American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-4, Issue-4, pp-40-49
www.ajer.org
Research Paper Open Access

The pre- stress concrete structure, Found to-be More Effective Then THE Reinforced concrete structure & System developed for mechanism OF, Anchoring devices in pre and post Tensioned concrete structural elements.

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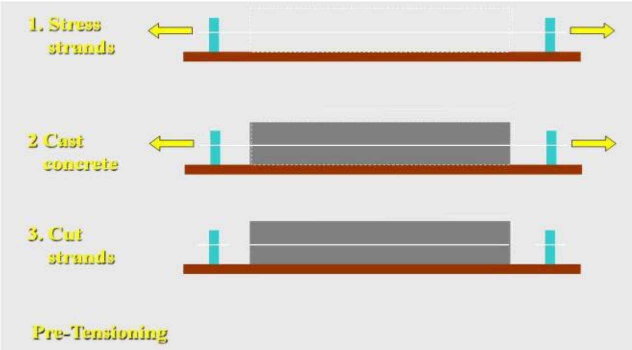
ABSTRACT: - *The pre-stressing concrete Used for casting of section is quite different from reinforced cements concrete (RCC.) in concrete Technology. The* pre- stressing system used is of two kind, pre- tensioning & posttensioning methods. The *prestressing by pre &post tensioning device mechanism, developed for Anchoring system in concrete structural element is adopted for structures. In modern type of Pre stressing electricity with Low voltage and high current is used in anchoring for a concrete member & sulpher Coating as applied on steel bars working, as duct material before the casting of concrete member. While supplying electricity in the structure sulpher get melted up because heat generated in* the steel structure & allow them for pre stressing. No provision of any duct is required .The High strength steel alloy structure could be anchored by tightening nuts at both the ends. *The Pre-stressing in concrete structure is found more effective then RCC technology. To-day prestressing is preferred for large structures like bridges etc. ,it is required to adopted for all small concrete structure sections also. It is to-days demand to replace RCC completely by Pre-stress concrete, because of RCC have large section with less strength as compare to pre-stress concrete. In RCC System it is rein-forced first and then loaded after casting, when ever in the Pre stressing system, where reinforcement which may called 'tendons' are as one kind used for stressing in the concrete itself . They are stressed first then casted & force is applied. It is required that, effective & less cost (Economic) anchoring devices must be available for the prestressing techniques; It is because of its initial investment is high and less pre-stress work is restricted also, must be possible to make adoption easily. It is found possible to make concrete having light weight & high strength in all structures. High strength alloy steel & Rich strength concrete may be used along with large prestressing force application along with avoiding grouting in to pos-tensioned duct.*

I. INTRODUCTION:-

It is know that, tensile stresses are completely resisted by steel bars of the section as concrete is weak in it and compressive stresses are resisted by concrete section it -self which are induced in above neutral axis only."This concept gave birth to pre-stressed concrete practically." In this context high Strength tensile steel & concrete are basic components considered an element of the structure also in practice steel is stressed first which Induce tensile strength, & compressive stress in the concrete while whole concrete resists external forces when required to-be bear by section. Theoretically precast is the design and developed the anchoring system for post- ensioning prestressing. Pre stressing in concrete technology is quite different form reinforced cement concrete (Rcc) in the sense that technologically both are divergent modes. Pre-stressing is the application of a predetermined force or moment to an element in the structures such that combined internal stresses resulting from applied force or moment and positive from external loads will be within specific limits and hence section is entirely compressive. Wires or strands or Tendons are stressed between anchorages. In fact structural behavior of RCC and Pre-stressed concrete is totally different. While steel is an integral part of RCC Section. Bond between steel and concrete plays an important part in RCC. And tension in steel develops when concrete begins to crack and during cracking strains of concrete are transferred to steel through bond. In Pre-stressing bond between steel and concrete does not exist, that is stress in steel does not depend on strain in concrete. A stress in steel varies with bending moment along the length of beam in RCC. Whereas there is, no variation stress in steel along the length of beam. In Pre-stress anchoring in section have less complex analysis. Crack control in RCC. Is a problem because of it is required that stresses in steel should be limited. In Pre-stressing with the inclusion of anchoring crack control is not difficult. There is no need to limit stress in steel. The phenomenon of steel acting as tension flange of a beam analogous to section is a part of RCC. Otherwise steel acting as tension flange of a beam analogous to section is a part of RCC.



