COMPARATIVE ANALYSIS OF RCC & POST TENSIONED BEAM USING ELECTRICALLY ANCHORED DEVICE

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ABSTRACT

Prestressed concrete technology is quite different from Rcc. concrete technology. The devices in the system of prestressed are of two types: pre- tensioning & post-tensioning. Through the use of prestressing for the mechanism of pre and post tension of the device, the development of the system of anchoring in the concrete structural element. In the modern type of pre-stressed pre-stressed and high current power used in anchoring device for a member of concrete and cladding of sulpher as material of the duct before the casting of the concrete element. 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.

1. INTRODUCTION

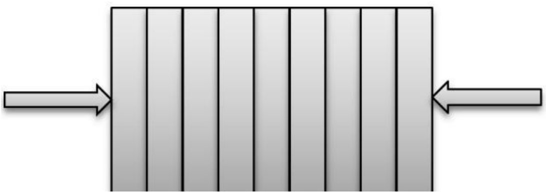
Concrete pre-stressed is a relatively new building material compared with plain and reinforced concrete. Therefore, it is reasonable to assume that the amount of analytical and experimental work in pre-stressed concrete to date is less than in plain or reinforced concrete [12]. Concrete is strong in compression, but weak in tension: its tensile strength varies from 8 to 14 percent of its compressive strength. Due to such low tensile strength, bending cracks develop in early stages of loading. In order to reduce or prevent the development of these cracks, a concentric or eccentric force is imposed in the longitudinal direction of the structural element. This force prevents development by rejecting or greatly reducing the tensile stresses in the critical sections of mid-span and support in the service load, increasing the bending, shear and torsional capacity of the sections of the cracks. The sections are then able to behave elastically, and almost the total capacity of the concrete in compression can be used efficiently throughout the depth of the concrete sections when all the loads act on the structure.

Concrete prestressed is a method to overcome the natural weakness of concrete in tension. It can be used to produce beams, floors or bridges with a longer than

It is practical with ordinary reinforced concrete. Prestressing tendons (usually high tensilesteelcable or bars) are used to provide a cargo hold that

It produces a compressive stress that balances the tensile stress that the concrete compression member would otherwise experience due to a bending load. Traditional reinforced concrete is based on the use of steel reinforcing bars, reinforcing steel within the concrete. Prestressing can be achieved in three ways: concrete pretension and bondage or unlimited post-tension concrete.

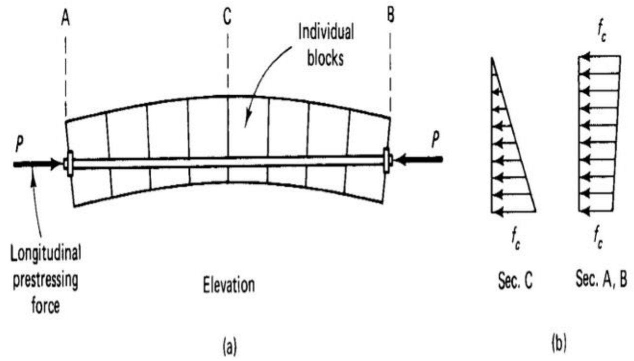
The classic everyday example of prestressing is this: a row of books can be lifted by pressing the ends together



The structural explanation is that the line of books has zero resistance capability [1]. Therefore, "electricity" of books also can not bear their weight. To overcome this, we provide an initial external stress (precompression) that compresses books together. Now they can be different only if the tone tension driven by the weight of books is more than pre-compressed compression.

2. HISTORY OF PRE-STRESS CONCRETE

Pre-stressed concrete is not a new concept, seeing back to 1872, when P. H. Jackson, an engineer from California, patented a prestressing system that used a tie rod to construct beams or arches from individual blocks **[2].**



