

integration of public transport, interchanges,  
share lanes, share bus and tram stops

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## **INTEGRATION OF PUBLIC TRANSPORT IN POLISH AND EU DOCUMENTS AND EXAMPLES OF SOLUTIONS FOR INTEGRATION OF PUBLIC TRANSPORT IN POLAND AND IN THE WORLD**

**Summary.** The article presents the problems and the importance of integration of public transport on the basis of Polish and EU documents relating to public transport, as well as gives examples of solutions that integrate urban public transport in Poland and worldwide. Public transport is a special kind of transport designed for fulfilling needs of city (communal) in range of urban and suburban transport of inhabitants. The main task of public transport is to enable the mobility of people with retaining the same conditions which are given by passengers. Issues concerning the public transport development (improvement in quality of public transport services in the all necessity and essence of its integration) are bringing up in many important Polish documents (e.g. State Transport Policy) and EU (e.g. White Paper, Green Paper). An example concern the solution of urban public transport integration in the country and world can be quoted of some solutions: implementation of the uniform tariff system, interchanges, share lanes for means of public transport, share bus and tram, share bus-tram routes implementation of the double system tram.

## **INTEGRACJA TRANSPORTU PUBLICZNEGO W DOKUMENTACH POLSKICH I UE ORAZ PRZYKŁADY INTEGRACJI PUBLICZNEGO TRANSPORTU W POLSCE I NA ŚWIECIE**

**Streszczenie.** Artykuł prezentuje problemy oraz istotę integracji transportu publicznego na podstawie dokumentów Polski i UE, podaje przykłady rozwiązań integrujących miejski transport publiczny w Polsce i na świecie. Miejski transport publiczny jest specyficznym rodzajem transportu przeznaczonym do zaspokajania potrzeb miasta (gminy) w zakresie miejskich i podmiejskich przewozów mieszkańców. Zadaniem miejskiego transportu publicznego jest umożliwienie przemieszczania się osób z zachowaniem pewnych warunków stawianych przez przemieszczające się osoby. Kwestie związane z rozwojem miejskiego transportu publicznego (poprawa jakości świadczonych usług publicznego transportu w tym konieczność oraz istota jego integracji) poruszane są w wielu ważnych dokumentach Polski (np. Polityka transportowa Państwa) oraz UE (Biała Księga, Zielona Księga). Jako przykłady dotyczące konkretnych rozwiązań integrujących miejski transport publiczny w kraju i na świecie można przytoczyć: wspólna taryfa dla transportu publicznego, węzły przesiadkowe, wspólne pasy, wspólne przystanki autobusowo – tramwajowe, wspólne trasy autobusowo – tramwajowe, wprowadzenie tramwaju dwusystemowego.

## 1. THE TERM OF INTEGRATION

The problem concerning the traffic condition improvement in the city is the most important matter. It can be improved by implementation of new solutions within public transport which results in increasing number of passengers and improvement of transport accessibility in the cities. Important elements which can improve operation of urban transport systems is suitable quality of public transport service. The quality of public transport can be made better by planning of transport network and taking into consideration different means of transport and infrastructure development. The aim of these activities is to create right connection, comfortable changes, design of transport services connecting trips realized by different means of transport for various distances with coordinated timetables, design of integrated services, concerning transport, information for passengers, ticket and tariff system. Activities presented above are popularly called: integration of transport system. The term of integration of urban transport system is often variously understood by different author.

The measures of Propolis project [11] were concentrated on integration of using of areas, spatial development and transport policy in metropolitan area. The authors offer alternative solutions for integration of transport systems for different city in the world (in Prospect [12]). Project author study influence of various integration tools on passenger behavior. The interesting observations within integration theme were showed in article A. Maya and others [8], where were presented the rules of creation of effective design of integrated urban transport system and they discuss the different ways of transport integration. In public transport the term of integration is popularly used for solution assuring continuity of journey from door to door [5].

Integration of urban public transport can be realized on different planes:

- spatial plane (in micro and macro scale e.g. creation of interchanges, shared lanes for means of public transport),
- building plane (e.g. passageways connecting public transport stops, overpasses, underpasses, shared stops for public transport),
- organizational plane (e.g. coordination of timetables),
- economical – financial plane (e.g. integrated tariff),
- information plane (e.g. tools which gives passenger information about public transport operators, lines, bus/tram stops, timetable, possibility of changes, actually run public transport vehicle, substitute transport, travel planners).

Main benefits of urban transport integration are following:

- increase in competitiveness of operators of urban public transport in comparison with individual transport,
- increase in competitiveness of city/region,
- better use of the different means of transport,
- decrease in cost of transport,
- decrease in traffic congestion in urban street,
- decrease in the pollutant of environment,
- reducing in travel time,
- improvement in the spatial accessibility.

