COMPARITIVE ANALYSIS OF CONVENTIONAL TECHNOLOGY AND MIVAN TECHNOLOGY

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Abstract - *Construction is an important sector and an integral part of the Indian economy. It also represents an important milestone in the country's development. India is desperately planning for the rapid industrialization and modular construction of economical construction facilities, as formwork enables the casting and construction of critical elements and components of any building facilities, which must be robust and efficient in handling of the structure. Mivan is a relatively new construction technology coming to the successful completion of a particularly large project frequently in nature. In this paper we have discussed about the cost as well as the time comparison between the mivan technique and the traditional formwork technique. Mivan technology is remarkably cost effective, quality and time saving compared to conventional. The basic ideology is to arrive at a strong conclusion regarding the superiority of the two technologies over the other.*

Key Words: Mivan Technology, Conventional Technology, Dynamic Analysis, Seismic Zones, Parameters.

1.INTRODUCTION

The Mivan technology system was developed by a Malaysian company as an effective system for the construction of large-scale housing projects in developing countries.. Compared with repetitive design, the system is built multiple times by structural elements, ensuring a fast and economical construction method. The solid concrete surface finish produced by the aluminum formwork can achieve a high-quality wall finish without external and internal plastering. This particular system is considered to be very suitable for large-scale structural construction conditions in India. In this case, the quality and speed can reach an excellent level instead of economic cost. The construction speed of this particular system will exceed the speed of most other recently used construction methods and techniques. Construction productivity at construction site level can be grouped under various departments likes productivity in Labor efficiency, Cost, concrete, steel work and shuttering. However, Mivan Technology is one of the techniques that are used for quick construction. It includes the wall-panel units and slab units directly added to building structure. The use of aluminum is also evolved as one of the techniques for quick construction. The human resource is extremely important in construction industry because construction projects are unique and complex. These characteristics inhibit full automation compared toother industries. The individual skill of each craftsman, the abilities to communicate, make decisions, work with others, and share information, makes this resource unique and irreplaceable in future.

1.1 Mivan Construction

In this Construction main or major part is Formwork and this formwork is different from other form work. In this construction formwork is prepared initially means formwork is planned for particular building and that will be used for related planes only and it will not fit for the other type of plans and these formwork can be used many times for construction these formwork will not break easily and we can easily handle materials means easy to assemble and dismantle. After dismantling the formwork we can get smooth surface or finishing on walls and other components this will reduce the plastering works. once concrete is done we cannot change and disturb the structure , we can't make a hole's on any surface. In this construction after concreting we will cross check the dimensions and slab levels of the Structure. In this construction it requires Skilled labors.

1.1.1 Advantages and Disadvantages Of Mivan Technology

Advantages	Disadvantages
Mivan Formwork requires less Laboure.	Skilled labors Requires.
Faster Completion of Construction.	Initial setup takes more time.
Lesser Noof joints and reduced leakages.	Changes cannot be done after completion.
Smoth Finishing of wall and slab.	Leakage issue during rainy season.
Low Maintenance.	Superior Quality of Materials.
More Seismic Resistance.	We cannot Provide any shape to Structure.
Huge Carpet area.	Special architecture we cannot provide
Good quality of Construction.	
Plastering is not necessary.	

1.2. Conventional Construction

This is the Basic or oldest method. Conventional construction is a method of ordinary or standard construction .it commonly involves the utility of traditional materials and that materials are available easily In near by places .Most of Conventional building are based upon plans are simple measurements, As well as regular floor plans. While prefabricated construction is quicker it doesn't always produce the same dependability as conventional construction. The However we can Build the beauty of Building or Structure Conventional Structure is that it causes no two buildings to be same each building constructed this way is individually designed from the ground up. Conventional structure building also posses an exceptional durability that is specific to thus method. In this construction method materials are to be modified however we want or depending upon work. For this construction skilled and non skilled both labors are Suitable .

