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City accessible for everyone – improving accessibility of public transport using the universal design concept

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Abstract

In the recent years more attention has been paid to accessibility of public transport and space. This growing interest is also visible in The European Union transport policy, aiming at securing rights of passengers with reduced mobility. However, big differences in local standards of designing public space and transport infrastructure are visible. Furthermore, particular cities chose different strategies to improve accessibility of public transport. This paper presents a perspective on contemporary transport policy of the European Union applying to passengers with reduced mobility. Additionally, a proposal of program consisting of 4 integrated actions, is formulated. Framework of the paper is the universal design concept, described for the first time by The Center for Universal Design at North Carolina State University. Paper refers to case study of improving accessibility in Warsaw.

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Keywords: accessibility; case study; public space; public transport; reduced mobility; universal design; Warsaw

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1. Introduction

Accessibility of public transport is becoming an important problem, especially for city planners and public transport experts. This topic is also highly promoted by European Commission (COM 2011/898), which distinguished three cornerstones of passenger rights, strictly bound with accessibility:

- non-discrimination;
- accurate, timely and accessible information;
- immediate and proportionate assistance.

2. Dimensions of accessibility of transport

Problem of public transport accessibility should be treated as a multidimensional phenomenon. In the basic sense, accessibility can be secured by proper design and procedures, which are supporting needs of possibly the biggest group of users, without additional cost for disabled passengers and passengers with reduced mobility. For instance, introducing low-floor trams and buses with adequate accessories enables usage of public transport to wider range of passengers, i.e. people using wheelchairs or parents with baby carriages.

Another important factor is time. Development of design regulations and systematic changes cause situation in which current solutions are much more complex than those made in the past. Nowadays stairs in public area are usually equipped with ramps or elevators, which main function is to provide an alternative path for those who are not able to use steps. However, even the biggest public transport systems are not fully accessible for people with reduced mobility. Adjusting the whole infrastructure to contemporary norms is either very expensive or even impossible due to lack of space and problems with adaptation of historical objects, such as train or subway stations. Furthermore, cohesion of applied solutions is needed to secure certain level of service.

The third aspect is a lack of universal and coherent patterns for different parts of infrastructure accompanying transport. Although all transportation modes (air, rail, waterborne, road – bus and coach) received in recent years EU regulations regarding passenger rights (including passengers with reduced mobility), design issues are still not regulated. Proper answer to this topic would be global implementation of one standard of design public spaces, such as ISO standards (i.e. ISO 21542:2011 Building construction – Accessibility and usability of the built environment, ISO 23599:2012 Assistive products for blind and vision-impaired persons – Tactile walking surface indicators), which are unfortunately still not obligatory in Poland. In place of above norms, there are basic regulations for designers included in ordinances enacted on the national level in late 1990s. Therefore, most attempts at improving accessibility lack expert knowledge and universal specifications, which should be accurately specified in the local law.

3. Groups of users of space and transport

Since 2001, the European Commission has been working on introducing passenger protection measures to all modes of transport. As noted in the introduction, regulations focusing on passengers with reduced mobility were key elements of these documents. Right to non-discrimination and right to mobility were two first out of 10 defined passenger rights. This led to setting up a definition of a passenger with reduced mobility. The first attempt, included in Technical Specifications for Interoperability(TSI PRM – European Commission 2008: 84), was characterized by its comprehensiveness:

'Persons with Reduced Mobility' (PRM) means all people who have difficulty when using trains or the associated Infrastructure. This includes the following categories:

- *Wheelchair users (persons who due to infirmity or disability use a wheelchair for mobility)*
- *Other mobility impaired including:*
- *people with limb impairment;*
- *people with ambulant difficulties;*
- *people with children;*
- *people with heavy or bulky luggage;*
- *elderly people;*

- *pregnant women;*
- *visually impaired;*
- *blind people;*
- *hearing impaired;*
- *deaf people;*
- *communication impaired […];*
- *people of small stature (including children).*

In newer version of the same regulation (European Commission 2014: 118), much simpler definition occurred, which does not list concrete groups:

'Person with disabilities and person with reduced mobility' means any person who has a permanent or temporary physical, mental, intellectual or sensory impairment which, in interaction with various barriers, may hinder their full and effective use of transport on an equal basis with other passengers or whose mobility when using transport is reduced due to age.

