Application of Software Tool for Pedestrian Flow Simulation, Case Study

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Abstract: The process of urbanization and motorization is in steady growth. A large number of people are moving to the cities, and as a result, the cities are constantly expanding. We are witnessing different types of means of mobility (car, bus, railway, bicycle, motorcycle, walking), ie movement from one point to another. Pedestrians play an important role in the movement of traffic. Walking for short distances, on previously arranged and marked areas. Every movement in traffic can be displayed, edited, controlled, organized, solved with the help of simulation software. Traffic simulation software is essential in traffic engineering for modeling and analyzing traffic flows, evaluating the impact of infrastructure changes, and optimizing traffic management strategies. Key software includes PTV Vissim, SUMO, Aimsun, and TSIS-CORSIM, each of which offers unique capabilities for microscopic, mesoscopic, and macroscopic traffic simulations. The AnyLogic software tool is also of crucial importance for engineering. In this research we will show the steps and power of the AnyLogic software tool, to conduct a comprehensive simulation analysis aimed at improving the performance of pedestrian flows in the city of Bitola.
Keywords: Pedestrians, anylogic, simulation, software.

1. Introduction

The main goal of the sustainable transport system plan is to ensure economic efficiency, sustainable environment, safety, quality of life, accessibility and social inclusion. When planning the traffic infrastructure, priority is given to the space for passenger car traffic, freight traffic and vehicles for public city transport, then the space for pedestrians and bicycles is never planned for a special space for public city transport vehicles in order to give priority. Sustainable urban mobility planning defaults to prioritizing space for walking, cycling and public urban transport over space for car and truck traffic. The behavior of road users is important for safety, the facts show that pedestrians, cyclists and motorcyclists are particularly vulnerable categories of road users. [1]

They are the least punished and the least controlled, which is why their behavior in traffic is overlooked by personal responsibility, awareness. The reasons for traffic accidents involving pedestrians are mostly non-compliance/ignorance of traffic rules and regulations by pedestrians, they often move outside the pedestrian crossing, talk on the phone etc. Although they are the most numerous and most massive pedestrian flows, in Macedonia the behavior of pedestrians has not been analyzed much.

On the territory of the city of Bitola, data collection was carried out on the number of pedestrians, their behavior when crossing a pedestrian crossing, whether they do it legally/illegally, whether they look left or right. The same data was entered into the AnyLogic software tool and a simulation of the movement of the pedestrians was made.

2. AnyLogic software tool

Simulation modeling solves real world problems safely and effectively. It provides an important method of analysis that is easy to verify, transfer and understand. Across industries and disciplines, simulation modeling is providing valuable solutions by providing clear insights into complex systems.

Simulation enables experimentation on a valid digital representation of a system. In contrast to physical modeling, simulation modeling is computer-based and uses algorithms and equations. Simulation software provides a dynamic environment for analyzing computer models while they are running, including the ability to view them in 2D or 3D. The uses of simulation in business are varied and are often used when conducting experiments on a real system is impossible or impractical, often due to cost or time.

AnyLogic Simulation Software is the leading simulation software for industrial and business applications, where over 40% of Fortune 100 companies use it worldwide today. AnyLogic's simulation models enable analysts, engineers and managers to gain deeper insight into and optimize complex systems and processes across a wide range of industry sectors, including logistics, manufacturing, transport, aerospace, defense and mining. [2]

AnyLogic simulation software is designed and developed by The AnyLogic Company, a multinational software company operating out of the US and Europe with a global network of partners including Engineering

Group and Engineering Industries excellence. Software applications offered by The AnyLogic Company include: AnyLogic - leading general-purpose simulation modeling software and AnyLogic Cloud, a private business environment for simulation model execution and integration. AnyLogic was the first tool to introduce multi-method simulation modeling and remains the only software that has that capability on the market today.

With the library, you can quickly and easily visualize any business process and verify results using AnyLogic's animation capabilities. Industry specific process modeling libraries included in AnyLogic are:
- A process modeling library for generic business or workflows;
- Fluid Library for simulating bulk cargo and transfer of liquids in industries such as mining or oil and gas;
- Library for rail transportation, terminals;
- Pedestrian library for pedestrian flows at airports, stadiums, stations or shopping malls;
- Library for road traffic for the movement of cars, trucks and buses on roads, parking lots and factories;
- Material handling library for production and warehouse processes.
- Pedestrian, rail and road traffic libraries provide detailed simulation of object movement and interaction at a physical level, which is not supported by any other general purpose simulation software tool on the market.[3]

