

Tactile Graphics at Railway Stations – an Important Source of Information for Blind and Visually Impaired Travellers

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Summary

Efficient movement of blind people at the railway station is associated with knowledge of the facility, location of important architectural elements as well as knowledge about hazards and dangerous places. The source of information in this field are tactile graphics being a plan of the facility. To fulfil their role, the tactile graphics must be made according to the same principles and allocated at appropriate and accessible places of the station. The article presents an analysis of this topic based on the conducted studies and evaluations. Final conclusions on the tactile guide system were clarified and they are addressed mainly to the station infrastructure managers and designers.

Keywords: information for the blind people, railway station, tactile graphics

1. Introduction

Any dysfunctions of vision are a growing problem of humanity. This applies particularly to developed countries, and results, among others, from population aging, the negative environmental impacts (e.g. the use of monitors, staying in air-conditioned rooms), as well as the occurrence of various diseases (e.g. cataract, glaucoma, retinal diseases, macular diseases, advanced myopia or optic atrophy). The Central Statistical Office data [2015] show that there are more than 1 million 800 thousand visually impaired people (4.74% of the population) in Poland.

Availability of transport infrastructure for the blind and visually impaired people depends on the creation of the right conditions for safe movement within the designated pedestrian routes. Such sequences are called: routes free from obstacles. The guarantor of the security are warning strips; such areas require intensive attention from travellers. An effective approach to destination is ensured by a tactile path [8].

Tactile graphics³ (plans and tactile diagrams) play an important informative role, whereby it is possible to know the arrangement of individual elements of

the railway station. It is well known that the graphic presentation of information is much better than a most accurate description [1].

In addition to warning belts or tactile paths, which are perceptible by the feet or by the walking stick of blind person, there is a group of informative signs read by hands. According to [7] „(...)At the fingertips there are tactile receptors (the so-called Pacinian cells), which quickly record any surface bulging. The touch impressions can be a carrier of information, allowing blind people to read through their fingers. The convex letters and texts written using Braille⁴ alphabet are used for this purpose; they have larger dimensions than those used for sighted people.”

It should be emphasized that in addition to the convex letters, the blind people can distinguish the shapes of the drawings. This capacity has been used to read convex drawings and diagrams. Additionally, diagrams placed on a contrasting background provide facilities for the visually impaired or colour – blinded people.

Given the above, a graphical description of the area has to be used in a simplified manner in order to streamline and facilitate the movement of travellers within the area of the station, Tactile Maps are an important support in the acquisition of knowledge

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³ Tactile graphics are wide range of techniques to highlight images that take into account the specificity of the sense of touch without focusing on details and highlighting the elements, which are the most important for the image as well as the effect of their application [9].

⁴ Braille alphabet (or Braille) corresponds to black printing alphabets (graphic). It involves the use of 64 combination of convex dots through six points arranged in two vertical columns, three points each. The term „Braille language”, is not the proper term [9].

[4]. In Poland, there is no regulatory guidance related to construction, displaying and extensive use of tactile graphics in transport infrastructure. Hence railway facilities, even recognized as fully adapted to people with disabilities, do not have the information carrier for the blind and visually impaired people. There are the first attempts to construct such sources of information, however their structures characterize the lack of consistency in the used graphics.

2. Features of correct tactile graphics at railway stations

Any plan or scheme describes the environment through a variety of signs and symbols. They are not the exact copies of all the elements of space, but a simplified reality, showing the location of the most important objects and places for the traveller. As indicated by, information delivered by the tactile graphics should include the mutual arrangement of the most important elements of the station and point the way to reach a certain place [6].

