ANALYSIS OF POSSIBILITIES TO COMBINE PUBLIC AND PRIVATE TRANSPORT IN VILNIUS BASED ON ZURICH URBAN TRANSPORT MODEL

Gražvydas Jakubauskas¹, Ulrich Weidmann²

¹ Vilnius Gediminas Technical University, Faculty of Transport Engineering, Transport Management Department, Plytinės Str. 27, LT-10105 Vilnius, Lithuania
² Swiss Federal Institute of Technology in Zurich, Institute of Transportation Planning and Systems, Wolfgang-Pauli Str. 15, 8093 Zurich, Switzerland
E-mails: Grazvydas.Jakubauskas@ti.vgtu.lt, Weidmann@ivt.baug.ethz.ch

Abstract. There is a strong need to better combine public and private transport in urban areas in order to reduce negative impacts of transport. To optimise the use of private transport (cars) it is necessary to promote new initiatives like car-sharing, to replace the need of transportation by means of communication i.e. “virtual mobility” (remote mobility, e-mobility), promote development of “Park&Ride” and “Bike&Ride” facilities, use smart parking policy, implement integrated ticketing approach. These are the focal areas analysed in the paper. As an example of good practice of combining private and public transport, Zurich city’s urban transport system model is analysed in the paper. Recommendations for a creation of a multimodal transport system of Vilnius city and generic practical recommendations for sustainable development of an urban transport are provided as well based on sharing the best practice.

Keywords: ITS, integrated ticketing, car-sharing, “Park&Ride”, “Bike&Ride”.

1. Introduction

In addition to urban impact, there are also global impacts under the influence of increasing urban traffic – climate change and global warming, increased health and well being problems, broken environmental balance and bottlenecks in the logistics chains. Better interaction between public and private transport (cars) could facilitate the task to cope with these problems. This might be achieved by applying multimodal integrated intelligent transport systems and services (ITS) and by implementing technological, infrastructural and regulatory measures, some of which are analysed in the paper. The main goal of the research is to analyse the best practice when combining public and private urban transport. The overall goal – reduced congestion and cleaner and better transport – might be realised through implementation of integrated sustainable urban transport strategies; those strategies require innovative attitude and great involvement and co-operation of all stakeholders. The following options to reduce congestion through better interaction of public and private transport in urban areas are analysed in the paper:

• To improve attractiveness and safety of alternatives to private car, such as walking, cycling, collective transport or the use of the motorbike and scooter;
• To ensure efficient links between the different modes of transport.
• To deploy Intelligent transport systems and services and adaptive traffic management systems;
• To promote less car-dependent solutions through car-sharing, differentiation of parking fees, providing “Park&Ride” facilities;
• To promote virtual mobility (various e-services), replacing the need of transport use by means of communication.

This is not a finite list of measures to be taken into account to mitigate congestion and reduce other negative impacts. But taken into one complex strategy, those measures produce great value added and are considered as the most effective.

2. Recent developments of combining public and private transport in urban zones

There are many new policies being implemented to reduce the need of growing private car use. One of the most promising of them is a car-sharing. A possibility of using (renting) a car for a short period for a significantly lesser price and by much simpler procedure than renting a car seems to be very attractive option, being implemented in many Western European cities. More over, a more sustainable use of the private car should be encouraged through various types of car sharing, for instance by carpooling or vanpooling, which lead to roads with fewer cars each
of them carrying more people. The recent developments of e-services (as an option to reduce the need of “physical” transportation by only using the means of communication instead) have already proven its feasibility. Starting from private sector and e-shops, tele-working, e-payment services, the public sector took the baton by providing e-health, e-registration services and the like.

Developing “Park&Ride” facilities is a common and very effective incentive for combining private and public transport. Parking policy for “Park&Ride” lots might be easily based by attractive payment fees – combined with public transport ticket, providing discount rates for public transport users depending on their location, or even allowing free parking for those who will continue their journey by public means of transport.

Smart parking policy is of utmost importance for balancing the traffic in urban zones, especially in the centre and old towns of the cities. Differentiated fees can be considered to reflect the limited availability of public space and create incentives (e.g. free parking spaces at the periphery and high fees in the centre) as well as car usage restraints where appropriate.

Having limited possibilities to provide new infrastructure, the deployment of ITS is considered as very effective tool to optimise use of private transport and improve public transport attractiveness. ITS enable optimised multimodal trip planning, better traffic management and easier demand management.

