

Urban Planning solutions to improve pedestrian's safety in urban areas

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Abstract

Right from the beginning of car transport development pedestrians have been paid little attention; with the growing number of vehicles and roads for these vehicles their position is becoming even worse. Unequal position of pedestrians is also emphasized by their significantly greater vulnerability in the road traffic as compared to other road users. These circumstances have been highlighted more frequently only in recent years, when suitable solutions have been searched on the worldwide scale particularly with regard to making especially the roads in towns safer and friendlier to pedestrians. The objective of COST 358 Action is to map bases for searching optimum outputs within the limits of the Czech urban space. We also consider our obligation to mitigate a special legal regime of walking.

1. Pedestrians' case and Urban Planning

Land Use and urban planning have a key influence on the mobility need. This impact has a long-term and lasting character. It is significant in the area of economic growth, transportation of people and goods; it also has an influence on the environment and is economically demanding.

Urban planning has strong influence on travel choices, because it creates and organizes city functional spatial structure. Urban planning priorities can be, if they are realized, the main component of spatial structure. So the question is for the sake of what urban planning should work. Car transport has big requirements on place and brings deterioration of environment along main lines. Besides, distances in city are not so long and time disparities between various types of transport are not so important that there couldn't be used another types of transport, which will be more sustainable, mainly we suggest walking.

Sustainable Urban Planning is a new framework for interdisciplinary expertise in the environmental design and engineering professions as well as the earth and social sciences about the processes that shape contemporary urban environments. It explores sustainability and cities in a rapidly urbanizing world by focusing on the form of the built environment – the infrastructure, transport, land developments, built landscapes, and facilities that collectively make up metropolitan regions.

Passenger cars congest contemporary cities, although there exist developed and well-designed public transport and cycling and walking networks. Frequent car using isn't a question of necessity; it is a result of many factors as lifestyle, comfort, time management, privacy or personal safety.

2. Benefits of walking

Walking can be beneficial for all sectors of society, trade and business, environment and health and safety of residents. Walking is a universal way of transport and for many people it is the only transportation possibility.

Walking is beneficial for health of walkers, it decreases the risk of cardiac diseases and heart attack, and at the same time it develops the quality of environment. Reduction of the number of streets with the prevalence of road traffic improved the level of noisiness and air pollution, and on the top of that it contributed to the improvement of social life. Human and economic losses incurred during traffic accidents and their prevention can be reduced, if more people use walking instead of driving motor vehicles. Walking makes people get closer quietly, quickly and cleanly.

Municipalities with good environment for pedestrians support gatherings and social life; they flourish with life and are often visited. On the contrary, shopping avenues choked up with motor traffic discourage people from visiting. The improvement of conditions for pedestrians' supports local economy brings more activities to municipal centres and enhances access to local stores, libraries and other facilities. Safer streets allow parents or guardians to give children more freedom, and thus also room for social communication and development.

Walking cannot be considered to be only a special type of transportation and should not be perceived separately. Development of better environment for pedestrians can make more people start walking, and through higher level of awareness it can retrospectively support the development of such environment not only for pedestrians, but for the others as well. Walking can improve the quality of life for everybody. It can improve social relationships, local economy as well as prosperity. Compared to the costs expended on construction of new roads or railways walking is not so much demanding.

What is common for all forms of transportation on foot is a set of physically and physiologically determined requirements regarding external environment.

3. Walking obstructions

Obstructions preventing walking can be divided into three general areas:

- Social environment
- Physical environment
- Travelling distance and needed time

These factors influence the stance and decision regarding choice of transportation means for planned journey.

Social environment comprises a range of walking obstacles that can have personal character, such as for instance age, sex, physical shape or financial possibilities. Walking can be perceived as a dangerous activity: speed of vehicles, danger from other people, dangerous bikers and problems regarding vulnerable groups. Walking is regarded to be somewhat commonplace activity: it is one of the first activities that we learn and one of the last that we need to give up as older people, however between these extremes it is generally ignored as a function. Walking is a slow process, and time or lack of time is a huge drive, which governs our lives and is a reason why we accomplish as shortest and fastest journeys as possible. "The automotive culture" and its emotional marketing support this image and along with a basic investment made into the purchase of a car it supports a negative perception of walking. Walking is considered to be of a secondary importance compared to a car, and when designing various equipments it is always the car which is prioritized. Pedestrians are

perceived as shabby people with heavy boots compared to people in branded suits with polished shoes.

Bad conditions of many pavements, which are quite often very narrow as well, link social attitudes and physical environment. The main concerns are as follows:

- Lack of safe and convenient places for crossing
- Narrow pavements and fast-moving vehicles increasing noise, pollution and danger
- Obstacles caused not only by street facilities but also by parking vehicles
- Damaged surface of pavements caused by the traffic and bad maintenance
- Bad street lighting
- Badly designed pavements that are inconvenient, narrow or are poorly designed, which leads to the nervousness of the participants; vehicles parking on the road in such a way that road cannot be crossed
- Insufficient cleaning, graffiti removing and stop vandalism
- Terrestrial plans preventing direct access among residential, work and leisure areas
- Weather (too hot, cold or wet)
- Lack of time or facilities for garment changing, safekeeping and cleaning after the end of the journey
- Criminality and hooliganism causing a close down of the pavements between public social facilities and residential areas etc. and the networks of public roads on plot of lands of other people
- Bad signs and maintenance outside public roads.