2.1 Steps for creating a model in AnyLogic software tool

Step 1: After the program is installed, we can start working by clicking on the icon. The Welcome page is the first page we see when we first start AnyLogic. Its purpose is to introduce us to the product. The welcome content includes an overview of the product and its features, tutorials that will walk you through some basic tasks, samples to get you started, etc. It is shown in figure 1.
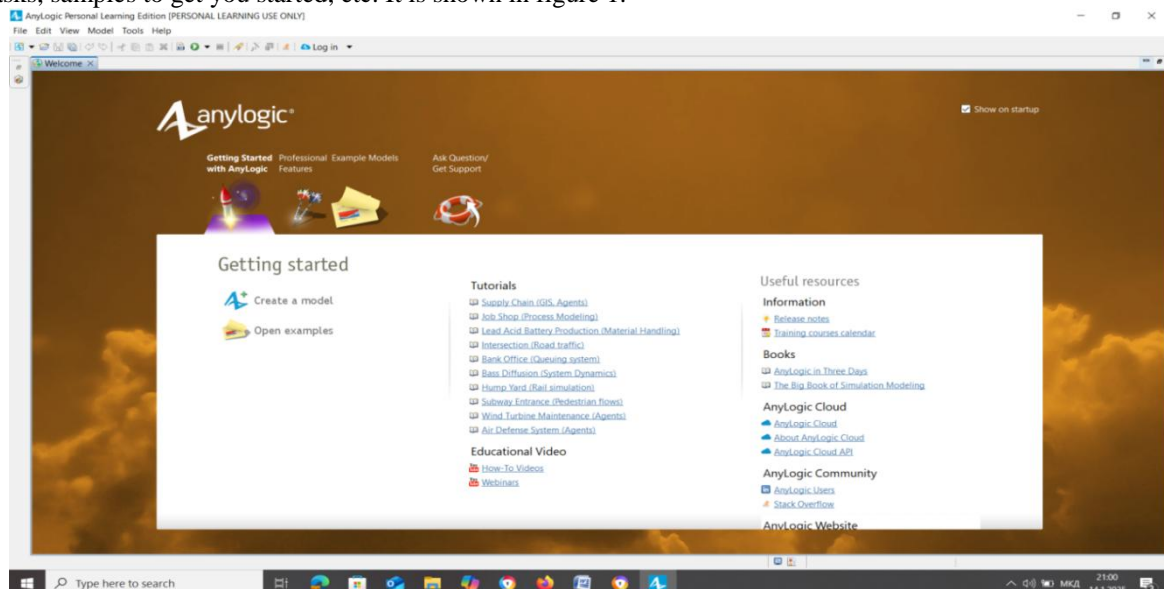

Fig. 1: Anylogic software utility window view

Step 2: Since we are creating a new model, in the following figure 2, we select Create a new model. It is also possible to open an existing one or to ask for some help, information about the software. In the Model name field, enter the name of the model we are creating. Since we are analyzing Solunska Street with Shirok Sokak, we name the model that way and click on the Finish tool.[4][5]
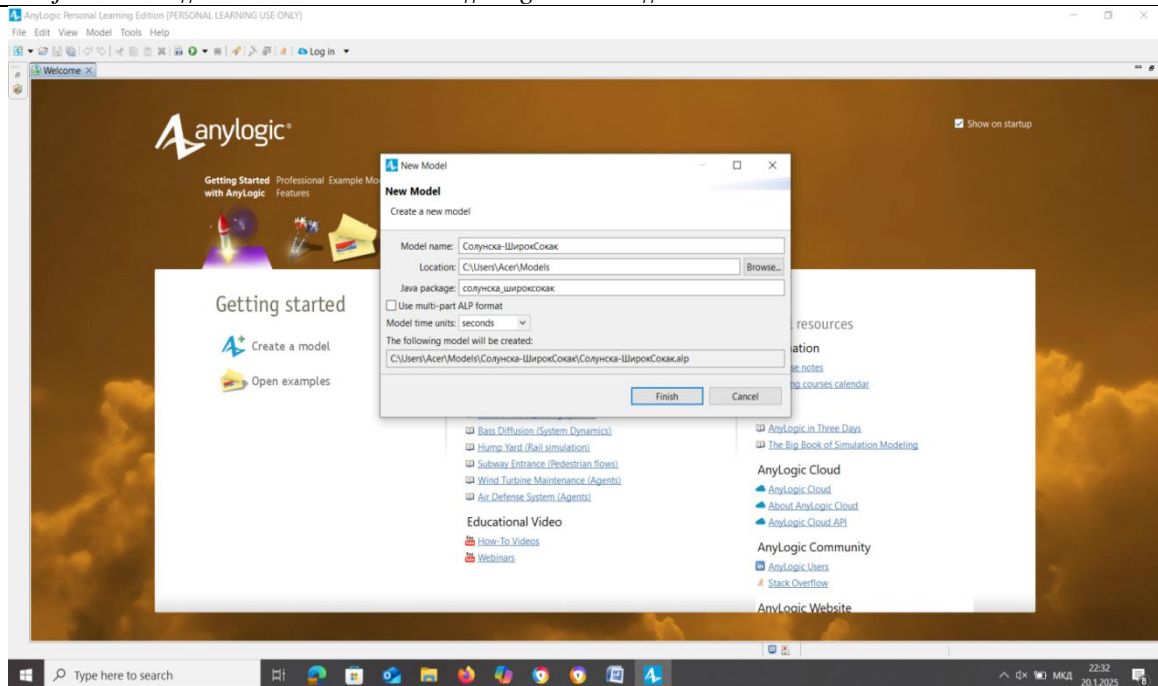
Fig. 2: Model naming