1.2.1 : Advantages and Disadvantages

Advantages	Disadvantages
Good resistance against corrosion	Difficult in providing the reinforcements in some cases
Low permeability to water and aggressive solutions	Settings up formwork takes more time
God Chemical resistance	Formworks in construction of dams and bridges difficult or risky.
Vibrator is requires to fill voids so that concrete distribute uniformly	It require more Curing time and it leads to more time to complete construction.
Lighter in Weight	Frequent maintenance is requires.
We Can provide any shape	Special care in expensive soils and high ground water conditions.
Cost control and analysis	Expensive to use.
Easy to handle the materials	
We can provide good, even grate architecture	

2.0 Objectives of the Study

1. To Check The dominant of The Conventional structure and Mivan Structures Under Earthquake Loading.
2. To Study The Form Works of Conventional And Mivan Structures.
3. To compare the Quantity of buildings based on the materials required in each of them.
4. To carry out the comparative analysis between the Conventional and Mivan construction . Considering Factors Base shear , Frequency , Time period, Story drifts ,Story shear , Story stiffness.

3.0 MODELING APPROACH

Analysis has been carried out using **ETABS 2013 Version** software package. Linear Dynamic analysis is considered and evaluate their overall performance. **Structural Modeling** In this study a 15story's R.C building and Mivan building is analyzed with different Seismic Zones. Plan and elevation are shown in the figure no's 3.1 & 3.2 below

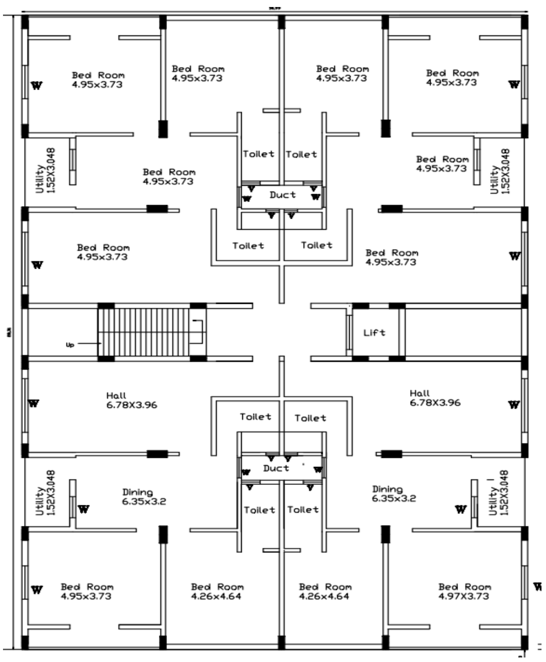

Fig -3.0.1: Plan of Building

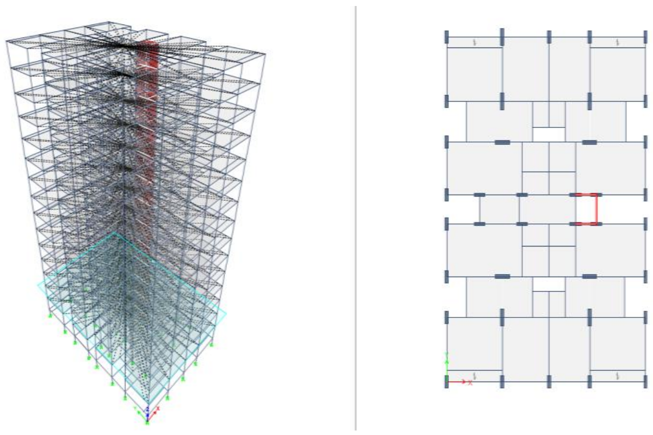

Fig -3.0.2: 3D Elevation and Plan

The building configuration, details, geometrical dimensions, material properties, gravity loading, seismic loading and details of various models are given below in the following tables

Type of building	Residential building
Plan area	19m X 28.3m
Bays	4 bays in X and 7 bays Y direction
Story height	3m
Type of soil	Medium soil
Location of building	Zone 3 , 4 , 5
Slab thickness	0.125 , 0.130 , 0.150 , 0.170m
Wall thickness	0.23m , 0.2 m ,0.125m ,0.15m
Total No of Columns	38 per floor
Total No of beams	65 per Floor

