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ANALYSIS OF RCC FRAMED STRUCTURE FOR DIFFERENTIAL TEMPERATURE

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ABSTRACT

Concrete is the broadly utilized development material in view of its economy it makes the most appropriate material for development. As per IS-456:2000, the structures surpassing 45meter length are exposed to warm anxieties. Be that as it may considering temperature load along gravity load is being ignored. Other than gravity concrete is exposed to occasional and day by day temperature change, because of the design being presented to sun-based radiation, the temperature load must be thought of. Fireplace & hearth incidents can damage a structure to quantity that it is able to crumble, no structure but properly build, is resistant to form hearth & therefore layout concerns for fireplace has end up very important part of structural engineering. These heaps lead to warm burdens in the primary individuals. In this analytical study G+5 RCC structure is considered and were generated with ETAB. Analysis turned into examine diverse parameters such as story displacement, Bending Moment, Shear Force, joint reaction. The results are tabulated and compared to test the effect of various temperature load.

Keywords: ETABS, Temperature, Story Displacement, Joint Reaction, Shear Force, Bending Moment.

I. INTRODUCTION

Lengthy structures without any expansion joints have turned out to be anecessity in a view of disturbing structure and presenting commercial trend. As per Indian preferred code, 6IS-456:2000, buildings longer than 45 meters shall be analyzed for the thermal stress and suitable measures will be taken in the course of solving the structural device. However, IS codes are silent in phrases of manner to observe in such kind of designs in addition to on load factors to be taken into consideration in a layout combination of temperature load with gravity loads? To get worse the state of affairs, there are no suggestion to be add with the design engineers to reach at design temperature cost that ought to be consider in running out in thermal stress

1.1 Objective of the study

The main aim of this analytical study is

- To study the effect of temperature load on the Framed Building.
- Comparative study of the RCC buildings with varying temperature loading.
- To study story displacement, Bending Moment, Shear Force, Joint Reactions various
- parameters due to application of varying temperature load.

II. METHODOLOGY

The behavior of multi-story frame under different temperature pressure was explored in this work the temperature loading about minimum and maximum of 0°C & 30^{0}C and 60^{0}C is being considered. An investigation of multi-story frame of G+5 Story's was performed. The study will be performed using Finite element method (ETABS) and the result will be compared.

III. MODELING AND ANALYSIS

The Symmetric structural parameters are considered for the analysis of the structure, the different Temperature load are considered in Model A and Model B and Model C.

Description of building

- Type of structure: Multi-storey RC frame Structure
- Number of stories: (G+5)

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- Intermediate storey height: 3m
- Grade of concrete and steel: M30 & Fe500
- Density of concrete: 25kN/m²

Member dimensions

- Beam Size: 400mm x 400 mm
- Column Size: 500mm x 500 mm
- Slab Thickness: 125 mm
- Wall Thickness: 200 mm
- Live Load: 3 kN/m²
- Floor finish Load: 1.5 kN/m²

