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EFFECT OF INFILL WALLS IN STRUCTURAL RESPONSE OF R.C.C. FRAMED STRUCTURES FOR DIFFERENT PLAN CONFIGURATION

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ABSTRACT: In the construction of buildings, framed structures are commonly utilised owing to their ease of construction and speed of completion. The infill wall acts as a compression strut between the column and the beam, transferring compression pressures from one node to the next. A dramatic shift in stiffness occurs throughout the building height in open ground storey constructions, making the storey more flexible. As a result, the columns and beams in those levels are under a lot of strain. The inclusion of infill walls in the frame, on the other hand, contributes to the building's lateral stiffness and seismic resistance. This research is concerned with the study of Lateral Loads such as Seismic and Wind Loads for various plan configurations utilising the Equivalent Strut Approach and ETABS software. The Equivalent width of these struts is the most important characteristic that affects stiffness and strength. For various plan configurations, the outcomes for Storey stifness2, storey drift, storey displacement, and time period are compared.

I. INTRODUCTION

1.0 GENERAL

Since the dawn of time, the desire to build ever-higher buildings has been in the human psyche. As India's metropolises grow, so does the need for skyscrapers. Many buildings in India and other developing nations use reinforced cement concrete moment-resistant frames filled with unreinforced brick masonry. For various reasons, masonry is a prevalent building material across the globe. These include its accessibility, use, and low cost. Masonry's major role is to protect the structure's interior from the elements or partition the inside into distinct areas.

Architectural aspects include infill walls. Engineers tend to overlook their importance. They are typically overlooked because of the intricacy of the issue, and their interaction with the bounding frame is often overlooked. Masonry infills interact with their surrounding frames, increasing the structure's ability to withstand lateral loads. Inaccuracy in forecasting the structure's reaction might result from this assumption. This is more likely to happen if the stress is applied laterally. Years of study show that infills have an important role in influencing the behavior of moment-resistant frames and their ability to transmit loads. A study of earthquake-damaged structures bolsters this conclusion. Infilled frames provide greater strength and rigidity because of the inclusion of infills. However, it's possible that they should not be ignored to classify the design as conservative. The inadequacies of the existing bare frame technique are shown by damage to structures caused by infill during previous earthquakes. There are no major issues with the normal vertical loads, dead or live, in high-rise buildings. However, lateral loads caused by wind or seismic vibrations need to be considered when designing these structures. Unwanted vibrations may be caused by the lateral forces, as can the structure swaying side to side.

1.1 INFILLED WALLS

For this definition, "Infill Panels" refers to any wall between beams, columns, or floors influenced by its location and structure. Infill walls in reinforced concrete frame structures increase lateral stiffness, strength, and energy dissipation, as is well-known and well recorded. Seismic occurrences often destroy infill walls, regardless of whether this is a good thing or bad. Slab crushing, corner crushing, sliding shear failure, and diagonal tension fractures are common infill wall damage types.

Due to the loss of inventory, business, downtime, etc., a nonstructural component in a building might easily cost more than the structure's replacement cost (Villaverde 1997). As a result, there is a need for technical solutions that are both economical and effective for preventing damage to infill walls.

Innovative techniques should be used to alter the brittle behavior of the infill walls so that they are better suited to withstand earthquakes. In this way, minor earthquakes will not cause significant damage to infill walls, and the energy will be dissipated elsewhere rather than destroying the infill walls. Figure 1.1 shows an example of a base shear lateral drift graph to demonstrate the fundamental idea of this study.

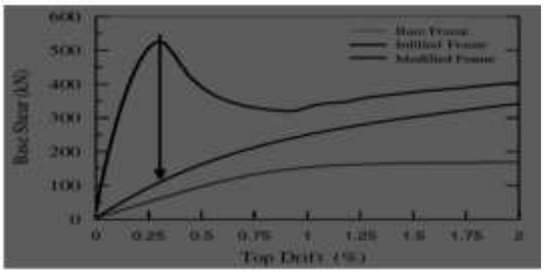


Fig1. A Sample graph of Base Shear vs. Lateral Drift Curve for Infilled and Bare Frames.

1.2 MODELING OF INFILL WALLS:

Using masonry infill walls between the columns of reinforced concrete framed structures contributes significantly to building damage and collapse during powerful earthquakes. In this work, infill walls are modeled using the program ETABS. Infill walls may be modeled using the equivalent static strut approach.

1.3 EFFECTS OF MASONRY INFILL WALLS

Most extant concrete frame construction systems include masonry infill walls. In India, where seismicity is a major concern, this infill wall is widespread. These masonry infill walls, built after the concrete frames have been completed, are considered nonstructural components. Masonry infill walls withstand lateral stresses with significant structural activity while serving architectural tasks.

In addition to this infill, walls have tremendous strength and stiffness, and they have a major impact on the structural system's seismic reaction. According to the study, infilled frames have more strength than frames without infill walls. The inclusion of the infill walls significantly enhances the lateral stiffness. The dynamic features of the structural system vary as the stiffness and mass of the system change. Recent earthquakes in Gujarat, Delhi, and Guwahati have shown that infill walls significantly impact building resistance and stiffness. The consequences of the infill walls on the building response under seismic stress, on the other hand, are quite complicated and need much arithmetic. ETABS is used to model the actual behavior of structural systems.

1.5 OBJECTIVE OF THE STUDY

The major goal of this study is to use the linear dynamic analysis approach, i.e., response spectrum analysis, to determine the influence of masonry infill walls on the seismic behavior of an R.C.C. High-Rise structure. For a G+ 22-story structure, the following findings for the infilled frames will be compared. The study's outcomes will be compared in terms of i) Story displacement, ii) Storey drift, iii) Storey Stifness, and iv) time period.

The primary goal of this research is to find out how masonry infill walls affect the lateral strength and stiffness of structures. A comparison study is conducted using a 3-D analysis model produced in ETABS, a commercial computer tool for structural analysis. Modeling of masonry infill walls Their tensile strengths, which were insignificant, were ignored. In order to compare and understand the impact of masonry infill walls, assessments of infill walls with various plan configurations were conducted.

II.LITERATURE REVIEW

Past relevant studies on masonry and masonry infilled concrete frames and their lateral load performance is presented in this part.

