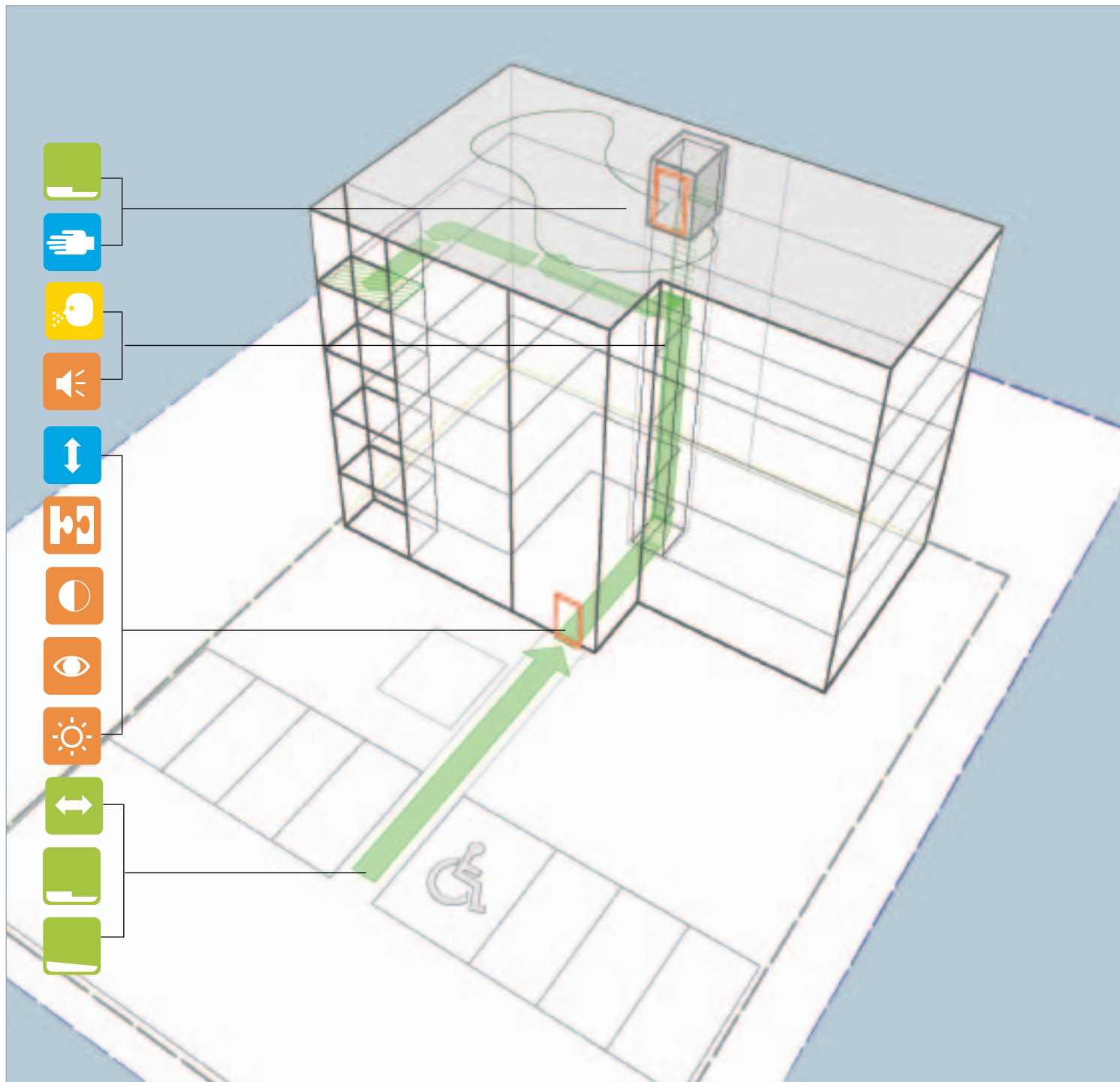




Building for Everyone

Understanding universal
design of buildings and
outdoor spaces

Universal design as a strategy



It is the Norwegian government's policy to strengthen the development and use of building designs that provide good functionality for everyone. The National Office of Building Technology and Administration and the Norwegian State Housing Bank – both of which are part of the Ministry of Local Government and Regional Development – are responsible for implementing measures that help make residences, public buildings and workplaces more functional for everyone.

Norwegian building rules include functionality regulations designed to enhance accessibility. These regulations are broad enough to accommodate universal design solutions. The Norwegian-language instructional guide “Bygg for Alle” (“Build for Everyone”) has been created to promote functionality as the basis for safe, useful and aesthetic buildings. The instructional guide presents tables with check-lists for each building area, and can be used as a reference tool during the planning and public approval phases of a project.