The distance and time spent on walking noticeably influences a combination of the impact of social and physical obstacles. The individuals will make decisions regarding when and where to go in accordance with the fact if their journey is leisure or not.

3.1 Walking and external environment requirements

The target is to provide the citizens with quality environment without any jeopardy caused by traffic noise and air pollution, and to secure the most important requirements: safety (i.e. protection against traffic accidents and risks and safety as a protection against sudden events), access (i.e. full accessibility of places), services, facilities and public transport stops. Convenience as the basis of physical and mental status, and as a prerequisite for movement and rest. If we focus on the development of these requirements as the citizens formulate them, the analysis state that the mobility is connected with life style.

This is linked to the necessity to concentrate on achievement of individual goals in the town, i.e. to map attractive locations and destinations of the most frequent arterial roads. Besides this it is necessary to identify dangerous places from the perspective of movement and traffic, and along with other aspects, such as unevenness of pedestrian paths, unsuitable lighting, these all have a negative impact on safety and do not generate any positive results regarding attainability, safety and convenience. It is necessary to focus the attention on regeneration of public urban premises so that the continuous pedestrian network along which we can move around the town can be developed. In addition to the general function, which is accessibility of the premises, safety and other values such as better special convenience, good identity with the place and feeling of common ownership are necessary. Such pedestrian routes promote only walking but encounters of people and rest in public places as well. The pilot projects were testing various solutions and technical procedures.

When attaining the quality of urban premises the basis is to achieve an optimum level for all users because everybody cannot achieve maximum satisfaction.

We can feel the increasing interest to regenerate the towns so that the conditions and quality of life of city dwellers and pedestrians can be improved through identification of the best-implemented solutions and development of new facilities and solutions. We expect the increase in the level of traffic and safety of pedestrians in the towns, which presupposes, apart from others, the following:

- Promotion of various methods of non-motor transportation and utilization of public traffic instead of private cars,
- Minimization of negative impacts of traffic on environment,
- Improvement of pass ability and accessibility of public premises,
- Improvement of citizens' health thanks to reduced emissions,
- Better evenness of streets, which also applies for motor traffic,
- Reduction of costs in the transport infrastructure in terms of construction of new roads and repairs, cost reduction aimed at elimination of air pollution as well as costs incurred due to traffic accidents and health care.

3.1.1 Urban space

Walking requires space. The man must have an option to walk at corresponding speed, without any botheration, without being squeezed and without the need to manoeuvre too much. The problem is to define human level of tolerance regarding obstacles appearing during walking, the space must be narrow enough and rich in experience, however still wide enough to have sufficient space for manoeuvre. The tolerance and requirements regarding space differ a lot when it comes to different persons, dependence on group of people or situation.

In situation when the level of space crowded with people can be determined, the indication is that the upper limit to accept admissible density of people in the streets and on the pavements with two-directional pedestrian traffic is approximately 10-15 pedestrians per minute per one meter of street width. It corresponds to the flow of about one hundred people per minute per 10 meters of the street width. If the intensity continues to grow we can see a clear tendency of streams. Due to this fact the pedestrians must keep right to pass the street and the freedom of movement more or less disappears. Then people do not meet each other in the streets, but they are going in the crowd, one after another. The squeeze is too high.

If the stream of pedestrians is too limited, the streets can be adequately narrow. The lanes in old towns as well as inside passages in the houses are rarely wider than one meter and rural footpaths are seldom wider than 30 cm.

Special requirements for space are attributed to traffic "with wheels": prams, wheel chairs, shopping trolleys etc. To respect this kind of traffic there must be a general request concerning determination of larger dimensions than stipulated. The idea what space can be required if there are prams moving around was identified when the main street in Copenhagen was converted from standard street comprising automotive traffic and narrow pavements to the street with pedestrian zone that was four times wider. Whilst the number of pedestrians increases during the first year approximately by 35%, the number of prams increased by 400%.

3.1.2 Surface for pedestrians, streets, squares

Foot traffic is very sensitive regarding paving and street surface. Stone block paving, sand, bulk gravel and uneven surface are inconvenient in particular for those who walk with

difficulties. The inconvenient type of street surface negatively influences overall foot traffic. People tend to avoid wet and slippery paving, water, snow and mud wherever possible. Those who have difficulties with walking are bothered by such conditions even more.

