MODULE 3

AGE-FRIENDLY BUILT ENVIRONMENT – ARCHITECTURE

UNIT 1

INTRODUCTORY UNIT – HUMAN-CENTRED DESIGN

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DESIRE

DESIGN FOR ALL METHODS TO CREATE AGE-FRIENDLY HOUSING

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DESIRE will provide professionals in the building industry and home furnishings sector with the tools and skills to apply Design4All methods as an integral part of the design process, with the aim to create or adapt age friendly housing as a solution for the wellbeing, comfort and autonomy of the older adults or dependents at home.

The DESIRE training platform consists of six modules and 21 units.

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This unit provides an overview of the basic principles, methods, and legislation focused on human-centred design methods (people at the heart of the design process) related to the built environment, such as the principles of Universal Design/Design for All, legislative frameworks, and European initiatives. This unit aims at the acknowledgment of human diversity and various needs and requirements of people in the built environment, including older people and persons with disabilities. Empathic and simulation exercises within this unit provide a deeper understanding of the requirements and needs of different users and understanding of the importance of participatory planning.

1.1 DIVERSITY OF PEOPLE IN THE BUILT ENVIRONMENT

IN A NUTSHELL

Every person is unique and has the right to be welcome in the built environment. To ensure inclusion of all people, we consider different areas of life, environments, as well as various needs of people in macro, meso and micro levels. The importance of this issue is emphasized by international conventions and documents, such as the Convention on the Rights of Persons with Disabilities, and we find more details regarding the built environment in ISO standards. Neuro-architecture offers an innovative research approach to this topic.

Accepting the diversity of people and the individuality of each person is a basic prerequisite for creating an **inclusive environment**, in which all people would have the opportunity to use the physical environment, products, services, means of communication and information on an equal basis, while actively participating in society. The environment must support the right of every individual to an **independent and full personal life**, so systemic solutions (from the micro to the macro level) should ensure the creation of a non-discriminatory environment.

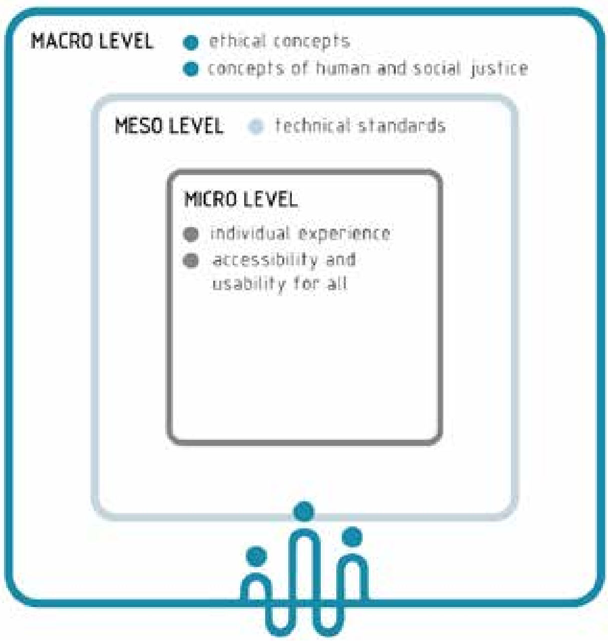

Figure 3.1.1 Systemic solution of inclusive environment (Suláková according to Samová, 2008)

1.1.1 The International Classification of Functioning, Disability and Health

To understand the diversity of people, it is essential to know the basic requirements and needs of a wide range of users of the built environment. **The International Classification of Functioning, Disability and Health** (ICF, WHO 2001) provides a terminological basis, including components and factors, that are important for the creation of an inclusive environment, products, services and information and communication technologies. The ICF is based on a description of situations regarding human abilities in the context of the environment and society in which one lives. It conceptualises functioning as a "dynamic **interaction between a person's health condition, environmental factors and personal factors**." The ICF covers the **entire lifespan** of people.

The ICF defines the following **components** that create comprehensive information about a person's condition:

- **Functioning and Disability:**
  - Body Functions and Body Structures
  - Activities and Participation
- **Contextual Factors:**
  - **Environmental Factors** (e.g. physical, social, cultural environment)
  - **Personal Factors** (characteristics of the individual – gender, race, age, lifestyle, education, experience, behaviour, etc.)

The ICF classification further classifies **environmental factors** into the following categories:

- built environment, products and technologies (personal consumption items, information and communication technologies, assistive technologies, means of transport, public buildings, public spaces, etc.)
- natural environment and human-made changes to the environment (climate, air quality, etc.)
- support and relationships (family, friends, neighbours, etc.)
- attitudes (social, individual)
- services, systems and policies (e.g. social security, health, education, etc.)

According to the ICF, a person's functional ability is understood as a **holistic concept** that includes all body functions, activities and participation in the environment and society. The term disability serves as an umbrella term for disorders, limitations in activity and participation. Disability is understood as a multidimensional phenomenon resulting from the interaction between people and their physical and social environment.

The importance of environmental factors and their impact on human activity and participation in society is also emphasized by the **Convention on the Rights of Persons with Disabilities** (hereinafter referred to as the CRPD Convention), which was approved by the United Nations in 2006: "Recognizing that disability is an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others." The importance of this interaction in creating the environment and its individual elements is emphasised by **Human-centred Design**, which focuses its attention on the people and reflects their diverse needs and abilities.

1.1.2 ISO Guide for addressing accessibility in standards

In connection with the creation of the built environment and the more rigorous expression of the relationship between the individual and the environment, it is recommended to use the ISO/IEC GUIDE 71: 2014 (E) **Guide for addressing accessibility in standards**. This ISO guide provides terminology relating to the accessibility and usability of the environment, products, information and communication technologies and services. This ISO guide utilises the term accessibility from an **inclusive perspective**, recognizing that accessibility generally **benefits everyone**.

The ISO GUIDE 71: 2014 uses terminology describing human abilities and characteristics according to the ICF classification (WHO,2001), so it does not use the term "disability" but the terms – body structure, bodily functions, disorders and consequences in relation to activity limits and restrictions in participation. The ISO guide emphasises the **diversity of human abilities and characteristics, which change over a person's life** and can be very diverse even among individuals of the same age group. It also draws attention to the fact that all people may experience certain limitations in activities and participation during their lives. The ISO guide points out that **sensory, physical and cognitive limitations** can be very diverse – from mild disorders to severe disorders. Although some disorders can be mild, the combination of several disorders can cause severe limitations, most often in the **ageing process**.

The basic structure of the ISO guide is divided into:

- a set of **goals to achieve universal accessibility** (based on the identification of peoples' needs and requirements)
- description of **human abilities and characteristics**
- description of **strategies/recommendations** to address peoples' needs in relation to human capabilities/functions and limitations

The ISO guide divides **human abilities/ functions and characteristics** as follows:

- **sensory abilities and characteristics**
  - seeing/vision function
  - hearing function
  - touch/haptic function
  - taste and smell functions
- **immunological system functions** (immune reactions, allergies and hypersensitivity, etc.)
- **physical abilities and characteristics**
  - height and body size
  - body movement (upper/lower limbs)
  - strength and endurance
  - voice and speech functions
- **cognitive abilities** (perception, attention, learning, memory, orientation, problem solving, decision making, emotional functions, etc.)

To know more about the human abilities, functions and characteristics read the Module 2, Unit 1 on Ageing process and changes to bodily systems.

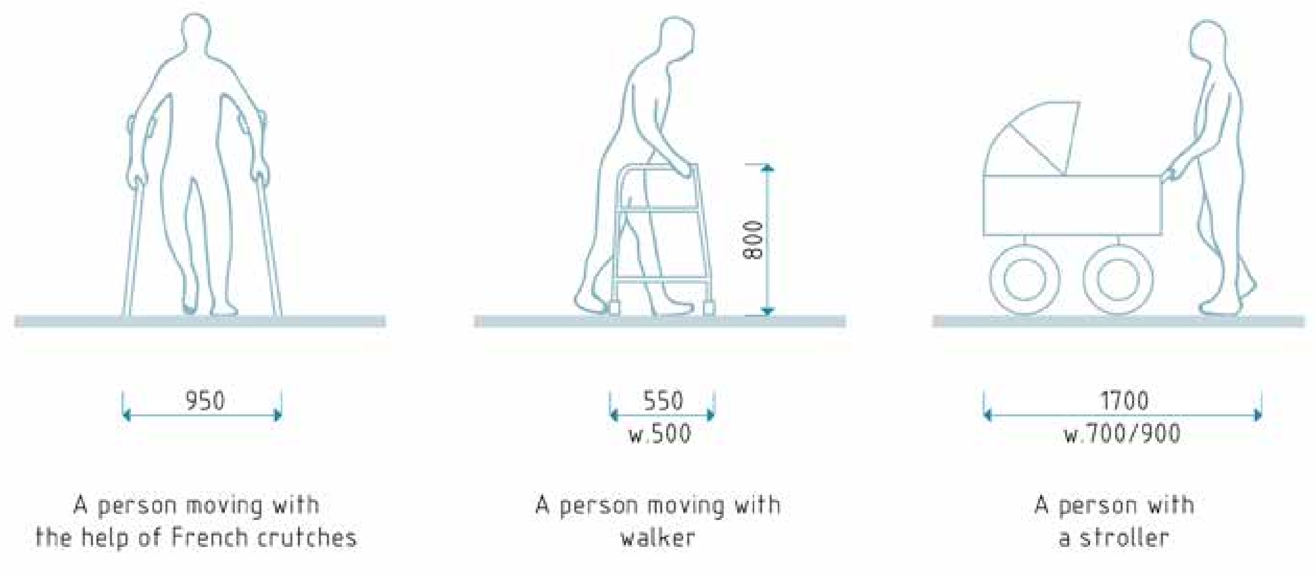

Figure 3.1.2 Spatial demands of people with diverse mobility (Suláková)

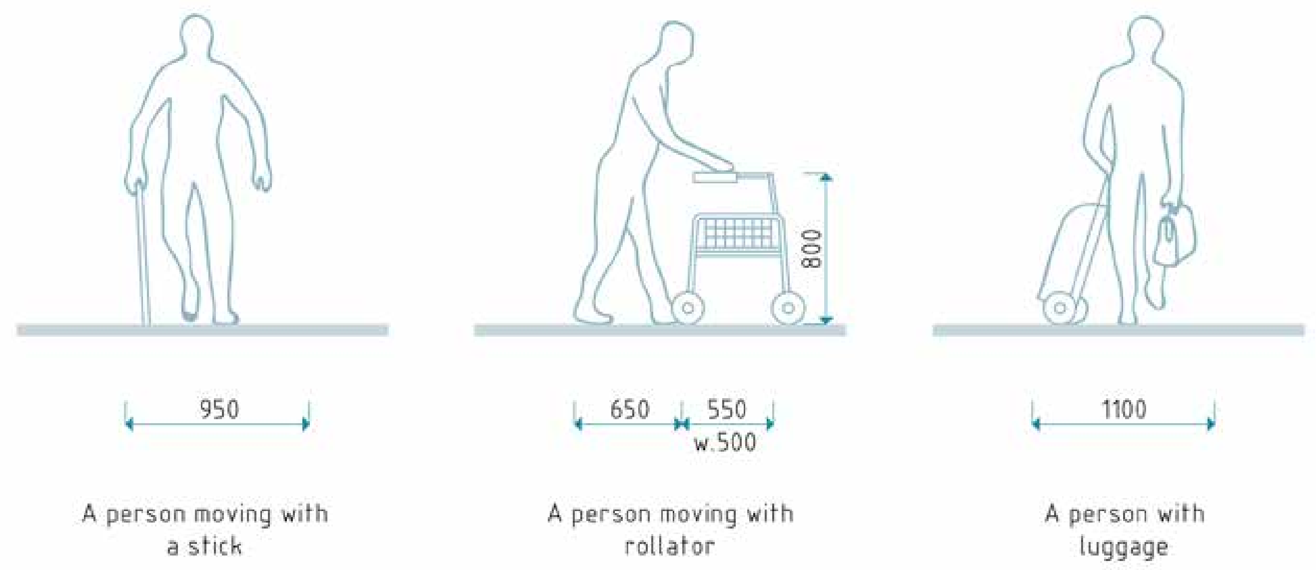

Figure 3.1.3 Spatial demands of people with diverse mobility (Suláková)

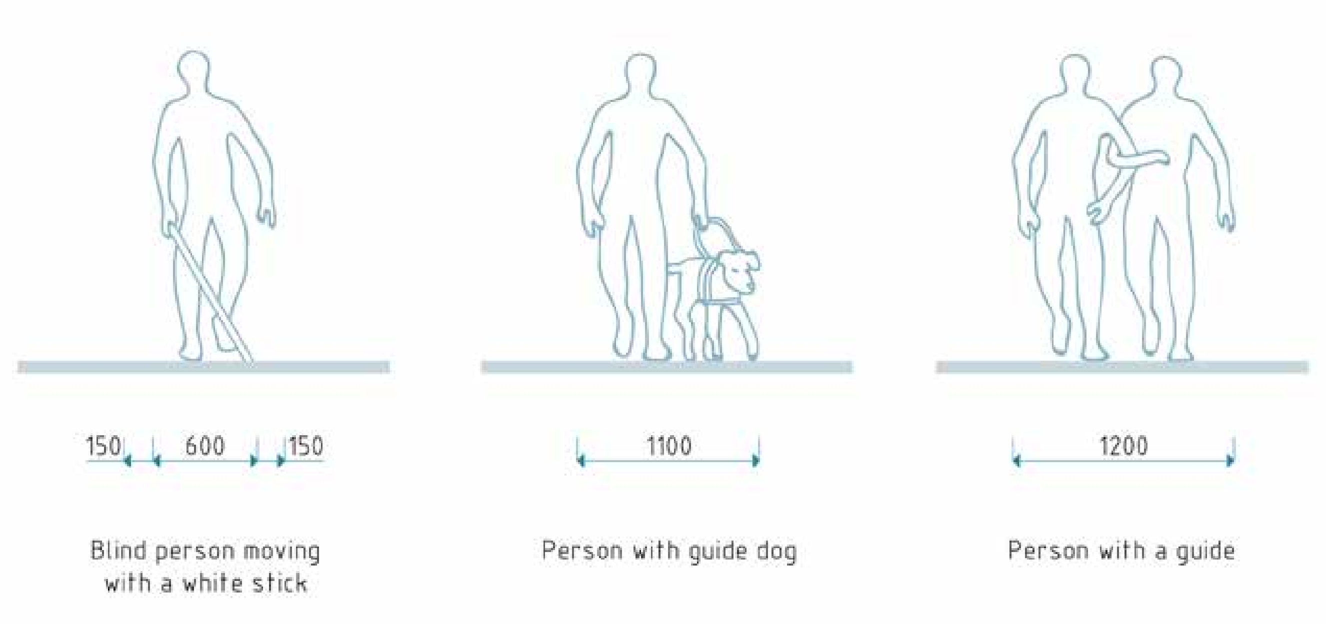

Figure 3.1.4 Spatial demands of people with visual impairments (Suláková)

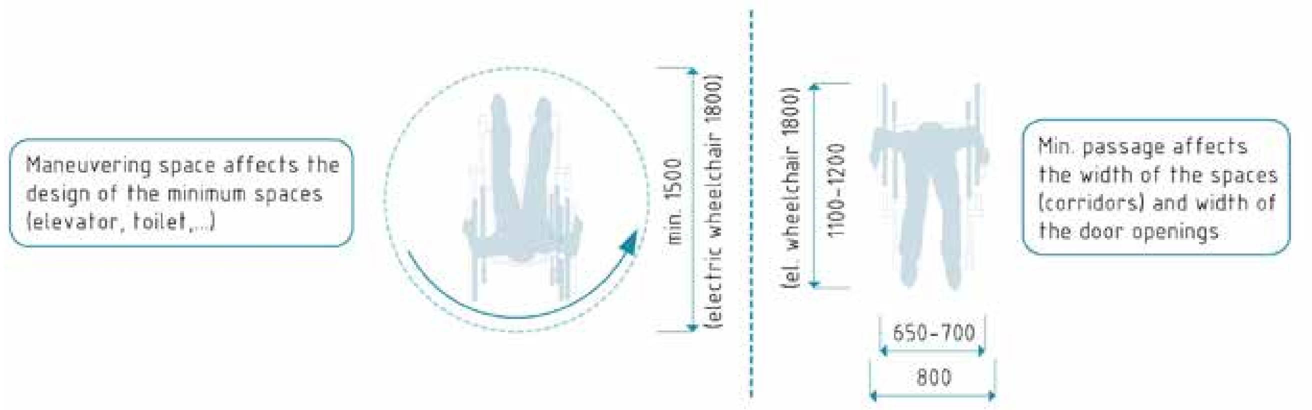

Figure 3.1.5 Spatial requirements of person in a wheelchair (Suláková)

1.1.3 Environmental psychology and neuroscience in architecture

The **challenge in architectural design** is to create such an environment that is **not only** responding to the **functional needs of the people**, but also reflecting their **psychosocial, cultural, and other needs**. Therefore, architectural design is linked with environmental psychology and neuroscience, which draws attention to the psycho-social aspects of the environment and examines the impact of the environment on people and their health and well-being. In the context of human-centred design, there is also an extended understanding of the attributes of a universally accessible environment, which includes, for example, physical, sensory and information accessibility, visitability, adaptability and flexibility of the environment for a wide range of people.

Architect and environmental psychologist Dak Kopec (2012) in his book "Environmental Psychology for Design" presents three basic **levels of human-environment interactions**:

- physical (e.g. the effect of lighting, temperature, colour and humidity on humans),
- social (e.g. the impact of the family environment, labour relations, etc.),
- biological (e.g. the effect of allergens, harmful substances, etc.).

It is also important to consider the impact of the **cultural background**, which affects people's interactions and attitudes towards the built environment.

Edelstein (2016) uses the term "**neuro-architecture**" as a new field of study that seeks to expand our understanding of the influence of the built environment on the brain, body and behaviour. Edelstein also introduces the new term "**neuro-universal approach**", as a response to the diversity of human abilities in the cognitive area (sensory perception, memory, orientation skills, emotions, etc.). **Neuroscience in architecture** is helping to design such an environment that minimises negative physiological, cognitive, and emotional effects. Advances in neuroscience are now able to explain the ways in which we perceive the world around us and navigate in space and the way our physical environment can affect our cognition, problem-solving ability, and mood. (Sternberg and Matthew, 2006).

An inclusive environment is not just about the physical accessibility of the built environment, but considers several factors, such as the psychological, social and cultural needs of a person. These factors are related to how a person perceives and feels (safe, tolerant, friendly) in the environment and society.

1.2 EMPATHIC AND SIMULATION EXERCISES

IN A NUTSHELL

The empathic and simulation exercises provide students or the general public with experience the situations and requirements of different people, e.g. a person in a wheelchair, person with visual impairment using a white cane, person with a broken leg or with a baby carriage, etc. Various aids, such as a wheelchair, glasses simulating various visual impairments, etc. can be used in these exercises.

Human-centred approach in the design process is based on a cooperation with the various people in participatory planning and to experience and understand different users' situations in empathic and simulation exercises.

Empathic exercises are based on three steps: (1) exploring people/users, (2) immersing into other people's lives through a simulation experience, and (3) connecting with people/users (Kouprieand, Sleeswijk Visser, 2009). To **cover heterogeneous groups of people**, empathic simulation exercises should consist of:

- simulation of a blind person's movement with a white cane;
- on-site survey from the position of person in a wheelchair;
- on-site survey using a baby carriage or using heavy luggage.

Simulation exercises can be conducted in an existing built environment (e.g. public spaces and buildings) or in a specially created environment, such as an exhibition with different types of spaces (e.g. Black Box – completely dark interior to show visitors how a blind person feels the space). These exercises can help students/visitors to test accessibility, safety, perceptibility and usability of different spaces, information and products.

Figure 3.1.6 a,b Simulation exercises in public spaces – in cooperation with Slovak Blind and Partially Sighted Union (Čerešňová)

Figure 3.1.7 a,b,c Simulation exercises in public spaces – survey of the exterior of the building from the position of person with visual impairment and person in a wheelchair (Čerešňová)

Figure 3.1.8 a,b,c Simulation exercises in the building – survey of the interior from the position of person in a wheelchair (Čerešňová)

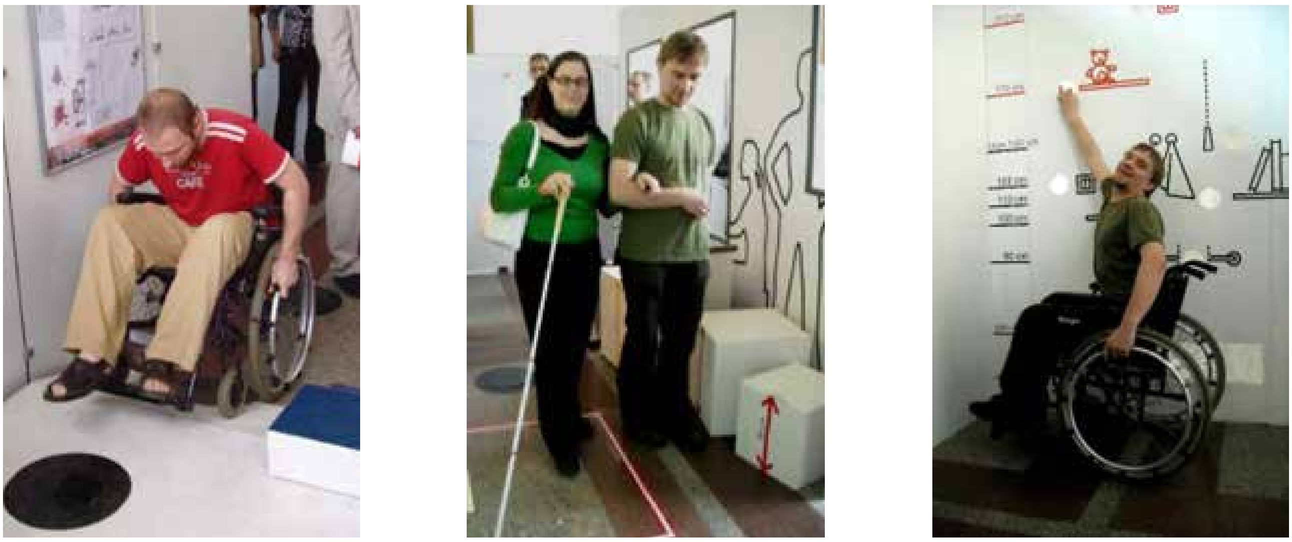

Figure 3.1.9 a,b,c Simulation exercises in a specially created environment – exhibition with different types of spaces (Čerešňová)

Empathic exercises help to **understand the interaction between people and environment/ society**, which may cause limitations to some groups of people due to incorrect design solutions. These exercises can help to better understand functional limitations of the built environment. Usually, some people do not realise the obstacles in the built environment but sitting in a wheelchair they discover how difficult it is to manage going up a steep ramp or to open a door and enter a room. By simulation exercises they understand how a good design can help to make the environment more accessible and usable for all people.

Another positive effect of simulation exercise is that attention is **shifted from visual perception of architecture to more multisensory experience** of all components of the environment, including hearing, touching and smelling. Multi-sensory perception and accessibility of the built environment, communication and information systems are often underestimated. Herssens and Heylingen (2007) point out that in the process of creating an environment without considering the user-friendliness, multi-sensoriality and functionality, this can result in physically and cognitively inaccessible spaces.

1.2.1 Instructions for emphatic/simulation exercises

- provide simulations of various types of limitations in the built environment (e.g. moving in a wheelchair, moving with white cane, moving with a baby carriage or using heavy luggage…)
- select different types of environments in exterior and interior spaces (with different surfaces, slopes, dimensions…)
- at the beginning provide basic information about the moving in a wheelchair, with white cane or other aids
- analyse and describe specific situations, for example:
- How to find the way with white cane (simulation of blind person) when the space is very spacious (such as square) without any orientation elements or guiding lines?
- How to move in a wheelchair when the slope of the ramp/terrain is very steep?
- How to move up the stairs when your legs are stiff (simulation with fixation of the legs)?
- How to open the door/window when sitting in a wheelchair or moving with white cane?
- How to reach the things (e.g. books in shelves) when sitting in a wheelchair?

1.3 HUMAN-CENTRED DESIGN METHODS AND PRINCIPLES

IN A NUTSHELL

Human-centred design is a broad term and contains many approaches and methods. However, all of them have one common aim, to create an accessible, usable and friendly built environment for all the diverse groups of people. Among them, we will study Universal Design (origin in the USA, 7 principles), Design for All (origin in Scandinavia) and Inclusive Design (origin in the UK, 5 principles) in more depth in this unit.

When creating the built environment, it is necessary to consider the diversity of people, so that a wide range of people have equal opportunities to use the physical environment, products, services and information. Therefore, it is necessary to use methods with a **human-centred approach** that focuses on people and their diverse needs, demands and abilities, such as methods:

- Human-Centred Design
- Design for All
- Universal Design
- Inclusive Design
- Design for all ages/Age-Friendly Design
- User-friendly Design/People-Friendly Design
- Body Conscious Design
- Participatory Design
- Barrier-free design/Accessible Design

Different terminology is related to the cultural-geographical and historical background in different parts of the world, for example, Universal Design has its roots in the USA and Inclusive Design originated in the United Kingdom. The term Barrier-free Design was originally aimed at removing barriers in the built environment in the 1950s to make it accessible to people with disabilities. Later, this term was replaced by the term Accessible Design to emphasise the concept of environmental accessibility, and not just the removal of barriers as a result of unsatisfactory design solutions. There is currently an emphasis on the shift from environmental accessibility to social inclusion (full integration of all people into society), which emphasises the importance of everyone's active participation in society as one of the factors of social sustainability. Thus, human-centred design becomes part of the strategy and creation of sustainable development (Sustainable Design).

1.3.1 Human-Centred Design

At the end of the 20th century, **human-centred design** began to develop in the field of ergonomics and information and communication technologies, in which attention was focused on the interaction of humans and products/computers in order to ensure comfortable and intuitive user properties of these products (Zhang, Dong, 2009). Human-centred design is defined in this area as a technical term in the international ISO standard (ISO 9241-210:2010 Ergonomics of human-system interaction. Part 210: Human-centered design for interactive systems) as
"…an approach to interactive systems development that aims to make systems **usable and useful** by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques. This approach enhances effectiveness and efficiency; **improves human well-being, user satisfaction, accessibility and sustainability**; and counteracts possible adverse effects of use on **human health, safety and performance**."

Later, human-centred design spread to other areas of creating environments and services, and even began to be enforced as a **way of design-thinking**, promoted mainly by the American company IDEO, which created the Human-Centered Design Toolkit in 2011 and The Field Guide to Human-Centered Design in 2015. Human-centred design is moving the focus from the user to the person, it means considering the recipient not only as a user, but as a carrier of needs, desires, emotions that go beyond the most functional aspects.

Human-centred design is characterised as an **innovation inspired by people**, involving people in the creative process itself in the form of **participatory planning**, in which they can actively make decisions about the creation of the environment or products. The **basic features of human-centred design** (IDEO, 2011) are:

- empathy (as a deep understanding of different human needs)
- collaboration (as a benefit of multiple user experiences and perspectives)
- optimism (as a belief that we can all improve the environment/products)
- experiment (as a driving force leading to more radical changes)

Figure 3.1.10 Basic features of human-centred design (Suláková according to IDEO, 2011)

1.3.2 Design for All

The Design for All method was initiated by the European Institute for Design and Disability (EIDD) – Design for All Europe, which was established in 1993. According to the EIDD Stockholm Declaration, adopted on 9 May 2004 at the EIDD General Assembly in Stockholm, the Design for All method has its roots in Scandinavian functionalism and ergonomic design. The social policies of the Nordic countries, especially in Sweden, supported the birth of the "**society for all**" concept in the 1960s, emphasising the importance of environmental accessibility. The concept of Design for All was introduced at the EIDD General Assembly in Barcelona in 1995.

The EIDD Stockholm Declaration (2004) defines Design for All as **design for human diversity, social inclusion and equality**. It provides a precise definition of Design for All and describes its purposes:
"This holistic and innovative approach constitutes a creative and ethical challenge for all planners, designers, entrepreneurs, administrators and political leaders. Design for All aims to enable all people to have **equal opportunities to participate in every aspect of society**. To achieve this, the built environment, everyday objects, services, culture and information – in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and **responsive to evolving human diversity**. The practice of Design for All makes conscious use of the analysis of human needs and aspirations and requires the involvement of end users at every stage in the design process." (EIDD Stockholm Declaration, 2004)

At present, the concept of Design for All needs to become an essential part of **sustainable development strategies**. For this reason, the EIDD, through the Stockholm Declaration, calls on the European institutions, national and public administrations in each European country, as well as the professions and organisations involved in planning and creating the environment and products, to implement the principles of Design for All into legislation and national strategies.

Design for All method is a **holistic and innovative approach** in making the built environment and products accessible and usable to a wide range of people. Design for All uses a human-centred approach for creating a people-friendly built environment, products and services. This method is a key driver of change towards an inclusive society.

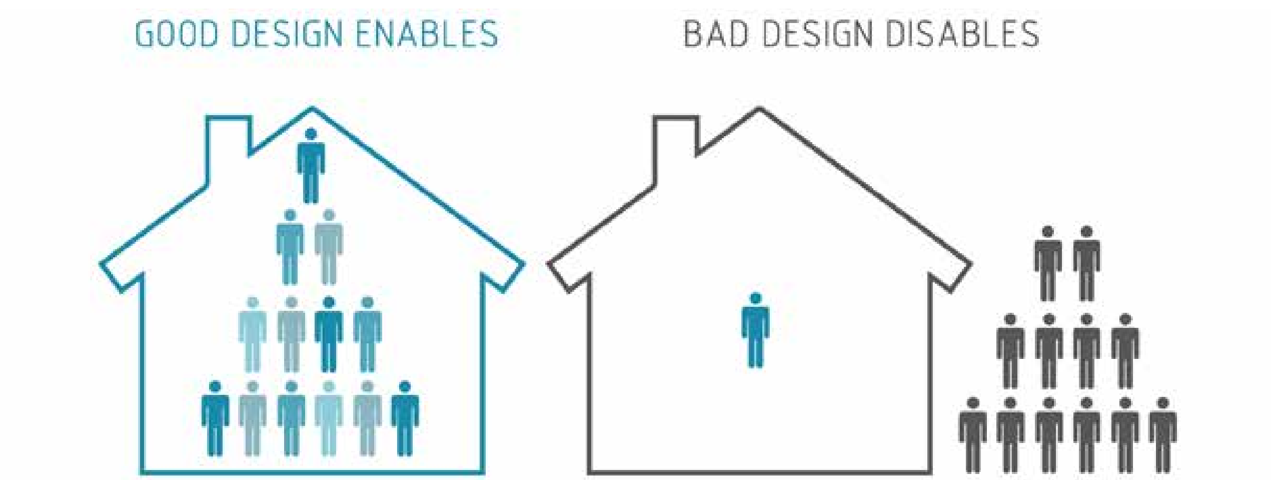

Figure 3.1.11 Scheme illustrating quotation „Good design enables, bad design disables" by Paul Hogan, founding member of the EIDD (author of the scheme Lenka Suláková)

1.3.3 Universal Design

Universal design does not provide the same solution for all people ("one size fits all") but emphasises the need for flexibility and adaptability of the environment so that it can reflect the individual needs of a wide range of people with diverse abilities and limitations.

A major milestone in the development of Universal Design was the formulation of **Seven principles of Universal Design** (NCSU, 1997) developed within the research centre at the North Carolina State University, coordinated by architect, designer and educator Ronald L. Mace. Each principle can be associated with a group of **design guidelines**:

- **Principle 1 – Equitable Use**: the design is useful and marketable to people with diverse abilities:
  a) Allows the same use to all users: identical, when possible, otherwise equivalent;
  b) Avoid segregating or stigmatising any users;
  c) The conditions of privacy, security and safety should be equivalent for all users;
  d) Makes the project attractive to all users.
- **Principle 2 – Flexibility in Use**: the design accommodates a wide range of individual preferences and abilities:
  a) Allows the choice of the method of use;
  b) Allows access and use with left hand and right hand;
  c) Facilitates accuracy and precision of the user;
  d) Provides adaptability to the characteristics of the user.
- **Principle 3 – Simple and Intuitive Use**: use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level:
  a) Eliminates unnecessary complexities;
  b) Corresponds to the expectations and intuition of the user;
  c) Provides a great variety of reading and comprehension alternatives;
  d) Structures the information consistently with their importance;
  e) Provides suggestions and signals during and after user actions.
- **Principle 4 – Perceptible Information**: the design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities:
  a) Uses different methods (visual, verbal, tactile) for a redundant presentation of the essential information;
  b) Provides adequate differentiation between essential and secondary information;
  c) Maximises the readability of essential information;
  d) Differentiates the elements so that they can be described (facilitating the issuance of instructions and directives);
  e) Provides compatibility with a variety of techniques and devices used by people with sensory limitations.
- **Principle 5 – Tolerance for Error**: the design minimises hazards and the adverse consequences of accidental or unintended actions:
  a) Places the elements to minimise risks and errors: the most used elements are more accessible; the risky elements are eliminated;
  b) Provides warnings on risks and errors;
  c) Provides elements of protection;
  d) Discourages unintentional actions or requires alertness.
- **Principle 6 – Low Physical Effort**: the design can be used efficiently and comfortably and with a minimum of fatigue:
  a) Allows to maintain a neutral position of the body;
  b) Requires a reasonable activation effort;
  c) Minimises repetitive actions;
  d) Minimises the physical effort supported.

- **Principle 7 – Size and Space for Approach and Use**: appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility:
  - a) Provides a clear view of the important elements for any seated or standing user;
  - b) Makes comfortable achieving all the components for any user sitting or standing;
  - c) Allows variations in the size of the hands and the handle;
  - d) Provides adequate space for the use of assistive devices or personal assistance.

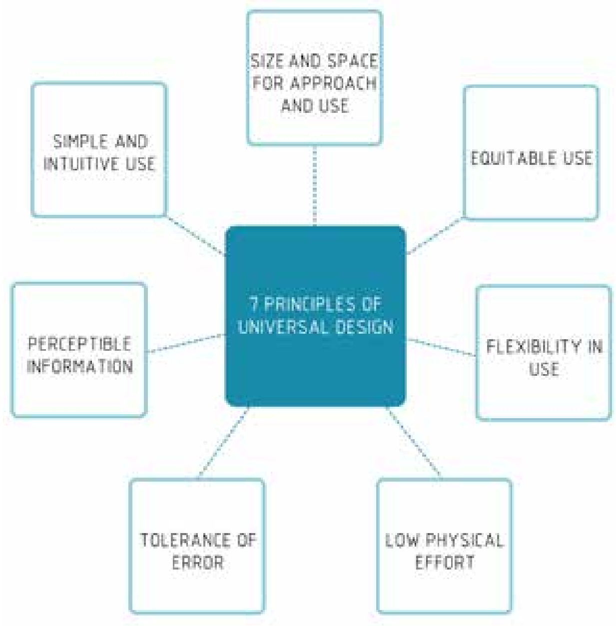

Figure 3.1.12 Diagram with 7 principles of Universal Design (Suláková according to Connect Design, 2020)

Steinfeld (2014), together with his colleagues, believes that a stronger acceptance of Universal Design in practice can be achieved by placing greater emphasis on social participation, focusing on **health and well-being**, recognizing the role of the context of the environment, and conceptualising **Universal Design as a process** rather than as a set of rules. Therefore, they propose the following definition: "Universal Design is the process that empowers diverse people by improving their performance, health, well-being and social participation in the environment." (Steinfeld and Maisel, 2012)

That was the incentive for the development of eight **Goals of Universal Design** (Steinfeld and Maisel, 2012):

1. Body Fit – Accommodating a wide range of body sizes and abilities.
2. Comfort – Keeping demands within desirable limits of body function.
3. Awareness – Ensuring that critical information for use is easily perceived.
4. Understanding – Making methods of operation and use intuitive, clear, and unambiguous.
5. Wellness – Contributing to health promotion, avoidance of disease, and prevention of injury.
6. Social Integration – Treating all groups with dignity and respect.
7. Personalization – Incorporating opportunities for choice and the expression of individual preferences.
8. Cultural Appropriateness – Respecting and reinforcing cultural values, and the social and environmental contexts of any design project.

