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PARAMETRIC STUDY OF CONFINED MASONRY STRUCTURE

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Abstracts-The paper elaborates the seismic behavior of a typical masonry building in B&H,built in the 60's without any seismic guidelines. Numerical modelling has beendone in single software packages, namely 3MURI. In this approaches, adequate. Constitutive assumptions were assumed to take into account the nonlinearbehavior of masonry. Seismic vulnerability has been conducted by performingpushover and time history analyses. A comparison in terms of dynamicproperties, crack pattern and capacity curves was done and a good agreementhas been found between the 3 Muri software packages. The paper's aim was toassess the seismic safety of this type of construction.

Keywords: -Masonry, nonlinear analysis, B&H residential masonry buildings, pushover, time-history analysis

1. Introduction

The vulnerability of Indian constructions in the past earthquakes has beenamply demonstrated by the recent damaging earthquakes. These include notonly the non-engineered constructions carried out by the common man, but alsomany "engineered" buildings. Addressing this problem requires simultaneouswork on several fronts. On one hand, we need to ensure that more and more constructionscomply with the design and construction requirements of thebuilding codes. On the other hand, we need to develop and propagateconstruction typologies that are inherently better in responding to earthquakes. Construction typologies differ from place to place for various reasons, includingavailability of local materials and skills, climatic conditions, living habits andtraditions. There have been successful interventions in the Indian sub-continenttowards introducing construction typologies that resists earthquakes better. Most houses of up to four stores in India are built of burnt clay brickmasonry with reinforced concrete slab .Depending on the building and theseismic zone of its location, certain earthquake resistant features are required insuch buildings. As per the Indian codes, e.g., the lintel band, cornerreinforcement,

1.1. Scope and Objective

The Purposeof this document is to:

1. Explain the mechanism of seismic response of confined masonry buildingsfor in- and out of plane seismic effects and other relevant seismic responseissues.

2. Recommend prescriptive design provisions for low-rise buildings related tothe wall layout and density, and prescribe minimum size requirements forstructural components of confined masonry buildings (tie-columns, tie beams, walls), reinforcement size and detailing,

3. Provide a summary of the seismic design provisions for confined masonry buildings from relevant international codes.In my current work I am going to research study on seismic behavior of confinedmasonry by using euro code 8 on 3 muri software:-

The objectives of this are:

a) Opening provided at wall at different locations for better enhancingstability integrity and ductility of confined wallb) To take best location of opening for differentiate displacement at differentanalyses the program

c) To find out the lower vulnerability of structure at most significant atanalyzes the model by FME method and obtain displacement in wall nodeor micro element

II.RESEARCH METHODLOGY

Edoardo Fusco1, Andrea Penna2, Andrea Prota1, Alessandro Galasco2 andGaetano Manfredi "seismic assessment of historical natural stone masonrybuildings through non-linear analysis" published paper in china based this topicrelated to masonry structure wide variety of the aspects involved, including thequality of masonry, the structural system, the large effort in inspection and diagnosis, the economic and cultural implications. The design approach for interventions on historical buildings does not require the complete seismic upgrading to a predefined seismic safety level, but it allows to reach only a partial upgrading in order to respect the preservation requirements accepting a level of7. Seismic protection lower than the one prescribed for new structures

Naida Ademović,, Daniel V. Oliveira "Seismic Assessment of a Typical MasonryResidential Building in Bosnia and Herzegovina" on this topic. The paperelaborates the seismic behavior of a typical masonry building in B&H built inthe 60's without any seismic guidelines. Numerical modelling has been done intwo different software packages, namely DIANA and 3MURI. In both approaches, adequate constitutive assumptions were assumed to take into account thenonlinear behavior of masonry. Seismic vulnerability has been conducted byperforming pushover and time history analyses. A comparison in terms ofdynamic properties, crack pattern and capacity curves was done and a goodagreement has been found between the two software packages. The paper's aimwas to assess the seismic safety of this type of construction. A further objectivewas to investigate if simple software packages could be used for the assessmentof these buildings. As a wide stock of this type of buildings is located throughthe former territory of ex-Yugoslavia, this work would enable a betterunderstanding of this type of structures and quick overview of their actualseismic behavior.

