

FAILURE AND REMEDIAL MEASURES

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"A "Building" is conceived when designed, born when built. It is protected by the skin of its façade, supported by the skeleton of its columns, beams, slabs and rest on the feet of its foundations. Like most human bodies most buildings have full lives and then they die"from the book, **"WHY BUILDINGS FALL DOWN"**.

FUNCTIONS OF FOUNDATIONS.

The sub- structure which transmits the loads of super-structure to the underlying soil is termed as foundation.

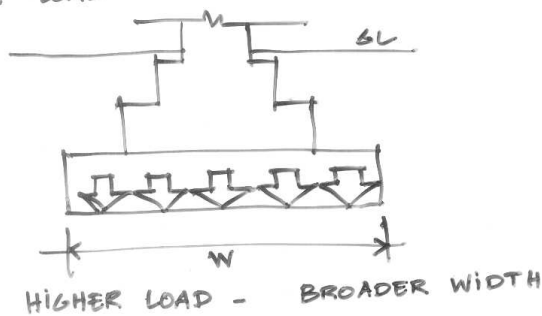
To distribute the load of the super- structure over a wide area.

Protect differential settlement of the structure.

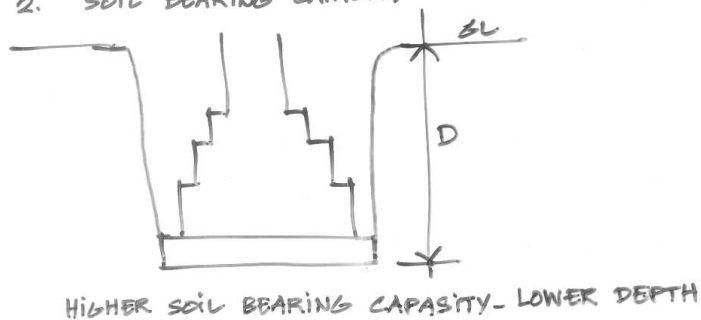
Anchor the structure against the lateral forces.

