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MODERN INFORMATION TECHNOLOGIES IN THE DESIGN OF ROADS AND RAILWAYS

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Abstract: *The article discusses the issues of design, construction and operation of highways, which include a huge number of tasks related to both planning, project coordination with existing infrastructure, and solving local technical problems. Each project involves a large number of participants whose interests should be taken into account. Information modeling, special software help to solve these and other tasks.*

Keywords: *modern information technologies, information design of roads and railways*

Recently, there has been a significant increase in the requirements on the part of the customer for the quality of transport facilities projects in the context of the need to shorten the design time. In this regard, an urgent task is the introduction of new technologies at all stages of project development from engineering surveys to computational justification and design.

Modern design technologies assume, firstly, the use of professional software to solve the tasks, secondly, the availability of special means of organizing joint work on the project, which allows to increase the reliability of data and minimize the time for approving changes, and thirdly, the possibility of designing a transport structure as a single object, including interconnected elements. In this case, making changes to one element automatically leads to changes in others related to it, which, in turn, significantly reduces the design time. Let's consider the main characteristics of software tools on the basis of which a modern technology for designing infrastructure facilities can be built, as well as examples of tasks solved with their help.

GeODin Program. This program is designed to process engineering and geological survey data. Engineering and geological surveys are a necessary stage of the pre-project study of the territory provided for construction. The results obtained at this stage largely determine the technology of design and construction, as well as provide the necessary data on the characteristics of soils that are used in the calculation justification [1].

To solve the problems of processing field and laboratory research data in the technological chain under consideration, it is proposed to use the GeODin program developed by the German company FUGRO. This program allows you to perform not

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only data processing to obtain the necessary graphs and tables, but also to create a Database of Geological Data of the territory, which can be replenished, adjusted and used in the design of other objects.

Plaxis software package. This complex is designed to carry out the design justification of the project, taking into account the joint work of structural elements in a complex geotechnical system "structure-base", taking into account the technology of construction of the object and its further operation. For linear structures, first of all, calculations are performed to substantiate projects of road embankments for various purposes. When performing these calculations, the design engineer faces a large number of complex geotechnical tasks. These tasks are related to the need to take into account a number of important provisions and factors in the project, which include:

– the geological structure of an inhomogeneous soil base, the properties of soils and the mechanical processes occurring in them;

– special construction conditions related to the proximity of existing structures, the availability of utilities;

– technologies for the construction of the roadbed and technologies for the artificial improvement of the foundation soils;

– application of combined building structures of ground and underground structures and their interaction with the ground;

– static and dynamic loading conditions during construction and operation of the structure.

The correct choice of the solution of the tasks facing designers determines the high rates of efficiency and reliability of the constructed and operated transport construction facilities.

One of the modern software tools for geotechnical calculations is the Plaxis software package, which is a package of applied computing programs for finite element analysis of the stress-strain state of complex geotechnical systems [2].

The AutoCAD Civil 3D program

The program offers the technology of designing the future. The use of this program allows you to solve the problems of processing geodetic survey data (creating a top plane and a digital terrain model) and designing transport facilities in a single information environment. This practically eliminates the need to convert data from one program to another, which, as a rule, is associated with the loss of time, and sometimes the data itself. But most importantly, AutoCAD Civil 3D implements the approach of designing a road as a single three-dimensional object. The necessary working documentation – drawings of the plan, profile, sections, statements and tables are created on the basis of this model.

All Civil 3D objects have logical connections to each other. The structure of these connections can be traced in the following diagram:

Due to this relationship, the 3D model of the projected object is dynamic, i.e. when the source data changes, it is completely updated. For example, after making changes to the earth's surface data, the longitudinal profile is updated, the corridor is rebuilt, the cross-sections are changed, volumes are recalculated and new parameters are entered into tables and drawings. Thus, all work is carried out only on the basis of up-to-date data.

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Dynamic three-dimensional model simultaneously with the powerful functionality of the program can significantly reduce the time of considering several options, developing projects of any complexity, making changes.