2.1:.ROLE OF LOAD IN WALL.

a) Effect on thickness of load

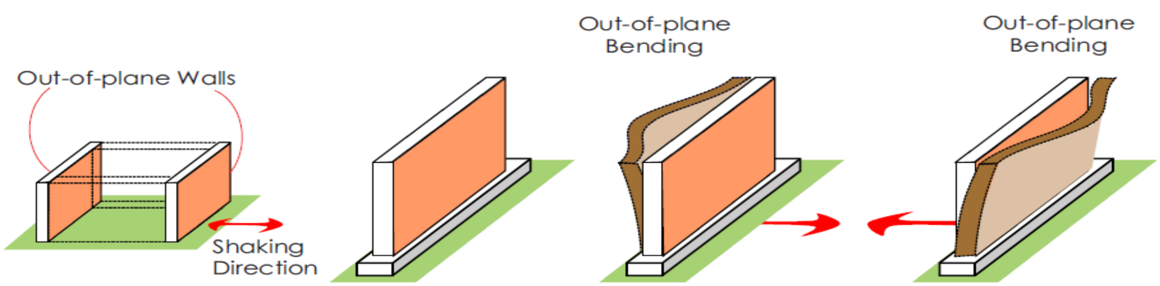

figure2.1:Shacking along thickness direction of masonry wall result collapse

b) Effect on length of load

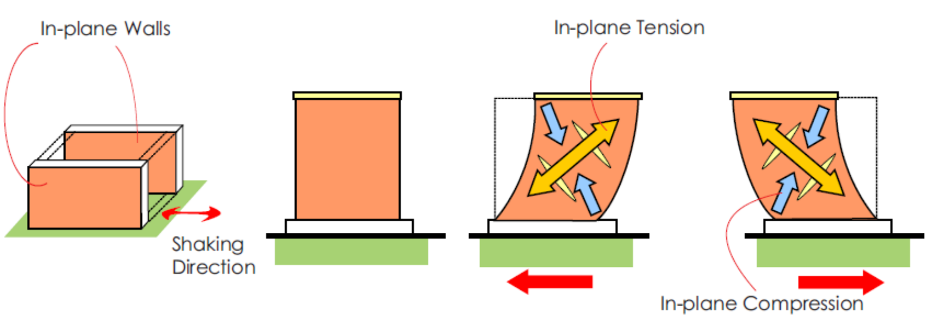

Figure 2.2: Shacking along length direction result in diagonal cracks

III. PLAN AND GEOMETRIC PARAMETER

Simple plan 3.6m X 3m and height 3m taken by me for analyzes to differentiate displacement and push over curve between shear and displacement on wallsnode and micro element.

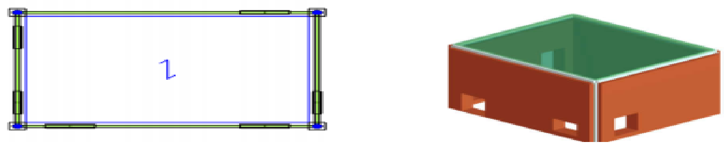

Figure 1: 3 D Model

Table 1: walls and opening size

No	Wall (m)	Thick wall (mm)	Opening left (m^2)	Opening right (m^2)	Total Opening area (m^2)	Total wall area (m^2)	Opening Percent %
Fig. 1	3.60×3.00	300	.900×.600	.600×.600	.9	10.8	8.33%
Fig. 2	3.00×3.00	300	.600×1.50	.6×.1.2	1.62	9	18%
Fig. 3	3.60×3.00	300	.600×1.50		.9	10.8	8.33%
Fig. 4	3.00×3.00	300	.600×.900		.54	9	6%

3.1: Materials properties and loading

The test structure is assumed to consist out of masonry with bricks and clay MB according to SIA 266.code The material characteristics are presented in Table

Table 2: properties of materials in EC 8

Name	Muratura
E (kN/m^2)	$5x10^6$
G (kN/m^2)	$2x10^6$
W (kg/m^3)	1224
F_m (kN/m^2)	7150
f_{vmo} (kN/m^2)	290
f_{vlim} (kN/m^2)	2200
f_k (kN/m^2)	5000
y_m	3

According SIA 266 Switz code and euro 8

Where E= modulus of elasticity, G = modulus of rigidity, W = weight of masonry, f_m=mean compressive strength of masonry, f_{vmo}= characteristics initial strength of masonry, f_{vlim} =limit shear strength of masonry, f_k= characteristic compressive strength masonry, y_m=partial factor of materials

3.3 Floor loads

Load is acting on floor areas of structure

Table 3: Types of load

Type of load	Load (kN/m^2)
G_K (The permanent loads)	5
Q_K (variable-live loads)	3

3.4 Parameter of floor

These are some parameter for analysis purposes

Table 4: Properties of floor

G (Shear modulus)	12X10^5 (kN/m^2)
E_X	25X10^6 (kN/m^2)
E_Y	25X10^6 (kN/m^2)
V	0.02

3.5: Seismic parameter

It's loaded window required characteristics of spectrum for ultimate limit state and damage limit state.