1888, CW Dahring of Germany received a patent for reputable slab with metal wires. But these initial temporary at prestige were not even successful. J. Land of Norway and G. R. Steiner of the United States tried to solve this problem at the beginning of the twentieth century, but it has no advantage. After the long interval of that time, the non-availability of high power steel to overcome the damage of reputation, the RE Dill of Alexandria, Nebraska recognized the effect of the contraction and crawling (transverse material flows) on the loss of reputation afterwards Developed the idea that due to the continuous post-tensioning rope of the unbalanced rod and the member of the shrinkage, Will compensate for a total loss. At the beginning of the 1920s, W.H. Hewett of Minneapolis developed theories of circular reputation. Due to the pressure of internal fluid, through the use of turnbuckle to prevent cracking, the emphasis was placed on horizontal strength around the walls of the concrete tank, thus strengthening the water. After that, the reputation of the rapidly developed tanks and pipes in the United States, in which thousands of tank water, liquid and gas storage were built and most of the reputed pressure pipes were kept in two to three decades after that. Linear reputation was developed in Europe and France, especially through the efficacy of Eugene Frisisinate, which was proposed in 1926 to 1928 to overcome reputation losses through the use of high power and high-flexibility steels. Done In the 1940s, he introduced the famous and well-approved Freeisyncet system, including coniferous veg anchors for the 12-wire band. During World War II and after that, it was necessary to rebuild in a quick way. G. Magnell of Belgium and Y. of Paris. Gaoyan developed a large scale and used the concept of prestige to design and construct many bridges in Western and Central Europe. The Magnell system also used wedges to anchor the coveted stars. They were different from the original Freyssinet wedges that they were flat in size, to accommodate the reputation of two wires at a time. PW Abels of England presented and developed the concept of partial reputation between 1930 and 1960. Germany's F. Leonard, V. of Russia Mikhailov, and T. Y. Lin of the United States also made a greatdeal of art

science of the design of prestressed concrete. Lin's load- balancing method deserves particular mention in this regard, as it considerably simplified the design process, particularly in continuous structures. These twentieth- century developments have led to the extensive use of pre- stressing throughout the world, and in the United States in particular.

Today, prestressed concrete is used in buildings, underground structures, TV towers, floating storage and offshore structures, power stations, nuclear reactor vessels, and numerous types of bridge systems including segmental and cable-stayed bridges. Note the variety of prestressed structures in the photos throughout the book; they demonstrate the versatility of the prestressing concept and its all-encompassing applications. The success in the development and construction of all these landmark structures has been due in no small measure to the advances in the technology of materials, particularly prestressing steel, and the accumulated knowledge in estimating the short- and long-term losses in the prestressing forces**[2]**.

3. CONCEPT OF PRESTREESING

There are two methods of prestressing

Pre-tensioning: Apply prestress to steel strands before casting concrete

Post-tensioning: Apply prestress to steel tendons after casting concrete.

