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A Literature Review on Post-Tensioned and Pre-Tensioned Concrete Elements

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ABSTRACT

Precast pre tensioned and post tensioned concretes beams are commonly used now- a-days in construction. Significant number of bridge structures, buildings, theatres, auditoriums, etc. is being built with the use of precast girder due to their advantages such as a quick construction process, moderate cost and reduction of scaffolding and shuttering works. To avoid failures, precast structural members must be subjected to strict quality control that requires the use of none destructive testing method. This paper gives the brief idea about the post-tensioned and pre-tensioned technologies that are used in current trends.

Keywords: Concrete, Reinforcement, Pre-Tensioned, Post-Tensioned.

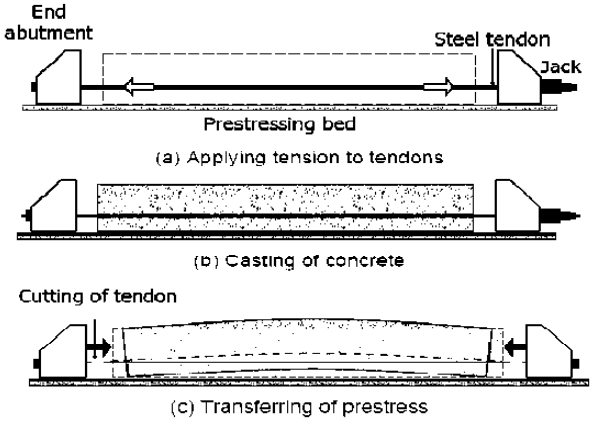
I. INTRODUCTION

Prestressing is defined as a method of applying pre-compression to control the stresses resulting due to external loads below the neutral axis of the beam tension developed due to external load which is more than the permissible limits of the plain concrete. The pre-compression applied (may be axial or eccentric) will induce the compressive stress below the neutral axis or as a whole of the beam c/s. Resulting either no tension or compression. Prestressed concrete is basically concrete in which internal stresses of a suitable magnitude and distribution are introduced so that the stresses resulting from the external loads are counteracted to a desired degree. Prestressed concrete requires concrete, which has a high compressive strength reasonably early age with comparatively higher tensile strength than ordinary concrete. The concrete for the members shall be air-entrained concrete composed of Portland cement, fine and coarse aggregates, admixtures and water. The air-entraining feature may be obtained by the use of either air-entraining Portland cement or an approved air-entraining admixture. The entrained air content shall be not less than 4 percent or more than 6 percent.

II. METHODS OF PRESTESSING CONCRETE

- **Pre-tensioning system**

In the pre-tensioning systems, the tendons are first tensioned between rigid anchor-blocks cast on the ground or in a column or unit –mould types pre-tensioning bed, prior to the casting of concrete in the mould. The tendons comprising individual wires or strands are stretched with constant eccentricity or a variable eccentricity with tendon anchorage at one end and jacks at the other. With the forms in place, the concrete is cast around the stressed tendon. The system is shown in Fig.



The various methods by which pre-compression are imparted to concrete are classified as follows:

1. Generation of compressive force between the structural elements and its abutments using flat jack.
2. Development of hoop compression in cylindrically shaped structures by circumferential wire binding.
3. Use of longitudinally tensioned steel embedded in concrete or housed in ducts.
4. Use of principle of distortion of a statically indeterminate structure either by displacement or by rotation of one part relative to the remainder.
5. Use of deflected structural steel sections embedded in concrete until the hardening of the latter.
6. Development of limited tension in steel and compression in concrete by using expanding cements.

Advantages of pretension concrete

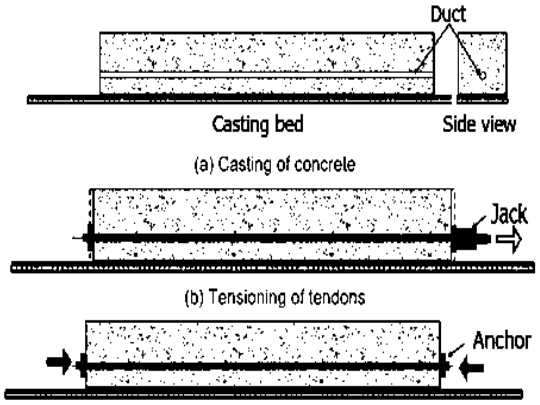
1. Prestressed concrete members are free from cracks and the resistance to the effect of impact, shock, and stresses are higher than RCC structures.
2. Longevity of Prestressed structure is greater than RCC structure because the reinforcement stays unaffected from outer agencies.
3. High compressive strength of concrete and high tensile strength of steel are used for Prestressing that makes it more economical.
4. Smaller sections can be used for longer span by reducing the section of members.
5. Prestressed members are lighter in weight and easily transportable.
6. It requires a smaller amount of construction materials.

Disadvantages of pretension concrete

1. The main disadvantage of prestressing is that it requires some special equipment like jacks, anchorage etc., which pretends the use of prestressing.
2. High tensile steel required for prestressing that is very difficult to procure.
3. It requires highly skilled workers and should be prepared under expert supervision.
4. It is costlier than other RCC structures.

- **Post-tensioned system**

In post-tensioning the concrete unit are first cast by incorporating ducts or grooves to house the tendons. When the concrete attains sufficient strength, the high-tensile wires are tensioned by means of jack bearing on the end of the face of the member and anchored by wedge or nuts. The forces are transmitted to the concrete by means of end anchorage and, when the cable is curved, through the radial pressure between the cable and the duct. The space between the tendons and the duct is generally grouted after the tensioning operation.



Most of the commercially patented prestressing systems are based on the following principle of anchoring the tendons:

1. Wedge action producing a frictional grip on the wire.
2. Direct bearing from the rivet or bolt heads formed at the end of the wire.
3. Looping the wire around the concrete.

Advantage of posttension concrete

1. It reduced or eliminates shrinkage cracking-therefore no joints, or fewer joints, or fewer joints, are needed.

2. Cracks that do form are held tightly together.
3. It allow slabs and other structural members to be thinner.
4. It allows us to build slabs on expansive or soft soils.
5. It lets us design longer spans in elevated members, like floors or beams.

Disadvantage of posttension concrete

1. Since there are a number of tendons and wires spread inside the cost tension slab, it can be result in corrosion .But largely, this tendency to corrode depends on the quality of the material used
2. The post tension slab can be made only by skilful professionals. The local worker may not have the necessary skill required to prepare this complex slab.
3. The main problem with using post tension slab is that if care is not taken while making it, can lead to future mishaps. Many a times, ignorant and wiring completely. This gaps cause corrosion of the wire which may break untimely, leading to some untoward events.

III. CONCLUSION

The aim of this paper is to give a brief idea about the current trends used in today's world. New technologies and techniques are also being updating along with the world. Though this technique is costly as compared to the conventional concrete but has a huge advantage over reinforced concrete in terms of strength, size of member, appearance, etc., which are far more important parameters in todays world.

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