Post-tensioning Pre-stress diagram

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 limit 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 in 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.
12	RCC has initial cost less.	Pre stress concrete has initial cost more.
13	RCC has large section for given load.	Pre stress concrete has smaller section for given load.
14	RCC can take fewer loads for given section.	Pre stress concrete can take more loads for given section.
15	RCC Requires less strength concrete for casting for given load.	Pre stress concrete Requires high strength concrete for casting for given load.
16	RCC gives less space for the required section	Pre stress concrete gives more space for the required section.
17	RCC do not require special equipments for casting.	Pre stress concrete does require special equipments for casting.
18	In RCC the phenomenon of steel acting as tension analogous to section.	In Pre-stress anchoring in section have less complex analysis.
19	Bond between steel and concrete plays an important part in RCC. Crack control is difficult. Crack control in RCC. Is a problem. As tension in steel develops when concrete begins to crack and during cracking strains of concrete are transferred to steel through bond.	In Pre-stressing with the inclusion of anchoring crack control is not difficult.
20	Steel acting as tension flange of a beam analogous to section is a part of RCC. & stresses in steel should be limited.	There is no need to limit stress in steel

Advantage of pre-stress concrete over Rcc:-

i) In pre-stressing system, complete section of a structural element is in use hence smaller section is required.
ii) In pre-stressing concrete system section is smaller; hence the available space is more.
iii) In pre-stressing concrete system section passes shear resistance increased.
iv) Pre-stressing concrete system has more resistance to fatigue, impact and vibrations.
v) Pre-stressing concrete system saves concrete from creaking, also once the pre-stress concrete structure is creaks; it behaves as a RCC Structure.
vi) Pre-stressing concrete system can take more loads which come on it, for a small section of concrete.
vii) pre-stressing concrete system protects concrete section from creaking, also once the pre-stress concrete structure creaks it behaves like a RCC Structur
viii) Complete section is in use hence smaller section is needed.
ix) Its shear resistance increased.
x) It has more resistance to frutigue, impact and vibrations

The major disadvantages of simple RCC:

i) RCC is weak in crack resistance at working load, causing corrosion in reinforcement and concrete.
ii) In RCC it is impossible to use high tensile steel in practice as tensile reinforcement hence, loss of load carrying capacity of the member.
iii) There is 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 by:

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

ii) 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.

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

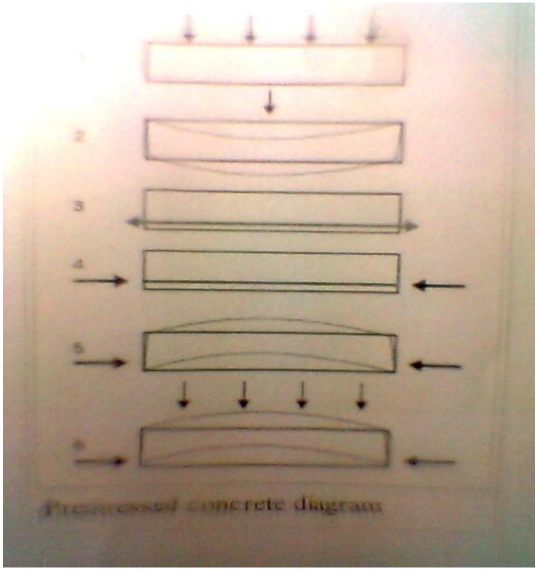
iv) R. E. DILL (1925) of Nebraska used high strength steel bars.

