Kaunas University of Technology
Civil Engineering and Architecture Faculty

Universal Design Adapting Living Environments for Aging Population

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Kaunas University of Technology

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Universal Design Adapting Living Environments for Aging Population

Master's Final Degree Project

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Declaration of Academic Integrity

I confirm that the final project of mine, Amina Dautova, on the topic „Universal design adapting living environments for aging population "is written completely by myself; all the provided data and research results are correct and have been obtained honestly. None of the parts of this thesis have been plagiarized from any printed, Internet-based or otherwise recorded sources. All direct and indirect quotations from external resources are indicated in the list of references. No monetary funds (unless required by Law) have been paid to anyone for any contribution to this project.

I fully and completely understand that any discovery of any manifestations/case/facts of dishonesty inevitably results in me incurring a penalty according to the procedure(s) effective at Kaunas University of Technology.

Amina Dautova	
(name and surname filled in by hand)	(signature)

KAUNAS UNIVERSITY OF TECHNOLOGY
Faculty of Civil Engineering and Architecture

Topic (theme) of the Master Final Degree Project: Universal design adapting environment for aging population

Theme of the Master Final Degree Project approved by the Dean's Order: Universal design adapting living environments for aging population

Master studies **Final Degree Project** (study module M000M168)

T A S K

Aim of the work:

To prepare master final degree project based on previous research work stages.

Tasks of the work:

To connect and summarize the data from the literature sources analytical paper, research in situ report and the experimental project, and prepare master thesis – to present grounded solutions of theoretical and practical problems.

Structure of the work:

Text. Title page, heading page, declaration of academic integrity, task of the final degree project (FDP) (if needed), summary, santrauka, content, list of figures (if needed), list of tables (if needed), list of abbreviations and terms (if needed). Main part: introduction (relevance and novelty of the topic, object of the FDP, aim of the FDP, tasks of the FDP, methodology of the FDP, and structure of the FDP); augmented and summarized data of theoretical research, empirical research and experimental design; conclusions of chapters, and the whole work conclusions. List of references, list of information sources (if needed), appendices, copies of graphical part (reduced in size).

The volume of the text (main part) is 2 – 3 author's sheets (1 author's sheet is 40 000 press characters with spaces), i.e. around 60 – 80 pages of computer text (recommended font Times New Roman, size 12, line spacing multiple 1,15 (Methodological Guidelines for the Preparation of Written Works)).

Graphical part.

The graphical part of the work is presented in posters (70x100 cm). It should reflect the most important results of theoretical material analysis, empirical research and experimental design, as well as general conclusions and proposals. The graphical part of the work should be arranged and exhibited in a way to form a visually unified whole and reflect the content of the work. It should be attractive aesthetically. When preparing the graphical part of the work, it is necessary to exclude the non-essential information, highlight the most important research results and ideas, and unify notes, graphical expression, and colours.

The most expressive part of the exposition should be experimental project, illustrating conceptual proposals of problems solutions. The experimental project should make up from **3/5** to **4/5** of the graphical part.

The volume of the graphical part is 10 – 16 posters, of 70 x 100 cm size (vertically oriented).

Inscriptions of the graphical part should not be smaller than 5 mm in size.

Model.

Digital copy of the final work text and graphical part.

Timetable of tasks performance:

1. Discussion of the task	2020 02 03
2. Constitution of final work writing program, work's structure	2020 02 10
3. Supplementation, systemization, analysis and generalization of existing data	until 2020 03 16

4. Review and evaluation of supplemented and generalized data	**2020 03 16**
5. Writing of the FDP text and finishing of the graphical part	until 2020 05 11
6. Review of the FDP text first edition	**2020 05 11**
7. Defending of the FDP in the commission of supervisors	**2020 05 18**
8. Public defence of the FDP	**2020 05 29**

Consultation time with supervisor

Week day	**Faculty of Civil Engineering and Architecture, Room 311**	**Workplace**
	Time and duration *	**Time and duration ***
Monday		
Tuesday	**9:00 – 11:30**	
Wednesday		
Thursday		
Friday		

* - 2.5 hours per week

Supervisor of the final degree project Indre Gražulevičiūtė-Vileniškė

(name, surname, signature)

Student Amina Dautova

(name, surname, signature)

February 2020

Summary. Amina Dautova, Universal design adapting living environments for aging population, Master's Final Degree Project / supervisor Assoc. Prof. Indre Gražulevičiūtė-Vileniškė; Civil Engineering and Architecture Faculty, Kaunas University of Technology.
Study field and area (study field group): K100 Architecture, K110 Architectural Design.

Keywords: aging population, Universal Design, age-friendly environment, quality of life, daycare center.

Kaunas, 2020. 103 pages.

Summary

Aging has become a significant research area in the last few decades. Growing old is a natural part of life. Many researchers had shown that, as we age, we become more "disabled". This term is usually used for people with obvious health issues, and many time, architects design spaces according to their needs. However, seniors' needs require some attention. With age, we get such "disabilities" like a decrease in mobility, vision, memory, and hearing. How can we help to make the process of aging more positive and easy?
Universal Design is one of the methods to make the environment suitable for everyone, no matter their age, gender, or abilities. It focusses on removing the barriers that create excessive effort and separation. It enables everyone to participate equally, confidently, and independently in everyday activities. Today we can help the elderly and many other people to feel comfortable in their environment just by implementing principles of Universal Design and related concepts. The main idea of this research project is to show and test various ideas, solutions within the universal design that we can implement, as architects, to our designs, to make our future more appropriate and convenient for everyone.

Santrauka. Amina Dautova. Universalus projektavimas, pritaikant gyvenamąją aplinką pagyvenusiems žmonėms. Magistro studijų baigiamasis projektas projektas / vadovė doc. Indrė Gražulevičiūtė-Vileniškė; Kauno technologijos universitetas, Statybos ir architektūros fakultetas.
Studijų kryptis ir sritis (studijų krypčių grupė): K100 Architektūra, K110 Architektūrinis projektavimas.

Raktiniai žodžiai: senėjanti visuomenė, universalus projektavimas, pagyvenusiems žmonėms pritaikyta aplinka, gyvenimo kokybė, dienos priežiūros centras.

Kaunas, 2020. 103 puslapiai.