A similar vision is visible in another regulation, specifying right of passengers with reduced mobility in bus & coach transport (European Commission 2011: article 3):

'Disabled person' or 'person with reduced mobility' means any person whose mobility when using transport is reduced as a result of any physical disability (sensory or locomotory, permanent or temporary), intellectual disability or impairment, or any other cause of disability, or as a result of age, and whose situation needs appropriate attention and adaptation to his particular needs of the services made available to all passengers.

Having one coherent definition of groups of users ensures that all adjustments needed in infrastructure and regulations will be provided. Without doubt newer definitions are simpler and easier to understand. However, former TSI PRM (2008) regulation gives better clue on who should be included to the group of passengers with reduced mobility. Although above regulations don't cover entire urban public transport (regulations for different modes), they should be considered as an example of proper specification of passengers with reduced mobility. These definitions are also key elements for public transport organizers, because they condition further actions like upgrading vehicles, the rebuilding of existing infrastructure and the development of its new elements. In this context, clear and universal specification of groups of users is essential to provide one, multimodal level of service.

4. Universal design in public transport

Accessibility of public transport is strictly connected to the design of public space and transport infrastructure elements, such as stops, stations and transport hubs. Apart from low floor trams and buses, proper stations with step--free access are essential for movement of passengers with reduced mobility. In fact, all of the actions aiming at improving accessibility should involve directly people with reduced mobility and organizations representing their interests (UITP 2014: 26). On that account, it is important to include in this article the description of universal design approach.

Universal design is a way of designing buildings, products and environments, that are inherently accessible not only to people without disabilities, but also to people with disabilities, including older people and many other people, often excluded by traditional design. As E. Ostroff (2011: 1.5) pointed out, universal design should be seen as an evolving paradigm, which emerged separately in different regions worldwide. Albeit there are significant cultural differences in the evolution of this approach in each country, the similarities are more visible than the differences. The whole concept can described by seven principles, compiled by Center for Universal Design at North Carolina State University (1997):

- Equitable use
- Flexibility in use
- Simple and intuitive
- Perceptible information
- Tolerance for error
- Low physical effort
- Size and space for approach and use

The principles are a base for further guidelines, specifying requirements for design suitable for people with different disabilities. It is important to note that the philosophy of universal design is much more popular among designers and architects than public transport experts. As E. Steinfeld (2011: 19.6) remarked, many of the lessons learned in design of buildings are also applicable to transportation systems. Additionally, it is clear that without proper design of space there is no possibility to improve accessibility of public transport. According to E. Steinfeld, main points of interest should be terminal design, passenger information systems, accommodation of level changes between vehicle and platform, and vehicle design. Nevertheless, conventional thinking of the concept is that universally designed projects are made for minority, i.e. people with disabilities or impaired. Thus additional costs generated by projects make them unprofitable from a socio-economic point of view, because benefits will be low as compared to the cost of realising them (Odeck, Hagen, Fearnley 2010: 304). Actually it should be underlined that all passengers benefit from universal design solutions, because they reduce the physical effort needed for certain activities, like boarding and exiting low floor trams or buses instead of high floor ones (shorter time of passenger exchange process). Alternatively, contrasting railings inside vehicles are better visible also to the people without sight impairments. Furthermore, most passengers represent more than just one group. An example of such situation is a person commuting every weekday to work by bus, who also uses public transport to escort child in pram to kindergarten two times per week and occasionally travels by the same bus to the airport with a large suitcase. In other words, passengers, who don't have any problems using existing infrastructure in most cases, need additional adaptation to their needs in just some situation. In this context universally accessible public transport not only should be considered as an important way for social integration of people with reduced mobility, but also an additional feature, which can be used in some specific situations by other people for their benefit.

5. Ways to improve accessibility of public transport

Due to increasing amount of regulations and strategies aiming at improving accessibility of public transport, it is important to come up with precise program of coherent operations. The main problem is implementation of demanding standards and theoretical guidelines into real action. Improving accessibility of public transport has different history in individual cities. A list of 5 actions aiming at improving accessibility is presented below, using the case study of Warsaw.

