

INTERMODALITY – A SOLUTION TO THE PROBLEMS OF LARGE URBAN AGGLOMERATIONS

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Abstract

The large urban agglomerations are facing the negative effects of traffic congestion, the most unpleasant phenomenon of the contemporary society. The classical solutions of reducing traffic congestion by developing the infrastructure transit capacities have led to an increase in land occupation, to a degradation of the natural landscape and have attracted additional traffic. The accepted solutions are interdisciplinary and must ensure easy access to intermodal passenger transport and reduce the user's need to travel without suppressing his access to activities and services.

Intermodality is an integral part of the sustainable mobility and its enhancement is of vital importance particularly, in high congested urban areas. This represents a solution to the current mobility problems in the cities and it involves the planning of the urban scheme so as to encourage short-distance trips. The case study is used to demonstrate the utility of such urban amenities concerns the regional bus stations in Bucharest and their paths in city. The locations of exchange poles is considered in order to reduce the pathways on Bucharest street network and the traffic congestion and, consequently, to increase the city dwellers' quality of life.

Keywords: intermodality, urban transport, sustainable mobility

1. Introduction

Urban expansion and high dependence on the car and truck have led to congestion in cities and towns across Europe. Economic growth in many emerging metropolises generates a strong augmentation in mobility demands. Increases in car ownership are a risky consequence of this process. If motorization fulfills the mobility needs of people who have access to car, it has an impact on the structure of the city. At local level, the distances increase, thus disadvantaging those who do not have access to private vehicles. In addition, congestion, air pollution and dangerous driving degrade city life quality. At global level, oil depletion and global warming are physical limitations preventing the reproduction of models of urban development favored during the 20th century.

While transport enables the economy to grow, if not well-managed, it can also retard growth and the efficient delivery of essential social services. The lack of

comprehensive planning of transport systems, without due consideration to social, economic, environmental and cultural elements of the city, can result in physical breaks in the fabric of communities and reinforce social exclusion. The impact on quality of life and the environment cannot be underestimated. (Shanghai Manual, 2011)

Congestion and the accompanying issues of road safety and environmental pollution present major challenges in planning for improved accessibility and reducing the environmental impact of transport. The priority is to create urban transport systems that meet individual needs for mobility and the economic and social demand for rapid and efficient movement of goods and people, safely and cost-effectively. An integrated component of efficient urban mobility is minimising environmental and health impacts, particularly in densely populated areas (European Commission, 2013)

2. Sustainable urban mobility

The competition between transport modes led to a segmented transport system instead of an integrated one, especially in urban areas. In fact, every transport mode tried to use its own advantages regarding the growth of attractiveness on a highly competitive market. The transporters tend to maintain the intensity of the activity by using the routes that they operate to their maximum capacity. The lack of modal integration was made much worse, on international level, by the government policies that prohibit the companies to operate in other ways than their own and by placing a transport mode under state authorities control, maintaining the monopoly. (Stefanica, 2013)

Also, the competition between transport modes led to decreasing of public transport attractiveness and to increasing number of private vehicles which dominates the roads. As a result, the transportation sector is heavily responsible for public health issues in cities such as air pollution (acidification, smog), noise, greenhouse gas emissions, and road accidents. (Shanghai Manual, 2011)

With growing car dependency, an ageing population, and demands for new and flexible lifestyles, cities are faced with finding new transport solutions for rapid and easy movement of people. Furthermore, new technologies create high expectations for smart mobility options, such as real-time traffic information for travellers, drivers, fleet operators and network managers. New technologies also bring opportunities for integrating data for journey planning and electronic ticketing, and smart cards to facilitate interoperability between public transport modes.

The challenges of global warming, scarce energy sources and increasing energy prices are on the top of European, national and local policy agendas. In this context, green solutions are needed to reduce the environmental impact of transport in urban

areas. A major concern is to find ways and means to sustainably reduce transport emissions because urban traffic is responsible for 40% of CO₂ emissions and 70% of other emissions from road transport in the EU. (European Commission, 2013)

In order to return urban places to people and to create more livable cities, decision makers in these cities urgently need to change the direction of urban transport development toward a more sustainable future. Establishing a sustainable urban transport system requires a comprehensive and integrated approach to policymaking and decision making, with the aim of developing affordable, economically viable, people-oriented and environment-friendly transport systems. (Shanghai Manual, 2011)

