

University of Al-Qasim Green
College of Water Resources
Hydraulic Structures Department



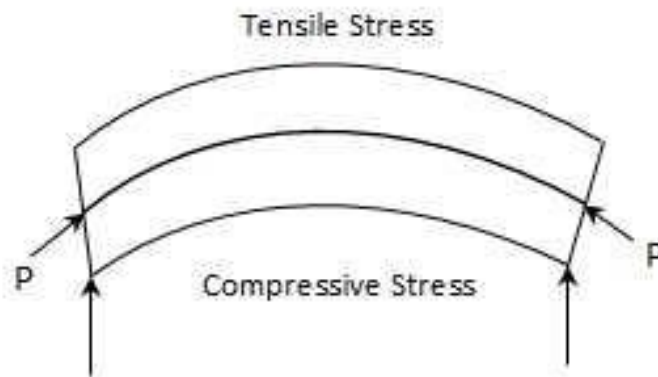
Structural Design of Hydraulic Structures

Prestressed Concrete

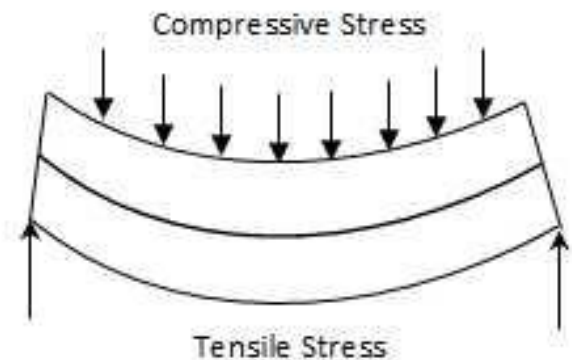
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Introduction

The prestressing of structure member may be defined as the creation of initial stress of opposite sign to the stress produce by the working load without increasing the actual max stresses in the member



(Before Loading) Due to prestressing



(After Loading) Due to external loads

Advantage of Prestressed Concrete

1. Control of deflection (may be get zero deflection).
2. Control of cracking (or prevent cracking).
3. Using high strength materials (steel and concrete) led to minimizing section of structural member following to reduce the dead weight.

Prestressing Systems:

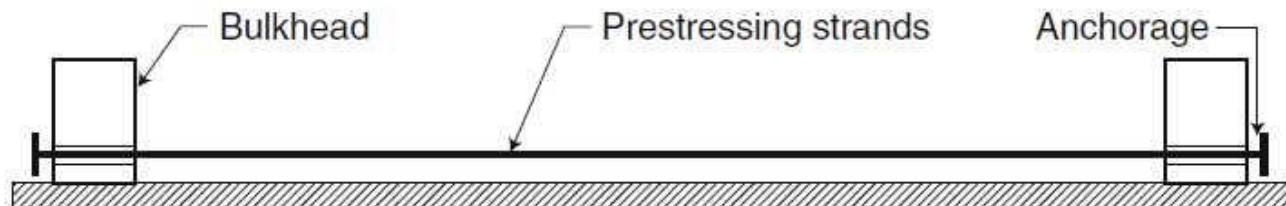
1-Pretensioning System:

In this system, we will be tension the reinforcement before casting of concrete.

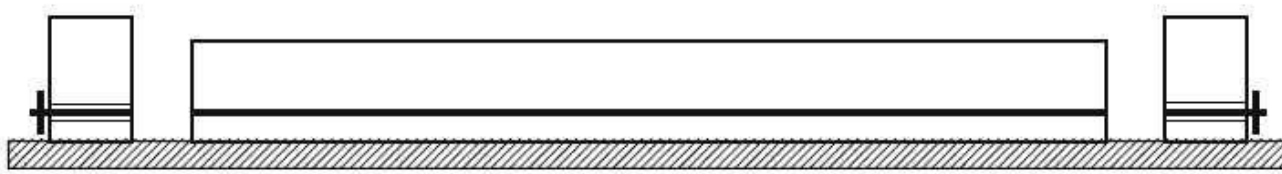
A-Tension reinforcement



B-Casting concrete



C- Transfer of prestress force to the concrete after left the jacks from the two ends.



