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A UNIVERSAL DESIGN MODEL FOR MULTI-FAMILY HOUSING DESIGN

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ABSTRACT

A research is made about the effects of the principles of the Universal Design on housing design. The aim of this study is to introduce universal design principles and to emphasize the positive effects of the application of these principles. The scope of the study is to examine the reflection of universal design concept on multi-family housing design. Also, the scope includes designs to be made to increase the application rate in the concept of multi-family housing. Rather than designing different products for the changing needs of the different individuals, it is aimed to design products suitable for the use of all of the individuals.

In order to obtain information, field research was made in the study. In the field research, all the common areas and residential areas searched in the projects were examined according to universal design principles. Information was obtained from inside and outside the selected examples of multi-family houses by observation and photography method. A chart was prepared to evaluate the requirements of housing projects and common problems identified. As a result, the general aim of the thesis is; universal design principles to be widely used in the design of multi-family houses.

Keywords: Universal design, multi-family housing, anthropometry, ergonomics, accessibility.

1. INTRODUCTION

Within the scope of the study, a research is made about the effects of the principles of the Universal Design on housing design. Until the last years, it was observed that the vast majority of designs to be done according to the average size. But individuals can't always be in the average size. For example, different user categories are listed as; size, culture / gender, age and skills.

Rather than designing different products for the changing needs of the individuals in these categories, it is aimed to design products suitable for the use of individuals in all categories. The 'design for all' concept was named starting from the submission requirements on equal terms to all individuals. In recent years awareness has been increasing in this regard. Different user categories were examined in the study. Also, the necessity of designing the designs to be customizable is mentioned.

2. DEFINITIONS AND CONCEPTS

In this part of the study, definitions and concepts are explained. Concepts related to human and concepts related to universal design are grouped under different headings. Concepts of human

anthropometry and ergonomics are explained. Also in this part, different user categories are examined. The necessity of designing the designs to be customizable is mentioned. Rather than designing different products for the changing needs of the individuals in these categories, it is aimed to design products suitable for the use of individuals in all categories. In the part of the study on concepts related to universal design, the definition of the concept of universal design, the conditions of being universal and the concept of sustainability are mentioned.

2.1. Concepts related to human

Concepts related to human are anthropometry and ergonomics. Also, different user categories are examined in this part of the study.

2.1.1. Anthropometry

Anthropometry is based on the size and proportions of the human body. Average measurements are available, but these measurements need to be converted to meet specific user requests. Since the main criteria to be referenced vary with age, sex, and race, the average measurements must always be carefully assessed(Ching, F.D.K., 1996).
The dimensions and proportions of the human body affect the proportions of what we do, the height and distance of what we need to reach, the dimensions of the furniture we use to sit, work, eat and sleep(Fig.1).

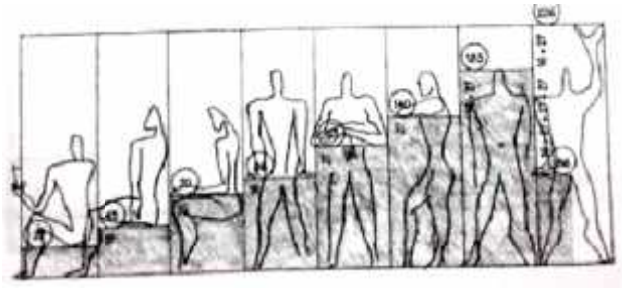


Figure-1. Anthropometry (Ching, F.D.K., 1996).

2.1.2. Ergonomics

Human is a user and is a physical structure arranged in living cells, tissues, organs and systems(Oral, A. 2008).In architectural regulations, one of the priority issues in the design criteria is the user body measurements. The science of ergonomics examines the environment in which the user interacts. Ergonomics works to ensure the best communication between the user and the environment.
Today's ergonomics research does not take into account only the physical environment, such as tools and methods used by people.At the same time, it deals with all the psychological and sociological environment such as the thoughts of the people, their emotions, their relationship with other employees, their ability to deal with problems.In short, ergonomics takes care of all of the emotions of the people (Altıparmak, 2006).

2.1.3. Different User Categories

The necessary to design designs that are customizable. Different user categories are listed as; size, culture / gender, age and skills.

•Size category includes; wheelchair users (Fig.3) and physical obstacle / walking aids (Fig.2).

Figure-2. Physical obstacle / walking aids (Young, L. C. & Pace, R. J., 1999).