1.3.4 Inclusive Design

The term "inclusive design" was used in the United Kingdom (UK) in the early 1990s, initially in connection with the "DesignAge" research project, which aimed to ensure an independent and quality life for an ageing population. Later, based on this project, the Research Centre for Inclusive Design the Helen Hamlyn Centre for Design, which is part of the Royal College of Art, was established in London. Currently, the centre also uses the term "people-centred design," that is, human-centred design.

In British standards, inclusive design is defined as "the design of common products and services that are accessible and usable to the widest possible range of people without the need for special modifications or special designs".

The Commission for Architecture and the Built Environment (CABE, now the Design Council) in the United Kingdom **defines inclusive design** as "the process by which an environment is planned, designed, managed, implemented and used with respect to the human being".

This definition emphasises the importance of applying the principles of inclusive design at all stages of the environment process. CABE is the creator of **five principles and key concepts of inclusive design** (CABE, 2006):

1. **People** – inclusive design places people at the centre/heart of the design process from its inception, through the active participation of users to project implementation;
2. **Diversity** – inclusive design acknowledges diversity and difference of individuals in terms of age, abilities and limitations;
3. **The right to choose** – inclusive design offers choice where a single design solution cannot accommodate all users;
4. **Flexibility** – inclusive design provides flexible environment and product solutions that are adaptable to the needs of a diverse range of users;
5. **Convenience** – inclusive design creates solutions that are comfortable and enjoyable for all users.

Figure 3.1.13 Diagram with 5 principles of Inclusive Design (Suláková according to CABE, 2006)

The Engineering Design Centre at the University of Cambridge developed an online Inclusive Design Toolkit in 2017 (www.inclusivedesigntoolkit.com). This centre provides training workshops and consultancy services on inclusive design.

1.3.5 Main characteristics of human-centred spaces

The basic characteristics of architectural and urban spaces, which are designed by the human-centred approach, are defined by Lori Gee (2006) using four areas, which can be specified in more detail as:

1. **Healthy space**
   - creating a sense of **physical and mental well-being** and respecting ergonomic aspects and the human diversity;
2. **Stimulating space**
   - offering a variety of **multisensory experiences** (visual, tactile, auditory and kinaesthetic) that have a positive impact on memory and information processing for different people, including people with sensory disabilities,
   - enabling **visual accessibility** and perceptibility of the space, as well as contact with the outdoor environment (especially the natural one);
3. **Space that balances community and solitude**
   - accepting person's need to be alone or in society/community,
   - combining a wide range of private spaces (sense of privacy), but also interactive spaces for group activities and socialisation;
4. **Adaptable and flexible space**
   - supporting the diversity of people and the diversity of activities,
   - providing flexibility and sufficient space for various groups (individual space, spaces for small or larger groups),
   - providing adaptable (e.g. height-adjustable) and mobile furniture, but also technologies that can be easily adapted to various needs of people,
   - using various information and communication methods, thus supporting several styles, or even different sensory abilities of individual persons.

According to the principles of Inclusive Design set out by CABE (2006), the human-centred space should have following characteristics:

- **Inclusive** so everyone can use them safely, easily and with dignity.
- **Responsive** taking account of what people say they need and want.
- **Flexible** so different people can use them in different ways.
- **Convenient** so everyone can use them without too much effort or separation.
- **Accommodating for all people**, regardless of their age, gender, mobility, ethnicity or circumstances.
- **Welcoming** with no disabling barriers that might exclude some people.
- **Realistic** offering more than one solution to help balance everyone's needs and recognising that one solution may not work for all.

1.4 LEGISLATIVE FRAMEWORKS AND EUROPEAN INITIATIVES

IN A NUTSHELL

The goal of many legislative documents, standards, initiatives and organisations is to promote universal accessibility and usability of the built environment.

Binding legislative documents:
- Convention on the Rights of Persons with Disabilities (CRPD)
- Union of Equality: Strategy for the Rights of Persons with Disabilities

Standards:
- Building construction — Accessibility and usability of the built environment
- Accessibility and usability of the built environment – Functional requirements

European organisations:
- EIDD – Design for All Europe
- EuCAN – The European Concept for Accessibility Network

Nowadays, the topic of human-centred approach and universal design is of a great importance for society all over the world. As inclusion and accessibility for all people with various needs and of different ages develops, these ideas become increasingly incorporated into various conventions, declarations, standards, and networks.

Many countries and cities are proclaiming to take steps to create an **inclusive and friendly living environment for all**. These intentions are reflected in their **legislative frameworks** and in various initiatives (unions, networks).

This unit provides information about the most important **documents and organisations** dealing with the issue of accessibility and universal design in the **European Union**.

1.4.1 Convention on the Rights of Persons with Disabilities

The **Convention on the Rights of Persons with Disabilities (CRPD)** is a fundamental international human rights treaty of the **United Nations** intended to protect the rights and dignity of persons with disabilities. This convention emerged from several previous declarations and became widely accepted throughout the world. It started an evolution of views from seeing persons with disabilities as objects of charity, medical care and social protection towards seeing them as full and equal members of society with human rights. (Pyaneandee, 2019, pp. 19–21).

The CRPD was created in 2006 and entered into force in 2008, was signed by 184 parties up to present (2022) and ratified by most of them. **The European Union** signed the CRPD in 2007 and **ratified** it in **2010**. (United Nations, 2006) Figure 20 shows the map exemplifying the participative countries.

The CRPD consists of the preamble and 50 articles. **Article 2** deals with **definitions** including universal design (United Nations, 2007, p. 4): "**Universal design**" means the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.

Article 3 mentions **general principles** such as respect, non-discrimination, participation and inclusion in society, equality, accessibility, and other (United Nations, 2007, p. 5). Article 4 states General obligations and further articles deepen and widen the ideas briefly named in Article 3.

Article 9 characterises **Accessibility** (United Nations, 2007, p. 9): "To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications […]" This article explains the areas which need to be accessible. Public buildings, spaces and components of the physical environment (for example, public transport) must be barrier-free. Moreover, crucial information should be accessible, presented in several ways, for example, using Braille and in easy-to-read and understand forms or also in sign language. The following articles deal with other important areas of life, for instance, situations of risks, access to justice, liberty, freedom from torture, exploitation, etc., living independently and being included in the community, personal mobility, freedom of opinion, respect for privacy, right to education, health, work, participation in all kinds of public life, and others.

Figure 3.1.14 The map exemplifies the participative countries (light: signed the CRPD, dark: signed and ratified the CRPD, Suláková).

1.4.2 The Strategy for the Rights of Persons with Disabilities 2021–2030

The document **Union of Equality: The Strategy for the Rights of Persons with Disabilities 2021–2030** (European Commission, 2021) is also a very important source of information. It follows the CRPD and other previous policies, The European Pillar of Social Rights and The European Disability Strategy 2010–2020. Despite these several prior documents, the European Commission sees a need for improvement in this area because there are still many barriers and risks. In addition to these shortcomings, the Strategy for the Rights of Persons with Disabilities 2021–2030 also examines consequences of the Covid-19 pandemic.

Similarly, to the CRPD, it discusses visions for accessibility, rights, autonomy, and equality. It also focuses on supporting **independent living**: accessible, inclusive housing in the community. The document promotes appropriate **community-based services** instead of institutional services, which show many obstacles, thus they support **deinstitutionalization** (European Commission, 2021, pp. 10–12). This topic includes older people, who should also not live in institutions, but rather in community-based homes.

The document further deals with inclusion in work, social protection, access to justice, education, healthcare, and other important areas of life such as culture and leisure activities.

1.4.3 Standards for accessibility and universal design

Standards elaborated according to principles of accessibility and universal design are very important sources of information. Standards consist of texts accompanied with illustrations detailing requirements for an inclusive built environment. They are essential, namely, for architects and designers.

One of the important standards is **Building construction — Accessibility and usability of the built environment** (ISO 21542:2021). It is an international standard, which is however not binding for the European Union, but further standards emerge from it. It also had a previous version from 2011 and followed by an earlier standard from 1994, Building construction — Needs of disabled people in buildings — Design guidelines. The current standard (ISO 21542:2021) replaces previous versions and specifies a range of **requirements and recommendations** for designing safe, inclusive, age-friendly and sustainable built environments that are accessible and usable by all people. The authors of the standard explain its objective in the following way: “The purpose of this document is to describe how a building should be designed, constructed, managed and maintained in order to enable people to approach and enter the building; use the facilities, services and information networks; egress from the building under normal conditions; and evacuate the building during an emergency.” (ISO 21542:2021, Introduction)

The scope of this standard includes the elements of construction, building assemblies, etc., and products that relate to usability and accessibility of buildings, i.e., access to buildings, circulation within buildings, evacuation, etc.

It also deals with common spaces in units on residential buildings. Recommendations regarding **residential units** are given in Annex A of the document. Furthermore, the reader can also find information about outdoor features directly concerned with access to a building; however, not about separate public open spaces not related to the use of a building.

Another essential standard for creating an inclusive built environment is **Accessibility and usability of the built environment – Functional requirements** (EN 17210:2021). It is based on a previous document, ISO 21542:2011 Building construction – Accessibility and usability of the built environment. This standard is the most important one for countries of the European Union because it has binding character; thus, the standard must be transferred to the national legislations of the member states. The current standard (EN 17210:2021) specifies functional requirements and recommendations for an accessible and usable built environment, following Design for All/Universal design principles applicable across the full spectrum of the built environment. In addition to building and interior environments, the standard also addresses urban settings. The requirements are elaborated based on the widest range of user needs and target groups, among others, older persons. Thus, it is a remarkably complex document in terms of varying physical environments and regarding multiple points of view of people with different needs.

The chapter on housing defines **adaptable housing**, which means "dwellings for all people throughout the lifecycle or in response to changing needs of the residents" (EN 17210:2021, p. 214). In addition to temporary situations such as injuries, it also considers ageing. Due to flexibility in basic design, easy and cost-effective adaptations can be made to housings. "This is especially important in an ageing society to make it possible for people to "**age in place**" or remain living in their own home as they get older." (EN 17210:2021, p. 214) The adaptability needs to be considered from the beginning, then it proposes affordable and easy changes when it is needed. The term "Lifetime Homes" can be used to address this topic.

1.4.4 Networks

Organisational networks dealing with issues of inclusion, accessibility, and universal design have a very important position in spreading a human-centred approach in design of the built environment.

EIDD – Design for All Europe, established in 1993, has one of its goals „to promote, communicate and disseminate the theory and practice of Design for All as a tool for social and economic inclusion "(EIDD, 1993, updated 2010). This platform spreads information about Design for All, promotes diversity, inclusion, and equality, and organises events (seminars, conferences, webinars, etc.) supporting these ideas. They formulated the **EIDD Stockholm Declaration (2004) with the quote**: "Good design enables, bad design disables". Concerning older people, one can mention an online event from 2021 "Design Age Institute: Age, Agency & Joy" by Royal College of Art dealing with designing products and services to experience joy at every age. Among the members is CEDA (Centre of Design for All) at Faculty of Architecture and Design, Slovak University of Technology in Bratislava, where the co-authors of this publication participate.

Another organisation is **EuCAN – The European Concept for Accessibility Network**. It states similar values as accessibility, inclusion, and human-centred philosophy. Its beginnings go back to 1985 and the document European Concept for Accessibility (ECA) was formed in 1996. The network publishes documents that promote the mentioned ideas in multiple languages. The document European Concept for Accessibility (Wijk, 1996) contains information about principles and criteria for accessibility including housings' adaptability and visitability. Another document from EuCAN is ECA European Concept for Accessibility: Technical Assistance Manual (Aragall, 2003). It also deals with theoretical background, as well as practical recommendations. Part of the focus areas of the document is also housing, and it briefly mentions, for example, an accessible kitchen for all.

SUMMARY

To conclude, this unit has shown basic information and background sources for the concepts of inclusion, accessibility, and human-centred design methods based on the **diversity of people, their needs and requirements**.

E**mpathic/simulation exercises** can help to understand different requirements and needs of people in the built environment, including identification of the limits and barriers.

Basic p**rinciples, characteristics and goals of human-centred design methods, such as Universal Design, Inclusive Design, Design for All** provides holistic solutions for creation of people-friendly (as well as age-friendly) environment.

Important and **binding documents** are the legislative ones, especially the United Nations' **Convention on the Rights of Persons with Disabilities** (CRPD) and the **Union of Equality: Strategy for the Rights of Persons with Disabilities** of the European Commission.

Then there are standards that are more technical and deepen the knowledge in detail. Among the important standards are **Building construction — Accessibility and usability of the built environment** (ISO 21542:2021) and **Accessibility and usability of the built environment – Functional requirements** (EN 17210:2021). They are essential for architects and designers who form the living environment.

Finally, there are several European organisations dealing with this issue. We have mentioned **EIDD – Design for All Europe and EuCAN – The European Concept for Accessibility Network**. These organisations promote, support, and spread awareness about inclusive design and inclusive society.

All these components are important pillars to create and better understand the design and notions of inclusive, accessible environments.

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MODULE 3

AGE-FRIENDLY BUILT ENVIRONMENT – ARCHITECTURE

UNIT 2

MULTISENSORY ENVIRONMENT AND WAYFINDING

Zuzana Čerešňová • Michal Kacej

DESIRE

DESIGN FOR ALL METHODS TO CREATE AGE-FRIENDLY HOUSING

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DESIRE will provide professionals in the building industry and home furnishings sector with the tools and skills to apply Design4All methods as an integral part of the design process, with the aim to create or adapt age friendly housing as a solution for the wellbeing, comfort and autonomy of the older adults or dependents at home.

The DESIRE training platform consists of six modules and 21 units.

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UNIT 2 – MULTISENSORY ENVIRONMENT AND WAYFINDING

This unit provides an overview of the wayfinding methodology which should help course participants create a multisensory and legible environment that facilitates and supports the wayfinding process. It includes architectural and graphic design guides and improvements for building organisation and layout that support wayfinding. Application of this knowledge on the age-friendly built environment can contribute to a more pleasant and supportive living space for all generations.

2.1 WAYFINDING AND SPATIAL ORIENTATION

IN A NUTSHELL

Spatial orientation is a fundamental aspect for the survival of mammals. Human beings are characterised by their focus on their goals in life, be it in a physical environment or a virtual one. Since the specificity of the objectives may differ, it is necessary to use different expressions to describe this process.

2.1.1 Movement in environment

Movement in the built environment is a multisensory experience because people are an integral part of it, thanks to the multisensory perception through the use of a combination of several senses (such as sight, hearing, touch, smell) and perception of body movement.

Each of us knows the inconvenience of momentary **disorientation due to insufficient recognition of an environment** as a direct consequence of the failure of the process of finding the way. Spatial disorientation causes feelings of **uncertainty and has a negative impact on people's overall well-being**. To understand these reasons, we need to know the development of human beings and the cognitive aspects connected with orientation in space.

The prehistoric hunter sought to control the natural environment, following natural landmarks, animal tracks and their odour so as to avoid danger and obtain adequate food. The position of the sun, the moon and stars was a reference that offered information about time and space. Then, as now, **intuition helps when we lack information**. Success lies in making the right decision when there is not enough information.

There are two types of targeted human movement in the physical environment:

- navigation, the tracking of guided routes – the term also includes the science of directing a craft by determining its position, course, and distance travelled;
- wayfinding, the ability of people to regularly reach the desired destination, is considered a fundamental physical, psychological and social need that has a direct impact on people's autonomy and quality of life, their behaviour and comfort.

2.1.2 Wayfinding

The term wayfinding was coined by Kevin Lynch, an urban planner, in his book The Image of the City in 1960. In his research, he investigated how the characteristics of a built environment affect the way people recognize and remember features in it and how a person's whole sense of well-being is deeply attached to their sense of space and time. In 1992, Arthur and Passini described **wayfinding as spatial problem solving** consisting of three interrelated steps:

- **decision making** and the development of a plan of action;
- **decision execution**, which transforms the plan into appropriate behaviour at the right place in space;
- **information processing** understood in its generic sense as compromising environmental perception and cognition, which, in turn, are responsible for the information basis of the two decision-related processes (Arthur, Passini, 1992, p. 25)

We should perceive wayfinding as a necessary spatial problem-solving capability to reach the destination if there is no appropriate solution in memory. During the process, people follow strategies as algorithms, how to follow the way that leads to their desired destination. **Good wayfinding is clear, intuitive, and non-verbal**. This process is part of cognitive spatial skills and the results are mental spatial representations, called **cognitive maps**. The ability to focus mainly on important location information, which helps in wayfinding, is related to this topic.

According to EN 17210 – chapter 6, wayfinding is a system where suitable information is available to assist a person to move through an environment to a specific location. It is related to the features of the environment which help with:

- **orientation** – processing of information such as location and direction;
- **navigation** – planning and following the way, avoiding obstacles, etc.

From the point of view of education and professional training, the responsibility for designing space has always lain with architects or interior designers. They are supposed to provide architectural designs which include adequate wayfinding features and can then be enhanced by other disciplines. Even without interior designers or graphic designers, a good architectural design should communicate to users how to get through the building, where to go, and where not to go. Architects should also understand the neuroscientific aspects of perception to better understand the users of the space. This is the reason why **this unit delves into those aspects of neuroscience, architecture, and perception that can assist in improving the wayfinding** and also the conditions of the personal experience of each user, their abilities, emotions, or skills. The application of this knowledge on the age-friendly built environment can contribute to a more pleasant and supportive living space for all generations.

The built environment should be designed, constructed and organised so as to aid orientation and navigation. The main principles that we will cover in more detail in this unit are:

- clear and comprehensible multisensorial information
- effective visual perception – good lighting and visual contrast
- tactile guidance
- logical, spatial organisation based on the appropriate design of key elements: approach, entrance and circulation system with sufficient amount of landmark points
- wayfinding signage – with appropriate design and placement

2.1.3 Cognitive accessibility

The term cognitive accessibility is commonly used by web developers. According to BOAI (Bureau of Internet Accessibility), the **term refers to inclusive practices that remove barriers for people whose disabilities affect the way they process information**. In architecture and design it is closely related to wayfinding – a **decisive characteristic of the environment which essentially determines the capacity for interaction and autonomy of each person and the chance for full social participation**.

The interplay between our cognitive abilities, the information offered by what we interact with, our background knowledge, and the circumstances of a particular moment may result in a positive inclusive experience or a situation of exclusion. Therefore, it is important to understand the principles of neuroscience, physical science, and biological science when designing an inclusive environment for all people.

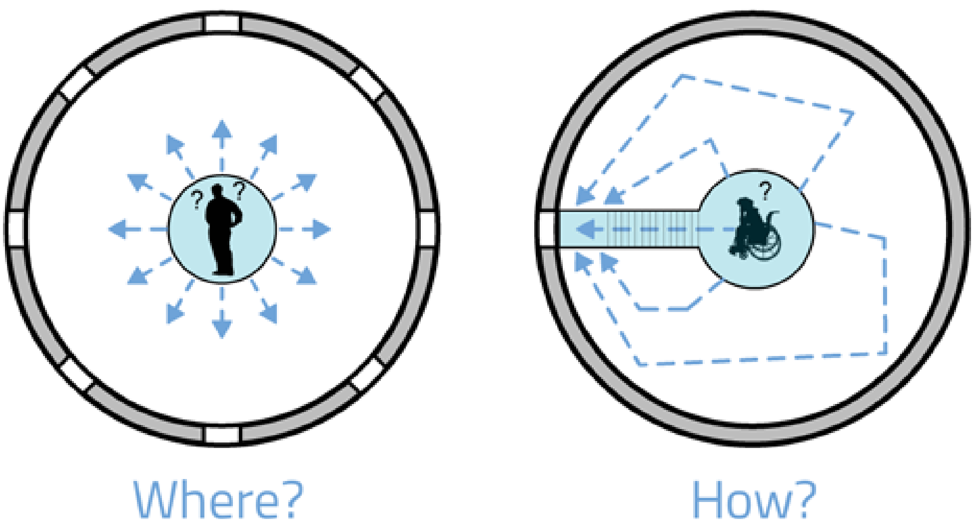

Figure 3.2.1 Difference between physical and cognitive accessibility (Kacej)

The design factors, fundamental in the cognitive processes, must be precisely identified and experienced to create a cognitively accessible environment, suitable also for the necessary conditions of physical and sensory accessibility. These experiences of satisfactory, effective, and successful interaction must be measured using a replicable and sustainable approach with respect to the capacities, expectations, and common and specific needs of the target population. The intrinsic simplicity or complexity of performing a task or process is also a factor that determines the challenge of cognitive accessibility, as well as how critical it is for each person to perform daily activities.

2.1.4 Functional ability

Functional ability is a **set of skills that enable people to perform daily activities without supervision or help from others**. It is an essential parameter that affects the quality of life the most. It is closely connected with healthy ageing, which the WHO described as "the process of developing and maintaining the functional ability" that enables wellbeing in older age. The better the functional ability – the higher the life expectancy. The World Report on Ageing and Health presents a framework for action to promote healthy ageing. New functional capacity concepts move away from the health or treatment models and bring them closer to comprehensive care, focusing on older people. What the report says about ageing can be applied to a set of all the people who, for some reason, maintain a situation of dependence on another member of society or who receive technical aids to preserve their autonomy.

2.1.5 Empathy and understanding

Empathy is the ability to understand and share the emotions of others and the basis for the experience and techniques of participatory design methods. Age-friendly design is based on empathy and understanding. The key is to engage the community and learn about their experience. Their comments implying disorientation could have several interpretations, and all could be valuable, as long as they explain and specify where disorientation points are.

2.1.6 Legibility

Legibility is **spatial organisation that helps to perceive and understand the environment**. It evolves through perceiving spatial information and processing it appropriately for the pertinent purpose. This essential quality of an age-friendly built environment is mainly determined by primary factors, the architectural design instruments, such as the building layout of the circulation space. In addition, helpful wayfinding elements such as graphical signage, among others, can be included as non-architectural instruments or secondary determining factors. Beyond the appropriate layout of the circulation system, all spaces or buildings must be designed to be legible. Their function is evident from their size, proportion, materials used, and furnishing. Thus, distinct and easily memorable places are created to help enhance the users' orientation.

In order to achieve legible space, it is necessary to design an accessible and supportive environment that allows perception and supports human spatial experience and promotes mobility and independence. In terms of navigation, a building should contain enough **landmark points** that can serve as navigational aids by providing a choice of points along a route. Familiarity with the environment is also helpful, which can be achieved by incorporating “known” landmark points or creating new ones life-based references of the user.

2.2 MULTISENSORY EXPERIENCE

IN A NUTSHELL

Architecture is often understood as a visual phenomenon; however, the opposite is true. If we use more senses for perception, the experience of space will be more intense. It helps to perceive the area entirely, subsequently creates a more intimate relationship between the perceiver and the environment and plays a crucial role in the perception of space by people with disabilities. However, it is necessary to avoid overstimulation as it harms the perceiver.

The main senses used in the wayfinding process are:

- sight is dominant because of its directional character, which can rapidly transfer information about colour or shape;
- hearing is omnidirectional, which makes acoustic alarms one of the most effective warning systems, it integrates and makes the space favourable;
- touch includes a perception of texture or temperature, it connects the body with its environment, and suitable ventilation and sunlight also stimulate the sense of touch;
- smell is immersive and helps associate space with smell, but it is only a complementary sense that streamlines the wayfinding process;
- taste is a sense that is not directly related to the human and space interaction, and this also applies to wayfinding.

References to architectural and urban designs that are perceived through senses other than sight should be used as a supplement and placed in key landmark points to support the wayfinding for people with visual impairments, e.g. tactile surfaces and objects or plants with strong scents and colours. These features are useful only if they are functional.

2.2.1 Sight

Sight is the dominant sensory organ in terms of the percentage of information received from the environment. Visual information is information that has been transmitted to the recipient through a visual experience. According to the VEF (Visual Experience Foundation) visual experiences are sight visits that incorporate memorable encounters and educational learning, thereby providing a robust experience that will live on in the individual long after they have lost their eyesight.

For an age-friendly built environment, the significant quality of accessible information is contrast. **Contrast helps** people, including those with partial visual impairments, **to move safely and identify elements** in the built environment. Some people are not able to perceive some or all colours. Most people, including those with partial visual impairments, are able to perceive light and darkness. The perception of visual contrast can be affected by the quality of the lighting. When designing visual contrast in the exterior, the weather and differences in daytime lighting should be taken into account. According to EN 17210, adequate contrast that supports wayfinding should be used:

- between **large areas** – floors, walls, ceilings or doors; contrasting floor patterns that **resemble stairs or holes** and overly decorative patterns **should not be used**;
- between the **door leaf and the door frames** – that includes interior and also entrance doors;
- between the **door leaf and the door fittings** – the door handle or lockset, if tactile interaction is needed;
- between the **wall and the railings or fittings in sanitary facilities**.

High contrast should be used to ensure identification of warnings and potential risks:

- such as windows, glazed facades and glass doors;
- at the edge of the stairs;
- as identification of potential risk – columns placed in the circulation system areas;
- high contrast of signs – information signs, instructions, door labels, etc.

2.2.2 Hearing

Hearing is the process, function, or power of perceiving sound, specifically the special sense by which noises and tones are received as stimuli. Perceived sound transformed into audible information is provided in the built environment to indicate potential risks, for emergency alarms installed in lifts, toilets or bedrooms and in addition to visual information. **Audible information has to be clear, unambiguous and easy to understand**.

2.2.3 Touch

Tactile information is the practice of encoding information that people can interpret through their sense of touch. It is used to provide accessible, safe and engaging designs. People with visual impairments rely on a range of **tactile environmental elements** in the built environment, such as **walls, edges, curbs and railings**. In addition, providing tactile contrast information allows the information to be perceived by touch, usually through fingers, hands or underfoot. A difference in floor surface, for example between grass and paving or between wooden and ceramic floor, can indicate the path to follow or delineate different zones.

Unless clearly provided by natural or building elements, such as a distinct natural edge or curb, warning, guidance, or information to people with visual impairments can be provided through a specific type of tactile walking surface, known as a **tactile walking surface indicator** (TWSI). It must be detectable via shoe soles and white sticks from surrounding or adjacent surfaces, and at the same time, must not cause undue discomfort when walking. **The TWSI must provide a visual contrast with adjacent surfaces to enable additional** identification; the surface must be non-slip and not glossy.

Examples of the use include a warning, when:

- approaching a pedestrian route to a pedestrian crossing where the sidewalk is flush with the road;
- when warning of obstacles on the route;
- when accessing stairs or an elevator;
- it is necessary to provide landmark points in a larger space (such as a square, a pedestrian zone, etc.)

2.3 SPATIAL ORGANISATION

IN A NUTSHELL

In the design of the architectural space, the concept of circulation systems is derived from the biological characteristics of people. Just as a human body in which blood does not circulate is not considered functional, a building in which people do not circulate is not considered functional either. **Spaces in which people move around** within a building **are called communication spaces**.

It is a concept of space between other spaces that has a primary interconnection function. Modernist architecture tended to concentrate on the spatial experience of architecture based on the movement through it. The Swiss-French architect Le Corbusier, one of the most influential architects of the twentieth century, called the concept of such an “itinerary” the Promenade architecturale, which is evident in his most famous works, such as Villa Savoye in Poissy or Villa La Roche in Paris.

Each space is accessible through a communication area that connects it with the rest of the layout. When we talk about the circulation system, we usually focus on the main layout, which means a set of interconnected spaces that serve the primary function of the building.

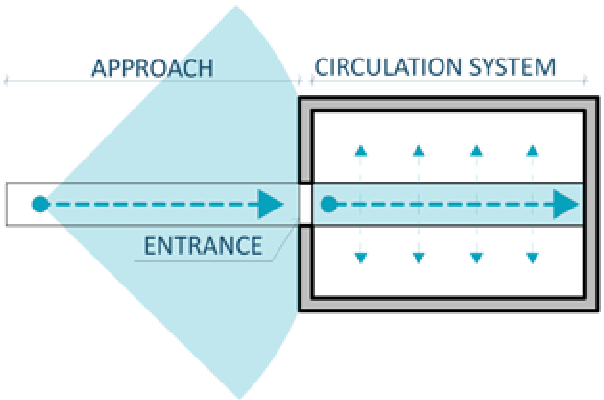

Figure 3.2.2 Three main elements of spatial organisation in terms of wayfinding (Kacej)

The **circulation system** of a building is considered a secondary or necessary part of the spatial structure. This is because it comprises a significant part of the floor area of the building, but does not serve a primary residential function. As a result, there are perceivable tendencies in architectural design towards **minimization of communication spaces** in terms of construction and economic efficiency. This is especially evident in apartment buildings, where the amount of communication space is usually minimized and the residential area of the apartments is maximized, thus economically efficient. This is especially true for multi-story buildings, where the vertical communication space is located in central partof the building, which includes stairs, elevators, and short corridors. Fortunately, this approach also has **positive aspects in terms of wayfinding** in the built environment. “The path of our movement can be conceived as the perceptual thread that links the spaces of a building or any series of interior or exterior spaces together.” (Ching, 2015, p. 252) We experience a space associated with the places we have been to and the places we expect to go to. The main components of spatial planning: **approach, entrance and circulation system** completely affect wayfinding.

2.3.1 Types of circulation spaces

Buildings with a larger and more complex layout are usually divided into several circulation systems. They have diverse interrelationships that may overlap, share common segments and entrances, or be completely isolated from each other. A suitable circulation system can be designed based on the adequate design of individual communication areas that must be defined in terms of basic characteristics, which are:

- **Availability: public, semi-public, semi-private, and private**. Availability does not mean accessibility, because a wheelchair-accessible ramp or lift can be private or public and at same time accessible. Public communication areas are always considered to have the highest usage, so they must be functional, aesthetic, durable, and accessible.
- **Direction: horizontal, vertical**. Horizontal routes represent the dominant movement without overcoming height differences. These include vestibules, entrance halls, corridors, galleries, and atriums. Vertical communication areas focus on overcoming height differences, i.e. vertical movement upwards or downwards. They include stairs, lifts, ramps, lift platforms, and escalators. Vertical communication areas ensure the interconnection of two or more spaces at different height levels.
- **Purpose of use: standard, evacuation, and service areas**. Standard communication spaces are those used predominantly and by the widest range of users. Evacuation routes are an addition to standard spaces and are supposed to ensure effective evacuation. Their primary goal is to provide the shortest escape routes that are identifiable, for example, in the event of a fire, according to applicable legislation and standards. Service communications are used to make the technical elements and equipment of the building available for operation, maintenance and inspection purposes.
- **Manner of movement: walking, moving in a wheelchair, by bicycle, or car**. The way of movement most significantly affects the dimensions of communication spaces.
- F**requency of use**: it can be a less frequent route or one used regularly. The frequency also affects the dimensions of communication spaces.

2.3.2 Graphical representation of communication spaces

Each type of communication space requires an adequate architectural solution. In architectural design, **communication areas are most often depicted in the diagrams with lines** ending in an arrow on one or both sides. This represents a stream, flow, or proposed interconnection of individual spaces. When designing a physical environment that is based on diverse circulation systems in terms of purpose, it is possible to use different colours to indicate for whom the communication space is intended. If the circulation system is based on different circulation systems in terms of the mode of movement, different types of lines are used, for example solid for pedestrian movement and dashed for cars.

2.4 APPROACH TO BUILDING

In a nutshell: As access to the building begins the process of finding a way, we can consider the arrival to the building as the **first exterior part of the building's circulation system**. Approach means exterior access to the building from a distance. The time required to access the building depends on the length of the access route, as well as the form in which we approach the building. Whether we walk or arrive by car or bicycle. In terms of the compositional solution of access to the building, we know three basic types.

- **Frontal approach** leads directly to the entrance to the building along a straight axis. The final visual goal of the approach is clear, whether it is the entire facade of the building or just a segment of it. Entrance is perceivable all the time while approaching the building.
- **Side approach** provides a better view of the façade and the shape of the building. The path can be redirected multiple times to delay and extend the approach sequence. If a building is to be approached from a far angle, the entrance should be projected beyond the façade or recessed so that it can be perceived more clearly.
- **Back approach** extends the approach sequence and highlights the three-dimensional shape of the building as we move through its perimeter. The entrance to the building can be observed at irregular intervals as it is approached so as to emphasize its location, or it can be hidden up to the arrival point.

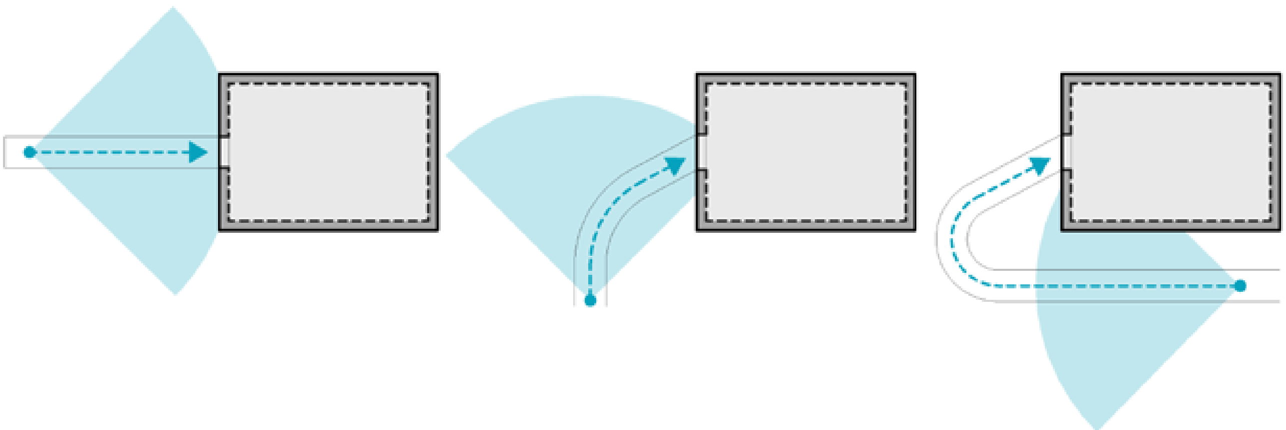

Figure 3.2.3 Types of Approach: Frontal approach, Side approach, Back approach (Kacej)

2.5 ENTRANCE

IN A NUTSHELL

An entrance to a building is the **boundary between the exterior and interior**. It contributes to the overall identity and plays an important role in visitor impressions and experiences. It provides a connection between a building's exterior and interior and distinguishes “here” from “there”.

The entrance should be designed so as to allow visitors and residents to easily find their way to the building and its surroundings. According to Francis D. K. Ching, we have three types of entrances: flush, recessed and projected.

- **Flush** entrance retains the continuity of a wall's or facade's surface and can be purposefully disguised – because of its sufficient plasticity, it is necessary to emphasize the flush entrance by its size, signage or additional construction of a shelter
- **Recessed** entrance provides protection from inclement weather conditions when you enter the building and it is a place to stand for the visitor while waiting for the doorbell to be answered. It usually has three solid walls, which increases the degree of intimacy and can have a negative effect with respect to increased crime risk in case the recessed entrance is deeper. In terms of wayfinding, the recessed entrance in the corner position is very effective – as it is perceptible from a wide range of viewing angles
- **Projected** entrance provides shelter, similarly to a recessed entrance, but offers a wide range of architectural solutions. On this basis, the degree of intimacy, clarity, security, perceptibility and design dimensions can be freely adjusted.

