IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"STRUCTURAL DESIGN AND COMPARATIVE STUDY OF RCC BUILDING ON PTSLAB & FLAT SLAB BUILDING UNDER THE DYNAMIC ANALYSIS"

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Abstract: Precast concrete is well known technology in which some Standardized units which are manufactured in factories are used for fast Construction. Though the technology is developed many years ago but the Implementation is not up the mark in our country. In this study we have carried out detailed study of various concepts of precast, go through number of Literature & found the facts associated with it. Existing reinforced concrete Structures stock is wide and also includes buildings with precast elements, being largely used since Fifties primarily to satisfy needs of the manufacture and tertiary purposes. Their diffusion has been supported by flexibility of structural net dimensions and by the economy and efficiency of the constructional process. For this purpose, a reference project at Chennai location is taken and modelled in SAP2000 software to analyses the structure and design.

Keywords– Design, Dynamic Analysis, PT Slab, Flat Slab, Prefabricated Structure, SAP2000

1. INTRODUCTION

Precast concrete processes are popular due to increased quality control, less waste, and speedier construction. Weakest link: precast joints. Mechanically attaching structural components uses bolts, welds, anchors, reinforcing steel, grout, and concrete. Structure connections must strengthen structural integrity. They transfer forces between system components to provide structural interaction. Researchers studied PCC beam–column junction load distribution and behavior. Connection type affects constructability, stability, strength, flexibility, and residual forces. PCC member connections are built for different loads. Researchers can analyze and generate accurate connections under different loads.

Precast concrete is fast and high-quality. Precast concrete is used to build car parks, commercial, cultural, hotels, dorms, apartment complexes, bridges, and industrial buildings. Beam-to-column connections govern precast concrete structures' structural performance. In prior earthquakes, faulty design, detailing, and manufacturing of the joints devastated precast concrete structures. Researchers believe weak connections are the main cause of earthquake damage.

Massive wall and floor concrete panels are linked vertically and horizontally to create room areas. A bond-like panels; panels resist gravity. Precast frames can be made with linear parts or beam- column sub-assemblages. Connecting faces between precast beam- column sub-assemblages can be far from crucial frame areas.

however linear elements are often preferred due to the difficulty of producing, handling, and erecting spatial parts. Shear walls withstand lateral loads, while slab-column structure resists gravity loads. This category includes two systems: Load-bearing columns and slabs are prefabricated in a lift slab system with walls. Two floors tall; precast structural parts have special joints. Slab-column pre-stressed Continuous horizontal pre-stressing in two orthogonal directions to-3-story precast columns. The column spans are reinforced concrete. Precast System Type

Precast systems are classified according to the load bearingstructure:

- Frame systems
- Slab column systems with wall
- System mix
- Precast Slabs
- Precast Beams and Girders
- Precast Columns
- Precast Walls
- Precast Stairs

Initially, precast parts are all designed and sized similarly. All floors' slab designs and drawings should be similar. Beams, columns, stairways, and railway sleepers are similar. Initial investment is needed for structure. If a factory makes several similar parts, the investment is less. The government should provide affordable land so the initial cost of building the pre-cast factory is lowered and the owner makes a profit, boosting the country's economy. Commercial and public sectors should organize workshops or training programs to train individuals or labor to solve difficulties arising from an untrained workforce for various phases of the activity. Good road access; site space Less traffic before building begins, site layout must be finalized. It should be well-planned and have enough space to store erected pieces. Plan the site layout. Light concrete is used to lighten precast parts.

New approaches and technologies have boosted the construction industry. Precast concrete is a cost-effective, quality-controlled procedure used in several nations. The safe, productive, and excellent environment; design and planning must be linked to improve and speed up building.

2. METHODOLGY

- Study for literature review survey
- To study the construction techniques of precast and traditional method we have gone through various research papers, books, and some field works
- Building design using Static Linear Analysis.
- Dynamic analysis using SAP2000 software
- Study of prefabricated structure and all parameters

    1) Story drift
    2) Story acceleration
    3) Overturning Moment
    4) Story displacements
    5) Axial force
    6) Base shear

- Analysis result
- Result and discussion
- Conclusion

DESIGN AND MODELLING

- All model design for response spectrum analysis
- Material properties
- M40 FE500
- Beam 300x600, beam 350x675mm
- Col 500x500
- Col 450x450