FOUNDATION DIMENSIONS CAN BE DETERMINED BY

1. LOAD

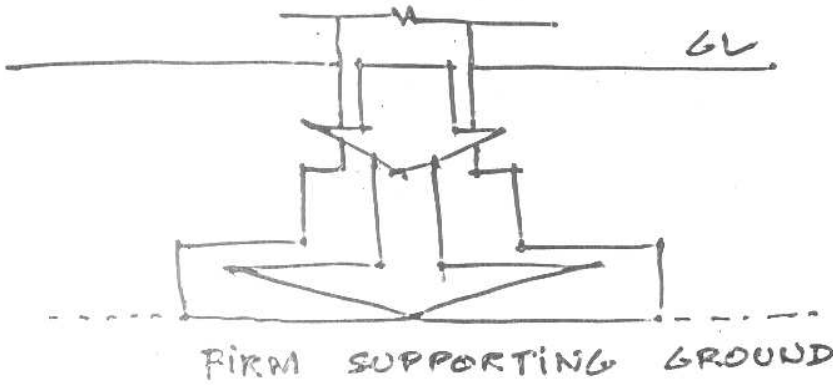


2. SOIL BEARING CAPACITY

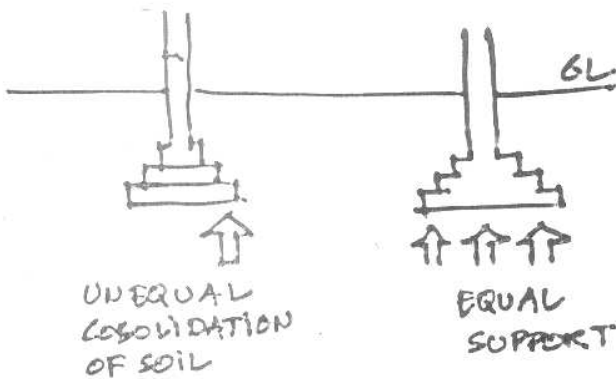


A FOUNDATION IS REQUIRED TO

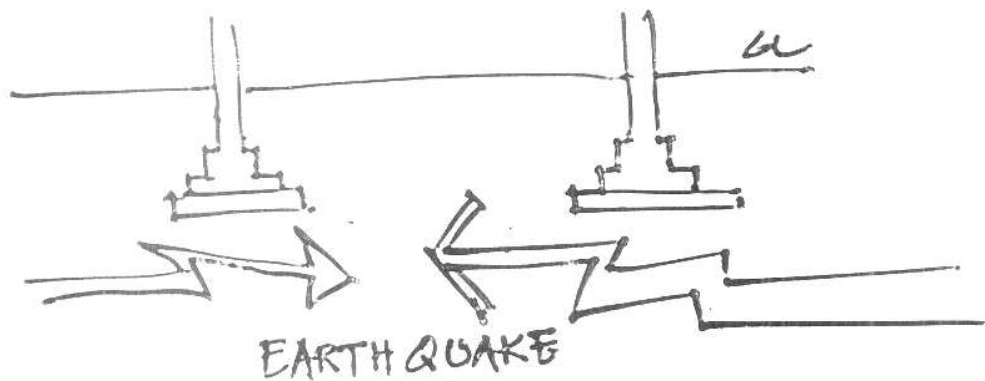
1. DISTRIBUTE LOAD OF THE STRUCTURE OVER A WIDE AREA



2. PREVENT DIFFERENTIAL SETTLEMENT OF THE STRUCTURE



3. ANCHOR THE STRUCTURE AGAINST LATERAL FORCES



TYPES OF FOUNDATIONS FOR RESEDENTIAL BUILDINGS.

- ◇ Open strip foundation.
- ◇ Isolated footing.
- ◇ Combined footing.
- ◇ Strip footings or strap footings.
- ◇ Inverted "Tie" strip foundation.
- ◇ Under reamed pile foundation.
- ◇ Raft foundation.

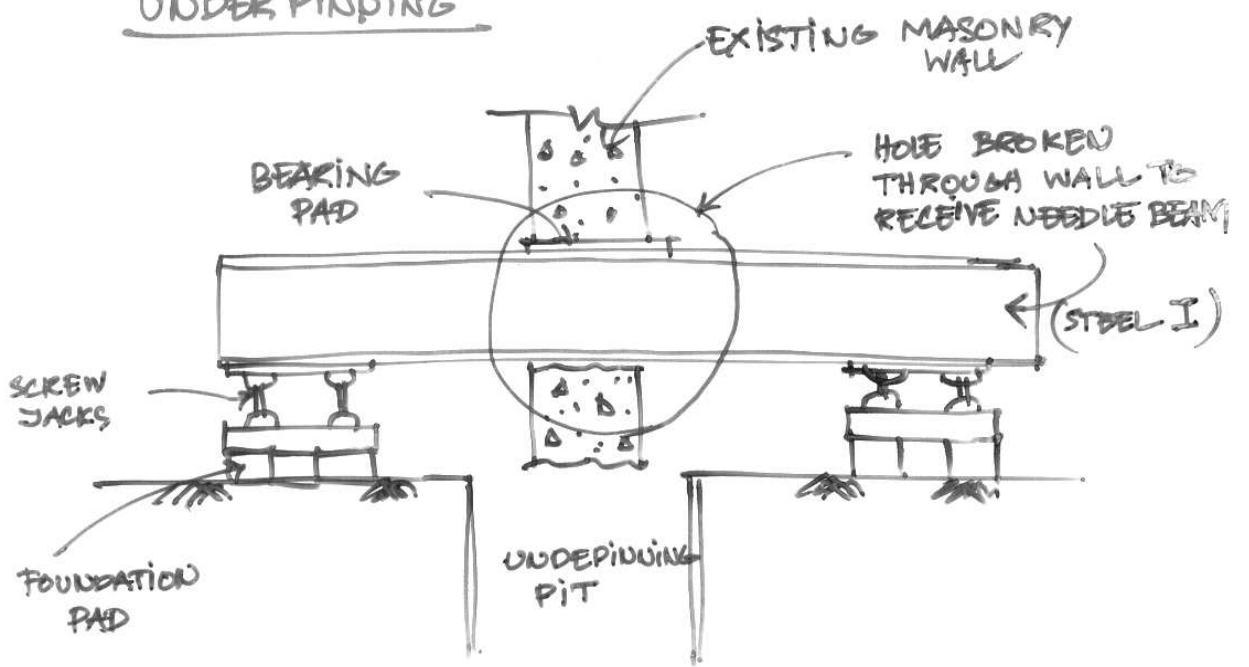
CAUSES OF FOUNDATION FAILURES.

