Effect of Aerocon Block, Reinforced Brick Masonry and RCC Diagonal Struct in Two Dimensional Single Bay Two Storey RC Frame under Cyclic Loading

B.Naufal Ahamed, S.Arulselvan

Abstract**: *This paper summarizes the analytical investigation of two dimensional single bays two storeys RC frame with Aerocon block, Reinforced brick masonry and Diagonal Strut under lateral cyclic loading. The paper analytically determines the behaviour of the RC frame with Aerocon block masonry, Reinforced brick masonry and Diagonal Strut under equivalent static lateral cyclic loading conditions. The preliminary test such as compression test on prisms for the infill panels were done experimentally and the values were incorporated in the analytical modeling. Analytical works have been conducted using ANSYS software. The frames were subjected to lateral cyclic loading and the behaviors such as Load carrying capacity of the frames, Load-deflection behaviour, Stiffness degradation, have been determine. The results of all the three frames were compared.***

Keywords—Aerocon Block, Reinforced Brick Masonry, Diagonal Strut, cyclic loading, Load-Deflection, Stiffness

I. INTRODUCTION

Brick work is one of the fundamental components of buildings. Brick walls are used as load bearing walls, partition walls and infills in the buildings. Such walls are used to support vertical load as well as shear walls along with RC frames upto its failures. Also the brick walls give diagonal strut effect to RC frames. The performance of brick walls are improved by introducing steel reinforcement in the brick works. Aerocon blocks infill in the RC frame is also taken in this analytical study. Aerocon infill is a popular choice of infill wall material due to its advantages such as being lightweight, providing high thermal insulation, sound insulation, lower water absorption, eco-friendly, fire-proofing, high durability, easy to construct and low cost. In real buildings, any infill interacts with the surrounding RC frame and contributes to the overall strength and stiffness of the structure, particularly when the building is subjected to lateral forces. A comparative analysis of RC frames with and without any infill material indicates that the presence of infill causes a change in the predicted structural behaviour of the frame due to the participation of the infill material in the load transfer mechanism. The strut between the column and beam joint connects diagonally on the either sides forming the infill.

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In this Paper, the analytical comparision of the above infill panels are done by using the finite element analysis software ANSYS as per 1893 (Part-I) 2002 codal provisions of seismic loads from the values obtained from preliminary tests including prism compression test. Adriana Ionescu, et. al., (2013) [1] have discussed static and dynamic simulation in the seismic behavior of a building structure using ANSYS program. This paper present the results of seismic behavior simulation obtained in the static equivalent forces method and the modal spectral analysis method used to analyze a two stories building. Akkinapalli Vishal kumar, et. al., (2019) [2] were carried out comparative analysis on reinforced and unreinforced brick masonry walls. They have conducted this study to deal with the crack patterns for different reinforced, unreinforced masonry walls and comparing the both. Armin B. Anubama M. et. al., (2016) [3] have conducted analytical study on seismic performance of RC frames in-filled with masonry walls using E-Tabs. Armin B. Meharbi et. al., (2003) [4] have been carried out seismic analysis of masonry-infilled reinforced concrete frame. They conducted experiment on a six-storey, three-bay, moment resisting reinforced concrete frame. Arton D. Dautaj, et. al., (2018) [5] have done the experimental study on the contribution of masonry infill in the behavior of RC frame under seismic loading. In this research the experimental investigation was conducted to study the behavior of masonry- infilled RC frames with various lateral strengths. Arunkumar A.S. et. al., (2013) [6] has determined the response of single bay two storeyed brick masonry infilled RC portal frames under in-plane cyclic loads. This paper presented the behavior of MI- RC frames under in-plane reversed cyclic lateral loads up to failure. The influence of brick MI on the post yield behavior has been investigated experimentally. Baris Binici, et. al., (2019) [7] conducted experimental work to study the seismic behavior and improvement of autoclaved aerated concrete infill walls. They found that the presence of out-of-plane pressure can significantly reduce the deformation capacity of RC framed AAC infill walls. Guang Yang, et. al., (2019) [8] have conducted the research on improved equivalent diagonal strut model for masonry-infilled RC frame with flexible connection. Firstly, they studied the effects of connection between infill wall and surrounding frame on in-plane behaviors of infilled RC frame were discussed. Secondly, based on deeply studying the equivalent diagonal strut models for infilled