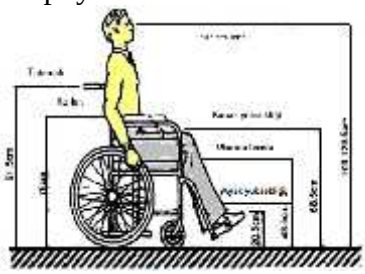


Figure-3. Wheelchair users (Url 1).

•Culture and gender category includes; differences between nations, races and cultures and gender differences(Fig.4).

Figure-4. Differences between nations, races and cultures(Url 2).

•Skill category includes; visual impairments(Fig.5), hearing impairments(Fig.6), and mental-neurological control problems(Fig.7).

Figure-5. Visually Impaired(Young, L. C. & Pace, R. J., 1999).

Figure-6. Hearing Disorders(Young, L. C. & Pace, R. J., 1999).

Figure-7. Perceptual Disability(Young, L. C. & Pace, R. J., 1999).

●Age category includes individuals in different age groups(Fig.8).

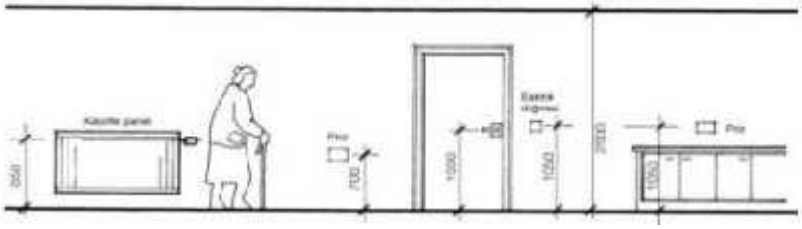


Figure-8. Location of door handles, sockets and electrical switches.

Rather than designing different products for the changing needs of the individuals in these categories, it is aimed to design products suitable for the use of individuals in all categories.

2.2. Concepts Related To Universal Design

2.2.1. Universal Design

Universal design is a design and thought approach aimed at enabling people to use at every level of competence in all physical spaces and using all different products at every age.

2.2.2. Principles of Universal Design

Seven principles that are universal conditions are listed and explained. They are; equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, size and space for approach and use.

2.2.3. The Concept of Sustainability

In the scope of the study, the effects of universal design on housing design are examined. The relationship between universal design and the concept of sustainability and human life cycle is the theoretical basis of this study. This is because; the houses are where people spend the most time in their life cycle and have a large majority of their basic needs.

"As we enter the 21st century, we encourage participation in a totally beneficial and attractive challenge for a positive vision for sustainable human settlements, a sense of hope for our common future, and a safe home for everyone with a decent life of dignity, health, safety, happiness and hope". This emphasizes the importance of living spaces and establishing a sustainable life (Yazar, 2006). The sustainability of housing will also increase due to the increase in the application rate of universal design principles.

3. FIELD RESEARCH

In this study, information has been given on the effects of universal design on multi-family housing design in Turkey, on the field research. In this field research on the effects of universal design in Turkey on multi-family housing design, selected examples of multi-family houses were examined according to multi-family housing categories. Information was obtained from inside and outside the selected examples of houses by observation and photography method.

Regions of Bakırköy and Esenyurt from the European side of Istanbul has been selected to make the field research. The reason for this choice is the fact that the two selected regions contain different type of housing environments; luxury residences and like to be alongside the shantytowns. Nowadays, Esenyurt and Bakırköy regions are rapidly differentiating due to newly built residences. Ever since the beginning of the 2000s, the rapidly developing regions of Istanbul, have changed from year to year. With the years 2000, it was aimed to examine the differentiation in these regions. In this part of the thesis, information has been given about the project name, project location, project type, total land area, project address information, project content and name of the architecture. Then, the layout of the projects and their general position, perspectives and concepts are explained. Architectural projects have been included and plans of residential buildings have been presented. After this information was supported by visuals and photographs, personal field research was started. Housing projects are divided into two as open spaces for common use and residential interiors. These places are photographed. The open spaces for common use are listed as; site entrance, car parks, common areas, residential entrances, elevators, sports fields, playgrounds, swimming pool, stairs and corridors. In-house spaces; entrance, kitchen and bathroom are photographed in a manner that allows them to be assessed in terms of accessibility.

3.1. Esenyurt Region

In Esenyurt region, Dumankaya Modern Valley Housing Project, Akkoza Housing Project and Kiptaş 4 Housing Project are investigated in field research.

