Application of Modern Information Technologies and Software Tools in the Design of Railways

Kodirov Nodirbek Bakhtiyorovich[1], Tayirov Shopulat Shomansurovich[2]

[1]Assistant of the department of "railway engineering", Tashkent State Transport University

[2]Student of Tashkent State Transport University

Abstract: The article provides an analysis of software products that can be used to design railways in a pandemic.

Key words: railway, design engineering, Google Earth, AutoCAD, SketchUp.

In the context of a pandemic and remote work, modern information technologies and computer-aided design tools have become relevant. Taking into account the fact that increasing the length of Uzbekistan's railways is an important task for the national railway company, the processes associated with the design of railways should not stop. In this article, we consider cases that can be used for design in this situation.

The situation in the IT market is undergoing changes that stimulate the development of cloud services and individual software products. On the one hand, it was necessary to change the situation in which the heterogeneous applications used in railway design institutes are often unable to use each other's formats. On the other hand, industry design institutes needed a software solution for modeling railways in cooperation with a system of efficient end-to-end "seamless" technological lines and chains of "survey - design - construction - operation". This solution, built on the basis of industrial platforms with an open architecture, should take into account industry specifics (for example, fundamental differences in project documentation) and be based on the domestic design methodology. And since the railway is a complex structure, the tools of the same product must be suitable for the design of other linear objects, [1].
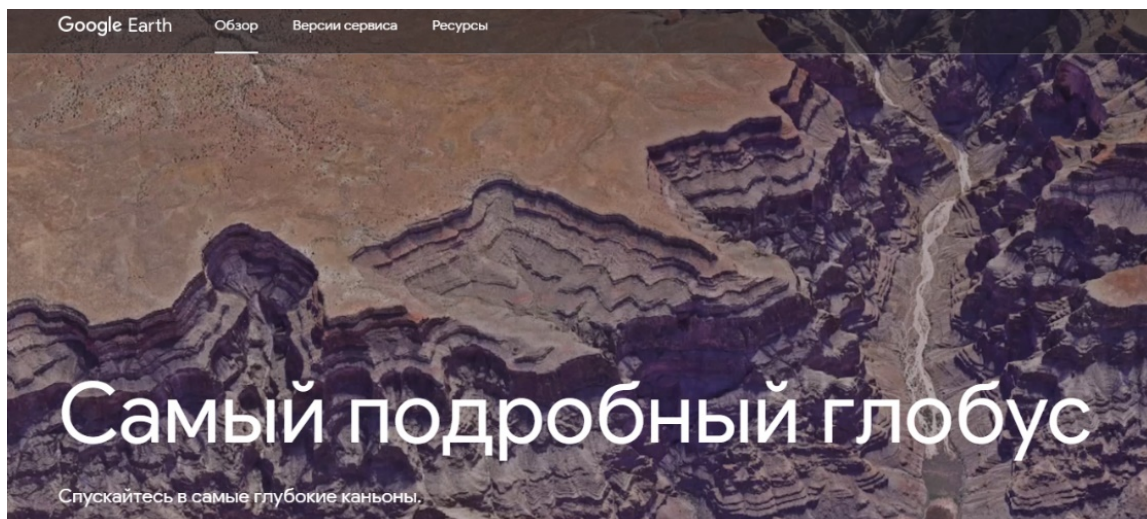
The Google Earth application (Fig. 1) contains additional analytical GIS information, volumetric relief, the necessary areas of which can be imported directly into SketchUP, all three dimensions are imported, and not just a two-dimensional map. SketchUp users are also relieved of the hassle of buying high-resolution maps from Google Maps or manually gluing them together in an image editor. So, during the research, I used not only the models built in 3D editors, but also the rebuilt relief.

There are two types of situations in which you need to export a 3D model from SketchUp to Google Earth. The modeling approach, export methods and final result are different in both cases:

In the first case, export for the purpose of demonstrating the project to the customer in the Google Earth environment built by enthusiasts. This allows you to save time on submitting the material, present the project more clearly and better assess its quality. The model appears only in the program installed on this

computer and does not affect the Google Earth database. An "ordinary", detailed and complex volume is being built.

In the second case, export for the purpose of enriching models of existing buildings with the Google Earth application, participation in a collective project. The model appears in the Google Earth database, is in the public domain and can be downloaded by any user of the program. The volume is built according to certain rules, the goal is to fit the maximum amount of data into as simple as possible, "light" form, [2].

Field survey data processing

The basic Autodesk AutoCAD Civil 3D toolkit allows you to read and process data from modern electronic total stations and GNSS systems. The data obtained allows you to automatically draw the situation in strict accordance with the current rules for the design of cartographic products. Depending on the subsequent tasks, a digital elevation model (DEM) is automatically formed on this basis or in a semi-automatic mode - a digital terrain model (DTM).

Built-in tools allow you to connect data from all types of laser scanning systems (ground, air, kinematic and bathymetric).

Autodesk AutoCAD Civil 3D has the ability to query custom survey data and display it in object marks.

Road design.

Autodesk AutoCAD Civil 3D has a powerful and extensive functionality for the design and modeling of railways. The use of design criteria (design constraints) allows the designer not to independently monitor compliance with these constraints - Autodesk AutoCAD Civil 3D checks all constraints automatically. The designer has a complete set of tools for tracing the road, creating complex transitions, floating and free curves, and blending complex sections. An existing profile is automatically built according to the created route, with the placement of all the marks and explanations necessary according to GOST. The alignment plan and profile are dynamically linked - any changes in the plan automatically lead to a change in the alignment profile. To create a design profile, the designer also has a complete set of tools to create complex vertical alignment elements.

Autodesk AutoCAD Civil 3D includes an extensive library of pavement structures. Structures can be edited by the designer, there is also the ability to create your own structures and make them as a library element, which allows you to use custom structures in many projects.

Autodesk AutoCAD Civil 3D also automatically creates alignment cross sections. The route in the program is represented as a special complex dynamic object - a corridor, in which a change in any element leads to an automatic change in all other elements interconnected with it. This allows you to make design changes as quickly and correctly as possible at any stage of the road design. Automatic creation and dynamic editing of the roundabout layout, the ability to analyze the creation of a roundabout at the intersection of roads. A new editor for superelevations, which allows you to calculate superelevations, create types of superelevations, which can be edited using "grips". Autodesk AutoCAD Civil 3D provides the ability to design railways. The program provides for a special type of track and a structural element. In addition, the calculation of the elevation of the outer rail along the railroad track has been implemented, [3].

Design of external engineering networks and conduits.

In the case when it is necessary to take into account engineering communications, a cloud service is also very useful. Interaction between SketchUp and Google Earth is straightforward. The product allows you to design water supply and sewerage networks, as well as pipelines of any purpose. The visibility, the simplicity of the interface is striking, giving rise to a large-scale result with disproportionately small efforts of an individual person, which comes from the very number of users who add models to the layer of 3D buildings, and who do it completely free of charge. Also, Autodesk AutoCAD Civil 3D has the ability to design pressure utility networks based on updated catalogs of pipes and equipment. All elements used in the design can be transferred to dynamic tables and specifications.

In conclusion, we can say that cloud services and automation programs are perfectly adapted for working at a distance. The process of designing railways, in turn, requires surveys and research of the terrain directly on

site, however, for preliminary analysis and for organizing work where it is necessary to work with other infrastructure facilities, the technologies and services under study are very useful and can contribute to organizing work in quarantine conditions.

Literature:

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