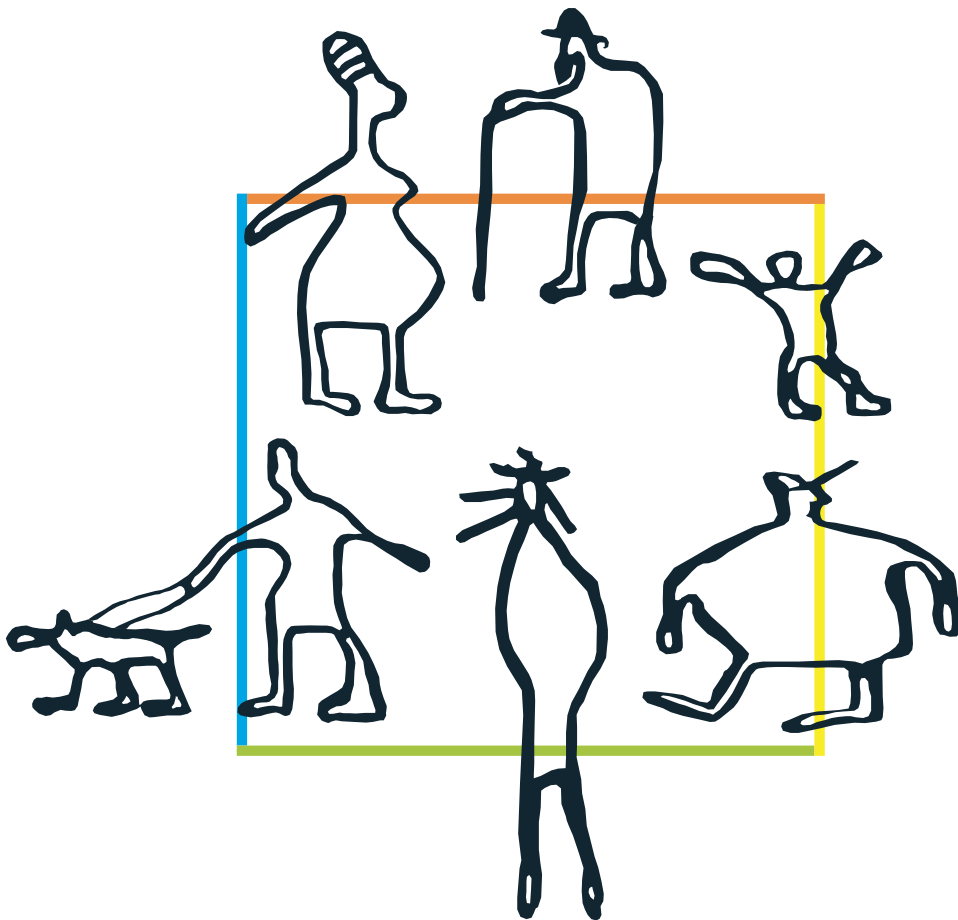
This booklet is meant to provide insight into the universal design concept and to inspire further study. As methods for understanding the universal design concept in buildings, we have used knowledge about differences between people, expository examples and architects touring their own buildings to experience them as disabled persons do.

We wish to encourage architects to tour their own buildings while wearing simulation glasses, pushing a walker or accompanying someone with reduced mental function. The experience may provide a valuable lesson in how to approach your next building project.

Text, pictures and illustrations are presented in combination with symbols and colours to clarify the challenges many people meet in their physical environments. The more reduced their functional capability, the greater is their challenge. The use of universal design principles in building and landscape projects is good for everyone – and necessary for some.

Planning with universal design principles requires an understanding of:

- 1) Childhood, adolescence, adulthood and old age
- 2) Reduced functional ability with regard to mobility, orientation and hypersensitivity to environment conditions
- 3) Human reliance on technical aids





(Photo: Torstein Ihle)

Throughout life, we change both physically and mentally.

Most young people and adults are well equipped to master physical challenges, while children and the elderly are less so. Apart from age, a person's functional abilities may be affected by injury or sickness. But the desire to live in a nice home – as well as to work, meet friends, travel and enjoy the outdoors – seldom changes over time.

Physical assumptions at different ages

Children

Children undergo constant physical and mental development. First they are pushed around in a carriage, but soon they are crawling and trying to walk. They learn things one at a time, gaining experience and understanding en route to mastering their surroundings. Planning and design must take account of the fact that children have a shorter arm reach and less mobility than adults. Children are also limited in their ability to understand written messages and to recognize danger.



(Photo:Torstein Ihle)

Youth

In schools and other public buildings, materials are often chosen without regard to whether they can stand up to the rigours of child's play. The needs of children are often ignored when outdoor areas are planned. In designing space for play and other activities, the choice of materials should be age-appropriate.

Adults

Buildings and their technical installations are often designed to meet the needs and habits of functionally capable adults. But many adults must navigate those buildings with small children in strollers. Most people over 50 years of age have reduced vision and often require reading glasses. Others have difficulty with stairs. New technologies are not always easy to understand. Even door buzzers and intercoms can be a challenge, especially for those who are blind or have impaired vision.

Elderly

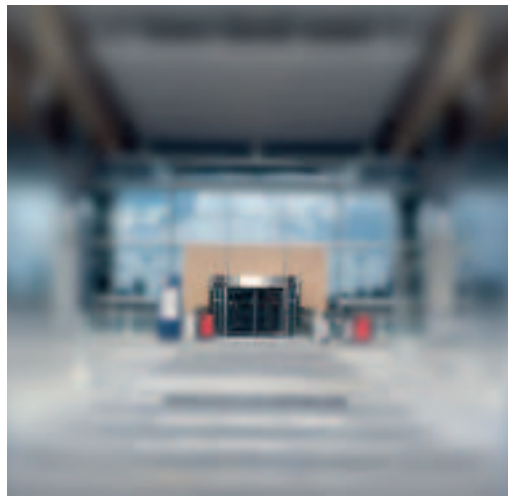
As adults approach old age, their functional capabilities generally decline. Eyesight and hearing get worse, and memory may fail. Many people lose arm and leg strength, making it harder to overcome distance. As technology develops and expands its reach into everyday life, it also confuses the people who cannot keep up.

Many elderly people get by using technical aids like glasses, a hearing aid, a cane or a walker with wheels. The design of buildings and technical solutions should take into account the widespread use of such devices.

In many homes the entrance includes a staircase, and important rooms are distributed over several levels. Normal residential neighbourhoods often lack homes that are suitable for all phases of life. Many public office buildings still lack an elevator, preventing many people from entering.



Parts of the field of view are blurry or missing.



Only part of the field of view is sharp.