Sucuoglu & Erberik

Erberik and Sucuoglu, The seismic performance of a three-story unreinforced masonry structure that escaped damage during the Erzincan earthquake in 1992, was studied. The mechanical qualities of the masonry walls were first determined via a series of tests. Then, with the aid of computer software, an accurate model for non-linear dynamic analysis of brick buildings was established. The dynamic analysis results, which included modal spectrum analysis, incremental collapse analysis, and time-history analysis, revealed that unreinforced masonry buildings have significant lateral load resistance in both the elastic and ultimate limit states if they meet seismic code requirements. Because of internal friction, they demonstrated that brick wall components had a remarkable energy dissipation capability. However, the whole result was based on the mechanical qualities gained via laboratory measurements. In other words, the validity of these findings is contingent on the identical material qualities being achieved.

Paulay & Priestley

Paulay and Priestley provided a theory of masonry infilled frame seismic behavior and a design procedure for infilled frames. Although masonry infill may boost overall lateral load capacity, it may modify structural response and draw pressures to different or undesirable parts of the building with an unbalanced design, according to the authors. This indicates that masonry infill might lead to structural issues. When it comes to the lateral stress level, infilled frames respond differently. Both the concrete structure and the infill work together at low elevations.

Hossain Mohammad Muyeed-Ul-Azam

Columns and other structural elements of RC frame constructions do not often take brick infill into account when planning their design. The in-plane stiffness of the brick walls contributes significantly to the rigidity of the structure when subjected to lateral loads. In comparison to the deflection of the frame without infill, the infilled frame exhibits much less lateral deflection. This results in varying steel needs for the frame structures when considering the infill material. A finite element analysis of a ten-story three-dimensional building frame is used to better understand the behaviour of frames and the steel needs of columns with and without brick masonry infill. The beam and columns were modelled using common three-dimensional frame components, whereas the slab was modelled using shell elements. An analogous strut approach is used to determine the brick wall's in-plane stiffness, which is then included into the finite element model using a specific link element with just axial stiffness. In order to determine steel needs and assess the influence of infill on the sway characteristics of the structure, a thorough research is carried out utilising different loads and load combinations on the building, with and without infill. For the purposes of analysing the structure with and without infill, typical corner columns, exterior columns, and interior columns are used, all with the identical beam and column size. Compared to frames without infill, frames with infill have substantially fewer deflections. In addition, the steel needs for interior and corner columns are similar, with the exception of the exterior column, where there is a large variance in steel requirements. Taking into account infill stiffness may not lead to savings in the design of multi-story structures if the number of internal columns is much more than the number of exterior and corner columns.

III. METHODOLOGY

3.1 DYNAMIC ANALYSIS :

In order to determine the seismic force design and the distribution of that force along the height of the building and to various lateral load resisting parts, the following structures must undergo dynamic analysis:

In zones 4 and 5, and zones 2 and 3, there are no restrictions on the height of regular structures. There should be an analytical model that accurately represents the sorts of irregularities prevalent in buildings with odd configurations for dynamic analysis. It is not possible to simulate dynamically any buildings that have plan abnormalities, as stated in IS 1893-2016, Table 4. It is possible to do dynamic analysis using the time history approach or the response spectrum method. Either technique requires comparison of the design base shear with a base shear determined by utilising a fundamental period of time (t). If is smaller than, then all response quantities (such as member forces and displacements and base responses) must be multiplied by /. The damping values building may be regarded as 2% and 5% of the critical value, respectively, for the purposes of dynamic analysis of steel and reinforce concrete structures.

3.2 RESPONSE SPECTRUM METHOD

The design spectrum provided in the code or a site-specific design spectra for a structure generated at the project site must be used for this procedure.

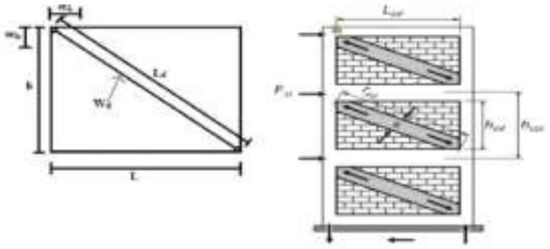
Analysis of the Response Spectrum Is 1893:2016 mandates the use of a response spectrum approach to examine high-rise and irregular structures, employing the spectra shown in Figure 2. IEC 1893:2016 The analysis must take into account enough modes to represent at least 90% of the building's participating mass in each of the building's two orthogonal primary horizontal directions. The response variables (members forces, displacements, storey shears, and base reactions) must be scaled up by the factor if the base shear derived from the static analysis is smaller than the design base shear.

In 1971, with the San Fernando quakes, the current concept of Response Spectrum Analysis was initiated. Strong-motion records have been combined with continuous monitoring data, then through an empirical scaling analysis, the magnitude of the motion could be predicted.

To perform structural engineering tasks, design history is required. It is impossible to obtain the data of every single apartment house. Therefore, comparing structures based on a single value would result in the overestimation of the property. To tackle tough challenges faced during earthquakes, spectrum analysis provides solutions. There are computational advantages in using the response spectrum method for seismic analysis of structural systems to predict displacement and forces. The maximum displacement is obtained using streamlined design spectra of earthquakes in the technique. This section presented the response spectrum as well as its implementation. The overview of the detailed code for response spectrum analysis of multi-story buildings based on IS:1893 (Part 1)-2002 code for response spectrum method of multi-story building is summarized.

3.3 EQUIVALENT DIAGONAL STRUT METHOD (FORMULA)

Many studies have been used to investigate the interaction between infill and frames, such as the theories of elasticity or finite element modeling. Some approximation techniques are being developed because of the difficulty and unpredictability of characterising the relationship between infills and frames. One of the most common and well-known ways is to use diagonal struts whose thickness is equal to the thickness of the masonry infill to replace the existing masonry infill. The most difficult part of this strategy is determining the actual width. The breadth of an analogous diagonal strut may be determined using a variety of methods. The extent of contact between both the columns and the wall (h) and the beam and the wall (L) determines the strut width.



According to IS 1893 (Part 1) 2016

Clause-7.9.2.1 Masonry infill walls must be given the elasticity modulus, Em (in MPa), as:

Em = 550fm

where fm is the compressive capacity of the concrete prism (in MPa) determined as per IS 1905.