Table 3.0.1 Properties of Building

Grade of concrete	M20, M25, M30
Density of concrete	$25kN/m^3$
Grade of steel reinforcement	HYSD415, HYSD5oo
Density of masonry (Brick)	$20kN/m^3$

Table 3.0.1 Properties of Building

Wall load	0.23X3 X20=13.8 kN/m
Partition wall load	0.15X3 X20=9kN/m
Floor finish	$1.0kN/m^2$
Live load	Floor -2 , Stairs - 3 , Roof - $1.5kN/m^2$
Live load reduction factor	25%

Table 3.0.1 Load Calculations of Building

Type of structure	Special Moment Resisting Frame
Damping ratio	5%
Seismic zone factor (Z)	0.36 , 0.24 , 0.16
Importance factor (I)	1.5
Response reduction factor (R)	5
Wind Speed	33 km/h
H/W	2.44
L/W	1.49
Category	II
K1 ,K2 ,K3	1 , 1.14 , 1
Scale Factor = (I/2R) *9.81*1000	1471.5

Table 3.0.1 Seismic Properties of Building

3.1 Wind Load Calculations

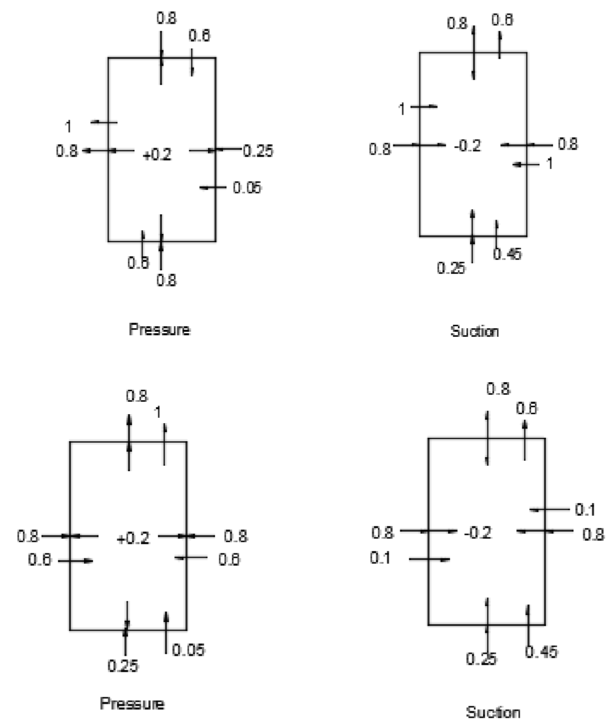

Fig 3.1 Wind Calculations At 0 and 90 Degrees

3.2 Analysis of Model

In the present study, fifteen-story RC building is analyzed for both gravity and seismic loads. Firstly static analysis of RCC building is carried out by considering the gravity loads such as dead and live loads and then load combinations are taken as per **IS 456:2000.** The seismic loads and combinations are carried out as per **IS 1893 (Part-1):2002.** For the seismic analysis Response Spectrum Method has been considered to determine the design base shear ,story shear ,story drift, time period , frequency.