Temperature Loads

- Model A: 0°C
- Model B: 30°C
- Model C: 60°C

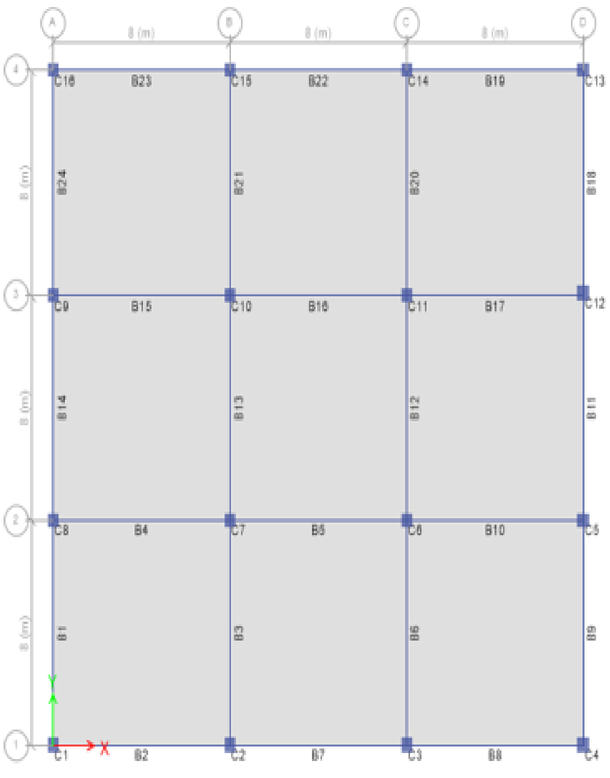

Figure 1: Plane view of G+5 building.

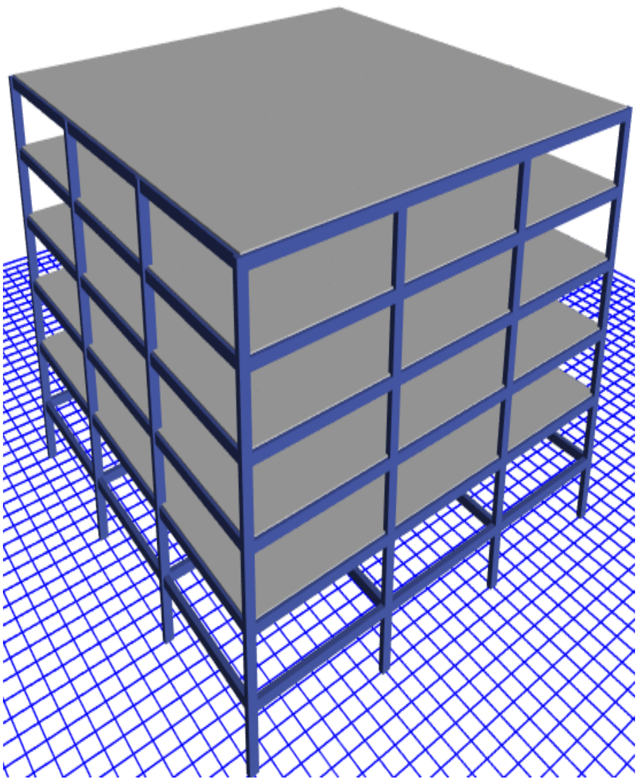

Figure 2: 3D view of building.

IV. RESULTS AND DISCUSSION

The Story displacement, Bending Moment, Shear Force for Model A, Model B and Model C with different Floor Level are accomplished in this chapter by assessing various scenarios like without temperature , 30^{0}C temperature and 60^{0}C temperature load effect. Parameters and Floors considered for comparing three models: Story displacement, Bending Moment and Shear force in:

1. Intermediate Floors
2. Footing Level
3. Exposed Columns and Beams
4. Intermediate Columns and Beams

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Displacement

The comparison of Story Displacement for Model A, Model B& Model C in both X&Y direction for the Symmetric Structure

Table 1: Story Displacement in X direction for the Symmetric Structures of Model A, Model B& Model C

Story	Model A	Model B	Model C
Terrace	8.3	9.06	11.6
4th Floor	6.3	5.9	5.5
3rd Floor	4.5	5.7	8.05
2nd Floor	2.8	2.3	2.5
1st Floor	1.3	1.09	1.13
Ground Floor	0.5	0.4	0.43
Base	0	0	0

