

Krystian Banet (kbanet@pk.edu.pl)

Faculty of Civil Engineering, Cracow University of Technology

Ewelina Stypułkowska

Faculty of Environmental Engineering, Cracow University of Technology

ADAPTING CRACOW'S STARE DEBNIKI AREA TO THE MOBILITY NEEDS OF SIGHT-IMPAIRED PEOPLE

ADAPTACJA OBSZARU STARYCH DĘBNIK W KRAKOWIE DO POTRZEB MOBILNOŚCI OSÓB NIEWIDOMYCH

Abstract

An ageing society and the predicted increase in the visual impairment of older people requires attention to be paid to the accessibility and social inclusivity of urban spaces. This paper reviews spatial barriers with particular emphasis on the limited mobility of people with visual dysfunction. Furthermore, by the example of the Stare Dębiki area in Cracow, the paper includes improvement opportunities related to the accessibility of urban spaces. The detailed Let's make noise project was developed at the 'Przepis na miasto' workshop.

Keywords: blind, pedestrians, sustainable mobility

Streszczenie

Starzejące się społeczeństwo i przewidywany wzrost niepełnosprawności osób starszych wymaga zwrócenia uwagi na kwestie dostępności i społecznej integracji przestrzeni miejskich. W niniejszym artykule dokonano przeglądu barier przestrzennych ze szczególnym uwzględnieniem ograniczonej mobilności osób z dysfunkcją wzrokową. Ponadto, przedstawiono możliwości poprawy dostępności przestrzeni miejskiej na przykładzie obszaru Starych Dębik w Krakowie. Szczegółowy wariant prezentujący Zróbmy hałas opracowany został w ramach warsztatów „Przepis na miasto”.

Słowa kluczowe: niewidomi, piesi, zrównoważona mobilność

1. Background: the mobility needs of sight-impaired people

Whether blind or sighted, our quality of life is strongly dependent on our abilities to make informed spatial decisions through the processing and synthesis of spatial information about our surroundings [5]. Despite medical progress, many still experience total or partial loss of vision. Regardless of the standard of their vision, blind people have the same mobility needs as sighted people. They have to go to work, school, or just for a walk. Sight-impaired people often travel to unfamiliar places for work, education, recreation or medical attention, and this is more problematic than travel to familiar places.

Blind people have problems leaving premises that are not equipped with elevators. If they surmount these odds, they have other problems on sidewalks and roads. Unfortunately, road and sidewalk infrastructures are not well suited to the needs of sight-impaired people. Visually impaired people either move around independently or with the aid of a sighted person who acts as a guide. Those who move around independently do so either alone with the use of their residual sight, or with the use of a mobility aid. The most common mobility aid used by pedestrians with poor sight to facilitate their independent mobility is a long white cane which is used to scan the ground in front of the person. Alternatively, a visually impaired person may have a guide dog to assist them with their mobility [4]. In Poland, infrastructure designers have started think more seriously about blind people in last 10–15 years. Previously, blind people were forced to overcome many difficulties when moving through cities. The UN Convention on the Rights of Persons with Disabilities states that the physical environment, means of transport, information and communication systems, as well as other devices and services must be made widely accessible in urban and rural areas through the recognition and elimination of accessibility barriers [9].

Sight-impaired people have a civil right to access information provided to other pedestrians [1]. Regrettably, blind people still do not have the same level of accessibility to, for example, public transport and pedestrian crossings. For them, easy tasks are not effortless. Visually impaired pedestrians need to perform a number of tasks to cross safely and independently at signaled intersections. This task is more difficult in unfamiliar places. Firstly, they must recognize the boundary line between the pavement and the street to know they have come to an intersection. Curbs are used as a cue for blind people that they have come to an intersection. The next task for blind people is to determine the junction's geometry, e.g. the width of the street, the angle of the junction, and the presence of splitter islands. A lot of information about this comes from vehicular sounds, but crossing might be impossible when there is even only a little traffic. Blind pedestrians then have to determine the nature of traffic controls, such as the order, onset, and duration of the traffic and pedestrian phases. This can be achieved by listening to the traffic flow. Before crossing, blind pedestrians try to establish a heading precisely towards the opposite side [1]. After preparing to cross, blind people have to know when the pedestrian phase starts. Traditionally, pedestrians who are blind have been taught that the walk interval begins with the onset of traffic on the street perpendicular to their direction of travel. This strategy is effective at most junctions with fixed timed signals, concurrent pedestrian phases and no right-on-red [1]. In other cases this strategy might be

