

Sustainable Transport Futures Transition of Belgrade to Low-Carbon Urban Transport

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Abstract: This paper looks at the potential of Belgrade for a transition to sustainable, low-carbon urban transport. Methodologically the paper follows a backcasting study approach. This has two main phases. The first is to define clearly the desired future and set rough targets for a future year (in this case 2030). The second phase is the core of the backcasting process, where alternative policy packages are assembled to lead to the images of the future, together with their sequencing in terms of when implementation should take place. There is an additional phase which seeks to identify a transport system that will meet the transition target; the phase is given in the form of recommendation to the local authorities. Hence the central argument made is for an integrated approach to transport policy making over the longer term – incorporating scenario testing and backcasting – to help assess likely progress against a range of objectives.

Key words: Urban transport, traffic emission, public transport.

I. Introduction

Population growth, increased urbanization and globalization, increased average incomes and increased consumption and discernment aspirations are all likely to lead to increased travel demand [1]. Mobilities involve heterogeneous ‘hybrid geographies’ of humans-and-machines that contingently enable people and materials to move and to hold their shape as they move across various networks [2]. There are many human-and-machine hybrid forms. Breaking the connection in ‘driver-car’ hybrid relations poses the main challenge and creates ground on which sustainable urban transport is to be developed, and this must be done in order to prevent a ‘business-as-usual’ (BAU) situation from progressing into the future, thus cutting GHG and CO₂ emissions and creating a safer, better quality and more sustainable urban structure.

The aim of this study is to explore the potential of the city of Belgrade for the transition to sustainable urban transport over the next twenty years, employing scenario-based methodologies which provide clear

insight into the near future, as well as the formulation of adequate policy responses in order to create that very future. Current transport systems in the city, the legacy of the communist epoch, with all their advantages and disadvantages, provide good potential for this transition. The main argument is that the transition should be even more radical because it will not only bring valuable benefits to the environment, but will, at the same time, improve significantly the economic performance of the city and country as a whole - foreign trade balance improvement and oil import dependency decrease. Additionally, with good public transport the city stands a better chance of attracting new FDI. A transition to sustainable transport will, inevitably, have multiple positive effects.

2. Tackling Sustainability

2.1. CO₂ and Traffic Reduction

In the next ten years, the world will consume a quarter of all the oil used in its entire history [3]. Half of the world’s population lives in urban areas, and this

share is increasing over time, projected to reach 60% by 2030. Cities consume a great majority of energy and are part of the climate change problem, but they are also a key part of the solution [4]. Given current trends, CO₂ emissions are projected to increase by nearly 50% by 2030. To avoid the worst impact of climate change, global CO₂ emissions must be cut by at least 50% by 2050.

The transport sector must contribute much more fully to achieving greenhouse gas (GHG) and CO₂ reduction targets. The *sustainable mobility* approach means taking actions to reduce the need to travel, to encourage modal shift, to reduce trip lengths and to encourage greater efficiency in the transport system [5-8]. Additionally, this approach requires clear and innovative thinking about city futures in terms of the reality (what is already there), the desirability (what we would like to see), and the role that transport can (and should) play in achieving sustainable cities [9-13]. Sperling alleges that transforming transport is necessary to avoid this business as usual, and brings to the point three measures: transforming vehicles ("easiest"), transforming fuels (hard), and transforming mobility (hardest).

2.2 Value of Car-use Reduction

The extensive use of cars triggers major problems for the environment, urban functions and accessibility. Besides technological solutions, effective solutions for the problems associated with car use require reductions in traffic volume. Car use is predominately explained through behaviour models that focus on instrumental factors related to car use, such as its speed, flexibility, and convenience. However, other motives seem to play an important role, such as sensation, power, superiority and arousal. Thus, the car appears to be a status symbol, people can express themselves by means of their car, driving is adventurous, thrilling and pleasurable (symbolic and affective factors) [14].