Santrauka

Per pastaruosius kelis dešimtmečius visuomenių senėjimas tapo reikšminga tyrimų sritimi. Senėjimas yra natūralus gyvenimo etapas. Daugelis tyrimų rodo, kad senėdami mes tampame „neįgalūs“. Šis terminas paprastai naudojamas apibūdinti žmonėms, turintiems akivaizdžių sveikatos problemų. Erdvių žmonės su negalia projektavimas jau tapo įprasta architektų veiklos dalimi. Tačiau senjorų poreikiams taip pat turėtų būti skiriamas tam tikras dėmesys. Su amžiumi žmonėms pasireiškia mobilumo, regos, atminties ir klausos sutrikimai. Kyla klausimas, kaip projektuotojai gali padėti senėjimo procesą padaryti pozityvesnį ir lengvesnį?
Universalus projektavimas yra vienas iš būdų, kaip padaryti aplinką tinkama kiekvienam, nepriklausomai nuo jų amžiaus, lyties ar sugebėjimų. Pagrindinis dėmesys skiriamas kliūčių, kurių įveikimas reikalauja daug pastangų, mažinimui arba pašalinimui. Tai suteikia galimybę visiems vienodai, užtikrintai ir savarankiškai dalyvauti kasdienėje veikloje. Šiandien galime padėti pagyvenusiems žmonėms ir daugeliui kitų žmonių jaustis patogiai savo aplinkoje, tiesiog įgyvendindami universalaus projektavimo principus ir su jais susijusias idėjas. Pagrindinė šio darbo idėja yra parodyti ir išbandyti įvairias universalaus projektavimo idėjas, sprendimus, kuriuos mes, kaip architektai, galime įgyvendinti savo projektuose, kad aplinka būtų prieinamesnė ir patogesnė ne tik pagyvenusiems žmonėms, bet ir kiekvienam.

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Introduction

Aging is not lost youth but a new stage of opportunity and strength
(Betty Friedan).

Over the past few decades, aging has become an essential area of research. The most important reason that makes aging a significant problem is the increase in the number of seniors among the population around the world. World's static data on aging shows that in the near future, the number of the population over 65 will increase dramatically (from 8,5% to 17% by 2050) (NIH, 2016). Two World Wars produced a large population of disabled veterans, and antibiotics and other advances in medicine allowed people to survive previously fatal accidents and illnesses. Due to this issue, we can affirm that there will be a need for specifically designed facilities for this portion of the population.

As we become older, our physical and mental characteristics face notable changes. A loss in hearing and sight, as well as their mobility, is the most common cause of older people's disabilities. These changes have varying degrees and are associated with a number of factors. As a result of these changes, senior people have to adjust their lifestyle, and sometimes the place where they dwell. These sudden or gradual adjustments to their lives are, at times, frustrating and confusing to an aged person.

Aging is an unconstrained part of our lives. It is the most commonly thought that all older people are usually grumpy. What if this happens just because they are uncomfortable in their environment? Aging does not turn a cheerful person into a grouch. A lot of researches have shown that, as we age, we become more emotionally stable and content. But often old people feel themselves as a burden for their families: someone needs to take care of them, cook, bring to clinics, help to put the cloth on and other day to day activities. Older people typically focus more on the activities in their households because, for outdoor physical activities, their physical abilities are not strong enough. Their homes become the only places they can keep social ties with family and society. However, aging at home displays more challenges to an elder's quality of life than moving into a facility in that all, the safety of a nursing home needs to be incorporated into the home that elders are resistant to change (Tara Bradley, 2018). Of course, many people directly think of retirement facilities as a solution. Nevertheless, in that kind of place, people usually feel bored and isolated, less freedom and fewer decisions made by them. How can we help the elderly population? How can we make theirs and our lives easier?

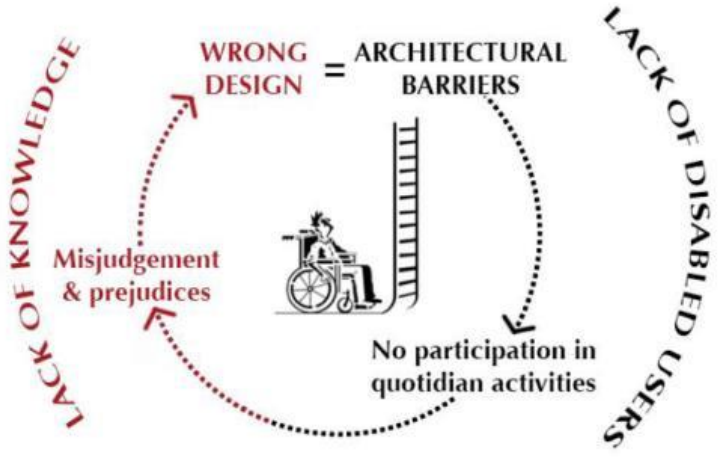


Figure 1. Marta Boardas Eddy's Endless loop (Natalia Pérez Liebergesellet al. 2018).

In many cases, the lack of information and knowledge of what disabled & older people require makes architecture not successful. Marta Bordas Eddy is an architect based in Barcelona who identifies an

endless loop, which she experiences ever since her spine injury: the participation of people with disabilities is undermined by architectural barriers and, besides, the existence of architectural barriers is the fundamental cause of the absence of people with disabilities in daily life, leading to stereotypes of their inherent skill (Natalia Pérez Liebergesellet al. 2018) (Figure 1).
Architecture is about creating an environment for the user, for them to experience it, no matter of his/her abilities. There have been projects done by architects worldwide for differently (dis)abled people. Architects have been pitching in creating awareness regarding disability, promote, protect, and ensure their equal rights and their respect (Sanjana Malhotra, 2015). In the course of time, a lot of new technologies and methods were developed and created to help people with limited abilities to live as fully as they can. One of those methods, not only in architecture, is Universal Design. The connection between person and environment is discussed in accordance with the principles of universal design and ensuring quality of life. Accessibility, safety, privacy, and independence are the common accepts of universal design and provision of a higher quality of life.

Definition of the problem.

