Detailed Analysis And Design of Slab Wall System & Column Beam Method

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Abstract

Construction is one of the significant sectors of Indian economy and is an integral part of the development. Today India's urban population is the second largest in the world and its future development leads to increased demand for housing to cope with this problem India should desperately need to plan for acquisition of land and rapid creation of dwelling units. Construction is a complex process involving basically the areas of Architectural planning, Engineering & Construction. There is growing realization today that speed of construction needs to be given greater importance especially for large housing projects. This is not only essential for the faster turnover of equipment and investment – leading possible to the reduction in the housing cost but also for achieving the national objective of creating a large stock to overcome shortest possible time. Fortunately, some of the advanced technologies catering to faster speed of construction are already available in the country. For e.g. Prefabrication, autoclaved blocks, slab-wall system of construction etc. This thesis describes the detailed analysis and design of slab-wall system and column-beam system in concrete building. At present construction the typical floor plan in a structural system of high raised concrete building's can be easily done by slab-wall form compared to column-beam system and the behavior of the building under gravity and lateral loads is analyzed by using STAAD. Pro V8i software for G+8 building. Comparisons with analytical results show that high base shear and deformation in column-beam system than slab-wall system in concrete building.
Keywords: STAAD, Concrete, Construction, PREFABRICATION, G+8.

I. INTRODUCTION

Now a day's Indian population is getting increased day by day and second largest country in the world regarding population. Future development leads to increased demand for housing; to overcome this India desperately need to plan for acquisition of land and rapid creation of dwelling units. The progress made by the construction industry of any country could be considered as the index of development of that country.

The traditional mode of construction for individual houses comprising load bearing walls with an appropriate roof above or reinforced concrete framed structure construction with infill masonry walls would be totally inadequate for mass housing construction industry in view of the rapid rate of construction. Further, such constructions are prone to poor quality control even in case of contractors with substantial resources and experience.

For undertaking mass housing works, it is necessary to have innovative technologies which are capable of fast rate construction and are able to deliver good quality and durable structure in cost effective manner. Several systems are adopted at different places in the world; eventually the systems which are reasonably economical and easy for operation with skilled labor are useful in India. Certain systems are in vogue and more and more contractors are trying to bring in new technologies.

Structural design in an art of science of designing, with economy and elegance, a safe serviceable and durable structure. The process of designing commences with the planning of the structure, primary to meet the functional requirements of the user. The requirements delivered by the client may not be well defined and may be vague also but it is the work of the designer to understand the needs and design the structure accordingly. The functional requirements and economy of the structure for its intended use over the life span of the structure are intended to by the structural designer.

