

Comparative Study of a Post Tensioned Flat Slab with Post Tensioned Voided Flat Slab

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Abstract

In developing countries like India, the use of post-tensioning method due to its various applications has been increasing day by day. Also, the Post-tension flat slab construction has long been popular for medium to high rise building such as office buildings, hospitals, residential buildings, university, and parking buildings. In the present study, a commercial office building has been selected to perform a parametric study. Various slab system i.e. RC slab with RC beam, Post tensioning flat slab with drop panel and Post tensioning flat slab without drop panel with Post-tensioning voided flat slab have been studied to compare their performance. Various parameters, such as thickness of slab, grade of concrete, punching shear, column size etc. have been selected for the present study to arrive at the best suitable slab system using ADAPT BUILDER 2015 Software.

Keywords: Prestressed Concrete, Flat Slab, Post Tensioning, PT Voided Slab.

INTRODUCTION

Post-tensioning slab:

Post-tension flat slab construction has long been popular for medium to high rise building such as office buildings, hospitals, residential buildings, university, and parking buildings. Prestressed concrete flat slab system are suitable for floor and roof construction of industrial buildings where the loads to be supported are of higher order and the uninterrupted floor space is desirable, for which reason longer spans between the supporting elements are required. Behavior of reinforced concrete member and behavior of post tensioned member under service load is as shown in figure 1 and figure 2.