3.3 ANALYTICAL MODELS

Zone 3 : Conventional Model

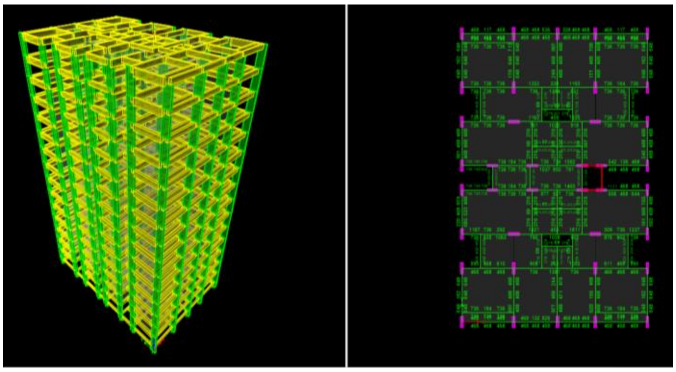

Fig 3.3 Conventional Model Zone 3

Zone 3 : Mivan Model

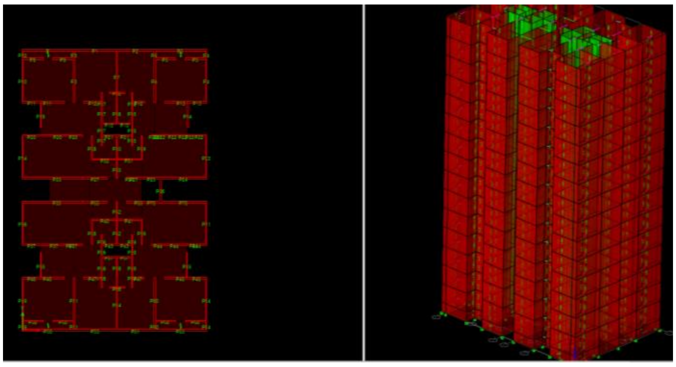

Fig 3.3 Mivan Model Zone 3

Zone 4 :Conventional Model

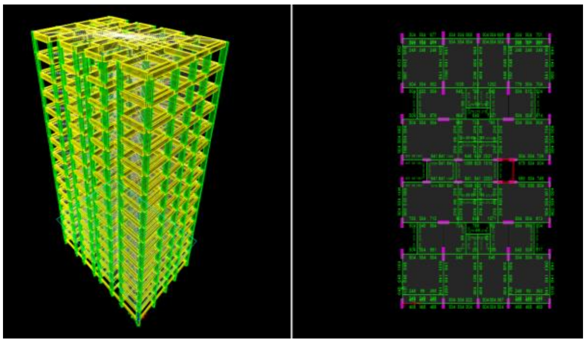

Fig 3.3 Conventional Model Zone 4

Zone 4 : Mivan Model

	Slab	Wall	
Total Quantity	43233.88	459390.18	Kg
Wastage 3%	1297.02	13781.71	Kg
Bending wire1%	432.34	4593.90	Kg
In Ton	44.96323803	477.765787	Mt
Total	522.7290246		

