



Grant ACTS-UL

- Materials and structural engineering
- Aggregates gradation analysis

Topic: Assessment of the fresh and hardened properties of concrete made of crushed aggregates containing no natural sand

Plan of PhD Research:

- Literature on Concrete technology, fresh properties, hardened properties
- Literature on aggregates for concrete, gradation, nature and shape
- Concrete in Lebanon contains two types of fine aggregates: Natural Sand (siliceous) and Crushed or Manufactured sand (limestone). The objective is to assess the concrete properties at fresh and hardened states using only crushed or manufactured sand and compare the results with a reference concrete containing both types of aggregates.
- Mix designs to be proposed: C25, C35, C45
- Large samples of crushed sand are to be provided, tested, sieved, divided into fractions, and then mixed again at selected proportions to fit the best gradation proposed as per ASTM C33.
- The proposed gradation of crushed sand will be tested versus a similar gradation containing crushed and natural sand.
- Comparison shall be made at fresh state: slump retention, water demand, admixture demand, setting time, density, air content
- Comparison shall be made at hardened state: compressive strength at 1, 3, 7, 14 and 28 days; flexural strength at 7 and 28 days, water penetration under pressure, Rapid

chloride Permeability, water absorption, expansion, alkali reactivity, durability, shrinkage and thermal other physico-chemical aspects.

- bonding tests
- Effects of admixtures.
- Cases of severe atmospheric conditions (high and low temperatures)
- Structural study and efficiency according to standard concrete
- Economical study, efficiency and feasibility in Lebanon
- Conclusions

Milestone

Expected duration of literature reading: 5 months

Expected duration of aggregates characterization: 1.5 months

Expected duration of concrete mix design and trials: 1.5 months

Expected duration of full testing: 8 months

Expected duration of analysis: 3 months

Expected duration of progress reports (two): 3 months

Expected duration of structural analysis: 4 months

Expected duration of economic study and feasibility in Lebanon: 2 months

Expected duration of publications in journals and conference (2 journals; 1 conference): 3 months

Expected time of PhD final report: 4 months

Time for defense: 1 month

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