Пут и саобраћај
Journal of Road and Traffic Engineering
Journal homepage: www.putisaobracaj.rs

E-mobility Concept Implementation in the Function of Sustainable Tourism Development Managing

Valentina Ivanović[a], Osman Lindov[a], Nikola Ivanović[b], Branka Spasojević[c]

[a] *Faculty of Traffic and Communications, University of Sarajevo, Sarajevo, B&H*
[b] *"Arhikon" Ltd. Design and consulting studio, Pale, B&H*
[c] *Public Institution "Tourist Organization City of East Sarajevo", Pale, B&H*

ARTICLE INFO

DOI: 10.31075/PIS.69.04.07
Professional paper*
Received: 18.10.2023.
Accepted: 08.11.2023.
Corresponding author:
Valentina.Ivanovic@fsk.unsa.ba
Keywords:
E-mobility,
Traffic,
Sustainable development,
Tourism

ABSTRACT

Planning as sustainable mobility development function requires new approaches and new planning concepts that encourage the transition to cleaner and more sustainable transport modes. Given the fact that electric mobility contributes significantly to the climate change mitigation through the reduction of pollutant emissions using different types of electric vehicles, it is necessary to consider the possibility of using e-mobility in order to strengthen the offer of tourist destinations while simultaneously protecting these areas from excessive noise, pollution, usurpation and deterioration of the quality and appearance of tourist areas. Considering that the city of East Sarajevo, as one of the tourist attractive local communities in terms of the tourist offer diversity with a scattered concentration of tourist destinations on predominantly hilly terrain, this paper will present the concept of introducing a bike-sharing system, an electric bus and an eco-taxi vehicle in the function of tourists transportation system with supporting infrastructure development plan, all based on tourist demand data analysis.

1. Introduction

In recent years, society is increasingly concerned about the environment and its pollution. State authorities strive to encourage society for accepting and using sustainable modes of transportation through their active commitment and action, both through the legislation creation and through the financing system. Consequently, a lot of people are accepting sustainable ways of mobility, whether it is due to personal attitudes and beliefs, or achieving certain savings or due to media pressure.

Tourism, as one of the non-productive branches of the economy, significantly affects the environment quality, due to mobility as the main actuator of tourism, and also because of the natural potentials degradation and area disruption. It is estimated that tourism on a global level contributes to the total world emissions of greenhouse gases with about 5%, of which about 40% belongs to aviation, 30% to automobile traffic and 20% to tourist accommodation.

2. Sustainable Mobility Management in Tourism

The precondition for sustainable tourism development is transport infrastructure development, so there must be a well-designed transport policy that meets current and future transport demand with the application of sustainable modes and transport technologies. In this sense, we should strive towards the strengthening and development of sustainable mobility, because a sustainable transport system in tourism means sustainable tourism at the same time.

A tourist place is considered to be one that meets the following basic conditions [1]:

- attractive (natural beauty, healing springs, cultural and historical monuments, various cultural, entertainment and sports events, etc.),
- communicative (possibility of access, traffic connections, etc.),
- receptive (accommodation facilities and accompanying facilities required for the provision of various services – trade, craft, PTT services, etc., as well as parks, swimming pools, promenades).

* Paper published at the 9th International Conference „Towards a Humane City" Reshaping Mobility, Novi Sad, 2023, ISBN: 978-86-6022-604-6, pp. 193-199

It is concluded that a certain place could not be categorized as tourist, regardless of its tourist potential, without adequate traffic communication.

2.1. E-mobility System Planning in the Function of Tourists Transportation

Electromobility (e-mobility) is a new mobility concept in urban areas that represents one of the most efficient and environmentally friendly transportation modes, which aims to achieve a sustainable balance between people, electric vehicles and the environment. This type of vehicle includes electric buses, electric taxis, electric bicycles, mopeds and electric scooters [2]. E-mobility has a positive effect on the greenhouse gas emissions reduction, as studies show that the reduction of CO_2 is from 11% up to 100% if the electricity for charging the vehicle is produced from renewable sources [3].

In order to minimize the harmful mobility impact in tourism on the environment, it is important to develop strategies to bring more people to their vacation spots in an environmentally friendly way, by establishing an adequate passenger transportation system to/from accommodation facilities, taking into account the comfort of passengers, their luggage and the spatial distribution of accommodation capacities. The biggest problem in traffic planning is the seasonal traffic capacities use and the uneven distribution of tourist flows, so it is necessary to find an adequate way of deploying and introducing sustainable e-mobility systems that can serve all categories of tourists in high tourist demand periods, depending on the electric way of transport type, distance and type of terrain where transportation is carried out.