Properly prepared graphics for blind people should have a few important features that support their usefulness in terms of providing information. Therefore, good tactile graphics must have the following properties, such as:

- **Appropriate legibility** comes down to the simplest forms of exposing important information. According to Czerwińska [3] „(...) it is necessary to present the facility in the terms of the most favourable way for observation based on touch, e.g.: the main parts should be clearly visible, and the individual elements cannot overlap. (...) it is not advisable to use drawings of perspective, axonometric or ideograms, since such conventions are too difficult to read by touching. It is important to keep to the correct shape and proportions of the facility, that should be presented in a manner as close as possible to the real.” It should be avoided the presentation of details, because their excess reduces a readability of drawing.
- **Attractiveness** comes down to prepare tactile graphics on a suitable material, in a friendly way for the future users (the convexity to be read by touch has to possess an adequate height, be not rough, sharp and do not have complex shapes).
- **Durability** as an essential factor for permanent use; all figures should be embossed on the material resistant to abrasion using the convex inscriptions and symbols. At the same time, diagrams exposed to changing weather conditions (placed outside the roofing) should be made of corrosion-resistant material.
- **Consistency** comes down to the use of identical signs depicting the same facilities (e.g. the stairs,

the lifts, the tactile paths). Keeping the same rules makes easier to understand the information provided on a various tactile graphics.

Due to the fact that on the rail network there are railway stations which were modernized or built from the scratch, as well as there are the old buildings that are not planned to be modernized in the near future, tactile maps may be made in two ways, i.e. including:

- a graphic presenting the path system or touch paths, so that the blind have the opportunity to learn about their course and about the obstacles occurring on the route (eg. stairs) or about occurring facilities (escalators and ramps, mobile, lifts), as well as to realize the distances from each object in the facility;
- a graphic, which shows different objects of the station together with the reference points, such as walls, roads, green areas. This type of tactile graphics applies mainly to the places with no leading path and a blind passenger will be forced to follow, the so-called, natural reference points indicated on the plan. Recently, the trend is observed to use such plans on those stations where tactile paths are installed. In such cases, they are applied to the tactile graphics.

3. Basic requirements for tactile graphics on railway station

Conducted recognition on today's design of railway stations in various countries shows that creating such plan is worth remembering that such source of information could serve all travellers. Hence, in recent times more and more common universal schemes are in place, Tactile graphics for blind people has been combined with a package of information for other travellers. Therefore, next to the convex drawings and inscriptions made by using Braille, there were color-coded graphics and traditional descriptions.

The scope and presentation of information

The tactile graphics should bear the following information:

- title – the name of the train station,
- legend,
- a description in Braille alphabet,
- subtitles using letters with large chromatic contrasts with the background, designed for the visually impaired,
- important elements of the station area and routes free from obstacles along the course of touch paths. In the case of the design for all travellers the different architectural elements can be varied in colours,

- drawings should not be complicated and should not contain details,
- abbreviations can be used on the map provided explanations of their significance in the legend; 2-letter mnemonic abbreviations will be the easiest to understand and remember [18],
- touch paths on the plan should be narrow, which enables the blind person to move the finger along a specific direction on the surface of tactile graphics,
- size of the map should be such that the whole map surface could be in reach. According to the experience of Japan, the height of the plan should not be greater than 610 mm, while its width not greater than 1220 mm. Such dimensions allow to keep a fixed posture while reading the plan by a blind person.

In addition, there should be possible inclusion of sound system on the tactile graphics (descriptions of surroundings in Polish and English).

The set of information included on the plan should be simple and easy to understand. A good plan of railway station is one which provides the information that are well remembered even at certain distance from it [6].

If the infrastructure of the railway station is very complex, the plans for its individual fragments or levels shall be applied. This information should be included in the legend, and tactile graphics should indicate where the next plans are placed.

Letters

As a result of hitherto experience and many opinions of blind and visually impaired people, the used font should be deprived of any ornaments of the letters. Therefore, it is recommended to use sans serif letters (letters without frills) and prohibit the use of italics. Recommended fonts are Arial, Tahoma, Verdana.

Title

There should be an inscription with the name of the station at the top of the map. The inscription should be made using both letters and Braille alphabet characters [6]. There should be no other information at tactile graphics, which has no relevance to travel, for example logo of PKP (Polish National Railway) or other facility manager.