Step 3: In this step, the work window is shown, where you can notice the three fields, on the left - palette of tools and projects, the middle part - workspace and on the right - input of the necessary data for each tool (See Fig. 3).
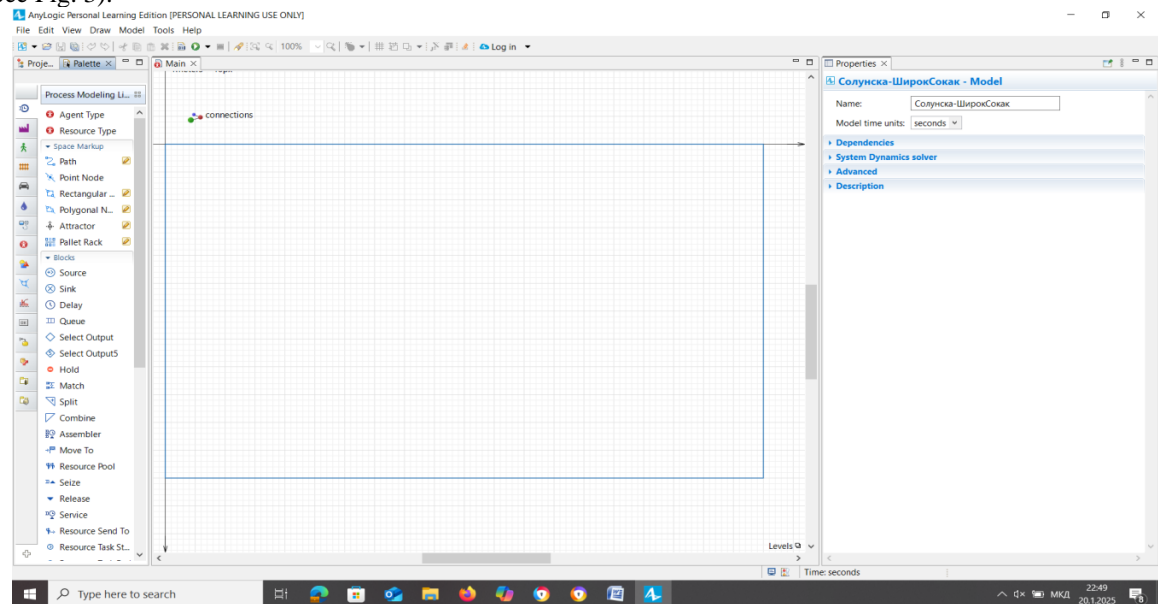

Fig. 3: Desktop view from the software

Step 4: First, we need to import a photo that we will work on. The photo was previously taken using the Google Earth tool, and shows us the location that is the subject of analysis. To import the photo, we use the following tools: Presentation – Image. We select the Image tool and drag it into the workspace (See Fig. 4).
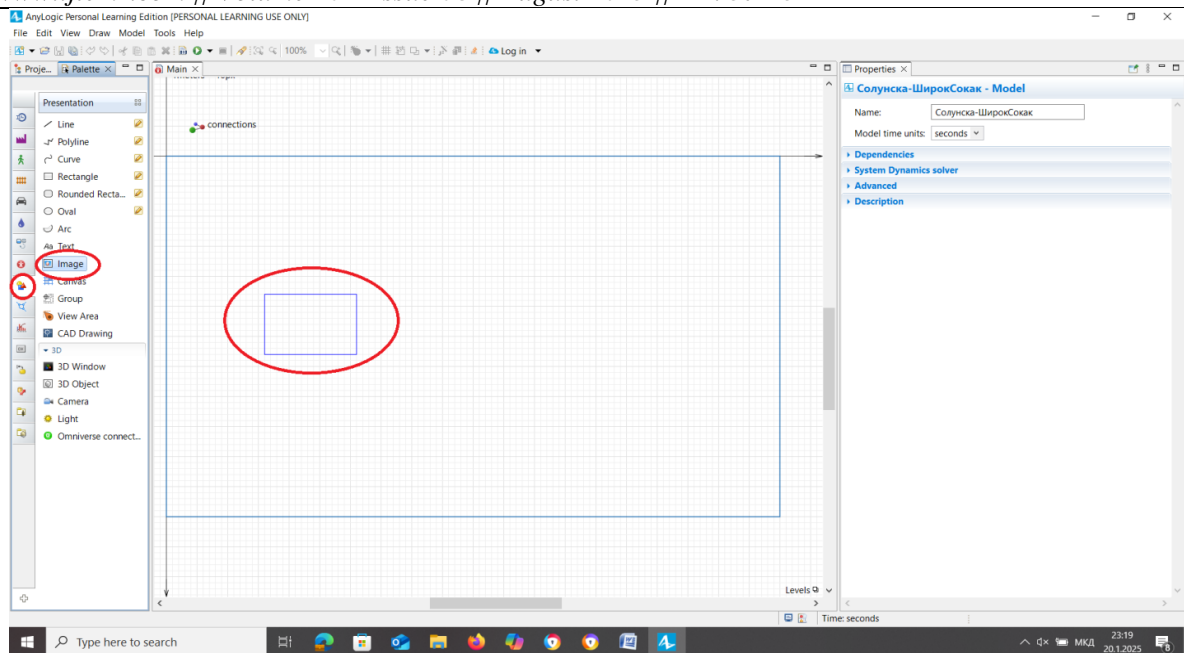
Fig. 4: Showing the location of the background input tool in the software