RC frame with rigid connection, an improved equivalent diagonal strut model for infilled RC frame with flexible connection was proposed. Hamid N. H, et. al., (2019) [9] have studied the seismic performance of single-bay two-storey RC frame under in-plane lateral cyclic loading. In this research, the specimen was tested under in-plane lateral cyclic loading using a double actuator starting from ±0.01% until ±2.25% with incremental of 0.25% drift. The total number of twenty-four cycles of drift was imposed to RC frame under control displacement method. Hrituraj Singh Rathore et. al., (2018) [10] have been made comparative study of AAC block and brick fully infill buildings and buildings having soft storey at different floor subjected to earthquake. Ionescu A., et. al., (2013) [11] have been carried out an analytical method using Boussinesq method in seismic analysis of a building structure using ANSYS program. Jagadeesan, et. al., (2018) [12] has been conducted the study on the influence of diagonal strut action in RC framed structure. the conducted the research on three types of specimen were cast and tested such as RC framed structure without infill, RC framed structure with brick masonry. Jurko Zovkic, et. al., (2013) [13] have conducted cyclic testing of a single bay reinforced concrete frames with various types of masonry infill. In this paper, a contribution of various types of masonry infill to the behavior of reinforced concrete frames under lateral loads was presented. Ning Ninga, et. al., (2019) [14] conducted the experiment on the influence of masonry infills on seismic response of RC frames under low frequency cyclic load. This study was focused on the effect of the Aerated Lightweight Concrete (ALC) blocks infills on the seismic performance of the RC frames and the interaction between infills and surrounding frames. Vincent Sam Jebadurai S. et. al., (2019) [15] have been conducted the research on enhancing performance of infill masonry with skin reinforcement subjected to cyclic load. In this paper chicken mesh were used as a confinement technique and the experimental investigation was presented for enhancing the in-plane properties of masonry infill walls like diagonal tension and shear thereby improving the in-plane strength of masonry infill wall. Xiaojie Zhou et. al., (2018) [16] have been carried out the study on influence of infill wall configuration on failure modes of RC frames. In this study, a bare frame and two single-story, single-bay RC frames, partially infilled with masonry, were tested under cyclic loading. The failure mechanism and seismic performance of these partially infilled RC frames (with an infill height of 600 mm) with different types of connections were analysed. Zuowei Wang, et. al., (2019) [17] have been conducted the tests on the bond-slip model for horizontal reinforcing bars in reinforced brick masonry. In this study, the gradual increase of the vertical load in masonry during construction was simulated using a convenient self-developed test setup that ensures that the specimen is under constant pressure based on the actual stress state of horizontal reinforcing steel bars in reinforced brick masonry.

1.1 Objective

The related objectives associated with the paper were identifies as follows:

- To obtain the values of load-deflection and load carrying capacity of RC frames with various infill.
- To compare the results of RC Frames with various infill panels.
- To analyze and compare the obtained values from the ANSYS software.

The research, findings and its analytical comparision will encourage the use of the new approach to produce other wall elements for any building system and hence promoting better quality construction and innovative system in our construction industry. The study is a step forward in the right direction to achieve quality products.

This paper acts as a key to:

- To produce a new potential structural composite, that is an integration of RC Frame structure with different infill wall panels.
- To develop a novel method of Aerocon block wall panel, Reinforced Brick Masonry infill and Diagonal strut action for use in the building system which can be developed and marketed nationally and internationally.
- To help solve the problem of low and middle-income earners to own house.
- To reduce the Global warming and transform our country eco-friendly.

II. MATERIAL COLLECTION

The materials used were cement, coarse aggregate, fine aggregate and water combined to form concrete. The concrete of compressive strength M20 grade was used. The rebars of respective sizes are provided for the beams and columns of the frame, for Reinforced Brick Masonry panel and Diagonal Strut panel as reinforcement. The stirrups and tie of desired size is also provided for frame and Diagonal Strut connection. Aerocon block and Traditional bricks was being used. The mortar is sufficiently required for binding of the blocks and bricks in the Aerocon block infill and Reinforced Brick Masonry infill panel.

