Soil Compaction

continued

Smooth-Wheel Roller

Pneumatic Roller

Sheepsfoot Roller

Vibratory Roller

Portable Compactors

Compaction Specifications

Relative Compaction

$$R\,(\%) = \frac{\gamma_{d(\text{field})}}{\gamma_{d(\text{max}-\text{lab})}} \times 100$$

Proctor Test

Relative Density

$$D_r = \frac{e_{max} - e_{field}}{e_{max} - e_{min}}$$

$$D_r = \left[\frac{\gamma_{d(\text{field})} - \gamma_{d(\text{min})}}{\gamma_{d(\text{max})} - \gamma_{d(\text{min})}}\right]\left[\frac{\gamma_{d(\text{max})}}{\gamma_{d(\text{field})}}\right]$$

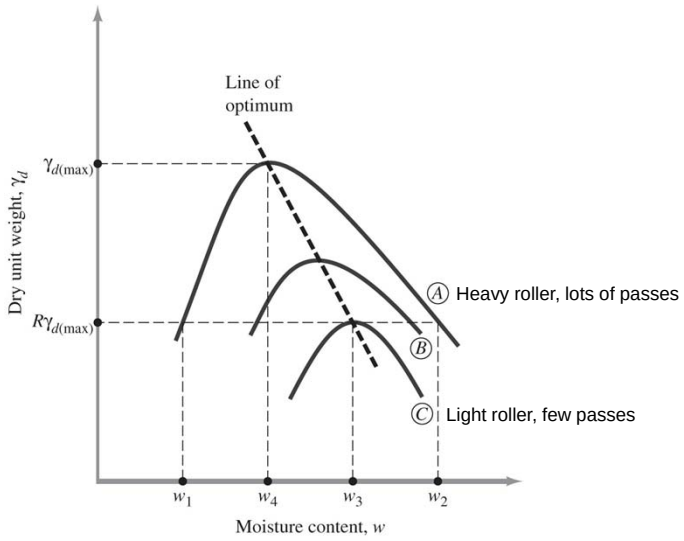
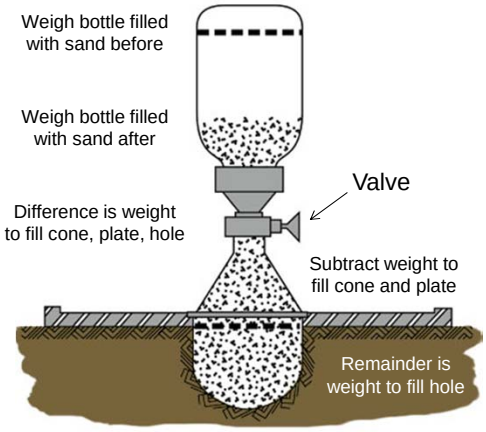


Figure 5.13 Most economical compaction condition

Sand Cone Test



Sand Cone Test

Example

SAND CONE CALIBRATION			
1. INITIAL WEIGHT OF APPARATUS + SAND		g	12,530
2. FINAL WEIGHT OF APPARATUS + SAND		g	10,931
3. WEIGHT OF SAND IN PLATE AND CONE	*2 – 1*	g	

Example

VOLUME OF HOLE DETERMINATION			
4. INITIAL WEIGHT OF APPARATUS + SAND		g	10,931
5. FINAL WEIGHT OF APPARATUS + SAND		g	6,608
6. WEIGHT OF SAND RELEASED	*5 – 4*	g	
7. WEIGHT OF SAND IN HOLE	*6 – 3*	g	
8. WEIGHT OF SAND IN HOLE	*7 ÷ 453.6*	lb	
9. UNIT WEIGHT OF SAND		lb/ft^3	94.9
10. VOLUME OF THE HOLE	*8 ÷ 9*	ft^3	

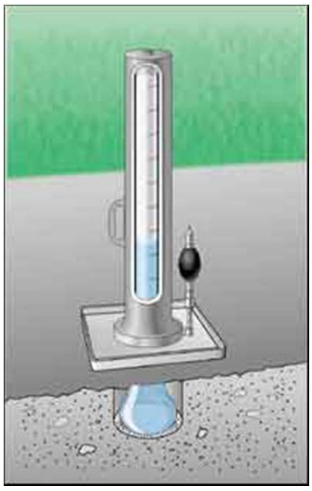
Example

WATER CONTENT DETERMINATION			
11. WEIGHT OF WET SOIL + TARE		g	2176
12. WEIGHT OF DRY SOIL + TARE		g	1875
13. WEIGHT OF WATER	*12 – 11*	g	
14. WEIGHT OF TARE		g	158
15. WEIGHT OF DRY SOIL	*12 – 14*	g	
16. WATER CONTENT	*13 ÷ 15*		

