Geotechnical Engineering–I

BSc Civil Engineering – 4th Semester

Lecture # 13

9-Mar-2015

by

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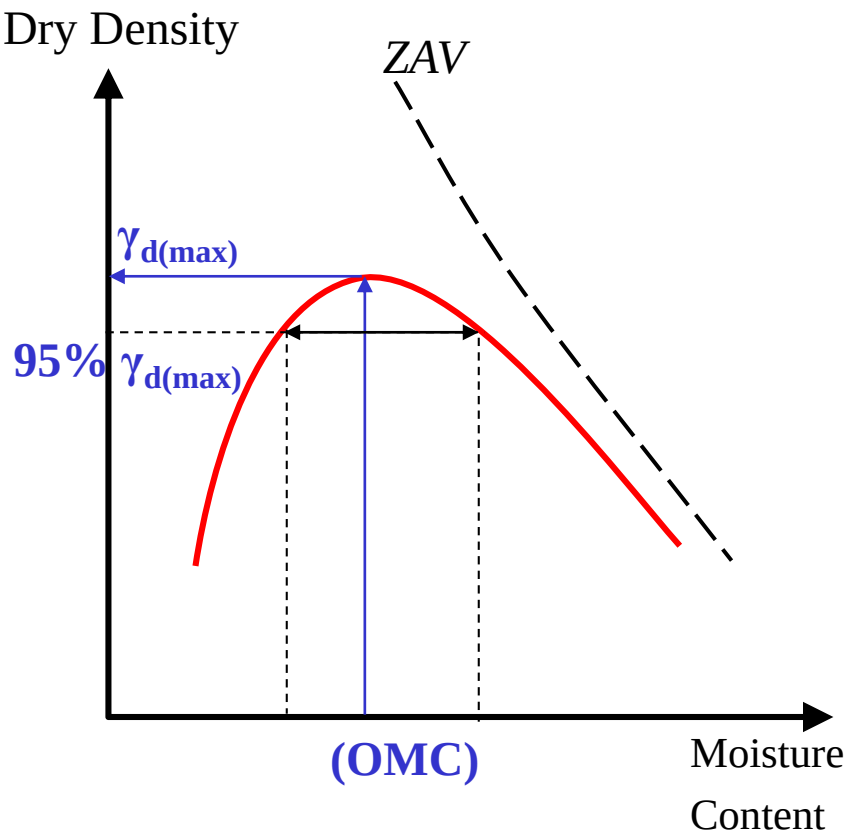
Lecture Handouts: https://groups.google.com/d/forum/geotec-1

FIELD COMPACTION

Use of compaction curve?

- *Not possible* to obtain $\gamma_{d(max)}$ in field.
- In the field, contractor is usually required to compact the soil to *90-95%* $\gamma_{d(max)}$.



RELATIVE COMPACTION

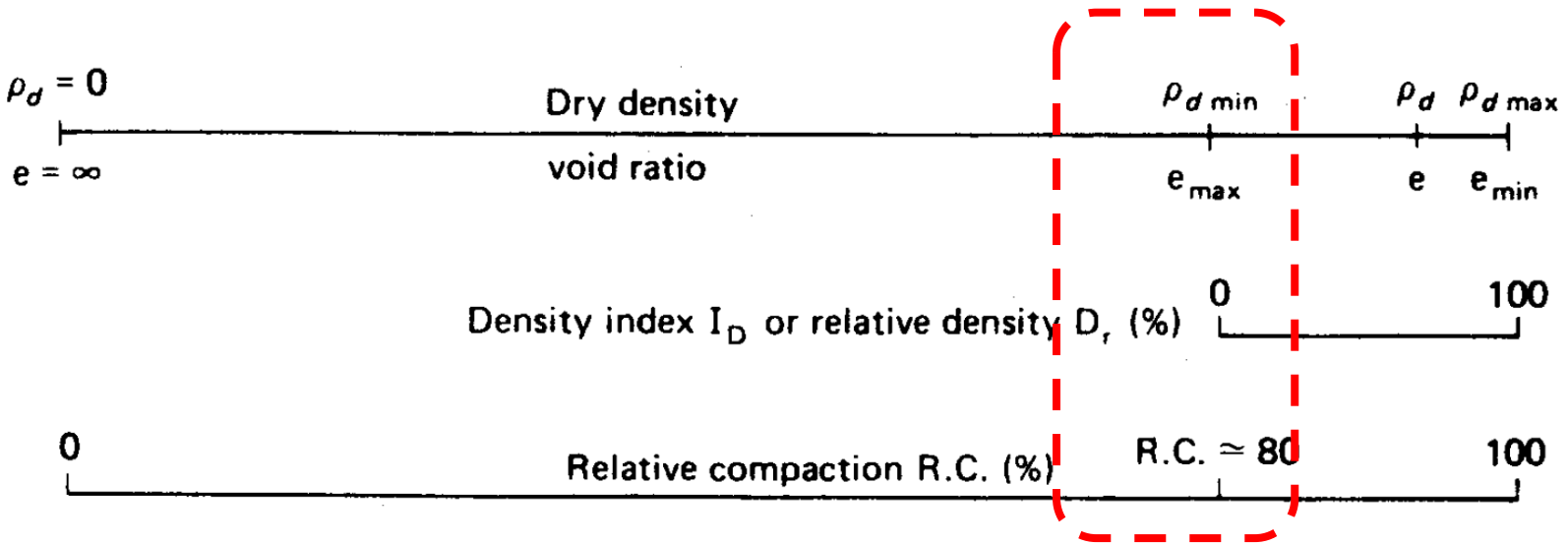
$$R(\%) = \frac{\gamma_{d\,(field)}}{\gamma_{d\,\max\,(lab)}} \times 100$$