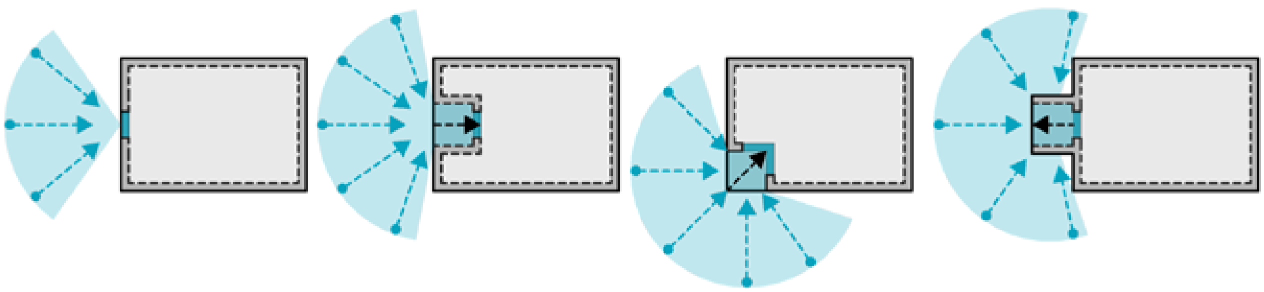

Figure 3.2.4 Entrances – Flush entrance, Recessed entrance, Corner recessed entrance, Projected entrance (Kacej)

Figure 3.2.5 Example of flush entrance, Haso – Helsinki (Čerešňová)

Figure 3.2.6 Example of projected entrance, Espoo – Helsinki (Čerešňová)

Figure 3.2.7 Example of recessed entrance, Tikkurila – Helsinki (Čerešňová)

2.6 CIRCULATION SYSTEMS

IN A NUTSHELL

A circulation system consists of a set of internal communication spaces and areas, mostly corridors. The circulation typology depends on physical specifications of circulation systems and can be divided into three primal forms: linear, focal and compound circulation systems.

2.6.1 Linear

Linear circulation systems support the wayfinding process the most. The primary organising element of such a layout is a line. The line can be straight, segmented or curved.

- Straight circulation system is based on a single main straight line, which is perceivable from each point of the line. It can be supplemented by additional secondary lines.
- Segmented circulation system consists of multiple segments – straight lines which are connected into one segmented line, which is not a perceivable whole. The places where the lines connect and thus change the direction of movement are natural landmark points.
- Curved circulation system is specific as it contains a slow and gradual change in direction. Compared to other linear circulation systems, it makes the wayfinding process the least easy.

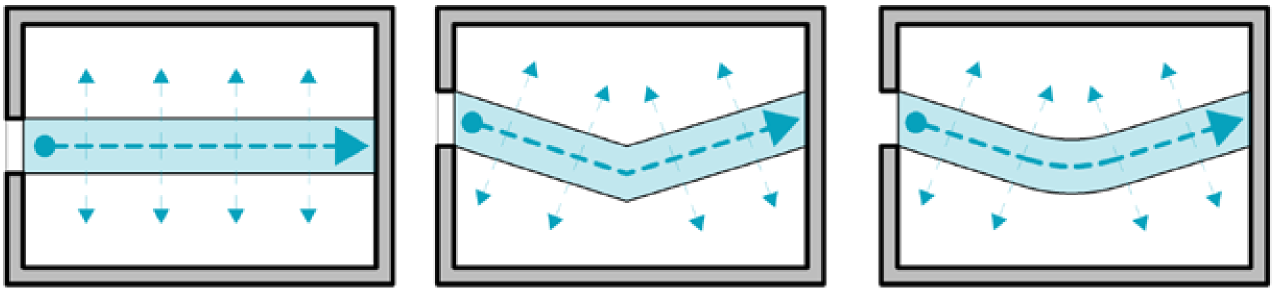

Figure 3.2.8 Linear circulation systems: Straight, Segmented, Curved (Kacej)

2.6.2 Focal

Focal circulation systems mostly comprise **circular layouts** with roundabout movement and with the **main focal landmark point in the centre of the layout**. There are four types of focal circulation systems with respect to perceivability and accessibility of focal points: radial, aatrial, loop and spiral.

- **Radial** circulation system has an **interior focal landmark point directly perceivable and accessible**, in the centre of the layout. All space units are organised directly around it and are perceivable directly from the landmark point. It supports the wayfinding process the most, but should only be used for **small scale buildings**.
- **Aatrial** circulation system has an **exterior focal landmark point directly perceivable and accessible**, in the centre of the layout, in the atrium. Remaining space units are not organised directly around the atrium, but around the interior corridor which is connected with the atrium through entrances or exits. This design is recommended for **medium scale building**, where thanks to the atrium it is possible to illuminate the interior of the building with natural light.
- **Loop** circulation system is based on a **concentric form**, where the **focal landmark point is neither perceivable nor directly accessible**. Space units in the centre are not suitable for a residential function, only for technical and storage functions, as they do not meet minimum lighting requirements. It is necessary to design additional landmark points which interpret segments of the loop, such as its start and end. If such landmark points are not included, infinite movement in the loop may cause disorientation. Loop circulation systems should be used for **large scale buildings**.
- **Spiral** circulation system contains **an accessible focal point which is not directly perceivable** if it organizes only one floor separately. If a spiral spatial circulation system is based on a single spiral that involves the whole building, and also includes the change in the height difference for the floors, it supports wayfinding and clearly explains the spatial structure of the building in the same way as a radial or aatrial circulation system. This system is rarely used in residential architecture and only in **large scale buildings**.

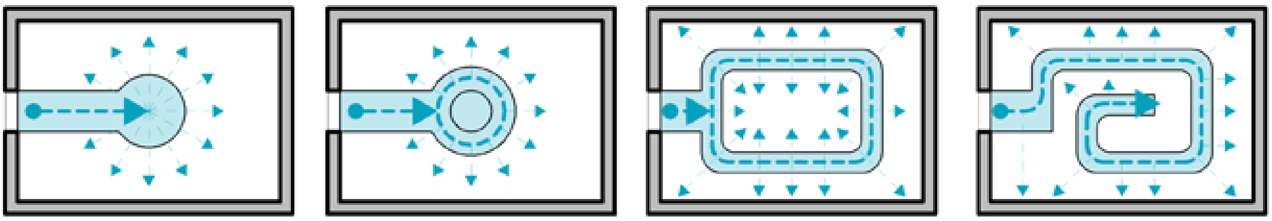

Figure 3.2.9 Focal circulation systems: Radial, Aatrial, Loop, Spiral (Kacej)

2.6.3 Compound

Compound circulation systems are the most complex ones and are only used in **extra-large-scale buildings**. They are rarely used in residential architecture, mostly in cases where several objects are organised into an urban structure.

- **Grid** is a **non-hierarchical two directional modular type** of a circulation system, based on intersecting sets of parallel lines. Usually, sets of parallel lines are regularly spaced and perpendicular, so the grid is based on the geometry of the square.
- **Network** is a hierarchical multidirectional modular type of a circulation system which consists of paths that connect multiple focal points.

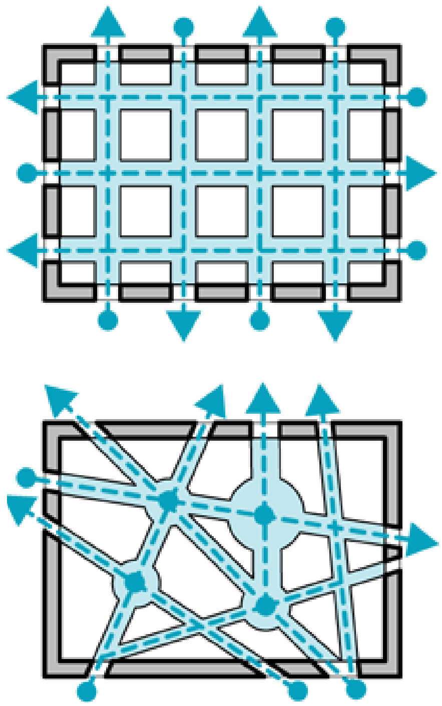

Figure 3.2.10 Compound circulation systems: Grid, Network (Kacej)

2.7 SIGNAGE AND GRAPHIC SYMBOLS

IN A NUTSHELL

The graphic orientation system and signage cannot compensate for the errors of an inappropriate architectural design of the building. The effort to supplement a large amount of graphic information in the environment actually has the opposite effect, resulting in a cognitive overload of the users, which reduces cognitive accessibility of a building. Signs can provide only additional information to help people to find their way. In addition to directing people to facilities, signs can also help identify accessible routes. The **signs must be easily read, understood, if necessary, raised in tactile and Braille**. The signs must be made of sturdy materials and be easily replaced, cleaned and repaired. Graphics, text, and icons on signs should be easy-to-understand and universally accepted.

According to EN 17210, the main types of signs are:

- **orientation**: sketches, plans, models, etc.;
- **directional**: directional information from point A to B;
- **functional**: explanatory information;
- **informative**: purely informative, for example a name;
- **signs for emergency exits**.

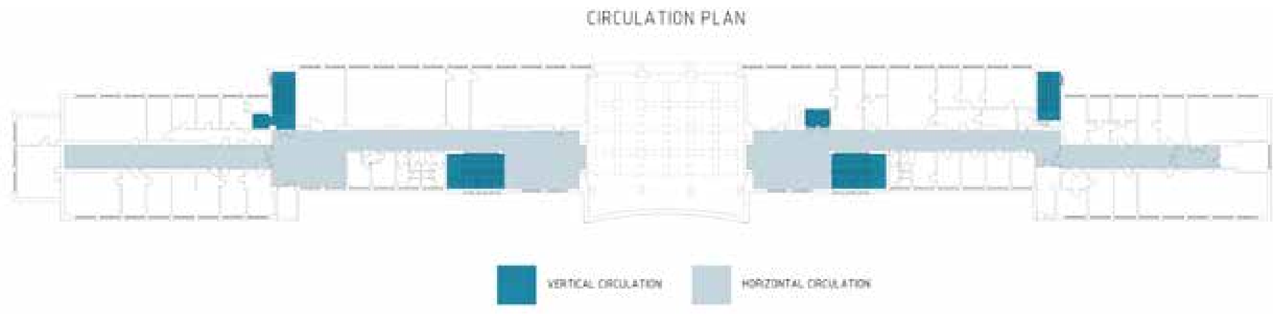

Figure 3.2.11 Types of signs – Orientation signage (Suláková)

Figure 3.2.12, 3.2.13 Types of signs – Directional signage, Functional sign (Suláková)

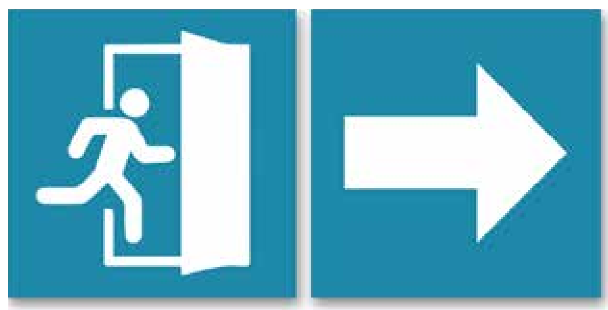

Figure 3.2.14, 3.2.15 Types of signs – Informative sign, Sign for emergency exits (Suláková)

Signs should be **located in a clearly identifiable and visible location**. The direction signs and plans of the buildings should be situated in accessible places adjacent, but not directly, to the main accessible routes so that they can be examined without disturbance and without any changes in the level of access routes. There should be enough space in front of the signs to accommodate people in wheelchairs, including people with companions, vision guides, and support dogs. With the manoeuvrability space of 1500 mm, people in wheelchairs can rotate and return to accessible routes. I**nformation and functional signs can be approached from a short distance** to read the sign. The **direction signs** should be located at the places **where the route decisions are made**, and they should be the logical direction sequence from the starting point to the different destinations. They should not be repeated too often, but offer the option to change the direction of movement every time it is possible.

- **Door information signs should be placed next to the door** and at the readable height on the latch side, so that raised tactile symbols and Braille information can be used.
- In all relevant areas of buildings such as corridors, directional signs for toilets must be provided.
- The **stairs must be equipped with information signs that identify all entrances and exits**. Where an alternative lift or ramp is not adjacent to the stairs, they must be clearly marked from the stairs.
- A **sign indicating the number of floors should be placed at the top and bottom of the stairs**, at the handrail and at least on one side of the outside frame of the entrance of each lift car. In addition, it must be displayed prominently elsewhere so that they can be seen from each level of lifts, if appropriate.
- Signs shall be located at a height where they are clearly visible to people who are seated, standing or walking – at a **height between 1 200 mm and 1 600 mm** from the floor or ground surface, in addition, signs should be at least **2 100 mm above ground**, such signs are mounted on ceilings or projected on walls in crowded areas.
- According to EN 17210, fonts should be sans serif type, for example **Arial or Helvetica**, fonts with clearly recognizable ascending and descending characters, with 20 percent of the height of the upper **letter. The letter height is at least 15 mm**, and the height increases with the distance of view from **20 mm to 30 mm for each metre**.

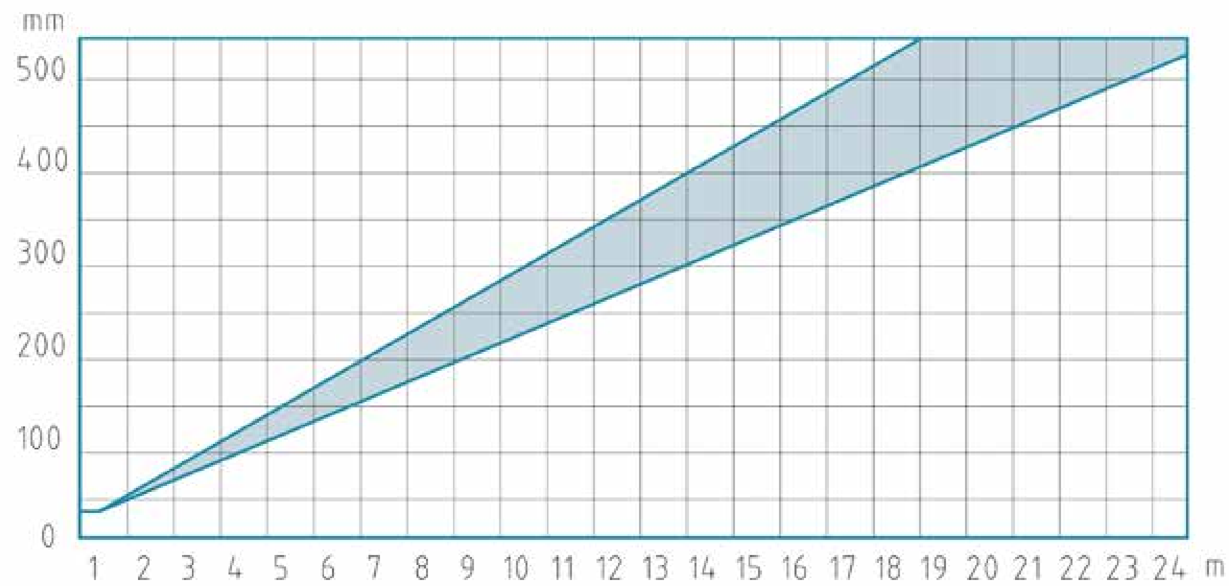

Figure 3.2.16 Ratio of the optimal height of the letters in millimetres in relation to the distance of the reader in metres (Suláková, according to EN 17210)

Graphical symbols or icons are useful in combination with signage systems, especially for people who struggle to understand the signage texts, for example, if the sign text is in another language. **The icon** can refer to specific components related to the facility's access, **has a high visual contrast and is well illuminated without glare**. The graphic symbols should be used on the direction and identification signs. When appropriate, the symbol must be tactile and accompanied by embossed letters or Braille on the direction signs and doors placed at an appropriate height, for a person to reach and read with their fingers. Internationally recognized symbols should always be used, especially in following facilities:

- accessible parking places;
- the access and entrance to the buildings without stairs, especially if not the same as the main entrance;
- lifting platforms or accessible lifts, if not all the lifts are accessible;
- locations where audible and tactile information is provided.

SUMMARY

Cognitive accessibility of the built environment can be explained as a decisive characteristic of the environment, which essentially conditions the capacity for interaction and autonomy of each person and the their capacity for to full social participation. Due to insufficient recognition of the environment as a direct consequence of the failure of the process of wayfinding, momentary disorientation may occur.

Good wayfinding is clear, intuitive, and non-verbal. The built environment should be designed in accordance with five basic principles to aid orientation and navigation: clear and comprehensible multisensorial information, effective visual perception, tactile guidance, correct spatial organisation, wayfinding signage with appropriate design and placement. The main components of spatial planning that mostly affect wayfinding are approach, entrance and circulation systems.

As access to the building begins the process of finding a way, we could consider the approach to the building as the first exterior part of the building's circulation system. Then there is the entrance, which is the boundary between exterior and interior. It contributes to the overall identity and plays an important role in visitor impressions and experience. A circulation system represents the composition of internal communication spaces and areas. Communication spaces are those which enable people to move around within the building.

The graphic orientation system and signage cannot compensate for the errors of an inappropriate architectural design of a building. The effort to supplement a large amount of graphic information in the environment may actually have the opposite effect, a person's cognitive overload, which reduces cognitive accessibility of the building. Signs can provide only additional information to help people to find their way.

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LIST OF PICTURES

MODULE 3

AGE-FRIENDLY BUILT ENVIRONMENT
– ARCHITECTURE

UNIT 3

RESIDENTIAL BUILDINGS AND THEIR SURROUNDINGS

Zuzana Čerešňová • Lea Rollová

DESIRE
DESIGN FOR ALL METHODS TO CREATE AGE-FRIENDLY HOUSING

DESIRE is a European project funded by the Erasmus+ programme.
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ISBN 978-80-227-5272-5

DESIRE will provide professionals in the building industry and home furnishings sector with the tools and skills to apply Design4All methods as an integral part of the design process, with the aim to create or adapt age friendly housing as a solution for the wellbeing, comfort and autonomy of the older adults or dependents at home.

The DESIRE training platform consists of six modules and 21 units.

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UNIT 3 – RESIDENTIAL BUILDINGS AND THEIR SURROUNDINGS

This unit is focused on the concepts, methods and principles of designing age-friendly residential buildings and their surroundings – family houses and apartment buildings, gardens, parks and pedestrian zones with multigenerational playgrounds and urban furniture. The aim is to provide accessible, adaptable, and flexible solutions to residential buildings, as well as adjustments of the environment according to the individual needs. On-site surveys and case studies of residential spaces help to better understand and consider changes during life.

3.1 PRINCIPLES OF DESIGNING AGE-FRIENDLY RESIDENTIAL BUILDINGS

IN A NUTSHELL

One of the main priorities of an aging society must be the provision of affordable and accessible housing. The focus of "ageing in place" is to help older adults ensure that they can live where they choose and get the help they need as long as they can, so that they do not have to be placed in an institutional setting. The concept of "lifelong housing" considers not only the aging processes, but also temporary or permanent changes in the lives of the population. For example, the Lifetime House concept provides a set of standards that would ensure that general housing is accessible to people with disabilities and is flexible to adapt to the changing needs of older people.

Living in one's own home symbolises independence and autonomy. For older adults, living in their own home is often a top priority, especially because they want to grow old close to family, friends, and neighbours. Based on the findings, older adults are not only connected to a particular home, but are also emotionally attached to their social networks, neighbourhood, and community. "We were also struck by the pragmatism of people's conceptions of ageing in place, including aspects like attachment to place. In each area, participants gave us a consistent and strong message of what a "warm" place their community is" (Janine L. Wiles and col., 2012, p. 364). When society promotes **active ageing**, the whole community benefits. In addition to the health and psychological benefits of older adults, community members can also benefit from their wisdom and commitment. Older adults tend to volunteer more than any other age group, and supporting them, as well as staying active in their community, will help people of all ages.

DO YOU WANT TO KNOW MORE ABOUT...

To learn more about community and social networks read the Module 1 Unit 2, the chapter 2.2.7 Home, and the chapter 2.2.8. Social networks.
To find out more about an active ageing read the Module 2 Unit 3 Active ageing and physical activity promotion in older adults.

3.1.1 Ageing in Place

The negative demographic trend of an ageing population has raised social and economic concerns and is one of the important issues of social sustainability. **Ageing in place policies** support the interest of older adults to stay in their homes as long as possible for several reasons, such as:

- **Human rights** – guarantee the right of older people to adequate housing so that they can lead an independent life in a community environment, people cannot be forced to live in a certain environment (such as an institutional setting).
- **Political reasons** – the trend of an ageing population places new demands on governments, communities, and families, it is necessary to adopt policies that support age-friendly communities and independent living.
- **Economic reasons** – staying in an institutional setting is an expensive solution, people should stay in their homes as long as possible and receive home or outpatient social care

Ageing in place[1] is a term used to describe a person living in the residence of their choice, for as long as they are able, as they age. This includes being able to have any services (or other support) they might need over time as their needs change.

The focus of ageing in place is to help older adults ensure that they can live where they choose and get the help they need as long as they can, so that they do not have to be placed in an institutional setting. The goal of an elderly person wanting to age in place should be to maintain and/or improve their quality of life.

Figure 3.3.1 Ageing society (Suláková according to DAA project, 2014)

[1] Source: https://ageinplace.com/aging-in-place-basics/what-is-aging-in-place/

3.1.2 Independent living

The term "Independent living" can be simply expressed as the possibility of choice and control over one's life. Independent living does not mean that older adults or people with disabilities want to do everything by themselves and do not need anybody or that they want to live in isolation. Independent living should take place in a community that is familiar to them, where they are close to their family and their friends. However, the movement for independent living is more often related to fulfilling the rights of people with disabilities. A well-known fighter for an independent life is A. Ratzka (STIL, 1996), who states: Independent living means that they demand the same choices and control in their everyday lives that nondisabled brothers and sisters, neighbours, and friends take for granted. They want to grow up in their families, use the same bus as our neighbours, work in jobs that are in line with their education and abilities, and start families of their own. Like everyone else, they need to oversee their lives. To this end, they need to support and learn from each other, organise themselves and work for political changes that lead to legal protection of their human and civil rights.

There was no comparable movement amongst older people in Europe. They are still faced with the stark choice of managing their own lives independent of the State, its service structure and its professional carers or having their lives managed for them (Oliver, M., 2001). Social welfare should design an appropriate range of community-based services that will allow older adults to live out their lives in the ways that they choose. They are currently fighting for the rights of the elderly, e.g., AGE Platform Europe: "… we need a sustained long-term vision of care for older people that supports a more positive image of ageing and affirms quality care as a social right" (AGE Platform Europe, 2022).

3.1.3 Accessible and affordable housing

One of the main priorities of an aging society must be the provision of **affordable and accessible housing**. To make the right of older people to adequate housing a reality, it is important to support changes in the legal and political environment as well. The European Union supports the right of older people to housing, as set out in the **EU Charter of Fundamental Rights** in Article 25 or the European Pillar of Social Rights, where key principles are defined, e.g., the right of "everyone" regardless of age to: access to social housing or quality housing assistance (principle 19); and access to good quality basic services (principle 20).

The UN Convention on the Rights of Persons with Disabilities provides, for example, in Article 19 for **the right to independent living and the right to adequate housing**, with people dependent on social care being able to "choose their place of residence and where and with whom they live on an equal basis with others and are not required to live in a particular living arrangement ". According to this article, the European Union supports the transition from institutional to community-based care by providing financial support. **Community living** and outpatient services take precedence over year-round living in institutions that cannot provide people with the same quality of living and living as community living.

As stated by AGE Platform Europe (2022), the **right to adequate housing** in old age has been particularly challenged during the COVID-19 pandemic: "The last two years have further highlighted the need for housing that allows everyone to age with dignity and for supportive measures to combat social isolation. Likewise, the dire situation in nursing homes has (re)opened support for a change of approach towards the so-called 'ageing in place' policies".

3.1.4 Age-friendly environments

The ageing of the population[2] is putting pressure not only on policy makers, financial budgets, but also on architects and designers to seek new innovative approaches to **designing age-friendly environments**, mainly residential buildings. For example, the World Health Organisation's **Global Age-Friendly Cities and Communities** project was set up to help cities prepare for rapid population ageing and urbanisation. The program focuses on environmental, social and economic factors that affect the health and well-being of older people. The output of the project is a publication (WHO, 2007) in which experts identified eight interconnected areas that can help identify and address barriers to the well-being and participation of older people[3]. These areas overlap and interact with each other.

Figure 3.3.2 Age friendly city topic areas (Suláková according to WHO, 2007, p. 9)

"Housing affects the needs for community support services, while social, civic, and economic participation are partly dependent on the accessibility and safety of outdoor spaces and public buildings. Transportation and communication and information particularly interact with the other areas: without transportation or adequate means of obtaining information to allow people to meet and connect, other urban facilities and services that could support active ageing are simply inaccessible." (WHO, 2007, p.10).

At its 2018 meeting, the Global Network for Age-Friendly Cities and Communities assessed progress and set priorities for the next period until 2030. The recommendations state: "The next decade should see cities and communities making measurable changes in building and maintaining older people's functional ability. This has important implications for whether they can keep working, whether they are able to look after themselves or will need (and get) social care, or whether they can spend time with friends and family and maintain social relationships." (WHO, 2018, p.20).

[1] Population ageing is a long-term development that has been apparent for several decades in Europe. This process is being driven by historically low fertility rates and increasing life expectancy. Population projections suggest that the ageing of the EU's population will quicken in the coming decades, with a rapid expansion in the number and share of older people.

[2] A practical approach has been taken within Eurostat:Ageing Europe (2020) – looking at the lives of older people in the EU. The following terminology is employed: • older people – those aged 65 years or more; • very older adults – those aged 85 years or more.

According to a report by the Royal Institute of British Architects (RIBA) and the Center for Towns think tank, many small towns will experience the largest population growth over the next two decades, aged 55 and over; in this context, call for changes to "high-quality, **adaptable, and age-friendly homes** and communities" (Stern D., Warren I., Forth A., 2019, p.9).

3.1.5 Adaptable homes

The adaptable house or flat is designed so that it can be used by all people and has the possibility of **further modifications if it is necessary** for the future needs of the family, the older adults or people with disabilities. This may include simply modifying the kitchen and bathroom to improve access and independence, raising lighting levels in response to visual impairment, or introducing support devices such as railings and other security measures. Details on adaptable housing are given in the following chapter 3.2.

3.1.6 Lifetime homes

The Lifetime Homes concept was developed in the 1990s in England by experts from the Helen Hamlyn Foundation, the Habinteg Housing Association, and the Joseph Rowntree Foundation. The concept encourages architects to think about house design a little differently. Lifetime homes should be **attractive, functional, and flexible to adapt to different stages of life or lifestyle changes**. Singles or couples of young or middle age have specific needs and desires, which may differ from families with small children. Completely different demands can be placed on the households in which older adults live. Developers and interior designers are aware of this, but they often create solutions that target only one typical type of household, anticipating that residents will move as the living situation changes. Lifetime homes offer an alternative approach to creating housing that can adapt to different stages of life and allow people to live longer in the same housing situation. Adaptable apartments must be designed according to the principles of universal design, and some parts of the housing unit can be designed to be easily adaptable to the current needs of apartment users. This approach allows people to stay home and in the neighbourhood despite lifestyle changes.

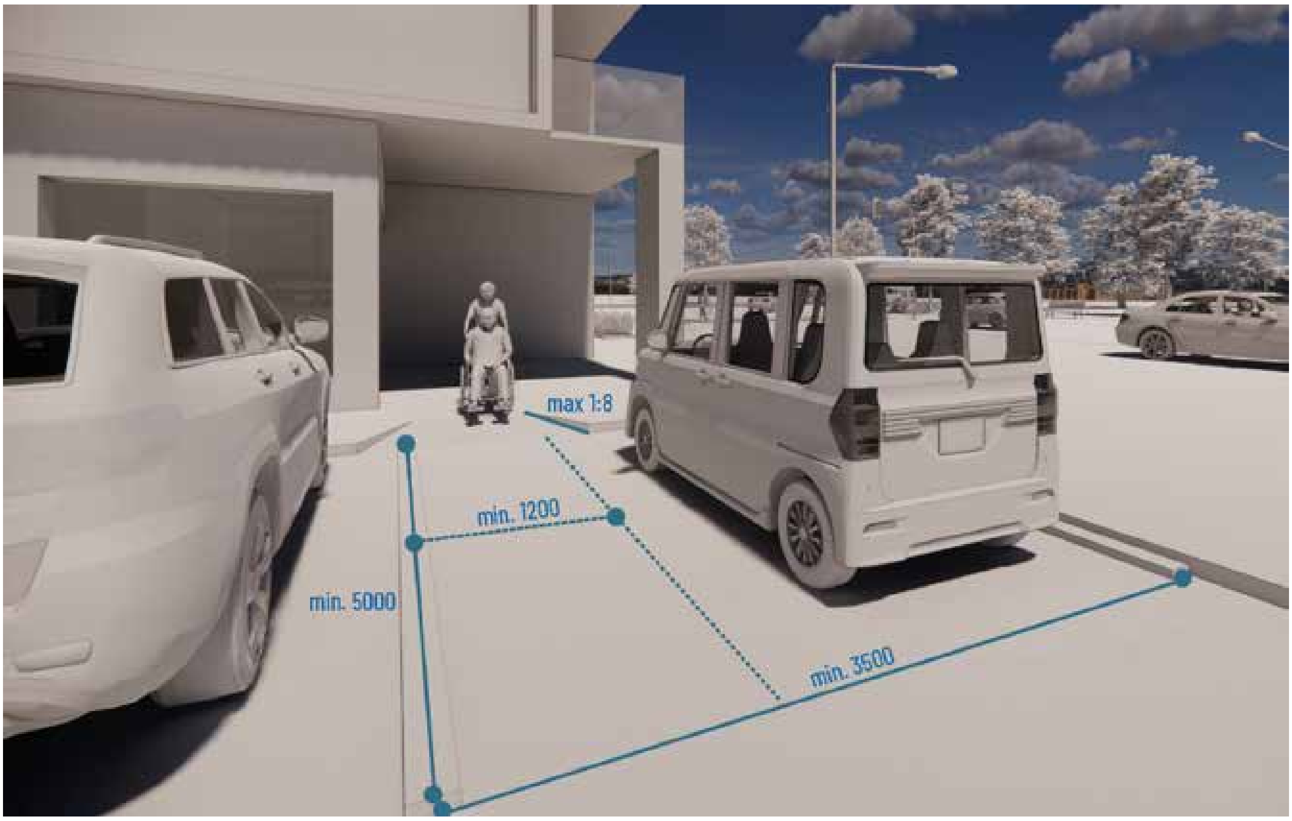

Figure 3.3.3 Accessible parking and approach to dwelling – one of the criteria of the Lifetime Homes Standards (Franko)

The aim of the Lifetime House concept was to create a set of standards that would ensure that **general housing is accessible** to people with disabilities and is flexible to adapt to the changing needs of older people. The sixteen-point criteria are published in **Lifetime Homes Standards** (2015):

1. Parking (wide or potential expansion)
2. Approach to dwelling from parking (distance, gradients and widths)
3. Approach to all entrances
4. Entrances
5. Communal stairs and lifts
6. Internal doorways and hallways
7. Circulation space
8. Entrance level living space
9. Potential for entrance level bed space
10. Entrance level WC and shower drainage
11. WC and bathroom walls
12. Stairs and potential through-floor lift in dwellings
13. Potential for fitting of hoists and bedroom/bathroom relationship
14. Bathrooms
15. Glazing and window handle
16. Location of service controls

These criteria have also been significantly affected by the **accessibility requirements for homes**, which were later set by the UK government and are now used in building regulations. Accessible houses as they fall into 3 categories [4]:

- Level 1: **Visitable housing** – The home includes basic accessibility of architectural features on the ground floor and is "visitable" for all guests. It has a no-step entry and entertainment area, wider hallways, and accessible bathroom. It has levered door handles and faucets.
- Level 2: **Accessible and adaptable housing** – The ground floor of the home is fully accessible including all Level 1 features plus an accessible bedroom and kitchen, parking area and entrance. It also has additional features such as a raised toilet and appliances and grab bars in the bathroom.
- Level 3: **Wheelchair usable housing** which there are two standards: adaptable and accessible. Wheelchair user adaptable dwellings are to be constructed to be adjustable for occupation by person in a wheelchair, whereas accessible dwellings should be constructed for immediate occupation.

[4] From October 2015 on, changes to national planning policy England meant that planning authorities in England could no longer apply many of the previous technical requirements, among them accessible housing. A single space standard was drawn up, the Nationally Described Space Standard (NDSS), which planning authorities could adopt as a requirement in their local plan if they chose to – it therefore was not compulsory. Secondly, three levels of accessibility were defined in Approved Document M volume 1

3.1.7 Homes4Life

The Homes4Life project was funded by EU funds in the years 2018 – 2021. The project was run by a multidisciplinary group of nine partners from five EU countries under the coordination of TECNALIA (Spain). The aim of the project was to find solutions that will allow one **to adapt an unsuitable housing stock to the needs of older adults** to allow them to age on the spot. One of the outcomes of the project was a new European certification scheme, which is based on an inspiring and realistic long-term vision of people's needs and requirements in a holistic approach to life and helps develop better living environments that integrate construction and digital solutions where this is beneficial. As part of the project, the Homes4Life Certification Scheme was tested in 11 pilot buildings in Europe, both in the design and operational phases.

3.2 ACCESSIBLE, SAFE, FLEXIBLE, AND ADAPTABLE DESIGN OF RESIDENTIAL BUILDINGS

IN A NUTSHELL

Accessible and adaptable apartments will significantly increase user quality in the long term, as it is likely that the demands and abilities of different users will change over the lifetime of the building. The basic precondition for a residential or family house to be truly suitable for all must be designed by the method of universal design, while the layout and construction solution of adaptable residential units must be designed to allow additional necessary modifications in a short time, at low cost, without changes to the supporting structure, installations, technology, or insulation. Housing designed in this way provides a great advantage to apartment users, as the required modifications and changes can be made with relatively little effort and low financial burden.

Old age is often associated with limited mobility and orientation, while with deteriorating health, the time spent at home gradually increases and the demands on the functionality and accessibility of the apartment space increase proportionally. The demands of younger and active people who leave their homes in the morning and return in the evening undoubtedly have different housing needs than older people who spend most of their time at home. People often do not realise this fact when acquiring real estate. With old age, physical and cognitive abilities deteriorate, and people need to adapt to their needs, which is often impossible in their own housing, or associated with great effort, long periods of time, or high building costs.

How should an age-friendly house be designed? The house or apartment should be designed to accommodate residents of different ages and abilities. It must be functional, secure, accessible, and can be adaptable and further customised to the needs of residents. To be able to meet all the above attributes, a house or apartment must be **designed according to the principles of universal design**. In addition to the quality of the house design, thermal comfort, indoor air quality, acoustic and visual comfort, sufficient daylight, natural ventilation, and the use of materials for health and safety are considered when evaluating the quality of housing. If the construction of a new house or apartment is considered, it is appropriate to support the construction of **accessible adaptable housing**.

Older people have different preferences and choose their housing from several options, each of which has its pros and cons:

a) **Housing in own home**

Older people are interested in staying in their home environment for as long as possible, preferring contacts with their family and friends.

- Advantages: stability and security, emotional attachment to the environment, proximity to family, friends, and neighbours, familiar local surroundings such as public spaces, stores, services, etc. Houses owned are generally in better condition than rented accommodation.
- Challenges: residential buildings are often full of barriers and are not designed for home care needs, may need to invest in removing barriers, risk of significant financial burden if on fixed or limited income.

b) Living in a rented apartment

Rental apartment can be in public or private ownership, operation, or administration and is an acceptable solution for many older people. Rental housing is generally of lower quality and more precarious. Leases, although varying from country to country, do not provide tenants with the same security that homeowners provide to the landlord.

