

EFFECT OF DELAY IN CASTING ON COMPRESSIVE STRENGTH OF CONCRETE

M. J. A. Chy.* , M. I. Kayes & SK. S. Ali

*Department of Civil Engineering, Bangladesh University of Engineering and Technology, Dhaka,
Bangladesh*

**Corresponding Author: jakiulbuet08@yahoo.com*

ABSTRACT

The casting of concrete may be delayed from the time of mixing due to many reasons, which can affect the compressive strength of concrete. This investigation showed that loose the casting delay causes considerable variation of the compressive strength of concrete. A large number of 4” inch by 8” inch cylinders have been cast for this study. The cylinders were cast at different times after mixing with water. The cylinders were tested at different dates to see the effect of curing time and age on compressive strength of concrete. OPC has been considered in this study for the testing compressive strength of concrete. The results of this study indicate that casting delay of concrete does not decrease the compressive strength rather it helps to enhance the strength. This investigation has been made for W/C ratio of 0.5 and 0.6 respectively. Results are quite encouraging which may invite interest to the researchers for further study by involving more parameters.

Keywords: Concrete; workability; compressive strength; water-cement ratio; mechanical properties; time independence; the strength of materials.

INTRODUCTION

Concrete industries and especially ready mixed concrete industries are faced with a common problem is known as casting delay, which usually results in a considerable loss of workability, so that concrete may be unworkable. Delay in the production and delivery of ready-mixed concrete is inevitable, which is influenced by the location of construction sites in relation to the central batching plant and traffic conditions on the route. On the other hand, improper methods of handling, lack of site organization, work scheduling, and breakdown of equipment are some other causes of unexpected long delays. So in this research, it is tried to investigate the relation between casting delay compressive strength of concrete.

Most of us have a silly notion that the delay of the casting of concrete causes reduction of strength significantly. For this they try to place the concrete as soon as possible otherwise concrete may be unworkable. If delay casting is unavoidable, which causes a considerable loss of workability it is a common practice in our country to add some water into the concrete mix. The addition of extra water is known as Re-tempering with water. That is why it is required to know the effect of Delay casting of concrete and re-tempering with water on strength. Gonnerman and Woodworth investigated re-temp that it was a harmful practice as the strength is lowered due to increase in w/c ratio of the re-tempered mix.

By studying the behaviour of concrete made with locally available Ordinary Portland cement (OPC) casting both before and after initial setting time with two different water-cement ratios(0.6 or 0.5), anyone can create a general scenario of the strength gain characteristics of concrete. And which will be helpful for the construction planning of building construction spatially for ready mixed concrete industries? This will give idea how much strength will be reduced if water is added after initial setting time because sometimes people of our countries are used to add extra to increase workability of concrete

METHODOLOGY

The properties of different ingredients of concrete (coarse aggregate, fine aggregate, and cement) would be tested. Then the amount of different ingredients of concrete for the target compressive strength of 3000 psi and 4000 psi would be calculated by ACI mixed design method of concrete of ordinary Portland cement (OPC). Concrete cylinders would be cast using OPC for two different target design strengths. The cylinder would be cast after a certain interval. Additional water would be mixed with 3 initial setting times. The sample would be cured continuously until they are tested. The compressive strength of concrete samples would be tested at 7 days, 14 days and 28 days of age of concrete. The graph would be plotted showing the compressive strength of concrete with age which would represent the compressive strength variation of concrete made with OPC at different delay casting of time. Also, the compressive strength variations of tempering with water would be studied.

Different physical properties of both fine and coarse aggregate would be tested according to ASTM codes. Fineness modulus, Unit weight and specific gravity of coarse aggregate would be performed according to ASTM C136, ASTM C29, and ASTM C127 respectively. Fineness modulus, bulk specific gravity and absorption capacity of fine aggregate would be performed according to ASTM C136 and ASTM C128 respectively. Normal consistency, initial and final setting time the direct compressive strength of cement mortar would be tested according to C 187, C191 and C109 respectively. Concrete testing is done by several steps such as preparation of mold, use of the batch mixture, controlled time of mixing, Placing and compacting the mixture, Vibration of concrete, Casting of concrete, Curing of concrete, Compressive strength test of concrete and finally calculate the compressive strength of concrete.

RESULTS AND DISCUSSIONS

This study gives a general scenario of the strength development characteristics of concrete made with locally available Portland composite cement (PCC). These finding will be useful for design and construction planning of concrete structure especially for ready mix concrete industries for calculating the transportation time on the basis of delay casting time. My findings of this investigation are described in graph below:

