APPLYING EARLY CONCRETE COMPRESSIVE STRENGTH PREDICTION IN INFRASTRUCTURE CONSTRUCTION; CASE STUDY

by

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- Nowadays using concrete in various structures, especially infrastructures, is one of the most affordable, reliable and popular methods in all around the world.
- Low cost, availability of constituents, workability, durability and appropriate compressive strength are the advantages of concrete.
- Quality control of concrete is made at three stages, control of properties of the constituents (water, cement and aggregates), tests on fresh concrete and test on hardened concrete(compressive, tensile and bending strength tests).

- Compressive strength is an indicator of utmost significance for acceptance of concrete quality and most of the other parameters such as tensile strength and durability are often a function of characteristic compressive strength of concrete.
- Purpose of this paper is deriving mathematical equations in order to predict compressive strength of concrete in older ages during construction of a dam site that it can help to modify procedure of execution and reduce costs and time of project significantly.

Previous Studies on prediction of concrete strength:

- ACI committee 209 : $f_{ct} = f_{c28}\left(\frac{t}{4+0.85t}\right)$
- Zain et al., 2008 has used non-linear regression equation for the prediction of concrete compressive strength at different ages.
- Khashman and Akpinar, 2017, used artificial neural network (ANN) model to predict and classify the compressive strength of different concrete mixes.
- Hasan and Kabir, 2012, developed a simple mathematical model to predict the compressive strength of concrete at 28th day from early age results.

Case Study:

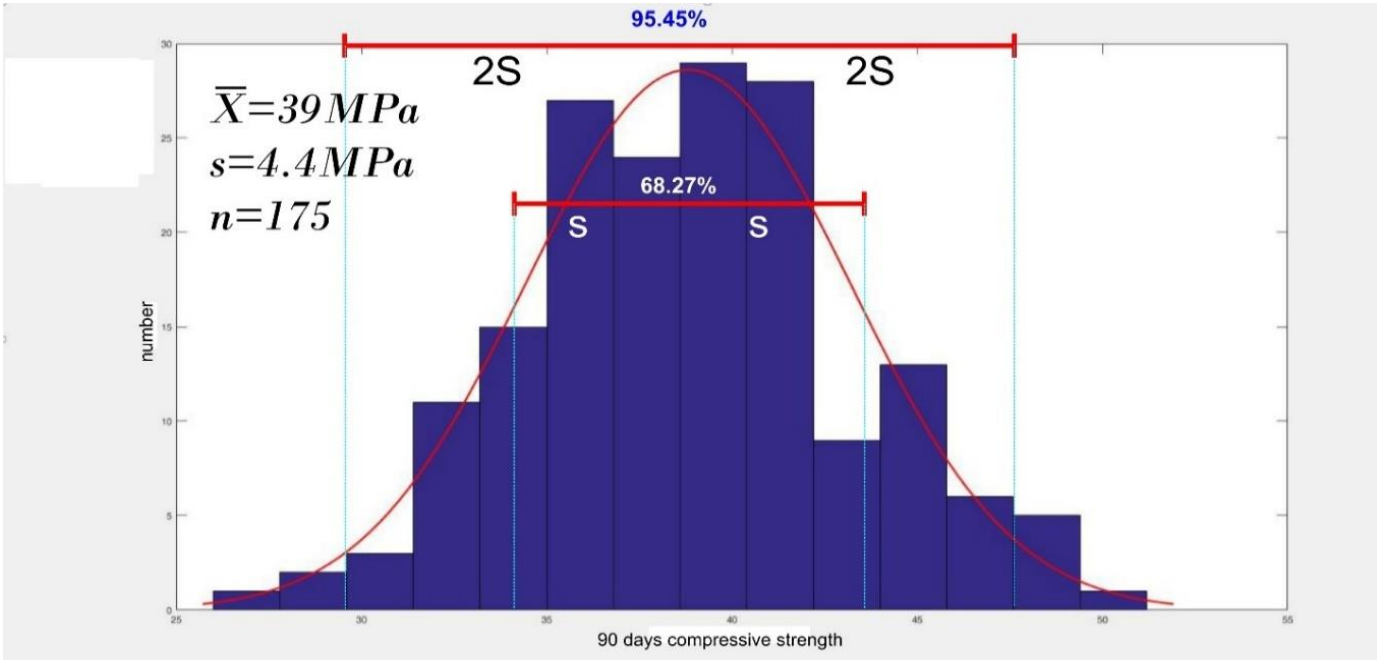
- Kanisib dam is a clay core embankment dam.
- Height = 65 meter
- Volume of earth filling: 2500000 m^3
- Dam reservoir capacity is almost 330 MCM.
- Volume of Spillway concrete work: 85000 m^3
- Volume of concrete work of Intake Tower= 1600 m^3
- Number of Specimens: 175 series

