

# Urban Space and Design for the Pedestrians

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## Abstract:

The main aim of the design of products, facilities and services for walking and sojourning is to improve the quality of the pedestrian's environment, so that his or her needs for mobility, accessibility, safety and health are satisfied in the best way. The Design For All principle provides such a focus. A second question is to which needs the design should address? According to the most current insights the 5 C's and the Sustainable Safety principles together provide good coverage of the most important pedestrian needs.

These 3 **general principles** will be covered:

- Design for all (D4A)
- The 5 C's (by Gardener c. s.): convivial, convenient, connected, conspicuous and comfort-able
- Safety Principles (including barrier-free design)

## Design Principles:

Important principles for a pedestrian-friendly design include:

- **Accessibility:** routes which lead directly and safely to the pedestrian infrastructure
- **Comfort and Attractiveness:** Pavements should be designed attractive and comfortably. Sidewalks should be regularly checked if they are in a proper condition, particularly with regard to slippery or damaged surface and obstacles.
- **Lighting:** Adequate lighting of pedestrian networks is a mean for improving road safety as well as to imply a certain level of security against criminal attack and for the pedestrians comfort.
- **Access to other Modes of Transport:** pedestrian routes to the public transport stops need to be reachable and in a path network

## Conclusions:

Substantially for pedestrian mobility in urban areas is a coherent, barrier-free, safe and comfortable path network. It contains continuous sidewalks with an adequate width along main roads as well as pathways along residential roads or through traffic calming zones. Junctions and street crossings have to be designed clearly arranged and well visible. They have to consider the special needs of handicapped people, elderly and children. If necessary they have to be secured by suitable measures.

## **Biography:**

Thomas Fessler, project coordinator within the Austrian Road Safety Board (KfV), graduated from the Technical University Vienna in the field of Regional Sciences in 1996. In 2003 he joined the KfV.

His professional expertises are: road safety, transport-economics, traffic engineering and telematics.

# Urban Space and Design for the Pedestrians

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## General Principles

The goal of design for pedestrians is to improve the quality of the specific environment, so that mobility, accessibility, safety and health needs are fulfilled – thus, the urban space should be attractive for all pedestrians. Different principles are known which describe such approaches:

- Design for All
- The 5 Cs
- Sustainable Safety Principles

## Design for All

Walking is open to everyone, with no requirements for a special education or a licence. Social exclusion is unacceptable, that's why society cannot afford to limit basic walking options. Design for All (D4A) is a principle aimed at satisfying this fundamental right.

Design for All (also known as Universal Design or Inclusive Design) is the approach to the design of products, services and environments to make them usable by as many people as possible regardless of age, ability or situation.

The idea of D4A is that the design of the transport system and public space should not be orientated on the average road user. Considering an average person as reference means that half of the road users would have adequate facilities but the other half would have trouble to cope with. On a community level it makes much more sense to provide for the vast majority of public space users and concentrate efforts on those that have most difficulty coping with the system, thereby automatically seeing to a much greater proportion of road and public space users overall (European Institute for Design and Ability, 2004).

The scope of the D4A principle is broader than that required to design individual products or situations, but can assist with the design of the system as a whole. For infrastructure, this means that not only is site design important, but the complete route from door to door should be in accordance with D4A principles, as well as the distribution of essential destinations within the system.

The starting point for a D4A approach is to identify needs and to look for weak links in the chain of circumstances that make it difficult or even impossible to satisfy design requirements. The most important life style factors for walking and sojourning are stage of life, abilities and alternative transport options (Vukmirovic, 2009). In practice, the main groups of concern are likely to be children, older people, people with limited walking ability and those without driver licences (Methorst, 2003).

## The 5 Cs

In 1996 Gardner et al. published a report on the development of a pedestrian strategy for London. They concluded that, in order to be functional for walking and sojourning, public space should comply with at least five requirements: it needs to be convivial, convenient, connected, conspicuous and comfortable.

**Convivial** connects two qualities: "liveable" and "together". Convivial public space means that its design and facilities support an agreeable sojourn, that it is liveable, enduring and tolerable. Convivial public space feels safe and inviting for pedestrians, mainly because (most of the times) there are other human beings.

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<sup>1</sup> Together with: Sabine Degener, Jörg Ortlepp and Rob Methorst

**Convenience** relates to the measure to which public space or a facility suits the pedestrians' special needs, i.e. that it saves time or frustration. Convenience is a very subjective term and its meaning tends to change over time. What was once a convenience (a zebra crossing) is today regarded as a normal part of life. Likewise today's luxuries will probably be perceived in the same way in the future.

**Connected** or Connectivity refers to the property of the infrastructure network that links trip origins to desired destinations, thus making it possible for persons to get where they want to go, as well as the extent of linkages between different routes and network.

