

**Petra KOCUROVÁ<sup>1</sup>, Alžběta BÍLKOVÁ<sup>2</sup>****SUSTAINABILITY OF STREET SPACE IN BUILT-UP TERRITORY IN THE CASE OF BARRIER-FREE USE****Abstract**

The street space is perceived as the multi-element dynamic public space. A diverse group of users with the often conflicting requirements is intertwined with it. To ensure the adequate utilization and hence its sustainability, it is essential to predict these claims for the future users in the already designed public spaces. However, in the already built-up area these tools reduce problems and increase the functionality of a limited area. The recovery by the creation of a functionally stable environment (safety, clarity, accessibility, attractiveness) for all user groups in urban settlements and creates a pleasant place to stay, work, live and relax. One of the risky groups with the specific requirements for the use of a public space are the people with limited mobility. This group is often physically or mentally disadvantaged in the comparison to the others. In the solution of a street area we have to deal with structural modifications to ensure an independent movement and orientation, for people with limited mobility or vision. Especially for blind and partially sighted people it is necessary to know and respect the principles and techniques of a spatial orientation. The environment which is created by construction has to produce information in sufficient quantities and quality adequate, so that street space is seen as a collection of various points, lines and characters for visually impaired people who would choose the indicatively important phenomena. The rules of barrier-free use, although legally binding, are in many cases incorrectly applied in practice. Nescience of these principles, their poor application and intensity of spatial orientation in urban environment often leads to disorientation for these users, the feeling of psychological isolation and often to the accidents. The article focuses on solving the existing street space in cities in a relation to the barrier-free use.

**Keywords**

Disabled accessibility, mapping, persons with reduced mobility, typology of buildings, accessibility.

**1 INTRODUCTION**

The street space, as a poly-functional dynamic element of urban structure, is a demanding space for adaptation to a barrier-free environment. It is affected by numerous aspects which can vary in time and in location. Such changes in environment may disorientate persons with limited orientation abilities and also present barriers for persons with limited mobility. This article shows the frequent errors made in street space design and emphasizes related risks.

Typical public areas which are characterized by unlimited accessibility are line elements – streets. Their dynamics complement domiciles and provide for functional service. During the increase

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of the motorization of inhabitants, their residential function is depressed and street spaces become roads. It is essential to rekindle the issue of re-occupying street spaces and creating a user-friendly and pleasant environment. Organized planning and coordination of new street spaces and a timely solution and regulation of existing spaces can make this happen. This uneasy solving of the task is characterised mainly by the polyfunctional utilization and the derived demands and impacts (natural climate and hygiene of the environment, mental and social peace, aesthetic utilization, street furniture and technical condition, spatial and economic demands).

We understand the polyfunction of a street as a variation of demands in terms of its users. These are various alternatives and their combinations derived mainly from the situation of the street in relation to the domicile, where streets near the centre have a commercial function. Residential streets are situated rather in less busy parts. Also here we must define various requirements for variant types of transport in terms of the speed of movement in space and divide this linear movement especially for the safety of all users.

In an effort to provide for the independent movement for persons with limited orientation in street spaces it is necessary to predict risks which arise from common daily activities. Subject to a correct definition of risks, it is possible to implement measures eliminating their origin or to mitigate impacts. The risks and their possible impacts can be identified especially for static elements in streets, where they can be prevented.

Regulation 398/2009 Coll., which is currently valid in the Czech Republic, defines persons with a sensory visual handicap as persons with limited orientation. In particular, these are persons with complete or partial loss of sight, or other handicaps, e.g. daltonism (colour blindness). Persons with this type of handicap are at a big disadvantage, especially during movement and orientation in larger spaces. Street spaces are complicated for these users, even though they move predominantly along familiar and trained routes – the long white cane technique. As was already mentioned, they are variable and live spaces where new perceptions arise randomly which can disturb orientation of these persons and cause complications in relation to walking along a given route and also disturb the safe movement of these persons or other users.

In the case of variable street spaces, we cannot preclude all risks, especially those which arise by dynamic elements of a street. Elements of independent and safe movement are defined to ensure explicitness and lucidity. These modifications are tactile, route and complemented by acoustic information [3].

