THE 6th INTERNATIONAL CONFERENCE
"TOWARDS A HUMANE CITY"
Smart Mobility – Synergy between Sustainable Mobility and New Technologies
Novi Sad, 26th and 27th October 2017

THE ROLE OF PUBLIC TRANSPORT IN SUSTAINABLE URBAN MOBILITY PLANS

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Abstract: *Public transport is a key element when implementing sustainable urban mobility plans due to high operating capacity compared to private car, cheapest availability to residents, and rationality by space, environment and costs. Therefore, when creating these plans, the cities try to achieve modal shift for some city trips from private car to public transport and non-motorized modes. According to the stated, public transport always needs to be made more attractive to passengers. The paper addresses the role of public transport within the sustainable urban mobility plan of the City of Sisak, firstly by examining the current state of bus lines. The results of the analysis indicate poorly equipped bus stops, outdated vehicle fleet, low vehicle occupancy and satisfactory operating speed – all this resulting in only 8 % of city trips by public transport. To improve the quality of public transport service in the City of Sisak targeting 2017 and 2030, measures were suggested. The stated measures should then serve as a base to conduct high-quality projects in public transport sector, contributing further integration with other sustainable modes of transport.*

Key Words: Public transport, Integration, Sustainable urban mobility plan, City of Sisak

1. INTRODUCTION

Public transport is the backbone of sustainable urban mobility in cities due to the high operating capacity compared to the private car, availability for most citizens, and rationality in terms of space, energy consumption and the environment. In terms of one passenger transported, public transport requires the least amount of space, has the lowest transport costs and has the minimum impact on the environment among the motorized modes of transport. The mentioned above makes public transport the framework of the sustainable urban mobility plans.

Despite the unsustainable massive private car usage, private car is the main competitor to public transport because of shorter travel times and higher comfort. Most urban

environments in the EU face excessive private car usage, and consequently, the external costs become higher (as well as noise, pollution, traffic congestion, higher number of road accidents), causing the regressive investment policy in terms of economy. Therefore, when developing sustainable urban mobility plans, the cities aim to shift a certain amount of city trips from private car to public transport. In accordance to the fact stated, public transport needs to be made more attractive.

For developing sustainable urban mobility plans, the following documentation in the European Union is mandatory: Action Plan on Urban Mobility (COM 2009) [1], A call for smarter urban vehicle access regulations (SWD 2013) [2], Targeted action on urban road safety (SWD 2013) [3], Together towards competitive and resource-efficient urban mobility (COM 2013) [4], Guidelines – Developing and Implementing Sustainable Urban Mobility Plan [5]. All of them are based on the EU traffic policy (White paper 2011 – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system) [6].

The goal of the paper is to present the major measures for implementation in public transport, as well as additional measures for increasing public transport attractiveness. The purpose of the paper is to present conclusions about these measures, emphasizing their relevance for the sustainable transport development in the City of Sisak, with predictions for modal shift in favour of public transport in the future.

2. THE PRESENT STATE

Based on the current public transport state, an analysis was conducted to provide sufficient amount of data describing the current transport network in the City of Sisak, operated by buses. The analysis encompassed the current bus network, vehicle fleet, vehicle occupancy and operating speed. The network (Figure 1) consists of two de facto bus lines operating from the bus station to Željezara terminal, Line 1(3), Line 2(4), and a newly-introduced circular bus line from the bus station to Zeleni Brijeg neighbourhood on the northwest part of the city (Line 5).

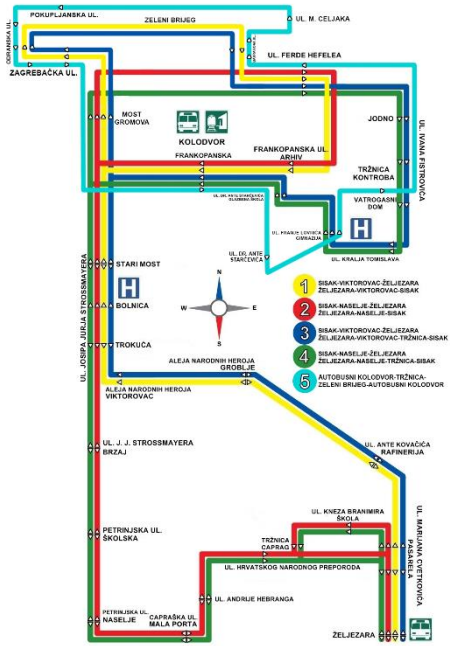

Figure 1. Public transport network scheme

The following conclusions were derived from the analysis:

- The vehicle fleet should be renewed by introducing new buses friendly to the environment, because the average vehicle age is above 15 years;
- The interval between buses should be shortened from 15 to 10 minutes in peak periods to improve the service and to attract more passengers;
- Vehicle occupancy is rather low – between 14 and 21 %, which is equivalent to buses where passengers occupy only the seats;
- Operating speed is between 18 and 19 km/h, which is in terms of dynamic performance a good characteristic for urban bus lines;
- The decline in the number of passengers transported between 2004 (2,3 M) and 2015 (1,3 M) is significant – 43 %;
- The reduction in the number of residents (2001 – 2011) of 9 % has an impact on the public transport demand;
- Inadequate bus stops and the bus station requires modernization and activities for better recognisability (branding);
- Public transport network has a good coverage – approximately 80 % of residents live in the 400-metre range.