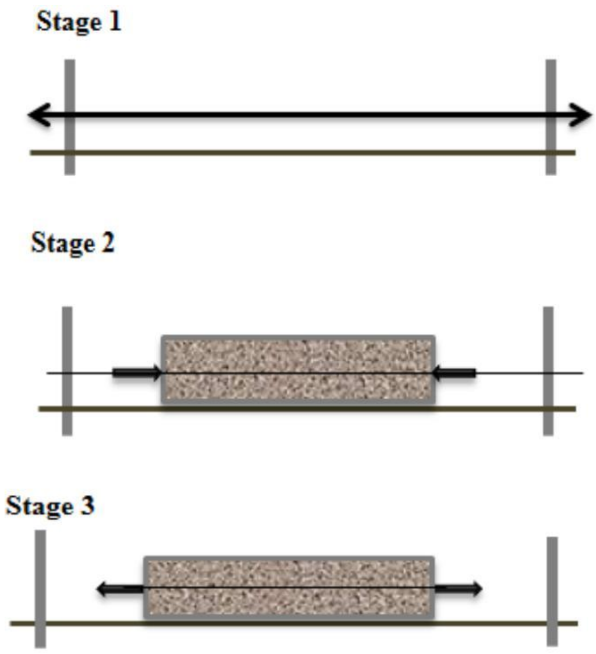
3.1 PRE-TENSOING CONCRETE

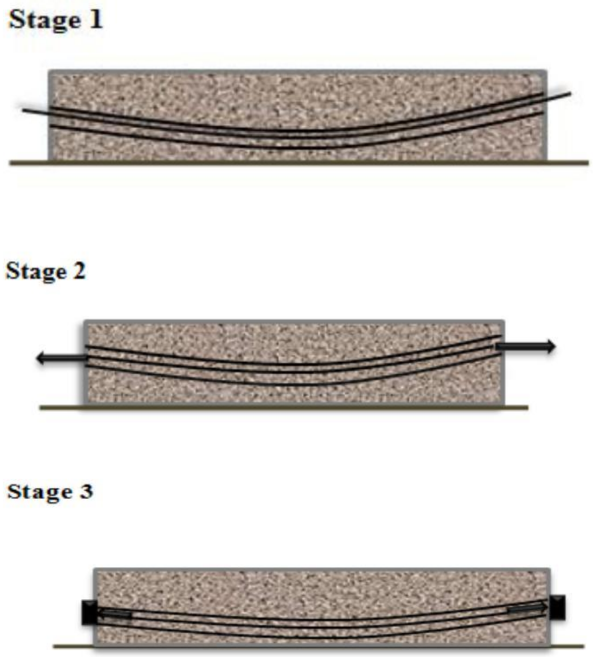
Pre-tensioned concrete is cast around steel tendons-cables or bars-while they are under tension. The concrete bonds to the tendons as it cure, and when the tension is released, it is referred to as the concrete as compression by friction. Tension subsequently imposed on the concrete

Pre-tensioning requires strong, stable anchoring points between the tendons are to be stretched. Thus, most pre-tensioned concrete elements are prefabricated and transported to the construction site, which may limit their size. Pre-tensioned elements can be incorporated into beams, balconies, lintels, floor slabs or piles [3]. An innovative bridged design is the stressed ribbon bridge.

There are three stage **Pre-tensioned concrete**

This is the most common form for precast sections. In Stage 1 the wires or strands are stressed; in Stage 2 the concrete is cast around the stressed wires/strands; and in Stage 3 the prestressed in transferred from the external anchorages to the concrete, once it has sufficient strength:





3.2 POST-TENS ONING CONCRETE

Bonded post-ten sioned concrete is the d escriptive t rm for a method f applying compression after pour ing conc rete and the curing process (*in situ*). The concrete is cast around a plastic, steel o r aluminum curved duct, to follo w the area where other wise tension would occu r in the concrete ele ment **[4]**.

A s et of tendons are fished through the duct and the conc rete is poured. Once the concrete has hardened, the tend ons are te nsioned by hydraulic j acks that re act (pus h) against th e concrete m ember itself.

Whe n the tendons have stretched sufficiently, accord ing to t he design sp ecifications (see Hooke' s law), they are wedged in position and mai ntain tension after the jacks are removed, tr nsferring pr essure to the concrete. The duct is then g routed to protect the tendons fr om corrosion.

This method is commonly us ed to create monolithic slabs for house construction in loc ations where expansive soils (so etimes call ed adobe cla y) create p roblems for the typical perimeter foundation . All stresse s from seaso nal exp nsion and contraction of the und erlying soil are taken into the e ntire tensioned slab, which supports the buil ding without significant flexure **[5].**

In th is method, the concrete has already set but has d cts cast into it. The strands or tendons are fed through the duct s (Stage 1) then tensioned (Stag e 2) and then anc ored to the concrete (Stage 3):

The anchorag es to post-tensioned members must dis tribute a la rge load to the concrete, and must esist bursting forc es as a result. A lot of ordinary rei nforcement is often nece ssary.

4. RESEARCH METHODOLOGY

Precast concr ete consists of concrete (a mixtur e of ce ment, water, aggregates and admixt ures) that is cast int o a specific shape at a location ot her than it's in-se rvice positio n. The con crete is pla ced into a form, ty pically wood or steel, an d cured before being stripped fro m the form, usually the follow ing day. T hese components are then trans ported to the constructio n site for erection into place. Prec ast concrete can be plant -cast or site-cast, bu t this book deals specifically with p lant- ca st concrete.

W e construct a rectangular beam the s ze of the 100 cm (L ength) x 10 cm (Width) x 10cm (Depth). As w ell as constructing r einforced co ncrete beam with the size of 100 cm (length) x 10 cm (width) x 10cm.