**Comfort** or Comfortable relates to the extent to which walking is accommodated to competencies and abilities of all types of pedestrians. In objective functional terms comfort refers to observable usability, where pedestrians can use spaces or facilities without the apparent need to strain one's self. Comfort is primarily associated with positive feelings. It can, however, also be seen as no negative feelings. Therefore, facilities are usually seen as comfortable if one does not notice anything negative. In subjective terms comfort is a state of mind, a feeling of usability without stress, uneasiness or pain.

**Conspicuous** relates the measure to which an object or a facility is noticeable or eye-catching in terms of clear and legible routes, signing and information.

### **Sustainable Safety Principles**

One of the most basic needs of pedestrians is safety. With regard to road safety, Sustainable Safety reflects the State of the Art of a science-based, systems approach (Wegman et al., 2006). For pedestrians, the principles need to be translated, because traffic safety is not exactly the same as pedestrian safety. Pedestrian safety also concerns the risk of falls and of personal security. Thus, the principles can be redefined as follows.

**Functionality** concerns the usability of public space for walking and sojourning. Pedestrians should be provided with shielded space, where they can walk and sojourn without being bothered or threatened by traffic or other external dangers.

**Homogeneity** of mass and/or speed and direction means that pedestrians should not be exposed to traffic that moves substantially faster than one can walk; heavy vehicles should be kept away from pedestrians; where pedestrians cross the road, traffic speed should be so slow that both the pedestrian and the driver can take appropriate evasive action.

Pedestrian's walkways should be **self-explaining**. It should be immediately clear where one can walk and sojourn, where one can go and how one can cope with difficulties and threats.

Pedestrians need **forgiving** environments, which do not mercilessly punish them for mistakes that they make in response to walking conditions or mistakes by other actors in their environment. Drivers can make foreseeable errors. The (physical) environment should be such that the errors will not lead to death or to long-term loss of health. In traffic encounters mistakes made by the pedestrian or driver can be forgiven only when the vehicle speeds are low (i.e., 30 km/h or less). When falling, the risks of falling should be limited and not aggravated by falling into an abyss, moving traffic, hard and sharp objects, etc.

Particularly in risky situations, people need to be aware of their actual task capability to handle their walking task. There are limitations to making people aware of their state of mind and task capability, particularly for children and mentally and physically impaired people. The pedestrians' environment should be designed and organised in such a way that specific risk groups are not stimulated or forced to cope with risky situations that they cannot handle.

### **Barrier Free Design**

Barrier-free design is one of the main factors to enable mobility for all pedestrians, regardless of ability, by removing physical barriers in the infrastructure. It is essential to cater for the mobility-impaired, but a barrier-free road and path network is of benefit to all pedestrians. Additional or special measures for handicapped people are only necessary where they are essential for functional or safety reasons. The intention must be design for all users (see D4A).

Barrier-free design requires well-defined footpaths that are sufficiently wide, without obstacles and provide safe street crossings. The common elements of current guidelines are as follows:

- **No steps:** Pathways without steps are a basic condition for a barrier-free footpath network. Where steps are necessary for topographic reasons, an alternative without steps must be offered, such as a ramp involving minimal detours. Similarly, the height of curbs should be minimised at intersections and street-crossings.
- **No obstacles:** Obstacles on footpaths are considerable barriers, for the visually-impaired as well as for people with impaired mobility and for wheelchair users. Sufficient widths for passage along footpaths should be maintained through the removal of obstacles such as advertising hoardings and commercial displays. Leading elements are used for orientation by the visually-impaired so house and curb edges, in particular, must be kept free of obstacles.
- **Recognisability:** The visually-impaired are dependent on well recognisable path guidance cues. Therefore, optical (high-contrast), acoustic and tactile elements are necessary for basic orientation and to point out specific features like dangerous places, road crossings and public transport stops. Guidance can be assisted by architectural edges (e.g. house walls or curbs) or by special leading elements (e.g. blind stones, cobblestones, markings) that are tactile and clearly contrasted from the surrounding footpath layer. Roadway edges should offer a clear optical distinction from the footpath layer and should have a tactile component. Acoustic and tactile features should be incorporated in traffic signals.
- **Path network:** Coherent path networks of at least 2.5m in width are essential for barrier-free mobility, allowing wheel chair users and pedestrians to interact without hindrance. Junctions and street crossings have to be designed to be simple and easily visible. If necessary, they should be equipped with suitable measures such as traffic lights.

## Legal Aspects

In some jurisdictions barrier-free design is a legal requirement. In Germany, for example, a law providing equal opportunities for the disabled<sup>2</sup> was enacted in 2002, defining this group as those whose physical function, spiritual ability or mental health deviates from that typical for their age and affecting their participation in society. Amongst others, the law prescribes the barrier-free design of public spaces (pathways, places and roads) as well as a barrier-free public transport so that people with physical impairments are able to use public infrastructure without encountering particular difficulties and largely without external help.

