JYOTHISHMATHI INSTITUTE OF TECHNOLOGY & SCIENCE

PRINCIPLES OF PRESTRESSED CONCRETE STRUCTURES

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What is Prestressed Concrete ?

- Concrete in which reinforcing steel bars are stretched and anchored to compress it and thus increase its resistance to stress.

Main difference Between

REINFORCED CONCRETE

&

PRE-STRESSED CONCRETE

- Both utilizes the structural capabilities of steel and concrete. Concrete is very strong in compression, but relatively weak in tension.

Ordinary Reinforced Concrete

- Beam supports a load by developing compressive stresses at the top, but since the concrete cannot resist the tension at the bottom, it cracks there.

- Reinforcing steel bars are placed within this tension zone to resist the tension and control the cracking.

Pre-stressed Concrete

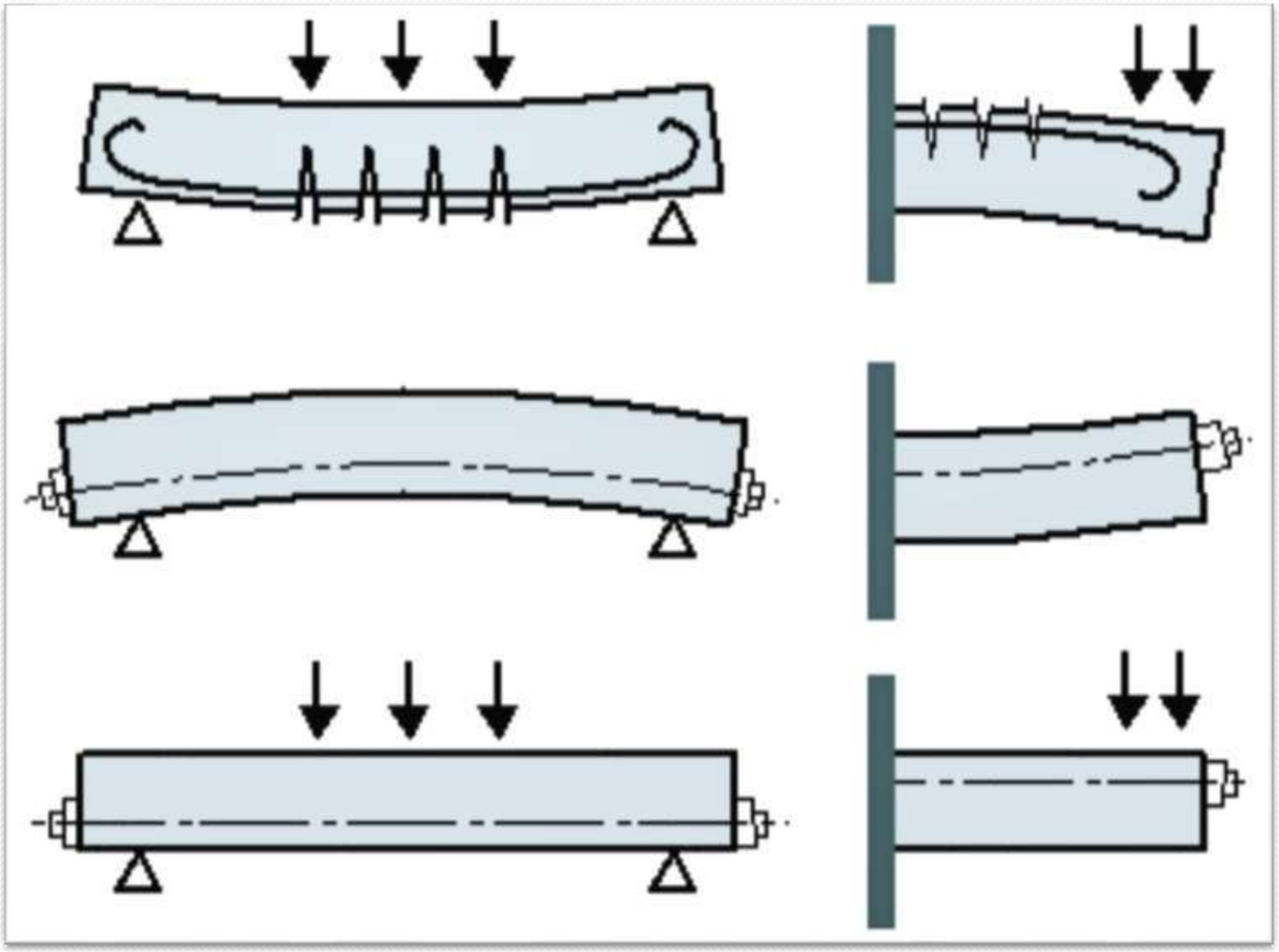
- It involves the application of forces tending to bend and compress a concrete element in order to counteract bending which results from loading.

