TECHNOLOGY AND EQUIPMENT EXAMINATION TARGETING AT PRESTRESSED CONCRETE STRUCTURE MAKING

ПРЕГЛЕД ОТНОСНО ТЕХНОЛОГИЯТА И ОБОРУДВАНЕТО, ЗА ДА НАПРАВЕТЕ ПРЕДВАРИТЕЛНО СТОМАНОБЕТОНОВА КОНСТРУКЦИЯ

ЭКСПЕРТИЗА ОТНОСИТЕЛЬНО ТЕХНОЛОГИИ И ОБОРУДОВАНИЯ, ЧТОБЫ СДЕЛАТЬ КОНКРЕТНУЮ СТРУКТУРУ ПРЕДВАРИТЕЛЬНО

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Abstract: *The need to tensioning the structural concrete is determined by the fact that the simple concrete or even reinforced concrete is characterized by resistance at stretching much smaller than the resistance at compression. The rise of resistance at stretching of reinforced concrete is obtained by prestressing it. The authors of the paper have made a hydraulic equipment of high pressure to stress and release the prestressed concrete structures presented in this paper.*
Keywords: PRESTRESSED CONCRETE, REINFORCEMENT, PRESTRESSING , POSTTENSIONING, HYDRAULIC EQUIPMENT OF HIGH PRESSURE, RELEASE (STRESS-RELIEVED), WIRE, TENDON

1. Introduction

Structural concrete or even reinforced concrete is characterized by reduced resistance at stretching in contrast with the resistance at compression. This means that these kinds of concrete should be used only for building foundations, foundations for heavy machine tools, foundations for heavy tanks etc. The concrete structures subjected to very powerful stretching loading need the stressing of the reinforcement, producing the prestressing of the concrete and finally the growth of resistance at stretching. This solution is necessary for the execution of big roofs for large industrial assembly rooms, concrete bridges, platforms of multistoried parking lots, etc [1]

The structure of uncompressed reinforced concrete subjected to strong stretching behaves as in fig. 1a, where we can notice that under the action of the loading, cracks appear in the beams or the plates simply supported or in console, which can have an unfavorable evolution. In fig. 1.b, the shape of the compressed structure is noticed, and in fig. 1.c, the situation of beams or plates under the loading pressure is shown, a situation in which the lack of cracks is noticed even if the loading has much higher values.

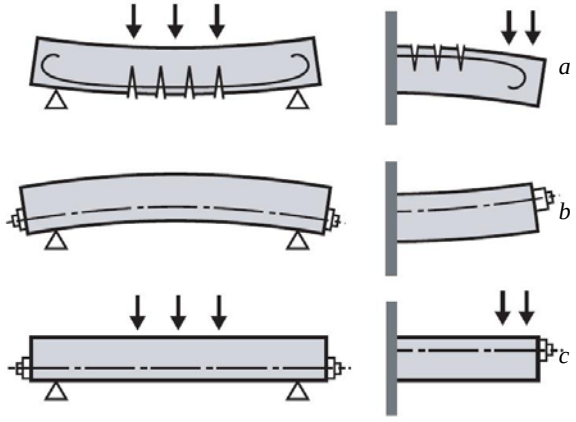

Fig.1- Behaviour of beams/plates of reinforced concrete and prestressed under load

a - reinforced concrete; *b* – prestressed reinforced concrete without load. *c* – prestressed reinforced concrete under load; [1]

An intermediate solution which bridges the gap between the reinforced concrete and the prestressed one can be obtained through a partial prestressing of the concrete structure. If the reinforced concrete is expected to crack when the loading is applied and the prestressed concrete doesn't crack, the partially prestressed concrete can crack by the amplification of the loading at the value that surpasses "the decompression moment", moment when the tension in the extreme fibers of the concrete structure surpasses the resistance to stretching.

Prestressing can be achieved by using steel strands and products of steel strand: bars, strands and cables, which are preferred to in general steel „tendons". In most of the applications, these tendons aren't covered for the protection to corrosion, but there are also solutions of strands covered with epoxy resin. In other cases, other materials can be used, having in their composition non-metal fibers with high level of resistance at stretching and which are stable in alkaline environment.

The prestressing of reinforced concrete structure can be achieved in two ways:

- by pretensioning
- by posttensioning

In the case of prestressed structures, which normally are achieved in industrial rooms, reinforcement strands are subjected to stretching against a retention head before casting the concrete. After the concrete has been casted, it is left to strengthen and to reach the necessary resistance, then the release of strands from the wires is produced and their force is transferred to the concrete structure, compressing it.

The posttensioning is especially achieved, "in situ", involving the installation and the tensioning of the wire strand or of some tendons under the shape of bars only after the concrete has been cast, has solidified and has reached a minimum resistance to compression.

The plates and beams precompressed through prestressing are used almost exclusively for building industrial assembly rooms or storied parking lots, while posttensioning is especially used for building „ in situ", of concrete bridges and viaducts; the stressing of anchorage systems is exclusively achieved through posttensioning.

2. The structure of hydraulic equipments in order to obtain prestressed concrete

To highlight the components of the prestressed concrete production by stressing shown in Fig. 2 the general structure of production of the prestressed concrete tendon strain tendon with straight tendons, structure built by the firm Paul Machinenfabrik GmbH [3].

Equipment used for this purpose should be to make the operation of tensioning the reinforcement, to maintain this situation by pouring concrete and reinforcement, after allowing reinforcement slow realization, during which efforts to spread the concrete structure is transmitted by pin or by marginal anchoring systems, creating compression in this effort. At any point of the route prestressed reinforcement, which may be straight or curved,

paralleled in unladed concrete structure which balances the two efforts: the extent of compression reinforcement and concrete.

