Comparative Analysis of Framed Structure Vs Mivan Structure

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Abstract- *Over the last few years there are vital changes in the construction industry. Buildings were originally constructed using the load bearing idea, before the invention of the RCC frame. Now the construction industry has started adopting new technologies and approaches in order to increase the overall efficiency of the project. The latest technique is invented for the modern construction is called as Aluform technique or Mivan technique. This innovative type of work is actually suitable for building houses in large numbers at a faster rate. Construction speed should be prioritised, especially for large housing projects or township projects. To address these uncommon challenges in terms of time, cost, and quality, the real estate industry has developed a smart construction method known as the Mivan system. In the present work, A residential of G+9 Framed and Mivan building is analysis statically (Linear method) for this work design software ETABS 2016 is used for design and analysis. All the members of the project are analyzed as per Indian codes IS 456:2000 and IS 1893:2002 (Part I) code using this software. Here the results for Maximum displacement, Story drift, storey shear and storey stiffness are compared static results for Zone-3 with medium soil type.*

Keywords- Framed System, Mivan System, Static Analysis, ETABS 2016, Comparison

I. INTRODUCTION

1.1 GENERAL

Mivan is basically an aluminium formwork system developed by one of the construction company from Europe In 1990; the MIVAN Company Limited from Malaysia started the manufacturing of such formwork systems. Now a days more than 3,00,000 square meter of formwork used in the world are under their operation. In Mumbai, India there are number of buildings constructed with the help of the above system which has been proved to be very economical and satisfactory for Indian Construction Industry. Construction is a vital part of India's development and one of the country's most important sectors. India's urban population is now the world's second largest, and the country's future growth will exacerbate the problem by increasing demand for housing. India desperately needs to plan for acquisition of land and also for rapid creation of dwelling units. Construction is a complicated process that entails primarily architectural planning, Engineering and Construction. According to the Federation of India Chamber of Commerce and Industries (FICCI), keeping in view the existing housing crisis, the country shall need addition of more 2.5 million new dwelling units annually.

Given the enormous task of providing affordable housing to the masses, the adoption of a cost-effective technology becomes even more important. The current strain on the Indian economy, as well as the ever-increasing demand for housing, necessitates the adoption of appropriate building technology that can result in cost savings and construction speed. As a result of experimenting with innovative construction techniques and modern construction management, it is now possible to save as much as 10% on the total cost of housing construction when compared to traditional housing. Today, there is a growing recognition that construction speed, particularly for large housing projects, must be prioritised. This is necessary not only for a faster turnover of equipment and investment, resulting in lower housing costs, but also for achieving the national goal of building a large stock in the shortest time possible.

Figure1: Mivan Technology

1.2 OBJECTIVES

1. To compare Framed structural System (FSS) & MIVAN structural System (MSS) on the basis of Seismic Structural Analysis.

2. To study the relationship between maximum storey displacement , maximum Storey drift, storey shear and storey stiffness.
3. The objective of this project is to check and design of multi-storey building using Etabs 2016.
4. To make the building Earthquake resistant against seismic effect.

II. LITERATURE REVIEW

Sajeet.S.B , "EARTH QUAKE RESPONSE OF DIFFERENT SHAPES OF MIVAN WALL TALL BUILDINGS"In the present work, the Different shapes of Mivan wall building which is irregular in shape is analyzed by Response Spectrum Method further the investigation is carried to know the contribution of different shapes of Mivan wall building to lateral strength and lateral stiffness of the high rise building. Along with this the comparison has been carried out between different shapes of Mivan wall building.

Pawan M. Walvekar , "Seismic Performance Evaluation of Mivan Structural System v/s Conventional Structural System with Effect of SSI by Pushover Analysis"In existing study an attempt is made to study the nonlinear performance and behaviour of Mivan Structures compared with Conventional Structures. Both type of structure is modelled with same material and loading configuration with identical plan and elevation. Both type of Structure is modelled for G+3, G+6, G+9 and analysed and designed as per IS codes. Linear and nonlinear results where compared for gravity loading, and inelastic seismic loading with soil flexible support. From the results it is observed that Mivan structures gives better seismic performance than Conventional structures when subjected to gravity as well as seismic loading.

A.A.Jadhav, "Comparison of the Effect of Earthquake and Wind Loads on the Performance of RC Framed Shear Wall Building with its Different Orientation."In this study; main objective is to determine the position of shear walls in multi-storey building. An earthquake load is applied to a building of twenty sixth storied located in zone III. The analysis is performed using ETABS software. Axial forces, shear force, bending moment, storey displacement and time period are computed and location of shear walls is established.

