IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

EFFECT OF VARIOUS TYPES OF STEEL BRACING AND SHEAR WALL ON RCC FRAMED TALL BUILDING

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Abstract: Indeed, as urbanization continues to advance and populations grow, the demand for space-efficient structures becomes increasingly important. High-rise buildings offer a solution by optimizing land use and accommodating larger populations within urban areas. However, with greater heights come greater challenges, particularly in managing lateral loads induced by factors like wind and seismic activity. To ensure the safety and stability of high-rise buildings against lateral loading, engineers employ various structural systems. Among these, bracing systems and shear wall systems are commonly utilized. Bracing systems play a vital role in stabilizing high-rise structures, especially against lateral loads from wind and seismic forces. By strategically placing braces throughout the building, engineers can significantly increase its overall stiffness and resistance to lateral movement. These systems are particularly effective in mitigating the effects of wind-induced sway. Shear walls, on the other hand, serve as vertically-oriented wide beams within the building's structure. By distributing earthquake loads downwards to the foundation, shear walls help minimize the building's response to seismic forces. This makes them indispensable in earthquake-prone regions, where enhancing structural stability is paramount for reducing the risk of damage and ensuring the safety of occupants.

In summary, both bracing systems and shear wall systems play crucial roles in stabilizing high-rise buildings against lateral loads, ensuring their safety, stability, and resilience in the face of environmental forces.

***Index Terms*:** Lateral load resisting system, high-rise building, Steel Bracing system, Shear wall, and RCC frame.

1. INTRODUCTION:

As buildings rise in height, the impact of lateral loads, including those from wind and seismic forces, becomes more significant compared to gravity loads. This shift necessitates careful consideration and mitigation of lateral forces to ensure the stability and safety of the structure. Designing tall buildings requires meticulous attention to both lateral and vertical loads. Structural engineers must analyze and address these loads to ensure that the building meets safety standards and can effectively transfer loads to the foundation. Structural engineers play a crucial role in selecting appropriate systems to resist lateral loads. Bracing systems offer versatility in this regard, serving as both retrofitting measures for existing buildings and integral components in the design phase to resist lateral forces effectively. Shear wall systems are highlighted as another effective mechanism for resisting lateral loads. These vertically-oriented elements act as wide beams, distributing seismic and wind forces down to the foundation. The inclusion of shear walls significantly enhances the lateral strength and stiffness of the building, thereby reducing deformations and ensuring stability during lateral loading events.

1.1 Bracing System:

In tall building design, bracing systems serve as crucial components for resisting lateral loads, such as those from wind and seismic activity. These systems provide structural stability and ensure the safety of the building and its occupants. Bracing systems significantly influence the performance of tall buildings under lateral loading conditions. They help reduce structural deformations, improve dynamic behavior, and enhance overall stability during windstorms, earthquakes, or other lateral force events. There are various types of bracing systems used in tall buildings, each with its own advantages and applications. Some common types include:

Diagonal Bracing: Diagonal braces are inclined structural elements that connect different levels of the building, forming diagonal patterns. They resist lateral loads by transferring forces diagonally, effectively stabilizing the structure.

Eccentric Bracing: Eccentric braces are similar to diagonal braces but are designed to be off-center from the building's core. This design allows for greater flexibility in architectural layout while still providing effective lateral load resistance.

X-Bracing: X-bracing configurations consist of diagonal braces arranged in an X-shaped pattern. This arrangement offers symmetrical lateral load resistance and is commonly used in steel and reinforced concrete structures.

Outrigger Bracing: Outrigger systems consist of horizontal structures, such as outrigger beams or belts, connected to the core of the building and extending to perimeter columns or walls. These systems enhance the building's lateral stiffness and distribute forces more evenly.

Bracing systems are often constructed using materials such as steel or reinforced concrete, which offer high strength and ductility to withstand lateral loads. Steel bracing systems are particularly popular due to their versatility, ease of fabrication, and ability to resist both tension and compression forces.

1.2 Shear Wall System:

Shear walls play a vital role in the structural integrity and stability of tall buildings, particularly in resisting lateral loads such as those from wind and seismic forces. In earthquake-prone regions, shear walls are crucial for enhancing a building's seismic resistance. During seismic events, shear walls help dissipate and distribute the seismic forces, reducing the risk of structural damage and ensuring the safety of the building and its occupants. Incorporating shear walls significantly increases the overall stiffness of a tall building. This increased stiffness is essential for reducing lateral deflections and controlling the building's response to lateral loads, thereby enhancing its stability and performance under windstorms, earthquakes, or other lateral force events. The enhanced stiffness provided by shear walls helps minimize lateral drift, which is the lateral displacement experienced by the building during lateral loading events. By limiting lateral drift, shear walls contribute to occupant comfort and reduce the risk of non-structural damage within the building.

Shear walls also play a role in optimizing the design of the building's foundation. By effectively transferring lateral loads to the foundation, shear walls help minimize overturning moments and horizontal forces, thereby optimizing the foundation design and potentially reducing construction costs. Properly designed shear walls can provide damping effects, absorbing and dissipating energy generated by lateral loads. This damping capability helps reduce vibrations and enhances the building's performance during windstorms or seismic events, improving occupant comfort and safety.

1.3 Objectives of Study:

i. To carryout seismic analysis of RCC Framed Tall building as per codes providing different types of steel bracings and shear walls by creating 3D model using E-tabs software.
ii. To compare the Story Shear, Base Shear, Lateral Displacement, Story Drift, Drift Ratio and Story Stiffness for different system of bracings and shear walls.
iii. To know the efficient and a suitable system of bracing and shear walls to resist seismic loading.

1.4 Types of Frame considered:

The modeling of the structure is done by using engineering software E-tabs. The different type of moment resisting frames considered for analysis is as follows

Table No-1: Model Name

Model-1	Without Shear wall and Steel Bracing	M-1
Model-2	Shear Wall at Corner Position of the Building	M-2
Model-3	Shear wall at Centre Span of Periphery of the Building	M-3
Model-4	X-Bracing at Corner Position	M-4
Model-5	X-Bracing at Centre Span of Periphery	M-5
Model-6	V- Type-Bracing at Corner Position	M-6
Model-7	V- Type -Bracing at Centre Span of Periphery	M-7
Model-8	Inverted V Type-Bracing at Corner Position	M-8
Model-9	Inverted V Type -Bracing at Centre Span of Periphery	M-9
Model-10	Eccentric Forward Type-Bracing at Corner Position	M-10
Model-11	Eccentric Forward Type -Bracing at Centre Span of Periphery	M-11
Model-12	Eccentric Backward Type-Bracing at Corner Position	M-12
Model-13	Eccentric Backward Type -Bracing at Centre Span of Periphery	M-13
Model-14	Shear Wall at Corner Position and X-Type Bracing at Centre Span of Periphery	M-14
Model-15	Shear Wall at Corner Position and V-Type Bracing at Centre Span of Periphery	M-15
Model-16	Shear Wall at Corner Position and Inverted V-Type Bracing at Centre Span of Periphery	M-16
Model-17	Shear Wall at Corner Position and Eccentric Forward-Type Bracing at Centre Span of Periphery	M-17
Model-18	Shear Wall at Corner Position and Eccentric Backward-Type Bracing at Centre Span of Periphery	M-18

2 METHODOLOGY

3D modeling and Analysis of multi-stories building considering different types of bracings and Shear Walls is done using ETABS Software. In this study RCC framed building is considered having an area of 20m X 20m and height 52.5 m with fixed supports. In this study, eighteen models having G+16 floors with different bracing system for regular structures were selected in order to determine the behavior of building during seismic activity in seismic zone V. The analysis is carried out by applying loads as per required IS code requirement.

A. Methods Of Seismic Analysis i) Equivalent Static Method ii) Response Spectrum Method

i. Equivalent Static Method: The Equivalent Static Method (ESM) is a simplified approach commonly used in seismic analysis and design to estimate the response of structures subjected to seismic forces and provides conservative estimates of the building's response to seismic forces. This method assumes that the seismic forces act statically, ignoring the dynamic characteristics of the seismic event. Seismic forces are typically determined based on the building's mass, stiffness, and period of vibration, along with other parameters such as the seismic hazard level, soil conditions, and structural configuration. The seismic forces are distributed throughout the structure according to prescribed load distribution patterns, such as the mode shapes of vibration or simplified lateral force distributions. The analysis evaluates the structural displacements, internal forces, and stresses induced by the seismic loading. The Equivalent Static Method is widely used approach for seismic analysis and design, particularly for simpler structures and preliminary design stages. However, for more complex or irregular structures, dynamic analysis methods, such as modal response spectrum analysis or time history analysis, may be necessary to accurately capture the dynamic behavior and response to seismic forces.

ii. Response Spectrum Method: The Response Spectrum Method (RSM) is a widely used technique in structural engineering for analyzing the response of structures subjected to seismic loading. It's particularly useful for evaluating the dynamic response of buildings and other structures to earthquake ground motions. The seismic input is represented by a response spectrum, which is a plot of the maximum response (displacement, velocity, or acceleration) of a linear single-degree-of-freedom (SDOF) system subjected to a range of frequencies. The response spectrum is typically derived from the site-specific ground motion records or spectra and adjusted based on the structural characteristics of the building.

The structure is idealized as a series of interconnected mass-spring-damper systems, known as modes of vibration. Modal analysis is performed to determine the natural frequencies, mode shapes, and modal damping ratios of the structure. This step involves solving the Eigen value problem of the structure's dynamic properties. The dynamic response of the structure is determined using the concept of mode superposition. Each mode contributes to the overall response of the structure based on its modal participation factor, mode shape, and modal mass. The response of the structure to the seismic input is calculated by combining the contributions from each mode using mode superposition. The dynamic analysis accounts for the interaction between the structure's modes and considers the time-history of the ground motion.

The dynamic analysis results in the calculation of structural response quantities, such as displacements, velocities, accelerations, and internal forces, as a function of time or frequency. These response quantities are compared to specified performance criteria or design limits to assess the structural safety and integrity under seismic loading. The Response Spectrum Method provides a comprehensive framework for evaluating the dynamic response of structures to seismic forces and is widely employed in seismic design codes and standards worldwide. It offers a more realistic representation of the dynamic behavior of structures compared to the Equivalent Static Method, particularly for buildings with irregular configurations or significant damping effects.

3 MODELING OF STRUCTURES & ANALYSIS:

3.1 Data Considered

Table- 2: Data (Geometrical Properties) considered in the Models

Sr No	Details	Dimensions	Unit
1	Plan Dimensions		
2	X-Direction:	20	m
3	Y-Direction:	20	m
4	Height of the Building from Base:	52.5	m
5	Story:	G+16	
6	Floor Height:	3	m
7	Bay Length in X-Dir	4	m
8	Bay Length in Y-Dir	4	m
9	Structure:	RCC_Regular_SMRF	
10	User Type:	Residential	
11	Live Load:	3	Kn/m2
12	Floor Finish:	2	Kn/m2
13	Roof Finish:	2.5	Kn/m2
14	Beam Size:		
	Depth:	450	mm

	Width:	350	mm
15	Column Size:		
	Depth:	575	mm
	Width:	575	mm
16	Slab Thick:	150	mm
17	Lift Core Wall Thickness:	175	mm
18	Shear Wall Thickness:	200	mm
19	Steel Bracing:	ISMB 200	
20	Grade Of Concrete:	M30	
21	Grade of Steel:	Fe345	
22	Grade of Rebar:	HYSD 500 & HYSD 415	
23	Seismic Zone	Zone V	
24	Zone Factor(Z)	0.36	
25	Reduction Factor (R)	5	
26	Importance Factor(I)	1.2	
27	Soil Type:	II	
28	Damping Ratio:	5%	

4 PLAN & 3D VIEW OF DIFFERENT MODEL

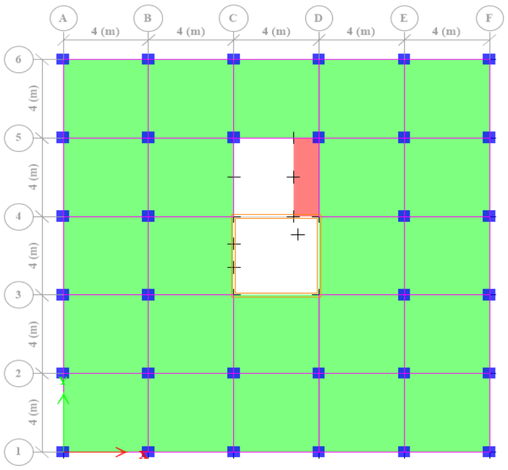


Fig-1: Plan View (Model- 1)

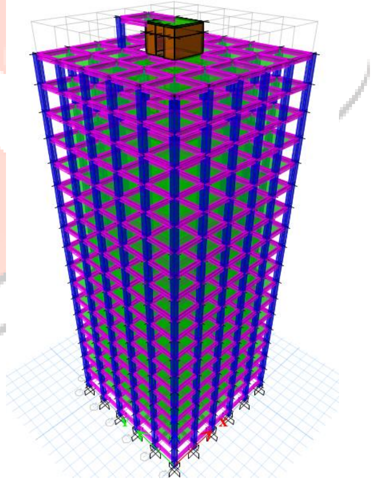


Fig-2: 3D View (Model-1)

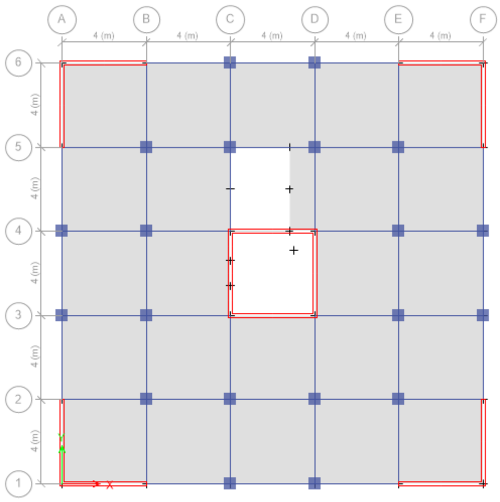


Fig-3: Plan View (Model 2)

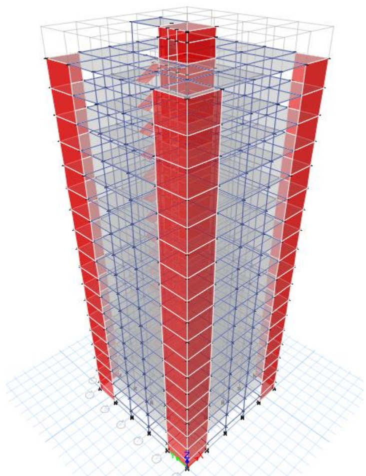


Fig-4: 3D View (Model 2)

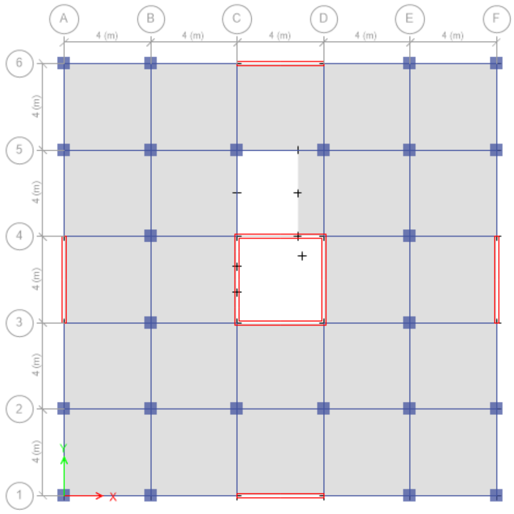


Fig-5: Plan View (Model 3)

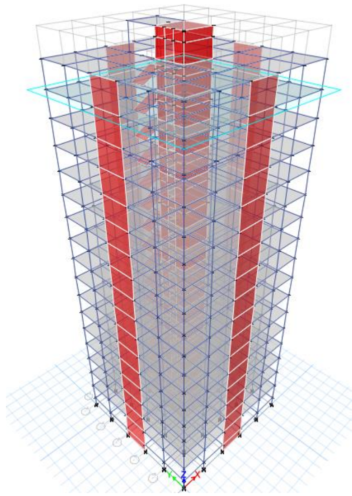


Fig-6: 3D View (Model 3)