5.1. Gradual upgrade of public transport vehicles

Introducing low vehicles can be considered as first and most important step in the process of improving accessibility of public transport. Warsaw acquired for the first time partially low-floor buses in 1994 and trams in 1998 (in 1994 the first prototype was introduced). For last 20 years, the technical specification for vehicles has been substantially developed, including such elements as electrically driven ramps, blind passengers indicators, door opening buttons, voice, sonic and visual information systems. Systematic substitutions of vehicles resulted in reaching in 2014 as much as 100% of low floor buses and 35% of low floor trams. Chart 1 presents the increasing share of low floor buses and trams in Warsaw. Nowadays, the total number of buses amounts at 1753 and trams at 761. Virtually all new deliveries provide 100% low floor vehicles with abundant accessories. Other urban means of transport, i.e. subway (Metro Warszawskie) and agglomeration trains (Szybka Kolej Miejska) have rolling stock, which provides step-free access in most cases. However, due to extended time of exchanging of cars, big differences among vehicles can be observed, what can be problematic mostly for passengers with reduced mobility. Further planned deliveries will gradually improve the overall accessibility of transport. For now, the main differences among existing rolling stock include:

- Different technologies of opening ramp: manual vs electrical (existing in low floor trams delivered from 2007 and in newest subway trains Siemens Inspiro).
- Diversified location, shape and appearance of push buttons for passengers (for example door opening) Further planned deliveries will gradually improve the overall accessibility of transport.
- Different colour of internal handrails and stanchions. Contrast colours are useful especially for sight-impaired passengers.

- Mixed payment methods and software in ticket machines (coins or card payments inside vehicles vs. both methods located in outside machines).

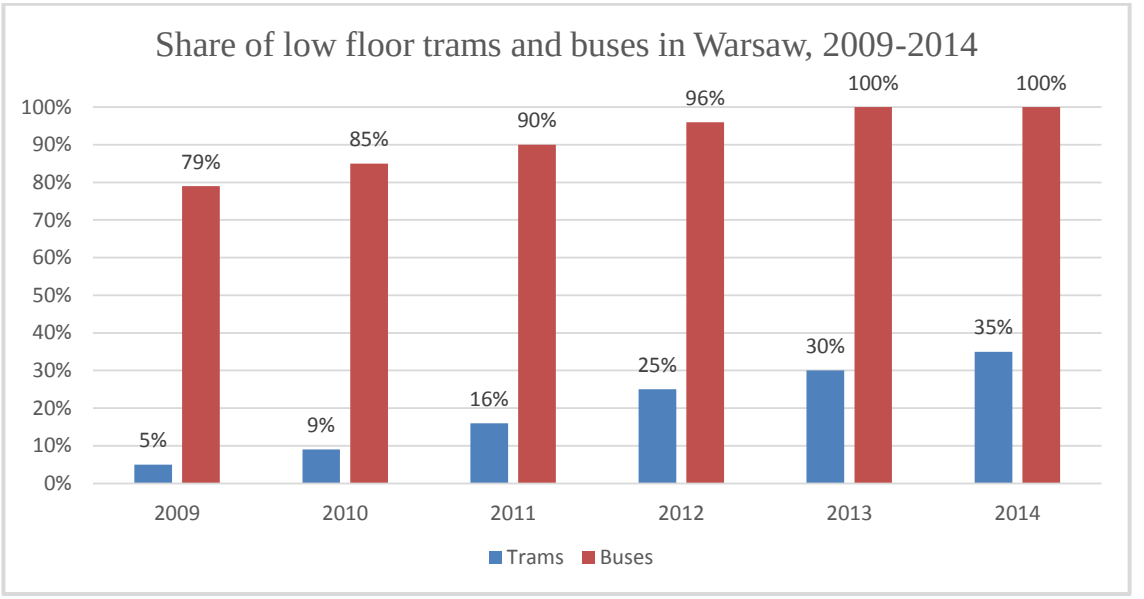

Fig. 1. Share of low floor trams and buses in Warsaw. Data source: Warsaw Transport Authority (ZTM) and Central Statistical Office of Poland (GUS).