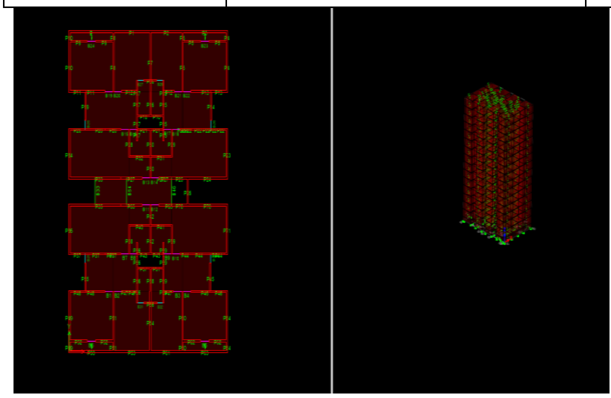

Fig 3.3 Mivan Model Zone 4

Zone 5 : Conventional Model

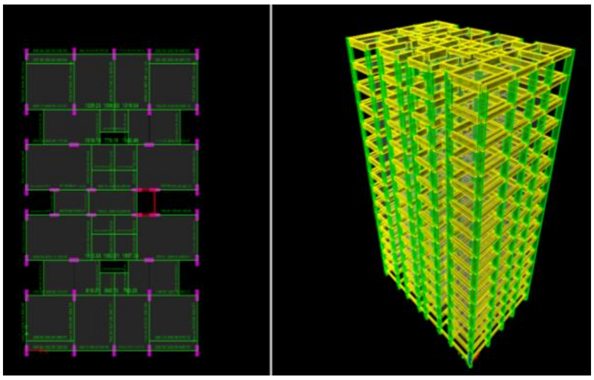

Fig 3.3 Conventional Model Zone 5

Zone 5 :sMivan Model

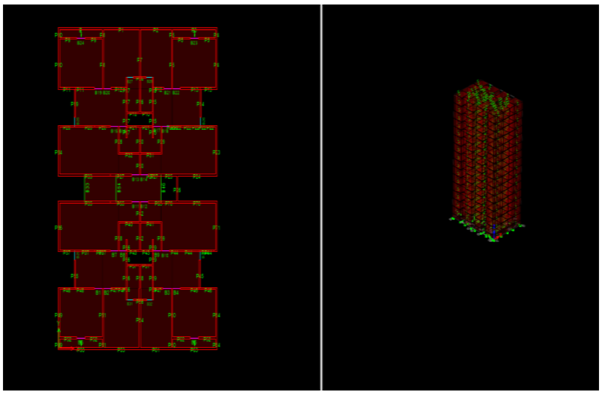

Fig 3.3 Mivan Model Zone 5

3.4 Estimation and quantity of all Components

3.4.1 Quantities Required for the Conventional Building

	Beams	Columns	Slabs	Wall	
Total Quantity	69094.47	77762.44	43233.88	7480.98	Kg
Wastage 3%	2072.8	2332.87	1297.01	224.43	
(B W) 1%	690.94	777.62	432.33	74.81	
Total	71858.24	80872.94	44963.24	7780.22	Kg
In Ton	71.85824	80.87	44.96	7.78	Mt
Total	205.4746387				Mt

3.4.2 Quantities of steel Required for Mivan Building

4.0 RESULTS AND DISCUSSIONS

The results are obtained for all the analytical models. An effort has been made to understand the effect of uncertainties in behavior of the structures. The parameters of buildings are represented interms of tables and figures.