Breaking the cycle of increasing urban congestion and accompanying impacts on economy, society and the environment requires a change in mindset by both decision makers and transport users. A new culture in urban mobility is needed in order to deliver integrated and sustainable transport planning, and users need to adapt their attitudes and behaviour with regard to mobility. (European Commission, 2013)

Political will has become a key ingredient to improving urban transport policies in cities. The knowledge of what is happening and how to improve a situation is already there, and tools to address problems are well known by many practitioners. When a city mayor or another decision maker takes these tools and applies them in their city knowingly and appropriately, positive outcomes and benefits for city inhabitants can result. (Shanghai Manual, 2011)

3. Transport and Land Use Interaction

Unfortunately, city managers in developing countries are following the same car-oriented transport development patterns made by many cities in developed countries in the past. In the developing world, however, the trend is still largely in favor of the expansion of infrastructure for private motor vehicles. Policies for more and more road construction have clearly failed to cope with ever increasing demand from rapid motorization, resulting in a vicious circle as depicted in Figure 1. This cycle shows how the increase of infrastructure to alleviate travel demand will have apparently positive consequences in the short term, but some months later there will be a much greater congestion than before, thus increasing the problem rather than solving it. (Shanghai Manual, 2011)

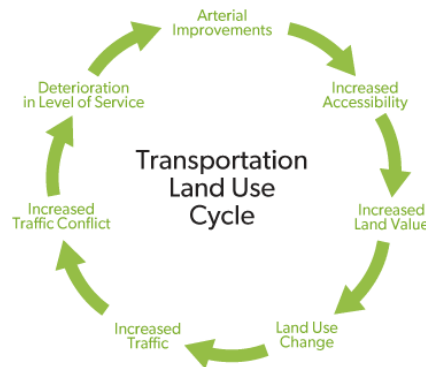


Figure 1. The transportation/land use cycle (Dragu, 2014)

A sustainable urban transport system requires strengthening various features of the system including mobility, accessibility, affordability, social equity, efficiency, safety, security, convenience, low carbon, comfort, and people- and environment-friendliness. In order to achieve all these elements, various challenges need to be addressed in an integrated manner. These challenges include improving human health through the reduction of urban air pollution, tackling climate change, reducing the number of deaths and injuries from road accidents, controlling excessive motorization, improving public transport services, encouraging more walking and cycling, and recognizing the specific needs of urban poor, women, the elderly, people with disabilities, youth, and children. It is critically important to understand that urban transport (or mobility) is not an isolated issue and is related to many other aspects of urban life in general. It is useful to note this integrated approach as an introduction to the more specific measures that are presented below (Shanghai Manual, 2011)

4. Reducing need to travel

Developing new infrastructure for reducing congestion is not anymore a solution to uncontrolled traffic growth. We have to look for solutions to actual problems of the cities in transportation and land use interaction. Transportation and land use are inexorably connected. Everything that happens to land use has transportation implications and every transportation action affects land use. We can't anymore use exclusive transport solution for traffic congestion, we must search for interdisciplinary solution coming from transportation and land use relation. We must choose new urban development location that short distance trips can be encourage, and non-motorized transport modes can be used. We have to look for solution for reducing the need to travel. (Roman, 2014)

The reduction of the urban mobility will be reached when a series of new policies will be simultaneously implemented. This goal can be achieved through a restrictive policy for travelling with private cars, a development of a proper public transport, a properly land usage, technological solutions and certificates for the

majority of the countries, where these measures are already implemented.

However, it should be retained three major difficulties that hinder the successfully application of the stipulated measures:

- I) It is difficult to quantify as well as to measure directly the mobility phenomenon;
- II) It is hard to obtain a global reduction of mobility due the fact that different situation will provide different number of trips;
- III) The effect of the measure concerning the limitation and the reduction of mobility has a little impact on the total volume of transport.

Anyway continuous efforts are needed to be made by governmental and non-governmental organizations, on order to assume the success of strategies concerning the reduction of mobility and to combat the undesired effect of an intense traffic. Some communities have found a promising new course for handling growth and their transportation problems. Planners refer to these ideas as "livable" or "sustainable" communities. By whatever name, these plans focus on people, rather than on cars. (Dragu, 2005)

5. Intermodality

The concept of intermodality, as part of sustainable mobility, refers to the door-to-door transfer of people or goods by using several means of transport, including walking or cycling (Jones et. al., 2000). In general, the idea of intermodality aims to optimize travel conditions reclaiming the advantages of each mode being used while minimizing the negative impact that each one of them causes. (Pitsiava-Latinopoulou, 2012)