Relative compaction, or percent compaction is defined as the ratio of the $(\gamma_d)_{field}$ to $(\gamma_{d\,max})_{lab}$.

Relative Compaction vs Relative Density

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

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



$$R_C = 80 + 0.2D_r$$

Statistical result based on 47 soil samples.

FIELD COMPACTION EQUIPMENT

A family of heavy fill movement and *compaction equipment*

FIELD COMPACTION EQUIPMENT

Motor-scarifier cuts and lays fills in 8 to 24 inch lifts for compaction

FIELD COMPACTION EQUIPMENT

Motor grader levels the ground

FIELD COMPACTION EQUIPMENT

Water truck used for attaining *optimum moisture* for compaction of the subgrade.

FIELD COMPACTION

Field compaction → mostly done with *rollers*.

Common *types* of rollers:

- Smooth-wheel rollers (or smooth-drum rollers)
- Pneumatic rubber-tired rollers
- Sheepfoot rollers
- Impact rollers
- Vibratory rollers
- Grid rollers

SMOOTH-WHEEL ROLLER (DRUM)

- *100% coverage* under the wheel
- Contact pressure up to *380 kPa*
- Used for *all soil types* except for rocky soils.
- Compactive effort: *static weight*
- Common use: *proof-rolling subgrades* and *compacting asphalt pavement*.