Legend

Each plan should contain a key to properly read information on it. It is the legend. Experience shows that the legend should be on the right side of the plan, or on the bottom. The first line should have the word „legend”. Below this inscription, the first position of the legend should be a graphic sign (usually a dot in a circle or a large dot) meaning „Here you are”. This designation allows the traveller to determine his position in relation to the surrounding infrastructure. To simplify the search of that graphic sign, it should be larger than the others and indicated with the colour

contrasting with the background (this facility is addressed to the people with low vision). Between the legend and the graphic maps there should be several centimetres distance.

If at the railway station there are placed other plans showing the location of the remaining infrastructure elements, their position should be marked for example by triangle on the legend.

The material used

The blind people using tactile graphic read it by touch. Therefore, the plan should be made of wear-resistant materials. If it is intended only for blind travellers, it can consist of aluminium or brass. Universal plans can be made of plastics, which can have the desired colour. At the same time, the material used should be resistant to mechanical damage and changing weather conditions (for outdoor locations).

The plans of railway stations placed outdoors should have such location of tactile graphics that are not being exposed to long-term operation of sun (heat in the summer, icing in the winter). That may hinder its use by the blind (too hot touch elements during the summer, icing of the scheme in winter) and fading of colours – the deterioration of legibility for the visually impaired people. Therefore, the preference should be given to indoor location.

Each plan should be easy to maintain and regularly cleaned of dirt settling from the air. Controls of technical condition should be in place in order to determine whether the plan has not been damaged. Any damage to the elements of touch should be kept repaired.

Universality

Each plan of railway station dedicated „to all” should be designed to combine visual elements (designed for sighted and visually impaired), with touch elements (intended for blind people). For this reason, there should be used: colours with good contrast, large font, legend in Braille, symbols of important infrastructure elements – tactile and visual. Universal maps of railway stations are:

- monochromatic (e.g. in the colour of the material of which they were made) – the solution should not be preferred.
- coloured (usually made using a colour contrasting with the background) – the preferred solution.

The size and the way of exposure

According to Poliński study [6] the map size should be related to the information contained herein. The Japanese experience says that the map height should not be greater than 610 mm, while its width not greater than 1220 mm. Maintaining such dimensions allows to keep a fixed posture while reading a map. Due to the height limit of map, Japanese suggest the need of placing any explanations included in the map in horizontal orientation – Figure 1.

Convenient reading by touch requires proper installation of tactile graphics. As an example, according to Japanese experience the reading of the tactile graphics could be improved by setting them on a special stand. The slope of the plan should be between 45 and 85 degrees relative to the horizontal plane. The map can also be mounted on the wall. For blind travellers using wheelchair and for children it is particularly important. The lower edge of the stand must be at a distance of 700–760 mm from the floor.

In the case of railway stations plans dedicated „to all” that are placed indoors, be aware of their good lighting. The lighting parameters should be similar to those used to the wall train schedules.



Fig. 1. Example of tactile graphics – subway station in Japan [18]
Rys. 1. Przykład tyflografiki na stacji metra w Japonii [18]

It should be emphasized that the observations field in the front of plan should prevent from slipping. The tactile graphic should stay cleaned out of snow and ice during winter time in the case it is exposed to the changing weather conditions. This also applies to a field surrounding the tactile graphics. Example of proper signage is shown in Figure 2.



Fig. 2. Exemplary tactile marking in front of tactile graphics dedicated „to all” [photo. authors]
Rys. 2. Przykładowe oznakowanie dotykowe przed tyflografiką „dla wszystkich” [fot. autorów]

Location

Location of tactile graphic should be determined prior to its design. It is associated with the correct location of the point „You are here”. Proper location of tactile graphic provides its easily positioning, gives the possibility of a direct approach and it's read by touch. Therefore, tactile graphics should be situated near the main entrances to the building of the railway station, along the main pedestrian routes and at the entrances to the platforms.

The practical tip

Recently there has been carried out a lot of modernization works on the Polish railway stations, therefore it is not advisable to take different graphical symbols to designate the same elements of infrastructure and to use different ways of their visualization on the tactile graphs. This mistake was already done by marking the danger zone with the warning stripes on the platform. That created a new kind of restrictions for the blind travellers. Therefore, any activity in this area should be arranged according to the pattern: develop the principles and based on that follow all projects [6].