## Accessibility

In the urban centres of most cities, there are well-functioning pedestrian routes for walking and sojourning. The issue then becomes the provision of ready access to these areas by pedestrians. Therefore, there should be one or more pedestrian or public transport routes leading the pedestrian directly and safely to their destination. If the pedestrian goes on foot, a sense of comfort and safety must be conveyed and be as direct as possible. Public transport should come at regular, short intervals and stops should be close to pedestrian destinations.

## Comfort and Attractiveness

Plans aimed at satisfying the needs of pedestrians can strongly encourage pedestrian mobility. It has been shown that footpaths formed in an attractive way encourage pedestrians to walk longer because the perception of distance travelled is less on a well-designed footpath. According to the FHWA and ITE standards and guidelines, a minimum pavement width 1.5m (5ft) is recommended (Harkey & Zegeer, 2004), allowing two people to pass comfortably or to walk side-by-side. Wider pavements should be installed near schools, at transit stops, in city centres, or anywhere pedestrians are highly concentrated. However, for a barrier free design minimum pavement widths of 2.5m (8ft) are recommended.

In addition, they should be continuous along both sides of a street and be fully accessible to all pedestrian categories in accordance with D4A principles and with guidelines regarding the negotiation of height differences, as described above.

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<sup>2</sup> Gesetz zur Gleichstellung behinderter Menschen – BGG

Footpaths should be regularly maintained in an appropriate condition, particularly with regard to slippery or damaged surfaces and obstacles. In countries with cold winters, clearing/removing the snow and salting/sanding the footpaths is necessary. In general, surfaces should be firm, stable, and slip-resistant in all circumstances, implying both good design and diligent maintenance to avoid abrupt height changes and damage from rainwater, icing and penetration of vegetation. These considerations will become increasingly important with ageing populations.

## Lighting

Adequate lighting of pedestrian networks is a means for improving road safety (at road crossings) and for security against criminal attack and for general pedestrian comfort. Specifications for the road lighting are determined from technical regulations and standards. The European Norm EN 13201 for example, released by the European Committee for Standardization CEN<sup>3</sup>, stipulates the requirements for lighting of public roads, but the lighting of pedestrian crossings is not detailed in this norm and instead must be regulated by national standards. Such standards<sup>4</sup> cover not only requirements like light density, but aspects such as pedestrian visual contrast against lit backgrounds. Installation of adequate lighting at pedestrian crossings can improve the car drivers' willingness-to-stop for pedestrians during darkness to similar levels as during daytime (Stefan et al., 2007). One possibility for ensuring adequate lighting is the use of light-band lamps, as shown in figure 1.



Figure 1: Light-band lamps (picture by Franz Luisi)

## Access to Alternative Transport Modes

### Public Transport

An appropriate local public transport system supports pedestrian-friendly urban spaces, since more attractive public transport systems lead to more road users, both locally and from surrounding areas, being likely to abstain from using private cars. Thus the quality of local public transport has a direct effect on increasing the use of environmentally-friendly transport.

Routes should consider the connection of all significant destinations with short walks to evenly distributed stops, so that they can be reached comfortably and safely. In built-up areas bus stops should be within 500m of pedestrian areas and railway stops 1,000m. All public transport stops

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<sup>3</sup> The national members are the National Standards Organizations of the EU-countries as well as Croatia, Iceland, Norway and Switzerland.

<sup>4</sup> See, for example, Austrian standard ÖNORM O 1051.

should be accessible on a coherent path network. Footpaths should be illuminated, barrier-free and of adequate width. Clear marking and sign-posting will assist pedestrians to locate stops easily.

The public transport stops themselves should be safe and easily accessible, with barrier-free design. Waiting areas should be clearly signed, illuminated and separated from adjacent infrastructure as far as possible. For reasons of safety from criminal activity, stops should be highly visible and clearly laid out. Safe and barrier-free street crossings are necessary for access to waiting areas and should be clearly recognisable during both day and night. Non-signalised crossings should be located behind the stopping vehicle, to allow pedestrians to see, and be seen by, oncoming traffic. Signalised crossings may need to be coordinated with public transport to avoid passengers crossing at red lights after stepping out of the bus or tram. In some cases guard rails or pedestrian fencing will be necessary to prevent crossings away from traffic signals. D4A principles should be followed with regards to stop accessibility to ensure that mobility-impaired road users are adequately catered for. Finally, bicycle lanes should be routed in such a way that conflict with passengers is avoided.

### **Interchange Points**

Interchange points serve as the interface between different routes or modes of transport. The design principles, outlined above, for stops also apply to interchange points, while single stops at an interchange point should be connected with each other by safe and barrier-free crossings. In addition, an easily understandable orientation system for all users is necessary, in particular at large interchange points.

