Nonlinear and Experimental modelling of
Prestressed SCC Bridge girders

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ABSTRACT
To achieve acceptance for use self consolidating concrete, SCC in prestressed concrete bridge girders, this study was conducted on T-beams fully prestressed SCC of 9m length. The girders were designed based on the Iranian bridge code of practice. Different types of electrical gauges were attached on the steel, prestressed strands and concrete surface at different sections. In the numerical study, 3-D ANSYS modelling was performed. The load-deflection and load strain diagrams for transfer and service conditions of two methods were plotted for different sections. The comparison of experimental and numerical results is performed and a very good agreement is available.

Keywords: Prestressed Concrete, Bridge, Self-consolidating-concrete, Finite Element, ANSYS.

INTRODUCTION
Concrete structural components require the understanding into the responses of those components to a variety of loading. There are a number of methods for modeling the concrete structures through both analytical and numerical approaches. Finite element analysis (FEA) is a numerical one widely applied to the concrete structures based on the use of the nonlinear behavior of materials. FEA provides a tool that can simulate and predict the responses of reinforced and prestressed concrete members. The use of FEA has increased because of progressing knowledge and capability of computer package and hardware. Any attempts for engineering analyses can be done conveniently and fast using such versatile FEA packages.

Self compacting concrete, SCC is a new type of concrete, which has generated tremendous interest since initial development in Japan by Okamura [1] in the 1980s in order to reach durable concrete structures. Since that time, Japanese contractors have used SCC in different applications. In contrast with the Japan research in Europe and American started latter [2]. The advantageous of SCC offers many benefits to the construction practice; the elimination of the compaction work results in reduced costs of placement, equipment needed on construction time and improved quality control.

With the rapid development of concrete technology in recent decades to enhanced durability of conventional concrete, the high strength concrete, HSC can be produced much more easily than before. However, considering SCC, reaching high strength self consolidating concrete, HSSCC is a new type of concrete introduced in more recent years preferred. HSSCC is less liable to shrinkage crack, has a higher modulus of elasticity and a reduced creep strain [3], resulting in smaller losses in the initial prestress. Thus the major emphasis of the present study was to determine flexural strength of high strength SCC prestressed bridge girders.

For modeling purpose, the prestressing wires (with initial pre-strain), ordinary reinforced steel and stirrups were been modeled as truss element. Tension stiffening and bond slip between concrete and reinforcement steel (prestressing wire, and rebar) were considered in the model by drawing truss element between concrete meshing. The main obstacle to finite element analysis of reinforced concrete structures is the difficulty in characterizing the material properties. Much effort has been spent in search of a realistic model predict the behavior of reinforced concrete structures [4].

By applying HSSCC in prestressed elements, it is possible to reduce the total amount of prestress losses. The theoretical and experimental research is required to understand the effect of concrete strength on SCC High-strength concrete is preferred in prestressed concrete members, as the material offers high resistance in compression. In the anchorage zone the bearing stresses being higher, high strength concrete is invariably [5].

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