

# The Importance of Soil Testing Prior to Construction

<sup>1</sup>JUMAH EID BIN OBAID, <sup>2</sup>Jasem Bouarki

Public Authority for Applying Education and Training

DOI: <https://doi.org/10.5281/zenodo.19730835>

Published Date: 24-April-2026

---

**Abstract:** Soil properties are the main determinants of the safety and sustainability of any structure that is built. This article explores the definition, objectives, importance, methods and the effects of soil testing on construction. The main soil testing techniques discussed are field testing (e.g. manual and mechanical boring), laboratory testing (e.g. particle size analysis) and geophysical testing (e.g. seismic wave testing). These tests influence the selection of the type of foundations used, the special processing methods that may be required to improve the safety and sustainability of the building, the identification of environmental risks (e.g. groundwater). The two case studies discussed in this article showcase the significance of soil testing which juxtaposes the preparation of the Burj Khalifa prior to construction with the lack of preparedness in the India case study where the building fell due to the presence of groundwater. This article will also illustrate the different challenges (e.g. limited availability of expertise) in soil testing and compare them to possible solutions (raising awareness for soil testing). The article concludes by advocating the necessity of implementing soil testing techniques prior to construction.

**Keywords:** soil testing; foundation design; bearing capacity; construction safety; building collapse.

---

## INTRODUCTION

The process of construction is one of the most complicated engineering procedures and it requires high precision and professionalism. Due to the safety and sustainability of buildings relying heavily on the soil on which it is built. Soil testing is considered an essential phase in planning any construction project, as it determines the properties of the soil being tested and its load-bearing capacity. In this Article, the significance of soil testing before construction, its types, the methodologies used and its effect on the sustainability and safety of buildings will be discussed.<sup>3</sup>

### 1. THE DEFINITION OF SOIL TESTING AND ITS OBJECTIVES

#### Definition

Soil testing is a process that analyses the properties of soil at a chosen construction site through making scientific and geological experiments that conclude the composition of the soil, how it responds to different loads and its ability to survive in various environmental conditions.

#### Soil Testing Objectives

1. Checking the suitability of the soil for construction: concluding if the soil is capable of bearing different loads for the building.<sup>3</sup>
2. Designing the foundations correctly: soil testing provides accurate data to identify the type of foundation (Shallow or Deep) that is suitable for the building.<sup>2,3</sup>
3. Preventing future soil issues: such as swelling or shrinkage that could lead to cracking or collapse.<sup>4</sup>
4. Identifying environmental hazards: to check if there is groundwater or any harmful materials that could affect the building.<sup>1</sup>

## **2. THE SOIL TESTING'S SIGNIFICANCE PRIOR TO CONSTRUCTION**

### **2.1 Ensuring the structural safety of the building**

Testing of the soil determines the capacity of the soil to withstand different loads, which ensures that structural collapse does not occur in the future. Unsuitable soil could lead to issues like land subsidence.<sup>3</sup>

### **2.2 Cost-effectiveness**

Testing helps to offer accurate data to design foundations, which lessens the additional costs associated with repairing buildings that were damaged due to a poor review of the soil.<sup>2</sup>

### **2.3 Dealing with Problematic Soil**

There are types of soils (e.g. expansive clay soil and sandy fragile soil) that require special processing. Soil testing helps identify these challenges ahead of time.<sup>4</sup>

### **2.4 Compliance with Environmental Regulations**

In some cases, the soil may contain chemical material or pollutants that might negatively affect the construction process. Testing guarantees compliance with health and safety regulations.<sup>1</sup>

### **2.5 Protection from Natural Disasters**

Testing aids in finding how much the soil is affected by earthquakes, flooding or landslides.<sup>4</sup>

## **3. METHODS OF SOIL TESTING**

### **3.1 Field Studies**

- Manual and mechanical boring: To obtain samples from the soil and analyse them.<sup>6</sup>
- In-situ load testing: To ascertain the capacity of the soil for direct load bearing.<sup>6</sup>

### **3.2 Laboratory Testing**

- Particle size analysis: To determine the distribution of particle size in the soil.<sup>3</sup>
- Atterberg Limits tests: To know the limit of plasticity and liquidity for the clay soil.<sup>4</sup>
- Compression Test: Used for obtaining the shear strength of the soil<sup>4</sup>

