

PRODUCTION OF "STRENGTH CURVES" FOR A LOCAL AGGREGATE

PROJECT REPORT SUBMITTED BY:

ANDREAS ROUSOS

&

ANDREAS MICHAEL

(3CE)

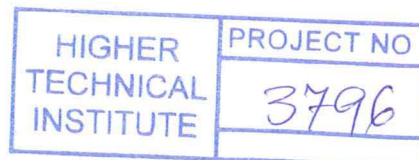
**PROJECT REPORT SUBMITTED TO
THE DEPARTMENT OF CIVIL ENGINEERING
OF THE HIGHER TECHNICAL INSTITUTE
NICOSIA CYPRUS**

C/1061

**in partial fulfillment of the requirements
for the diploma of
TECHNICIAN ENGINEER

in
CIVIL ENGINEERING**

June 2009



Abstract:

This project has four objectives closely related to concrete technology. The first one is to describe the main properties and characteristics of cement, aggregates and fresh concrete.

The second objective is to describe the main factors that effect the strength of concrete and possible ways of succeeding the maximum strength for a specific concrete mix.

The third objective is to investigate experimentally the effect of w/c ratio on the strength of concrete.

The concrete mix used in the experimental work was grade 25 N/mm² and different mix designs were prepared for w/c ratios. Four cubes were prepared for each mix and cured for 7 and 28 days.

The fourth and last objective is to discuss the experimental results and to compare them, having in mind the every day practice in Cyprus construction industry.

CONTENTS:

Introduction.....	iii
Acknowledgements.....	v
Abstract.....	vi
Part A	vii
1.0 Cement.....	1
1.1 Termination of cement.....	1
1.2 Difference between cement and concrete.....	1
1.3 History of cement.....	2
1.4 Types of cement.....	4
1.4.1 Portland cements.....	4
1.4.1.1 Normal Portland cement.....	4
1.4.1.2 White Portland cement (W.P.C).....	5
1.4.1.3 Colored cements.....	6
1.4.1.4 Rapid hardening Portland cement (R.H.P.C).....	6
1.4.1.5 Extra rapid hardening Portland cement (E.R.H.P.C).....	7
1.4.1.6 Low heat Portland cement (L.H.P.C).....	7
1.4.1.7 Sulphate resistant cement (S.R.C).....	8
1.4.1.8 Portland blastfurnace cement (P.B.C).....	8
1.4.1.9 Supersulphate cement.....	9
1.4.2 High Alumina cement.....	9
1.4.3 Pozzolanas.....	10
1.5 Manufacture of Portland cement.....	11
1.6 Cement storage.....	12
1.7 Setting of cement.....	13
1.8 Hardening of cement.....	13
1.9 Hydration of cement.....	14
1.9.1 The hydration process – reactions.....	14
1.9.2 Cement hydration products.....	16
1.10 Fineness of cement.....	17
1.11 Tests for Portland cement.....	18
1.12 Stiffening.....	18
1.13 Influence on the properties of the mix.....	19
2.0 Aggregates.....	20
2.1 Introduction.....	20
2.2 Shape and Size Matter.....	21
2.3 Properties of aggregates.....	22
2.3.1 Strength of aggregates.....	22
2.3.2 Size of aggregates.....	23
2.3.2.1 Maximum size.....	23
2.3.2.2 Grading.....	23
2.3.3 Particle shape and texture.....	24
2.3.4 Specific gravity.....	26
2.3.5 Moisture content of aggregates.....	26
2.3.6 Bulk density and bulking.....	27
2.3.7 Cleanliness.....	27
2.3.8 Porosity and absorption of aggregates.....	28
2.4 Lightweight aggregates.....	28
3.0 Concrete.....	30
3.1 Introduction.....	30
3.2 Shrinkage of concrete.....	33

3.3 Workability of concrete.....	34
3.4 Curing of concrete.....	35
3.5 Bleeding of concrete.....	35
3.6 Mixing of concrete.....	36
3.7 Mechanical strength of concrete.....	36
3.8 Durability of concrete.....	37
3.9 Permeability.....	38
3.10 Fire resistance.....	39
3.11 Chemical attack.....	39
3.11.1 Resistance to sulfate attack.....	40
3.11.2 Seawater exposure.....	40
3.11.3 Corrosion resistance.....	40
3.11.4 Resistance to alkali-silica reaction (ASR).....	41
3.12 Effects of frost on fresh concrete.....	41
3.12.1 Effecting conditions occur before initial set.....	41
3.13 Frost attack of Hardened concrete.....	42
Part B.....	43
4.0 Strength of concrete.....	44
4.1 Introduction.....	44
4.2 The main factors affect the strength of concrete.....	45
4.3 Flexural and indirect tensile stresses.....	47
4.4 Characteristic strength.....	47
4.5 Relationship between the compressive and tensile strengths.....	48
4.6 Failure modes in concrete.....	48
4.7 Curing of concrete.....	49
Part C.....	50
5.0 Experimental work.....	51
5.1 Objectives.....	51
5.2 Presentation of the results.....	51
6.0 Experiments.....	52
6.1 Preliminary experiments.....	52
6.1.1 Removal of moisture from the sand.....	52
6.1.2 Distribution of dust from the sand by sieving.....	53
6.2 Main Experiments.....	54
6.2.1 Experiment for trial mixes – Making and curing tests cubes in the laboratory.....	54
6.2.2 Compressive strength of moulded cubes.....	57
Mixes.....	59
Conclusions.....	64
A better product in the future.....	66
Appendix A – Results.....	67