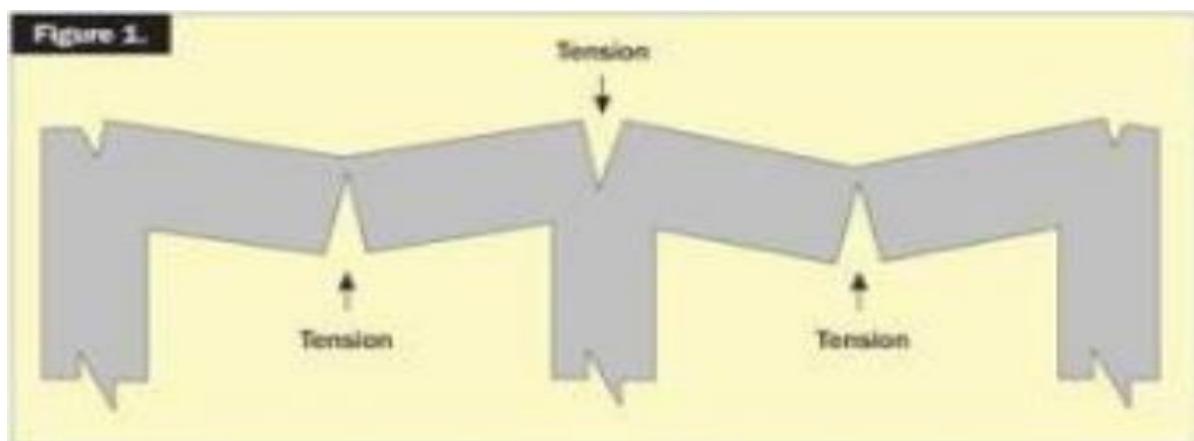


Fig.1: Behavior of RC Member

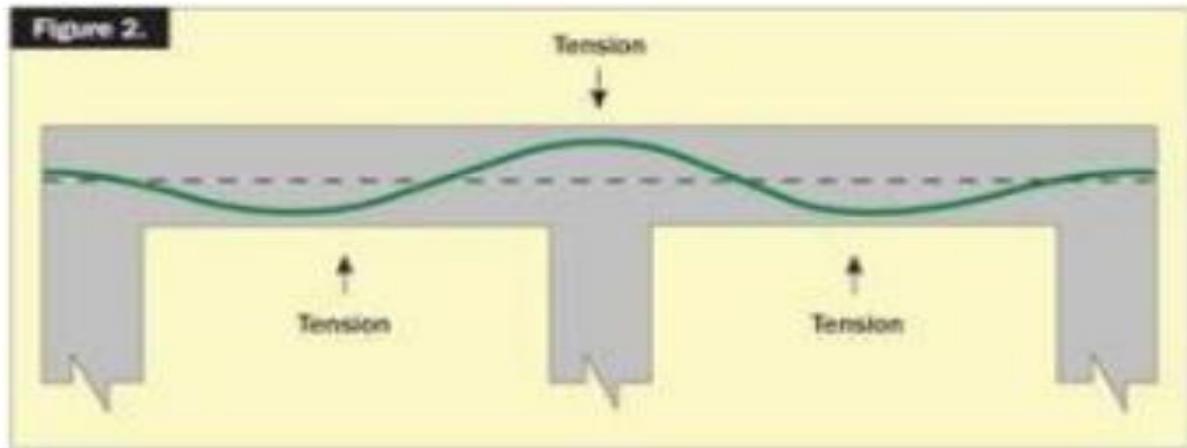


Fig.2: Behavior of PT Member

Flat slab:

Flat slab is reinforcing concrete slab supported directly by concrete column without using beam. Flat slab are one of the most popular system used in various types of building, parking and many other structure where the clear floor to floor height is more require.

Voided slab:

The concept of bubble-voided flat slabs involves placing hollow recycled plastic shapes (typically spherical) in-between two layers of rebar, in the middle of a concrete slab. Due to the replacement of concrete with air, the slab will have a lower dead load and therefore a higher allowable span – up to 18m without using beams. The act of replacing concrete portions in the slab with plastic air bubbles will decrease the amount of concrete used, saving money and resources, as well as lighten the entire structure. Due to this smaller dead load, the columns and foundation will also decrease in size.

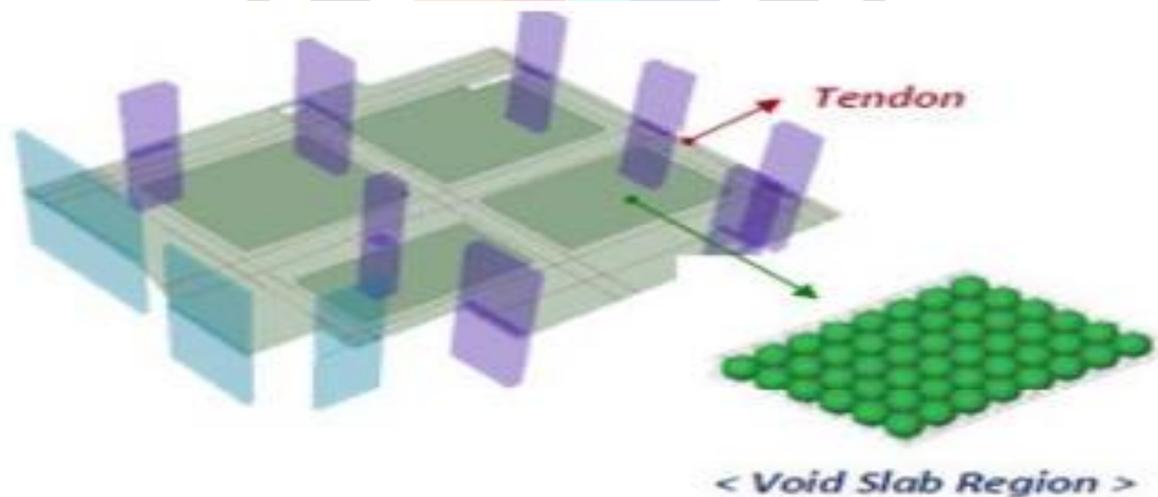


Fig.3: PT Voided Flat slab

Many researcher and authors have presented their views for analysis and design of post-tensioning slab.

Objective of Study:

The motto of the present study is to the analysis and design of the post-tensioned flat slab with drop panel and post tensioned voided slab by using the ADAPT BUILDER 2015.

Problem Statement:

To analyse and design Post-tension voided flat slab and compare with PT slab with drop panel along with difference parameter like, punching shear, deflection, stresses, Column section type and cost by using ADAPT Builder 2015.