wrong. As this example shows, it is complicated for blind pedestrians to cross the road without any help. At a lot of junctions, curb ramps have become more prevalent, yet the geometry of junctions has become more complex and traffic has become quieter, both of which make it more difficult for the blind.

Not only is crossing the road an effort for blind people. Walking along bumpy and narrow sidewalks and using public transport or public utility buildings also presents a challenge. The UN Convention on the Rights of Persons with Disabilities does not indicate specific implementation standards for the above activities beyond public utility buildings and signs in Braille. Poland does not have unified rules of designing infrastructure for visually impaired people [8]. For years, the Polish Association of the Blind has attempted to address the needs of people with eyesight restrictions, their access to cultural goods, and their free and safe movement. In general, this association handles education related to blind and visually impaired people [9]. Increasing accessibility to public spaces for blind people can be achieved using rules of universal design. Products, the environment, programs and services should be designed in such a way as to be useful to as many people as possible, without the need for adaptation or specialized design.

2. Careful design of public spaces for blind people

City planning oriented to the needs of people with disabilities has become popular in recent years. When designing spaces, most urban planners remember to consider those with physical disabilities. Nevertheless, in many situations other conveniences are required for sight-impaired people that might also be helpful for other groups, e.g. the elderly. The most awkward aspects of being blind are limitations in spatial orientation, limited ability to move independently, and the necessity of other people's help [2]. Universal design and space adaptation helps not only to improve orientation in space, but can also improve the social life and work conditions of sight-impaired people. Especially in urban areas, people who are blind have problems with a sense of distance and depth, which is particularly important when overcoming differences in height, e.g. stairs, or when entering an area with a different degree of brightness. Blind people also have problems with distinguishing the sidewalk from the road, moving across large sidewalks and pedestrian areas, finding proper buildings, and moving in a straight line or interpreting traffic. The last two issues are especially dangerous when crossing roads [9]. In her research, Laskowska identified five places and situations which are dangerous for sight-impaired people: sidewalks, public transport stops and vehicles [3], streets, bus and railway stations and public utility buildings [6]. Even without curbs and parked cars, pavements are bumpy. Pedestrian crossings do not use one consistent system of sounds. Public transport stops and stations are not equipped with public address systems. Blind people cannot find the place to get in buses or trains. In addition, many public utility buildings do not have marked ways to elevators or main thoroughfares. Infrastructure for people who are blind must be designed such that blind people receive early warnings about what is going on around them. Sight-impaired people learn to navigate routes via characteristic

points. Orientation and wayfinding information should be provided by the use of high visibility and, where appropriate, tactile signing [4]. Hence the idea of tactile paths was born. These paths start and end in particular places like the entrance to a building or an elevator. The most important factor is that the space should be designed in a consistent, logical way [9]. Layouts of all pedestrian areas should be simple, logical and consistent as this enables people to memorize environments that they use regularly and predict and interpret environments they are encountering for the first time [4].

In this paper, the authors decided to focus on universal design aspects related to street designing (excluding informational sound schemes). The most common solution is tactile paving, which consists of a marked passage free of obstacles (90 cm width is recommended) whose objective is to guide sight-impaired people to particular places like pedestrian crossings or stairs [9]. When moving around the pedestrian environment, visually impaired people actively seek and make use of tactile information underfoot, particularly detectable contrasts in surface texture [4]. Tactile paving is a detectable warning system of indicators on the ground that is used to assist visually impaired pedestrians, whether or not they use a long cane [10]. The use of blister paving as a warning device at controlled and uncontrolled pedestrian crossing points is now well established. The installation of tactile paving surfaces should be considered as part of a wider package of measures to assist visually impaired people [4]. Tactile paving comprises two elements: guidance path (guide belt) and attention fields (blister surface, Fig. 1.). The blister surface should be wider than the guide belt and be installed on forks of tactile paths and in front of final points.