4. Examples of used tactile graphics on the polish railway stations

The facility plan of Warsaw East Station, modernized due to EURO 2012, was one of the first tactile graphics on the Polish railway station. Then, similar plans have been placed in the part of the suburban railway station. At the same time the plan was removed from the long-distance part of station. Currently on that part of the station there are tactile graphics for the blind people. The fragment of tactile graphic is shown in Figure 3.

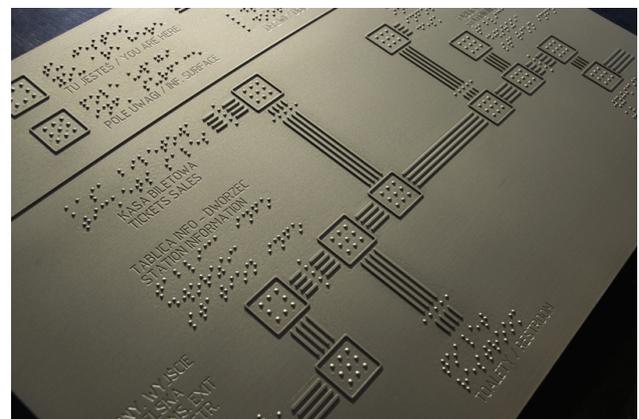


Fig. 3. Tactile graphics for blind people at the Warsaw East Station [13]
Rys. 3. Tyflografika dla osób niewidomych na dworcu Warszawa Wschodnia [13]

It should be noted that the presented plan does not contain the name of the object, which is shown on it. The legend was placed in the upper part of the plan. Symbol „You are here” is practically identical to the note field. Furthermore, the subtitles were made by extrusion of the material (concave letters, not convex). That makes difficult the use of such plan by partially sighted people or by those who do not know Braille alphabet. It is not an universal plan, it narrows the audience to the blind people only. It is worth noting that setting such tactile graphics outdoors, would cause difficulties to read during the winter time, when water stored in the carved letters would freeze at the temperature below 0°C.

A different type of tactile graphic intended only for blind people was applied at the so-called innovative system railway stations. The name of the station was placed on the plan and the field „You are here” was clearly marked. That significantly facilitated orientation in the station area. An example of tactile graphic for the blind people at the Nasielsk system station is shown in Figure 4. It should be noted that the legend is provided across the width of the plan and just below the title. Noteworthy is an aesthetic and vandal-resistant stand.



Fig. 4. Tactile graphics at the station in Nasielsk [14]
Rys. 4. Tyflografika na dworcu w Nasielsku [14]



Plan of the main hall of the Main Lublin Station [15]

Examples of universal tactile graphics at Main Lublin Station, Katowice Station and Main Szczecin Station are presented in Figure 5.

Thanks to the used colours the presented plans are legible for all travellers. The upper part of the plan provides the name of the facility, under which the legend was placed. However, the PKP logo was placed on the map, which does not contribute to the presented content.

The above shown tactile graphics are produced by different companies, which advertise their products by emphasizing the contribution of the blind community in their design. Unfortunately, diversity of both graphics used, and symbolism is observed. It is a pity that this heterogeneity does not pay attention of the manager of railway stations, and thus the principal recipient of ordered modernization projects.

5. Conclusions

1. Commission Regulation EU 1300/2014 [17] does not mention about tactile graphics at the station, as an important element of tactile information for the blind people. However, this does not entitle to ignore the tactile plan as a source of knowledge about the facility or to create it according to different rules.
2. Each tactile graphic depicting a fragment of the railway station or the bus stop should provide information to all travellers both sighted and blind people (tactile graphics dedicated to all). Hence, it should be an universal plan, with. That increases readability and facilitates its use for visually impaired people.
3. At each plan there should be included the following information:
 - tactile graphic title;
 - legend, which the first element is a symbol in-



Plan of the main hall of the Katowice Station [16]

Fig. 5. Examples of tactile graphics dedicated „to all”
Rys. 5. Przykłady tyflografiki „dla wszystkich”

dicating its location („you are here”), and next the location of other map if one exists. The legend should be located in the same area of the plan on each tactile graphics;