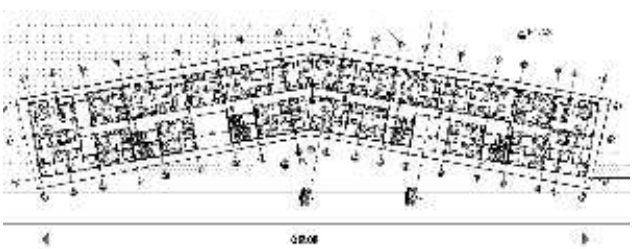
3.1.1.DumankayaModern Valley Housing Project

The design of the Dumankaya Modern Valley project was developed from a general landscape idea surrounding the islands in the valley. The site consists of a building complex both for commercial and residential areas.Generel information is given about Dumankaya Modern Valley housing project (Table-1). Then, informative images of Dumankaya Modern Valley housing project are placed in the study (Table-2).

Table-1. General information of Dumankaya Modern Valley Housing Project

Project Name	Dumankaya Modern Valley
Project Location	Esenkent / Esenyurt / İstanbul
Type Of Project	Luxury Housing
Total Land Area (m²)	52.412,00 m²
Project Content	Residential And Commercial Areas
Architect Of The Project	Db Architecture_Bünyamin Derman

Table-2. Informative Images of Dumankaya Modern Valley Housing Project

SITE PLAN 	**LOCATION** 
PERSPECTIVE  	**ARCHITECTUREL PROJECT**  

The common used open spaces of Dumankaya Modern Valley Housing Project are; site entrance, parking lots, common areas, residential entrances, elevators, sports fields, playgrounds, pools, stairs and corridors (Table-3).

Table-3. The Open Spaces of Dumankaya Modern Valley Housing Project for Common Use.

Site Entry		
Car Parks		
Common Areas		

Housing Entry		
Elevators		
Sports Field	 	
Outdoor / Indoor Pool		
Stairs		

Corridors		

The residential interiors of Dumankaya Modern Valley Housing Project are; entrance, kitchen and bathroom (Table-4).

Table-4. Residential Interiors of Dumankaya Modern Valley Project.

Entrance		
Kitchen		
Bathroom		

3.1.2. Akkoza Housing Project

Generel information is given about Akkoza housing project (Table-5). Then, informative images of Akkoza housing project are placed in the study (Table-6).

Table-5. General information of Akkoza Housing Project

Project Name	Akkoza
Project Location	Esenkent / Esenyurt / İstanbul
Type Of Project	Luxury Housing
Total Land Area (m²)	80.940 m²
Project Content	Residential And Commercial Areas
Architect Of The Project	Design Development Group (DDG)

Table-6. Informative Images of Akkoza Housing Project

SITE PLAN

LOCATION

PERSPECTIVE

ARCHITECTURAL PROJECT

1+1

2+1

3+1

4+1

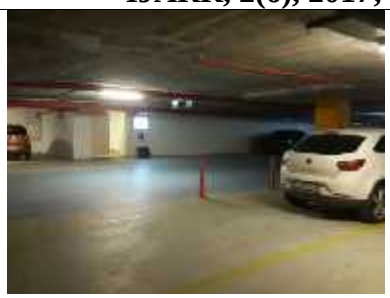
5+2

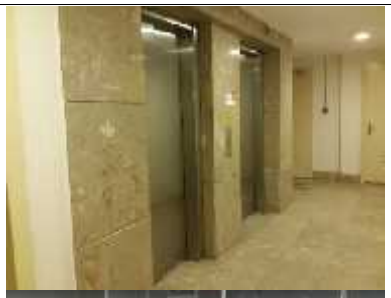
Penthouse 6+1 (1. ve 2. floor)

The common used open spaces of Akkoza Housing Project are; site entrance, parking lots, common areas, residential entrances, elevators, sports fields, playgrounds, pools, stairs and corridors (Table-7).

Table-7. The Open Spaces of Akkoza Housing Project for Common Use.

Site Entry		
Car Parks		

	 	
Common Areas	 	
Housing Entry	 	

		
Elevators	 	 
Sports Field	 	

Play Ground		
Stairs		
Corridors		

The residential interiors of Akkoza Housing Project are; entrance, kitchen and bathroom (Table-8).

Table-8. Residential Interiors of Akkoza Housing Project.