A blister surface is similar to tactile paving, with dropped curbs at pedestrian crossings (Fig. 2.). The tactile blister surface should be installed in the absence of an upstand at both controlled and uncontrolled crossing points where the footway has been dropped flush with the carriageway or where the carriageway has been raised to the level of the footway [4].

Another solution for sight-impaired people is a corduroy surface. The purpose of a corduroy surface is to warn visually impaired people of the presence of specific hazards, including steps, level crossings, or the approach to on-street rapid light transit platforms. They are also used where a footway joins a shared route [4].

Infrastructure designers should also remember about proper platform edge warning surfaces on public transport stops (Fig. 4.). The purpose of this surface is to warn sight-impaired people of the edge of all on-street tram or bus platforms.

To help people locate amenities, for example a ticket machine or post office, an information surface is recommended. This is helpful to blind people who are regular users of a particular area and will become familiar with the type of amenity indicated [4].

Urban designers should also remember to use proper contrast. From ophthalmologic tests it is clear that yellow is the best color for partially sighted humans and it should therefore be used to create contrast [9]. Street furniture (benches, baskets, flowerbeds) should be made of durable materials and devoid of sharp edges. All elements and their edges should be marked with a color that contrasts with the surroundings. Tactile typhlographic plans and schemes with information in Braille should supplement friendly infrastructure with consistent signs, contrasting colors and helpful sounds.



Fig. 1. Tactile paving (source: [10])

