Part 7

COMPACTION METHODS

No. of Passes	Depth to 75% Rel. Density
2	1.7 ft
5	2.5
15	3.2
45	4.0

For Clays: Using a Self-Propelled Cat 837 Sheepsfoot Roller

No of Passes	Depth to 90% of ASTM D-1557			
2	0.25	0.38	0.33	ft
4	0.42	0.54	0.50	
6	0.50	0.67	0.60	

2% over optimum

optimum moisture

3% dry of optimum

- **The number of passes needed to achieve the desired compaction depends on the lift thickness, contact pressure, and soil moisture content.**
- **Most contractors get a feel for these figures, based on their local experience. If you are dealing with a contractor who has not previously worked in the area, you should be wary.**

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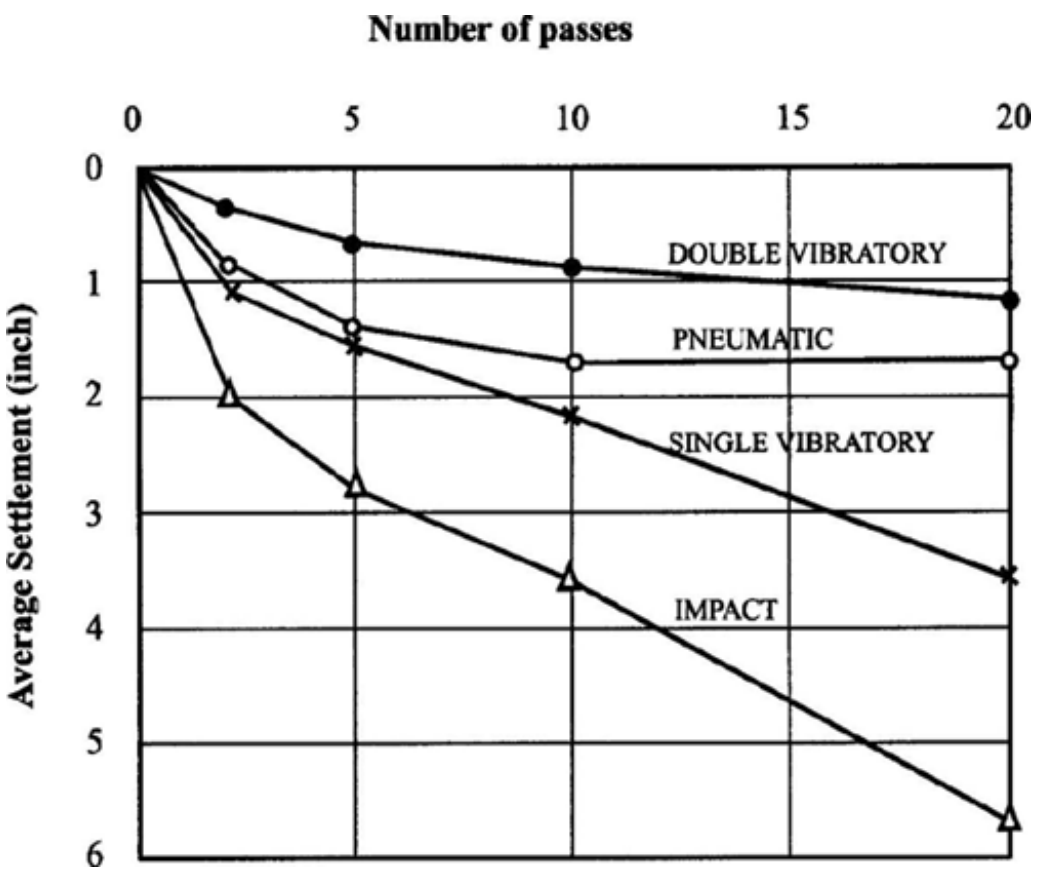
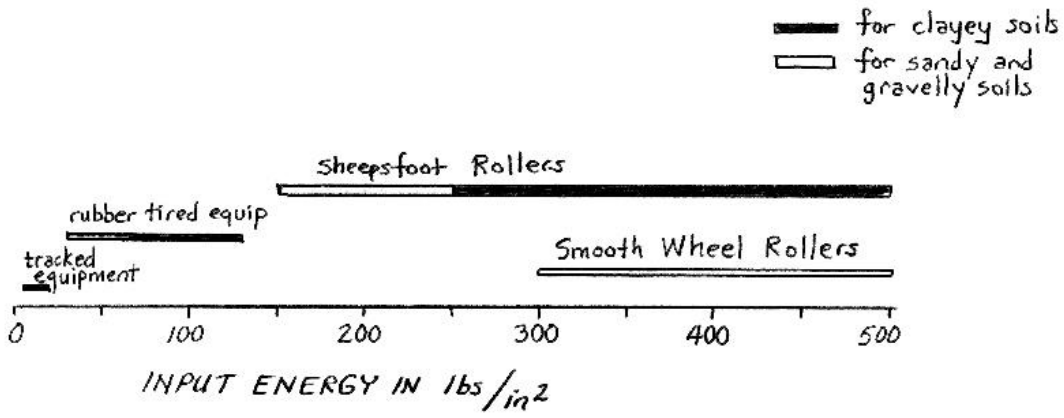
ROLLER EFFICIENCY and CONTACT PRESSURES



