Lecture Notes on

Underpinning; Scaffolding; White Washing; Sound Insulation; Thermal Insulation

UNDERPINNING

Underpinning

- Underpinning is the process of strengthening and stabilizing the foundation of an existing building or other structure without disturbing its stability.


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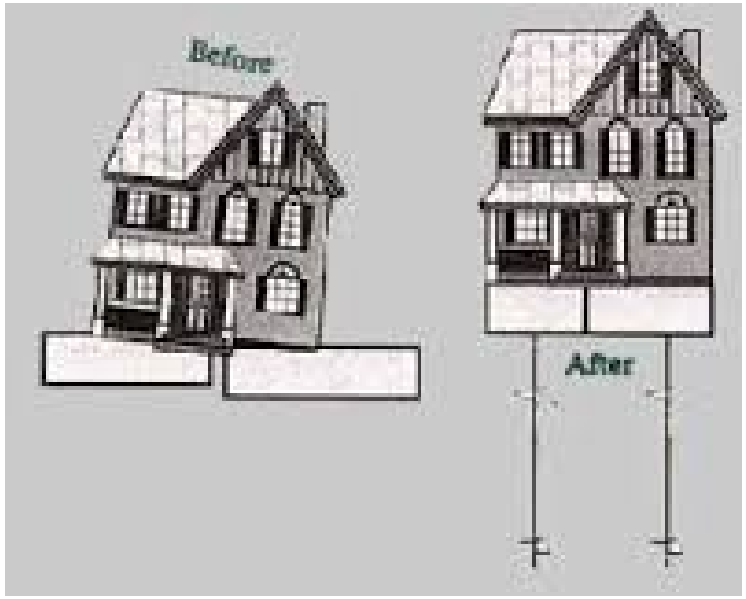

Before
After

Why it is necessary

Underpinning may be necessary for a variety of reasons:

- The original foundation is simply not strong or stable enough.
- The usage of the structure has changed.
- The properties of the soil supporting the foundation may have changed (possibly through subsidence) or were mischaracterized during design.
- The construction of nearby structures necessitates the excavation of soil supporting existing foundations.
- It is more economical, due to land price or otherwise, to work on the present structure's foundation than to build a new one.