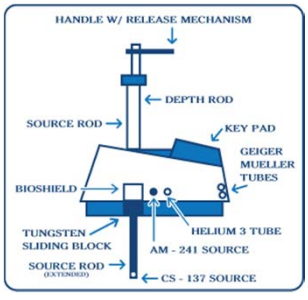
Example

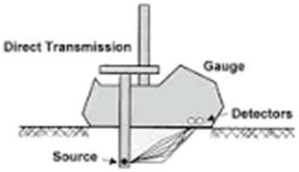
UNIT WEIGHT DETERMINATION			
17. WEIGHT OF WET SOIL + TARE		g	3627
18. WEIGHT OF TARE		g	158
19. WEIGHT OF WET SOIL	*17 – 18*	g	
20. WEIGHT OF WET SOIL	*19 ÷ 453.6*	lb	
21. WET UNIT WEIGHT	*20 ÷ 10*	lb/ft^3	
22. DRY UNIT WEIGHT	*21 ÷ (1 + 16)*	lb/ft^3	

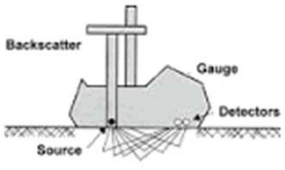
Balloon Density Test



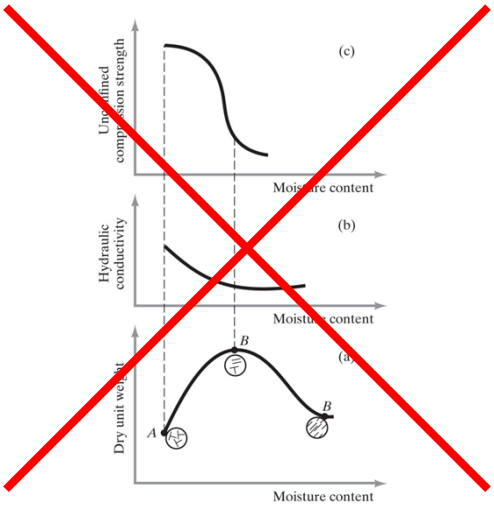
Nuclear Density Gauge

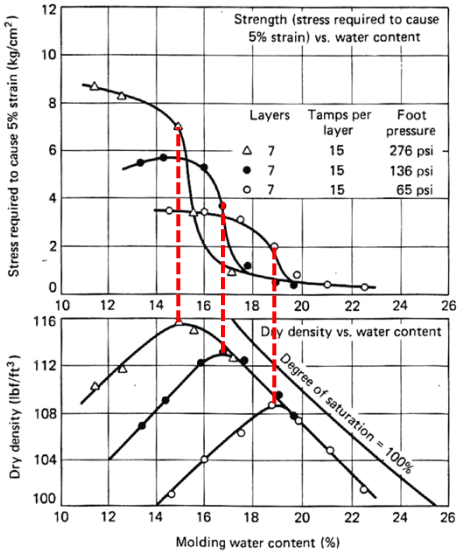






Compaction Effects





Holtz & Kovacs, *An Introduction to Geotechnical Engineering*, 1981

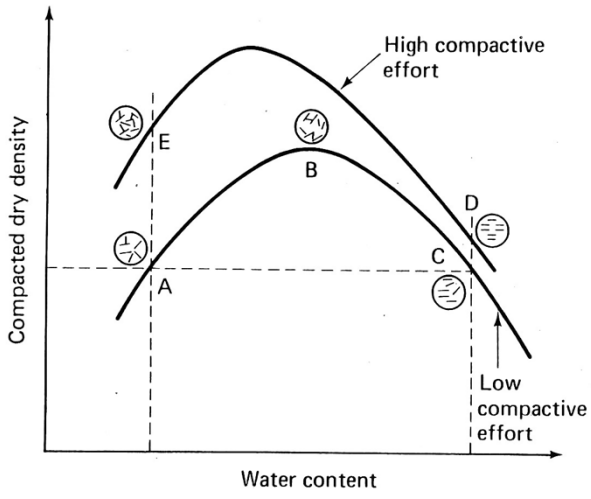


Fig. 5.5 Effect of compaction on soil structure (after Lambe, 1958a).

Holtz & Kovacs, *An Introduction to Geotechnical Engineering*, 1981