3.1.3 The distance walked

Walking is physically demanding and there exists strict limits determining how far most people can go. In the course of many observations the monitored acceptable walking distance for most people under the usual daily situations was from 400 to 500 metres. In case of children, old people and handicapped this distance is often even shorter. To determine an acceptable distance under the given situation it is not only physical distance but experience distance what is important as well.

A 500 metres long section seen as a direct, unprotected and monotonous journey is perceived as a very short distance from the perspective of experience, if the journey is perceived in phases. For instance the streets can turn a bit so the space is bordered and the distance that must be passed through cannot be immediately seen, and this all under the assumption that there are good external conditions for walking. The acceptable walking distances are also a sum of street length and path quality with regards to protection and also the level of stimulation.

3.1.4 Directional deviations

As it is tiring to walk the pedestrians naturally choose their routes very conscientiously. The pedestrians reluctantly accept considerable deviations from the determined main direction, and if the destination is within view they tend to head directly to it.

Everywhere people go they prefer direct routes and shortcuts. This behavioural model can be disrupted only by very significant obstacles, such as dangerous traffic, huge barriers etc. How desirable a human tendency to use the shortest possible way is can be illustrated in many observations. In the course of the research of Copenhagen square the subject of observation were pedestrians crossing the square diagonally, even if it meant that they had to come across the depressed area in the middle of the square and use two short staircases. At Campo in Sienna a similar behavioural model was observed, even if the pedestrians had to go 3 metres down the paved slope first of all and then again 3 metres up.

In busy streets there is a tendency to use the shortest instead of safest way. Only in places where the motor traffic is too heavy, where the street is too wide or where the zebra crossing is appropriately located, these crossings are really used. Combination of heavy motor traffic, obstacles and inconvenient road crossings results in many irritating bypasses and senseless restrictions of foot traffic. In spite of the fact that walking is tiring, when a person sees the total distance, that he is to go through to the place of destination, it is even more tiring and unacceptable when he must use other than direct route leading to the destination which is within view.

Translated to practical designing it puts emphasis on the importance of thorough design of pedestrian paths in places where you cannot see the remote destination, however where it is possible to use primary direction and with a great respect to put an emphasis on designing direct paths for short distances.

One of the most important requirements regarding properly functioning pedestrian system is to organize movement of pedestrians in such a way to monitor the shortest distances between natural destinations within the premises. Once the problems with the skeleton of traffic system are resolved, it is important to design individual connection points within the traffic network and thus have the entire system more attractive.

As already mentioned, designing long direct routes for pedestrians should rather not be applied. Winded and interrupted streets make pedestrians movement more interesting. Pedestrian network with streets and small squares often has a psychological effect, as the

distance seems to be shorter. The journey is naturally divided into manageable phases. People will rather concentrate on movement itself from one square to another than on the fact how long their journey is.

In places, where foot paths lead between the buildings, the street sections should be dimensioned in proportion to the number of perspective users, so that the pedestrians can move within intimate, clearly defined premises and are not "drifted" inside huge half-empty area. In places, where certain sections of the path are narrow, it is easier to create valuable spatial contacts. If the streets are 3 metres wide, then a 20 metres wide area will seem to be a square in the contrast to these streets. The quality of experience caused by a huge area is enriched substantially when we are getting closer to it, when there are sequences and contrasts between small and huge. However if the planning as a whole is to maintain its human standard, then small areas must be really small, otherwise there is a danger that the large areas become too huge.

Similarly in places where large areas must be crossed over, usually it is more convenient to move along the peripheries, not to pass over large areas and not to enter the centre of the area. Movement around the area peripheries brings both, experience from huge area and small details of street frontages of the peripheries of area which you are passing by. On one hand a person has an experience from the open field and on the other hand from a building. Walking around the area peripheries brings two different experiences instead of one, and in dark or during bad weather you can move along protecting frontages, which is another advantage, in principle.

The principle of situating pedestrian paths on the peripheries of large areas can be found, in a special sophisticated form, at many squares of South European cities where foot traffic is leading through the archways along the periphery of the square. Here people walk in a pleasantly intimate space, in which they are protected against wind and foul weather, and between pillars they can feast their eyes on a huge space. The other extreme is represented by many paths leading through so called green lanes within the premises that were located in the middle of the space in such a way that on their both sides there are prescribed small lanes of "landscape".

3.2 Altitudinal deviations

Likewise roundabouts a real problem for pedestrians is represented by the differences in altitude. Any substantial movement up or down requires more effort, more muscular activities and interruption of walking rhythm. The result is that people tend to avoid the problems caused by the changed level of surface and pass the place around.¹

Difficulties with operation of multi-story urban centres and department stores also indicate the unwillingness of pedestrians to divert from simple horizontal paths, if they are not offered non-complicated escalators. And even escalators can be complicated. The ground floors of the department stores always experience more customers than any other floors.

The differences between various levels mean a real complication. Outside there are very good reasons why to avoid different levels at all or at least to design connective lines so that they are easy and psychologically practical and utilizable.

