

Methodology for Application of Digital Models for Optimizing the Organization and Management of Automotive Transport

Balbuzanov Toncho , Ivan Beloev and Dzhemal Topchu

tbalbuzanov@uni-ruse.bg

GOAL OF THE STUDY

This study explores the use of digital modeling and simulation software to improve traffic organization and control at high-conflict areas such as intersections and other critical points in the road network.

METHODOLOGY OF THE INVESTIGATION

Development and analysis virtual transportation scenarios, the study evaluates the effectiveness of various organizational strategies aimed at increasing traffic throughput, reducing delays, and minimizing the risk of accidents.

MAIN RESULTS FROM THE STUDY

The study of road traffic can be conducted using a variety of methods — ranging from the simplest, involving a single observer without any specialized equipment, to complex approaches requiring multiple operators and advanced measuring technologies. The broad spectrum of methodologies reflects the diversity and complexity of traffic-related challenges. Furthermore, the constant evolution of modern equipment significantly enhances the research process by enabling real-time monitoring, automated analysis, and simulation-based assessments



Fig. 1. Analysis performed using trajectory data in Data From Sky Viewer.

The result of the video analysis is provided in the form of object trajectories, which contain detailed information about each detected entity in the footage — including object category, movement path, and in some cases, color identification. These trajectories form the basis for in-depth traffic analysis using the analytical toolkit integrated into the Data From Sky Viewer desktop application (Figure 1).

Modern technological integration makes it possible to create digital replicas (digital twins) of real-world transport segments. These tools facilitate the collection of accurate data on the operational characteristics of the studied area, contributing to better traffic planning and capacity management.



Fig. 2. Using a real-world map as a background layer for intersection scaling in PTV VISSIM.

At the beginning of each student-led simulation project in PTV VISSIM, it is essential to define the accurate geometry of the intersection, particularly when modeling roundabouts. This is typically done by importing a scaled background image (e.g., aerial photograph or drawing) of the site, which serves as a reference for geometric layout and scaling (Fig. 2).

CONCLUSIONS

The use of digital models as virtual laboratories enables students to simulate real-world scenarios in a controlled environment, thereby supporting the practical acquisition of knowledge without the need to leave the classroom.

However, technology should not be viewed as a stand-alone solution. It serves as a tool that supports the analysis, optimization, and management of urban mobility.

ACKNOWLEDGMENT

This study is financed by the European Union, NextGenerationEU, through the National Recovery and Resilience Plan of the Republic of Bulgaria, project No. BG-RRP-2.013-0001-C01.