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GREEN SOLUTION FOR CLEAN ENVIRONMENT: THE CASE OF SKOPJE, MACEDONIA

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Abstract

Many countries face environmental problems along with traffic jams, over-crowded traffic and poor public transportation system. The paper elaborates a project idea of introducing a new sustainable city transport in the capital of Macedonia, based on light and electricity driven monorail system. Yet, the research does not attempt to provide a detailed map applicable to solve pollution problems of Skopje, but rather to suggest framework for serious consideration for answering profound issues, like the nature of urban air pollution, pollution sources, and available resources. Moreover, the study posts some valuable recommendations for developing monorail as probably the only permanent solution that may improve environmental footprint of Skopje. By following many positive world-wide examples, the paper proposes a scheme in which local and central policy makers may approach in selection and implementation of internationally based experiences. It places a special emphasis on how to coordinate policies across many sectors that are closely linked to the mitigation of air pollution from city urban transport, in the first line environment, transport, and energy. Greater use of public transport offers a single most effective strategy currently available for achieving significant energy savings and environmental gains, without creating new government programs or imposing new rules on the private sector. Consequently, Skopje may have fast, reliable, modern, ecologically friendly and long-term sustainable city transport.

Key words:

Energy; Clean environment; Monorail.

INTRODUCTION

Monorail (MR) is a modern, economical and environmentally friendly, fast and widely-used way for urban transport, particularly applicable for large city environments. Many countries worldwide apply this way of urban transport due to many advantages that it

has. Today, such systems are widely used in almost all major world cities in the United States, Japan, Germany, Australia, France, Sweden, South Korea, Taiwan, Canada, China, etc.

Up-to-date, various models of new city transportation system have already been discussed, such as the gasification of the buses and/or procurement of new electric buses, up to introducing trolleybuses or even trams. However, so far, no model has been introduced or even deeper investigated. Some are just make-up solutions (gasification), others are not suitable due to existing overcrowded city structure and its geographical characteristics (trams), or their implementation needs totally new and expensive infrastructure that leads to additional traffic congestions (trolleybus and tram). Introduction of a subway was quickly rejected due to extremely high investment cost and lack of feasible number of passengers (needs > 20,000 passengers/hour) to justify such high investment costs, make it cost-effective and evaluate properly the possible alternatives (Azar et al., 2003; Kato, et al., 2004; Tzeng & Shiau, 1987).

By introducing an intelligent energy system for efficient energy processes and mitigation technologies for the reduction of environmental pollutants, many positive environmental, social and economic impacts arise (Barrero et al., 2008; Ozzie, 2012; Yann, 2015). The most targeted measures to reduce pollution should be aimed at transportation emissions since the energy use and greenhouse gas (GHG) emissions are closely related when considering public transport as a major element of urban development (Norman et al., 2006; Schipper et al., 1992). Furthermore, there is an inevitable link between transport, energy and urban form as part to create sustainable cities (Banister et al., 1997; Næss et al., 1996; Shapiro et al., 2002; Thackeray et al., 2012).

This paper elaborates a project idea of introducing a new sustainable city transportation model based on light and electricity driven MR system for the city of Skopje, Macedonia. As a city which has been consecutively ranked as one of the most polluted in the world, Skopje is faced with rapid life quality reduction, along with aggravated potentials for public transportation and commuting within the city.

BACKGROUND MATERIAL

From a technological viewpoint, the MR may be considered as long electricity driven bus that moves along a single rail above the ground. MR tracks are usually not more than half the width of the vehicle, which means for safety reasons, a monorail vehicle has to be internally stabilized to prevent its lateral overturning. Thus, due to its narrow rails, these systems provoke less negative economic and environmental impacts compared to light or heavy rail systems. Commercially, there are three major MR types: (i) Monorails that envelope/straddle a track (Figure 1); (ii) Monorails that run on top of a track or a slab at

the surface (Figure 2); and (iii) Suspended monorails under a track which is above the vehicle and the propulsion motors and bogies are on the top of the vehicles (Figure 3).