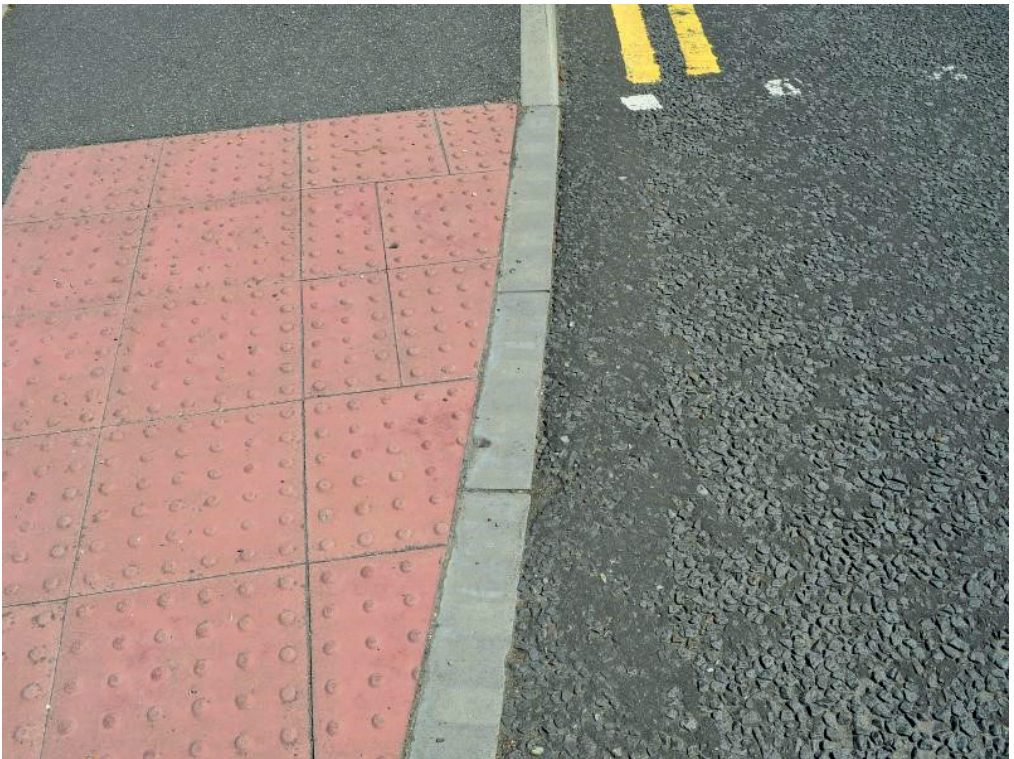


Fig. 2. Blister surface and dropped curb at a pedestrian crossing
(source: www.DirectEnquiries.com, accessed 09.03.2018)



Fig. 3. Corduroy surface (source: www.tactilesurface.co.uk, accessed 10.03.2018)



Fig. 4. Platform edge warning surface on a tram stop (source: www.marshalls.co.uk, accessed 10.03.2018)

3. Stare Dębniki – current conditions

Cracow is situated in the Lesser Poland region in south Poland on the Vistula River. Cracow's population is 766,700 people [11]. The city was founded in 1257, based on a location act which introduced city rights modelled on the Magdeburg law. From the founding of the city to the 20th century, Cracow grew. In 1910, nine surrounding suburban communities, including Dębniki, were incorporated into a single administrative unit: Cracow [7, 12].

Dębniki is one of eighteen districts of Cracow, located in the southwest part of the city. The district's area is 46.19 square kilometers. Stare Dębniki is the northern part of Dębniki district and is delimited by Generała Bohdana Zielińskiego street, Monte Cassino street and Vistula River (between Zwierzyniecki and Grunwaldzki bridges). The primary land use of Stare Dębniki is residential housing (a mix of single and multi-family housing). Characteristic points of Stare Dębniki are Rynek Dębnicki, Saint Stanisław Kostka Church and Dębnicki park. Rynek Dębnicki (Fig. 5.) is the main square of Stare Dębniki and has the shape of an irregular quadrilateral. There are several schools in Stare Dębniki: the Primary School with Integration Units No. 30¹, the Secondary School of Integrating No. 3² and the Special School and Educational Center for Blind and Visually Impaired Children³. The latter was established in 1948. It is an important center of education, counseling and rehabilitation of a wide age range of children and youth with sight dysfunction.



Fig. 5. Rynek Dębnicki – main square of Stare Dębniki.

Photo by: Ewelina Stypulkowska (2018)

¹ Szkoła Podstawowa z Oddziałami Integracyjnymi nr 30 – transl. note.

² Zespół Szkół Ogólnokształcących Integracyjnych nr 3 – transl. note.

³ Specjalny Ośrodek Szkolno-Wychowawczy dla Dzieci Niewidomych i Słabowidzących – transl. note.



Fig. 6. School entrance gate.
Photo by: Ewelina Stypulkowska (2018)



Fig. 7. Rynek Dębnicki square – pedestrian crossing and bus stop.
Photo by Ewelina Stypulkowska (2018)

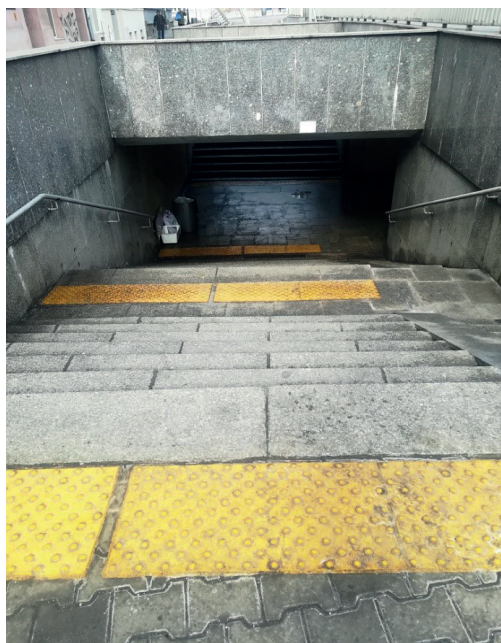


Fig. 8. Marii Konopnickiej street – underground passage.
Photo by Ewelina Stypulkowska (2018)