5.2. Improving accessibility of platforms

Next important element of accessibility is the design of platforms. Basic requirement is step free access to the platform from the surrounding area. Nevertheless, much more detailed vision is essential in this case. Other demands include: height of platform (linked with vehicle floor height), width of platform, tactile indicators on floor, passenger information systems etc. In this moment there is no database of platforms accessibility. In 2013 SISKOM Association presented a report diagnosing main architectural barriers in public space of Warsaw, based on the data from Warsaw Map of Barriers project and field inspections. The estimated number of inaccessible platforms was 292. However, as authors remarked, the real number was meant to be higher due to limits of gathered data (not all of around 1700 platforms were inspected).

In its publication, SISKOM (2013: 27) presented main problems concerning public transport platforms in Warsaw:

- too narrow and too short platforms,
- stairs without ramp on the way to platform,
- lack of paved connection to platform and/or lack of paved platform,
- non-standard bus bays, hindering proper stopping of vehicles.

According to SISKOM database, in December 2015 there were 473 inspected platforms of different means of public transport. 56 of them were marked as ‘fixed’, which usually refers to improving accessibility by providing step-free access. Table 1 shows more detailed information about share of respective groups. The biggest share of quota belongs to bus stops (78%), followed by tram stops (13%) and train stops/stations (9%). Furthermore, bus stops are the most problematic type, having the highest share of all inaccessible platforms. On the contrary, train platforms may be considered as the most passenger friendly. Out of total number of 46 objects in Warsaw, 17 (37%) provide step free access.

Table 1. Inaccesible platforms of different means of public transport in Warsaw. Source: SISKOM database.

Mode of transport	Overall number	% of total	Inaccesible platforms	% of total	Fixed platforms	% of total
Bus	366	78%	341	81%	25	44%
Tram	61	13%	48	11%	13	23%
Train	46	9%	29	8%	17	33%
Total	**473**	**100%**	**417**	**100%**	**56**	**100%**

Warsaw Transport Authority (ZTM Warszawa) as well as other public offices is systematically rebuilding platform infrastructure and removing obstacles. Additional equipment is also installed, including Kassel type kerbstones on bus platforms and tactile indicators for sight-impaired passengers. However, without complete data concerning platforms and existing barriers, it is not possible to introduce integrated program of improving accessibility of platforms. Such record would also be important from the passengers point of view, enabling better barrier-free route planning.

5.3. Modernization of large scale infrastructure objects

Presumably complete modernization, according to contemporary standards, of overpasses and underpasses is the most complicated and the most expensive type of action aiming at improving accessibility. SISKOM (2013: 12) estimated the amount of inaccessible underpasses on 69 and overpasses on 47. Each object of this type requires individual project of rebuilding, aiming at improving accessibility. Easiest way to solve typical problems is providing additional pedestrian crossing on the street level. Nevertheless, this solution is sometimes impossible due to traffic safety. Alternatively, elevators and ramps can ease access for physically impaired users. In addition, tactile indicators for stairs should be provided.

Although the general situation of infrastructure is systematically improving, it is important to list main issues concerning accessibility of large scale infrastructure objects:

- Building and proper maintenance of lifts machinery.
- Installation and monitoring wear of tactile indicators, especially attention patterns.
- Installation of ramps with a gentle slope (maximum of 1:16 according to ISO 21542:2011) as an alternative way for people with reduced mobility.
- Providing clear directional informatory signs for complicated under- and overground objects.

Big number of large infrastructure objects not fulfilling contemporary regulations require systematic actions and planning of future adjustments in urban scale. Frequently, complex modernization requires installing several elevators or ramps, depending on local circumstances. In this context it is important to provide reliable and clear information about the places where different kinds of users may have problems with moving, so they can plan an alternative route.

5.4. Small scale investments, aiming at elimination of local obstacles

Apart from big investment projects, small scale adjustments play vital role in providing accessible city. Vast number of streets and other kinds of public areas makes it impossible to introduce in a short time universal changes, such as lowering kerbstones on all pedestrian crossings or introducing tactile indicators for blind persons. Usually long-time waiting for complex modernization of certain area is not acceptable for its users. Thus “Fix My Street” approach is good a addition to large scale investments, where users can formulate their demands and needs.