Entrance		

Kitchen		
Bathroom	  	

3.1.3.Kiptaş 4Housing Project

General information is given about Kiptaş 4 housing project (Table-9). Then, informative images of Akkoza housing project are placed in the study (Table-10).

Table-9. General information of Kiptaş 4 Housing Project

Project Name	Kiptaş 4
Project Location	Esenyurt / İstanbul
Type Of Project	Public Housing
Total Land Area (m²)	37.000 m²
Project Content	Residential Area
Architect Of The Project	Arsel İnşaat A.Ş.

Table-10. Informative Images of Kiptaş 4 Housing Project

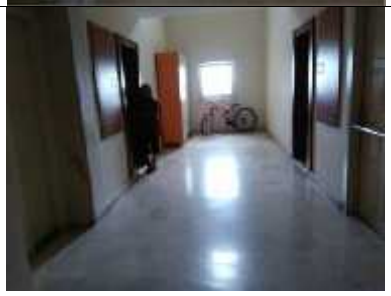
SITE PLAN 	**LOCATION** 
PERSPECTIVE 	**ARCHITECTURAL PROJECT** **75 m²**

The common used open spaces of Kiptaş 4 Housing Project are; site entrance, parking lots, common areas, residential entrances, elevators, sports fields, playgrounds, pools, stairs and corridors (Table-11).

Table-11. The Open Spaces of Kiptaş 4 Housing Project for Common Use.

Site Entry		

Car Parks		
Common Areas		
Play Ground		
Housing Entry		
Elevators		

Sports Field		
Stairs		
Corridors		

The residential interiors of Kiptaş 4 Housing Project are; entrance, kitchen and bathroom (Table-12).

Table-12. Residential Interiors of Kiptaş 4 Housing Project.

Entrance		
Kitchen		

Bathroom	 	 

3.2. Bakırköy Region

In Bakırköy region, Novus Housing Project and Ataköy Housing Projectare investigated in field research.

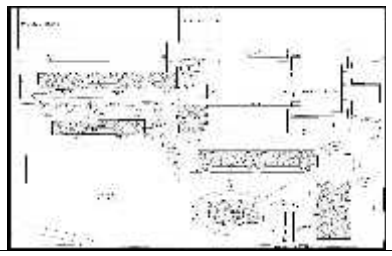
3.2.1. Novus Housing Project

Generel information is given about Novus housing project (Table-13). Then, informative images of Novus housing project are placed in the study (Table-14).

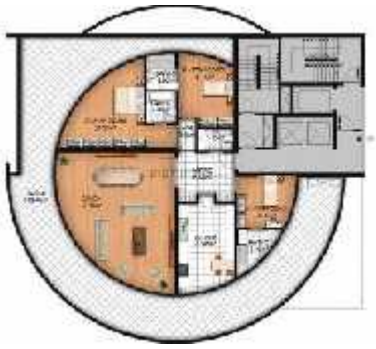
Table-13. General information of Novus Housing Project

Project Name	Novus
Project Location	Bakırköy/ Ataköy / İstanbul
Type Of Project	Luxury Housing
Total Land Area (m²)	12.600 m²
Project Content	Residential Area
Architect Of The Project	Tatsuya Yamomoto

Table-14. Informative Images of Novus Housing Project

SITE PLAN 	**LOCATION** 
PERSPECTIVE  	**ARCHITECTURAL PROJECT**  

2+1



3+1 (303.34 m²)

The common used open spaces of Novus Housing Project are; site entrance, parking lots, common areas, residential entrances, elevators, sports fields, playgrounds, pools, stairs and corridors (Table-15).

Table-15. The Open Spaces of Novus Housing Project for Common Use.

Site Entry		
Car Parks		

		
Common Areas		
Housing Entry		
Elevators		
Outdoor / Indoor Pool		

		
Outdoor / Indoor Pool		
Stairs		
Corridors		

The residential interiors of Novus Housing Project are; entrance, kitchen and bathroom (Table-16).

Table-16. Residential Interiors of Novus Housing Project.

Entrance		

Kitchen				
Bathroom				

3.2.2.Ataköy Housing Project

Generel information is given about Ataköy housing project (Table-17). Then, informative images of Ataköy housing project are placed in the study (Table-18).

