Search for requirements for the width of pedestrian roads in the context of the classification of public space

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Abstract. Walking has long been the primary means of human transport. Nevertheless, in recent decades, the insufficient emphasis has been placed on it in the creation and renewal of public space. It focuses mainly on the needs of road transport, the volume of which is constantly growing enormously. It is only in recent years that the view begins to be re-evaluated and trends in the organization of public space gradually changed, as it is true that a larger supply generates a greater demand. Therefore, leading architects are gradually changing their approaches to the organization of public space and put humans, pedestrian transport, and its requirements first. In the Czech Republic, the trend is gradually changing, as it is worldwide. Walking again plays an important role in the creation of sustainable mobility plans for the cities of the Czech Republic. The main problems arise in the actual implementation of these ideas, as the legislative requirements are formulated only in general, unlike the requirements for road transport, which sets out the requirements for minimum road profiles in the context of design speed and traffic intensity in a given cross-section. These requirements are set out in Decree No. 501/2006 Coll. on general requirements for land use and also in CSN 73 6110 Design of local roads (CSN is Czech technical norm). However, such a categorization of requirements for pedestrian roads is not yet solved uniformly for the entire territory of the Czech Republic, even though CSN 73 6110 deals with sidewalks (functional group D roads). So far, this categorization is replaced only by seldom locally valid methodologies, manuals, or requirements and regulations in the town plans of individual cities. This paper aims to search for current approaches, legislative requirements, and approaches to addressing the width requirements for pedestrian roads in public space in the context of the classification of this area.

1. Introduction
Walking - the oldest means of transport of man. Already in the period when homo sapiens began to separate from the animal kingdom, he controlled this type of transport. It was not until many millennia later that man began to use animals for transportation, and even a few thousand years later machines. Nevertheless, until recently, walking has always been considered the primary mode of transportation at the settlement. Only the last decades have changed this approach.

Humans with the development of individual car transport began to emphasize this type of transport, and car transport has completely dominated public space in the last 40 years. Today, the form and structure of public space are very often subject exclusively to the requirements of the passage of cars and the need for parking spaces. This trend is evident not only from the professional literature, the current form of public space but also from the legislative basis. As the requirements for width passage
profiles differ from country to country, the paper will continue to deal only with the requirements and legislation in force in the Czech Republic.

The legislation of the Czech Republic is generally given by the wording: "A man behaves legally if he does not do what laws and decrees prohibit him". In other words, "Everything that is not forbidden is allowed." However, a different rule applies to the actions of the authorities and individual officials: "An official may do only what is required by laws or decrees." Therefore, most officials only require what is explicitly prescribed. For example, if a decree specifies a minimum width value, the official is requesting it without requesting a larger width, because he is not sure whether he would be able to legally defend this requirement as justified. This situation leads to completely inappropriately formulated requirements and assignments, especially for contracts related to modifications, revitalization, and new public space designs. The paper, therefore, aims to examine this situation and evaluate whether or not it is necessary to propose changes in approaches.

2. Legislation of the Czech Republic

Pedestrian road - sidewalk - is defined in Act No. 13/1997 Coll. about roads in §6 as the local road the IV.th class by which the road is inaccessible to the operation of road motor vehicles or on which mixed traffic is permitted. Furthermore, §12, paragraph 4 of this Act states: If they are not separate local roads, roads also include adjacent sidewalks, sidewalks under arcades, public car parks and turning points, underpasses, and facilities for securing and securing pedestrian crossings [1]. In Decree No. 104/1997 Coll. in §3, paragraph 4 is then called: Local roads IV.th classes are separate sidewalks, footpaths, bike paths, paths in cottage areas, subways, footbridges, stairs, footpaths, calm roads, residential and pedestrian zones, etc. [2]. We do not learn more about sidewalks in terms of width requirements from Act No. 13/1997 and its Decree No. 104/1997. However, in matters of design, the Decree refers, inter alia, to CSN 73 6110, Design of local roads. As the standard is listed in the annex to the decree only as recommended, it is not binding and if it is not listed, for example, in the contract award as required, the processor of the documentation is not obliged to comply with its requirements.

