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Why pre- stress concrete structure must be used instead of Reinforced concrete structure to day.

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ABSTRACT

*The Pre-stressing in concrete structure is found more effective form reinforced concrete technology. To-day pre-stressing is preferred for large structures, must be adopted for all small concrete work also. It is required to replace RCC completely by Pre-stress concrete. Because of RCC have large section & less strength as compare to pre-stress concrete. In RCC System it is rein-forced first then loaded after casting, when ever, in the Pre stressing system, reinforcement which is could '**tendons**' are used , as anchoring in concrete may classified in two ways first is pre- tensioning & other is post- tensioning. They are stressed by said methods first then casted & force is applied. It is found that, effective & less cost (Economic) anchoring devices must be available for the process of pre-stressing, Because of its initial investment is high so that, at less payment it must be possible to adopt easily. It is possible to make concrete be light weight& high strength. High strength alloy & Rich strength concrete may be used for large pre-stressing force applied.*

INTRODUCTION:

As we know that, tensile stresses are completely resisted by steel bars and compressive stresses are by concrete it -self , which have compressive stress above neutral axis only "this concept gave birth to pre-stressed concrete." In this system high tensile steel &concrete are basic components also; steel is stressed firstly which Induce pre-stress in concrete having compressive nature, hence whole of concrete resists external forces as when required.

Table 1: Difference between reinforced concrete and pre-stressed concrete

S.N	Reinforced cement concrete(RCC)	Pre-stress concrete
1	Steel can resist tension but concrete cannot resist.	Steel inducing pre-stress force. (If this can be by other means then steel is of no use.)
2	The concrete get cracked due to tension and strains are through steel bands.	Band between steel &concrete is not necessary. (As stress in steel does not depends on concrete strain and stresses in steel do not vary along the length.)
3	Banding moment change, means change in resultant force.	Banding moment change, means change in location of pre-stress line.
4	Stresses in steel must limited because, it controls cracking.	Stresses in steel must be unlimited to control cracking.
5	Required IS Code is IS:456-2000	Required IS Code is IS : 1343-2012
6	In RCC reinforcement is not stressed before casting	In pre-tensioning reinforcement is stressed before casting & in post-tensioning reinforcement is placed in duct after casting also stressed.
7	RCC member steel play passive role.	Active role of steel is played by pre stressed concrete member.
8	In RCC stress in steel is variable with lever arm.	In Pre stress concrete the stresses in steel is constant.

9	In Pre stress concrete members, deflections are less.	In RCC deflections are more due to eccentric force induced couple.
10	RCC is less durable, as it is less dense.	Pre stress concrete is more durable.
11	RCC has fatigue resistance less.	Pre stress concrete fatigue resistance is more as compare to RCC.

Advantage of pre-stress concrete over Rcc:-

- In pre-stress, complete section, is in use hence smaller section is needed.
- As the concrete section is smaller, the available space is more.
- Its section passes shear resistance increased.
- It has more resistance to fatigue, impact and vibrations.
- It saves concrete from creaking, also once the pre-stress concrete structure is creaks, it behaves as a RCC Structure.
- It can take more loads which come on it, for a small section of concrete.
- It protects concrete section from creaking, also once the pre-stress concrete structure creaks it behaves like a RCC Structure

The major disadvantages of simple RCC:

- As RCC is get weak in crack resistance at working load, because of corrosion in reinforcement and concrete
- In simple RCC it is impossible to use high tensile steel as tensile reinforcement hence, loss of load carrying capacity of the member.
- To avoid this trouble of permanent negative strain as due to shrinkage and creep in concrete, It is seen that, permanent strain is greater than, initial strain in mild steel. Results In low pre-tension & the section sooner disappears also, member behave as simply reinforced.

Some Suggestions made:

C.R. Steiner (1908) of USA recommended the tightening of reinforcing rod after some shrinkage and creep of concrete had taken place.