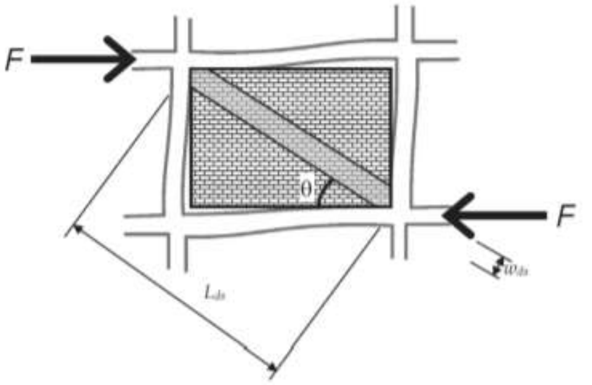
Clause-7.9.2.2 The diagonal struts used to simulate URM infill walls are shown below:

Diagonal struts with pin-jointed ends on the RC frame are regarded to be diagonal struts, and the width Wds of an analogous diagonal strut (see Fig.) is believed to be:

$W_{ds} = 0.175\ \alpha_h^{-0.4}, L_{ds}$

Where

$$\alpha_h = h\left(\sqrt[4]{\frac{E_m t \sin 2\theta}{4 E_f I_c h}}\right)$$



Width of Strut = W_{ds} =1030mm

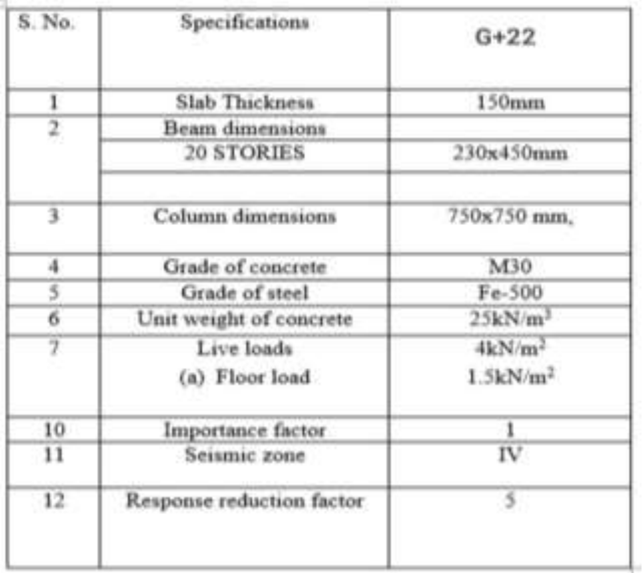
IV. MODEL DETAILS AND ANALYSIS

4.1 BUILDING DESCRIPTION FOR G+22MODEL

4.1.1 Type of Models*:*

Square Type, L-Type, C-Type, H-Type, T-Type, Tube Type and I-Type

In the All prototype, an IV zone rc framed building is studied. The building's plan size is 35 × 35 m, with average storey heights of 3m. It has 7 X-bays and 7 Y-bays.



S. No.	Specifications	G+22
1	Slab Thickness	150mm
2	Beam dimensions	
	20 STORIES	230x450mm
3	Column dimensions	750x750 mm,
4	Grade of concrete	M30
5	Grade of steel	Fe-500
6	Unit weight of concrete	25kN/m³
7	Live loads (a) Floor load	4kN/m² 1.5kN/m²
10	Importance factor	1
11	Seismic zone	IV
12	Response reduction factor	5

Table 4.1: Structural Specification for G+20 Building

4.2 STRUCTURAL SYSTEM OF THE BUILDING

The column, beam dimensions are detailed in the below tables:

S. No.	Description	Information	Remarks
1	Plan size	35mx35m	------
2	Building heights	66 m	------
3	Number of storey's above ground level	20	------
4	Number of basements below ground	0	------
5	Type of Structure	RC frame	------
6	Infill wall thickness	230 mm	------
7	Infill strut	230x1030 mm	------
8	Type of building	Regular frame with open ground storey	IS-1893:2016 Clause 7.1
9	Horizontal floor system	Beams & Slabs	------
10	Software used	ETABS 2019	------

Table 4.2: General Data for G+22Buildings

Model 1 : Square-TYPE BUILDING

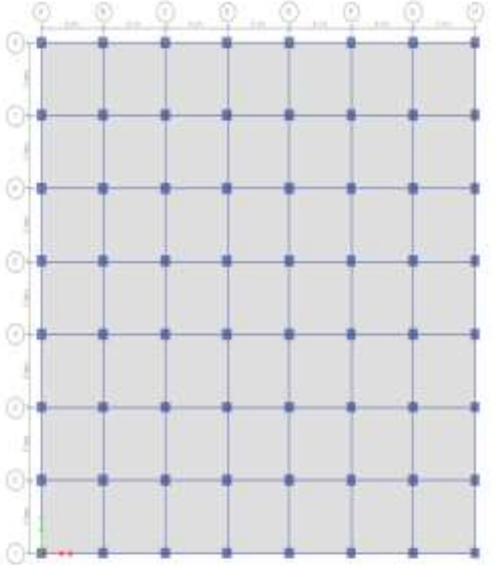
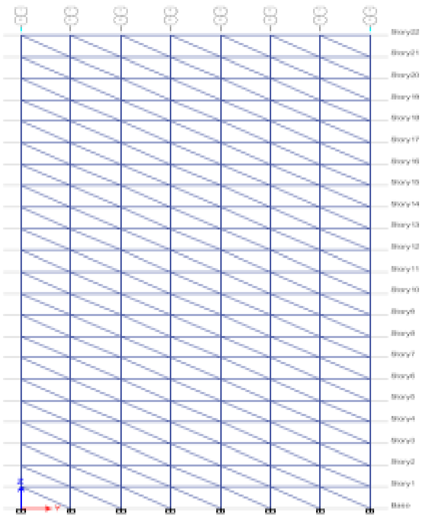


Figure2: Model Plan View of Square Building



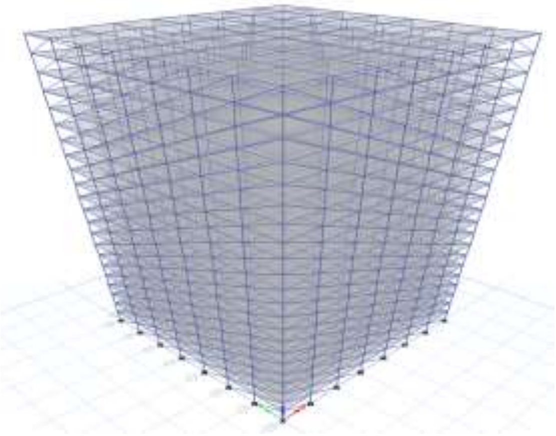


Figure 3: Isometric Views of Square Building and Elevation view of Square Building