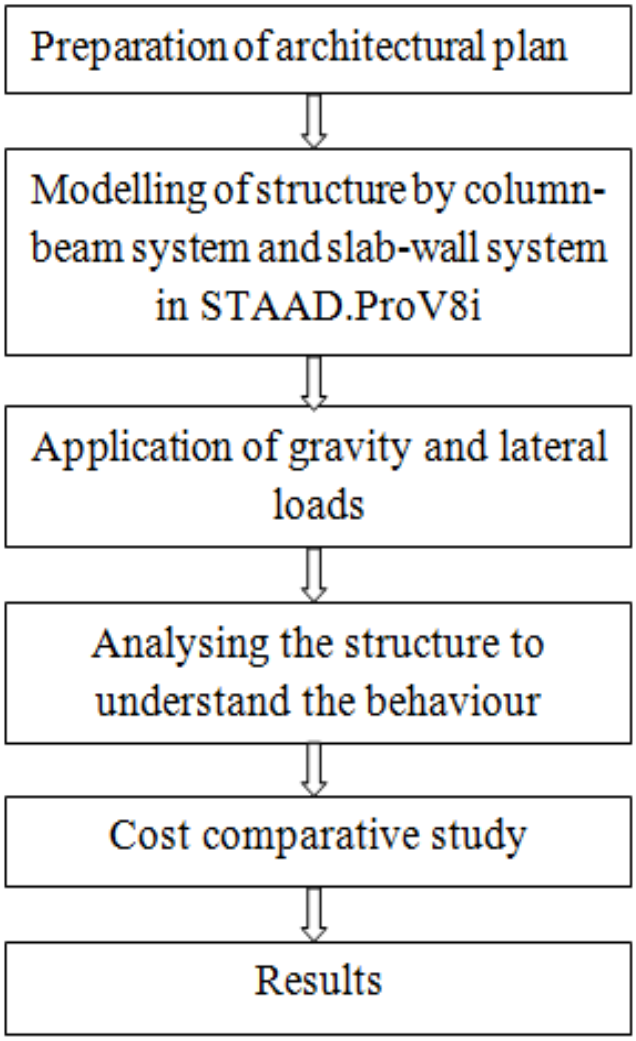
II. METHODOLOGY

Slab-wall system buildings are built in many countries such Japan, Italy and other countries. The main components of this system are walls and flat plate slabs, where in-situ concrete is poured into two half-box forms to shape loading walls and floor

slabs simultaneously. Generally in 24hrs, residential units can be rapidly built up. For this reason, slab-wall system buildings are an attractive system for medium high-rise buildings having respective plan. The loading in slab-wall system is transferred from slabs to walls. In slab-wall system the dead load is less compared to column-beam system.

In slab-wall system the casting of whole structure and transverse walls done in a continuous operation, using controlled concrete mixers obtained from central batching, mixing plants and mechanically placed through concrete buckets using crane and compacted in leak proof moulds using high frequency vibrators. In this system, the walls and floors are cast together in one continuous operation in matter of few hours and in built accelerated curing overnight enable removal and re-use of forms on daily cycle basis. The Room Sized wall panels and the ceiling elements cast against steel plates have smooth finishing and the interiors have neat and clean lines without unsightly projections in various corners. The walls and ceilings also have smooth even surfaces, which only need color or white wash. Textured or pattern colored concrete facia can be provided; this will need no frequent repainting. The efficiency in slab-wall system is around 87.5% (useful carpet area as % of plinth area)

Cement used in this system is more than that used in column-beam system and Steel requirement is more, as it is required for the shear wall construction. But shear wall construction increases. The walls and ceiling being smooth and high quality concrete repairs for plastering and leakage's are not at all required frequently. In slab-wall system the maintenance cost is negligible



For this thesis, M30 grade concrete was used. The grade of steel used for main reinforcement is Fe500 and shear reinforcement is Fe415.

A. COLUMN-BEAM SYSTEM CONCRETE BUILDING

1) *BUILDING MODELLING FOR ANALYSIS*

The column-beam system building is modelled in STAAD. Pro as a space frame.

2) *LOADS ON BUILDING*

Dead loads are calculated on the basics of unit weights of materials specified for construction.

3) *PRIMARY LOADS*

a) SELF WEIGHT

Self-weight of the RC columns and beams are calculated automatically based on the geometry by the software and is included in the analysis.

Direction	*Column-Beam (mm)*	*Slab-Wall (mm)*	*% Variation*
EQ-X	*36.24*	*1.29*	*27*
EQ-Z	*50.4*	*1.6*	*30*
WL-X	*7*	*1.23*	*5*
WL-XN	*7*	*0.3*	*22*
WL-Z	*10.62*	*0.43*	*24*
WL-ZN	*10.62*	*0.43*	*24*

III. RESULTS AND DISCUSSIONS

With reference to the above mentioned slab-wall system and column-beam system analysis results are presented and compared in the Table 6.1 and 6.2.

Table - 6.1
Base Shear Values For Column-Beam System And Slab-Wall System Concrete Building

Direction	*Column-Beam (kN)*	*Slab-Wall (kN)*	*% Variation*
EQ-X	*2553.75*	*1804.58*	*41*
EQ-Z	*2516.75*	*1778.41*	*41*

Table - 6.2
Maximum Displacement Values For Column-Beam System And Slab-Wall System Concrete Building

The below graphs shows that the deformation variation from ground floor to top floor level in slab-wall system and column-beam system concrete building. Values for the below graphs are tabulated in Appendix-A.