- Advantages: the possibility to choose an apartment according to your needs, the possibility to exchange an apartment, if necessary, exemption from many financial and physical obligations associated with owning a house.
- Challenges: less independence for tenants, restrictions on pet ownership, and the need to rely on landlords to make the necessary repairs and adjustments. Landlords can terminate their tenants' leases before residents want to move. Appropriate, accessible, or affordable rental units may not be available in some communities.

c) Life in community housing

Community housing, called supported housing, is used by adults and the elderly who need social care. They can be remodelled apartment complexes or remodelled houses. They can include an apartment-style living room or dormitory. The reasons why people seek this type of service can be different, for example if they need more personal care than they receive at home but do not need the constant care they would receive in an institutional setting. However, group housing does not offer the level of health care provided in retirement homes. It is very important to determine if a particular type of group housing is the right one for an individual. Information is provided by social counselling services.

- Advantages: a life filled with planned activities that they share with others in their age range, they can make new friends, if they are lonely, it is a safe environment with a wide range of social services according to individual needs.
- Challenges: Group settings can partially restrict privacy. Residents who need more care or supervision may need additional services or move to another more suitable facility.

3.2.1 Accessible Environment

Accessibility of the environment, products, and services is one of the conditions for the fulfilment of the rights of persons with disabilities, as enshrined in Article 9 Accessibility in the Convention on the Rights of Persons with Disabilities (adopted in 2006). Accessibility is the ability of people to move around an area and reach places and facilities, including older and disabled people, those with young children, and those carrying luggage or shopping. Accessibility will also improve the quality of the building in terms of operation if it is necessary to supply individual operating units.

Accessibility is essential for all public buildings, but it is not yet a matter of course for residential buildings. The construction of **accessible apartment buildings** often depends on the attitude of local politicians. Many cities have adopted zoning regulations that require the construction of accessible or adaptable housing. There are differences between countries, most of them require the implementation of only accessible common areas of apartment buildings (entrance, corridors, vertical interconnection of floors, etc.), but these requirements often do not apply to apartments. However, due to demographic changes, many cities have already adopted territorial regulations that require the construction of accessible or adaptable housing.

Figure 3.3.4 Universal design solutions for bedroom (Franko)

3.2.2 Visitable residential environment

Visitability is a global trend that corresponds to the quality of housing for different user groups. Visitability is the lowest level of accessibility. The term refers to owner-occupied or rented housing designed so that people who have difficulty walking or who use wheelchairs or walkers can live or visit it.

A house is visitable if it meets the following three basic requirements:

- Main entrance without stairs.
- Doors at least 800 mm wide (entrance doors at least 900 mm wide).
- Accessible bathroom on the main floor, which can be reached by a resident or visitor in a wheelchair.

Visitable housing is a suitable solution for all people, because it allows better use of the apartment, for example, if the resident has temporarily impaired mobility due to injury or illness, or if he needs to transfer something (parent with stroller, shopping, luggage, furniture, etc.). The biggest advantage is just the visitability, which means that the users of the apartment can be visited by anyone without significant restrictions, such as a grandmother who uses a walker or a wheelchair.

3.2.3 Adaptable housing

An adaptable house/apartment can be easily adapted and modified without costly and complex construction modifications according to the current needs of residents. The first models of adaptable housing began to take shape after the Second World War, when the ideas of structuralism, which is characterised by the search for social and functional connections in architecture and urbanism, began to come to the fore. Buildings implemented in the spirit of this stream are often characterised by adaptable and incremental modules. Architect N. John Habraken first developed the concept of adaptable housing in 1962, which consisted in the ideological separation of the building structure from the spatial solution, while in the design process the apartment space is completed in cooperation with future users. For example, H. Hertzberger's project: Diagoon housing in Delft from 1967–1970 is well known, where modifiability consisted of variable assembly of modules using removable partitions, while each user could decide where the kitchen and living room would be located, or what the number of bedrooms should be, while the layout can be further changed according to the user's needs. Later, this concept was developed both in terms of the philosophy of "open building"[5] (also called agile architecture) and "visitable housing", developed by Selwyn Goldsmith. Their understanding of the concept of adaptable housing is based on the knowledge that many of us will have limited abilities (physical, sensory, mental) in childhood, during illness, due to an accident, or in old age. These housing models have not gone unanswered and are now often reflected in practice. Adaptable apartments are available in many countries around the world, such as Scandinavia, the Netherlands, the United Kingdom, Austria, Australia, or the United States.

[5] Note: The essence of the Open Building philosophy is space flexibility, while the function remains the same. However, it takes into account the change of owners or residents of the premises and their different requirements. Adaptable use of all types of buildings is preferred. In housing construction, it refers to apartments that are flexible enough to meet future specific residents requirements. This concept is often applied in the Netherlands and Japan.

Figure 3.3.5 Diagoon housing in Delft from 1967–1970 was one of the first adaptable apartment buildings (arch. Herman Hertzberger, https://www.dezeen.com/2011/12/06/key-projects-by-herman-hertzberger/)

The philosophy of adjustable housing is based on expected changes during the life of apartment users, respectively. family homes. These are not only possible adjustments in line with the changing needs of seniors or people with disabilities, but also the need for adaptability of the premises in terms of expected changes in family life in terms of the number of household members or the creation of adequate caregivers for elderly parents. The argument of "visitability" is also not negligible, where the opportunity to visit family or friends is also provided to those people who have various permanent or temporary mobility disorders, sensory or mental disabilities. The basic precondition for a residential or family house to be truly suitable for all must be designed by the method of universal design, while the layout and construction solution of adaptable residential units must be designed to allow additional necessary modifications in a short time, at low cost, without changes to the supporting structure, installations, technology, or insulation. Housing designed in this way provides a great advantage to apartment users, as the required modifications and changes can be made with relatively little effort and low financial burden.

Basic requirements for a universally designed residential building:

- entrance to the building at ground level (no height differences)
- wider door (entrance door at least 900 mm, other doors at least 800 mm)
- manoeuvring space (Ø 1500 mm) in the entrance areas, in the bathroom, in the kitchen, in the bedroom, in the living room
- ergonomic opening mechanisms (on doors, windows)
- controls (switches, windows, etc.) located at a lower height – within reach of the seated person
- easy control of appliances and easy handling of the device
- security system for the occupants of the house (protection against burglary or fire)
- colour contrasting interior design (doors and walls, stairs and walls, etc.).

The greatest demands are placed on a **good bathroom design** so that it can be easily adapted to the needs of the household. An integral part of the hygienic areas (bathrooms and toilets) is the floor drain, so that it is possible to shower next to the bathtub or toilet, which is used by the family in unpredictable situations, for example after an accident or post-operative situation, when it is impossible for many to enter or leave the bathtub. The drain is at the same time a preparation for the additional implementation of a roll in shower.

Similarly, an adaptable house might be designed to easily enable a reduction in size over time through the division of a large family home into two smaller housing units, offering residents the opportunity to continue living within a familiar environment.

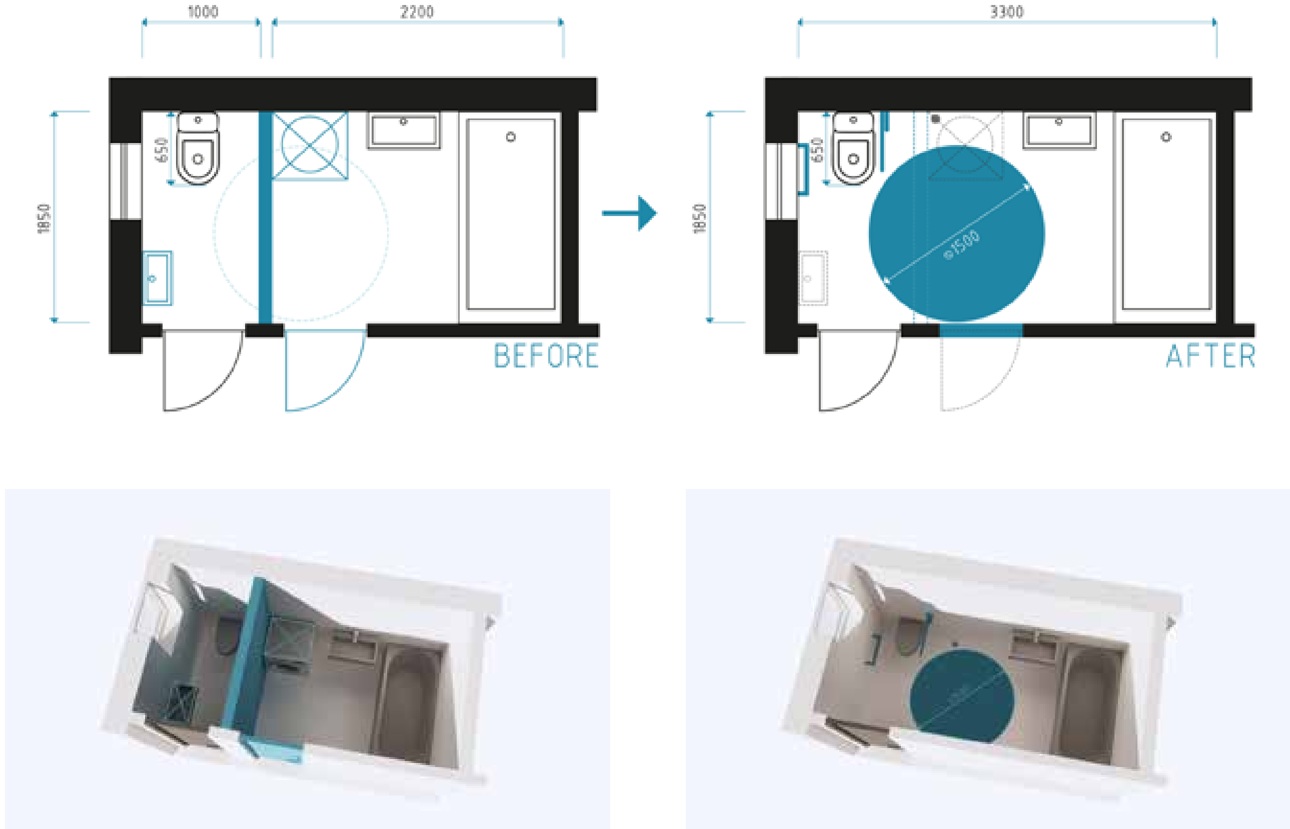

Figure 3.3.6 a, b, c, d Accessible bathroom is achieved by removing the wall between the bathroom and the toilet. No plumbing and pipe fittings can be installed on the removable wall. The bathroom floor must be sloping into the floor drain (Rollová, Suláková)

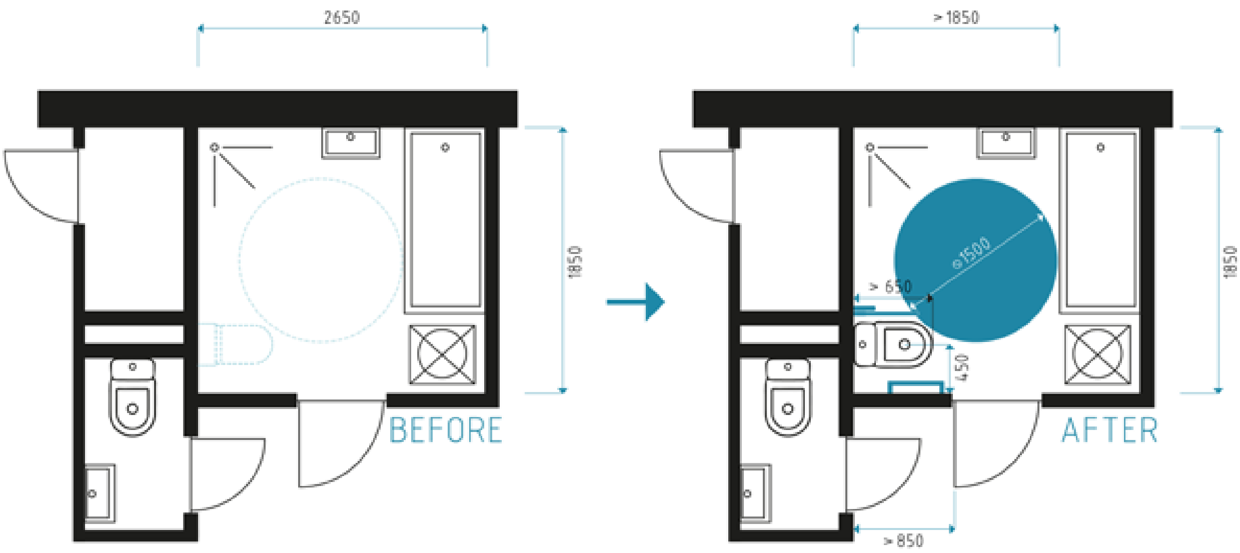

Figure 3.3.7 a, b Location of the installation core allows the additional implementation of another toilet in the bathroom to create an accessible bathroom (Rollová, Suláková)

3.2.4 Summary of requirements for adaptable housing

Fixed accessible features

- wide doors, passages
- accessible routes/corridors (wide enough, without height differences)
- manoeuvring space (dimensioned for turning the wheelchair)
- controls/opening windows within reach of a person in a wheelchair/lower height.
- visual and audible alarms
- foot storage area (washbasin, kitchen sink, hob, table…)
- roll-in shower
- load-bearing walls with the possibility of additional installation of handles (according to the specific needs of the resident)
- accessible balcony or terrace through a low-threshold balcony door

Adjustable Features

- removable wall, which is realised by dry assembly (for example, plasterboard)
- adjustable height of table, kitchen worktop, washbasin, etc.
- adjustable height of storage spaces (upper kitchen cabinets, wardrobe…)

Optional Removable or Added Features

- mobile container storage systems under the kitchen worktop, under the bathroom sink, etc.
- handles that can be added/installed as needed
- folding/additional seat in the shower.

"Smart House"

- uses systems of computer and electronic control and management of technical equipment of the house (heating, lighting, etc.)
- provides a sensor system for motion control, vital signs monitoring and a safe bed (eg falling out of bed)
- provides a security system for the occupants of the house (protection against burglary or fire)
- enables greater independence and autonomy for people with disabilities

3.3 AGE-FRIENDLY RESIDENTIAL SURROUNDINGS

IN A NUTSHELL

Residential surroundings should ensure **accessible, safe and comfortable** movement and usability of the spaces as much as possible for all persons, including people with limited mobility and orientation. Therefore, it is very important not only to create accessible routes and public spaces, but also to design a comprehensive and logical guidance and way-finding system, especially for people with visual or cognitive impairments. Moreover, it is necessary to provide activities for all age groups of people in residential surroundings, e.g. multigenerational parks.

3.3.1 Basic principles

Age-friendly and inclusive residential surroundings should be created in accordance with the Design for All/Universal Design methods; it is necessary to focus on the following **basic principles**:

- **accessibility and equal usability** of the environment – to allow all people to access, move and use the environment in an equal way (e.g. not to create separate routes and entrances);
- **flexibility and adaptability** of the environment – to provide various activities for wide range of users of different ages, with different abilities and limitations;
- **perceptibility** of the environment and **easy orientation in space** also for people with sensory impairments or people with limited cognitive and mental abilities;
- **accessibility and availability of information** and activities in a multisensory form using a combination of at least two modes of sensory perception (for example, visual and tactile, or visual and auditory perception);
- **safety** in the environment – to ensure the identification of areas, elements and objects that could pose a risk, especially for persons with visual impairments;
- **low physical effort and comfort** in using the environment and its elements for diverse groups of people;
- **sufficient space for movement and manoeuvring** in the environment and in the use of its individual elements, including suitable range distances for users of different heights as well as people in wheelchair;
- **self-realisation and active participation** in a community life – to provide an equal opportunity for the participation of all persons in activities in public spaces.

3.3.2 Pedestrian routes and system of wayfinding

Dimensioning the width of pedestrian routes depends on the frequency of use (often set out in national legislation); however, the main routes should be at least 1,500 mm wide for passing people in a wheelchair or the pedestrians along each other smoothly. If the pavements are made of cobblestones, wood or stone, the joints between the pieces must not exceed 10 mm. Pavements made of crushed materials are harder to maintain and are often difficult to be used by parents with baby-carriages, people in a wheelchair, or with other walking aids.

Pedestrian routes and public spaces must provide a **system of wayfinding elements** for people with visual impairments. The basic elements are:

- **natural or artificial guiding lines**, which help to keep the direction of a person moving by the white cane technique;
- **warning and signal tactile lines**, which help people moving by the white cane technique to identify the area and any obstacles.

Guiding lines help to maintain the direction of walking when using the white cane technique, while it is important to use mainly **natural guiding lines**, which can take the form of:

- **the contact line** (interface) of the pavement surface with the wall of the house, fence, or other fixed element (for example, raised flower beds);
- **park curb** at the interface with the lawn (however, it must not be a curb directly at the road, as it is necessary to maintain a safety distance of at least 500 mm from the road);
- interface of two significantly **tactilely different surface** treatment structures, for example different types of paving.

There must be no obstacles in the guiding lines that could endanger the safety of people with visual impairments when moving on the pedestrian route.

Figure 3.3.8 a, b, c   Natural guiding lines created by flower beds and park curbs (Stockholm and Athens, Čerešňová)

Artificial guiding lines are only proposed on pedestrian routes where no natural guiding lines are available and where the transition distance between natural guiding lines is greater than 8 metres, for example on paved squares or pedestrian zones.

Artificial guiding lines can be created in the form of:

- a strip of **tactile paving** with a surface structure of longitudinal character (e.g. grooved profile) with a total width of 400 mm;
- a **strip of elements** (metal or plastic) mounted directly on the paving or walking surface – the so-called **tactile indicators** of longitudinal shape, which should have a total width of 400 mm.

When solving **artificial guiding lines**, it is necessary to consider these requirements:

- the line should be straight, turning and changing its direction is allowed at a 90° angle (arcs are unsatisfactory);
- paving with a smooth surface with a length of 400 mm must be placed at the intersection or branch of the artificial guiding line;
- no obstacles must be placed in the 800 – 1,000 mm wide strip on either side of the axis of the artificial guiding line;
- artificial guiding lines must always follow the system of natural guiding lines and other landmarks to create a comprehensive navigation system.

Figure 3.3.9 a, b Artificial guiding lines – metal tactile indicators (Dessau, Germany and Poprad, Slovakia, Čerešňová)

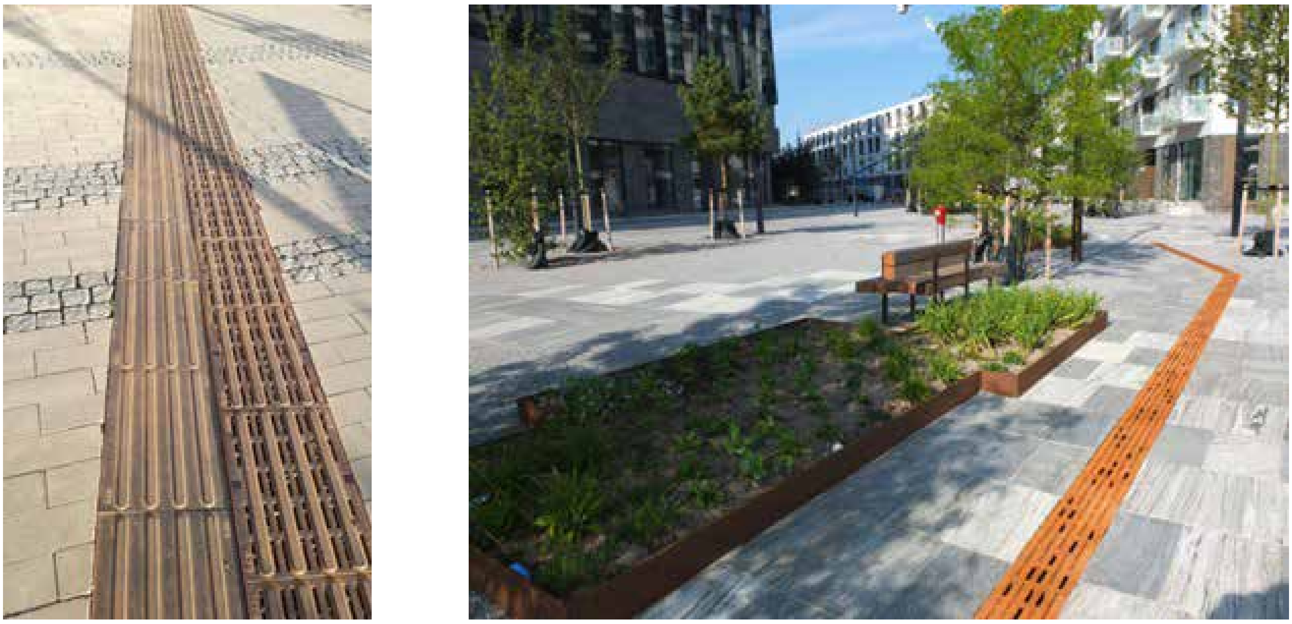

Figure 3.3.10 a, b Artificial guiding lines – tactile tiles with drainage (Stockholm and Copenhagen)

From the point of view of **user safety**, it is necessary to pay attention to regular maintenance of the pedestrian zone in order to avoid injury or slipping of pedestrians. For example, growing greenery must not interfere with the routes, and the appropriate head clearance (minimum 2,200 mm) under the trees must be maintained on the routes. The root system must not interfere with pavement surfaces and create obstacles for movement. As for safety of pedestrian routes and public spaces, emphasis is placed on the correct use of surface materials, as well as on lighting and perception of users with visual impairment, but also on the design of fixed elements such as benches, waste bins, way-finding signage and maps, and so on.

3.3.3 Overcoming height differences

When creating pedestrian routes and public spaces in residential areas, it is necessary to consider the configuration of the terrain. When there is a slope terrain, the pavements should preferably be situated in the direction of the terrain contour lines so that they do not have a steep inclination. The routes with a slope greater than 1:20 should be designed as ramps, which are interrupted by horizontal landing and equipped with handles on both sides.

When solving the exterior ramp, it is necessary to comply with these requirements:

- the arms of the ramp must have a straight shape with a length of at most 9,000 mm, then a horizontal landing at least 2,000 mm long must be inserted (in the case of perpendicular connection of the arms, the landing can be 1,500 × 1,500 mm);
- the ramp arms must have a sufficient clear width of at least 1,300 mm (optimally 1,500 mm), as well as sufficient manoeuvring space at the beginning and end of the ramp arm (1,500 × 1,500 mm);
- the handles must be placed on both sides of the ramp arm – at a height of 900 mm and a second handle at a height of 750 mm is also recommended;
- the ramp arms should have a raised edge up to a height of 100 mm and a guide bar at a height of 300 mm (this is not necessary for full railings);
- beginning and end of the ramp must be clearly recognizable in colour and surface finish from the surroundings, for example by tactile paving;
- ramps must have a non-slip surface and a solution (e.g. tempering or roofing) in order to be usable even in winter.

The longitudinal slope of the ramp is designed depending on the height difference to be overcome (according to the standard EN 17210):

- not more than 1:12 (8.3 %) with a height difference of up to 210 mm;
- maximum 1:15 (6.7 %) with a height difference of up to 300 mm (2 steps);
- maximum 1:17 (5.9 %) with a height difference of up to 500 mm (3 steps);
- optimal 1:20 (5.0 %), especially with a height difference above 500 mm (4 or more steps);
- maximum 1:8 (12.5 %) in rare cases, for example when overcoming the curb height (approx. 75 mm);
- the slope of the ramp must be the same on all arms of the ramp.

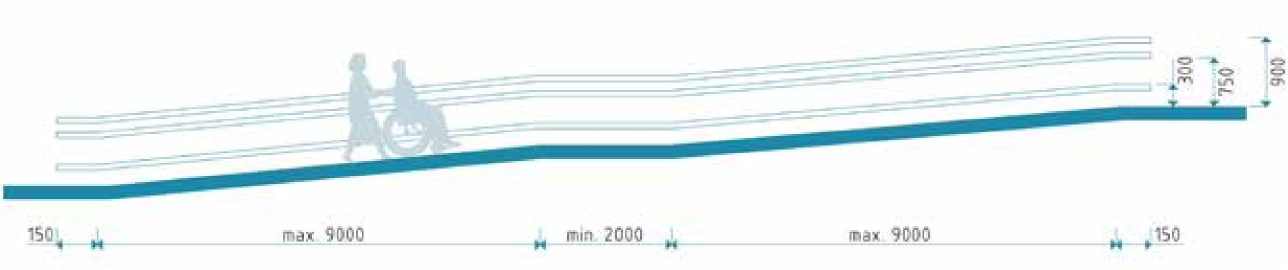

Figure 3.3.11 Dimensions of the ramp with handles (Čerešňová, Suláková)

Figure 3.3.12 a, b Ramps situated next to the stairs (Vienna and Stockholm, Čerešňová)

For height differences of more than 2,000 mm, it is recommended to use an **exterior lift**, which must meet these requirements:

- free manoeuvring area at least 1,500 × 1,500 mm before entering the lift;
- lift cabin dimensions at least 1,100 × 1,400 mm (optimally 1,400 x 1,600 mm);
- automatic door opening at least 900 mm wide (according to EN 17210);
- location of control panels in the height range 800 – 1,200 mm, with tactile description next to the buttons (description in Braille on the left and tactile symbols/numbers on the right);
- providing an acoustic signal upon arrival of the lift cabin;
- handles in the lift cabin at a height of 750 mm and 900 mm;
- folding seat in the lift cabin.

Ramps and lifts can create interesting spatial divisions of the outdoor environment, thus enriching its aesthetics and comfort. Ramps and lifts are usually combined with stairs.

Stairs that are part of walking routes must have:

- straight shape of the stair arm and suitable shape of the stair step (continuous shape without gaps and protruding edge of the step);
- placement of handles on both sides of the stair arm at a height of 900 mm (a second handle at a height of 750 mm suitable for children is also recommended);
- differentiation of colour and surface treatment of the first and last staircase step from the surroundings.

From the point of view of the safety of persons (especially with visual impairment), an area less than 2,200 mm below a staircase or ramp must be clearly marked (or enclosed) so that it can be identified by white cane technique, such as furniture elements (e.g. flower beds) or other elements, which would prevent entry into such an area.

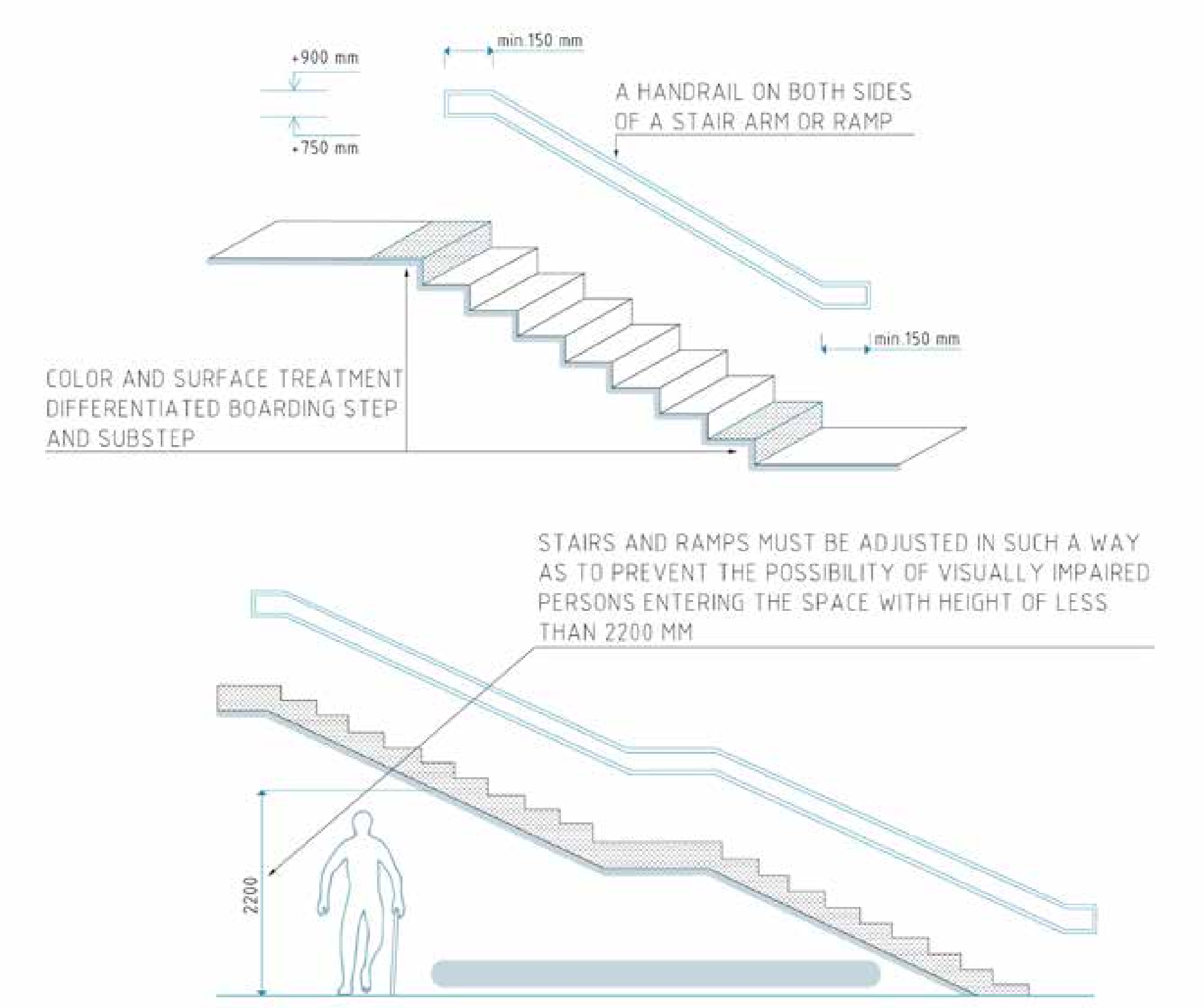

Figure 3.3.13 Stairs and safety (Čerešňová, Suláková)

Underpasses and overpasses that serve to overcome great height differences (even at level crossings for pedestrians or on platforms) must be accessible. When solving the overcoming of height differences, it is suitable to combine several accessible methods, e.g **combination of a ramp with a lift** or a vertical lifting platform. The ramp reaches a very long length when overcoming significant height differences, which is more difficult for many people in a wheelchair to overcome. However, it is not appropriate to design only one lift, as it may be a barrier at given times due to failure (or vandalism).

3.3.4 Urban furniture and greenery

Urban furniture is an integral part of the outdoor environment. The furniture elements are not only used for relaxation, but they could also be a meeting place for inhabitants. When creating these elements, it is always necessary to consider the diversity of people and their different demands, so it is recommended to offer various furniture elements, which allow the possibility of choice according to individual needs and abilities. For example, **combinations of seating elements** (with backrest, with armrests, etc.) or tables are suitable.

Benches should have different seat heights; some benches with a 450 mm seat height should have armrests to facilitate sitting down and standing up. Near the benches, there should be a clear **space area for person in a wheelchair or a baby-carriage** which should be situated outside the clear circulation width of the walkway, so it is recommended to **create nooks**. These nooks should be no longer than 8 metres in length, which is the maximum length to maintain the direction of movement of a person with white cane in the case of an interruption of a natural guiding line (e.g. a park curb on a sidewalk).

People with hearing impairment need to have visual contact with discussing persons, so it is advisable if the bench arrangement is opposite to each other or at a 90° angle orientation, eventually in arches or circles.

Seating should be located, so that people can rest or put things down without tiring, for example, the European standard requires the placement of accessible seats at intervals of no more than 50 m, while in the Slovak legislation a rest area must be located at intervals no longer than 200 m.

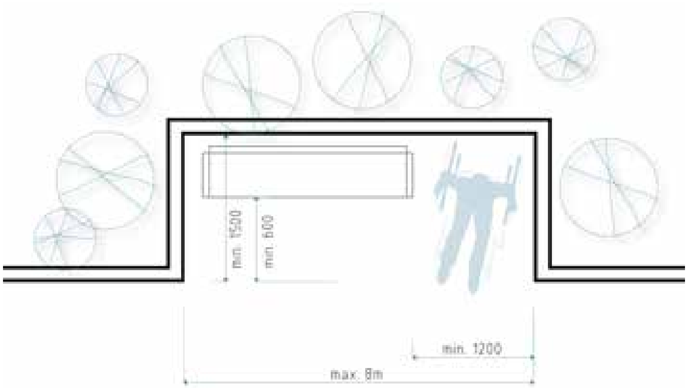

Figure 3.3.14 a, b Benches situated in nook with clear space for person in a wheelchair or a baby-carriage (Čerešňová, Suláková)

The **refreshment tables** in a standing position must be supplemented with a table at a standard height which can be used in the seated position, including persons in a wheelchair.

Waste bins must be located within reach of people in wheelchairs or people of smaller stature; the height of the opening should be approximately 800 mm from the ground. The waste bin must be identifiable by the white cane technique at the level of the walking area.

Within the recreation areas on pedestrian routes and in parks, it is appropriate to solve some **flowerbeds** at a height of 350 mm to 650 mm above the level of the sidewalk, which allows a person in a wheelchair to have direct contact with the planting. There may be a **seating area** on the border of the flowerbeds. For people with visual impairment, it is advisable to place **tactile labels** with the name of plants in flower beds.

Figure 3.3.15 a, b Flower beds with seating area and tactile labels (Brno, Czechia, Čerešňová)

If summer **terraces or podiums** are in elevated position or elevated terrain, access must also be provided by a suitable ramp.

For persons with visual impairment, it is important that the **elements of urban furniture are well perceptible**, that is, contrastingly colour-differentiated from the surrounding environment and identifiable by the white cane technique. All public areas and furniture elements must be designed to consider the diversity of users and their various demands.

People perceive the surrounding environment through **multiple sensory perceptions**: eyesight, touch, smell and sound. Based on a combination of these sensory modes, the environment can be modified by different colours, textures, sounds or scents that can contribute to the wayfinding. Greenery and water elements can improve regeneration of the human body or reduce stress. Trees and shrubs planted along busy roads reduce noise and filter smog. It is also important to choose and select appropriate trees and plant species. Plants having the risk of injury should not be placed immediately adjacent to the pavements and areas for rest and recreation.

3.3.5 Multigenerational parks

The attractive parks for all generations provide activities for different age groups of people. The park must meet not only the requirements of **accessibility, but also functionality and safety** according to the standards for the equipment and surface of playgrounds.

It is necessary to place as much play equipment as possible, accessible to children in wheelchairs from the ground level, such as interactive panels, play counters and tables, drawing stands and whiteboards. **Interactive panels, stands and drawing boards** must be placed within reach of children in a wheelchair at a height range of 500 – 950 mm from floor level.

Some parts of the **sandpit** should be designed in the form of **sand play tables** to create space for insertion of children in wheelchairs. The height of the upper edge of the table can be a maximum of 785 mm from the floor level. Access with a wheelchair can also be solved from the side – the so-called parallel access, but this solution is not optimal.

Universally designed play equipment allows all children to play together, regardless of their physical capabilities, examples of which are carousels and swings designed for inclusion of children in wheelchairs. Swing chairs with a fixed backrest, seat belts and a fixed (non-chain) attachment are also recommended.

Figure 3.3.16 Accessible sand play table (Oslo, Čerešňová)

Figure 3.3.18 a, b Accessible elevated play equipment with ramp in Sundsvall, Sweden and accessible carousel in Ljubljana, Slovenia (Čerešňová)

Figure 3.3.17 Play equipment with interactive panels by HAGS Sweden (Stockholm, Čerešňová)

Elevated play equipment can be accessed for children in wheelchairs by:

- **the ramps** with a width of minimum 900 mm and a slope of max. 1:12, with handles on both sides,
- the **transfer system**, which includes a transfer platform and transfer steps used to independently move the child in a sitting position without a wheelchair (with the help of a parent or peers).

The active parks for all generations should consist of these main areas:

- **playground** (equipment mainly for children),
- **workout area** (equipment for fitness, sport activities, etc.)
- **multifunctional playground** (various sport activities),
- **relaxation area** (quiet zone with seating).

The **playground surface** should be very flexible and durable (e.g. rubber EPDM floor). The floor has a primarily safety character, it has a damping function in the event of a fall. At the same time, it forms another functional space for playing and exercising.

