DETERMINATION OF WATER CONTENT- DRY DENSITY RELATION (HEAVY COMPACTION)

STANDARD

- IS: 2720 (Part 8) 1983.

OBJECTIVE

- To determine the required amount of water to be used when compacting the soil in the field and the resulting degree of denseness, which can be expected from compaction at optimum moisture content.

APPARATUS

- Cylindrical metal mould shall be either of 100mm diameter and 1000cm^3 volume or 150mm diameter and 2250cm^3 volume and shall confirm to IS: 10074 – 1982.
- Balance of capacity 500grams and sensitivity 0.01gram.
- Balance of capacity 15Kg and sensitivity one gram.
- Thermostatically controlled oven with capacity up to 250 ^{0}C.
- Airtight containers.
- Steel straight edge about 30cm in length and having one beveled edge.
- 4.75mm, 19mm and 37.5mm IS sieves confirming to IS 460 (Part 1).
- Mixing tools such as tray or pan, spoon, trowel and spatula or suitable mechanical device for thoroughly mixing the sample of soil with additions of water.
- Heavy compaction rammer confirming to IS: 9189 -1979.

PROCEDURE

- Take a representative sample of air dried soil of about 5 kg (soil not susceptible to crushing during compaction) or 3 kg from 15 kg sample (soil susceptible to crushing during compaction) passing through 19mm IS sieve and mix thoroughly with a suitable amount of water depending on the type of soil, generally 4 to 6 percent for sandy and gravelly soils and plastic limit minus 8% to 10% for cohesive soils.
- For soils susceptible to crushing during compaction take different samples for every determination and for soils not susceptible to crushing during compaction use the same sample for all the determinations.

- Weigh the 1000cc capacity mould with base plate attached and with out extension to the nearest gram (m_1).

- Place the mould on a solid base such as a concrete floor or plinth and compact the moist soil into the mould, with the extension attached in 5 layers of approximately equal mass, each layer being given 25 blows with the 4.90kg hammer dropped from a height of 450mm above the soil.
- Distribute the blows uniformly on each layer.
- The amount of soil used shall be sufficient to fill the mould leaving not more than about 6mm to be struck off when the extension is removed.

Compaction of soil in to mould

- Remove the extension and carefully level the compacted soil to the top of mould by means of straight edge.
- Weigh the mould and the soil to the nearest gram (m_2). Remove the compacted soil from the mould and place on the mixing tray.
- Collect a representative sample from the soil in the tray and keep in the oven for 24 hours maintained at a temperature of 105^0 to 110^0 C to determine the moisture content (W).

Compacting soil containing coarse material up to 37.50 mm size

- Take representative sample of material passing through 37.50 mm IS sieve.

- Compact the material in 2250 cm^3 volume of mould in five layers each layer being given 55 blows with 4.90 kg rammer dropped from a height of 450mm above the soil.
- The remaining procedure is same as described above for 1000cc mould.
- In all the above cases make at least five determinations and the range of moisture content shall be such that the optimum moisture content at which the maximum dry density occurs is within that range.

CALCULATIONS

- Calculate the bulk density γ_w in g / cm^3 of each compacted specimen from the equation,

  $\gamma_w = (m_2 - m_1) / V_m$

  m_1 = Weight of mould with base plate.

  m_2 = Weight of mould with compacted soil.

  V_m = Volume of mould in cm^3.
- Calculate the dry density γ_d in g/cm^3 from the equation,

  $\gamma_d = \gamma_w / (1+W/100)$

  γ_w = Bulk density

  W = % of moisture content

REPORT

- Plot the values obtained for each determination on a graph representing moisture content on x-axis and dry density on y-axis.
- Draw a smooth curve through the resulting points and determine the position of the maximum in the curve.
- Report the dry density corresponding to the maximum point to the nearest 0.01.
- Report the percentage corresponding to the maximum dry density i.e. optimum moisture content to the nearest 0.2 %for values below 5% and to the nearest 0.5% for values from 5 to 10% and to nearest whole number for values exceeding 10 %.

PRECAUTION

- With clays of high plasticity or where hand mixing is employed, it may be difficult to distribute the moisture uniformly through out the air dried soil by mixing alone,

So it may be necessary to preserve the mixed sample in a sealed container for a minimum period of about 16 hours before conducting the test.

APPENDIX D
FORM D1

Punjab State Road Sector Project
PWD B&R Branch, Govt. of Punjab
Punjab Roads & Bridges Development Board

LABORATORY COMPACTION

(IS 2720 Parts 7 & 8)

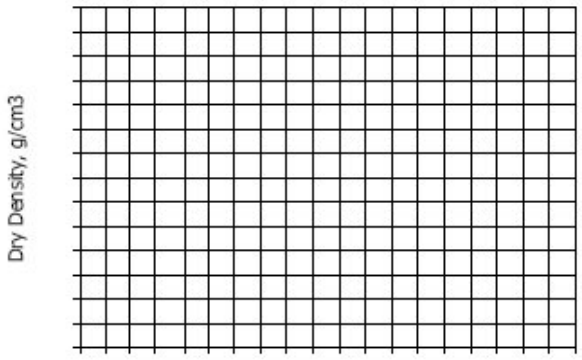
Contractor: _____ Date: _____
Station: _____ Sample No.: _____
Soil Description: _____ Date Tested: _____
Tested by: _____
Test Designation: Part 7/ Part 8 (circle one) Specimen Preparation: single / separate (circle one)

WATER CONTENT DETERMINATION

Sample No.	1		2		3		4		5	
Moisture Can No.										
Wt. of Can+Wet Soil, g										
Wt. of Can+Dry Soil, g										
Wt. of Water, g										
Wt. of Can, g										
Wt. of Dry Soil, g										
Water Content, %										
Ave. Water Content, %										

DENSITY DETERMINATION

Wt. of Moist Soil+Mould, g					
Wt. of Mould, g					
Wt. of Moist Soil, g					
Vol. of Mould, cm3					
Wet Density, g/cm3					
Dry Density, g/cm3					



Diameter of mould, mm	
Weight of rammer, kg	
Height of fall, mm	
No. of blows	
No. of layers	
Optimum Moisture Content, %	
Maximum Dry Density, g/cm3	

Remarks: _____

Approved /Not Approved:

_____ Contractor's Representative

_____ Materials Engineer Consultant

_____ Resident Engineer Consultant