III. PRELIMINARY TESTS ON STRENGTH CHARACTERISTICS OF INFILL PANELS

Preliminary tests have been conducted on the brick prisms with dimensions 230mm x 230mm x 400mm constructed by aerocon blocks and reinforced brick prisms as shown in Fig.1.

IV. GEOMETRIC DESCRIPTION

The geometric description of RC frame and three infill panels of Aerocon block wall panel, Reinforced Brick Masonry infill and Diagonal strut action are required for modeling in the ANSYS software.

4.1 RC Frame and Diagonal Strut Geometry

IS 10262 code was used for mix design purpose. IS 1893, IS 13920, IS 4326 code is used for seismic designing and analyzing. IS 13920 used for the reinforcement detailing. The geometry descriptions of RC frame are as follows. Diagonal strut with sizes 100mm x 150mm x 1600mm have been used.

The diagonal strut in the RC frame is shown in Fig.2. The geometric description is shown in Table 1.

4.2 Aerocon Block Infill Geometry

The Aerocon block of size 100mm x 80mm x 230mm used as infill. The Mortar layer acts as a binding material between the aerocon blocks and the sides of beam and column. The actual manufacturing dimension of the aerocon block is 600mm x 200mm x 100mm. The actual size is reduced to the size of the traditional bricks since the frame is compared with the Reinforced brick masonry and the thickness of the infill panel is 100mm. The aerocon block infill is mentioned in Fig.3.

4.3 Reinforced Brick Masonry Infill Geometry

The Reinforced brick masonry infill comprises of bricks, reinforcement and mortar. Steel reinforcements of 6mm diameter were placed at every third, sixth and ninth layer. Infill panel sizes 1250mm x 1000mm x 100mm were used. The reinforcement layers are shown in Fig.4.

V. ANALYTICAL INVESTIGATION USING ANSYS SOFTWARE

The analytical investigation was carried out by using the finite element analysis program named ANSYS software. The three frames are modeled with the basic and appropriate same values for the RC frames since all are same. The infill panels of the three frames are modeled separately for each infill using the values obtained from the prism compressive strength of the preliminary tests. The support is fixed support. After modeling, the lateral cyclic load is given to the beam column joint of the frame on any one of the side. The values of load-deflection are obtained. Using the values, the stiffness degradation and ductility nature of RC Frames are determined.

5.1 ANSYS Software

ANSYS simulation software gives designers the ability to assess the influence of these variables in a virtual environment. Through visualizing the effect of a wide range of variables, engineers can narrow the scope of field investigations, save considerable time and cost on projects, and move more quickly to the groundbreaking stage. It is used for projects as diverse as high-rise buildings, bridges, dams, stadiums, etc. By experimenting with innovative design in a virtual environment, engineers and designers can analyze safety, strength, comfort and environmental considerations.

Its stimulations can provide understanding of vibrations from phenomena such as brake squeal, earthquakes, transport, and acoustic and harmonic loads to predict the behavior of products and components and helps to overcome toughest vibration challenges.

5.2 Incorporating Material Properties

The basic material properties of the RC frames and the material properties of the infill panels which are obtained from the preliminary tests are incorporated into the ANSYS software. The values are incorporated as engineering data such as young's modulus, poisson ratio and compressive strength.

VI. RC FRAME WITH AEROCON BLOCK INFILL

6.1 Deformation of the RC Frame with Aerocon Block Infill

The engineering data of the RC frame and Aerocon block infill are incorporated. The material properties of M20 grade for concrete, respective diameters of rebar used for reinforcement and compressive strength for infill which is obtained from preliminary test are provided for the RC frame with Aerocon block infill. The modeling is done using the geometric description mentioned above. Since the support of the foundation block is fixed, reinforcement is provided for the beam and column of the RC frame as shown in the Fig 5 and 6. The meshing of the element should be done as fine as possible to achieve high accuracy of the results. The results heavily depend upon the quality of mesh. To carry out a finite element analysis, the model is divided into a number of small pieces and those pieces are known as finite elements. The entire model of the RC frame with Aerocon block infill is meshed. For applying the lateral cyclic load, the two plates of size of cross section of the beam with 5mm thickness is modeled on the left side of the two central points of the cross section of the beam. The loading pattern is cyclic with the progress of 4kN. The load progress is in the steps of 4kN, 8kN, 12kN…etc. The loading is carried out till the structure reaches the maximum deflection. The RC frame with aerocon block infill and its meshing is shown in Fig. 5 and deformation of the frame is shown in Fig. 6.