There is no general agreement on the specific age at which a person becomes a senior. For the purpose of this research project, the 'elderly' shall be characterized as those people who are over the age of sixty and, independent most of the time, do not rely on constant twenty-four-hour care and medication. We can see the problems are qualitative and quantitative. There are not enough facilities for additional care for the aging population, as well there is a lack of environments that provide not only medical care but combined psychological, social, and physical care of the seniors.
There is a difference in requirements and needs for facilities for the elderly compared to facilities for kids, and not everyone taking this into account. It is essential to understand that care for the elderly has not limited by care from family members or medical professionals as well as relates to thinking about their need to keep up their independence and live an active life in the community and age-friendly environment.

Aim of this research project.

This thesis intends to search for and practice a design solution for the environment for the elderly population. Secondly, to understand and find a way on how to adapt the universal design to the environment for the elderly people. It focused on the impact of current environmental situations, the needs of older people, and what was already done to improve it.

Tasks of this research project.

- Identify the main principles, aim, and philosophy behind Universal Design.
- To review the main concepts of architecture for the elderly to be able to create active ageing, the strength of weak links, and an affirmative sense of place.
- Identify the primary needs of the elderly population in relation to Universal Design principles.
- Outline how these needs will be met by appropriate measures and design solutions in the form of the built environment

- To collect data from seniors, caregivers, and general experts on their suggestions, desires, and criticism related to the current situation of planning of an environment that offers to the aging population in Lithuania.
- To investigate current architectural objects and their compatibility with the Universal Design principles through pertinent precedent studies and case studies.
- Apply a combination of assessed findings to determine the design criteria, principles, and guidelines for an age-friendly environment.
- Demonstrate these pre-assembled concepts by designing a building model.

Methodology and structure of this research project.

This research work divided into 3 parts, such as literature analysis, empirical research, and experimental design. The first section has an overview and analysis of all the data related to aging, universal design, and quality of the environment for the elderly population. It reveals aspects of the impact on the aging population from the physical and social sides. It addresses different needs and concerns relevant to the elderly in order to inform the architectural approach needed to facilitate a quality lifestyle for elderly people. The one research tool which was applied during this part of the thesis was a narrative literature review that helps to establish a theoretical framework and focus or context for your research. This literature review forms the introduction to a thesis and must be established by the research goals, underlying the problem with the hypothetical solutions.
The second chapter includes empirical research of universal design adapting living environments in Lithuania for the elderly population. The empirical method describes any information gathered by analyzes, observations, or investigations. The core framework of the scientific method includes observational, in the case of this research project it will consist of site visits. Additionally, with the help of a survey which is characterized as a method of research used to gather data from a predefined group of respondents in order to obtain information and insights on the needs and wishes of the aging population of Lithuania, mainly Kaunas and Vilnius.
The following section of this thesis shows how different found solutions can be implemented in the proposed design. This part of the research project mostly consists of the experimental design research method that involves the development of a series of hypothesis testing procedures. The success of experimental studies hinges on manipulation and testing of the constant variables, hypotheses, and solutions that were found in previous parts of the research work. A significant cause and effect should be identified in the study.
All this research work led to the general conclusions summarizing all found solutions for the living environments for the aging population. The general conclusions can be divided into statements about the general current situation and the evaluation of hypothetical solutions and their implementations. Although the findings raised in this section are standalone elements, they can only be properly interpreted and understood in conjunction with the information provided in the chapters of this thesis.

1. Analysis of literature related to universal design adapting living environments for an aging population

This chapter of the research project consists of the systematic method of relevant data collection for further investigation and comparison to get an overall idea of existing knowledge in the given field. Additionally, it consists of the analysis of existing facilities and spaces for older people. The main questions that need to get answers are: What do they have in common? How can they be improved? And do they follow any Universal design principles? Furthermore, this part focusing on finding some ground rules, standards, and requirements for architecture for the elderly.
After studying findings related to the specific social, psychological, and physical needs of the elderly in combination with an understanding of relevant aspects in the built and natural environments, there is a possibility to make deductions and develop an area of design that help to produce meaningful architecture for the elderly population.

1.1 Definitions of universal design and related concepts

In modern societies, there is often a negative stigma around aged people who often seen as a liability rather than a part of the community who still have a crucial role. It always has seen that greater duration of individual human life seen as an accomplishment. However, when the elderly live longer, most of the time, they experience an increase in their levels of suffering by been dependent on others due to decreased health.
Faced with the growing number of people with disabilities all around the world, it often observed that disabled people not viewed as family members, employees, customers, clients, or tenants. For that reason, most people are not interested in trying to accommodate to their special needs. A more thoughtful design approach is required. Therefore, architects producing more buildings that are accessible to everyone due to the high demand in the market as well as legal pressure. Accessibility is not a special requirement that benefits only a minority of the population. If an environment is accessible, safe, usable, convenient, and effortless to use everyone benefits. Universal Design is one of those many methods to create a well-design environment.
We all probably used one or more products of universal design without even realizing it. Among the most commonly used representations of universal design is the sidewalk ramp, or curb cut. For people who are using wheelchairs, kids riding bikes, seniors who are using walkers, parents using strollers, and even postman pulling a heavy cart, a curb cut is a significant feature. When something universally designed, it can be used easily by everyone.

"Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaption or specialized design."
(Finn Aslaksen et al. 1997).

The design, which meant to be used and experienced by people of different ages and abilities without adaptation, represented as the primary concept of the universal design (Moyen M. Mustaquim, 2015). Equal status, equal treatment, and equal merit are key concepts. There are two significant, distinctive connections worldwide which can be traced to the emergence of the Universal Design paradigm: (Wolfgang F. E. Preiser and Korydon H. Smith,2011):

1. the legislative measures that included specialized requirements to accommodate people with disabilities, primarily affecting the larger-scale built environment
2. the non-regulated market-driven responses to an aging society, primarily relating to products (Wolfgang F. E. Preiser and Korydon H. Smith,2011).

But how the term "Universal Design" was created and implemented into architecture?

Figure 2. Ronald Mace (NCU,2008)

More than 30 years ago (1970), Ronald Mace, an architect, and wheelchair user, proposed the revolutionary idea that physical environments should be designed to meet the needs of a broader range of people who access these spaces (Wilkoff and Abed, 1994). Mace suggested that design fields such as architecture, landscape, interior, and product development have to please the needs of different consumers (e.g., young people, elderly people, individuals with temporary and permanent disabilities), (Joan M. McGuire et al. 2006).

