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Influence of concrete matrix creep and shrinkage on performance of steel-concrete composite prestressed structural members subjected to long-term loads

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Abstract

The main idea in this present report reflects the combination of the economical use of composite construction materials with the long and durable safe service life to cover large floor spaces, using steel-concrete composite precast and prestressed trusses accommodating composite precast and prestressed roof slabs and supported by composite columns. Many previous theoretical and experimental studies have shown that the use of prestressed steel-concrete composite for the above said structural members is effective. But few original research works concerning the long-term deflections due to the concrete matrix creep and shrinkage, and especially using the aging theory have been really conducted in these last years of theoretical and experimental conditions of modern technology and equipment. The originality of this present report relates to fundamental concepts of previous results obtained by the Author's PhD Supervisor, Professor E.A Yatsenko together with other great Authors like Vlasov, Alexandrovskiy, Timoshenko, Barashikov, Ulitskiy, Golishev, Bondarenko and many other Authors. This paper describes the present ongoing numerical and experimental analysis model used to evaluate the structural long duration flexural and non-linear creep characteristics of the said composite members. This present study has been based on nonlinear differential equations of the concrete matrix creep theory which reflects the correlation between the matrix stress and strain by its modulus of elasticity and on the well-known geometrical preconditions of the theory of elasticity concerning thin plates with small flexural deformations. For structural and crack predictions, the well-known virtual work principles have been used to estimate (a) transient bi-directional strains due to the matrix creep and shrinkage for the composite slabs, (b) the resulting time-dependent stress redistribution for other two composite members, as well as (c) displacement variations in the composite structural members and finally (d) prestressing losses in the prestressed high yield tendons. The matrix concrete shear stresses have been evaluated by the well-known principle of Juravskiy. A series of original test experiments with once evaluated strength parameters has been planned to be successfully used to provide encouraging support for the numerical evaluations said at above points (a) - (d).

Key words: *Nonlinear differential equations, Transient bi-directional strains, Steel-concrete composite*

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