6.2 Load Deflection Behavior of RC Frame with Aerocon Block Infill

The frame with aerocon brick work was analysed and Load - deflection behavior of the frame was studied. Elastic behavior of the frame was monitored up to 60kN load. After that, plastic stage was started. This was due to yielding of steel reinforcement of the frame and crack formation and failure of aerocon brick work. The load deflection curve is plotted as shown in Fig.7 and the values are tabulated in the Table 2. The trend line equation of the load deflection curve is

$$y = 1E\text{-}05x^5 - 0.001x^4 + 0.082x^3 - 1.769x^2 + 18.53x + 3.157$$
$$R^2 = 0.998 \qquad (1)$$

6.3 Stiffness Degradation of the RC Frame with Aerocon Block Infill

Stiffness behavior of the frame with aerocon brick work was determined. Stiffness was found more in the initial stage. After yielding of reinforcement and minute cracks formed in aerocon brick work, stiffness was gradually decreased. The Initial value of stiffness was 26.67kN/mm and the final value is 1.97kN/mm. The stiffness curve is plotted as shown in Fig.8. The trend line equation of the stiffness curve is

$$y = 9E\text{-}05x^5 - 0.005x^4 + 0.126x^3 - 1.142x^2 + 2.634x + 25.04$$
$$R^2 = 0.999 \qquad (2)$$

VII. RC FRAME WITH REINFORCED BRICK MASONRY INFILL

7.1 Deformation of the RC frame with Reinforced Brick Masonry Infill

The engineering data of the RC frame and Reinforced brick masonry infill are incorporated. The material properties of M20 grade for concrete, respective diameters of rebar used for reinforcement and the compressive strength for infill which is obtained from preliminary test are provided for the RC frame with Reinforced brick masonry infill. The modeling is done using the geometric description mentioned above.

Since the support of the foundation block is fixed, reinforcement is provided for the beam and column of the RC frame as shown in the Fig 9 and 10. The meshing of the element should be done as fine as possible to achieve high accuracy of the results. The results heavily depend upon the quality of mesh. The entire model of the RC frame with Reinforced brick masonry infill is meshed. For applying the lateral cyclic load, the two plates of size of cross section of the beam with 5mm thickness is modeled on the left side of the two central points of the cross section of the beam. The loading pattern is cyclic with the progress of 4kN. The load progress is in the steps of 4kN, 8kN, 12kN…etc. The loading is carried out till the structure reaches the maximum deflection. The deformation is shown in Fig.10.

7.2 Load Deflection Behaviour of RC frame with Reinforced Brick Masonry Infill

The frame with reinforced brick work was analysed and Load - deflection behavior of the frame was determined. Elastic behavior of the frame was monitored up to 92kN load. This increment was found due to the presence of reinforcement in the brick work. After that, plastic stage was started. This was due to yielding of steel reinforcement of the frame and crack formation and failure of reinforced brick work. The load deflection curve is plotted as shown in Fig.11 and the values are tabulated in the Table 3. The trend line equation of the load deflection curve is

$$y = 1E\text{-}06x^5 - 0.000x^4 + 0.022x^3 - 0.869x^2 + 15.79x + 4.411$$
$$R^2 = 0.998 \quad (3)$$

7.3 Stiffness Degradation of the RC frame with Reinforced Brick Masonry Infill

Stiffness behavior of the frame with Reinforced brick work was determined. Stiffness was found more in the initial stage. After yielding of reinforcement and minute cracks formed in brick work, stiffness was gradually decreased. The Initial value of stiffness was 26.67kN/mm and the final value is 2.15kN/mm. The stiffness curve is plotted as shown in Fig.12. The trend line equation of the stiffness curve is

$$y = -4E\text{-}07x^6 + 6E\text{-}05x^5 - 0.002x^4 + 0.059x^3 - 0.563x^2 + 0.681x + 26.85$$
$$R^2 = 0.998 \quad (4)$$