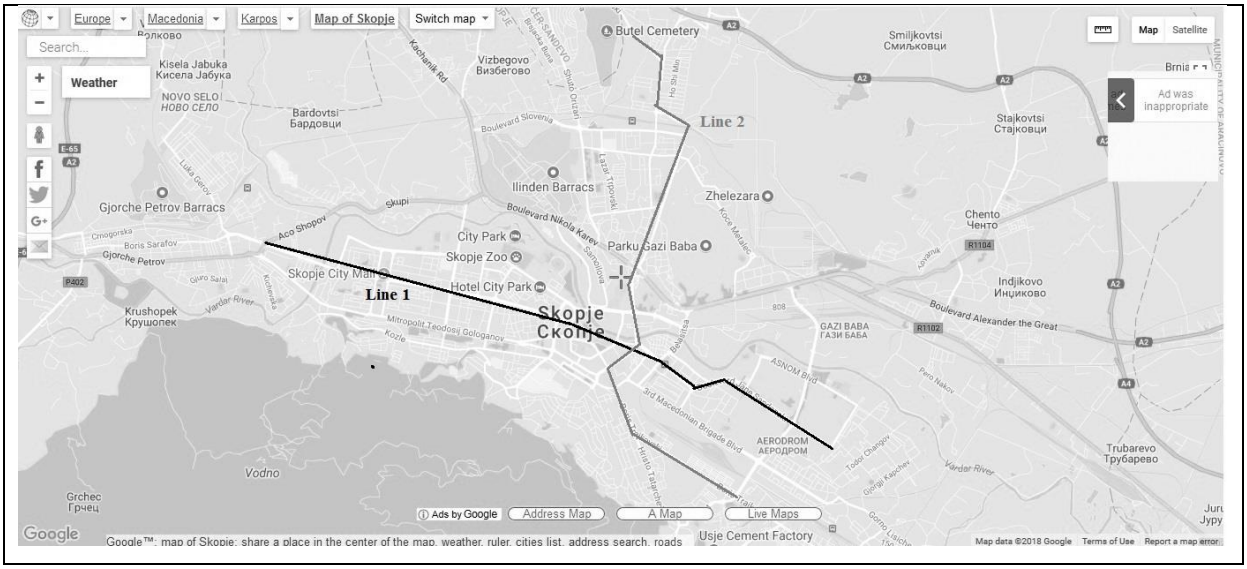
FIGURE 1. STRADDLE TYPE OF MR STRUCTURE

FIGURE 2. URBANAUT TYPE OF MR STRUCTURE

FIGURE 3. SUSPENDED TYPE OF MR STRUCTURE

PROJECT IDEA FOR MONORAIL IN SKOPJE

Based on desk research and taking into consideration the location of Skopje, the average number of potential passengers, as well as the location of various strategic urban units, the research revealed possibility of proposing construction of two perpendicularly positioned MR lines.



Legend:
____ Line 1 (Gjorce Petrov to Novo Lisice)
------ Line 2 (11 October to central Cemetery)

FIGURE 4. PROPOSED MR LINES FOR SKOPJE
Source: Adopted according to (Cingoski & Petrevska, 2018: 426).

Figure 4 presents two MR lines, whereas:

- Line 1 may start from the municipality of Gjorce Petrov to Novo Lisice, with future potential line extensions to the municipality of Saraj and the recreation center Matka on one side, and the Skopje International Airport on the other side; and
- Line 2 may start from the suburbs of October 11, through Kisela Voda and the Koco Racin Boulevard towards the municipality of Chair and Butel, ending in the vicinity of the Skopje central Cemetery.

By constructing such MR transport system, Skopje may cover almost 70% of its city public transportation needs, with just two MR lines. In a case of a construction with a total length of approximately 16 km, some initial projection of financing may be calculated. So, for a single line, the cost may be around 120 mil. EUR, while for a dual line 220 mil. EUR.

These lines will be the backbone of the whole future MR public transportation system for the capital city. This study recommends to be constructed as dual lines allowing passengers commuting in both directions, as well as enabling further extension of the system with other single MR lines to other areas. In the first phase, all stations of the MR system may be well connected with other city suburb areas that already have active bus lines. This will support utility and increase number of passengers for the MR system at least for additional 50%, thus achieving usage rate of more than 10,000 passengers/hour.

By achieving this, the project feasibility might be undoubtedly improved. Hence, the projections for expected number of passengers may expand to approximately 65 million/year, allowing the average price of at least 1 EUR per single use.

However, more detailed feasibility analysis is required, leading to financial justification, whereas, everything that may result in investments return rate under 12 years, is strongly acceptable. Due to general fact that construction costs for MR is heavily depended on many issues (like: total length of the system, terrain topography, location and current utilities, passengers' requirements, speed, number of stopping stations, etc.), it is necessary for the case of Skopje to make more in-depth feasibility analysis.

BENEFITS OF MR FOR SKOPJE

By constructing elevated MR transportation structure, Skopje may benefit in multiple ways since it provides many advantages, such as:

- It occupies less space, provides better traffic safety, and it is faster and more secure;
- It is relatively cheap, easy operational and straightforward for maintenance, and since it uses concrete or metal tracks, provides fast and simple driving;
- Since it is electrical, it is almost noiseless, environmentally highly acceptable and recommended for very densely populated central city core;
- It is fully "green" thus saving lot of pollutant's emissions and being fully applicable for Skopje;
- It may be easily accommodated within the current public transport; and
- It allows to keep green areas under the tracks which will give additionally environmentally friendly footprint to Skopje.

CONCLUDING REMARKS

The study does not attempt to provide a detailed map applicable to solve pollution problems of Skopje, but rather to suggest framework for serious consideration for answering profound issues, like the nature of urban air pollution, pollution sources, and available resources. Moreover, it intends to propose some scheme in which local and central policy makers may approach to identify a solution based upon international experience. The research findings revealed that greater use of public transportation offers single most effective strategy currently available for achieving significant energy savings and environmental gains, without creating new government programs or imposing new rules on the private sector.

By proposing a monorail powered vehicles as efficient public transportation system, Skopje may significantly reduce emissions and achieve pollution reduction. Although being defined as an expensive alternative, MR massively declines the lifecycle GHG emissions. Only with two suitably designed MR lines of about 16 km, almost 70% of all city public transportation needs might be accommodated. Since it will be positioned above the ground level, Skopje may gain more green areas, parks, bicycle tracks and parking spots thus enabling environmental improvement. Yet, the proposed project requires considerable economic policy dimension that is heavily dependent on cost-benefit analysis. Hence, the capital city of Skopje must design and adopt air pollution strategy appropriate to its own circumstances. Namely, environmental and ecological impacts are important, but are only one aspect of urban transport policy, vis-à-vis economic, financial, social and distributional concerns which also come into play.

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