

A Research on Comparison of PT beam and RCC beam for Cost and Deflection

Vaibhav G Tejani, Hitesh K Dhameliya, Jasmin Gadhiya

Civil Engineering Department, CGPIT, Uka Tarsadia University, Bardoli, India

ABSTRACT

PT not only give the problems beautiful solution, but he also showed us how to build it., Now a days , as architectural demand ,structure become more slender and have a very long span ,by RCC we cannot fulfill architecture requirement ,in some case RCC also fulfill architecture requirement for a certain span length but after span RCC structure become costly , so it's a research work which structure is economical for post tensioning ,for a span, also high labour cost countries is to avoid external scaffolding, for low-rise structures to precast as far as practical and to prestress concrete, not only horizontally, but also vertically so as to resist lateral loads. In most structures today, the increasing use of prestressing has given new freedom to any concept of forms previously considered uneconomic or unfeasible or unduly bulky to resist loads. This research paper is focused on beam design for long span which is used at cinema, multipurpose hole, shopping mole. Pt beam is analysis and design by ADAPT-PT/RC 2015.RCC beam is analysis by STAAD.PRO v8i SS5 and design by manually. Here take beam with two span both span equal length, span of beam 5m to 20m at 3 m interval

Keywords: Prestressing Systems Pre-Tensioning Systems Post-Tensioning Systems, ADAPT-PT/RC 2015, STAAD.PRO v8i SS5

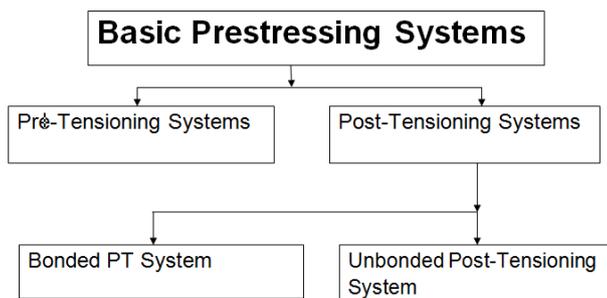
I. INTRODUCTION

The Principal design objectives for structural engineers are safety, functionality, economy and now a day's legality of design. When selecting a structural building system, it is important for the engineers and architects to understand the appropriate application of post-tensioned concrete and the effects that may result. If properly analysed and assembled, concrete structures from high quality materials can provide a superior combination of durability, sound control and fire safety needed in today's building market. Considering the current market factors of cost options, material supply and lower floor-to-floor heights, and available developer financing, concrete is often selected as the more cost effective material over steel. Concrete in which there have been introduced internal stresses of such magnitude and distribution that the stresses resulting from given external loadings are counteracted to a desirable degree. A basic concept is a prestressed concrete structure is

different from a conventional reinforced concrete structure due to the application of an initial load on the structure prior to its use. The initial load or 'prestress' is applied to enable the structure to counteract the stresses arising during its service period. The prestressing of a structure is not the only instance of prestressing. The concept of prestressing existed before the applications in concrete.

Basic Prestressing System

Mainly pre-tensioning system used in pre-cast structural element like railway sleeper etc. post-tensioning system used for site work like bridge girder ,beam flat slab etc , initially bonded PT system is used but now a days un bonded PT system is used. I work on post-tensioning system. I study on when PT system is economical to used.



II. METHODS AND MATERIAL

A. Scope of Study

One may extend this work as follows:

- beam is design and analysis for I c/s and any other c/s of beam
- also PT design with higher grade of concrete greater than M35 and compare its cost comparison factor
- also check for cantilever beam for various span
- cost comparison between bonded and unbonded PT beam
- also in bridge girder design , comparison of PT girder and RCC girder

B. Parametric Study

For the purpose of parametric study of PT beam and RCC beam design of beam in RC building, in these RC building has 2 spans from 5 m to 20m at 3 m interval. As shown in Figure 1

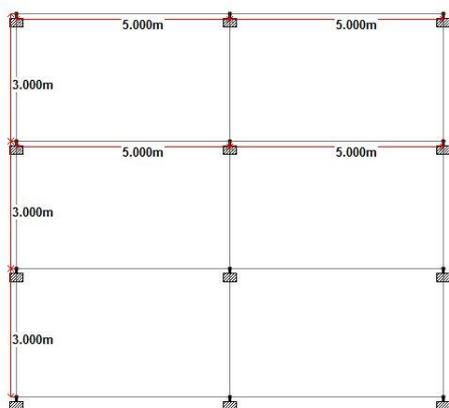


Figure 1. Plan of Building Structure

Story height:	3m
No of bay:	1
Concrete grade for RCC and PT	
Concrete grade for RCC Beam:	M20
Concrete grade for PT Beam:	M35
Strength of steel in RCC:	500 N/mm ²
Post-Tensioning details	
Nominal diameter:	12.9 mm
Nominal area:	98.7 mm ²
Weight:	0.785 Kg/m
Strength of steel:	860 N/mm ²

PT beam is design and analysis in ADAPT-PT/RC 2015 Software for unbonded PT .RCC beam is analysis STAAD.PRO v8i SS5 and RCC beam design by manually are done according to the specifications given in IS 1343: 1980 , IS 1343:2004 and IS456:2000