Model 2 : L-TYPE BUILDING

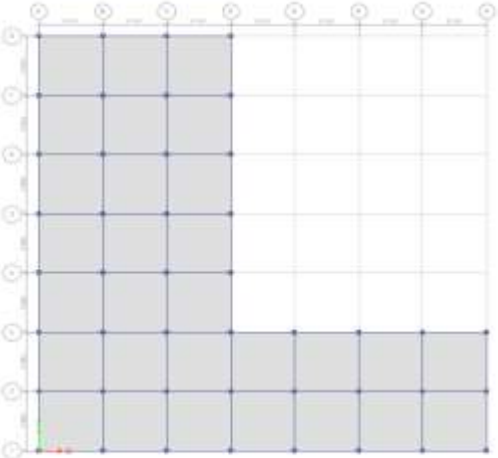


Figure4: Model Plan View of L- Building

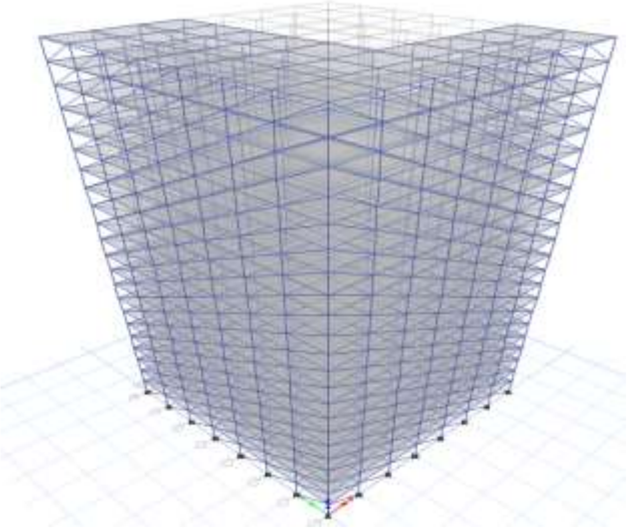


Figure 5: Isometric Views of L- Building

Model 3 : C-TYPE BUILDING

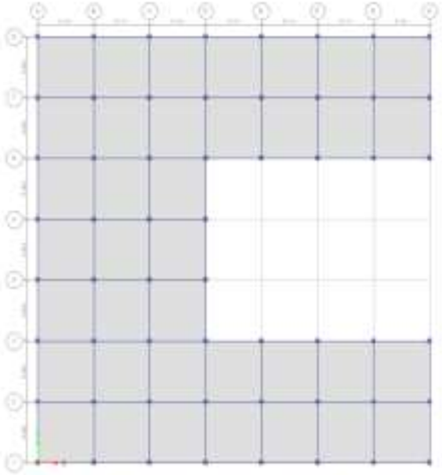


Figure6: Model Plan View of C- Building

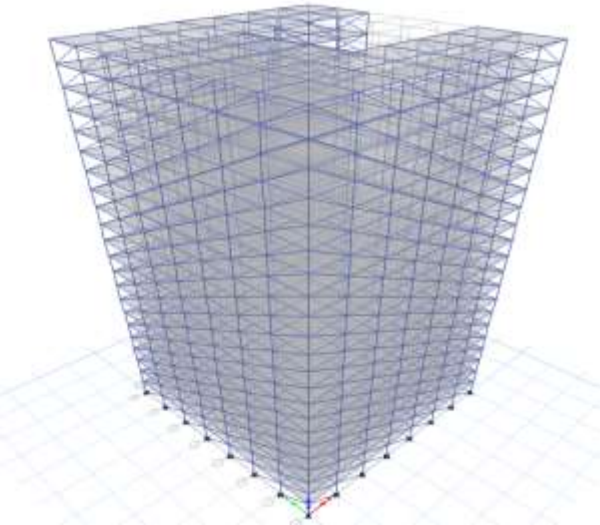


Figure 7: Isometric Views of C- Building

Model 4 : H-TYPE BUILDING

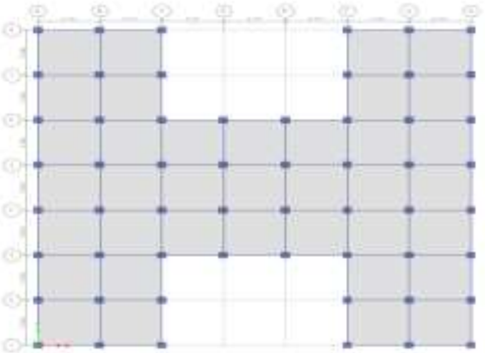


Figure8: Model Plan View of H- Buildings

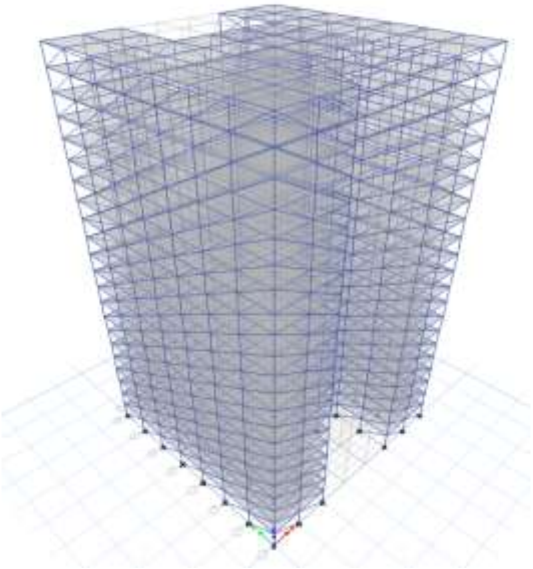


Figure 9: Isometric Views of H- Building

Model 5 : T-TYPE BUILDING

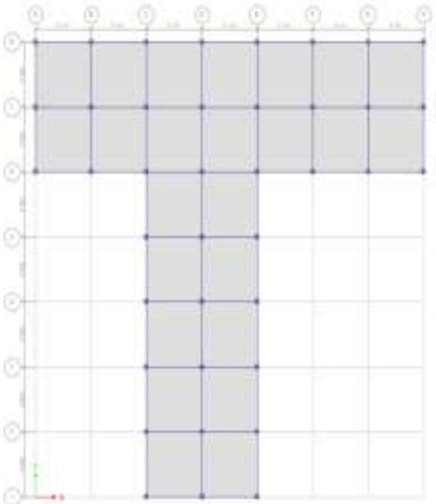


Figure 9: Model Plan View of T- Buildings

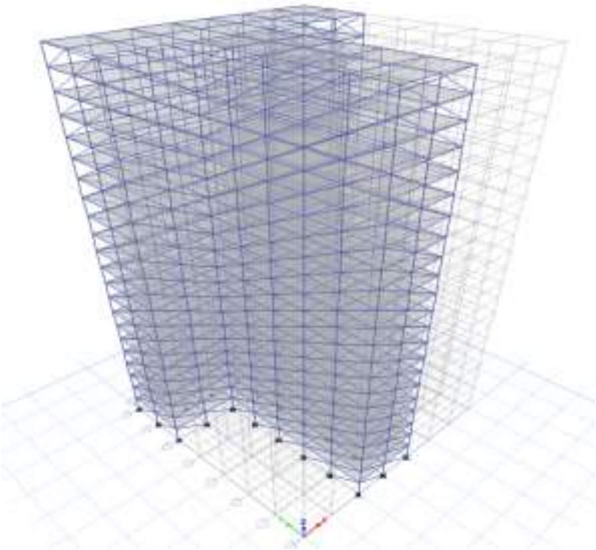


Figure 10: Isometric Views of T- Building

Model 6 : TUBE-TYPE BUILDING

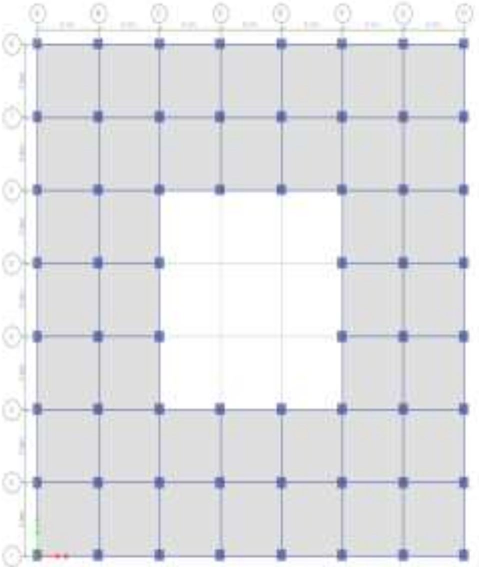


Figure10: Model Plan View of Tube- Buildings

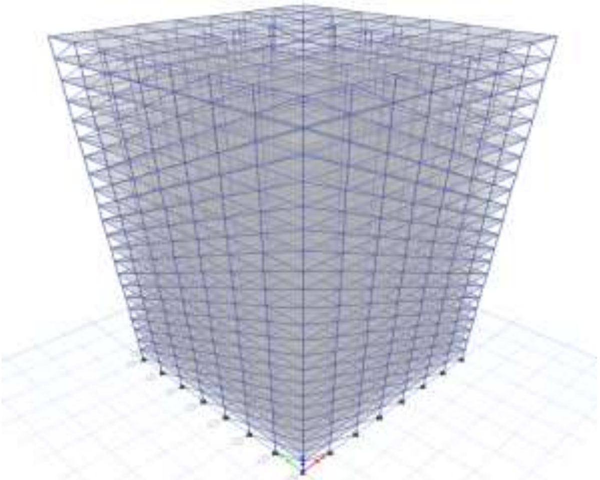


Figure 11: Isometric Views of Tube- Building

Model 7 : I-TYPE BUILDING

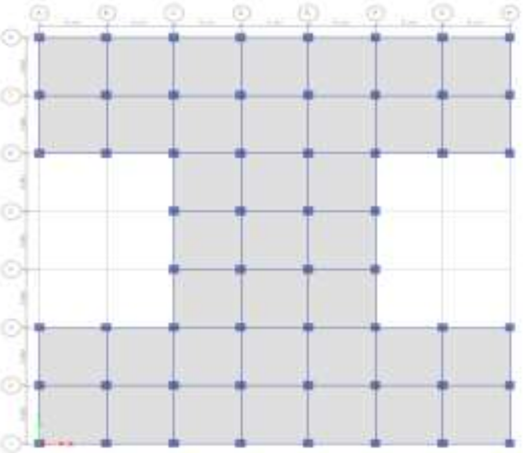


Figure12: Model Plan View of I- Buildings

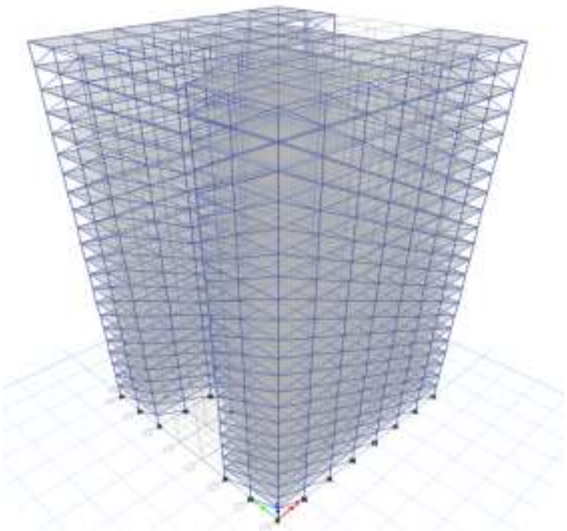


Figure 13: Isometric Views of I- Building

V. RESULTS

5.1 GENERAL

In this part, the result of each building will be obtained, and then the result will be comparative between building with square, L-Type, , C-Type. T-Type, H-Type, I-Type, Tube-Type.in the following categories: -