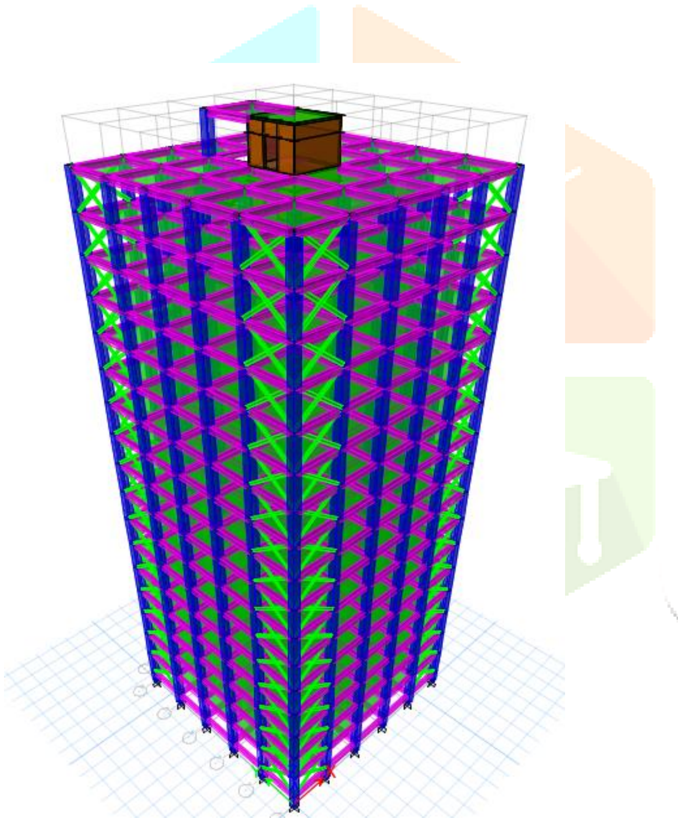


Fig-7: 3D View (Model 4)

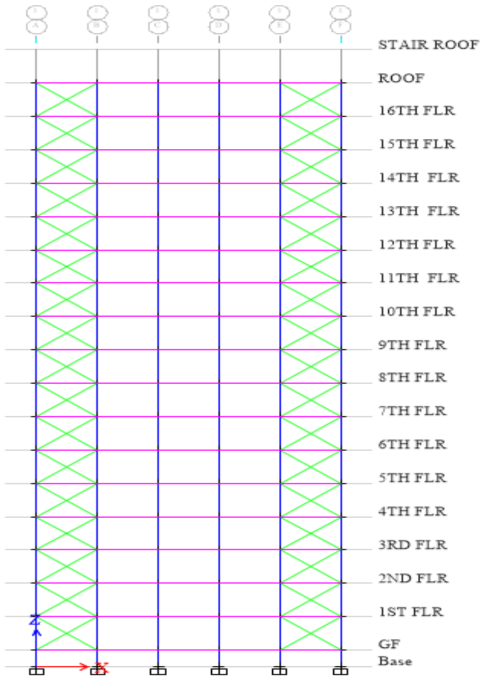


Fig-8: Elevation View G-1 (Model 4)

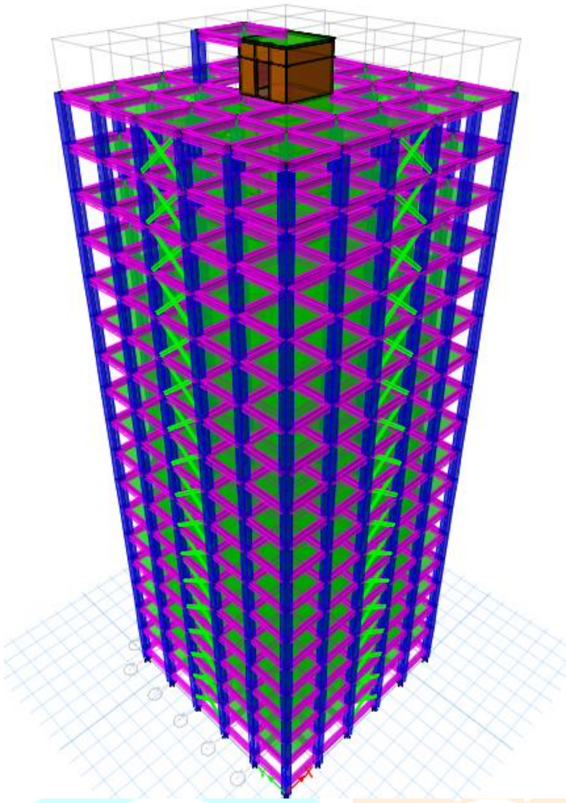


Fig-9: 3D View (Model 5)

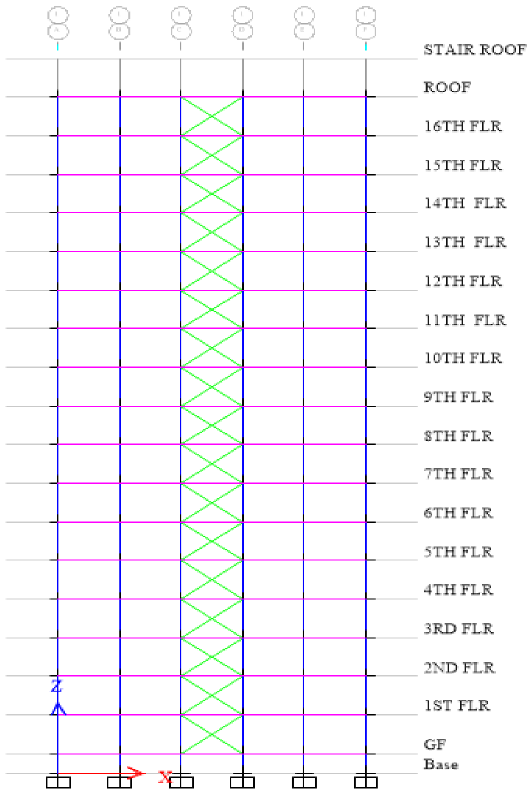


Fig-10: Elevation View G-1 (Model 5)

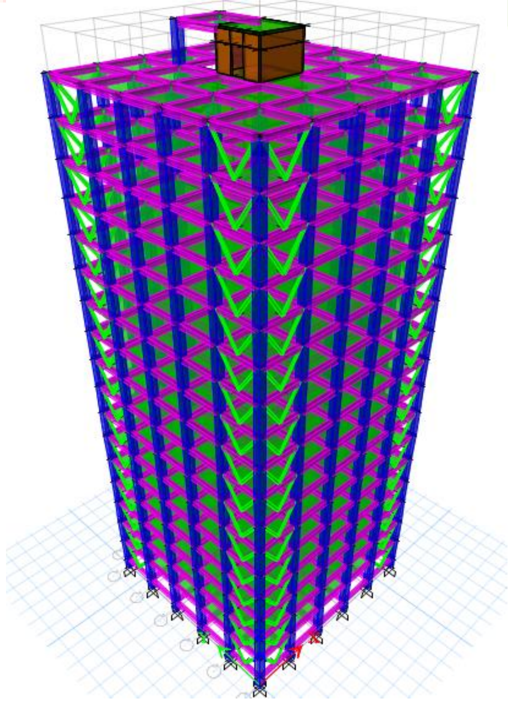


Fig-11: 3D View (Model 6)

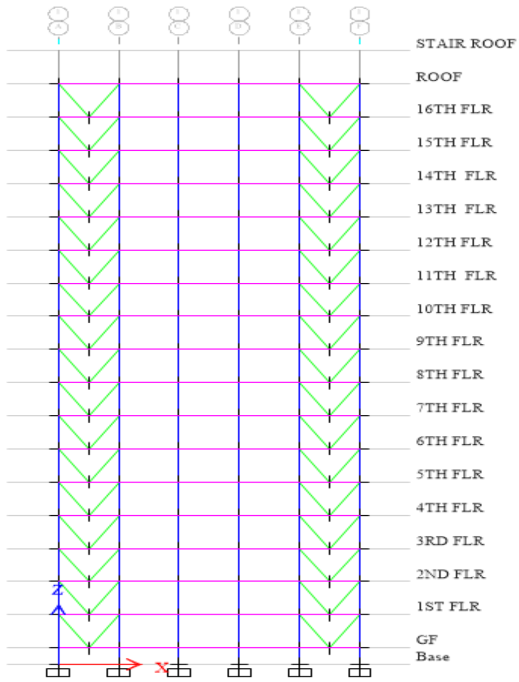


Fig-12: Elevation View G-1 (Model 6)

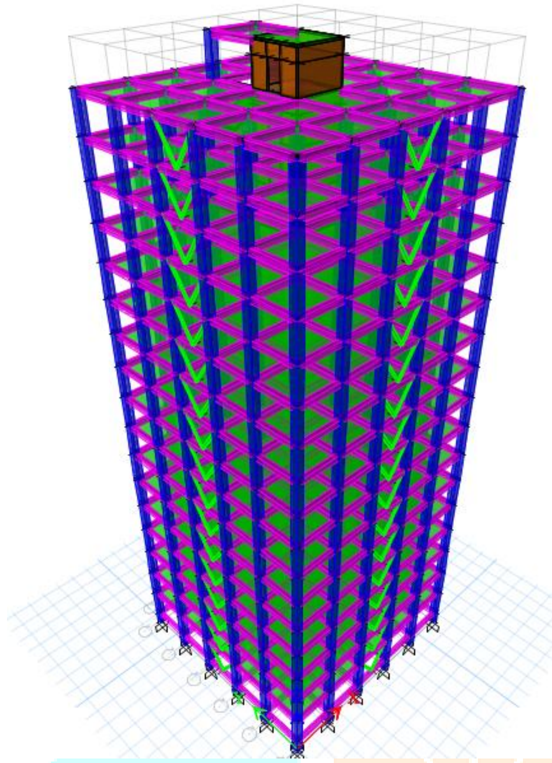


Fig-13: 3D View (Model 7)

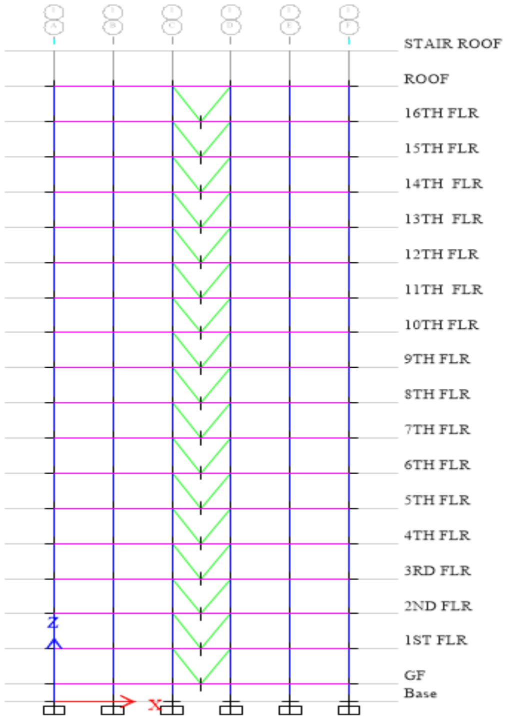


Fig-14: Elevation View G-1 (Model 7)

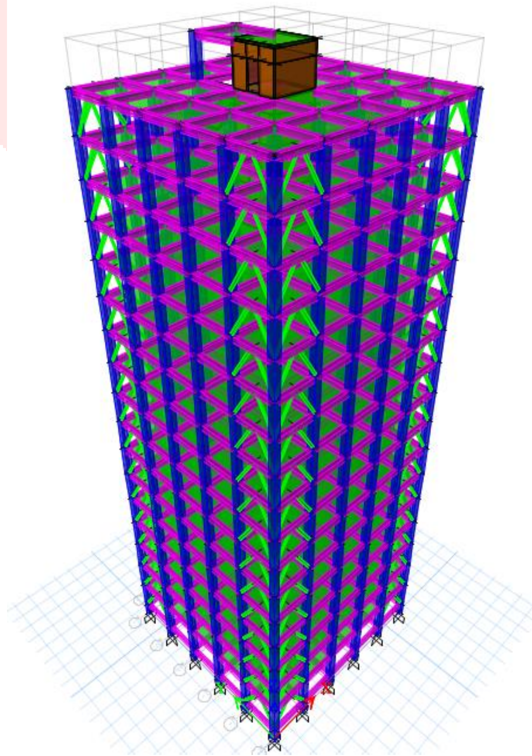


Fig-15: 3D View (Model 8)

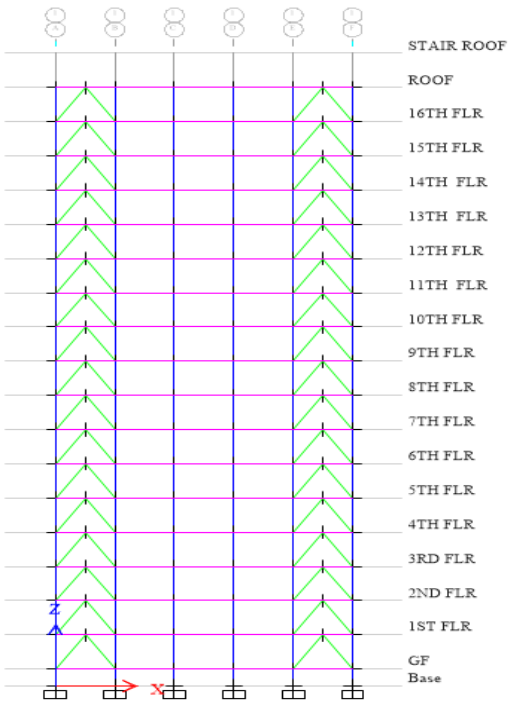


Fig-16: Elevation View G-1 (Model 8)

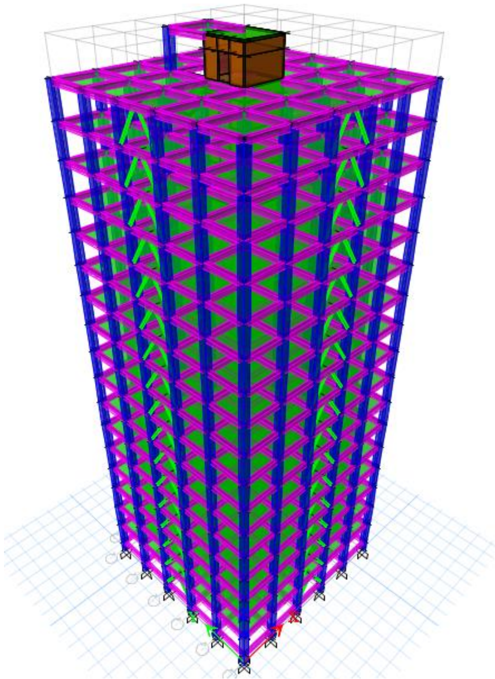


Fig-17: 3D View (Model 9)

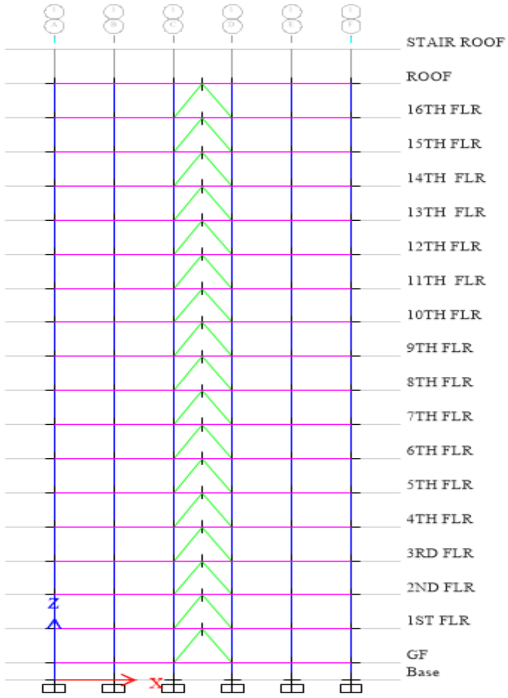


Fig-18: Elevation View G-1 (Model 9)

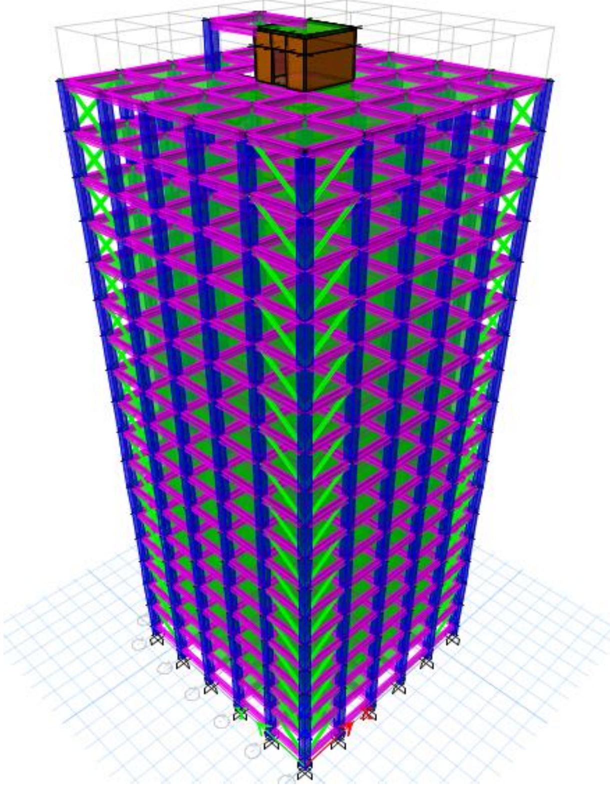


Fig-19: 3ew (Model 10)

