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Review for Study of Prestressing Systems for all Structural Element

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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. Curvilinear forms have produced an entirely new vocabulary for architecture that inprevious decades would have been thought of as impractical. The use of prestressing has also been found to be a way of achieving waterproof flat roof surfaces even without the application of normal bituminous waterproofing, since the concrete is kept in continual compression and resists cracking which can otherwise lead to water penetration in the long term.

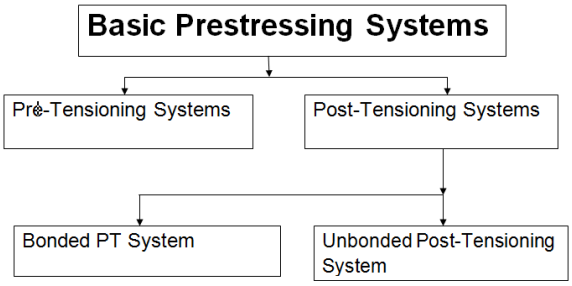
Keywords: Prestressing Systems Pre-Tensioning Systems Post-Tensioning Systems

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.

II. BASIC PRESTRESSING SYSTEM

Mainly pre-tensioning system used in precast 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



III. LITERATURE REVIEW

The concept of pre-stressed concrete appeared in the year 1888. In this present engineering technology Durable and sustainable bridges play an important role for the socio-economic development of the nation. Owners and designers have long recognized the low initial cost, low maintenance needs and long life expectancy of pre-stressed concrete bridges. This is reflected in the increasing market share of pre-stressed concrete, which has grown from zero in 1950 to more than 55 percent today. This growth continues very rapidly, not only for bridges in the short span range, but also for long spans in excess of length which, here therefore, has been nearly the exclusive domain of structural steel. Many bridge designers are surprised to learn that precast, pre-stressed concrete bridges are usually lower in first cost than all other types of bridges coupled with savings in maintenance, precast bridges offer maximum economy. The precast pre-stressed bridge system offered two principal advantages: it is economical and it provides minimum downtime for construction. Pre-stressing is the application of an initial load on the structure so as to enable the structure to counteract the stresses arising during its service period.

As Rajamoori Arun Kumar et. Al. [1] Bridge is very important for road network, for both urban and rural areas. With new technology growth the conventional bridge has been replaced by cost effective structural system. One of these solutions presents a structural PSC system that is T-Beam. PSC T-beam, which is wide acceptance in freeway and bridge systems due to their structural efficiency, good stability, serviceability, economical in construction and pleasing aesthetics view. PSC beam design is more complicated as structure is more complex, also required special from work. In compare with PSC Tbeam, RCC T- beam geometry is simple and does not complicated in construction. Bridge design is an complicated and important approach of structural engineer. As in case of bridge design, span length and live load are always important factor. These factors affect the conceptualization stage of design. The effect of live load for various span are varied. In shorter spans track load govern whereas on larger span wheel load govern. Choice of structural system for span is always a research work. Structure systems adopted are governed by factor like economy and complexity in construction. The 24 m span as selected for this study, these two factor are important aspects. In 24 m span, codal provision allows to choose a structural system i.e. PSC T- beam. This study about the structural systems for span 24 m and detail design carried out with IRC loadings and IS code books. The selection of economical and construction of structural system is depending on the result.

The following important are as below:

1. Bending moments and Shear force for PSC T-beam girder are lesser than RCC T-beam Girder Bridge. Which allow designer to choose less heavy section for PSC T-Beam Girder than RCC T-Girder for 24 m span.
2. Moment of resistance of steel for both has been find and concluded that PSC T-Beam Girder has more capacity for 24 m and more than 24m of span.
3. Shear force resistance of PSC T-Beam Girder is more than RCC T- Girder for 24 m span.
4. For a PSC TBeam Girder, Total Super structure of a Bridge Project the Quantity of steel and the Cost of concrete is less than RCC T-Beam Girder
5. Deflection for PSC T-beam Girder is less than RCC TBeam Girder Bridge.
6. PSC T-beam Girder is more Durable than RCC TBeam Girder Bridge.

