Case Studies on Transport Policy 12 (2023) 101003

Contents lists available at ScienceDirect

Case Studies on Transport Policy

journal homepage: www.elsevier.com/locate/cstp

Research on walking as a mode of transport: Recommendations of the International Walking Data Standard project versus Czech national transport research project Czechia in Motion

Zdeněk Dytrt

Department of Travel Behavior Analyses and Transport Modelling, Transport Research Centre CDV, Brno, Czech Republic

ARTICLE INFO

Keywords:
Walking research
Transport modes
Transport research
International Walking Data Standard

ABSTRACT

Research into the transportation behavior of the population often reveals deficiencies in the representation of walking as a self-contained mode of transportation in its methodology. This text provides proposals for possible improvements to this situation using the example of a nationwide transportation behavior survey conducted in the Czech Republic. The International Walking Data Standard project, which aims to create an internationally recognized standard for collecting and presenting data on walking, is introduced as a reference framework. The methodological recommendations of this standard are compared with the methodology and design of the nationwide transportation survey "Czechia in Motion", conducted in the Czech Republic between 2017 and 2019. Relevant research results are also presented for the individual topics. The comparison is intended to give an idea of the possibilities and pitfalls of attempting to obtain objective data on walking. The comparison result shows that the "Czechia in Motion" study meets most of the International Walking Data Standard project recommendations, with the largest deficit identified as the absence of a more detailed record of individual sub-stages of trips recorded by respondents. Should the national transportation behavior survey be repeated in the future, options for adjusting its design are discussed in order to better meet the requirements for an objective representation of walking as a mode of transportation.

1. Walking as a transport mode

Walking as a mode of transport in popular and professional texts is usually given only marginal attention. Nevertheless, pedestrian mobility is an important and widely used mode of transport. Pooley points out that until the mid 19th of the century, walking was the dominant mode of transport and in many poorer regions this situation persists - examples from the Global South are presented by Herrmann-Lunecke et al. (2020). In Global North countries, contrastingly, people without access to a car experience traffic-related social exclusion (Pooley, 2020). A typical feature of walking is easy combinability with other modes of transport. "As walking is an integral element of all trips, it can be seen as the 'glue' that binds the transport system together, although this might be better conceptualized as 'oil' that helps system to run more smoothly" (Goodman and Tolley, 2003). Its self-evidentness and omnipresence sometimes leads to it being overlooked and underestimated as a mode of transport. Litman (2017) states that the lower prestige of walking is also reflected in its omission in transport models, making walking invisible to transport planners. The perception of walking as a recreational or leisure activity and not as an equivalent mode of transport is also widespread (Tight, 2018).

1.1. Benefits and barriers related to walking

Walking has a number of advantages at both individual and societal levels. It is the easiest and most universal mode of transport. Besides suitable footwear, it does not require any special clothing or equipment. There is no need to have a means of transport (car, bicycle), no need to obtain a license or special skill[1], no fare. It can be carried out spontaneously and, if necessary, flexibly regulated in terms of length, speed of movement and, to a certain extent, route selection. Pedestrian routes are not conditioned by the need to park a car or store a bike safely after reaching the destination. The flexibility of walking in the urban area was also manifested during the Covid-19 pandemic, when the movement on

E-mail address: zdenek.dytrt@cdv.cz.

[1] In the preamble to the International Charter for Walking, John Butcher aptly sums up the firm integration of walking into each person's life story: "Walking is the first thing an infant wants to do and the last thing an old person wants to give up" (Walk21 Foundation, 2001).

https://doi.org/10.1016/j.cstp.2023.101003
Received 2 December 2022; Received in revised form 15 February 2023; Accepted 3 April 2023
Available online 5 April 2023

foot made it easier to maintain the necessary social distancing compared to public transport (Paydar and Kamani Fard, 2021). Using comparative data from cities around the world, Wu et al. (2021) show that urban density and mixed land use improve walking access to employment opportunities.

The health benefits of pedestrians are increasingly recalled (e.g. Pucher and Buehler, 2010; World Health Organization, 2011). Regular walking is often referred to as the most natural and healthy physical activity. It helps to increase endurance skills and compared to some other types of movement it only slightly strains the joints of the lower limbs. It contributes to the reduction of blood pressure and improves the functionality of the cardiovascular system. In regular implementation, it helps to prevent obesity and the associated risks, and thanks to optimal strain on bones, it is a good prevention of osteoporosis. "The advantage of this physical activity, unlike many others, is that walking can be carried out in ordinary shoes and clothes, and thus, for example, from a half-hour journey to work, it is not demanding organizationally, financially or from a time perspective, and at the same time a useful aerobic activity" (Sekot, 2015). Regular walking at an older age is particularly important, as it remains one of the few physical activities an elderly person can engage in (Turrel et al., 2014).

