

Essential Civil PE Exam Notebook

Breadth and Depth

Review of Geotechnical Theory and Sample Exam Problems

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SOIL COMPACTION EQUIPMENT

Compactors are machines used in the compaction of soil.

Sheepsfoot roller or tamping roller applies kneading action to soil through hoof like round or rectangular elements on the roller. Through those elements, the roller applies high contact pin point pressure from about 200 to 1000 psi; similarly to a herd of sheep walking across a field. It compacts layers up to 12" thick. It is appropriate for fine grained soils (clays and silts), and sands or gravels with at least 20% of fines. It is not suitable for uniform gravels or very coarse soils (Townsend and Anderson, 2004).



Figure 1. Compactor with Sheepsfoot Drum (Wikipedia, 2007).

Vibratory roller compactor is similar to sheepsfoot or tamping roller. Vibration is achieved by dropping eccentric, alternating weights with frequency of 1000-3500 rpm inside of the 5 - 16 ton drum. Vibration is most effective for compaction of granular soils. Typically, compaction with vibratory roller is done in lifts of 4-12 inches (Townsend and Anderson, 2004).



Figure 2. Towed Vibratory Roller (Broons, 2011)

Mesh roller or grid roller applies pressure with a towed unit consisting of numerous bars 1 - 2 inches in diameter. The drum obtains 50% coverage with soil and exerts contact pressures from 200 to 900 psi. The soil material is vibrated, crushed and impacted. It is most suitable for rocky soils, gravels and sands (Townsend and Anderson, 2004).



Figure 3. Grid or Mesh Roller (Broons, 2011).

Impact roller is a non-cylindrical drum with three to five sides. It applies pressure to the soil surface by turning on a corner and falling on the flat side at a rate of two impacts per second. The main benefit of impact roller is the increased depth of influence (2.5 ft to 8.5 ft) when compared to conventional rollers (1 ft). Reportedly, It has been used successfully on both cohesive soils and granular soils including gravel and rock fill (Broons, 2011).



Figure 4. Towed Impact Roller (Broons, 2011).

Pneumatic rubber tired roller compacts layers from about 6 to 12 inches using both pressure and kneading techniques. Compaction is achieved with several (4-6) closely spaced tires. They are used in the last stage of compaction achieving about 80% coverage, with tire pressure of about 100 psi. They are applicable for compaction of concrete, asphalt and a wide variety of soils. Typically, they are used for highway fill and earth dam construction (Townsend and Anderson, 2004).



Figure 5. Pneumatic Rubber Tired Roller (CAT, 2011).

Smooth Wheeled Roller, drum roller or steel-wheeled roller applies pressure through smooth rollers ranging from 2 - 20 tons. It is used in the final stages of compaction to proof roll subgrades, fills and for compaction of asphalt pavements. It obtains 100% compaction coverage under the wheel, with ground contact pressures of up to 55 psi. It is used on both sandy and clayey soils. It is not appropriate for rocky soil (Townsend and Anderson, 2004).



Figure 6. Smooth Wheeled Roller (CAT, 2011).

Table 1. Applicability of compactor use per material type.

Equipment	Application	Granular Soil	Cohesive Soil	Asphalt
grid or mesh roller	subgrade, subbase	yes	no	no
impact roller	moist and saturated soils	yes	yes	no
pneumatic rubber tired roller	concrete, asphalt, dams, fills, subgrade	yes	yes (not soft clays)	yes
sheepsfoot roller	subgrade, dams embankments	if > 20% fines	yes	no
smooth wheeled	base courses, subgrade	yes	yes (not soft clays)	yes
vibratory roller compactor	subgrade	yes	no	no

Bibliography

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