Vakas K. Rahman et al. [2] without any doubt, in RCC construction has been the most revolutionary construction technique in modern times. Combining the high compressive strength of concrete with high tensile strength and elasticity of steel has resulted in a composite material which is durable ,economical and strong .Moreover, any new technology required a testing , concrete is weak in tensile. But we use concrete ‘s most power full property which is compression. The problem of serviceability related with the R.C.C. structures sent the human mind working over-time. The solution was found in prestressing. Like ordinary

reinforced concrete, prestressed concrete consists of concrete resisting compression and reinforcement carrying tension. Prestressing became essential in many applications in order to fully utilize the compressive strength of reinforced concrete and to eliminate or control cracking and deflection. The aim of this work is to design Flat Slab of R.C.C. as well as prestressed concrete variety and then compare the results. The idea is to reach a definite conclusion regarding the Superiority of the techniques over each other below table gives the cost in rupees for various spans for both R.C.C. Flat Slabs in M:30 grade concrete & Prestressed Concrete Flat Slabs in M: 30 & higher grade concretes Based on the experiment study, it could be concluded that RCC flat slabs are economical up to 9m span but beyond the pre-stressed concrete flat slabs become a better choice. The cost advantage in percentage terms increasing in favour of prestressed concrete with increasing span. Besides, pre-stressed concrete flat slabs being thinner give a more headroom & result in lesser seismic forces. Better durability of prestressed concrete structures is already a well-established fact.

Table 1: Cost Comparison of Flat Slab

Span (m)	Concrete Grade	Estimated Cost of Prestressed Concrete Flat Slab (Rupees)	Estimated Cost Of RCC Flat Slab For M30 Grade Only(Rupees)	% Difference on the basis of Higher Value (%)
6	M_{30} M_{40} M_{50}	10,41,832.55 11,49,725.88 12,93,028.59	7,97,417.39	23.43
7	M_{30} M_{40} M_{50}	15,47,927.56 14,89,880.00 16,76,070.00	12,75,25 ß.64	17.58
8	M_{30} M_{40} M_{50}	20,05,632.48 21,57,895.70 21,76,305.96	19,34,49 2.04	3.49
9	M_{30} M_{40} M_{50}	27,28,601.36 29,64,421.83 30,26,162.00	26,87,13 0.5	≈ 0
10	M_{30} M_{40} M_{50}	37,36,.27.85 40,66,529.37 42,92,180.92	39,76,10 0.49	-6.04
11	M_{30} M_{40} M_{50}	43,88,401.82 44,99,976.70 48,48,999.00	52,58,04 4.6	-16.54
12	M_{30} M_{40} M_{50}	56,04,387.18 57,64,089.07 60,83,029.00	76,17,20 2.13	-26.42

Ankit Sahu, et al. [3] in world RCC Structures are commonly used for Residential as well as commercial Buildings. Post-tensioned Pre-stressed beams are very less used for the same Buildings, or it cannot use 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 available for these works. 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 done because I want to know the percentage cost difference between both techniques with respect to span.

Two 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.

A. R. Mundhada, et al. [4] this paper presents the economics of continuous R.C.C. beams vis-à-vis continuous pre-stressed concrete beams. This work includes the design and estimates of continuous R.C.C. beams and continuous pre-stressed concrete beams of various spans. In today's jet age, we have a host of construction techniques at our disposal. Steel structures, R.C.C. Structures, Core and hull type of structure (combination of steel & R.C.C. construction), Ferro-cement and prestressed concrete are some examples. At times this choice available leads to confusion. The best way is to select the type of construction, depending on the circumstances and type of structure. The aim of this paper is to design medium span continuous R.C.C. beams as well as continuous pre-stressed concrete variety and then compare the results. Programming in MS EXCEL is done to design the beams. The idea is to reach a definite conclusion regarding the superiority of the two techniques over one another. Results reveal that a continuous R.C.C. beam is cheaper than continuous pre-stressed concrete beam for smaller spans but vice versa is true for larger spans.

Pradeep Nath Mathur , et al. [5] The pre-stressing concrete technology is quite different from RCC. Concrete Technology. The pre- stressing system devices

are of two types, pre- tensioning & post-tensioning . By using prestressing for pre &post tensioning device mechanism development of anchoring system in concrete structural element. In modern type of Pre stressing electricity with Low voltage and high current is used in anchoring device for a concrete member & sulpher Coating as a duct material before the casting of concrete member. While supplying electricity in the structure sulpher get melted up because heat generated in the structure. The structure could be anchored by nutting at both the ends.

We found from study that pre stress concrete anchoring devices influencing greatly to the civil engineering. As involved various process of pre stressed concrete help us very much in understanding the mechanism of the working system & various tools are available to performing for structures called anchoring devices, Further we knew that structures by pre stress are more reliable, strong & reduced in size as compared to RCC . Hence we can say that by using anchoring devices better concrete structures can be made. Also pre stress beam can take more loads that is taken by RCC beam. It is one of the simple methods for anchoring the beam at cheaper rate.

IV. CONCLUSION

From, the above study it can be conclude that,

- Pre –stressed concrete is economical for large span than RCC work but for small span quite expensive
- PT system is removed shrinkage crake and make water proof
- in some work PT system is compulsory because as per architecture requirement more cantilever projection and slender member is used
- as study review of literature ,I think less work on economy study for various c/s of beam or girder

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