## **2 THE PRINCIPLES OF MOVEMENT OF BLIND PEOPLE**

Blind persons moving independently in the space orientate according to natural and artificial guide lines (compact elements like building facades, fence socles, garden curbs, etc.). Another aid for orientation in space is orientation points which can include structured building corners, freely standing elements like posts and orientation signs (olfactory, aural, surface structure, terrain, etc.). The movement of blind persons is guided using the white cane technique and by treading. For orientation in familiar buildings, a sliding finger technique (trailing) is also used. A blind person uses hand touching to orientate during movement parallel to guide lines and tries to feel for orientation points and signs – doors, signs in Braille. To facilitate for movement using these techniques it is important to provide for free passage along guide lines while maintaining a minimal pass-through height, provide enough tactile elements, whether artificial or natural and also tactile contrast against other elements which are located in the plane [3].

In the case of weak-sighted persons it is important to create visual contrasts, eliminate glossy and transparent surfaces while adding a simple orientation system using comprehensible symbols and signs.

An environment that accommodates a broad range of visual characteristics should have:

- a simple, logical and easily understood arrangement, preferably with intersecting routes at right angles to each other,
- an easily discernible system of way finding visual contrast between adjacent objects and surfaces where it is necessary to provide important information, choices of colour that satisfy the needs of those with anomalous colour vision,
- appropriate warnings of the edge of abrupt changes of level or the existence of obstructions,
- no reflections from floor and wall finishes,
- careful placement of mirrors and glazing, to prevent dazzling and confusion,
- a suitable level of lighting, free of glare,
- complementary audible information [2].

Guide line: it can be defined as a horizontal element used for orientation by weak-sighted and blind persons in interiors and exteriors. A blind person moves along this line with constant spacing of 300 – 400 mm and checks the route by the extended waving of the cane every 3 – 5 steps. Guide lines are divided into natural and artificial lines. A natural guide line is a natural part of the environment, e.g. building walls, fence socles, grass curbs higher than 60 mm, railings with stops for white canes or other compact objects wider than 400 mm and higher than 300 mm. An artificially made guide line is a special part of a structure, which is made from a longitudinal groove with a minimum width of 400 mm in the exterior. An artificial guide line must smoothly link up to a natural guide line. Due to the method of movement of blind persons along an artificial guide line, there must be no obstacle situated within 800 mm from its axis in either direction, and unobstructed thoroughfare must be provided for [3].

A types of artificial guiding lines are defined in European legislation. They should be constructed of parallel flat-topped bars, ribs or sinusoidal rib pattern [2].

Tactile contrast: an environment comprehensible and safe for movement by blind persons is created by using structural modifications, specifically elements which are distinguishable from their surroundings by touch. A person feels such elements by hand, trading or by using a white cane. They have specific and unique surfaces and dimensions. They include a warning strip, a signal strip, a guide line functioning as a warning strip, a tactile strip or a guide strip on pedestrian crossing and information signs in Braille, which are legible by hand touches. These integrated products are subject to TN TZÚS 12. 03. 04 - 12. 03. 06 manuals, shaped like a sine curve, with projections or a trapezoid surface. It is concrete small-scale paving with projections, artificial stone paving, polymer-concrete panels for warning strips on a special track, plastic strips with projections [3].

Acoustic elements: these elements are defined clearly by their signal or trill. These include mainly acoustic signalling devices on pedestrian crossings and crossovers, acoustic orientation beacons, acoustic information beacons, information system boards with voice information, information modules, electronic elements of information systems according to TN TZÚS 12.03.07. According to appendix No. 1 of Regulation 398/2009 Coll. an acoustic element is defined as an acoustic signalling device for pedestrians signalling “Stop” or “Go” or an orientation beacon with respective trill and possible voice information. The trill is louder by a third compared to voice acoustic pressure. The formulation of voice phrases must respect the principles of the spatial orientation of persons with visual handicaps [1].

## **2.1 The movement of blind people using guide line**

The move of blind people using a white cane technique can be divided in the following ways:  
according to a type of guide line

- Using a natural guide line,
- Using a guide line.

according to a movement technique

- Shuttle technology,
  - Sliding,
  - Sliding shuttle.
- according to the location of the blind person
- On the auxiliary element,
  - Partially on the auxiliary element,
  - Outside the auxiliary element.