Instrumental dimension is linked to mobility, and emotional one to psychology (the factor that cannot be attributed particularly to public transport). Based on these two dimensions, car-use reduction initiatives can

be broadly characterised as *structural* or *psychological*. Examples of structural initiatives include be road pricing, road closures, and bus priority lanes. Psychological interventions are designed to change perceptions, beliefs and attitudes and are less costly [15]. Banister emphasises that the intention is not to prohibit the use of the car, as this would be difficult to achieve and might be perceived as being against notions of freedom and choice. The intention is to design cities of such quality that people would not need cars. Additionally, levels of car use (and air travel) currently enjoyed by high-income groups are not sustainable or generalisable. These modes do not provide equity in access and are socially divisive. The growth in these modes will adversely affect the welfare of future generations.

2.3 Congestion

"You can't pave your way out of congestion".

Road traffic congestion poses a challenge for all large and growing urban areas. Dynamic and liveable urban regions will never be free of congestion [16-20]. Traffic speeds have been reducing each year in many cities, with the severity of congestion tending to increase with the city. Businesses and individuals waste much valuable time in traffic and road construction and expansion has been the cornerstone of automobility policies. The principle of predict-and-provide is being increasingly abandoned, but the question now is how to fight against congestion. *The answer depends on context and time. Traffic congestion in Lagos has completely different genesis and structure to the congestion in Budapest, so policy instruments are different.* A strategy for roads must concentrate on the movement of people, rather than the movement of vehicles, through traffic and demand management, as well as on the provision and maintenance of road infrastructure. Integrated land use and transport planning and coordinated transport development involving all transport modes - including public transport – are fundamentally important to the high

quality access needed in large urban areas. On the other hand, a certain level of congestion on roads is now seen as “desirable” in many locations, and new low speed limits have been introduced.

2.4 Urban Form

Urban form matters: the lower the urban density, the more energy is consumed for electricity and transportation [21-23]. Since activities such as housing, working, shopping and leisure are separated in space, travel is essential. The spatial ‘deconcentration’ of housing and employment gives rise to many undesirable consequences, such as increases in the amount of overall travel and this encourage people to take the car. Moreover, a scattered urbanisation pattern encourages criss-cross travelling, which is not easy to serve by public transport. A high degree of concentration in a large city produces high travel intensities for passengers and high land values. Less centralized cities are not faced with the same problem. But the penalty of decentralisation is longer journey distances which add to vehicle operating costs, to the volume of traffic and to the requirement of transport facilities to carry out the traffic; railways are not practicable and all transport must be by road. Therefore, it could be argued that the greatest difficulties occur in the cities which are neither very centralised nor very decentralised, because the volume of traffic to the city centre is too large to move entirely by road, yet not large enough to support a really good rail or rapid mass transit system. Therefore, a proper spatial planning is needed to support creating new urban form. Rydin emphasizes the importance of spatial planning looking at coordinating land uses, development activity and infrastructure investment across urban areas to deliver on public policy goals. The involvement of infrastructure stakeholders and planners, is the key to spatial planning for sustainable urban development.

3. Case Study: Belgrade

3.1 Context and Baseline

The City population is ~1.6 million. This is slightly

above Asian figures and is growing. Belgrade modal split for its 1.6 million passengers is: Public Transport – 52.86%, Walking – 24.41%, Private Car – 21.55%, Cycling – 0.55%. Motorization rate is ~260PV/1000 inhabitants. Average net income is RSD 55k.