In addition, the public transport operator conducts ticket pricing under a unique tariff system, in which the fare is the same no matter the relation passengers travel on. The unique tariff system has its advantages: it is simple, it is not difficult for passengers to understand, and ticket sale is a fast process.

3. PROPOSED MEASURES IN PUBLIC TRANSPORT

Based on the analysis of current passenger flows in the City, the measures have been proposed to redesign bus line routes to meet passenger needs. The key years for the implementation of solutions are 2017 and 2030, and the new network design is shown in Figure 2.

The changes in the public transport network suggested for the end of 2017 involve improving vehicle interval and the new traffic flow regulation in the city centre. The Line 1(3) route would be shortened in the north-eastern part. The Line 2(4) route would remain unchanged. The Line 5 is suggested to be extended. The public transport system is also suggested to be upgraded with a new line, which would connect eastern parts and the city centre. The introduction of the new line is suggested to be a pilot for the first 6 months, and afterwards, a decision on permanent introduction, line route adjustments or line cancellation would be proposed.

Due to the construction of the new bridge on the Kupa River in the southeast part of the City, changes for 2030 are suggested for lines 1(3) and 2(4). Line 3 route would be extended to the eastern part of the city. The modification of the Line 1 route is suggested, so that it becomes a completely circular line with the bus station as the only terminal, with 3 buses operating on the line. On Line 2(4), a shortening is recommended in direction towards the bus station. Because of this, passenger demand for transport to Zeleni brijeg would be taken completely by Line 5.

In the current state, Sisak Bus Station serves as a regular bus stop for public transport lines only, and therefore, the existing bus lines have only one terminal on their routes. In this manner, line route length and cycle time are rather large, resulting in problems related to the timetable execution in terms of punctuality and regularity of vehicles arriving at stops. Therefore, it is suggested to upgrade the Kolodvor stop into a terminal, considering cycle times as partial, which results in reduction of irregularities in timetable execution and increased punctuality in arriving at stops. Since Sisak Bus Station already has a bus stop for public transport lines, it is necessary to adjust the location of the Kolodvor stop to act as a public transport terminal, which will enhance the role of Sisak Bus Station as an intermodal passenger transfer point.

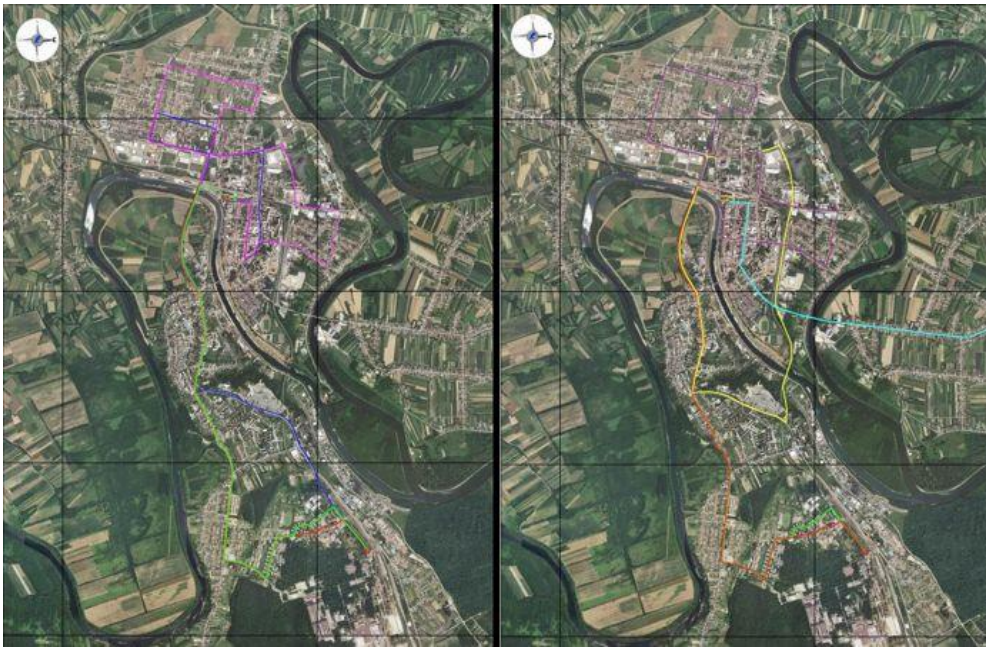

Figure 2. Public transport network proposal for 2017 (left) and 2030 (right)