The aim of universal design is to develop approaches, principles, and strategies to enable everybody to use the same physical solutions to the greatest extent possible, whether it be buildings, outdoor-areas, or households. Universal design aims to bring awareness, comfort, wellness, and social integrity. In a universally designed world, people's differences are not highlighted by building usage but designed to create seamlessness between users. The center for Universal Design defines this term and the purpose of the concept in the following way:

"The universal design concept intends to simplify life for everyone by making products, communications, and the built environment more usable by more people at little or no extra cost. The universal design concept targets all people of all ages, sizes, and abilities."
(Finn Aslaksen et al. 1997).

Universal design as an idea is developing in all the fields and expanding towards the inclusive design. An inclusive design like a synonym for the universal design, although it extends explicitly by including not only people with disabilities but also the elderly and aging population. The British Standards Institute defines inclusive design as "the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialized design." (Moyen M. Mustaquim, 2015). While Design Council defines inclusive design as 'a general approach to designing in which designers ensure that their products and services address the needs of the widest possible audience, irrespective of age or ability' (Ann Heylighen and Matteo Bianchin, 2012). Inclusive design is intended to remove the obstacles causing unnecessary effort and isolation. This helps everyone to engage in daily tasks equally, with confidence and independently. Inclusive design, like universal design, centered on achieving and creating space that can be used by people to create healthy, lively, and sustainable communities.

1.2 Design for the elderly using the concept of universal design

1.2.1 Principles of universal design in architecture

As the Universal design established, architects still required guidelines or set of rules to follow and be able to implement the universal design to their work. In 1997 a group of specialists of North Carolina State University working on universal design in the fields of architecture, industrial design, assistive technology, and environmental design draft the "Seven Principles of Universal Design". The authors of principles were researchers and practitioners in empirical fields such as ergonomics and human factors research, industrial design, gerontology, and rehabilitative medicine. They drafted principles guiding the universal design method toward designs that are flexible, equitable, simple, easily usable, and tolerant of error (Aimi Hamraie, 2012). The list which they created consisted of seven different principles:

1. Equitable Use;
2. Flexibility in Use;
3. Simple & Intuitive Use;
4. Perceptible Information;
5. Tolerance for Error;
6. Low Physical Effort;
7. Size and Space for Approach and Use.

Each one of them represents some fundamental but crucial aspects. By looking in-depth to each one of them, we can see the differences and have a clear understanding (Story, Molly Follette, et al. 1998):

Principle one: Equitable Use.

The concept is beneficial, as well as marketable, to people with different skills.

- Provide all users with the same means of use; the same where possible and similar where is not.
- Do not segregate or stigmatize any person.
- Make confidentiality, authentication, and protection reasonably accessible to all users.
- Make the design attractive for any consumer. (Story, Molly Follette, et al. 1998).

Examples: Power door with a sensor at entrances that are convenient for all users

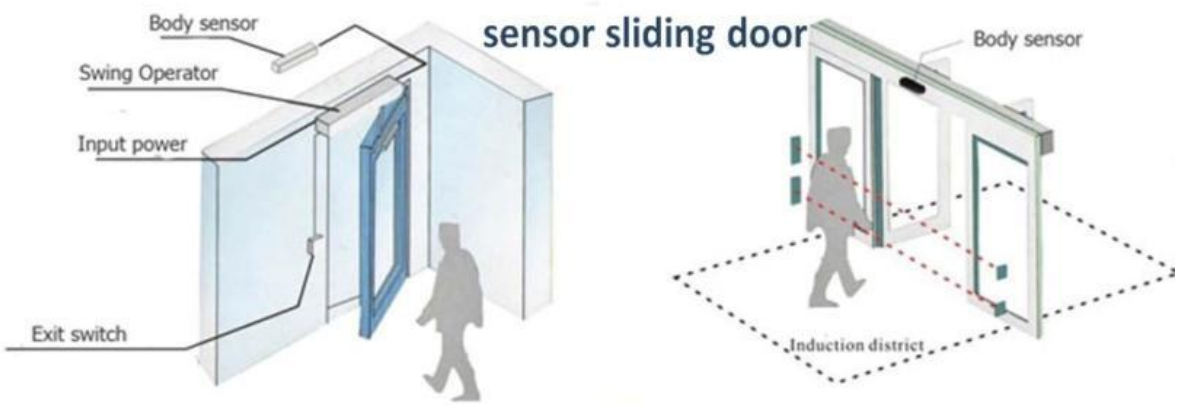


Figure 3. Sensor doors (RK security solution, 2018).

Principle two: Flexibility in Use.

The design fits a wide variety of particular preferences and capabilities.

- Diversity is uses
- Suitable for use with the right or left hand.
- Contribute to precision and accuracy for the consumer.
- Adaptable to the user's pace (Story, Molly Follette, et al. 1998).

Examples: Railing from both sides, which allow use of right and left hand entry; powered height-adjustable work surface.

Figure 4. Ramp with railing from both sides (Kee Safety, 2017-2020).

Principle three: Simple & Intuitive Use.

Usage of the design is simple to understand, irrespective of the experience, knowledge, language skills, or current level of concentration.

- Get rid of needless confusion.
- Be attuned to consumer needs and instincts.
- Match a broad range of abilities.
- Arrange information as it matters (Story, Molly Follette, et al. 1998).

Examples: A moving sidewalk or escalator; instruction manual with drawings and no text.

Figure 5. Moving walkway in airport (Harriet Baskas, 2016).

Principle four: Perceptible Information.

The design effectively communicates the necessary information to the user, irrespective of the environmental conditions, or the sensory abilities of the user.

- Use various types of representation (pictorial, verbal, tactile) for excess crucial details.
- Distinguish the elements in ways that can be represented (i.e., make instructions or directions simple to give).
- Implement a connection with a variety of techniques or tools used by sensory restricting persons (Story, Molly Follette, et al. 1998).

Figure 6. Dark background on overhead airport terminal signage contrasts with lighter ceiling (Designworkplan).

Examples: Tactile, visual and audible signals and instructions (on a thermostat, voice communications and signage in airports, train stations & etc.).