Step 5: This step shows the already entered background that will be worked on and the scale tool. Since the background is not to scale, we pre-measure some dimension in actual size and enter it into the software.
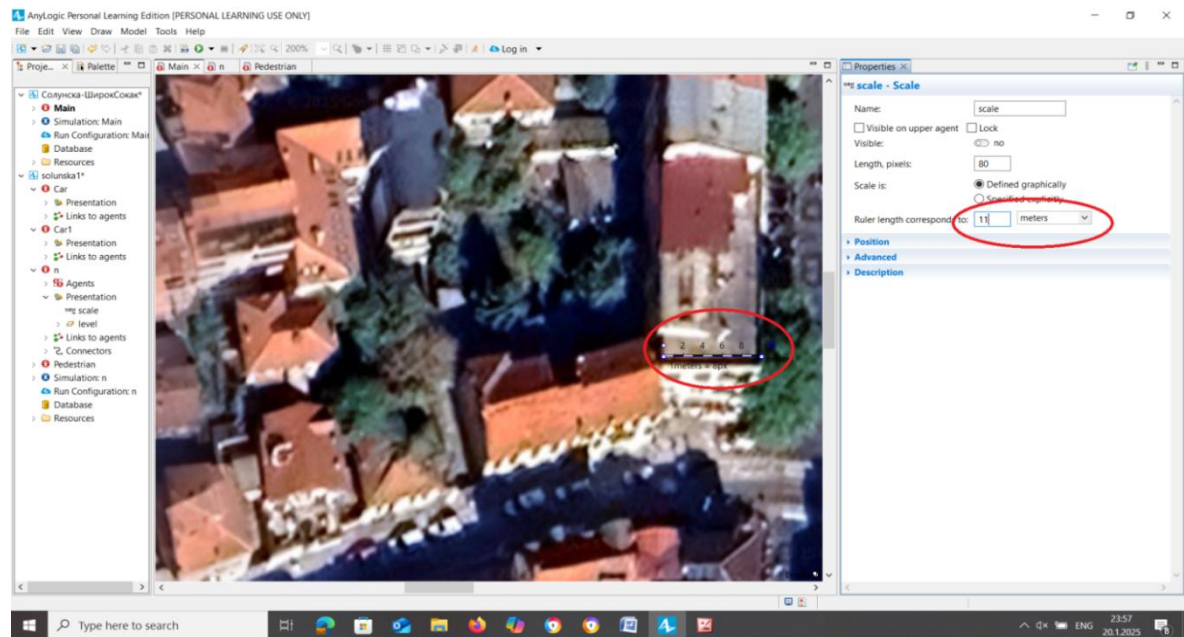

Fig. 5: Setting the scale of the background

Step 6: Plotting the traffic network, this step shows the location of the tool for plotting the traffic lane, correcting the parameters and setting the stop line. Solunska street is one-way, on both sides of the street we have parallel parking for vehicles.