Pre stressed concrete structures are classified as:

i) Pre-tensioning: The steel Reinforcement is

ii) Tensioned before placing of concrete.

ii) Post-tensioning: The tendon is tensioned in duct, after concrete has hardened.



Pre-stress concrete diagram

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:

i) Freyssinet system.

ii) Gifford-Udall system.

iii) Magnel Blaton system.

iv) Lee-McCall system.

Basic assumptions made:-

i) Concrete is a homogenous material.

ii) In working stress condition steel and concrete behave elastically, under suspended load condition without withstanding any small amount of creep.

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

Type of losses in pre stress-

Pre-tensioning:

a) Elastic deformation, Shrinkage and Creep of concrete.

b) Relaxation of stress in steel.

Post-tensioning:

a) In concrete no loss due to elastic deformation takes place if wires are tensioned simultaneously.
b) Relaxation of stress in steel.
c) Shrinkage & Creep of concrete
d) Anchorage slips in steel .
e) Friction between steel & concrete.

REVIEW OF LITERATURE:-

The design and development of anchoring mechanisms are a function of pre-stressing perfection the compression and takes part in resisting moments. There is no corrosion of Steel and sections are much smaller. Self weight is reduced because anchors also do not add to self weight of structural elements, this saves cost of foundations which have to bear less loads.

According to **IS 1343 (1980)** anchoring devices may add to a smaller section of disadvantages along with high strength concrete and steel as well as skilled labor, yet there is an overall economy in using prestressed concrete because decrease in member sections results in decrease in Design loads, Economical structure and foundations. The only common items in RCC. And pre-stressing are materials – concrete and steel, but anchors need high strength tendons to establish compressive stresses in all sections.

FRP reinforcement can have advantage over steel in being lighter in weight, higher in tensile capacity, more resistance to corrosion and electromagnetically transparent. Several manufacturing methods are available for fabrication of FRP reinforcement for concrete. For rod and grid type reinforcement, pultrusion and braiding are the most commonly used manufacturing methods because of low cost, high quality and efficient fiber orientation. Flat or round FRP rods come in a variety of surface shapes, E.g. Dimpled, Indented or Coated with sand in order to provide better bonding with concrete.

Taerwe ET. al. (1992) has considered that concrete is conventionally reinforced with steel bars and tendons. It is well known that the deterioration of concrete structures can mostly be attributed to corrosion of the reinforcing steel. This results from exposure to environments high in moisture and chlorides. Chlorides come from sources such as sea water or de-icing salts used in the winter time on bridges and parking garages.

Coating the steel reinforcement with a layer of epoxy has been the most common method of several practices used for controlling corrosion some recent failures have left doubts about the dependability of epoxy coating protection. Galvanizing of steel reinforcement, another form of protective coating, is suspected of UN satisfactory protection in chloride contaminated concrete, of impairing steel to concrete bonding & of causing hydrogen embritalment of pre-stressing tendons.

Nanny et.al. (1996) concluded that ultimate load capacity is generally controlled by the anchor rather than the tendon itself, suggesting that anchor efficiency can be improved. It is explained that the three classes of anchor systems (That is wedge, resin potted and spike) offer advantages and disadvantages. The degree of complicity in terms of installation procedure varies for wedge type anchors, dry lubrication and sand coating on the two faces of the wedges are helpful. Protection of the tendon can be attained with a sleeve. High temperature did not adversely affect the performance of the system tested. Wedge anchor systems are suitable for pre-tensioning application.

Spike anchors if used with dry fiber ropes may work relatively well. This system requires the longest setup time resulting from the combination of removal of the plastic sheath, combing and spreading of the individual fibers and proper placement of the spike with a uniform distribution of fibers all around it.