- The forced applied is the tensioning or stretching of the steel component which usually in the form of high tensile strands, wires or bars.

Reinforced Concrete

Prestressed Concrete Before Loading

Prestressed Concrete After Loading



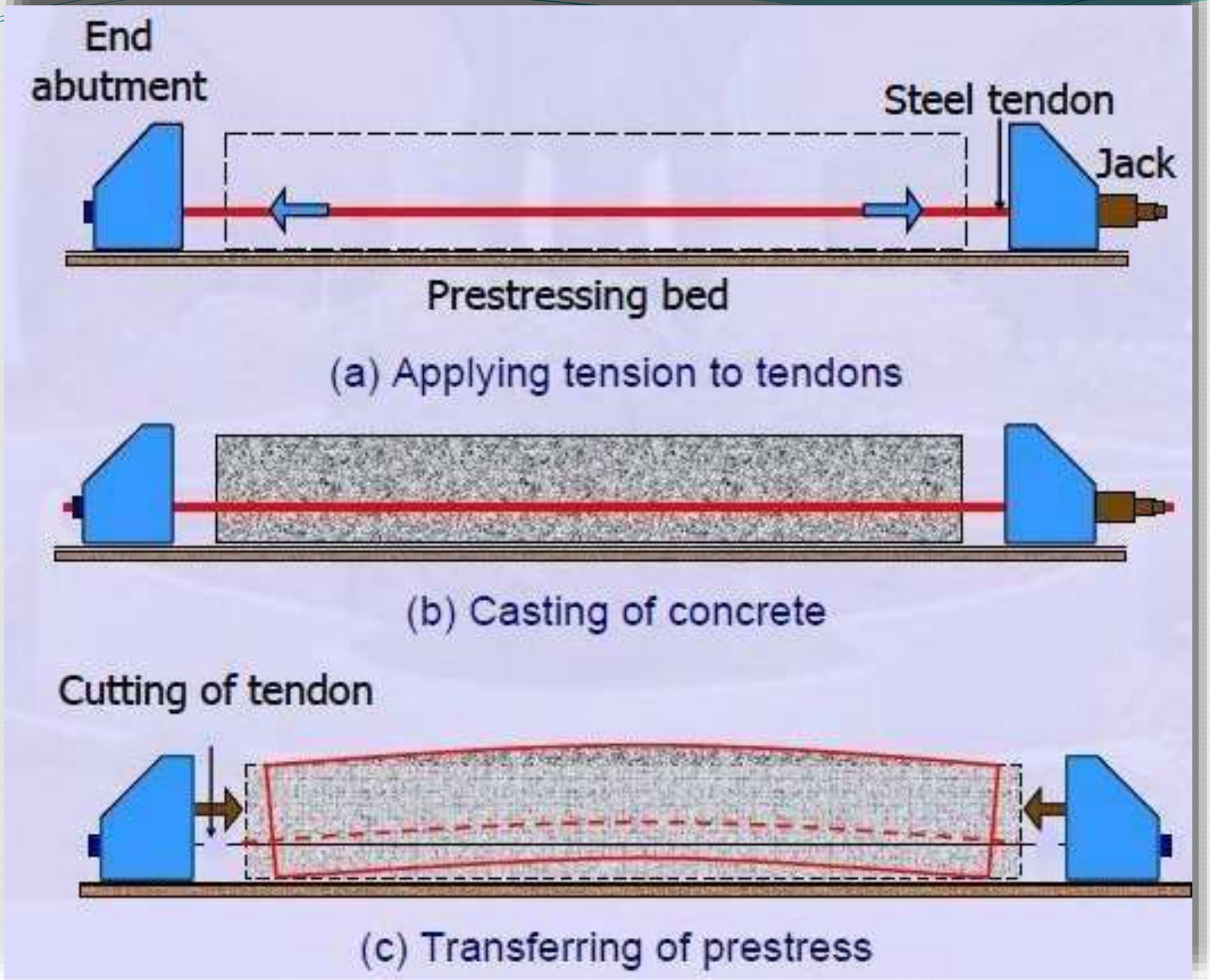
Pre-Tension & Post-Tension

- These two differ in the method of stressing the elements. A description of the construction sequences will help bring out this difference.