VIII. RC FRAME WITH DIAGONAL STRUT

8.1 Deformation of the RC frame with Diagonal strut

The engineering data of the RC frame and Diagonal Strut are incorporated. The material properties of M20 grade for concrete and respective diameters of rebar used for reinforcement are provided for the RC frame with Diagonal Strut. The strut is formed between the top-left beam-column joint and the bottom-right beam-column joint within the panel and vice-versa for both the infill panels. The meshing of the element should be done as fine as possible to achieve high accuracy of the results. To carry out a finite element analysis, the model is divided into a number of small pieces and those pieces are known as finite elements. The entire model of the RC frame with Diagonal strut is meshed. The modeling is done using the geometric description mentioned above. Since the support of the foundation block is fixed, reinforcement is provided for the beam and column of the RC frame as shown in the Fig. 13 and 14. For applying the lateral cyclic load, the two plates of size of cross section of the beam with 5mm thickness is modeled on the left side of the two central points of the cross section of the beam. The loading pattern is cyclic with the progress of 4kN. The load progress is in the steps of 4kN, 8kN, 12kN…etc. The loading is carried out till the structure reaches the maximum deflection. The deformation of the frame is shown in Fig.14.

8.2 Load Deflection Behaviour of the RC frame with Diagonal strut

The frame with RCC diagonal strut was analyed and Load - deflection behavior of the frame was determined. Elastic behavior of the frame was monitored up to 184kN load. This increment was found due to the presence of reinforcement in the brick work. After that, plastic stage was started. This was due to minute cracks in RC members and in the joints, yielding of steel reinforcement of the frame and crack formation and failure of reinforced brick work. The load deflection curve is plotted as shown in Fig.15 and the values are tabulated in the Table 4. The trend line equation of the load deflection curve is

$$y = 0.000x^3 - 0.087x^2 + 7.478x + 25.36$$
$$R^2 = 0.990 \quad (5)$$

8.3 Stiffness Degradation of the RC frame with Diagonal strut

Stiffness behavior of the frame with RC diagonal strut was calculated. Stiffness was found more in the initial stage. After yielding of reinforcement and interface separation of brick layer and reinforcement in brick work, stiffness was gradually decreased. The Initial value of stiffness was 44.88kN/mm and the final value is 2.48kN/mm. Higher initial stiffness was found more in this frame by the additional opposite reaction of RCC struts in the frame. The stiffness curve is plotted as shown in Fig.16. The trend line equation of the stiffness curve is

$$y = -1E\text{-}07x^6 + 3E\text{-}05x^5 - 0.001x^4 + 0.070x^3 - 1.169x^2 + 5.683x + 38.88$$
$$R^2 = 0.983 \quad (6)$$

IX. COMPARISION OF RESULTS

From the above results,

1. The load carrying capacity is in the maximum to minimum order of Diagonal strut RC frame, Reinforced brick masonry RC frame and Aerocon block RC frame.
2. The deflection obtained for the corresponding load has the maximum to minimum order of Diagonal strut RC frame, Reinforced brick masonry RC frame and Aerocon block RC frame.
3. The maximum value of stiffness is obtained in RC frame with Diagonal strut and the minimum value is in RC frame with Aerocon block.
4. The ductility nature for RC frame with Diagonal strut is maximum and for RC frame with Aerocon block is minimum.
5. When comparing the Reinforced brick masonry RC frame with Aerocon block RC frame, the value of ductility nature and stiffness is maximum for RC frame with Reinforced brick masonry than the RC frame with Aerocon block.

