Post-Tension Slabs: Analysis, Design & Construction

An Online Continuing Education Course for Engineers

Course Number: C-3036

Credit: 3 Hours / 3 PDH / 3 CPD

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Post-Tension Slabs: Analysis, Design & Construction

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Introduction

In the realm of civil engineering, the demand for efficient construction solutions is on the rise. Post-tension slabs have emerged as an ideal choice for a wide range of applications, offering unparalleled durability, strength, and flexibility. In this course, we will delve into the major benefits of post-tension slabs, including their enhanced safety, design versatility, and cost-effectiveness. Additionally, we will explore essential considerations to bear in mind when opting for post-tension slabs for a construction project.

Understanding Post-Tension Concrete Slabs

Post-tension concrete slabs belong to the category of prestressed concrete, where high-strength steel cables or wires are utilized to apply tension to the concrete. This prestressing force effectively counters the compressive forces that would otherwise impact the concrete. The application of post-tension slabs finds common use in constructing bridges, parking structures, high-rise buildings, and other projects that demand heightened durability and strength.

How Post-Tension Slabs Work

Post-tension slabs represent a specialized type of construction method, boasting numerous advantages. They seamlessly integrate into various structural applications, each with its unique development process. The arrangement of tendons in concrete for simply supported beams, continuous beams, slabs, box girders, and other structures varies significantly. The design concepts also adapt to suit the specific type of structure being built.

By capitalizing on the inherent properties of high-strength steel and concrete, post-tension slabs have become a preferred choice for engineers seeking to optimize construction projects. Their ability to withstand varying forces and offer efficient solutions makes them an asset in modern civil engineering endeavors.

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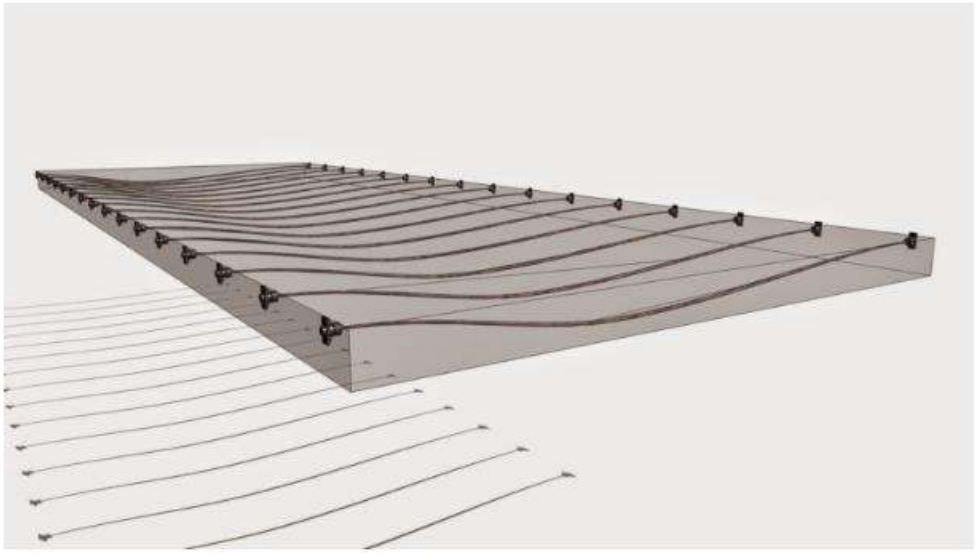
Post-tension cables are provided similarly as we provide the reinforcement to carry the tensile stresses in the section. Though the design concepts of post-tension elements and reinforced concrete elements differ, they are used for the same purpose.

As you can see in the above figure, cables are placed close to the bottom of the slab and the top of the slab based on the sagging and hogging bending moment developments.