When designing easily manageable vertical connections we use the same general rules as

¹ Ola Fagelmark from Technical University in Lund, Sweden analysed foot traffic from bus stop on one side of heavily frequented road to the shopping centre on the other side of the road. Out of three options - 50 metres of not direct walk to the pedestrian crossing, directly across the road and pedestrian subway with two staircases - 83% of pedestrians have chosen the first option, 10% went directly across the road and only 7% have chosen subway and staircases. In cases when foot traffic leads directly to a high pedestrian bridge almost always it is necessary to install the fence to make pedestrians use the footbridge.

when designing acceptable horizontal connections. This connection must be perceived as easy and non-complicated as possible. Gradual short ascents and descents are less difficult for movement than long and steep ones. A long steep staircase is considered to be tiring, whilst several short series of stairs with a platform similar to street with a small square is psychologically more convenient. If the foot traffic is conducted from one level to another it is easier to start with the downward movement than upward movement. This can be an argument to prioritize subways to bridges. When the transportation issues are handled in this way it is obviously more convenient to conduct the pedestrians above or below automotive traffic as much horizontally as possible, for instance on discretely vaulted foot bridges or through simple subways so that the walking rhythm and direction cannot be deviated anyhow.

In places where foot traffic must go up or down, in principle relatively flat ramps are preferred to staircases. The ramps do not disrupt walking rhythm and moreover they allow for manoeuvring with prams and wheel chairs. The general rule in terms of foot traffic and level deviations is to avoid different levels wherever possible. If the pedestrians must be conducted up and down, ramps should be used instead of staircases.

3.3 Standing around

Activities, such as walking and sitting around, are more complex and put more requirements on physical environment than those which concern standing around. We will investigate standing activities thoroughly, as they clearly illustrate certain important behavioural models typical for a great number of stationary activities in public places. It is naturally important to be able to stop in public places, however the key word is to stay.

When stopping somewhere there is usually a certain functional reason behind it: to stop at the crossings at red light, to stop to have a look at something, to stop to concentrate on something. Regarding these short stops physical environment does not have any substantial impact. The pedestrians' stop where they have to stop: on the curb, at the house facade or everywhere they need to.

The act of stopping to talk to someone belongs to this group of more or less unnecessary activities. The interactive situations are developed when a person meets his acquaintances, and the conversation is carried out right at the spot. In principle it is an unnecessary activity, as it is not polite to avoid contact with good acquaintances. As it is not known beforehand if the conversation is going to be short or long, and thus nobody can propose to move to more suitable place, the talking groups can be seen in all places where people meet each other – at the staircases, at the store doors, in the middle of the premises independently on time and space.

Different rules apply for stopping for longer period of time. In situations where this activity has developed from a short informal stop into a real staying function aimed at stopping to wait for something or somebody, to enjoy the surrounding environment or to see what is happening, there appears a problem to find a good place where to stop.

Favourite standing zones have been identified along the frontages within the area or in transitional zones between the two spaces from where at the same moment both areas are within sight. When identifying the preferred zones for standing in Holland recreational resorts Derk do Jonge, a sociologist, noticed a characteristic effect of peripheries. Stopping zones were usually on the peripheries of forests, riverbanks, groups of trees, clearings, whilst open country or beaches were not used until the peripheral zones were completely occupied. Comparable observations can be found in urban areas where preferred stopping zones were identified to be the borders of the premises and the borders of the premises within the open space as well.

The obvious explanation why these peripheral zones are so popular is the fact that the location on the periphery provides for better chance for observations. Edward T. Hall who, in book *The Hidden Dimension*, describes how the location on the periphery of the forest or near frontage helps an individual or a group to keep distance from other people delivers an additional explanation.

On the forest edge or at the house frontage a person is less exposed than inside, in the middle of the area. As thus the person does not obstruct anyone and anything. He or she can see, however can be hardly seen, and his or her personal territory is restricted to a semicircle in front of him (her). If a person's back is protected, other people can approach only from the front side, which facilitates observation and reaction by showing, for instance, reserved face in case of undesirable invasion into a personal territory.

The peripheral zone as a place for standing offers a great many of evident practical and psychological benefits. Moreover the area around the frontage is a clear outside area for standing of citizens and a function for surrounding buildings. It is relatively easy to move certain functions outside the house to the zone along the house frontage. The most natural place for staying and standing is a stair in front of the door, from where you can go outside to the open area or remain standing on the stair. From the physical and psychological perspective it is easier to stay than to go outside. A man can always go out if he wants to.

Then we can draw a conclusion that the events are growing from outside towards inside, from the periphery to the centre of public spaces. Children start their gatherings, first of all, around the house door until they begin to play a group game and move outside to occupy the entire area. Other age groups also prefer to start at the house door or house frontage from where they can go out to the outside space or come back home or only hang around.

Christopher Alexander, in his book *A Pattern Language*, sums up experience from observation of peripheral effect and peripheral zones of public areas: "If the periphery fails, then the area will never become alive."