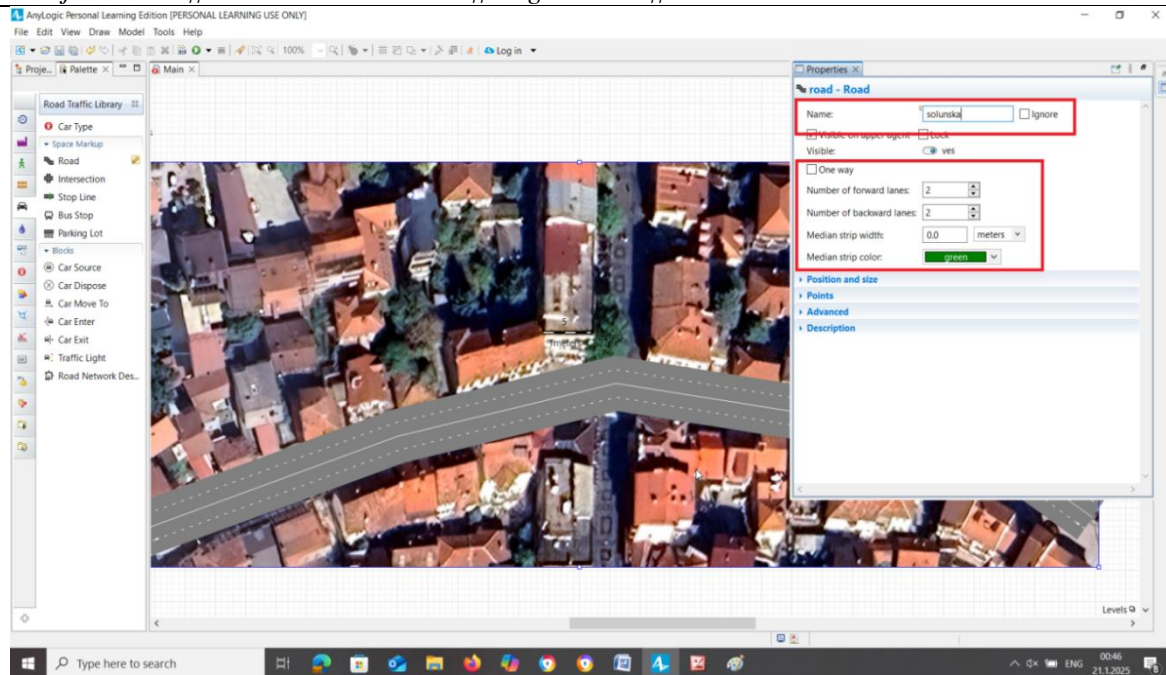From tools, we select the road traffic library and the road tool, that is, Road Traffic Library – Road.

Fig. 6: Display of the correction field for the number of traffic lanes

Step 7: In this step, the location of the tool for creating parking spaces and the stop line are shown (See Fig. 7).
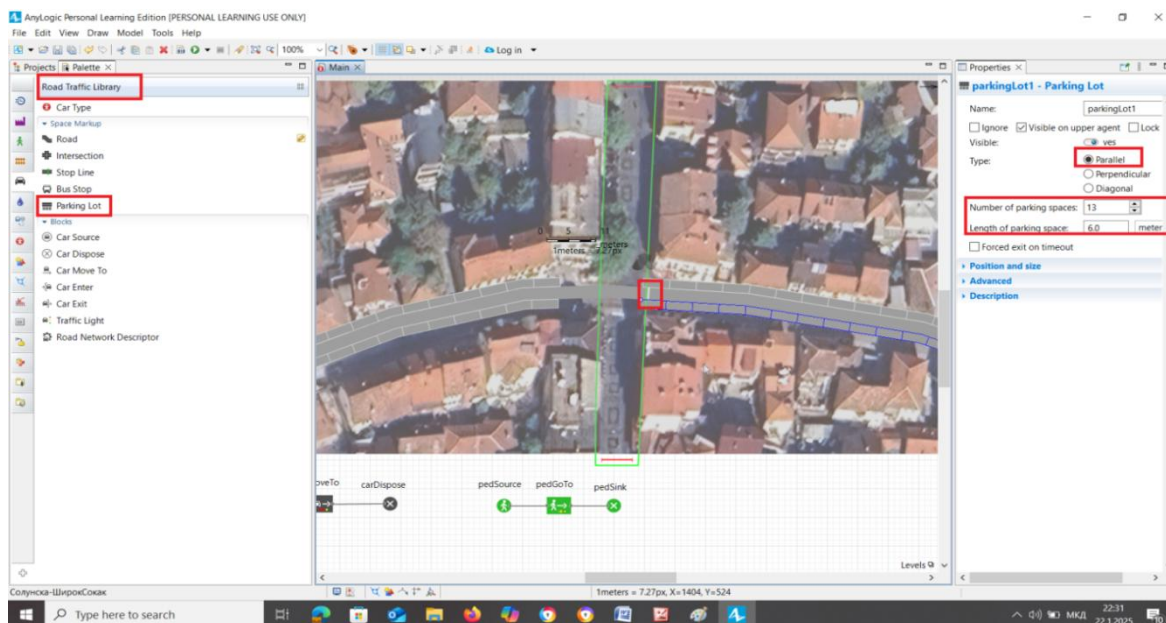

Fig. 7: The traffic network of the street in question is drawn

Step 8: Placement of blocks for road traffic In order for there to be movement of cars, we need to make one chain of three blocks. That is, we use the following blocks:
- Car Source – source of cars,
- Car Move To – movement of cars,
- Car Dispose – Removal of cars.