- Number of passes versus average settlement (compression) in inches for various modern compactors. Note efficiency of impact rollers.



- **Contact pressures/Input energy** for various types of compactors. Note that track-walking fill with dozers is not an adequate means of compaction.

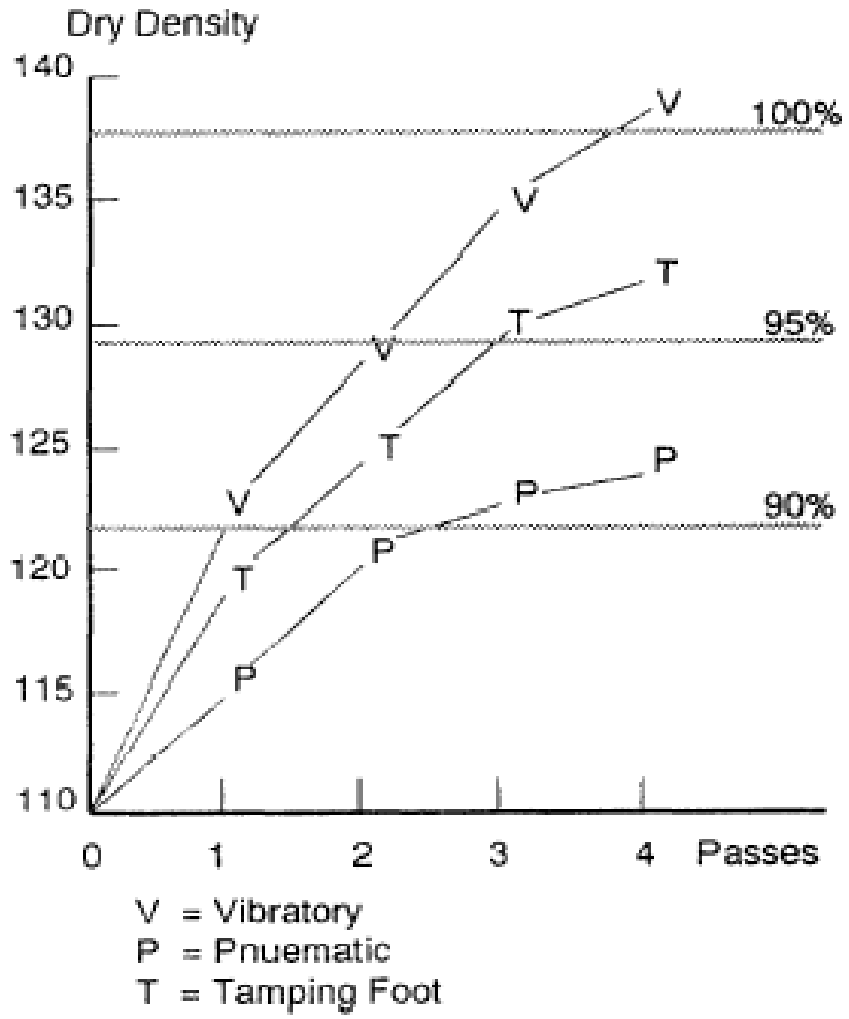
Recommended field compaction Equipment for different soils

(from Rollings and Rollings, 1996)