Spotted background of forest edge under overhanging tree tops gives a different quality desirable for stationary activities – an option to be partly hidden in a shadow and at the same time to have a nice view of the surrounding area.

Colonnades, marquises and parasols at the house frontages in urban areas provide similar attractive options for people who dwell here, watch surrounding environment and cannot be seen at the same time. In case of residential houses we can see niches built in house fronts in the front yards having the same purpose. Protection is secured, and the view is still very good.

Within the staying zones people carefully select the places for standing in niches, at the corners, in door fronts, near columns, trees, street lamps or similar physical supports, which define resting areas in this small scale.

Columns, which we can see in the squares of many South European cities, are frequently used as perfectly utilizable supporting devices for longer standing. People use them for resting; they stand next to them, play around them and put their belongings next to them. On Campo in Siena almost all stationary activities concentrate around columns that are situated just on the border of two square zones.

Similar utilization of supports in public areas or other environments can be seen in restaurants and hotel dining rooms or during the first phases of parties, when people tend to stand near the walls or furniture. Similar observations were conducted during the initial phases of games, when quite often children stand at the furniture or various toys. In the parks and open grassy areas near dwellings, on the contrary, people find it awkward to sit on the lawn if "there is nothing to sit at".

In conclusion we can say that it is very important to design the details when trying to develop stationary options in public places. If the areas are devastated and empty – without

benches, columns, plants, trees etc. – and if the fronts of the houses lack attractive details – niches, openings, entrance doors, staircases etc. – it can be very difficult to find the place where to stop. Or we can put it another way: Good towns, where people stay outside, have irregular frontages and various supports on its outside premises.

3.3.1 Sitting

It is especially important to specify what it actually means to arrange appropriate sitting facilities in all types of urban public areas and residential premises. The stay can have any duration only in places with existing sitting possibilities. If there are not enough of these options or if they are not appropriate, people only pass by. Then it means that the stay in public places is short and external activities are excluded beforehand. The existence of adequate opportunities for sitting generates possibilities for many activities that are the main attraction of public places: eating, reading, sleeping, knitting, playing chess, sunbathing, watching people, talking etc.

These activities are so substantial for quality of public space in the towns and residential premises that the availability or lack of good opportunities for sitting must be considered to be a very important factor when evaluating the quality of public space in the given area. If you want to improve the quality of the external area using simple means, almost never it can happen that you make a mistake, if you create more and better sitting facilities.

Sitting has several important requirements regarding specific situation, climate and space. Certain special requirements concern the place for sitting and they are somewhat identical with requirements regarding standing activities. However these requirements are more specific, as sitting is more sophisticated than random and transitional forms of stopping and standing. Sitting activities usually appear only in places with more favourable outside conditions, and places for sitting are selected more carefully than places for standing.

The above-mentioned peripheral effect can also be seen in situations when people choose their places where to sit. The places along the building frontages and area borders are preferred to the places in the middle of the space, and alike in standing situations people tend to look for a support in details of physical environment. The places for sitting in the niches, at the ends of the benches and other perfectly designed spots and places, where people's backs are protected, are prioritized.

4. Pedestrian infrastructure

Responsible institutions should monitor the following targets:

- Traffic should not be the only prioritized function of street space, as still the street has many other functions that have the same level of importance,
- Motor traffic should not be prioritized to other types of traffic,
- Motor traffic should adapt to the settlements, it means that the speed of passing vehicles should be reduced and the space demand of vehicle traffic should be reduced in both, stationary and street space,
- To reduce the road load to a level acceptable for given territory,
- To increase the safety of traffic and in particular the safety of those participant groups who are, for various reasons, more jeopardized by traffic accidents - children, senior citizens, people with low mobility and cyclists,
- To improve the aesthetics of public space,
- To perceive the solution of street and public space in a comprehensive way and to adapt it so that it suits the needs of all of its users and all of its functions – not only traffic

ones. This can be achieved only in case we adopt a multi-branch approach and involve general public in the planning process.

4.1 Public space

Streets and public space are generally one of those key elements forming the settlements. Their general functions are as follows:

- Compositional and structural – settlement segmentation, development of structure and layout,
- Space-creative – creation and restriction of settlement premises,
- Esthetical – general element of perception of settlement and its architecture, esthetical impression,
- Residential – living space for inhabitants, place for children games,
- Social and cultural – space for encounters and establishment of social contacts,
- Business – space in which business relations take place,
- Traffic – provision of territorial resident traffic,
- Hygienic – provides for lighting, insolation and ventilation,
- Adjacent buildings, place for greenery,
- Technical equipment – space for engineering utility network and their connection to the development.

