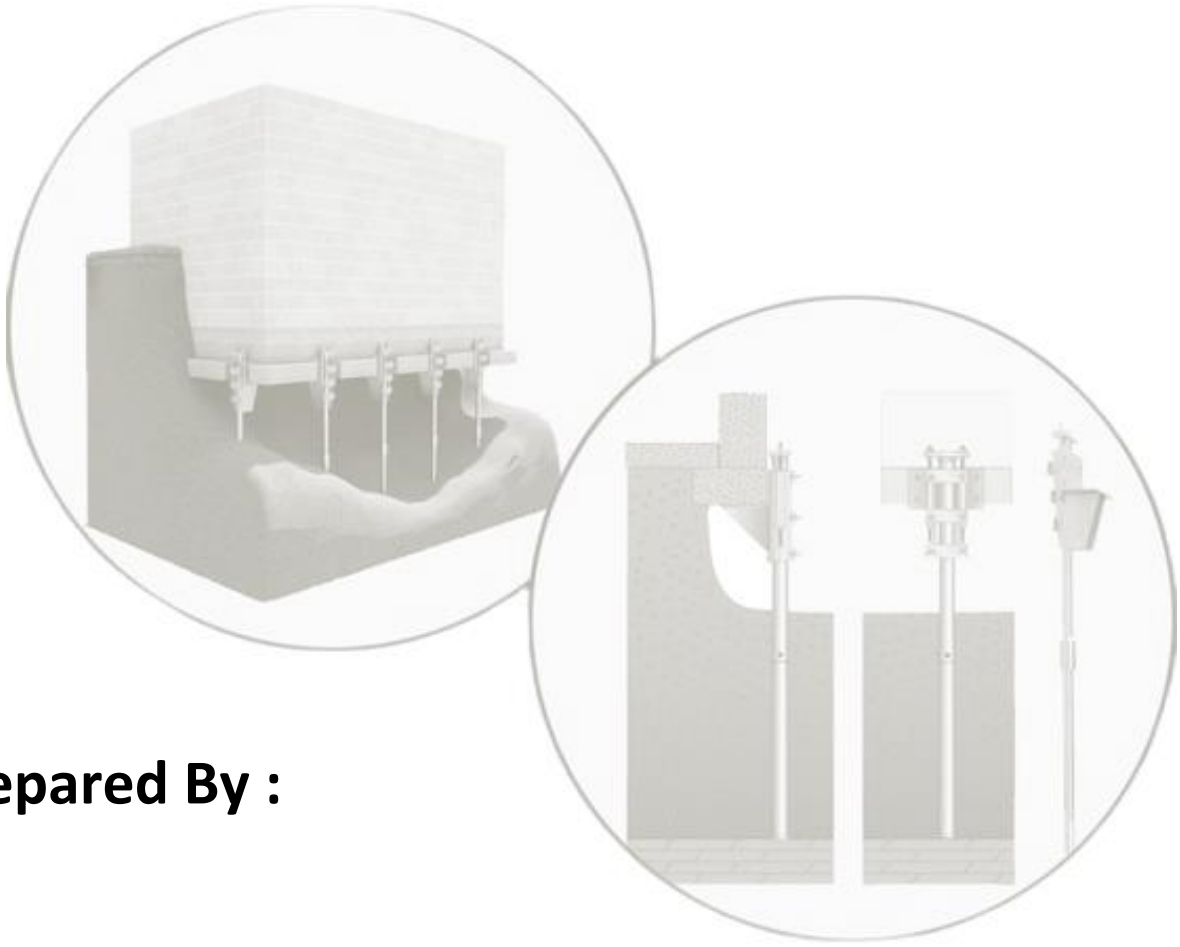
Underpinning Method

Of Foundation



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Abstract

Underpinning is a method of repairing and strengthening building foundations. Methods and procedures and their application in strengthening different types of foundations are discussed in this study. Basically, an unexpected failure occurs after the completion of the structure (both substructure and superstructure).

At this time , a remedial method must be proposed for structural stability. The underpinning method helps to strengthen the foundation of an existing building or any other infrastructure. It involves the installation of permanent or temporary supports to an existing foundation in order to achieve greater depth and bearing capacity.