Benefits mentioned above result from urban transport integration are related not only with functionality of public transport but also has large influence on society, environment as well as transport cost.

## 2. INTEGRATION OF PUBLIC TRANSPORT IN POLISH AND UE DOCUMENTS

Issues concerning the public transport development (improvement in quality of public transport services in the all necessity and essence of its integration) are bringing up in many important Polish documents (e.g. State Transport Policy) and UE (e.g. White Paper, Green Paper). The State Transport Policy is taking note of current situation in Polish cities concerning motorization level, traffic conditions, technical infrastructure conditions, rules of public transport organization, degree of preparation and realization of policies and transport development programs. Among the most important city problems which are written in State Transport Policy [10] can be indicated weakly integration of city transport systems what isn't conducive to spreading of intermodal travels (traveling with usage of few transport means), growing congestion and its influence on the traffic conditions, decreasing share of public transport in the modal split etc. Among the main tasks of State Transport Policy is promotion of spatial and functional integration of transport subsystems, in the all encourage to create intermodal systems (e.g. interchanges, park and ride systems), coordinated timetable, uniformed tariff systems etc.

The equinox with west European Countries regards decree of civilization development and level of quality life is one of the most urgent task for realization in framework of sustainable Polish development. It demand creation of strong structural bases of economical growth, in that efficient transport system. The main aim of the state transport policy is improvement in transport system quality and its extension with sustainable development rules, because the quality of transport system is one of the key factors which decide about inhabitants' life conditions and about country and regions economical development. The main aim will be achievement by realization of six detailed aims among its there are e.g. accessibility and transport quality improvement, effectiveness improvement and integration of transport system in branches and territorial order. One of the rules of transport policy is the rule of influence on transport demand and way of its satisfaction is related with limitation of pace of growth and transport in chosen transport subsystem (e.g. urban individual transport), limitation of distance of journey and modal split. Concerning priorities formulated in State of transport policy, some of them direct concern urban public transport: improvement in quality of urban transport by improvement in competitiveness of public transport towards individual transport, improvement in quality and competitiveness of public transport in metropolitan and regions among other by provision of facilitations and encouragements for organization of rail network agglomeration, exchange fleet, expansion and modernization of technical infrastructure condition.

The official transport policy of European Union is White Paper [3]. The fundamental tasks proposed in White Paper are following:

- revitalization of rail,
- realization of intermodal postulate,
- development of high quality public transport.

In the White Paper the Commission UE affirms that it is needed to improve in travel conditions through the solutions which facilitated changes for passengers. The Commission takes a note of need of development of ticket integration system between rail companies and other branch of transport as well. Moreover the development of information for passengers about travel conditions, through intelligence traffic management systems, should allow to decrease in waste of time during changes between different means of transport. White Paper concentrates a lot of attention on the postulate of provision of travel continuity which is a large role of local planning. The area where the interchange from car to public transport is done should offer appropriate services (e.g. shops) and encourages to public transport traveling, thus stops of metro, rail, buses and parings should be "mesh". Location of parking places outside of the city next to stops of metro, rail, tram or bus, gives possibility to leave a car and travelling by means of public transport (included taxi). Development of intelligent passenger information systems about transport conditions to reduce waste of time on changes. Changes of style of life and flexibility characteristic for car use cause that public transport offer is not always appropriate. Public transport in actual forms can't ensure expected flexibility of services. The main cause of traffic congestion is excessive usage of private car. It is a need to create alternatives for

private car in framework of infrastructure (metro lines, tram, pathways, traffic lines with priority for public transport) and parameters of service as well (quality, information). Public transport should achieve a comfortable level in accordance with expectation of inhabitants. It concerns mainly disabled people (limited mobility people).

Other important UE document, which takes into consideration the transport integration is the Green Paper [19]. In the framework of public transport integration the Green Paper takes a note of infrastructure meaning which can make easier the changes. This documents also concerns the issue of other means of transport which have to make easier the travel with changes: possibility of tickets purchase for all journeys or network ticket, integration of information and the other activities which could make the public transport more attractive and competitive. This document puts a lot of weight on mobility notion. Green Paper presents approach to mobility in the city as a optimization of different means of transport and creation of comodality between various means of transport (rail, tram, metro, bus, taxi) and different means private transport (car, motorbike, bicycle, walk). Urban mobility is the important factor favorable growing and employment with large influence on sustainable development in UE. Mobility should enables economic development, provides the appropriate level of citizens' quality life and protects the environment. European cities stand before five challenges, which need the integrated approach. It can be directed:

- Towards flowing traffic in the cities;
- Towards more intelligent urban transport;
- Towards accessibility urban transport;
- Towards green cities;
- Towards safety and more reliability in public transport.