According EC 8 (euro code 8 clause 5.16.3)

Table5: Seismic action

Zone V	horizontal ground acceleration a_{gr} (m/s^2)
ULS (ultimate limit state)	2.9
DLS(Damage Limit state)	3

Type of soil E (EC8) seismic zone v	
S (soil factor)	1.40
T_b (The values of constant acceleration response)	0.15 Sec
Tc (The values of constant velocity response)	0.50 Sec
Td (The values of constant displacement response)	2.00 Sec
Importance factor	1.00

3.6:Result unit formates

Geometry parameter are given below table

Table 6: units of parameter

Step	Parameter	Parameter pattern	Unit
1	Geometric	Distance,height elevation	mm
2	Structure	Base, hight, ecc. thickness	mm
		Area	mm^2
		Inertia	mm^4
		Modulus of resistance	mm^3
3	Reinfocement	Rebar distance between rebare	mm
		Reinfocre area	mm^2
		Concrete cover	mm
4	Materials	Modulus of elasticity	kN/m^2
		Strength	kN/m^2
		Density	Kg/m^3
5	stiffness	Translation stiffness	kN/m
		Rotary stiffness	KNm/rad.
6	Load	Surface load (Gk)	kN/m^2
		Linear load Gk, Qk	Kn/m^2
		Concentred load Gk, Qk	Kn/m
7	Result	Displcement	mm
		Rotation	rad
		Load	kn
		Moment	knm
		Stress	n/mm^2
		Mass	kg

3.7: Distortion of wall at different location of opening

We were taken opening at different wall and keep different size, so there how many possibility in wall for maximum distortion

a) .Wall 1

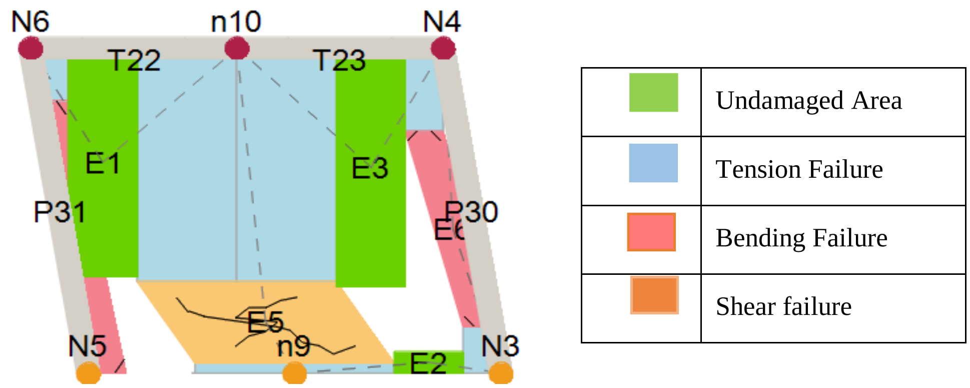

Figure2: Collapse mechanism due loading in –x direction at wall 1

Table 7: Displacement in first wall on nodes

Node	Ux[mm]	Uy[mm]	Uz[mm]
3	0.00	0.00	0.00
4	-11.96	-8.83	-0.02
5	0.00	0.00	0.00
6	-11.96	0.18	-0.01
9	0.00	0.00	0.00