4.2 Historical heritage

In the last fifty years there appeared a very significant new element in the streets – a personal vehicle. Regarding appearance, character and function of street space this event has caused changes, the extent, depth and consequences of which have not been, regardless the increased number of critical voices, dully appreciated yet. Still, many people have not realized how important this change was. Already in the 20's of the 20th century, it means in the period of beginning of functionalism, there appeared uncritical fascination by a vehicle, considered to be a symbol of progress and prosperity, whereas its negative aspects, emerging along with the development of automotive industry in larger extent, are neglected. Since then the vehicle has become the standard for planning and designing the settlements – to attain a full utilization of its technical parameters, the vehicle must be given maximum space and roads must be adapted. These conceptions were in particular implemented in the aftermath of World War II, when the planners used the opportunities and rebuilt bombed out towns of western Europe in line with their ideas on modern road network.

A massive construction of road network was implemented in the West twenty years earlier than a real boom of automotive industry emerged and thus stimulated it significantly. At the same time the public transport systems collapsed. In the periods when public transport had a share of 80-90% of the total traffic capacity, only 10-20% of the total capacity of funds designed for traffic was invested in it. When in the 70'th, in particular in Western Europe, due to the increased standard of living and systematic economic favouritism of motor transportation, the automotive industry experienced a great boom, the existing roads failed to be sufficient. Although these roads were designed generously at that time, jams and traffic collapses became an everyday nuisance. Therefore further roads and flyovers are built more frequently now, obviously with larger capacity and higher investments. However, the increased level of motorization and increased volume of traffic quickly exhaust the capacity of recently constructed roads, and the traffic situation is becoming worse despite higher investments. This trend is ongoing even today.

4.3 Non-regulated traffic deteriorated traffic situation

In connection with an intense development of motorization we can already see evident changes in the character and function of street space that were caused by the development of automotive industry.

How is motorization reflected in the individual aspects of street life then?

- Traffic function has become a dominant function in street space handling. Instead of architectural-urban development construction and dimensioning of streets have become the subject of traffic-technical typology and standardization. This development has entirely been subordinated to the needs of motor transport, as its passable profiles had to be complied with at all costs. The motor transport – both going and stationary – has high areal demands, whereas areas for pedestrians, cyclists and greenery are considered to be residual, subordinated to areal requirements of vehicles.
- The pedestrians who could use the entire area of the street before were now expelled to sometimes very narrow pavements, and could cross the road only on restricted pedestrian crossings, bridges and subways. And thus the movement of pedestrians is somewhat limited and decelerated. Heavy motor traffic also substantially restricts the possibilities of public transport and deteriorates traffic serviceability of the territory.
- Hygienic function. Along with the increased number of vehicles on the roads the environment of human settlements is significantly jeopardized as well – due to gaseous emissions, noise, dust, vibrations, microclimatic changes, pollution of streets caused by spills of fuels and grease, decline of greenery, reduction of surface absorbability and the changes of water regime ensuing from the above mentioned, damage of historical buildings due to vibrations and emissions etc. In many cases this deterioration of environment reaches unacceptable values, and thus has an impact on the health of citizens, restricts their life activities and depreciates residential and historical districts.
- Esthetical function. The dominance of traffic function had been naturally evidenced in the appearance of streets. Passing and in particular parking vehicles dominate the street today. Apart from this the street is visually filled up with traffic equipment – traffic lights, direction boards, horizontal and vertical traffic signs etc., which are foreign elements especially in historical zones.
- Compositional, structural and space-creating function. As for the dominance of traffic function there appeared a noticeable shift. Instead of space merging many functions the street became a dedicated - traffic - area. Thus the streets are primarily perceived as roads and squares as parking lots. Due to a deteriorated environment, jeopardy of pedestrians and difficult surpass ability the main arterial roads become barriers. Whilst in the past the main roads used to be unifying elements of the districts, flourishing with many different activities, now those are more or less borders separating different city districts. And the result is a change of the urban orientation of the entire area, change of the individual life activities of citizens and change of attractiveness of the individual areas. Specific elements appeared, such as high-capacity expressways and flyovers. These are almost unsurpassable barriers for pedestrians or cyclists.
- Their impact on settlement functioning can be compared to medieval fortifications. The motor traffic influences the overall urban structure of the city by loosening building density, disproportional area expansion of towns and interfering into the multi-purpose effect of settlement complexes.
- Residential, social and cultural function. Obviously, all these changes have been reflected in everyday lives of the citizens. The result is a noticeable change of life style. Now the street does not stand for a living space. It is also the reason why people spend more time at home nowadays. This change of life style is most evident with children, where it

also has the most serious consequences. Children lost an option to play outside in the streets, and besides due to safety reasons they can move around outside only when they grew older. This represents a severe infringement into their physical and mental development. Loss of residential function of street space is also indicated by a cut off of social interactions and links and contacts that used to take place in the streets, by a decline of neighbourly relations and overall infringement of communication among people. As a consequence people become introverts, they tend to stay in their apartments and lose the general ability to communicate. The most affected groups are children and older people, for whom the social contacts in the streets used to represent the compensation of their loneliness. The reduced quality of residential environment along with an increased level of motorization and general mobility resulted in the shift of the core of the individual activities to different places, whereas the distance to these places is becoming farther as the traffic and transportation options are better. In the endeavour to escape from negative consequences of traffic people spend more and more time outside their apartments, in various facilities used for recreational activities (sports, culture) or outside their settlements. And again this generates the need of additional traffic and deepens the deterioration of settlement environment. When losing quality of surrounding environment people need to look for more distant places for their activities. In case of children various clubs etc must compensate the loss of playing fields.

