UDC 691

OPTIMIZATION OF STRUCTURAL SOLUTIONS OF REINFORCEMENT CAGES OF BENDABLE REINFORCED CONCRETE ELEMENTS

YANA STRALETSKAS, HANNA LYUBETSKAYA, ALEXANDER KOLTUNOV
Polotsk State University, Belarus

This article discusses the comparison of the design solutions of welded and knitted reinforcement cages used for reinforcement of concrete structures and evaluated their advantages and disadvantages

Introduction. In recent years in the construction industry of most developed industrial countries has clearly identified the trend towards saving energy expended in the production of concrete products, since the reduction in energy consumption directly associated with a decrease in the cost of production needed by all industries. Cost reduction means increasing the competitive ability on the markets of construction materials and products. Against the background of these data can be considered possible options for making reinforcement cages with justification costs, the identification of the advantages and disadvantages of the options. Spatial reinforcement frames are a separate kind of metal used for reinforcing concrete constructions.Reinforcement cages three-dimensional structures depending on the features of the manufacture are divided into several types

Welded frames: Performed using the pin-point or arc welding with pre-selection mode ensuring when testing cruciform joints in shear breaking strength required by the current normative-technical documentation. Welding is used only in the case if the properties of the chemical composition of the core allow it to do (see Fig. 1).

Knitted frames: Knitted scaffolds can be applied to all classes of reinforcing bars. Is used for binding steel wire with low carbon content. Tally of elementorganic special crochet hook or a gun (see Fig. 2).

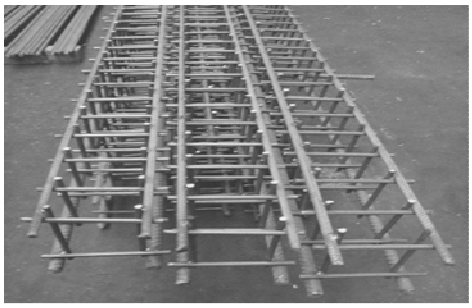

Fig. 1. Welded frames

Fig. 2. Knitted frames

The analysis of previously completed work shows that research in the field of reinforced concrete elements collapsing on the inclined cross sections are relevant.In line with this, the present study aims at comparative evaluation of the experimental data on the work of designs with different types of connection of longitudinal and transverse reinforcement, taking account of questions of technology and economic costs. In accordance with the tasks designed and constructed reinforced concrete beam of rectangular cross section in the amount of four pieces with the size of the cross section 140 × 300 mm, 1750 mm long, reinforced with longitudinal and transverse rods of steel class S500.Connection of longitudinal and transverse rebar in the frame beams was implemented in two variants (see Fig. 3):

– "knitted " in the form of closed stirrups, longitudinal reinforcement envelope;

– "weld", made with contact-spot welding with the advanced selection mode that provides for testing of cruciform joints in shear stress, equal to 100% and 30% breaking strength clamps.

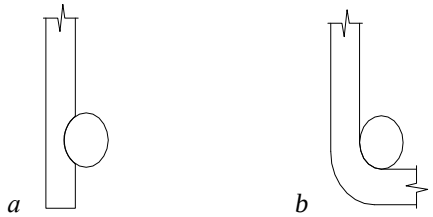

Fig. 3. Connection of longitudinal and transverse rebar in the frame beams:
a – coupling; *b* – closed clamps

Transverse reinforcement made frames, as shown in Fig. 4.

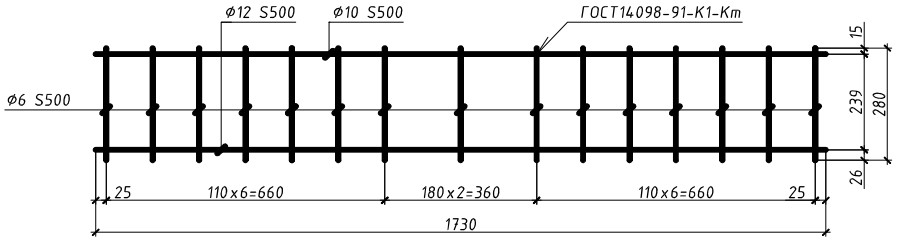

Fig. 4. Diagram of transverse reinforcement prototypes.

Prototype testing of bending was carried out in a hydraulic press PR-1000 in accordance with the scheme of Fig. 5.