1- Time Periods,

2-Building displacement

3-Inter story drift.

4-Story stiffness

5.2 STORY DISPLACEMENT IN X AND Y- DIR

STORY DISPLACEMENT IN X DIR							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
	RPX	RPX	RPX	RPX	RPX	RPX	RPX
	mm	mm	mm	mm	mm	mm	mm
Base	0	0	0	0	0	0	0
story 1	0.384	0.143	0.174	0.133	0.203	0.177	0.229
story 2	0.792	0.412	0.376	0.283	0.443	0.387	0.476
story 3	1.23	0.856	0.62	0.461	0.738	0.641	0.752
story 4	1.71	1.48	0.911	0.672	1.069	0.939	1.064
story 5	2.237	2.267	1.247	0.916	1.426	1.278	1.41
story 6	2.814	3.198	1.625	1.192	1.808	1.657	1.791
story 7	3.438	4.259	2.045	1.496	2.214	2.072	2.203
story 8	4.108	5.434	2.505	1.826	2.645	2.52	2.644
story 9	4.818	6.708	3.001	2.178	3.1	2.997	3.111
story 10	5.565	8.069	3.529	2.549	3.575	3.498	3.601
story 11	6.342	9.503	4.087	2.936	4.068	4.021	4.111
story 12	7.147	11.001	4.668	3.337	4.576	4.561	4.638
story 13	7.973	12.551	5.269	3.748	5.094	5.115	5.178
story 14	8.817	14.144	5.886	4.169	5.621	5.681	5.73
story 15	9.675	15.772	6.517	4.596	6.153	6.255	6.289
story 16	10.543	17.427	7.157	5.028	6.688	6.836	6.855
story 17	11.417	19.101	7.804	5.464	7.224	7.422	7.424
story 18	12.295	20.788	8.455	5.901	7.76	8.01	7.995
story 19	13.174	22.482	9.11	6.338	8.294	8.598	8.567
story 20	14.05	24.18	9.765	6.774	8.823	9.185	9.136
story 21	14.922	25.877	10.419	7.208	9.348	9.77	9.703
story 22	15.786	27.57	11.072	7.64	9.868	10.352	10.265