Belgrade is aiming to become a sustainable city, a city that can combine economic growth and carbon emissions reduction. Its population is expected to grow insignificantly – 3.8 % by 2030, so the population growth will not be major driver of traffic demand. GDP is expected to grow by c. 120% until 2030. Current CO₂ emissions are 15% lower than the EU average, and amount to 6.8 t per capita. What is especially interesting (and worrying) is the fact that CO₂ emissions, measured per unit of GDP, is triple the EU average. Unlike in developed countries, where high CO₂ emissions are the result of intense use in the process of production and creation of new values, high emissions in Serbia are the result of irrational use of electrical power. The total annual damage caused by air pollution and greenhouse gas emissions is estimated to range between 1.8% and 5.5% of GDP. Domestic production of oil and petroleum products covers 20% of domestic consumption. Car manufacturing and entire automotive industry employs c. 20.000 people, while car production reaches 200.000 cars per year, purchased both domestically and abroad. Persistent congestions in the city pose threat to the environment and economic development. The action plan for implementation of the national strategy of sustainable development sets a target for 2017: 1.5 t of CO₂ on every 1000 constant US dollars of GDP. This is not too concrete a target, since Serbian GDP is volatile in nature. Other strategies are general rather than specific. Interestingly, Article 50 of the Law of Environmental Protection (LEP), states that “the Republic of Serbia is not big emitter of gasses with the GHG effect, but, by limiting emissions, a series of possibilities will be created, not only in terms of attracting new investments on the ground of implementation of flexible mechanisms defined by Kyoto protocol, but the import dependency would decrease, thus mitigating

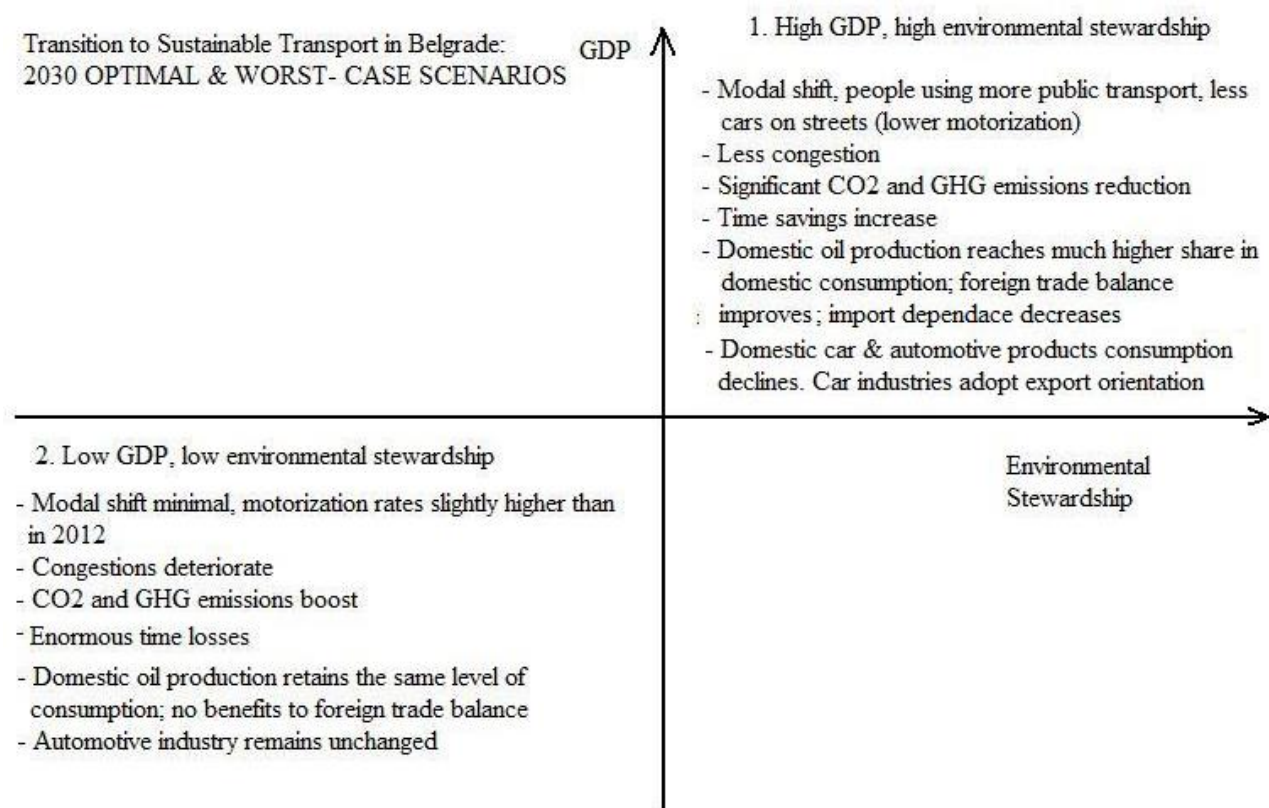
foreign trade imbalance”. Although environmental stewardship is at a low level, it is gradually changing, initiatives are being taken and this topic is increasingly being presented to the public. As the country is on its way to EU integrations, legislation harmonization will set targets for CO₂ and GHG emissions in the near future (EU Twinning Project: SR 07 IB EN 01). Many sustainable transport forms exist in the city, which is a good base for further investment and radical transition to sustainable urban transport. However, transport systems are mostly inefficient, people are frustrated, fare evasion remains a boiling problem, and heavy investments are required. Implications of radical transition are further scenario-tested with local policies derived to support the best-case scenario implementation and see how do-minimum scenario impacts both the city and