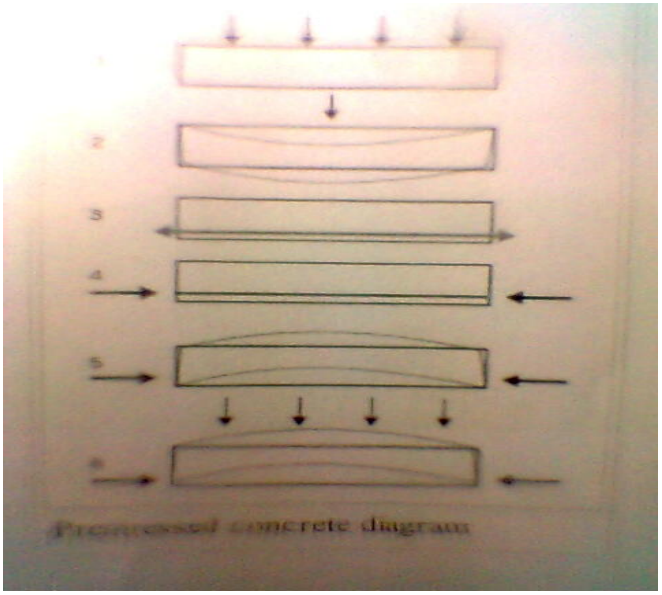
According to ACI Committee "Pre-stressed concrete is the one in which there have been introduced internal stresses of such magnitude and distribution that the stresses resulting from giving external loadings are counteracted to a desired degree. P. Jackson (1886) of USA obtained patents for pre-tensioning steel tie rods in artificial stones and concrete arch to serve as floor slabs.

K. Doring (1888) of Germany suggested pre-tensioning of wires in reinforced concrete floor structures.

R. E. DILL (1925) of Nebraska used high strength steel bars.

Pre stressed concrete structures are classified as:

1) Pre-tensioning : The tendons are
2) Tensioned before placing of concrete.
3) Post-tensioning: The tendon is tensioned in duct, after concrete has hardened.



Tensioning Devices: The principal upon which devices works are as under-

1) Mechanical devices
2) Hydraulic devices
3) Electrical devices
4) Chemical device

Methods of pre-stressing:

1) Freyssinet system.
2) Gifford-Udall system.
3) Magnel Blaton system.
4) Lee-McCall system.

Basic assumptions made:-

1) Concrete is a homogenous material.
2) In working stress condition steel and concrete behave elastically, under suspended load condition without withstanding any small amount of creep.

3) The plane section is assumed remain plane before bending even after bending.

Type of losses in pre stress-

Pre-tensioning:

1) Elastic deformation, Shrinkage and Creep of concrete.
2) Relaxation of stress in steel.

Post-tensioning:

1) In concrete no loss due to elastic deformation take place if wires are tensioned simultaneously.
2) Relaxation of stress in steel.
3) Shrinkage & Creep of concrete
4) Anchorage slip in steel .
5) Friction between steel & concrete.

Conclusion & Rec*omme*ndations:-

We concluded to adopt pre-stress concrete in practice for all kind of structural work to-day. As pre-stressed structures are more economical may be at long run but, with small section can take more loads in a structure. It Have more strength & Durability as compare to RCC. Rich concrete grade is used with high strength alloy hence, density and load caring capacity is enlarged. Other benefits of pre-stressing property of light weight along with high strength may be adopted by including FRP, also as more space, resistance to cracks, impact, fatigue, vibration etc. The cracks in RCC. May be eliminated having large section but, load caring capacity is increased with less sized section in pre-stressing. As It can be made high strength and light weight sections with using pre-stressing in FRP (Fiber Reinforced Polymers) the crack is also controlled. In prestressing concrete about 10 to 20 percent losses may be due to, creep and shrinkage in concrete. As we know even greater numbers of expensive equipment are required in using this process, though it is found effective then unstressed RCC structures.

It is sincere recommendation for adopting pre-stressing in all possible concrete structures instead of RCC works.