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DEVELOPMENT OF URBAN MOBILITY FOR INTRODUCTION OF A PEDESTRIAN ZONE IN THE CENTER OF BITOLA USING A MICROSIMULATION MODEL

Key Words
Sustainable Urban Mobility Plan
City of Bitola
VISSIM

Abstract

The SUMP – Sustainable Urban Mobility Plan – introduced by the European Union in 2013, is a strategic mobility tool intended to promote sustainable activities at an urban level. The SUMP wants to improve the quality of life of citizens and to involve people and stakeholders in the decision-making process. SUMP contributes to achieving balance of social equity, environmental quality and economic development. It represents a new approach to traffic planning and does not replace, but complements and builds on the existing strategic documents of the city. Consequently, in the process of traffic and urban development, walking, cycling, public transport should be put into the first place, and then the use of private cars in a sustainable way. This paper is focused of developing sustainable urban mobility plan in center of city Bitola for safe urban space. In order to protect pedestrian and bicycle traffic, two variant of traffic solutions are envisaged, which envisage closing part of the streets for traffic, connection with a pedestrian street which result with continuous pedestrian street, introduction of a zone of calm traffic, application of a "contra-flow" bicycle lane on streets with one-way traffic regime and "Zone 30". For the variants of the traffic solutions were used a microsimulation model VISSIM.

1. INTRODUCTION

The SUMP – Sustainable Urban Mobility Plan – introduced by the European Union in 2013, is a strategic mobility tool intended to promote sustainable activities at an urban level. As key components, this requires a thorough assessment of the current situation and future trends, a widely supported common vision with strategic objectives, and an integrated set of regulatory, promotional, financial, technical and infrastructure measures to deliver the objectives – whose implementation should be accompanied by systematic monitoring and evaluation. The development and implementation of the Sustainable Urban Mobility Plan (SUMP) aims to reduce the negative impact of transport, improve the accessibility of persons and provide high quality of life, integrated and combined solutions and services for the movement of persons and goods. In contrast to traditional planning approaches, SUMP places particular emphasis on the involvement of citizens and stakeholders, the coordination of policies between sectors (especially transport, land use, environment, economic development, social policy, health, safety, and energy), and broad cooperation across different layers of government and with private actors [1] [2]. The concept also emphasises the need to cover all aspects of mobility (both people and goods), modes and services in an integrated manner, and to plan for the entire “functional urban area”, as opposed to a single municipality within its administrative boundaries.

In this paper is presented introduction of beginnings for future development of SUMP in center of the city Bitola for safe urban space. In order to protect pedestrian and bicycle traffic, two variant of traffic solutions are envisaged, which envisage closing part of the streets for traffic, connection with a pedestrian street which result with continuous pedestrian street, introduction of a zone of calm traffic, application of a "contra-flow" bicycle lane on streets with one-way traffic regime and "Zone 30". For the variants of the traffic solutions were used a microsimulation model VISSIM. Traffic modelling and simulation is one of the frequent tools used in road infrastructure design. Software tools designed for traffic simulations are an important supportive tool in decision-making and in choosing the optimal solution. The traffic on the selected area is modelled and simulated.

2. RESEARCH AREA PROBLEM

The subject in this paper is proposal of variant traffic solutions for improvement of the overall level of traffic service and increase of the safety of all traffic participants for street network in the central city area in Bitola. The purpose is to assess the operational performance of the existing street network and determine the impact of the planned changes in the traffic regime on the street network in the central city area in Bitola.

The problem in the central city area is congestion. The current situation of traffic in the city center of Bitola result with congestion from the large volume of traffic and parked vehicles in the city center is located the main pedestrian street Sirok Sokak

which is intersected by a street for motor traffic. Pedestrians and cyclists do not have their own movement areas, so safety is on low level.

The limits of the research scope are:

- to the north: 1st of May boulevard;
- to the west: st. Kuzman Josifovski, st. Borka Levata and st. Stevo Patako;
- to the south: st. Solunska;
- to the east: st. 4th November.

The spatial scope also includes the approaches to the intersections that are on the border of the spatial scope, in a length of at least 20 meters. The boundary of the spatial scope is shown in Figure 1.

2.1. Research methodology

In order to make optimal traffic solutions for the central city area in Bitola, activities were undertaken for data collection from basic documentation and traffic research on terrain which includes:

- manual counting and classification of vehicles according to the directions of intersections;
- manual counting of pedestrians at pedestrian crossings;
- manual recording of vehicle license plates on cordon;
- manual measurement of time and speed of travel on the route;
- monitoring the behavior of drivers in conditions of free flow and when standing in a column of vehicles.