X. FIGURES AND TABLES

10.1 list of figures

Fig.1 Brick Prisms

Fig.2 RC frame with Diagonal Strut

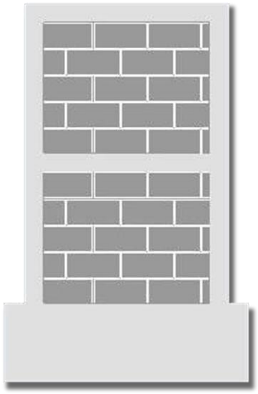

Fig.3 Aerocon block infill RC frame

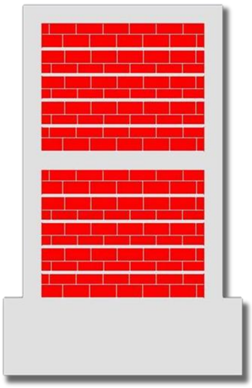

Fig.4 Reinforced Brick Masonry infill RC frame

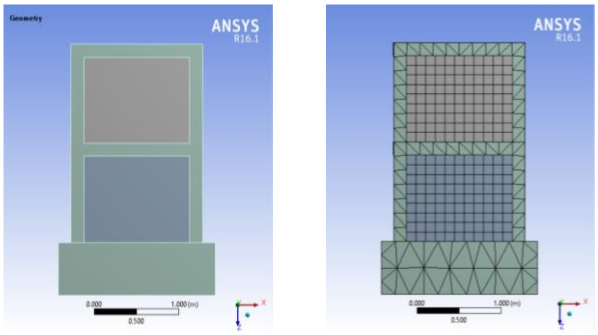

Fig.5 RC frame with Aerocon Block infill and Meshing of RC frame with Aerocon Block infill

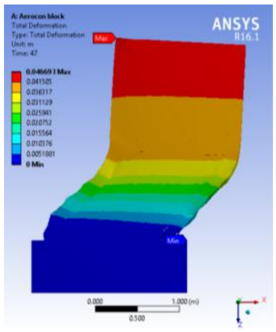

Fig.6 Deformation of RC frame with Aerocon Block infill

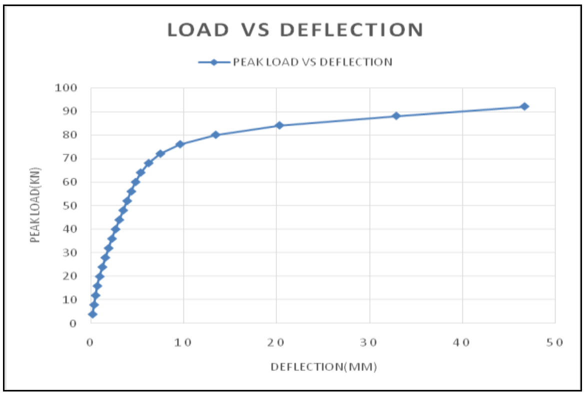

Fig.7 Load - Deflection Curve of RC Frame with Aerocon Block Infill

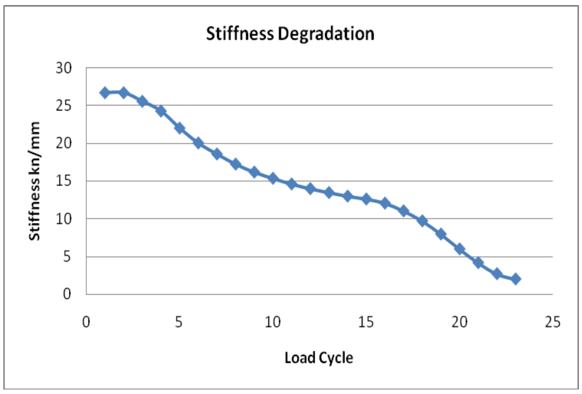

Fig.8 Stiffness Degradation curve of RC Frame with Aerocon Block Infill

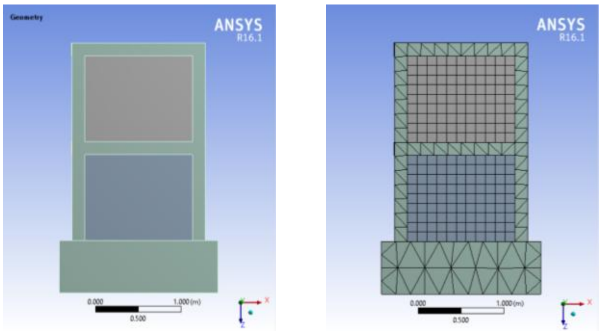

Fig.9 RC frame with Reinforced Brick Masonry infill and Meshing of RC frame with Reinforced Brick Masonry infill