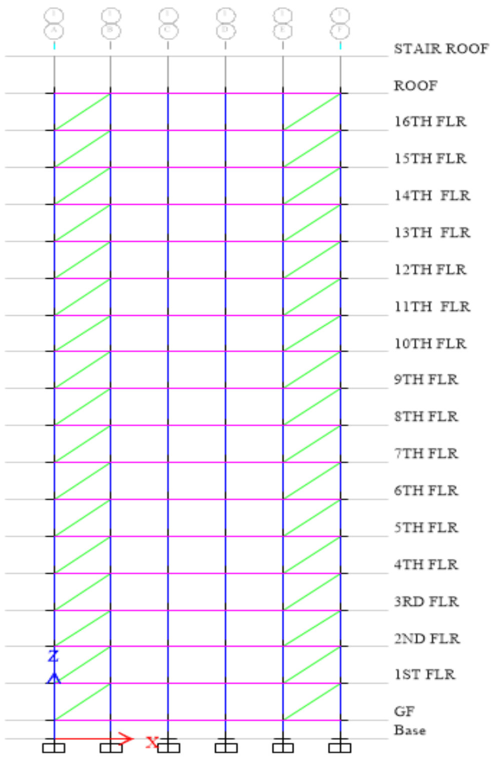


Fig-20: Elevation View G-1 (Model 10)

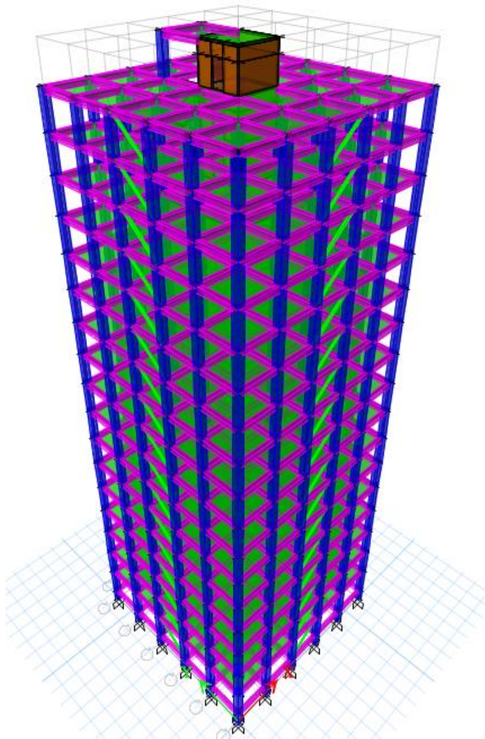


Fig-21: 3D View (Model 11)

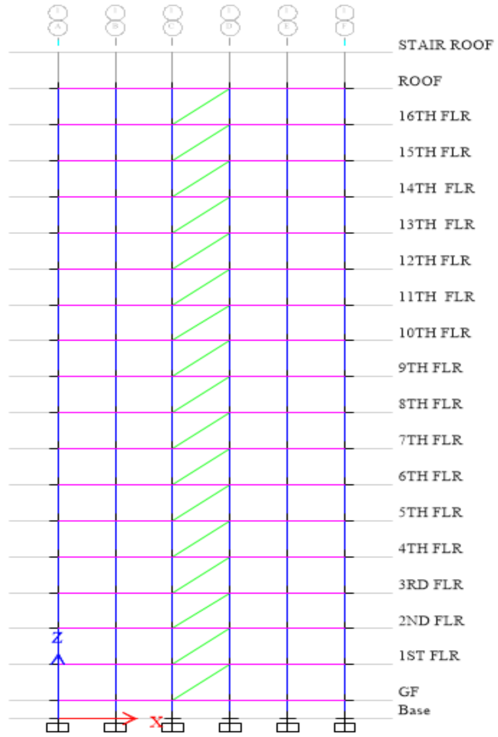


Fig-22: Elevation View G-1 (Model 11)

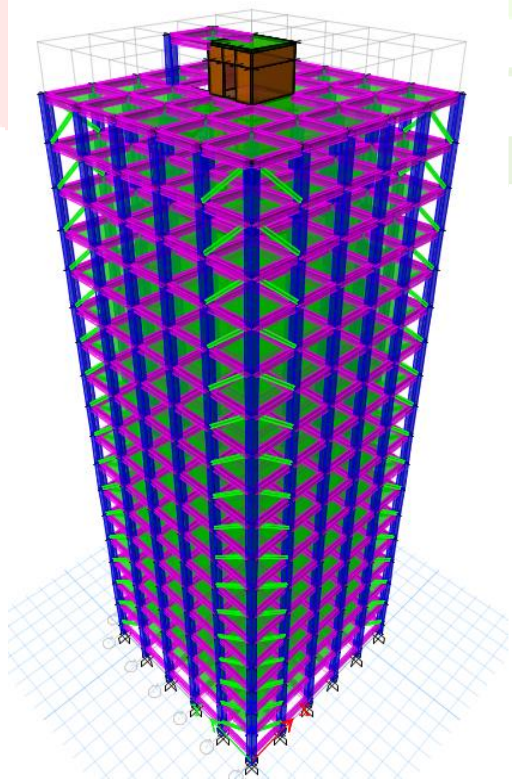


Fig-23: 3D View (Model 12)

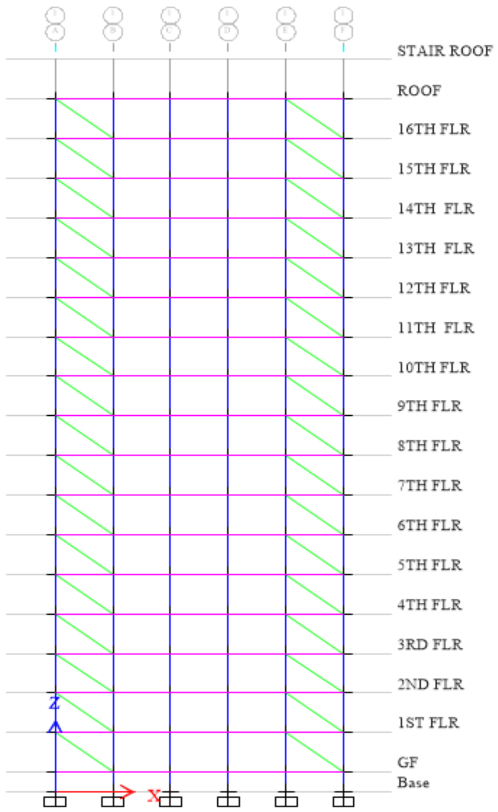


Fig-24: Elevation View G-1 (Model 12)

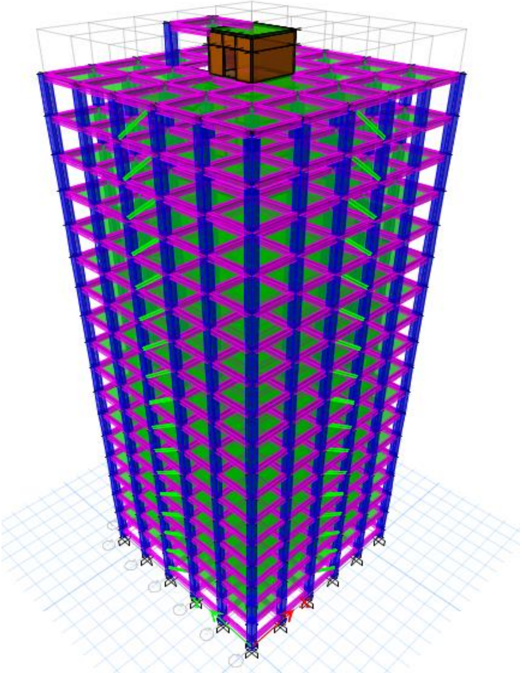


Fig-25: 3D View (Model 13)

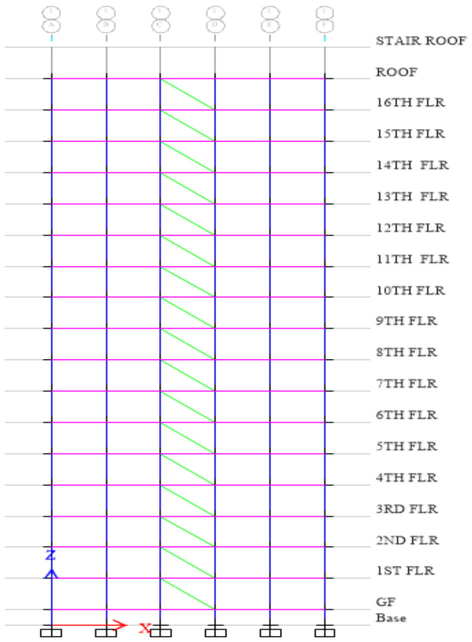


Fig-26: Elevation View G-1 (Model 13)

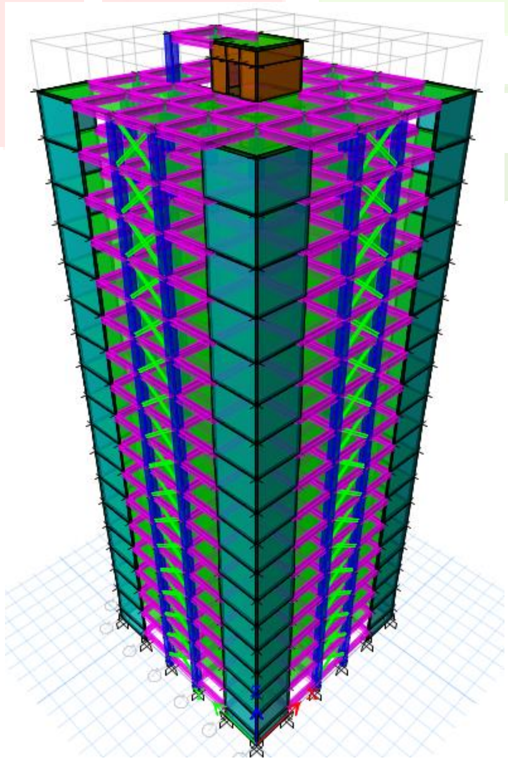


Fig-27: 3D View (Model 14)

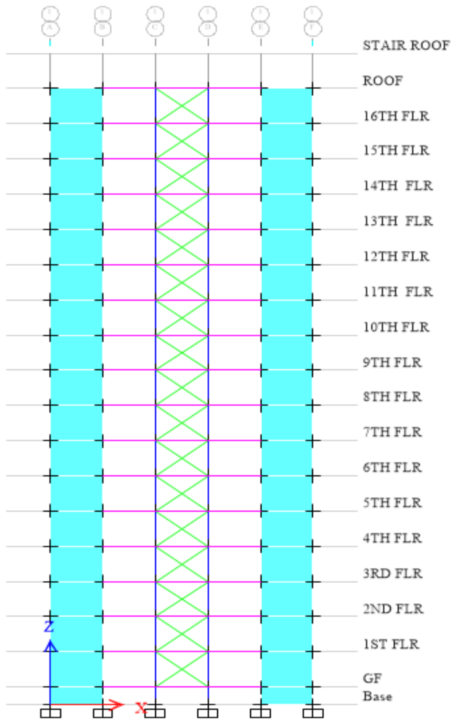


Fig-28: Elevation View G-1 (Model 14)

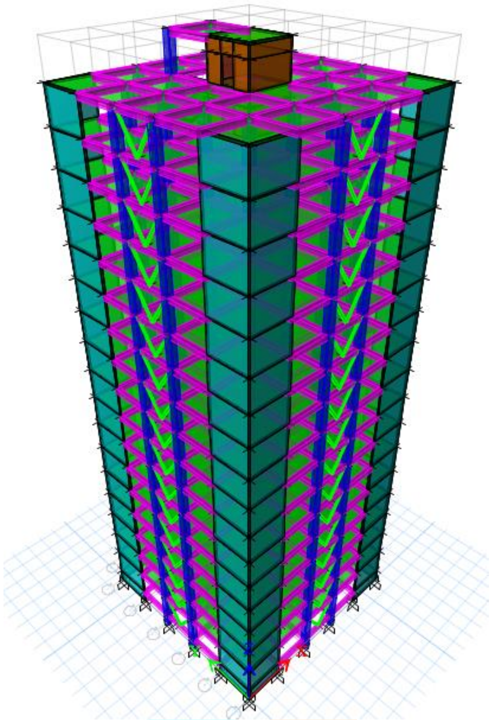


Fig-29: 3D View (Model 15)

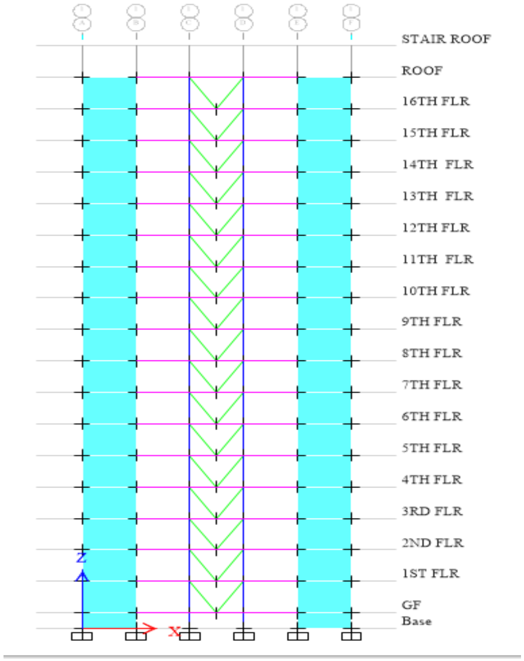


Fig-30: Elevation View G-1(Model 15)

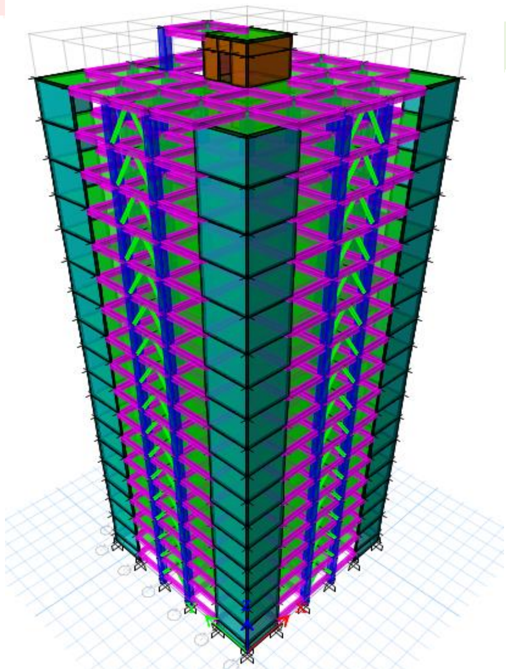


Fig-31: 3D View (Model 16)

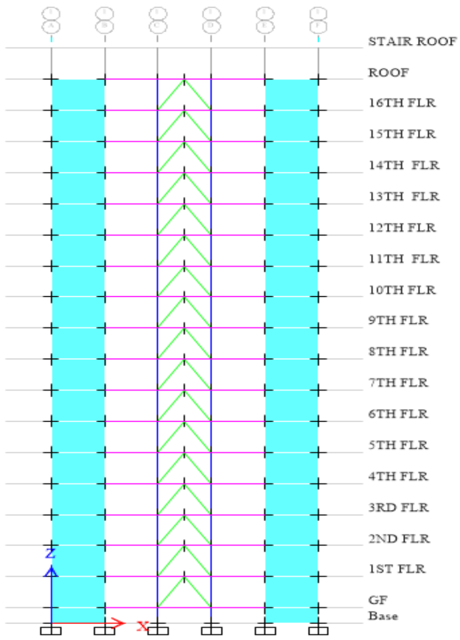


Fig-32: Elevation View G-1 (Model 16)

