Terminals for Suburb Bus Transport in Bratislava

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Abstract. The main objective of this article is to describe the strategy for development of the public transport terminals in the city of Bratislava, Capital of Slovak Republic. The reason goes from the private operator Slovak Lines, who operates the suburb bus transport in the agglomeration of the city. For this operator was created a transport model, while placing emphasis on optimizing the compliance of suburban public transport with urban public transport in the city of Bratislava and evaluating the significance of the new Bus Station to be constructed at Mlynské Nivy – in a new downtown centre of the city. The main issue is to ensure the best available offer of public transport (PT) to passengers in the Bratislava agglomeration. The subject of the study was oriented to specify and propose changes in the transport infrastructure and integrated public transport organisation on the area of the city in terms of the significant position of the new Mlynské Nivy Bus Station (MN BS), which is under preparation with realization in the year 2017.

1. Introduction - Suburban Bus Service in Bratislava Agglomeration

Passengers travelling from outside of Bratislava agglomeration can use the services of suburban buses and railway. Travelling has become easier as part of operating the integrated public transport. It also brings several benefits to passengers travelling not only outside the city, but also inside the city itself. The Suburban Bus Service (SBS) fleet stops in the city only at selected stops, at major Urban Public Transport (UPT) interchange points, i.e... SBS has the nature of express public transport in Bratislava.

The main task is significantly to save travel time as a very important factor for deciding whether to use public transport of to use individual cars. The central bus station Mlynské Nivy, Bajkalská, Gagarinova, Zlaté Piesky, and Patrónka stops (Figure 1) are the main interchange hubs for this mode of transport. Figure 1 shows a diagram of the area serviced by suburban bus stops. The result of the research was to find the logical deployment of terminals on the area of Bratislava from the integrated public transport point of view. The main task was to define the strategy for new development of the terminals for Bratislava Integrated Transport (BIT).

The article is risen up according the huge study [2]. Bratislava has a Master Transport Plan [1] from 2015, where is an expectation for multimodal transport solution of the modal split. The problem is that inside of this main strategy document for the city, the integrated public transport is not oriented in a relevant level. The [1] deals not with the railway on the area of the city and with the suburban bus service to a small extent. It arises only sporadically in the statement:

- creating conditions for the preference for road public transport at entrances to the city in close cooperation with the Bratislava Self-governing Region;
to develop and adopt a common procedure for the benefit of preference for public transport, including a funding agreement.

This article has an aim to show how influence a higher quality of PT service can, if the philosophy of cooperation trough integrated terminals, help for the development of the whole agglomeration of Bratislava.

Figure 1. Scheme of the stops of suburb bus transport in Bratislava

2. Integrated Passenger Transport Terminals in Bratislava

Transport integration in public passenger transport means mainly the following:

- Transport coordination - the single coordination and optimization of timetables and scheduled lines between carriers;
- Tariff integration - as a uniform price list, a uniform ticket for all modes of transport, uniform tariff conditions and transport regulations;
- Building and operation of interchange terminals, including controlled connections to cars (park-and-ride lots, i.e. P+R) and to non-motorised transport (pedestrian traffic, utility cycling – bike sharing, parking for bicycles).

The result is a unified customer solution - a single transport offer which is also the most attractive offer of public transport able to compete with passenger cars traffic. The operation of individual modes of transport on a sufficiently dense network of public passenger transport is aligned so that passengers can easily transfer from a bus to a train or tram, from a car or bike to a means of public passenger transport. Timetables are designed so that time losses at interchange hubs are minimal, and lines and connections are managed according to demand to the greatest extent possible. A detailed analysis based on an extensive transport survey to assess the functioning of the current integrated transport is still missing but to the end of 2016 was realized a big inquiry survey on railway and suburb bus PT. The results are not published yet.

Based on the strategy of the Transport Master Plan (TMP) [1] which defines the essential attributes for large cities (megacities and urban conurbations), we cannot fully agree with the proposal defined in this strategic document. These are:

- The TMP [1] deals with interchange hubs, where their function was presented as a simple form of potential of possible interchange hubs ascertained on the basis of the “GIS analysis”, which identified the “points on the infrastructure”. These points were defined as an area in which rail and road transport are up to 300 m from each other. Without any spatial and logical way of public interest. Another analysis or proposed designs are not included in the TMP. Meanwhile the average distance among the PT stops in Bratislava are 180 m only (!);
In [1] it is not enough information for the analysis of pedestrian flows at interchange hubs and stops, and it is advised by this document to elaborate another study, including conducting an appropriate transport survey which should address precisely this specification. But to the end the TMP defines priorities for Integrated PT (on which survey and analysis was defined the strategy?);
• does not address the comprehensiveness of PT service and guides the development only within city limits, [1]. Terms of Reference for the public procurement of TMP which were to address satellite towns are not included in the final copy of the TMP for “Integrated Passenger Transport Terminals”. How this strategy (TMP) could define what a need for solving integrated PT is?