Compared to other modes, walking is very social, allowing a wide range of interactions and social activities[2]. It is not necessary to monitor the traffic situation constantly like when driving, and any possible phone call is not limited by the presence of passengers as in public transport. Several authors consider the intensification of pedestrian movement in the locality to be its revival, a means of crime prevention and generally an indicator of improving quality of life (Gehl, 1996). Higgs et al. (2019) show that locations rated as more liveable exhibit higher levels of walking and other sustainable transport modes.

According to Arroyo et al. (2020), the attitude towards walking is positively correlated with universalism values (understanding, appreciation, tolerance, protection) and negatively correlated with power-related values (social status and prestige, dominance). Positive attitudes towards walking, on the other hand, lead to greater use of active modes of transportation and a reduction in motorized modes (cars and public transportation).

From a societal point of view, walking and cycling are the most sustainable modes of transport. They do not produce any emissions and do not contribute to climate change, and building the necessary infrastructure does not usually require major construction modifications and occupation of space. Walking is also very socially inclusive. With a well-built barrier-free pedestrian infrastructure, including the necessary adjustments for the blind and partially visually impaired, a large proportion of older people or people with health limitations, for whom other forms of transport are difficult to access, can make at least short journeys. Investments in improving and making pedestrian routes more attractive are therefore of great social value and bring direct benefits to a wide range of people. Interventions in favor of walking should aim to change the existing power relations between different transport modes in a desirable way (Tight, 2018).

In cities, a larger proportion of pedestrians can contribute to the development of the local economy (Litman, 2003). Unlike users of other transport modes, pedestrians can more easily purchase and use certain services during their trip (e.g. restaurant gardens). The investment in increasing pedestrian routes and calming traffic can thus return thanks to the greater attractiveness of the location for walks and other forms of utilitarian and non-utilitarian pedestrian movement of potential customers. This is especially true in areas where a large proportion of pedestrians are expected – city centers, the vicinity of terminals and major public transport stops, attractive tourist locations, etc.

If we perceive walking as a means of individual transport, we can also easily point out a number of disadvantages and limitations associated with it. Pedestrian movements are more time-consuming compared to other modes of transport, and for trips exceeding the unit length of kilometers, walking is difficult. A number of factors influence the time it takes to walk. One of them is walking speed, which disadvantages less physically fit population groups (women, older people, children, people with reduced mobility, etc.). They take longer to walk the same distance than more physically fit people. Poor quality pedestrian infrastructure or unsuitable walking conditions (e.g. long waits at traffic lights) also increase the time-consuming nature of walking.

A longer walk puts strain on physical fitness, especially in hilly terrain, which is a limiting factor especially for the elderly and disadvantaged population. Pedestrian mobility is difficult to use for journeys requiring carrying of loads (e.g. when returning from shopping errands). Walking is highly dependent on the external environment – on the weather, but also on the existence, condition and safety of walking routes.

Walking especially in abandoned unlit places and at night can cause personal safety concerns. Research shows that the existence of attractive and safe facilities for pedestrian movement contributes to the increase in the share of pedestrian routes (Alfonzo, 2005; Gehl, 1996). Tight (2018) points out that transport research cannot determine the scope of suppressed demand for walking – i.e. pedestrian routes that are not implemented due to safety concerns or lack of infrastructure.

Walking risks are unevenly distributed across different social groups; for example, women are more concerned about pedestrian safety in some locations in the evening and night hours, elderly people and disabled people have more trouble overcoming physical barriers, and also face more serious consequences in the event of an accident (e.g., falling on a slippery sidewalk).

1.2. Walking in traffic behavior research

The above-mentioned subordinate walking position is also reflected in the research of transport behavior and may limit its informative value. Even trips made by other modes of transport (mainly by car or public transport) usually involve at least a small proportion of walking at the beginning or before the end of the journey.

As Rietveld (2000) points out, the usual procedure for interpreting data from transport behavior surveys is to focus on one main transport mode used during the trip, which leads to underestimation of other parts of the transport chain. Litman (2017) states that another source of distortion of the outputs from transport research is the limited degree of recognition of certain types of trips, caused by both the design of the research and the incomplete record of the trips made on the part of the respondents. In addition to trips made by non-motorized means of transport, this also applies to short trips in general, non-working and recreational trips and children's trips.

The analytical surveying of pedestrian paths for research purposes is also hampered by the fact that, unlike other transport modes, they are defined only by movement in space and cannot be defined by the use of a means of transport (cars, bicycles, public transport vehicles). This creates confusion about what can be regarded as a footpath (e.g. movement inside buildings or enclosed areas, shopping in shopping centers, very short movements, etc.) (Wigan, 1995).

