

MAIN PROPERTIES OF ROCKY SOILS AND THEIR ROLE IN BUILDING
AND ROAD CONSTRUCTION IN UZBEKISTAN

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MAQOLA MALUMOTI

ANNOTATSIYA:

MAQOLA TARIXI:

Received: 26.12.2025

Revised: 27.12.2025

Accepted: 28.12.2025

KALIT SO`ZLAR:

Rocky soils, rock mass,
engineering geology, foundations,
highways, Uzbekistan, seismic
regions

Rocky soils are extensively distributed throughout Uzbekistan, particularly in mountainous and foothill regions such as the Tien Shan and Pamir-Alay systems. Their physical, mechanical, and hydrogeological properties play a decisive role in the design, construction, and long-term performance of buildings and road infrastructure. This article provides a detailed analysis of rocky soil characteristics, engineering behavior, construction challenges, and mitigation measures, with special emphasis on local geological, climatic, and seismic conditions of Uzbekistan

Introduction

Rapid development of infrastructure in Uzbekistan has increased construction activities in mountainous and piedmont areas where rocky soils dominate. These soils differ significantly from fine-grained soils due to their high strength, structural discontinuities, and

heterogeneous nature. Engineering decisions related to foundations, slopes, and road alignments depend heavily on the accurate assessment of rock mass properties.

2. Geological Background of Uzbekistan

Uzbekistan’s territory includes diverse geological formations ranging from Quaternary alluvial deposits in plains to hard bedrock in mountainous regions. Rocky soils are mainly composed of limestone, sandstone, granite, and metamorphic rocks. These formations are often affected by tectonic faults and seismic activity, which significantly influence their engineering behavior.

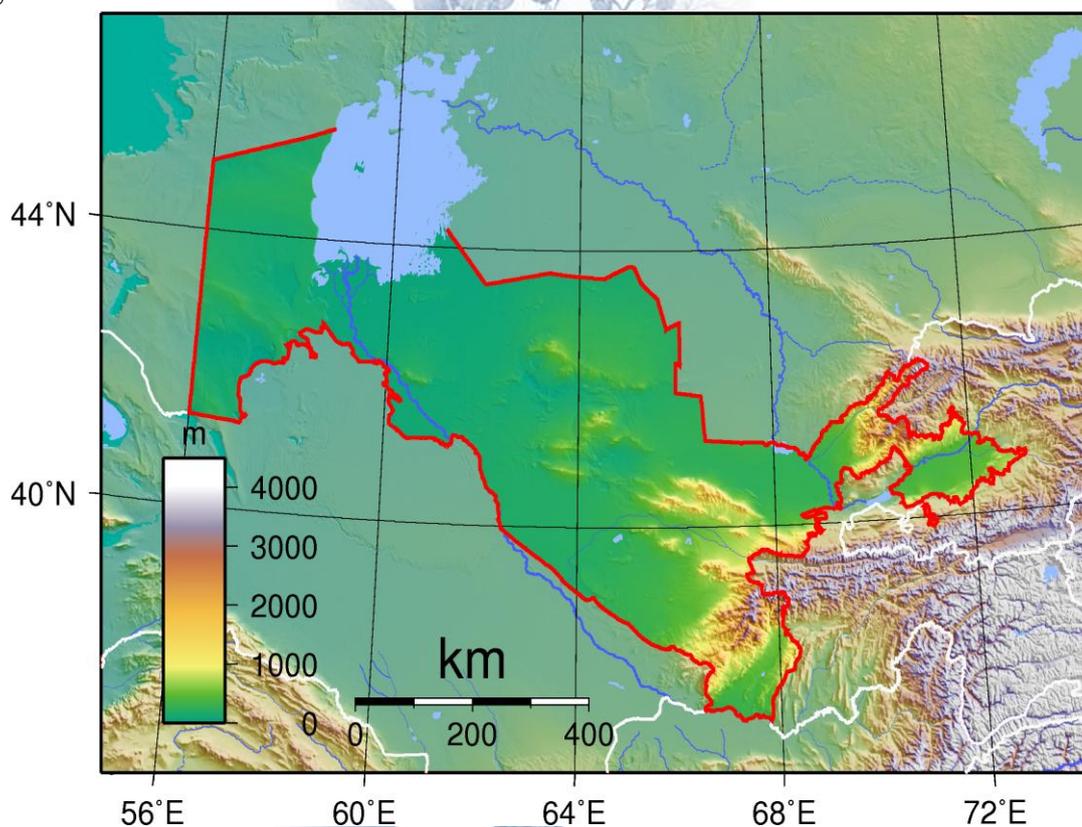


Figure 1.

3. Physical Properties of Rocky Soils

Physical properties of rocky soils include density, porosity, moisture content, and degree of weathering. Intact rocks generally exhibit low porosity, while fractured and weathered rocks show increased void ratios and permeability. These properties directly affect groundwater flow and slope stability.