Principle five: Tolerance for Error.

The design minimizes the risks and negative impacts of unexpected or unwanted actions.

- Organize elements to alleviate hazards and errors: most used elements, most accessible;
- Delete, separate, or cover hazardous elements.
- Present hazard and error warnings;
- Implement safety features (Story, Molly Follette, et al. 1998).

Examples: A double-cut key that is comfortably inserted in one of two ways into a recessed keyhole; an undo feature in computer software that helps users to fix errors.

Figure 7. Lip or curb at sides of ramp reduces the risk of slipping off (Northshore, 2018).

Principle six: Low Physical Effort.

The design can be used efficiently and conveniently and with minimal discomfort

- Enable users to maintain a neutral position of the body.

- Use the reasonable force of action.
- Minimizing repetitive behaviour.
- Reduce sustained physical effort (Story, Molly Follette, et al. 1998).

Examples: handles with levers or loops on doors and faucets; touch lamps controlled without a switch.

Figure 8. Door lever can be operated with closed fist or elbow, unlike door knobs (Michael A. Capuano & Camila Sainz De La Peña, 2015).

Principle seven: Size and Space for Approach Use.

Appropriate size and space are provided for access, reach, manipulation, and use regardless of the body type, posture, or versatility of the individual.

- Provide a clear line of view of essential elements for any consumer who is sitting or standing.
- Offer any seated or standing user easy access to all components.
- Suitable for hand and grip combinations.
- Provide spaces designed for the use of personal assistance or assistive devices (Story, Molly Follette, et al. 1998).

Examples: Controls on the front and clear floor space around appliances, mailboxes, dumpsters and others; wide gates.

Figure 9. Lowered counter section (U.S. Department of Justice, 2014)

Universal design principles require architects to understand how, and by whom building and space will be used. Places need to be designed with possibilities of add and change the uses and demands of spaces. Numerous research papers already evaluated the benefits for consumers of using some of the principles (Table 1).

Table 1. Examples of simple Universal Design in residential home (Syazwani Abdul Kadir & Mariam Jamaludin, 2013).

DESIGN SOLUTION	BENEFITS TO USERS
Using lever type handle on faucets and doors instead of the knob	Minimize energy used
Providing different counter height at the standard 36 inches and lower counter at 30-32 inches (American standard codes)	Flexible to users with different heights (i.e. children, adult or wheelchair user)
Providing doorways and hallways with the adequate width	Comfortable to move around even with two people in the same walkway
Using rounded edges for doors, windows and counter tops	Ensuring safety by avoiding injury due to accidental bumps

Evaluating current designs, directing the design process, and informing designers and customers about features of more functional designs could be implemented to create architecture that will accommodate all people. The adoption of these ground rules will provide users with safety, comfort, convenience, and confidence in the development. People will be able to participate in any activities which development offers on equal terms.

The Principles of Universal Design are a breakthrough in specifying all aspects of the concept for all design disciplines. These principles help analyze current products and conditions, as well as direct the design process. Just by including even some out of those seven principles architects and designers can help to simplify life for not only disabled people but in addition for aging population all around the world and end up with a development that is:

- Inclusive; so that everyone can use them safely and comfortably.
- Responsive; considering what people need and want.
- Flexible; so that everyone can use offered spaces in different ways.
- Convenient; so that everyone can use them without too much effort or separation.
- Practical; offer different solutions to help meet everyone's needs (Howard Fletcher, 2006).

1.2.2 Aspects of universal design for the aging population

The average human lifespan at the start of the 20th century was about 47-50 years old. Nowadays, people live longer, the average lifespan has risen to 76-80, primarily due to safer living conditions, improved medicine, vaccination, and sanitation that have prevented many infectious and fatal diseases. According to the 2010 Census, on 1 April 2010, there were 40.3 million 65 and older people, an increase of 5.3 million since the 2000 Census, when this number was 35.0 million (Jones and Sanford, 1996). By 2020, the Census Bureau forecasts that 7 million to 8 million people will be over 85 years of age, and 214,000 will be over 100 years of age. In comparison, just 1 in 500 at the end of World

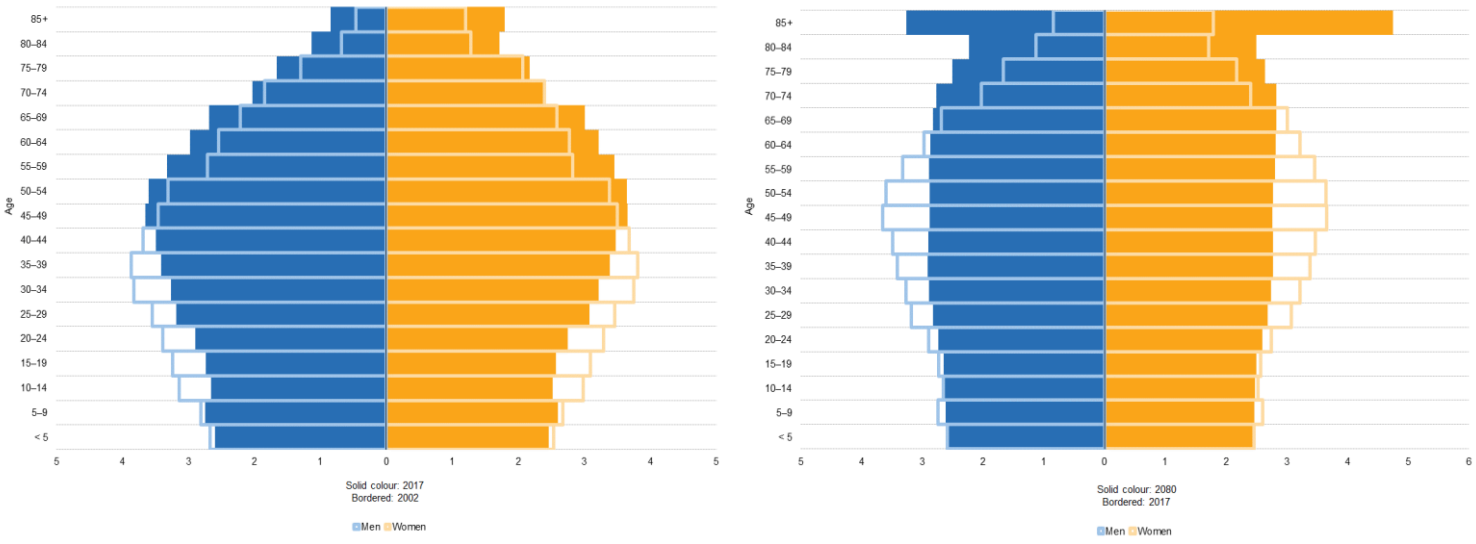


Figure 10. Population pyramids, EU-28, 2002 and 2017 (left) and 2017 and 2080 (right), (% of total population) (Eurostat, 2018).

