

Cost Comparison Between Rcc & Post-Tensioned Prestressed Beams Spanning 26m.

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ABSTRACT:-

I am going to work on the economic comparison between R.C.C. beam and Pre-stressed concrete beam. This work includes the design and estimate of R.C.C. Beam and post-tensioned Beam of 26m Span. The aim of this work is to design & estimate 26m span beam of R.C.C as well as pre-stressed concrete beam and then compare the results. The idea is to reach a definite conclusion regarding the superiority of the two techniques over one another.

I. INTRODUCTION

In India RCC Structures are commonly used for Residential as well as commercial Buildings. Post-tensioned Pre-stressed beams are rarely used for the same Buildings, or we can say for short Span Buildings. Two Decade ago there was a big problem of Skilled Workers for Pre-Stressing work. But now there are so many agencies for execution of the same work. In RCC Beams, depth of beam increases with increase in Span, because of deflection limitation. Depth of beam can be reduced in Pre-stressed section, for longer span pre-stressed beams are cheaper. This work is proceeding because I want to know the percentage cost difference between both techniques with respect to span.

II. SCOPE

This work includes the design and estimate of beam for Span 26 m, by R.C.C. and pre-stressed concrete techniques. And calculation of percentage cost comparison between RCC & Post-tensioned pre-stressed concrete beam.

III. METHODOLOGY

For RCC beam Design, I am taking M-30 Grade of Concrete. Initially I prepared a MS Excel Sheet for Design using IS: 456-2000. Similarly I have prepared MS Excel sheet for Design of Post-Tensioned pre-stressed beam using British code provisions. After Design comparing results. For Post-Tensioned beam M-35 Grade of Concrete is taken for Design. Design is carried out for parabolic cable profile only, which is the most popular one. Programs is also prepare for estimating & costing. Rates will be taken from Amended PWD SOR-2009 of Madhya Pradesh. In case of pre-stressed concrete, some of the rates will be obtained from a well-known private Infrastructure company . Pre-stressed concrete beams is designed for TYPE 3 only which is the practice in field. TYPE 1 & TYPE 2 structures are used only in special cases like Water Tanks, Pipes, Sleepers & Electric Poles.

Observation Table:- On the Basis of Design Results we have got Data for Estimate.

Estimate for 26 m Long RCC Beam

Support	0.5	m		
Span	26	m		
Width	0.5	m		
Depth	1.4	m		
Main Reinforcement				
Top	25	mm	5	Nos.
Main Reinforcement				
Bottom	32	mm	15	Nos.
Stirrups	10	mm	0.326	m c/c

SOR No.	Description Of Item	Nos.	Length	Width	Height	wt./m	Qty.	Unit	Rate as per MP PWD <u>Amended</u> SOR-2009	Amount
5.27+5.28.2	Beam (M-30)	1	26	0.5	1.4		18.2	Cum	5603	101974.6
5.16.1	Reinforcement Top	5	29.62			3.85	570.39	Kg	48	27378.88
5.16.1	Reinforcement Bottom	15	29.62			6.31	2803.6	Kg	48	134572.7
5.16.1	Stirrups	80.8	3.75			0.61	186.611	Kg	48	8957.34
5.16.1	Skin Bars	8	26			0.88	184.572	Kg	48	8859.44
5.9.3	Shuttering Bottom	1	26	0.5			13	Sqm	229	2977
5.9.3	Shuttering sides	2	26		1.4		72.8	Sqm	229	16671.2
							Total Amount		=	301391

Estimate for 26 m Long PT Beam

Support	0.5	m		0.5	0.25	1.2	0.15
Span	26	m					
Sectional area	355000	mm ²					
	0.355	m ²					

Main Reinforcement

Bottom	16	mm		16	Nos.
Stirrups	10	mm		0.26	m c/c
End Anchorage Reinforcement	12	mm		40	Nos.