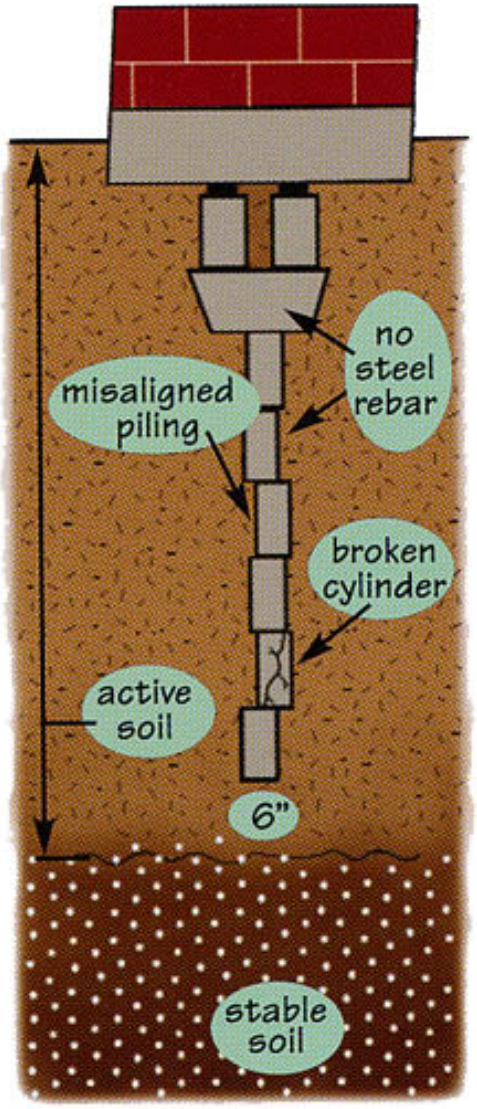
Common Methods

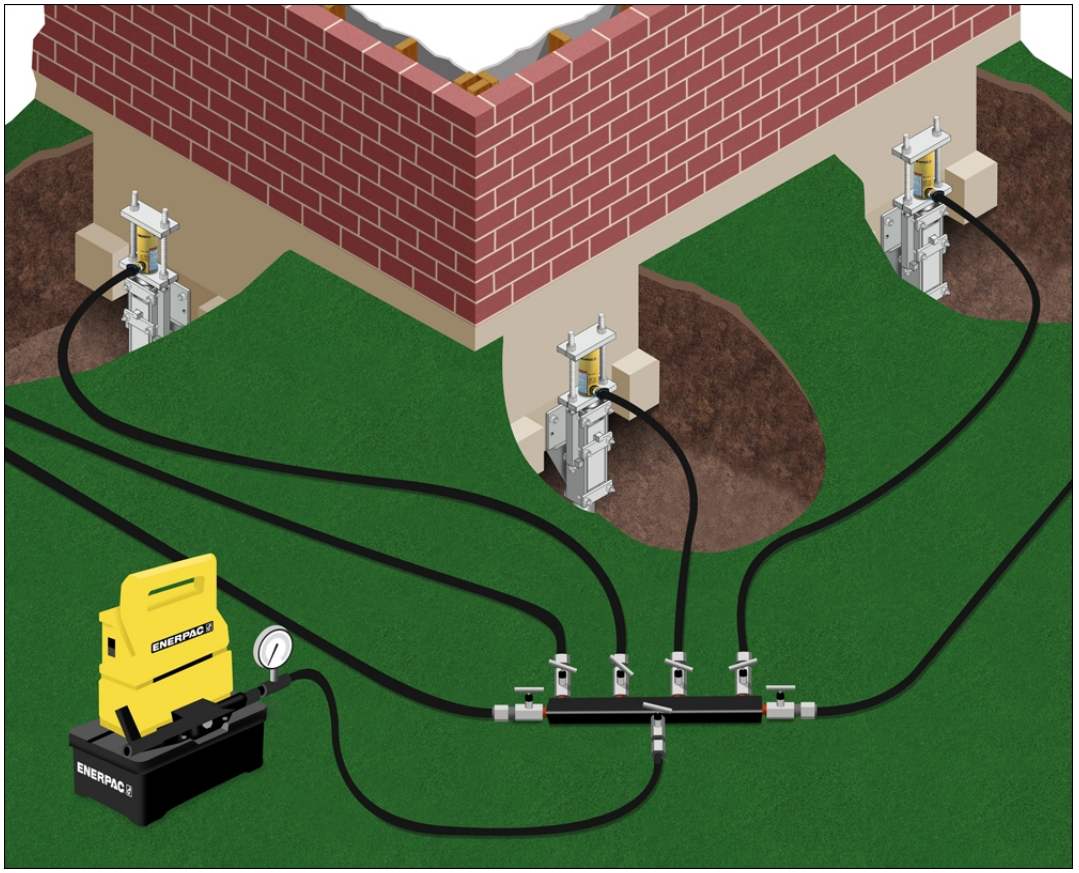
1. Mass Concrete Underpinning
2. Beam and base underpinning
3. Mini-piled underpinning

Mass Concrete Underpinning

- Known as Traditional Underpinning
- Strengthens an existing structure's foundation by digging underneath and sequentially pouring concrete in a strategic order.
- The final result is a foundation built underneath the existing foundation.
- Applied when the existing foundation is at a shallow depth
- Very simple, low cost and the continuity of the structure's uses during construction

Mass Concrete Underpinning





Beam & Base Underpinning

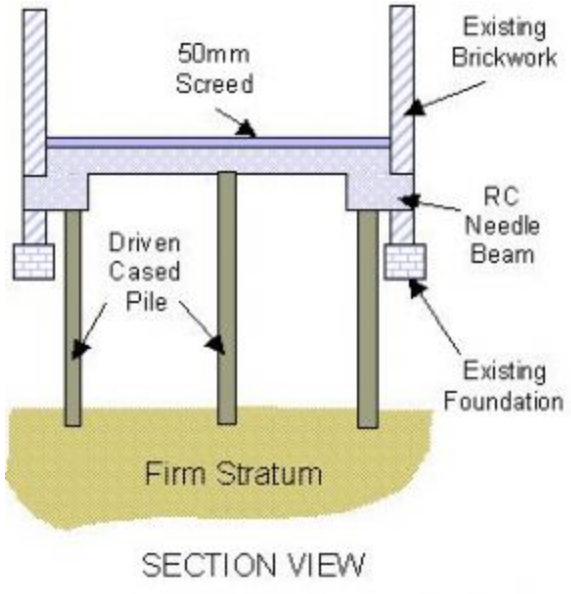
- More technically advanced adaptation of traditional mass concrete underpinning.
- A reinforced concrete beam is constructed below, above or in replacement of the existing footing.
- The beam then transfers the load of the building to mass concrete bases, which are constructed at designed strategic locations
- Base sizes and depths are dependent upon the prevailing ground conditions.
- Beam design is dependent upon the configuration of the building and the applied loads.