Figure 3.3.19 a, b Accessible elevated play equipment with transfer system – transfer steps and platform by HAGS, Sweden (Čerešňová)

Figure 3.3.20 Active park for all generations in Pezinok, Slovakia (source: Octago)

Figure 3.3.21 Workout area in Active park for all generations in Pezinok, Slovakia (source: Pezinok)

3.3.6 Parking spaces

Near the entrance to the building/complex, it is necessary to reserve an accessible parking space for people with severe disabilities, which has dimensions of 3,500 × 5,000 mm (with transverse parking layout) and ensure a smooth transition from the parking lot to the sidewalk without steps or with a small ramp. For longitudinal parking, the parking space has minimum dimensions of 3,500 × 6,000 mm (width × length).

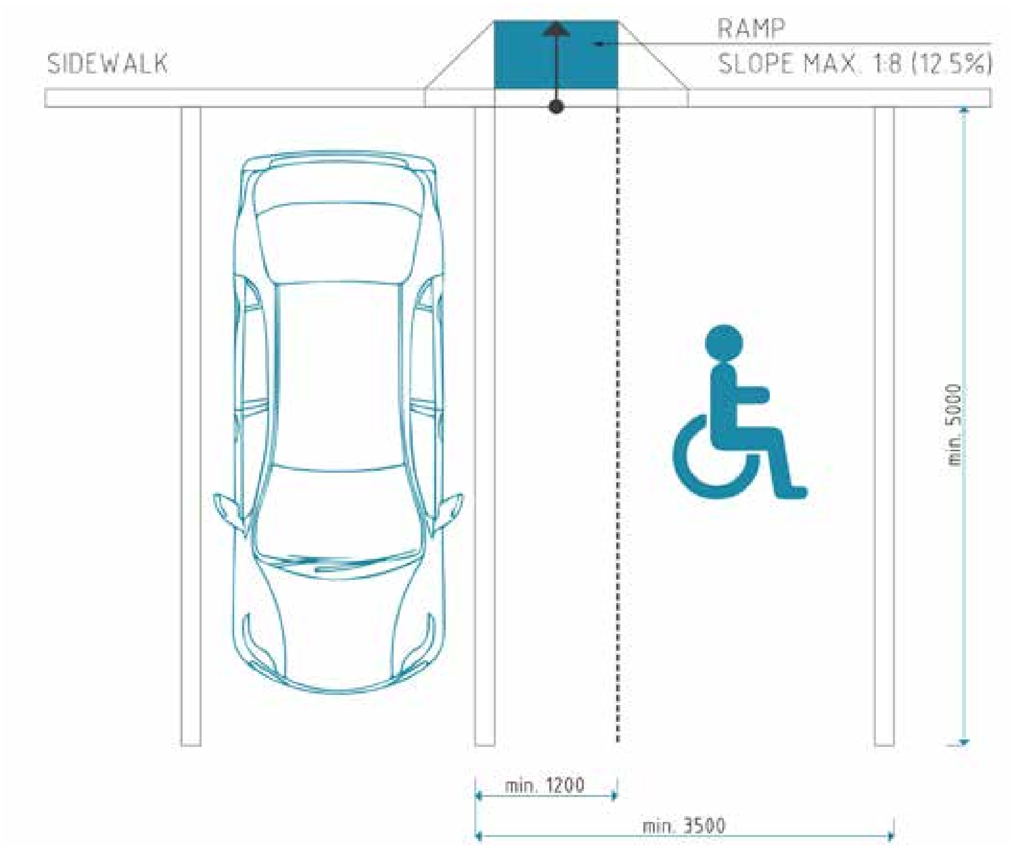

Figure 3.3.22 Parking space dimensions in transverse parking layout (Čerešňová, Suláková)

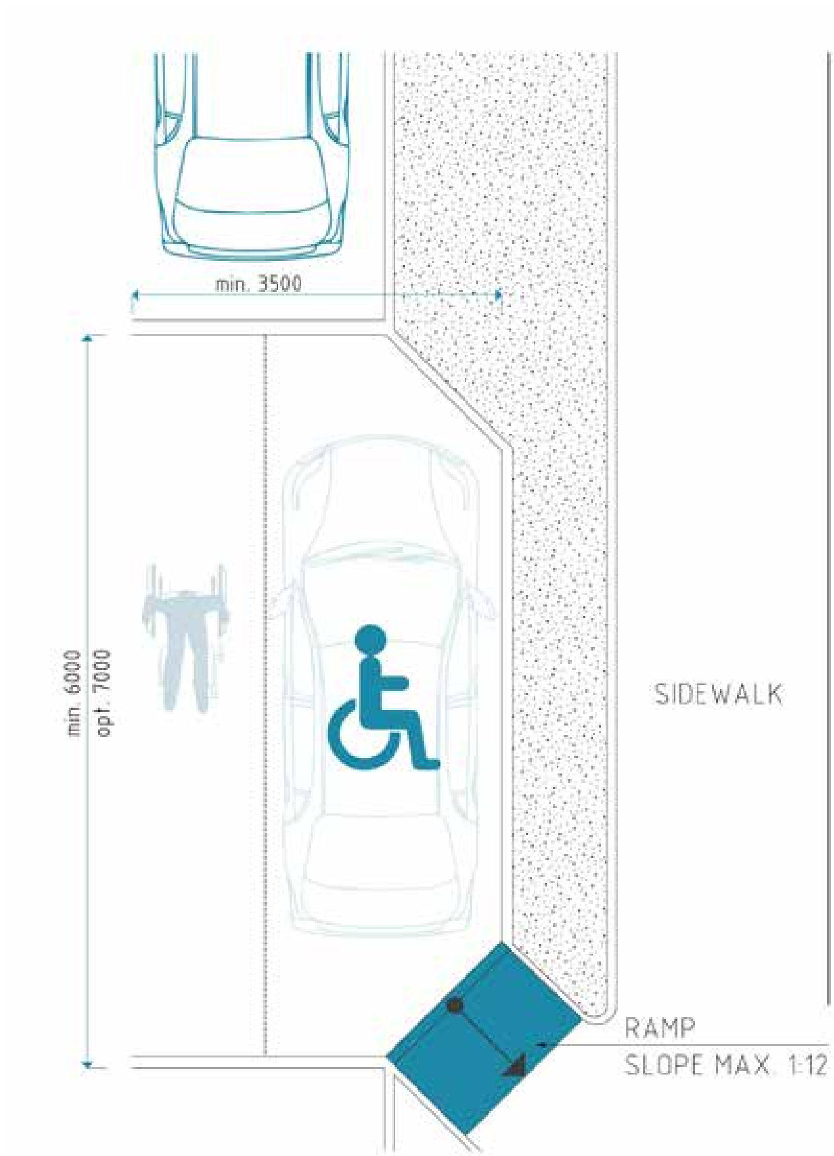

Figure 3.3.23 Parking space dimensions in longitudinal parking layout (Čerešňová, Suláková)

3.4 ON-SITE SURVEYS OF EXISTING LIVING SPACES

IN A NUTSHELL

Carrying out an on-site survey of the built environment is now common practice in a professional construction industry. In relation to the needs of older adults or people with disabilities, an **evaluation system** (Evaluation Sheet) has been created in many countries to assess the accessibility of buildings and public spaces. The problem is that many existing evaluation systems mostly provide an essential overview of whether the required spaces or products exist or not but do not provide information on the correctness of required solutions. In order spaces or products to be usable for people with different limitations, every detail must be well resolved. For example, it is not enough to state that there is an accessible toilet, it is also necessary to examine whether it is properly designed. For example, if there is no manoeuvring space near the toilet, or if there is no equipment within reach of a person in a wheelchair, this is an incorrect solution. The aim is that all spaces and products are usable independently for all people (as much as possible) in a built environment designed by method of Universal Design.

3.4.1 Evaluation sheet – identification of barriers

A well-prepared **evaluation sheet** (worksheet) is an important element in the development of an evaluation system and creates the quality background for the evaluation report and for the formation of recommendations. Therefore, it is necessary to implement many legislative provisions into the evaluation sheet which, even persons without professional education (architecture/civil engineering) could understand. The process can be difficult, as it is necessary to reflect the demands on wayfinding systems, measures to improve communication and to think about the safety of users, as well as the solution for accessibility of the environment. Therefore, CEDA[6] divided the structure of the worksheet into several tables, each for different groups of spaces. Due to several legislative provisions, each table is divided into rows and columns. In the rows basic requirements for accessible environment are formed, and in the columns, there is space for Clues, Answers and Remarks (see Figure 3.3.24).

The correctness of proposed evaluation system was verified in practice when assessing the accessibility of many buildings in Slovakia. A user guide has been prepared to assist in carrying out an accessibility assessment on site.

[6] CEDA – Centre of Design for All at the Faculty of Architecture and Design, Slovak University of Technology in Bratislava.

	REQUIREMENTS	ANSWERS	CLUES	REMARKS
C.6	Vertical Circulation – Elevator available to overcome the floors	☒ YES ☐ NO ☐ Y/N ☐ 0		Identical elevators are available in each wing of the building.
C.7	The dimensions and spaces of the elevator follow building regulations	☐ YES ☐ NO ☒ Y/N ☐ 0	– elevator cabin size is min. 1,100 × 1,400 mm + manoeuvring space Ø 1,500 mm + door opening width min. 800 mm	Real size of cabin: 1,308 mm × 1,045 mm.
C.8	Elevator equipment follows building regulations	☐ YES ☒ NO ☐ Y/N ☐ 0	– automatic door opening – elevator calling button at the high of 900 – 1,200 mm – elevator control panel button max. 1,400 mm – embossed sign next the buttons – auditory information	Elevator equipment does not meet the requirements. **Exchange of elevator cabin and replacement of elevator calling button needed!**

Figure 3.3.24 Selected Part of Table „Vertical and Horizontal Circulation“ (CEDA)

Explanatory Notes – Answers
Yes: meets the requirements
No: doesn't meet the requirements
Y/N: partially meets the requirements
0: space or element doesn't exist

Explanatory Notes – Clues
+ meets the requirements
– doesn't meet the requirements

3.4.2 Accessibility assessment procedure

The assessment process is conducted in four phases:

- a training of the members of the Assessment Committee,
- a survey on the building and filling in the Access Audit Checklist,
- a final report and recommendations to remove barriers of the facility,
- a proposal of an Action Plan.

Assessment group members (recommendation):

- building manager,
- people with disabilities (different type of impairments),
- expert on accessible built environment.

The training of the members of the assessment group can be realised by an expert on accessible built environment. To carry out the training and the following assessment procedure, the expert should have a good understanding of disability issues and knowledge about the demands of people with disabilities in the built environment. The expert also needs to have experience with building construction and with identifying practical and appropriate design solutions. The training is complemented by practical exercises in the premises of a selected building; the expert gives advice on how to carry out the evaluation and how to fill in the evaluation sheet. The role of the expert is to highlight the problems that should be noted, as well as to highlight appropriate and inappropriate solutions.

An assessment process is realized by carrying out an on-site survey that includes a thorough assessment of the use of the building; existing findings and barriers are recorded simultaneously on the evaluation sheet. Consultations with users with disabilities and employees are a useful method for assessing how well their needs are met and what their requirements for new projects or developments might be.

3.4.3 Evaluation report

The evaluation report, together with detailed recommendations for modifications or improvements, must highlight accessibility deficiencies, including suggestions on how they can be resolved in the best way. When preparing the report, it is necessary to consider several factors that affect movement, comfort, and safety of all users.

- evaluation in terms of independence and the movement and use
- evaluation in terms of wayfinding and access to information;
- assessment of safety, health hazards, and evacuation.

The **independence of movement** and use of all facilities for older adults and people with disabilities is very important. Many of them depend on the help of an assistant in a barrier-built environment. In assessing the building premises, it is therefore important to examine whether people with disabilities could use all parts of the building, products and services independently, to the greatest possible extent. It is necessary to check the access and usability of the horizontal and vertical circulations. It is also important to check if there is manoeuvring space available in all building premises and if a person in a wheelchair can reach for objects, switches, controls, etc.

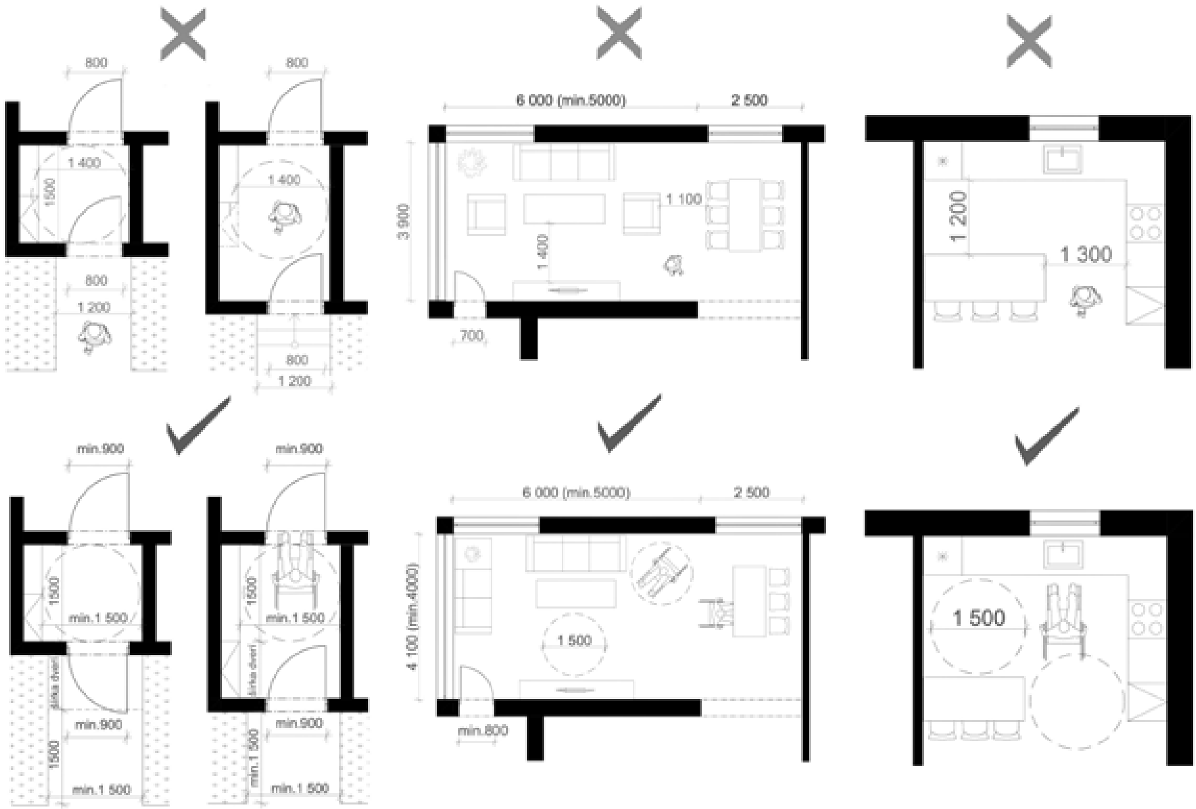

Figure 3.3.25 Accessibility evaluation of the residential environment (Suláková)

Wayfinding within the built environment depends to a large extent on its visual design, particularly on contrast, light, and colour for most people. A quality orientation and information systems are essential for users with sensory impairments. This system must be mediated by at least two different ways of sensory perception e.g., visual, and auditory, or visual and tactile. It is necessary to check whether the orientation elements such as pictograms, tactile maps, orientation labels with large, Braille, and embossed lettering, and sound information are available. Appropriate orientation aids for people with visual impairments are contrasting coloured areas to indicate important elements, such as information desk, elevator doors, or toilet doors. Different materials, texture changes or raised symbols could indicate floor levels, room numbers, or key information such as “stairs are being approached”.

In terms of **safety**, it is necessary to consider whether outdoor or indoor surfaces are not slippery, if exterior ramps can be used during winter and in bad weather. It is also dangerous to have any objects hanging on the wall that are not perceptible by the white cane. Freestanding stairs must also have an entry barrier under them to prevent injury. It is also important to assess the building in terms of quality lighting, heating, and ventilation or if the spaces are not draughty.

When evaluating the facilities in terms of **evacuation**, it is necessary to examine whether an evacuation plan is made for people with disabilities. Buildings must have two-way communication devices (to receive and transmit messages) installed in elevators and areas of rescue assistance so that users can call for evacuation assistance. The trained personnel that can provide assistance to people with disabilities during evacuation must be available. Furthermore, it must be tested if an emergency alarm has audible and visible notification systems.

At the end of the final report, **recommendations for proposals** for adaptation work should also be included. The accessibility requirements for the built environment for all users should be proposed as the best possible solution and not as a minimum solution when evaluating facilities and public spaces.

3.4.4 Excercises/discussion

- Identification of barriers in the living environment during the changes of the life (ageing process).
- Analyses of the existing living environment according to Universal Design/DfA principles.
- Conclusions of surveys: What are the main barriers in existing buildings? Are the new apartments better prepared for the ageing of users?

Figure 3.3.26 Main barriers in existing buildings (Suláková)

3.5 PRESENTATIONS OF CASE STUDIES AND GOOD EXAMPLES

The concept of adaptable housing was developed in Sweden in the early 1970s by the Fokus Society. It spread to many countries, mainly in northern Europe (Steinfeld and Maisel, 2012). In Nordic countries, all new apartment buildings and the surrounding environment are being implemented in accordance with the concept of adaptable housing and Universal Design/Design for All. The environment is designed to allow not only access, but also active participation in various activities in the community, such as barbecues with neighbours, physical activities in multigenerational parks and relaxation areas.

Good example from practice is the adaptable residential environment in Nordic countries, which has the following basic characteristics:

- in the vicinity of the apartment building there are enough accessible areas for various activities (e.g. barbecue, fitness, sitting, etc.);
- there is an accessible parking space in front of the apartment building (near the entrance to the building);
- the apartment building has a clearly marked entrance and the opening of the door is automated by means of a button (all control mechanisms are within reach of a person in a wheelchair);
- in the apartment building there is an elevator with sufficient dimensions also for people in electric wheelchairs;
- all doors have a clear width of at least 800 mm (entrance door at least 900 mm), without a threshold (or max. 15 mm), including balcony doors;
- manoeuvring space Ø 1500 mm in the common areas of the apartment building and in the apartment unit, especially in the vestibule, at the kitchen, in the bathroom and in other rooms, as well as in the balcony/ terrace;
- lowered windowsills and opening windows within reach of a person in a wheelchair;
- the light switches and electrical sockets are located within reach of the person in the wheelchair;
- the bathroom has a floor drain and the shower is located at floor level, while it is situated next to the toilet bowl, and this shower space can also serve as a transfer/ manoeuvring space from wheelchair to toilet;
- a free-standing bathtub (on legs) can be placed in the bathroom – but there is always a floor drain;
- the door in the bathroom opens outwards.

Figure 3.3.27 a, b   Accessible parking space and entrance to the residential building in Lahti, Finland (Čerešňová)

Figure 3.3.28 a, b   Horizontal and vertical circulation in the residential building in Lahti, Finland (Čerešňová)

Figure 3.3.29 a, b   Hallway and adaptable bathroom in a new apartment in Espoo, Finland (Čerešňová)

SUMMARY

Good design goes beyond aesthetics. If the residential buildings and their surroundings are designed correctly according to the principles of universal design and provides the possibility of additional adaptation of the apartment according to current needs, it has the potential to improve the health of older adults and people with disabilities, the local environment, and can solve several other problems. If we are serious about building high-quality, sustainable and adaptable residential spaces, we must constantly promote good and timeless design.

- Concept of **"lifelong housing"** – considers not only the aging processes but also temporary or permanent changes in the lives of the population
- Concept of **"age-in-place"** – allows people to grow old at their place of residence
- Concept of **"independent living"** – allows people with disabilities to live independently with the support of community social care services provided in family houses/flats (de-institutionalisation)
- Concept of **"community living"** – provides multigenerational living, co-housing, social housing, etc.
- Concept of "**adaptable housing**" – allows easy to adapt existing housing to changing needs of users

For older people with reduced mobility, reduced vision, or other disabilities, the ability to perform common tasks such as carrying home shopping, cooking, using the bathroom, or accessing high-shelf items can often be limited by inappropriate house design. The needs of individuals are specific, and it is therefore appropriate to consider the various aspects and demands that may affect the approach to residential building design.

1. **"Visitability"** is the design approach for new housing such that anyone who uses a wheelchair or other mobility device should be able to visit.
2. **"Accessible house"** that meets universal design standards and is able to accommodate wheelchair users in all areas of the dwelling.
3. An **"adaptable house"** is one which can respond effectively to changing household needs without requiring costly and energy-intensive alterations. The design must comply with the principles of universal design.

REVIEW TOPICS:

- Discuss **accessibility and visitability** of residential environment for all users (principles, solutions, dimensions according to the movement of a person in a wheelchair).
- Discuss accessible a**daptations of protected (listed) historical** residential buildings.
- Discuss **safety** of residential environment – movement safety, evacuation in case of fire, etc.
- How can we create **flexibility and adaptability** of residential environment to accommodate all users (mobile and flexible components, adaptable solutions)?
- Discuss **adjustments** of residential environment according to the individual users' needs (mobile furniture, high-adjustment furniture).

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MODULE 3

AGE-FRIENDLY BUILT ENVIRONMENT – ARCHITECTURE

UNIT 4

APARTMENT SPACES

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DESIRE

DESIGN FOR ALL METHODS TO CREATE AGE-FRIENDLY HOUSING

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Slovak Academy of Sciences

Technical Research Centre of Furniture and Wood of the Region of Murcia
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SPEKTRUM STU

DESIRE will provide professionals in the building industry and home furnishings sector with the tools and skills to apply Design4All methods as an integral part of the design process, with the aim to create or adapt age friendly housing as a solution for the wellbeing, comfort and autonomy of the older adults or dependents at home.

The DESIRE training platform consists of six modules and 21 units.

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UNIT 4 – APARTMENT SPACES

A basic prerequisite of human satisfaction is healthy housing capable of responding to all phases of the life cycle or to the needs of different people. Older people and people with disabilities should have housing that supports independent, active, and healthy living. Therefore, when housing units are created, it is recommended to apply the human-centred design methods, such as Universal Design/Design for All which achieves the desired harmony of design with diverse human needs. Integrating "Universal Design in the procurement, design, construction, management, and use of the built environment contributes to sustainability, providing buildings and spaces that are accessible and usable for all and adaptable for future use and user requirements." (EN 17210:2021 A: p. 21)

In new construction, human-centred design must be implemented as early as the initial stages of creating a detailed design, which will demonstrably reduce the costs of accessible solutions while attaining optimal results from the point of view of user needs. A conducted study (Meyer-Meierling, 2004, p. 4/8) proves that the costs of accessible construction are the lower, the sooner the implementation of a barrier-free solution is considered.

When designing a universally accessible apartment, it is recommended to consider a **combination of adaptable and fixed elements**. The mentioned combination of elements will create a flexible environment that can be additionally adjusted according to the current needs of the apartment users (Rollová, Čerešňová, 2015, p.13). The basic principles of applying adaptable and flexible elements in a universally accessible environment were defined by R. Mace in 1991. Among the adaptable elements, Mace included (Mace, 1991, p. 161) for example, movable and adjustable elements and equipment, adjustable height of interior elements, or mobile storage systems. Among the fixed elements, he mainly included elements of the construction system of the object (corridor and aisle width with the possibility of creating manoeuvring spaces for turning the wheelchair, installation of control elements within the reach of a seated person, load-bearing walls with the possibility of additional installation of handholds (according to the individual needs of the user), etc. The inexpensive elements include, without limitation, ergonomic opening mechanisms or colour-contrasting interior design (door and wall, stairs and wall, etc.).

In order for new housing units to provide the required flexibility of spaces, the architect should **apply the principles of adaptable design** when creating them, which allow easy adjustments to the apartment layout in a short time with low costs (further information provided in M3 chapter 3.2 Accessible, safe, flexible, and adaptable design of residential buildings). Adaptable apartments will significantly increase user quality in the long term, as it is likely that the demands and abilities of different users will change over the lifetime of the building. The argument of "visitability", i. e. providing the possibility to visit the apartment users together with friends or family members, who may have various temporary or permanent disorders of mobility or sensory perception, is also important.

4.1 APPARTMENT SPACES LAYOUT (FLOORPLAN) AND DIMENSIONS

IN A NUTSHELL

The adaptable house or flat is designed so that it can be used by all people and has the possibility of further modifications if it is necessary for the future needs of the family, the older adults or people with disabilities. This may include simply modifying the kitchen and bathroom to improve access and independence, raising lighting levels in response to visual impairment, or introducing support devices such as railings and other security measures.

As mentioned above, the construction of adaptable apartments is preferred for them being accessible to and usable by a wide range of users with different needs and abilities. They include accessible design elements, especially wider doors, a reasonably large floor area, switches, and controls located at a lower height. An adaptable apartment does not have to be fully accessible from the start of use, but must allow for the selection of accessible elements or accessories that can be modified or added if necessary to better meet the various specific access requirements of users. "Adaptable housing design is affordable, especially over time, because it reduces the need for people to move or make costly and disruptive structural modifications by building flexibility and adaptability early on." (EN 17210:2021 A: p. 214)

Figure 3.4.1 Adaptable apartment and removable walls that allow changes in the number or size of rooms (Rollová, Šuláková)

The adaptability of the apartment layout can also be ensured by **removable walls** in which no installations are built (electric cables or water pipes). Figure 3.4.1 shows an example of an adaptable apartment, where a family can adjust, thanks to removable walls, the number or size of rooms depending on the family needs. The separate toilet room is enlarged to provide enough space for manoeuvring a person in a wheelchair or for assistance. The larger toilet room is also comfortable for household members without disabilities, there can be a bidet or a washing machine in the room, and everyone can simply use the space according to their own needs.

The living area of the apartment has the character of an **open layout**, which provides enough space for a variable arrangement of furniture, and the kitchen corner has a large floor area allowing to manoeuvre even a wheelchair. An apartment designed in this way is just one example of a variable apartment solution; the architect has the opportunity to apply these principles to any layout of the apartment.

The greatest demands must be placed on a good bathroom design, so that it can be easily adapted to the household needs. In Figure 3.4.1, there are two bathrooms in the apartment, which can be modified according to the current needs of the family. The bigger bathroom is designed in such a way that one sink is accessible separately (in front of the room), which is an advantage for a multi-member household. The bathroom on the left has the minimum dimensions of an accessible bathroom (Figure 3.4.2), but it can serve several purposes, for example as a toilet with a washing machine, a toilet with a bidet, or as an accessible bathroom with a roll in the shower. Then, there is the option to additionally mount handles. As has been demonstrated, the architect must take into account these modifications and prepare everything to work without demanding structural modifications. **A floor drain is an integral part of the hygienic spaces (bathrooms and toilets) allowing to shower next to the bath or toilet, if necessary.**

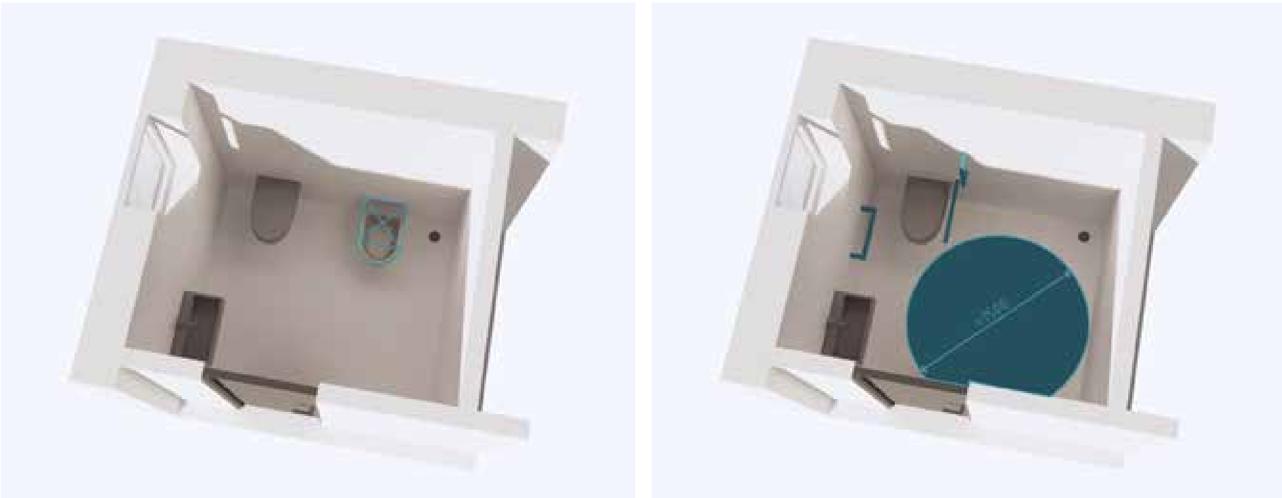

Figure 3.4.2 a, b A variable bathroom solution (Rollová, Suláková)

The following requirements and recommendations apply when creating an apartment layout:

- **a)** Corridors or halls within the apartment must have an adequate width (at least 1,400 mm) so that persons using mobile devices on wheels or walking aids can easily move and manoeuvre around and enter all rooms.
- **b)** Furniture arrangement in rooms for various purposes, e. g. cooking, hygiene, sleeping, living room, storage, etc., is designed with an adequate manoeuvring space for at least one person using a mobile wheeled device. The aisles between the furniture must be at least 900 mm wide, and it must be possible to create a free space of 1,500 mm in front of the cabinets, allowing enough space for handling.
- **c)** In apartments with two or more floors, there is a living room, a kitchen and an adaptable toilet at the entrance level with a space and drain allowing for the installation of a shower, but also one room with space to place a bed if necessary.
- **d)** If there is a separate storage or laundry room in the apartment, it must have sufficient space for manoeuvring mobile wheeled equipment that allows easy access and use of the equipment.
- **e)** Switches, sockets, ventilation and service controls must be easy to use for everyone and at a height that can be reached by sitting and standing persons.
- **f)** Bedroom lighting must be controlled by two-way switches, one of which is located by the door and the other by the bed.
- **g)** Electrical supply should be provided near windows to allow installation of remote-controlled window controls, blinds and curtains/blinds.

4.2 HORIZONTAL CIRCULATION

IN A NUTSHELL

Horizontal circulation in the building includes **entrances and exits, internal lobbies and vestibules, and corridors**. It is mainly affected by the appropriate layout design and building construction. It may include access routes through open spaces, corridors, and lobby areas. The general layout of the horizontal circulation should be as logical, understandable, usable, and direct as possible to provide access to all users. Travel distances should be reduced to a minimum, but this naturally depends on the type and size. The design of well-designed buildings and clear and easy-to-follow circulation paths will benefit everyone. Floor height differences in the building must be avoided as much as possible. In the case of an existing building that has floor height differences, it may be necessary to consider and design vertical circulation such as ramps, passenger lifts, or platform lifts because of accessibility.

4.2.1 Entrances and exits

The entrance must be easily found and clearly distinguished from the exterior space. The location of the entrance can be highlighted by architectural features such as the canopy and door recesses. Changes in the surface textures of the pavement and entrance space can help indicate the position of the entrance, especially for people with visual impairments. Audio clues such as small fountains or plants, and olfactory features can also help. Artificial lighting highlights the entrance of a building and makes everyone visible at night. Entrances are also typically used as evacuation and emergency exits; buildings may have multiple accessible entrances, but it is unacceptable for persons with different abilities to use only secondary or alternative entrances.

Accessible entrances allow all users to access and exit buildings and places safely and independently. The entrances to the building or site should be designed to provide equal access to all users. Building entrances may need to function in potentially contradictory ways, such as allowing certain users to access controls and denying other users access for security reasons. An entrance hallway or passage is a common space with external and internal door arrangements and is often necessary for security, climate conditions, or safety.

- The main entrance must be covered to form protection against rain or snow for people waiting outside. Weather protection is particularly useful when security or access devices are needed before entering buildings. The depth of the door recess and the canopy should be 1,200 mm and the head height should be at least 2,200 mm.
- Visual identification methods for improving perception, such as visual contrast and improved lighting, should be provided.
- A suitable tactile indicator should be provided, such as changing the surface texture of the parking lot or front yard or providing Tactile Walking Surface Indicators (TWSI) to guide the user to the entrance. If a tactile surface is applied, this should

continue as needed, for example, at the reception point or the information point.

- If the entrance is at a level different from the level of the surrounding ground, the appropriate slope and ramp approaches and landings must be provided just outside the main entrance.
- All permanent or temporary features provided on the floor to limit the flow of dust or water should allow an easy passage without the risk of falling or sliding.
- Where gratings are provided in front of the outer doors to prevent dirt, snow, soil, or sand from entering, the slots in the grating must run across in the travel direction and shall be flush and well-drained. Groups integrated in visual and tactile entrance systems contribute to acoustic orientation. The small metal grating above the entrance allows guide or assistance dogs an easy access. The coating is well fixed in the drain with a maximum slot width of 10 mm and a maximum slot length of 20 mm.

4.2.2 Entrance space

- Entrance spaces should provide a sufficient operating space for people using wheels to turn; they must provide a turning space in front of the entrance door, beyond the door or the door ring. The minimum horizontal manoeuvre space is **1,500 × 1,500 mm** in front of the opening door of the building. The minimum horizontal operating space is **1,600 × 2,150 mm**, with a 180° rotation of a person in a wheelchair.
- If an open-out door is located near the steps or the ramp flight, it should be placed so that no one falls backwards at the opening of the door. Doors open to the outside, are preferably recessed, with horizontal landings of at least 1,600 × 2,150 mm, without the door swing.
- The door latch must have a clear space of 600 mm so that a user in a wheelchair can operate the handle.
- Crossing traffic should not be obstructed in front of the entrance to allow unauthorised access.

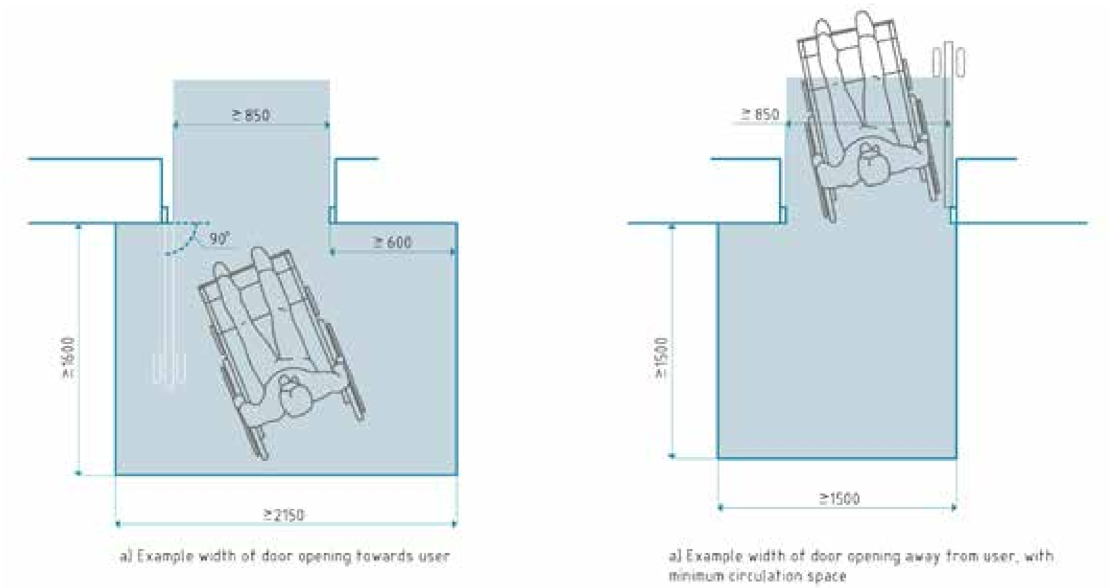

Figure 3.4.3 Entrances (Suláková according to EN 17210:2021)

In multistorey buildings, accessible entrances must allow an easy access to an accessible lift located in a convenient location. Entry to the building from the underground or multi-storey parking lot is accessible and consists at least of a lift accessible or a direct entrance. The main entrance to the building must be identified or marked from the land borders and the parking lot.