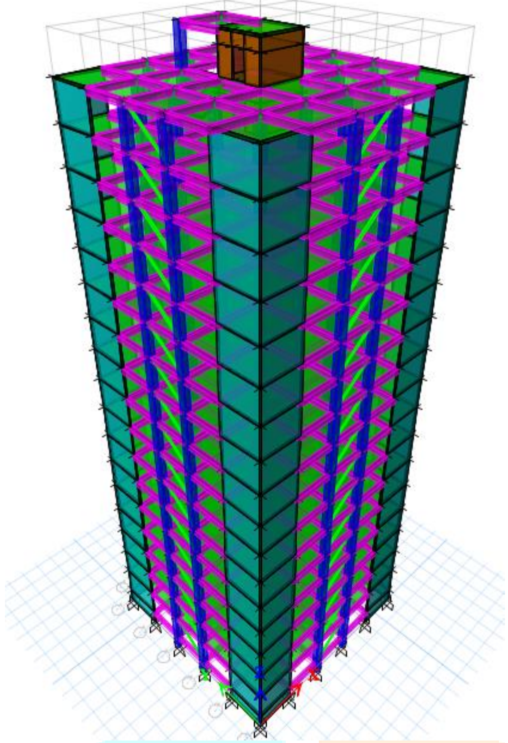


Fig-33: 3D View (Model 17)

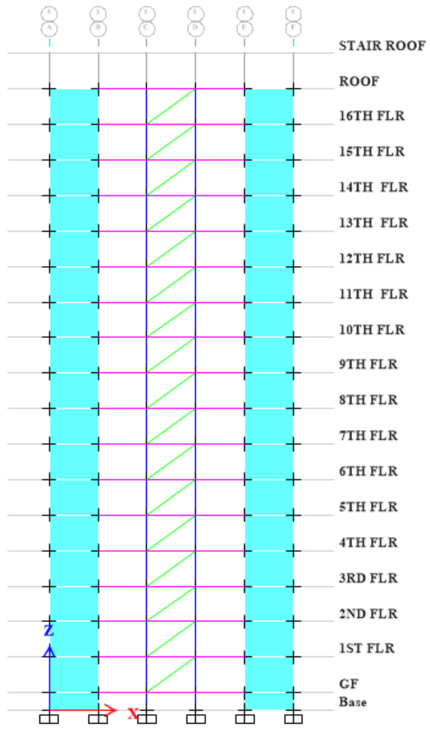
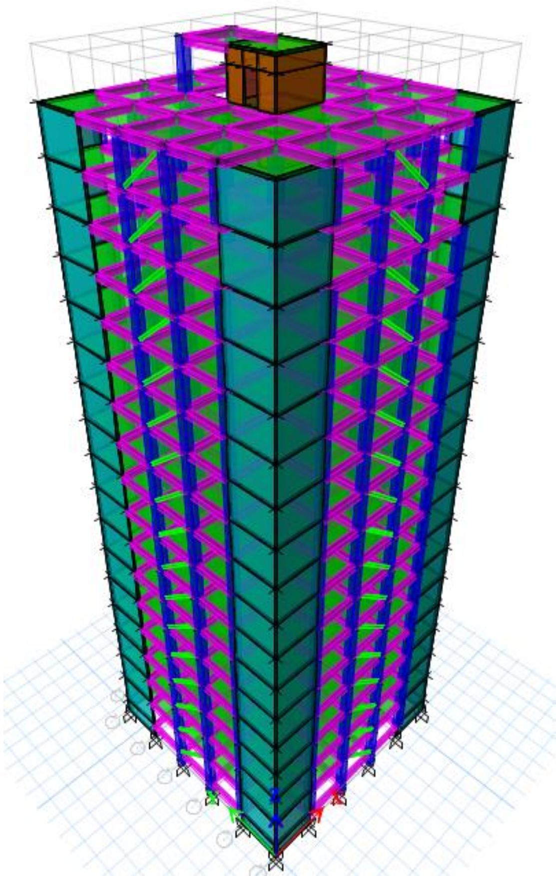


Fig-34: Elevation View G-1(Model 17)



-35: 3D View (Model 18)

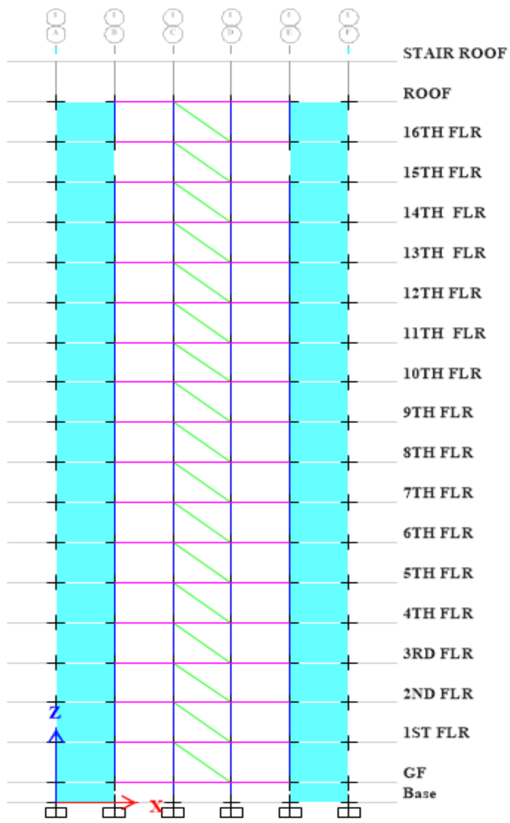
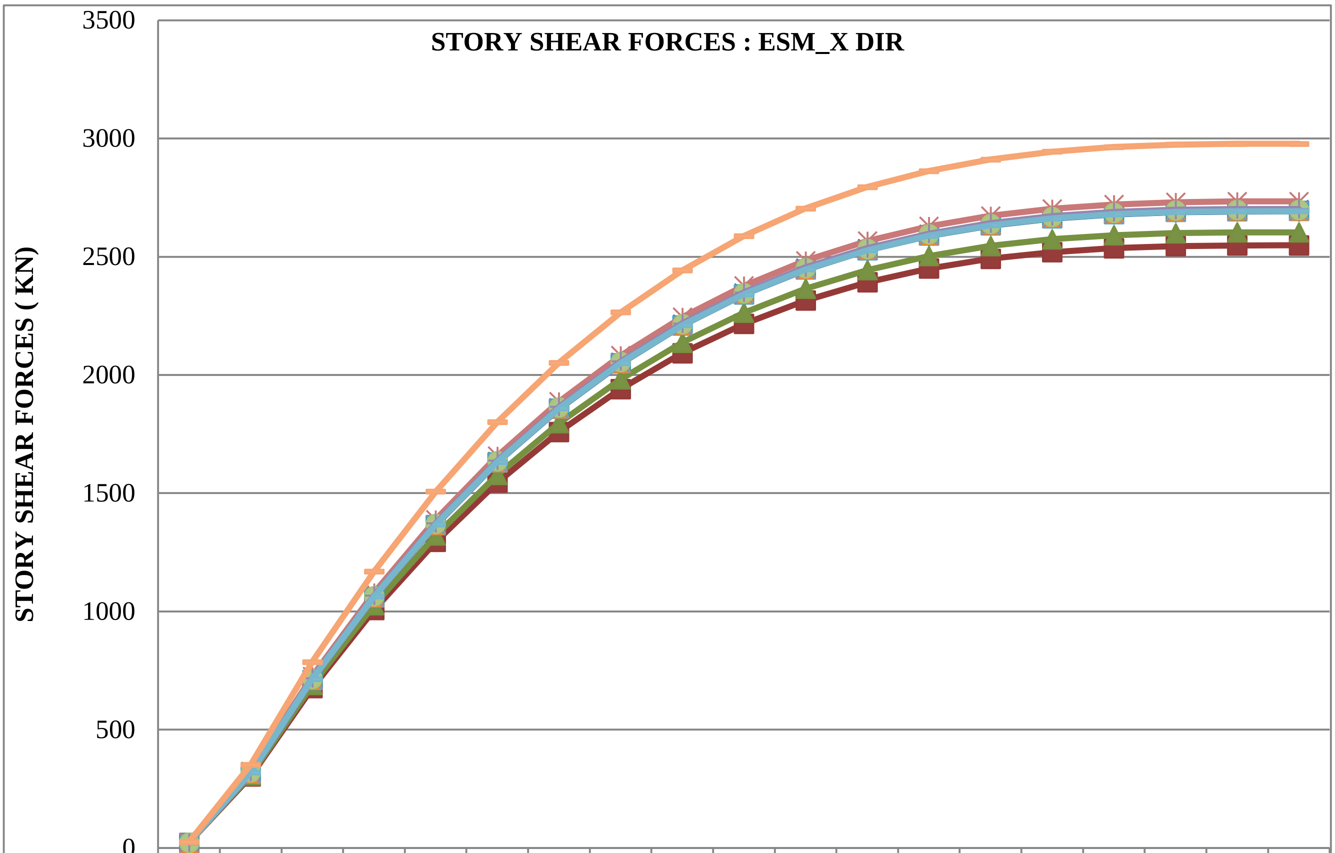


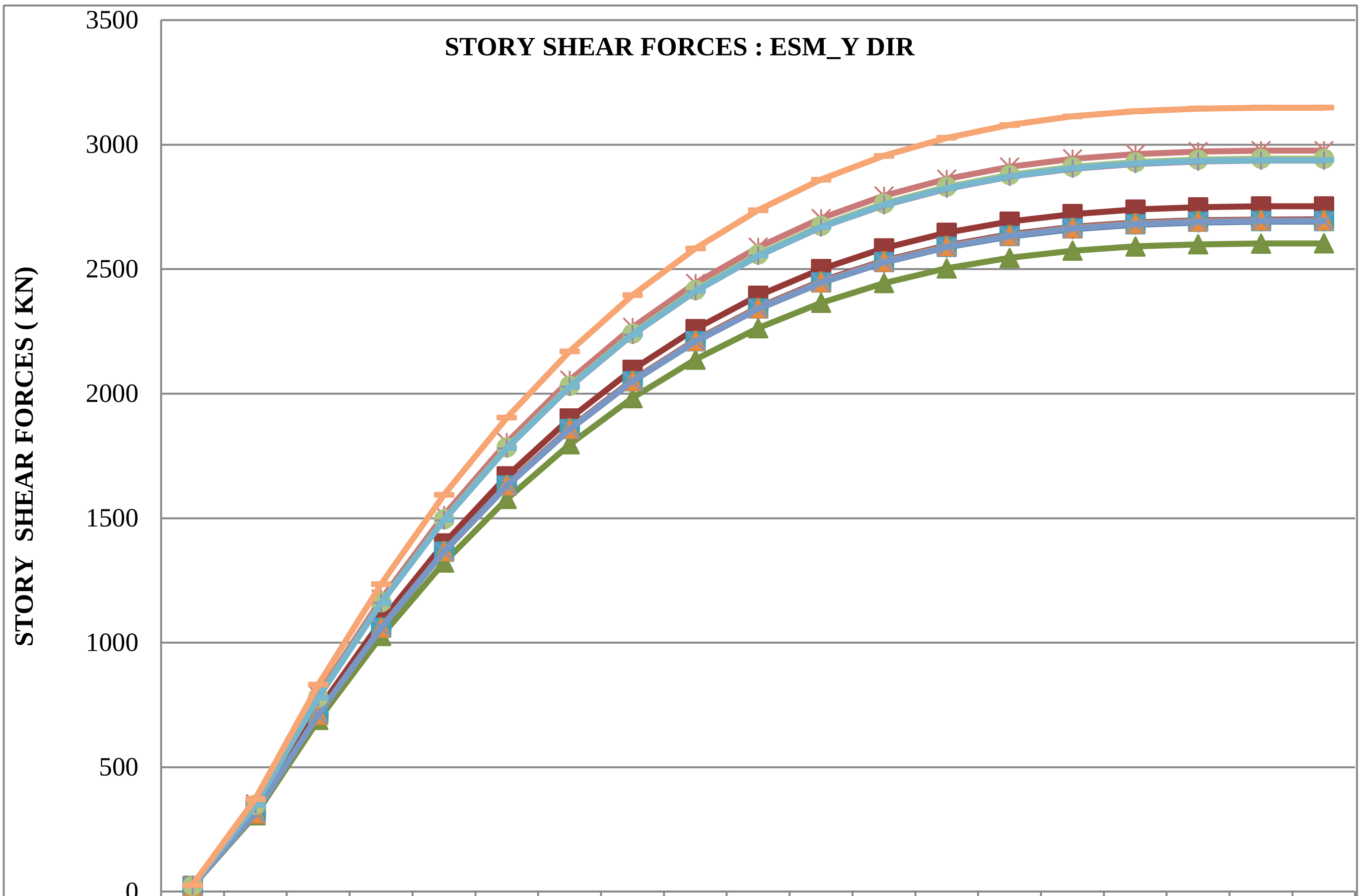
Fig-36: Elevation View G-1 (Model 18)

5 RESULT AND DISCUSSION

5.1 Story Shear Forces

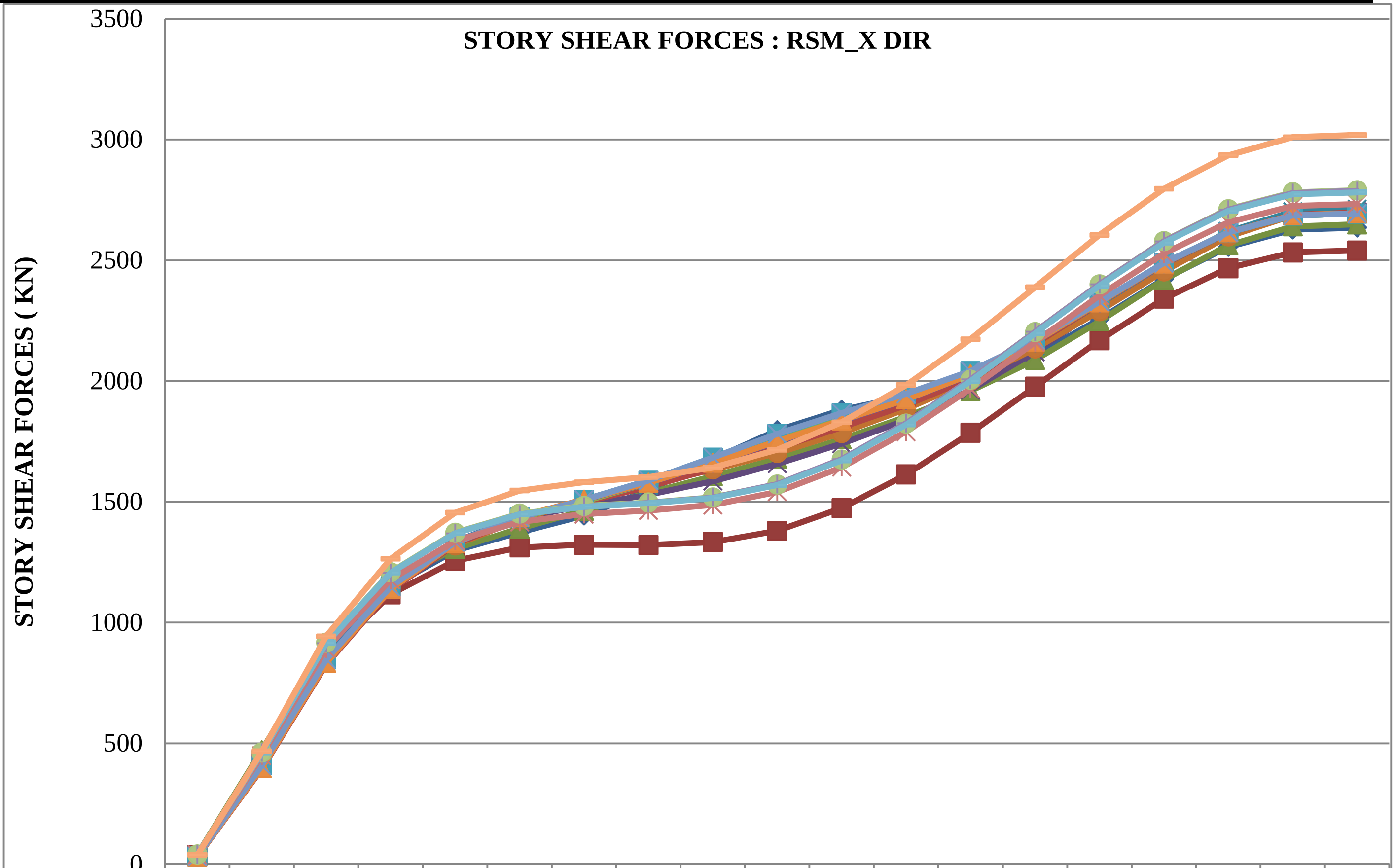


	STR RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	22	315	710	1059	1365	1629	1856	2049	2209	2340	2445	2526	2588	2632	2661	2679	2688	2691	2692
M2	22	303	676	1006	1295	1545	1759	1941	2092	2216	2315	2392	2450	2492	2520	2536	2545	2548	2548
M3	22	307	689	1027	1322	1577	1797	1982	2137	2264	2365	2444	2503	2546	2574	2591	2600	2603	2603
M4	22	315	712	1062	1369	1634	1862	2055	2215	2347	2452	2534	2596	2640	2669	2687	2696	2700	2700
M5	22	315	711	1061	1367	1632	1859	2052	2212	2343	2448	2530	2592	2636	2665	2683	2692	2695	2696
M6	22	315	711	1061	1367	1633	1860	2053	2213	2345	2450	2532	2593	2638	2667	2685	2694	2697	2697
M7	22	315	711	1060	1366	1631	1858	2051	2211	2342	2447	2529	2591	2635	2664	2682	2691	2694	2695
M8	22	315	711	1061	1367	1633	1860	2053	2213	2345	2450	2532	2593	2638	2667	2685	2694	2697	2697
M9	22	315	711	1060	1366	1631	1858	2051	2211	2342	2447	2529	2591	2635	2664	2682	2691	2694	2695
M10	22	315	711	1061	1367	1632	1859	2052	2212	2343	2448	2530	2592	2636	2665	2683	2692	2695	2696
M11	22	315	711	1060	1366	1631	1858	2050	2210	2342	2447	2528	2590	2634	2663	2681	2690	2693	2694
M12	22	315	711	1061	1367	1632	1859	2052	2212	2343	2448	2530	2592	2636	2665	2683	2692	2695	2696
M13	22	315	711	1060	1366	1631	1858	2050	2210	2342	2447	2528	2590	2634	2663	2681	2690	2693	2694
M14	24	325	725	1079	1389	1657	1887	2082	2244	2377	2484	2566	2629	2673	2703	2721	2730	2734	2734
M15	23	320	716	1065	1371	1636	1863	2055	2216	2347	2452	2533	2595	2639	2668	2686	2695	2698	2699
M16	24	322	718	1067	1373	1638	1866	2058	2218	2350	2455	2537	2598	2642	2671	2689	2698	2702	2702
M17	23	320	715	1063	1368	1632	1859	2051	2210	2341	2446	2528	2589	2633	2662	2680	2689	2692	2693
M18	25	352	786	1169	1507	1800	2052	2265	2442	2588	2704	2795	2863	2911	2944	2964	2974	2977	2978