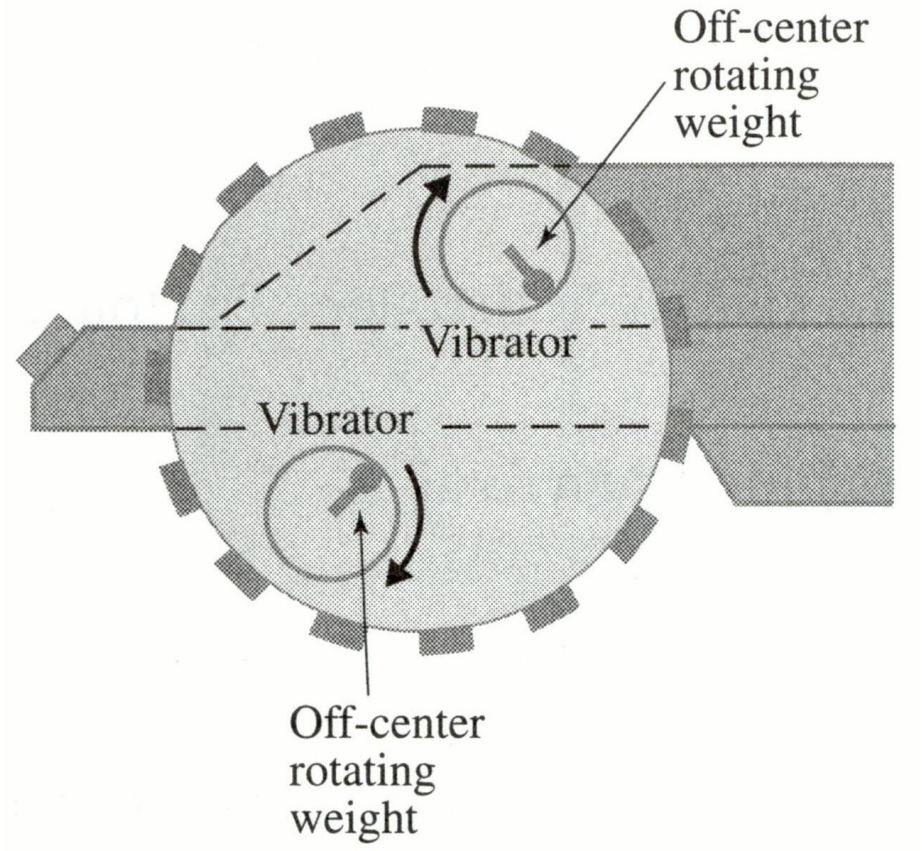
PNEUMATIC (OR RUBBER-TIRED) ROLLER

- *80% coverage* under the wheel
- Contact pressure up to *700 kPa*
- Used for both *granular* and *fine-grained soils*.
- Compactive effort: static weight and *kneading*.
- Typical use: *Highway fills* or *earth dam construction*.

SHEEPSFOOT ROLLERS

- Several *round or rectangular* shaped protrusions or *"feet"* attached to a steel drum
- *8% ~12% coverage*
- Contact pressure is from *1400 to 7000 kPa*
- It is best suited for *clayey soils*.
- Compactive effort: *static weight* and *kneading*.

VIBRATING DRUM ON SMOOTH-WHEEL ROLLER



- ***Vibrators*** can be attached to smooth, pneumatic rubber-tired, or sheepfoot rollers to provide vibratory effect to soil.
- *Particles rearrangement* due to *oscillations* of roller.
- Extremely efficient in compacting granular soils.