These blocks in other words mean assembling a pattern consisting of the location from where the cars appear, the movement of the cars along the intended path and the end of the movement.
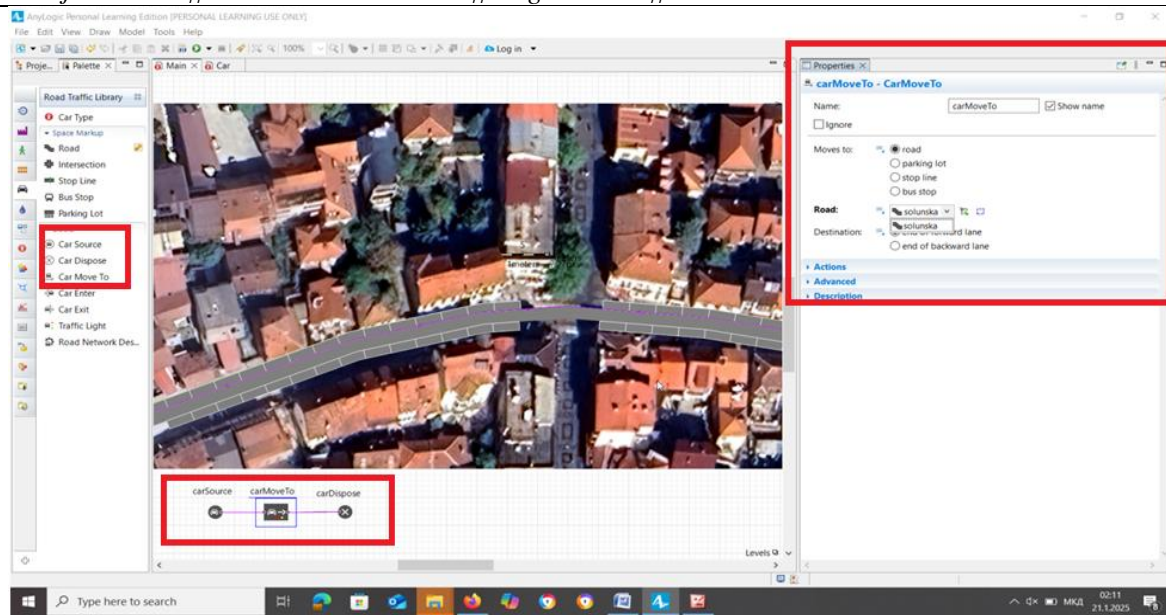
Fig. 8: Presentation of tools for creating blocks for motor traffic as well as defining parameters

Step 9: Drawing of the surface on which the pedestrians will move, that is, Shirok Sokak, as well as the starting and final destination. For both motor and pedestrian, we use the Wall tool from the pedestrian library (See Fig. 9).
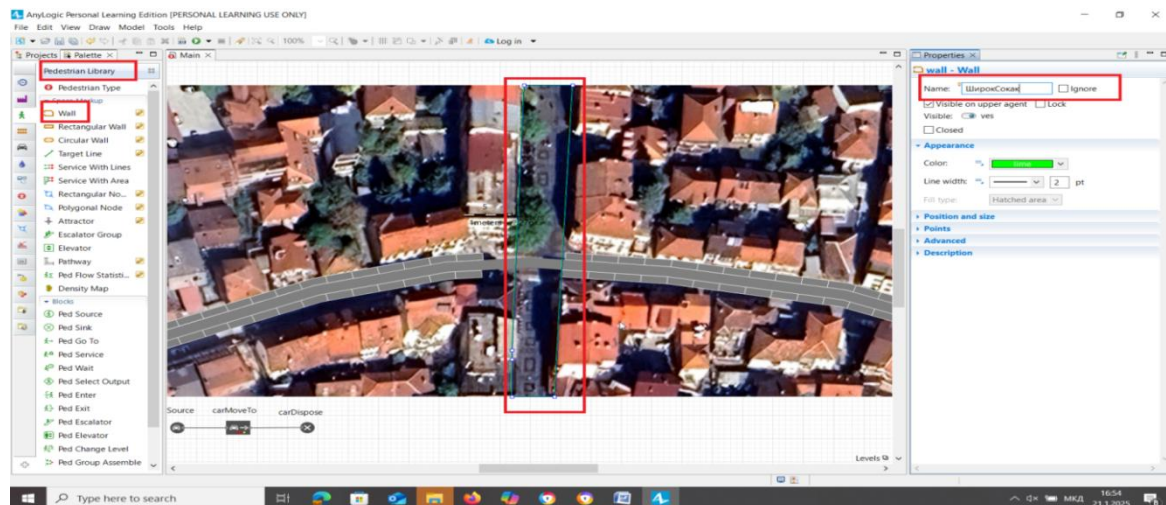

