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Prestressed Concrete Structures for the Future

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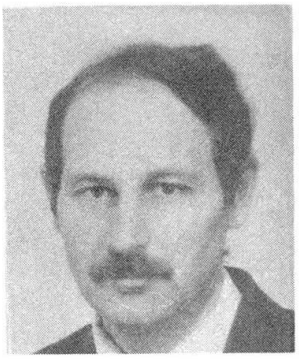

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Summary

Prestressed concrete structures of the future must have high strength, better quality and be environmentally friendly. Among them we can consider reinforced concrete elements made according to the "during-tensioning" method offered by the author. It is achieved due to compressing unset concrete mix during the operation of steel tensioning. The improvement of structure quality is provided here by concrete compaction, increasing cohesion and adhesion of the material. Adequate calculation apparatus has been developed. The research results were successfully used in the construction of a big bridge.

Keywords: pretensioning, post-tensioning, during-tensioning, concrete mix, column.

1. Introduction

The artificial environment created by man on the threshold of the third millennium, is characterized by a wide use of concrete. The dominant position of cement concrete in building practice is due to sufficient reserves of raw materials and relatively low concrete cost. The combination of positive properties of concrete and steel has ensured its leading place in bearing structures. The application of prestressing in concrete has allowed people to have relatively cheap, crack resistant, rigid and durable structures. At present, there are a great number of proposals as to the implementation of prestressing. The majority of them are well studied, and some of the best ones find practical application. Almost all of these suggestions can be classified into two groups according to the methods of steel tension: pretensioning and post-tensioning.

The possibilities of developing new and more effective ways of prestressing of reinforced structures in the frames of the two methods are in many aspects exhausted. Here we need a new qualitative transition to new concepts, beyond the existing prestressing methods, to set a precedent for fresh ideas and development.

2. New method of prestressing

The author has offered and put into practice the principle of prestressing transfer onto the freshly placed concrete mix of structures. In this case prestressing is made already at the stage of cement concrete components.

After vibrodynamic compaction, the placed unset mix is under compression of the steel prestressing force, and it hardens under the pressure. All this leads to the concrete mix compaction, the removal of water excess and air from the mix, to eliminating macro-and partly microdefects of the concrete structure, and to restraining destructive processes during concrete hardening. Steel prestressing is preserved, for after the compaction of the specially proportioned concrete mix, rather a strong and rigid skeleton of solid ingredients is formed, and the stressed steel is then fixed onto this skeleton (fig.1).

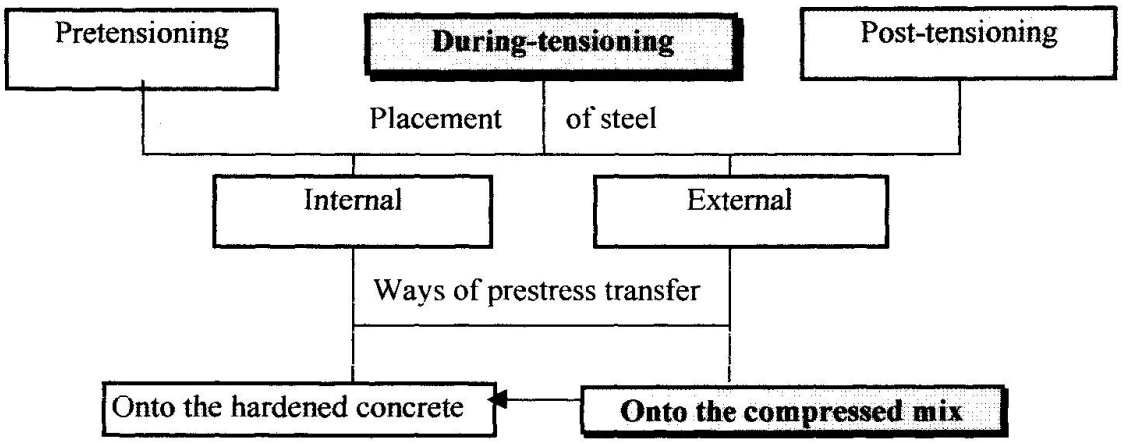

Fig.1. Extended scheme of methods of making prestressing in reinforced concrete structures

It is also possible to partially transfer steel prestressing onto the concrete mix. The realization of the new technology method of concrete mix prestressing became possible after the author had invented original movable forms and devices for full or partial prestressing transfer.

Considerable increase of the effect of uniform concrete compression, the elimination of undesirable initial stress in reinforcement is possible due to the application of movable steel bars proposed by the author. The bars are made in a special way. During the pretension these elements are shortened within the length of the structure. The concrete contacting the steel is compressed and reaches a high degree of compaction. A high quality contact is provided. Prestressing is transferred onto the concrete.

3. Production implementation

The level of research includes production implementation. At present, large 30-ton bridge elements of prestressed concrete made by compressing the unset concrete mix by the force of steel tensioning are successfully used in Ukraine.
Favoring practical application of the above mentioned elements was the device invented by the author, which provides reliable control over the quality of the compressed concrete directly in the product. Service observations of the reinforced concrete pillars produced according to the technology offered in the piers of the trestle part of a large bridge over the river Dnieper in the town Dneprodzerzhinsk (Ukraine) confirmed high quality of the structures compressed according to the "during-tensioning" method.