Another option is a flexible and multiple use of transport infrastructure. Flexible bus-lanes, no-car lanes, flexible loading zones/parking places, flexible use of traffic lanes during peak hours, intelligent traffic lights system, permission of using bus lanes for cars with high occupancy rates and the like could lead to reducing pressure on road space.

Comprehensive mobility management is intended to complement traditional infrastructure-based measures by influencing travel behaviour before it starts and shifting people’s attention towards more sustainable transport options. In the light of the climate change issues, the mobility management helps to reduce strong negative impacts of congested urban traffic.

Dense network of footways and bicycle lanes also play important role in a multimodal system. In practice, urban transport network has to have fast public transport links in order to eliminate (reduce) congestion in the main transport arteries. Those links connect main urban passenger terminals (stations) with the main city station (main passenger train terminal with multimodal links) which in turn is linked to airport (usually located outside the city) by fast transit link and serves for international and national traffic.

The scheme in Fig. 1 illustrates a streamlined model of combined transport links.

Effective co-operation of stakeholders allows involving all the parties concerned to participate in transportation (planning, managing, operating, financing, evaluating) processes. Practical implementation of organisational structure for managing public transport system in canton of Zurich is thereinafter analysed more in detail.

This notwithstanding, an ideal organisational model is difficult to achieve: builders (operators) want to provide the smallest possible network (to minimize production costs) while users want to have the largest possible network (to minimize travel costs/time) [3]. Development of high quality urban transport is seen as a priority of European Union’s transport policy. White Paper of European transport policy proposes to place the emphasis on exchanges of good practice aiming at making better use of public transport and existing infrastructure [4].

Without efficient public transport the cities would have faced with unavoidable and invincible congestion phenomena. Nevertheless, public transport succeeds to attract users only if a set of urban public transport characteristics (price, service frequency, service punctuality, comfort, safety, security, average time, waiting time, reliability, purpose of travelling, intangibles) tilt the balance of advantages compare with personal cars. [5]. The less multimodal system is, the less advantages (travel options) it has.

![Fig. 1. Generic scheme of private transport links](image)
Private cars might be of better choice depending on certain circumstances (mostly on a trip purpose) therefore efficient private-public transport interaction is needed as well. Passenger transportation covers many possible ways of travelling. The choice of transport mode usually is multiple; integration of different multimodal concepts into one urban transport system makes it even more attractive would it be public, private or other type of passenger transport (see generic example in fig. 2).

Success of reducing car traffic, especially in central zones of the city depends on commercial speed of the public transport means. Non-segregated public transport (buses, trams, trolleybuses, etc.) or partially segregated (light rail transit (LRT), tram on tyres, autotrams, bus rapid transit (BRT)) are not that attractive from drivers point of view such as segregated (heavy, cable, inclined, rack railway, maglev, water transport means, gondolas) or grade separated public transport (elevated trains, suspended monorails, underground metro, light rail rapid transit (light metro, LRT)) that usually provide rapid or express services. Therefore, “Park&Ride” is attractive when drivers are willing to transfer into public transport means by perceiving this as saving their time. Partially public urban transport means (demand responsive transport (DRT), paratransit, automated people movers (APM) or personal rapid transit (PRT)) should add a third dimension into the system.

Regulatory measures to implement car restraint actions (congestion taxes, entry prohibition, etc.) could definitely lead to less congested streets, but on the other hand, might raise a great dissatisfaction, especially amongst those to whom the car is a must (suburban population, etc.). Smartcard integrated ticketing is a common way to better integrate private and public transport. Smartcard might be developed into electronic omnipurse and should allow paying not only for public transport but for parking of private cars. A further generation of smartcard is to make them “international”. For example, the Brussels (Mobib) card could be compatible with those of Amsterdam (OV-Chipkaart), London (Oyster), Paris (Navigo) and Cologne (eTicket), and also recognised on Thalys, Eurostar, TGV and ICE services, [6], but there are many issues to be solved, particularly from international transactions side. Contactless smartcards are seen as a necessity in a multimodal (combining public and private) trip as part of integrated ticketing system. Sensors ticket gates reads the card from the distance, with the price of a fare being automatically deducted when the traveller exits a station. The aim is to cut cash transactions and reduce dwell time at stops and queues at stations. Route planning systems and real-time traffic information should help drivers to be just-in-time at the station (or „Park and Ride“ zone).