1.3. International walking data standard project

The International Walking Data Standard (hereinafter IWDS) is an international project aiming at creating an internationally recognized standard for the collection and presentation of walking data in order to increase the importance of this sustainable transport mode in urban and transport planning (Sauter et al., 2016). Reliable and internationally comparable walking data is an important prerequisite for planning and

[2] "In walking-together, for example, such activities as conversing, being available for conversation, touching, laughing, offering of offerables such as cigarettes or sweets, parting, and so on, are made relevant, and expectable, by the sheer fact of walking together" (Ryave and Schenkeln, 1973).

investment decisions. "What is not measured is not seen as important, and what is not seen as important is not properly measured" (Sauter et al., 2016). Currently, this tool is used by London (Transport for London, 2016) and Hong Kong (Tight, 2018) to present walking data.

The ambition of IWDS is to reach experts and agencies involved in research of transportation behavior with information on how their methods and procedures may be better utilized to describe walking. The second target group is made up of urban and transportation planners who need high quality and understandable data for their work.

According to IWDS, three basic problem areas are characteristic of the current situation regarding examination of walking as a transport mode. The first of these is adequateness, i.e. incorrect or insufficient measurement of walking in transport research. This leads to its underestimation and makes the data on other transport modes also problematic. Another problem is comparability – data collection methods differ from one set of research to another, and therefore the data is hard to compare. The last challenge is manageability related to the costly and time-consuming collection of research data.

In order to achieve comparability of walking data in future transport research studies, IWDS defines three levels of recommendation for research preparation and implementation. The minimum level allows only a basic comparison of data with other research and has a limited explanatory value. Ideally, it should only be used in cases where it is not possible to proceed according to the standard level. The standard level enables both valid mapping of the scope and character of walking in mobility behavior, and an effective international comparison of research results. The laboratory level is an ideal variant providing a comprehensive insight into pedestrian mobility. IWDS defines it as an add-on that may potentially become part of the standard scenario in the future.

The research organization may choose, according to its capabilities, which of the levels it will follow in its work.

1.4. Czech nationwide transport research project Czechia in Motion

We apply the recommendations of the IWDS project in this text to the Czech national research on transport behavior in the Czech Republic – Czechia in Motion (Česko v pohybu, 2022). This was the first nationwide survey of transport behavior, carried out in the Czech Republic. The research was carried out by the Transport Research Centre, a public research institution based in Brno. The research analyzed the transport behavior of 9,419 households chosen by the probabilistic random selection method. In addition to basic transport-relevant data on households, their members and means of transport used by the household, travel journals were filled in by members of the household of ages 6 and older. They recorded data on all trips taken on a predetermined decisive day (starting point and destination, means of transport used, including walking, duration and estimated length of the trip and its main purpose). Information was collected on 51,434 trips made by 22,122 people[3]. A total of 18,203 trips were made exclusively on foot (35%).

The quality of data collection was continuously checked in cooperation with the supplier. Once the collection was completed, the data cleaning and preparation process was initiated, which consisted of several phases. The completeness of the supplied matrices, maintenance of the allowable range of variables, data integrity and compliance with logical links were checked. The temporal attributes of the paths, their temporal sequence and coherence were checked. Subsequently, the spatial attributes of the paths were added using the geocoding method and the distances between sources and destinations were calculated (Kouřil et al., 2022).

Czechia in Motion researchers are in the process of going through the range of topics examined and meet the requirements of the SHANTI project, which seeks to coordinate and harmonize surveys of transport behavior in individual European countries[4]. "Whatever methodology used and people surveyed, the information acquired has to be the same: personal and household information, vehicle information, daily mobility of an individual, long-distance mobility of an individual of household" (Armoogum et al., 2014).

The following table shows which transport modes were mainly used by the survey respondents. Walking (35%) came first, followed by driving (29%) and travelling by public transport (20%) (Table 1).

In the table below we can see how walking was represented in each trip – 35% of trips were walking only, in 12% walking was one of the modes used (Table 2).

2. Comparison of the research parameters of Czechia in Motion with the requirements of the International walking data standard

IWDS defines three areas for the preparation, implementation and presentation of transport research, for which it formulates its recommendations to help more accurately reflect the role of walking and to enable data harmonization on an international scale. These areas are sampling, data collection and reporting and general methodological issues. Each of these groups contains a number of specific issues or dilemmas that need to be decided, and the IWDS makes specific recommendations for each of them. In the following text, we will look at the optics of these recommendations on Czechia in Motion, we will monitor to what extent it is complementary to these instructions, and we will analyze possible differences. As mentioned above, IWDS presents its recommendations in three levels – minimal, standard and elaborate levels. Furthermore, in the article, we will compare specific research parameters of Czechia in Motion with the requirements of the standard level.