For a detailed planning e-mobility process in tourism, input parameters related to tourist flows are necessary, such as number of tourists on an annual, semi-annual (seasonal) and daily level, the age and gender tourists structure, the number of tourists visiting certain tourist attractions, data on existing road infrastructure and public transport, parking spaces, etc.

2.2. Model of Implementation of the E-mobility System in the Tourist Offer of the City of East Sarajevo

Due to the great tourist potential in the city of East Sarajevo area, tourism represents a strategic economic branch. The most important tourist facilities that are available in this area for tours are mountains for winter and summer tourism (skiing, children's winter sports, mountaineering, recreation, adrenaline sports, paragliding, gondola rides), cycling, speleological facilities, picnic areas, waterfalls, lakes, sources of rivers, etc. The most frequently visited tourist destinations are Jahorina (Dvorišta), Trebević (Brus, Tvrdimići) and Romanija Mountain, Ravna Planina, The Orlovača Cave and the Miljacka Spring.

The proposed concept of implementing the e-mobility system is based on the assessment of tourist demand in the winter and summer seasons and the most visited City destinations data. This concept in terms of available transport capacities can satisfy the needs of sustainable mobility in a trial period of exploitation, where it is necessary to provide the expanding capacities and supporting infrastructure possibility in accordance with the tourist needs determined on the functionally designed and developed system basis of monitoring and data recording. Having this in mind, it would be necessary to predict the possibility of introducing the following measures as soon as possible:

- Restriction of entry into the tourist destination area without prior notice;
- Adoption of regulations that will regulate the practice of submitting data on the number and structure of tourists who rent accommodation;
- Increased inspection supervision regarding the rental of accommodation facilities;
- Establishing quality cooperation between the Tourist Organization, authorities, inspection authorities, restaurants and transport companies in order to data exchange;
- Establishing of e-reservation system and purchase of transport tickets.

According to the data of the Statistical Office of the Republic of Srpska on tourist arrivals and overnight stays by municipalities and cities in 2021, about 82% of arrivals and about 91% of overnight stays were realized in the area of the municipality of Pale out of the total realized in the city of East Sarajevo area [1], [3]. According to the data on the number of ski passes sold in the winter tourist season on a daily basis, which is about 20,000, it can be concluded that there is a great need for mobility on a daily basis. Tourist flows are served by traditional ways of transport (passenger cars and buses powered by internal combustion engines). Hereof the need to start the process of implementing the sustainable e-mobility concept as soon as possible.

The proposed E-mobility model of the tourist transport system in the city of East Sarajevo includes the following:

- Bike-sharing system of electric bicycles with accompanying infrastructure;
- Electric buses with accompanying infrastructure;
- Eco-taxi service for transporting tourists within and between tourist centers.

The most optimal solution for the positioning of the e-mobility main center is the location "Famos" next to the main (transit) road in Pale, where is planned the departure station of the gondola to Jahorina.

Within the facility of this e-mobility center would be the main e-bus departure point, a space intended for electric bicycles based on the bike-sharing system principle, and a place for eco-taxi vehicles, all with accompanying charging infrastructure connected to solar panels (e-charging stations with 22kW power with a charging time of a completely empty bus battery in about 8.5h and at least two up to 150kW power with a charging time of about 2.5h) and adequate parking space. There is also planned a space for providing tourist information and services, as well as buying train tickets and renting bicycles.

In order to make the e-bike-sharing system functional, it is also necessary to install rental equipment in Jahorina and Trebević. In order to serve tourists with electric buses, it is planned to introduce at least three departures (morning, midday, evening) from Pale on the routes Pale – Dvorišta - Jahorina, Pale - Sumbulovac (The Orlovača Cave) - Romanija, Pale - Trebević (Brus) - Tvrdimići, which will be served by two electric buses. For the e-buses function, it is necessary to install one arranged stand in Dvorišta along the main road, one stand in Trebević (Brus) with an e-charging station and one arranged stand in Romanija. When planning the installation of equipment, the locations of existing e-charging stations should be taken into account. All existing bus stands can be used for the passengers entry and exit, with the fact that they need to be arranged and adapted for tourists (tourist maps with all important information about transportation) and, if possible, equipped with wi-fi internet. For eco-taxi transport services, in addition to the main stand in Pale, it is necessary to install stands in Jahorina and Trebević (Brus) with e-charging stations. There is a possibility that the number of places intended for eco-taxi vehicles can be increased for already existing taxi stands by decision of the City, without endangering private taxi carriers.