- Study for literature review survey to study the construction techniques of precast and traditional methodwe have gone through various research papers, books, and some field works
    - Building design using Static Linear Analysis.
    - Building plan using AutoCAD
    - Dynamic analysis using SAP 2000 software
    - Study of prefabricated structure and all parameters

1. Base Reaction
2. Base vertical Reaction
3. Time Period
4. Base shear

Material Properties and Load

- Grade of concrete M-40
- Grade of steel Fe500

Model Description

- **Load pattern**
- Method of analysis – non-linear static analysis (responsespectrum analysis)
- Dead load
- Live load
- Super dead load
- Earthquake x dire (IS 1893:2002)
- Earthquake y dire (IS 1893:2002)
- Seismic Zone = Zone – III
- Wind Zone = Zone – V

For regular Structure

- Frame properties
- Beam 250mm x 450mm
- Column 250X 500mm
- Slab thick 150mm

For Flat Slab

- Col 400mm X 400mm
- Slab 250mm

PT slab model

- Tendon dia 300mm
- Beam 250mm x 450mm
- Column 250X 500mm
- Slab thick 150mm

Load Combinations

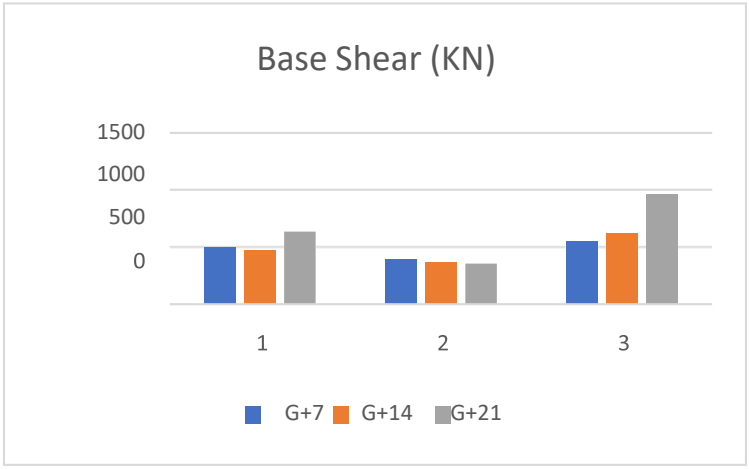
- 1.2DL+1.6LL
- 1.2DL+LL+EQx/y
- 1.2DL+LL-EQx/y
- 1.2DL+LL+EQx/y
- 1.2DL+LL-EQx/y
- 0.9DL+EQx/y
- 0.9DL-EQx/y
- 1.2DL+LL+Rsx/y
- 1.2DL+LL-Rsx/y
- 0.9DL+Rsx/y
- 0.9DL-Rsx/y

3. RESULT &DISCUSSION

1. Building Analyses

Table1.1: Base Shear for RCC, Flat, and PT

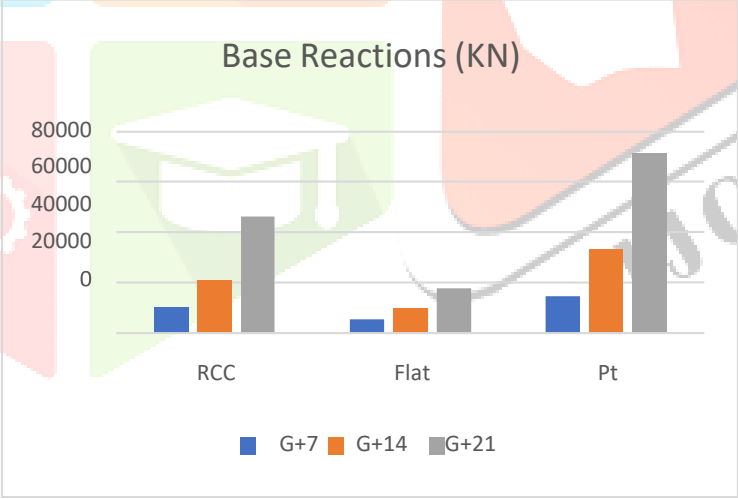
	BASE SHEAR (KN)		
TYPE	**RCC**	**FLAT**	**PT**
G+7	496.023	391.294	549.57
G+14	466.55	365.85	621.607
G+21	631.683	355.96	962.15



