

Unit-II

- Methods & Systems of Prestressing
- Losses of Prestress

Learning Objectives

- Understand pretensioning and post-tensioning methods.
- Study major prestressing systems.
- Explain all losses of prestress.

Introduction

- Prestressing improves structural performance by inducing compressive stresses before service loads.

Pretensioning Method

- • Tendons stressed before casting.
- • Force transferred by bond.
- • Used in precast members.
- • Advantages and limitations.

Pretensioning Procedure

- Step 1: Stretch tendons.
- Step 2: Cast concrete.
- Step 3: Cure concrete.
- Step 4: Release tendons.

Applications of Pretensioning

- Sleepers, electric poles, piles, precast beams, hollow-core slabs.

Post-tensioning Method

- • Tendons stressed after concrete hardens.
- • Uses ducts and anchorages.
- • Suitable for long-span construction.

Post-tensioning Procedure

- Cast member → Cure → Insert tendons → Stress → Anchor → Grout ducts.

Comparison

- Pretensioning vs Post-tensioning: equipment, bond, applications, economy.

Hoyer System

- Uses bond transfer between steel and concrete after release.
- Simple and economical for precast production.

Magnet-Blaton System

- Uses flat wedges and anchorage plates.
- Suitable for multiple wires with reliable anchorage.

Freyssinet System

- Uses conical wedges and multi-wire cables.
- One of the earliest practical post-tensioning systems.

Gifford-Udall System

- Uses split wedges and steel anchorages.
- Widely adopted in bridge construction.

Lee-McCall System

- Uses threaded bars with nuts as anchorages.
- Suitable for bar prestressing.

Comparison of Systems

- Table: Anchorage, Tendons, Applications, Advantages.

Introduction to Losses

- Prestress reduces with time due to material behavior and construction effects.

Elastic Shortening

- Immediate loss due to shortening of concrete during transfer/loading.

Shrinkage of Concrete

- Concrete volume decreases with time causing reduction in steel stress.

Creep of Concrete

- Long-term deformation under sustained load causing prestress loss.

Relaxation of Steel

- Steel stress decreases under constant strain over time.

Anchorage Slip

- Loss occurs due to movement of wedges during anchoring in post-tensioning.

Friction Loss

- Occurs due to tendon curvature and wobble in ducts.

Losses in Pretensioned Members

- Elastic shortening, shrinkage, creep, relaxation are dominant.

Losses in Post-tensioned Members

- Elastic shortening, shrinkage, creep, relaxation, friction and anchorage slip.

Summary Table

- Compare all losses: Cause, Occurrence, Formula (brief), Prevention.

Methods to Reduce Losses

- Use high-strength materials, proper curing, low-relaxation steel, accurate stressing.

Numerical Problem Steps

- General procedure to solve prestress-loss problems.

Exam Questions

- Important university questions and viva points.

Key Takeaways

- Revision of methods, systems and losses.

Thank You

- Questions & Discussion