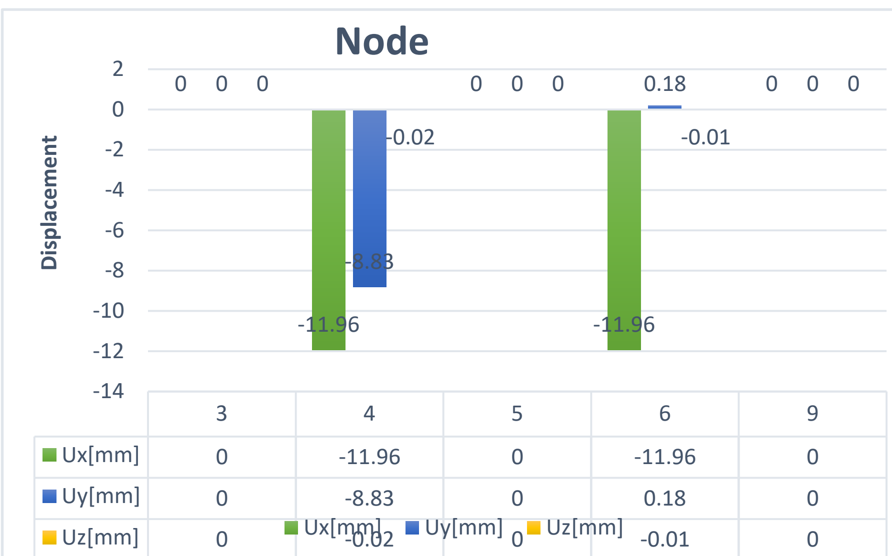

Figure 3: Curve between node and displacement on first wall

b) Wall 2

Analyzes loading in –x direction

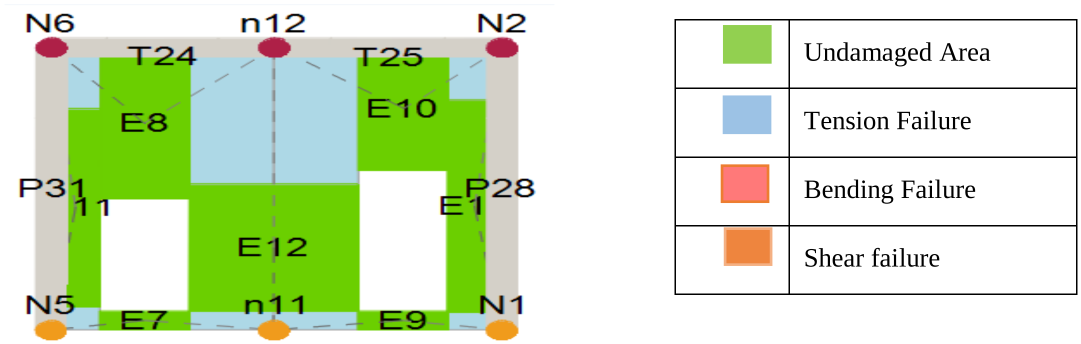

Figure 4:Collapse mechanism of wall 2 during loading x direction

Table 8: Displcement wall 2

Node	Ux[mm]	Uy[mm]	Uz[mm]
1	0.00	0.00	0.00
2	-4.40	0.08	-0.06
5	0.00	0.00	0.00
6	-11.96	0.08	-0.01
11	0.00	0.00	0.00
12	0.08	0.00	-0.03