Every car trip, bicycle and motorbike ride begins and ends with a walk to and from the parking site as a pedestrian, so parking sites for all vehicles must be accessible by safe footpaths and unsafe crossings of dangerous streets should be avoided.

## **Pedestrian crossings**

### **Traffic Control**

The purpose of an intelligent city-wide traffic control system should be to limit dangerous interactions between pedestrians and road traffic. Particular attention should be paid to reducing traffic volume (by re-routing traffic) and speed in areas with high pedestrian volumes and sensitive areas such as schools. Pedestrian-friendly traffic lights are required, with average waiting times no longer than 40 seconds. Turning traffic should not be allowed during pedestrian green time. Pedestrian traffic lights with push-buttons (like pelican crossings) should give right-of-way to pedestrians within a few seconds.

### **Visibility and Conspicuity**

Although fewer pedestrians walk after dark than during the daytime, the risk of a vehicle colliding with a pedestrian at night is 5-7 times higher than a collision during the day time (Sullivan & Flannagan, 2007). Thus, the pavement and crossings should be lit sufficiently to ensure adequate pedestrian visibility at night, with additional specialist lighting necessary if not available from the existing infrastructure.

Another source of danger for pedestrians is obscuration by parked cars, billboards or trees. To avoid visibility problems, curb extensions should be built. These lengthen the pavement into the parking lane and prevent motorists from parking on or too close to a crosswalk or from blocking the curb ramp or crosswalk. Curb extensions should be free of all visibility masks and have the added benefit of reducing the crossing distance.

### **Crossing width and number of lanes**

To increase pedestrian safety, the width of crossings has to be minimised or crossings divided into sections so pedestrians have less traffic to deal with at one time and the gap selection task simplified. The minimisation of crossing width can be fulfilled with the help of curb extensions, as described above. These significantly improve pedestrian crossings by reducing the pedestrian

crossing distance, visually and physically narrowing the roadway and reducing the time that pedestrians are on the carriageway.

For wider roads, crossing islands may be used to divide the crossing width into sections, consisting of a raised island in the centre of the roadway at intersections to provide a refuge from motor vehicles for pedestrians. Centre crossing islands allow pedestrians to deal with one direction of traffic at a time, and enable them to stop part-way across the street to wait for an adequate gap in traffic before completing their crossing. It has been demonstrated that crossing islands radically decrease pedestrian road crossing crashes, due to fewer conflicts, reduced vehicle speeds approaching the island, greater crossing conspicuity and shorter exposure time for pedestrians (Stefan et al, 2007).

Due to previous planning philosophies biased towards vehicle capacity considerations, some roads have many travel lanes and are difficult for pedestrians to cross because of their width and pedestrians on the roadway may be masked by cars in adjacent lanes. Reducing the number of lanes on a multi-lane roadway can reduce crossing distances for pedestrians and may reduce vehicle speeds. Therefore, a traffic analysis should be carried out to determine whether the number of lanes on a roadway could be reduced while maintaining adequate traffic flows. A reduction of the number of lanes is able to provide more space for pedestrians, bicyclists and parked cars, reduces crossing times and improves the social interaction and neighbourhood feel along the street.

## **Public spaces and the Shared Space concept**

Public spaces like squares, gardens and parks are essential for cities, offering opportunities for socialising, recreation, sport and games for all classes and ages. Consequently, they must be designed to be pedestrian-friendly, barrier-free and reachable by safe and comfortable paths. Adequate lighting is needed to ensure social safety.

Shared Space is a philosophy of urban road design developed in the Netherlands, with the main benefits being a substantial improvement in the spatial quality of neighbourhoods. The concept replaces traffic regulations with informal social-minded rules. In particular, traffic signs and traffic lights are removed to allow people to settle potential conflicts by eye contact. Traffic in these areas is regarded as a guest and the layout should clearly indicate that the primary function of the area is residential. This approach is also expected to result in lower driving speeds and improved road safety, although the latter has not yet been conclusively proven for each example in real use. Shared Space is not able to be used everywhere, still involving significant conflict situations and therefore should be limited to specific situations (e.g. depending on width and function of the road, traffic volume, etc.). It emphasises the importance of a well-designed road network, since without well-designed through roads, traffic will be encouraged to rat run on the secondary road network, with consequent negative effects.

## **Conclusions**

Critical for pedestrian mobility in urban areas is a coherent, barrier-free, safe and comfortable path network, containing continuous footpaths of adequate width along main roads as well as pathways along residential roads or through-traffic calming zones. Junctions and street crossings must be clearly arranged, highly visible and must consider the special needs of people who are mobility-impaired, elderly or young. If necessary, they have to be secured by suitable measures (e.g., traffic lights). The pedestrian network should also be adequately integrated with other transport modes, with public transport of greatest importance, but interchanges with cars and bicycles also significant.

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