C. Analytical Study

Here, we used 2-d ADAPT PT software A building is design for only vertical load, now a days PT design is not done for lateral load. For design PT beam building is divided in strip than only strip is design. As shown in Figure 2 Here for design beam ,consider effective flange width check deflection criteria which is within 20 mm or 1/250.The beam is design by manually as per IS456:2000, beam is design singly or doubly reinforced which depend on mu of beam. Each beam design at both end and centre of beam c/s. mainly the deflection criteria satisfied in design of beam which is not more than 20 mm or 1/250

D. Estimating and Costing

From the analysis and design results of the beam the total estimation for the quantities for a typical beam is calculated. The quantities of concrete, reinforcing steel, prestressing steel and the formwork and their cost according to the current rate including the labour charges for beam. Rate consider as per current market, 2016(Rate of concrete M35=4500/-per m³, Rate of concrete M20=3600/-per m³ Rate of steel=38/-per kg, Rate of form work=130/- per m², Rate of prestressing steel with consultant fee=130/-per kg)

III. RESULTS AND DISCUSSION

Table 1 comparison of cost for RCC beam and PT beam for various span lengths

Sr no	Spa (in m)	Size of PT beam (in m)	Cost of PT beam (in Rs)	Size of RCC beam (in m)	Cost of RCC beam (in Rs)
1	5	0.30x0.30	25677	0.30x0.30	17522
2	8	0.45x0.45	51732	0.45x0.45	39025
3	11	0.45x0.60	108509	0.45x0.60	115000
4	14	0.45x0.60	145652	0.40x0.80	160500
5	17	0.60x0.65	225819	0.60x1.20	243331
6	20	0.60x0.75	295806	0.70x1.40	363270

Graph of cost comparison is given as below

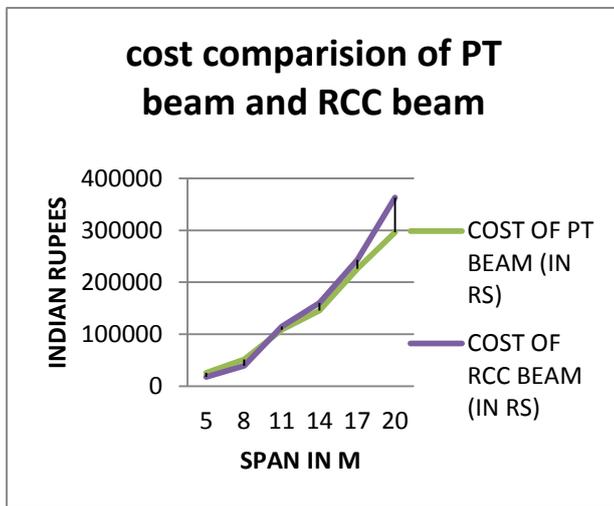


Figure 2. Graph of Cost Comparison

if pt beam and rcc beam is design for same size than deflection criteria is not satisfy ,shown as in table 2, deflection is required to less than 20 mm

Table 2. comparison of deflection for RCC beam and PT beam for various span lengths

Sr. No	Span (in m)	Deflection in PT beam (in mm)	Deflection in RCC beam (in mm)
1	0.30x0.30	-1.6	4.74
2	0.45x0.45	3.5	8.12
3	0.45x0.60	5.8	14.18
4	0.45x0.60	9.2	35.17
5	0.60x0.65	12.9	52.17
6	0.60x0.75	19.9	70.85

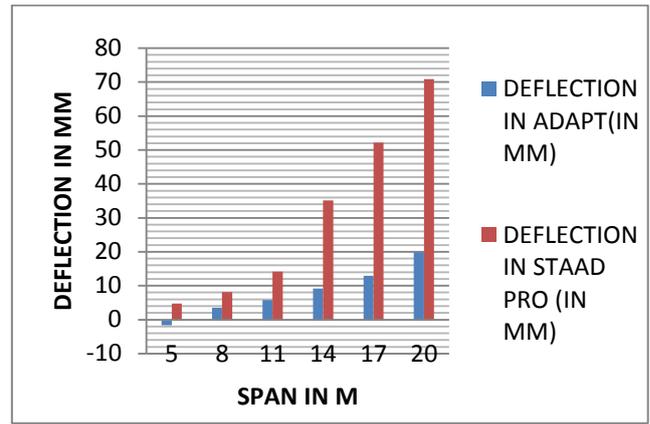


Figure 3. Graph of Cost Comparison

IV. CONCLUSION

From, the above study it can be conclude that,

- As per result we can conclude that deflection in RCC beam is more than PT beam for same c/s of beam. Deflection is more than 20mm means greater than permissible limits so ,RCC beam required to increased its size
- So concrete and steel consumption in RCC beam is more at greater span length
- PT beam is economical for long span specially more than 8m span as shown in figure 4 and RCC beam is economical for short span

For design of RCC beam for greater span which is required large size of beam so we get less headway ,in other side if we used PT beam instead of RCC beam than it give smaller c/s of beam and cheaper than RCC beam.

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