For wedge anchors, grit should be present on the wedge surface to ensure proper gripping of the tendons. When comparing carbon stress tendons with Arapree tendons both of which utilize plastic wedges, the carbon stress system with applied grit does not show the slippage of the untreated Arapree wedges.

For resin/Grout Potted anchors, failure may be due to pull-out of the tendon from the resin/Grout anchor without rapture of the tendon however parabolic system may show shifting and erecting of the resin plugs. The plotted anchors are by for the easiest to setup for testing when pre-installed. The practical drawbacks include pre-cutting the tendons to length and curing time for the resin/Grout.

Lin & Ned (2001) assert that in pre- tensioning, anchoring mechanism is not integral working part of structural element. However at the construction stage and/or manufacturing of pre-tensioning members, tendons are stretched by jacks and anchored at the ends. After concrete has set and hardened, the tendons are separated from anchors thereby imposing pre-stressing in the beam or structural elements. The system consists of two bulk heads anchored against the ends of a stressing bed. The tendons are pulled between the two bulk heads. A pre-stressing bed is used for casting usual units and possibly shorter units. It supports vertical reactions due to which pre-stressing of bent cables can be done. Hoyer system shall be analyzed. The anchoring devices for holding pre-tensioning strands to the bulkheads remain on the wedge and friction principle. One common device consists of a split cone wedge, which is made from a tapered conical pin. The existing tapered conical pin is drilled axially and tapped & then cut in half longitudinally to form pair of wedges. The anchoring block has a conical hole in which tapered conical pin holes are strands. These grips can be used for single wires as well as for twisted wire strands. Alternately the pin is not drilled, but is cut in half longitudinally and the flat surface is machined and serrated. As a third option, quick release grips which are more complicated and costly, are used especially when wires are to be held in tension only for short periods. Another method, under study is to add mechanical end anchorages to the pre-tensioned wires. Dorland anchorage, consisting of clips, can be gripped to the tendons under high pressure and the edges of the clips can then be welded together at several points. In such mechanical anchorages, tendons of greater diameter can be permitted. In post-tensioning systems, mechanical pre-stressing, electrical pre-stressing by application of thermal energy and chemical post-stressing by using expanding cement shall be the part of research.

METHODOLOGY / LABORATORY WORK :- Some of the systems shall be studied, analyzed and verified in efficiency and strength so that minimum pre-stress losses occur. The first anchoring system FREYSSINET had quite useful advantages and yet needed improvement and / or additions and deletions. Other systems under study shall be Magnel Blaton, Gifford Udall (with two types of anchoring-plate anchorage and tube anchorage), PSC Mono wire system & Lee Mecall systems.

Electric pre-stressing shall be experimented in which bars shall be

Stretched by means of heating using electrical energy. It shall be considered as a transition from RCC. To pre-stressing. Chemically pre-stressing or self stressing shall be experimented in which self stressing cement shall be used that expands chemically after setting and during hardening.

Finally comprehension of theoretical nature of pre-stressing anchoring technology which is a significant part can be analyzed on rational basis and critical study of the existing devises modification there of as well as attempt towards development of better and efficient mechanisms will be a purposeful possibility. Role of welding shall be attempted and highlighted practically for strong grips.

Electrical pre-stressing:- This is modern type of pre-stressing. We use electricity for working of Anchoring device system. It is introduced by Biller & Carlson. For post-tensioning we use sulphar coating to cause duct material while casting with concrete. When electric current is passed

Through the tendons it gets heated up and sulphar coating is melted. The tendons end as threaded & nuted. By tightening those Anchoring of the section is achieved.

PRACTICAL APPROACH:

We consider for Fe-410 steel bar – 8mm ф

The properties come between cast iron and wrought iron. It is having property of getting hardened and tempered, also has 0.1%-1.1% of carbon & granular like structure.

Its sp. Gr.-7.85 & melting point between 1300^0 to 1400^0 C.