Figure 1. E-mobility center Pale
Source: Ivanović, N. (2023). Conceptual solution of the E-mobility center Pale. Arhikon Ltd.

The proposed e-mobility model was suggested on the situation in terms of different distances between tourist attractions and accommodation facilities, the possibility of overcoming different distances on extremely hilly terrain, the diverse structure of tourists in terms of age and ability, the possibility of communication with remote places and monitoring current needs and tourist movements. However, in order to determine the required number and capacity of vehicles more precisely, their schedule depending on the period of the day and season, and to create a timetable for electric buses, it is necessary to carry out more detailed analyses.

Prerequisites for the e-mobility system implementation:

- Create a sustainable urban mobility plan for the City of East Sarajevo with precisely defined measures and activities with strict monitoring and evaluation process;
- Approach changes in regulatory plans in order to systematically solve traffic infrastructure problems in accordance with the sustainable urban mobility plan and regulations;
- Establish an electronic system for quality monitoring of tourist flows (by introducing mandatory prior announcements of visits to each tourist destination);
- Access to rehabilitation of existing and construction of new traffic areas;
- Application of traffic policy instruments regarding to more expensive parking fees or payment for the accommodation facilities access roads use or tourist centers for passenger vehicles with internal combustion engines, depending on the possibility of legal regulation of such measures;
- Logistics problems solving system, i.e. supply of accommodation and other catering facilities in terms of time service time and type of vehicle for logistics;
- Informing public about new sustainable transportation modes;
- Creation of accurate maps of tourist centers in digital (with navigation) and printed format, with all essential data and informations;
- Solving the problem of digitization and public access to wi-fi internet in tourist areas, especially in rural areas, in order to facilitate the sustainable transport use;
- Establishing cooperation with sustainable mobility companies and the electric vehicles sale/rental companies with the aim of obtaining possible subsidies;
- Establishing cooperation with an electricity supply company in order to conclude special contracts on subsidies for vehicle charging;
- Formation of the ownership structure at the level of the City over the e-mobility system;
- Establishing cooperation with transport companies;
- Adoption of regulations on taxi transport in terms of subsidies provision for e-vehicles;
- Defining an appropriate and non-discriminatory tariff policy for transport services by sustainable mobility forms, with the provision of introducing privileges/rewards for using e-mobility instead of traditional transport forms.

3. The Significance of E-mobility System Implementation in Tourism

In modern globalization, we are faced with rapid economic growth as well as its negative environment impact. If we take into account the fact that both traffic and tourism are a segment of the economic system of a country, it can be concluded what consequences their synergy has on the environment. However, in recent years, interest in ecologically clean and sustainable modes of transport has expanded, thus creating the basis for the sustainable tourism development.

The benefits of sustainable mobility and sustainable tourism can be felt most by those local communities that have significant tourism potential and have developed tourist offer, one of which is the city of East Sarajevo. The advantages of the e-mobility system implementation in the function of sustainable tourism development of the city of East Sarajevo are:

- Environmentally friendly ways of transporting without harmful gases emissions;
- Easier fleet maintenance due to efficient vehicle operation;
- Possibility of cheaper charging and cheaper self-driving;
- Significant noise reduction in tourist centers;
- The sustainable transport using possibility for the needs of the local population;
- Relieving the traffic network and preserving its quality;
- Reducing the need for additional parking facilities;
- Preservation of areas, as well as the natural beauty of tourist destinations;
- Preservation of the life quality of the population in rural areas;
- Possibility of contribution to tourism by the rural areas population;
- Easier and more financially acceptable communication with extremely rural areas;
- The possibility of planning transport capacities depending on tourist demand.

References

[1] The Republic Institute for Statistics of the Republic of Srpska. (2010). Cities and Municipalities of Republika Srpska. *Statistical Bulletin*. vol. 10, 160.

[2] Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH. (2020). *Sustainable urban mobility plan of the Canton of Sarajevo and the City of Sarajevo – SUMP*, 55.

[3] Ćurković T. et al. (2017). *Electromobility. Learning about electromobility within the "Learning E-Mobility" project*. Zagreb: Road Traffic School.

[4] The Republic Institute for Statistics of the Republic of Srpska. (2022). *Statistical Yearbook of Republika Srpska*.

[5] Ivanović, N. (2023). Conceptual solution of the E-mobility center Pale. *Arhikon Ltd*.