

## **Towards Sustainable Concrete: Maturity Method to Evaluate the Effect of Curing Conditions on the Strength Development in Concrete Structures under Kuwait Environmental Conditions**

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**Abstract :** Conventional methods of determination of concrete strength under controlled laboratory conditions will not accurately represent the actual strength of concrete developed under site curing conditions. This difference in strength measurement will be more in the extreme environment in Kuwait as it is characterized by hot marine environment with normal temperature in summer exceeding 50°C accompanied by dry wind in desert areas and salt laden wind on marine and on shore areas. Therefore, it is required to have test methods to measure the in-place properties of concrete for quality assurance and for the development of durable concrete structures. The maturity method, which defines the strength of a given concrete mix as a function of its age and temperature history, is an approach for quality control for the production of sustainable and durable concrete structures. The unique harsh environmental conditions in Kuwait make it impractical to adopt experiences and empirical equations developed from the maturity methods in other countries. Concrete curing, especially in the early age plays an important role in developing and improving the strength of the structure. This paper investigates the use of maturity method to assess the effectiveness of three different types of curing methods on the compressive and flexural strength development of one high strength concrete mix of 60 MPa produced with silica fume. This maturity approach was used to predict accurately, the concrete compressive and flexural strength at later ages under different curing conditions. Maturity curves were developed for compressive and flexure strengths for a commonly used concrete mix in Kuwait, which was cured using three different curing conditions, including water curing, external spray coating and the use of internal curing compound during concrete mixing. It was observed that the maturity curve developed for the same mix depends on the type of curing conditions. It can be used to predict the concrete strength under different exposure and curing conditions. This study showed that concrete curing with external spray curing method cannot be recommended to use as it failed to aid concrete in reaching accepted values of strength, especially for flexural strength. Using internal curing compound lead to accepted levels of strength when compared with water cuing. Utilization of the developed maturity curves will help contactors and engineers to determine the in-place concrete strength at any time, and under different curing conditions. This will help in deciding the appropriate time to remove the formwork. The reduction in construction time and cost has positive impacts towards sustainable construction.

**Keywords :** curing, durability, maturity, strength

**Conference Title :** ICSDDC 2016 : International Conference on Sustainable Development in Developing Countries

**Conference Location :** London, United Kingdom

**Conference Dates :** March 17-18, 2016