### 3. Public and private transport interaction in Zurich and Vilnius: sharing best practices

Since the establishment of the legal basis for the setting up of the Zürcher Verkehrsverbund (ZVV) company in 1990 that led to creation of integrated urban transport system in Zurich, the individual transport operators no longer function as separate businesses. The ZVV defines the strategic objectives and directions, is responsible for finances and takes charge of strategic marketing in canton of Zurich.

In many cases throughout the Europe, it became necessary for the public authorities to help finance
transport infrastructure and even the operations. Yet, sufficient incentives must still be in place to ensure that the operator is optimising its level of performance. The primary role of the public authority lies in the area of system regulation to verify that the public service is indeed provided under optimal conditions [7].

ZVV focuses on both urban/suburban and regional public transit providing well developed solutions on modal choice, timetables frequency, transport fares and related infrastructure. This enable sustainable transportation processes throughout all the area of Canton of Zurich. Public transport helped easing most cars off the city-centre streets. Tram network is one of the densest in Europe, fast bus and trolleybus routes are used as access links from suburban termini to outlying districts. S-Bahn suburban trains, most originating from or passing through the main station are extremely popular. Night traffic, boats and funiculars complement multimodal choice as well. Network of bicycle lanes, bearing in mind the mountainous landscape of Zurich, is quite well developed, and excellent parking facilities for bicycles, mopeds and motorbikes are provided [8]. The interaction of different transport modes in central part of Zurich is shown in fig. 3.

Along with bike-sharing, Zurich offers well developed car-sharing services. “Mobility” concept, including “Park and Rail” facilities, is designed to provide fast and convenient links for cars drivers with special ZVV annual ticket (Travelcard + Mobility) to S-Bahn train, trams and bus stations. Out of more than 2000 cars throughout Switzerland, 1/3 of these are in the ZVV region at 360 locations at or near ZVV train, tram and bus station. The concept is based on self service, using internet or portable devices – ordering travelcard, registering it, making online reservation of a chosen car and picking up the vehicle directly from its parking space near stations. ZVV Annual Travelcard + Mobility has an integrated electronic chip which allows opening the car doors one have booked by swiping the card over the checkpoint on the windscren of the vehicle and start the engine with keys taken from the glove box.

The emphasis in Zurich, as well as in many other Swiss cities has been in improving the frequency of service and the spatial coverage of public transport systems, ensuring a maximum of the population are close to bus and tram stops. Improving the performance of existing systems through telematic control and information systems has been given priority over heavy investments in new fixed infrastructure and metro systems [9].

In terms of population, Vilnius is relatively comparable to Zurich. Moreover, in the light of benchmarking policy, Zurich urban transport system is attractive as giving a priority to efficient utilisation of multimodal modes without urban underground system. Mainly due to fast economic growth of Vilnius, that lead to spreading out boundaries and natural change of traffic flows, urban transport system has became less sustainable and unable to serve need of passengers effectively. Present system due to insufficiently developed bicycle network, lack of high-speed transport means, congested streets, insufficient urban/suburban rail links, different tariff and ticketing systems is not functioning as a sustainable and multimodal entity. Therefore, car commuting in longer distances is still very attractive due to absence of rapid public transit vehicles. Implementation of “Park and Ride” facilities into common system could reduce car traffic, yet the lack of grade separated or segregated public transport means might not give the expected result. Introduction of integrated ticketing, improvement of information provision system, better integration of all public transport means and types are seen as a necessity [10].

Fig. 3. Multimodal transport node in centre of Zurich
In December 2008–January 2009, co-author made a two-round Delphi survey on importance of multimodal concepts for Lithuanian urban transport development. 46 experts in total (top level transport managers from public and private companies and scientists) filled the questionnaire. The development of public transport priority systems and better scheduling was emphasized (see fig. 4).

Concerning the question on “Park&Ride” and “Bike&Ride” facilities location, the vast majority of experts (over 70% and 50%) expressed their opinion on the need to combine “Park&Ride” facilities with terminals of city buses and trolleybuses respectively.