War II reached a benchmark of 100 years old. Population pyramids (Figure 10) show the distribution of the population in 2002 (outline shape), 2017 (solid shape on the right chart and outline shape on the left chart), and 2080(solid shape). By looking at the two pyramids side by side, we can notice a quite

rapid increase in the senior population by 2080, from 8% for men and 18% for women in 2002 to about 32% for men and almost 60% for women in 2080 (Eurostat, 2018).
It has further predicted that by 2050, Europe will have 173 million people aged 65 and over. Across Southern Europe, aging is the most significant. In comparison, 'just 25 percent' of the population in Northern Europe would be 65 or older in 2050 (Story, Molly Follette, et al. 1998). By 2070, the EU will go from having 3.3 working-age people per each person over 65 to only two working-age people. (SilverEco org, 2018).
In 2011, elderly people were more likely to live by themselves (Figure 11). In 2011, 28.5 percent of the EU-28 population, age 65 and over, lived alone. In Denmark, this percentage grew as high as 42.4 percent, followed by Belgium, the Netherlands, and Finland, with the next highest percentage. At the other end of the spectrum, less than 20 percent of the population aged 65 years and over is living alone

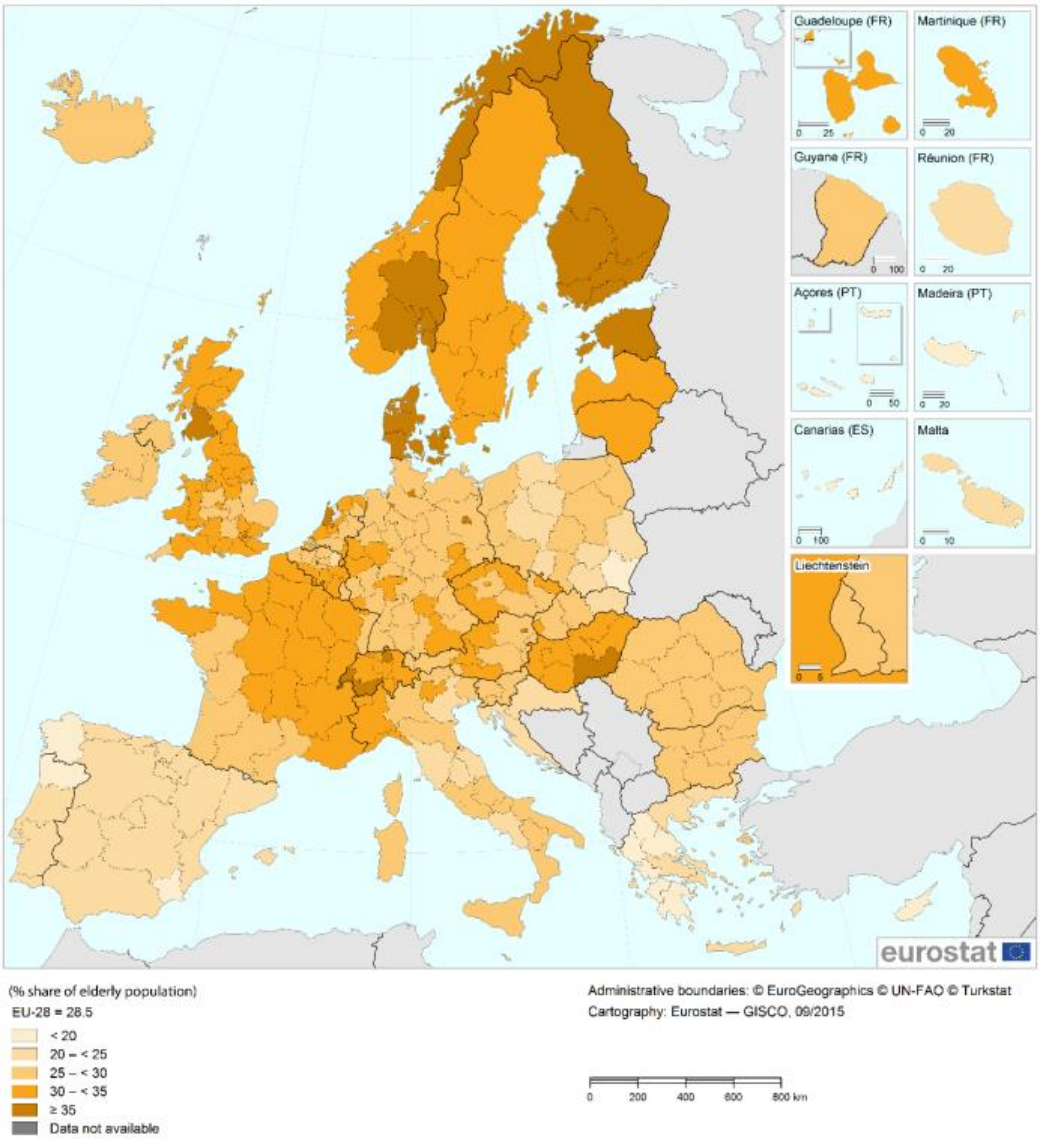


Figure 11. Elderly population aged 65 years and over living alone, by NUTS level 2 region, 2011 (% share of elderly population) (Eurostat, 2018).

in many regions of Greece, Spain, and Portugal, as well as in Cyprus and Poland's south-eastern region. The northwestern Spanish region recorded the lowest proportion of the elderly living alone (16.8 percent).

Baltic countries (Latvia & Lithuania), as well as the northeastern part of France, have about 30-35 percent of seniors living independently from their families (Eurostat, 2018). That shows us that most elderly people value their independence and would prefer to live in their own homes.