Introduction

Underpinning is a sensitive process in which the foundation of the structure is strengthened, so we must choose the right method, which requires complete information on the soil layers, the current condition and the problems of the entire foundation and the depth and distance required for the new foundation.

In other words, underpinning creates a new foundation that replaces the old one

The process of underpinning begins by removing or excavating the soil from beneath an existing foundation.

In order to prevent the possibility of the foundation being undermined and causing structural failure, the soil removal is done in controlled, limited-length phases known as "pins."

A geotechnical engineer determines the depth of the excavation by analyzing the composition of the soil to locate the strata that can support the weight of the project. New material, usually concrete, is added to the excavated soil to create a new foundation on top of the old one. The procedure is repeated on the following portion of the foundation until the wall's full length is strengthened once one of the "pins" is finished and the concrete has had time to cure.

When the wall's full length is strengthened, the procedure is repeated on the following part of the foundation.

Purpose of Underpinning

Underpinning is done for the following purposes:

• When the building next to it is built with a deep foundation, it is done to guide an old shallow foundation to the deeper depth.

• The current building's basement is being built with underpinning.

• To strengthen a settled foundation that may be the result of wall cracks; underpinning is done to deepen the current foundation (which is resting on poor stratum) and make it rest on deeper soil strata with higher bearing capability.

• To strengthen a settled foundation that may be caused by cracks in the wall.

Reasons for Underpinning

Underpinning an established foundation can be done for a variety of reasons, the most popular being as follows:

1 Because older buildings were not built to today's standards, their foundations are shallow.

2 Because the initial design did not adequately evaluate the soil conditions, the curr ent foundation is insufficiently sturdy.

3 Unstable structural integrity brought on by calamities like floods and earthquakes

4 The building's intended use has evolved, typically following extensive renovations

5 Construct a stronger foundation to enable the addition of a story.

If you're not sure if your house or structure needs underpinning, you can search for warning indicators of potential foundation problems.

Common ones include sagging cabinets, sloping floors, stuck windows and doors, mold and mildew, and fractures in drywall and concrete slabs. For underlying services, you should contact experts as soon as you detect these.

Types of works for selection of underpinning methods:

Conversion Works

The structure must be modified to serve a different purpose, necessitating a stronger foundation than the one that already exists.

Protection Works

A building has to have protective work done on the following issues:

•The existing foundation is not strong or stable

• The current foundation is weak and unstable.

•Stabilization of the foundation soil to resist against natural calamities

• The requirement to build a basement beneath an existing structure

Remedial Works

- Mistakes in initial foundation design caused subsidence of the structure
- Work on present structure than building a new one

Precautionary Measure Before Underpinning

The following general measures should be undertaken before starting the underpinning operations:

(i) Prior to using underpinning, it is important to determine the building's current strength (e.g., poor workmanship, nonstandard construction methods, or inferior materials).

(ii) Where necessary, strutting and sufficient shoring should be used to offer temporary support.

(iii) Building underpinning requires keeping an eye out for any movements, which should be checked and fixed right away.

(iv) No damage should be caused to the adjoining structures.

(v) It should be ensured that no obstruction is created to the passage of people or vehicles in the