The top of the field of view is “overexposed” and barely visible.
(Original photo: Guy Fehn)

People with reduced functional capability

When we become sick, suffer an injury or simply get older, our ability to function is altered. Functional disabilities can be seen as a mismatch between physical designs (determined by society) and the needs of the individual. The dismantling of physical barriers through universal design will reduce the number of people who are inhibited from taking part fully in society. Disabilities are generally divided into three main types: mobility-, orientation- and hypersensitivity-related.

Mobility

Mobility-related impairment involves trouble moving, whether as a result of illness or injury. Reduced strength in the hands and arms makes it more difficult to use equipment, open doors, reach things, etc.

Orientation

Orientation-related disabilities occupy three broad sub-categories: reduced vision, reduced hearing and reduced cognitive function. Visual disabilities range from total blindness to mildly impaired eyesight. Cognitive disabilities involve problems in understanding.



Hypersensitivity-related conditions

Hypersensitivity-related disabilities include allergies and asthma as well as other forms of lung disease and immune deficiency. People with such disabilities may react to certain substances, usually in the air.

A large segment of the population, especially children and youth, are plagued by some degree of hypersensitivity to certain chemicals or compounds.

Problematic situations may include poor ventilation or the presence of allergenic plants or materials that emit irritating gases or smells.

Multiple disabilities

Many people fit in more than one of these main groups. An elderly person, for instance, may have trouble hearing as well as walking. But the same may apply to young people with disabilities.

Human reliance on technical aid

The prevalence of technical aids has consequences. To move around, some people need a technical aid, whether it's a cane, a crutch, a walker or a wheelchair. Both manual and electric wheelchairs are available. They come in different sizes and with different manoeuvring characteristics. Some people use hearing aids and some blind people use canes. The prevalence of such devices should affect how surfaces and technical installations are designed.



In order to visualise and further the understanding of important features necessary to achieve universal design, we have developed a set of symbols. The colour code refers to the functions of three primary needs of human beings: mobility and manoeuvrability – seeing, hearing and comprehending - environmental sensitivity. The second level of the symbols refers to the design of the building elements in order to facilitate these needs.

It is hoped that when applied to photographs and drawings, the critical issues will become more visible and that the use of the symbols may become a valuable tool in assisting the planning and design process to achieve a built environment in accordance with universal design.



Green and blue: mobility – manipulation

Green colour and green symbols refer to issues of mobility and accessibility, such as the space required to carry baggage or to manoeuvre a wheelchair, baby carriage or walker.

Blue colour refers to issues related to manipulating or operating devices that must be opened and closed, or turned on and off. Examples are doors, windows, kitchen appliances, light switches, control panels, doorbells and magnetic card readers.



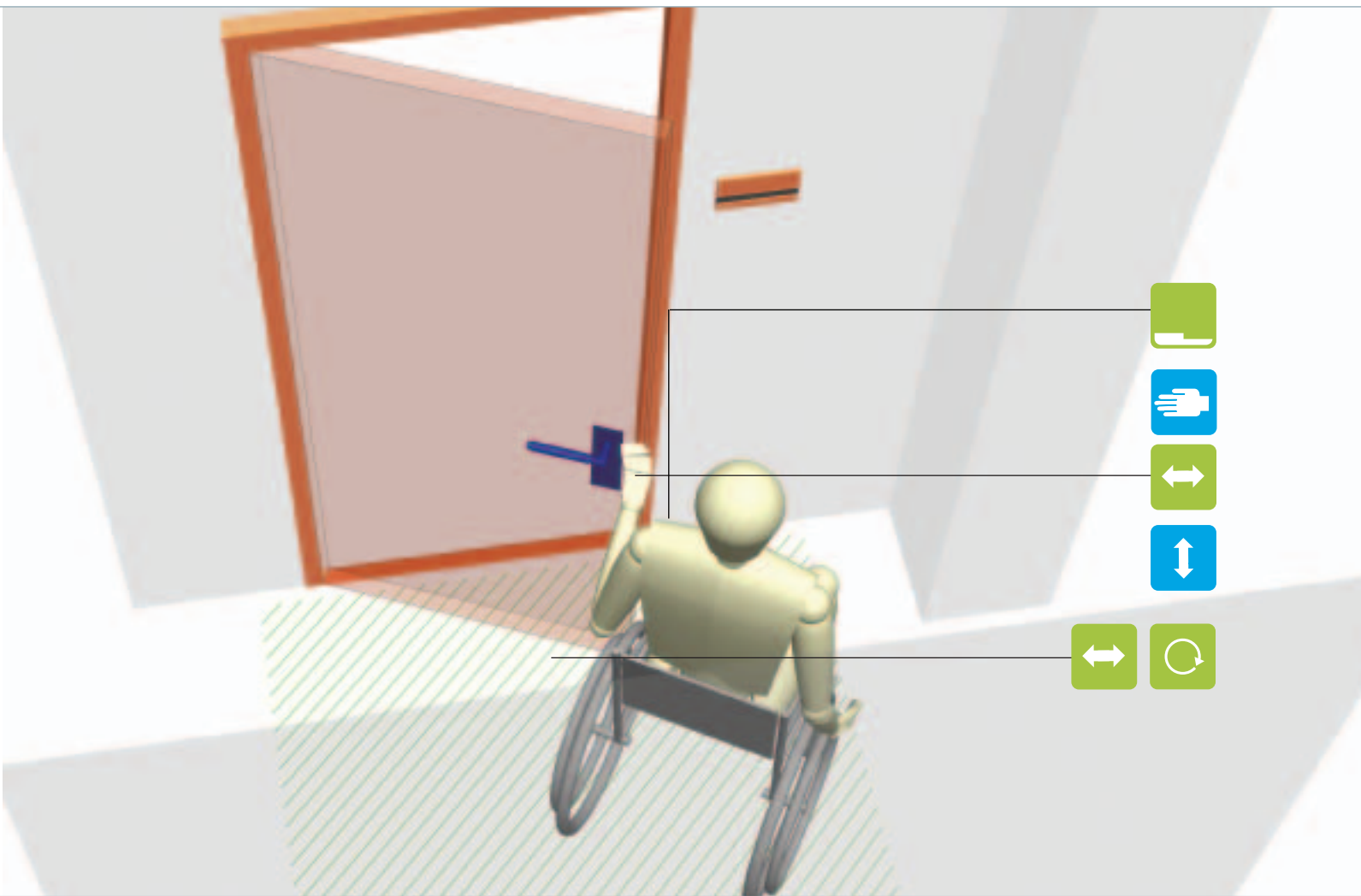
Orange: orientation – see, hear and understand