Table 5.1 : story displacement in x dir

Figure 14 : story displacement in x dir

STORY DISPLACEMENT IN Y DIR							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
	RPX	RPX	RPX	RPX	RPX	RPX	RPX
	mm	mm	mm	mm	mm	mm	mm
Base	0	0	0	0	0	0	0
story 1	0.384	0.162	0.275	0.181	0.177	0.203	0.229
story 2	0.792	0.47	0.598	0.389	0.387	0.443	0.476

story 3	1.23	0.975	0.98	0.64	0.641	0.738	0.752
story 4	1.71	1.675	1.413	0.924	0.939	1.069	1.064
story 5	2.237	2.557	1.881	1.233	1.278	1.426	1.41
story 6	2.814	3.606	2.378	1.561	1.657	1.808	1.791
story 7	3.438	4.805	2.9	1.905	2.072	2.214	2.203
story 8	4.108	6.139	3.443	2.262	2.52	2.645	2.644
story 9	4.818	7.59	4.004	2.634	2.997	3.1	3.111
story 10	5.565	9.141	4.58	3.019	3.498	3.575	3.601
story 11	6.342	10.78	5.167	3.415	4.021	4.068	4.111
story 12	7.147	12.492	5.764	3.821	4.561	4.576	4.638
story 13	7.973	14.266	6.369	4.235	5.115	5.094	5.178
story 14	8.817	16.091	6.98	4.655	5.681	5.621	5.73
story 15	9.675	17.957	7.595	5.078	6.255	6.153	6.289
story 16	10.543	19.855	8.214	5.503	6.836	6.688	6.855
story 17	11.417	21.777	8.834	5.927	7.422	7.224	7.424
story 18	12.295	23.715	9.454	6.35	8.01	7.76	7.995
story 19	13.174	25.662	10.072	6.77	8.598	8.294	8.567
story 20	14.05	27.614	10.686	7.186	9.185	8.823	9.136
story 21	14.922	29.567	11.296	7.597	9.77	9.348	9.703
story 22	15.786	31.515	11.9	8.002	10.352	9.868	10.265

Table 5.2 : story displacement in y-dir

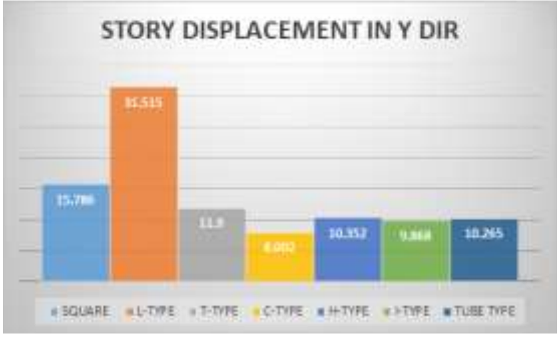


Figure 15 : story displacement in Y- dir

5.3 STORY DRIFT IN X AND Y- DIR

STORY DRIFT IN X DIR							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
	RPX	RPX	RPX	RPX	RPX	RPX	RPX
	mm	mm	mm	mm	mm	mm	mm
Base	0	0	0	0	0	0	0
story 1	0.000128	4.80E-05	5.80E-05	4.40E-05	6.80E-05	5.90E-05	7.60E-05
story 2	0.000136	9.00E-05	6.70E-05	5.00E-05	8.00E-05	7.00E-05	8.30E-05
story 3	0.000147	0.000149	8.10E-05	5.90E-05	9.90E-05	8.50E-05	9.20E-05
story 4	0.000161	0.000209	9.70E-05	7.10E-05	0.000111	0.0001	0.000104
story 5	0.000177	0.000263	0.000113	8.20E-05	0.000119	0.000114	0.000116
story 6	0.000193	0.000312	0.000127	9.30E-05	0.000127	0.000128	0.000127
story 7	0.000209	0.000355	0.000142	0.000103	0.000136	0.00014	0.000138
story 8	0.000225	0.000394	0.000155	0.000112	0.000144	0.000151	0.000148
story 9	0.000238	0.000428	0.000168	0.000119	0.000152	0.000161	0.000157
story 10	0.000251	0.000458	0.000178	0.000126	0.000159	0.000169	0.000165
story 11	0.000261	0.000483	0.000188	0.000131	0.000165	0.000176	0.000171
story 12	0.00027	0.000505	0.000196	0.000136	0.00017	0.000182	0.000177
story 13	0.000278	0.000524	0.000202	0.000139	0.000174	0.000187	0.000182
story 14	0.000284	0.000539	0.000208	0.000142	0.000177	0.000189	0.000185
story 15	0.000288	0.000552	0.000212	.000144	0.000179	0.000193	0.000188

story 16	0.000292	0.000561	0.000215	0.000146	0.00018	0.000195	0.00019
story 17	0.000294	0.000568	0.000217	0.000147	0.00018	0.000197	0.000191
story 18	0.000295	0.000572	0.000219	0.000147	0.00018	0.000197	0.000192
story 19	0.000295	0.000574	0.00022	0.000147	0.000179	0.000197	0.000191
story 20	0.000294	0.000574	0.00022	0.000147	0.000177	0.000197	0.000191
story 21	0.000292	0.000573	0.000219	0.000146	0.000176	0.000196	0.00019
story 22	0.000289	0.000571	0.000219	0.000145	0.000174	0.000195	0.000188