(during execution of 19000 m^3 of concrete)

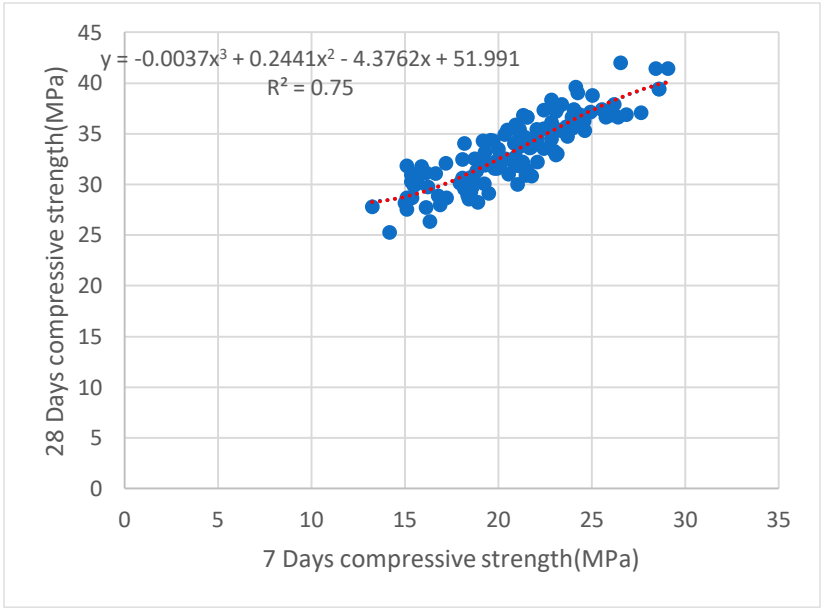

Armenia
Azerbaijan
Baku
Turkmenistan
Ashgabat
Tabriz
Golestan National Park
Mashhad
Khar Turan National Park
Erbil
Tehran
Karaj
Neyshabur
Baghdad
Iraq
Isfahan
Iran
Basrah
Shiraz

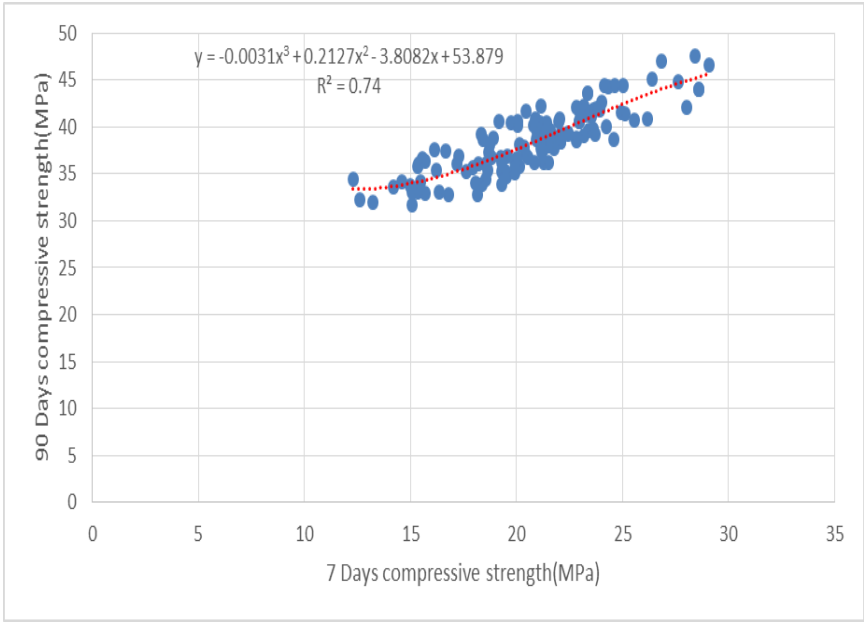
(a) (b)