In CSN 73 6110, a separate subchapter 10.1 is reserved for sidewalks, which is divided into 5 parts. Chapter 10.1.1 gives general principles of pavement design, such as traffic safety, minimization of subjective feeling of danger, accessibility, smooth movement, freedom of movement, clarity, etc. Chapter 10.1.2 lists the minimum width profile: The width of one lane for pedestrians is 0.75 m, the pedestrian strip is a multiple of the number of lanes. The number of lanes is determined by the required quality of pedestrian movement and the performance of pedestrian roads. The intensity of pedestrian traffic is only taken into account when dimensioning their high concentration. The pedestrian lane/belt is separated from the main traffic area by a safety distance of 0.50 m or 0.25 m and can also be separated by a side dividing belt or railing... The width of the sidewalk should not fall below 2.00 m on the local road with the built-up area ... (figure 1).

Chapters 10.1.3 and 10.1.4 deal with crosswalks, footbridges, pedestrian underpasses, and viewing triangles - specific additional elements. Only chapter 10.1.5 addresses the efficiency of pedestrian roads. Here, the relationships between the speed of pedestrian movement, their intensity, and the density of pedestrian current are introduced. Categorization in terms of the quality of pedestrian movement is also being introduced. However, all of these indicators do not generate straight width profiles, but numbers of people per square meter. [3] This is unsatisfactory in terms of easy design or a set of essential requirements. For such a design, it is necessary to know the intensity of pedestrian movement based on locally performed measurements. These requirements cannot be met for most settlements in the Czech Republic, because these measurements are not available and their acquisition is very costly for them. This standard also does not take into account the requirements for barrier-free movement of persons with reduced mobility and orientation, as it sets a value of 0.75 m as the basic passage profile - the width of these sets is greater.
Figure 1. Width arrangement of sidewalks according to CSN 73 6110: sidewalk next to the solid barrier, sidewalk next to the barrier with an isolated obstacle, sidewalk next to the barrier with a continuous obstacle, and sidewalk next to the barrier with a continuous obstacle (source: [3])

Another decree dealing with public space and its organization is the implementing Building Act Decree No. 501/2006 Coll., On general requirements for the use of land. This decree in §22 addresses the requirements for the delimitation of areas for public spaces. Although the exact values of the width of pedestrian roads are not given here, the minimum area of public space is given here:
   12.0 m, if it makes the land of the apartment building accessible and it is a two-way road;
   10.5 m, if it makes the land of an apartment building accessible and it is a one-way road;
   8.0 m, if it makes the land of a family house accessible and it is a two-way road;
   6.5 m, if it makes the land of a family house accessible and it is a one-way road. [4]

At first glance, it seems that these are very wide spaces, but if we start to examine this width arrangement in more detail, the results will not be so optimistic.

If we start from the above dimensions, for example for a two-way road to an apartment building, and at the same time consider that it is a service local road, then we include the design speed of cars in this area of 30-50 km/h (lane width and strip 3.00 + 0.25 m [3]). If we also include one-sided longitudinal parking spaces 2.5 m wide in the space, then the remaining space is 3.0 m wide. If we take into account the expected increased density of pedestrian traffic (apartment buildings), then the sidewalk width of 3.0 m is not it is possible to further divide into both sides of the road, because a width of 1.5 m is not
sufficient - min. 2 times the width of the pedestrian lane 0.75 m (two directions) and 0.5 m safety
distance (figure 1).

Decree No. 398/2009 Coll., On general technical requirements ensuring barrier-free use of buildings,
deals in §4 with requirements for roads. Their specific requirements are set out in Annexes No. 1 and 2
to this Decree. The values of maximum inclinations, height differences, location of controls/buttons,
signal strips,… [5] However, the values of the minimum pavement width profiles are not given here.
The same applies to the dimensions of different spatial configurations - people in wheelchairs, people
accompanying a child in a stroller, people accompanying a child under 3 years of age, people using
walking support (cane, crutch, walker,…),… These dimensions are given only in literature dealing with
the typology of buildings, which, however, is only recommended and cannot be legally enforced.

3. Methodologies and typological literature
One of the most important typological supports for design in the architecture of buildings and public
space can be considered the book Buildings Design by Ernst Neufert. It is a comprehensive set of
recommendations and minimum dimensions for individual types of buildings and their internal
arrangement, as well as for different types of public space and modes of transport. The dimensions given
here are based on the original DIN (Deutsche Industrie-Norm - German national standard), so they can
generally only be taken as illustrative. Neufert lists both the wide range of human activities and their
spatial requirements (Figure 2), as well as the spatial requirements that are based on their use by these
activities.