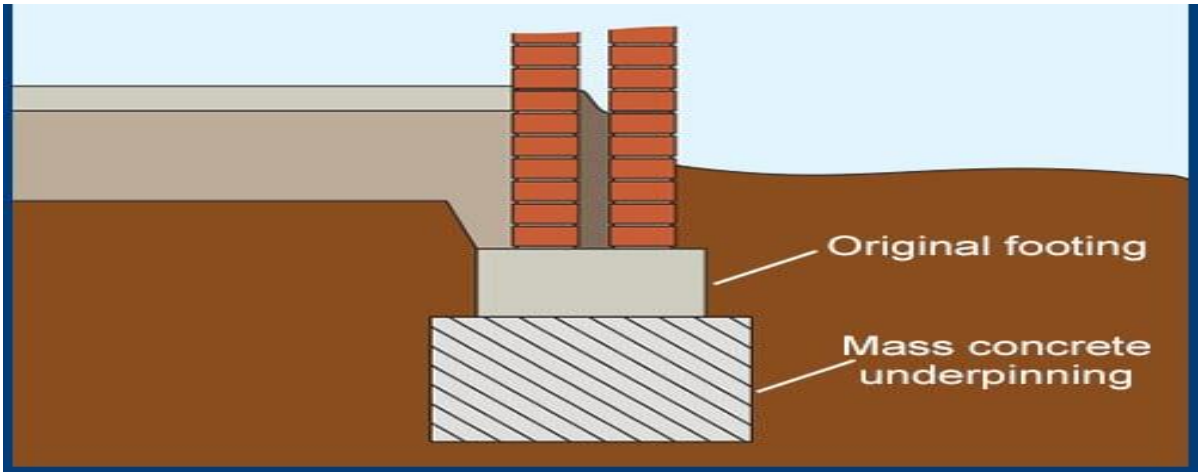
Methods of Underpinning

Underpinning can be carried but by the following methods:

1 .Pit Method or Mass Concrete Underpinning Method

One of the earliest methods is mass or pit concrete underpinning. Methods are implemented to expand the current foundation until a stable layer is reached. The earth beneath the present foundation is visible through the use of stages or pegs. The excavation is backfilled with concrete once the desired layers have been reached, and it is allowed to dry before the next removal procedure can start.

To help transfer the weight from the old base to the new one, a second linchpin made of dried sand and cement can be added. The light foundation makes this easy technique successful. There are better ways to deal with more complex problems the grassroots level



.Fig.1: Mass Concrete Underpinning

2. Pile Method of Underpinning

The pit method may be impracticable or uneconomical in the following cases:

(i) A wet area;

(ii) heavy loads on already-existing buildings; and

(iii) the need to shift loads to a deeper depth.

It is possible to use the pile method in these circumstances.

The piles are driven along the edges of the existing wall using this technique. Next, as illustrated in Fig. below, needles in the shape of pile caps are inserted through the current wall. Thus, the loads that are bearing down on the existing wall are released.