(a) Spillway of KANISIB reservoir dam, April 2019. (b) Water intake tower of KANISIB reservoir dam, February 2019



Normal distribution of 90days compressive strength

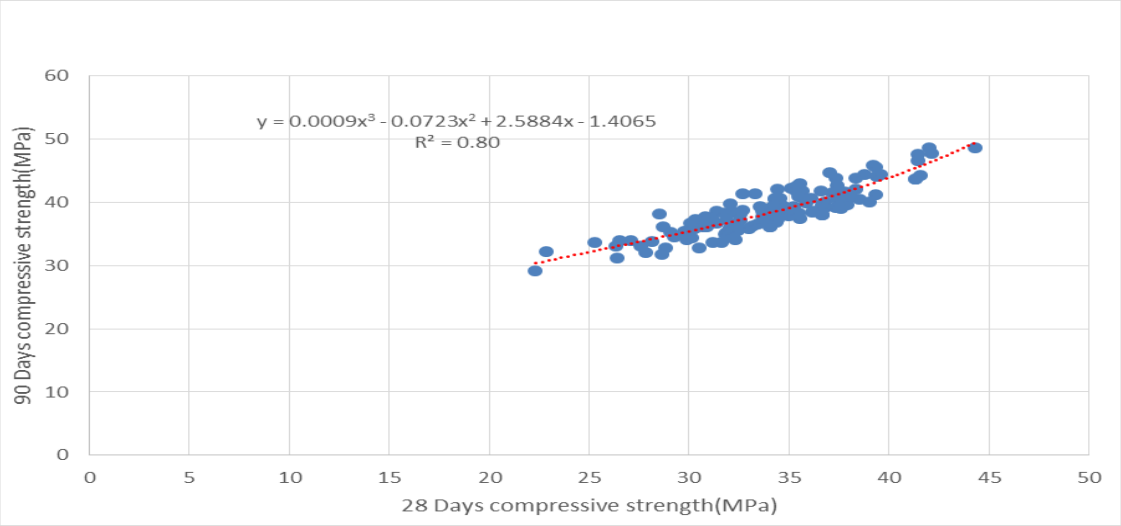




A B

A: $y = -0.0037x^3 + 0.2441x^2 - 4.3762x + 51.991$

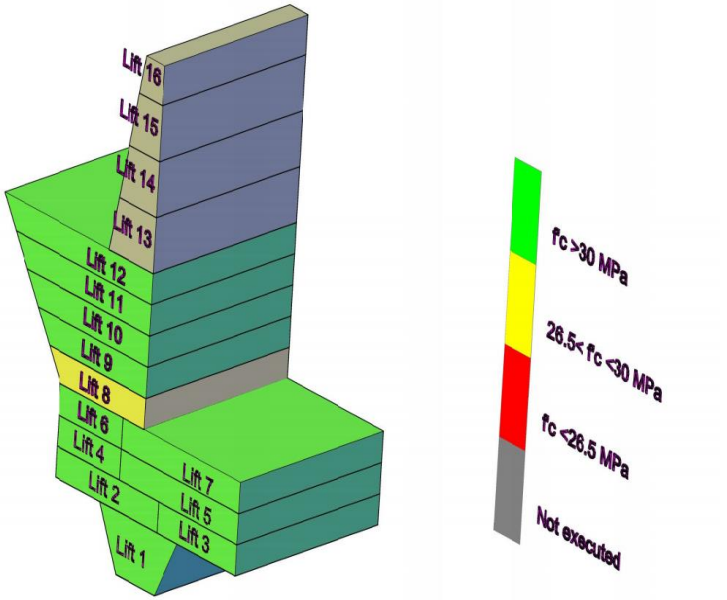
B: $y = -0.0031x^3 + 0.2127x^2 - 3.8082x + 53.879$



C: $y = 0.0009x^3 - 0.0723x^2 + 2.5884x - 1.4065$

Conclusion and practical notes:

- Prediction of final compressive strength by help of developed equations can led to understand and modify deficiencies.
- This prediction can help to make decisions for retrofitting defected structures based on standards and criteria.



- Concrete contains different materials that their quality shall be controlled periodically. Quality of fine and coarse aggregates, additives and cementitious material shall be checked regularly based on Inspection test plan(ITP) of project.

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