Orange colour and orange symbols refer to the ability of people to experience their surroundings by seeing, hearing, feeling, smelling and thinking. Because experience is dependent on sensations, our senses are critical to orientating ourselves in the physical environment.



Yellow: environment – hypersensitivity to air and materials

Yellow colour and symbols refer to situations that can call forth skin reactions, respiratory distress or other debilitating symptoms related to hypersensitivity.



Mobility

When physical powers and mobility are reduced, we often compensate by leaning on something or using a technical aid. Well conceived floor plans and well designed building features and technical installations all help to increase accessibility for everyone.

Width



Wheelchair users need space in which to move. The width of doorways and the distance between ceiling posts, furniture and other building fixtures must be sufficient to let wheelchairs pass and turn where natural. All passageways, indoors and outdoors, must be wide enough to allow people to pass.

Utility areas

Utility areas are those areas required to operate or service fixed equipment in buildings. A standing adult has different space requirements and a wider range of motion than a child or wheelchair user.

Height and reach



Equipment ought to be placed within the reach of someone in a sitting position. Both children and adults can operate such well-placed equipment.

Floor surfaces



Carpeted floors and uneven floor surfaces make it harder to manoeuvre a wheelchair or other assistive device. Surfaces must be slip-resistant to prevent falls and injuries, especially where there may be water, as in entry halls and bathrooms.

Inclines



A solid, level floor is best for everyone. People with crutches, a cane or a manual wheelchair use more energy than others to ascend inclines. Even a short incline may tire people with asthma, reduced lung capacity or other physical limitations. Ramps and pavements inside and outside should be neither long nor steep. Short ramps may be somewhat steeper than long ones, and long inclines should feature landings at intervals.



(Photo: Svein Magne Fredriksen)

Levels, steps and edges



The possibility of falling increases with uneven surfaces and changes of level.

People with difficulty walking are more likely to stumble on uneven surfaces. Raised edges or thresholds can be a problem for people with carts, baby carriages, wheeled walkers or wheelchairs. Changes in level and other such hindrances should thus be avoided wherever possible.

In touch with buildings



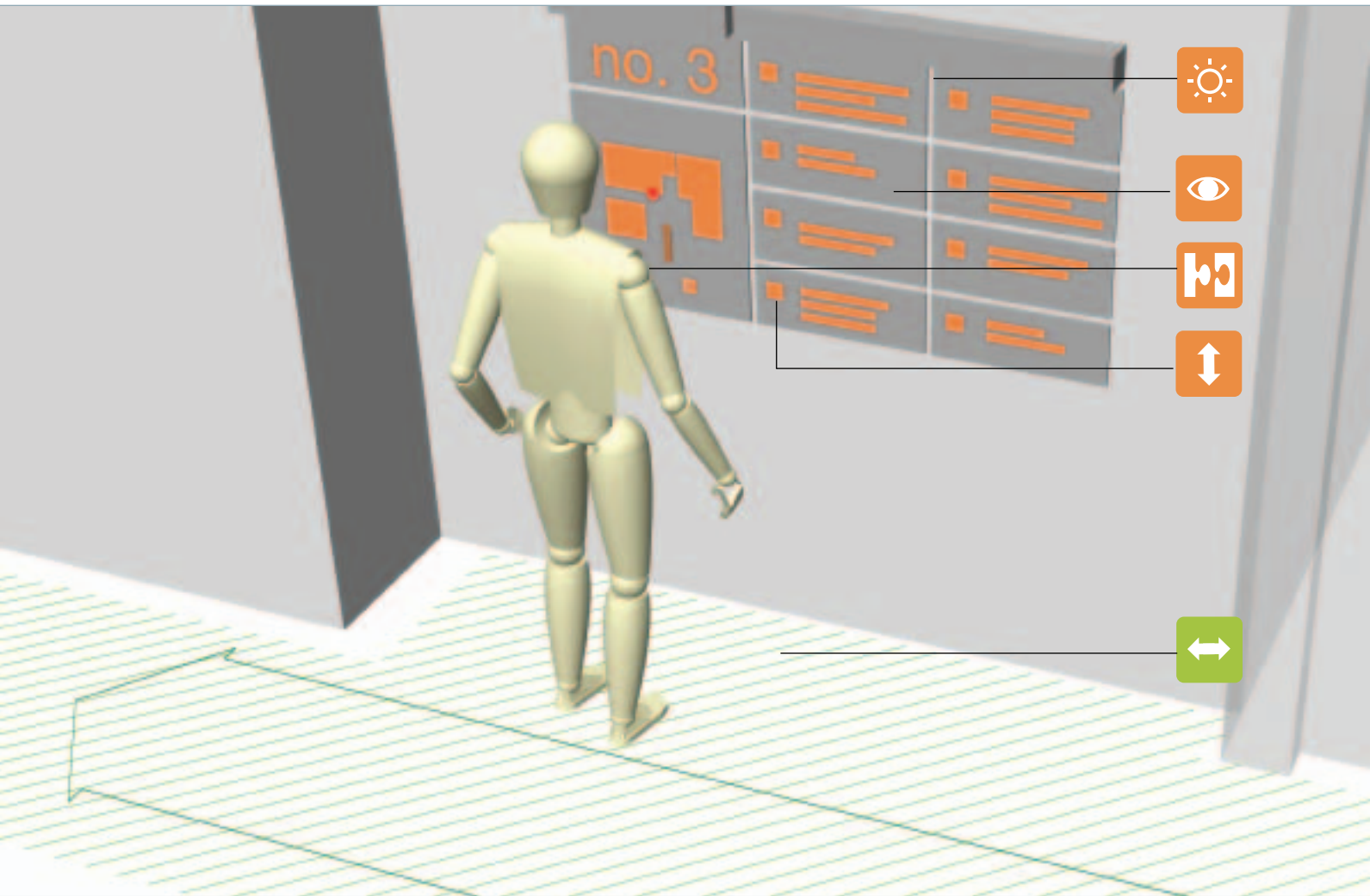
For a building to serve its occupants, the control knobs, intercoms, doorbells, door handles, window latches and other features must be easy to see, understand and operate. If such items are placed too high, wheelchair users will have a hard time reaching them, as will children and short adults. Handles must be easy to grasp and easy to turn or pull.