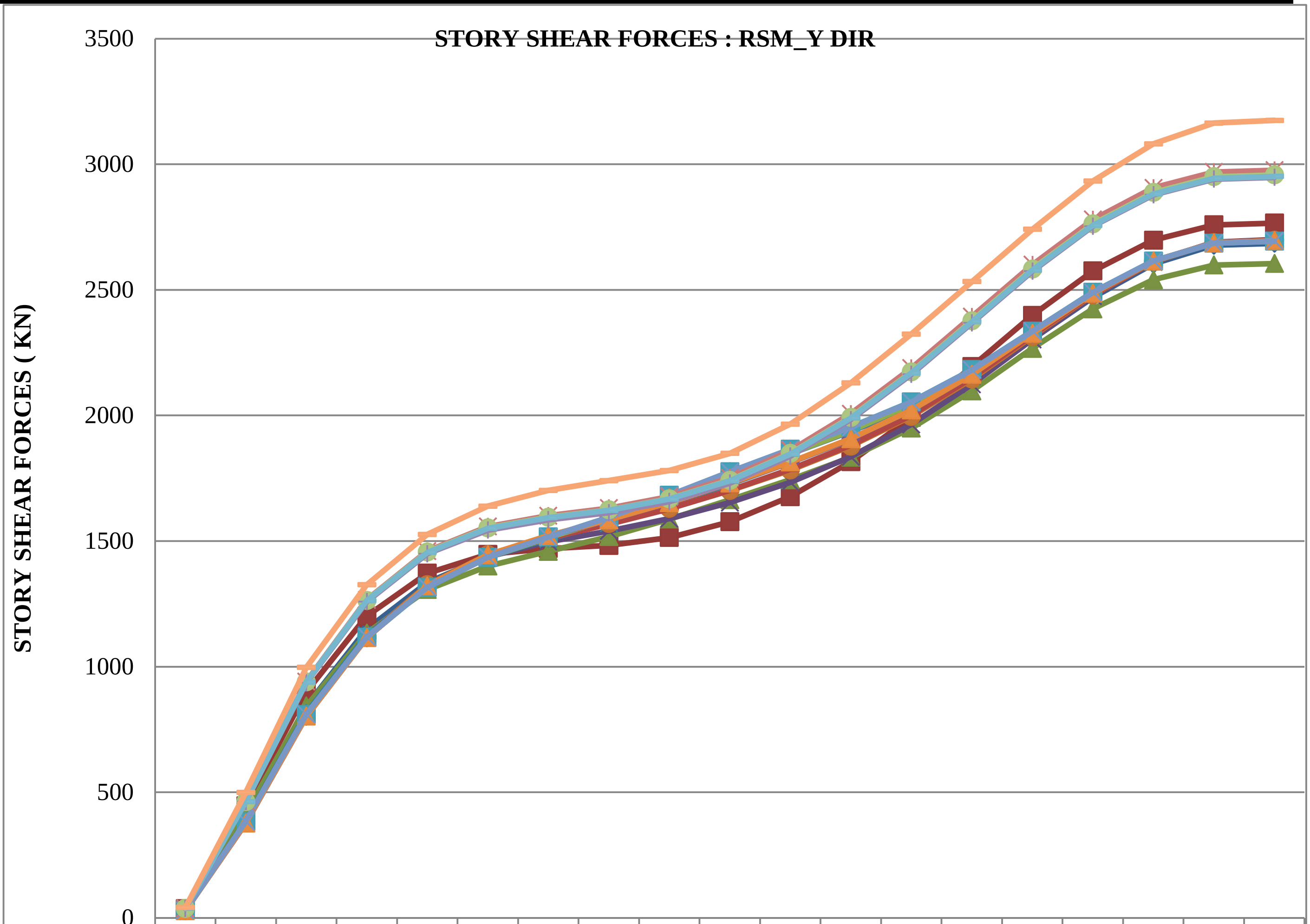
	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	22	315	710	1059	1365	1629	1856	2049	2209	2340	2445	2526	2588	2632	2661	2679	2688	2691	2692
M2	24	327	730	1087	1398	1668	1900	2096	2259	2393	2500	2584	2646	2691	2721	2739	2749	2752	2752
M3	22	307	689	1027	1322	1577	1797	1982	2137	2264	2365	2444	2503	2546	2574	2591	2600	2603	2603
M4	22	315	712	1062	1369	1634	1862	2055	2215	2347	2452	2534	2596	2640	2669	2687	2696	2700	2700
M5	22	315	711	1061	1367	1632	1859	2052	2212	2343	2448	2530	2592	2636	2665	2683	2692	2695	2696
M6	22	315	711	1061	1367	1633	1860	2053	2213	2345	2450	2532	2593	2638	2667	2685	2694	2697	2697
M7	22	315	711	1060	1366	1631	1858	2051	2211	2342	2447	2529	2591	2635	2664	2682	2691	2694	2695
M8	22	315	711	1061	1367	1633	1860	2053	2213	2345	2450	2532	2593	2638	2667	2685	2694	2697	2697
M9	22	315	711	1060	1366	1631	1858	2051	2211	2342	2447	2529	2591	2635	2664	2682	2691	2694	2695
M10	22	315	711	1061	1367	1632	1859	2052	2212	2343	2448	2530	2592	2636	2665	2683	2692	2695	2696
M11	22	315	711	1060	1366	1631	1858	2050	2210	2342	2447	2528	2590	2634	2663	2681	2690	2693	2694
M12	22	315	711	1061	1367	1632	1859	2052	2212	2343	2448	2530	2592	2636	2665	2683	2692	2695	2696
M13	22	315	711	1060	1366	1631	1858	2050	2210	2342	2447	2528	2590	2634	2663	2681	2690	2693	2694
M14	26	353	790	1175	1512	1804	2055	2267	2443	2588	2704	2794	2862	2910	2943	2962	2973	2976	2976
M15	25	350	781	1162	1496	1784	2032	2242	2417	2560	2674	2764	2831	2879	2911	2930	2940	2944	2944
M16	26	350	780	1160	1492	1781	2028	2237	2411	2554	2668	2757	2823	2871	2903	2923	2933	2936	2936
M17	25	349	780	1160	1493	1781	2029	2238	2412	2555	2670	2759	2825	2873	2905	2925	2935	2938	2938
M18	27	372	832	1236	1594	1904	2170	2395	2583	2737	2860	2956	3027	3079	3113	3134	3145	3149	3149

Chart-2: Story Shear Force _Equivalent Static Method_ Y Direction



	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	34	429	869	1148	1297	1373	1443	1547	1677	1796	1881	1937	2001	2106	2256	2422	2556	2628	2635
M2	37	432	853	1117	1256	1311	1322	1321	1333	1380	1474	1613	1785	1976	2169	2341	2468	2533	2541
M3	40	471	911	1169	1305	1389	1464	1537	1607	1678	1760	1853	1959	2088	2247	2419	2563	2641	2649
M4	31	398	834	1141	1330	1431	1484	1529	1586	1658	1741	1839	1963	2120	2300	2475	2612	2690	2700
M5	34	419	861	1158	1334	1432	1499	1568	1648	1734	1821	1910	2014	2146	2309	2478	2620	2701	2711
M6	33	416	852	1143	1319	1427	1505	1571	1634	1702	1785	1885	2001	2135	2290	2455	2599	2686	2697
M7	32	410	851	1153	1336	1436	1505	1579	1670	1764	1850	1930	2026	2157	2319	2484	2614	2686	2695
M8	31	395	828	1133	1324	1432	1499	1562	1637	1722	1809	1900	2011	2154	2321	2485	2616	2688	2697
M9	32	408	846	1148	1330	1432	1502	1577	1669	1764	1851	1933	2030	2161	2323	2486	2615	2686	2694
M10	31	398	832	1138	1328	1437	1508	1577	1660	1749	1835	1922	2026	2162	2324	2487	2615	2687	2696
M11	32	408	847	1149	1332	1435	1508	1588	1683	1780	1867	1946	2041	2169	2328	2488	2616	2686	2694
M12	31	398	832	1138	1329	1438	1509	1579	1662	1751	1837	1924	2028	2163	2326	2487	2616	2687	2696
M13	32	408	847	1149	1332	1436	1509	1588	1684	1781	1867	1947	2041	2169	2328	2489	2616	2686	2694
M14	38	449	892	1177	1338	1416	1449	1464	1487	1541	1643	1790	1968	2161	2354	2528	2657	2725	2734
M15	39	462	916	1208	1372	1451	1483	1497	1518	1572	1675	1824	2006	2203	2401	2580	2712	2782	2791
M16	39	461	914	1205	1369	1448	1480	1495	1518	1573	1676	1825	2007	2204	2401	2579	2710	2779	2788
M17	39	461	915	1207	1370	1448	1480	1494	1515	1569	1671	1820	2000	2197	2394	2572	2704	2774	2782
M18	38	466	943	1264	1455	1546	1581	1603	1642	1716	1829	1983	2174	2388	2605	2796	2935	3010	3019

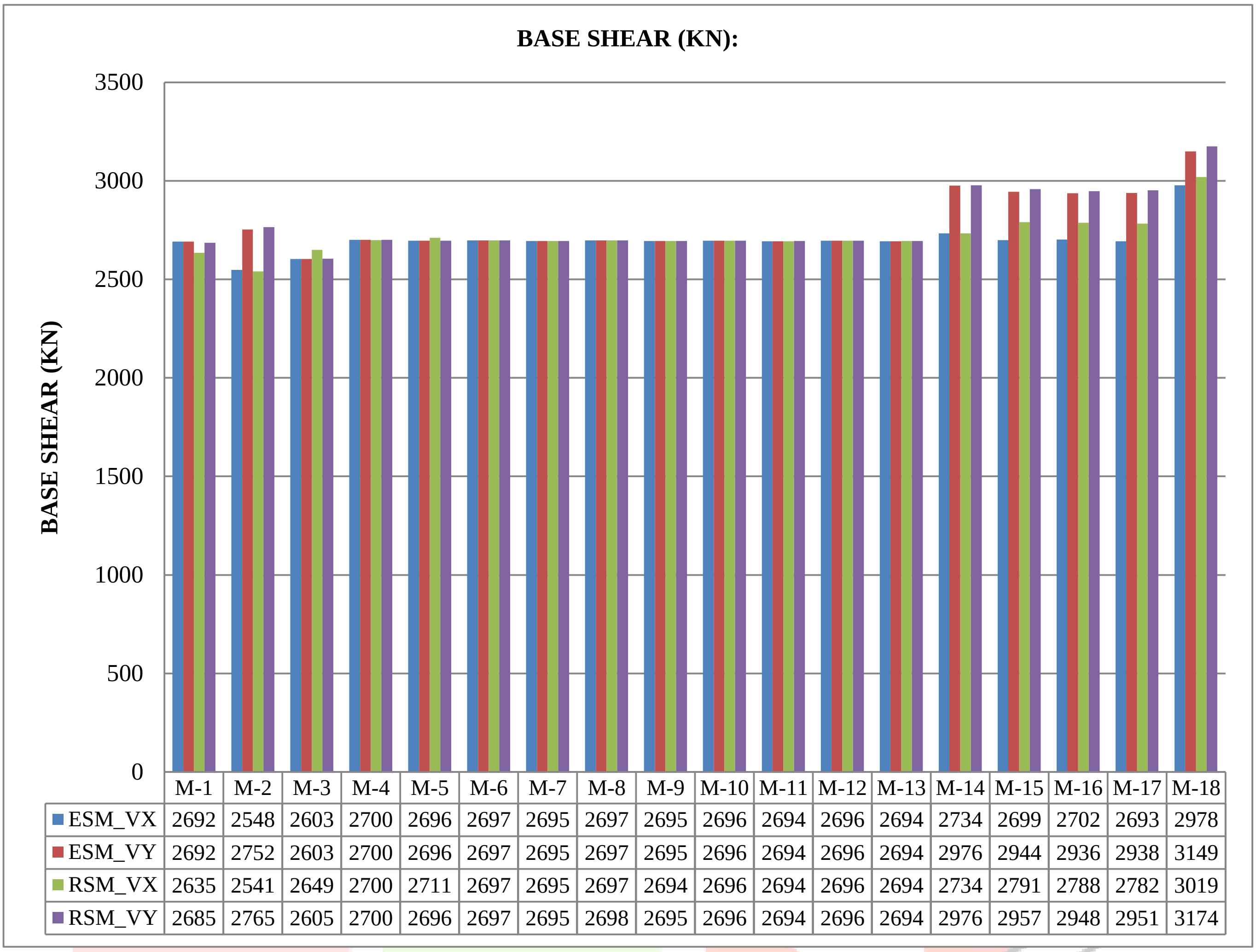
Chart-3: Story Shear Force _Response Spectrum Method_ X Direction



	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	31	405	844	1149	1335	1438	1507	1584	1678	1776	1862	1938	2026	2148	2304	2470	2603	2677	2685
M2	36	446	899	1201	1372	1447	1470	1483	1514	1577	1676	1815	1992	2195	2399	2575	2698	2758	2765
M3	33	414	843	1133	1307	1400	1459	1517	1587	1664	1744	1833	1949	2098	2267	2424	2540	2599	2605
M4	29	381	809	1121	1322	1436	1497	1540	1589	1653	1734	1835	1964	2124	2303	2474	2611	2689	2700
M5	29	386	816	1125	1322	1437	1508	1571	1644	1727	1813	1905	2016	2156	2320	2482	2613	2687	2696
M6	29	380	808	1121	1326	1446	1516	1570	1630	1701	1783	1878	1996	2144	2314	2480	2612	2688	2697
M7	29	384	812	1121	1320	1438	1516	1588	1670	1759	1847	1936	2040	2172	2329	2487	2614	2686	2695
M8	28	377	803	1114	1319	1440	1511	1567	1629	1702	1785	1882	2002	2150	2319	2483	2613	2688	2698
M9	29	382	809	1116	1315	1435	1513	1586	1669	1759	1848	1938	2043	2176	2332	2489	2615	2686	2695
M10	28	377	802	1114	1320	1444	1520	1583	1651	1729	1813	1906	2020	2162	2326	2486	2614	2687	2696
M11	29	383	809	1117	1315	1435	1516	1594	1682	1776	1865	1953	2054	2182	2335	2490	2615	2686	2694
M12	28	377	803	1115	1321	1445	1522	1584	1653	1730	1814	1908	2021	2163	2327	2487	2614	2687	2696
M13	29	383	810	1117	1316	1436	1516	1594	1682	1775	1865	1952	2053	2181	2335	2490	2615	2686	2694
M14	37	462	940	1266	1460	1558	1601	1631	1677	1752	1861	2007	2188	2394	2600	2780	2906	2969	2976
M15	37	462	939	1263	1456	1552	1595	1624	1668	1742	1849	1993	2173	2377	2583	2762	2887	2950	2957
M16	37	462	936	1258	1449	1544	1585	1613	1657	1730	1838	1983	2163	2368	2574	2753	2878	2941	2948
M17	37	462	938	1262	1455	1551	1593	1622	1667	1740	1846	1990	2169	2373	2578	2757	2881	2944	2951
M18	41	499	997	1325	1526	1639	1701	1740	1781	1849	1965	2129	2324	2533	2741	2933	3081	3164	3174