Fig. 9: View of the tool for the pedestrian surface

While we use the Target Line tool to draw the initial and final lines (See Fig. 10).
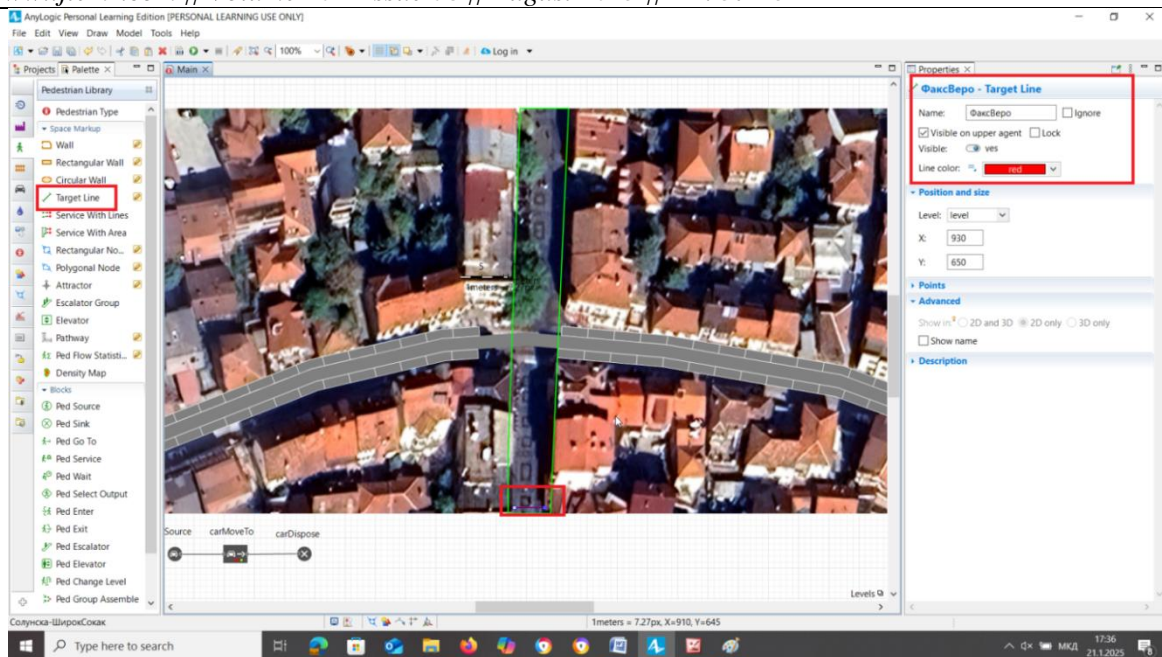
Fig. 10: Marked pedestrian walkways and starting and ending lines of movement

Step 10: In the same way as for pedestrian flows, we draw blocks to realize the movement from one point to another. Figure 11 shows the blocks and the parameters created.
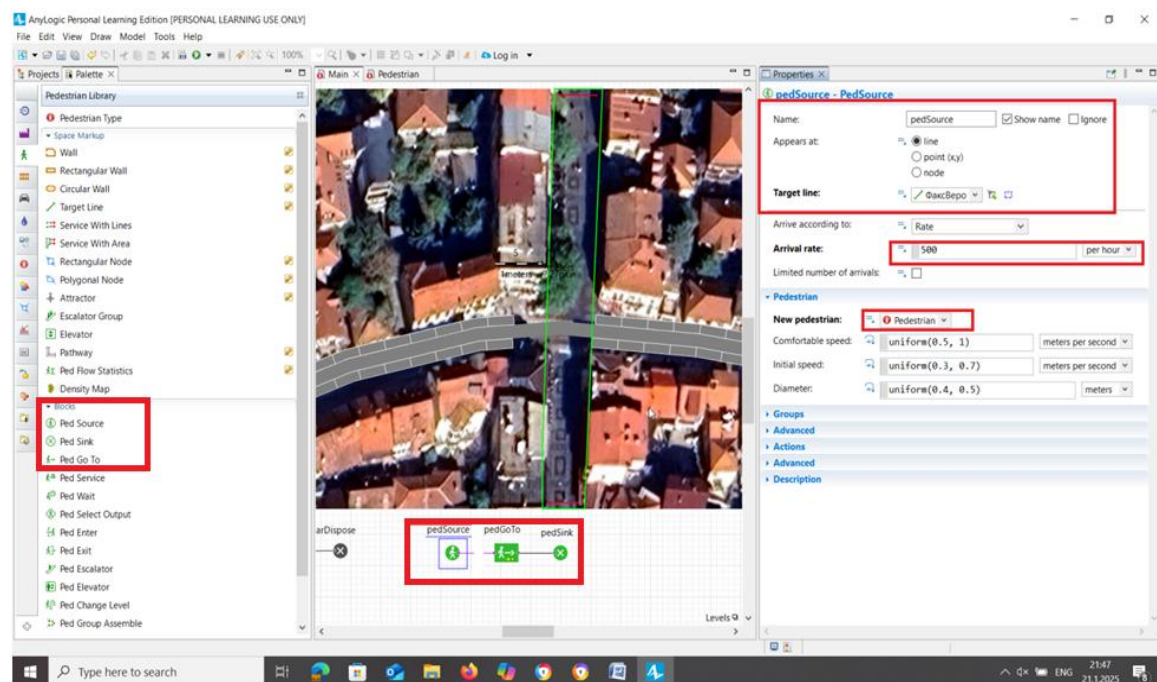