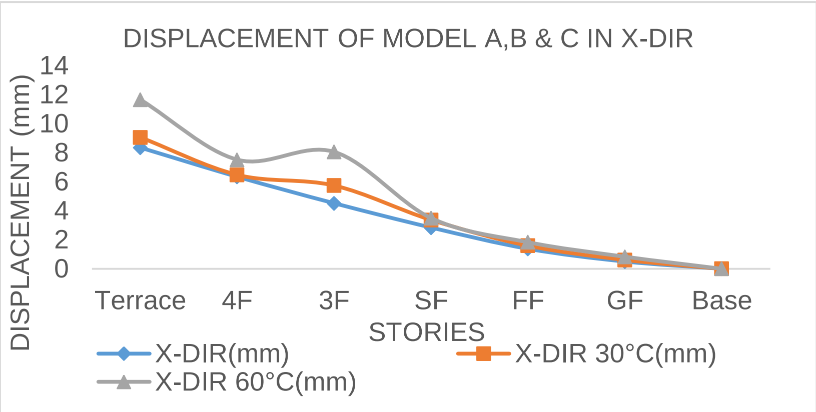

Figure 3: Comparison of Story Displacement in X direction for the Symmetric Structures of Model A, Model B& Model C

Table 2: Story Displacement in Y direction for the Symmetric Structures of Model A, Model B& Model C

Story	Model A	Model B	Model C
Terrace	2.2	4.1	6.3
4th Floor	1.7	1.5	1.63
3rd Floor	1.2	3.05	5.31
2nd Floor	0.7	0.68	0.7
1st Floor	0.3	0.3	0.3
Ground Floor	0.2	0.2	0.2
Base	0	0	0

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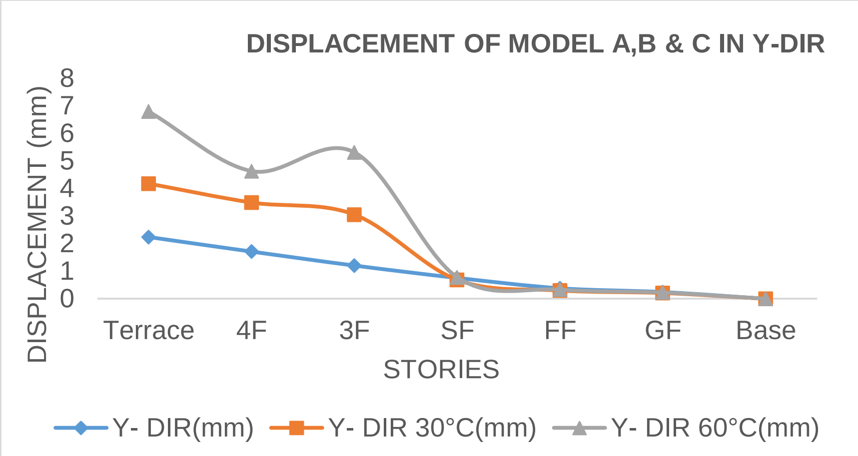

Figure 4: Comparison of Story Displacement in Y direction for the Symmetric Structures of Model A, Model B& Model C

Bending Moment and Shear Force for the Floors:

- **Intermediate Floors [Third Floor]**

The comparison of Bending Moment and Shear Force for the Symmetric Structure Model A, Model B & Model C in both X &Y direction is done For Exposed & Intermediate Column and Beam to the Third Floor

Table 3: Bending Moment of Columns to the Model A, Model B & Model C

Columns	Model A	Model B	Model C
C9 (A3)	230	187.8	391.81
C10 (B3)	40.54	14.62	69.34
C11 (C3)	50	16.28	63.21
C12 (D3)	109.04	183.72	380.77
C13 (D4)	144.76	100	315
C14 (C4)	16.77	5.07	75.42
C15 (B4)	31.75	7.7	73.5
C16 (A4)	115.2	97.52	314.6