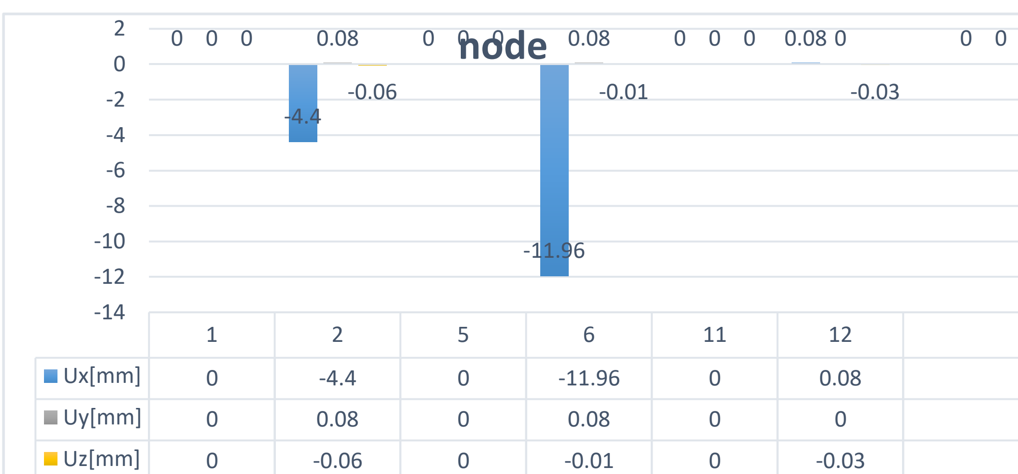

Figure 5: Displacement in second wall during x direction loading

c). Wall 3

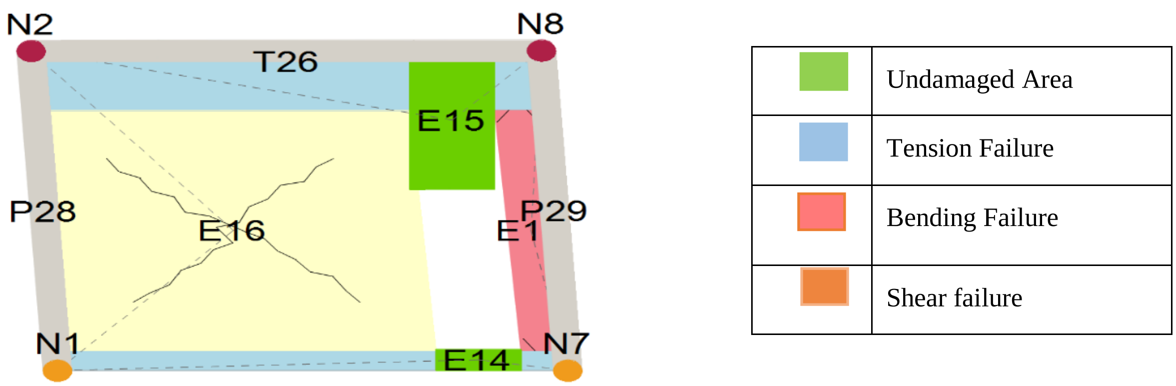

Figure 6: Collapse mechanism of third wall during –x direcrion loading

Table 9: Displcement wall 3

Node	Ux[mm]	Uy[mm]	Uz[mm]
1	0.00	0.00	0.00
2	-4.40	0.08	-0.06
7	0.00	0.00	0.00
8	-4.40	-8.83	0.03

