Behaviour of Post Tension Beam under Combined Bending & Shear

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Abstract-*To study the influence of geometric parameters on the maximum tensile strain that can be developed in a mild steel plate before breakdown of the adhesive layer or failure of the concrete member. No failures occurred in the epoxy adhesive, and strains exceeding yield could be developed in the plates, but the stress concentration at the end of each plate caused cracking at low loads, followed by failures of some of the concrete members in combined shear and tension at loads of about half the expected strengths of these regions.*

Keywords-PGA, Partially prestressed, Fully prestressed, T-shaped, Steel fibers, Polypropylene fibers, Cracks-width, Flexural strength

I. INTRODUCTION

It is a concrete construction material which is placed under compression prior to it supporting any applied loads (i.e. it is "pre" stressed). A more technical definition is "Structural concrete in which internal stresses have been introduced to reduce potential tensile stresses in the concrete resulting from loads." This compression is produced by the tensioning of high strength "tendons" located within or adjacent to the concrete volume, and is done to improve the performance of the concrete in service. Tendons may consist of single wires, multiwire strands or threaded bars, and are most commonly made from high-tensile steels, carbon fibre or aramid fibre The essence of prestressed concrete is that once the initial compression has been applied, the resulting material has the characteristics of high-strength concrete when subject to any subsequent compression forces, and of ductile high-strength steel when subject to tension forces. This can result in improved structural capacity and/or serviceability compared to conventionally reinforced concrete in many situations.

Ground motion is the movement of the earth's surface from blasts or earthquakes. It is generated by waves that are produced by sudden pressure at the explosive source or abrupt slip on a fault and go through the earth and along its surface. In this chapter, the characteristics of the six ground motions, which are used for the time-history analysis of the RC buildings, are explained. Then, a brief description is given for linear time-history analysis. The motion of sufficient strength that effects people and environment is called strong ground motion. It is described by three transitions and three rotations. The effect of the three rotations is very small which may be neglected. The maximum absolute value of the ground acceleration is peak ground acceleration (PGA). PGA, frequency content and duration are the most important characteristics of earthquake.

A. Objectives

1. To check behaviour of post tension beam under combined bending & shear

2. To find out maximum bending moment & shear force in post tension beam.

II. METHODOLOGY

Dynamic analysis using the time history analysis calculates the building responses at discrete time steps using discretized record of synthetic time history as base motion. If three or more time history analyses are performed, only the maximum responses of the parameter of interest are selected.

Time history analysis is the study of the dynamic response of the structure at every addition of time, when its base is exposed to a particular ground motion. Static techniques are applicable when higher mode effects are not important. This is for the most part valid for short, regular structures. Thus, for tall structures, structures with torsional asymmetries, or no orthogonal frameworks, a dynamic method is needed.

In linear dynamic method, the structures is modeled as a multi degree of freedom (MDOF) system with a linear elastic stiffness matrix and an equivalent viscous damping matrix. The seismic input is modeled utilizing time history analysis, the displacements and internal forces are found using linear elastic analysis. The playing point of linear dynamic procedure as for linear static procedure is that higher modes could be taken into account.

Buildings are subjected to ground motions. The ground motion has dynamic characteristics, which are peak ground acceleration (PGA), peak ground velocity (PGV), peak ground displacement (PGD), frequency content, and duration.

These dynamic characteristics play predominant rule in studying the behavior of RC buildings under seismic loads. The structure stability depends on the structure slenderness, as well as the ground motion amplitude, frequency and duration. Based on the frequency content, which is the ratio of PGA/PGV the ground motion records are classified into three categories :

1) High-frequency content PGA/PGV > 1.2
2) Intermediate-frequency content 0.8< PGA/PGV< 1.2
3) Low-frequency content PGA/PGV < 0.8

A.MATERIAL PROPERTIES

Concrete Properties		Steel Bar Properties	
Unit weight (γ_c)	25 (kN/m^3)	Unit weight (γ_s)	76.9729 (kN/m^3)
Modulus of elasticity (E_c)	22360.68 (MPa)	Modulus of elasticity (E_s)	2x10^5 (MPa)
Poisson ratio (v_c)	0.2	Poisson ratio (v_s)	0.3
Thermal coefficient (α_c)	5.5x10^{-6}	Thermal coefficient (α_s)	1.170x10^{-6}
Shear modulus (G_c)	9316.95 (MPa)	Shear modulus (G_s)	76923.08 (MPa)
Damping ratio (ζ_c)	5 (%)	Yield strength (F_y)	415 (MPa)
Compressive strength (F_c)	30 (MPa)	Tensile strength (F_u)	485 (MPa)