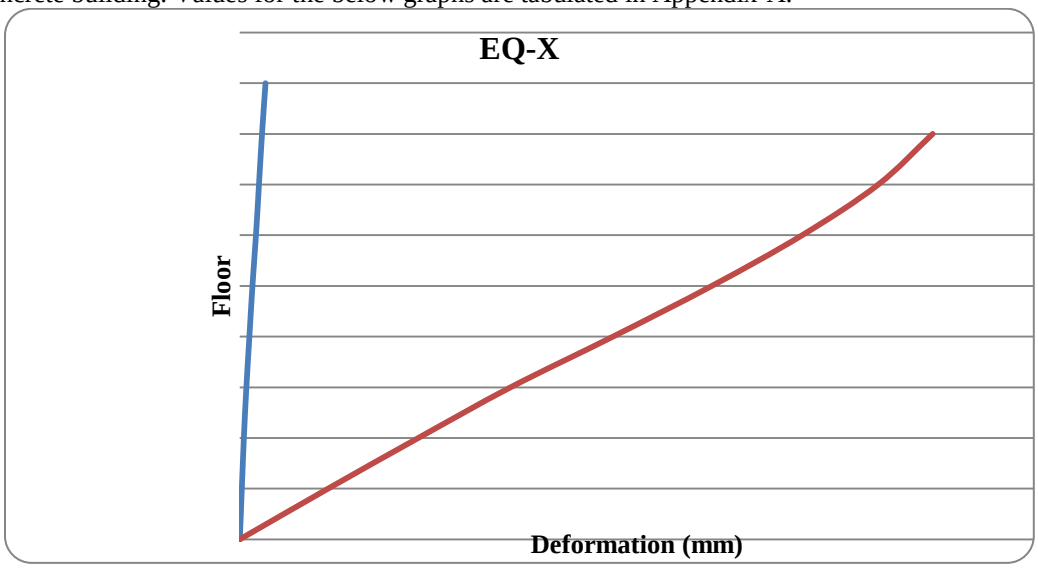


Fig. 6.1: Comparison of Displacement In EQ-X Direction

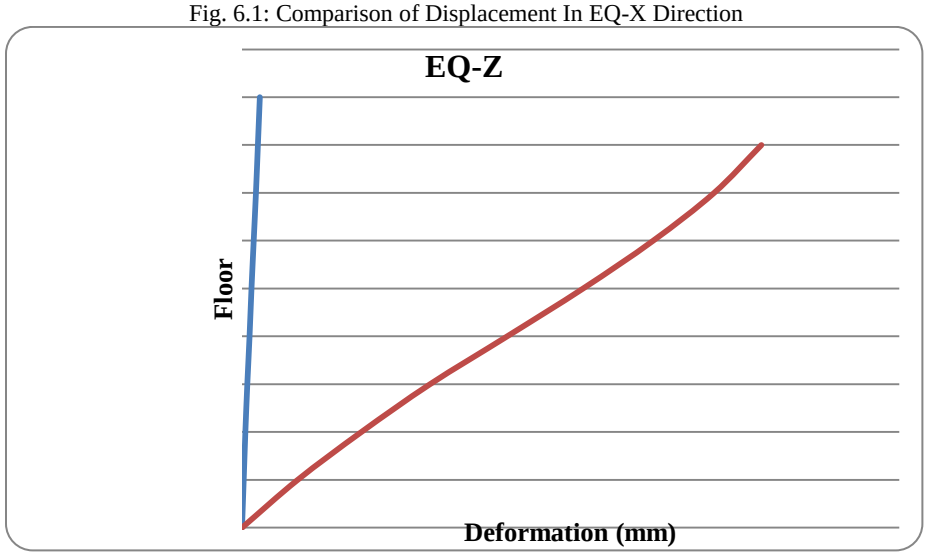


Fig. 6.2: Comparison of Displacement In EQ-Z Direction

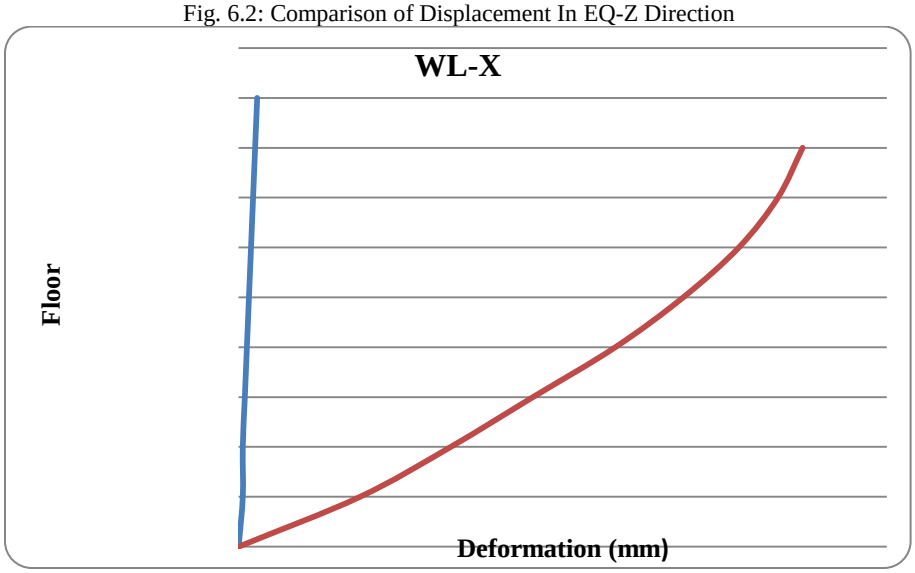


Fig. 6.3: Comparison of Displacement In WL-X Direction

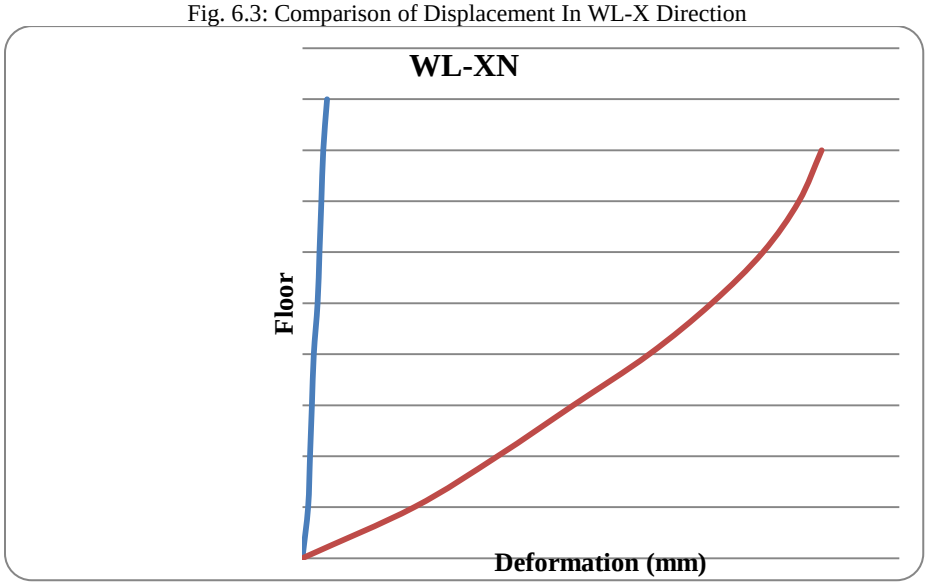


Fig. 6.4: Comparison of Displacement In WL-XN Direction

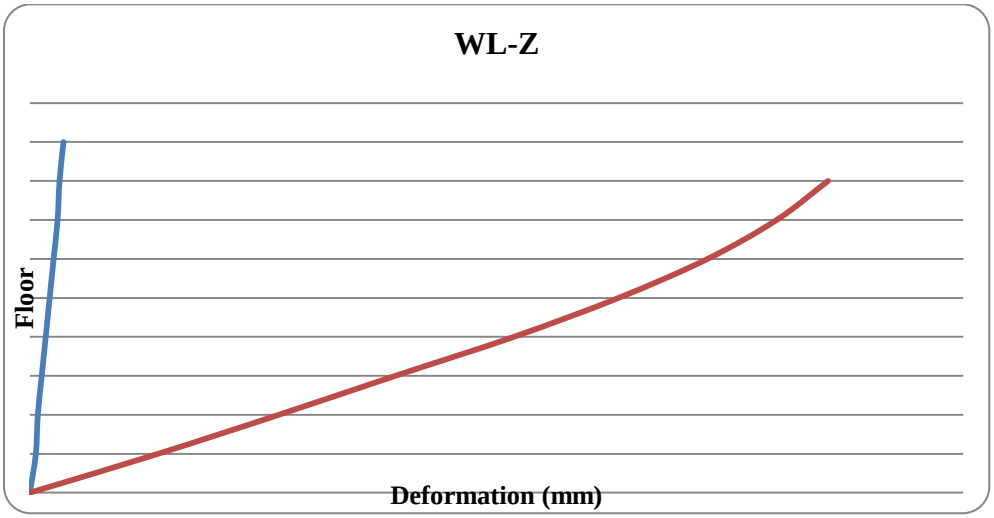


Fig. 6.5: Comparison of Displacement In WL-Z Direction

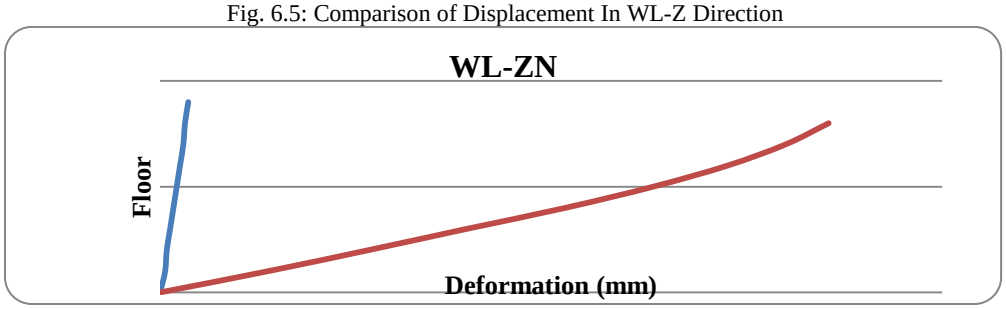


Fig. 6.6: Comparison Of Displacement In WL-ZN Direction

Table - 1

Deformations (Mm) In EQ-X Direction

Floor	*Slab-Wall*	*Column-Beam*
1	*0.1016*	*0.445*
2	*0.2032*	*8.9916*
3	*0.3302*	*13.6398*
4	*0.4826*	*18.796*
5	*0.635*	*23.7744*
6	*0.8128*	*28.321*
7	*0.9652*	*32.1564*
