**MIDDLE EAST TECHNICAL UNIVERSITY**

**DEPARTMENT OF CIVIL ENGINEERING**

**CE 344: MATERIALS OF CONSTRUCTION**

**LABORATORY REPORT 1: TESTS ON CONCRETE**

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**SUBMISSION DATE: 27.05.2019**

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**1. Object and Scope**

In this test method, unit weight (density) of freshly mixed concrete is determined . Then, compressive strength, splitting tensile strength and flexural tensile strength can be calculated.

**2. Preliminary Remarks**

Unit weight of concrete is very important parameter for the concrete mix design because it defines concrete characteristic features such as strength, durability, workability etc.

Quantities of materials i.e. weight of cement or volume of air entrapped are important for the concrete's characteristic. Proportions of these materials should be based on previous data or the test results.

3. Test Specimen

Mass of Measure = 6.5 kg

Mass of Measure filled with concrete = 25 kg

Volume = 8 L

**4. Apparatus**

* Measure
* Tamping Rod
* Balance

5. Test Procedure

1. Put the fresh concrete in the measure (1/3rd of measure)
2. Tamp 25 times with tamping rod
3. Put 2nd 1/3rd layer of fresh concrete
4. Tamp 25 times again
5. Put last 1/3rd layer
6. Tamp 25 times
7. Fill and vibrate the measure in two approximately equal layers. Continue vibration long enough to achieve proper consolidation of the concrete
8. Remove the extra part on the surface to get smooth surface
9. Place the measure on the scale and take the measurements.

6. Calculation

Calculations will be done according to ASTM C138.

*Density(Unit Weight)*

Mc=Mass of the measure filled with fresh concrete

Mm=Mass of the measure

Vm=Volume of the measure

**7. Results**

Density is calculated as 2350 kilogram per cubic meters.

**8. Discussion of Results**

*1a-)* Mass =unit weight \*volume

For C1, C2, C3, MC1= MC2=MC3= kg

For S1, S2, S3, MS1= MS2=MS3= kg

For F1, F2, F, MF1= MF2=MF3=

*1b-)*

= compressive strength(MPa) = maximum load(kN) D = average measured diameter(mm)

For C1: fcm= 29,857 MPa

For C2: fcm= 31,655 MPa

For C3: fcm= 34,352 MPa

T = splitting tensile strength(MPa) P = maximum applied load indicated by the testing machine(N) l = length(mm) d = diameter(mm)

For S1: T=2,626 MPa

For S2: T=2,737 MPa

For S3: T=2,951 MPa

R = flexural tensile strength (MPa) P = maximum applied load indicated by the testing machine(N) L = span length(mm) b = average width of specimen at the fracture (mm) d = average depth of specimen at the fracture (mm)

For F1: R=2,933 MPa

For F2: R=3,129 MPa

For F3: R=3,207 MPa

Table 1 : Strengths

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name of the specimen** | **Compressive Strength (MPa)** | **Name of the specimen** | **Splitting Tensile Strength (MPa)** | **Name of the specimen** | **Flexural Tensile Strength (MPa)** |
| C1 | 29,857 | S1 | 2,626 | F1 | 2,933 |
| C2 | 31,665 | S2 | 2,737 | F2 | 3,129 |
| C3 | 34,352 | S3 | 2,951 | F3 | 3,207 |
| Average | 31,958 | Average | 2,771 | Average | 3,090 |

*1c-)*

Figure 1 : Graph of Linear Relations bw. Strengths

1. Splitting Tensile Strength = 0,0728 \* (Compressive Strength) + 0,4453 (in MPa)
2. Flexural Tensile Strength = 0,0585 \* (Compressive Strength) + 1,2212 (in MPa)

*1d-)*

1. For the compressive strength of 115 MPa, the values are as below;

0,0728\*115+0,4453= 8,8173 MPa for Splitting Tensile Strength

0,0585\*115+1,2212= 7,9487 MPa for Flexural Tensile Strength

1. ERROR (C-S) =

Error (C-F) =

Because of the concrete's heterogenic and anisotropic features, we cannot determine its strength using linear relationship. Because of that we have almost 25% error.

2-)

Table 2 : Concrete Samples

|  |  |  |
| --- | --- | --- |
|  | Concrete 1 | Concrete 2 |
| Cement (kg/m3) | 300 | 300 |
| Water (kg/m3) | 135 | 135 |
| Fine aggregate (kg/m3) | 1100 | 1100 |
| Coarse aggregate (kg/m3) | 900 | 900 |
| Air – entraining admixture | - | + |
| Air content (%) | 2.2 | 5.0 |

Concrete 2 has higher workability since air entrainment increases the workability.

Concrete 1 has higher strength. Air entrainment decreases the strength of concrete.

**9. Conclusion**

In this lab session determination of the unit weight of concrete have been done with provided data. According to results, type of concrete is indicated as normal weight concrete. Afterwards, in the light of the given 3 samples and their data, compressive, flexural tensile and splitting tensile strengths are calculated according to ASTM formulas.

**10. References**

CE344 Lecture Notes

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