III. PROBLEM STATEMENT

Cross section of beam: 30 cm × 20 cm
Prestressed by;15 no. 5 mm diameter wires (6.5 cm from bottom)
3 no. 5mm diameter wires (2.5 cm from top)
Prestress in steel: 840 N/mm2
Span of the beam: 6 m
Density of concrete: 24 kN/mm2

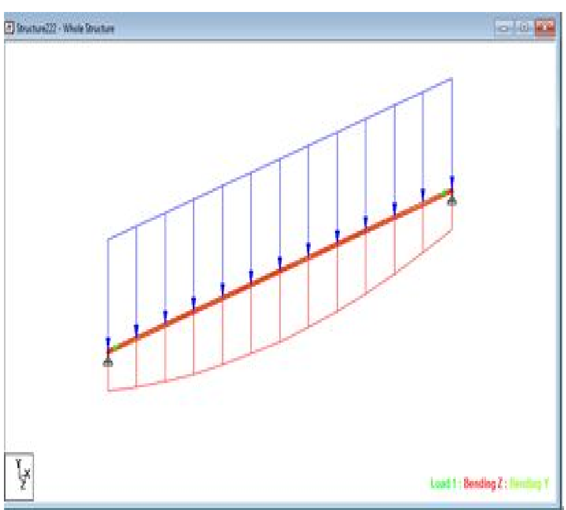

Fig 1-Bending in Y and Z direction

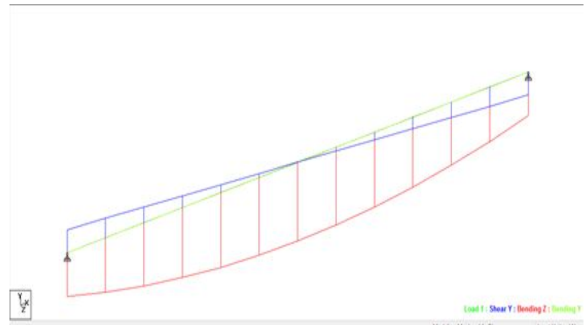

Fig 2- Combination of Shear, Bending in Y and Z direction.

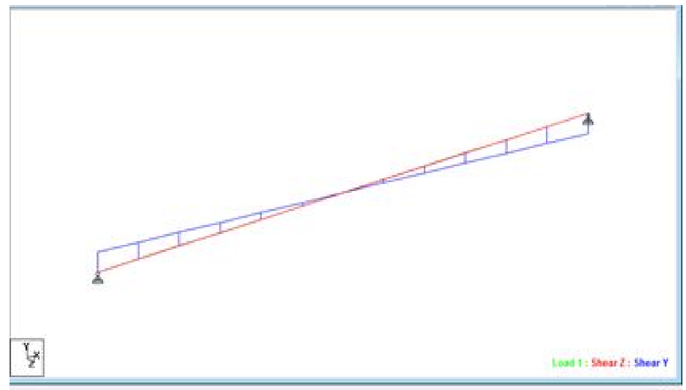

Fig 3- Shear Stress in Y and Z direction.

IV. RESULTS & DISCUSSION

Distance	Fy (KN)	Mz (KN.m)
0	22.241	-42.000
0.5	18.534	-52.194
1	14.827	-60.534
1.5	11.121	-67.021
2	7.414	-71.655
2.5	3.707	-74.435
3	0.000	-75.362
3.5	-3.707	-74.435
4	-7.414	-71.655
4.5	-11.121	-67.021
5	-14.82	-60.534
5.5	-18.534	-52.194
6	-22.241	-42.000

V.CONCLUSION

- Resultant stress at top fibre observed in post tensioned beam is 11.7 Mpa in Compression and 5 Mpa in Tension.
- Maximum Shear force at Starting end point ie at 0 m is 22.241 KN.
- Maximum Bending moment **at 3 m ie at center is 75.342 KNm.**

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