Pretension - Pre-stressed Concrete

- The beams or elements are constructed on a stressing bed and stranded cable is placed between two buttresses anchored to a stressing bed which holds the force in the stretched cables.

- After stretching the steel with hydraulic jacks, concrete is placed in forms around the cables and allowed to harden. When the concrete reaches sufficient strength, the pre-stress forced is transferred to the concrete by bond when the steel strand at the ends of the beam is cut loose from buttresses.


End abutment
Steel tendon
Jack
Prestressing bed
(a) Applying tension to tendons
(b) Casting of concrete
Cutting of tendon
(c) Transferring of prestress

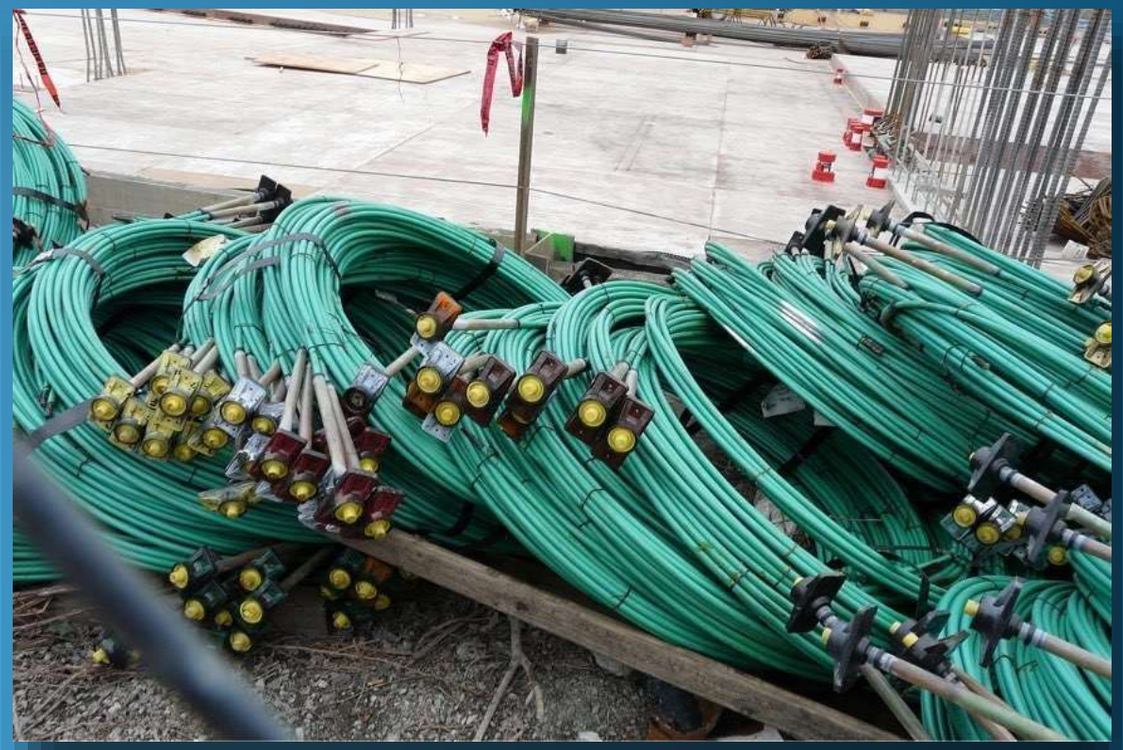
Pre-tensioned Concrete Beam

Post-tensioned Pre-stressed concrete

- Post tensioning is a technique for reinforcing concrete.
- Steel cables inside plastic ducts or sleeves, are positioned in the forms before the concrete is placed. Afterwards, once the concrete has gained strength, the cables are pulled tight and anchored against the outer edges of the concrete.