Reinforcement of the concrete structure can be achieved in a number of strands (cluster steel wire) with diameters variation from 9 mm and 16 mm tendons are placed at intervals, for prestressed weak concrete, or beam, for concrete beams. Normally, if the plates, pretensioning is done individually, strand after strand and strands is group pretension, release reinforcement are done but, always, for all tendons the same time, this avoiding production of undesirable deformation different tension concrete structure due to a strand or another.[2]

The general structure of stands of pretensioning / release / casting prestressed concrete structures is shown in fig. 2. The first stage are placed tendons 1 which are arranged in coil of image and guided by cutting and pushing device 8. Strands 1 are anchored at the left end of fixed abutment anchor at 2 and right free ends pass through abutment 7 is located on bracket support 5 stands using fixture and relaxation cylinders 6, and then blocked through bushed bearing with mantle corbel.

In the next phase - pulling tendons - is done with a stressing pulling devices (hydraulic pulling devices) 9, powered by high-pressure hydraulic unit 11. Stressing can be accomplished in one working cycle of the device 9 (if stroke has its cylinder strand extent of the achievement of force necessary) or a sequence of working cycles (depending on the force required pretensioning and strand length).

After stressing and anchoring all strands the mantle corbel blocking the abutment 7, pass the following stages pouring concrete and its reinforcement.

Concrete is casting into the mould and leave 3 to strengthen as necessary. After the time of hardening of concrete, is passed to the release of the structure, namely the transfer tension stress in mass concrete.

It is to operate the system to release with hydraulic relaxation cylinders 6, place the bracket support 5 and whose piston is initially positioned the rod tip back down to the abutment 7, leading thus its position during prestresing and anchoring strands tension, 6 hydraulic relaxation cylinders are powered by high-pressure hydraulic unit 10.

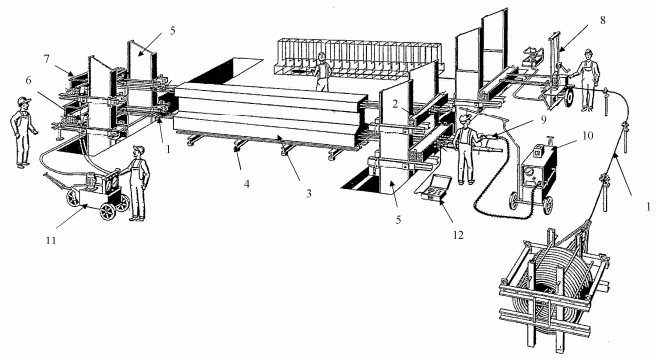

Fig. 2. - Overall structure of the stand of making prestressed concrete structures by stressing: 1 - strands, 2 – abutment anchor; 3 - mould, 4 - pedestal, 5 – bracket suport, 6 - hydraulic realaxation cylinders, 7 - abutment, 8 - cutting and pushing device; 9 - tensioning jack; 10 - High pressure hydraulic unit, 11 - High pressure hydraulic unit, 12 - measuring and control system [3]

For realization of tendons is unblocked while piston and hydraulic relaxation cylinders 6, the controlled discharge of fluid behind the piston, is to withdraw the piston to the left with speed and controlled, while moving to the left and abutment 7, the realization and induction of compression to tension concrete structure, speed of realization is determined by the speed of induction in mass concrete efforts compression without producing deformation or even destruction of its potential for high speed release or release of sudden.

The power of the strands is measured using measurement and control system 12 and the tension becomes zero, the strands heads cut off. Cutting strands usually run hydraulic cutting or flame cutting. After cutting heads, the concrete structure is handled by cranes in the reception and storage.

Remove the ends left over after cutting the wedge grips and mantle corbel can proceed to repeat the cycle for developing new beams.

These devices made in reinforcements tension structure prestressed concrete with forces variation between 6.3 and 25 Tf on each reinforcement. Strain of concrete structures is achieved with minimum lengths of 6 meters to 25 meters. For very long beams are used for tensioning of high tension by 25 Tf requiring and achieving drawing from several stroke of tensioning device. An important role is to release are stroke cylinders, which should increase the length and the structure and tasks to which it is subject.

3. Conclusion

Loss of pretensioning is defined as the difference between the tension applied wires and pretensioning of the element itself. This definition concerns the loss and the instant in time.

Most of these are in some way subject to "slip", under the action of a sustained standing tasks, tends to show a certain plasticity in the material so that material is not entirely in original form if it removes the load. It is produced or retained as an irreversible deformation, known as "slip."

Contraction of concrete and "slip" of concrete and steel reinforcement are potential sources of losses for pretensioning and the design and implementation of pretensioned concrete elements to take account of this contraction.

Contraction intensity may variation to 0.02% depending on environmental conditions and type of concrete. If pretensioned concrete, contractions begin immediately after casting concrete, while for post-tensioned concrete element they "consume" some of the contractions before the tendon tension, and thus power losses caused by contractions are lower.

Slipping: pretensioning reinforcement compression (shortening) of concrete and the phenomenon of "slip" of concrete. It should be added to the contraction of concrete.

The tension steel tendons, the effect of "laying" is lengthening tendon, leading to a further loss of tension. For all pre-tensioning system using wedge grips type attachments, expected some degree of stretching in one or both ends of a ussualy deviced. Under normal conditions, the most common devices, the spread is 3 - 13mm.

All these losses of power should be taken into account in the design process from design and drawing force of pull hydraulic jack.

4. Reference

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