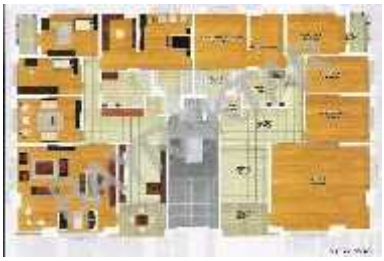
Table-17. General information of AtaköyHousing Project

Project Name	Ataköy Houses
Project Location	Bakırköy/ Ataköy / İstanbul
Type Of Project	Luxury Housing
Total Land Area (m²)	250.000 m²
Project Content	Residential Area
Architect Of The Project	HHS Hüseyin Sarı Architecture

Table-18. Informative Images of Ataköy Housing Project

SITE PLAN 	**LOCATION** 
PERSPECTIVE 	**ARCHITECTURAL PROJECT**

270 m2



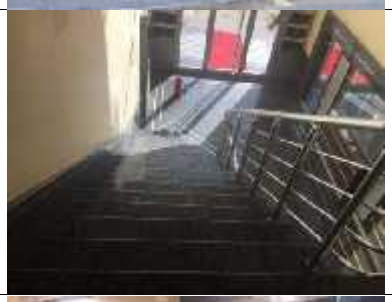
260 m2

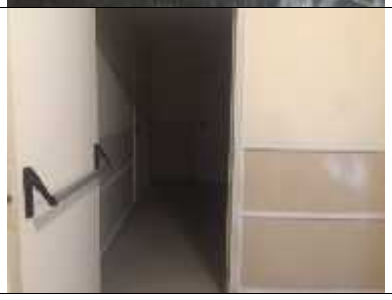
211 m2

176 m2

The common used open spaces of Ataköy Housing Project are; site entrance, parking lots, common areas, residential entrances, elevators, sports fields, playgrounds, pools, stairs and corridors (Table-19).

Table-19. The Open Spaces of Ataköy Housing Project for Common Use.

Site Entry		
Car Parks		
Common Areas		
Housing Entry		
Elevators		
Play Ground		

Sports Field		
Outdoor / Indoor Pool		
Stairs		
Corridors		

The residential interiors of Ataköy Housing Project are; entrance, kitchen and bathroom (Table-20).

Table-20. Residential Interiors of Ataköy Housing Project.

Entrance		

Kitchen		
Bathroom		

4. CONCLUSION

In the conclusion of the study, proposals are given. To extend the use of universal design principles; It is aimed to inform the users and the authorities about universal design to make them be aware of the issue. To enable institutions and designers to implement universal design principles in multi-family houses, it is important to inform them adequately and properly about universal design principles. In this part, proposals have been made for the design of outdoor and indoor spaces of multi-family houses suitable for universal design principles. In the field survey, all the common areas and residential areas searched in the projects were examined according to universal design principles. As a result of the field research, a chart was prepared to evaluate the requirements of housing projects and common problems identified (Table-21). As a result, the general aim of the thesis is; universal design principles to be widely used in the design of households. For it to be, it is important to develop proposals appropriate to the budgets of central governments and their families.

Table-21. Evaluation of Housing Spaces in Terms of Universal Design Principles.

		UNIVERSAL DESIGN PRINCIPLES						
		Flexibility İn Use	Equitable Use	Perceptible İnformation	Low Physical Effort	Tolerance For Error	Simple And İntuitive Use	Size And Space For Approach And Use
COMMON SPACES	**Site Entry**	●Entrance to the site should also be designed for pedestrian access besides the transit area for the cars.	● Site access should be equally available to all users, including children, elderly people, sight and hearing impaired people. This is an important feature for equality.	●Site entry should be made clear with signboards.This is one of the requirements of the 'perceptible information' principle.	● The site entrance gate should be automated to provide the residents with a low physical effort requirement.	● Separate entry area for pedestrian and for vehicle should be planned. This way, site entry provides safety requirements for all user groups, primarily wheelchair users.	● The entrance should be marked with embossed coverings for the visually impaired and with audible stimuli for the hearing impaired.	●Pedestrian entry must be separated from car entry. Pedestrian entry should be made in the ideal width to ensure the passage of all users.
	Car Parks	● Pedestrian access to parking lots should be designed. ● Level differences should be made accessible by ramps at suitable slopes for the use of children's cars and wheelchairs.	● Pedestrian access in the parking lots should be designed with hearing and sight impaired users and wheelchair users.	● Car parks should be defined for hearing impaired users with sound stimuli. ● Embossed surfaces should facilitate the sense of direction of the visually impaired.	● If the stairs are used at the entrance of the car park, there should be chair lift for wheelchair users, embossed floor covering for visual impairments and audible stimuli for hearing impaired	●Information boards must be descriptive and directional. In this way, accidents must be prevented. ● The floor covering must be suitable for car parks and must reduce the amount of error in the design.	● Entry and exit should be highlighted by placing lighted signs in the car parks. ● Sufficient lighting, audible warnings and signs and entry and exit should be indicated for pedestrian access to the parking lot.	● The distance required for vehicle passage in the parking lot must be left. ● At the pedestrian entrance in the parking lot, the distance to pass the wheelchair should be designed.