Intermodality is an integral part of the sustainable mobility and its enhancement is of vital importance particularly, in high congested urban areas. One of major reason why inducing mode shift from private cars to public services is difficult it is the lower accessibility of public transport modes. One possible strategy to improve accessibility by public transport is to extend the possibility to use public modes in various combinations (or even in combination with car). The basic idea is that even if one public transport network (e.g. rail) alone cannot provide high accessibility, an integrated use of different networks (e.g. rail plus bus) can. When a combination of transport modes is involved, interconnection represents a key part of the trip and the quality of interconnectivity is then a major requirement. A smooth transfer from one network to another is a matter of physical connections but also of functional and organisational aspects like e.g. integrated services and ticketing. (Stasio, 2011)

Effective interconnection requires the provision of both integrated networks and services. The achievement of this integration usually requires a strong co-operation between a range of authorities and providers in the public and private sectors. The

creation of effective interconnection may sometimes conflict with the priorities of authorities and providers who have hitherto been concerned solely with serving a local constituency.

Particularly in passenger transport none of the various actors is responsible for the whole intermodal route from house to house or for intermodal network connection. No transport company is generally responsible for building and operating interchange points either. (Stasio, 2011)

The points where the transfer from one mode to another takes place represent sensitive points that can encourage or discourage intermodality. The existing amenities in these places, regarding the reduction of transfer time and especially the commodity and comfort of the transfer (escalators and moving walkways, minimum walking distances, transport schedules correlations, guidance signs and commercial and social facilities etc.) lead to an increased intensity of use of such facilities with major implications in enhancing intermodality that is so necessary in urban environment. (Stefanica, 2013)

The weak links in the overall Intermodal passenger transport chain are considered to be the Intermodal Terminals, as often inadequate planning leads to the reduction of the level of service of the means using the station, thus resulting in partial or total disdain for its users and the shift of the latter to other transport modes, mostly to private vehicles. Instead, an integrated design with emphasis on Intermodal Terminals which acts as the interface between the different modes not only increases the proportion of commuters who use urban public transport but also consolidates the overall public transport system of an urban area. (Pitsiava-Latinopoulou, 2012)

The main objective of an exchange pole is the integrated and efficient transfer of passengers between various routes and different modes of transport. In order to ensure the effectiveness of this essential function, a terminal should provide:

- reliable and adequate level of service of the means involved in the operation of the terminal
- satisfactory level of facilities serving the transfer
- provision of low cost travel (less than or equal to the cost of travel without transfers)
- adequate accessibility of the site for all users (especially the disabled)
- reduced travel time compared to that needed for the same trip without transfer
- direct access between two different platforms for almost all platforms of different modes of the terminal

6. Case Study

The Bucharest like every other world capitals is facing the problem of congested and damaged road infrastructure and with neglected rail infrastructure. The competition between public transport modes, especially between regional and local transport operators has led to a lack of connexions between regional and local networks. The authorities allowed regional minibuses to enter in city centre. In this case study I analysed the regional minibus routes and their stop points in Bucharest city to see what influence they have over the traffic growth.

In order to analyse solutions for improvement of the interconnectivity one has to identify the key problems of poor connectivity in Bucharest. They can be enumerated as follows:

- Non provision (or inadequate standard) of the infrastructure for local links;
- Poor design, maintenance or operation of modal interchange points;
- Inefficient procedures for interchange (e.g. delays while waiting for luggage);
- Inadequate provision of local transport services (e.g. no fast public transport from an airport to city centre);
 - Local transport services exist but do not serve the needs of connecting long distance travellers (e.g. time tables are uncoordinated, nearest bus stop requires a long walk);
 - Inadequate provision of information;
 - Unavailability of integrated tickets (covering the local as well as the long distance parts of the journey).

In Bucharest there are 32 stop point for regional minibus which are presented in the figure 2. It can be seen that the stop points are located all over the city.