In Green Paper is written that citizens expected satisfaction from public transport in frame of quality, effectiveness and accessibility. Public transport which is attractive it also not only accessible, but also has to be fast, reliable, comfortable, and need to offer frequently connections as well. Nowadays there isn't enough weight attach to fellow modality and there is a lack of integrated solutions in public transport such as rail system suburban, tram-rail system and appropriate located "Park&Ride" parkings next to stations on suburban cities.

Reassuming the most important Polish and UE documents can state that discussed documents about differed scale of reference, concerning policy and strategy, very important role assigned to urban public transport.

### 3. INTEGRATION OF PUBLIC TRANSPORT EXAMPLES

Examples of concrete solutions of urban public transport integration in the country and in the world can be quoted as following:

1. Interchanges which make easier the changes between different means of transport – interchanges is place where passengers change means of transport , is the place where different operators and various means of transport can be met. In interchange passengers can change travel routs or use connection roads which means they can realize activities which before were realized in the city center. Interchange which is well planned, exploited and management cause reduction of time needed to change of means of transport but also waist time for waiting for transfer which results in decreasing in travel time. Interchange is place where can be use for public transport promotion and marketing activities. Creation of comfortable conditions for passenger leads to situation when public transport is received by the travelers as more friendly and comfortable way of traveling and they are more convicted to use it [23]. According to Swedish research the interchange is the place in transport system where people can change at least two means of transport during their journey. For standard needs this definition was limited, and it determines that at least three different means of transport should be accessible in interchange [18]. For main base elements of interchange recognized:

- accessibility of interchange with usage of different means of transport,

- infrastructure accessibility in transportation interchange,
- good information, understood signboards and explanation of passageways, correctly indicated passageway to interchange, additional, simple information in different languages, sales and services offering in the area of interchange but only that concern passenger services,
- renting services of different means of transport,
- additional services e.g. luggage, toilets, cafe bar etc.,
- short passageways, good conditions for walking,
- short waiting time for change.

Examples of interchanges in Canada (fig. 1) [3], Nantes (fig. 2), Berlin (fig. 3) [6] were presented below.



Fig. 1. Interchange in Canada  
Rys. 1. Węzeł przesiadkowy w Kanadzie



Fig. 2. Interchange in Nantes.  
Rys. 2. Węzeł przesiadkowy w Nantes



Fig. 3. Design station Lehrter Bahnhof in Berlin  
Rys. 3. Projekt stacji Lehrter Bahnhof in Berlin

Below fig. 4 [20] introduces interchange of public transport integration in Karlsruhe Hauptbahnhof – where on the right side tram-train system on rail network is operated and on the left side can see train e.g. ICT.



Fig. 4. Karlsruhe Hauptbahnhof  
Rys. 4. Stacja w Karlsruhe

As above mentioned in interchange integrating urban public transport should be provided the possibility to buy tickets and obtain information. Examples of tickets box (automat) where showed below fig. 5 [23], fig. 6 [7].



Fig. 5. Example of tickets box in Atocha, Madryt  
Rys. 5. Przykład automatów biletowych  
w Atocha, Madryt



Fig. 6. Example of tickets box in Cracow  
Rys. 6. Przykład automatu biletowego w Krakowie

In interchange should be provided good information for passenger about possibility to change, time of transport means leaving and arriving, disruption in traffic, changes of routes etc. Very helpful will be implementation of special travel planner in which passengers can plan their journey. Passengers' knowledge on transport service is often very weak and attempts related with getting information taking by passengers usually are disappointed. Many passengers particularly require clear information about transport services and current delays. Especially important is information available through internet (before start of travel) or by special telephonic line, information provided during traveling by monitors on bus/tram stops or in vehicle, maps and information points. Below there are some examples of information tables (fig. 7 [14], 8 [16]). In Denver there are special Info-Kiosk (fig. 10 [13]) in which can be obtained real – time information about e.g. lines, routes of public transport, arrival times, etc. One additional method of providing real-time bus information is to display actual vehicle locations on a map of the service area that is available via the Internet and/or kiosks. This method does not provide real-time arrival information, but it requires less data and is a visual method to show customers where

their vehicles are currently located. One example of this application is available from the Cape Cod Regional Transit Authority via the Internet (<http://www.capecodtransit.org>), as shown in fig. 9. [13].