2.1. Sampling

In the case of sampling, IWDS deals with three basic questions: Whether to survey only residents living in the area, or also visitors, tourists and commuters. Whether to limit the age of the respondents to the younger ages and possibly to have an age limit. Whether to interview throughout the week and during all seasons?

Residents or also non-residents?

When it comes to interviewing locals or visitors, IWDS recommends interviewing locals, mainly for methodological reasons. Data collection for research on transport behavior is often carried out by surveying households, which would be complicated by surveying tourists and

Table 1
Distribution of trips by main transport mode (N = 51,434 trips).

Main mode used	In %
Walk	35%
Car-driver	29%
Public transport	20%
Car-passenger	10%
Bike	5%
Other	1%
Total	100%

[3] More information about the research in the Czech language, including basic results and anonymized data sets, is available online at https://www.ceskovpohybu.cz.

[4] The project aims to harmonize research not only among individual European countries, but also to make data comparable over time. It also promotes the use of new technologies and methods that allow for more efficient and frequent research, with the goal of obtaining more up-to-date data. IWDS uses the recommendations of the SHANTI project in formulating its standards.

Table 2
The role of walking during the journey (N = 51,434 trips).

The role of walking during the journey	In %
Walking trips only	35%
Walking as one of the modes used	12%
Absence of walking	53%

visitors. An ideal variant of the elaborate level is if visitors can be asked using other methods of data collection – a significant proportion of walking can be expected.

Czechia in Motion was a nationwide research project, so the target population consisted of all households in the Czech Republic.

Minimum and/or maximum age?

IWDS places particular emphasis on including the widest possible range of age categories, as walking is an important element of mobility for children and older people. Moreover, these groups have mobility patterns different from the rest of the population. Therefore, the basic recommendation is to collect data from respondents ages 5 or 6 years old and not to set any upper age limit. Armoogum et al. (2014) also recommend including children ages 8 and older in the research on transport behavior of households, as this group already has its own mobility behavior.

Czechia in Motion collected travel data from respondents ages 6 and older, without a maximum age limit. Each of the respondents was asked at the time of data collection to provide their year of birth, so the data could be presented in any sorting by age.

All days of the week and seasons?

In terms of the time distribution of data collection, IWDS places relatively high demands on researchers (or the resources at their disposal). It recommends collecting travel data from all seasons and throughout the week, including non-working days. This requirement may pose a particular problem for urban and smaller-scale research, for which there is a limited budget and less time. (For these reasons, the IWDS allows for the establishment of an 'average season' specific to a given geographical area for smaller surveys). The collection of data at different times of the year and on all days of the week is also recommended by Armoogum et al. (2014), on the grounds that mobility patterns may vary during the year, both due to climatic differences and when taking into account periods showing exceptional travel patterns. Even stronger emphasis is placed on collection throughout the week: "We strongly endorse covering all days of the week in travel surveys; otherwise comparability will be inhibited" (Armoogum et al., 2014).

Czechia in Motion researchers collected data on mobility in 2017–2019 during what can be referred to as regular transport days, which were defined as follows: "If on a working day, Tuesday to Thursday, except on days preceding or following the day off" (CVP, 2022). Trips on non-working days have therefore not been analyzed. The original intention was to conduct the surveying only in the months when standard mobility behavior of the population can be expected without seasonal fluctuations. Due to problems with extensive data collection, continuous collection was carried out, except during December and January. The concept of regular transport days was followed at all times.

We consider the recommended collection plan throughout the week, including non-working days, to be adequate for objectively mapping the share of walking. Local researches conducted in various Czech cities show that the share of walking is greater on non-working days, with different lengths, purposes and other characteristics of trips. People generally make fewer trips on weekends, with a much higher proportion of trips taken for leisure activities, while the proportion of trips for work, school, and shopping is lower.

However, this change in the research design should not take place in the form of a transition from a one-day survey to a multi-day survey (the respondent would record trips both during a working day and during a non-working day). IWDS does not recommend the use of multi-day surveys in view of the increased burden on respondents, which may lead to selectivity and inaccuracies in the trip log. These inaccuracies may mainly affect the record of pedestrian stages perceived as less relevant. Armoogum et al. (2014) point out that multi-day surveys can lead to the loss of both very mobile respondents, for whom the recording of tripss becomes a big burden, and not very mobile respondents, who perceive themselves as irrelevant to a given type of research. A random assignment of reference working and non-working days to individual respondents appears to be a suitable solution.

2.2. Data collection and reporting

With regard to data collection and presentation, IWDS deals with six areas of questions, which we will address again gradually.