Orientation – hear and understand

The built, physical environment must be clear and well organized, so that it can be negotiated even by someone with reduced or absent sensory functions.

Sight

When people with impaired vision try to orient themselves, they do the same as people with normal sight. First they try to gain an overview; then they look for details. For the first overview to be helpful, the building must be well laid out, with the correct use of colours and contrasts, labels and signs. Blind people often form an impression of the whole on the basis of details. Changes in level, protruding objects and glass surfaces that are not adequately marked or protected can cause falls or collisions.



Signs and information boards must be well lit and placed at readable heights in a way that does not conflict with the flow of traffic.

People find it easier to orient themselves when rooms and room functions are positioned logically in relation to one another.

To accommodate people with orientation disabilities, try to make the most of:

- Markings and signage
- Colours and contrasts
- Daylight and artificial lighting

Markings and signage



Labels and signs are there to prevent accidents and to provide additional guidance when other visual cues are insufficient to indicate where one is and where one should go. Clear markings are especially important for the visually impaired and the blind, but people with cognitive difficulties also rely on them.

Three type of marking are of use:

- Contrast markings
- Tactile markings
- Signs and information boards with text

Colours and contrasts

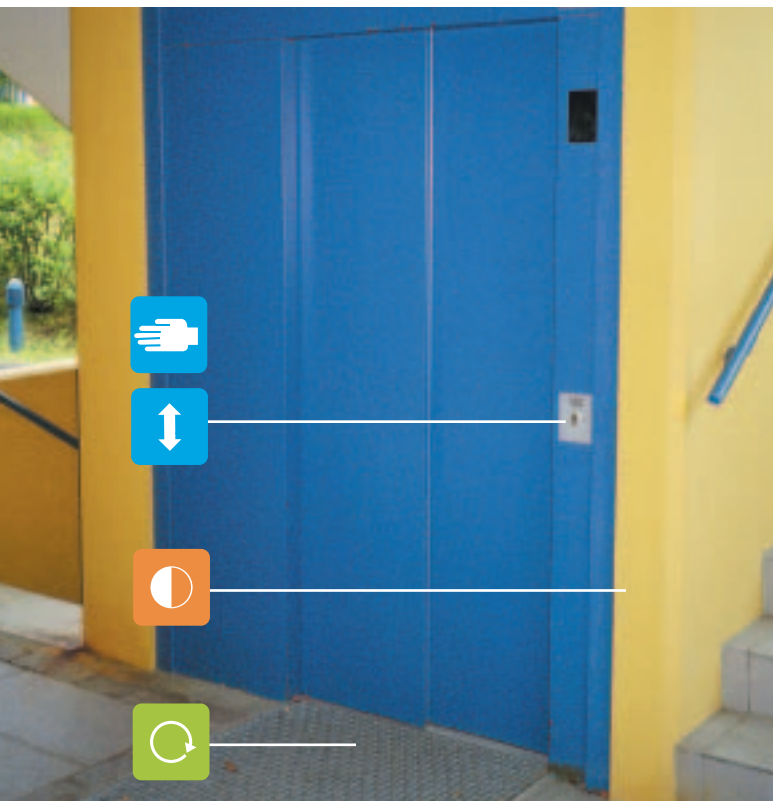


Contrast markings are used to distinguish building sections and installations so they are easy to find. Materials and colours must be chosen with care. Excessive variation may be confusing and disturbing. Shiny materials may produce disturbing reflections. Large mirrored surfaces can be particularly disconcerting.

Three factors determine whether contrasts can be seen and understood:

- The strength of the contrasts
- How well lit they are
- The relative width of adjacent surfaces, such as step treads and edge strips

12: ARCHITECTURAL PLANNING ELEMENTS



Colours

Colours may be used as an aid to improve orientation for the visually impaired. For people with normal vision, the ability to distinguish colours begins to fail at an illumination of 50 lux when the background, such as a floor, is dark. Most people with impaired vision require even more light to distinguish colours. Colour coding must therefore be adequately lit.

Recognition is important for orientation. Colours are part of the codes that cue place recognition. They are especially important for those whose visual world is limited.

Tactile markings

For blind people and people with impaired vision, tactile markers are a great help. Ranging from hand railings to Braille text, they may include any aid that can be felt by the hands, the feet or a cane. Braille text may be placed on the back side of a hand railing to indicate place, direction or distance.