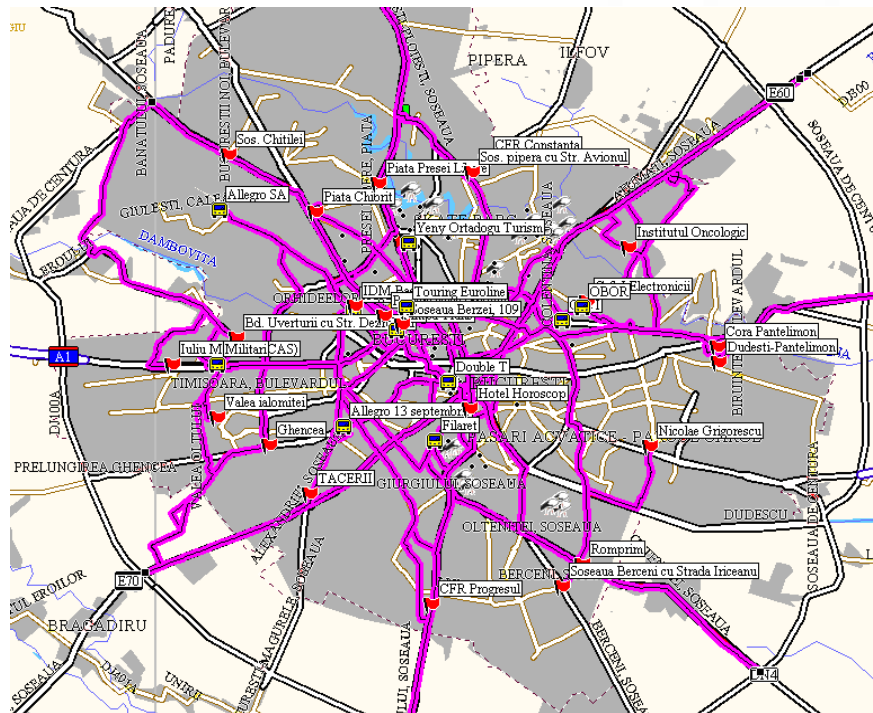


Figure 2. Regional bus stop point

About regional minibus stop point I can say they aren't organised as an interchange terminal, being organised even in a house yard.

It can be seen in the picture that regional minibus routes are spread on all city. There are situation when minibus travel 20km on the congested road infrastructure creating additional traffic.

Knowing the timetable of each regional transport line the traffic flow were calculated (on every national road). This are presented in Tabel 1.

Tabel 1. Hourly average flows on national roads ([standard vehicles/hour])

DN1	DN2	DN3	DN4	DN5	DN6	DN7
5,1	19,3	2	8,9	7	6,3	3,7

The biggest hourly average flow is on national road 2 (DN2), (120standard vehicles – 80 minibuses), at every 45 seconds a minibus leaves from Bucharest regional minibus stop point.

This is alarming and requires measures to reduce or even eliminate these flows. A first step to reduce these flows would be the prohibition of using of minibuses and replace them with buses. A regional bus has the capacity to transport a minimum of 50 seats, which means it can take passengers transported in 2.5 minibuses (they having capacity up to 20 seats). In this way, additional traffic flows will be reduced by 2.5 times.

Besides this solution it is important to rethink the bus stations locations through the city, so that no longer allow minibuses enter in the capital. These regional bus stations should be placed in the key points of transport system and activity system.

Transforming the regional bus station in interchange terminals means granting a major importance interconnections between local and regional transport networks and encourage intermodality. This involves either placing them in a hub or in a local public transport terminal or near one or rethinking their uniform locations of future transport terminals by converging both means of transport surface and underground and regional transport.

For the new bus station to be considered intermodal terminals they must have the following features

- Facilities necessary for the proper functioning of the bus station;
- Shopping center;
- Spaces for the operation of urban transport networks;
- Park&Ride to encourage modal shift between private vehicle and public transport;

- areas with urban functions - entertainment areas, restaurants, banks.

To say that the bus terminal is an interchange terminal it needs to make a good interconnection between different transport networks. This can be achieved by correlating the regional bus programs with local transport programs.

For rational located bus stations we should take into account:

- To be at the periphery of of the capital;
- to be located near or in an urban transport network node providing travelers easy access as the local and regional network;
- Near railway stations or passenger station buildings;
- Near the commercial and administrative center of the village;
- Routes coaches must be separated from roads carrying heavy traffic (with large traffic flows).

Under these requirements a solution would be to have an interchange terminal for each of the seven national roads. For coaches departing and arriving from the bus stations do not create congestion inside the city they should be located near the exit of Bucharest.

For transfer from one interchange terminal to another make easy, ideally they should be located near the railway line belt or passenger station building. Thus travelers who want to go from one side to another side of country and have to change regional bus in Bucharest will not cross the center will not create additional traffic and they save time. Another condition that must be fulfilled is to be near a commercial and administrative center. This could be achieved by building a shopping centre in the terminal building - supermarket or bus station in the parking lot of a supermarket location.