	Common Areas	● On pedestrian roads and on sidewalks, the necessary distances for wheelchair passages should be left and appropriate materials should be selected.	● Ramps should be designed at appropriate slopes so that the pavements can be reached by wheelchair users.	●The roads in common areas should be covered with embossedsurfaces that can be felt by visually impaired users to simply walk in the road. ●The roads must be sufficiently illuminated. ●With signs and voice stimuli, directions of users should be facilitated.	● Surface coatings of roads should be smooth and should prevent slipping. ●The pave height must be max 15cm.	● Surface coatings of roads should be smooth and should prevent slipping.	● Embossed surfaces should be designed for the visually impaired.	● The appropriate distance to the wheelchair passage on the sidewalks should be designed and the ramps should be designed at the required slopes.
	Housing Entry	● Housing entrances should have ramps at the appropriate slope. These ramps provide accessibility for the elderly, baby car users and wheelchair users.	● Housing entrances should be designed with sufficient width so that everyone can pass.	●Housing entries should be easy to perceive.	●Auto-opening doors can be used in the design.	● The choice of non-slip, smooth flooring material is effective in reducing the amount of error in design.	● A low physical strength should be provided with automatic opening doors.	● Transition distances should be suitable for wheelchair, baby carriage passage.In this way the requirementsof dimension and space provision for the approach and use are provided.

	Elevators	● Designs must be customizable to different users and must be presented with the right to choose. ●For the elevator to have a flexible design, for example, wheelchair users need to have grip handles. ● Buttons must be designed at ideal height so that children and short users can reach.	● The requirements of the equality principle should be the ideal width for wheelchair users and baby carriage users in elevators.	● Elevator entries should be clearly marked with illuminated signs. ● Elevation information should be provided with audible stimuli and floor numbers should be given audibly to be more perceptible by hearing-impaired users.	● The elevator door must be automatic and provide a low physical power requirement for site residents.	●The design of the elevators should have the protection against hazards and faults that may occur and must be capable of reducing damage ● Non-slip flooring materials should be used in elevators. ● Users should be guided by audible and light stimuli.	● Embossed floor coverings and audible stimuli should be used for visual impairment. ● Floor numbers should also be written in the alphabet of visually impaired users.	● Elevators should be provided with suitable space for wheelchair and baby carriage use.
	Playground	● The toys in the playground should have flexible design to allow different user groups to play.	● Children's playgrounds should have toys that allow all user child groups to play.	● The presence of tactile stimuli and auditory stimuli in children's playgrounds is destructive and perceivable to use for children with barriers for vision and hearing impaired.	● Coating of the floor with non-slip, smooth material is important for low physical power consumption.	● The use of toys should include directors with written or audible reliefs that must be described or used before children use them.	●Information for intuitive use of children's playgrounds must be understandable in terms of all user groups.	● Children's playgrounds should be provided with a suitable use area for wheelchair and baby carriage use.

	Sports Field	● Sports equipment should have a flexible design to allow the use of different user groups. For example, the height and the distance of the flexible parts and the position of the sports equipment should be changeable.	● Sports areas should have sports equipment that allows all groups of users to use.	● Sports areas should have tactile and audible stimuli for sight and hearing impairments.	● The use of non-slip material in the floor of the space is important for low physical power consumption. ● Materials that make the use of the space difficult for individuals with limited mobility should not be used, because it will cause more energy expenditure.	● Sports equipment should minimize the amount of mistakes and accidents as they enter and leave the sporting equipment. ● The use of sports equipment should be described before use in persons. There must be written, audible and tactile directors.	●The equipmentm ust be understanda ble in terms of all user groups.	● Sufficient space must be provided for wheelchair and baby carriage use.
	Outdoor / Indoor Pool	● It is necessary to have handles for wheelchair users to use when going to and out of the pool. ● Pools at different depths should be designed so that children and short-term users can swim.	● In the pool there must be automatic and lifting and lowering tools in the pool which allows all user groups to enter the water.	● There should be tactile and audible stimuli around the pool, in the locker rooms, in the showers and toilets for the sight and hearing impaired.	● The use of non-slip material around the pool is important for low physical power expenditure.	● There should be written, audible and tactile directors to warn people about the use of the pool. ● The pool edge should be covered with non-slip material in order to minimize the accident risk.	● The orientation in the pool must be understanda ble in terms of all user groups.	● Suitable areas for the use of wheelchairs and baby carriages should be provided around the pool, in the locker rooms, in the showers and toilets.