Input Parameters:

Content	PT Flat Slab With Drop Panel	Voided Slab With Drop Panel
Full Slab dimension	54 m x 54 m	54 m x 54 m
Each Panel dimension	12m x 12m	12m x 12m
Slab thickness	275 mm	250 mm
Column size	750 mm x 750 mm	750 mm x 750 mm
Column c/c distance	12 m	12 m
Drop panel dimension	4000 mm x 4000 mm x 250 mm	2000 mm x 2000 mm x 150 mm
Voided slab panel	-----	8m x 8m
Dead load	2 kN/m ²	2 kN/m ²
Live load	5 kN/m ²	5 kN/m ²
Concrete grade & Steel grade	M40 & Fe500	M40 & Fe500
Tendon material property	fpu: 1860 MPa fpy: 1700 MPa Eps:200000 MPa	fpu: 1860 MPa fpy: 1700 Mpa Eps:200000 MPa

Analysis and Design Different Slab System in ADAPT BUILDER 2015.

In this present study, two models were generated for analysis and design purpose and compare the result of this model. In both the model by using finite element analysis method. Here, design of Post – tensioned flat slab system is designed by the using load balancing method in ADAPT Builder 2015 software. And check for deflection and top and bottom stresses are calculated by the finite element analysis method in ADAPT Builder 2015 software.

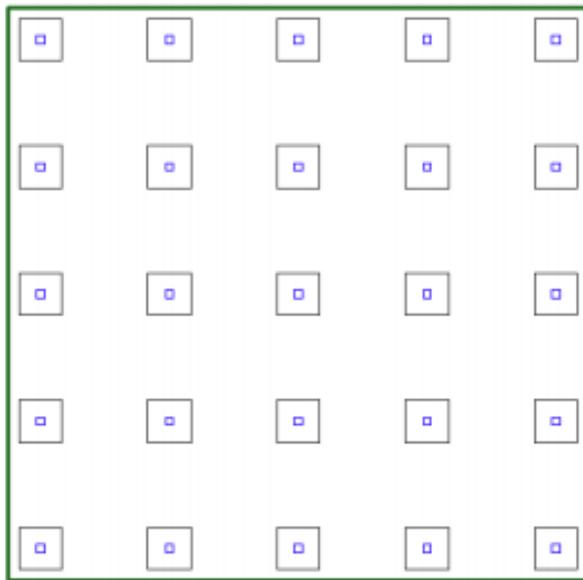


Fig.4: PT Flat slab with drop panel

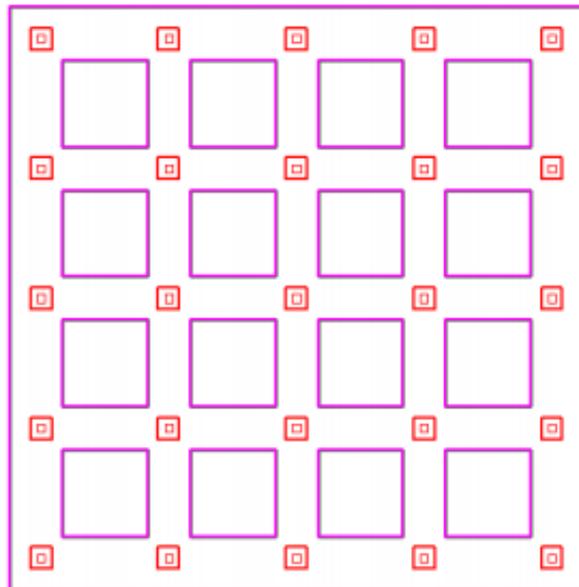


Fig.5: PT voided slab with drop panel

CONCLUSION:

1. Self-weight of voided slab is less compare with solid slab, so by providing 35% voided portion into solid slab, deflection can be reduce up to 19%.
2. Punching shear is major problem in flat slab system by providing voided flat slab system punching shear reduce up to 23%.
3. Numbers of tendons are less required for control deflection and stress in voided slab compare than Solid flat slab.
4. By provided voided slab 35%, self-weight of slab is reduced up to 13%.

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