Fig. 11: Shows the blocks and the parameters created

3. Output from AnyLogic software

After we have created the model, entered the necessary data, drawn the traffic and pedestrian area, placed the blocks, the next step is to simulate the model. We start the simulation by clicking on the tool Build Model (F7), then on the tool Run Simulation. Placed vehicles and pedestrians are shown in 3D (See Fig. 12).
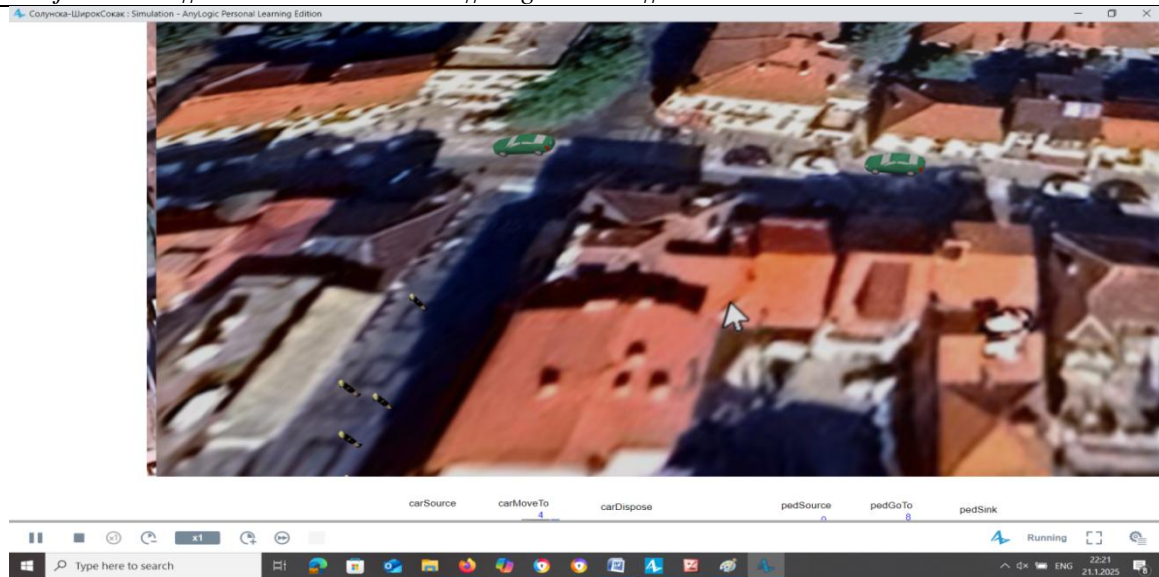
Fig. 12: Output from AnyLogic software

4. Conclusion

Traffic planning in urban areas using sophisticated computer software is a challenging branch for a traffic engineer. Traffic and planning are interconnected, for traffic to exist, a certain road must be planned in advance, but even to have a well-planned road, planning for its reconstruction in the coming years is necessary. [6][7] From the analysis of the Anylogic software tool, it can be said that it is an extremely current and used tool for analyzing and simulating vehicle movements as well as in the industry. The software tool offers a large range of tools and libraries whose analysis can be done in future research.

Advantages of the AnyLogic simulation software are:
- more intelligent decision,
- making, risk-free testing and research,
- saving money and time in the real world,
- providing insight into complex system dynamics,
- increasing the accuracy and visibility of data and processes,
- better handling of uncertainty and minimizing risks,
- improving planning processes and results,
- ensuring the quality of processes,
- products and services,
- reducing inefficiency and time to market. [8]

In this paper, we looked briefly at the basic steps needed to create motor and pedestrian traffic, and as an output we had the simulation of Solunska Street and Shirok Sokak in Bitola.

The research was done on a market day, when the flow of pedestrians at this location is the highest. Solunska is a street that intersects with the flow of pedestrians that move along Shirok Sokak.[9][10] The results of the field research show that pedestrians do not respect the rules and regulations in traffic, they often talk on mobile phones and do not look left and right when crossing the street.

For the needs of the software, a base was used from the location that was the subject of analysis, setting a scale of a previously measured dimension, delineating the traffic network, the area for pedestrians, stop line, parking spaces, etc. Creation of blocks for the implementation of road and pedestrian traffic.

Studying the basic steps of the software tool led to the creation of a simulation model.

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