	Stairs	● There should be ramps on the ideal slope to be an alternative to the stairs.	●Wheelchair lifts should be placed on the sides of the stairs. In this way equality principle will be established. ● The height of the ridges used in the stairs should not exceed 17-18 cm.	● Tactile and auditory stimuli should be placed in the entrance of the stairs for the sight and hearing impaired. ● For visual impairments, all step edges must be differentiated.	● Non-slip material should be used on the surface of the stairs. ● In cases where the stairways are wide, a guardrail must be installed at certain intervals for the users to hold who have difficulty walking.	● To minimize the risk of an accident, stairs should be covered with a non-slip surface coating.	● In order to use the stairs comfortably, the orientation must be understanda ble in terms of all user groups.	● When designing the stairs, appropriate ramps for wheelchair and baby carriage use should also be designed at suitable distances.
	Corridors	● Corridors need to be designed in the ideal width so that they can be used flexibly. In addition, they must be perceptible using auditory and sensory stimuli.	● Corridors should be designed in an ideal width for wheelchair users and baby carriage users.	● In the corridors, tactile and auditory stimuli should be placed for sight and hearing impairments. ● In floor corridors, it is necessary to use different surface coatings to make housing entries easier to perceive.	● Non-slip material should be used on the corridor surfaces.	● The corridors must be covered with a non-slip surface coating to minimize the risk of accident.	● The directions in the corridors must be understanda ble in terms of all user groups.	● Sufficient width must be provided for passage of wheelchair and baby carriage in corridors.

RESIDENTIAL INTERIORS	**Entrance**	● Entrances must have a flexible design that allows for the use of different user groups. ● In the entrances, space must be provided for the passage of baby carriages and wheelchair users.	● Door handles should be designed for children and short stays at different heights.	●Residential entrances should be highlighted by illuminated signs and audible stimuli. This is one of the requirements of the 'perceptible information' principle.	● The door handles must be at a distance that can be reached using low physical force.	● Materials that do not slip should be used in floor coverings of entrances. The possibility of an accident in this way should be minimized.	● In the entrances, information should be given when necessary. Information needs to be understandable in terms of all user groups.	● When designing door widths, the appropriate width for wheelchair and baby carriage passage must be left.
	Kitchen	● When the kitchen is designed, the height of the countertops should be changeable. ● Some kitchen-related modules must be removable and portable.	● The place under the sink must be left empty so that wheelchair users can use the kitchen sink, or the module belonging to the basin of the sink should be removed and designed to be dragged to another place.	●Storage – preparation - cooking sections of the meal should be made clear and perceptible.	● Household luminaires should be designed suitable for users with joint disease. ● Luminaires should be of the type that opens and closes by consuming low physical power.	● The possibility of an accident by using non-slip material in kitchens should be minimized.	● The mechanisms of the kitchen cabinets should be easy to use. ●Mechanisms with a single button or use of products that do not strain users with joint pain should be preferred.	● When designing kitchen widths, the appropriate width for the wheelchair pass must be left.

	Bathroom	● Bathroom sinks, bench heights should be changeable.	● The place under the bathroom sink must be left empty so that wheelchair users can use the bathroom sink, or the module belonging to the basin of the sink should be removed and designed to be dragged to another place.	● When designing the bathroom, places for the toilet, bathroom and hand wash should be made clear and perceptible.	●Household luminaires should be designed suitable for users with joint disease. ● Luminaires should be of the type that opens and closes by consuming low physical power.	● The possibility of an accident by using non-slip material in bathrooms should be minimized.	● The mechanisms of the bathroom cabinets should be easy to use. ●Mechanisms with a single button or use of products that do not strain users with joint pain should be preferred.	● When designing bathroom widths, the appropriate width for the wheelchair pass must be left.

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