Table 5.3 : story drift in X-dir

Figure 16 : story drift in x- dir

STORY DRIFT IN Y DIR							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
	RPX	RPX	RPX	RPX	RPX	RPX	RPX
	mm	mm	mm	mm	mm	mm	mm
Base	0	0	0	0	0	0	0
story 1	0.000128	5.40E-05	9.20E-05	6.00E-05	5.90E-05	6.80E-05	7.60E-05
story 2	0.000136	0.000103	0.000108	7.00E-05	7.00E-05	8.00E-05	8.30E-05
story 3	0.000147	0.00017	0.000128	8.50E-05	8.50E-05	9.90E-05	9.20E-05
story 4	0.000161	0.000235	0.000144	9.50E-05	0.0001	0.000111	0.000104
story 5	0.000177	0.000296	0.000156	0.000103	0.000114	0.000119	0.000116
story 6	0.000193	0.000352	0.000166	0.000109	0.000128	0.000127	0.000127
story 7	0.000209	0.000402	0.000174	0.000115	0.00014	0.000136	0.000138
story 8	0.000225	0.000448	0.000181	0.000119	0.000151	0.000144	0.000148
story 9	0.000238	0.000487	0.000187	0.000124	0.000161	0.000152	0.000157
story 10	0.000251	0.000522	0.000192	0.000129	0.000169	0.000159	0.000165
story 11	0.000261	0.000552	0.000197	0.000133	0.000176	0.000165	0.000171
story 12	0.00027	0.000578	0.0002	0.000136	0.000182	0.00017	0.000177
story 13	0.000278	0.0006	0.000203	0.000139	0.000187	0.000174	0.000182
story 14	0.000284	0.000618	0.000205	0.000141	0.00019	0.000177	0.000185
story 15	0.000288	0.000633	0.000207	0.000142	0.000193	0.000179	0.000188
story 16	0.000292	0.000644	0.000208	0.000143	0.000195	0.00018	0.00019
story 17	0.000294	0.000652	0.000208	0.000142	0.000197	0.00018	0.000191
story 18	0.000295	0.000657	0.000208	0.000142	0.000197	0.00018	0.000192
story 19	0.000295	0.00066	0.000207	0.000141	0.000197	0.000179	0.000191
story 20	0.000294	0.000661	0.000206	0.000139	0.000197	0.000177	0.000191
story 21	0.000292	0.00066	0.000204	0.000138	0.000196	0.000176	0.00019
story 22	0.000289	0.000657	0.000202	0.000135	0.000195	0.000174	0.000188

Table 5.4 : story drift in y dir

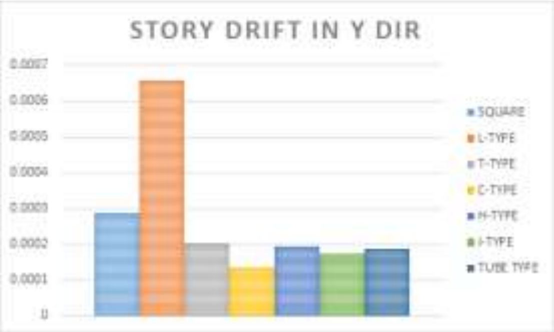


Figure 17: story drift in y dir

5.4 STORY STINNESS IN X AND Y-DIR

STORY STIFFNESS IN X DIR							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
	RPX	RPX	RPX	RPX	RPX	RPX	RPX
	mm	mm	mm	mm	mm	mm	mm
Base	0	0	0	0	0	0	0
story 1	1.04E+08	66801099	99221026	1.43E+08	1.32E+08	1.42E+08	130759698
story 2	90482182	39416572	78459256	1.16E+08	1.06E+08	1.11E+08	110798798
story 3	80848220	25650690	62439291	94290212	85924166	89544673	94993318.79
story 4	71214387	18384917	50342319	76771466	73416679	74467071	81246752.94
story 5	62508657	14439808	42151505	64323530	64214673	63434974	69941767.65
story 6	54759572	11885321	35851580	55380958	56596853	54505608	60773234.41
story 7	48032430	10083441	30667941	48246609	50053083	47404162	53305943.21
story 8	42337107	8740459	26562773	42512675	44407354	41786980	47160289.77
story 9	37613160	7698377	23312921	37861133	39611801	37279613	42054974.84
story 10	33678913	6864555	20667030	34006828	35577623	33553906	37752306.99
story 11	30339651	6179853	18440889	30727931	32170098	30369459	34060143.3
story 12	27438372	5602942	16518853	27863801	29231748	27561747	30827832.64
story 13	24853747	5103907	14824348	25294206	26615459	25015682	27932339.06
story 14	22486942	4659655	13296790	22922361	24197550	22643444	25268233.58
story 15	20251443	4249863	11880877	20665759	21876391	20370772	22741672.74
story 16	18067168	3854345	10524538	18452164	19566880	18130674	20266145.82
story 17	15858988	3452057	9179393	16217484	17196032	15861036	17760611.95
story 18	13559201	3020841	7800189	13902985	14700899	13503570	15150704.99
story 19	11103875	2536848	6344439	11451235	12021257	11000367	12365958.71
story 20	8428194	1974512	4773138	8801257	9093139	8291753	9336949.616
story 21	5466156	1308080	3049472	5893398	5847244	5313812	5995342.945
story 22	2153088	516524	1144070	2678318	2224939	2018542	2279634.654

Table 5.5: story stiffness in x dir

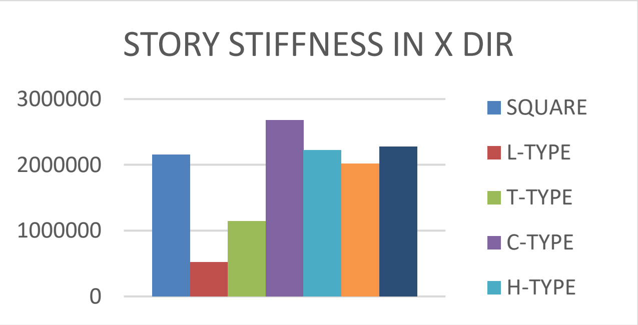


Figure 18 : story stiffness in x dir

STORY STIFFNESS IN Y DIR							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
	RPX	RPX	RPX	RPX	RPX	RPX	RPX
	mm	mm	mm	mm	mm	mm	mm
Base	0	0	0	0	0	0	0