4.1 Base Shear

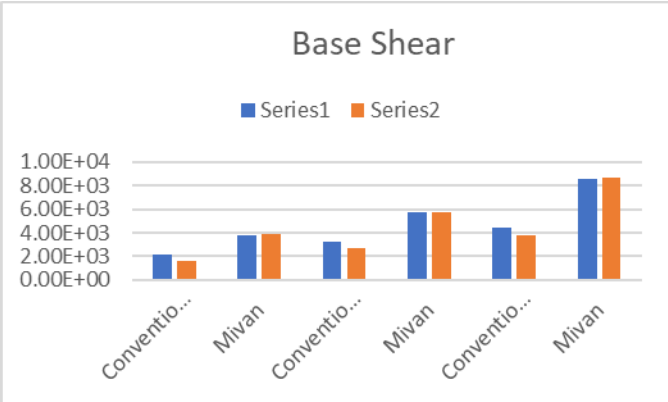

Fig 4.1 Base Shear for All Zones

4.2 Time Period and Frequency

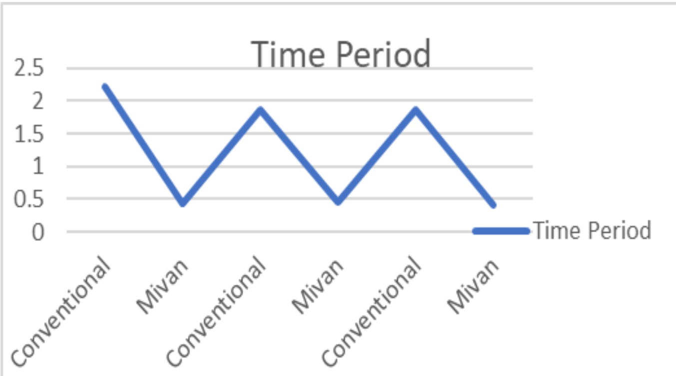

Fig 4.2 Time Period for All Zones

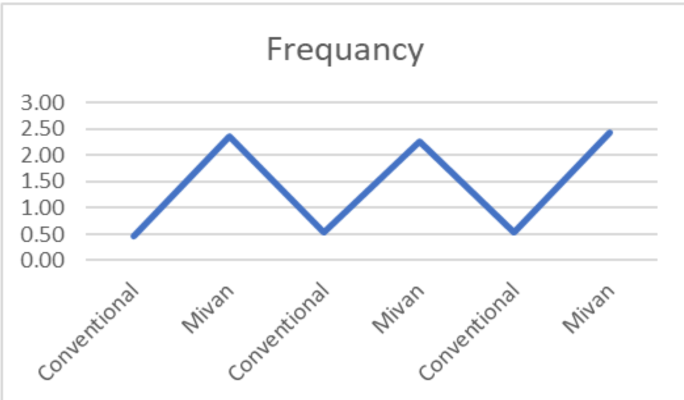

Fig 4.2 Frequency for All Zones

4.3 Story Drift

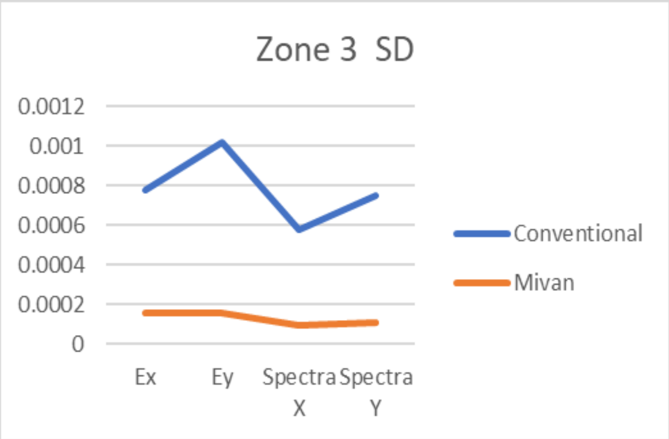

Fig 4.3 Story Drift for Zone 3

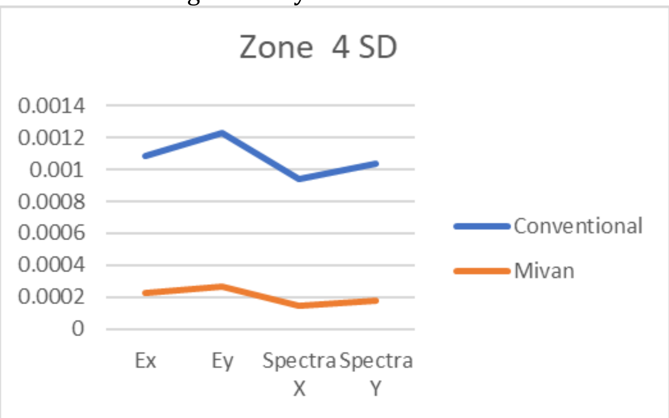

Fig 4.3 Story Drift for Zone 4

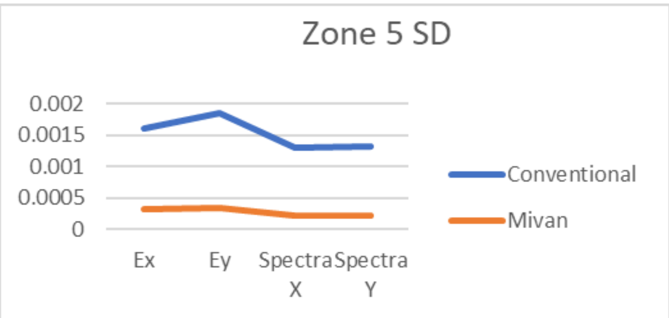

Fig 4.3 Story Drift for Zone 5

4.4 Estimation and quantity of all Components

4.4.1 Quantities Required for the Conventional Building

	Beams	Columns	Slabs	Wall	
Total Quantity	69094.47	77762.44	43233.88	7480.98	Kg
Wastage 3%	2072.834	2332.8733	1297.01	224.43	
Bending Wire 1%	690.9447	777.62442	432.33	74.81	
Total	71858.24	80872.94	44963.24	7780.22	Kg
In Ton	71.85824	80.87294	44.96	7.78	Mt
Total	205.4746387				Mt

