

AUTOMATION OF THE PROCESSES OF DESIGNING ROADS AND ROAD STRUCTURES

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Abstract. This article examines issues related to the automation of the design processes of roads and road structures. The role and importance of digital technologies in the road sector are also explained. As a result of the research, it was established that the use of automated design systems increases the quality indicators and efficiency of projects. In addition, the widespread introduction of automation technologies into road design processes is an important factor in the sustainable development of transport infrastructure.

Keywords: automation, design, highways, structures, digitalization, technologies, quality, infrastructure, stability.

INTRODUCTION

Automation of the processes of designing highways and road structures is one of the priority areas of the strategy for the digital transformation of the transport infrastructure of the Republic of Uzbekistan today. In particular, based on the decree of President Shavkat Mirziyoyev dated October 10, 2023, large-scale reforms have begun to modernize the road management system and increase management efficiency. In this process, design, construction, and operational functions were clearly defined, and mechanisms for training specialists were introduced [1]. Also, with the approval of the national program "Safe and Smooth Road" for 2022-2026, the improvement of road infrastructure, digitalization of traffic management, and ensuring public safety are defined as priority goals. This policy creates the need to improve project quality through the introduction of digital technologies, save time and resources, reduce the impact of the human factor, and ensure the sustainable development of the transport system [2].

Literature analysis and methodology

Uzbek scientists have conducted a number of scientific studies on the issues of automating the processes of designing highways and road structures. In particular, M.M. Mirsaidov and Sh.Kh. Kadyrov (2018) in their research analyzed the significance of automated design systems in the design of road routes [3]. A.A. Rakhmonov (2019) substantiated the possibilities of increasing project accuracy and economic efficiency through the use of digital technologies in the road design process [4]. Also, in the works of B.S. Ismailov and U.A. Zhuraev (2021), it was shown that the use of CAD and GIS technologies reduces the influence of the human factor in road construction projects [5].

In the research of foreign scientists, this issue is covered even more extensively. For example, studies by Eastman C., Teicholz P., Sacks R., and Liston K. (2011) scientifically substantiated the effectiveness of BIM technologies in infrastructure projects [6]. S. Azhar (2012) demonstrated the possibilities of improving project quality and execution speed using automated design systems [7]. In the studies of Volk R., Stengel J., and Schultmann F. (2014), BIM and digital modeling were assessed as important tools for the sustainable development of transport infrastructure [8]. In recent years, Li X. and Zhang Y. (2020) have studied the prospects of using artificial intelligence and digital technologies in road design [9].

In this article, integrated research methods were used in the study of issues of automation of the design processes of roads and road structures. In the research process, first of all, an analysis of the literature was carried out, and modern technologies and automated design systems in the works of Uzbek and foreign scientists were studied. Subsequently, computer-aided design



systems CAD, BIM, GIS were practically analyzed, through which indicators of efficiency, quality, and resource saving in the process of designing road structures were measured.

RESULT AND DISCUSSION

According to the research results, the use of automated design systems in the design processes of roads and road structures significantly increases the quality indicators and efficiency of projects. Compared to traditional design methods, automated systems allow for improved project accuracy, technical completeness, and economic efficiency. At the same time, automated systems accelerate the processes of project modeling, calculation of material volumes, design of roads and road structures, reduce errors and the need for processing, and minimize the influence of the human factor.

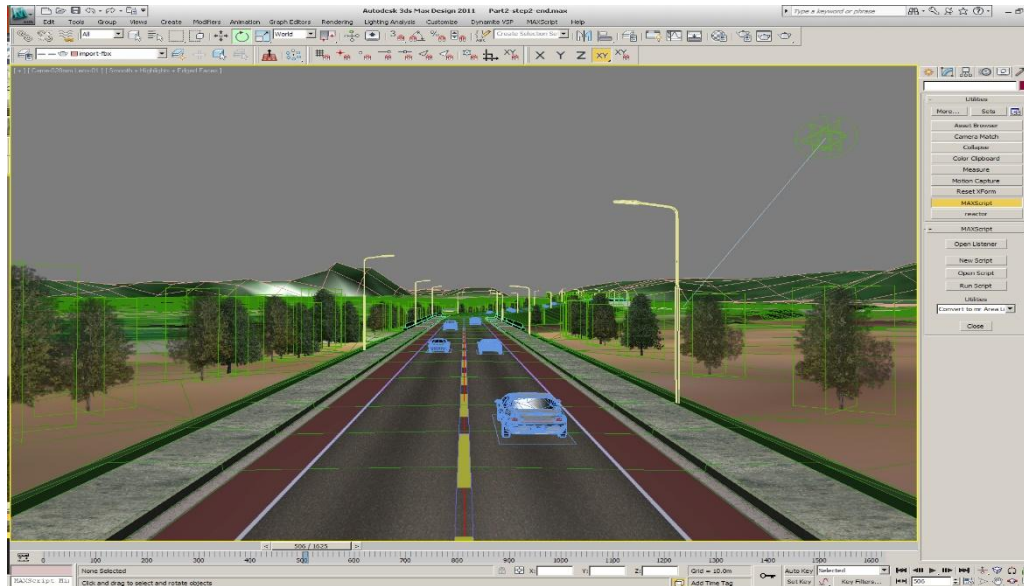


Figure 1. Use of automated design systems in the processes of designing road structures.

Automated design systems provide a clear advantage in the following aspects:

1. Improving quality. In the design process, the systems calculate various parameters in real time, ensuring the optimal formation of structures. This will bring the quality of the project to a high level.
2. Saving time. Automation of design and calculation work allows it to be completed 30-40% faster than traditional methods, which contributes to the implementation of projects in a short time.
3. Resource efficiency. The calculation and optimization of material and financial resources are accurately carried out using automated systems, which increases economic efficiency.
4. Security and stability. Automation technologies reduce errors in the design process, increase the service life of road structures, and contribute to the sustainable development of transport infrastructure.
5. Reducing the human factor. Automated systems minimize the impact of human error by automatically performing complex calculations and design work.

In the discussion section, it is noted that the widespread introduction of automation technologies into road design processes serves as an important factor in the sustainable development of transport infrastructure, improving project quality, optimizing time and costs, and ensuring safety. At the same time, the practice of designing roads and structures using modern CAD, BIM, and GIS systems provides effective and digitalized management of the entire transport infrastructure. In general, the implementation of automated design systems not only improves the quality of the project, but also has strategic significance for the sustainable development of transport infrastructure and ensuring economic efficiency.



Conclusion. This article examines the issues of automating the processes of designing highways and road structures. The study showed that the use of automated systems increases the quality of projects, improves efficiency, and serves the sustainable development of transport infrastructure, where digital technologies play an important role.

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