Graph 1.1 Base Shear for RCC, Flat, PT

Table 2 Base Reaction

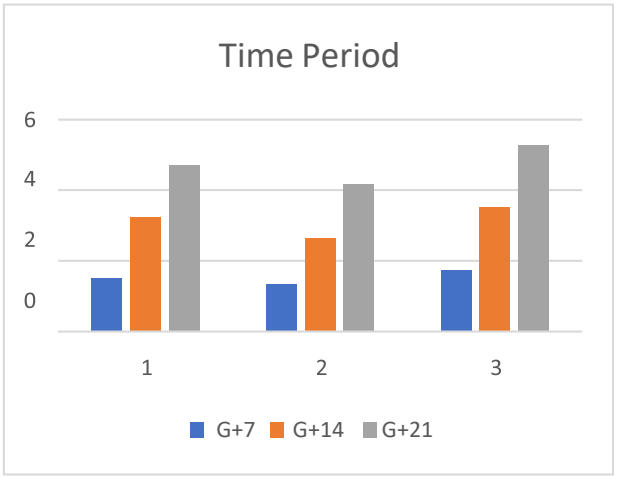
	BASE SHEAR (KN)		
TYPE	**RCC**	**FLAT**	**PT**
G+7	10377.72	5426.944	14589.72
G+14	20755	10033.77	32973.63
G+21	46295	17852.22	71451.95



Graph 1.2 Base Reaction

The graph1.2: The maximum base reaction for PT slab continuously increasing for G+7, G+14 and G+21 in the three models it can show the above graph. The base reaction is around 44% increases as compare to the RCC slab structure. And the 70% increases as compared to Flat slab structure.

	Time period (Sec)		
TYPE	**RCC**	**FLAT**	**PT**
G+7	1.5217	1.3329	1.7476
G+14	3.25	2.6586	3.5213
G+21	4.1793	4.17	5.28

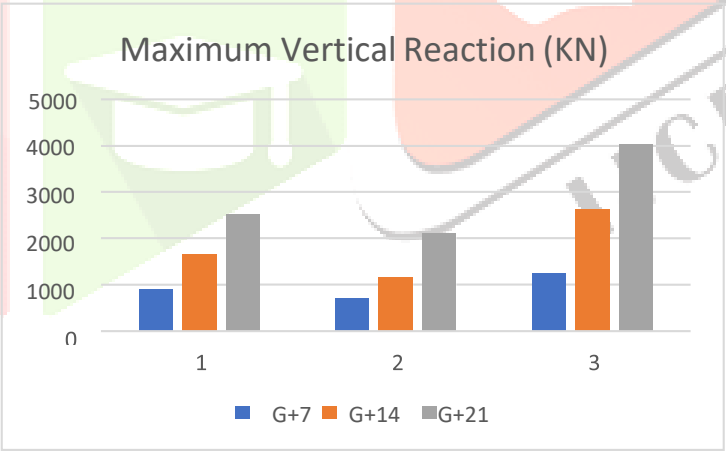


Graph 1.3 G+7 Time Period (Sec)

The Graph1.3: the time period is increases for the PT slab structure as compared to the RCC slab and Flat slab is shown in the above graph.

Table 1.4 Maximum Vertical Reaction

TYPE	RCC	FLAT	PT
G+7	904.81	698.61	1246.25
G+14	1648.85	1143.96	2629.78
G+21	2515.23	2098.56	4039.65



Graph 1.4 Maximum Vertical Reaction

The Graph1.4: The above graph shows that the maximum vertical reaction (KN) for PT slab is increases for all G+7, G+14 and G+21 it almost 35% and 70% as compare to RCC slab and Flat slab structure.

4. CONCLUSION

- In comparison of the conventional R.C. building to flat slab building, the time period is more for conventional building than flat slab building because of monolithic construction.
- The above graph shows that the maximum vertical reaction (KN) for PT slab is increases for all G+7, G+14 and G+21 it almost 35% and 70% as compare to RCC slab and Flat slab structure.
- The maximum base reaction for PT slab continuously increasing for G+7, G+14 and G+21 in the three model it canshow the above graph. The base reaction is around 44% increases as compare to the RCC slab structure. And the 70%increases as compared to Flat slab structure.
- The Dead load of PT slab structure is increased by 20% and38% as compared to RCC and Flat slab structure.
- As a result, because the concrete required and the cost of steel required are substantially lower in the case of PT slab construction than in the case of R.C.C, Flat Slab construction,it is more economical to construct the structure evaluated with PT Slab than with

R.C.C and Flat Slab

- The time period will be maximum at mode 1, 2 and 3. Aftermode 3, time period will reduce drastically.
- Flat slab structures are the best solution for high rise structure as compared to conventional slab structure. And post tension slab

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