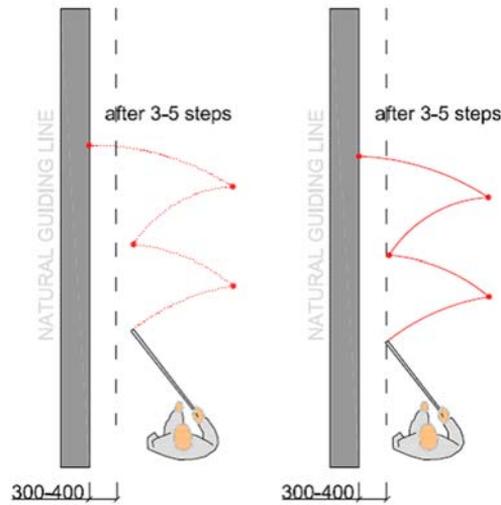


Fig. 1: Natural guiding line - sliding shuttle technique, sliding technique

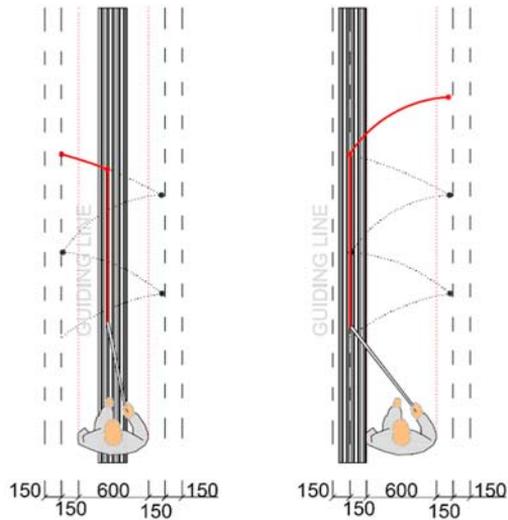


Fig. 2: Artificial guiding line - location on the element, outside of element

## 2.2 Situation of furniture

Seems problematic in the street space. In an effort to provide the most user-friendly inhabited space and maintain the human aspect, furniture with utility and aesthetic character is placed in this space. However, the location of furniture must not be random, disarranged and irregular. Particularly in barrier-free environments for persons with limited orientation, it is necessary to respect the rules set out by Regulation 398/2009 Coll. This solution is subject to Section 4, Art. (5), Appendix No. 1 in clauses 1.1.7, 1.1.8, 1.2.10, Appendix No. 2, clauses 1.2.1, 1.2.2, 1.2.3 [1]:

- Situation of the furniture and similar equipment must not limit the natural movement of pedestrians and interfere in the walking space, respectively the walking space along guide lines must be maintained at a width of at least 1,500 mm,
- Above publicly accessible roads and areas there, only fixed building parts which protrude from the wall contour not more than 100 mm can be located there, at a height of 250 to 2,200 mm above the surface, particularly store fronts, technical or other equipment and, furthermore, technical equipment of the building of similar character. In the case of technical building equipment not more than 400 mm in length (measured parallel to the building wall) this value can be increased to 300 mm,
- There must be no obstacle on the artificial guide line at least 800 mm from its axis in both directions, on a natural guide line and there should be no obstacle 900 mm from it,
- The height of furniture control elements and other components must be 600 - 1,200 mm and the distance from a solid obstacle at least 500 mm [3].

The most critical part of a street space for persons with limited orientation abilities is mainly the interruption of a natural guide line and the narrowing of walking space along such a line.

## 3 STATIC ELEMENTS

In an effort to ensure independent mobility for persons with impaired orientation in a street space it is necessary to predict hazards arising from normal daily operation. When the risks are identified properly, it is possible to implement measures by eliminating their occurrence or mitigation of the impacts. The risks and their possible impacts can be mainly identified as the static elements of street profile, where they can also prevent crisis situations to users.

The structural elements of street space, especially if they are permanently natural, may assist persons with limited ability with outdoor orientation. It is necessary to provide a comprehensive network of a permanent landmark with static elements, i.e. unchanging elements, to ensure the barrier-free space.

The flexible and temporary static elements should have to establish the integrity of solutions, especially within those which are assigned to barrier-free routes. The elements of public space can be either in public or private sectors to ensure such adjustments to respect the needs of persons with reduced mobility. An imprudent and unregulated placement of the static elements into street space created risks which may endanger safety, disorient or create a mental barrier of users with limited orientation.

## 4 DYNAMIC ELEMENTS

The second group of elements under consideration concourses are dynamic elements. Due to their variability in time and movement have been regulate only partially, they are more complicated to solve for creating a safe and pleasant space. Especially in shared highway space it is necessary to define the routes for certain modes so as to disrupt the safety, especially during variations of different speeds and crossing directions.

