9th INTERNATIONAL CONFERENCE
''TOWARDS A HUMANE CITY"
Reshaping Mobility
Novi Sad 19th and 20th October 2023

Filip Dobrić[1]
E-mail: filipdobric@yahoo.com
Miljana Djukić[1]
E-mail: miljadot@gmail.com
Mladen Dobrić[2]
E-mail: dobric_mladen@yahoo.com
Milan Simeunović[1]
E-mail: milansim@uns.ac.rs
[1] Faculty of Technical Sciences, University of Novi Sad
Trg Dositeja Obradovića 6, 21000 Novi Sad
[2] Faculty of Economics and Engineering Management (UBAINS)
Cvećarska 2, 21000 Novi Sad

UNINTERRUPTED PASSENGER TRANSPORT – E-SCOOTER TRANSPORTATION TRAILERS

Keywords

E-scooter
Bus trail
Mobility
Transport

Abstract

Recent years brought the rise in electric scooters (e-scooters) use that has transformed urban transportation and general mobility. These compact and eco-friendly vehicles provide an efficient means of commuting within cities. Challenge lies in integrating e-scooters into existing public transportation systems. Bus trailers offer a promising solution, enabling convenient and sustainable e-scooter transportation.

1. INTRODUCTION

In recent years, the rise of electric scooters (e-scooters) has transformed urban transportation. These compact and eco-friendly vehicles provide an efficient means of commuting within cities. However, the challenge lies in seamlessly integrating e-scooters into existing public transportation systems. Bus trailers offer a promising solution, enabling convenient and sustainable e-scooter transportation.

E-scooters by capacity characteristics cover in most cases only short travel distances, on the door-to-door principle. By incorporating bus trailers dedicated to e-scooter transportation, public buses can bridge the gap between major transit hubs and final destinations. Passengers disembarking from a bus can quickly access an e-scooter from the trailer, thus becoming drivers of their scooters, allowing for an uninterrupted and efficient transition.

In densely populated urban areas, time and space optimization is crucial. Bus trailers for e-scooters maximize the utilization of limited transportation infrastructure. Rather than allocating separate parking areas or docking stations for e-scooters, which can be space-consuming and costly, bus trailers offer a flexible and compact solution. It acts as an intermodal bridge for uninterrupted urban mobility.

Figure 1. E-scooter driving

Figure 2. Bus train on road [5]

One of the primary objectives of incorporating e-scooters into public transportation is to alleviate traffic congestion and reduce carbon emissions. By encouraging commuters to use e-scooters combined with buses for shorter distances, bus trailers could help decrease the number of private vehicles on the road. This potential reduction in traffic congestion could result in smoother traffic flow leaning to a sustainable urban environment.

In this light bus trailers can help create a harmonious link between bus system of public transportation and e-scooters, as personal vehicles. Commuters can effortlessly transition from buses to e-scooters, enjoying the benefits of both modes of transport without disruptions. This seamless multimodal experience encourages greater adoption of sustainable transportation options.

Integrating e-scooters into public transportation can be a cost-effective alternative to establishing separate infrastructure. Compared to constructing designated e-scooter stations, charging stations, and traffic routes, bus trailers require minimal investment. This cost efficiency makes the adoption of bus trailers for e-scooter transportation an attractive and transitory option for transportation authority’s seeking sustainable and budget-friendly solutions.

2. E-SCOOTER SPECIFICATIONS

Since there is a lot of different types and models of e-scooter on world market, as well as in Serbia, for the purpose of taking of a model into account, the most approachable model in use will be emphasised.

Most affordable model of an e-scooter mostly used on the streets of Novi Sad is “Xiaomi 3 Lite” [6].

Table 1. E scooter characteristics

XIAMI 3 LITE CHARACTERISTICS	
Speed [km/h]	25
Range [km]	20
Weight [kg]	13
Carrying capacity [kg]	100
Nom. Power [W]	300
Dimensions [mm]	1105x430x1137
Driver height [cm]	120 - 200

Figure 3. Xiaomi 3 Lite e-scooter [6]

Due to the characteristics of e-scooter in consideration, it is clear that onboard requirements of bus trails would not need to significantly change interior design of passenger compartment to meet the needs of a combined passenger – scooter transport.

3. ROAD BUS REQUIERMENTS

A bus designed for transporting e-scooters would have certain features to accommodate the unique requirements of these vehicles. Some characteristics that such a bus might have should be:

- Special necessity capable of safely suiting every passenger and his e-scooter,
- Potential in-bus charging system: Using the on-bus travel time to the advantage of further e-scooter travel range. This would allow the e-scooters to charge while being transported, ensuring they are even more ready for use upon arrival to the desired destination.
- Tie-down or securing mechanisms as well as passenger safety: The bus may feature mechanisms such as straps, clamps, or locking systems to securely fasten the e-scooters in place, preventing them sliding through passenger compartment during transit. Standing posts for passengers with adequate handrail equipment, depending on the transportation capacity.
- In-Out Accessibility: The interior layout of the bus should provide enough space for passengers to comfortably board and disembark with their e-scooters. Wider aisles and designated side areas with regard to e-scooter manoeuvre necessities.