Boundary: All trips made or only those within the city?

Czechia in Motion respondents recorded all their trips, regardless of whether they took place within the municipality where they live, elsewhere in the Czech Republic or abroad.

Units of travel: Stages, trips and/or main mode?

This point can be considered to be one of the most important from the point of view of pedestrian mobility analysis. The reason is mainly the category of the main mode of transport – that is, the mode that represents the entire multimodal journey route, consisting of multiple stages carried out by different means of transport. IWDS presents two basic ways to determine the main mode of multimodal journal routes. The standard procedure is to designate as the main mode the mode of transport that the respondent used to complete the longest part of the journey. The second variant is the application of a predetermined hierarchy of transport modes, in which walking is usually only in one of the last places. In the same way, the construction of the main mode is approached by the international project SHANTI, which seeks to harmonize transport surveys (Armoogum et al., 2014). However, as pointed out by the Eurostat methodology, the modal hierarchies used in each country differ from one country to another and thus complicate the international comparability of results (Eurostat, 2018).

The category of the main mode of transport is problematic with regard to walking. If the trip, was carried out by another means in addition to walking, it will almost always be assigned to this other means, and the walking part of the journey will not be visible. IWDS shows examples of several trips to work, how negligent walking occurs when reporting based on the main mode or length of individual stages. Tight (2018) reports that, according to British data, 22% of stages in urban areas were on foot. IWDS therefore recommends using, in addition to the main mode, alternative indicators based on the time spent using individual modes and the number of stages carried out using individual modes.

It should be stressed that this is not just a methodological question. It can logically be assumed that the vast majority of trips by car or public transport include at least one stage on foot, which can be quite long. Whichever of the above two methods is used to determine the main mode, in most cases these pedestrian sections will not be captured by research, even though they use pedestrian infrastructure. This creates a distorted representation of the demand for this type of transport and provides inaccurate information to urban and transport planners.

Since the Czechia in Motion researchers did not collect data on the length and duration of individual stages, but only on all modes used during the trip, it was necessary to use predefined hierarchies of individual modes to determine the main mode. This hierarchy was based on the recommendations of the Austrian KOMOD methodology: miscellaneous means of transport –> train –> bus - > car – passenger - > car – driver –> bicycle –> walking (Fellendorf et al., 2011). The above reservations with regard to this indicator therefore apply to the presentation of data on the main mode of transport.

Data from Czechia in Motion can also demonstrate less emphasis on recording walking as part of multimodal journeys. Although respondents were explicitly warned in the instructions for the travel diary that they should also mention pedestrian journeys, the records of 97% of car journeys and 51% of public transport journeys do not mention the

use of walking[5]. For similar cases, the IWDS proposes the use of a conversion factor to provide a more accurate picture of the proportion of walking: "For each public transport main mode, add 2 walking stages; for each motorized trip, add one walking stage" (Sauter et al., 2016).

Duration and length: Trip distance and/or time?

IWDS considers it essential to measure not only the length of the trip, but above all the time spent traveling. A specific characteristic of walking is the great amount of time required for a relatively short trip. If only distance is recorded, the role of walking in the overall mobility behavior is significantly underestimated. It is therefore recommended to measure the length and duration not only for the entire trip, but also for individual stages. Since the average is as an arithmetic variable influenced by very long journeys of a small number of respondents, IWDS considers it appropriate to use the median and percentiles, which are not influenced by a small number of very long journeys, instead of the usual average, when presenting the length and duration of trips.

Czechia in Motion recorded both the duration of the entire trip and its length (declared by the respondent and subsequently verified by geocoding). However, it was only about data for the entire route, not individual stages, which in the case of multimodal routes does not allow for a detailed analysis of pedestrian stages. For national research recording all respondents' journeys, including very long journeys, it is essential to use the median and percentiles for the presentation of data on the length and duration of trips – which was observed when publishing research data. The median length of exclusively pedestrian routes was 0.8 km, the median length of trips in the whole set was 4.3 km. The median duration of only walking trips was 13.2 min, in total it was 12.6 min. Walking trips are therefore the shortest of all modes in terms of distance, but in terms of duration they approach the median of the whole set (CVP, 2022). Here we encounter one of the basic pitfalls of walking as a mode of transport, and this is that it is considerably time-consuming compared to other modes of transport.

Threshold: Minimum and/or maximum length of stage or trip

IWDS states that it is common practice for transport research to refer to only movement in public spaces as a stage. However, it may be difficult for the respondent to tell whether or not he is moving within a public space. IWDS therefore recommends recording those journeys and their stages that are undertaken within public accessible spaces. Therefore, they include locations such as parking lots at shopping centers, railway stations or places that are only open to the public at certain times of the day. However, they do not include walking inside shops or university buildings. The main criterion for differentiation remains using common sense.