story 1	1.04E+08	54755356	63990484	1.14E+08	1.42E+08	1.32E+08	1.31E+08
story 2	90482182	30991065	53066739	91658823	1.11E+08	1.06E+08	1.11E+08
story 3	80848220	19874249	43238805	73970236	89544673	85924166	94993319
story 4	71214387	14559546	36514311	63520119	74467071	73416679	81246753
story 5	62508657	11432366	31818118	56070760	63434974	64214673	69941768
story 6	54759572	9358136	28210067	50388281	54505608	56596853	60773234
story 7	48032430	7886792	25248732	45647631	47404162	50053083	53305943
story 8	42337107	6793676	22770971	41377403	41786980	44407354	47160290
story 9	37613160	5952949	20659005	37494244	37279613	39611801	42054975
story 10	33678913	5286925	18822228	34029173	33553906	35577623	37752307
story 11	30339651	4744375	17194376	30971577	30369459	32170098	34060143
story 12	27438372	4290764	15724121	28255374	27561747	29231747	30827833
story 13	24853747	3901492	14367972	25794792	25015682	26615459	27932339
story 14	22486942	3557170	13086822	23504605	22643444	24197550	25268234
story 15	20251443	3240784	11843806	21306808	20370772	21876391	22741673
story 16	18067168	2936263	10602866	19132794	18130674	19566880	20266146
story 17	15858988	2627633	9328056	16920023	15861036	17196031	17760612
story 18	13559201	2298166	7983007	14602559	13503570	14700899	15150705
story 19	11103875	1929573	6530659	12110783	11000367	12021257	12365959
story 20	8428194	1502319	4934517	9372608	8291754	9093139	9336950
story 21	5466156	996695.1	3161714	6317020	5313812	5847244	5995343
story 22	2153088	396124.9	1186422	2889971	2018542	2224939	2279635

Table 5.6: story stiffness in Y dir

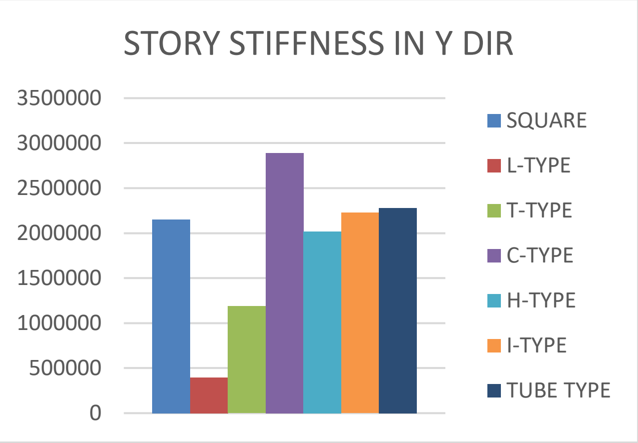


Figure 19: story stiffness in Y dir

5.5 TIME PERIOD

TIME PERIOD							
STORIES	SQUARE	L-TYPE	T-TYPE	C-TYPE	H-TYPE	I-TYPE	TUBE TYPE
MODES	SEC	SEC	SEC	SEC	SEC	SEC	SEC
1	0.997	2.298	1.041	0.721	0.86	0.86	0.873
2	0.911	1.266	0.846	0.693	0.81	0.81	0.824
3	0.226	0.431	0.193	0.171	0.197	0.197	0.197
4	0.179	0.281	0.188	0.139	0.163	0.163	0.16
5	0.11	0.258	0.094	0.082	0.095	0.095	0.094
6	0.074	0.156	0.092	0.075	0.092	0.092	0.066
7	0.07	0.118	0.075	0.061	0.067	0.067	0.062
8	0.067	0.082	0.063	0.053	0.062	0.062	0.061
9	0.057	0.074	0.047	0.042	0.047	0.047	0.047
10	0.047	0.065	0.044	0.037	0.043	0.043	0.038
11	0.04	0.055	0.038	0.035	0.039	0.039	0.036
12	0.039	0.051	0.037	0.032	0.039	0.039	0.032

Table 5.7 : time period for G+22building

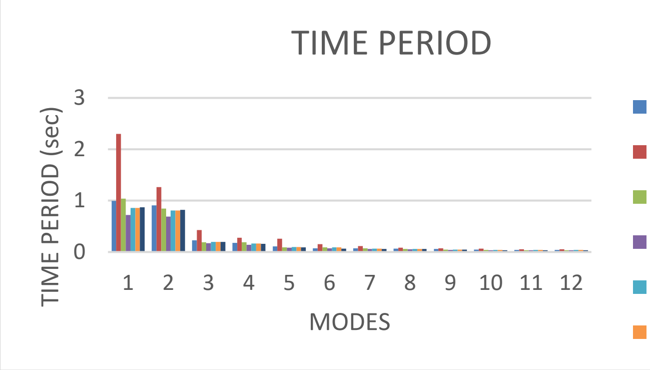


Figure 20 : time period for G+22building

VI. CONCLUSION

1. STOREY DISPLACEMENT: When compared to square, L-Type, T-Type, H-Type, I-Type, Tube-Type, the displacements at the top storey of the C-Type building with infill's wall in zone IV are reduced by 40%, 65 percent, 18 percent, 10%, 14%, and 14.36 percent along X-direction and Y-direction, respectively.
The maximum storey displacement owing to a particular design lateral force with a partial load ratio of 1/500 is times the building height H. The maximum storey displacement for a building is 1/500 * H, or 0.132m for a 66 m storey height.
Tables 5.1 and 5.2 show that the value does not surpass 0.132m everywhere. As a result, the displacement is within the prescribed parameters.

2. STORY DRIFT: According to the codal rules, storey drift for infilled wall models is within acceptable limits. When compared to square, L-Type, T-Type, H-Type, I-Type, Tube-Type, the drift at the top storey of the C-Type structure with infill walls in zone IV is reduced by 60% along Xdirection and 40% along Ydirection.

3. TIME-PERIOD: According to table no. 5.7 for zone IV, the time-period for mode shape 1 with infill wall is 0.7949sec and 2.6813sec without infill wall.
As a result, infill walls shorten the time duration.

4. Story stiffness: According to the findings, the Story stiffness of the C-Type building is enhanced by 19.46 percent when compared to the other model with infills.

5. Time-period and drift are minimised in the High Rise Building top storey displacement due to infill walls. Shear at the base is increased. The addition of non-structural masonry infill walls may significantly alter the seismic behaviour of a R.C.C.-framed high-rise structure.

6. It is obvious from the findings that the drift, displacement, time-period, shear force, and bending moments have all decreased. With the infill walls, we can also see that the base shear is growing.

7. When masonry infills interact with their surrounding frames, the structure's lateral stiffness and load bearing ability significantly increase. As a result, including the influence of infill walls in building structural calculations minimises lateral load deflection and drift.

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