A tactile guideline is a continuous system of aids which visually impaired people can see and blind people can follow by touch while moving safely to some natural destination. Outdoor tactile guidelines must remain free of ice and snow, and must not become blocked by objects such as bicycles. Changes in direction, intersections and places where pedestrians must stop should be marked by a change in texture. Tactile guidelines must proceed in straight lines, with changes of direction delineated by right angles.



Elevator doors, elevators and stairways. The contrasts are strong and distinct, and the edge strip in front of the elevator doors is both visual and tactile.

Picture of control panel: Clear numerals, letters and Braille symbols.

(Photo: Steinar Anderssen og Jon Christophersen)

Signs and information boards



For people with cognitive difficulties, pictograms often work better than text, but the symbols should be well known and of sufficient size and contrast. They must also be positioned at suitable heights and locations. When text is used the letters must contrast strongly with the background. Words should be short, and foreign words should be avoided.

Daylight and artificial lighting



People with severely impaired vision and many blind people can sense light even if they cannot detect contrasts. Bright light and open views often make it easier for them to orient themselves indoors. If only one side of a room has windows, the sensation of light from that direction may enhance orientation ability. If there are windows on several sides, the effect is reduced. People whose eye lenses prevent full transmission of light are often bothered by bright light or reflections. Windows should be placed so as to provide light from the side, rather than head-on. The warmth of the sun also provides an orientation cue.

In order to see in three dimensions, an effective depth vision is required. Depth vision in turn is dependent on the light. A high degree of indirect light restricts modelling ability, whereas direct ceiling light enhances modelling ability. Often, the best modelling conditions involve a combination of direct and indirect light.



(Photo: Svein Magne Fredriksen)

Sound



A good acoustic environment is important for general well-being. Bad acoustics, more over, are a nuisance for everyone. For speech to be clearly understood, it must overcome two things: background noise and echo.

The sound landscape is an important aid for blind people and those with severe visual impairment. They depend on their hearing to orient themselves. People can be trained to detect obstacles and openings by listening to the echoes from their own footfalls or cane taps, assuming that the surrounding acoustics are not too heavily dampened or that the background noise or echo are not too strong. The physical environment should be arranged purposefully to clarify the sound landscape. Acoustic signals may also be of help. Acoustic signals can be heard 10 m to 15 m away, assuming the background noise is not too loud.

In and around elevators, acoustic signals in combination with synthetic speech are of significant help to the visually impaired.

Acoustic signal devices also help visually impaired people to orient themselves at entrance doors and other important locations.

In rooms with speaker systems, teleloop devices are helpful to wearers of hearing aids. The speaker system transmits sound wirelessly to the hearing aid without picking up background noise.

Background noise

Many people whose hearing is impaired are easily disturbed by background noise, especially if they wear a hearing aid. Background noise makes it harder to distinguish individual sounds from one another. Rooms should therefore be insulated against air noise, footstep noise, mechanical or electronic noise and outdoor noise. Background noise should be reduced as much as possible.

Echo

The degree of echo depends on surface materials and design. Echoes reduce speech clarity and clutter the sound landscape, even for people with good hearing. Smooth, hard surfaces reflect lots of sound and cause echoes. Soft surfaces, by contrast, absorb sound. For blind and visually impaired people, echo signals provide important information about a room's shape and use. A long echo time delay signifies a large room, while a short echo time delay indicates a small room.

Environment— hypersensitivity to air and materials

The proportion of people with asthma and allergy complaints is growing. Construction materials, exhaust gases, certain vegetation, etc., can irritate mucous membranes in the eye and respiratory system and cause eczema, headaches, difficulty concentrating and other symptoms. Children and the young are particularly vulnerable.



Air quality

Clean buildings

Systematic cleaning during the building process helps avoid the build-up of dust and particles that can cause problems later.

Ventilation systems, ducts, appliances and fittings must be delivered clean and sealed, and must be kept sealed through the building process. Before a building is occupied, there should be a post-construction clean-up.

Regular, effective cleaning

Health concerns are one reason to design rooms and choose materials that are easy to clean. Dust and dirt swirling in the air can cause serious health problems for people with degraded immune systems. False ceilings must therefore be fit securely. Floors should be hard and smooth, and wall surfaces smooth. Avoid surfaces where dust can collect.

Contaminants

Some people experience discomfort, irritation or worse when exposed to pollution from building and surface materials. Tolerance levels vary greatly from

person to person. As a rule, use well-ried materials that do not give off gases or otherwise affect health. Interior cement and plaster surfaces should be sealed to keep particles from eroding into the air. Choose materials that can stand up to normal use and cleaning. Avoid planting pollen sources near windows.

Moisture

Moisture can provoke allergies and hypersensitivity. Building materials must be stored and used so as to avoid moisture-related problems. When moisture creeps into a building structure as a result of poor workmanship or design, it may degrade the interior climate.

Ventilation

Indoor air must be replenished with enough fresh air to dilute the airborne contaminants given off by materials, people and their activities. If the outdoor air is severely polluted, it should be filtered before being introduced.

Vegetation

The most common allergenic tree species are birch, alder and hazelnut. Offending plants include grass and mugwort. The best way to help pollen allergy sufferers is to avoid planting allergenic plants and trees around access ways, entrance doors and windows that are frequently opened.

Materials

Nickel and cobalt are naturally occurring metals often used in metal alloys. People with a nickel-cobalt allergy often experience skin inflammation immediately upon contact. Limit the use of metal handles and other household devices with nickel-cobalt content.