Chart-4: Story Shear Force _Response Spectrum Method_ Y Direction

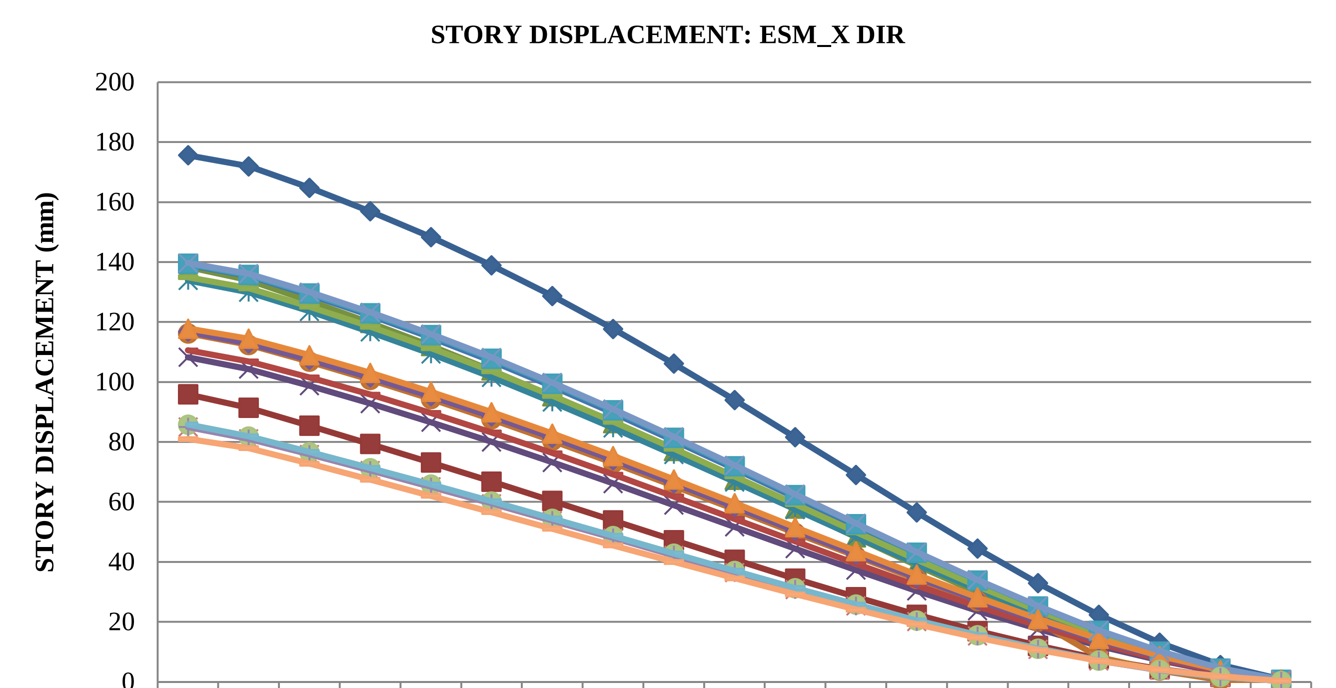
5.2 Base Shear



	M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	M-9	M-10	M-11	M-12	M-13	M-14	M-15	M-16	M-17	M-18
ESM_VX	2692	2548	2603	2700	2696	2697	2695	2697	2695	2696	2694	2696	2694	2734	2699	2702	2693	2978
ESM_VY	2692	2752	2603	2700	2696	2697	2695	2697	2695	2696	2694	2696	2694	2976	2944	2936	2938	3149
RSM_VX	2635	2541	2649	2700	2711	2697	2695	2697	2694	2696	2694	2696	2694	2734	2791	2788	2782	3019
RSM_VY	2685	2765	2605	2700	2696	2697	2695	2698	2695	2696	2694	2696	2694	2976	2957	2948	2951	3174

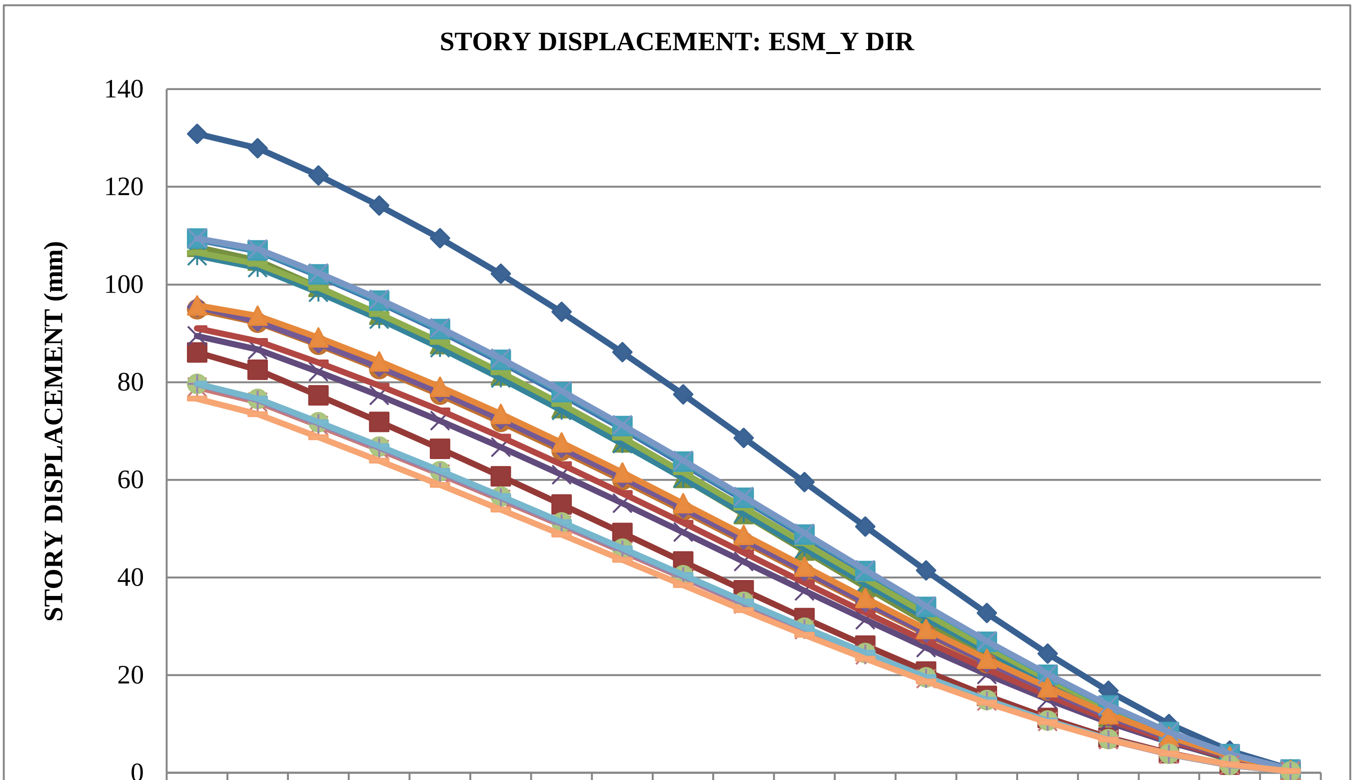
Chart-5: Base Shear_ Equivalent Static Method and Response Spectrum Method

5.3 Story Displacement



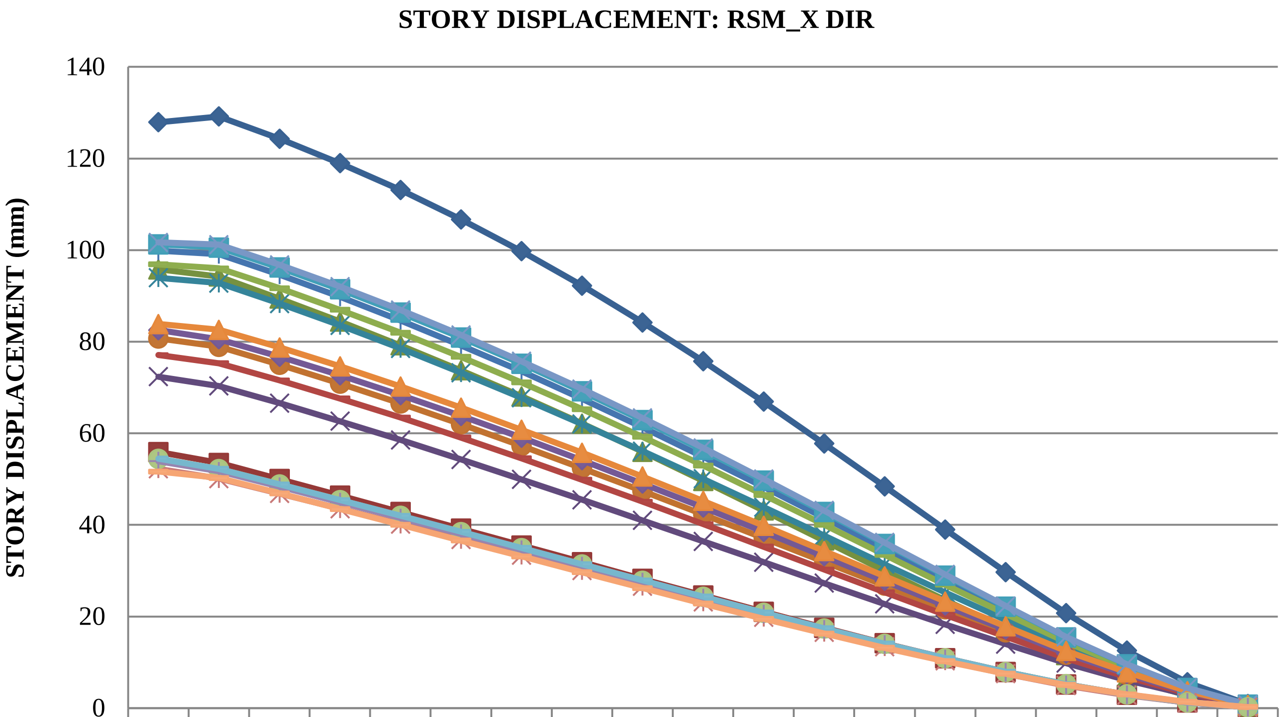
	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	176	172	165	157	148	139	129	118	106	94	82	69	57	44	33	22	13	6	1
M2	96	91	85	79	73	67	60	54	47	41	34	28	22	17	12	8	4	2	0
M3	138	134	127	120	112	104	95	86	77	67	58	48	39	30	22	14	8	3	0
M4	108	104	99	93	87	80	73	66	59	52	44	37	30	24	18	12	7	3	1
M5	134	130	124	117	109	102	93	85	76	67	58	48	39	31	23	16	9	4	1
M6	116	112	107	101	94	88	80	73	65	58	50	42	34	27	20	8	4	1	1
M7	139	135	129	122	115	107	99	90	80	71	61	52	43	33	25	17	10	4	1
M8	111	107	102	96	90	83	76	69	62	54	47	39	32	25	19	13	8	3	1
M9	135	131	125	118	111	104	95	87	78	69	59	50	41	32	24	16	9	4	1
M10	117	113	107	102	95	89	81	74	66	58	50	43	35	27	20	14	8	4	1
M11	139	136	130	123	116	108	99	91	81	72	62	53	43	34	25	17	10	4	1
M12	118	114	109	103	97	90	83	75	68	60	52	44	36	28	21	14	9	4	1
M13	140	136	130	123	116	108	100	91	82	72	63	53	43	34	25	17	10	5	1
M14	85	81	76	71	65	59	54	48	42	36	31	25	20	15	11	7	4	2	0
M15	86	82	77	71	66	60	54	49	43	37	31	26	20	16	11	7	4	2	0
M16	85	81	76	71	65	60	54	48	42	37	31	25	20	15	11	7	4	2	0
M17	86	82	77	71	66	60	54	49	43	37	31	26	21	16	11	7	4	2	0
M18	81	78	73	67	62	57	51	46	40	35	29	24	19	15	11	7	4	2	0

Chart-6: Story Displacement_ Equivalent Static Method _X Direction



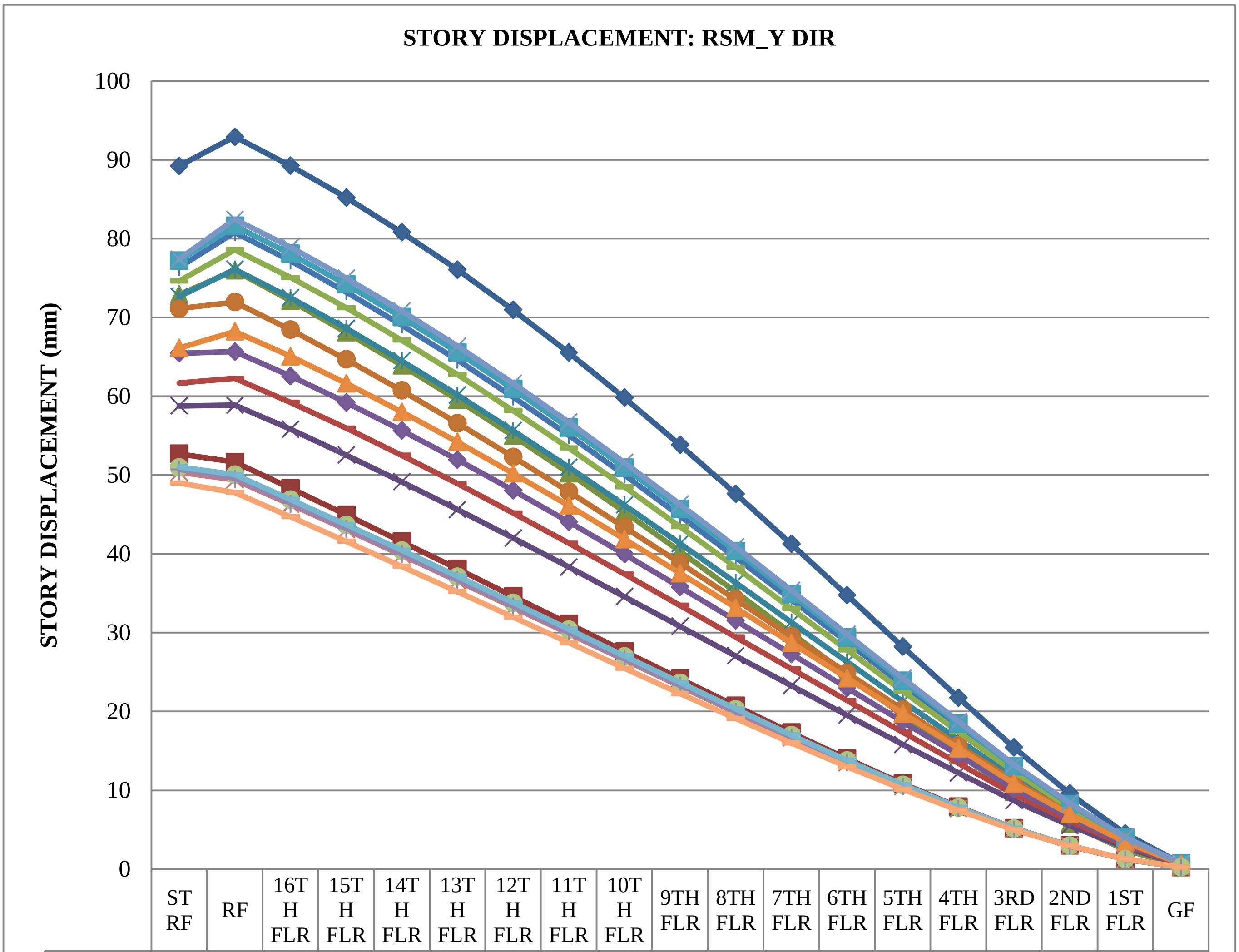
	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	131	128	122	116	109	102	94	86	77	69	60	50	41	33	24	17	10	5	1
M2	86	83	77	72	66	61	55	49	43	37	32	26	21	16	11	7	4	2	0
M3	108	105	99	94	88	81	75	68	60	53	45	38	31	24	17	11	6	3	0
M4	89	87	82	77	72	67	61	55	49	43	37	31	26	20	15	10	6	3	1
M5	106	103	98	93	87	81	74	67	60	53	46	39	32	25	19	13	8	4	1
M6	95	92	88	83	77	72	66	60	54	47	41	35	28	22	17	12	7	3	1
M7	109	107	102	96	90	84	77	70	63	56	48	41	34	27	20	14	8	4	1
M8	91	88	84	79	74	69	63	57	51	45	39	33	27	21	16	11	7	3	1
M9	107	104	99	94	88	82	75	69	62	54	47	40	33	26	19	13	8	4	1
M10	95	92	88	83	78	72	67	60	54	48	41	35	29	23	17	12	7	3	1
M11	109	107	102	97	91	85	78	71	64	56	49	41	34	27	20	14	8	4	1
M12	96	94	89	84	79	73	68	61	55	49	42	36	29	23	18	12	7	3	1
M13	109	107	102	97	91	85	78	71	64	57	49	42	34	27	20	14	8	4	1
M14	79	76	71	66	61	56	51	45	40	35	29	24	19	15	10	7	4	2	0
M15	80	77	72	67	62	57	51	46	40	35	30	25	20	15	11	7	4	2	0
M16	80	76	72	67	62	56	51	46	40	35	29	24	19	15	11	7	4	2	0
M17	80	77	72	67	62	57	51	46	41	35	30	25	20	15	11	7	4	2	0
M18	77	73	69	64	59	54	49	44	38	33	28	23	19	14	10	7	4	2	0