- essential elements of the station site for the travellers;
 - routes free from obstacles;
 - subtitles in Braille alphabet and convex inscription letters (not concave);
 - symbols indicating the location of architectural elements.
4. The sizes of tactile graphics should be such, that the whole surface stays in reach (the size of the tactile graphics should be based on the information contained herein). Based on the tactile graphics existing in Japan, the height of the plan should not be greater than 610 mm, while its width not more than 1220 mm. Keeping to these dimensions allows to maintain a fixed posture while reading. Because of the height limit of tactile graphics, Japanese suggest the necessity of placing all of the explanations in the horizontal orientation in the legend [6].
 5. On tactile graphics there should be placed only those items that are target directions for traveller. Placing on the map irrelevant information, for example abbreviations without explanation, complex diagrams or long descriptions reduces the readability and makes it difficult to remember. A good plan contains easily legible information, which can be well memorized even at a certain distance from it.
 6. Touch paths on the plan should be narrow, which enables the blind person to move the finger along a specific direction on the surface of tactile graphics.
 7. Convenient reading by touch requires a suitable installation of tactile maps. Regarding Japanese regulations a well reading could be ensured by placing the map on the adjusted special stand. The slope of the touch map should vary between 45 and 85 degrees to the horizontal plane. The map can also be suitably installed on the wall. For blind travellers using wheelchairs and for children, the lower edge of the stand must be placed between 700-760 mm from the floor. [6, 7].
 8. Tactile maps do not provide complete information on mobility. Innovative solutions can be equipped with special buttons applied on the plans, which pressing starts a sound description of the plan, including particular emphasis on available facilities as well as possible dangers for people with disabilities.
 9. Correct location of tactile graphic ensures it is easy to find and to approach directly as well as it is readable by touch. For this reason, they should be placed near the main entrances to the main hall, along the main pedestrian routes, as well as at accesses to the platforms.

10. With regard to tactile graphics designed to all travellers that are situated indoors, be sure to provide adequate lighting. The lighting parameters should be similar to those that apply to the wall train schedules.
11. Tactile graphics should be durable and easy to maintain, and regularly cleaned from the settling pollutants of the air. Inspections of the technical condition are recommended, in order to repair any damage that has occurred [6].
12. It is not advisable to use various graphic symbols to denote the same elements of the infrastructure at the railway station. The action should be systematize according to the following: develop a rules – give them legal status – on their basis carry out the projects.

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Tyflografika na dworcach kolejowych – ważne źródło informacji dla podróżnych niewidomych i słabowidzących

Streszczenie

Sprawne poruszanie się osób niewidomych po dworcu kolejowym jest związane ze znajomością obiektu, położeniem jego ważnych elementów architektonicznych, jak również wiedzą o istniejących zagrożeniach i niebezpiecznych miejscach. Źródłem informacji z tego zakresu są tyflografiki, będące planami obiektu. Aby spełniały swoją rolę, muszą być wykonane według jednakowych zasad i prezentowane w odpowiednich, dostępnych miejscach dworca. W artykule zamieszczono rozważania na ten temat na podstawie przeprowadzonych analiz i oceny oraz sprecyzowano wnioski adresowane głównie do zarządców infrastruktury dworcowej i projektantów.

Słowa kluczowe: informacja dla niewidomych, dworzec kolejowy, tyflografika

Тифлографики на железнодорожных вокзалах – важный источник информации для невидящих и слабовидящих пассажиров

Резюме

Четкое передвижение невидящих по железнодорожном вокзале связано со знакомством объекта, местоположением важных архитектурных элементов, а также осознанием существующих угроз и опасных мест. Источником информации на эту тему являются тифлографики представляющие план объекта. Для того, чтобы исполнять свою роль, они должны быть сделаны по одинаковым правилам и размещены в подходящих, доступных частях вокзала. В статье помещены рассуждения на основании проведенных анализов и оценок, а также уточнены выводы направлены к управляющим инфраструктурой вокзалов и дизайнерам.

Ключевые слова: информация для невидящих, железнодорожный вокзал, тифлография