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**BASIC SYSTEMS OF REINFORCED CONCRETE BRIDGES,  
AREAS OF APPLICATION AND DESCRIPTION OF 3D MODELING**

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*Annotation.* This article discusses reinforced concrete bridges in modern bridge construction, their structure and systems, areas of application and applications that can be used in 3D modeling, their structure and construction methods on the example of bridges of various constructions, 3D modeling in the organization of the construction process the use of specialized software in itself, the procedure for developing a 3D model (or a carcass model in the form of a three-dimensional object) was studied.

*Keywords.* *Cantilever systems, beam bridges, frame bridges, extras, 3D modeling, software packages, Autodesk 3D Studio.*

**Introduction.** The design, construction and operation of fabricated structures is a complex and interconnected process that must be managed by highly qualified professionals in the field of bridges and transport tunnels. To develop the industry, road engineers will also need to build and operate bridges, pipelines and tunnels. In the current situation, the design of artificial structures requires the use of special computer programs for the creation of structures and the preparation of working drawings, taking into account the improvement of their structural forms through the development of the most optimal of various materials [2].

We all know how important 3D modeling is today in computer graphics and design. The term refers to the creation of various three-dimensional models using special software. There are many applications that apply to three-dimensional graphics. Today, programming technology is also evolving rapidly, and programmers are using a variety of programming languages[6]. That is why special software is created for the production of graphics programs.

**The main part.** In modern bridge construction, reinforced concrete bridges are widely used to close small, medium and long distances. They use a variety of

design solutions and static schemes: beam, frame, arch and mixed schemes. Intermittent, continuous and cantilever bridges are widely used [1]. Creating three-dimensional graphics of modern bridges and road structures should start with three-dimensional modeling. The concept of three-dimensional modeling involves the creation of three-dimensional models of objects on a computer. Programming languages or software can be used to develop 3D modeling, in short, 3D modeling. It is more efficient to develop 3D modeling using ready-made software. This makes creating objects faster and easier. The possibilities of the most common 3D modeling software are very wide, which allows you to develop models of any structure. In order to program the finished 3D models, it is necessary to write program codes on the translators. This requires a lot of software code[3]. A number of graphics software has been developed to optimize this work. Ability to automatically copy the necessary materials for the program to a single directory, write script codes separately and then combine them into objects, ease of viewing the software product and, most importantly, compile the program for many platforms. is the ability to do[4].

**Mechanism.** A simple frame system bridge (Fig. 1.g) is used at intervals of 30-60 m. Because the intermediate devices work in conjunction with the base, the bending moments acting on the intermediate devices are reduced. This allows the construction height of the intermediate device to be reduced. Sloping columns are the most common (Fig. 1.d.). The most common T-shaped frame bridges: frame-beam and frame-cantilever. Rim-beam (Fig. 2.a) bridge systems are formed by the interlocking combination of a frame and intermediate devices. The range of such systems can range from 40 m to 150 m. Only negative moments occur in the crossbars of T-shaped frames, and in its intermediate devices - only positive moments. The supports of these frames transmit vertical force and bending moment to the base under the influence of vertical forces[5]. In frame console systems (Fig. 2.b.), the T-shaped frames are attached to each other by means of a hinge. Such systems are used in the range of 60 to 200. The supports of such systems transmit additional horizontal forces to the base. Frame brackets can be made of solid

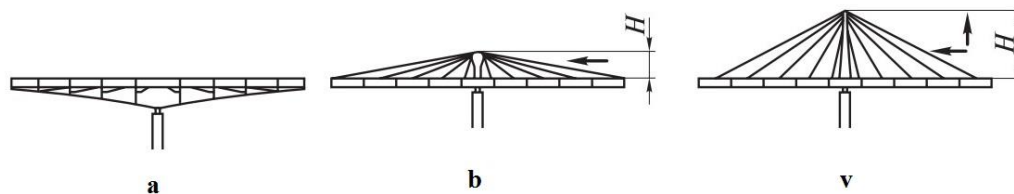
concrete, in which case multi-span frame systems with a spacing of up to 250 m are formed. The framed systems considered can be suspended by integral concreting and the parts can be assembled by suspension. Special types of frame cantilever bridges are built (Fig. 2.v). T-shaped frames consist of two semi-arches, connected from the level of the carriageway. The distance between such structural bridges is up to 120. Arched structural bridges can be used if the foundation has a solid ground (Figure 3.a.).