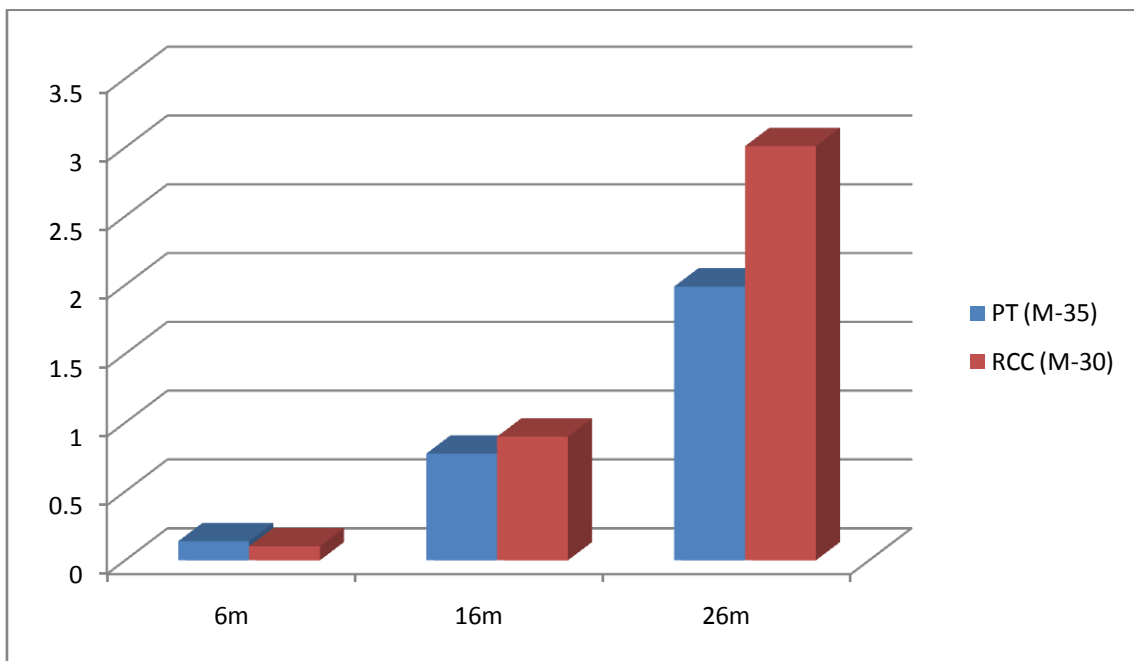
Sr. No.	Description Of Item	Nos.	Length	Width	Height	wt./m	Qty.	Unit	Rate as per MP PWD <u>Amended</u> SOR-2009	Amount
5.27+5.28.3	Beam (M-35)	1	26		0.355		9.40	Cum	5658	53227.63
5.16.1	Reinforcement Bottom	16	27			1.57	681.49	Kg	48	32711.78
5.16.1	Stirrups	101	5.05			0.616	314.30	Kg	48	15086.66
5.16.1	End Anchorage Reinforcement	20	1.2			0.88	21.29	Kg	48	1022.24
5.16.1		20	0.5			0.88	8.87	Kg	48	425.93
	Anchor Plate	4	0.15	0.15	0.008	7850	5.65	Kg	52	293.90
5.9.3	Shuttering Of Bottom	1	26	0.85			22.1	Sqm	229	5060.9
5.9.3	Shuttering Of sides	2	26		1.2		62.4	Sqm	229	14289.6
NSOR	Tendons with Anchors	4	26			4.7	507.6	Kg	152.55	77434.38
							Total Amount		=	199553

