A STUDY ON THE MIX DESIGN OF POLYMER CONCRETE MADE WITH POLYESTER AND EPOXY RESINS

by

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Centre for Materials Science and Technology

Thesis submitted
in fulfilment of the requirements for
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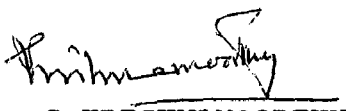
DEDICATED
TO
MY PARENTS

Late Sri VELIDANDI RAMADASS
AND
Smt. VELIDANDI SANTHA

CERTIFICATE

This is to certify that the thesis entitled **"A STUDY ON THE MIX DESIGN OF POLYMER CONCRETE MADE WITH POLYESTER AND EPOXY RESINS"**, being submitted by Mr. **V.V.L.KANTHA RAO** to the Indian Institute of Technology, New Delhi, India, for the award of the degree of **DOCTOR OF PHILOSOPHY** in **CENTRE FOR MATERIALS SCIENCE AND TECHNOLOGY** is a record of bonafide research work carried out by him under my guidance and supervision.

To the best of my knowledge the thesis has reached the required standard. The material presented in this thesis has not been submitted in part or full to any other university or institution for award of any degree or diploma.



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V.V.L. KANTHA RAO

ABSTRACT

Experimental investigations for the purpose of developing a suitable mix design procedure for polymer concrete made of resins (unsaturated polyester, epoxy), mineral aggregates (coarse and fine aggregate) and microfiller (calcium carbonate) have been reported in this work.

Unlike cement concrete, where cement plays both the roles of a binder and a microfiller, and rapid placement in a very large scale would be one of the major criteria, polymer concrete uses a (relatively viscous) resin as a binder and a separate microfiller. The cost of polymeric resins are several times more than that of cement and, as such, economy in the use of resin becomes a major criterion in the proportioning of polymer concrete mixes.

As is well known, the strength of the particulate composites is adversely affected by their voids-content, the work presented herein adopts the principle of successive minimisation of voids of the composite.

First, the voids-content of coarse and fine aggregate mixture is sought to be kept to a minimum, both for continuously graded fine aggregate and fine aggregate of restricted sizes. Guidelines for the suitable proportioning have been arrived at from a very large number of experimental results, for 20 mm, 10 mm and 4.75 mm maximum size of aggregates.

Existing theoretical considerations for such proportioning have also been examined.

As a second step, the voids-content of the polymer concrete is further reduced to a minimum possible value using appropriate amounts of microfiller contents. Such an appropriate amount can be obtained from simple, approximated, theoretical or experimental considerations, based on the bulk density or voids-ratio determinations of dry (without resin) mixtures of coarse and fine aggregates and microfiller.

The mix design procedure takes into account the increased strength of the polymer concrete composite with increasing microfiller content subject to a limit and also the increase in strength with resin content, again up to a limit.

The work also reports the results of experiments on the shrinkage of polymer concrete and the influence of the materials content, namely resin and microfiller contents on the magnitude of such shrinkage.

The mix design procedure suggested in this work also caters to the proportioning of polymer concrete composites which may have to be designed for the least possible shrinkage. Such polymer concrete is likely to be used for repair or rehabilitaion of existing cement concrete structures.

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