With the help of the AutoCAD Civil 3D program, you can develop projects for both the construction of new and reconstruction of existing roads and railways, transport interchanges and many other infrastructure facilities.

As an example, we can consider several typical projects performed in the AutoCAD Civil 3D program.

The first project is a two-level transport interchange of the "clover leaf" type. As part of this project, a three-dimensional model of the entire object was created. The initial data were surface points, routes of intersecting main roads with longitudinal profiles and typical cross-sections.

Taking into account the geometry of the cross sections, circular exits were originally designed, and then right – hand ones. The removal of the transverse slope at the exits from 20% to 40% was provided by means of an additional longitudinal profile along the outer edge of the exit.

Models of all exits and main roads were created as separate corridors, which made it possible to determine the amount of excavation and materials separately for each exit and for each road.

The second project is the reconstruction of a city street. Within the framework of this project, the tasks of reconstructing the carriageway of the avenue with adjacent sidewalks and preserving red lines were solved [3].

The dynamic model created in the AutoCAD Civil 3D program made it possible to quickly determine the optimal level of the axis of the roadway, taking into account the position of the drainage wells and the marks of the red lines.

The third project is the reconstruction of the intersection. To ensure drainage, longitudinal profiles were designed along the trays, and the complicated geometry was described with the help of additional routes. Linking the corridor model to additional routes and profiles made it possible to take into account all the nuances of the urban intersection.

Working in the AutoCAD Civil 3D program is based on working with objects and their types, so by setting a new type, you can easily change the appearance of objects on the screen or in the drawing. This approach makes it possible to adjust to industry standards for the design of drawings.

To date, the task of computer-aided design is solved to one degree or another by most design organizations, while the issue of teamwork and project management often remains unresolved. To solve this problem, Autodesk offers the Vault application, which is included in the delivery of AutoCAD Civil 3D. The Autodesk Vault program allows you to organize projects that are available to users with certain rights. The advantage of this system is the ability to add to projects and further work with absolutely any files. Any change is recorded in the project log, which allows you to track who and when edited the data and, if necessary, restore any version of the file.

A distinctive feature of the Autodesk Vault program is its integration into Civil 3D. This allows you to access the project directly from the AutoCAD Civil 3D program, as well as create links to individual drawing objects: surfaces, routes, profiles, etc [4].

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Modern operating conditions of infrastructure facilities impose ever-increasing requirements for design work of both new construction and repair and reconstruction. It is possible to meet such requirements only if new design technologies are introduced and modern software is used.

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БЎСАҒАВИЙ ФУНКЦИЯЛАРГА АСОСЛАНГАН ТАНИБ ОЛИШ АЛГОРИТМЛАРИ

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КИРИШ

Бир неча 10 йиллар давомида тимсолларни таниб олиш соҳаси информатика ва информацион технологияларнинг кенг тарқалган йўналишлардан бири бўлиб қолмоқда. Охирги йилларда тимсолларни таниб олиш йўналишида олиб борилган тадқиқотларнинг натижаларидан фойдаланиб, ҳал қилинаётган амалий масалаларнинг сони ҳам узлуксиз ортиб бормоқда. Шунга қарамай, ҳозирги кунда белгилар фазоси ўлчамининг катталигини ҳисобга олган ҳолда таниб олиш алгоритмларини синтез қилиш муаммолари етарли даражада ўрганилмаган [1-3].

Мазкур мақоланинг асосий мақсади белгилар фазосининг ўлчами катта эканлигини ҳисобга олган ҳолда таниб олиш алгоритмлари моделларини ишлаб чиқишдан иборат. Ушбу мақсадга эришиш учун қуйидагиларни амалга ошириш керак: 1) таниб олиш алгоритмларининг ҳозирги ҳолатини таҳлил қилиш ва тадқиқот масаласини аниқлаш; 2) белгилар фазосининг ўлчами катта бўлганлигини ҳисобга олган ҳолда тимсолларни таниб олиш алгоритмлари моделларини ишлаб чиқиш; 3) модель масалаларни ечишда ишлаб чиқилган таниб олиш алгоритмларини синовдан ўтказиш.