- ◇ Undermining of safe support.
- ◇ Load transfer failures.
- ◇ Lateral movement.
- ◇ Unequal support.
- ◇ Drag down and heave.
- ◇ Design error.
- ◇ Construction error.
- ◇ Floating and water level changes.
- ◇ Vibration effects.
- ◇ Earth quake effects.

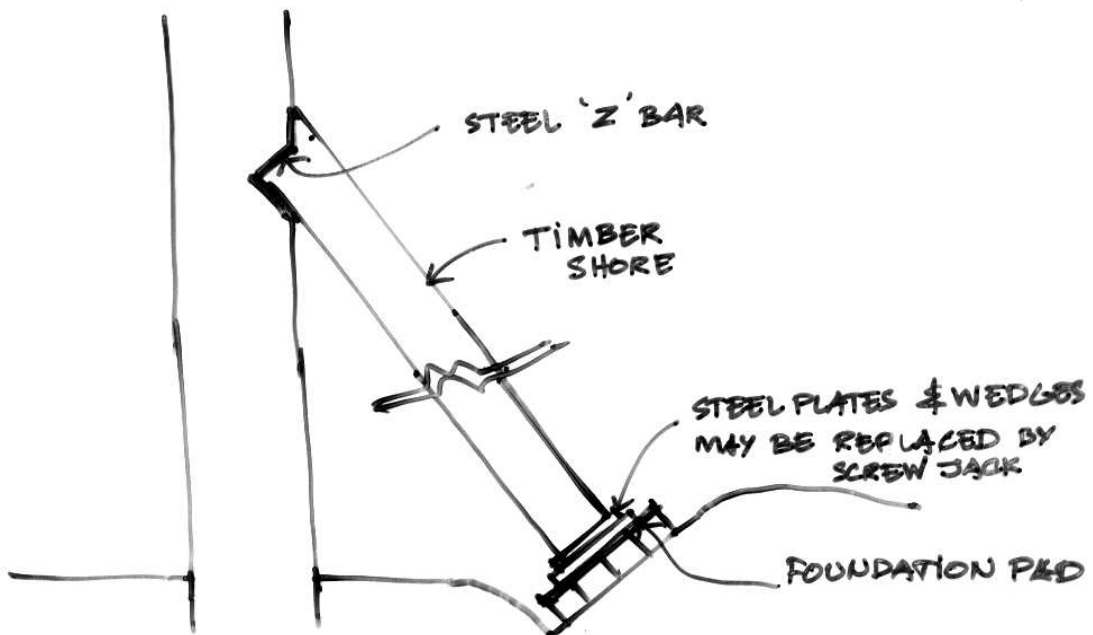
Undermining of safe support.

A careful study of the soil strata at the site of the proposed building along with the adjacent existing structures is very important. Temporary and permanent supports to the structure such as underpinning have to be installed to prevent the undermining.