In terms of travel length, it is preferable not to set any lower threshold for it, although in some traffic research this limit has been set. Armoogum et al. (2014) present an overview of the transport research carried out from different countries, where the lower limit of the length of the stage was somehow limited (e.g. 100 m, 50 yards, a 5-minute walk). The exclusion of short pedestrian stages combined with other modes of transport is also recommended by the Eurostat methodology: "It is recommended to formalize the exclusion as "less than 50 m" or similar" (Eurostat, 2018). As Armoogum et al. (2014) recalls, these restrictions do not significantly affect the length of trips made, but will significantly affect the distribution of used modes to the detriment of walking.

Czechia in Motion researchers did not set any limits for the trip, either in terms of length or duration, or on the basis of the type of environment where the trip or parts thereof took place (the degree of public accessibility of the space). The geographical location of the starting and end points (within the Czech Republic or abroad) was also not the limit. The definition of a trip in the travel diary for respondents was: "We mean moving for a purpose defined below", followed by a list of nine categories of travel purposes, including the "miscellaneous" option, where respondents could provide their spontaneous answers. We believe that such a broad definition is more comprehensible for respondents, and the greatest possible simplicity and clarity of instructions helps a successful record of the trip. In addition, public accessibility of the space may in some cases be questionable, limited in time, hierarchically graded, etc.[6]. However, we consider it appropriate to add a minimum negative delimitation to the trip route definition; the trip should not take place inside buildings or in closed areas.

Research data from Czechia in Motion confirms the crucial role of walking in short-distance trips. Trips of up to one kilometer were made exclusively on foot, with increasing distance of the share of only walking routes decreasing. Trips of 1–2 km were carried out exclusively on foot in more than half of the cases (53%), for the length of 2–3 km there were approximately a quarter (27%) and in the range of 3–4 km less than a fifth (17%) (CVP, 2022).

Trip purposes: All purposes or commuting only?

In the record of the purposes of trips, the Czechia in Motion research meets the requirements of IWDS almost completely. In accordance with the recommendations of the document, all trips made on the decisive day were recorded, including those that had a purpose in themselves (e.g. walking dog, strolling). Only one main purpose was recorded for each trip[7], so for multi-purpose trips, it was decided which of them was perceived as the main purpose by the respondent. Return trips have their own category of purpose and are thus distinguishable from other trips.

A certain shortcoming was the absence of a purpose of "escort" among the categories offered, which represented a certain loss of information. Another category worth considering is that of "care for another person", which probably represents a significant portion of daily trips, especially for women.

The most common purpose of trips surveyed in Czechia in Motion was returning home (41%), followed by trips to work (18%). Returns to residence also dominate for pedestrian-only journeys (39%), but leisure activities follow (18%) (CVP, 2022).

Participation: Whole population and/or mobile persons?

Even in the area of defining the studied population, the Czech Republic proceeded in accordance with the IWDS recommendations. The project prefers to present mobility data both for the entire population and for those who made at least one trip during the day. In the Czechia in Motion research, all available members of households chosen by the multi-stage random selection method were surveyed, regardless of whether they traveled on the decisive day or not. Research can therefore present basic mobility indicators both for the entire population and only for those who have traveled. In addition, if the respondent did not make any trip, he/she was asked to state spontaneously the reason why he/she stayed at home.

In the section devoted to the general methodological characteristics of research on transport behavior, IWDS still deals with several other topics, which, however, are not directly related to walking and therefore go beyond the focus of this text.

3. Conclusion

Although the nationwide transport research study Czechia in Motion

[5] The journeys, which did not involve walking, were carried out mainly with the use of a car (71%). A total of 8% of journeys without using walking were cycling journeys. For a large share of these journeys, it can be assumed that walking at least over a short distance was part of them, but the respondents did not consider it significant in the context of the whole journey and did not notice it (CVP, 2022).

[6] These include, for example, residential, university or administrative premises, technical facilities of buildings, etc.

[7] Respondents were offered the following list of possible travel purposes: to work, as part of work, education, leisure time activity, shopping and errands, catering, private furnishing, return home, miscellaneous (they were given the opportunity to list their own purposes).

in some areas does not meet the standard recommended by the IWDS document, in most key points it meets it. However, a comparison of the research with the IWDS requirements also shows several modifications that, if repeated, would contribute to a clearer and more objective picture of the role of walking in the mobility mix of the Czech population.