Figure 2. shows the hierarchy of hubs and terminals for the city of Bratislava [2], which is derived from the context of urbanisation, and the development of the city and its agglomeration.

Figure 2. Systemization of integrated PT Hubs and Terminals in the City of Bratislava

Legend:
- **Red dots**: PPT main hubs – Main Station, Filialka, Mlynské Nivy, Petržalka Centrum
- **Blue dots**: PPT terminals – Bory – Lamačská brána, Vinohrady – Predmestie, Ružinov, Janíkov dvor – Petržalka
- **Yellow-black dots**: Strategic interchange terminals of PPT: Devínska Nová Ves, Patrónka, Rača, Nové Mesto, Vajnory, Prievoz – Domové role, Petržalka, Rusovce
- **Black dots**: Railway Integrated public terminals

In spite of that the base rules for development of operated BIT is defined transport integration. It concerns the establishment of such transport solution that creates a uniform transport offer so that passengers can easily combine individual modes of transport: railway transport, bus regional service, and UPT, etc. The alternative kind of transport modes which can help to PT operation are not solved.
The respective steps include the harmonization of individual modes of transport with the following features:

1. multimodal PT is oriented in a direction of priorities from railway to tramway, bus and trolleybus;
2. preference for rail transport where possible with regard to capacity and availability;
3. optimization of line schedules;
4. harmonization and coordination of timetables;
5. networking of interchange sites: P+R, K+R;
6. common use of stops through several modes of transport.

The main hubs of public passenger transport can be defined as follows (red dots on Figure 1):
- Main Railway Station,
- Filiálka,
- Mlynské Nivy Bus Station,
- Petržalka Centrum.

The following hubs can be determined as the main strategic terminals of Integrated Public Transport System (IPTS) for Bratislava. The second level of terminals are (blue dots on Figure 1):
- Lamačská brána – BORY,
- Vinohrady - Predmestie,
- Ružinov,
- Janíkov dvor (Petržalka),

and in terms of the space-regional development of the city their function is to radially ensure the distribution of the travelling public to the major transport hubs of passenger transport in accordance with the development axes of the city.

On the borders of the wider centre of Bratislava, the strategic terminals from unequivocal “supporting hubs” of passenger transport for the future development of the area in terms of rail infrastructure, which must include the linked comprehensive services of UPT (black dots with yellow ring on Figure 1). This concerns mainly the network structure of rail transport represented by the railway and tramway (perhaps suburban railway rolling stock – may be future tram-train) public transport. The network is supplemented with trolleybus and bus lines. These hubs must be equipped with a high standard of pedestrian traffic services with a direct link to the urban and above urban functions of the city. The logical attribute is also the possibility of changing to SBS. “Strategic terminals” are not currently elaborated in sufficient detail. Services for the parking of bicycles and alternative modes of transport, such as bike and car sharing, must be a natural tool for these terminals.

There are projects for the Main Railway Station and the Bus Station, but only implementation of the Bus Station project is actually progressing. It is also necessary to examine the comprehensive function and role of the hub “Petržalka Centrum” in terms of design in relation to all surrounding investment activities being prepared in this area. With respect to SBS, the Main Railway Station and Petržalka Centrum can have stops created directly in the area of the hubs in order to link them to MN Bus Station. However, this function should also necessarily be performed by tramway PT.

The Main Railway Station should be fully integrated after the conversion. Especially those SBS lines that pass through in close proximity and serve the relevant area of the Bratislava region should have a stop there to allow passengers to use, for instance, railway long-distance transport and vice versa. SBS lines would further continue to MN Bus Station, thus also providing for direct and fast connection of these most important main hubs in Bratislava at an acceptable time interval.

The IPTS strategic terminals mentioned above for the main hubs constitute an important radial structure to the hinterland of Bratislava with the basic architecture of decentralization of the city territorial development, thus creating a base for the continuous and quality territorial development of the Bratislava agglomeration. By connecting these hubs and terminals, Bratislava has an ideal opportunity to create a network structure of urban public transport which must be represented by the Supporting System of UPT - a tram (or its urban track version: a tram-train).
A network of express buses which will improve the range of services provided in public passenger transport is a supplementary system combining terminals and tram stops.