Table 4.4.1 Conventional structure Quantity

Parameters		**Zone 5**	
		Conventional	**Mivan**
Storey Shear			
Maximum	E_x	0	0.000133
	E_y	0	0
	Spectra X	4436.7	8528.69
	Spectra Y	3825.88	8689.65
Minimum	E_x	-5244	-11839
	E_y	-4358	-11839
	Spectra X	0	0
	Spectra Y	0	0
Base Shear	X	4.44E+03	8.53E+03
	Y	3825.88	8689.65

4.4.2 Quantities Required for the Mivan Building

	Slab	**Wall**	
Total Quantity	43233.88	459390.18	Kg
Wastage 3%	1297.02	13781.71	Kg
Bending wire1%	432.34	4593.90	Kg
In Ton	44.96323803	477.76	Mt
Total	522.7290246		

Table 4.4.1 Mivan structure Quantity

4.5 Story Shear

Parameters		Zone 4	
		Conventional	Mivan
Storey Shear			
Maximum	E_x	0	0.00005
	E_y	0	0
	Spectra X	3272.92	5766.83
	Spectra Y	2745.59	5803.67
Minimum	E_x	-3430	-7896
	E_y	-2877	-7896
	Spectra X	0	0
	Spectra Y	0	0
Base Shear	X	3.27E+03	5.77E+03
	Y	2745.59	5803.67

Table 4.5 Story Shear for Zone 3 & Zone 4

Parameters		Zone 3	
		Conventional	Mivan
Storey Shear			
Maximum	E_x	1.19E-07	3.00E-06
	E_y	0	0
	Spectra X	2109.14	3832.7
	Spectra Y	1665.3	3906.8
Minimum	E_x	-2428	-5263
	E_y	-1943	-5263
	Spectra X	0	0
	Spectra Y	0	0
Base Shear	X	2.11E+03	3.83E+03
	Y	1665.3	3906.8

Table 4.5 Story Shear For Zone 5

5. CONCLUSIONS

1. Dominancy Check : on Bases of Analysis Mivan Building is More Dominant and it shows more stability compared with conventional structure,
2. Formwork of the Mivan Structure is designed by Company and that is complicated and it is not easily available easily in near by places but in Conventional Formwork it is simple and it is available easily in near by places.
3. Story Shear : Story Shear is more in Mivan Structure and Less in Conventional Structure.

Comparing all Zones Story Shear increasing zone wise due to increasing seismic parameter.

%	Zone 3	Zone 4	Zone 5
X	29.01	27.6	31.56
Y	40.23	35.77	38.86

Above table shows that Shear Stress in X and Y direction that much of % more in Mivan Structure Comparing with Conventional Structure.

4. Base Shear : More the Base Shear that will resist more lateral forces or seismic forces.

Base Shear is more in Mivan structure and Less in Conventional Structure.

Comparing all Zone Base Shear is increasing in both structures due to increasing in Seismic parameter.

Hence it indicates that Mivan structure is more stable in earthquake occurring areas Than the Conventional Structure.

5. Story Drift : on bases of Results all Structures are in Safe Zone.

Story Drift is less in Mivan Comparing with Conventional Structure.

6. Time Period : Comparing of all zones Time period is Less in Mivan Structure and more in Conventional Structure. Time Period is decreases with zone wise and in 3 zone is high compare to Zone 5 is Low in Conventional Structure.
7. Frequency : Frequency is more in Mivan structure and less in Conventional Structure in all zones.

Small Variations are there in Mivan structure and in Conventional Structure Little bit more Compared to Mivan.

8. Story Stiffness : on bases of Results Story Stiffness is more in Mivan structure and Less in Conventional Structure. Story Stiffness is increasing with seismic parameter and Low in Zone 3 and High in Zone 5.
9. Quantities : Mivan Structure required more steel quantity and Conventional structure required Less quantity of Steel.

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