Laboratory Investigation of Mechanical Properties of Pavement Quality Concrete Mixes Using GGBS and Stone Sand

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Abstract— The optimum percentage of GGBS for maximum Flexure strength of 3.98MPa at 25% GGBS. Addition of GGBS to PQC mixes up to the optimum value has shown an increasing trend in Flexure strength. With further increase of GGBS content, Flexure strength has shown decreasing trend. The optimum percentage of Stone Dust for maximum flexural strength is decreased as increase the quantity of stone dust. Maximum value of flexural strength of 3.27MPa was obtained at 60% Stone Dust replacement. The flexural strength of GGBS (25%) and Stone Dust (40%) GGBS+MS-PQC is increased by 4.93N/mm2 to 5.12N/mm2 at 28 days as compared to Conventional PQC.

Keywords: Pavement Quality Concrete Mixes, Mix Design, Workability, Flexural Strength

I. Introduction

A large part of the development budget is spent on the maintenance and improvement of roads and this indicates the importance and role of roads in the national economy. Concrete is the most trusted artificial material in the world. Concrete is used for the construction of many types of structural components for various civil engineering applications. In this modern era, cement concrete pavements are in demand as compared to bituminous pavements in highway projects. Due to the limitation of quality natural resources for making concrete, the waste utilization in the production of concrete especially for pavements is a major concern in civil engineering.

A. Types of Concrete Pavements

As there are differences in the definitions of “flexible” and “rigid”, in Australia only cementitious concrete pavements are regarded as rigid, with all other types classified as flexible. The types of concrete pavements are:

- Jointed Plain (unreinforced) Concrete Pavement – PCP
- Jointed Reinforced Concrete Pavement – JRCP
- Continuously Reinforced Concrete Pavement – CRCP
- Steel Fibre Reinforced Concrete Pavement – SFCP
- A fifth type is the Prestressed Concrete Pavement, but this has not been used in Australia.

B. PVA fiber as fiber reinforcement

The use of Polyvinyl Alcohol (PVA) fibers as a reinforcing material have several advantages. PVA fiber reinforcement increases the quality of concrete by making it more fatigue and corrosion-resistant. Steel fibers, glass fibers, synthetic fibers, and natural fibers are among the several types of fibers used in concrete, each with its own set of qualities.

C. Research Objectives

The principal objective of this thesis is to study the possible techniques of improving the properties of concrete that is made up with 15% or higher percentages of Flyash. Investigate the potential of PVA fibers in Mortar.