The road is categorized (by a code that indicates a binding cross-section and width arrangement with
dimensions) for a given traffic intensity and type of road (based on DIN). The minimum width of the
sidewalk is 1.5 + 0.5 m on both sides of the sidewalks and directionally non-separated double lanes, for
higher categories of roads it gives values of width 2.25+ m and 3.75+ m (figure 3), near the school,
leisure center, or shopping center min. 3.0 m, common paths for cyclists and pedestrians 2.5 m (min.
2.0 m) [6]. It always depends on the number of communication lanes. Roads for cyclists are then solved
completely independently. These values roughly correspond to CSN 73 6110 and can therefore be
considered recommended in the Czech Republic.

Another well-known and world-renowned architect, Jan Gehl, also deals with public space and
pedestrian movement in great detail in his works. His book Cities for People presents 12 criteria for the
quality of public space, for example, feeling safe, safe, walking, stopping, seeing, scale, etc. The book
is a theoretical guide to a new trend in understanding and proposing revitalization and new spaces in the

Figure 2. Space requirements for walking by Neufert: with one piece of luggage, with two pieces of
luggage, passing people with luggagewith a cane, with an umbrella (source: own inspired by [6])
city. As such, it lists and analyzes the functions and activities of public space, its scales, but does not give any criteria in the form of specific values (minimum dimensions, maximum distances, …) [7].

The creation and categorization of public space is a very old issue, which is dealt with in the teaching of many scientific capacities. Vítězslav Kuta was chosen as a representative of these capacities. In his textbook from 1996, Theory of Urban Construction and Urbanism, the chapter devoted to traffic areas categorizes streets, determined and analyzes transport times (walking time, waiting time, transport time, and walking time to the destination), and criteria for road layout - speed and clearances and road width requirements [8]. Unfortunately, there are no specific width requirements here either. Also, it is literature from the period of intensive development of individual car transport, therefore pedestrian transport and its importance and requirements are mentioned only to a lesser extent.

![Figure 3. Examples of spatial arrangement of street space in cross sections according by Neufert; P - pedestrians, R – road for cars, C - cyclists (source: own inspired by [6])](image)

Furthermore, various methodologies, manuals, and professional articles also deal with the issue of public space and its arrangement, including pedestrian roads. The first representative is the methodology arising from the international project UrbSpace - Quality Public Spaces. There is an overview of factors influencing the actual process of revitalization and the creation and implementation of public space design. However, specific numerical values or layout schemes for streets or squares are not given here. Only at the end of the methodology are five case studies conducted [9].

Also, the Methodology of Designing Public Spaces from the Institute of Garden and Landscape Architecture does not state specific numerical values. The methodology was certified by the Ministry of Culture of the Czech Republic and is one of the results of the project Methods and Tools of Landscape Architecture for Territorial Development (No. DF11P01OVV019). It typifies individual types of public spaces, shows the methodology of their analysis, and sets out in general terms the principles of designing public spaces. Its further contribution to the emphasis on interdisciplinary cooperation (local government, owners, urban planner/architect, landscape or landscape architect, traffic engineer, sociologist, demographer, ecologist, economist, etc.) [10].

Another certified methodology that emerged from the same project (No. DF11P01OVV019) is the Methodology for evaluating the main squares of small towns. This methodology deals with the categorization of main squares in small towns describe the methods of their research analysis and the general principles of the design of modifications. Of interest is the analysis of traffic load, where the methodology recognizes the need for transport to the main urban area but also sets a quota of 50% of the square area without the burden of road traffic. This significantly limits the use of the square as a parking space in the center of the development [11]. However, specific numerical values concerning pedestrian roads are again not represented here.
One of the methodologies published on the website of the Ministry of Transport is the Methodology for the Preparation of Sustainable Mobility Plans for Cities in the Czech Republic. At first glance, this is a methodology dealing with the development of Sustainable Urban Mobility Plans (SUMPs). It, therefore, describes this process and the factors that can affect it. At the same time, the importance of pedestrian and bicycle transport and their inclusion in strategic urban planning is emphasized. Annex B.2.4 of the methodology lists, in particular, the main elements of non-motorized transport diagnostics, data sources, and possible problems and challenges to be solved within the SUMP from the point of view of non-motorized transport [12]. Although there are no specific or general elements determining the requirements for the design, the possibility of obtaining quality data for the analysis of a specific area is shown.

Some cities in the Czech Republic have developed their separate methodologies, which manage the development, categorization, and modification of public spaces. Two representatives were selected from several existing ones. Approaches implemented in Prague and Pilsen. Both cities are large urban agglomerations with a large population (more than 170,000). However, it is necessary to mention that not all cities have such methodologies or manuals. Not even all regional cities, let alone cities with a size of up to 15,000 inhabitants.

