement of building with bamboo reinforced horizontal bands at sill and lintel levels.

The maximum displacement was observed as 10.664mm.

### 3. CONCLUSIONS

From the above analysis of both the models, the following conclusions are obtained:

- Horizontal bands at lintel and sill levels with Bamboo reinforced concrete found to be safe under hydrostatic pressure.
- The displacement in building with bamboo reinforced concrete at lintel and sill levels is less than that with RCC bands provided above openings.
- The analysis results have shown that the building with bamboo reinforced concrete bands behaves better as compared with the RCC bands.

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