Fig. 9. Konopnickiej bus stop – platform edge warning surface.
Photo by Ewelina Stypulkowska (2018)

The authors analyzed the main walking route between the Special School and Educational Center for Blind and Visually Impaired Children and Konopnickiej bus stop, the nearest public transport stop with a high frequency of transport. During the inventory, attention was paid to places and situations which are dangerous for sight-impaired people. As mentioned in the second chapter, these are sidewalks, public transport stops and vehicles, streets, bus and railway stations, and public utility buildings [6]. The route leads about 400 m along Tyniecka street, Rynek Dębnicki and Antoniego Józefa Madalińskiego street to Konopnickiej bus stop. The school is equipped with a special entrance gate. It is adapted to sight-impaired people's mobility needs by its yellow color, description in Braille and blister surface (Fig. 6.). Furthermore, the school exit is marked by information and warning signs, so drivers must be careful.

The pavement along Tyniecka street is in good technical condition. A pedestrian crossing with traffic lights is located about 60 m from the exit gate. It is equipped with a blister surface, dropped curbs, and a pedestrian crossing control panel with transition plan and sound signal. The analyzed path does not require this pedestrian crossing to be crossed. The next pedestrian crossing is located on Rynek Dębnicki square (Fig. 7.). It is not equipped with traffic lights; it features dropped curbs and a rough cobble pavement. Rynek Dębnicki is the most difficult area to pass. The entire Rynek Dębnicki surface is a rough cobble pavement. There are many obstructions for sight-impaired people, such as cycle racks, concrete plant pots, and different levels (raised curbs). Rynek Dębnicki bus stop is not equipped with any information for impaired sight people; it is an information barrier [3]. Along Antoniego Józefa Madalińskiego street (about 210 m) there are two pedestrian crossings without traffic lights that are equipped with blister surfaces and dropped curbs. The pavement along Antoniego Józefa Madalińskiego street is in very good technical condition.

Konopnickiej bus stop is located on Marii Konopnickiej street, which is a four-lane road. Buses going to the center of Cracow leave from the other side of the street. The only way to get to the other street side is via an underground passage (Fig. 8.) The underground passage entrances are well marked: yellow blister surfaces with dropped curbs located on each level of the stairs. The underground level is poorly lit and is not equipped with any tactile pathing; especially notable is the absence of a guidance path. The platforms of Konopnickiej bus stop are equipped with blister surfaces at the platform edges (Fig. 9.). There is no information for impaired sight people; it is an information barrier [3].

4. Stare Dębniiki change concept – *Przepis na miasto* workshop

In May 2017, a team from the Faculty of Civil Engineering of Cracow University of Technology⁴ organized the “Przepis na miasto”⁵ multidisciplinary workshop. A group of students from Cracow University of Technology, Cracow University of Economics, Wrocław

⁴ WIL PK – Polish abbreviation, transl. note.

⁵ The workshop took place between 18–20.05.2017. Krystian Banet and Ewelina Stypułkowska were organizing committee chairmen. The workshop was organized by KNSK Student Scientific Association of Transportation Systems (Koło Naukowe Systemów Komunikacyjnych – transl. note).

University of Science and Technology, the University of Economics in Katowice, Adam Mickiewicz University in Poznań and European Students of Industrial Engineering and Management participated in the workshop. The end product of the workshop was six charts and mockups of fragments of Cracow's Stare Dębniki and Salwator districts. The fact that the work had a multidisciplinary character was crucial: the students represented branches of engineering associated with transport, spatial management, and urban and architectural design across two levels of higher education (Bachelor, Master). Students' work was supported by a panel of experts: Andrzej Szarata, Tomasz Kulpa, Marek Bauer, Mariusz Dudek, Aleksandra Faron, Katarzyna Nosal, Kinga Racoń-Leja, Agnieszka Szumilas, and Ada Wolny. The overall goals of the workshop were to connect the two banks of the Vistula river, to analyze urban transport system integration, and to propose changes in the selected public spaces.