Since 2008, Vilnius, Kaunas and Klaipeda have introduced electronic smartcard tickets. In coming years the ticket system is going to be compatible with train ticketing system and planned to serve as electronic purse for parking payment. To benefit from integrated ticketing, it is recommended to provide more incentives than single ticket for several transport modes. In Switzerland, fare policy for public transport is based on half-price pass where approximately 50% of population has this kind of pass. One forth of population has monthly or annual seasonal tickets [9]. Comparison of the main urban transport indicators in Vilnius and Zurich is provided in the table 1 below.

**Table 1. Comparison of main features of Vilnius and Vilnius urban transport system**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Vilnius</th>
<th>Zurich</th>
</tr>
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<tbody>
<tr>
<td>2 Area</td>
<td>401 km²</td>
<td>92 km²</td>
</tr>
<tr>
<td>3 Population with suburbs (Vilnius District and Canton of Zurich)</td>
<td>650 thous. (in 2008)</td>
<td>1,307 thous. (in 2007)</td>
</tr>
<tr>
<td>4 Total area of District/Canton</td>
<td>2,129 km²</td>
<td>1,729 km²</td>
</tr>
<tr>
<td>5 Number of cars/1 000 inhab. (in 2007)</td>
<td>554 (national average: 470)</td>
<td>510 (national average: 519)</td>
</tr>
<tr>
<td>6 Car Sharing</td>
<td>–</td>
<td>“Mobility” Car Sharing</td>
</tr>
<tr>
<td>8 Park and Ride</td>
<td>–</td>
<td>Combined with car-sharing close to S-Bahn train stations.</td>
</tr>
<tr>
<td>9 Bike and Ride</td>
<td>–</td>
<td>Main intermodal terminals</td>
</tr>
<tr>
<td>10 Bike station</td>
<td>–</td>
<td>“Velostation Landesmuseum” (guarded, bad weather protection)</td>
</tr>
<tr>
<td>11 Kiss and Ride† at airport or railway station</td>
<td>Vilnius main railway station: Pick up or drop off zone</td>
<td>Kloten airport: 15 min. free to pick up or drop off passengers.</td>
</tr>
<tr>
<td>12 Rail and Ride (intermodal PT terminal)</td>
<td>Bus and rail station are close but not directly linked</td>
<td>Bus and rail station are close but not directly linked</td>
</tr>
<tr>
<td>14 Interaction of urban and suburban transport</td>
<td>Separate transport systems for Vilnius city and Vilnius district</td>
<td>Zone system for entire Canton of Zurich</td>
</tr>
<tr>
<td>15 Means of urban public transport</td>
<td>Buses, trolleybuses, shared taxi, trains (partly)</td>
<td>Trains, trams, buses, trolleybuses, cable railway, mountain railway, river buses, lake steamers, public bicycles</td>
</tr>
</tbody>
</table>

† An area in which cars can discharge and pick up passengers, allowing to stop and park temporarily free of charge, instead of the longer-term payable parking.
This short list of main criteria to combine private and public transport clearly shows the effectiveness of Zurich city model comparing to Vilnius one. Growth in travel and more and more dispersed land use will contribute to even more increased commuting time and other negative impacts in Vilnius. Placing an emphasis on better implementation of before-mentioned concepts and experience of Zurich city should allow achieving better synergy and systematic development of urban transport system.

5. Conclusions

1. Urban sprawl and fast growth of car ownership and car use greatly limited capacity of public transport in many cities throughout Europe and caused negative impacts as a result of congestion, noise, air pollution, etc.

2. Suburban areas are usually poorly served by public transport and therefore private transport usage is unavoidable. Nevertheless, the recent trends shows efficiency of “Park and Ride”, or “Bike and Ride” concepts to reduce private car run at a minimum to transfer into public transport means from nearest intermodal station.

3. Involvement of urban transport stakeholders must ensure that all of them participate in mobility management process in a co-operative way. ZVV model could be considered as suitable for sharing best practice.

4. Implementation of intelligent transport systems and services greatly affects all the factors influencing urban journey and leads to sustainable functioning of multimodal urban transport systems.

5. Drivers of the outskirts or suburbs of a city perceive “Park&Ride” facilities as a practical option (incentive) to save time and costs. Car restraints, such as taxes, lane use constraint or entry prohibitions are recommended to implemented as supplementary option if incentive tools to combine private and public transport had no positive outcomes.

6. Time savings is a crucial factor for car drivers. Therefore integrated ticketing systems based on contactless multifunctional smartcards are seen as a necessity in a multimodal (combining public and private) trip.

References


