

Pakistan Building Code (Seismic Provisions 2007)

Chapter 4: Soils and Foundations — Advanced Professional Interpretation

Purpose of Chapter 4

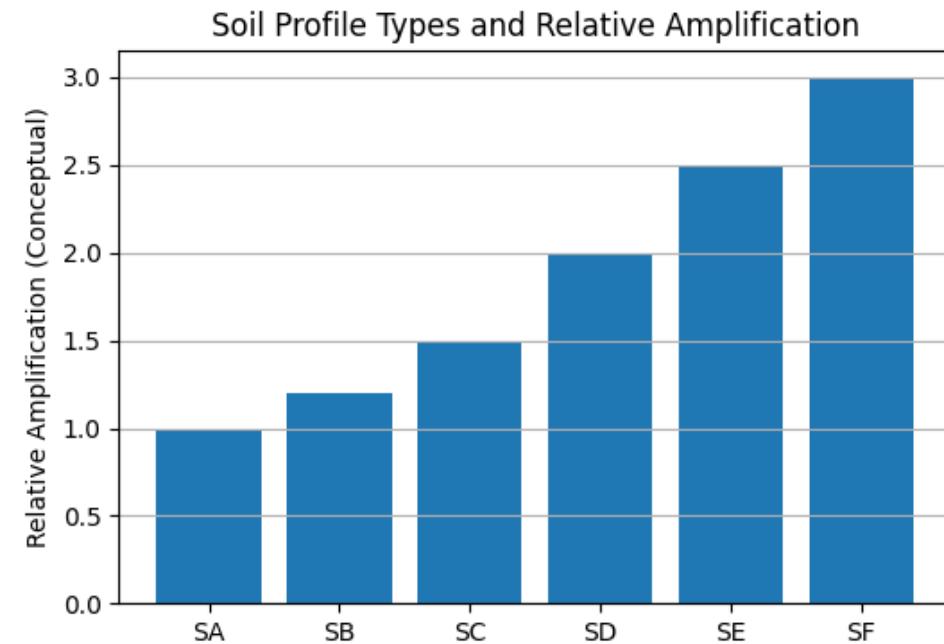
Chapter 4 establishes how ground conditions modify earthquake demand and how foundations must safely transfer seismic forces to soil. Structural strength alone is not sufficient; soil behavior strongly controls seismic performance.

1. Determination of Soil Conditions

Each site must be assigned a soil profile type using geotechnical data such as shear wave velocity (V_s), standard penetration resistance (N), or undrained shear strength (S_u).

2. Soil Profile Types — Critical Classification

The code defines six soil profile types (SA through SF) representing increasing seismic amplification and risk. Correct classification directly affects design base shear.



SA: Hard rock ($V_s > 1500 \text{ m/s}$) — minimal amplification.

SB: Rock (750–1500 m/s) — low amplification.

- SC: Very dense soil / soft rock — moderate amplification.
- SD: Stiff soil — significant amplification (common in Pakistan).
- SE: Soft soil — very high amplification and settlement risk.
- SF: Special soils — require site-specific study.

3. Methods to Determine Soil Profile

The preferred method is the average shear wave velocity (V_s) for the top 30 m of soil.

Average Shear Wave Velocity (V_s) Concept

$$V_s = \frac{\sum d_i}{\sum (d_i/V_{si})}$$

Computed over top 30 m soil

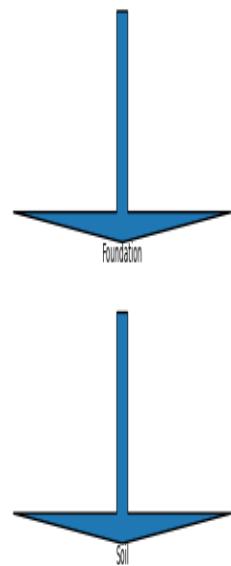
Alternative methods include SPT N-value averaging and undrained shear strength for cohesive soils.

4. Foundations in Seismic Zones 3 and 4

Foundations must safely transmit base shear and overturning forces into the supporting soil. Design checks must include bearing, sliding, overturning, and settlement.

Superstructure

Seismic Load Path to Foundation



5. Special Requirements for Piles and Caissons

Pile foundations must consider lateral displacement effects and provide special transverse reinforcement over the critical flexural length. Earthquake loading can induce significant bending due to soil movement.

Professional Risk Notes

Common mistakes include defaulting to SD without investigation, ignoring soft clay thickness, missing liquefaction checks, and inadequate pile confinement. Proper geotechnical coordination is essential for seismic safety.