The first and easiest change would be a greater focus of research on the equivalence of walking with other modes of transport, including motorized modes. This should practically be reflected in the emphasis on the recording of pedestrian routes and, in particular, the pedestrian parts of multimodal routes at all stages of the preparation and implementation of research, especially when communicating research towards respondents. It can be assumed that these efforts could lead to a reduction in the proportion of recorded trips where the logically foreseeable walking component of the multimodal route has not been reported. We can also assume that due to the lower walking status compared to other modes, a number of pedestrian trips were perceived as insignificant and were not documented at all (but we can only speculate about the share of these unrecorded trips).

Apparently, the most significant potential change is the introduction of the recording of individual stages in travel logs (or other similar types of research tools used to record specific trips). Although this change would substantially increase the burden on respondents and probably also reduce the findings from research, it would allow for significant shifts in favor of a more objective understanding of the real role of walking. It would be possible to describe more precisely all the pedestrian parts of multimodal journeys, including their length and duration. Of course, this also applies to all other modes – recording individual stages would help to refine their shares in the total transport research work. It would also be possible to determine the main mode of multimodal journeys more adequately – not on the basis of an arbitrary hierarchy, but using empirically measured values.

Another possible modification in the next wave of research would be changes in the time distribution of data collection, in particular the extension of the existing mobility record in one regular transport day (a working day not coinciding with weekends or holidays) by non-working days, because pedestrian mobility patterns vary significantly between working and non-working days. However, this change should take place while maintaining the one-day research plan, so as not to further increase the burden on respondents, which could result in inaccurate travel records, particularly affecting pedestrian mobility.

In preparation for a new wave of research, the use of modern data collection technologies (devices with GPS tracking capability, and mobile phones with sensors and applications that allow for a wider range of data recording) should be considered. However, Wang et al. (2018) note that the implementation of these technologies presents significant demands on researchers. They must be able to comprehensively analyze variously structured data, have expertise in transportation to properly formulate questions and interpret results, and be proficient in the necessary hardware and software tools. Aschwanden et al. (2021) examine the possibilities of using neural networks to identify types of urban environments more commonly used for walking using data from a transportation behavior survey combined with satellite images from Google Maps.

Funding

This article was produced with the financial support of the Ministry of Transport within the programme of long-term conceptual development of research institutions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Alfonzo, M.A., 2005. To walk or not to walk? The hierarchy of walking needs. Environ. Behav. 37, 808–836. https://doi.org/10.1177/0013916504274016.

Armoogum, J., Bonsall, P., Browne, M., Christensen, L., Cools, M., Cornélis, E., Hegner, K., 2014. Survey harmonisation with new technologies improvement (SHANTI). Retrieved from Les collections de L'INRETS. https://www.semanticscholar.org/paper/Survey-Harmonisation-with-New-Technologies-(SHANTI)-Armoogum-Bonsall/329bd735e4265b0cd3d9db22fb42671f94cae880.

Arroyo, R., Ruiz, T., Mars, T., Rasouli, S., Timmermans, H., 2020. Influence of values, attitudes towards transport modes and companions on travel behaviour. Transport. Res. F: Traffic Psychol. Behav. 71, 8–22. https://doi.org/10.1016/j.trf.2020.04.002.

Aschwanden, G.D., Wijnands, J.S., Thompson, J., Nice, K.A., Zhao, H., Stevenson, M., 2021. Learning to walk: Modeling transportation mode choice distribution through neural networks. Urban Anal. City Sci. 48 (1), 186–199. https://doi.org/10.1177/2399808319862571.

Česko v pohybu (CVP) – zpráva z průzkumu [Czechia in Motion - survey report]. (2022). Retrieved from https://www.ceskovpohybu.cz/zprava/.

Eurostat, 2018. EU transport statistics. Retrieved from, Eurostat guidelines on passenger mobility statistics https://ec.europa.eu/eurostat/documents/29567/3217334/Guidelines_on_Passenger_Mobility_Statistics+%282018_edition%29.pdf/f15955e3-d7b4-353b-7530-34c6c94d2ec1?t=1611654879518.

Fellendorf M., Herry M., Karmasin H., Klementschitz R., Kohla B., Meschik M., et al., 2011. KOMOD - Konzeptstudie Mobilitätsdaten Österreichs: Handbuch für Mobilitätserhebungen. [Concept Study Mobility Data of Austria: Handbook for Mobility Surveys.] Bundesministeriums für Verkehr, Innovation und Technologie. Retrieved from https://www.bmk.gv.at/dam/jcr:e6e7f62e-7f19-4383-9e50-786003c56f86/KOMOD_Handbuch_V1_Stand_2011.pdf.

Gehl, J., 1996. Život mezi budovami. [Life between buildings]. Nadace Partnerství, Brno.

Goodman, R., Tolley, R., 2003. The decline of everyday walking in the UK: explanations and policy implications. In: Tooley, R. (Ed.), Sustainable transport: Planning for walking and cycling in urban environments. Woodhead, Sawston, pp. 70–96.

