

## **Module 8 : Foundations in difficult ground**

### **Lecture 35 : Foundations – Design Methodologies [ Section 35.1 : Design Of Shallow Foundations for Expansive Soils ]**

#### **Objectives**

**In this section you will learn the following**

- Isolating structure from swelling ground.
- Design the structure to remain undamaged due to swelling.
- Minimizing the swelling

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### Lecture 35 : Foundations – Design Methodologies [ Section 35.1 : Design Of Shallow Foundations for Expansive Soils ]

#### Design Of Shallow Foundations for Expansive Soils

The various techniques of providing foundations and improvement of soil at a given location are discussed below:

- Isolating structure from swelling ground.
- Design the structure to remain undamaged due to swelling.
- Minimizing the swelling

#### Isolating structure from swelling ground.

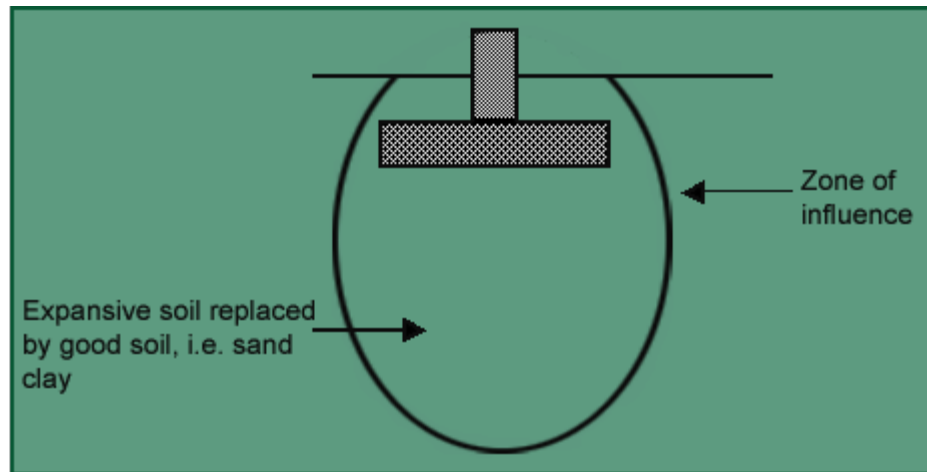


Fig 8.3 : Isolating structure from swelling ground

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### Lecture 35 : Foundations – Design Methodologies [ Section 35.1 : Design Of Shallow Foundations for Expansive Soils ]

Design the structure to remain undamaged due to swelling.

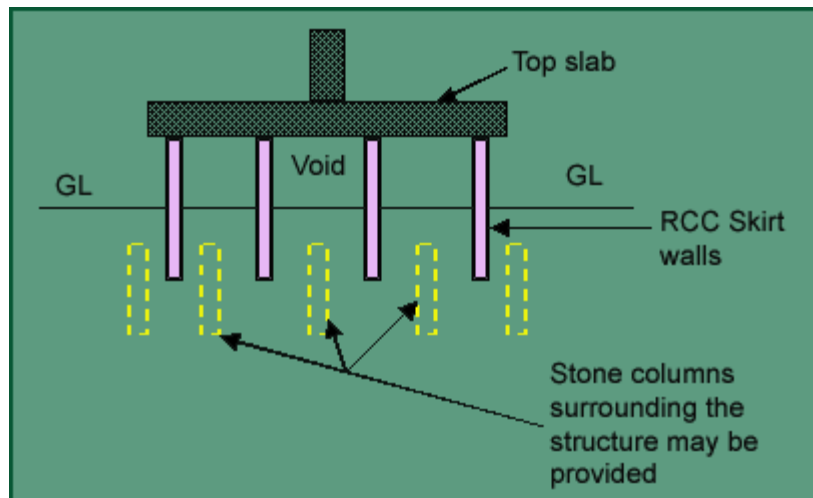
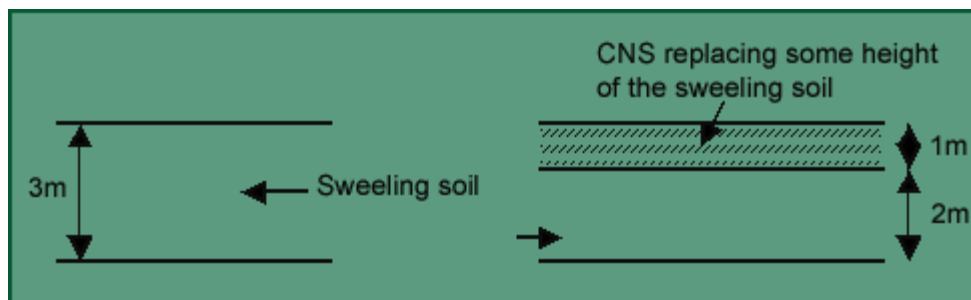


Fig. 8.4 : Skirt walls

#### Minimizing the swelling



In this method some part of the swelling soil is replaced by CNS soil so that swelling is minimized. However by this method total swelling cannot be avoided. Also, in place of CNS layer we can provide a sand layer.