<p><i>Figure 1. Types of bridges (a- v) and girders (g, d)</i></p>	<p><i>Figure 2/ Frame-beam (a) and frame-cantilever (b, c) bridge systems</i></p>	<p><i>Figure 3/ Arched (b) and gantry (c) structural bridges</i></p>

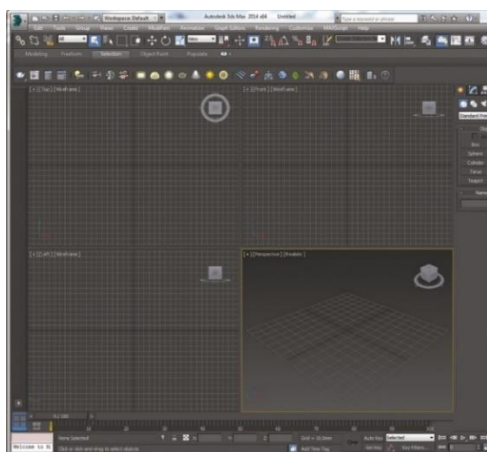
Over the last decade, reinforced concrete bridges have been used for tension systems (Figure 3.b). The Dev column works mainly on compression. The distance between the reinforced concrete bridges in this system has now been increased to 400 m. In the last ten years, in the construction of world bridges, extradition (Fig. 4.b.) has been carried out by the method of equalized concreting (or assembly) and screwing of solid reinforced concrete intermediate structures (Fig. 4.a.b.) in the middle (Fig. 4.v) The use of reinforced concrete intermediate structures, which are built in conjunction with intermediate devices, is spreading. Modern reinforced concrete bridges are built in a prefabricated and integrated way. Bridges made of solid concrete in various ways are built using metal formwork. Prefabricated bridges are assembled from elements made in factories or on special sites.

**Offer.** Improving the overall design, construction methods and mechanisms of reinforced concrete bridges can increase the cost-effectiveness and quality of practical work. This process is increasingly being used by many people today, especially computers and mobile phones. Of course, the demand for software is also growing, and 3D modeling is one of the most widely used methods today[6].

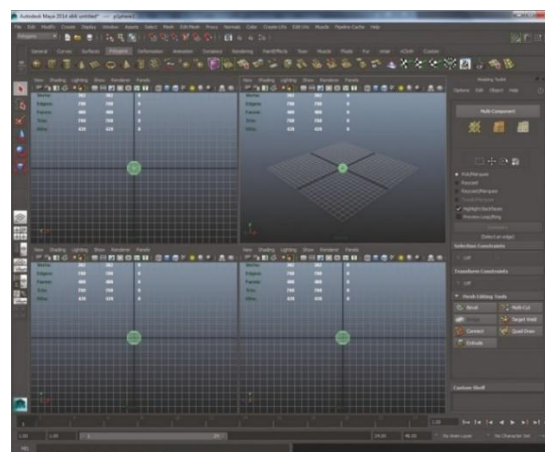
**Analysis of modern 3D modeling software packages.** 3D modeling involves the development of a 3D model (or three-dimensional object-shaped carcass model) using specialized software. A three-dimensional model is created using many points that are interconnected by lines and curved surfaces. The field of 3D modeling is constantly expanding.



*Figure 4. Comparison of extrodzle (b) with beam (a) and threaded (c) intermediate devices*



*Autodesk 3D Studio Max software interface*



*Autodesk Maya software interface*

There is no publicly accepted answer as to which 3D software is good or bad. Every user thinks that the 3D software that suits them is important for this question. How well a user can work with the 3D software he or she is working on depends on his or her creative abilities (in addition to knowing the tools, acquiring artistic skills, color matching, knowing the composition is desirable).

**Results.** The modern way is to organize the continuous production of complex mechanized parts for the construction of artificial structures on the highway and to assemble them at the same time. Reinforced concrete bridges can be covered with arches from 50 m to 390 m. Because the bridges of these bridges have undergone significant horizontal reactions, it is necessary to strengthen the foundation. The arches work on compression, with the strength of the reinforced concrete giving good results[5].

Single bridges are more reliable than prefabricated bridges, but the pace of construction is slower than prefabricated bridges. The use of prefabricated bridges allows to increase the speed of construction and reduce the workload on the construction site. Intermediate devices can also be assembled in both summer and winter. In these processes, the features of 3D modeling and the ability to add animated actions in them dramatically increase the interest in them. Them:

- ✚ show effects in the film and video industry;
- ✚ television in commerce (advertising);
- ✚ in interactive games;
- ✚ in industrial and architectural design (decoration);
- ✚ in scientific, medical and judicial demonstrations;
- ✚ training programs and can be used on a computer.

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