(Photo: Olaug Thortveit)

Planning provisions

The planning and design of outdoor areas can affect the configuration of approach ways and the overall usability of an area. In the case of land-use plans that are subject to regulation, planning authorities may stipulate outdoor design provisions that are more specific than the technical planning regulation.

Such provisions may include:

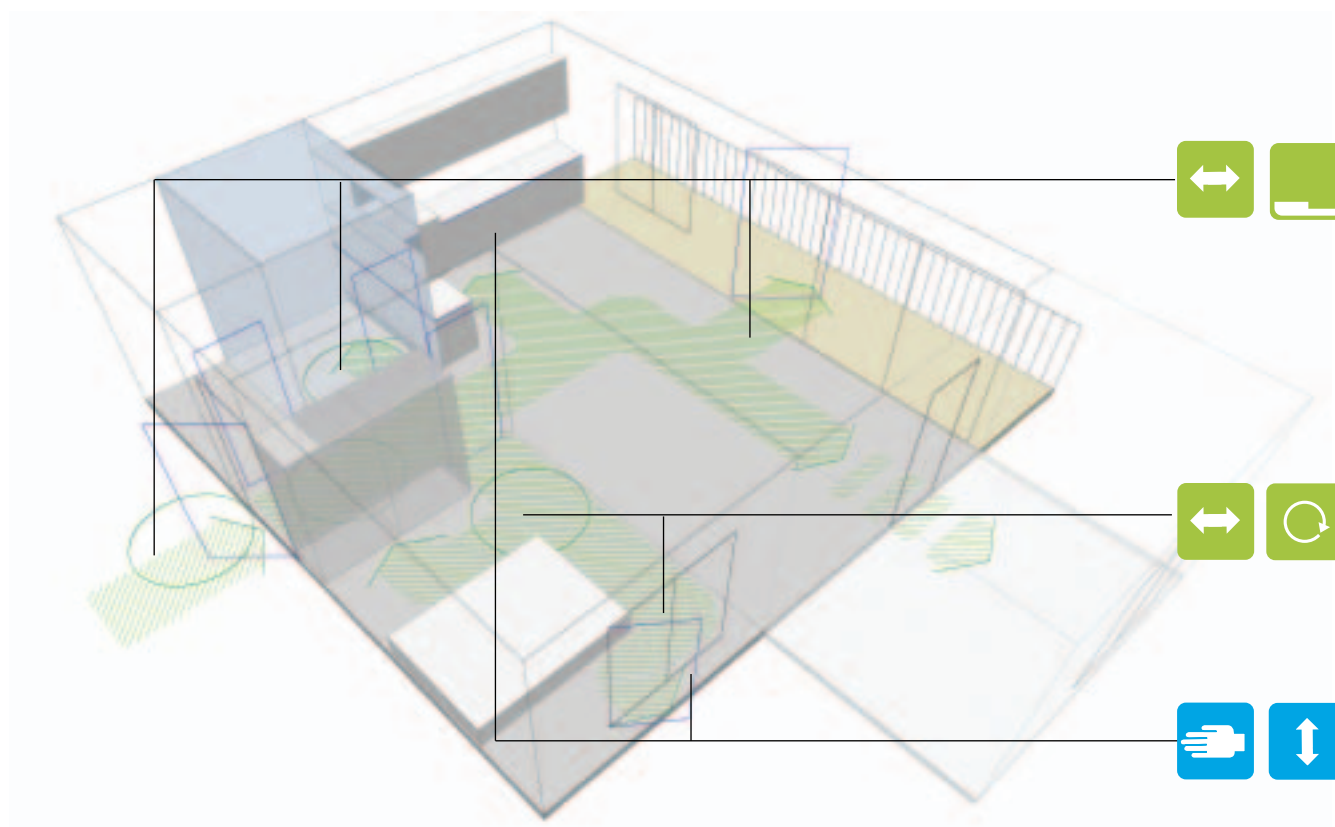
- Requirements for easy access to certain buildings, recreations areas, adjacent open space, etc.
- Pre-requisite infrastructural projects
- Requirements about building configuration, technical plants and outdoor spaces

According to the Norwegian Planning and Building Act, planning provisions may be added to municipal land-use plans, zoning plans and other area plans. Beyond upholding the physical standards of the Building and Planning Act and technical regulations, planning authorities may stipulate universal design solutions.

The authorities may thus use land-use plans to stipulate such features as parking location, parking practices, building height, building density and the amount of property to be set aside for outdoor activity. Parking issues subject to regulation may include the number and size of places reserved for the disabled. Planning authorities may also stipulate the maximum allowable steepness of approach roads and walkways.

Building placement is critical to a property's overall utility. The distance between parking spaces and the entrance door should be as short as possible, and the approach road itself should be short, with as little incline as possible and recreation areas in which to spend time or wait.

If the terrain is steep, it may be advisable to lay out the approach from above. Usually, that makes it easier to design the stair-free entrance that characterizes homes which are suitable for all phases of life. All told, the Building and Planning Act provides excellent opportunities to ensure accessibility and mobility in outdoor areas.



Lifespan housing: All main functions on floor of entry, no stairs, and wide passages through and between rooms.

Residences

As a general rule, all homes should be planned so that residents of all ages and functional ability can get to the principal rooms and use them. Lifespan housing (as defined by the Norwegian State Housing Bank) is built on the principle that all important areas (entrance, bathroom, kitchen, living room and bedroom) shall be on the floor of entry, and that the main functions in each room shall be accessible for wheelchair users. The path from parking space to entry door shall also be free of steps.