Abhay Guleria, "Structural Analysis of a Multi-Storeyed Building using ETABS for different Plan Configurations" The case study in this paper mainly emphasizes on structural behavior of multi-storey building for different plan configurations like rectangular, C, L and I-shape. Modelling of 15- storeys R.C.C. framed building is done on the ETABS software for analysis. Post analysis of the structure, maximum shear forces, bending moments, and maximum storey displacement are computed and then compared for all the analyzed cases.

Ali Kadhim Sallal ,"Design and analysis ten storied building using ETABS software-2016"ETABS software stands for extended three dimensional analysis of building systems. The main purpose of this software is to design and analysis multi-Storeyed building in a systematic process. This paper present a building where designed and analyzed under effect of earthquake and wind pressure by using ETABS software. In this case, (18m x 18m) and eight stories structure are modeled using ETABS software. Ten story is taken as (3m) height and making the total height of the structure (31m).

III. BUILDING MODELING

Structural Modeling Data

For the analysis and Design work, Use a typical residential building plan is selected having G+9 storey. For that typical plan both Framed system and Mivan system framing is decided. Framed system is constructed by regular construction process with conventional formwork. Mivan system is constructed by using Aluform or Mivan Technique. Modeling of both systems is carried in ETABS 2016 with certain assumptions. Analysis and design of both systems are carried in ETABS for various loading. Typical residential building plan have total floor area 4161.22 square feet.

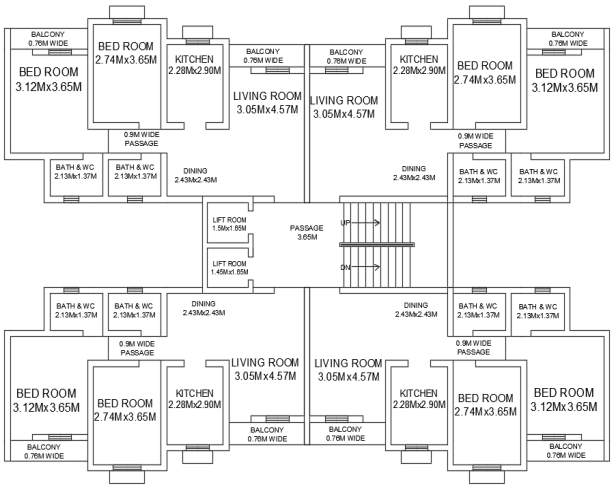


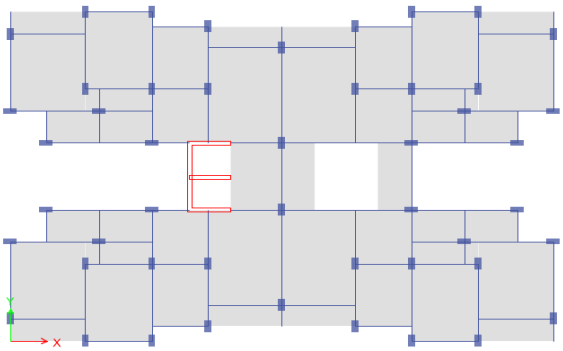
Figure 2: Typical Floor plan

Table 1 : Structural Data and Material Properties

Sr. No.	Structural Data	Property
1	Concrete Grade	M25
2	Directional Symmetry Type	Isotropic
3	Weight per unit volume	24.99 KN/m³
4	Modulus of Elasticity, E	25000 Mpa
5	Poisson's Ratio, U	0.2
6	Steel Grade	Fe 500
7	Directional Symmetry Type	Uniaxial
8	Weight per unit volume	76.97 KN/m³
9	Modulus of Elasticity, E	200000 Mpa
10	Number of Stories	G+9
11	Storey Height	3m
12	Depth of Foundation	2m
13	Beam size in Framed system	300 X 600
14	Column size in Framed system	300 X 600
15	Wall Thickness	160mm& 200mm
16	Slab Thickness	120mm
17	Waist Slab Thickness	120mm

Table 2: Seismic, Dead, Live Loading Parameters

Sr. No.	Parameters	Value
1	**Seismic Coefficient as per IS 1893:2002**	
	Seismic Zone	III
	Seismic Zone Factor	0.16
	Soil Type,	II (Medium)
	Importance Factor (I)	1
	Response Reduction Factor(R)	5
2	**Dead Load**	
	External Wall Load on Beam	11.04 KN/m
	Internal Wall Load on Beam	5.52 KN/m
	Floor Finish Load	1 KN/m²
	Steps (Staircase)	2 KN/m
3	**Live Load**	
	For Floor	2 KN/m²
	For Staircase	3 KN/m²