Chart-7: Story Displacement_ Equivalent Static Method _Y Direction



	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	128	129	124	119	113	107	100	92	84	76	67	58	48	39	30	21	13	6	1
M2	56	54	50	46	43	39	36	32	28	25	21	18	14	11	8	5	3	1	0
M3	96	94	89	84	79	74	68	62	56	50	43	37	30	24	17	12	7	3	0
M4	72	70	67	63	59	54	50	45	41	36	32	27	23	18	14	10	6	3	1
M5	94	93	88	84	79	73	68	62	56	50	44	38	31	25	19	13	8	4	1
M6	81	79	75	71	67	62	57	52	47	42	37	32	27	22	17	12	7	3	1
M7	100	99	95	90	85	79	74	68	61	55	48	42	35	28	21	15	9	4	1
M8	77	75	72	68	63	59	55	50	45	40	35	30	25	20	16	11	7	3	1
M9	97	96	92	87	82	77	71	65	59	53	47	40	33	27	21	14	9	4	1
M10	83	81	77	73	68	64	59	54	49	44	39	33	28	22	17	12	7	4	1
M11	101	101	96	91	86	81	75	69	63	56	50	43	36	29	22	15	10	4	1
M12	84	83	79	75	70	66	61	56	51	45	40	34	29	23	18	12	8	4	1
M13	102	101	97	92	87	81	76	70	63	57	50	43	36	29	22	16	10	4	1
M14	52	50	47	44	40	37	33	30	27	23	20	17	13	10	8	5	3	1	0
M15	54	52	49	45	42	38	35	31	28	24	21	17	14	11	8	5	3	1	0
M16	54	52	48	45	42	38	35	31	28	24	21	17	14	11	8	5	3	1	0
M17	54	52	49	45	42	38	35	31	28	24	21	17	14	11	8	5	3	1	0
M18	52	50	47	43	40	37	33	30	26	23	20	16	13	10	8	5	3	1	0

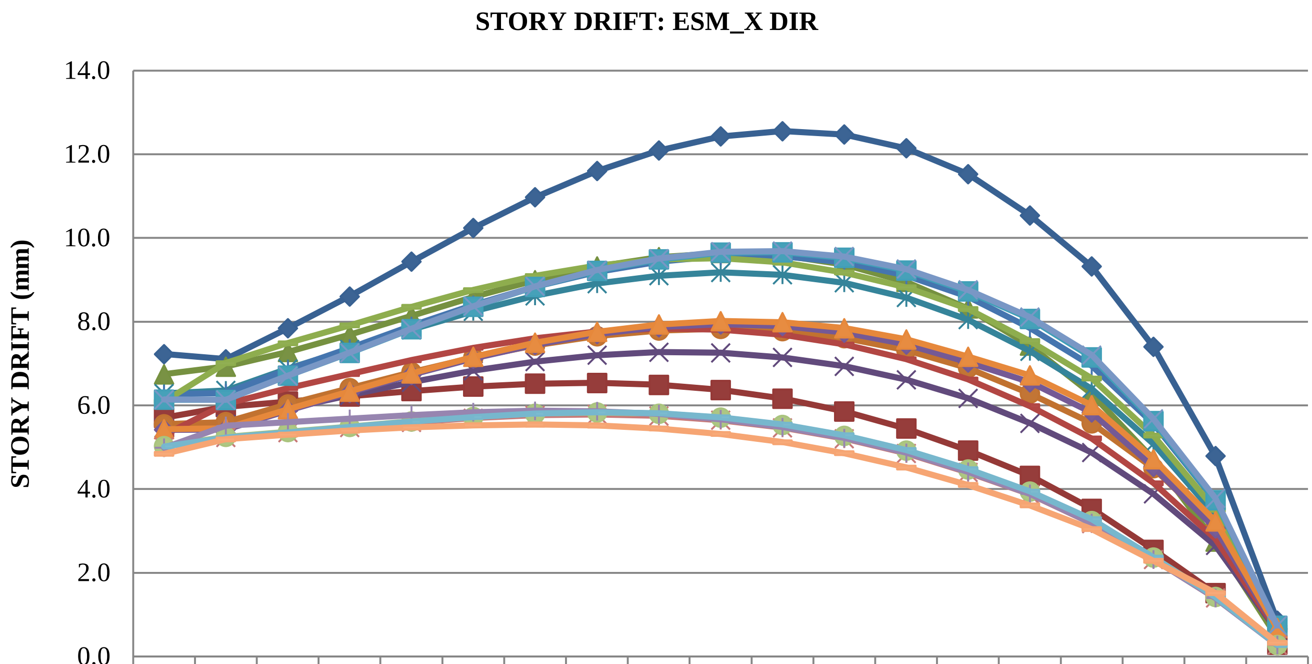
Chart-8: Story Displacement_ Response Spectrum Method _X Direction



	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	89	93	89	85	81	76	71	66	60	54	48	41	35	28	22	15	10	5	1
M2	53	52	48	45	42	38	35	31	28	24	21	17	14	11	8	5	3	1	0
M3	73	76	72	68	64	60	55	50	45	40	35	30	25	20	15	10	6	2	0
M4	59	59	56	53	49	46	42	38	35	31	27	23	20	16	12	9	6	3	1
M5	73	76	73	69	64	60	56	51	46	41	36	31	26	21	16	12	7	4	1
M6	71	72	68	65	61	57	52	48	43	39	34	30	25	20	16	11	7	4	1
M7	76	81	77	73	69	65	60	55	50	45	40	34	29	23	18	13	8	4	1
M8	62	62	59	56	53	49	45	41	37	33	29	25	21	17	13	9	6	3	1
M9	75	79	75	71	67	63	58	53	49	43	38	33	28	23	17	12	8	4	1
M10	65	66	63	59	56	52	48	44	40	36	32	27	23	19	14	10	7	3	1
M11	77	82	78	74	70	66	61	56	51	46	40	35	29	24	18	13	8	4	1
M12	66	68	65	62	58	54	50	46	42	38	33	29	24	20	15	11	7	3	1
M13	77	82	79	75	71	66	62	57	52	46	41	35	30	24	19	13	8	4	1
M14	50	49	46	43	40	37	33	30	27	23	20	17	13	10	8	5	3	1	0
M15	51	50	47	44	40	37	34	30	27	24	20	17	14	11	8	5	3	1	0
M16	51	50	46	43	40	37	33	30	27	23	20	17	14	11	8	5	3	1	0
M17	51	50	47	44	40	37	34	30	27	24	20	17	14	11	8	5	3	1	0
M18	49	48	45	42	38	35	32	29	25	22	19	16	13	10	7	5	3	1	0

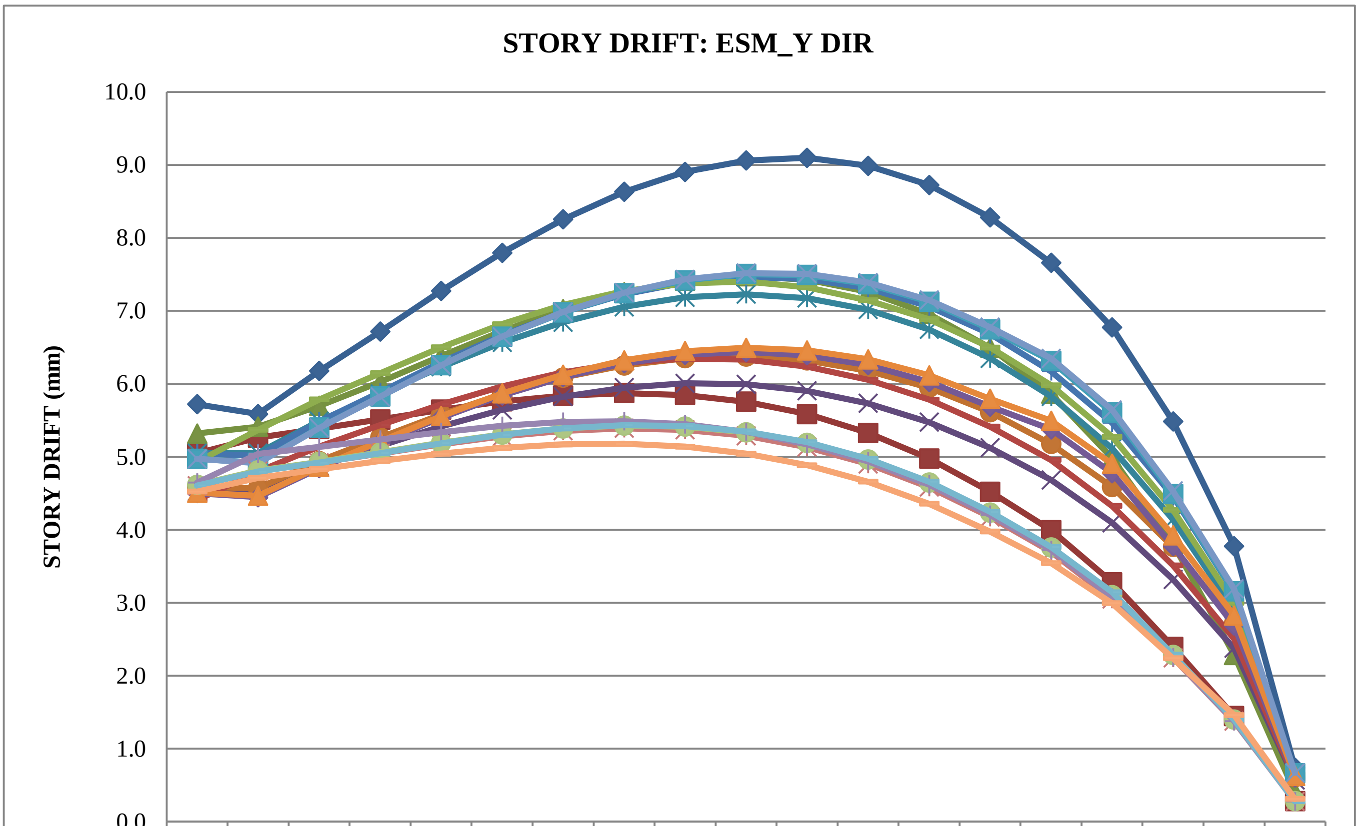
Chart-9: Story Displacement_ Response Spectrum Method _Y Direction

5.4 Story Drift



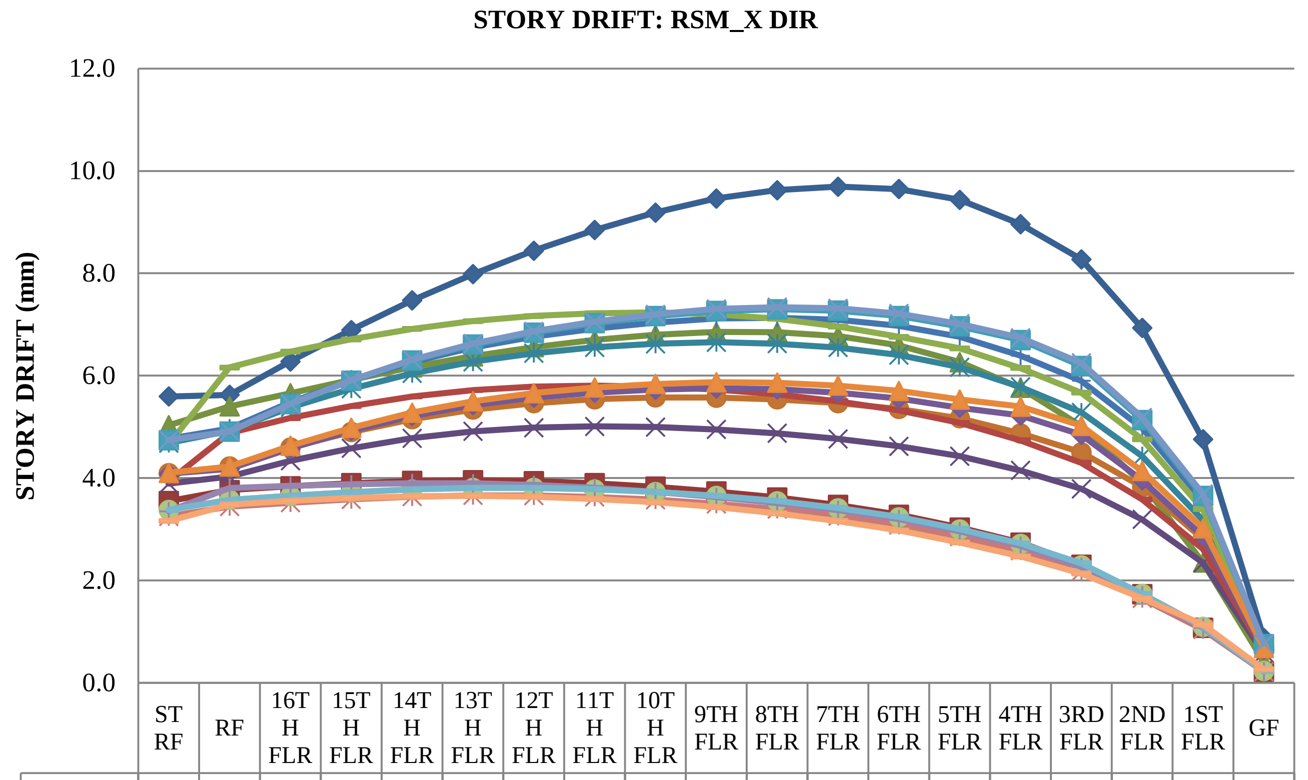
	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	7.2	7.1	7.8	8.6	9.4	10.2	11.0	11.6	12.1	12.4	12.6	12.5	12.1	11.5	10.5	9.3	7.4	4.8	0.9
M2	5.7	6.0	6.1	6.2	6.3	6.5	6.5	6.5	6.5	6.4	6.2	5.9	5.4	4.9	4.3	3.5	2.6	1.5	0.3
M3	6.7	6.9	7.3	7.7	8.1	8.6	9.0	9.3	9.5	9.6	9.6	9.4	9.0	8.3	7.4	6.3	4.7	2.7	0.5
M4	5.5	5.6	5.9	6.2	6.6	6.8	7.0	7.2	7.3	7.3	7.1	6.9	6.6	6.2	5.6	4.9	3.9	2.7	0.6
M5	6.3	6.4	6.9	7.3	7.8	8.2	8.6	8.9	9.1	9.2	9.1	8.9	8.6	8.1	7.3	6.4	5.1	3.4	0.7
M6	5.5	5.6	6.0	6.4	6.8	7.1	7.4	7.7	7.8	7.8	7.8	7.6	7.3	6.9	6.3	5.6	4.5	3.1	0.7
M7	6.3	6.3	6.9	7.4	7.9	8.4	8.8	9.2	9.4	9.6	9.6	9.4	9.1	8.6	7.8	6.9	5.6	3.7	0.7
M8	5.3	6.0	6.4	6.7	7.1	7.4	7.6	7.8	7.8	7.8	7.7	7.5	7.1	6.6	6.0	5.2	4.1	2.8	0.6
M9	6.1	7.0	7.5	7.9	8.4	8.8	9.1	9.3	9.5	9.5	9.4	9.2	8.8	8.3	7.5	6.6	5.3	3.5	0.7
M10	5.4	5.4	5.9	6.3	6.7	7.1	7.5	7.7	7.9	7.9	7.9	7.7	7.5	7.0	6.6	5.8	4.5	3.1	0.7
M11	6.1	6.1	6.7	7.3	7.8	8.4	8.8	9.2	9.5	9.7	9.7	9.5	9.2	8.7	8.1	7.1	5.6	3.7	0.7
M12	5.4	5.5	5.9	6.3	6.8	7.2	7.5	7.8	7.9	8.0	8.0	7.8	7.6	7.2	6.7	6.0	4.7	3.2	0.7
M13	6.1	6.1	6.7	7.3	7.8	8.4	8.8	9.2	9.5	9.7	9.7	9.6	9.3	8.8	8.1	7.2	5.7	3.8	0.7
M14	5.0	5.2	5.4	5.5	5.6	5.7	5.8	5.8	5.7	5.6	5.5	5.2	4.9	4.4	3.9	3.2	2.3	1.4	0.3
M15	5.0	5.2	5.4	5.5	5.6	5.7	5.8	5.8	5.8	5.7	5.5	5.3	4.9	4.5	3.9	3.2	2.4	1.4	0.3
M16	5.0	5.5	5.6	5.7	5.8	5.8	5.9	5.9	5.8	5.7	5.5	5.2	4.9	4.4	3.9	3.2	2.3	1.4	0.3
M17	5.0	5.2	5.4	5.5	5.6	5.7	5.8	5.8	5.8	5.7	5.5	5.3	4.9	4.5	3.9	3.3	2.4	1.4	0.3
M18	4.8	5.2	5.3	5.4	5.5	5.5	5.5	5.5	5.4	5.3	5.1	4.9	4.5	4.1	3.6	3.0	2.3	1.5	0.3