The ultimate compressive strength is 180-350 MPa. &ultimate tensile strength is 310-700 MPa.

It is found to be tough, malleable and ductile in nature.

The coating thickness of sulphar material forming a duct, on steel bar shall be considering - 0.5 mm.

A mould is using to cast as a beam by concrete on coated steel bar. Mould is shown in figure below- dimensions 420x150x150 mm. cu. M15 Grade concrete having ratio1:2:4 is prepared of required workability then it is poured to fill the mould to cast required beam. After 24 hours it is taken out from mould &cured for 7 days the casted beam required is two for our experiment of same dimensions. The prepared beam as figured below-

Now the base plate on both ends of beam is placed. Electric current is passed so that coating is malted & at bars nuts are tightened at both sides so that required anchoring purpose is solved.

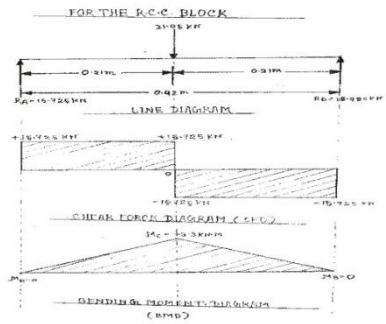
FIGURE:- Beam with sulphur coated steel bar

FIGURE: Transverse test on pre-stress beam

FIGURE : Transverse test on RCC beam

Figure- Universal Testing Machine with Plotter & Hydraulic Load Dial

Result –
The Peak load of Pre-stress beam = 32.50 KN.
The Peak load of RCC beam = 31.45 KN.



Beam with base plate and nut is shown in figure

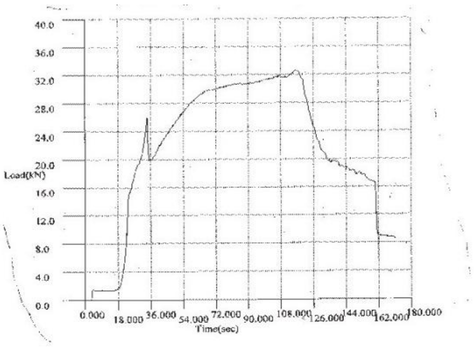
Heat generated about 170^0 C which causes sulpher to be melt & bars to elongate at this time we will tighten the nuts by using mechanical tools. Some losses will occur in

Beam after anchoring been done hence it needs 24 hours for further test . Now considering beam as simply supported & using UTM (Universal Testing Machine) as for calculation of bending moment.

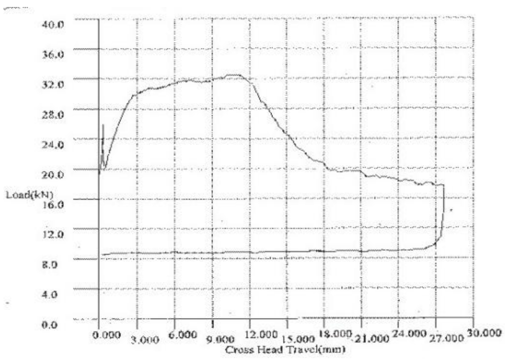
This process is applied for both the conditions that are flat &transverse so that graphs may be made for both the conditions. Under UTM the distance between supports is fixed. Width, Thickness & Crosshead Travel is first found then Peak Load, Cross Head Travel at Peak &Transverse strength is found. *Plotter attached with UTM machine draw complete graph till start to specimen break*

Transverse Test Report is as under:

