

MICROBIAL PROTEIN – AN INNOVATIVE ADDITIVE FOR CEMENTITIOUS MATERIALS

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ABSTRACT

Addition of microbial protein extracted from microorganisms of a typical hot spring increases the compressive strength of cement paste and mortar samples. The microstructure of such protein amended samples indicates more hydration of cement particles in the matrices resulting in increment of calcium and silicate percentages within calcium-silicate-hydrate gel. Modification of pore size distributions in the protein incorporated cement matrices was also established. Nano-indentation study showed improvements in hardness and dynamic elastic modulus of protein treated mortar samples. Such protein addition in cement matrices may be useful for the development of high performance concrete and also as a suitable repair material in near future.

EFFICIENT FINITE ELEMENT MODEL OF REINFORCED CONCRETE BEAM STRENGTHENED WITH FIBRE REINFORCED POLYMER SHEETKaushal B. Parikh^{a*}, C. D. Modhera^b^{a*}Department of Applied Mechanics, Government Engineering College, Surat - 395001, Gujarat, India^bDepartment of Applied Mechanics, Sardar Vallabhbhai National Institute of Technology, Surat - 395007, Gujarat, India**ABSTRACT**

Numerical analyses are performed using the ATENA finite element program (nonlinear analysis software) to predict accurately the ultimate load carrying capacity of reinforced concrete beams strengthened by fibre reinforced polymer sheet applied at bottom. Constitutive models are used to simulate the nonlinear behaviour of plain concrete, steel reinforcement and fibre reinforced polymer sheet. The influences of beam length, fibre reinforced polymer sheet length, layers of sheet and distance between loading points on the ultimate strength of beam are investigated. This FE modelling is used to predict the load-carrying capacity and the applied load-midspan deflection response of RC (Reinforced Concrete) beams. The proposed 3D finite element model is also able to predict the type of failure of beam. Finite element simulation and experiment measurement are compared based on numerous tests available on the literature and published by different authors. The finite element simulated response agrees remarkably well with the corresponding experimental results. Thus this accurate and efficient finite element modelling of flexural strengthening of RC beam with externally bonded FRP (Fibre Reinforced Polymer) sheets/plates is suitable for practical use in design-oriented parametric studies.

SELF-COMPACTING CONCRETE AS A REPAIR MATERIAL – SOME GENERIC ISSUES

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ABSTRACT

Self-compacting concrete (SCC) is emerging as a potential repair material because of its significantly improved performance compared to traditional concrete (TC). However, for SCC to be an effective repair material one has to consider several pre-requisites, which include proper characterization procedure for ingredients, effect of ingredients characteristics on the determination of mix composition to meet target performance of rheology and strength, criteria to determine ingredient quantities satisfying the target performance, and robustness of the mix. An experimental exercise is undertaken to study the issues related to mix proportioning of SCC with supplementary cementitious material such as fly ash and outcome of the exercise suggests that rheological characterization of ingredients is necessary in addition to the conventional approach based on physical and chemical characteristics. A rational method to proportion optimum SCC mix should be based on explicit criteria to meet target performance taking directly into account the ingredient characteristics. Higher powder content and the composition of powder are favourable for the robustness of the mix.

REPAIR OF DISTRESSED BRIDGES AND CULVERTS ON A NATIONAL HIGHWAY IN INDIA – A CASE STUDY

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ABSTRACT

The old distressed bridges and culverts between Chikkaballapura to Bagepalli in the State of Karnataka in India on the National Highway No. 7 were repaired and rehabilitated by using polymeric repair materials in the year 2009 - 2010. The repair work consisted of corrosion treatment as well as the repair of spalled and extensively damaged concrete. The structures were strengthened by injection grouting in cracks and honeycombs. The deck slab and piers were additionally protected with anti-carbonation coatings for long term durability. The present case study narrates the step by step approach taken during this repair and rehabilitation project.

BEHAVIOUR OF REINFORCED CONCRET BEAM-COLUMN JOINT RETROFITTED WITH CARBON-FIBRE-REINFORCED POLYMER WRAP**K. Balasubramanian^{a*}, N. Lakshmanan^a, C. Antony Jeyasehar^b, T. S. Krishnamoorthy^a and B. H. Bharatkumar^a**^aCSIR-SERC, Taramani, Chennai – 600 113, India.^bAnnamalai University, Annamalainagar – 608 002, India.**A B S T R A C T**

FRP materials have a number of favourable characteristics, including: ease of installation; immunity to corrosion; extremely high strength; availability in convenient “to apply” forms etc. In recent years, the technique of strengthening RC columns using FRP composites has been used increasingly to replace steel jacketing. Beam-column joints, being the key lateral and vertical load resisting members in RC structures are particularly vulnerable to failures in earthquakes and hence their retrofit is often the key to successful seismic retrofit strategy. Investigations were taken up at Structural Engineering Research Centre (SERC), Chennai, India to study the behaviour of RC beam-column joints retrofitted with Carbon-Fibre-Reinforced Polymer (CFRP) wraps. A corner bar has been introduced at the beam column joint location to improve the joint efficiency. It is concluded that, in situations, where deficiencies are encountered in both design of main reinforcement and spacing of stirrups, retrofitting of such structural members with a CFRP will restore the load capacity of the member. Results of the investigations are presented in this paper.