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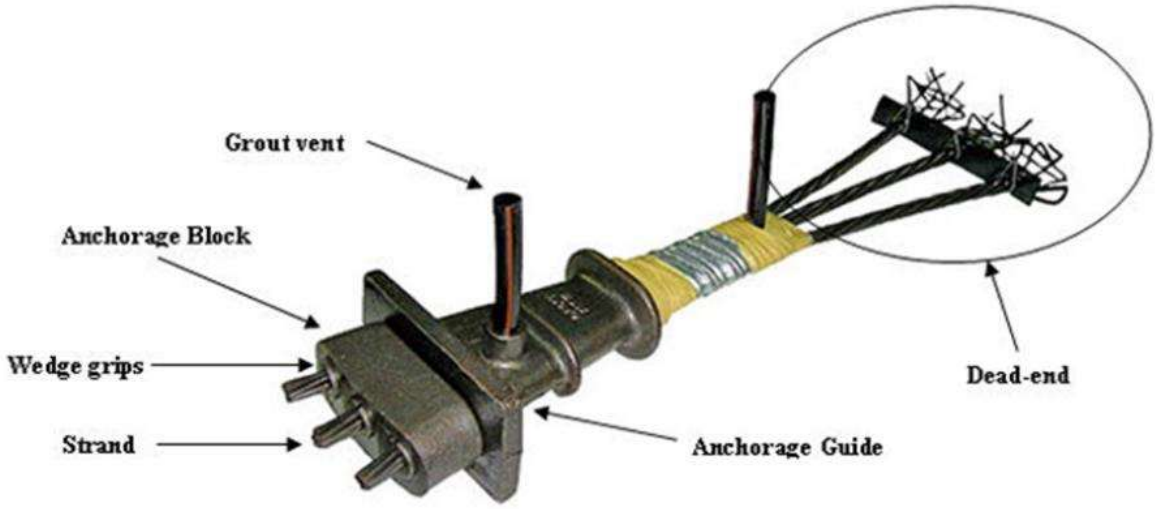
Main Component of Post-Tensioning

1. Anchors

Anchor is the main component that holds the tensioned cable. There are different types of anchors, and the type of anchor varies at two ends.



2. Ducts

There are different types of ducts. They can be categorized based on the type of material used for construction. Steel or corrugated pipes are used for this purpose. The tendons are run in these ducts and they should be placed as specified in the tendon layout.

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3. Tendons

A major component of pre-stressing and post-tension is the tendon. Depending on the loads to be applied on the tendons in post-tension slabs, the area of the tendons is determined.

PT slab Construction Steps

The basic steps of the construction of the PT slab are as follows:

- Complete the formwork of the slab.
- Lay the bottom reinforcement of the slab which is specified by the design.
- Lay the post-tension concrete slab ducts.
- Fix the top reinforcement net.
- Installation of reinforcement net would be done together with the post-tension ducts.
- Install all other MEP amendments.
- Proceed with concreting after confirmation of the formwork, setting out, reinforcement, ducting arrangement, etc.
- After the concrete gains adequate strength, proceed with stressing of the post-tension cables.
- Proceed with grouting.

Advantages of Post-tension Slabs

The major benefits of post-tension concrete slabs include their increased safety, design versatility, and cost-effectiveness.

Regarding safety, post-tension slabs offer several advantages. The prestressing force applied to the concrete helps to increase its resistance to both tensile and compressive forces. This results in a more

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stable structure that is less likely to experience cracking or failure. In the event of an earthquake or other catastrophic event, post-tension concrete slabs are less likely to collapse, making them a safer option for construction projects.

Post-tension slabs also offer increased design versatility. Due to the pre-stressing force, PT slabs can span greater distances than conventional concrete slabs. This makes them an ideal solution for a variety of construction projects. In addition, post-tension slabs can be designed to accommodate a variety of loads.

Some advantages of PT slabs:

- Floor-to-floor height can be reduced in some cases, resulting in lower costs.
- PT reduces or eliminates shrinkage cracking; therefore, fewer joints are needed.
- Cracks that do form are held tightly together.
- The weight of the structure can be reduced.
- PT allows us to build slabs on expansive or soft soils.
- Less columns allow more space without disturbances.
- PT allows slabs and other structural members to be thinner.
- Lower serviceability issues
- Lower maintenance
- Sustainable construction

Disadvantages of Post-tension Slabs

- Since this is specialized work, skilled labor and technical staff are required.
- Poor workmanship could lead to failure of construction.
- Quality of construction is very important; failure could lead to serious issues.
- Laying of tendons shall be done as specified in the drawings and there is no room for errors.

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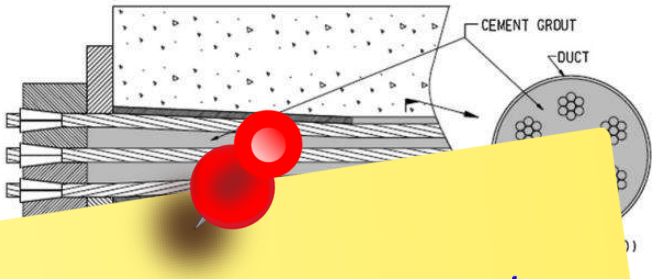
Post-Tension Type



(a) Bounded Post-Tensioning

(b) Unbounded

To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.

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(a) Bonded Post-T
Used for large stru nclude increased span leng

(b) Un-bonded Post-
Typically used in new rders, joists, shear walls, and mat can be easily and rapidly installed – pro

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