- Business function. Last but not least we also need to mention the impacts on business relationships. Loss of attractiveness of frequented streets results in the loss of attractiveness of the stores located here and shopping in the centres of the towns in general. Concurrently more and more business activities are moved to suburban shopping centres, accessible only by car. And again this trend represents a serious process of degradation of functions of human settlements and becomes a threat for small stores which used to be a settled phenomenon of the street space.

To find an acceptable arrangement of street space within the municipality we have to recognize and take into account the requirements of individual user groups. As ensuing from the following paragraphs these requirements are very different. It is a calm-down of the traffic what represents the way how to achieve the harmonization of all these requirements.

4.3.1 Pedestrian needs

Movement of pedestrians differs from all other types of traffic in particular due to its irregularity, flexibility and spontaneous ness. It is the most natural and the most frequent type of movement as far as the frequency is concerned. However the pedestrians are the most vulnerable participants of road traffic. And therefore they have to be prioritized and protected. The intensity of pedestrian movement depends on the length of the journey and especially on its attractiveness. This is indicated not only by its safety parameters, i.e. the level of safety against a collision with motor traffic, but in particular by its psychological attractiveness - architectonic solution, number and diversity of different perceptions, frequency of interaction with other people and last but not least by personal safety feeling, especially at night. The composition of pedestrian stream is very non-homogeneous. The stream of pedestrians in the streets comprises all age categories – starting from playing children, through adults travelling to work and ending up with strolling senior citizens and persons with lower mobility. As for the purpose of the journey the composition of pedestrians is also non-homogeneous and dependent on local conditions. The same area is often used by pedestrians who move somewhere intentionally (typically hurry to work) and pedestrians who link movement with other activity – shopping, window-shopping, establishing contacts, in case of children a game etc. In accordance with a specific situation the solution of pedestrian movement must therefore correspond to different requirements of both groups (direct and fast movement versus possibility for an uninterrupted stay within the street space) and enable their coexistence.

The general aspect when giving preference to pedestrian traffic is the enhancement of its convenience. How do pedestrians behave and what is a condition for their safety?

- Within local roads we can find even small children moving around on their own - 50% of children from the age of six regularly participate in motor traffic.
- Depending on the type of executed journey and pedestrian age the movement speed is within 1.8-6.5 km/h.
- Compared to motor traffic the pedestrians spend longer time within the street. The ability to perceive surroundings and its details is markedly higher in case of pedestrians than motorists. Concurrently the pedestrian do not like dull and monotonous spaces, which is not boring for a motorist.
- Visual striking ness of a pedestrian is low. Especially at night, if pedestrian's clothes are not equipped with reflective elements, the pedestrian blends with surroundings. Another issue is so called "hiding", when all of sudden the pedestrian can appear on the road from behind the corner of the building or bus standing in the stop.
- From psychological perspective there is generally very low willingness of pedestrians to wait. Even after half a minute waiting at the crossroads when the light is red, the pedestrians start risky crossing.
- The pedestrians are also not willing to accept any detours, nevertheless it depends on age and purpose of the journey. The straightest routes are preferred, regardless the risk. Even small detours are not accepted. What is particularly disturbing is a detour longer than 60 m.
- On the roads of higher functional classes in certain cases we can apply flyovers between motor traffic and foot traffic. However it must be emphasized that subways (often dark and untidy places) and foot bridges (route extension) are not given preferences by most pedestrians, and if at least slightly possible they try to avoid them. Due to this reason many towns have already started to replace the already existing subways with grade crossing.

City for Pedestrians General principles

1. To provide for pedestrian access to and clear routes across all parts of the city
2. To assert comfortable routes both from the technical parameters point of view and with regard to user friendliness of the proposed solutions
3. To give preference to single level crossings inside the city with application of modern safety and calming down elements
Even though single level crossings reduce automobile traffic fluency they provide to pedestrians the needed user comfort and safety if designed correctly
4. Multilevel crossings should be designed to minimise loss drops and provide for facilities for persons with reduced mobility and orientation

System Approach *System design of pedestrian routes*

1. To provide for comfortable foot connections of all city quarters to the city centre
2. To provide for foot connections between the individual residential and other urban areas of the city
3. To provide for foot connections to the city outskirts with facilities for rest and recreations of the citizens
4. To provide for foot connections to the surrounding municipalities on demand