Beam & Base Underpinning

Mini Pile Underpinning

- Very useful where ground conditions are very variable, access is restrictive, environmental pollution aspects are significant, and structural movements in service must be minimal
- Generally used when the loads from the foundations need to be transferred to stable soils at considerable depths - usually in excess of 5.0 meters.
- May either be augured or driven steel cased

Mini Pile Underpinning



SCAFFOLDING

Scaffolding

- Temporary rigid structure having platforms raised up as the building increases in height
- The purpose of a working scaffold is to provide a safe place of work with safe access suitable for the work being done
- Provide a working platform for laborers

Scaffolding

Materials Used in Scaffolding

- Steel
- Bamboo

WHITE WASHING

WHITE WASHING

- Made from pure flat lime (white stone lime) or shell lime
- As a rough guide 5 liters of water should be added to each kg of lime
- Alum/common salt may be added to stick the coating well to the surface
- Usually applied to exteriors
- Used as a primary coating during paint

Preparation of Surface

- Use the sandpaper to remove any paint or lacquer that is currently on the surface
- Create the basic whitewash mixture
- Use the paint brush to apply long strokes to the surface
- Before the whitewash can completely dry, use a clean cloth to wipe

Application of White Wash

- Applied in a specified number of coats until the surface presents a smooth & uniform finish
- Usually three coats for new work and one/two coats for old work
- Each coat consists one top to downward stroke and other bottom to upward
- Similarly one horizontal stroke from left to right and another right to left
- Each coat be allowed to dry before the next one is applied

Purpose of White Wash

- For coloring (aesthetic purpose)
- Protect brickwork from moisture
- Removing germs

SOUND INSULATION

Sound Insulation/Sound Proofing/Acoustic Insulation

- Is a means of reducing the sound pressure with respect to a specified sound source and receptor.

- There are several basic approaches to reducing sound:
  - By increasing the distance between source and receiver,
  - Using noise barriers to reflect or absorb the energy of the sound waves,
  - Using damping structures such as sound baffles,
  - Using active anti-noise sound generators.

Commonly Used Methods

- Increasing Distance
- Damping
- Absorption
- Reflection
- Diffusion
- Room within a room
- Noise cancellation

Increasing Distance

- The energy density of sound waves decreases as they spread out
- By increasing the distance between the receiver and source results in a progressively lesser intensity of sound at the receiver.
- In a normal three dimensional setting, with a point source and point receptor, the intensity of sound waves will be attenuated according to the inverse square of the distance from the source.

Damping

- Damping means to reduce resonance in the room, by absorption or redirection (reflection or diffusion).

- Damping can reduce the acoustic resonance in the air, or mechanical resonance in the structure of the room itself or things in the room.

Absorption

- Absorbing sound spontaneously converts part of the sound energy to a very small amount of heat in the intervening object (the absorbing material), rather than sound being transmitted or reflected.
- There are several ways in which a material can absorb sound. The choice of sound absorbing material will be determined by the frequency distribution of noise to be absorbed and the acoustic absorption profile required.

Reflection

- In an outdoor environment such as highway or embankments, paneling are often used to reflect sound upwards into the sky.

Diffusion

- If a specular reflection from a hard flat surface is giving a problematic echo then an acoustic diffuser may be applied to the surface. It will scatter sound in all directions

Room Within a Room

- A room within a room (RWAR) is one method of isolating sound and stopping it from transmitting to the outside world where it may be undesirable.

Noise Cancellation

- Noise cancellation generators for active noise control are a relatively modern innovation.
- A microphone is used to pick up the sound that is then analyzed by a computer; then, sound waves with opposite polarity (180° phase at all frequencies) are output through a speaker, causing destructive interference and cancelling much of the noise.

THERMAL INSULATION

Thermal Insulation

- Thermal insulation is the reduction of heat transfer between objects in thermal contact or in range of radiative influence.
- Thermal insulation can be achieved with especially engineered methods, as well as with suitable object shapes and materials.
- Thermal insulation provides a region of insulation in which thermal conduction is reduced or thermal radiation is reflected rather than absorbed by the lower-temperature body.