Studies have shown that one of the essential facets of positive aging is psychological well-being. It reported that elderly residents with diminished abilities, if they are familiar with the surroundings, can carry out daily life activities nearly successfully.

On the other hand, since they are not acquainted with the environment, these tasks can be challenging to carry out even for the less impaired elderly. Accessible features for the elderly in dwellings include items like large doors, ample clear space for wheelchairs, hardware loop-type handles, bathroom grab bars, and knee spaces underneath the sink.

Few research papers are showing how implementing universal design principles create a healthy community environment for the elderly. In one of the case studies, a group of the researchers aims to evaluate the effectiveness of the facilities and design elements in the housing of Hong Kong and test how it can be improved to meet the needs of the elderly. In the process of their investigation, they found some of the aspects which were used in the design of the dwellings in Hong Kong (Table 2).

Table 2. Universal design features in public rental housing in Hong Kong (Wadu Mesthrige Jayanthaa et al. 2018).

Scale/level	Design features
Micro-scale	
Physical home	
Bathroom	Non-slip flooring
	Grab bars
	Vertical rod type sliding shower-head and soap holder
	Lever type shower, basin & sink mixer
	Sunken shower
Interior design	Increase door width
	Shallow entrance door threshold with beveled edges
	Large light switches and doorbell push button
	Light switches, doorbell push button, door phones, socket at convenient height
Meso-scale	
Eastate design	Signage
	Barrier access routes
	Connect domestic blocks to major estate facilities
	Avoid level changes & promote continuity and convenience
Macro-scale	
Community care	Personal care
	Health care/prevention care
	Transport facilities to care

Architects have found themselves facing new and exciting design challenges for seniors, and they are trying to put in some new and fresh ideas that are innovative, imaginative, and appropriate to older people. The following concepts can be applied in projects, and can also meet universal design "laws."

Designs to Aid Mobility.

One of the biggest problems facing seniors is mobility. Architects are building wide hallways, stair-free spaces, or open floor plans to make a home more accessible. Broad doorways and no-step entry

can eliminate many accidents to older people, as only a minor difference in levels can lead to loss of balance or a fall (Shelley Little, 2014).

Lighting.

Lighting is one of the essential things for the elderly, mainly because poor lighting can lead to accidents and falls. When people age, they undergo several vision issues from macular degeneration, neurodegeneration, and decreased retinal illumination (primarily, smaller pupils and a thicker eye lens cause it to look less vibrant and bright). Designer, Eunice Noelle-Waggoner, points out that the elderly prefer light sources that are veiled with shadow because they cut down on bright glare. Generally, they prefer natural light over intense high-contrast lighting (bulbs are possibly best, and large windows are a must). Overall, the house must be well-lit along the walls, floors, corridors, and stairs to ensure unhindered views and maximum security (Shelley Little, 2014).

Color Palette.

Additionally, the high contrast colors used in the interior of a home will help to improve poor eyesight for seniors. A darker color on the bathroom walls, for example, helps a senior to see the white toilet seat or the white porcelain sink. It is a well-known fact that mood often influences colors. Seniors may become depressed or melancholy as they start feeling shut-off from outside. Soft pinks and greens can allow users to feel content, while red and orange can increase levels of energy. The color usually affects what seniors feel inside their homes (Shelley Little, 2014).

The use of various colors in the environment can be beneficial for those dealing with dementia. Color preferences are red, brown, and green for those with dementia. Research shows that the use of blue will reduce blood pressure in the physical setting. Red enhances brain wave activity; it helps attract an individual's attention to Alzheimer's or dementia. Green color reduces the activity of the central nervous system and helps people stay calm. For particular, lime green is useful for visual recognition for people for Alzheimer's or dementia, i.e., visual signs for toilets, bedrooms, walkers, etc. (Anonyms (the Advocate), 2016). Studies in nursing/rest homes show that soft pink-beiges contrasted with soft blue/greens are calming and peaceful.

Elders need spaces that adapt to their activities, and sensory experiences that deterioration. Around 1980, Lawton proposed that by deliberately constructing as few physical obstacles as possible and paying more attention to the needs of the elderly, it would be possible to make the atmosphere better suited to the elderly. Lawton and Simon established the "environmental docility hypothesis" based on observed trends of fragility and disability among elders. They found that the less capable an individual is, the more impact the environment has on restricting the capacity of that person (Douglas E. Crews and Susan Zavotka, 2006). Therefore, it is crucial to develop environments that will increase opportunities for independence and self-reliance in order to enhance the capability and health of the elderly.

1.2.3 Problems of the architectural design for elderly in the context of universal design

Unfortunately, it is not so common to meet all these principles used in actual designs for the senior population. There a considerable amount of projects which care more about profit instead of the well-being of the consumers and the successful design that eliminates the challenges they face (Table 3).

Facilities for the aged often associated with institutionalization that diverts from the concept of a home, a place of warmth and safety, and one that makes a person happy to reside in. As a result, seniors have

a negative impression of these facilities, thus further damaging their psyche. Due to the physical and mental deterioration of the elderly, they slowly become more isolated from the rest of the community.

Table 3. Common challenges faced by the seniors (Wadu Mesthrige Jayanthaa, et al. 2018).

Area (s)	Details
Housing design	
1. Appropriate housing	*Accessibility issues:* lack of accessibility features such as missing grab bars in bathroom and insufficient door width for accommodating wheelchairs. *Affordability issue:* difficulties in keeping up with maintenance cost and increasing rent particularly for those with fixed income.
2. Safety	*Safety issue:* mainly falling due to weak physical conditions such as weak eye sight and loss of hearing. Difficult to hear emergency alarms/signals. Some may even be vulnerable to crime.
3. Home repair & maintenance	Difficulties in keeping up with home repair and maintenance works; also finding affordable and trustworthy repair companies.
Health problem	
4. Personal care	Due to poor mobility of elderly, some are in need of assistance with personal care.
5. Health care	Due to frail health conditions, they are in need of significant health care needs such as preventive care and treatment for chronic conditions. Yet, financial and transportation limitations may hinder access to health care in time.
Social network	
6. Transportation	Elderly with limited mobility or with wheelchair may need special transportation arrangements. Others who often rely on public transportation may also find difficulties because of the changes of transport network/route.
7. Community involvement	Poor mobility of some seniors may hinder participation actively in their communities.