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### **Lecture 35 : Foundations – Design Methodologies [ Section 35.1 : Design Of Shallow Foundations for Expansive Soils ]**

#### **Recap**

**In this section you have learnt the following.**

- Isolating structure from swelling ground.
- Design the structure to remain undamaged due to swelling.
- Minimizing the swelling

## **Module 8 : Foundations in difficult ground**

### **Lecture 35 : Foundations – Design Methodologies [ Section 35.2 : Design of Deep Foundations ]**

#### **Objectives**

**In this section you will learn the following**

- Design of Deep Foundations

### Design of Deep Foundations

Underreamed piles are used in case of expansive soils. Due to swelling pressure, the lifting effect is minimized or avoided by anchorage of underreamed piles due to bulbs present in it.

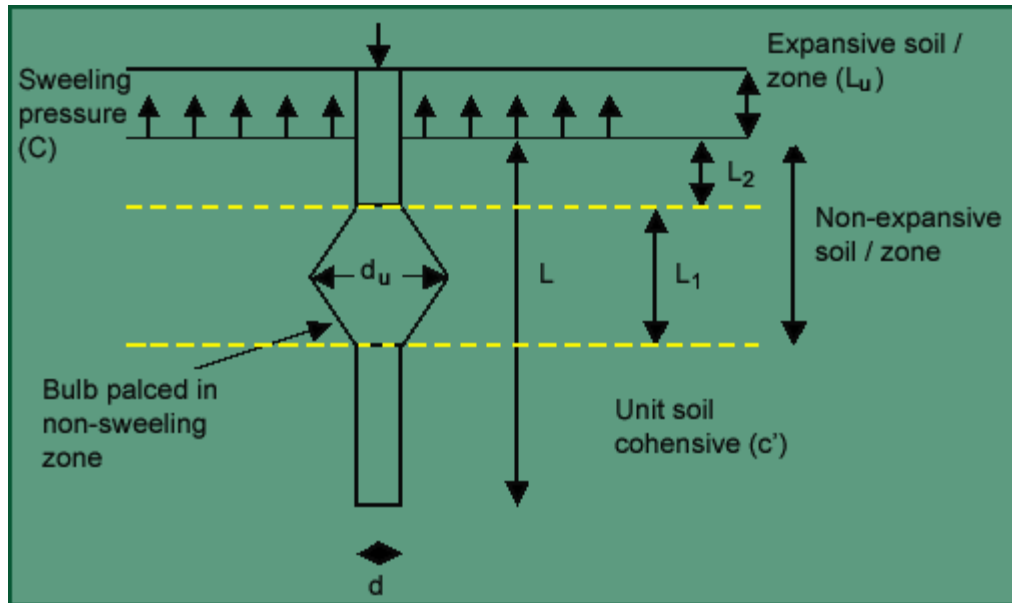


Fig. 8.5 : Underreamed piles

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### Lecture 35 : Foundations – Design Methodologies [ Section 35.2 : Design of Deep Foundations ]

Uplift force due to swelling =  $\pi d L_u C$

Resisting force due to swelling =  $\pi d_u c' L_1 / 2 + \pi d c' L_2$

For single bulb, only top portion of the bulb contributes to skin friction. Lower half is not considered. Factor of safety is 1.5 to 2.0.

In dry season, total capacity of piles -

$$P_u = c' N_c \times \frac{\pi}{4} (d_u^2 - d^2) + \pi d \alpha c' (L - L_u - 2d)$$

Drilled shafts with bells and grade beams can also be constructed in swelling soil to resist the swelling force.

## **Module 8 : Foundations in difficult ground**

### **Lecture 35 : Foundations – Design Methodologies [ Section 35.2 : Design of Deep Foundations ]**

#### **Recap**

**In this section you have learnt the following.**

- Design of Deep Foundations