W e used in device M40 concrete grade with the pr oper proportion of t he water cem ent and aggr egate.

DIMENSIONS OF DEVICE				
DESCRIPTION	Device Types	Types I	Types II	Types III
Length(cm)		50	60	70
Width(cm)		13	16	19
Depth(cm)		13	16	19

W e used the 4 steel bars of 12 mm in th e device which is te nse by the m echanical prestressing me thod.

This device is c onstruct by the post tens ioning method in this method we stressed be am after the casting concrete.

We prestressed beam by the mechanical prestressingmethodwhich is define in the paper.

4.1 MATERIAL

These materials are used in devices which are given below:

CEMENT

- Ordinary Portland cement we used 50 N/mm^2 strength.

STEEL

- **Bar:** we used specially formed bar of high strength steel of greater than 12 mm diameter.

AGGREGATE

- We used larger than 48mm, bigger than 140mm aggregate.

4.2SOURCE OF PRESTRESSING FORCE

4.2.1 MECHANICAL PRESTRESSING

We are used the mechanical Prestressing In this type of prestressing, the devices includes weights with or without lever transmission, geared transmission in conjunction with pulley blocks, screw jacks with or without gear drives and wire-winding machines. This type of prestressing is adopted for mass scale production [5].

4.2.2 ELECTRICAL PRESTRESSING

In this type of prestressing, the steel wires are electrically heated and anchored before placing concrete in the molds. This type of prestressing is also known as thermo- electric prestressing.

4.2.3 HYDROLIC PRESTRESSING

This is the simplest type of prestressing, producing large prestressing forces.

The hydraulic jack used for the tensioning of tendons, comprises of calibrated pressure gauges which directly indicate the magnitude of force developed during the tensioning.

5. RESULTS AND DISCUSSIONS

The prestressing of concrete has several advantages as compared to traditional reinforced concrete (RC) without prestressing. A fully prestressed concrete member is usually subjected to compression during service life. This rectifies several deficiencies of concrete.

The following text broadly mentions the advantages of a prestressed concrete member with an equivalent RC member. For each effect, the benefits are listed **[6].**

5.1 LOADING PERFORMANCE

Load bearing capacity of device is that which are given table:-

Load bearing capacity of beam is that which are given table:-

NAME OF BEAM	GRADE OF CONCRETE	CROSS SECTIONAL AREA(cm^2)	CHARACTERISTIC COMPRESSIVE STRENGTH(F_{CK}) OF BEAM (kN)
BEAM I	M40	650	35
BEAM II	M40	960	35.5
BEAM III	M40	1330	36

5.2 SCTION REMAINS UNCRACKED UNDER SERVICE LOAD

- Reduction of steel corrosion
- Full sections is utilized
- Increase in shear capacity.
- Less deformation
- Increase in shear capacity
- Suitable for use in pressure vessels, liquid retaining structures.
- Improved performance (resilience) under dynamic and fatigue loading.

5.3 HIGH SPAN-TO-DEPTH RATIOS LARGER SPANS

- Possible with prestressing (bridges, buildings with large column-free spaces)
- Typical values of span-to-depth ratios in slabs are given below. Non-prestressed slab 28:1 Prestressed slab 45:1

Typical values of span-to-depth ratios in slabs are given below

Non-prestressed slab	28:1
Prestressed slab	45:1

For the same span, less depth compared to RC member **[13].**

- Reduction in self-weight
- More aesthetic appeal due to slender sections
- More economical sections.

5.4 SUITABILITY

- Rapid construction
- Better quality control
- Reduced maintenance
- Suitable for repetitive construction
- Availability of standard shapes.

5.5 SMALLER SECTION SIZES

Since PSC uses the whole concrete section, the second moment of area is bigger and so the section is stiffer:

5.6 SMALLER DEFLECTIONS

The larger second moment of area greatly reduces deflections for a given section size **[11]**.

5.7 INCREASED SPANS

The smaller section size reduces self-weight. Hence a given section can span further with prestressed concrete than it can with ordinary reinforced concrete.