UNDER PINNING

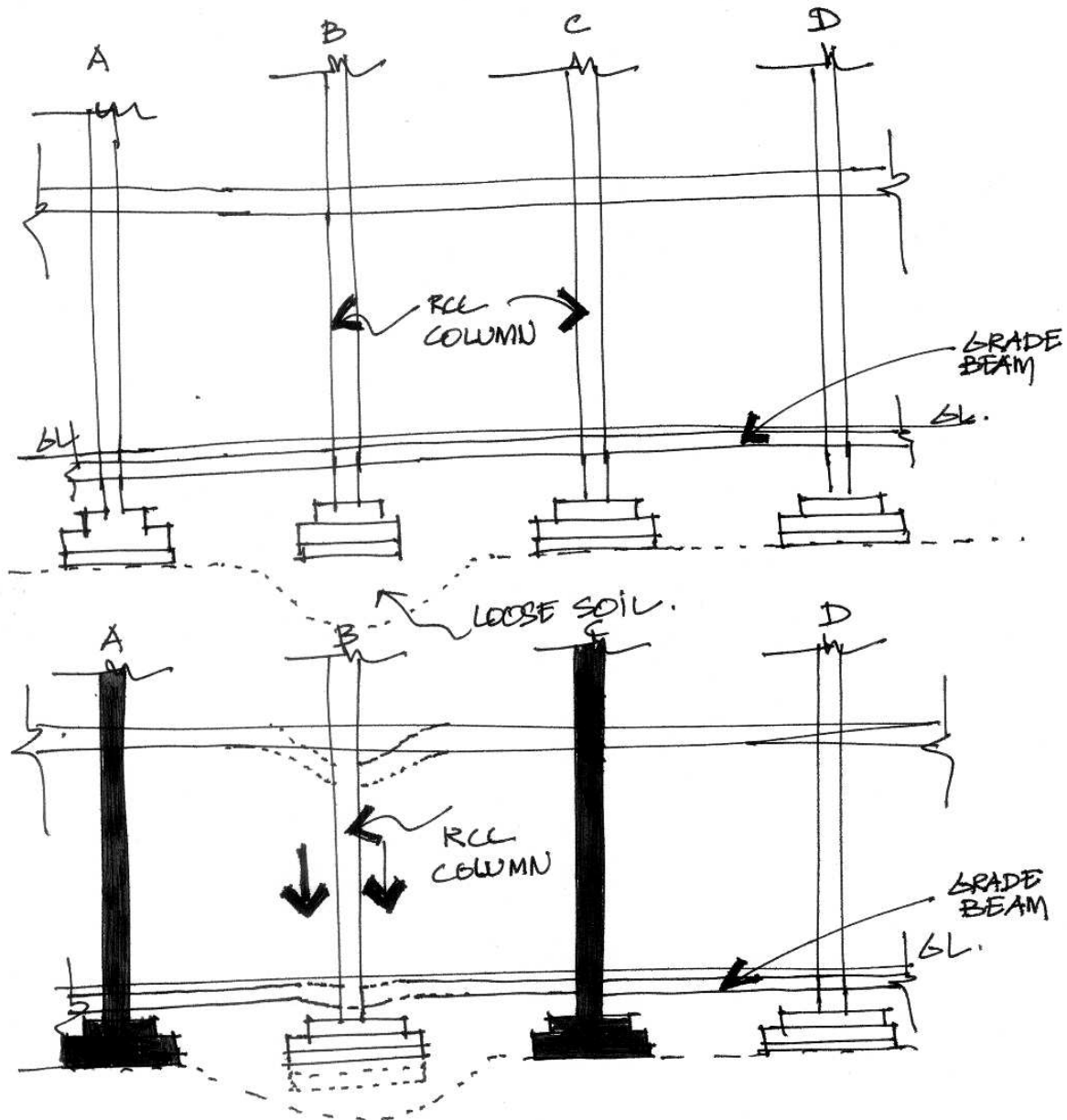


SHORING.



Load transfer failures.