Safety *Conditions for safe pedestrian movement*

1. To assert application of modern elements of traffic calming down, such as raised pedestrian crossings, slow-down islands, elements for reduction of passage speed etc.
Traffic professionals exercise long-term efforts at introduction of modern traffic calming down and traffic safety elements to practice
2. To provide for location of pedestrian crossings to natural pedestrian routes
The most inconvenient way from the pedestrian safety point of view is the current practice of placement of pedestrian crossings in the crossroads off the adjacent pavement line. The pedestrians then continue along their natural routes, cross the street off the crossing situated behind the block corner and thus the inconveniently situated crossings do not add to pedestrian safety, rather making the situation even worse.
3. To provide for protected pedestrian crossings on access routes to schools and healthcare institutions
4. To prefer separation of foot and cycling paths rather than to build joint pedestrian/cycling paths

Technical Standard *Conditions of technical standard of pedestrian routes*

1. To provide for conditions for use of public foot areas pursuant to Decree no 369/2001 Coll., of the Ministry for Regional Development on general technical requirements for use of buildings by persons with restricted mobility and orientation
The condition of wheelchair access is one of the basic requirements for public spaces. Some important areas in the city centres still wait for implementation of this requirement.
2. To provide for conditions for use of public buildings pursuant to Decree no 139/2001 Coll., of the Ministry for Regional Development on general technical requirements for use of buildings by persons with restricted mobility and orientation
3. To provide for conditions for use of city transport stops pursuant to Decree no 139/2001 Coll., of the Ministry for Regional Development on general technical requirements for use of buildings by persons with restricted mobility and orientation; to resolve shortening and improvement of transfer routes in the changing nodes
4. By preventive and consequent actions to create conditions for quality of foot traffic along pavements and other public areas not to be negatively affected by objects forming obstacles to pedestrian movement
In addition to mobile obstacles, often permanently placed on the pavement, though, there are fixed objects in the form of pillars, switchboard and fuse boxes and other technological equipment

Pleasant Feel *Usability and aesthetic quality of pedestrian areas*

1. To support development of foot traffic by emphasis on aesthetic quality of foot paths
2. To support development of foot traffic by equipment of foot paths, foot areas, squares and parks with suitable street contents
Conveniently placed, aesthetically well designed and functional benches represent the most frequently used street contents
3. To support development of foot traffic by equipment of foot paths and areas with greenery, especially shading
The shadow of the trees planted along foot paths creates pleasant environment attracting people to walks in the street

4. To develop residential function of the current urban space and parks by intense maintenance or reconstruction of the urban areas; with the aim to increase their usability value for short-term recreation
The development of residential function of public areas not only pleasantly enlivens the urban environment for also favourable affects increase of intensity of foot traffic

Coordination *Traffic, urbanism and support*

1. To coordinate development of foot traffic with the other components of the traffic system, such as city transport, cycling paths, but also bus and tram stops, public parking places (park and walk), cycling paths etc.
Pedestrians represent an element of traffic, the better the coordination of the individual components of traffic the better the function of the traffic system as a whole
2. To coordinate development of foot traffic with functional use of the territory and to create conditions for localisation of commercial and non-commercial activities creating a symbiosis with public space and further supporting attractiveness of foot paths and areas; the links of the foot paths to the surrounding space should further be supported by development of the city information system
Direction tables informing about the individual foot destinations form an integral part of the city
3. Public order keeping, maintenance and cleaning should create favourable preconditions for pleasant stay and movement of people along the foot paths and other public spaces of the city; free pedestrian movement along reserved spaces should be provided for by emphasis on observance of traffic regulations concerning car parking
Foot paths along the river bank in the city centre would certainly deserve to be a better representative space of the city
4. To actively use programmes of the European union, the Government of the Czech Republic, and non-governmental non-profit organisations supporting foot traffic by grants, education and other activities
A good example is represented by the National Development Programmes of Mobility for All, Healthy City, Local Agenda 21, Day without Cars etc.

5. Conclusion

In conclusion it should be stated, even in view of the above facts that the regulations regarding the position of pedestrians in the Czech Republic are at the level of the European standards both in the sphere of active and passive safety. Particularly recently it has become obvious in the whole society that each road user is starting to understand in a better way the importance of enhanced safety of pedestrians. This was mainly helped to by relatively new legal regulations encompassing some essential elements of pedestrian protection, such as the introduction of an absolute right of way of pedestrians, decreased speed limits of vehicles in towns, and also reduced tolerance to drinking and driving. This work has introduced a certain legal framework, which defines a mutually relatively well-balanced system of rights and obligations of road users increasingly focused on the protection of pedestrians as relatively most vulnerable road users. Nevertheless, any legal arrangement only provides a certain degree of formal protection, and to achieve the highest possible safety of pedestrians a strong appeal to each individual is necessary.

References

1. Act no 50/1976 Coll.
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of the Ministry for Regional Development on general technical requirements for use of buildings by persons with restricted mobility and orientation
3. CSN 73 6110 standard on design of local roads
4. National Development Programme of Mobility for All