4.2.3 Entrance doors

The entrance door must be wide enough to allow all persons, including people with mobility devices and tall people, to enter freely. The entrance and lobby doors have a minimum width of 900 mm and are preferred at 1,000 mm, with a minimum clear height of 2,000 mm.

Type of main entrance door according to the EN standard

- Side-mounted automatic doors must have an adjustable delay closing mechanism.
- Revolving doors must be avoided because they are difficult to use and hazardous to people using wheelchairs, canes, guide dogs, and assistance dogs, as well as people with lower balance.
- The handle, pull, latch, lock, control is located between 800 mm and 1,000 mm above the floor, preferably at 900 mm.
- The handle and hardware of the door is located 30 mm from the edge of the door.
- All door opening hardware can be operated by one hand without requiring grasping or turning, and should preferably provide lever action.
- The glazed door should be marked – the visual indicator is at least 75 mm high, contrasted to the background and at 900 – 1,000 mm and 1,500 – 1,600 mm above the ground level, or an opaque strip on the opening edge of a frameless glass door with a minimum width of 25 mm, visually contrasted with the surrounding environment.

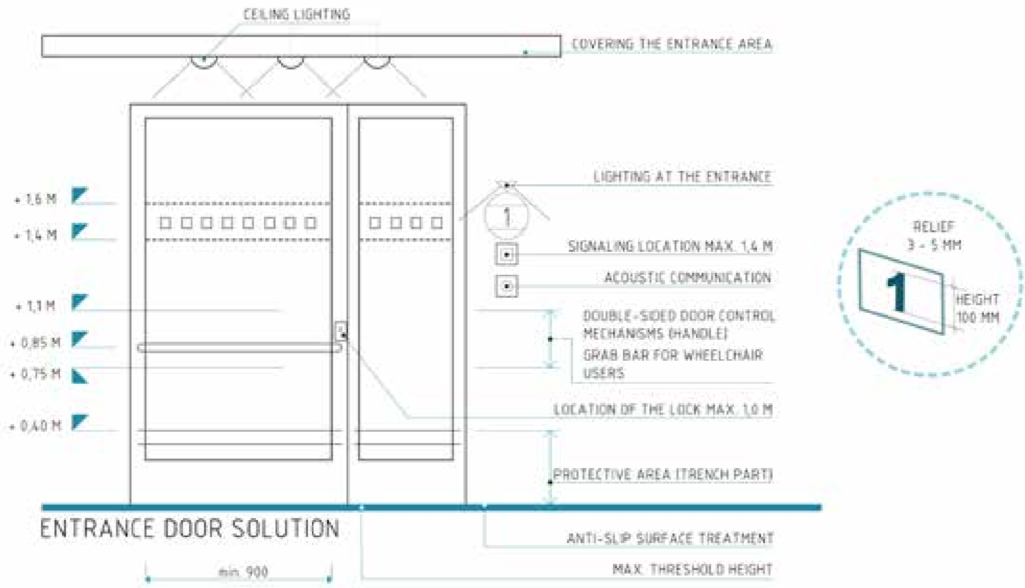

Figure 3.4.4 The entrance door (Rollová, Suláková)

4.2.4 Entrance lobby and vestibule

An entrance hall, that is, an external and internal door arrangement, is common in many buildings and is often necessary for safety or climate reasons. The creation of a lobby should not be considered mandatory, unless the external door and building design is capable of functioning without it. Even the most accessible doors can cause potential obstacles and reduce the available space. Therefore, if there is no need for a lobby, the lack of a lobby entrance is probably a better solution.

Where appropriate, the entrance lobby must be as large as possible and provide sufficient space for everyone to move between the internal and external doors. The minimum uninterrupted operating space between the doors is 1,500 mm from the swing of the door, with a single swing door opening outside. The total size depends on several factors, including the type of building, the number of people who will use the entrance at any time, whether it is used simultaneously as an entrance and exit, or need security features.

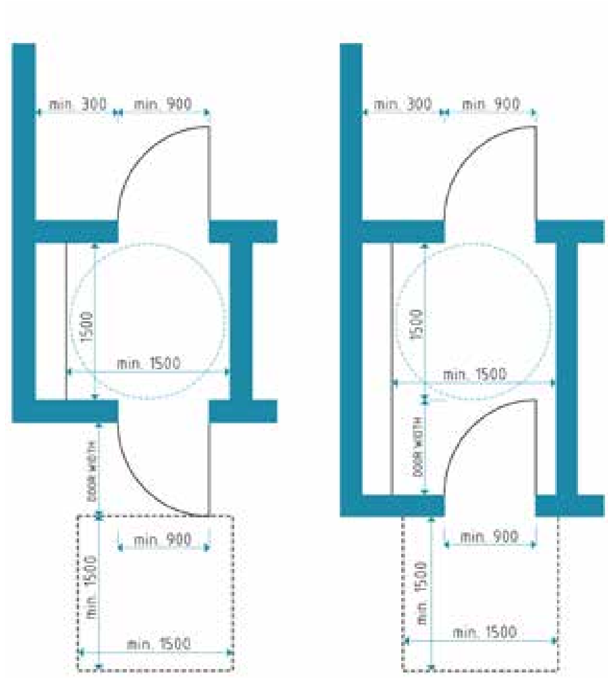

Figure 3.4.5 The entrance area (Rollová, Suláková)

4.2.5 Corridors

Corridors are the main spatial unit of the circulation system of a building and must be easy to follow. People must be able to easily find their way without restrictions. The corridors will enable all persons to open and close the doors and to enter the room and the facilities easily and independently, by passing without obstacles or turning in a wheelchair. They should be designed without steps, if necessary, they should contain ramps to overcome small differences in level, provided these cannot be avoided. To minimise collision hazards, doors must not open into corridors. In addition, accessible toilet doors should open outside, and if the corridor is sufficiently wide, the door allows clear passage when fully opened, and it must be clearly marked. The overall design of the corridors and passages of the building must be as direct as possible. The distance to travel must be minimised in accordance with the type and size of the building.

The minimum width of corridors in residential buildings is 1,500 mm. The objects projected into corridors such as heaters, or fire extinguishers can pose a risk to all users. The width of a corridor may be reduced to a minimum width of 1,200 mm in small distances if it is limited by local obstructions such as service conduits, fire rods, and columns.

- Corridor floors must be arranged as much as possible so that all users can move comfortably and safely.
- The minimum clear height of corridor and passageway passages shall be 2,400 mm above the floor surface. If corridors run next to staircases, ramps, stairs and ceilings are limited, protection must be provided to detect warning or other barriers at an appropriate height above floor level to prevent user collisions.
- If the corridor in a flat house is less than 1,500 mm wide, there should be passing places of 1,800 mm and 1,800 mm at an interval of up to 20 m between.

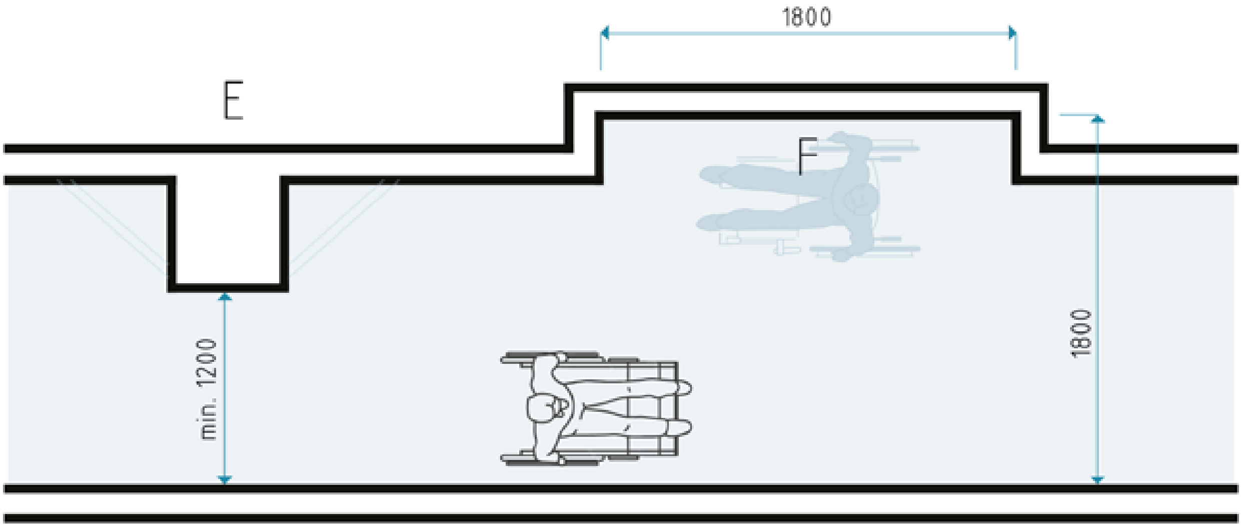

Figure 3.4.6 Minimum corridor width allowing a 90-degree turn while using a) small sized mobility devices, b) larger wheeled mobility devices (Suláková)

4.2.6 Auxiliary premises

Auxiliary premises include areas that support the primary function of the building. They are not part of the primary purpose of the building, but are required and add useful value such as: parking areas and garages, common storage areas, plant, cleaner and garbage rooms.

Accessible garages contain designated parking spaces for persons with disabilities located as near as possible to the main entrance of the building. According to the EN standard, at least one accessible parking space must be available in any parking area up to ten parking spaces. This increases to at least four and eight in parking areas with up to fifty and one hundred parking spaces, respectively.

The minimum width of accessible parking space for a passenger car is 3,900 mm, including the transfer area beside the car of at least 1,500 mm and a minimum length of 5,400 mm. Two adjacent accessible parking spaces with a shared transfer area have a minimum width of 6,300 mm. Locations of accessible parking spaces must be clearly and appropriately marked with an international symbol of access on the ground and with a vertical sign.

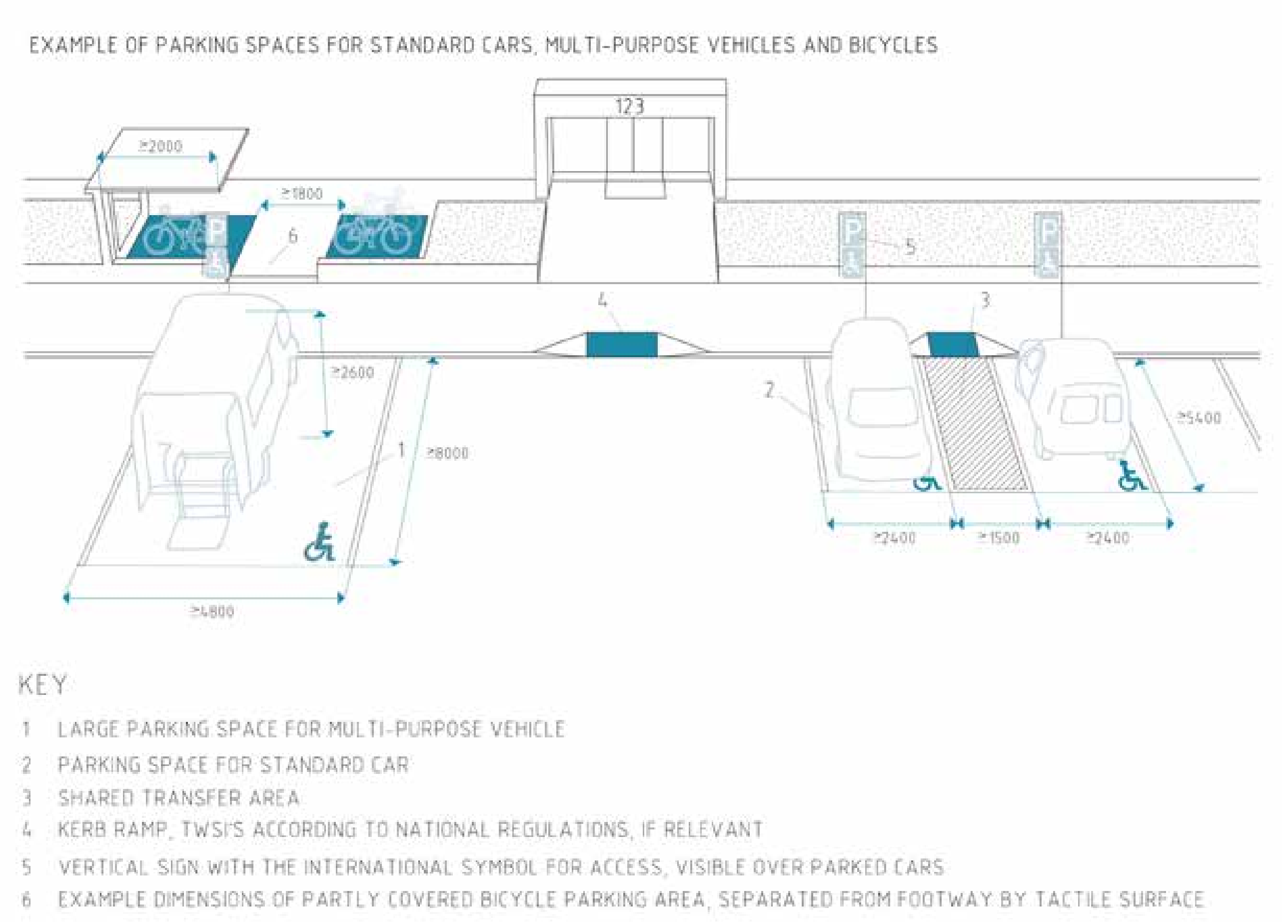

Figure 3.4.7 Accessible parking area (Suláková according to EN 17210:2021)

Accessible pedestrian paths in car parks and garages shall be clearly perceivable. Parked vehicles cannot reduce the clear width of an accessible route. Areas with a combination of traffic, bicycles, cars and pedestrians should be carefully considered. It may be very difficult for a person with vision impairments to safely follow a route.

4.3 VERTICAL CIRCULATION

IN A NUTSHELL

Because of accessibility, the lift is the optimal component for overcoming height differences and floors. There should be a lift in every new residential building, which will ensure accessible overcoming of height differences between floors. Small height differences within the floor should not be designed in new buildings. In existing buildings where the level change is higher and there is no space for an elevator and the installation of a ramp is not practical, it should be considered to provide a vertical platform lift rather than an inclined platform lift. Although stairs are the most common way to overcome level differences, they can cause serious injury after fall. Therefore, it is essential to design stairs to ensure that they are safe for everyone, also in an emergency.

4.3.1 Ramp

Ramps provide accessible routes to people unable to use stairs because there is already a level change that cannot be avoided. Some people, including those with strollers, wheeled luggage, or using wheelchairs, need ramps. The design of ramps is essential for their usefulness and safety. Any ramp must have an adequate and constant gradient. When using a wheelchair, a steep ramp can be difficult to climb and increases the risk of falling. The need for an adequate manoeuvring space at the top and bottom of the ramp and direction change is also an important factor in ramp accessibility. During regular landings on the long ramp, the person can rest; the minimum length of a landing is equal to the ramp width.

The building should be designed so as ramps are avoided as much as possible on the internal circulation system. If a ramp is required, carefully consider the existence of an elevator/ lift or a lift platform. If the slope on the access route is less than 1:20 (5.0 %) it means there is a **sloping path**. If it is greater than 1:20, a ramp landing and handrail is needed. Because of causing difficulty to people using wheelchairs, curving ramps should be avoided.

- According to the EN standard, the approach to the ramp at both ends is highlighted by coloured indications or visual contrasts to indicate its existence and facilitate the use by diverse users, including people with vision impairment. Ideally, ramp approaches should be near the location of lifts (or lift platforms) and stairs.
- Ramps must have adequate constant gradients and the length between the landings is necessary to facilitate a comfortable, safe, and independent use. Long ramps with total rise greater than 2,000 mm must be accompanied by accessible lifts.
- The width of the clear surface and the width between the handrails must allow all people using wheeled mobility devices, including people in wheelchairs, to pass without obstruction. The ramp width must be determined depending on the expected level of use and the possibility that people will use the ramp simultaneously in both directions. The minimum horizontal distance between handrails is 1,000 mm for one person in a wheelchair, 1,500 mm for two-way traffic permitting a walking person and a person in wheelchair to pass each other; 1,800 mm

Examples of rises, gradients and lengths of ramps

Example application	Maximum rise (mm)	Gradient (rise in length) (%)	Maximum length (horizontal projection) between landings (mm)
Sloping path	No limit	Less than 1 in 20 (5.0%)	No limit
Ramp	500	1 in 20 (5.0%)	10 000
Ramp	500	1 in 18 (5.6%)	9 500
Ramp	375	1 in 16 (6.25%)	6 000
Ramp	263	1 in 14 (7.14%)	3 500
Ramp	210	1 in 12 (8.3%)	2 260

NOTE: A ramp with a gradient higher than 1 in 12 (8.3%) can be difficult or impossible to use for some persons with disabilities and can create an increased risk of injuries due to fall or tripping.

Figure 3.4.8 Correct ramp dimensions (Suláková according to EN 17210:2021)

is required for two wheelchair users to pass each other.

- At the top and bottom of the ramp, level landings are placed and direction changes are made to allow pedestrians using wheels to move and manoeuvre in space. The intermediate landings must be performed at an appropriate interval to allow the user to rest or recover. The landing length must be at least equal to the ramp width.
- The ramp surface must be smooth and slip-resistant so that all people can move easily and safely also in wet conditions. The ramp flight must be visually contrasted with the landing surface to highlight changes in slope for persons with visual impairments. The ramp surface should not be covered with a thin and loose textile floor covering. If textile floor coverings are used, they must be fixed on a firm backing, with all edges fastened to the ramp surface.
- The ramp must have a handrail on both sides and must be continuous throughout the entire flight until they intersect with the door or travel route; they are used as a means of support, stability, safety, and guidance to users around the intermediate landing, except when they intersect with a door or path. The handrails extend horizontally above the two ends of the ramp to support the person moving from the level surface to the slope. Handrails must be set at an appropriate height for people using wheeled mobility devices, people of shorter stature or children and people who have difficulty walking, balancing, or moving. According to the EN standard, the ramp must have edge protection, a continuous upstand with a minimum height of 150 mm, or rail with its lower edge of maximum height of 100 mm from the ramp surface. Handrails should also be 850 – 1,000 mm above the surface of the ramp, the second lower handrail between 600 and 750 mm.

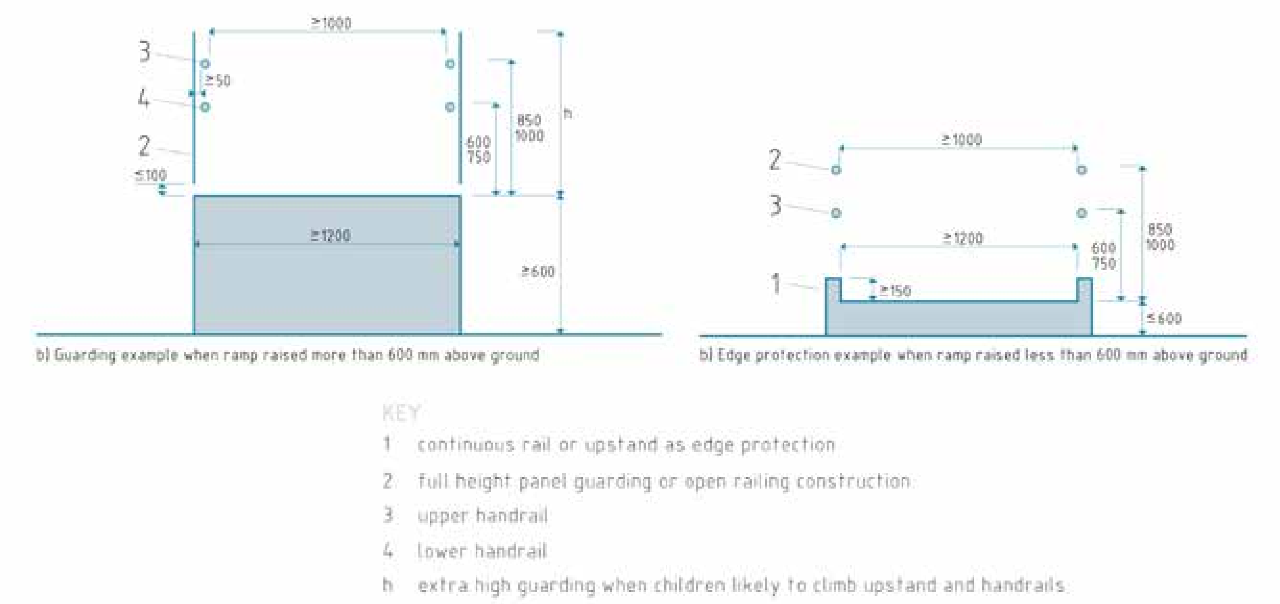

Figure 3.4.9 Ramps' sections (Suláková according to EN 17210:2021)

4.3.2 Lift

In general, passenger lifts are the most practical way to overcome distance between the floors of buildings, especially for those who cannot or do not wish to use stairs. In multi-storey buildings, especially high-rise buildings, lifts are the most important means of access for all users of the building between the floors. Lifts are used by people with different skills and needs. It is important that all functions, including functions for regular use, emergency, or evacuation, are easy to understand and safe to use. It is desirable to consider the installation of lifts in new buildings for evacuation purposes. If the elevator is not designed according to the evacuation elevator standard, designers should ensure that there are alternative mechanisms for vertical movements for persons with disabilities, such as persons using wheelchairs.

Lifts should always be located next to stairs to provide alternative access. This is to meet the needs of those who may not be satisfied with using lifts and who prefer to use stairs to get to other floors.

Whenever possible, the passenger lift should be installed instead of the platform lift, especially in new buildings. Passenger lifts must be universally designed, capable of carrying more people at a given time, and faster than platform lifts.

To use lifts, it is essential to install appropriate lift control devices and communication systems. Especially for people with visual and cognitive disabilities. For example, careful placement, high contrast, and tactile properties help users detect, recognize, and use lifts. People with hearing impairments may have hearing communication problems; in case of an emergency, an alternative visual solution and an audio enhancement system is needed.

- Before the entrance of the lift car, the platform space must be clear with a minimum diameter of 1,500 mm to provide adequate space for the movement/operation of wheeled mobile devices. The location of the entrance to the car, particularly linked to stairs, should provide a clear space to avoid accidents.
- The minimum inner dimensions of an accessible car for one person in a wheelchair and an

accompanying person are 1400 × 1,100 mm, while leaving the car backwards. Cars of minimum dimensions of 1,600 × 1,400 mm allow persons using wheelchairs to rotate within the car.

- The width of the unobstructed entrance will allow all persons, including those using wheelchairs, to pass through. The automatic vertical sliding door is operated by electrical power. Contrast colours on surrounding walls must be specified. Minimum clear door width of cars mentioned above is 900 mm.
- All floors should accommodate level landings and provide sufficient manoeuvring space outside the lift entrance for those using wheeled mobility devices, not in any passageway or directly opposite any staircase passageway. To avoid accidents, an enlarged manoeuvring area outside the lift car will be provided in the opposite direction to the downward staircase.
- Lifts must have a comprehensible (two-way) alarm system accessible to all, including people with visual, auditory, and cognitive disabilities according to the multisensory principle.
- Landing and car control devices designed for operation should be placed between 850 and 1,100 mm above floor level, with minimum distance of 500 mm from any adjacent corner or wall.

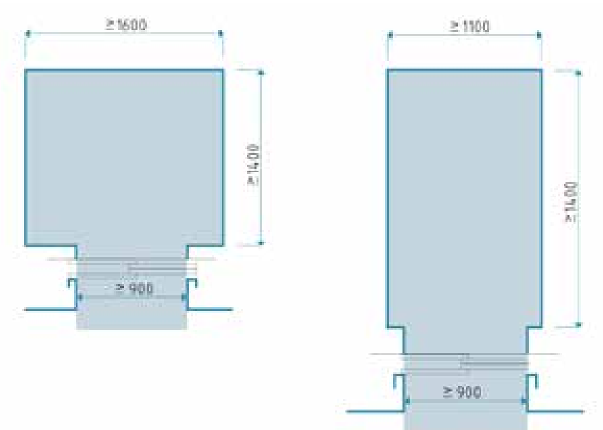

Figure 3.4.10 Suitable lift layout possibilities (Suláková according to EN 17210:2021)

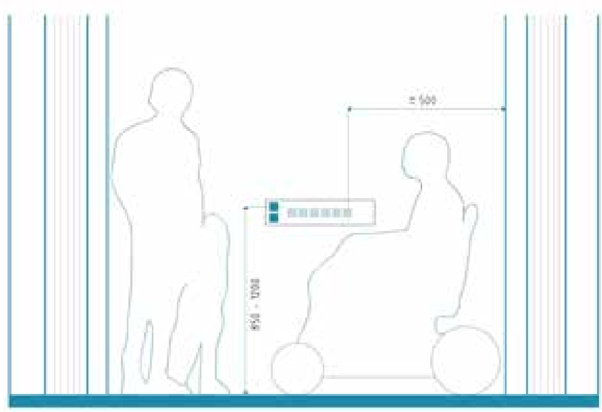

Figure 3.4.11 Suitable placement of controls (Suláková)

4.3.3 Staircase

Moving between different floors requires safe and easy-to-use steps both indoors and outdoors. When users step on them with only a part of their foot placed on the step, this can increase the probability of slipping while going down. When stairs deflect, excessive heights can cause excessive stress on the joints, knees, and/or hips of some people with walking disabilities. Furthermore, height differences often occur at the bottom and top of stairs and can cause injury, especially to osteoporosis patients. When climbing stairs, people with arthritis in the hips or knees are particularly vulnerable to trapping of toes under the projection, nosing or open riser, and the resulting tripping. Additionally, when looking at the open door, some people with visual impairments may feel unsafe, and guide dogs may refuse to continue. People with visual impairments are particularly vulnerable to falling or losing balance if they do not know the stair steps or if the steps are not designed properly.

- Optimal compositions of staircases are: straight flights, half turn with intermediate landing or large diameter curved flights with intermediate landing. Stairs with half or quarter turn without intermediate landing or spiral stairs should be avoided.

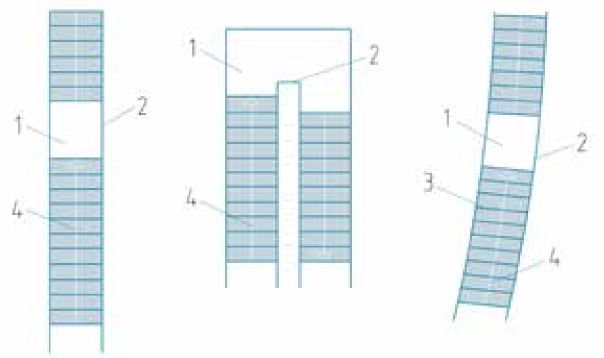

Figure 3.4.12 Optimal staircases 1 – intermediate landing, 2 – handrails, 3 – aberration of going +/-5 mm across full width, 4 – pitch line (Suláková according to EN 17210:2021)

- The stairs are accompanied by ramps or other access routes, such as lifts. If there is no technical capacity for a lift, a vertical lift platform can be used.
- There shall be no isolated steps. The flight of the stairs must be straight or, where necessary, curved stairs of large diameter can be used.
- The stairs must be wide enough to allow the passing pedestrians to move without obstruction. The minimum width of stairs is 1,200 mm and the minimum width between handrails is 1,000 mm. The minimum clear width of evacuation stairs is 1,500 mm between handrails, so that it is possible to use evacuation chairs and have space to move down while accommodating a contraflow.
- The use of stairs must have adequate headroom to avoid possible collisions of taller people. The minimum head clearance of stairs is 2,100 mm. When moving under stairs, it is necessary to provide sufficient height clearance, also 2,100 mm; or, if this is not possible, the space with insufficient height should be prevented and secured.
- Each step has a uniform rise, preventing accidents and trips, and helping people evacuate safely. Stairs must not be without risers; the steps should be stable and slip-resistant in humid and dry conditions. Maximum height of rises is 180 mm and minimum going width is 280 mm. Projection of step nosing should be avoided; if necessary, the maximum projection is 25 mm, however, in some countries, the nosing and projection must not be used at all, the stairs must have only vertical and horizontal faces.

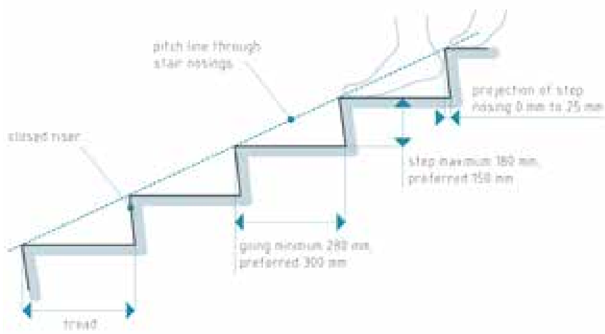

Figure 3.4.13 Stairs, in some countries, the nosing and projection must not be used at all (Suláková according to EN 17210:2021)

- Stairs must have an appropriate visually contrasting line on the front edge of all steps. A visually contrasting line of 40 mm should be set back a maximum of 15 mm from the front of the nosing. The contrast line should also return down the riser for a maximum of 10 mm.

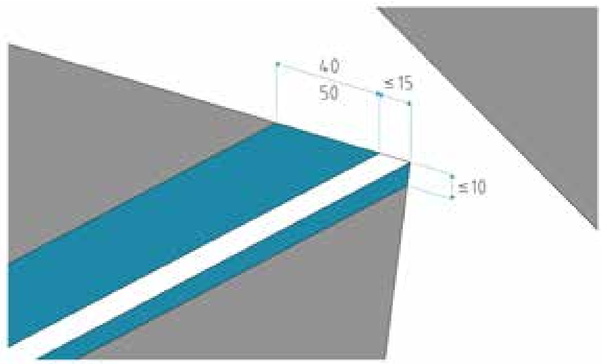

Figure 3.4.14 Contrasting stair line (Suláková according to EN 17210:2021)

4.3.4 Vertical platform lifts

Vertical platform lifts, also known as powered lifting platforms, are typical for renovation applications, and should be considered as a means of improving access in existing buildings when the installation of a passenger lift is not possible. They should not be installed in new buildings. Vertical platforms must facilitate independent, practical, and comprehensible access. It should not be necessary to obtain help or permission to use.

Platform lifts are often not suitable for many different disabilities. In addition, their use is generally limited and difficult to understand and operate. The most problematic issues with these products are the lack of enclosures or landing doors that are controlled by key operation and/or hold-to-operate buttons.
It should also be noted that they cannot be easily used by people in electric wheelchairs and that they must have a higher lifting capacity than those for conventional wheelchair users.

Vertical platform lifts should have a platform size of at least 1,100 × 1,400 mm. However, this size of platform is not sufficient for some electric wheelchairs and scooters with a length bigger than 1,400 mm when being used. To make them accessible to everyone, larger platforms should be provided as much as possible. Vertical platform lifts include doors, gates, or railings on multiple sides. This is an essential feature in which the floor level is located at a distance of less than a step in height. These "short-rise" lifts, that travel up to 2,000 mm vertical distance, usually have doors or barriers on the opposite side, allowing passengers to cross. This is the most preferred arrangement, because it avoids a person having to turn 90 degrees when entering or leaving the platform. However, if it is impossible to travel through the platform, it is acceptable to place the entrance and exit points adjacent to the platform. Vertical platform lifts are also available with three-side doors, adapted to multiple height levels.

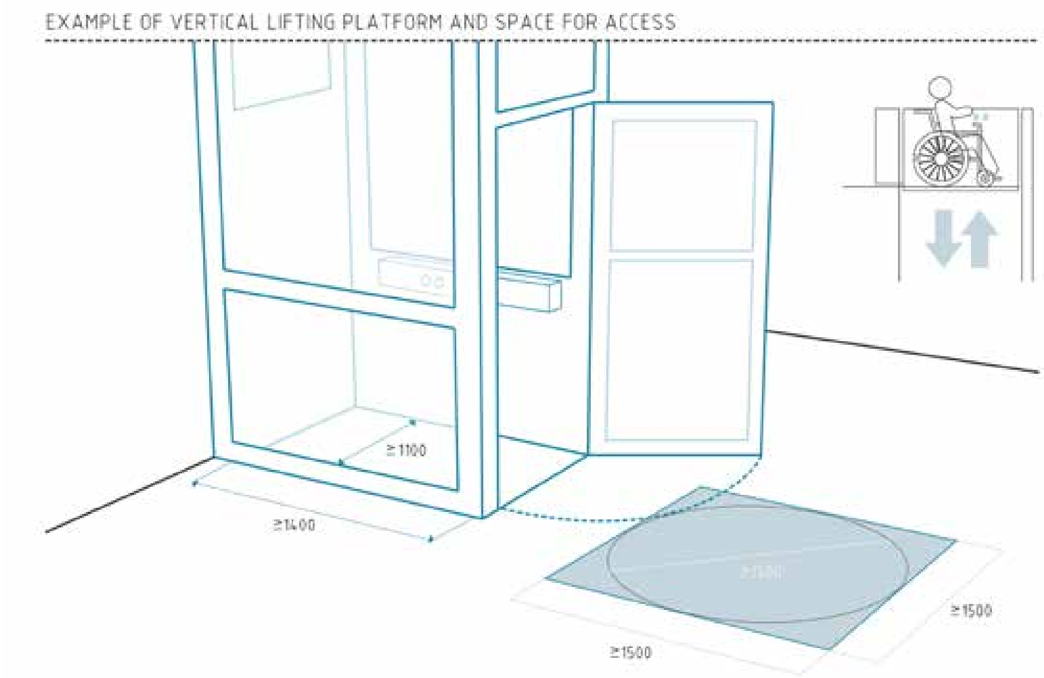

Figure 3.4.15 Vertical lifting platform (Suláková according to EN 17210:2021)

4.3.5 Inclined platform lifts and stairlifts

Inclined platforms and stairlifts travel along the stairs. They may include folding platforms for a person in a wheelchair, as well as a lift seat to facilitate the use by older people, or people with balance and endurance problems. Generally, installation in new buildings should be avoided. They can be accepted in small existing buildings where vertical platform lifts cannot be installed. They should not be used if parts of the platform or support lines interfere with the recommended clear width of the stairs, or the safety of other building users is endangered. When the unit is folded, all parts must be inserted from the circulation space and all exposed edges padded, reducing the likelihood that people may come on the platform or their clothing becomes caught on the sharp edge. Since inclined platform lifts are usually not designed for safe use in evacuation, it should be ensured that there are alternative mechanisms available to vertically move people with disabilities in emergency situations. Inclined platform lifts should only be used in buildings that are renovated, but should be available to be used independently if necessary.

Stairlifts can be used in residential architecture in exceptional cases, when adapted to meet individual needs and to be used by people fully trained to use the device. They are occasionally used in a specific place where they are provided to be used by an individual. In such areas, they should not block the specified width of stairs or emergency exit routes.