Rates as per Approved Agency for PT work in India

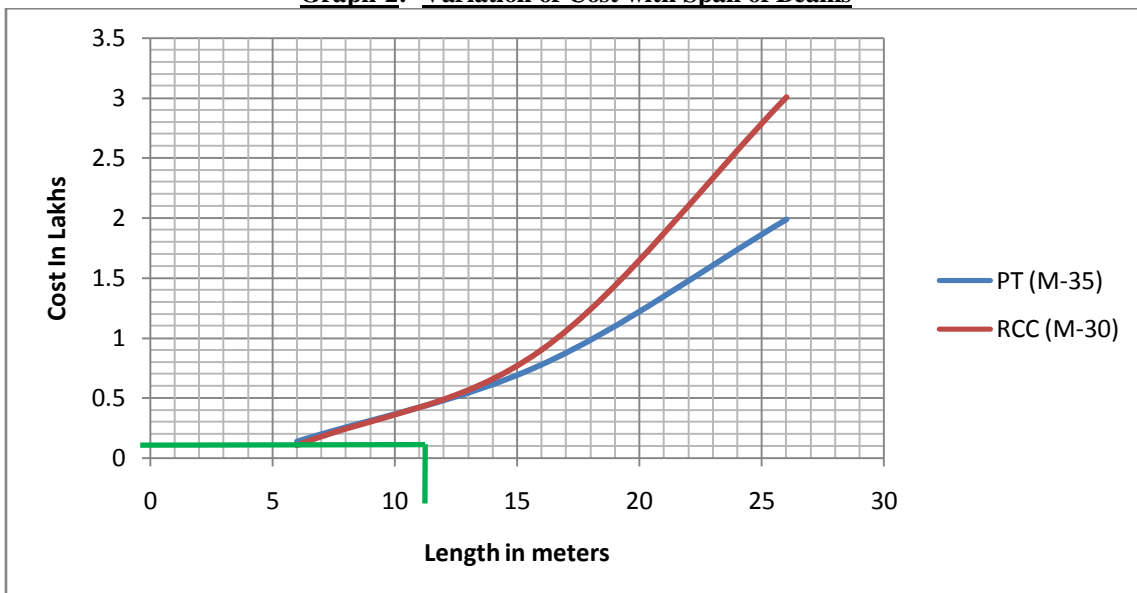
TABLE.1: "Economic comparison Between R.C.C. Beams & Post-Tensioned Pre-stressed Concrete Beams"

Sr. No.	Length of Beam in meters	Estimated Cost of RCC with M-30 grade concrete Mix in rupees (₹)	Estimated Cost of Post-tensioned with M-35 grade Concrete Mix in rupees (₹)	Percentage rate difference	Post-tensioned Beam is
1	26	301391	199553	34	cheap

Graph-1:- Variation of Cost with Span of Beams



Graph-2:- Variation of Cost with Span of Beams



IV. RESULTS & DISCUSSION

Result shows that, for span 26m Post-Tensioned Pre-stressed concrete beam is 34% cheaper than RCC beam. Table 1, & Figure-1 are showing same things, which are mentioned above. The cost of Pre-stressed concrete beam includes the cost of accessories like split cones, bearing plates, sheathing tubes, grouting etc. In our country, concrete grade higher than M: 30 are generally not used in case of RCC construction. Furthermore, simply supported T beams mostly result in under-reinforced sections. Savings resulting from using a higher grade of concrete are in a balanced or doubly reinforced section. Pre-stressing requires skilled workmanship & need for superior quality control. But we must not forget that along with these minor inconveniences pre-stressing delivers a structure that is better from limit state of serviceability & durability point of view. Bulk concreting in Large Span RCC beam creates problem during construction. It increases floor height and creates problem to design staircase.

V. CONCLUSIONS

A couple of decades back, when pre-stressing was not commonly used in India, R.C.C. beams used to be cheaper even for 25m spans. This is because the mix design for high strength concrete used to be based on 500kg/m³ (i.e. 10 bags of cement/m³) as permitted by IS: 456-1978. With modern methods of mix design based on maximum 8 bags of cement/m³ (to minimize shrinkage & creep) the cost of high grade concrete has come down. Furthermore, the price difference between HYSD bars & high tensile steel used for Pre-stressing has come down to 25-30% from more than 100%. Ditto for fixtures & accessories associated with pre-stressing. These used to be very costly then but have now become affordable because of the greater demand resulting in economics of scale for the manufacturers.

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