II. Results

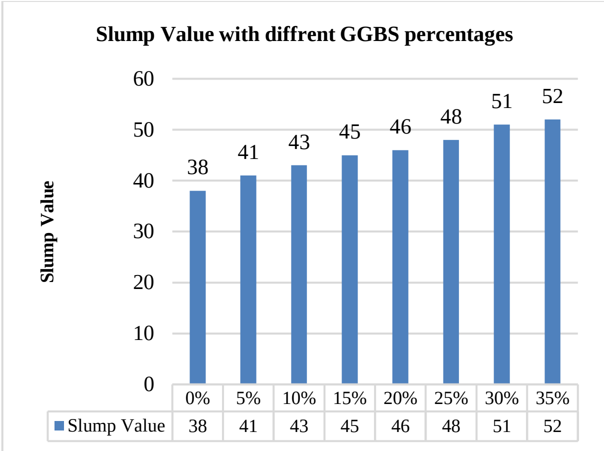

Fig. 1 Slump Test Results GGBS in Concrete M-30

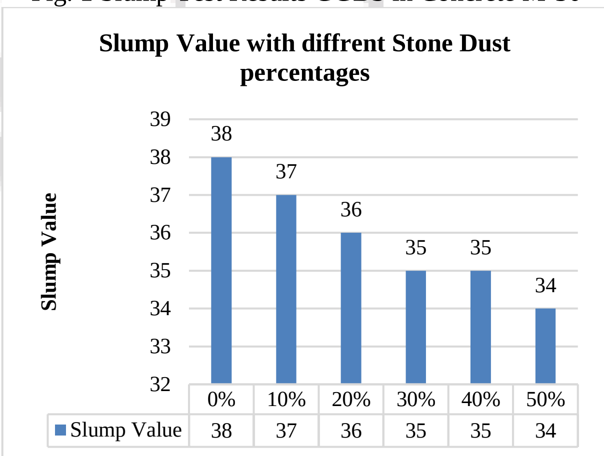

Fig. 2 Slump Test Results Stone Dust in Concrete M-30

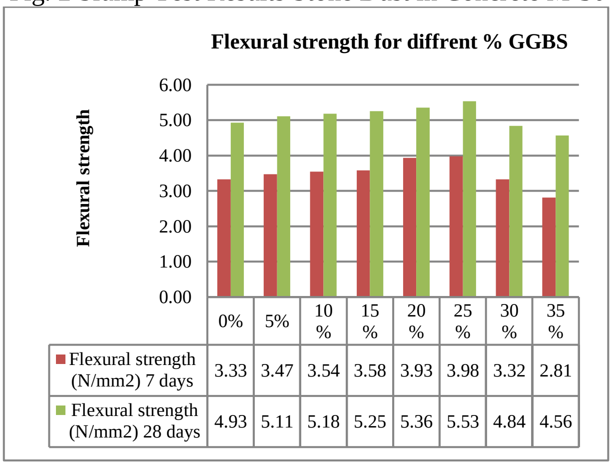

Fig. 3: Flexural strength (N/mm2) Different % of GGBS

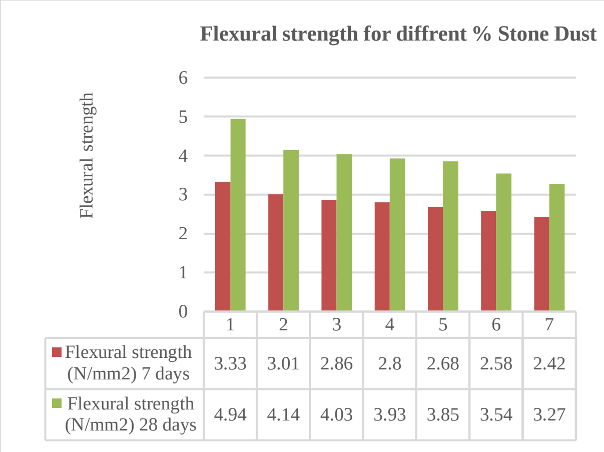

Fig. 4 Flexural strength (N/mm2) Different % of Stone Dust

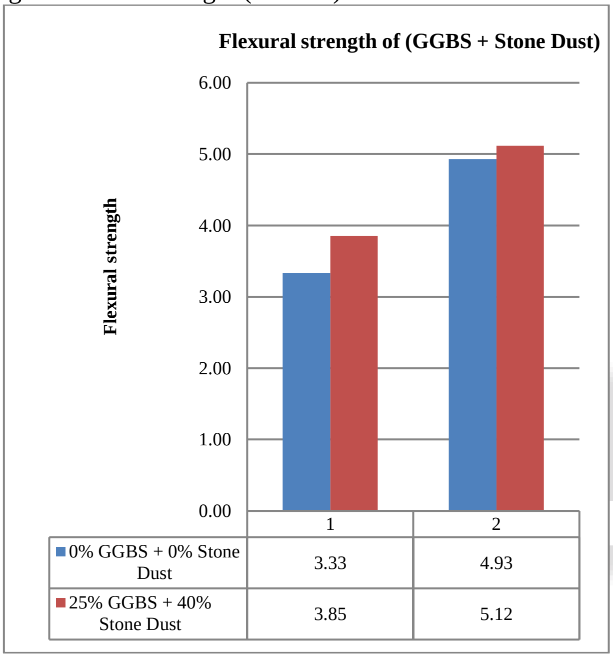

Fig. 5: Flexural strength (N/mm2) Different % of (GGBS and stone dust)

III. Conclusion

- The optimum percentage of GGBS for maximum Flexure strength of 3.98MPa at 25% GGBS. Addition of GGBS to PQC mixes up to the optimum value has shown an increasing trend in Flexure strength. With further increase of GGBS content, Flexure strength has shown decreasing trend.
- The optimum percentage of Stone Dust for maximum flexural strength is decreased as increase the quantity of stone dust.
- Maximum value of flexural strength of 3.27MPa was obtained at 60% Stone Dust replacement.
- The flexural strength of GGBS (25%) and Stone Dust (40%) GGBS+MS-PQC is increased by 4.93N/mm2 to 5.12N/mm2 at 28 days as compare to Conventional PQC.

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