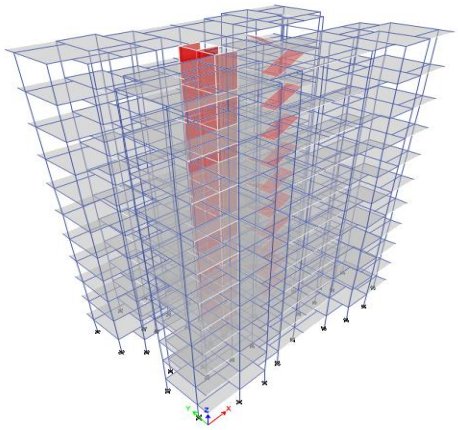
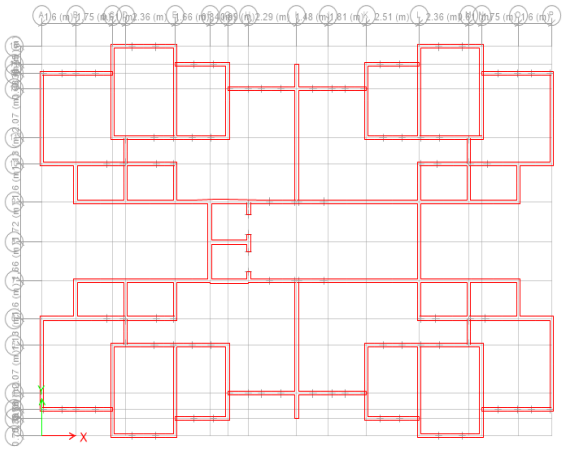


Figure 3: Plan and 3D view of Framed structural building



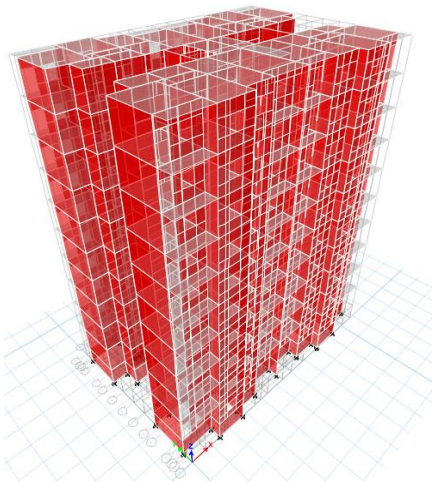


Figure 4: Plan and 3D view of Mivan structural building

IV. RESULTS AND DISCUSSION

In this context G+9 storey Mivan structural system and Framed system analysis output is considered. In this section results obtained by analysis is represented in comparative forms. The effect of maximum storey

displacement, maximum storey drift, storey shear and storey stiffness are observed for different stories. The analysis is carried out using ETABS and database is prepared for different storey levels are as follows. Both system analysis results are represented in table.

a) Comparison of Maximum Storey displacement:

Table 3: Storey NO. and Maximum Storey Displacement

Storey	Elevation (m)	Maximum Storey Displacement (mm)	
		Framed System	Mivan System
Story10	32	30.357	2.349
Story9	29	29.069	2.162
Story8	26	27.148	1.951
Story7	23	24.644	1.717
Story6	20	21.69	1.463
Story5	17	18.412	1.198
Story4	14	14.927	0.929
Story3	11	11.338	0.667
Story2	8	7.736	0.423
Story1	5	4.206	0.211

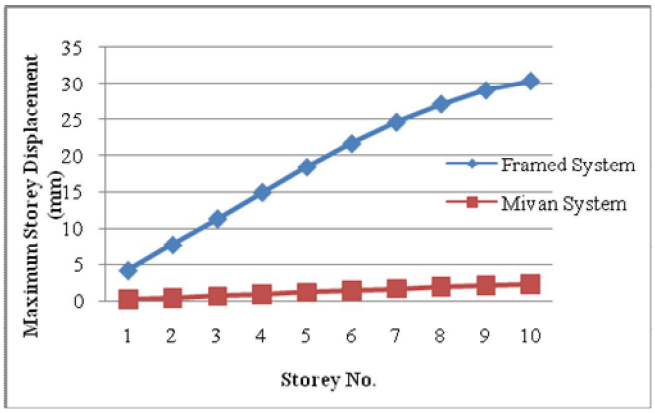


Figure 5: Storey No. and Maximum Storey Displacement

b) Comparison of Maximum Storey drift:

Table 4: Storey No. and Maximum Storey Dfifts

Storey	Elevation (m)	Maximum Story Drifts	
		Framed System	Mivan System
Story10	32	0.000429	0.000062
Story9	29	0.00064	0.00007
Story8	26	0.000835	0.000078
Story7	23	0.000985	0.000085
Story6	20	0.001093	0.000088
Story5	17	0.001162	0.000089
Story4	14	0.001196	0.000087
Story3	11	0.001201	0.000081
Story2	8	0.001177	0.000071
Story1	5	0.001064	0.000067