3. Strategy of Suburban Bus Stops
The very suitable principle for increasing the attractiveness of public transport use, in spite of the radical opposition of passengers to transfers between individual PT systems – PT operators, is to create combined spaces for common PT stops that would facilitate such transfers. This is a fundamental issue for creating integrated PT terminals. At present, common services are already provided in simple form at certain stops. It is the suburban bus service along with UPT lines in the city of Bratislava.

In general, the issue of transfers is the basic negative for passengers using PT. What causes passengers’ negative approach to using transfers when travelling by public transport? Basic issues include time losses and the variable convenience of transport resulting from:

1. physically inappropriately-designed location of stops – separate embark edges and the need to move from one stop to another, frequently with a distance longer than 100 m;
2. a non-uniform way of using tickets, and delays in getting on/off PPT, especially the suburban bus service – it belongs to the past by introducing the 3rd stage of BIT as from 1st September 2016;
3. failure to comply with timetables and loss of links to following connection;
4. long waits for the next connection – applies mainly to transfers between railway – SBS/UPT;
5. variations in travelling comfort, among others, by changing the means of transport at different quality levels and different levels of service.

However, as part of the integration of public passenger transport, the basic principles to be accepted by each operator must be dealt with. Such principles must include:

1. a unified ticketing system (exiting in Region of Bratislava) – including the purchase of one-way tickets – a uniform ticket machine (not as complicated as in couple of German cities);
2. a unified system of electronic season tickets (exiting in Region of Bratislava);
3. optimization of performances between the operators through a system of strengthening quality service in the area.

In terms of service in the territory of Bratislava which is covered by a dense network of UPT lines, the capacity of SBS if sufficient with the operators can be utilised for an additional network of creating express lines. These should use their existing routes in the communications network with the current stops, and where appropriate also at other stops combined with the UPT network as demanded by passengers.

The integrated stops have a base quality definition for operation rules. According to [2] the comprehensiveness of services provided and equipment of IPTT stops are provided by the following elements:

- a ticket machine,
- an information system,
- radio,
- CCTV security system,
- connection to a dispatching centre,
- benches and bicycle parking racks,
- wheelchair access,
- roofing of staircases and lifts,
- shelters on platforms.

This standard could be supplemented with equipment of a commercial nature, which could make particular stops more attractive and entice passengers.
4. Terminal Mlynské Nivy Bus Station - Service Strategy
The construction of a new bus station at Mlynské Nivy (MN Bus Station – Figure 3) is under preparation on the boundary of the inner ring road of Bratislava and the new administrative and business centre of the city. The basic aim is to increase the attractiveness of public transport in terms of suburban, intercity and international transport. The new MN Bus Station will significantly contribute to reducing the share of passenger cars in favour of PT in such a way, as well as the quality of the comprehensive service. MN Bus Station is also the only site officially approved by Ministry of Transport for international and long-distance bus services (with a length of bus routes over 250 km in Bratislava) – near the centre, under Regulation (EU) No. 181/2011 of the European Parliament and of the Council. Moreover, it is a link with a very dense network of UPT lines (trolleybus and bus services – in a peak hour 50 s interval only), and the strategic document of the transportation master plan [1.] also accounts for the introduction of a supporting system of rail transport in the direction from the city centre (from Kamenné námestie) along Dunaíská Street and across Mlynské Nivy up to the administrative centre APOLLO continuing to Prievoz [4.]. The second strategic axis leads from Petržalka from Staré Mesto (the Old City) along the inner city ring road (Dostojevského rad, Karadžičova Street) to the future Filiálka station [5.]. The importance of the MN Bus Station terminal will increase due to the upcoming implementation of a parking policy aimed at the gradual removal of cars from the city for the benefit of public transport.

![Figure 3. New Bus Station Mlynske Nivy in Bratislava](https://example.com/image)

Source: © Siebert + Talaš, 2014

Complementary services of alternative modes of transport to be prepared in the city of Bratislava are of great importance. These services include bike sharing and car sharing. There is a strong assumption that these services, which otherwise very appropriately complement the services of public transport, will also be available similarly to the premises. It can only be assumed that the project designed these areas in front of the building of MN Bus Station itself. Stops of the supporting system of UPT are also expected to be built in a touch of the MN Bus station. Neither the transport solution to MN Bus Station, nor walking routes, dispersal areas, utility cycling, nor static and dynamic automobile traffic, are subject to this study. The project [3.] verified spatial gabarits for a possible tramway in the area, located in bus lanes in Mlynské Nivy as a reserve for the tram line, and it also verified the spatial possibility of placing a one-way loop around the building of VÚB. The technical solution is solved in [4.].