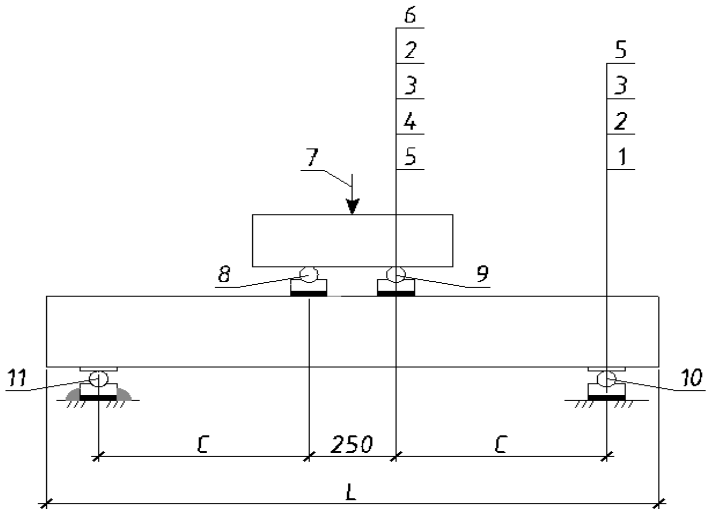

Fig. 5. Scheme of tested beams:
1 – support; 2 – steel packer; 3 – steel plate; 4 – solution of cement; 5 – test beam;
6 – traverse camshaft; 7 – the test load; 9,10 – movable support; 8, 11 – fixed support

When loading the prototypes in accordance with the adopted test procedure were controlled by the nature of the formation and opening of cracks and breaking load. The number of inclined cracks formed in the process of loading not influenced by the type of connection of longitudinal and transverse reinforcement.Measurements of widths of cracks is determined that the maximum opening had cracks that intersect the transverse rods located in the middle of the span length of the cut beams, crack widths in beams with a " knit" and "welded" connection was recorded approximately the same. The bearing capacity of specimens with welds and "equally strong" connections was approximately the same. The efforts correspond to the width of inclined cracks is equal to 0.4 mm was obtained at the level of (0.6–0.9)Qu.

Consideration of technological features of manufacture of the frames shows:

– welded frame has 4 cut transverse reinforcement in the section plane, in contrast to the untethered jailbreak that has one RES;

– welded frame used contact spot or arc welding with eight locking points;

– knit frame consolidation takes place after a preliminary bend of transverse reinforcement to form a closed rectangle, and the frame is additionally fixed with reinforcement elements, which are designed to eliminate bias during transportation and concreting;

– knitted frame, not raskreplennye welding is highly deformable;

– the main negative option is the use of welded frames is the possibility of weakening of the valves in the heat-affected zone high temp.

Given the technological and design features of making the most rational frameworks should recognize the frame having end portions (in the area of anchorage) welded transverse rods. These rods provide additional anchoring and spatial resistance in the stage of transportation and concreting.

REFERENCESE

1. LRFD Bridge Design Specifications / AASHTO (American Association of State Highway and Transportation Officials). – 1st ed. – Washington, D.C., 1994. – 1091 p.
2. Case hardening steels. Methods of tensile tests : GOST 12004-81. – M. : Publishing house of standards, 1980. – 45 c.
3. Welded joints of reinforcement and embedded products for reinforced concrete structures : GOST 14098-91. – M. : Stroyizdat, 1992. – 32 p.
4. Reinforcement and cage welded products, welded joints of reinforcement and embedded inteligentemente designs : GOST 10922-90. – M. : Stroyizdat, 1990. – 24 p.
5. Zalesov, A.S. Resistance of reinforced concrete elements by the action shear forces. Theory and new methods of strength calculation : abstract. diss. ... doctor. tech. Sciences : 01.23.01/NIIZHB / A.S. Zalesov. – M., 1980. – 46 p.
6. Klimov, Yu.A. Theory and calculations of strength, crack resistance and deformation of reinforced concrete elements by the action shear force : diss. ...doctor. tech. sciences : 05.23.01 / Yu.A. Klimov. – Kiev, 1992. – 503 p.
7. Koltunov, A.I. Strength and fracture toughness of the inclined section of bendable reinforced concrete elements with shear reinforcement class At600c. diss. … kand. tech. sciences : 05.23.01 / A.I. Koltunov. – Novopolotsk, 1998. – 153 p.