The project which adapts Stare Dębniki area to the mobility needs of sight-impaired people is the *Let's make noise*⁶ conceptual design (Figs. 10, 11). In this solution, the authors focused on Rynek Dębnicki square, the most difficult area to overcome by sight-impaired people. The concept assumed the revitalization of the public space. In this proposal, the removal of road lanes around Rynek Dębnicki square was intended to improve pedestrian safety. A reduction in private traffic would permit a friendly public space to be created. The authors proposed widening the sidewalks, introducing trees near buildings, changing the surfaces of pavements according to the needs of sight-impaired people, and improving free-standing small shops and street lighting. The concept assumed the revitalization of the municipal greenery and the introduction of a green pergola on the western side of Rynek Dębnicki square. The greenery would protect space users from the sun. The authors proposed residential and non-residential land use, and small facilities on the ground floors of surrounding buildings. In the central part of Rynek Dębnicki



Fig. 10. The *Let's make noise* – design concept developed as a part of the *Przepis na miasto* workshop. Prepared by Jakub Salach, Małgorzata Stec, Maciej Pilny, Justyna Mazur, Natalia Kobza

⁶ Authors: Jakub Salach (CUT), Małgorzata Stec (CUT), Maciej Pilny (WUT), Justyna Mazur (CUT), Natalia Kobza (ESIEM).

square, the authors designed an interactive board whose main aim is to teach and entertain using sounds such as clash, crackle, flutter, hiss, jingle, splash, twitter, and whistle. The *Let's make noise* conceptual design proposal would give a chance to integrate sight-impaired people with non-disabled people in a space in which people would be present at all hours.

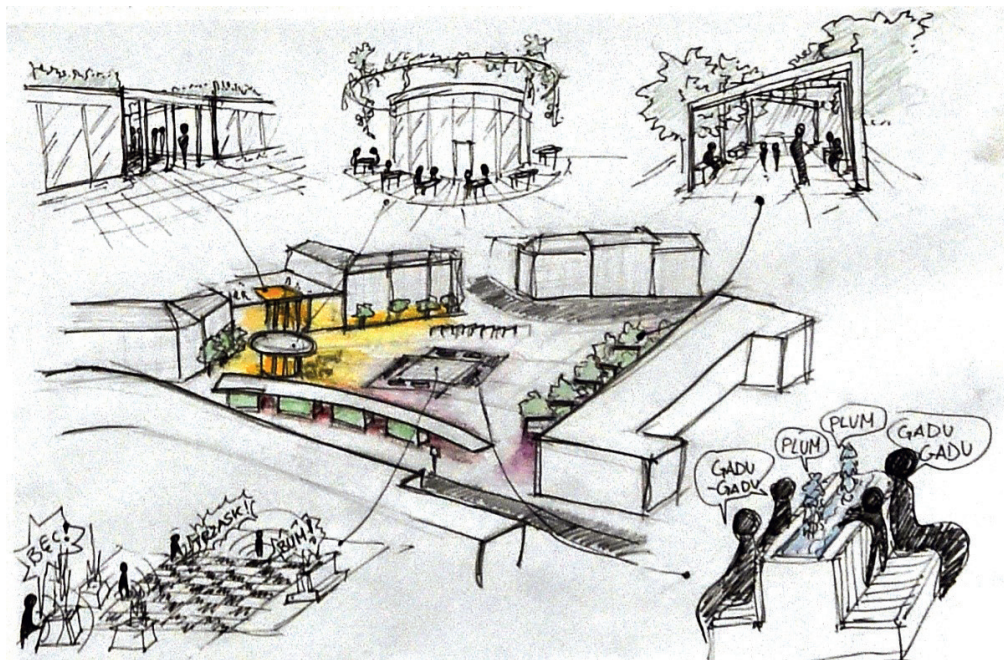


Fig. 11. The *Let's make noise* design concept developed as a part of the *Przepis na miasto* workshop. Prepared by Jakub Salach, Małgorzata Stec, Maciej Pilny, Justyna Mazur, Natalia Kobza