5. Urban Public Transport in the Area of MN Bus Station
The city of Bratislava must consider a solution to the capacity system of UPT in order to service the new modern city centre. Terminal MN Bus Station has to be solved by the UPT tramway lines. Certain
double-track solutions as shown in Figure 4 were sought in search of a system transport solution to tram lines according to the interests of key developers in this area. The proposed routes, however, must be primarily assessed by traffic flows of passengers through a comprehensive transport model, and then it is necessary to look for an engineering design of lines placement in the area under intense development in terms of architectural and construction designs with individual investments in this area, which can be subject to restrictive conditions.

A design in technical study level according to [4.] as shown in Figure 5 is a partial result. However, the proposed technical design has not been assessed in terms of traffic flows of passengers travelling by UPT, and it can be assumed that only a double-track solution to service in the area will be meaningful from the south from Dostojevského rad, further along Karadžičova Street, as well as a two-way solution in relation to the city centre (Dunajská Street) towards Mlynské Nivy. The proposed solution to the location of stops will very likely be suitable for service in the area as well as for the operation of MN Bus Station.

![Figure 4. Scheme of Possible Tramway Lines in a New City Centre of Bratislava [2.]](image)

6. Optimization of Interchange Hubs in the City of Bratislava

According to [1.] it is contained in the output of the analytical part, where these premises are defined in terms of spatial city development:

1. **in terms of agglomeration**: an expected increase in population in the hinterland of Bratislava due to intensifying suburbanisation will lead to growth in demand for transport services of a regional/suburban nature in a radial direction – namely the main radial roads towards satellite towns, but only in urban terms. Therefore is a high levelled priority to deploy strategically the terminals according to the suburb bus transport together with a big investment to the railway infrastructure;
2. **in terms of the inner city**: localities with the highest disproportions between work activities and residential functions are the high-density housing areas (Petřžalka, Vrakuňa, Karlova Ves, Dúbravka, Lamač, Devínska Nová Ves). Given the high demand for transport services, it is advisable to introduce a high-capacity transport connection to these localities, thus easily reducing these disproportions as opposed to the same disproportions in suburbia.

![Designed Tram Line](image)

**Figure 5.** New Tramway Line from City Centre to Prievoz in Bratislava [4.]

In terms of the city development, a tram is defined as a high-capacity transport connection – the supporting system of UPT (some parts of the master plan regard a trolleybus as the supporting system (?) which has a very limited transport capacity at peak hours and besides, is dependent on transport conditions of vehicular traffic in the network of urban roads).

However, the analysis and design of the transport system according to [1.] do not define the principles of functions of integration of several PT modes. In terms of SBS, the termination of SBS lines is not mentioned anywhere, except for Bory and Filiálka terminals. The integration of the new MN Bus Station at Mlynské Nivy is not addressed, but it also means that reasonably and professionally it is automatically correctly considered an important transport hub. Transport model scenarios according to [1.] do not deal with relations how during the time periods 2020 - 2025 - 2030 - 2040 passengers are redistributed between the respective modes of public transport, such as between railway and individual tractions of UPT, between SBS and trams, or trolleybuses and buses of DPB. In this way, the “mobility sustainability” can be little assessed in the area of the city in the PT system itself by 2040. Similarly, it can be stated that the design of the P+R system at the terminals is also not reflected in the respective scenarios (at least it cannot be identified anywhere).

7. **Conclusions**

Based on the foregoing we can conclude:

- the system of hierarchy of terminals and hubs for Integrated PT is sufficient according to [2.];
- the basic philosophy of interchange hubs with a walking distance of 300 m according to [1.] is inapplicable to the conditions of Bratislava at present and in the medium term. The transport survey showed that the average distance from source/to destination to/from a stop is 179 m (!);
- the idea according to [1.] about the hubs and terminals philosophy is incorrect in several parts, which may be caused by an ignorance of the spatial arrangement of the area of Bratislava. Reference to the solution according to GIS analysis is purely theoretical, and not practical in terms of service in the area and its urbanisation. Some terminals are completely outside the main transport/traffic flows or are addressed as a relation between long-distance transport and railway with links only to UPT;
- other functions of terminals as links to alternative modes of transport are not defined at all; the system of IPTTs deals with the issue of railway transport only in a single-purpose way, and in some cases it tries to address the links between ŽSSK and UPT. Otherwise it lacks the comprehensiveness of ITS services at each IPTT and highlighting the advantages of the integrated transport service;
- with respect to the strategy, it is advisable to define the network structure of creating strategic hubs and terminals of PT in the hierarchy of agglomeration, and not only in terms of the city itself. This structure should be focused on the system of the transport substrate volume structure along with the time intervals of service between individual carriers.
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