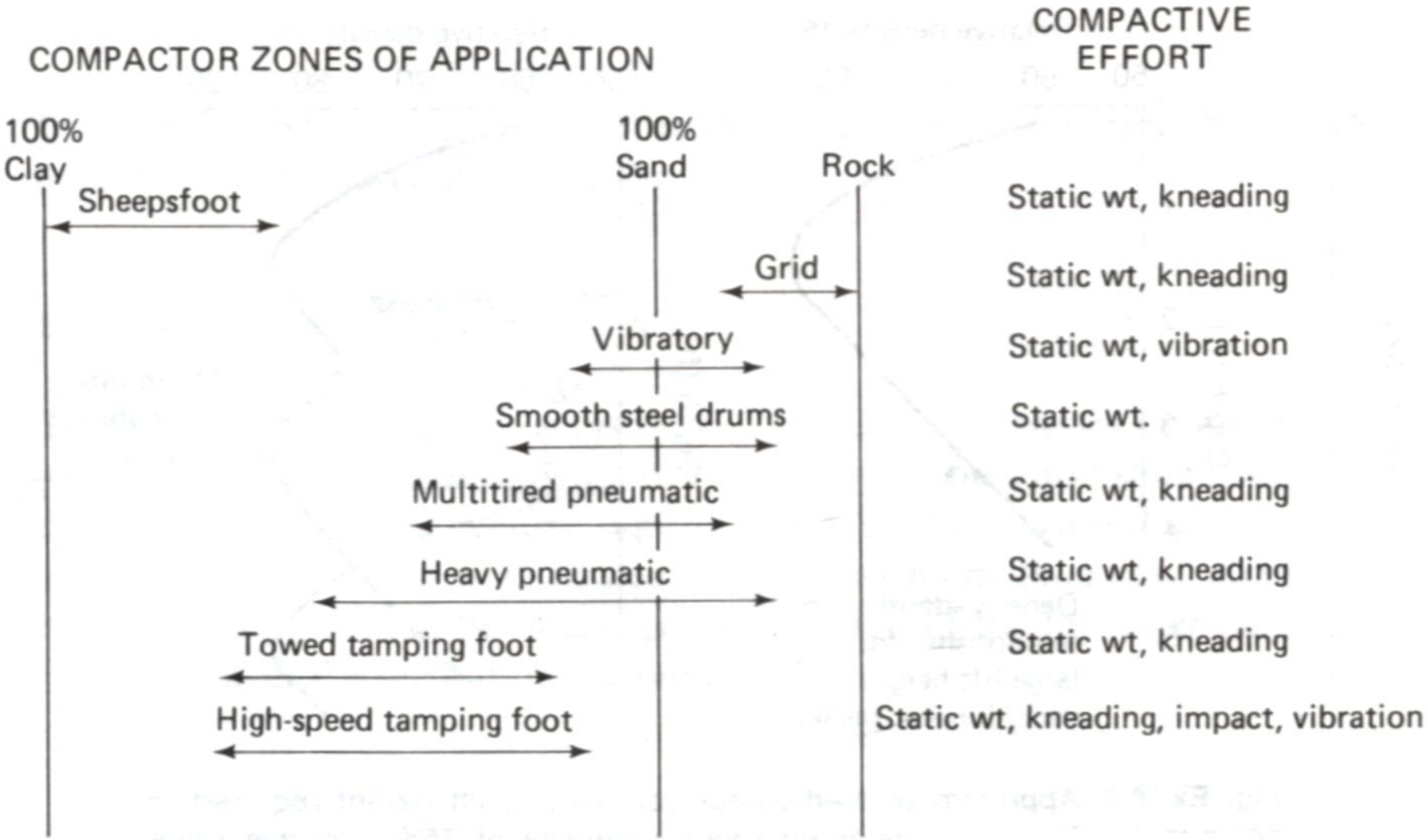
MESH (OR GRID PATTERN) ROLLER

- *50% coverage*
- Contact pressure is from *1400 to 6200 kPa*
- Suited for compacting *rocky soils*, *gravels*, and *sands*.
- Compactive effort: *Static weight* and *vibration*.

PORTABLE COMPACTORS

- Used at places where *space is limited*.
- *Foundation trenches*, compaction for *backfills.*