Process Post-tensioning

1.Rolls of post-tensioning cables



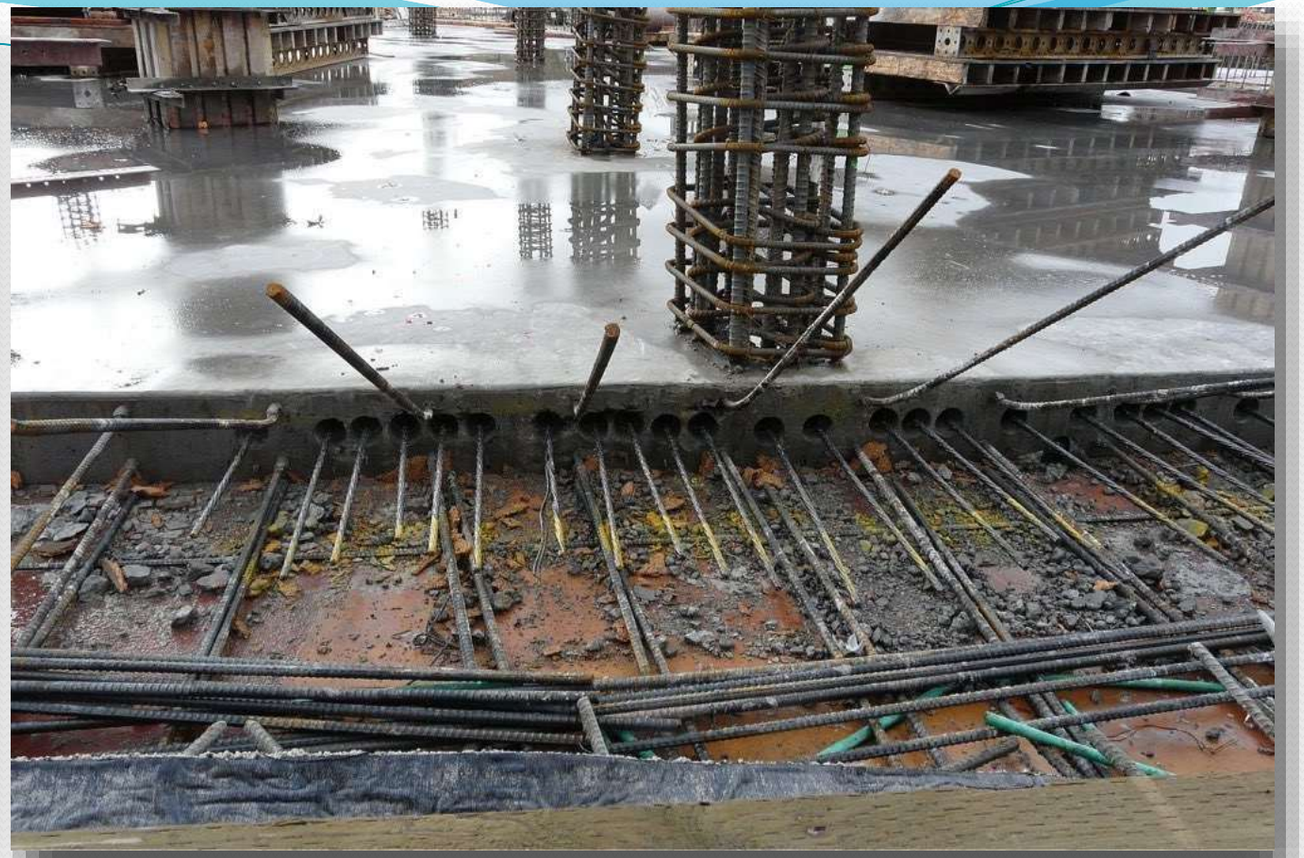
2. Pulling anchors

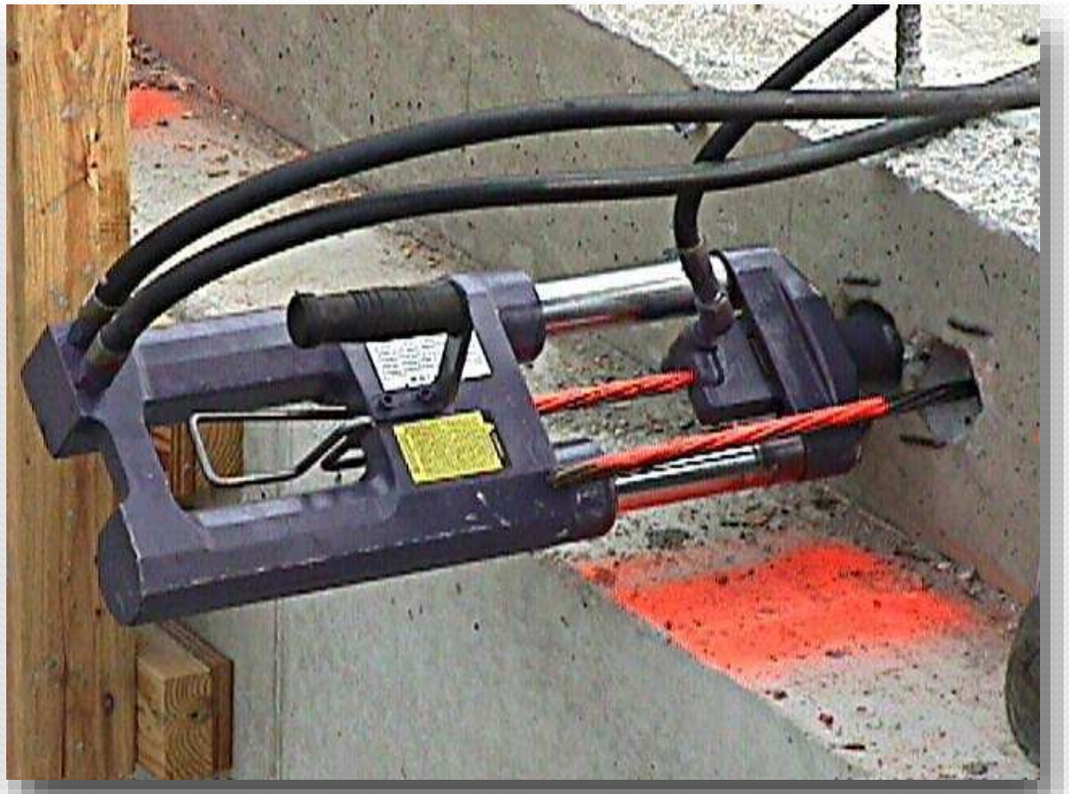
for post- tensioning cables

3.Positioned

post- tensioning cables

4. Post-tensioning cable ends extending from freshly poured concrete





5. Hydraulic Jack are used to pull the Cables

Pre-tensioned pre-stressed concrete is usually fabricated away from the job site in a pre-stressing plant, whereas in post-tensioned pre-stressed concrete the application of stressing forces to the structure is done at the job-site.

Tensioning Devices

1.Mechanical devices: The mechanical devices generally used include weights with or without lever transmission, geared transmission in conjunction with pulley blocks, screw jacks with or without gear devices and wire-winding machines. These devices are employed mainly for prestressing structural concrete components produced on a mass scale in factory.

2.Hydraulic devices: These are simplest means for producing large prestressing force, extensively used as tensioning devices.

3.Electrical devices: The wires are electrically heated and anchored before placing concrete in the mould. This method is often referred to as thermo-prestressing and used for tensioning of steel wires and deformed bars.

4.Chemical devices: Expanding cements are used and the degree of expansion is controlled by varying the curing condition. Since the expansive action of cement

Advantages of Prestressed Concrete

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Lower construction cost

- Thinner slabs, which are especially important in high-rise buildings where floor thickness savings can translate into additional floors for the same or lower cost
- Fewer joints since the distance that can be spanned by
- post-tensioned slabs exceeds that of reinforced construction with the same thickness
- Longer span lengths increase the usable unencumbered floorspace in buildings and parking structures
- Fewer joints lead to lower maintenance costs over

Disadvantages of Prestressed Concrete

- The major problem with prestressed concrete is that it needs specialised construction machineries like jacks anchorage etc.
- Advanced technical knowledge and strict supervision is very important.
- For concrete prestressing, high tensile reinforcement bars are needed which costs greater than generally used mild steel reinforcement bars.
- Highly skilled labor is needed for prestressed concrete constructions.

Thank You