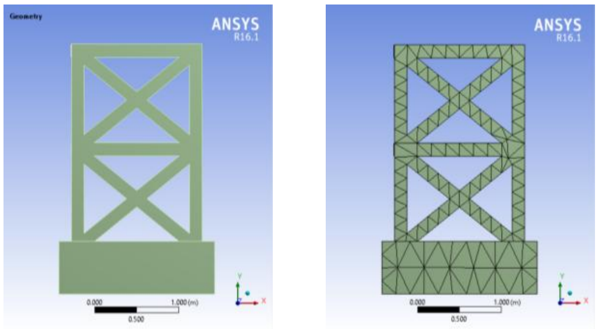

Fig.13 RC frame with Diagonal strut and Meshing of RC frame with Diagonal strut

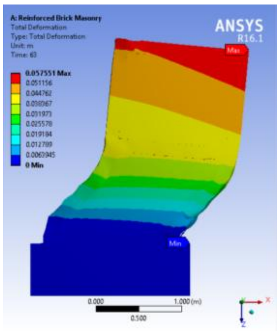

Fig.10 Deformation of RC frame with Reinforced Brick Masonry infill

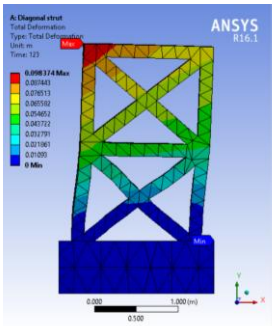

Fig.14 Deformation of RC frame with Diagonal strut

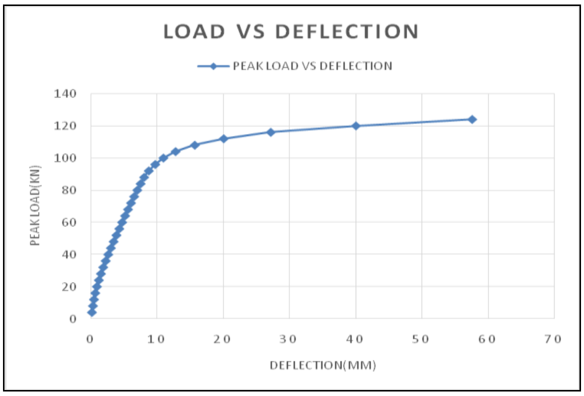

Fig.11 Load Deflection curve of the RC frame with Reinforced Brick Masonry Infill

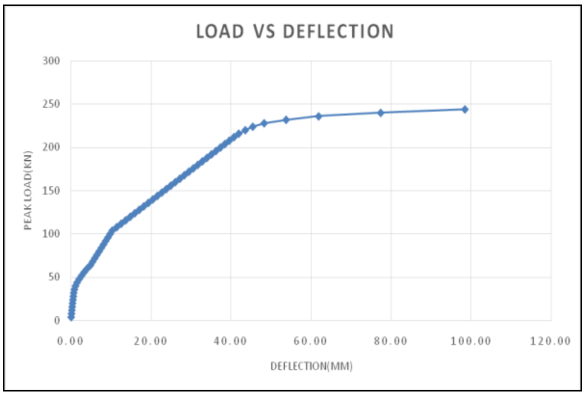

Fig.15 Load Deflection Curve of the RC frame with Diagonal strut

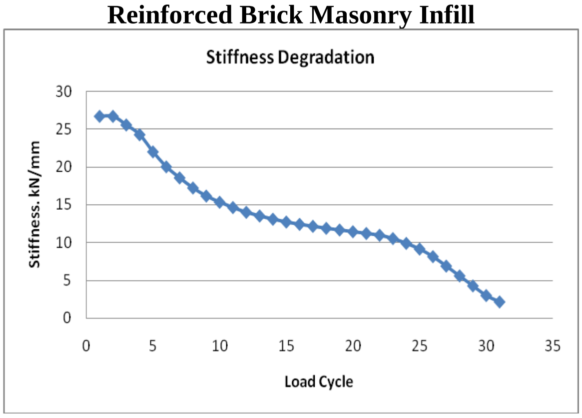

Fig.12 Stiffness Degradation curve of the RC frame with Reinforced Brick Masonry Infill