In the case study I propose creating 7 intermodal terminals located like it can be seen in the picture below.

The distances traveled by buses on city streets will be following: DN1- 5 km, DN2 – 9,8 km, DN3 – 4,7 km, DN4 -3,5 km , DN5 – 3 km, DN6 – 5,1km, DN7 – 2,6 km. This locations have a benefit on decreasing traffic congestion on Bucharest streets because of the effect on encouraging the public transport use, this terminals being located in next to local transport terminals, and next to shopping centre.

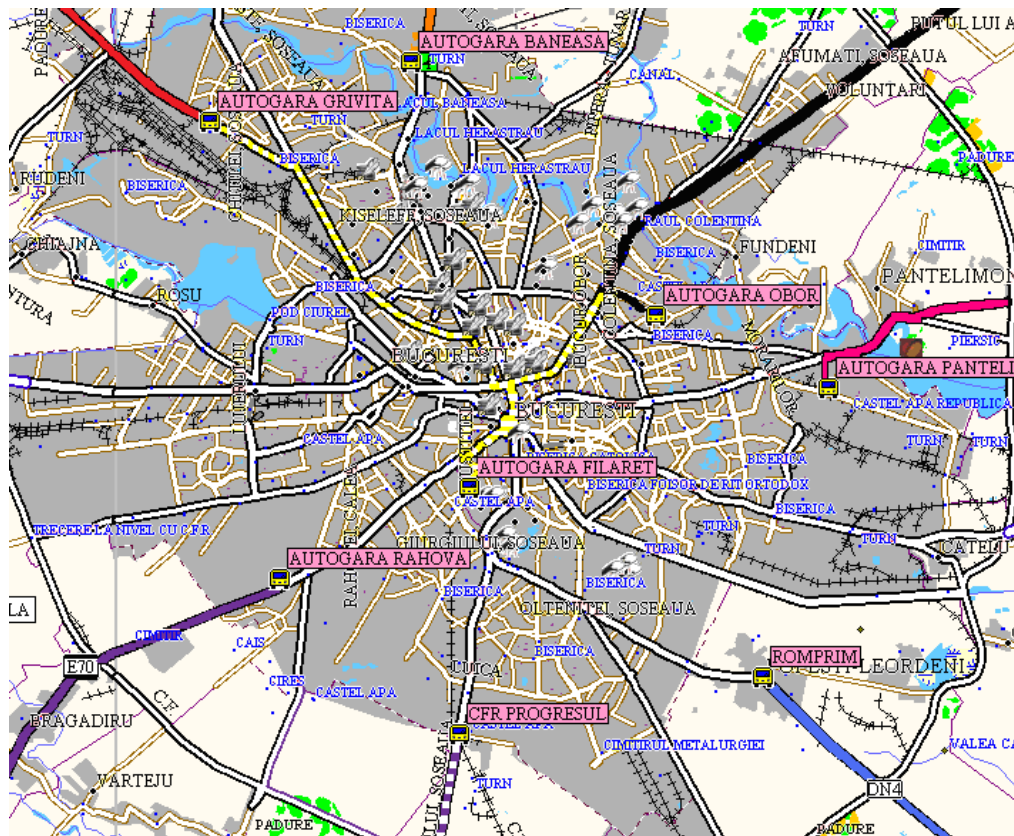


Figure 3. New locations for regional bus station

7. Conclusions

Lifestyles and travel behaviours are constantly change. Mobility is vital for quality of life in a city, and beyond, and it is expected to grow. There is not enough to find solutions to meet the urban mobility by increasing the supply of transport. It is necessary to identify interdisciplinary solutions based on link between transport and urban planning through which spatial solutions related to the development of transport lead to reduced need for mobility without suppressing user access to services and activities, and to encourage travel on short distance leading to a non-motorized transport more attractive. The integration of public and private transport, but also the integration of urban and suburban transport by development of

interchange terminals which include urban functions and which are located in the passenger transfer points is a satisfying solution for urban mobility that will lead to change in travel behaviours and decrease need for mobility. Interchange terminals are places characterized by accessibility, attractiveness, and nodality. Identifying new locations for interchange terminals, starting from the correlation between transport and urban development will lead to a strong urbanization around their location and it will determine a changing on urban form and on urban structure leading to a high urban density and a mix of urban functions, especially to a compact city.

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