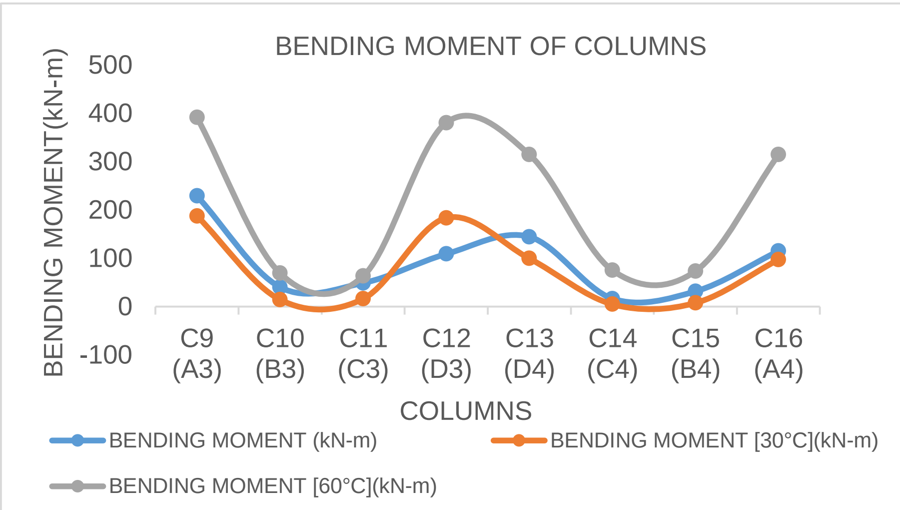

Figure 5: Comparison of Bending Moment for Columns to the Model A, Model B & Model C

Table 4: Bending Moment of Beams to the Model A, Model B & Model C

Beams	Model A	Model B	Model C
B15	217	170.35	172.15
B16	177	142.18	142.81
B17	285	170.61	172.72
B19	125.8	98.76	100.18
B22	107.12	84.34	85.48
B23	127.27	99	100.47

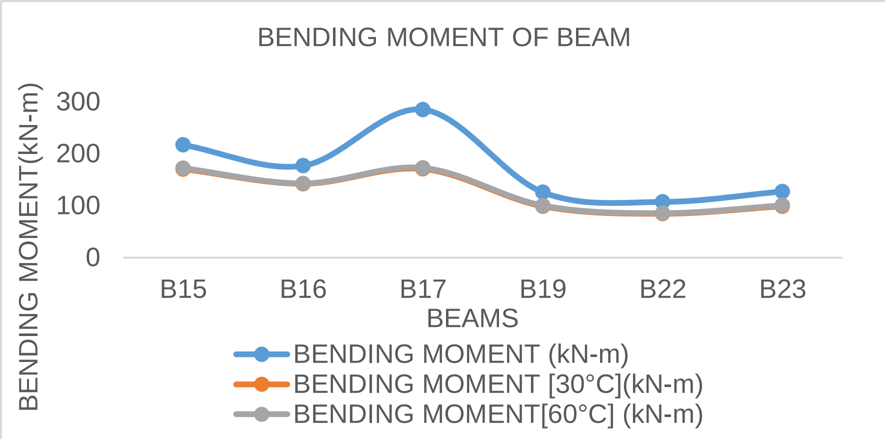

Figure 6: Comparison of Bending Moment for Beams to the Model A, Model B & Model C

Table 5: Shear Force of Beams to the Model A, Model B & Model C

Beams	Model A	Model B	Model C
B15	0.76	0.21	3.38
B16	0.3	0.1	2.9
B17	0.9	0.08	3.12
B19	2.69	0.6	16.58
B22	2.98	0.59	15.65
B23	2.64	0.59	15.7