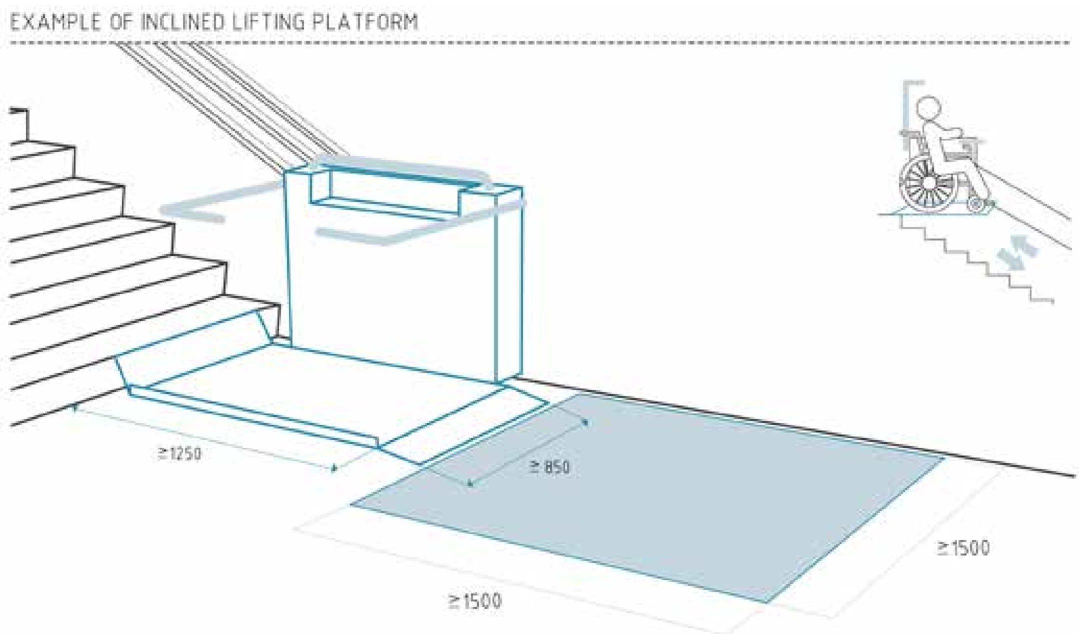

Figure 3.4.16 Inclined lifting platform (Suláková according to EN 17210:2021)

4.4 BATHROOM, TOILET

IN A NUTSHELL

Accessible and usable bathrooms and toilets are essential spaces in housing as well as in public buildings. They offer an adequate manoeuvring space and use for people who find it difficult to use general facilities, particularly people with mobility restrictions and people in wheelchairs, but they are also useful for wide range of other people, such as people with vision impairments, older people, families with small children, etc.

Adaptable solutions respond to different living situations and should be preferred in apartments due to the concept of age-friendly living and universal design. Especially in the family/community type social care housing, in facilities for older people and people with Alzheimer's disease, location of the accessible toilet and bathroom should be indicated in multiple ways using signage: visually contrasting information, pictograms, raised tactile and Braille, so that they also serve people with visual impairments and people with dementia. Accessible toilets should be situated conveniently in **easy-to-find areas**, such as waiting spaces, receptions, near lifts, etc. The routes must be with no steps or obstacles.

In housing buildings, an accessible bathroom could be located in various layout positions. It is suitable to have the bathroom **near the bedrooms**, and a toilet or bathroom is usually also situated in the entrance corridor of the apartment. For older people, especially those with severe physical disability, it is beneficial to have an accessible bathroom near the bedroom with direct connection and the possibility of installing a ceiling lifting system for an easy transfer from the bed to the bathroom. For people with Alzheimer's disease, it is very important to have a visual connection with the doors to the bathroom.

This chapter presents information about principles and appropriate dimensions from EN 17210:2021 (A: pp. 163–172, B: pp. 129–131).

4.4.1 Bathroom layout principles including manoeuvring space for a person in a wheelchair

Firstly, an appropriate and comfortable access to the bathroom is essential. Adequate manoeuvring and transfer space is another very important feature.

An accessible toilet or bathroom **door** should be wide enough: min. 800 mm, but preferably 900 mm and open outwards from the bathroom space. The orientation of the door opening (left or right) depends on the situation in the floor plan, it is important that it simplifies the transfer from the inhabited parts of the apartment (living room, bedrooms), so that a person is not forced to walk around the door when opening it. It is necessary to consider the corridor or the space leading to the bathroom, so that there are no conflicts with other manoeuvring spaces. Ideally, the

corridor can be recessed in the area, where the door opening is located, allowing the space for manoeuvring of the person in a wheelchair – a circle with a diameter of min. 1,500 mm, opt. 1,800 mm. The circle must not collide with the door opening route. Outward opening is also necessary for easier access to the bathroom in case of an emergency.

Sliding doors are also suitable, which can save space mostly where the hallway or corridor is not too wide. Nevertheless, their disadvantage is weaker soundproofing. The door threshold can be max. 15 mm high, optimally, there is none.

The layout should be useably equipped and easy to operate. The dimensions depend on the functions they have to fulfil, e. g. people with an assistant, with larger mobility devices or a person with a mobility disability need more space. There are various layouts of accessible bathrooms and they differ among countries.

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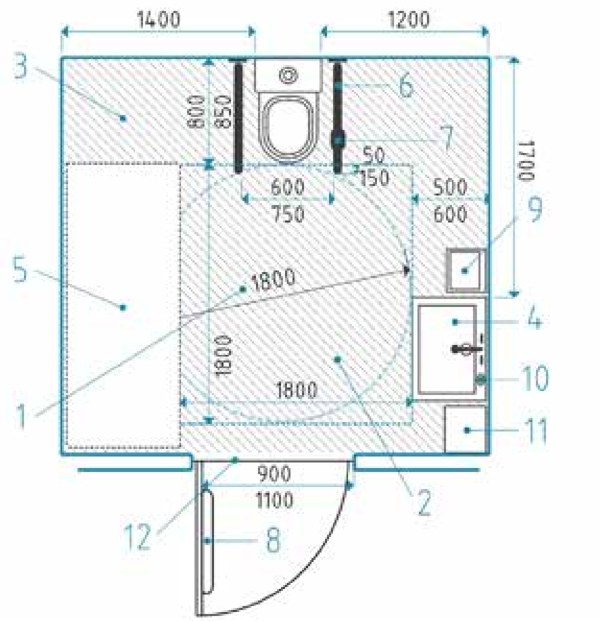
Transfer to and from the toilet seat should ideally be possible in multiple ways: frontal transfer, oblique and side transfer from left and/or right.

Individual users favour various solutions, for example, some users prefer the layout with the corner solution, where the toilet is situated next to a wall and the user can reach the washbasin and water tap, when seated on the toilet bowl. The access in this case can be from left only or from right only, depending on the position of the toilet, so it is not possible to suit all at once, because various people prefer or are able to use one side or the other. When designing multiple accessible toilets of this kind within one building, it is suitable to design both possibilities, so that users can choose.

Another layout type is the both side solution (peninsula) which allows users to approach the toilet from the left or right at the same time. This is suitable for all people regardless of their preferred side. In some countries, space for lateral transfer from both sides is required. However, in this layout the user cannot access the washbasin when sitting on the toilet, which can be a disadvantage in comparison to the corner solution, as well as higher spatial demands as this solution requires more space.

When designing an accessible bathroom for housing buildings, the toilet and the bathroom with shower and/or bathtub are usually together in one room.

The following floorplans show both solutions of a bathroom with a shower and another one with a bathtub, indicating the dimensions.



1 LARGE MANOEUVRING SPACE AND SPACE FOR ASSISTANCE
2 FULL-ROOM COVER TRACKED HOIST
3 POSSIBLE SHOWER AREA
4 LARGE TYPE WASH BASIN
5 MOBILE OR FOLDABLE AND HEIGHT ADJUSTABLE BENCH
6 FOLDABLE GRABRAIL
7 TOILET PAPER
8 PULL BAR ON INSIDE OF TOILET DOOR
9 PAPER DISPENSER AND WASTE BIN
10 SOAP DISPENSER
11 SHELF
12 EXTRA-WIDE DOOR OPENING FOR USE OF LARGER MOBILITY DEVICES

Figure 3.4.17 Accessible bathroom with shower and a bench, peninsular toilet and space for transfer (Suláková according to EN 17210:2021)

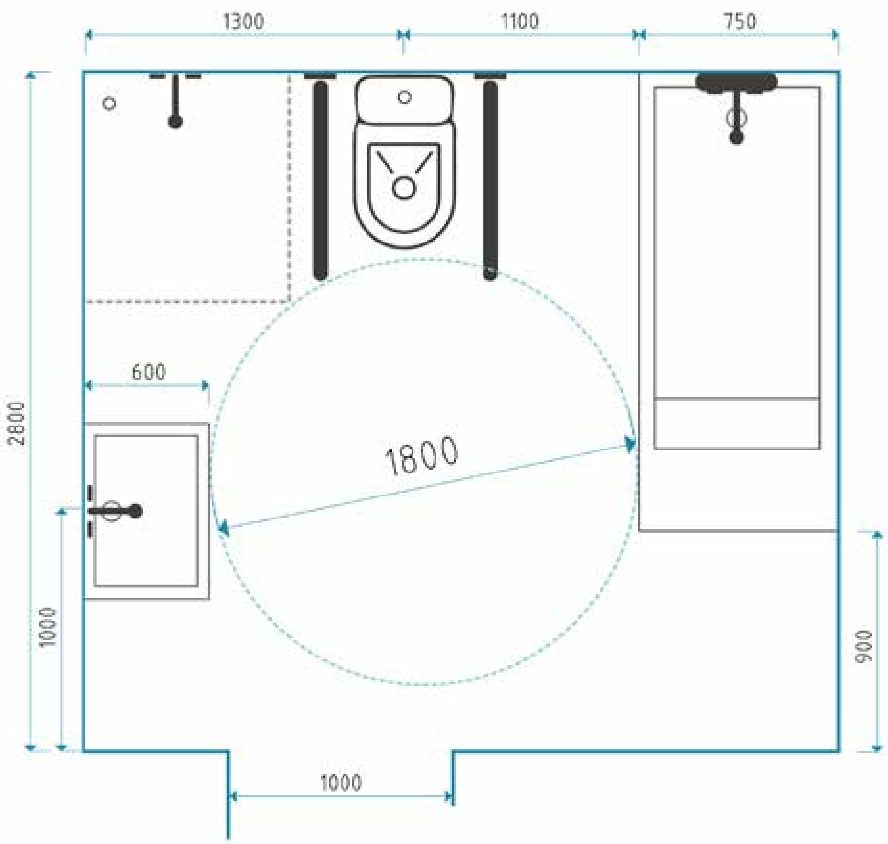


Figure 3.4.18 Accessible bathroom with bathtub, peninsular toilet and space for transfer (Suláková according to EN 17210:2021)

4.4.2 Adaptable bathroom solutions

The adaptable bathroom is realised with a view of serving as **accessible in the future**. An enlarged bathroom space can be created by merging spaces such as toilet and bathroom, toilet and storage/dressing room, bathroom and storage/dressing room, etc. A **removable partition** (e. g. made of plasterboard) between the merged spaces is only installed at the end, when the wall and floor cladding is finished and the removable partition must not be equipped with any plumbing. When creating an adaptable bathroom, it is necessary to take into account the need for a **shower at floor level**. If there is only a bathtub in the bathroom, a **floor drain** must also be implemented so that, if necessary, a shower can be installed next to the bath or toilet. New apartments in the Nordic countries have a bathtub that is not permanently built in (walled in), but is placed on legs on the floor, so that it can be easily removed if necessary. A typical and standard solution is a roll-in shower (with floor drain), located next to the toilet bowl, so that this space can also serve as a transfer space for a person in a wheelchair.

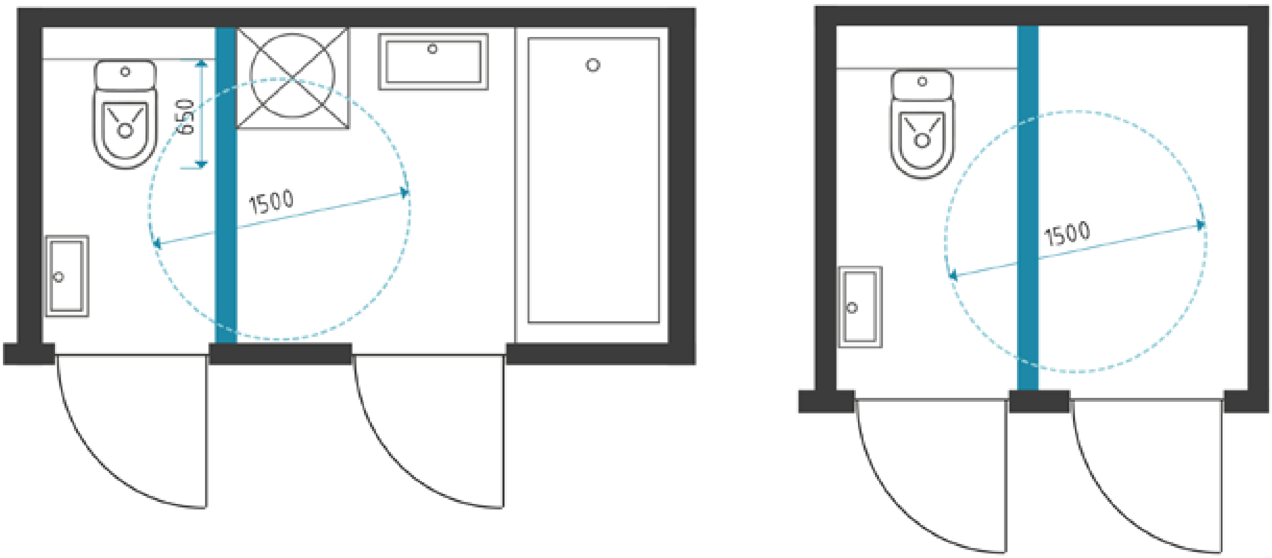


Figure 3.4.19 Examples of merging rooms together to adapt spaces for an accessible bathroom (Rollová, Suláková)

Additional equipment is added when adapting a bathroom to be accessible. In advance, we must design appropriate load-bearing capacities of the structures where accessibility devices are intended to be installed, ideally made of reinforced concrete.

The equipment consists of:

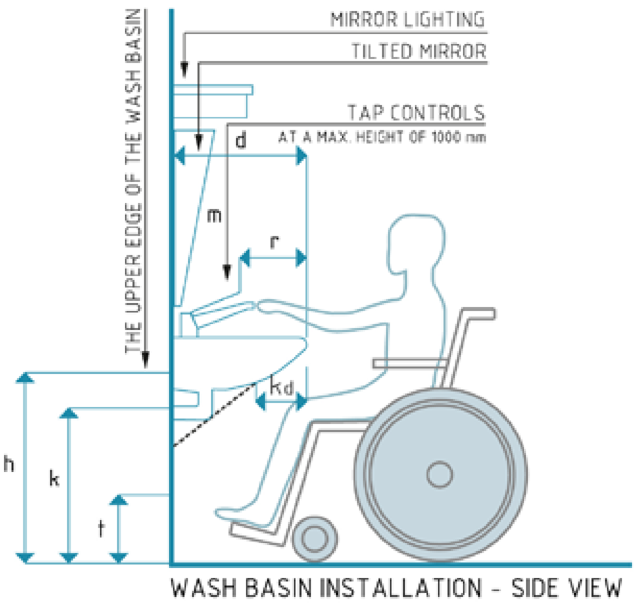
- Long handles on the door, so that people in wheelchairs can reach them.
- Foldable support grab rails next to the toilet, washbasin and in the shower according to the user's needs. The walls on which the handrails are expected to be fitted must have sufficient load-bearing capacity.
- The possibility of using the lifting device/ceiling lift as a transport aid, pre-fitting with an electrical socket can be near the ceiling and in case of need for the lifting device, it is easy and fast to install.
- An extension to the toilet seat in order to raise it.

We can also mention **flexibility**, ability to relocate some furnishings without the need for construction interventions. For example, the bathroom may comprise a space which can be used for folding a shower tray/relocatable bath/shower cubicle with a washing machine. In some cases, two options for entrances to the bathroom can also be designed, which can be used according to the current need, e. g. one from a corridor and one directly from a bedroom.

4.4.3 Dimensions for installation of fixtures and furnishings

Fixtures and accessories must be placed in appropriate layout positions and also height. Otherwise, they cannot function in the expected way and provide optimal and ideally independent use for all.

The appropriate layout positions of these elements are shown in chapter 4.4.1. Bathroom layout principles including manoeuvring space for a person in a wheelchair. **Appropriate heights** of fixtures and furnishings are shown below. An assistance call device (e. g. an **emergency pull cord switch or button**) should also be provided near the floor in all accessible toilets and bathrooms reachable for a person who has fallen and is lying on the floor).



h wash basin height 750 mm to 850 mm above floor surface

k knee space height minimum 650 mm above gloor surface

t toe space height minimum 300 mm above floor surface

d wash basin depth 350 mm to 600 mm

r tap conctrols maximum 300 mm from front edge of wash basin

kd knee depth 300 mm to 600 mm

m mirror 900 mm to 1900 mm above floor surface

Figure 3.4.20 View of washbasin with appropriate dimensions (Suláková according to EN 17210:2021)

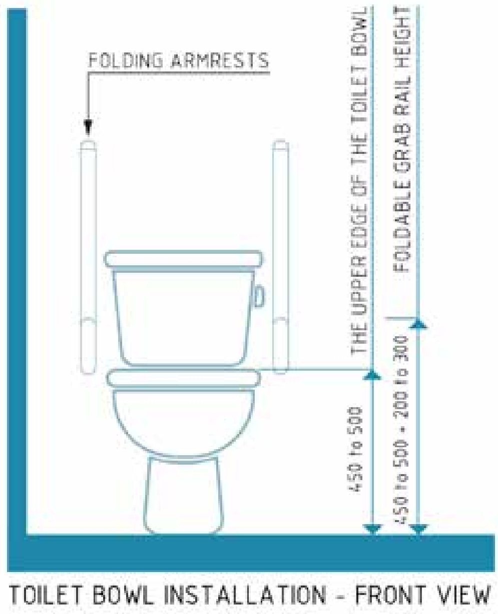


Figure 3.4.21 View of toilet with appropriate dimensions (Rollová, Suláková)

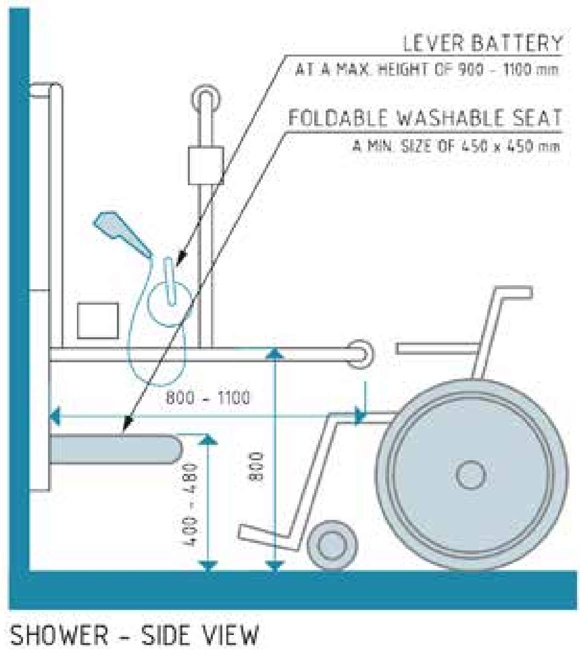


Figure 3.4.22 View of shower with appropriate dimensions (Rollová, Filová, Suláková)

4.4.4 Washbasin, toilet, shower, bath, and other items

There are many furnishings, items and a lot of equipment in a bathroom.

- An accessible bathroom needs a large type of washbasin for comfortable use. The **washbasin** must be with knee and toe space. The soap dispenser, a paper dispenser or a towel and a waste bin are located within reach. A mirror should be placed above the washbasin, ideally it should be a little inclined from the top, so that the seated person has a better view.
- The **toilet** can be longer than usual, approx. 650 – 800 mm from the rear wall on which it is installed. A back support (or cistern with a back support) is suitable, especially for older people. Near the toilet, toilet paper must be placed which can be situated on grab rails.
- The **shower** has a mobile or foldable and height adjustable bench or seat. There should also be a shelf.
- Foldable **support grab rails** must be placed on both sides of the toilet and are also recommended on both sides of the washbasin. Fixed grab rails are necessary in the shower or in proximity of the bath and a pull bar on the inside of the toilet door.

Other important elements are adequate lamps providing **good lighting**. Although natural light and ventilation is not obligatory, it adds value to these hygienic spaces, so it is favourable to design a window there, when possible. If there are no windows, artificial **ventilation** is also necessary. The design should propose visual **contrasts** improving navigation in space and among accessories. **Non-slip** surfaces are crucial, because many accidents can happen in bathrooms due to slippery surfaces.

More detailed information about design solutions is provided in Module 4, Unit 1.

EXERCISE

Find **a floorplan** of an apartment from a development project in your neighbourhood (e. g. from real estate portal) and try to **evaluate** whether it would be theoretically possible to adapt the bathroom to an accessible one.

- Notice whether it is suitably located with adequate **manoeuvring space** in front of the entrance to the bathroom, whether it could be merged with another available space, e. g. with the toilet, closet or store, etc.

Suggest such modifications, also including grab rails and indicate them in the floorplan.

4.5 KITCHEN AND DINING ROOM

IN A NUTSHELL

The kitchen, along with the dining room, is a very important space in the home. It belongs to the main housekeeping parts of the apartment and should be well connected with the entrance area to allow short distances for goods and waste. This space should therefore be welcoming, friendly, well-lit and ventilated, ideally with a connection to an outdoor area, and have dimensions and equipment adapted to be universally accessible to all inhabitants in the household. The kitchen layout and a logical division of zones is essential for a good useability. We consider the concept of the kitchen triangle and several possibilities of shapes (straight line, parallel, L, G, U – shapes or islands).

The kitchen should be ideally oriented to the **northeast or northwest**. Nowadays, the kitchen and the dining room often form not only a space for preparation and consumption of food, storing or washing, but also a **social space** for gathering, visiting, conversations, games or other activities. The reason for this evolution is the merging of duty with fun and an attempt to include the person preparing food in the social scene. The kitchen, the dining room and the living room is nowadays often combined into one common living space, the living area in the apartment. Therefore, the kitchen can be included in such a multipurpose living space as an “open kitchen”. Some information and dimensions presented in this chapter are retrieved from EN 17210:2021 (A: pp. 160–162, B: pp. 110–112), Neufert (2019, pp. 306–317), Daniel et al. (2017, pp. 183–187).

4.5.1 Kitchen layout principles including manoeuvring space for a person in a wheelchair

There are **five basic zones** in modern kitchen layout, each dedicated to a particular task:

- consumable storage zone, storage of food (refrigerator, food cabinet)
- non-consumable storage zone, storage of utensils (dishes, cutlery, slicers, bowls)
- cleaning and waste zone (dishwasher, sink, cleaning supplies, bins)
- food preparation zone (cooktop, stove, microwave, small appliances, cutting boards, spices, etc.)
- cooking and baking zone with pots, baking dishes and pans

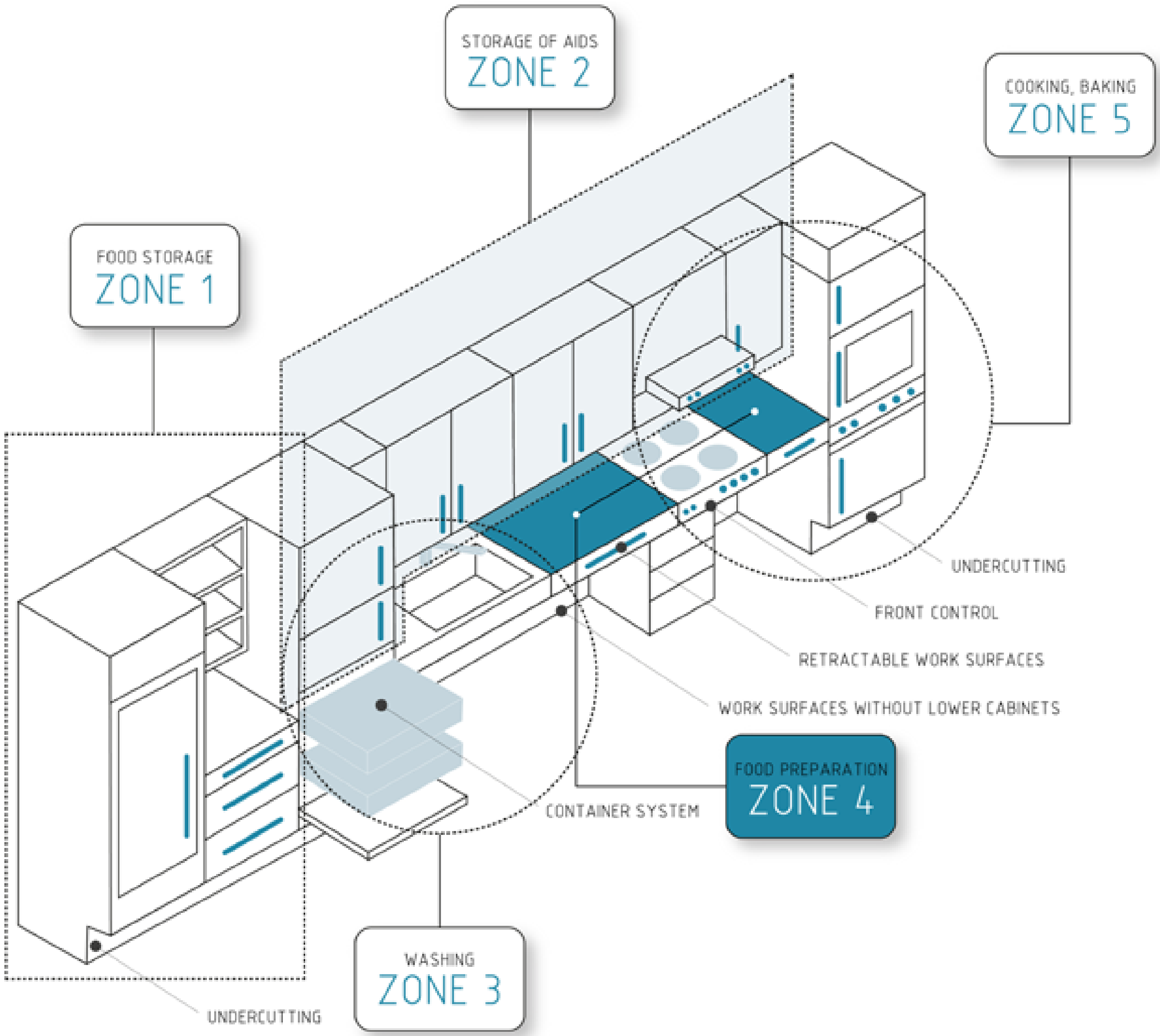


Figure 3.4.23 Zones and their sequence in the kitchen (Rollová, Filová, Suláková)

The size of each zone should accommodate the needs of the household and should be adaptable, able to be partially changed over time. There are often **additional functions** in the kitchen, most often in the form of dining, whether it is a small additional (breakfast) or the main one, but also a zone for making tea/coffee/cocoa, toasts, etc., possibly also a medication zone, a mobile phone charging station, a work or entertainment corner, all according to individual needs and wishes, adjustable over time.

In the first half of the 20th century, people were more dealing with the topic of functional kitchen design and in the 1940s, the concept of **kitchen work triangle** was created at the University of Illinois School of Architecture (Adams, 2018). According to the triangle, three elements: **(1) stove/cooktop, (2) sink, (3) refrigerator/ storage of resources** should be positioned in such a way that they form a triangle (or a line) in this order. The three components arranged clockwise – from left to right are suitable for right-handed people, the counterclockwise arrangement would suit the left-handed. The triangle sides should have lengths ranging from 1,200 mm to 2,700 mm. However, this interval was not calculated with regards to people in wheelchairs, so it is possible to design longer lengths for accessible kitchens if necessary. When considering minimal efficient manoeuvring space to achieve accessibility, floor clearances between all kitchen units or between the units and any wall must be at least 1,500 mm for a regular wheelchair and 1,800 mm for an electric wheelchair to allow turning. The refrigerator door opens in such a way that there is no need to go around the door, which simplifies the transfer of food to the worktop.

Based on the knowledge of the functional areas/zones of the kitchen and the kitchen work triangle, there are several **types of kitchen layouts**. In each case, the length of the free work surface on the counter should be at least 700 mm, each distance between the fridge, sink and cooktop should vary between 900 and 2,700 mm and the sum of all these distances should be in the range between 2,660 and 7,930 mm.

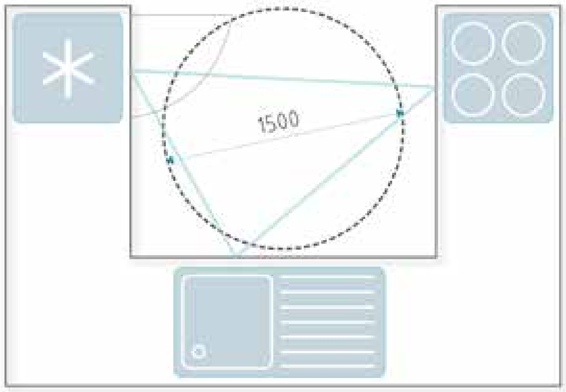


Figure 3.4.24 The kitchen triangle between fridge, cooktop and sink (Filová, Sulákova)

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Adam Thomas (2022), accessible kitchen design specialist, recommends a very beneficial solution – to design the **cooktop, stove and sink on the same run of the worktop** to avoid carrying heavy or hot items. It is suitable not only for people in wheelchairs, but also for people with lower physical strength, with a poor grip or other dexterity problems and generally for everyone to avoid potential risks.

- The cooktop should not be at the end of the kitchen counter to ensure enough working area around it. If the cooktop is larger, it increases flexibility.
- A better solution is a separate cooktop and oven, in comparison to a combined stove (cooktop and oven together), because it allows the oven to be placed at a higher height and the cooktop with empty space underneath, so that a person on a wheelchair can slide in.
- The dishwasher should be located next to the sink (left or right side). The layout of kitchens should be designed to minimise travel distance and avoid the need to carry items across the room.

1. **The one-wall/single-wall/single-row/straight** kitchen layout is the simplest solution suitable especially for less generous spaces. It does not implement the classic kitchen triangle, but rather a line, so the disadvantage can be redundant **walking back and forth**. The contact of the cooking person is worse as compared to some of the following solutions, because it is possible only from the **side view or indirectly** from behind the back, which makes the person less involved in the social activities. Moreover, people with hearing impairments need to maintain visual contact with their surroundings, which is hard to achieve using this constellation. Nevertheless, a very important advantage considering accessibility is that, unlike with some other types of layouts, there is less risk of difficult manoeuvring of a person in a wheelchair even in smaller apartments, because the space in front of the single-row kitchen is **usually naturally sufficiently spacious**.

2. **The two-row/double/parallel/corridor** kitchen consists of two separate opposite situated single-row segments. The disadvantage of this type is the **discontinuity** of the kitchen fittings, which can be problematic for people with mobility problems and with less physical strength, thus causing an increased risk of injuries, accidents or dropped food. This is because there is often a need to carry dishes, pots, etc. in the air (e. g. from the cooker to the sink), whereas in most other types of kitchens, items can be moved continuously across the countertop. In general kitchens, a distance between the rows of 1,200 mm is recommended (enough space for two cooks), but for an accessible solution, at least 1,500 mm is necessary (1,800 for electric wheelchair). On the other hand, for people not using a wheelchair, this distance can be slightly too long, requiring redundant movements (max. 1,400 – 1,450 is recommended by Daniel et al.). Thus, this layout type is harder to plan using the universal design. In this case, however, the advantage is the possible **frontal visual contact** with the dining room and the living room, if the kitchen is a part of this space, providing a great benefit for socialisation and people with hearing impairment. Possible follow-up space with serving and seating is also a plus.

3. **The L-shaped** layout is placed along two adjoining walls perpendicular to each other. The corner cabinets are challenging when placing shelves – these are hard to reach. However, it can be solved by installing corner mechanisms such as kitchen carousel or kidney corner unit, which can maximise the space under the corner counter and make it reachable. Another issue to consider is not to have **too long distances** between the ends of the L-shape which can then be ineffective. In case that the sum of the distances should exceed 7,930 mm, Daniel et al. recommend to use the island type. This layout usually does not occupy too much space, so it is also suitable for smaller apartments, and naturally allows enough room for **manoeuvring** in a wheelchair. Another positive feature can be the placement of a dining table or an island in the empty corner of the L. As the L-shape is located along the walls, there is **insufficient visual connection** for the person using the kitchen with the rest of the space, similarly to the straight kitchen type, so it is not very suitable for people with hearing impairment.

4. **The U-shaped** kitchen is composed of a combination of two-row and L-shaped kitchen. This is a spatially demanding type of layout, therefore suitable for bigger apartments. As with the two-row kitchen, there are slightly contradictory needs for various people, because for people using wheelchairs, it is again necessary to have at least 1,500 mm between the opposite segments, whereas for people not using wheelchairs, this can cause **too long distances** and redundant walking or movements. However, it can be advantageous in case of a multi-member household, the spacious solution can be effective when several

people are involved in food preparation at the same time. This layout can also offer **nice views** of the living area, of course if the U-shape is not entirely enclosed by walls. This can be of great advantage for people with hearing impairment who can see into space. Moreover, if the room is exceptionally large, even an island or a table in the centre of the U-shape can be incorporated. It would create a central work/social zone. The potentially problematic corner cabinets are solved similarly to L-shaped kitchens, using corner mechanisms.

5. **The G-shaped/peninsula** layout is quite similar to the U-shaped one, but another perpendicular segment is added to the U, or it can also be similar to the island type, when the island is connected to one wall. A peninsula adds another segment in space in addition, which can have seating in that area and form a nice **social element with views** of the space. This arrangement is suitable for people with hearing impairment. However, the G shape is very **space-demanding** and to be fully accessible, requires a minimum distance of 1,500 mm between the segments to allow a person in a wheelchair to manoeuvre, thus being suitable for larger apartments.

6. **The island** kitchen can be made as a combination of several already mentioned layout types with an island which is not connected to any wall or segments of a row, L or U-shape. It usually requires **generous space**, even more generous to achieve accessibility. As described in the two-row kitchen, the **discontinuity** can cause problems while carrying objects in comparison to continuous counter shapes. The island can create a **social zone with views** and its design can be very good-looking. However, when making a decision, the use of L, U or G-shapes using peninsula instead of an island should be preferred, mainly because of the undoubted advantages of continuous work surface and possibility of creating a social zone at the same time. Alternatively, it can be a good solution to place all the three elements (fridge, sink and cooktop) in one row or in the L or U-shape and to have the island only as a social zone, possibly with occasional dining. This solution eliminates the dangers caused by discontinuity of countertop when preparing meals, and provides social and visual opportunities for people with hearing impairment as well.

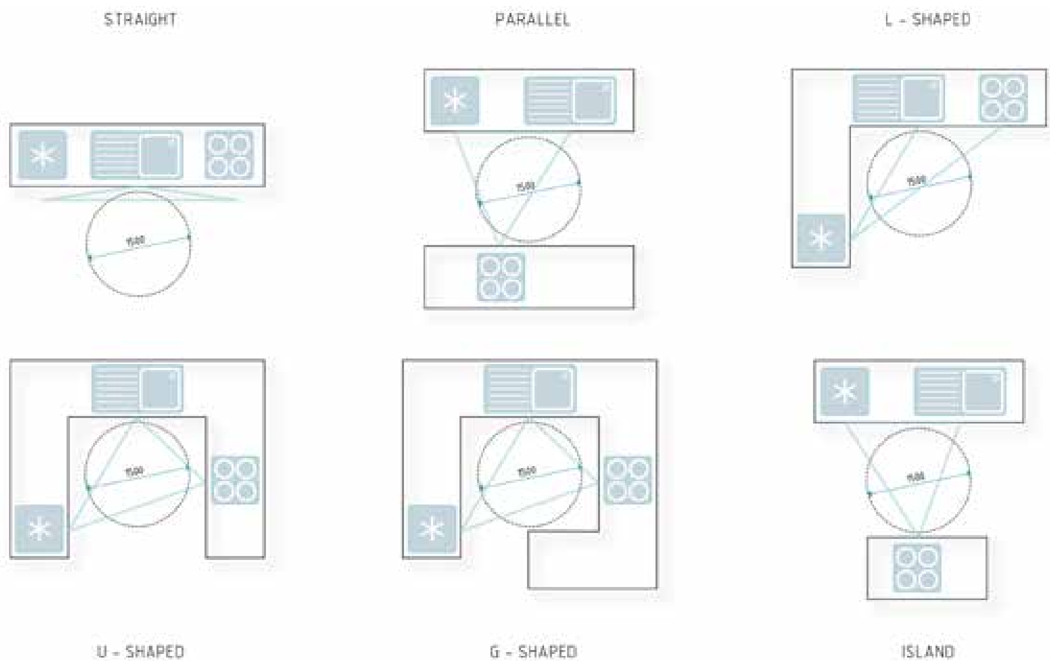

Figure 3.4.25 Layout kitchen types (Filová, Suláková)

4.5.2 Adaptable kitchen solutions

On average, people replace kitchen every 20 years, so we have to think about the **changing conditions** in the home. The requirements and health conditions of users change over time, so the kitchen should be as adaptable and timeless as possible.

