CIVIL ENGINEERING DEPARTMENT

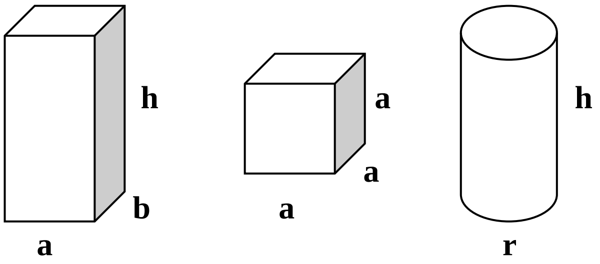
MATERIAL SCIENCE AND ENGINEERING

LABORATORY REPORT

Name-Surname:
Student Number:

Session: ☐ $13:^{00}$-$13:^{50}$ ☐ $14:^{00}$-$14:^{50}$ ☐ $15:^{00}$-$15:^{50}$

1. PHYSICAL PROPERTIES OF MATERIALS



Regular Geometric Shaped Specimens

Irregular Geometric Shaped Specimens

Table 1.1. The dimensions and weights of the specimens

Sample	**a (cm)**	**b (cm)**	**h (cm)**	**W_o (g)**	**W_{SA} (g)**	**W_{SW} (g)**
Brick						
Natural Stone						

1.1. UNIT WEIGHT (DENSITY) (β)

Calculations:

Table 1.2. Unit weights of the samples

Sample	**W_o (g)**	**V_t (cm^3)**	**β (g/cm^3)**
Brick			**…………..**
Natural Stone			**…………..**

1.2. SPECIFIC GRAVITY (γ)

Calculations:

Le Chatelier flask

Table 1.3. Specific gravities of the samples

Sample	**W_{powder} (g)**	**V_1 (cm^3)**	**V_2 (cm^3)**	**γ (g/cm^3)**
Brick				**…………..**
Natural Stone				**…………..**

1.3. COMPACTNESS (k) and POROSITY (p)

Calculations:

Table 1.4. Compactness and porosity of the samples

Sample	Compactness (%)	Porosity (%)
Brick	…………..	…………..
Natural Stone	…………..	…………..

1.4. WATER ABSORPTION (a_m & a_v)

Calculations:

Table 1.5. Water absorption ratios of the samples

Sample	Water Absorption by Mass (%)	Water Absorption by Volume (%)
Brick	…………..	…………..
Natural Stone	…………..	…………..

1.5. CAPILLARITY (K)

Table 1.6. Cross-section dimensions of the specimens

Sample	a (cm)	b (cm)	Area (cm^2)
Brick			…………..
Natural Stone			…………..

a and *b* are the dimensions of the cross-section which is in contact with water.

Table 1.7. The results of the capillarity test

Sample	W_o (g)	W_1 (g)	W_4 (g)	W_9 (g)	W_{16} (g)
Brick					
Natural Stone					

Calculations:

Table 1.8. Coefficient of capillarity

Sample	K (cm^2/sec) for 16th minutes	
	by the Equation	from the Graph
Brick	…………..	…………..
Natural Stone	…………..	…………..

2. MECHANICAL PROPERTIES OF MATERIALS

2.1. TENSION TEST

Table 2.1. Tension test results

Specimen		Mild (Low Carbon) Steel
Class / Type		S420 / Ribbed
Nominal Diameter (d_o, mm)		
Load (P)	P_{yield} (kN)	
	P_{max} (kN)	
	$P_{fracture}$ (kN)	
Final Diameter (d_f, mm)		
Gauge Length (l)	Initial (l_i=5d_o, mm)	…………..
	Final (l_f, mm)	
Yield Strength (σ_y, MPa)		…………..
Tensile Strength (σ_t, MPa)		…………..
Apparent Fractural Strength (σ_{af}, MPa)		…………..
True Fractural Strength (σ_{tf}, MPa)		…………..
Ductility (ε_f, %)		…………..
Necking Ratio (R_A, %)		…………..