Locations of terrain researching are presented on Figure 2.

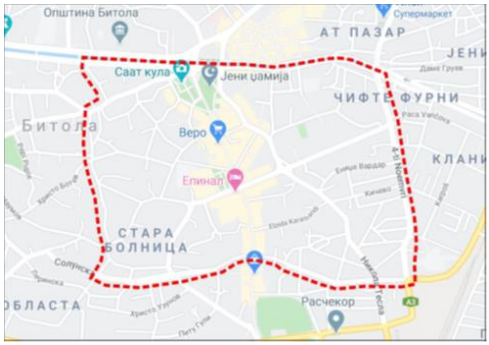

Figure 1. Boundary of the spatial scope

Figure 2. Locations of terrain traffic research

The purpose of terrain research is to obtain information about the total the traffic load at the intersections in order to determine the peak hour in the morning or afternoon period and the relevant hourly traffic load, as well as obtaining information on the distribution of flows by directions of movement and the structure of the flow. At most intersections, the traffic load is highest in the period from 15:00 to 16:00, due to which this period is determined as the peak hour.

2.2. Results of data collection

The total number of vehicles as well as the number of vehicles by vehicle categories in the peak hour for each intersection is given in Table 1. It can be seen that from the analyzed intersections, the busiest intersection is the intersection K5 (Nikola Tesla St. - Dimitar St. Ilievski Murato), while the smallest number of vehicles appears at the intersection K1 (street Kuzman Josifovski - Pitu and street Car Samoil).

Table 1. Relevant traffic load for characteristic intersections

Intersection	Cycle	Motorcycle	Vehicles	BUS	TV	Total
K1	31	38	354	1	5	429
K2	33	41	1178	11	22	1285
K3	19	24	926	2	35	1006
K4	25	30	986	21	119	1181
K5	56	68	1272	2	72	1470
K6	15	18	748	1	30	812
K7	63	76	908	1	40	1088
K8	18	23	669	0	22	732
K9	10	13	674	13	12	722
K10	23	28	1086	28	117	1264

The results of the pedestrian counting of pedestrian flows for the peak hour indicate that in the spatial scope, pedestrian flows are most pronounced at the pedestrian crossings located on the streets Dimitar Ilievski - Murato and Solunska which intersect with st. Sirok Sokak.

Based on the cordon recording of the license plates in the peak hour, results were obtained that refer to the number of vehicles entering and leaving the cordon. From the performed analysis of the registered license plates of the vehicles that entered or left the cordon, it was determined that more than 50% of the vehicles made transit, i.e. did not complete the trip in the spatial scope.

According to the results obtained from the observation of the drivers' behavior show that in 85% of the cases the drivers in free flow conditions move at a speed of up to 35 km/h, while the average distance between vehicles standing in a column is 1.6 meters.

3. DEFINING OF TRAFFIC VARIANTS

In defining variants process, respectively proposed measures in them, the concept of planning sustainable urban mobility with a focus on people and places and

ensuring accessibility and quality of life in order to deal with problems related to urban transport (traffic congestion and air pollution) and moving to a new one culture of urban mobility. This implies prioritizing spaces for walking, cycling and public city passenger transport.

Two variant solutions for phase realization are proposed.

Variant 1 which provides for the following major changes in traffic mode:

- transformation of the parking lot at the House of Culture into a public space – square,
- establishment of two-way traffic on Vienenska Street only for residents and visitors of accommodation facilities,
- closure for traffic of motor vehicles on part of st. Pece Maticevski and Dimitar Ilievski - Murato on the move from entrance / exit in Hotel Epinal to the building of the former JAT and transformation into a pedestrian zone, ie merging with the pedestrian street Shirok Sokak,
- introduction of "Zone 30" on the streets in the area covered by spatial conditions for providing sidewalks with a minimum width for safe pedestrian traffic, and
- introduction of "Zone of calm traffic" on streets in the area of coverage where there are no space conditions for providing sidewalks with a minimum width for safe pedestrian traffic with treatment at the entrance to the street.

The proposed traffic solution for variant 1 according the above changes in traffic mode is given in Figure 3.