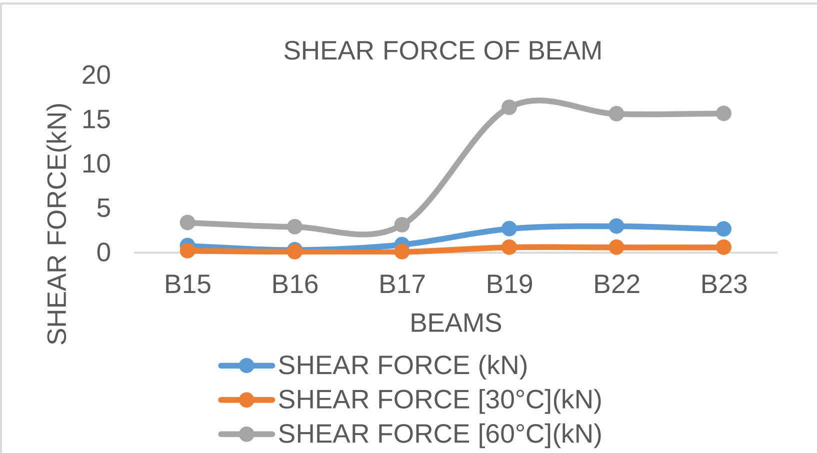

Figure 7: Comparison of Shear Force of Beams to the Model A, Model B & Model C

- **Footing Level**

The comparison of Joint Reactions for Model A, Model B& Model C is

Table 6: Joint reactions for Base of Force [Fz] and Moment [Mz] for Model A, Model B and Model C

joints	Model A		Model B		Model C	
	Fz	Mz	Fz	Mz	Fz	Mz
5	3824.3	0.42	3047.14	0.09	3083.85	0.098
6	6464	0.32	5175.4	0.011	5169.45	0.025
7	6788.04	0.26	5195.87	0.012	5212.88	0.025
8	3555.22	0.94	2775.8	0.065	2740.29	-0.045
9	2334.7	0.74	1838.53	0.02	1902.38	0.041
10	3851.1	0.67	3045.45	0.095	3070.03	0.10
11	3836.63	0.41	3045.63	0.06	3070.94	-0.035
12	2278.93	0.6	1816.11	0.019	1844.8	0.041

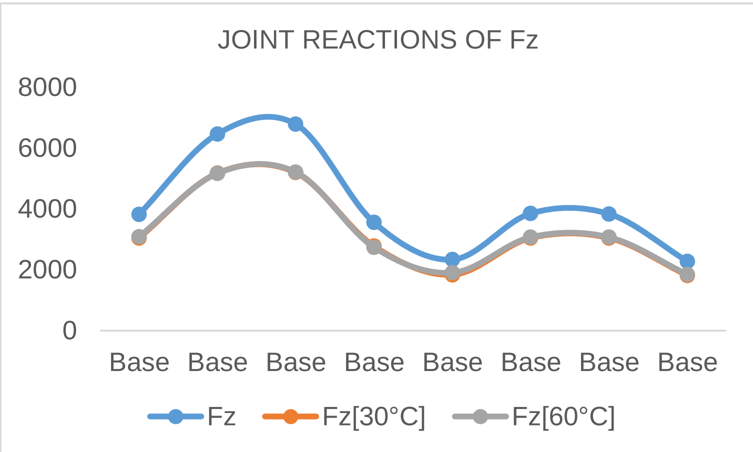

Figure 8: Comparison of Joint Reactions to the direction Force [Fz] for Model A, Model B and Model C

- **Exposed Columns and Beams**

The comparison of Bending Moment and Shear Force for the Symmetric Structure Model A, Model B & Model C in both X&Y direction is done For Exposed & Intermediate Column and Beam to each Floor.

Table 7: Bending Moment for Beams to the Model A, Model B &Model C

Story	Model A		Model B		Model C	
	B19	B22	B19	B22	B19	B22
Terrace	110.2	139.5	92.64	115.8	105.64	86.26
4th Floor	103.4	121.5	84.74	96.96	99.6	86.14
3rd Floor	107.1	125.8	84.34	98.76	100.18	85.48
2nd Floor	106.4	124.5	84.44	98.3	93.4	80.63
1st Floor	106.2	125.8	84.4	99.73	101.25	85.54
Ground Floor	57.63	58.51	42.77	43.93	46.35	45.63