Soil	First choice	Second choice	Comment
Rock fill	Vibratory	Pneumatic	-
Plastic soils, CH, MH (A-7, A-5)	Sheepsfoot or pad foot	Pneumatic	Thin lifts usually needed
Low-plasticity soils, CL, ML (A-6, A-4)	Sheepsfoot or pad foot	Pneumatic, vibratory	Moisture control often critical for silty soils
Plastic sands and gravels, GC, SC (A-2-6, A-2-7)	Vibratory, pneumatic	Pad foot	-
Silty sands and gravels, SM, GM (A-3, A-2-4, A-2-5)	Vibratory	Pneumatic, pad foot	Moisture control often critical
Clean sands, SW, SP (A-1-b)	Vibratory	Impact, pneumatic	-
Clean gravels, GW, GP (A-1-a)	Vibratory	Pneumatic, impact, grid	Grid useful for over-sized particles

Reference: Rollings, M.P., and R.S. Rollings (1996). *Geotechnical Materials in Construction*, McGraw-Hill, NY

RUNNING TEST STRIPS



- Test strips are useful to determine which type of compactor and how many passes will be necessary to achieve the desired compaction
- In this example, P is pneumatic tire roller; T is a tamping foot, or pad roller; and V is a vibrating drum roller
- The example at left is for a granular soil mixture; which benefit from vibratory compaction

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- **Vibratory plate and spiked or pad roller compactors (at right) can be attached to tracked excavators to provide mechanical compaction of trench backfill, mostly for buried utilities. These trenches are not usually compacted in 6 to 8 inch lifts, so can settle noticeably.**

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- The diesel powered Ramex P/33 Trench Compactor is hand-operated and used in trenches and difficult access areas.
- These walk-behind and remote controlled compactors weigh about 3000 lbs and were developed for compacting backfill in pipeline trenches more than 27 inches wide
- They typically exert between 10 and 18 psi contact pressures at frequencies around 62 cycles per second (Hz), necessitating lift thicknesses of no more than 4 or 5 inches.

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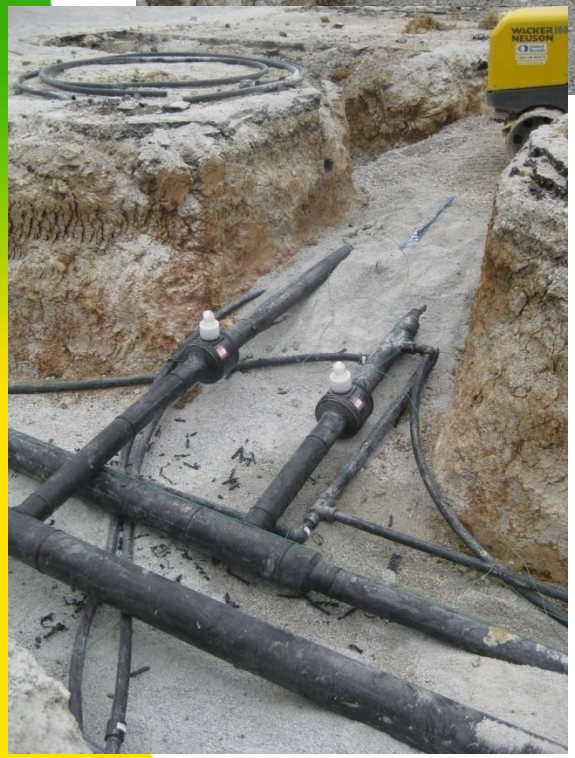
REMOTELY OPERATED MINI-COMPACTORS



Remotely-operated mini-compactors have taken over the burden of trench backfill compaction operations

These machines only engender about 10 to 14 psi compactive effort

Hand Operated Tampers and "Pogo Sticks"

- Hand-operated tampers, like this *Wacker BS 700*, typically exert compaction contact pressures between 7 and 18 psi
- Tampers are only useful for compacting soils in lifts 2 to 3 inches thick at near-optimum moisture content, if trying to achieve 90% of the ASTM D 1557 compaction standard

Vibratory Plate Compactors

- **Above left - This *Wacker VP1340A Plate Compactor* only weighs 170 lbs, but only exerts a dynamic contact force of 5 to 7 psi, using 63 Hz frequency**
- **Lower left - This *Bomag plate compactor* weighs 726 lbs and exerts a compactive force of 13 psi, at 62 Hz frequency.**