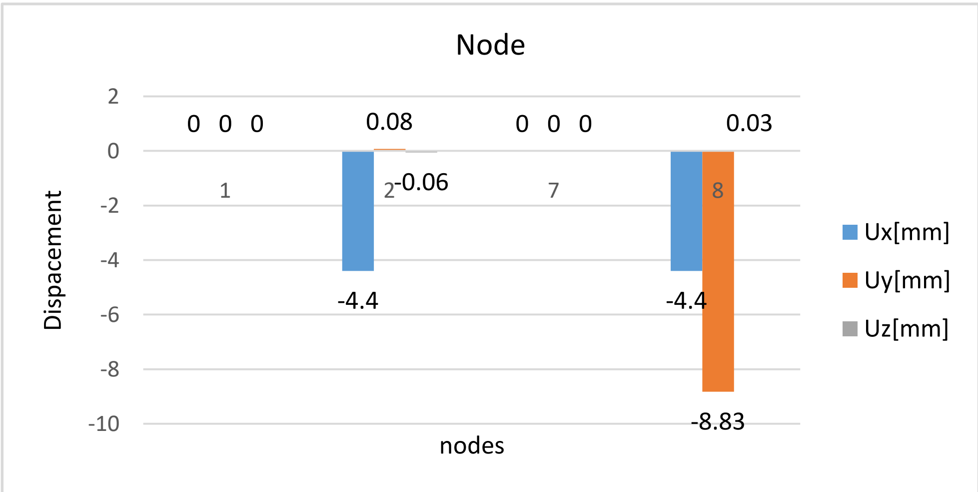

Figure7: curve between displacement and wall 3 nodes

d) Wall 4

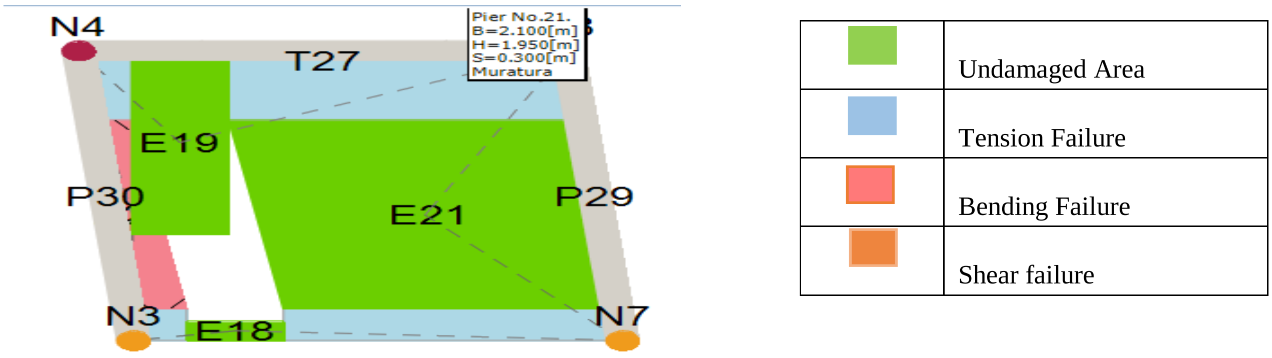

Figure 8: collapse mechanism in fourth wall during –x direction loading

Table10: Displacement wall 4

Node	Ux[mm]	Uy[mm]	Uz[mm]
3	0.00	0.00	0.00
4	-11.96	-8.83	-0.02
7	0.00	0.00	0.00
8	-4.40	-8.83	0.03

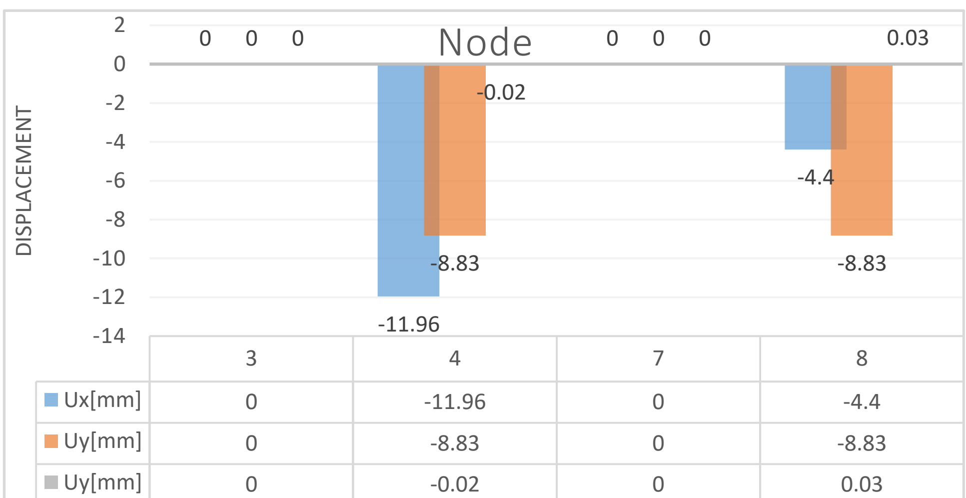

Figure 9: curve between displacement and nodes on fourth wall

Mathematically analysis -

$$\text{Moment of inertia} = bd^3/12$$

$$\text{Moment of inertia of wall with opening} = BD^3/12 - bd^3/12$$

Here

B = Width of Wall, D = Depth of Wall, b = Width of Opening, d = Depth of Opening

3.8: Result and discussion

1) We find after analysis more displacement at node 4, and 6 in x direction of wall 1.Whichgreater than other wall. Which is 11.96mm due to double opening

2) We were find minimum on wall 3, displacement at node 2 and 8. Which is 4.40mm due to single opening only

IV.Conclusions

In this study, various walls having different size of opening have been studied. The carried out study has shown that opening area is dangerous for masonry walls during earthquake. There are some conclusion which found in the analysis:

1. The shear failure of the wall can be reduced by avoiding large opening in wall and number of opening in wall because opening reduces moment of inertia of the wall which reduces the stiffness of the wall. This increases possibility of shear failure in the wall.
2. Large opening in masonry walls increases flexibility which increases top displacement in the wall.
3. The length of wall also affects the stiffness of the wall because length of wall is inversely proportional to the stiffness of the wall.
4. Location of opening is important in masonry walls. It has seen that the wall having door is failed but in same case of a window the wall shows better results. Both the openings obstruct the flow path of load but the door is open at the end. So, due to stiffness at the end of door is zero, the wall collapse.
5. We should also avoid number of opening. Its increase flexibility and give us more displacement.

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