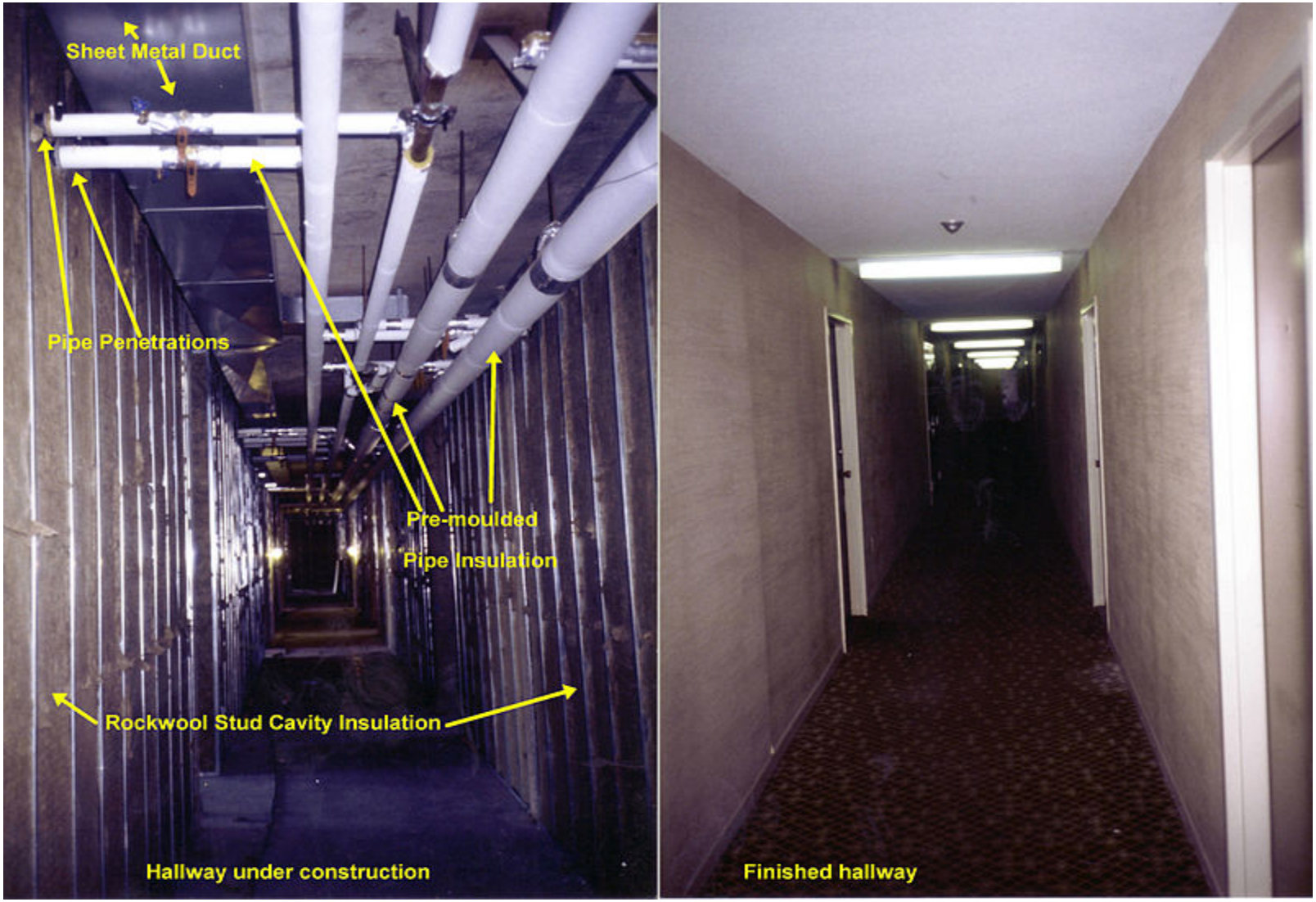


Figure: Thermal Insulation of a Hallway

Why Necessary

When well insulated, a building:

- Is energy-efficient, thus saving the owner money.
- Provides more uniform temperatures throughout the space. Thus producing a more comfortable occupant environment when outside temperatures are extremely cold or hot.
- Has minimal recurring expense. Unlike heating and cooling equipment, insulation is permanent and does not require maintenance, upkeep, or adjustment.
- Also reduce noise and vibration, both coming from the outside and from other rooms inside a building