A rigid frame structure will tolerate foundation movements when the walls, floors and partitions are rigidly connected by a frame, the system will adequately adjust itself to differential foundation movement when the inter connecting rigidity fails, the load at the point goes to the soil vertically through the support at the point

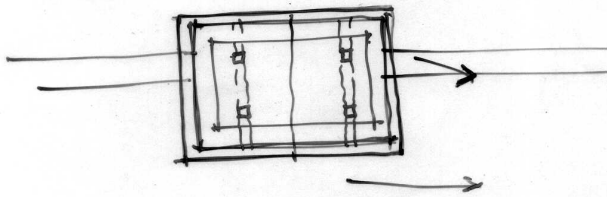
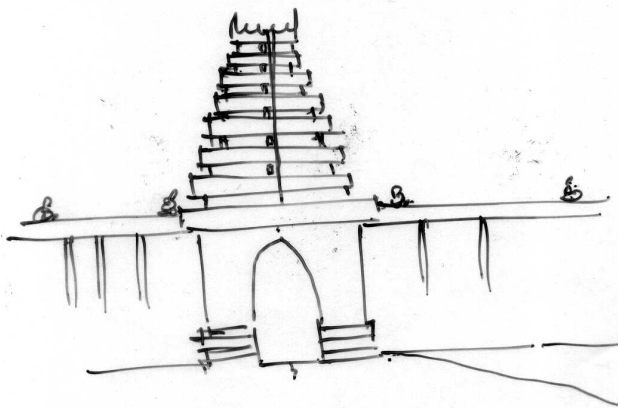
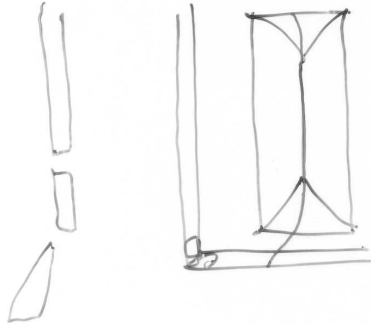
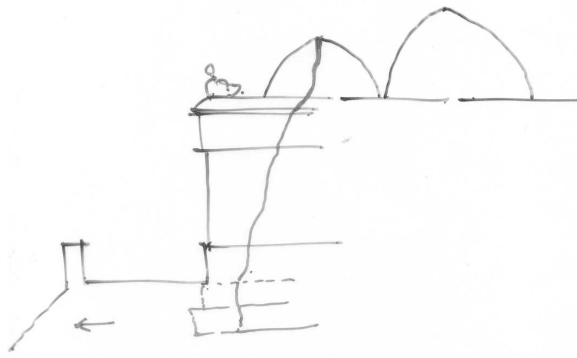


LOAD -TRANSFER FAILURE

WHEN THE 'B'S FOUNDATION IS INADEQUATE
COLUMN A & B MAY BE UNABLE TO SUPPORT
THE ADDITIONAL LOAD

Lateral movement.

Lateral movements are caused by either the elimination of existing lateral

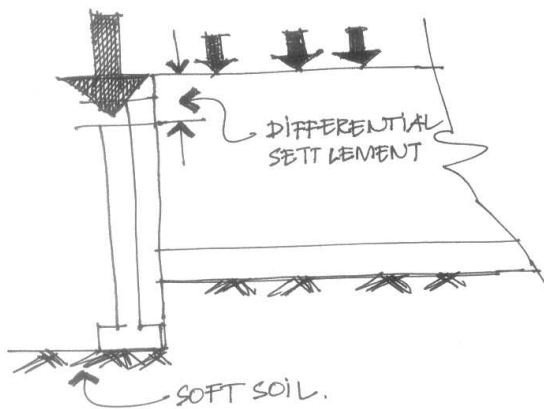
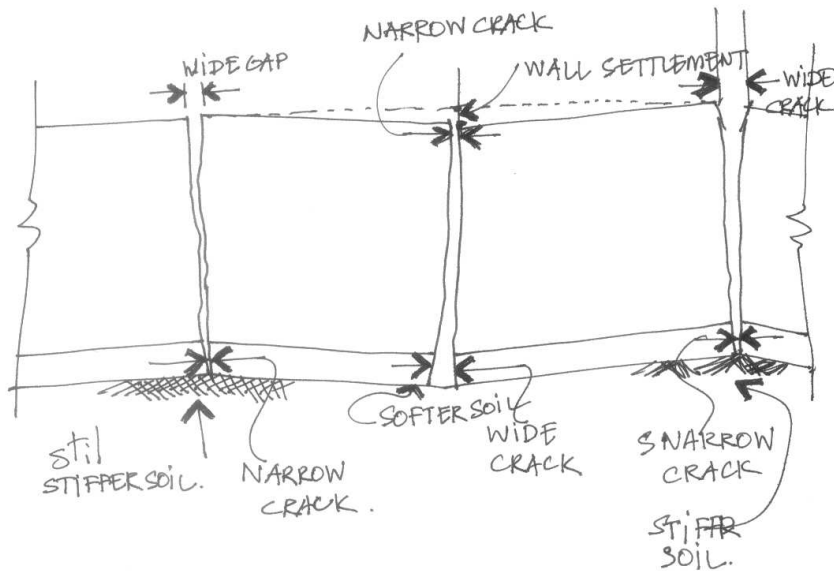