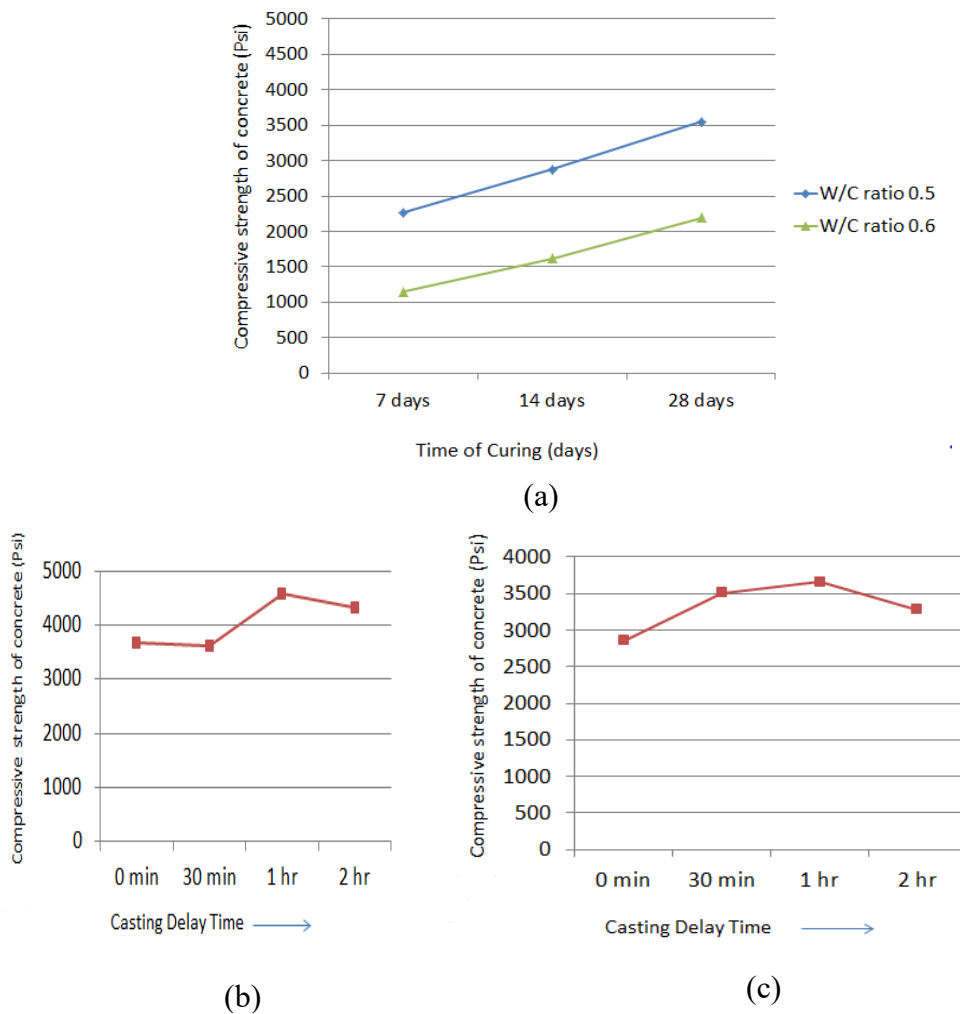


Fig. 1: (a) compressive strength vs. Time of curing (days); (b) compressive strength vs. Casting delay time(for w/c ratio 0.5); (c) compressive strength vs. Casting delay time(for w/c ratio 0.6).

By analysing those graph we observe the following behaviour:

- 1) Graph (a) indicates that with the increase of water cement ratio compressive strength increases. But we know up to a certain value of water cement ratio compressive strength increases after that compressive strength decreases with the increase of water cement ratio.
- 2) Graph (b) and (c) indicates that with an increase in casting delay time the strength of concrete increases (after an initial setting time until it cast). But after an optimum time, the strength of concrete begins to decrease.

CONCLUSIONS

From the experimental investigation based on general and comparative study of cylinder compressive strength at different time and different age of two fixed w/c ratios, following conclusion can be drawn

- In the general compressive strength of concrete made with Ordinary Portland cement (OPC) increases due to casting delay (0 min, 30 min, 60 min, 120 min) up to an optimum time. (Initial setting time)
- In general, the casting attains maximum strength at 60 min. Casting delay time after which the strength starts decreasing.
- With the increase in W/C ratio compressive strength of concrete decreases

ACKNOWLEDGEMENTS

First & foremost, thanks to almighty God for his graciousness, unlimited kindness & with the blessings of whom the good deeds are fulfilled.

I offer my sincerest gratitude to my supervisor Dr. SK. Sekender Ali, Professor, Department of Civil Engineering, BUET, Dhaka. Without his prudential advice and inspiring support, the project would not have been successful.

I wish to convey my special thanks to the staff of Civil Engineering Concrete lab, BUET who helped me to overcome the daily difficulties.

I would also like to thank all of my friends & well-wishers for their assistance.

REFERENCES

Bako ca, A., Ozkul, M.H. and Artirma, S. “Effect of chemical admixtures on workability and strength properties of prolonged agitated concrete”, *Cem. & Conc. Res.*, 28(5), pp. 737–747 (1998).

Cheong, H.K. and Lee, S.C. “Strength of retempered concrete”, *ACI Mat. J.*, 90(3), pp. 203–206 (1993).

Erdogdu, S., Arslantürk, C. and Kurultai, S. “Influence of fly ash and silica fume on the consistency retention and compressive strength of concrete subjected to prolonged agitating”, *Const. Build. Mat.*, 25, pp. 1277–1281 (2011).

Hawkins, M.J. “Concrete retempering studies”, *ACI J. Proc.*, 59(1), pp. 63–72 (1962).

Ravina, D. “Slump retention of fly ash concrete with and without chemical admixtures”, *ACI Conc. Int.*, 17, pp. 25–29 (1975).