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| Course No. : CE363 | Date of Testing : 14.10.2011 |
| No. And Title of Test : (8)DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATION BY THE 2.5 KG RAMMER | |
| Year and Section : 2011/5 | Lab Group : 3 |
| Surname, Name: | |

**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATION BY THE 2.5 KG RAMMER**

**Object**

Object of this experiment is to determine dry density of the soil when compacted in a specified manner with different water contents and the water content at which the dry density is maximum value.

**Apparatus**

1. Proctor compaction mould, with removable base-plate and collar
2. A 2.5 kg rammer, with a suitable arrangement for controlling the drop to 300mm
3. A balance readable and accurate to 1.0 g
4. A palette knife
5. A metal straightedge
6. A 20 mm test sieve and a receiver
7. A large metal tray
8. Apparatus for moisture content determination
9. Apparatus for extracting specimens from mould



1. **Proctor compaction mould, (2) 2.5 kg rammer**

**Theory**

Soil compaction is defined as the method of mechanically increasing the density of soil.  In construction, this is a significant part of the building process.  If performed improperly, settlement of the soil could occur and result in unnecessary maintenance costs or structure failure.  Almost all types of building sites and construction projects utilize mechanical compaction techniques

**Procedure**

1. *For soils not susceptible to crushing during compaction*
2. Take 5 kg sample of dry soil which can pass the 20 mm sieve, and mix with a specific amount of water depending on the type of soil (4-6% for sandy and gravelly soils, 8-10% below the plastic limit for cohesive soils).
3. Smear the inner walls of the compaction mould with vaseline. Weigh the mould with base-plate, record as . Put the mould on a solid base and compact the soil in the mould as three equal-mass layers by hitting each layer with 25 blows of free fall of the rammer from 300 mm height. Ensure that the blows are distributed uniformly on the surface. Fill the mould with sufficient amount of soil. Remove the collar, carefully level the surface by straightedge. Then weigh the mould and soil, and record as .
4. Remove the compacted soil off the mould, place it on the large metal tray. Take a sample of the soil and determine its water content(w).
5. Break up the remainder of the soil specimen rub through the 20 mm sieve and mix the remainder of the original sample. Add suitable increments of water and mix into the sample. Then repeat the above procedure from operations (2) to (4) for each increment of water added. The total number of determinations made must be at least five and the range of moisture contents should be such that the optimum moisture content at which the maximum dry density occurs is within that range.

*b)For soils susceptible to crushing during compaction*

1. Take five or more 2.5 kg samples of air-dried soil smaller than 20 mm test sieve. Mix the samples with a different amount of water to give a suitable range moisture contents. The range of moisture contents should be such that the optimum moisture content at which the maximum dry density occurs is within that range.
2. Treat each sample as in (a) step 2 above.
3. Treat the compacted specimen as in (a) step3 above.
4. Discard the remainder of each soil specimen.

**Calculations**

= 1.21 g/ml

=2.7\*(1-0.05)/(1+2.7\*0.0578)=2.22 g/ml



**Discussion of Results**

There are some factors that can produce errors in this test. Firstly, while arranging the soil sample water is added to soil. The water must be added homogeneously. Secondly, hammering action should be done properly. The rammer should be released from the correct amount of height.

The results obtained from the test and further calculations are as they are expected before the test. In the graph, the theoretical dry density curves for 0%, 5%, 10% air void soil. However, the data obtained in the test shows that practically it is not the case. Dry density increases as water content increases, while after a specific value of water content dry density decreases. That value is the optimum moisture content of the soil.

**Conclusion**

Finally, maximum dry density and optimum moisture content of the soil tested are calculated. According to the data obtained from the test maximum dry density is determined as 1.35 g/ml and optimum moisture content as 25.2% with the help of the graph in the calculations section.

**References**

Mirata, T. (2009). *Laboratory instructions for soil mechanics students.* Ankara: METU Press.