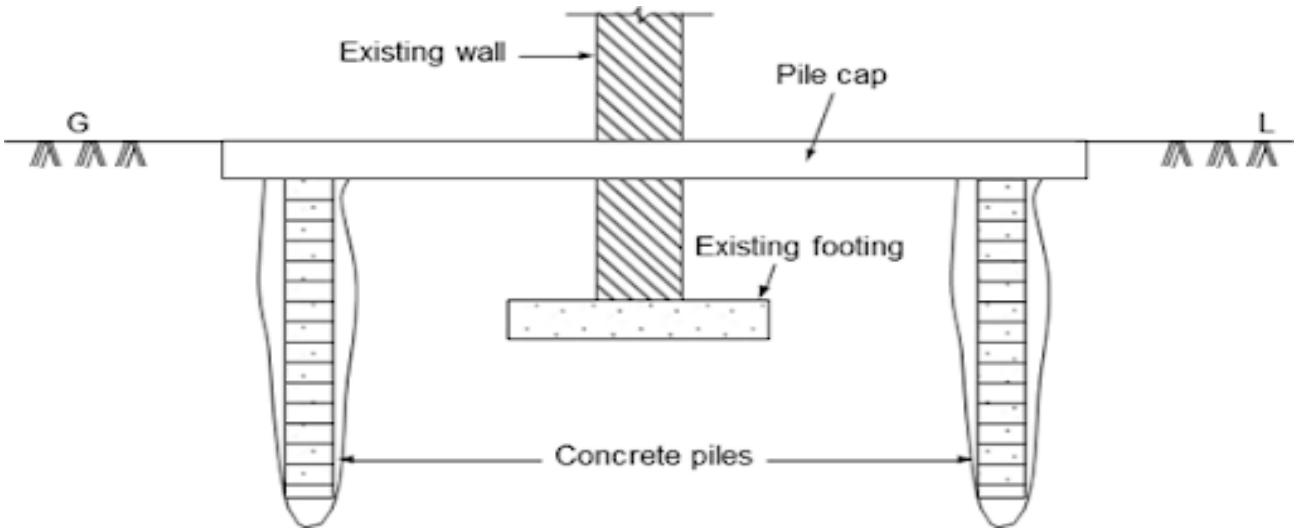


Fig 2: Pile Method of Underpinning

3. Jack Pile Method of Underpinning

Jack Pile Underpinning is an alternative when the depth of strong bearing capacity subsoil makes regular underpinning too expensive. Jack pile underpinning is silent, vibration-free, and versatile since the pile depth may be changed to accommodate the underlying soil. The state of the existing foundations is crucial because, after the hydraulic jacks are removed, the pile caps are cast directly onto the jack pile heads.