Chart-10: Story Drift_ Equivalent Static Method _X Direction



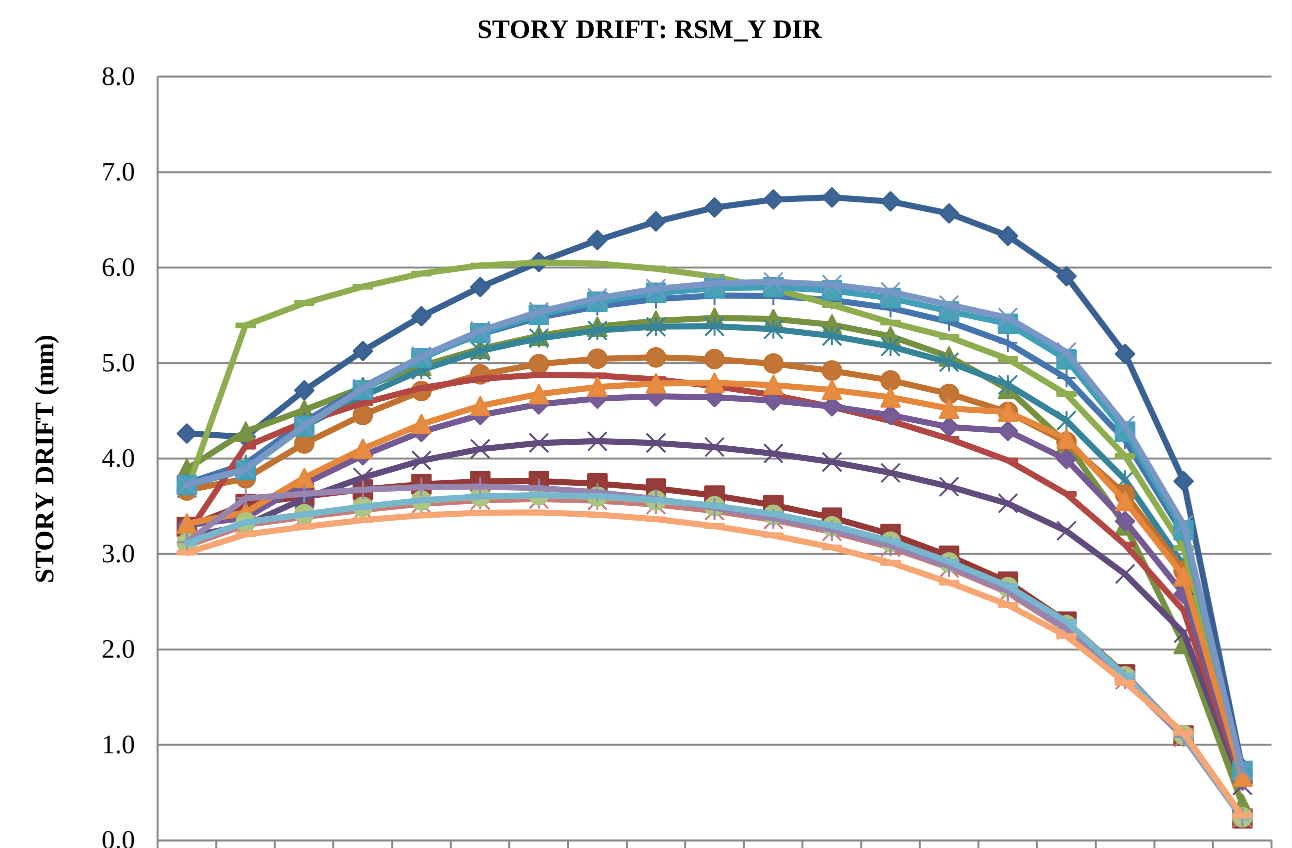
	SR RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	5.7	5.6	6.2	6.7	7.3	7.8	8.3	8.6	8.9	9.1	9.1	9.0	8.7	8.3	7.7	6.8	5.5	3.8	0.7
M2	5.0	5.3	5.4	5.5	5.6	5.8	5.8	5.9	5.8	5.8	5.6	5.3	5.0	4.5	4.0	3.3	2.4	1.4	0.3
M3	5.3	5.4	5.7	6.0	6.4	6.7	7.0	7.3	7.4	7.5	7.4	7.3	7.0	6.5	5.9	5.0	3.8	2.3	0.4
M4	4.5	4.5	4.9	5.2	5.4	5.6	5.8	5.9	6.0	6.0	5.9	5.7	5.5	5.1	4.7	4.1	3.3	2.4	0.6
M5	5.1	5.1	5.5	5.9	6.2	6.6	6.8	7.1	7.2	7.2	7.2	7.0	6.7	6.3	5.8	5.1	4.1	2.9	0.6
M6	4.6	4.6	4.9	5.3	5.6	5.9	6.1	6.3	6.4	6.4	6.3	6.2	5.9	5.6	5.2	4.6	3.8	2.7	0.6
M7	5.0	5.0	5.5	5.9	6.3	6.7	7.0	7.2	7.4	7.5	7.4	7.3	7.1	6.7	6.2	5.5	4.5	3.1	0.7
M8	4.4	4.8	5.1	5.4	5.7	6.0	6.2	6.3	6.3	6.3	6.2	6.1	5.8	5.4	5.0	4.3	3.5	2.5	0.6
M9	4.9	5.4	5.8	6.1	6.5	6.8	7.1	7.3	7.4	7.4	7.3	7.1	6.9	6.5	6.0	5.3	4.3	3.0	0.6
M10	4.5	4.4	4.8	5.2	5.5	5.8	6.1	6.3	6.4	6.4	6.4	6.3	6.0	5.7	5.4	4.8	3.8	2.7	0.6
M11	5.0	4.9	5.4	5.8	6.3	6.6	7.0	7.2	7.4	7.5	7.5	7.4	7.1	6.7	6.3	5.6	4.5	3.2	0.7
M12	4.5	4.5	4.9	5.2	5.6	5.9	6.1	6.3	6.4	6.5	6.5	6.3	6.1	5.8	5.5	4.9	3.9	2.8	0.6
M13	5.0	4.9	5.4	5.8	6.3	6.6	7.0	7.3	7.4	7.5	7.5	7.4	7.2	6.8	6.3	5.6	4.5	3.2	0.7
M14	4.6	4.8	4.9	5.0	5.2	5.3	5.4	5.4	5.4	5.3	5.1	4.9	4.6	4.2	3.7	3.1	2.2	1.4	0.3
M15	4.6	4.8	4.9	5.1	5.2	5.3	5.4	5.4	5.4	5.3	5.2	5.0	4.6	4.2	3.8	3.1	2.3	1.4	0.3
M16	4.6	5.0	5.1	5.2	5.3	5.4	5.5	5.5	5.4	5.3	5.2	4.9	4.6	4.2	3.7	3.1	2.3	1.4	0.3
M17	4.6	4.8	4.9	5.1	5.2	5.3	5.4	5.4	5.4	5.3	5.2	5.0	4.7	4.2	3.8	3.1	2.3	1.4	0.3
M18	4.5	4.7	4.8	4.9	5.0	5.1	5.2	5.2	5.1	5.0	4.9	4.7	4.4	4.0	3.5	3.0	2.2	1.5	0.3

Chart-11: Story Drift_ Equivalent Static Method _Y Direction



	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	5.6	5.6	6.3	6.9	7.5	8.0	8.4	8.8	9.2	9.5	9.6	9.7	9.6	9.4	9.0	8.3	6.9	4.8	0.9
M2	3.6	3.8	3.8	3.9	3.9	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.3	3.0	2.7	2.3	1.7	1.1	0.2
M3	5.0	5.4	5.7	5.9	6.2	6.4	6.6	6.7	6.8	6.9	6.9	6.8	6.6	6.3	5.8	5.0	3.9	2.4	0.4
M4	3.9	4.0	4.3	4.6	4.8	4.9	5.0	5.0	5.0	5.0	4.9	4.8	4.6	4.4	4.2	3.8	3.2	2.3	0.6
M5	4.7	4.9	5.4	5.7	6.0	6.3	6.4	6.6	6.6	6.7	6.6	6.6	6.4	6.2	5.8	5.3	4.4	3.2	0.7
M6	4.1	4.2	4.6	4.9	5.2	5.3	5.5	5.5	5.6	5.6	5.5	5.5	5.4	5.2	4.9	4.5	3.8	2.8	0.7
M7	4.8	5.0	5.5	5.9	6.3	6.6	6.8	6.9	7.0	7.1	7.1	7.1	7.0	6.8	6.4	5.9	5.0	3.6	0.8
M8	3.9	4.9	5.2	5.4	5.6	5.7	5.8	5.8	5.8	5.7	5.6	5.5	5.3	5.1	4.7	4.3	3.6	2.6	0.6
M9	4.7	6.2	6.5	6.7	6.9	7.1	7.2	7.2	7.2	7.2	7.1	7.0	6.8	6.5	6.2	5.7	4.8	3.4	0.7
M10	4.1	4.2	4.6	4.9	5.2	5.4	5.6	5.7	5.7	5.8	5.7	5.7	5.6	5.4	5.2	4.8	4.0	2.9	0.6
M11	4.7	4.9	5.4	5.9	6.3	6.6	6.8	7.0	7.2	7.3	7.3	7.3	7.2	7.0	6.7	6.2	5.1	3.7	0.8
M12	4.1	4.2	4.6	5.0	5.3	5.5	5.7	5.8	5.8	5.9	5.9	5.8	5.7	5.5	5.4	5.0	4.1	3.0	0.7
M13	4.7	4.9	5.5	5.9	6.3	6.6	6.9	7.1	7.2	7.3	7.3	7.3	7.2	7.0	6.7	6.3	5.2	3.7	0.8
M14	3.3	3.4	3.5	3.6	3.6	3.7	3.7	3.6	3.6	3.5	3.4	3.3	3.1	2.9	2.6	2.2	1.7	1.0	0.2
M15	3.4	3.6	3.7	3.7	3.8	3.8	3.8	3.8	3.7	3.6	3.5	3.4	3.2	3.0	2.7	2.3	1.7	1.1	0.2
M16	3.4	3.8	3.8	3.9	3.9	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.2	3.0	2.7	2.3	1.7	1.1	0.2
M17	3.4	3.6	3.7	3.7	3.8	3.8	3.8	3.8	3.7	3.7	3.6	3.4	3.2	3.0	2.7	2.3	1.7	1.1	0.2
M18	3.2	3.5	3.6	3.6	3.6	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.0	2.7	2.5	2.1	1.7	1.1	0.3

Chart-12: Story Drift_ Response Spectrum Method _X Direction



	ST RF	RF	16TH FLR	15TH FLR	14TH FLR	13TH FLR	12TH FLR	11TH FLR	10TH FLR	9TH FLR	8TH FLR	7TH FLR	6TH FLR	5TH FLR	4TH FLR	3RD FLR	2ND FLR	1ST FLR	GF
M1	4.3	4.2	4.7	5.1	5.5	5.8	6.1	6.3	6.5	6.6	6.7	6.7	6.7	6.6	6.3	5.9	5.1	3.8	0.8
M2	3.3	3.5	3.6	3.7	3.7	3.8	3.8	3.7	3.7	3.6	3.5	3.4	3.2	3.0	2.7	2.3	1.7	1.1	0.2
M3	3.9	4.3	4.5	4.7	5.0	5.1	5.3	5.4	5.4	5.5	5.5	5.4	5.3	5.1	4.7	4.2	3.3	2.1	0.4
M4	3.2	3.3	3.6	3.8	4.0	4.1	4.2	4.2	4.2	4.1	4.1	4.0	3.9	3.7	3.5	3.2	2.8	2.2	0.6
M5	3.7	3.9	4.3	4.7	4.9	5.1	5.3	5.3	5.4	5.4	5.4	5.3	5.2	5.0	4.8	4.4	3.8	2.9	0.7
M6	3.7	3.8	4.2	4.5	4.7	4.9	5.0	5.0	5.1	5.0	5.0	4.9	4.8	4.7	4.5	4.2	3.6	2.8	0.7
M7	3.7	3.9	4.4	4.7	5.1	5.3	5.5	5.6	5.7	5.7	5.7	5.7	5.6	5.4	5.2	4.8	4.2	3.2	0.7
M8	3.2	4.1	4.4	4.6	4.7	4.8	4.9	4.9	4.8	4.8	4.7	4.5	4.4	4.2	4.0	3.6	3.1	2.4	0.6
M9	3.7	5.4	5.6	5.8	5.9	6.0	6.1	6.0	6.0	5.9	5.8	5.6	5.4	5.3	5.0	4.7	4.0	3.1	0.7
M10	3.3	3.4	3.7	4.0	4.3	4.5	4.6	4.6	4.7	4.6	4.6	4.5	4.5	4.3	4.3	4.0	3.3	2.6	0.6
M11	3.7	3.9	4.3	4.7	5.1	5.3	5.5	5.6	5.7	5.8	5.8	5.8	5.7	5.5	5.4	5.0	4.3	3.3	0.7
M12	3.3	3.4	3.8	4.1	4.4	4.6	4.7	4.8	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.2	3.6	2.8	0.7
M13	3.7	3.9	4.3	4.7	5.1	5.3	5.5	5.7	5.8	5.8	5.9	5.8	5.7	5.6	5.5	5.1	4.3	3.3	0.7
M14	3.1	3.3	3.4	3.5	3.5	3.6	3.6	3.6	3.5	3.5	3.4	3.2	3.1	2.9	2.6	2.2	1.7	1.1	0.2
M15	3.1	3.3	3.4	3.5	3.6	3.6	3.6	3.6	3.6	3.5	3.4	3.3	3.1	2.9	2.7	2.3	1.7	1.1	0.2
M16	3.1	3.6	3.6	3.7	3.7	3.7	3.7	3.6	3.6	3.5	3.4	3.3	3.1	2.9	2.6	2.2	1.7	1.1	0.2
M17	3.1	3.3	3.4	3.5	3.6	3.6	3.6	3.6	3.6	3.5	3.4	3.3	3.1	2.9	2.7	2.3	1.7	1.1	0.2
M18	3.0	3.2	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.3	3.2	3.1	2.9	2.7	2.5	2.1	1.7	1.1	0.3

Chart-13: Story Drift_ Response Spectrum Method _Y Direction

6 CONCLUSION

By the analysis of above models we can conclude that

- Steel bracing increase the stiffness and stability of the RC building as compared to bare frame model.
- The lateral displacement of the building is minimum by the use of X type of bracing systems and shear wall at the corner position of the building thus significantly contributes to greater structural stiffness to the structure.
- There is reduction in Storey deflection in the frame due to bracing and shear wall.
- X-type and inverted V type bracing shows better result (lateral displacement, stiffness point of view) than other type of bracing system. Location of this bracing system in the structure also affects the behavior of the RC building frame under seismic forces.
- Steel bracing system(X-Type) shows the efficient and economical measures for RC multi-storey buildings located in high seismic regions.
- Storey drift is significantly lower after inserting shear wall and bracing.
- The base shear is found to be increasing from bare frame to braced frame and is even more for shear walled frame.
- Story Shear Force is reducing after using Shear wall & Steel Bracing separately but increasing when used in combination.
- Drift Ratio is reducing when shear wall and steel bracing used.

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