To increase public transport usage, the tariff system needs to be simple with a reasonable number of tickets considering user needs. The fare charging scheme should be transparent, easily understandable, and efficient. Ticket sales points should be widely available, on as many as possible distribution channels, sales points located at the most important city locations, with ticket vending machines for automated ticket sales, via Internet or a smartphone app. It is suggested to make corrections in the existing tariff system by introducing single tickets valid for an hour, enabling passengers to use public transport independently of the direction or the route within the City. In this manner, fare charging for commuting would remain unchanged, because commuters mostly use public transport in different time periods; in addition, such decision would increase public transport usage among tourists, visitors or citizens that need to make a return trip in short time (shopping, private activities, etc.). To integrate public transport into a joint passenger transport system (train, inter-city bus, car sharing schemes, and similar), it is suggested to establish a project considering a joint tariff system which could provide detailed solutions for fare charging. It is necessary to completely avoid fare charging systems based on buying tickets in the vehicle. These kinds of systems mainly cause longer stop dwelling times, which makes cycle times longer, reduce cycle speed, and this results in the need to provide higher transport supply because the dynamic network performance becomes worse. Therefore, if the fare charging system with ticket sales in vehicles is chosen to be kept, it is necessary to reduce the number of sold tickets to minimum such that ticket sales are encouraged through alternative distribution channels (kiosks or the Internet), or the number of monthly sold tickets is increased (by interventions into tariff system).

4. EXPECTED RESULTS

In the current state, the vehicle interval on lines 3(1) and 4(2) is 30 minutes. On joint corridors, the average interval becomes 15 minutes. With these kind of intervals, passengers must rely on timetables when planning their journeys. Since the sustainable urban mobility plan has a goal to achieve modal shift of city trips from private car to public transport, it is necessary to reduce the interval between vehicles at least to 20 minutes on lines 3(1) and 4(2) (i.e. 10 minutes on the joint corridor) to make waiting times at stops acceptable for passengers who arrive at stops randomly. With adding one vehicle on each line, the result can be accomplished. This kind of change would result in increased operating costs in peak periods; however, the increased quality of service would expect to create modal shift of city trips from private car to public transport, which results in the increased number of city trips by public transport, and therefore, better public transport utilization and revenue increase for the service provider, as well as the decreased external costs produced by private car usage (pollution, noise, road accidents, etc.).

5. ADDITIONAL MEASURES IN PUBLIC TRANSPORT

The three major redesign measures in public transport described above (line routes, bus station, tariff system) are considered as basic and necessary for improving public transport service. However, in developing sustainable urban mobility plans, additional measures should be considered as well if the service wants to be improved for passengers. The measures proposed for implementation in the City of Sisak include:

- Bus stop renovation,
- Introducing real-time information displays,
- Wi-Fi in buses,
- Public transport promotion,
- Smartphone app,
- Bus park replacement with eco-friendly buses,
- Bus priority at signalized intersections,
- Public transport integration with suburban and intercity lines (bus or railway).

6. CONCLUSIONS

The analysis of the existing public transport in the City of Sisak revealed that public transport has a poor status among passengers. Therefore, the improvement requires several priorities – enhancing visual identity, adjusting line routes, decreasing intervals between vehicles in peak periods, and introducing new vehicles. In addition, the bus fleet must be monitored properly, i.e. roadworthiness coefficients (age and kilometres crossed), and the bus fleet must be renewed on-time by eco-friendly buses, to reduce the average bus fleet age to 10 years in 2030. Tariff policy measures dealing with the fare charging system are highly important. The ticketing system must be reliable, enabling simple passenger monitoring.

There is a series of measures that can also have impact on the passenger number increase and the increase of the quality of service in public transport such as: public transport promotion, Wi-Fi Internet in city buses, multi-modal application and bus priority on signalized intersections.
Considering high unemployment rates and the decreased number of unemployed people by 4 % until 2020, public transport must offer a high-quality service to attract new users on their routes to work. It is assumed that a high-quality public transport service should attract one quarter of the unemployed people, and that the number of trips in a workday should increase by a significant 10 % until 2020. An additional 10 % increase (until 2030) was planned to be achieved with shifting from private car to public transport.

7. ACKNOWLEDGEMENTS

This paper is a result of the project Sisak Urban Transport – Sustainable Urban Mobility Planning, which resulted in the developed Sustainable Urban Mobility Plan for the City of Sisak (January 2016 – March 2017) [8]. The project was conducted by the Faculty of Transport and Traffic Sciences of the University of Zagreb and Deloitte d.o.o., Zagreb.

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