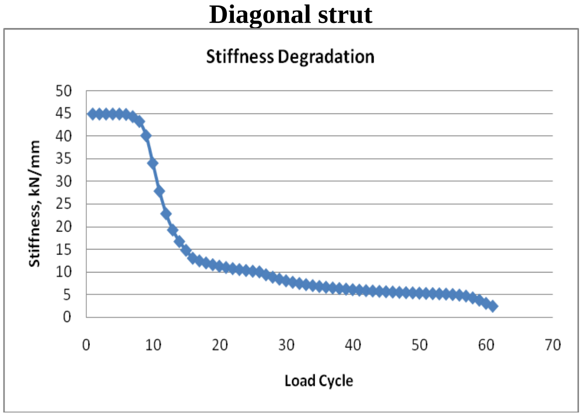

Fig.16 Stiffness Degradation curve of the RC frame with Diagonal strut

10.2 LIST OF TABLES

Table- 1: Geometric description of the RC frame

Description	Detail
Frame along X axis	1850mm
Frame along Y axis	2910mm
No of storey	G+1
Height of each storey	1000mm
No of bays	1
Width of each bay	1250mm
Beam dimension	100mm x150mm x 1250mm
Column dimension	150mm x100mm x 2300mm
Foundation block dimension	200mm x610mm x 1850mm
Beam (top reinforcement)	2 no's of 8mm diameter
Beam (bottom reinforcement)	2 no's of 10mm diameter
Column (reinforcement)	4 no's of 12mm diameter
Stirrups	8mm diameter for both column and beam

Table- 2: Load Deflection Curve of RC Frame with Aerocon Block Infill

LOAD	DEFLECTION
kN	mm
4	0.15
8	0.3
12	0.47
16	0.66
20	0.91
24	1.2
28	1.51
32	1.86
36	2.23
40	2.61
44	3.02
48	3.44
52	3.87
56	4.32
60	4.77
64	5.32
68	6.18
72	7.44
76	9.58
80	13.42
84	20.29
88	32.88
92	46.69

Table- 3: Load Deflection Curve of RC Frame with Reinforced Brick Masonry Infill

LOAD	DEFLECTION
kN	mm
4	0.15
8	0.3
12	0.47
16	0.66
20	0.91
24	1.2
28	1.51
32	1.86
36	2.23
40	2.61
44	3.01
48	3.43
52	3.85
56	4.28
60	4.72
64	5.16
68	5.6
72	6.06
76	6.52
80	7
84	7.5
88	8.03
92	8.74
96	9.71
100	10.94
104	12.78
108	15.68
112	20.04
116	27.14
120	40
124	57.55

Table- 4: Load Deflection Curve of RC Frame with Diagonal strut

LOAD	DEFLECTION
kN	mm
4	0.09
8	0.18
12	0.27
16	0.36
20	0.45
24	0.54
28	0.63
32	0.74
36	0.90
40	1.17
44	1.58
48	2.10
52	2.70
56	3.34

60	4.05
64	4.90
68	5.44
72	5.99
76	6.53
80	7.08
84	7.62
88	8.17
92	8.71
96	9.26
100	9.80
104	10.35
108	11.47
112	12.60
116	13.72
120	14.85
124	15.97
128	17.10
132	18.22
136	19.35
140	20.47
144	21.60
148	22.72
152	23.85
156	24.97
160	26.10
164	27.22
168	28.35
172	29.47
176	30.60
180	31.72
184	32.85
188	33.97
192	35.10
196	36.22
200	37.35
204	38.47
208	39.60
212	40.72
216	41.92
220	43.55
224	45.43
228	48.25
232	53.73
236	61.86
240	77.34
244	98.37

XI. CONCLUSION

* In this study, a detailed Two Dimensional Model was developed and analyzed for the lateral cyclic loading conditions using the finite element software ANSYS. The Aerocon blocks can be used in high rise buildings in the top storey and the site having less soil stability since it is light weight. It can also be used in fire prone areas due to its fire resistance property.

* The Reinforced brick masonry can be used in the earthquake regions since it provides seismic resistance due to the presence of reinforcement. It can be used in the buildings instead of the RC shear walls due to its additional strength and economical benefits. Reinforced brick masonry has high stiffness and ductility nature when compared to the normal traditional masonry.

* The diagonal strut can be utilized in the walls of buildings and industrial structures and also in the open area of high rise buildings. Diagonal strut effect is more beneficial and addtional strength to the walls, so that it can be used in aerocon brick works and in the normal brick works of the buildings. Soft storey is more susceptible to earthquake and this can be minimized by introducing diagonal strut in the soft storeys.

* Diagonal strut effect is also significant in the RCC frames. This can used in the framed buildings. The diagonal strut is give additional reaction force and stiffness to the frame. The diagonal effect can considered in the design of buildings

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