Since 2014, the Municipality of Warsaw has provided additional funding for small interventions, aiming at improving conditions of pedestrian traffic. Main source of information about the problems is the database provided by SISKOM Association, based on Warsaw Map of Barriers project, which also includes inspected notifications from inhabitants. In 2014 209 small barriers were removed at the cost of PLN 1 000 000. Plan for 2015 involves improving situation in 331 places at total cost of PLN 1 400 000. Standard improvements include lowering kerbs on pedestrian crossing, installing tactile indicators, local pavements reparations and widening of pavements. Before 2014 such actions were undertaken on a smaller scale by individual municipal offices, usually classified as maintenance of

existing infrastructure elements and not counted in one registry. Unifying different undergoing processes gives possibility for better supervision and improves cost-effectiveness of actions. Eventually, full information for inhabitants, including locations, costs and undertaken actions is provided.

6. Summary

As it was remarked in the paper, improving accessibility of public transport plays vital role in European Union transport policy. Increasing number of standards and regulations can be seen as first step on providing equal, high quality solutions for passengers with reduced mobility throughout Europe. Next important step is to find a way to quickly implement above regulations and adjust them to local specification. Basis of this actions should be universal design approach, well known and frequently used in planning accessibility by architects.

Four types of actions aiming at improving at accessibility of Warsaw were presented in the article: gradual upgrade of public transport vehicles, improving accessibility of platforms, modernization of large scale infrastructure objects, small scale investments. Universal design approach demands integrated actions undertaken by different public institutions. Nowadays one of the main problems, which limits the possibilities of evaluation of undertaken actions, consists in scarce data. Alternatively, user experience might be an important source of information for designers and planners.

All activities concerning improving accessibility should be consulted with stakeholders, including representatives of passengers with disability. Effective public consultations of planned actions directly with stakeholders ensures making less mistakes and builds public support from the beginning. Ultimately, all of accessibility solutions should be based on universal standards and tested locally by people with different impairments to ensure total accessibility. Such processes gives possibility to keep universal standards and make necessary adjustments when needed.

References

Center for Universal Design, 1997. The Principles Of Universal Design. Version 2.0 – 4/1/97, North Carolina State University.

European Commission, 2008. Commission Decision of 21 December 2007 concerning the technical specification of interoperability relating to persons with reduced mobility in the trans-European conventional and high-speed rail system. Document No. 2008/164/EC.

European Commission, 2011. Communication From The Commission To The European Parliament And The Council: A European Vision For Passengers: Communication On Passenger Rights In All Transport Modes. Document No. COM/2011/0898.

European Commission, 2014. Commission Regulation (EU) of 18 November 2014 on the technical specifications for interoperability relating to accessibility of the Union's rail system for persons with disabilities and persons with reduced mobility. Regulation no. 1300/2014.

International Association of Public Transport, 2014. Improving access to public transport. Paris: European Conference of Ministers of Transport, OECD.

ISO 21542:2011. Building construction – Accessibility and usability of the built environment.

ISO 23599:2012. Assistive products for blind and vision-impaired persons – Tactile walking surface indicators.

Odeck J., Hagen, T., Fearnley, N., 2010. Economic appraisal of universal design in transport: Experiences from Norway. In: Research in Transportation Economics, 29 (2010), 304–311.

Ostroff E., 2011. Universal Design: An Evolving Paradigm. In: Universal Design Handbook (Second Edition). Preiser,W.F.E.,. Smith K.H. (Ed.), New York: Mc Graw Hill.

Preiser,W.F.E.,. Smith K.H. (Ed.). Universal Design Handbook (Second Edition). New York: Mc Graw Hill.

SISKOM, 2013. Diagnoza głównych barier architektonicznych w przestrzeni publicznej Warszawy. Raport Stowarzyszenia Integracji Stołecznej Komunikacji. Available at: http://mapabarier.siskom.waw.pl/wp-content/uploads/2013/12/SISKOM_Diagnoza_glownych_barier_architektonicznych.pdf (2015-10-12).

Steinfeld Edward, 2011. Universal design in mass transportation. In: Universal Design Handbook (Second Edition). Wolfgang F.E. Preiser, Korydon H. Smith (ed.) New York: Mc Graw Hill.