5.8 DURABILITY

Since the entire section remains in compression, no cracking of the concrete can occur and hence there is little penetration of the cover. This greatly improves the long- term durability of structures, especially bridges and also means that concrete tanks can be made as watertight as steel tanks, with far greater durability.

If we study about the Prestress concrete and we find some important factors in comparison which are given below-

5.9 DESIGN FLEXIBILITY

Architectural precast concrete panels can be sculpted to resemble a wide range of finish materials, including limestone and brick. This substitution ensures the building blends with nearby structures, whether contemporary or historic, or projects its own striking, cutting-edge appearance while meeting a tight budget **[8]**.

A brick façade can be easily achieved with precast concrete using inset thin-brick techniques, in which thin (1/2 to 1 in.) clay tiles are cast into the panel's face. Alternatively, form liners can be used to create a molded look on the panel's face that replicates a brick appearance. Either technique eliminates the long scheduling needs of laid-up brick while removing several trades from the site. It ensures a high-quality, evenly spaced appearance that is difficult to achieve with field- laid-up brickwork. And the panelized system provides fast erection of entire walls, speeding construction.

Architectural precast concrete panels offer a plasticity in shapes, curves, and geometries that can interface smoothly with glass and other modern materials. The designer can also add pigment to the concrete and provide several tones within one panel by using various surface finishes**.[7]** These capabilities give designers more versatility in designing panels while minimizing the number of components. A wide range of finish combinations and textures can be achieved, with more than one finish provided within one component.

Company names, emblems, and other custom touches can be cast into panels, creating unique accents. Glass fiber– reinforced

5.10 CONTROLLED PRODUCTION

Casting components under controlled factory conditions provides an unsurpassed level of quality assurance. This quality level produces advantages that benefit the project in many ways.

Designers exert more control over the final appearance of the structures using precast concrete because they can view finish and range samples as well as mockup panels prior to full-scaleproduction. The architect and owner can visit the precast plant to monitor progress, ensuring that no surprises arise at the site.

Plant production's high quality-control standards result in tighter tolerances. This approach ensures a smoother, faster fit during erection that speeds construction and minimizes the need for on-site adjustments.

As the single source for so many architectural and structural components, and the source for brickwork, natural stone, or other finishes, the precaster works closely with the construction team to ensure satisfaction with the design and quickly alleviates any on-site challenges that may arise.

5.11CERTIFIED QUALITY

The precast concrete plants of PCI members meet a stringent quality-control program that encompasses the plant, materials, and personnel. Every plant undergoes two unannounced inspections each year to review their quality-control procedures and ensure that each product meets rigorous standards. More than 120 areas are inspected and tracked over time. PCI certification meets International Building Code requirements and eliminates the need for special inspections.

Certified precast concrete plants bring a host of skills and efficiencies to each job that can aid the construction process, especially if the precaster is brought into the design process early. The architect, with the assistance of the precaster, can create architectural effects, efficient sizes and shapes, value-engineering options, state-of-the- art connection systems, and other aspects that produce aestheticallypleasing, functional, and cost-effective precast concrete designs.

5.12SUSTAINABILITY

Precast concrete helps projects attain several of the rating criteria used by the LEED standards from the USGBC. For instance, the material is typically produced locally, generates no job waste, has no outgassing, and can incorporate fly ash, silica fume, and blast-furnace slag to reduce the amount of cement used. Precast concrete components offer high durability, which means fewer chemicals are needed to keep it clean and maintained.

The use of insulated sandwich wall panels, which typically include 2 in. or more of high-performance insulation between two waythese of concrete, provides high energy efficiency. Precast concrete's high thermal mass also minimizes energy consumption naturally.

Precast concrete ensures that building users will have a safe and healthy work- place environment throughout the facility's long lifetime. The material's minimal joints or water-penetration points ensure that no devastating mold growth will occur, and it offers no outgassing that can cause deteriorated air quality.

5.13 LAYOUT FLEXIBILITY

Precast hollow-core slabs and double tees provide long, clear spans, opening interior spaces in projects from office buildings to parking structures in order to allow designers to maximize functional layouts. Loadbearing precast concrete wall panels can reach heights of 55 ft. while double tees can span 80 ft. or more **[8].**

Precast concrete insulated sandwich wall panels provide a thin cross-section that maximizes interior floor space while minimizing the footprint. A typical precast concrete panel is 8 in. thick (3 in. exterior 2 in. insulation layer, 3 in. interior. Saving space over other construction materials throughout the building cuts material costs, speeds construction, and produces a more energy-efficient building.