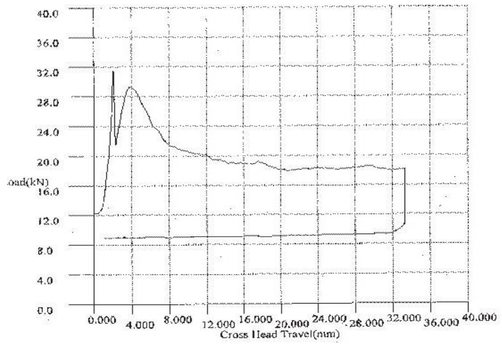
1)
Machine Model : TUE-C-1000.
Machine Serial No. : 2009/50
File name : A4, CIVIL, UTM.
Material Type : RCC Beam 1 (Pre-stress)
Distance between
Supports : 420.00 mm
Width : 150.00 mm
Thickness : 250.00 mm
Max. Cross head
Travel : 250.00 mm
Peak Load : 32.50 KN.
Cross head Travel
At Peak : 11.20 mm
Transverse strength :06.07 N/mm^2



Transverse Test Report is as under:
2)
Machine Model : TUE-C-1000.
Machine Serial No. : 2009/50
File name : A4, CIVIL, UTM.
Material Type : RCC Beam 2 (Pre-stress)
Distance between
Support : 420.00 mm
Width : 150.00 mm
Thickness : 250.00 mm
Max. Cross head
Travel : 250.00 mm
Peak Load : 32.50 KN.
Cross head Travel
At Peak : 11.20 mm
Transverse strength :06.07 N/mm^2

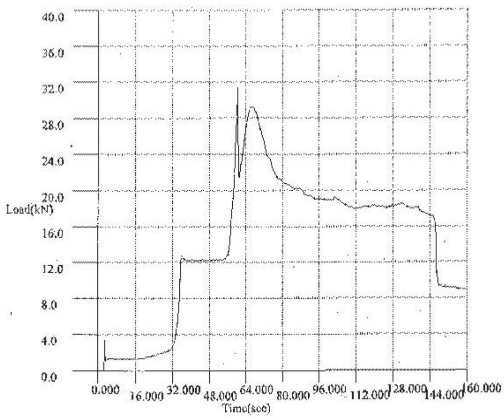


Transverse Test Report is as under:
3)
Machine Model : TUE-C-1000.
Machine Serial No. : 2009/50
File name : A4, CIVIL, UTM.
Material Type : RCC Beam 3
Distance between
Support : 420.00 mm
Width : 150.00 mm
Thickness : 250.00 mm
Max. Cross head
Travel : 250.00 mm
Peak Load : 31.45 KN.
Cross head Travel
At Peak : 2.20 mm
Transverse strength :05.87 N/mm^2



Transverse Test Report is as under:
4) Machine Model : TUE-C-1000.
Machine Serial No. : 2009/50
File name : A4, CIVIL, UTM.
Material Type : RCC Beam 4
Distance between
Support : 420.00 mm
Width : 150.00 mm
Thickness : 250.00 mm
Max. Cross head
Travel : 250.00 mm
Peak Load : 31.45 KN.
Cross head Travel
At Peak : 2.20 mm

Transverse strength : 05.87 N/mm^2



CONCLUSION:-

We found from study that pre stress concrete anchoring devices influencing tremendously to the civil engineering decisions. It involve various process of pre stressed concrete which 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 are taken by RCC beam. It is one of the simple methods for anchoring the beam at cheaper rate.

RECOMMENDATIONS:-

As we knew about the methods of pre stressing i.e. pre & post tensioning systems are better effective in their respective fields.

But the post-tensioning system has less loss then the other system of pre-tensioning in pre stressing. The reliability and accuracy of anchoring device meet the requirement of design &specifications.

CONCLUSION & REC*OMME*NDATIONS:-

We came to conclusion to adopt pre-stress concrete in practice by using this method for all kind of structural work to-day. As pre-stressed structures are found more economical may be at long run but with small section can take more loads in a structure. It has been found more strength & durability as compare to RCC structure. Rich concrete grade can be used with high strength alloy steel hence, density and load caring capacity may enlarge. Other benefits of pre-stressing property of light weight along with high strength may be adopted by including FRP to reduce cracks as resistance to cracks is obtained, also gives more space, 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.

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