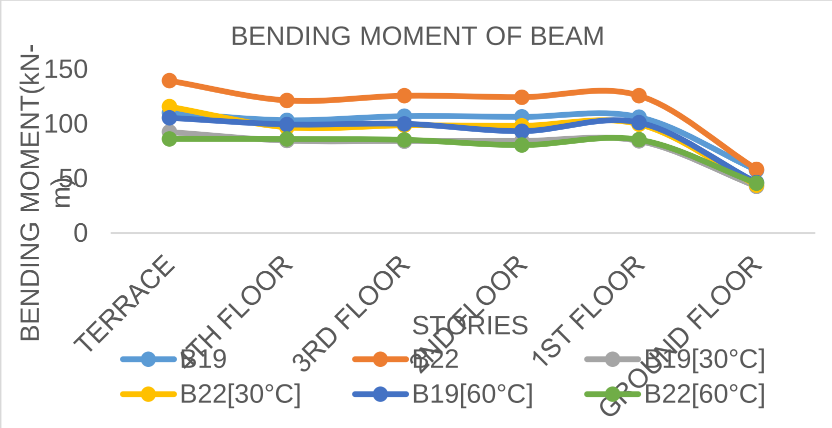

Figure 9: Comparing Bending Moment for Beams to the Model A, Model B &Model C

- **Intermediate Columns and Beams**

The comparison of Bending Moment and Shear Force for the Symmetric Structure Model A, Model B & Model C in both X&Y direction is done for Intermediate Column and Beam to each Floor.

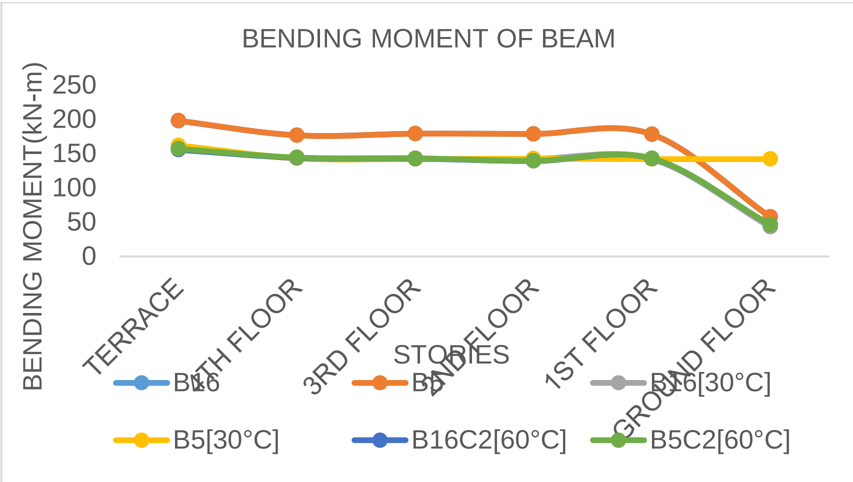

Figure 10: Comparison of Bending Moment for Beams to the Model A, Model B &Model C

V. CONCLUSION

The objective of the present work is to study the thermal effect in RCC framed structure by varying the temperature from Model A[without Temperature], Model B[with 30^{0}C Temperature] to Model C[with 60^{0}C Temperature]. Here the response of the structural parameters is studied and compared. From the results of ETABS and based on the results and observation from the previous chapter, the following conclusions are made,

- Story Displacement is maximum for Model C, when compared to Model A and Model B in both X and Y direction.
- For Intermediate Floor Bending Moment for column Model C is Maximum, Bending Moment for Beams Model A is More and the Shear Force for Beam Model C is grater when compared to each Model B and Model C and Model A
- Joint Reaction in Base for Force [Fz] direction and Moment [Mz] direction Model A is more Compared to Model C and Model B
- For Exposed Column and Beam Bending Moment for column Model C is Maximum, Bending Moment for Beams Model A is More and the Shear Force for Beam Model C is grater when compared to each Model B and Model C and Model A
- For Intermediate Column and Beam Bending Moment for column Model C is Maximum, Bending Moment for Beams Model A is More and the Shear Force for Beam Model C is grater when compared to each Model B and

Model C and Model A

VI. SCOPE FOR FUTURE STUDY

1. The study may further be carried out my applying seismic zones
2. Analyze the building with Steel Structure
3. Development of a city to deal with Temperature and environmental challenges

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