Unequal support.

Footings bearing on different soils with different and unequal soil-bearing resistances.

All the soil support deficiencies can be corrected by underpinning the weakened support.

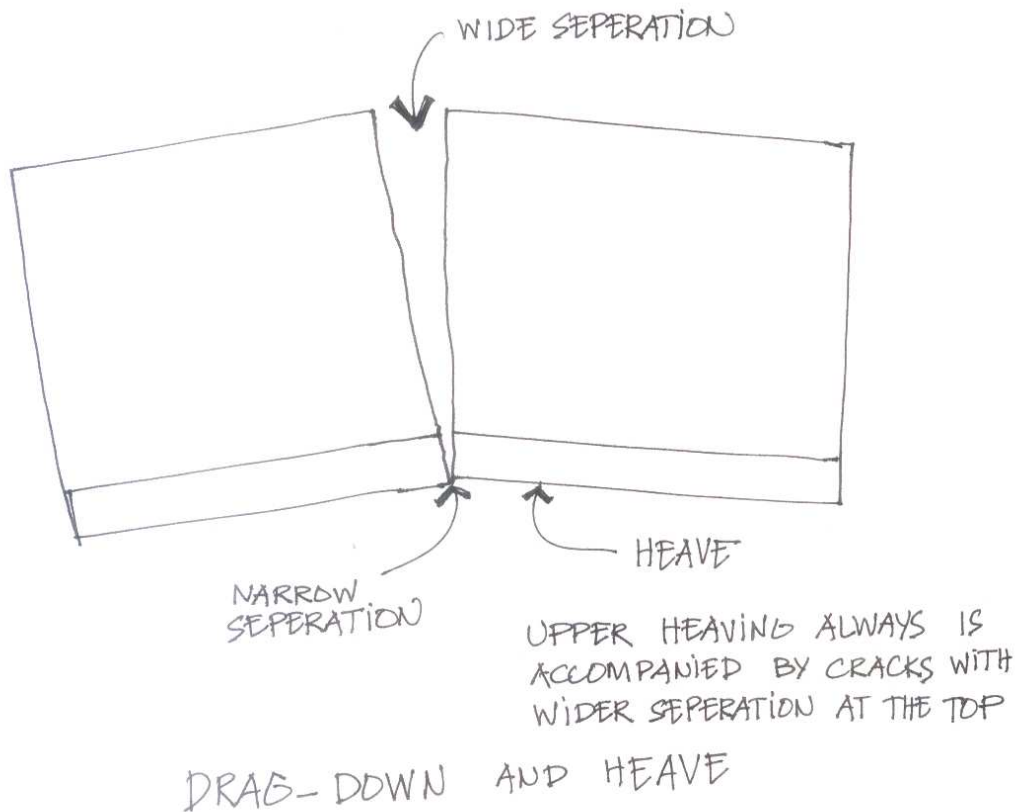
Soil stabilization by cement or chemical injection or sub-surface enclosures-usually a tight sheet pile. The dewatering may also be the



UNEQUAL SUPPORT

Drag down and heave.