Calculations:

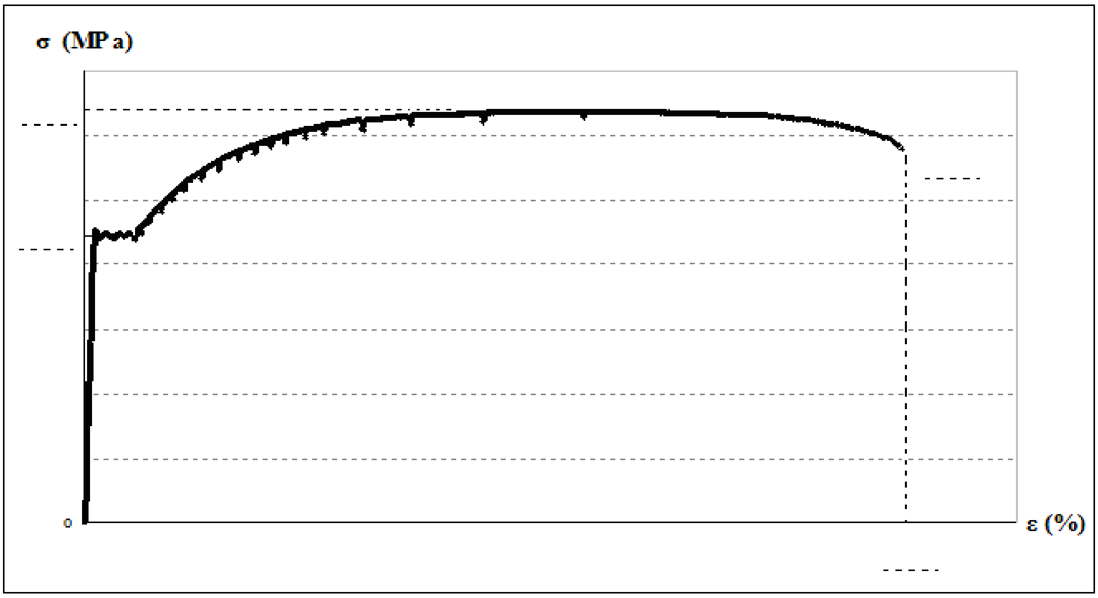


Figure 1. The stress-strain curve of the steel specimen

3. CONCRETE MIX DESIGN

Table 3.1. Physical properties of the constituents

Material	Particle Density (kg/dm^3)	Ratio in the Mix (%)	Moisture Condition
Fine Aggregate : Natural sand	2.7	30	SSD
Fine Aggregate 2: Crushed sand	2.7	30	1% Moist
Coarse Aggregate: Crushed stone #1	2.6	40	SSD
Cement: CEM I 42.5 R	3.1		
Admixture: Superplasticizer	1.1		

Table 3.2. Recommended limit values for composition and properties of concrete

Exposure Class	Minimum Strength Class	Maximum Water/Cement	Minimum Cement Content (kg/m^3)	Minimum Air Content (%)
XD3 (Chloride-induced Corrosion)	C35/45	0.45	320	-

- ✓ Selected water/cement ratio is “0.39” and cement dosage is “360 kg/m^3”.
- ✓ The air content is 2%.
- ✓ Desired consistency class is obtained by 1.5% superplasticizer.

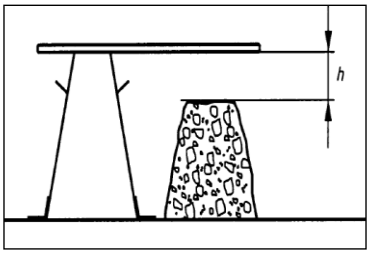
Calculations:

Table 3.3. Quantities of the constituents for 1 m^3 concrete

Material	Weight (kg)
Cement	…………..
Water	…………..
Natural sand	…………..
Fine Aggregate 2: Crushed sand	…………..
Crushed stone #1	…………..
Superplasticizer	…………..

3.2. FRESH AND HARDENED PROPERTIES OF CONCRETE

3.2.1. Slump Test (TS EN12350-2)



Since the measured slump (h) is ……………… cm, the consistency class is …………….. as defined in TS EN 206.

Figure 3.1. Measurement of slump

3.2.2. Compressive Strength Test (TS EN 12390-3)

Table 3.4. Test results and conformity criteria for the compressive strength classes (TS EN 206)

No.	P_c (kN)	f_c (MPa)	Evaluation
1	**1154**	…………..	$f_{cm} \geq f_{ck} + 4.0$ (MPa)
2	**1076**	…………..	
3	**1188**	…………..	$f_{c,i} \geq f_{ck} - 4.0$ (MPa)
Average (f_{cm}):		…………..	
Minimum Individual ($f_{c,i}$):		…………..	

Calculations:

a=150 mm

Conclusion:

According to the compression test results, this concrete ***conforms*** / ***does not conform*** the minimum strength class requirement (C35/45) for XD3 exposure class which was considered during the mix design.