The biggest problem for users with limited orientation occurs in the case when these dynamic elements are extended into the defined barrier-free routes. Blind and visually impaired are stochastically in danger, which should these elements bring. Difficult response and prediction of the risks arise in the case where the object does not emit sufficient acoustic track that could blind person informed about the impending danger.



Fig.3: Placing a restaurant's furniture along a guide line, not protected by a compact element without an artificial guide line in the whole walking space (Masaryk Square, Ostrava).

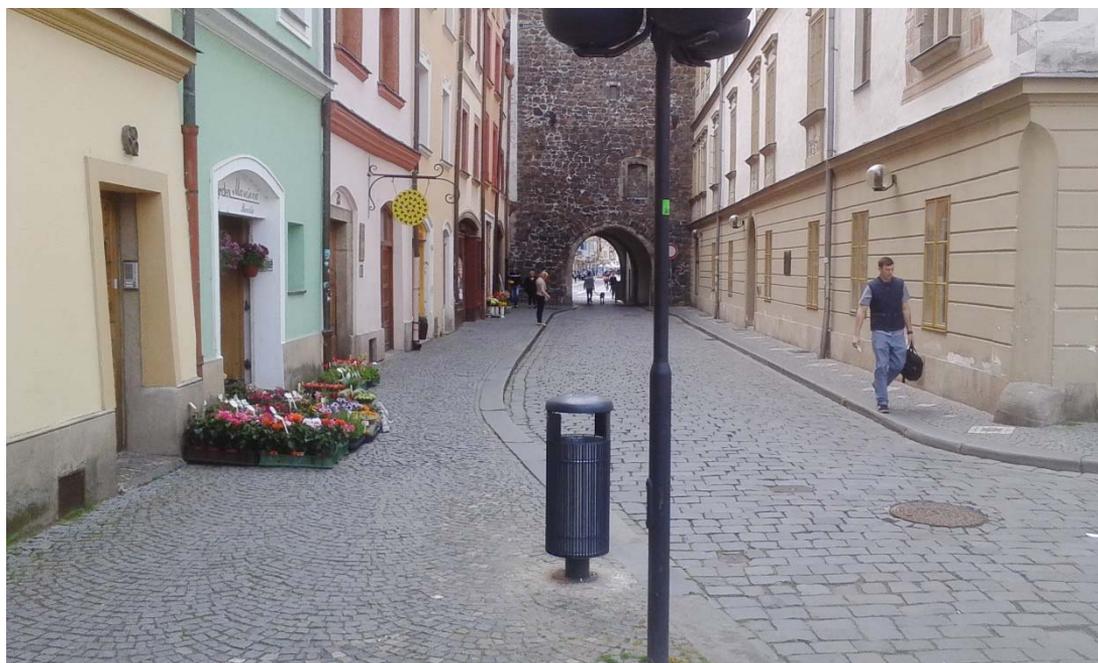


Fig.4: Unsuitable placement of goods at a natural guide line – risk of damaging goods and discomfort for persons with limited orientation abilities (Zelenobranská street, Pardubice)



Fig.5: Unsuitably close placement of furniture in space without providing for a comprehensible walking strip, without any line orientation (pedestrian zone in 28. října street, Ostrava)

## 5 CONCLUSION

Persons with limited orientation abilities are the sensitive users of public spaces. Unthoughtful intervention during the placement of furniture and other street equipment creates complicated obstacles which prevent sight impaired persons from their daily use, even though they are moving along familiar and trained routes – the long white cane technique. As was mentioned, it is a variable and live space where new perceptions arise randomly which can disturb orientation of these persons and cause complications in relation to walking along a given route and also disturb safe movement of these persons or other users.

A solution can be seen in regulation by public authorities by the issue of statutory regulations which shall set out requirements for the placement of furniture, especially goods in public spaces. Modifications should be as natural as possible, while using fixed furniture and permanent static components. Static components provide for a network of orientation points which can be helpful to persons with limited orientation abilities during orientation in space. The front gardens of restaurants, as a semi-private space, should be solved as a compact element at a height exceeding 60 mm, so that it can serve as an artificial guide line. If space allows, front gardens should be located away from the natural guide line while maintaining a walking area.

## ACKNOWLEDGMENT

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