There should be, for example, **adjustable and removable components** that will serve even in case of mobility impairment. The key is to choose the right layout shape suitable for the room. Natural accessibility can be achieved using a single-row kitchen unit and the L-shape. The rest of the shapes, the two-row kitchen unit, the U and G-shape or the island are only accessible when positioned to allow 1,500 mm between the fixed elements, which is above standard distances and not optimal for people not using a wheelchair. Therefore, we can consider a U or G-shaped layout installed in a way allowing to remove or move the peninsula part further from the other parts of the kitchen in case of need for manoeuvring space for a wheelchair in the future.

The heights of various kitchen components must also be carefully considered. The countertop, shelves and all storage spaces should be reachable from a seated position. The kitchen countertop should be positioned lower than what is usual, the usual height being between 850 and 920 mm according to Neufert. The exact decision for the height is based on the height of the person using the kitchen the most, but for wheelchair accessibility, it should be a max. of 800 mm high. Also, various heights of the working area are suitable for various activities, for example, Daniel et al. mentions heights for people not using a wheelchair in this way:
(1) the zone for food preparation, cooking, its disposal area should be ideally 800 mm high and (2) washing, working and its disposal area is ideally 900 mm high.

Thus, ideal heights differ for people of different heights, as Gilbreth advised as early as 1930 (Penner, 2022). For various activities and for diverse mobility conditions, we can see that an ideal solution for a multi-member household with different heights and needs (and for various activities) is a countertop with **adjustable height**. It can be operated using a button or lever with power booster, we can also mention voice-activated home assistants and remote controls. When adjustability is not applied, work surfaces and appliances are at two different heights. The sink should always be shallow to enable easy access from a seated position. Darker coloured work surfaces for countertop are preferable as they make it easier to identify lighter objects located on them.

A similar principle is applied to **overhead cabinets**, the height of which should be adjustable, the cabinets ride on wall rails, and there are even pull-down shelves, cabinets that swing out of the wall entirely by means of a lever mechanism to a comfortable height within the reach of a seated person. So, over time, we can consider replacing fixed and high upper wall cabinets with a flexible movable solution, rise-and-fall worktops that allow people to reach all spaces even from a sitting position.

The need for the amount and purpose of **storage spaces** can also be modified over time, thus also cabinets can be designed to be removable to allow enough empty space below the countertop. Alternatively, they can be replaced with cabinets on wheels that can be easily moved while maintaining storage space.

In order for the above options to be functional, it is necessary to have well placed static and hard-to-change elements connected to utility networks, for instance, the sink and heavy equipment like dishwasher and oven. The dishwasher and the washing machine should be on a plinth, so they are easier to reach for everyone. Waist height is ideal for placing the oven, both for people in wheelchairs and others, because they do not need to bend with the side opening door to prevent leaning over the door.

Kitchen surfaces are also an important issue, they should be **easy to maintain and anti-slip** to ensure hygiene. The application of **colour contrasts** is also important to make the kitchen usable even in the case of partial visual impairment. The floor is an especially important decision. Fortunately, cabinet doors can be replaced relatively easily over time, so that in case the original surfaces deteriorate, or are not contrasting enough or appealing any more, etc., they can be adapted.

4.5.3 Dimensions for installation of kitchen furnishings and equipment

Many basic layout dimensions and their application are explained in more detail in chapter 4.5.1. Kitchen layout principles including manoeuvring space for a person in a wheelchair. Here is a summary and conclusion of the **basic dimensions**:

- All **distances** between opposing pieces of equipment must be **at least 1,500 mm** for a regular wheelchair and **1,800 mm** for an electric wheelchair.
- The work surface – **countertop** must have a free space of **at least 700 mm** long and ideally **height-adjustable**. Otherwise, there should be two heights, the lower work surfaces should have a clear knee space underneath to enable people to sit during food preparation. A suitable work surface for persons in a seated position is between **740 and 800 mm**.
- The minimum **clear height under the countertop** should be **700 mm** to allow the approach of a person using a wheelchair.
- **The distances** between the **fridge, the sink and the cooktop** should vary between **900 and 2,700 mm**. The sum of all these distances should be in the range between 2,660 and 7,930 mm.
- All lower **cabinets** should be approx. **200 mm above floor** with a recess to allow space for feet of the person in a wheelchair.
- **The dishwasher** and the **washing machine** should be on a plinth, also approx. **200 mm from the floor**.
- The wall cabinets should ideally be adjustable, and part of the **shelves** should be at a reachable height of **500/1,100 mm** above the floor surface. Protruding cabinets and shelves should be marked at floor level, e. g. with a stopper or a decoration/house plant, so that they are detectable for people with visual impairment using the white stick technique. They should also have a contrasting colour as the background to help people with residual vision.
- The **oven** should ideally be at **waist height** with a sliding or side opening oven door.
- Electrical **sockets and switched** sockets should be placed on side walls at a maximum height of 150 mm above the work surface.
- **Microwave ovens** are either located on a work surface or mounted so that the base of the oven is at a **max. height of 850 mm** from the floor and its **controls max. 1,150 mm** from the floor.

4.5.4 Dining room layout principles including manoeuvring space for a person in a wheelchair

The dining room is frequently replaced by a dining zone in the kitchen, or in the living area together with the living room and the kitchen in one space. It should be placed in the **south or west** part and well connected with the kitchen to ensure easy transfer of meals. The dining space is a very important area because many social events take place there. The dining room fulfils a communication function, together with the living room it provides a common space for the apartment residents and also guests.

For the dining room or area, it is also essential that the wheelchair user has enough space for manoeuvring, at least on the route to one seat at the table, so the minimum width of 1,500 mm, opt. 1,800 mm is important. The dining area dimensions depend on the number of people at the table and on whether the table is intended to be accessible for a person in a wheelchair from one side only or from several sides. If the dining area should offer one accessible seat, it should be a space of at least 3,000, 2,600 mm or 3,400 × 2,900 mm, depending on the table layout. Two accessible seats are available in case of a dining area with the width of 3,100 mm and all places are accessible when the dining area is at least 4,000 mm wide.

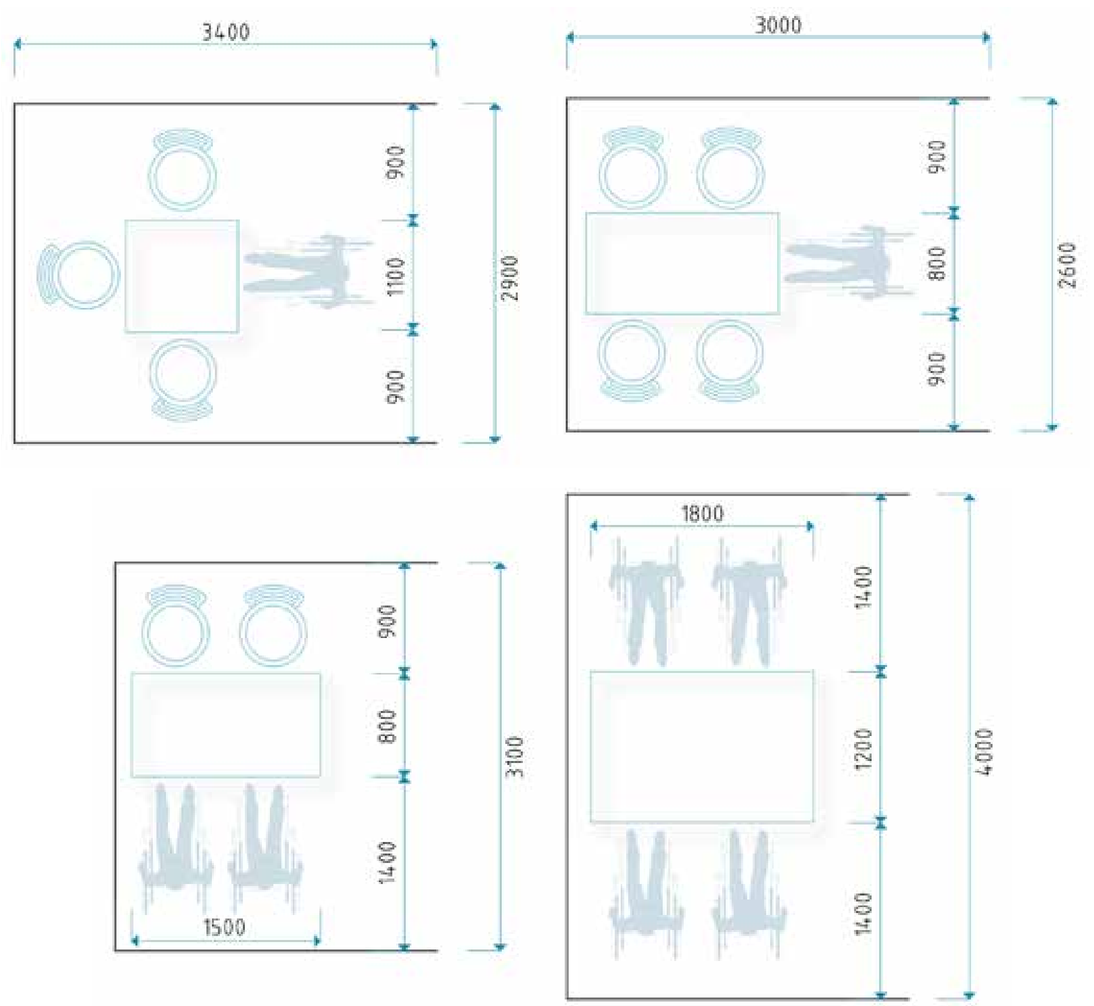

Figure 3.4.26 Schemes of accessible dining area examples (Rollová, Filová, Suláková)

4.5.5 Kitchen cabinets, table, chairs and other furnishings and appliances

When possible, all equipment and furnishings should be **flexible**. **Kitchen cabinets** should be easy to use, with door handles which are easy to grip or touch-operated tip-on systems without handles. Kitchen elements, such as cupboard doors, cupboard door handles and drawer fronts, should contrast visually with the adjacent surfaces so that all are clearly identifiable.

Tables need to have an empty space underneath to be usable by people in wheelchairs. The empty space must be a min. of 900 mm wide and 600 mm deep. Darker coloured surfaces help to identify lighter objects placed on them, such as plates.

Chairs must have backrests and at least some of them should also have armrests, and also seat cushions to provide comfortable seating and getting up for older adults, but also people with back problems or pregnant women.

Also, other furnishings and items need to be ergonomic, contrasting, easy to maintain, etc. More information about the design of these elements can be found in Module 4, Unit 1 and in Module 5, Unit 2.

EXERCISE

Analyse the kitchen in your household:

- **Identify zones in your kitchen**: Consumable storage zone, non-consumable storage zone, cleaning and waste zone, food preparation zone, cooking and baking zone.
  - Are there also other additional zones in your kitchen?
  - Would you suggest any modifications regarding location and dimension of the zones in your kitchen for better functioning?
  - What additional zones would you think about adding for (a) a small child, (b) a teenager, (c) an adult, (d) an older adult.
- **What modifications** would you suggest in your kitchen to make it **accessible** for people in wheelchairs and for those with hearing impairment?

4.6 LIVING ROOM

IN A NUTSHELL

The living room really is a space for everyone and should be inclusive and universally accessible. Adequate manoeuvring space and dimensions must be taken into account.

In this unit, we will analyse solutions for various functions placed in living rooms, such as socialising and hobbies.

Nowadays, the living room is often connected with the **dining room and the kitchen** in one space. The living room should have nice **views to the exterior** and ideally also a physical connection with it using a balcony, terrace, loggia or (winter) garden and oriented to the **sunny** sides, usually in combination with the south side. The living room should not only be a place for the residents of the apartment, but also for visitors; therefore, the **visitability** of the apartment for people with various needs is also very important. Luckily, thanks to the generous space that living rooms should have, it is easier to achieve enough manoeuvring space.

4.6.1 Living room layout principles including manoeuvring space for a person in a wheelchair

The living room should be **spacious**, its narrow side should be at least 4,000 mm wide. The size of the room depends on the functions the living room has to provide, and also on the number of people who will live in the apartment. Usual functions comprise social interactions, watching TV (or other audio-visual media), reading (with a possible home library), playing games or musical instruments, doing other hobbies, etc. As was already mentioned, the living room space is often seamlessly connected with the dining room and kitchen. The open floor plan solution also saturates the needs of people with hearing impairment, who need extra visual connection while communicating or taking care of children.

To enable accessible **manoeuvring** in the living room, like in other spaces, it is necessary to have zones for activities with a min. circle diameter of 1,500 mm, opt. 1,800 mm. Local distances between furniture can have smaller distance in a lesser extent (approx. 900 mm), but only as a short transitional space leading to a place, where the circle for manoeuvring is provided.

Living rooms are often connected with **exterior spaces**. To enable an accessible way to the exterior, balcony doors must be a min. of 800 mm, opt. 900 mm, wide with a door of maximum threshold height of 15 mm. To be able to manipulate the doors, there must be a manoeuvring circle in front of it (not colliding with the path of the door). A space-saving solution is sliding doors.

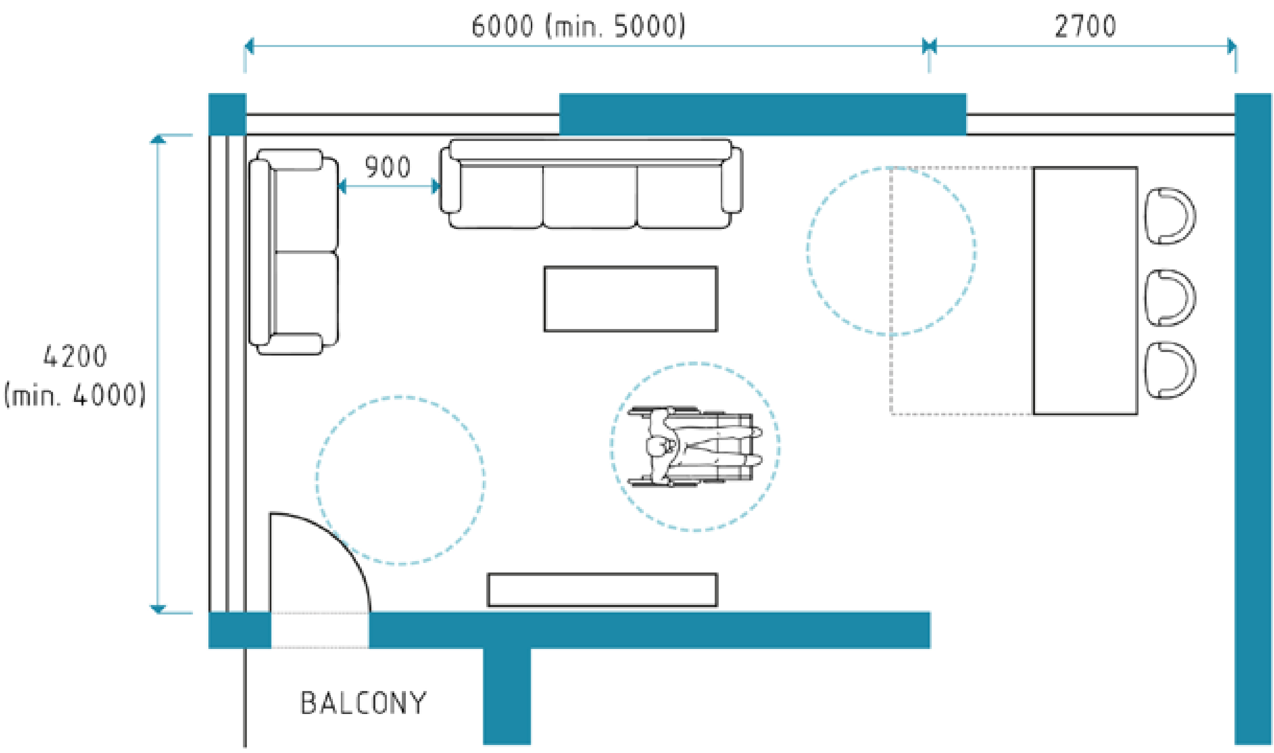

Figure 3.4.27 Illustrative floor plan of an accessible living room (Lacho, Suláková)

4.6.2 Adaptable solutions

Usually, there are few or no built-in interior elements in the living room, most of the furniture is mobile. This solution allows great daily flexibility, and also easier complete replacement of furniture. Easily movable, light and smaller furniture with various possibilities of configuration in the layout is preferable. Unnecessary furniture or decorative pieces should be relocated or entirely avoided, because they cause obstacles and barriers.

When considering floor surfaces, we can also anticipate the need for possible changes, so we can have, for example, a wooden, cork or cast floor and a carpet on top. In the future, when the carpet is too difficult to maintain, we can remove it and have a suitable layer already prepared under it.

4.6.3 Adaptable solutions

Sitting in the living room has become less formal and more relaxed than in the past. Nowadays, mobile solitaire seating sets complemented by serving tables are preferred. These furnishing items allow for **different variations** of set-ups and are more optimal than a compact and heavy seating set-up.

Young people prefer sitting bags and various informal types of seating, where ergonomics and multi-functionality play a big role. Older adults need other, more stable types of seating furniture, with higher lever for sitting, optimal height being 500 mm, to facilitate standing, often with adjustable back and arm rests.

More information about seating furniture possibilities can be found in Module 4, Unit 1 and Module 5, Unit 2.

4.6.4 Dining space (in the living room)

In modern layout solutions, the dining room is very often integrated into the living room. It is a nice way to connect people in the household in one space and enjoy shared time and space. This solution is especially beneficial for people with hearing impairment, who can see what is happening in all these spaces and, for example, watch over the children playing in the living room while eating. The dining room, which is part of the living room, should be located to the **south**, possibly also to the west facade.

In addition to eating, the dining area provides opportunities for social life, communication, meeting guests, but also for doing homework, etc.

As mentioned several times, the space for manoeuvring is very important to achieve accessibility, therefore the minimum circle of 1,500 mm, opt. 1,800 mm, must be in front or next to a place for seating at the dining table.

4.6.5 Working space (in the living room or separate)

The workspace usually consists of a work table/desk and a chair.

- A key condition for an inclusive workspace is the provision of manoeuvring space in front of the work desk of a minimum circle of 1,500 mm, opt. 1,800 mm.
- Another important issue is the possibility of tucking in under the table, so the empty space must be a min. of 900 mm wide and a min. of 600 mm deep.
- The height of the table should ideally be adjustable; otherwise, it should be approx. 700 mm.
- We can also think about the inclination of the desk; for writing, the inclination is 10 – 15°, for reading it is 25 – 30°.
- The colour of the table surface should be dark, so that lighter objects placed on the table can be easily identified.
- As for the chair, it should be ergonomic, with back and arm rests and be adjustable.

4.6.6 Other furnishings

Similar to kitchens, there are often **shelves and cabinets** in the living room. They should be approachable and reachable for people in wheelchairs, so that the preferred height to place them is **500 – 1,100 mm above the floor surface**.

Piece rugs/carpets can create difficulties for a person using a wheelchair, in addition to posing a risk of stumbling. A better solution is therefore **full-surface floor finishes**. Carpets can create a warm and acoustically comfortable environment, which can be pleasant for older people. However, carpets are more difficult to maintain in a hygienic standard, they can be a source of dust and allergens. Therefore, the designer should consider all the advantages and disadvantages and find optimal solutions for individual people in cooperation with the client. Cork is also a consideration for being soft and warm natural material, but also wood or cast floor, while attention must be always paid to **anti-slip** properties of the materials.

4.6.7 Daylight and thermal comfort

Concerning the daylight, we should firstly design the living room in a good position, so that it faces **sunny cardinal points**. Combinations with the south are suitable, possibly also with the west, as people usually spend most of the time in the living room during afternoons.

In this regard, we should also think about nice views. To enable views also for people in a standing or lying position, the **window sill** must be lowered to a maximum height of **600 – 700 mm**. French windows without a window sill are optimal, of course with railings if an apartment is on an elevated floor. To provide a nice view, glass railings or railings made of other subtle material are suitable. The area of the window to the area of the room should be at least 1:8, optimally more.

When choosing windows, we also consider their energy performance; there are glasses that capture up to 70 % of heat radiation while maintaining 80 % transparency (Pifko, Špaček et al., 2008., p. 138).

To ensure the possibility to set the desired level of daylight, architects and designers must also think about shading. **Shades** can be installed in the interior or exterior, or both. There are several types, such as sliding sunshades, blinds, roller blinds or curtains. Shades can also prevent the penetration of unwanted sunlight into the interior. When considering a thermal point of view, exterior shades are preferred for already blocking the sun rays outside, so as the windows do not overheat and the interior gets less warm.

DO YOU WANT TO KNOW MORE ABOUT...

To support naturally **optimal thermal comfort**, the Socrates House principle is applied (Dumitracu et al., 2018). This principle says that the living rooms face the south, when the building is in the northern hemisphere. (It would be north when designing in the southern hemisphere.) To ensure the desired thermal conditions, there is a cantilever overlay above the south windows, which ensures that

(1) in the summer, when the sun shines from a higher incidence, the overlay blocks the sun rays from entering the interior, thus preventing overheating,

(2) in the winter, the sun angle is closer to the horizon, so as the rays enter the room and warm it.

If this basic principle is followed, thermal comfort is naturally easier to achieve and finances for air conditioning and heating are saved. The principle does not work when the position relative to cardinal points is different, e. g. when the windows face the east or the west. In those cases, we need to prevent the sun rays from entering the interior using preferably exterior shades.

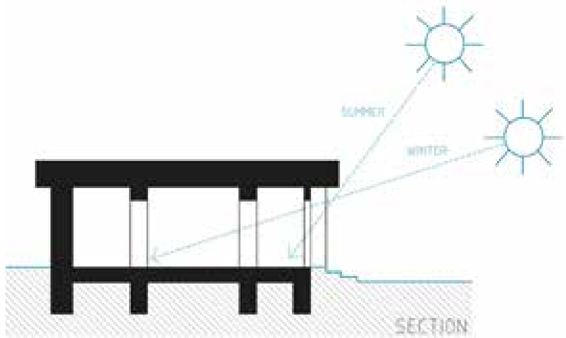

Figure 3.4.28 Principle of the Socrates House (Filová, Suláková)

Of course, it is also necessary to implement artificial ways of ensuring thermal comfort. For example, installing **air conditioners** to prevent overheating during the hottest days.

Heating systems are definitely a necessity, and we can think of multiple techniques which also reflect ecological and economic conditions (various types of boilers, heat recovery systems, pumps, etc.). Floor heating is the most comfortable solution, because it provides pleasant radiant warmth from the feet and prevents the need for radiators that could obstruct manoeuvring. A fireplace can also be a pleasant and aesthetic secondary source of heat. Of course, it is important to take safety into account when using it.

EXERCISE

See a current **catalogue of furniture** and try to choose pieces you would use in design of **an accessible living room** with a seating area, dining area and working space.

- You can also choose an additional space for a hobby according to your preferences.

Consider shapes of the furniture (not dangerous, to be able to tuck in, reachable, with supporting elements like armrests, etc.), but also contrasting colours and aesthetic appeal.

4.7 BEDROOM

IN A NUTSHELL

Bedrooms are the most private, individual and intimate rooms in the apartment and are essential for physical and psychological health of people. Quality sleep, relax and intimacy is a very important part of life. Therefore, the bedroom design must be deeply-thought and discussed with future users. Accessibility, safety, comfort and calmness are key determinants of a suitable bedroom solution.

Bedrooms are designated for apartment's residents and visitors usually do not enter these rooms, with the exception of children and students who often invite friends to their room. The bedroom includes many **important functions** such as sleeping, resting, intimate life, taking care of oneself and small children, but also storage space mainly for clothes and bed linen. Sometimes, there can also be a work desk. One bedroom should be intended **for a max. of two people** (except parents with a small child).

4.7.1 Bedroom layout principles including manoeuvring space for a person in a wheelchair

The good position of bedrooms in a layout is the one when **separated from the social zones** (kitchen, dining room, living room) and when visitors should not need to go to the private areas (e. g. to go to the toilet). Each bedroom should have its own entrance from a common space, hall or corridor. Transition rooms are no longer applicable nowadays.

Ideally, bedrooms face the **east**, south-east, north-east, so that there are sun rays in the morning. In the case of bedrooms for children, optimal combinations are with the south, south-east, but also combinations with west can be beneficial, because children spend their time in the room mostly during afternoons, so they can enjoy afternoon sun rays.

The bedroom area for two adults is at least 14 m^2, opt. 16 m^2. For one adult person or a child, it is a minimum of 10m2; for two children, it starts from 12 m^2. To enable manoeuvring space, it is important to place bed(s), wardrobes or tables in such a way that in front or next to these pieces of furniture, there is a circle with a minimum diameter of 1,500 mm, opt. 1,800 mm. The route from the room entrance to the bed should be simple, ideally straightforward.

Preferably, the bedroom and the accessible **bathroom** with toilet should be **adjacent**. It is a recommended solution especially for the elderly due to their hygiene requirements and limited movement and orientation. This arrangement is also suitable for retrofitting a ceiling lifting device to move from the bed to the bathroom.

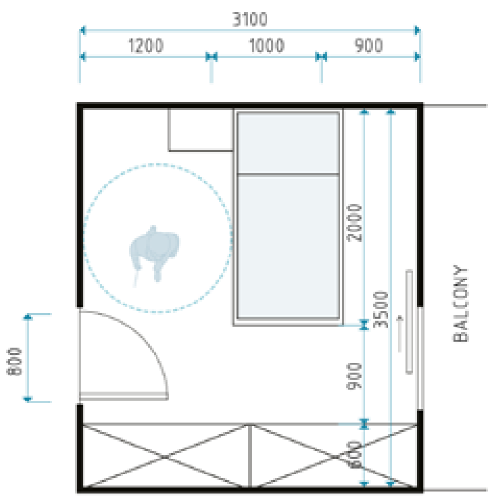

Figure 3.4.29 Illustrative floor plan of an accessible bedroom with a single bed (Lacho, Suláková)

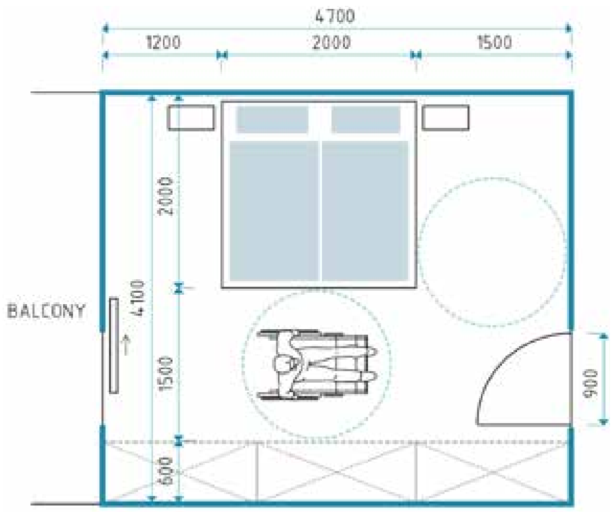

Figure 3.4.30 Illustrative floor plan of an accessible bedroom with a double bed (Lacho, Suláková)

4.7.2 Adaptable solutions

The bedroom should be adaptable, because as adult people and also children grow older, their needs and preferences evolve and change. At one time, the bedroom can be a room for a child who needs a small bed and plenty of space to play, then a room for a teenager who needs a big bed and space for studies. Later, it can be a bedroom for a couple with a small child needing a crib, then it can be a bedroom for an older couple or a single person. An adaptable solution can be, for example, swapping of various pieces of furniture, e. g. a baby crib for a dressing table, and, if necessary, free up this space completely for comfortable manoeuvring and installing grab rails.

The room should be subsequently **easily furnished and modified**. Therefore, easily changeable mobile furniture is generally a good solution. Of course, built-in elements are also practical, because they save space and provide a complete look tailored to the room. In the case of designing built-in furniture, care must be taken to ensure that it is designed correctly, timelessly and with good access, because it would be difficult and expensive to change it. However, these elements can also be adapted, for example a wardrobe with sliding doors that can be changed or removed quite easily.

4.7.3 Bed

The bed must be placed in the bedroom in such a way that the accessible entrance side of the bed must be at least 1,500 mm, optimally 1,800 mm from the wall. Of course, if the room is larger, the bed should be accessible even from both sides. If it is a double bed, it would be accessible for both partners, or a person in a wheelchair could choose the optimal side.

The bed is a **key piece of furniture**, because it largely determines the quality of sleep, which is a very important part of everyone's life. It should be comfortable, hygienic, with a nice, relaxing design and colour solution. Its optimal **height** for older adults is higher than the standard **approx. 500 mm**. The bed can be portable on wheels and adjustable, positionable. Such types of beds are usually slightly larger than regular beds and are made in different designs, they can look homely and cosy, not hospital-like.

More information about the bed and matrasses can be found in Module 4, Unit 1.

4.7.4 Wardrobes

Accessible wardrobes are easier to use when they do not have doors or they have only an easy-to-operate closing system. They should have lower storage spaces, so that they are **reachable** by a sitting person at a maximum height of 1,200 mm. It is also possible to use the entire height of the cabinet up to the ceiling, if a pantograph system is used.

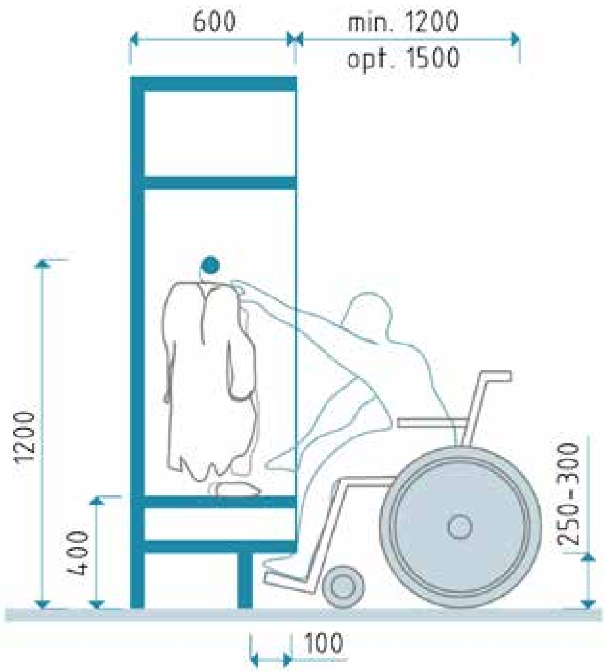

Figure 3.4.31 Reachable heights for storing for a sitting person/a person in wheelchair (Rollová, Suláková)

4.7.5 Other furnishings

There can also be other furnishings in the bedroom. For example, **bedside tables**, sometimes a **dressing table** or a **work desk**, carpet or rug, etc. can be mentioned. Very good solutions are low cabinets and commodes with drawers, which are, however, quite space-demanding and these must not interfere with manoeuvring. Each of the furniture pieces must not obstruct the route and pose possible risks of injury. Sleepy people and older adults especially can get dizzy, so the furniture must be designed and placed in a way to **prevent the risk of injuries**. For example, we could prefer rounded corners, soft materials in the parts, where one could easily bump into, but we should also avoid placing rugs or smaller carpets in the bedroom, that could curl, slip or snap, causing a person to trip and fall.

Grab rails can provide support for people not only in bathrooms, but also in other rooms such as bedrooms. They would be especially suitable on the way from the bed to the door. The same applies to the emergency pull cord switch or button which can be placed in the bedroom, so that a person who has fallen from the bed to the ground can call for help.

Ceiling lift is a helpful aid for transferring people with significant mobility limitations. It can be installed on the ceiling, providing transfer from the bed to the bathroom, living room, or any other desired part of the apartment. The system can also overcome door lintels.

4.7.6 Daylight and thermal comfort

Just as the living room, the bedroom also needs **sufficient daylight and thermal comfort**. Moreover, the need to regulate the amount of light is higher to meet the conditions for an undisturbed sleep even during the day.

The bedroom requires a slightly lower temperature than other rooms to support a good sleep. However, older adults often prefer higher temperatures than younger people, so an ideal solution to meet everyone's needs is to have the thermoregulation of each room separately.

EXERCISE

Ask 3 – 5 people of various ages in your neighbourhood what three features of a bedroom are the most important to them and compare the results.

SUMMARY

An **adaptable apartment** does not have to be fully accessible from the start of use, but must allow for the selection of accessible elements or accessories that can be modified or added if necessary to better meet the various specific access requirements of users.

The adaptability of the apartment layout can be ensured by **removable walls**, in which no installations (electrical cables or water pipes) are built. Thanks to the removable walls, the number or size of the rooms can be adjusted depending on the needs of the family.

The living area of the apartment has the character of an **open layout**, which provides enough space for a variable arrangement of furniture, and the kitchen corner has such a large floor area that it is possible to manoeuvre even for people in a wheelchair.

The greatest demands must be placed on a **good bathroom design**, so that it can be easily adapted to the needs of the household. An integral part of hygienic spaces (bathrooms and toilets) is a floor drain, so that it is possible to shower next to the bath or toilet, if necessary. The accessible bathroom is a key space in age-friendly housings. Entrance to the bathroom should allow comfortable manoeuvring in front of the door, the door must be wide enough and opened outwards or sliding. There are several layout possibilities, two basic types are with a toilet situated in the corner and both side solution (peninsula). There are also accessible bathrooms using a shower or a bathtub, or both. There is a possibility to design an **adaptable solution**, so that it is possible to easily create an accessible bathroom in an apartment in the future. Dimensions for positioning individual furnishings have a great importance and effect on the functionality and usability of a bathroom, as well as its design, e. g. surfaces with **visual contrast** and **anti-slippery** properties.

Multiple **kitchen** layouts offer different positive and risky features. When designing a smaller kitchen, we should consider the single-row unit and the L-shape which naturally offer enough

space for manoeuvring with a wheelchair. On the other hand, when there is enough space, the U and G-shape can be designed, because they allow continuous working sequence. Two-row/parallel units and the island kitchen are less suitable to be designed as accessible. The key rule is to have a functional kitchen work triangle with (1) stove/cooktop, (2) sink, (3) refrigerator/storage in this order for right-handed people and the opposite one for the left-handed. To achieve accessibility, we always must have at least 1,500 mm, opt. 1,800 mm between fixed elements of the kitchen to allow manoeuvring. The size and function of the five kitchen zones can be adapted over time, for example by mounting/dismounting the upper cabinets, by fitting a larger or smaller number of lower cabinets which are ideally flexible, movable on wheels. Preferably, the countertop is also flexible and can be positioned in various heights.

The **living room** should be an **inclusive space** for all inhabitants of the apartment, and also for possible guests. Many diverse activities happen in the living room such as relaxing, communicating, playing, but also learning and dining in case the dining area is a part of the living room. Daylight, thermal comfort and views to the exterior are crucial factors of the living room which determine the quality of the space. People of various ages often spend a long time there, and to be able to enjoy it fully, the living room should be also well equipped. The furniture should be flexible, propose various types of seating and ergonomic with enough manoeuvring space.

Bedrooms are very important and **private** rooms of an apartment. They should serve their inhabitants optimally, and therefore be accessible and safe especially for people with special needs and older adults according to their individual requirements. There are several elements which can help achieve accessibility and safety, such as enough manoeuvring space, straight easy route to the bed, near distance to the bathroom, grab rails, ceiling lift and assistive device for calling for help. The right choice for bed and wardrobes is essential to create a functional environment, while being pleasant, cosy and relaxing.

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