5.14 LOW MAINTENANCE

Precast concrete panels require caulking only every 15 to 20 years to maintain their reliability. This makes precast concrete easier to maintain than other façade materials. The panels' fewer locations for moisture penetration prevent unsightly stains or damage to interiors. Joints can be inspected quickly to find any locations that need attention**.[8]**Precaster work with designers and owners to ensure that building management understands the few maintenance needs required to keep the building looking new for decades.

5.15 ACOUSTICAL CONTROL

Precast concrete's mass and insulation create strong acoustical performance, producing a quieter, less disruptive environment, particularly in taller structures that use hollow-core slabs for flooring. Its mass and damping qualities also reduce vibration for buildings where that is desirable, including housing, schools, and hospitals.

5.16 MOLD RESISTANCE

Because concrete is an inorganic material, it will not aid the growth of mold spores. Typical panel layouts provide fewer locations where moisture can penetrate, and these joints can be inspected and repaired quickly and easily if necessary. In addition, precaster work with designers to create a system of water control to ensure that rainwater is directed away from the building in an efficient manner to alleviate any residual moisture that could penetrate the building or allow mold to gain a foothold.

5.17 CONTROLLED ENVIRONMENTS

Precast concrete designs can be provided for buildings with functions that require extreme cleanliness, particularly food-preparation, -processing, and -delivery areas or laboratory research areas. The durability of precast concrete panels ensures that they can resist mildew and bacteria while withstanding regular cleaning by harsh chemicals.

Freezer compartments that often are required in food- processing plants can be created with precast concrete panels, providing the tight insulation required while also supplying separation from surrounding surfaces that can induce humidity or groundwater to freeze and disrupt the structure.

5.18 EXPANSION CAPABILITIES

Precast concrete systems can provide the option for expanding a building in the future when needs grow or change. This can be accomplished by either adding new adjoining space or merging the new space with the existing structure. In some cases, an existing facility clad with precast concrete panels can be expanded by disconnecting the non-loadbearing panels on the end wall from the framing and adding panels and framing on each side. With the new structure in place, the end panels can be replaced. Precast concrete designs also can provide structural support, so a second level can be added onto the existing roof if later desired, expanding the structure with- out eliminating any green space **[9].**

5.19 ECONOMY

Precast concrete's speed of construction can eliminate months from a construction schedule, resulting in less time to carry financial bonds, lower contractor overhead costs and risk, elimination of expenses for other trades, and reduced subcontractor costs by giving more responsibility to a single-source supplier.

Total precast concrete systems save by combining both architectural and structural components into one piece **[10].** In some cases, panels can have foundation pieces cast into them, eliminating those separate components. A smaller amount of footing is required, due to the thin cross-section of a precast concrete wall compared to a masonry design (8 in. vs. 16 in.). This also reduces the overall weight of the structure, cutting the size of flooring packages by as much as 25% over the cost of a brick/block/steel construction.

These advantages come into play in varying degrees on each project, based on its specific needs, logistics, location, and budget. By working with the precaster early in the design phase, the full benefits possible with precast concrete can be included in the design. Efficiencies in component size, connections, delivery, and erection can be factored into the design, maximizing the benefits offered by precast concrete **[10].**

6. CONCLUSION

While the advances made in prestressed device technology have been very impressive, they are only indicative of the vast potential for its use in the future. As we seen the prestressed device has more capability to the bear load as compression to the RCC beam. It is anticipated that a far greater role for this construction method lies ahead in infrastructure construction, housing, industrial applications, and resource recovery.

Our oceans cover nearly 70% of the earth's surface and it represent a large untapped area for exploration and industrial development to meet the needs of the growing world population. It is anticipated that precast prestressed concrete will play a major role in the construction of the necessary platforms, habitats, undersea structures, ocean farms, and many other applications yet to be developed or discovered for the ocean environment. In the future we can build the small hoses by the help of precast.

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