High Early Strength of Ultra High Performance Self Compacting Concrete with the Utilization of Quartz

Final Project

by:

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Yogyakarta,

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APPROVAL

Final Project Report

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14/20, 2019 2/220 July 25, 2019



PREFACE

First and foremost, I would like to thanks to Jesus Christ for blessing that given to me, so I finish this final project report. The purpose of this final project with the title "High Early Strength of Ultra High Performance Self Compacting Concrete with the Utilization of Quartz" is to complete the requirement of undergraduate program in International Civil Engineering Program, Department of Civil Engineering, Faculty of Engineering, Universitas Atma Jaya Yogyakarta. For the completion of this final project, I would like to express my gratitude to:

- 1. Johan Ardianto, S.T., M.Eng., as the coordinator of International Civil Engineering Program.
- 2. Dr., Ir., AM. Ade Lisantono, M.Eng. as the supervisor of my final project, who had already given directions and guidance during my final project.
- 3. My parents and family for their supporting, praying, caring, and unconditional loving so that it was possible for everything to be done.
- 4. All my friends, juniors and seniors in International Civil Engineering Program for their support and cooperation which help me to complete this report.

Finally, I as the writer of this report realize this report has many mistakes and may have space for further improvement. For that, any suggestion and critics will be accepted.

Yogyakarta, July 2019,

Joshua Bernard Susanto

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ABSTRACT

HIGH EARLY STRENGTH OF ULTRA HIGH PERFORMANCE SELF COMPACTING CONCRETE WITH THE UTILIZATION OF QUARTZ,

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Nowadays infrastructure comes in rapid and massive development to support economic growth and activities. Therefore, the construction process also must be efficient in time and also in cost. Normally, concrete hardening needs 7 to 14 days and achieve minimum compressive strength of 0.7 to 0.85 fc' as minimum structural strength, so the solution to get faster strength in early age is required. Utilization of local potential materials such as quartz, is one option to cut the cost of construction.

This research was conducted by making a concrete with the idea of Ultra – High Performance Concrete to get the dense matrix of particle and also idea of Self – Compacting Concrete to get the better workability of concrete. It is expected to get better strengths of concrete in early age so it can cut down the construction time. In addition, fully quartz sand used as fine aggregates to get the denser matrix, additives such silica fume was used to help the hydration process takes earlier and also High Range Water Reducer to help the workability of concrete in low water to cement ratio. The research to carry out the compressive strength conducted by making concrete to be tested in 1 day, 3 days, 7 days, 14 days, 21 days, and 28 days and it was taken 3 specimens for each ages of the concrete. The modulus elasticity test conducted in the concrete with age of 28 days.

The result of the research shows that the average strength of concrete in 1 day is 10 MPa, 3 days with 27.16 MPa, 7 days with 36.41MPa, 14 days with 40.93 MPa, 21 days with 50.36 MPa, and 48.66 MPa. The average modulus elasticity of the concrete in 28 days is 18703.4548 MPa. In line with that, the failure to make the concrete's adequate strength in one day period caused by the lack of bonding capacity from the quartz to the paste since the used particle size of quartz were too fine. The SCC requirement was fulfilled by the number of slump flow value and blocking ratio value in accordance to EFNARC. Based on the experiment, it is concluded that the super fine size of grains used in concrete can lead to the faster rate of evaporation of the concrete so the concrete will lose the moisture faster and stop the hydration process of concrete so in the age of 28 days the concrete can't achieve expected strength of UHPC.

Key Words: Early Strength, Ultra – High Performance Concrete, Self – Compacting Concrete, Quartz Sand