Fig. 7. Information table in Głogów  
Rys. 7. Tablica informacyjna w Głogowie

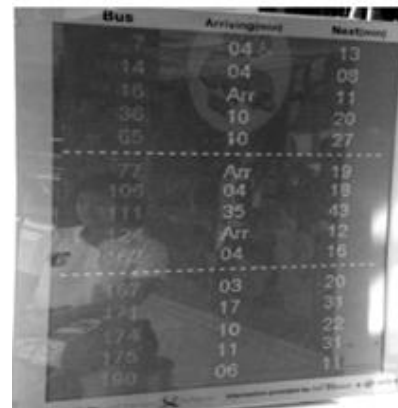


Fig. 8. Real-time bus information panel in Singapore  
Rys. 8. Tablica informująca o rzeczywistym czasie odjazdów autobusów w Singapurze

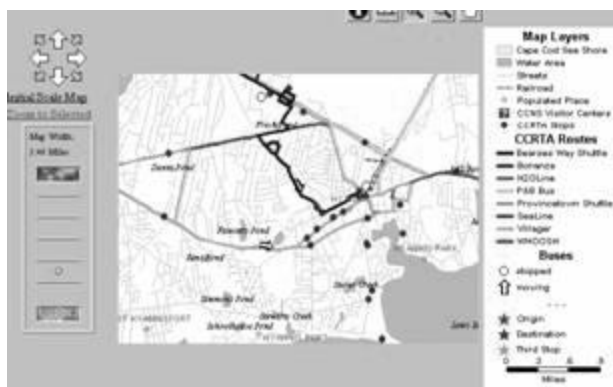


Fig. 9. Real-time bus location map – travel Planner in Cape Cod (in USA, Massachusetts state)  
Rys. 9. Mapa lokalizacji autobusów w czasie rzeczywistym – planer podróży w Cape Cod (USA stan Massachusetts)



Fig. 10. Info – kiosk in Denver  
Rys. 10. „Kiosk” informacyjny w Denver

Separate lane for public transport from private car or share lanes for means of public transport - there are a lane restricted to public transport, and generally used to speed up public transport that would be otherwise held up by traffic congestion. Bus lanes give priority to buses and cut down on journey times where roads are congested with other traffic. A bus lane is not necessarily very long, as it may only be used to bypass a single congestion point such as an intersection. Some cities have built large stretches of bus lanes amounting to a separate local road system, often called a busway system. Bus lanes are normally created when the road in question is both likely to be congested and heavily traveled by bus routes. Entire roads can be designated as bus lanes (such as Oxford Street in London or Fulton Street in New York City), allowing buses, taxis and delivery vehicles only, or a contra-flow bus lane can allow buses to travel in the opposite direction to other vehicles. Some bus lanes operate at certain times of the day only, usually during rush hour, allowing all vehicles to use the lane at other

times, and it is common to have bus lanes in only one direction, such as for the main direction of the morning rush hour traffic, with the buses using normal lanes in the other direction. Bus lanes may have separate sets of traffic signals, to allow priority at intersections [1].

Such solution is for e.g. in Berlin, Genoa, Amsterdam – share bus and tram lanes, Bogota – two parallel separate bus lanes in each direction, Utrecht – temporary separated with traffic signalization bus lane operated against the stream. Below there some examples share, separate lanes for public transport on the world fig.: 11-12 [1], 13, 14 [2], 15 [22], 16 [17], 17 [9]. There is also special indication about lane only for public transport fig. 18, 19 [1].



Fig. 11. Separated bus lane in Delphi  
Rys. 11. Wydzielony pas autobusowy w Delphi



Fig. 12. Separated bus lane in Curitiba, Brazil  
Rys. 12. Wydzielony pas autobusowy w Brazylii (Curitiba)



Fig. 13. Separated, shared bus and tram line in Amsterdam  
Rys. 13. Wydzielony, wspólny pas autobusowo tramwajowy w Amsterdamie



Fig. 14. Separated, shared bus line in Bogota  
Rys. 14. Wydzielony pas autobusowy w Bogocie



Fig. 15. Separated, shared bus line in Rouen  
Rys. 15. Wydzielony pas autobusowy w Rouen



Fig. 16. Separated bus line in Łódź  
Rys. 16. Wydzielony pas autobusowy w Łodzi



Fig. 17. Separated bus line in Cracow  
Rys. 17. Wydzielony pas autobusowy w Krakowie



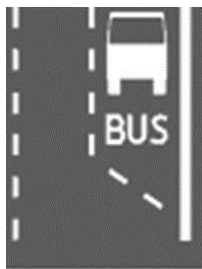


Fig. 18. Information sign about separated bus line in Poland

Rys. 18. Znak informujący o wydzielonym pasie autobusowym w Polsce



Fig. 19. Information sign about separated bus and taxi line in Norway

Rys. 19. Znak informujący o wydzielonym pasie autobusowym oraz dla taksówek w Norwegii