FIELD COMPACTION EQUIPMENT – SUMMARY



VIBRATORY COMPACTION – EFFICIENCY

A- Characteristics of *Compactor*

(1) Mass, size

(2) Operating frequency

B- Construction procedures

(1) Number of passes of roller

(2) Lift thickness

(3) Towing speed

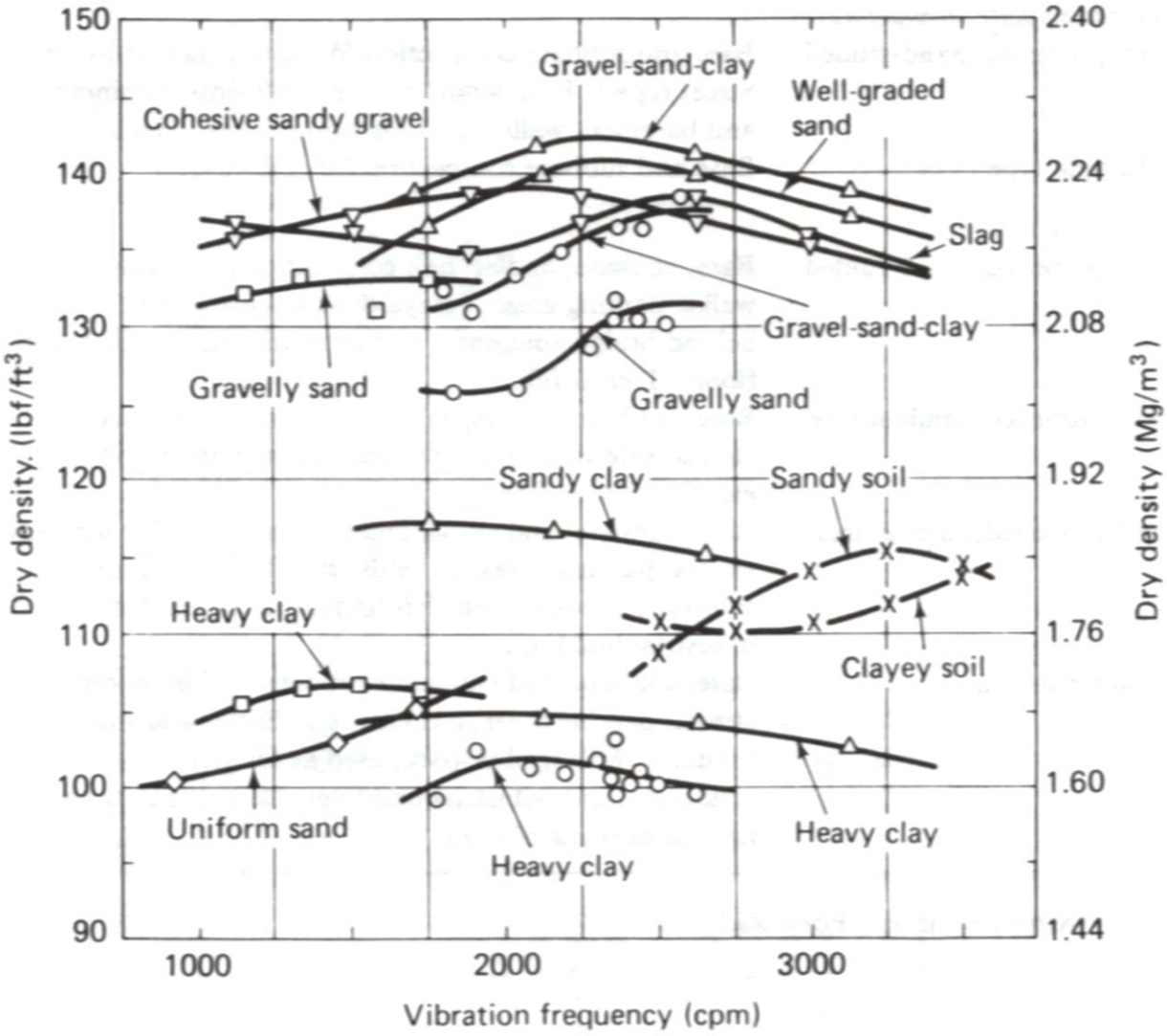
C- Characteristics of *Soil*

(1) Initial density

(2) Grain size and shape

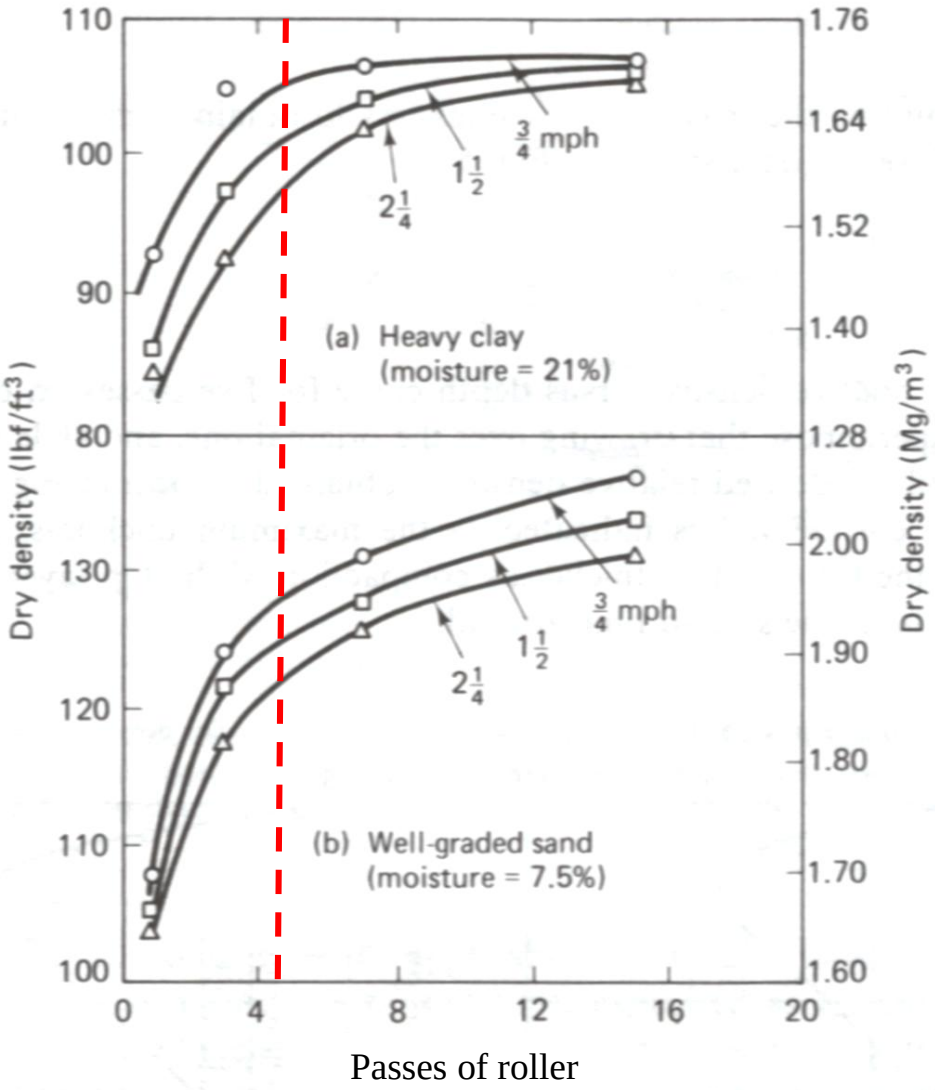
(3) Water content

Effect of *Compactor Size* & *Frequency*