### **3.3 Geophysical Tests**

- Seismic wave testing: Used for determining the nature of the soil and the depth of the different layers.<sup>6</sup>
- Electrical resistivity survey: Electrical Resistance Test: To detect the presence of groundwater or mineral deposits.<sup>1</sup>

## **4. RESULTS OF SOIL TESTING AND ITS EFFECT ON CONSTRUCTION**

### **4.1 Selection of Foundation Type**

- Rocky soil can handle large loads, and it needs shallow foundations.<sup>3</sup>
- Sandy or clay soils require deep foundations or special processing.<sup>3</sup>

### **4.2 Deciding Soil Processing Method**

Unfavourable soil may need to be processed (e.g. compaction, stabilisation using cement or lime) to improve its properties.<sup>2</sup>

### **4.3 Assessing Environmental Risks**

- Soils that are rich in groundwater may cause issues like water leakage or foundation erosion.<sup>4</sup>
- Soil contaminated with chemical materials may require removal or special processing.<sup>1</sup>

## 5. CASE STUDIES ABOUT THE IMPORTANCE OF SOIL TESTING

### 5.1 Building Collapse in India due to not checking the Soil

In 2013, a residential building collapsed as a result of neglecting to conduct soil testing, as it was found that the soil could not bear large loads due to the presence of groundwater. <sup>5,9</sup>

### 5.2 Burj Khalifa Project in Dubai

Studies have shown that soil in the Burj Khalifa location has high-strength rocky soil, which helped in designing strong and giant foundations to support the tallest building in the world. <sup>7,8</sup>

## 6. CHALLENGES AND SOLUTIONS

### Challenges

1. High Costs: The cost of soil testing may be high, which could push the engineers working on the project to skip it. <sup>6</sup>
2. Time: Soil testing may take a long time to finish, which may delay the schedule for the project. <sup>1</sup>
3. Expertise Availability: The necessary expertise and the specialised teams may not be available in some regions to conduct the tests. <sup>5</sup>

### Solutions

1. Enforcement via Regulations: Implementing laws that require soil testing before beginning construction. <sup>1</sup>
2. Raising Awareness: Raise the awareness of developers and contractors about the importance of soil testing. <sup>5</sup>
3. Modern Technologies: Use of technologies like artificial intelligence (AI) to hasten the soil analysis processes.

## 7. CONCLUSION

Soil testing is an essential step to guarantee the safety and quality of any construction project. This provides the required data to design the appropriate foundations and to handle any possible issues in the soil. Ignoring this step may result in structural disasters and large financial loss. Therefore, all relevant authorities should comply and conduct the necessary testing to ensure the sustainability and safety of the buildings <sup>2,3</sup>

## REFERENCES

- [1] ASCE. Geotechnical Site Characterization. Manual of Engineering Practice No. 56. Reston (VA): American Society of Civil Engineers; 2018.
- [2] Coduto DP, Kitch WA, Yeung MR. Foundation Design: Principles and Practices. 3rd ed. Upper Saddle River (NJ): Pearson Education; 2016.
- [3] Das BM, Sivakugan N. Principles of Foundation Engineering. 9th ed. Mason (OH): Cengage Learning; 2019.
- [4] Knappett JA, Craig RF. Craig's Soil Mechanics. 9th ed. Boca Raton (FL): CRC Press; 2019.
- [5] Kumar RS. Lessons from structural failures in India. Proc Inst Civ Eng Forensic Eng. 2016;169(4):143–8.
- [6] Mayne PW, Christopher BR, DeJong J. Subsurface Investigations: Geotechnical Site Characterization. Publication No. FHWA-NHI-01-031. Washington (DC): U.S. Department of Transportation, Federal Highway Administration; 2002.
- [7] Poulos HG, Bunce G. Foundation design for the Burj Dubai — the world's tallest building. In: Proceedings of the 6th International Conference on Case Histories in Geotechnical Engineering; 2008 Aug 11–16; Arlington (VA). Paper No. 1.47.
- [8] Russo G, Abagnara V, Poulos HG, Small JC. Re-assessment of foundation settlements for the Burj Khalifa, Dubai. Acta Geotech. 2013;8(1):3–15.
- [9] Satyendra KJA, Naik VK. India Disaster Report 2013. New Delhi: National Institute for Disaster Management, Ministry of Home Affairs, Government of India; 2014.