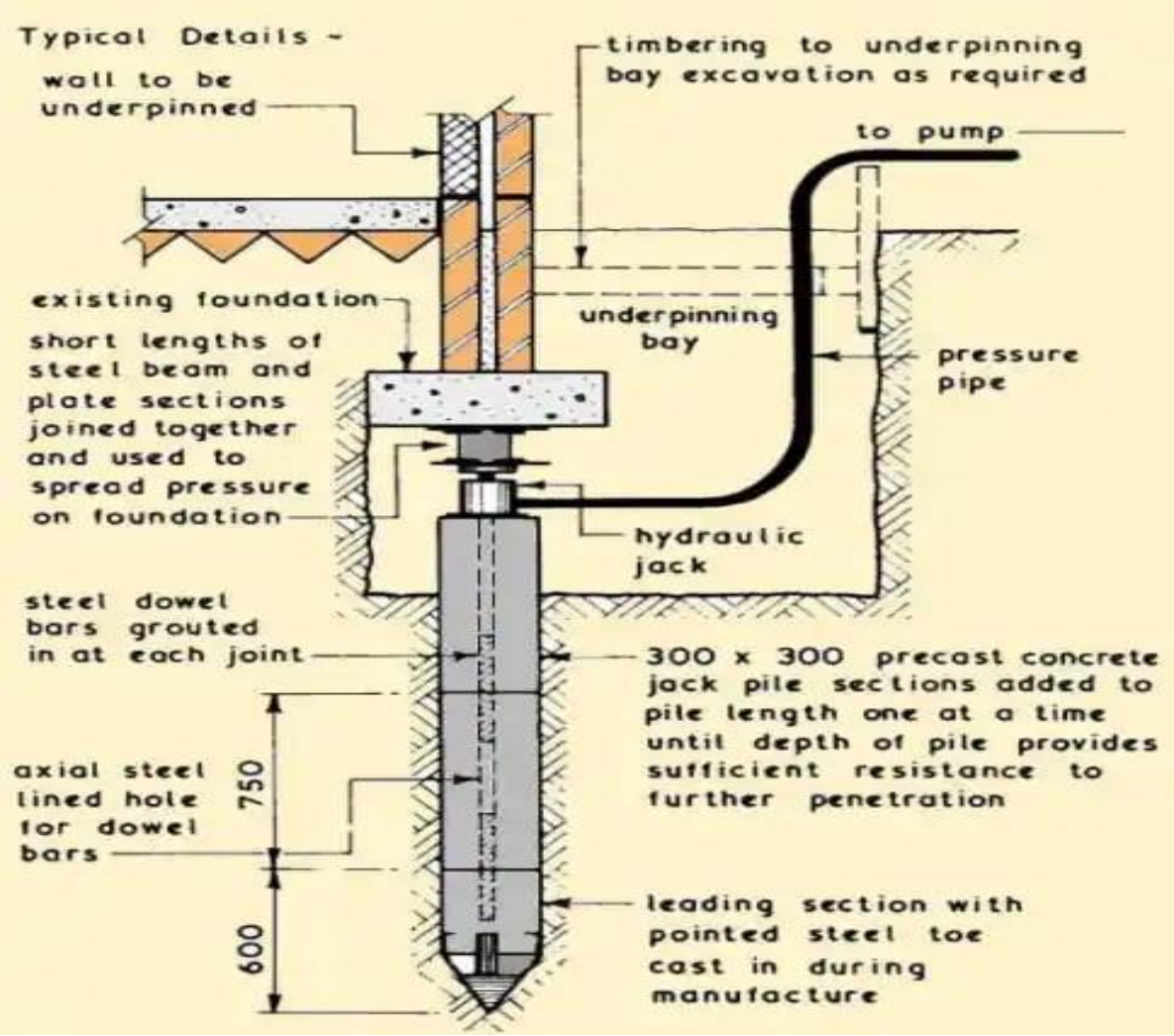


fig 3: Jack Pile Method of Underpinning

4. Root Pile or Angle Piling For Underpinning:

Modern concrete drilling technologies are used in the Root or Angle piling method to manufacture concrete, which lowers building costs and time. Line It is common practice to place or drive pairs of reinforced concrete piles at right angles to one another. Without causing any damage to the subfloor, predrilling with an air-flushed percussion drill strengthens the brick wall. Installing angle piling inside a wall could be difficult. To guarantee their stability, they are so packed closely together.