8	*1.1176*	*34.8996*
9	*1.2954*	*36.2458*

Table - 2

Deformations (Mm) In EQ-Z Direction

Floor	*Slab-Wall*	*Column-Beam*
1	*0.1524*	*5.08*
2	*0.3048*	*10.8966*
3	*0.4826*	*17.1704*
4	*0.6858*	*24.2062*
5	*0.8636*	*31.1404*
6	*1.0668*	*37.5412*
7	*1.27*	*43.1038*
8	*1.4478*	*47.4218*
9	*1.6256*	*50.4444*

Table - 3

Deformations (Mm) In WL-X Direction

Floor	*Slab-Wall*	*Column-Beam*
1	*0.0508*	*1.4986*
2	*0.0508*	*2.6162*
3	*0.0762*	*3.6322*
4	*0.1016*	*4.6482*
5	*0.127*	*5.4864*
6	*0.1524*	*6.1722*
7	*0.1778*	*6.6548*

8	*1.2032*	*6.9596*
9	*1.2286*	*7.0358*

Table - 4
Deformations (Mm) In WL-XN Direction

Floor	*Slab-Wall*	*Column-Beam*
1	*0.762*	*1.4986*
2	*0.1016*	*2.6162*
3	*0.127*	*3.6322*
4	*0.1524*	*4.6482*
5	*0.2032*	*5.4864*
6	*0.2286*	*6.1722*
7	*0.254*	*6.6548*
8	*1.2794*	*6.9596*
9	*1.3302*	*7.0358*

This study deals with the analytical investigation of a structure subjected to gravity and lateral loads. Based on the results the following conclusions are drawn.

- The base shear of column-beam system is more than slab-wall system.
- The reduction in displacement of about 30% is achieved using slab-wall.
- Reduction in displacement shows the capacity of slab-wall system in resisting earth quake loads than the column-beam system, thereby minimizes the damage.

Slab-wall system gives least cost for construction of high raised building

IV. FUTURE SCOPE

- To study the behavior of the building under gravity and lateral loads.
- Cost comparison.
- To model a G+8 RCC residential building by using STAAD.ProV8i software for wall-slab system and column-beam system

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