5. Conclusions

Sight-impaired people are a disadvantaged group in society because urban areas are not suited to their needs and expectations. Spatial designers should adapt urban spaces for people who are blind and create friendly and safe surroundings without spatial traps. This is especially important in areas which are frequently visited by blind people, e.g. the Stare Dębnyki area in Cracow, where a school for blind children is located. One of the most popular solutions is the use of tactile paving, which is part of a detectable warning system of indicators on the ground that is used to assist visually impaired pedestrians. Another solution which is dedicated to sight-impaired people is corduroy surfaces. Infrastructure designers should also remember to create proper platform edge warning surfaces at public transport stops. In addition, an ageing society and the predicted increase in visual impairment of older people requires attention to be paid to the accessibility and social inclusivity of urban spaces.

References:

- [1] Bentzen B. L., Barlow J. M., Franck L., *Addressing barriers to blind pedestrians at signalized intersections*, Institute of Transportation Engineers Journal, Natural Science Collection, 2000, 32-35.
- [2] Bilewicz M., *Sytuacja życiowa osób niewidomych i słabowidzących – Kontekst teoretyczny*, [in:] *Bezpieczeństwo osób niewidomych i słabowidzących w ruchu drogowym. Wybrane aspekty praktyczne*, red.: Laskowska K., Filipkowski W., Glińska E., Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2014.
- [3] Dębiec M., *Dostępny transport kluczem do rehabilitacji społecznej i zawodowej osób niepełnosprawnych*, Tyfloświat, nr 4 (17) 2012, Fundacja Instytut Rozwoju Regionalnego.
- [4] *Guidance on the use of Tactile Paving Surfaces*, Department of Transport, Government of United Kingdom [online], <https://www.gov.uk/government/publications/guidance-on-the-use-of-tactile-paving-surfaces> (access: 08.03.2018).
- [5] Jacobson D. R., *Cognitive mapping without sight: four preliminary studies of spatial learning*, Journal of Environmental Psychology, Vol. 18/1998, School of Geosciences, Queen's University of Belfast, Belfast, Northern Ireland, U.K., 289-305.
- [6] Laskowska K., *Katalog zagrożeń w ruchu osób niewidomych i słabowidzących*, [in:] *Bezpieczeństwo osób niewidomych i słabowidzących w ruchu drogowym. Wybrane aspekty praktyczne*, red.: Laskowska K., Filipkowski W., Glińska E., Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2014.
- [7] Małecki J., *W dobie autonomii galicyjskiej*, [in:] *Dzieje Krakowa*, praca zbiorowa pod red. J. Bieniarzówny, Vol. III, Wydawnictwo Literackie, Kraków 1979, 359-360.
- [8] Polišński J., *Oznaczenia dotykowe dla osób niewidomych i słabowidzących część I – dotykowe elementy ostrzegawcze*, Problemy Kolejnictwa, vol. 157, 2012.
- [9] *Projektowanie i adaptacja przestrzeni publicznej do potrzeb osób niewidomych i słabowidzących. Zalecenia i przepisy*, Instytut Tyflogiczny, Polskiego Związku Niewidomych, Warszawa 2016.
- [10] *Tactile Paving Patterns*, <http://www.bj56.org/tactile-paving-patterns.html> (access: 09.03.2018).
- [11] *Statystyczne Vademecum Samorządowca*, Urząd Statystyczny w Krakowie, 2017, <http://krakow.stat.gov.pl/statystyczne-vademecum-samorzadowca/> (access: 11.03.2018).
- [12] Wood Nathaniel D., *Becoming Metropolitan: Urban Selfhood and the Making of Modern Cracow*, DeKalb: Northern Illinois University Press 2010, 272.