Figure 4. Examples of human modules in different situations by Manual for Creation of Public Spaces in the Capital City of Prague (source: own inspired by [13])

The Manual for the Creation of Public Spaces in the Capital City of Prague is an extensive and very detailed publication. It is structured and contains definitions, a typological division of public spaces, a general level of recommendation, as well as precise requirements for the dimensions and location of width profiles, materials, vegetation, furniture, advertising, kiosks, etc. [13]. Overall, it is necessary to state that the methodology is a clear and well-arranged foundation (instructions) on how to approach the creation and modification of public space throughout the capital city of Prague. This approach ensures a consistent and harmonious approach.
to public space for all parts of Prague. The above are examples of requirements for the layout of a public pedestrian area (figure 4).

A completely different approach was chosen in Pilsen. The local methodology is divided into a total of five parts - A-E. For this text, only parts A and D were used. In part A, in addition to the definitions and categorization of public spaces, general methods of classification are also described and an analysis of model significant public spaces, including their cartograms, is performed. Part D characterizes, among other things, the goals/requirements for individual types of public space and the means to achieve these goals. Special chapters are then devoted to the qualitative parameters of public space. Specifically, Chapter II.2.2 is devoted to walking conditions. Here, the recommended width of the sidewalk for various types of streets is directly defined by numerical values - 2 m as the minimum width in especially cramped conditions, 3 m as the basic measure of a normal sidewalk, and 3-10 m for streets where accompanying activities are expected (public transport stop, front gardens, etc.) [14]. It should be noted that this document sets out the method of evaluating the quality of public space and sets out the goals that should be achieved in this space according to its classification. In addition to very frequent mentions of the importance of walking, it names it in the goals and requirements for individual types of spaces and also clearly defines the recommended minimum values for the width of pedestrian roads.

4. Conclusions
The legislative normative and methodological basis concerning the requirements and recommendations for solving the width parameters of pedestrian roads was examined. The results of this survey are not satisfactory and point to gaps in the approach to solving the width parameters of pedestrian roads.

Legislative basis - Act No. 13/1997 Coll., Decree No. 104/1997 Coll., Decree No. 501/2006 Coll. and Decree No. 398/2009 Coll. - deal with definitions and general requirements. The only Decree No. 501/2006 Coll. mentions specific minimum width requirements, but these relate to the width of the street space as such, not to the width of the pedestrian space.

Normative regulations that deal with pedestrian roads and their design, specifically CSN 73 6110, are in Decree No. 104/1997 Coll. listed as recommended only. This greatly complicates its applicability in practice. Also, all design of the width of pedestrian roads is governed by pedestrian current intensities. These parameters are not available in most cities in the Czech Republic, because their acquisition/measurement is very time and money expensive.

There is also a large amount of professional literature dealing with public space. In this literature, qualitative criteria and ways to achieve them, in general, are mainly set. Another disadvantage is the predominant focus of this literature on large cities and agglomerations. Of course, these settlements are very important, but most of the recommendations are usually difficult to transfer to the environment of smaller settlements. One of the few publications that deviate from this scheme is Buildings Design by Neufert [6], which is a comprehensive overview of the requirements and recommended dimensions for ground, traffic, and street layouts.

Large cities in the Czech Republic, which have separate departments of the city architect, or various institutions are trying to create various methodologies/manuals. The vast majority of them, however, are only general, without specific numerical values. An exception is the approaches to the issues described in Prague and partly in Pilsen. The Prague Manual of the Creation of Public Spaces [13] is an example of a very complex and concrete approach, which can be taken as a starting point for the creation of similar locally valid documents. Public spaces in Pilsen [14] divided into five separate parts, in turn, show a relatively clear methodology for evaluating the quality of public spaces, which can also be used after small modifications.
However, as the whole of the Czech Republic consists mainly of smaller settlements, which do not have the financial resources to create separate approaches, it would be appropriate to supplement or modify the normative regulation. At the same time, it would be beneficial to modify the reference in the existing legislation and not only to recommend the standard but to make its part binding. This would unify the requirements for the minimum width of pedestrian roads. Another alternative is to create a technically oriented methodology that would classify public and street spaces and set out the minimum width requirements for sidewalks in an easier way than the intensity of the pedestrian current. However, the applicability of such a methodology to design and permitting practice remains a big question.

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