2. Shared stops of public transport – creation of shared stops for public transport gives a lot of benefits for passengers. Passengers can't make a decision where should they go – on tram or bus stops in order to realize journey and they have guarantee, that use the fast solution. Creation of shared stops for public transport increasing in safety of passengers, who haven't conflict with vehicle of individual transport during change means of transport. Examples of shared stops for public transport can find e.g. in Nantes, Stuttgart, Goteborg, Zurych, Poznan, Wroclaw , Cracow. Below are photos with examples of such stops for public transport fig. 20-21.



Fig. 20. Shared bus and tram stops in Nantes

Rys .20. Wspólny przystanek autobusowo tramwajowy w Nantes



Fig. 21. Shared bus and tram stops in Krakow

Rys. 21. Wspólny przystanek autobusowo tramwajowy w Krakowie

3. Implementation of the uniform tariff system e.g. electronic ticket - Oyster card for public transport in London, Krakow – integrated tariff on the Krakow-Krzeszowice route with possibility of travel by public transport in Krakow, Warsaw – integrated ticket for all means of public transport (metro, bus, tram). Important elements among urban public transport integration tools is shared ticket and tariff for different means of transport. The main aim of integrated ticket-tariff system is attempt to encourage city inhabitant to use of public transport services. Thanks to systems passenger using integration ticket can travel by different means of transport without buying separated ticket for each transport means. An example of tariff integration can be seen in Cracow. In framework of Civitas-Caravel project the city of Krakow implemented the activity concerning the tariff integration. In the beginning the offer was dispatched only for passengers using term tickets for travels by the slow train on the Krakow Główny – Krzeszowice route and means of public transport (trams, buses) within city area ticket. Since 1 may 2009 the offer was expanded (integration of rail and public transport tickets). Now passengers can use this offer during travelling by slow train on the five intake route to Krakow in connection with public transport trips. As an examples promotion integration tariff in Cracow is special leaflets fig. 22.



Fig. 22. Promotion of integrated tariff in Cracow  
Rys. 22. Promocja zintegrowanej taryfy w Krakowie

In London, the Oyster card (fig. 24 [21]) – shared ticket for all means of transport is operated. Oyster Card is size of credit card with magnetic reader. Paying in the kiosk can code on it two kinds of charge:

- Charge for period ticket (weekly, monthly, quarterly, yearly),
- Charge for single journey (it is free amount, after each journey the charge for ticket will be counted out).

It is a solution which has improves very much using means of public transport. Passengers having loaded card need not to buy ticket every time they travel. Shared tickets functioning very similar as the London's one were led by Polish cities: Krakow, Warszawa, Gdańsk, Czestochowa, Siedlce, Głogów, Poznań, Płock, Piła, etc. fig. 23 [21], 24 [7], 25 [15].



Fig. 23. Oyster card in London  
Rys. 23. Karta Oyster w Londynie



Fig. 24. Urban card in Cracow  
Rys. 24. Karta miejska w Krakowie



Fig. 25. Urban card in Siedlce  
Rys. 25. Karta miejska w Siedlcach

#### 4. SUMMARY

Nowadays it is important to increase the role of public transport in the city by ensuring:

- cohesion of transport systems: local (urban and suburban), regional, national and continental,
- staying in reach of inhabitants' accessibility, spatial and functional system integration (interchange, shared timetable, integrated tariff, etc.),
- cooperation of public transport with individual transport (by building change parking for cars and bicycles, possibility of transport of bicycles by public transport means),

- streamlining of routes (line order) and timetables adapting them for actual and potential needs,
- improving role of tram as a basic means of public transport,
- adaptation of railway in order to serve the city and suburban zones and building its role in regional connections,
- radical increasing in frequency of connections and in spatial accessibility of railway by creation of additional public transport stops,
- development of information system for passengers containing actual traffic conditions, information about arrivals of means of public transport, establishing the internet travel planning system,
- increasing in passenger's security (monitoring of public transport vehicles, stations, public transport stops) etc.

In effect of above activities concerning comfort, reliability and safety improvement it is possible to obtain increasing in attractiveness of public transport. Constantly improvement in quality of public transport operation is one of the best way to increasing in share of public transport in journeys. Only high quality of public transport has chance to effective competition with private car. European cities are very different but have the similar challenges and try to find shared solutions. Increase in car traffic in the centers of European cities causes constantly traffic congestion which has negative results for society and environment as well.

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