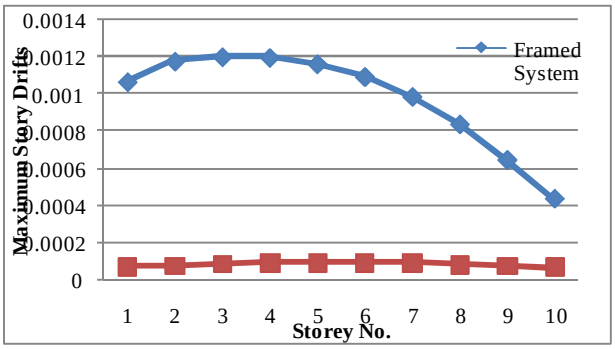


Figure 6: Storey No. and Maximum Storey Drifts

c) Comparison of Storey shear:

Table 5: Storey No. and Storey Shear

Storey	Elevation (m)	Storey Shears (KN)	
		Framed System	Mivan System
Story10	32	317.4505	455.9139
Story9	29	821.9999	1004.2637
Story8	26	1227.5592	1445.03
Story7	23	1544.9273	1789.9491
Story6	20	1784.9033	2050.7576
Story5	17	1958.2859	2239.1917
Story4	14	2075.8741	2366.9879
Story3	11	2148.4668	2445.8824
Story2	8	2186.8629	2487.6118
Story1	5	2201.8614	2503.9186

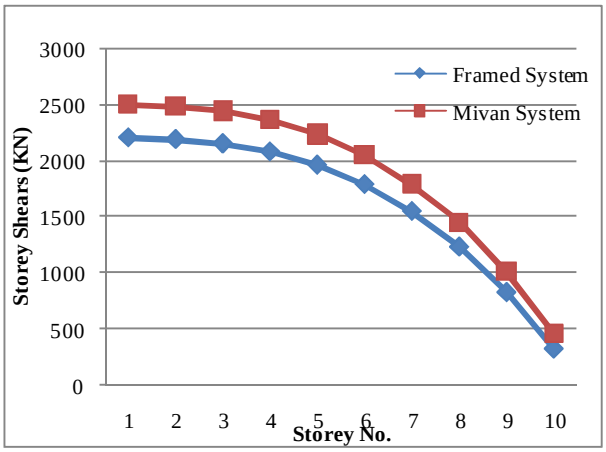


Figure 7: Storey No. and Storey Shear

d) Comparison of Storey Stiffness:

Table 6: Storey No. and Story Stiffness

Story	Elevation (m)	Story Stiffness (kN/m)	
		Framed System	Mivan System
Story10	32	300306.765	4751825.869
Story9	29	595985.597	9167328.905
Story8	26	712892.794	12025539.412
Story7	23	760899.8	14035207.366
Story6	20	786997.039	15674452.723
Story5	17	807921.726	17294999.886
Story4	14	831623.618	19024090.775
Story3	11	868684.477	21304096.96
Story2	8	960489.737	24846474.515
Story1	5	1220017.185	28546660.865

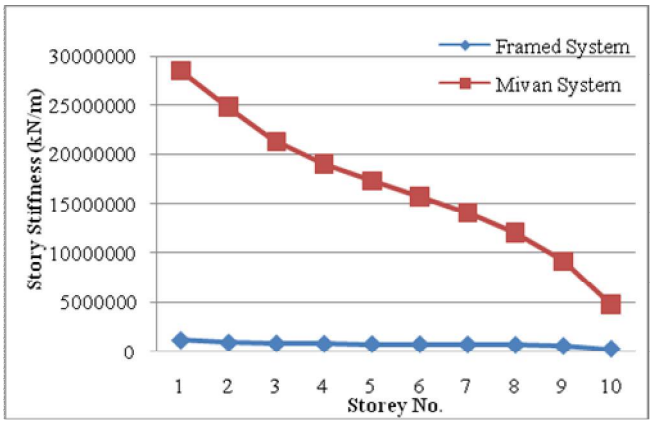


Figure 8: Storey No. and Story Stiffness

V. CONCLUSION

The present study makes an effort to evaluate the seismic performance of Framed structural system v/s Mivan structural system, using ETABS software. The results of the study lead to the following conclusions.

1. Mivan structural system provides better lateral resistance to overall displacement. At top storey maximum storey displacement in the case of Framed structural system is 92 percent greater than Mivan structural system.
2. At top storey Framed structural system is greater storey drift than Mivan structural system All storey drift are within limit as per the requirement of IS 1893: 2002(Part 1).
3. Storey shear in Mivan structural system is greater than the Framed structural system.
4. Mivan structural System has high structural performance to worst loading than Framed structural system.
5. From the results It can be observed that Mivan structural system perform better than the Framed structural system.

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