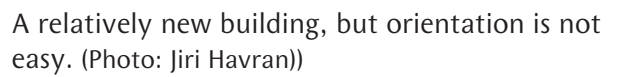
Workplace buildings

Buildings in which people work are subject to the Norwegian Worker Protection and Working Environment Act. The publication “REN veiledning til teknisk forskrift,” available in Norwegian from the National Office of Building Technology and Administration, provides guidance on the technical provisions of this act.

People with orientation and mobility challenges should be able to work in the building. Rooms of special importance include:

- Entrance and reception
- Offices, workplaces and work stations
- Meeting rooms
- Resting rooms, break rooms and toilets
- Cafeterias and other eating areas
- Assembly halls

Building design and construction details must be considered as a function of the building's purpose and the capabilities of the people who will use it. Since most public buildings are also workplaces, accessibility requirements may be applied throughout them.



Architects tour their own building

Architects were challenged to tour buildings designed by themselves. The buildings were then evaluated according to how easily people with visual impairments were able to enter and move around inside. The tour participants wore special glasses that mimic a variety of visual impairments.

Theatre tour

The 4B Arkitekter firm chose Det Norske Teater ("The Norwegian Theatre"). This is a public building designed to accommodate a large number of people, including those with a range of disabilities.

When Det Norske Teater was planned and designed, the needs of disabled guests were weighed carefully. Meetings were held with both the Norwegian Association of the Disabled and the Norwegian Association of Blind and Partially Sighted. The building was completed in 1985. Civil Architects Tom Thoresen and Bjørn Hovstad of 4B Arkitekter took a "visually impaired" tour of the theatre's public areas. They used two pairs of glasses. One pair simulated blindness in the right eye and tunnel vision in the left (by restricting the passage of light to a 4-mm opening). The other pair let the wearer see clearly only toward the left. Both of its lenses were altered to block two-thirds of the view to the right.

Entry area

From Kristian IV's Gate, three covered entryways open into the foyer. The middle entrance has automatic door openers with a push-button switch on the outside. The button is situated appropriately for wheelchair users, but the sign indicating the button is so small that it could be overlooked, especially by first-time visitors. There are no bothersome grade changes or thresholds in the entrance and foyer area. The strong contrast between the dark slate floor and the white walls help the visually impaired gain oversight.

Floor

Where the black floor is smooth and reflective, it is fine to walk on. But the dull black doormats may give the appearance of being "holes in the floor," thereby causing unease.

Our glasses gave a clear but restricted view. If the remaining view had been weaker or more diffuse, the wearers would have had an easier time if the floor had been dealt more clearly into zones or if the main traffic routes, such as those leading to the cloakrooms and theatre halls, had featured a different colour and structure.

Tickets

The ticket counters are easily visible just inside the entrance, and are clearly marked with signs.

Bistro

The bistros on the first floor are in clear view. The wine glasses stand on the sales counters and would be somewhat exposed to bumping if not for the self-service tray track on the outside.

Cloakrooms

Finding the way to the cloakrooms is easy, and the cloakroom numbers are easily visible on signs above the different zones.

Signs posted above the coat-hook rows, however, are made of brass with black numerals. The contrast is rather weak, and the numerals are flush instead of raised.



(Photo: 4B Arkitekter)

Hand railings

With poor peripheral vision, it was comforting to follow a wall or railing on the side where vision was poorest. The hand railings positioned along all the walls in the foyer area provided good support. The fact that they also encompass pillars and pilasters increases the sense of security.

Chairs, display cases and other objects placed near the hand railings are sometimes hard to notice. A glass case positioned atop the stairway to the second-floor lobby was hard to see because it stood in the blind spot of our “visually impaired” architects. The theatre’s hand railings are made of polished brass with a diameter of 40 mm. They are easy to see against the white walls, and good to hold on to.

Stairs

Each step should be clearly marked with tread nosing or inlaid edging in a colour that contrasts with that of the treads and risers. When navigating a staircase, the first down-step and the first up-step are critical.

On many stairway, especially prefabricated ones, the “final step tread” is actually flush with the upstairs floor. The difference in texture and colour between this final step tread and the rest of the floor may suggest to visually impaired people that there is another step to come. To avoid confusion, the material/colour scheme of the upstairs floor and walls should take effect directly above the final riser.

The hand railings in the foyer stairways generally extend about 60 cm beyond the top step. People preparing to walk down are thus offered support well before they begin searching for the first step.

Elevators

There are two elevators in the foyer area. Both are designed with control panels suitable for wheelchair users. Because the panels are low, they may be inconvenient for visually impaired people to read. Standardized panels of high quality – with large buttons and numerals that are shown in relief and sometimes illuminated – are available today and should be installed everywhere. The button indicating the basement should be different from all others. Inside the theatre’s elevators, the current floor is indicated by an illuminated red numeral above the doors, but people with impaired vision may have trouble reading it.

The theatre hall

Hand railings run continuously through the entryways and along the interior walls of the theatre hall. The floor, steps and floor mouldings are of light oak, which provides good contrast to the dark brown walls. Each step has an inlaid black strip on its forward edge, making it easy to move around in the hall. Lighting fixtures are well positioned to illuminate both the steps and the seating row numbers.

Scene 2

Scene 2 (“Stage 2”) is a typical black-box venue with black walls and a dark brown wooden floor. It was being extensively refit during our tour, so our ability to move around was limited. However, the dark interior, with its few contrasts, may make it hard for some visually impaired people to orient themselves.

Toilets

The toilets are brightly lit, with strong contrast between floor and wall. Despite our visual impairments it was easy to get oriented and move around.

Signage

The main signs, with large brass letters against a flat white background, are positioned under the ceilings. They are easy to read, with strong contrast.

Summary

The tour was highly informative. It is easier to empathize with visually impaired people when you have experienced their plight, even for a short time. The glasses are available for loan to other architects and planners.



Glasses to be used in touring a building.

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