When the footing is loaded the supporting soil reacts by yielding and compressing to provide resistance. In plastic soils the new settlements are often accompanied by upward movements and heave some distance away. Since the liquid in the soils cannot change volume, every settlement must produce an equal-volume heave.



Design error.

Many foundations are designed with insufficient sub-surface investigations.

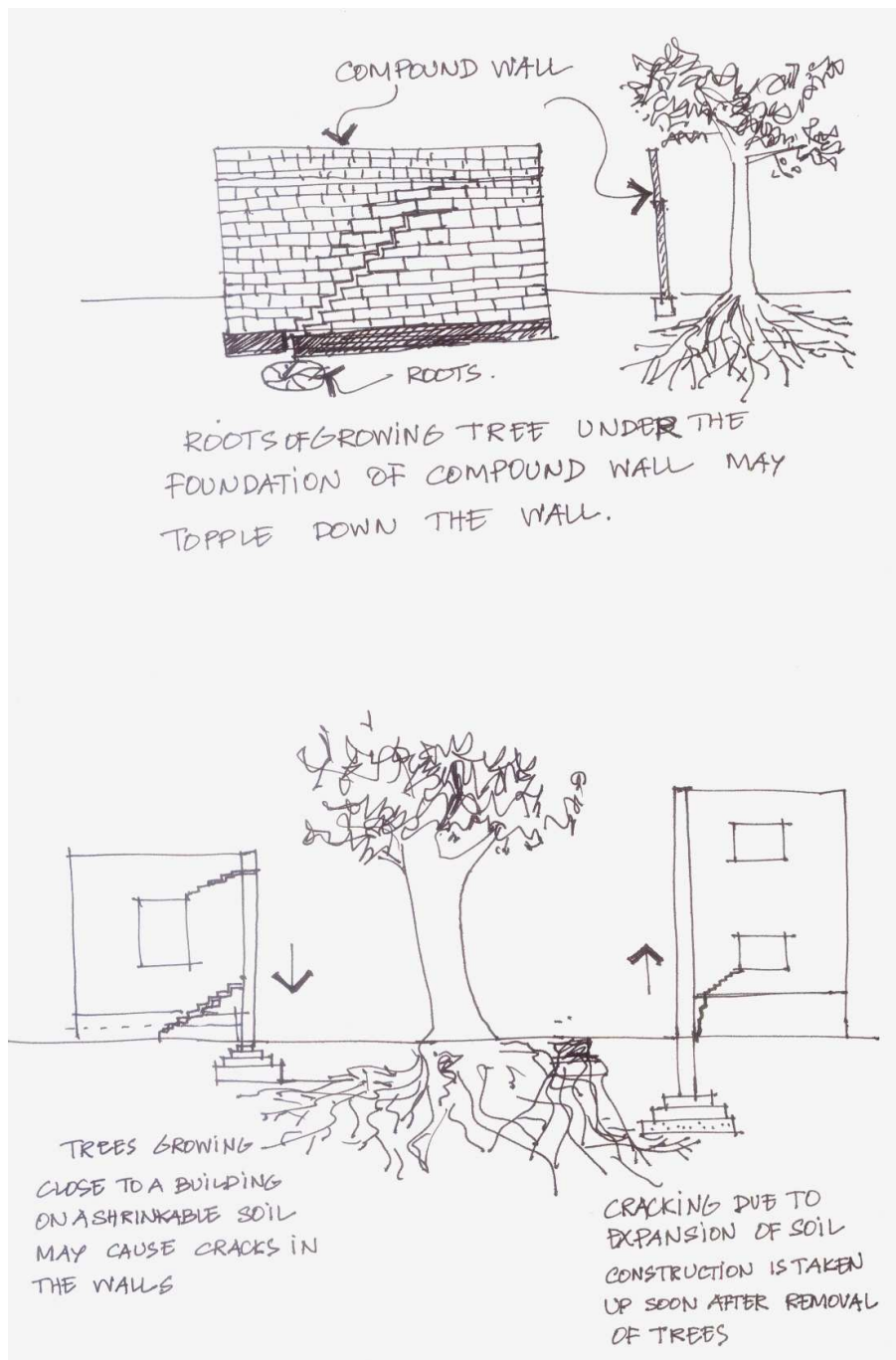
Construction error.