- Information displays: Screens or digital displays that provide information about the location, charging status, and availability of e-scooters within the bus. This option would have its elementary purpose to inform the outside users on the number of free stands inside the bus.

It's important to note that as e-scooter transportation evolves, bus manufacturers and operators may need to explore innovative solutions to meet the needs of this growing mode of transportation.

Possible solution to this transportation project could be Suisse HESS BusTrain [7]. HESS BusTrain, transport companies can react on-site to fluctuations in passenger numbers and save overcapacities and fuel: At lower passenger frequency, the economic standard bus is used, and at peak times, the trailer is used.

In short, HESS BusTrain generally manufactures buses as well as bus trails for passenger transport. Thus, bus trails can be custom made, and set up to match the towing characteristics of the bus.

Figure 4. HESS BusTrain [8]

Next thing is to analyze the interior of the bus trail in question, and consider remodeling options, to match the needs of potential e-scooter/passenger transport.

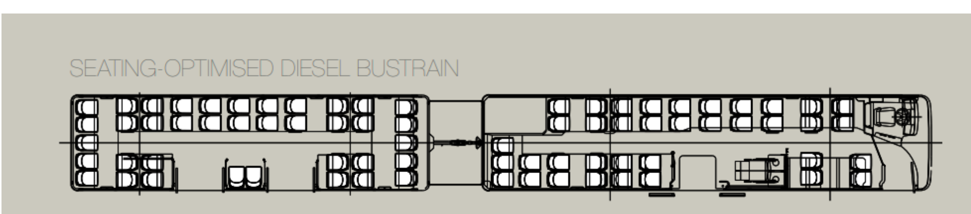

Figure 5 – Schematics of a HESS BusTrain featuring Bus and the trail [8]

In order to adapt existing bus trail to meet the needs of wanted transport, all seats or most of them need to be removed to make way for standing room, since most of e-scooter users are pictured standing and holding on to the handrail with one hand, while holding on to their e-scooter with the other during transportation.

Regarding standing/seating positions on-board the standard HESS bus trailer type, number of seats is app. 28, while the standing room numbers 57. For the case of proposed intermodal system, this would need to change. Since the dimension of e-scooter do not change much in spatial sense as compared to exclusive passenger transport, the only necessity in trailer interior change is to have minimum number of seats, and therefore maximum in standing room. This would also imply more handrail joints, and potential safety rails, for safe transport of e-scooter, as well as their charging ports.

Initial difficulties in a system like this would be longer detains of busses in stations, due to the slower disembark of e-scooter equipped passengers, opposed to those that are just regular passengers in the bus (towing vehicle). This would further leave consequence of proposed time schedules of stationary buss arrivals, which in case of implementation would have to be compensated through time redistribution.

All things considered for “pilot” laps of the potential reprogramming of the existing public transport mode, approximately the same number of standing passengers that can be transported, could be equaled to the potential number passengers of intermodal system linked to the e-scooter use.

The question of safety of passengers must be considered, first and foremost by choosing adequate selection of public transportation lines that correspond to the densest network of e-scooter urban mobility routes. Prone to this in consideration must be put the safety of regular passengers, and their potential endangerment by e-scooter passengers on stations, during embarkation and disembarkation.

4. DISCUSION

Due to the increasing use of e-scooters for the purpose of urban mobility, in most world urban centers, it would not be unusual for the proposed system to find its integration spot inside the Novi Sad public transport network. Due to its ease of conjuring with the existing public transportation system, a combined intermodal transit system could emerge, benefiting both the passengers as well as the public transportation operators.

Pros for such a system would definitely be shorter travel time, maneuver independence and a cost-efficient transportation benefits. Cons of such integration would definitely highlight the absence of adequate regulations, which could take e-scooter into lawfulness, thus disabling the chaotic movement and misuse of various traffic surfaces and areas by mostly, in terms of traffic regulations and traffic safety, uneducated and unaware e-scooter users.

5. CONCLUSION

Bus trailers present a viable and efficient means of integrating e-scooters into existing public transportation systems. By utilizing these trailers, cities can enhance last-mile connectivity, optimize space utilization, reduce traffic congestion and emissions, achieve seamless multimodal integration, and do so in a cost-effective manner.

The combined efforts of e-scooters and bus trailers have the potential to revolutionize urban transportation, creating more sustainable and accessible cities for the future.

ACKNOWLEDGMENT

This work has been partially supported by the Ministry of Education and Science of the Republic of Serbia within the Project "Development and application of modern methods and technologies in education and research in traffic and transportation", University of Novi Sad, Faculty of Technical Sciences.

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