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DEPARTMENT OF

CIVIL ENGINEERING

Lecture Notes
on
23CE703 - Prestressed Concrete

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UNIT IV

Transfer of Prestress in Pretensioned Members

Transmission of Prestress

This section covers the following topics.

- Pre-tensioned Members

4.1 Pre-tensioned Members

The stretched tendons transfer the prestress to the concrete leading to a self equilibrating system. The mechanism of the transfer of prestress is different in the pre-tensioned and post-tensioned members. The transfer or transmission of prestress is explained for the two types of members separately.

For a pre-tensioned member, usually there is no anchorage device at the ends. The following photo shows that there is no anchorage device at the ends of the pre-tensioned railway sleepers.

For a pre-tensioned member without any anchorage at the ends, the prestress is transferred by the bond between the concrete and the tendons. There are three mechanisms in the bond.

Adhesion between concrete and steel

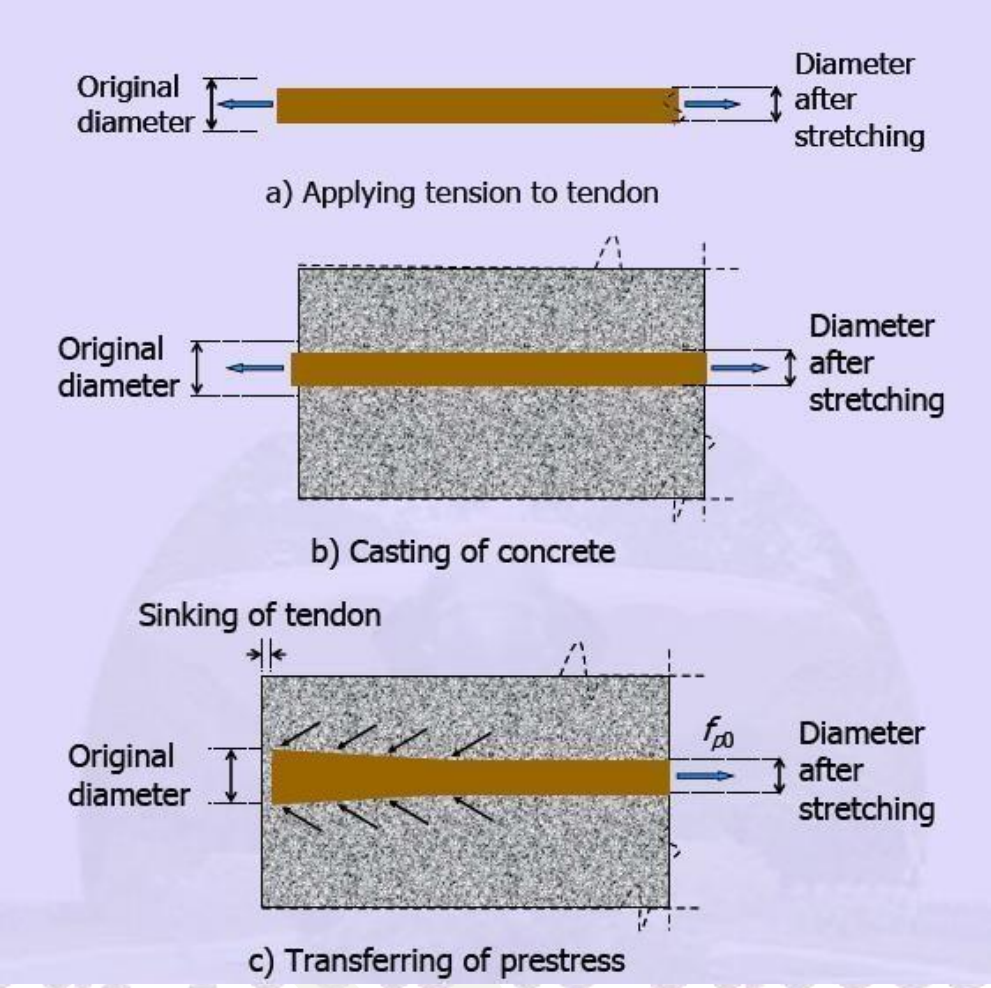
Mechanical bond at the concrete and steel interface

4.2 Hoyer Effect

After stretching the tendon, the diameter reduces from the original value due to the Poisson's

effect. When the prestress is transferred after the hardening of concrete, the ends of the tendon sink in concrete. The prestress at the ends of the tendon is zero. The diameter of the tendon regains its original value towards the end over the transmission length. The change of diameter from the original value (at the end) to the reduced value (after the transmission length), creates a wedge effect in concrete. This helps in the transfer of prestress from the tendon to the concrete. This is known as the Hoyer effect. The following figure shows the sequence of the development of Hoyer effect.

Since there is no anchorage device, the tendon is free of stress at the end. The concrete should be of good quality and adequate compaction for proper transfer of prestress over the transmission length.



Transmission Length

There are several factors that influence the transmission length. These are as follows.

1) Type of tendon
   - wire, strand or bar
2) Size of tendon
3) Stress in tendon
4) Surface deformations of the tendon
   - Plain, indented, twisted or deformed
5) Strength of concrete at transfer
6) Pace of cutting of tendons
   - Abrupt flame cutting or slow release of jack
7) Presence of confining reinforcement
8) Effect of creep
9) Compaction of concrete
10) Amount of concrete cover

The transmission length needs to be calculated to check the adequacy of prestress in the tendon over the length. A section with high moment should be outside the transmission length, so that the tendon attains at least the design effective prestress (f_{pe}) at the section. The shear capacity at the transmission length region has to be based on a reduced effective prestress.

IS:1343 - 1980 recommends values of transmission length in absence of test data. These values are applicable when the concrete is well compacted, its strength is not less than 235 N/mm at transfer and the tendons are released gradually. The recommended values of transmission length are as follows.

Values of transmission length

For plain and intended wires	$L_t = 100\ \Phi$
For crimped wire	$L_t = 65\ \Phi$
For strands	$L_t = 30\ \Phi$

Here, Φ is the nominal diameter of the wire or strand.