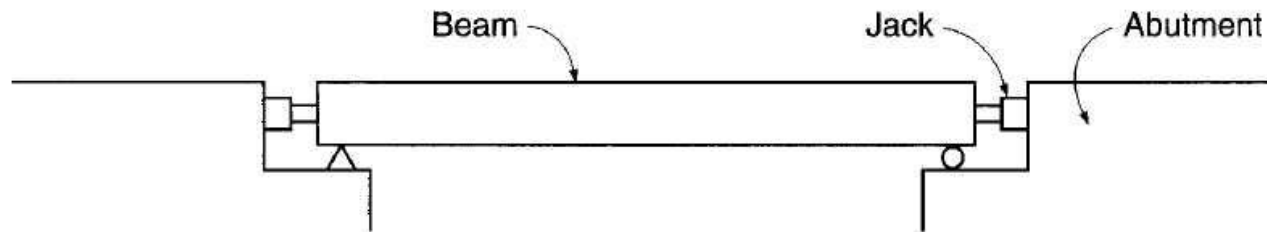
The system using in:

- ✓ Precast prestressed members.
- ✓ Small member.

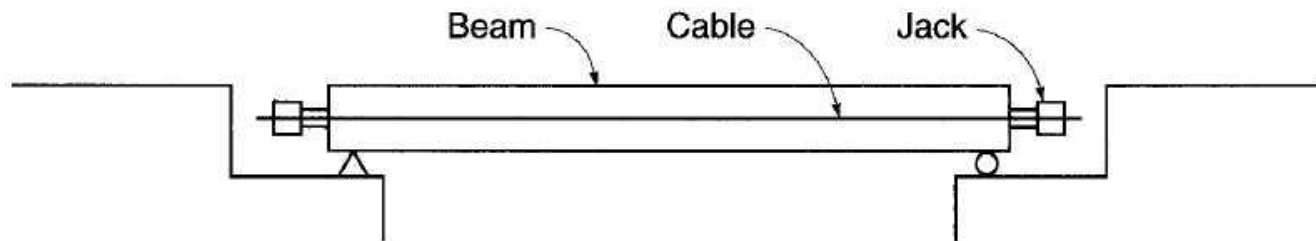
2-Post-tensioning System:

In this system, we will be tension the reinforcement after casting of concrete.

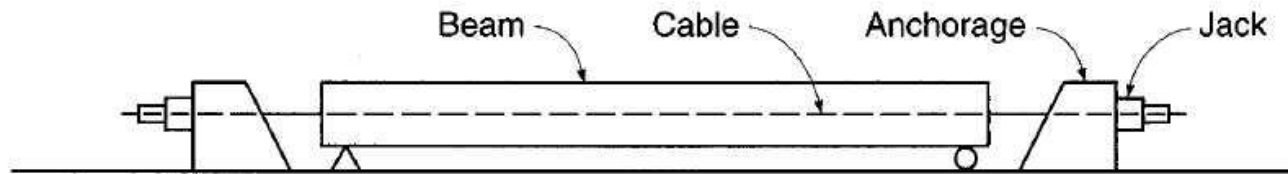
a-Casting concrete



b-Transfer of prestress



C-Lifting jack



The system using in:

- ✓ Precast prestressed members
- ✓ Small member

The duct for the tendon **empty** named as **unbounded** or **(ungrouting)**; but when **fill** with concrete, it named as **bounded (grouting)**.

Properties of Concrete and Steel Used for Prestress Concrete:

1-Concrete:

High strength concrete is used for prestressed structures members

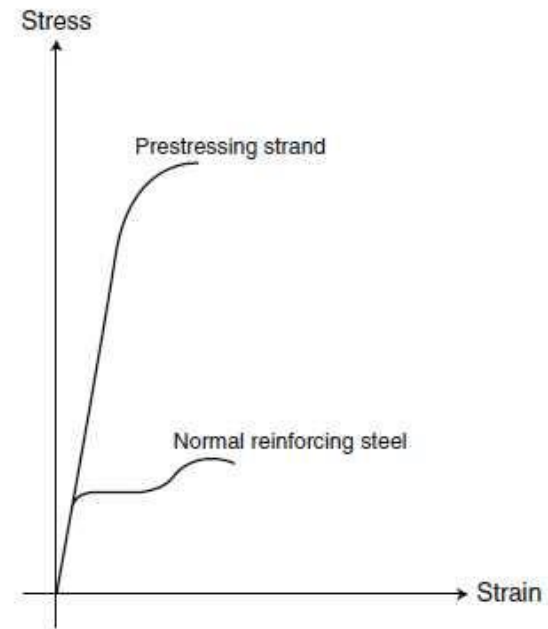
$f_c' \geq 40 \text{ Mpa}$ according ACI Limits.

2-Prestressing Steel:

High tensile strength steel is used in prestress concrete.

Types of Prestressing Steel:

- 1- Individual wire tendon.
- 2- Strand cable: made up of seven wires.
- 3- Alloy high strength steel.



Stress-strain curve of prestressing strands versus reinforcing steel

Flexural Analysis of Prestress Concrete Members

- 1- Elastic Analysis
- 2- Ultimate Strength Analysis (Flexural Strength)