Figure 3. Proposed traffic solution for variant 1

Variant 2 which provides for the following major changes in traffic mode:

- retention of changes from variant 1,
- change of the existing one-way traffic regime and introduction of one-way traffic regime on streets with existing two-way traffic regime,
- application of "counter flow" bicycle lane on the streets with one-way traffic regime and "Zone 30",

- closing for motor vehicle traffic on st. Wide alley of move from st. Jorgo Osmano to Blvd. May 1st and transformation into pedestrian zone, i.e. junction with pedestrian street Shirok Sokak,
- introduction of two lines for public city passenger transport,
- removal of street zone parking on st. Car Samoil and st. Borka Levata,
- transformation of part of st. Josif Josifovski in a pedestrian street in accordance with the approved basic traffic project, and
- transformation into a pedestrian street on a branch of Blvd. 1st May at the school St. Cyril and Methodius to the intersection with st. Nikola Tesla.

The proposed traffic solution for variant 2 accordingly the above changes in traffic mode is given in Figure 4.

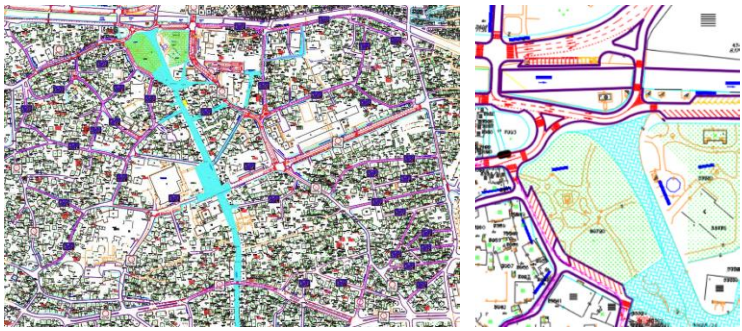

Figure 4. Proposed traffic solution for variant 2

4. DEVELOPMENT OF MICRO - SIMULATION MODEL

For the development of the micro-simulation model, i.e. making a microscopic dynamic simulation, the tool for micro-simulation modeling VISSIM was applied. The primary goal of the micro-simulation model is to evaluate the operational performance of the existing and street network as well as to determine the impact of the planned changes in traffic regime on the street network in the spatial scope. The process of developing the basic model for the base year in VISSIM in principle consists of three parts:

- modeling of a network of roads,
- entering traffic data, and
- calibration and validation of the model.

The network of roads, which is located in the spatial scope, is shown in Figure 5.

The process of creating models for scenarios in principle consists of 3 parts:

- defining scenarios,
- assessment of the future traffic demand,
- changes in the traffic network and transport service.

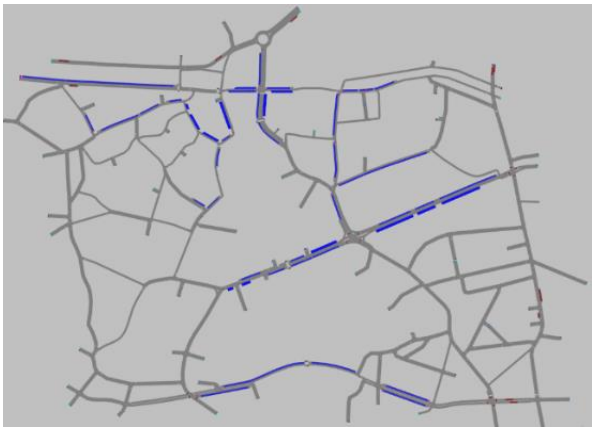

Figure 5. Network of existing roads in VISSIM

Traffic analysis includes performance at the intersection and corridor level performance in the microscopic simulation model developed in VISSIM for the current situation and proposed variants in the three time sections.

5. CONCLUISION

Planning for Sustainable Mobility is a strategic way of tackling transport and transportation problems in the modern way of life.

The development and implementation of the Sustainable Urban Mobility Plan (SUMP) aims to:

- reduce the negative impact of transport
- improve the accessibility of persons and provide high quality of life
- integrated and combined solutions and services for the movement of persons and goods

Unlike conventional methods of traffic planning which are constituents of all traffic studies done in the previous period, the contemporary method incorporated in SUMP means a significantly wider array of instruments of traffic demand management. The measures proposed in this manner mean a great number of soft measures of the encouragement of greater use of sustainable transport means.

The results for the cross-level effectiveness measures show that variant number 1 offers slightly better performance than variant number 2, but in order to encourage a change in travel habits by creating better conditions for the use of sustainable modes of transport.

The closure of the streets in question does not have a major impact on motor traffic, but it does have a major impact on the development of pedestrian and bicycle traffic.

The development of urban mobility affects the reduction of motor traffic in the downtown area.

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