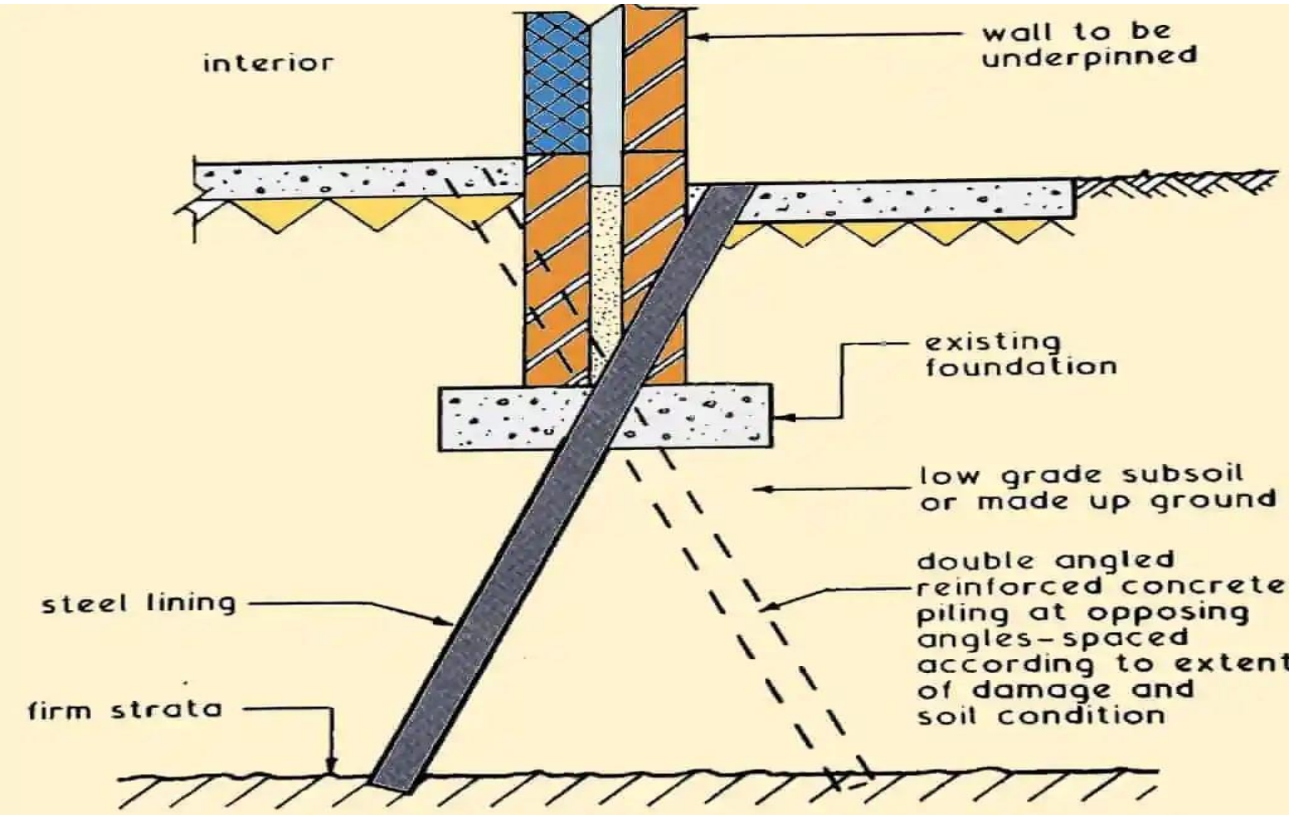


Fig 4: Angle Pile Method of Underpinning

5. Pynford Stool Method for Underpinning

This technique can be used to support the wall in a single continuous run without the requirement for needles or shoring when the existing foundations are in poor condition. The resultant reinforced concrete beam could be utilized alone to support the weight of the wall or it could be combined with other underpinning strategies like jack piles or normal piles.

Fig 5: Underpinning pynford stool

6. Underpinning Columns:

After the weights on the columns are released, they can be supported using standard or jack piles, just like walls. When dead beaches are employed, the columns lose their beam loads, and two beams resting on a collar at the foot of the column shaft transfer the actual column weight.

7. Pre-test Method of Underpinning

For pad or strip foundation, it is used. Suitable for structures up to ten floors tall. In this instance, the new excavation level compacts and compresses the subsurface, applying preset loads on the soil. This is completed before to underpinning. Here, less disturbance and noise are anticipated. Raft foundation cannot be used with this strategy. Continue reading: Underpinning and Shoring in Building Construction

8. Pier Underpinning Method

This method is generally resorted to in the dry ground. This is a simple method of underpinning. It involves the installation of piers under foundations of structures through the approach pits. Filling the pits with concrete and finally wedging up to transfer the loads to the new piers, Fig. below.

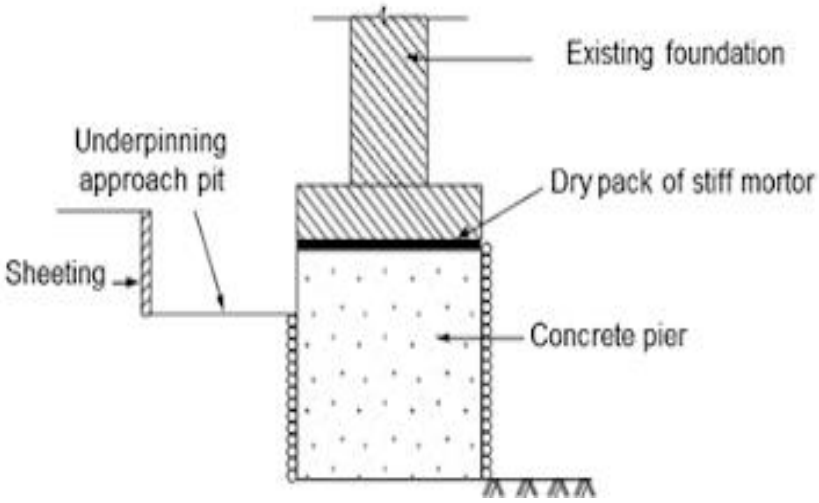


Fig.6: Pier Underpinning Method

9. Underpinning By Cantilever Needle Beam Method

The configuration of the cantilever pit underpinning method, an expansion of the pit method, is shown in Figure below . This method can be utilized for underpinning if the foundation only needs to be extended to one side and the plan features a stronger inner column.