There are two common sources of these errors.

1) Temporary protection measures.

Error relating to, temporary shoring, bracings and temporary coffer dams.

2) Foundation work itself.



Floating and water level changes.

A change in water content will modify the dimensions and structure of the supporting soil whether from flooding or from dewatering. Pumping from adjacent construction excavations also affect the stability of the existing footing. Clays heaves from over-saturation. Water level should be monitored.

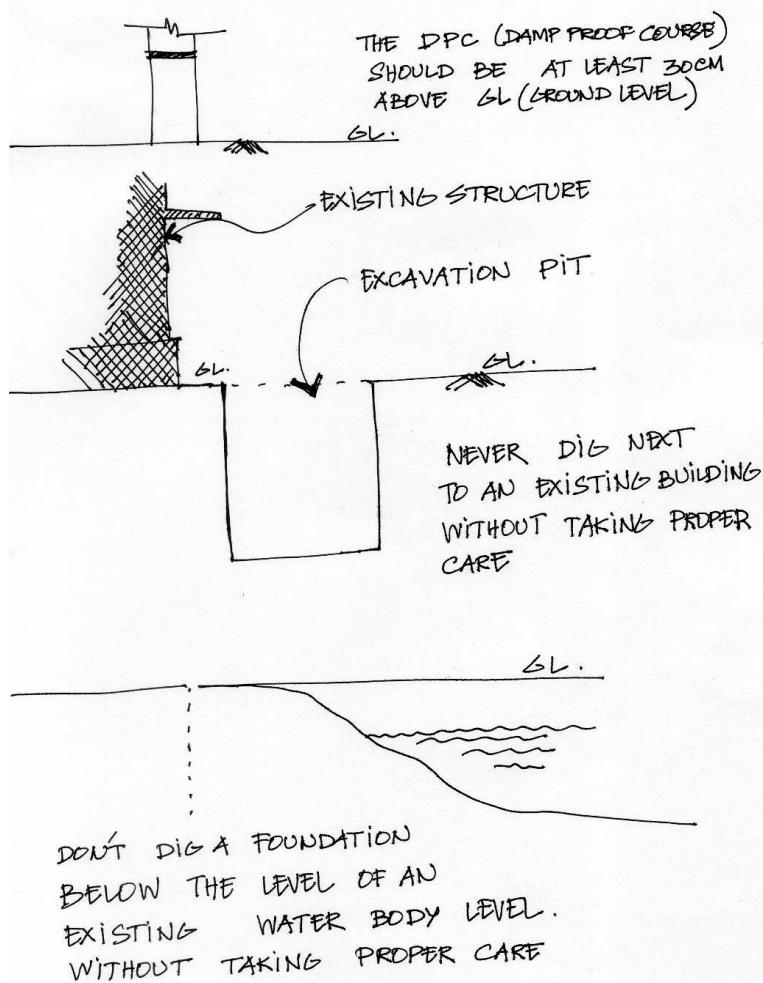
Vibration effects.

The earth masses which are not fully consolidated will change volume when exposed to vibration impulses. The sources of vibrations can be blasting, construction equipment (esp. pile drivers), mechanical equipment in a completed building, traffic on rough pot-holed pavements adjacent to the site.

Earth quake effects.

Foundations at the earth quake affected zones must be designed to tolerate the expected shock by the Nature. The quakes of short duration have less severe effect on the foundation than on the super structure.

PREVENTION IS BETTER THAN CURE!



Conclusion.

structures have some tolerance to unequal settlements but when the soil is stretched beyond the elastic limit the ultimate failure is certain. However, foundation failures have a unique nature of often affecting the entire structure and seriously impairing the adjacent structures, so let us take all necessary precautions at the time of construction and avoid the failures. Prevention is better than cure.