**MIDDLE EAST TECHNICAL UNIVERSITY**

**DEPARTMENT OF CIVIL ENGINEERING**

**CE 344: MATERIALS OF CONSTRUCTION**

**LABORATORY REPORT 1: TESTS ON PORTLAND CEMENTS**

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**SUBMISSION DATE: 25.03.2018**

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**1. Object and Scope**

The aim is firstly determining density of Portland cements. Then using density, required mass, specific surface area of sample to find fineness will be calculated. Afterwards, Normal consistency and setting time of Cement Pastes can be calculated and finally cement mortars compressive and flexural strengths can be calculated.

**2. Preliminary Remarks**

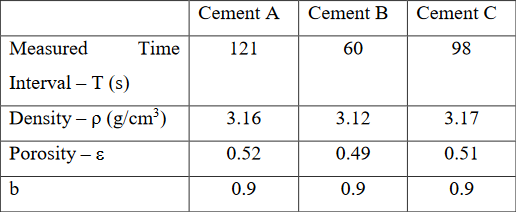
Portland cement is hydraulic binder material. It is produced by burning reaction of small amount of gypsum and Portland cement clinker. It sets and hardens when water is added to same place or container. Cement and water's reaction is an exothermic, so heat that known as heat of hydration is formed. That warms up the concrete.

Fineness is expression of average size of the cement particles. It is a vital terminology, affects total surface area of the particles. It is vital because hydration starts on the particle faces and total surface area affects the rate of hydration.

3. Test Specimen

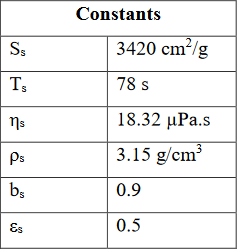
Three type of Portland cement is used. Their data is as below.

Table 1 : Data of Cement Samples

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Constants are given as shown below.

Table 2 : Table of Constants

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**4. Apparatus**

* Filter Paper
* Timer
* Plunger
* Monometer

5. Test Procedure

1. Put a filter paper into monometer in order to water is not wet the cement
2. Put cement specimen
3. Put an another filter paper onto cement specimen.
4. Put plunger onto specimen. This provides that voids that are inside of specimen will remove.
5. Slowly remove air in one side of monometer until liquid reaches the top mark.
6. Measure the time between second and third mark

6. Calculation

Fineness calculations according to ASTM C204-18

For Cement A:

For Cement B:

For Cement C:

Required mass calculations:

For Cement A:

For Cement B:

For Cement C:

**7. Results**

Table 3 : Calculated Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Time(s) | Density(g/cm3) | Required Mass(g) | Fineness(cm2/g) |
| Cement A | 121 | 3,16 | 2,67 | 4740,47 |
| Cement B | 60 | 3,12 | 2,80 | 2866,33 |
| Cement C | 98 | 3,17 | 2,73 | 4024,75 |

**8. Discussion of Results**

ASTM C348-18 defined flexural strength in MPa as Sf=0,0028P where P is the total maximum load.

Because three fracture loads are given in the data, In order to calculate Flexural Strength, we have to use average of these 3 fracture loads.

Table 4 : Table of Mortar's Flexural Strengths

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mortar A [N] | Mortar B [N] | Mortar C [N] |
| 1 | 1065 | 1252 | 951 |
| 2 | 1095 | 1221 | 1002 |
| 3 | 1078 | 1275 | 1012 |
| Flexural Strength(MPa) | 3,02213333 | 3,49813333 | 2,76733333 |

If water/cement ratio decreases, the strength of sample will increase because W/C ratio affects brittleness of samples. So, we can say that, according to flexural strengths, Mortar C has the largest and Mortar B has the smallest amount of water among them.

Mortar C > Mortar A > Mortar B

To estimate the flow percentage, the start and end diameters of the samples in the flow tables are needed. Therefore, we can only say that Mortar C has the largest flow percentage and the lowest flow percentage of Mortar B based on its water content.

Mortar C > Mortar A > Mortar B

**9. Conclusion**

For three different type of cement, Determination of Fineness of Hydraulic Cement by Air –Permeability Apparatus(ASTM C 204-18(Method A)) is done. Relevant data given by CE344 Assistants to us. In the light of ASTM C204-18 Method A, fineness values are calculated and required mass calculations have done. With fineness values, Cement B has more finer component and Cement A has less finer component can be said. Then required mass have calculated with densities and porosities.

**10. References**

CE344 Lecture Notes

ASTM. (n.d.). *Designation: C204-18*. Retrieved 03 23, 2019, from American Society for Testing and Materials: https://compass.astm.org/

ASTM. (n.d.). *Designation: C348—18*. Retrieved 03 23, 2019, from American Society for Testing and Materials: https://compass.astm.org

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