4. Mechanical Properties of Rocky Soils

Mechanical properties such as compressive strength, shear strength, elasticity, and durability define the load-bearing capacity of rocky soils. In Uzbekistan, uniaxial compressive strength values vary widely depending on lithology and weathering degree. Weathered rocks often show reduced strength, requiring conservative design approaches.

Property	Typical Range	Engineering Importance
Compressive strength	5–250 MPa	Determines bearing capacity
Elastic modulus	1–70 GPa	Controls deformation behavior
Permeability	Very low–moderate	Affects drainage and stability
Weathering degree	Low–high	Reduces strength and durability

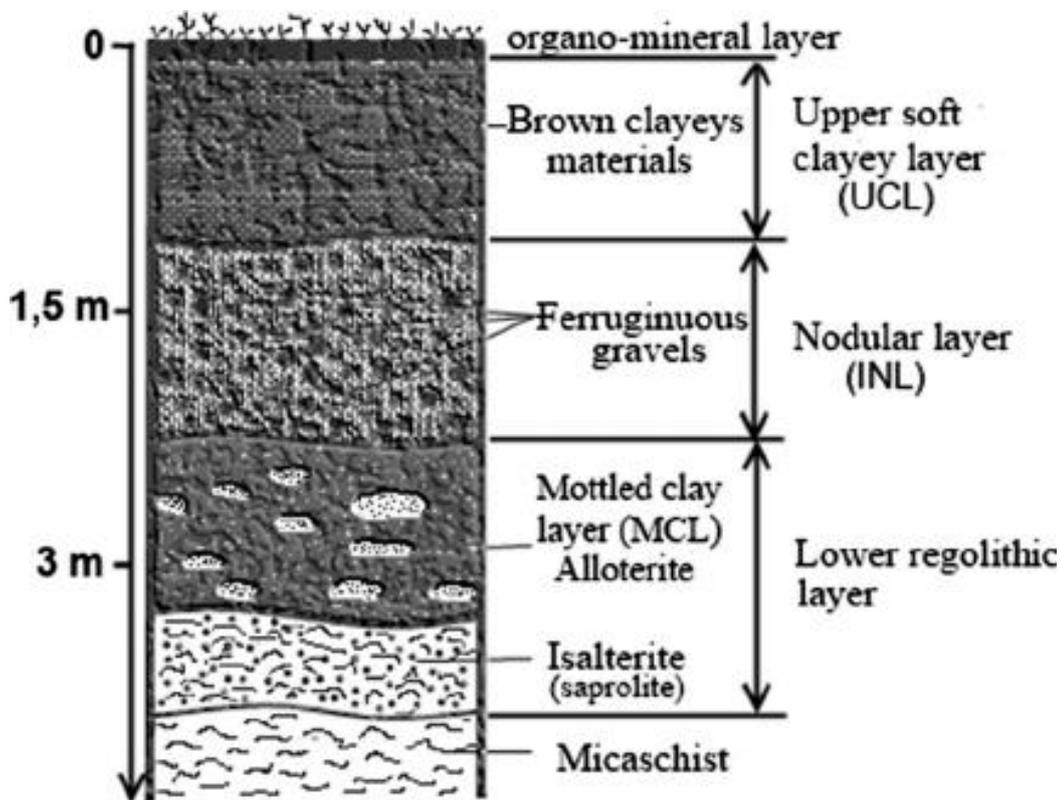
5. Engineering Behavior Under Load

Under structural loads, rocky soils usually demonstrate elastic behavior with minimal settlement. However, stress concentration near fractures may lead to localized deformation. In seismic regions of Uzbekistan, dynamic loading can activate joints and faults, increasing instability risks.

6. Application in Building Foundations

Rocky soils allow the use of shallow strip or raft foundations in many cases. For high-rise or critical structures, rock anchors and pile foundations may be employed. Excavation in hard rock requires blasting or mechanical breaking, increasing construction costs but ensuring long-term stability.

Figure 2.



7. Role in Road and Highway Construction

In road engineering, rocky soils provide a strong and durable subgrade. However, road cuts in rocky slopes require stabilization to prevent rockfalls and landslides. Drainage systems are essential to control groundwater infiltration through fractures.

8. Engineering-Geological Investigations

Investigations include geological mapping, borehole drilling, rock strength testing, fracture analysis, and groundwater monitoring. In Uzbekistan, these surveys are regulated by national construction standards and are mandatory for large infrastructure projects.

9. Environmental and Seismic Considerations

Seismic activity is a major factor influencing construction on rocky soils in Uzbekistan. Earthquake-induced stresses may reduce rock mass stability. Environmental impacts such as erosion and slope degradation must also be addressed through sustainable engineering practices.

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