Herrmann-Lunecke, M.G., Mora, R., Sagaris, L., 2020. Persistence of walking in Chile: lessons for urban sustainability. Transp. Rev. 40 (2), 135–159. https://doi.org/10.1080/01441647.2020.1712494.

Higgs, C., Badland, H., Simons, K., Knibbs, L. D., Giles-Corti, B., 2019. The Urban Liveability Index: developing a policy-relevant urban liveability composite measure and evaluating associations with transport mode choice. Int. J. Health Geogr., 18, 14. Retrieved from: 10.1186/s12942-019-0178-8.

Kouřil, P., Šimeček, M., Dytrt, Z., 2022. Česko v pohybu. Metodika a základní výsledky celostátního průzkumu dopravního chování. [Czechia in Motion. Methodology and basic results of the national traffic behaviour survey.] Brno: Centrum dopravního výzkumu, v. v. i.

Litman, T.A., 2003. Economic value of walkability. Transp. Res. Rec. 1828 (1), 3–11.

Litman, T., 2017. Short and sweet. Analysis of shorter trips using national personal travel survey data. Victoria Transport Policy Institute. Retrieved from https://www.vtpi.org/short_sweet.pdf.

Paydar, M., Kamani Fard, A., 2021. The hierarchy of walking needs and the COVID-19 pandemic. Int. J. Environ. Res. Public Health 18 (14), 7461. Retrieved from 10.3390/ijerph18147461.

Pooley, C., 2020. Pedestrian stories: Recovering sustainable urban mobility. In: Emanuel, M., Schipper, F., Oldenziel, R. (Eds.), A U-turn to the future. Berghahn Books, Brooklyn, NY, pp. 123–143.

Pucher, J., Buehler, R., 2010. Walking and cycling for healthy cities. Built Environ. 36, 391–414. https://doi.org/10.2148/benv.36.4.391.

Rietveld, P., 2000. Non-motorized modes in transport systems: a multimodal chain perspective for The Netherlands. Transp. Res. D 5, 31–36. https://doi.org/10.1016/S1361-9209(99)00022-X.

Ryave, A. L., Schenkeln, J. N., 1973. Notes on the art of walking. In R. Turner (Ed.), Ethnomethodology (pp. 265-247). Harmondsworth: Penguin.

Sauter, D., Pharoah, T., Tight, M., Martinson, R., Wedderburn, M., 2016. International walking data standard. Treatment of walking in travel surveys. Retrieved from https://files.designer.hoststar.ch/hoststar10546/file/1-international_walking_data_standard_version_aug_2016.pdf.

Sekot, A., 2015. Pohybové aktivity pohledem sociologie. Movement activities from a sociological perspective. Masarykova univerzita, Brno.

Tight, M., 2018. Walking in the UK transport system: how and why is it changing? Government Office for Science. Retrieved from. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766764/WalkingUKtransportsystem.pdf.

Transport for London, 2016. Travel in London, report 9. Retrieved from. https://content.tfl.gov.uk/travel-in-london-report-9.pdf.

Turrel, G., Hewitt, B., Haynes, M., Nathan, A., Giles-Corti, B., 2014. Change in walking for transport: A longitudinal study of the influence of neighbourhood disadvantage and individual-level socioeconomic position in mid-aged adults. Int. J. Behav. Nutr. Phys. Activity 11, 151. https://doi.org/10.1186/s12966-014-0151-7.

Walk21 Foundation, 2001. The International Charter for Walking. Retrieved from. https://walk21.com/wp-content/uploads/2020/02/walking-charter-document-2020.pdf.

Wang, Z., He, S. Y., Leung, Y., 2018. Applying mobile phone data to travel behaviour research: A literature review. Travel Behav. Soc. 11 (April 2018), 141–155. 10.1016/j.tbs.2017.02.005.

Wigan, Marcus (1995): Walking treated as a transport mode. Paper 950862, Transportation Research Board Annual Meeting. Retrieved from https://www.

researchgate.net/publication/248157347_Treatment_of_walking_as_a_mode_of_transportation.

World Health Organization, 2011. Health in the green economy. Retrieved from, Health co-benefits of climate change mitigation https://www.researchgate.net/publication/310605245_Health_in_the_Green_Economy_-_Health_co-benefits_of_climate_change_mitigation_Transport_Sector.

Wu, H., Avner, P., Boisjoly, G., Braga, C. K. V., El-Geneidy, A., Huang, J. et al., 2021. Urban access across the globe: an international comparison of different transport modes. npj Urban Sustain. 16. Retrieved from: 10.1038/s42949-021-00020-2.