national economy [24-26].

3.2 Scenario Testing

Scenario 1 (high GDP/GDP growth, high environmental stewardship): seeks low carbon driving, extensive use of public transport, high investments in urban infrastructure and public transport, ‘proper’ urban planning, which impacts positively the quality of life, as well as local and national economies.

Scenario 2 (BAU continuation: low environmental stewardship and low GDP/GDP growth): Some investments in infrastructure, old and obsolete public transport rolling stock, congestions, traffic collapse in certain parts of the city, CO₂/GHG emissions increase significantly due to no or little modal switch. No improvement in foreign trade balance figures.



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3.3 Backcasting

Policy interventions to achieve a desired future (Scenario 1), including intensity of application, are

recommended within following policy packages (PP):

PP1 Urban Planning: high intensity in implementation of policies (i) limiting construction outside the city, (ii) retrofitting urban areas to integrate

with new public transport investments. SACTRA¹ model findings need to be reflected in urban master planning – no new roads in core urban areas are to be built, excluding major capital projects which will discharge city centre and improve the safety. The city is polycentric. Central areas are dense, while other areas are fairly scattered. By limiting construction spatially, densities will increase and public transport will be able to serve dwellers and businesses efficiently. Removing the main train station and making Sava riverbank accessible to dwellers, with supporting infrastructure, is part of this package.

PP2 Heavy Investments in Public Transport: investments in public transport are crucial and create environment where an individual can *easily choose* a sustainable alternative. The intensity of this policy is high, and includes construction of either metro or BRT, and LRT, widening suburban rail networks, updating the rolling stock of buses, trams and trolleybuses, as well as construction of complementary forms of public transport. The airport rail link is built under this package.

PP3 Pricing Regimes: intensive application of this package. Alternative, sustainable and efficient forms of public transport are provided, there is less need for cars, thus the congestion charge and/or area-wide road pricing is to be introduced harshly. Another way of reasoning may be implemented here (see recommendation at the end of paper).

PP4 Walking and Cycling: high intensity investment in walking and cycling facilities as the most sustainable means of transport.

PP5 Low Emission Vehicles: medium application of this policy. Rolling stock (individual motor vehicles) was too obsolete until not long ago and transition is not easy yet.

PP6 Alternative Fuels: low intensity policy bearing in mind that this concept is very new, people are sceptical, and there is a lack of proper infrastructure to

support this policy.

PP7 Wider Interventions: intense application of these policies, e.g. road space reallocation, encouragement of informal street crossing in city centre(s) to calm the traffic, parking restrictions, higher parking pricing and time management, promotion of information and communication technologies (ICT) to support flexible working and shopping (lower intensity of this one because sustainable options are already out there), as well as psychological interventions (cut affective links with cars) in terms of promoting sustainability and its benefits over TV, radio, internet and newspapers.