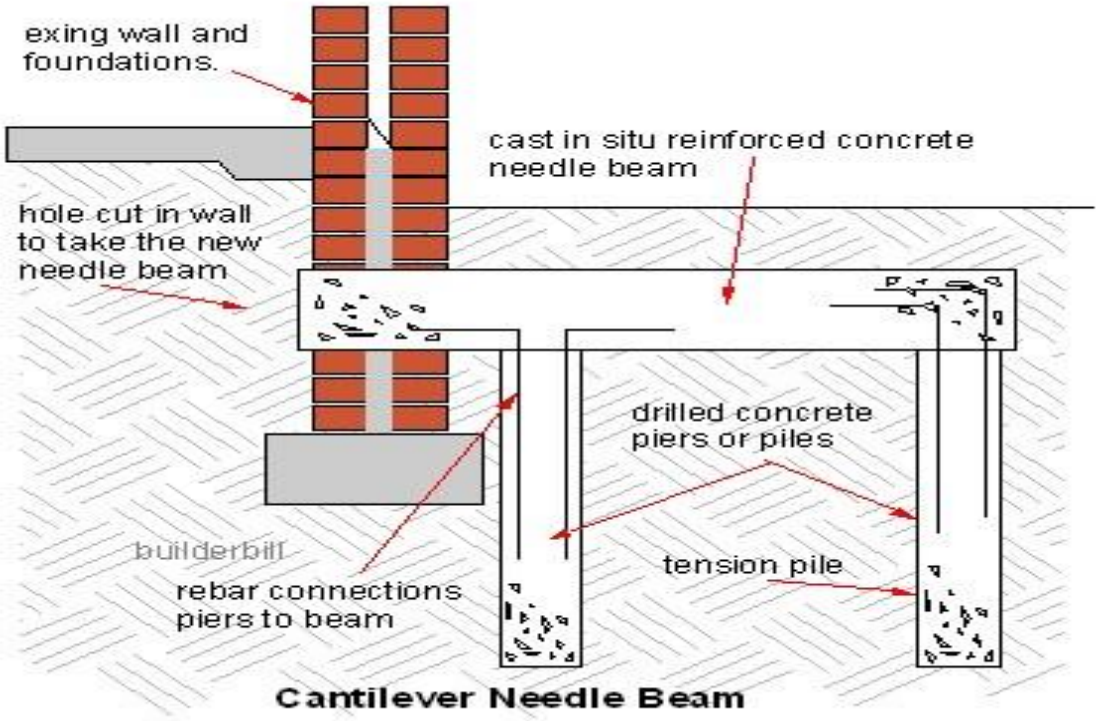


Fig.7: Cantilever Needle Beam Underpinning Method

10. Chemical Method

Using chemicals, the foundation earth is consolidated using this process.

Underneath the foundation, perforated pipes act as a driver in an angled direction (see Fig. below). The slopes are designed so that the entire area beneath the footing corners that are now in place is beneath the region that was strengthened.

A sodium silicate solution mixed with water is injected through the pipes once they have been fitted. This technique uses two injections. When the pipes are being removed, calcium or magnesium chloride is administered through them at that moment. These two substances interact chemically, strengthening the soil through consolidation. This technique works well with granular soils.

Fig.8: chemical Underpinning Method

Discussion

All the ways to treat the foundation are to avoid the collapse of our buildings. These collapses may be directly caused by foundation problems or the demolition of the building by the owner for fear of sudden collapse, which can cause serious material and environmental damage. However, when one of the above solutions is taken, it will be very beneficial in terms of material and environmental because we avoid the collapse and repair of cracks in the building caused by foundation problems.

The environment is also a major aspect of our issue because the demolition of any building will be part of the environmental pollution and our planet needs a lot of environmental protection. Another point to note is the importance of environmental sustainability for the ability to maintain the ecological balance of our planet's natural environment and conserve natural resources to support the well-being of present and future generations. Less use of natural resources and their conservation because they are not only our property but also for future generations.

Therefore, foundation treatment has a great impact on:

1. Avoiding the collapse of our buildings.
2. Reduce economic losses.
3. Avoid fear and anxiety.
4. Protection of Cultural Buildings.
5. Environmental protection.
6. Conservation of natural resources.

So, it saves you time on maintaining your foundation, as well as saving an amount of money. Foundation maintenance can be more expensive, so the longer you wait, the more expensive it will be. Extensive damage means some serious repairs, including the need for bigger equipment, more boards and larger crews. While these costs don’t fully add up when you identify and fix the problem early, the cost of foundation repairs in your home can be greatly reduced if you fix it early

Conclusion

Underpinning is a technique used to reinforce and restore the foundation of a building. Weak foundations in already-existing structures and infrastructure can be strengthened through underpinning. One such technique is deepening and strengthening an existing base by adding temporary or permanent support.

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