High Performance Concrete

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Abstract:

This study deals with the formulation, calibration and validation of a new hygro-thermo- chemical model for high performance concrete suitable for the analysis of moisture transport and heat transfer at the early age and beyond. In part first of the study the theoretically formulation is presented and discussed in detail. Classical microscopic mass and energy conservation laws are written by using humidity and temperature as primary variables and by taking into account explicitly various chemical reaction such as cement hydration, silica fume reaction and silicate polymerization. The effect of cement hydration is modeled through the classical concept of silica fume reaction and silicate polymerization are modeled by introducing the degree of silica fume reaction and the concentration of silicate polymers along with their evolution laws.

The present model can simulate early age phenomena such as self heating and self desiccation with great accuracy. Numerical implementation calibration and validation of the model by compression with experimental text data are postponed to part second of this study.

Key words: high strength concrete; high performance concrete; self-compacting, Concrete, rigid pavement of roads.

Introduction:

Keeping concrete competitive with construction materials encouraged the achievement of new high performance, and implicitly, high strength and ultrahigh strength concrete. The need for tall buildings and the construction of highway program from Romania made high performance concrete with remarkable physical, chemical and mechanical characteristics to be used.

The convenient utilization of this concrete consists in

a) The reduction of structural elements' dimensions, which reduces the self weight of structural members, material consumption and seismic loads;
b) The possibility to increase the bays and net areas;
c) The cost reduction of the structure.

There are some inconveniences in using the high performance concrete, namely the brittle failure, higher endogenous shrinkage and low fire resistance.

All these disadvantages can be corrected by using fiber admixture or by replacing parts of heavyweight aggregates with lightweight ones. From all high performance concrete types, a special place is taken by the self–compacting concrete. A short exposure of the recent studies and researches related to high performance concrete achieved in Cluj-Napoca, in PhD studies activity, is presented in the next sections

Literature Review:

Zetea C.A.(April 3, 2009):- The paper presents the last studies and researches accomplished in ClujNapoca related to high performance concrete, high strength concrete and self compacting Concrete. The purpose of this paper is to raid upon the advantages and inconveniences when a particular concrete type is used. Two concrete recipes are presented, namely for the concrete used in rigid pavement for roads and another one for self-compact in concrete **Matthew D. D(April 4, 2013):-** The Tollway is committed to minimization of environmental impact, with initiatives to improve the sustainability of highway infrastructure through the use of recycled materials and the improvement of service life. As new infrastructure is constructed, amongst the primary objectives will be to provide long lasting and durable concrete bridge decks. To achieve this goal, a new performance-related specification will be needed for future bridge deck concrete mixtures. In addition to creating durable concrete that possesses the required mechanical properties, the purpose of the specification is to minimize the potential for cracking in newly constructed bridge decks based on current structural design. Minimization of cracking will prolong the service life of the bridge decks by preventing or delaying corrosion of reinforcing steel. Longer service life is valuable for many reasons, including reduction of life cycle cost of the Tollway infrastructure, reduction of the impact on the environment through sustainable construction, and reduction of interruptions to traffic and delays for Tollway users.

Methodology:

Materials:- Normal Portland cement (PC) and silica fume (SF) where used in the experimental program. The Portland cement was characterized by the following Bogues compassion; C_3S 64%, C_2S 14%, C_3A 4%, and C_4AF 14%.

Project Development:

- To recommended guidelines for reducing water penetration through a construction joint to be included in specification
- To improve concrete mix design
- To avoid shrinkage cracks leakage
- To used in multistoried building

Conclusion and Observations:-

The following conclusions can be made on the basis of the current experimental results.

1. A mix design procedure for HPC using silica fume and super plasticizer is formulated by ACI method of mix design and available literature on HPC.
2. As the silica fume content increases the compressive strength increases up to 15% [HPC4] and then decreases, Hence the optimum replacement is 15%.
3. The 7 days and 28 days cube compressive strength ratio of HPC is 0.84 to 0.9
4. The percentage replacement of cement by silica fume increases, the workability decreases.