PP8 Freight Transport: high intensity application. This policy concentrates on improving river and rail mode share, modernisation of Belgrade port, and includes construction of Belgrade bypass road. Finishing some crucial capital investments such as UMP (Inner City Semi-Ring Project) and planned bridges over Sava and Danube will create a solid ground for implementation of this package, since freight transport will be relocated out of the core urban areas. Accordingly, safety is to be tackled. PP8 is in harmony with the City development strategy which aims to make the city transport nod of South Eastern Europe, without interrupting urban transport.

PP9 Waterway Public Transport: high intensity application of this policy. PP9 is in connection with PP1 because significant parts of riverbanks are both inaccessible and placed in the most attractive area of the city. Construction of at least 20 stations along Sava and Danube rivers is part of this package. The Port of Belgrade remains in charge of cargo/freight transport. The package promotes growth of tourism since it river potential of the capital city needs to be unlocked.

4. Conclusions and Recommendations

This paper tests two diametrically opposed scenarios for the urban transport sector in the context of Belgrade.

¹ SACTRA – Standing Advisory Committee for Trunk Road Assessment

The optimal scenario, the one that leads to CO₂ emissions reduction, focuses on creating low carbon transport and implies breaking with current, BAU trends. Making trend-breaks and setting new trends requires time, alongside well-coordinated and well-integrated actions in terms of delivering a proper policy packages. The balance between policy packages is important. Drawing from the context, there will be more emphasis on the public transport investments, urban planning, pricing regimes and walking and cycling, than on vehicle efficiencies and alternative fuels, although those will be promoted equally. More rigid policy packages regarding fuels and vehicles are to be delivered in the next planning stage – up to 2050.

A change in the behaviour of crowds is important to reducing CO₂ emissions. The process of this change has to be simultaneous with the process of creating efficient low carbon public transport alternative, in order to achieve an intense modal shift and justify the introduction of congestion (or area-wide) charge.

Therefore, the recommendation to the city authorities is either to (i) provide efficient public transport options *first* and then introduce congestion or area-wide charge, while accompanying the process with public campaigns to promote behavioural change; or (ii) introduce congestion/area-wide charge *first*! Before investing in the delivery of sustainable alternatives, this option needs to be seriously considered, regardless of a potential resistance. Congestion charge is *transfer*; thus this would be the most favourable intervention to kick off with.

In the current transport planning there is no word about BRT option. A recommendation is to consider wisely this alternative. In some cities, such as Mexico City, the BRT is built as a complementary system. In Bogota or Curitiba it is a principal MRT. Bearing in mind all advantages of BRT over tube systems, *the recommendation is to consider the BRT as a principal MRT option for Belgrade*, thus declining growing requests to build tube. It is efficient, effective, and way less costly to build. Needless to say, no technical issue

can pose impediment to the BRT delivery, anywhere.

In terms of urban planning, it could be argued that this is one of the more ‘difficult cities’ to deal with when it comes to the introduction of mass rapid transit systems (neither centralized, neither scattered enough to be categorized). Applying a policy of limiting building outside the city while planning the in-city building along transport corridors, has the potential to contribute to CO₂ emissions reduction significantly, thus creating a dense urban structure, i.e. fewer trips, less criss-cross travel, and more efficient public transport. Accordingly, current planning should include this dimension. This should be reflected in the master plan.

The 3-pronged sustainability oriented strategy: *AVOID-SHIFT-IMPROVE* should be used as an organizing principle for recommended actions. *AVOID*: Travel does not take place; Need/desire to travel has been reduced. *SHIFT*: to non-motorised (walking and cycling) and public motorised transport. *IMPROVE*: both public and individual motorised transport.

Finally, extensive investments in public transport can be additionally justified because those are likely to give leverage to foreign trade balance, decrease deficits and decrease oil import dependence, thus improving the economic performance of the country. Belgrade, with 27% of Serbia’s population, will be vital to this process.

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