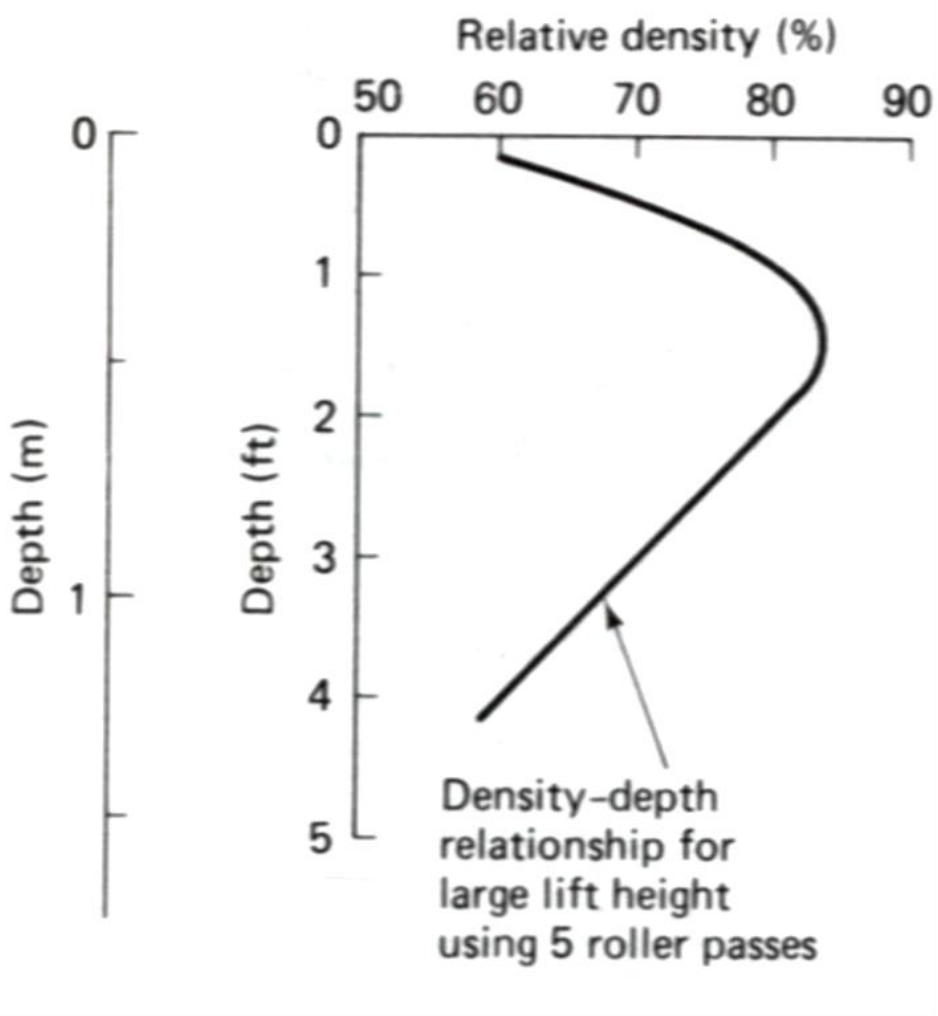
- *Heavier* the compactor, *better* is compaction
- Best compaction achieved at *optimum frequency*

Effect of *Roller Speed* & *No. of Passes*



- Increase in density not significant beyond *5 passes*.
- For a given number of passes, a *higher density* is obtained if the vibrator is towed more *slowly*.

Effect of *Lift Height*



- *Max. density* achieved at around *75% lift height*.

DYNAMIC COMPACTION

CONCLUDED