One of the most common problems which the elderly faced once they been put in nursing or retirement home is space. Frequently, nursing homes try to provide different areas in the facilities so people can move around. In reality, however, seniors will be transitioning from home to smaller living arrangements, generally allowing for a minimum set of essentials such as bed, dresser, table, and a few chairs. Such rapid changes can affect the emotional and mental health of older people, who now need to get to know their new dwelling space.

Many people in traditionally designed housing want to stay at home, and this presents another set of challenges. In one of the researches, a questioner was given to seniors to find out what the environment is lacking. As a result, it found that all the seniors emphasize that they want to age in their own homes or a familiar environment than to move into the specialized institutional shelter (Wadu Mesthrige Jayanthaa. et al. 2018). Adaptations of homes for the elderly vary from significant design renovations, such as elevators, to small repairs. Government funding has increased for improvements, and in some cases, home improvement companies offer advice and assistance to underprivileged people in need of upgrades and improvements (Steve Ongeri, 2009).

Furthermore, the area is vital to older people who want buildings that allow them to remain independent and allow them to contact their friends and family. Nobody chooses to live in isolated or unsafe parts of town, and most people want local facilities such as parks and shops, to be accessible. Researchers find that the social factor is the primary thing that is missing for the elderly population in a lot of research papers, where the social survey held.

Besides, problems from the personal side and interior architecture for the elderly, there are urban spaces that also need careful designing and rebuilding. Nowadays it is quite common to have

parks/playgrounds which are age-friendly. Mobility issues should be taken into account when designing access paths, systems, and equipment. There are a few points which quite often not taken into count:

- The parks must be safe to travel around using a wheelchair or roller (walking frame modified with wheels), and thus the surfaces must be smooth (age-friendly sidewalks), and the paths must be wide enough with appropriate gradients.
- There should be handrail ramps on both sides, instead of stairs.
- Bench seats should be slightly higher than standard, with comfortable backrests and hand rests that make it easier to sit and get up.
- Equipment for exercise should be safe to use and must have specific written instructions. The equipment should be readily accessible, either from a wheelchair or from a roller. It must be constructed in a way that people with no prior knowledge with exercise equipment can additionally find out how to use it.

Additionally, the lighting is a really important aspect. Sometimes we can see loads of parks do not have good lighting, which makes it more dangerous for the users (Sarah Stevenson, 2015).
In terms of universal design, you can see that usually, people will follow the most straightforward principles and items to make space more accessible. Unfortunately, making a wider doorway and automatic doors or elevators is not enough for space to be suitable for everyone.
An environment that does not meet the changing needs of elderly people can easily prevent successful aging.

1.3 The analysis of examples for architecture for elderly according to universal design aspects

The fundamental analysis was made to demonstrate the in-depth difference of designs and approaches architects use for architecture for the aging population.
Following analysis was made between 5 institutions specialized in accommodating seniors:

Retirement Home by Meire + Associes Architects
The project, which takes up 5.000 sqm, was built in 2008 in Baud, Switzerland. The master plan's goal is to deliver a scheme and landscape that will create an alternative to the adjacent commercial zone's

Figure 12. Retirement home exterior, photography by Yves Andre (Meier + architects associés, ArchDaily, 2011).

built-up environment. The project creates a more cohesive and accommodating environment in which architecture and nature coexist (Meier + architects associés, ArchDaily, 2011), (Figure 12).

Retirement & Nursing Home by SRAP Sedlak Rissland + Durschinger Architekten

A winning development plan by three Tyrolean municipalities Ellmau, Scheffau and Söll, this nursing home was built in 2017 and located at the foothills of the "Wilder Kaiser" Mountain Range, Austria. The building consists of two compact volumes that interlock at the central section where they form an atrium, and the building consists of 54 apartments in total. The placement generates three different outdoor spaces on the plot: a public garden, a separate dementia garden, and a children's playground (SRAP Sedlak Rissland + Dürschinger Architekten, ArchDaily, 2018) (Figure 13).

Figure 13. Retirement & nursing home, photography by Rene Rissland (SRAP Sedlak Rissland + Dürschinger Architekten, ArchDaily, 2018).

De Bouwmeester by LEVS Architecten

This fascinating residential complex was built in 2013 in the city of Utrecht, Netherlands. The whole complex takes about 10.000 sqm. De Bouwmeester has a combination of social and functional roles. The house includes spaces not only for residents but for their families as well. The Architect has merged ground level with nursery and community center extends via a large glass window into a garden. The ground floor architecture is versatile and extends via a large glass facade into a garden. Meeting areas and spatial relationships create a place where young and old alike come together; protected and yet correct in society (LEVS. De Bouwmeester, Utrecht), (Figure 14).

Figure 14. De Bouwmeester, photography by Marcel van der Brug (LEVS. De Bouwmeester, Utrecht).

Hawkhead Center by Page/Park Architects

The Hawkhead Center is an activity and support center for the charity Scottish War Blinded, which was built in 2017 and takes about 15.300 sqm. The center offers a wide variety of facilities to support

Figure 15. Hawkhead center, photography by Keith Hunter (Page\Park Architects, ArchDaily,2018).

the charity in its work, including a sports hall, gymnasium, art studio, wood workshop, and a large dining area that forms the building's social hub and heart. Each room in the building has a visual connection to this extensive roof and the central meeting area, providing a sense of community and relation to the entire building (Page\Park Architects, ArchDaily,2018), (Figure 15).

Residential Care Home by Dietger Wissouning Architekten

In 2015 a residential care home was built for 105 elderly residents in Graz, Austria. A large shared living area serves as additional living areas for each private group on the ground floor and an atrium with tower galleries on the top level. The two-story building consists of four wings grouped around a "village square" semi-public, designed to host different events. Particular attention paid to ensuring that enough natural light enters the entire house (Dietger Wissounig Architekten, ArchDaily,2016), (Figure 16).

Figure 16. The residential care home, photography by Paul Ott, Helmut Pierer (Dietger Wissounig Architekten, ArchDaily,2016).

The analysis shows the comparison regarding universal design principles and how they are implemented to the design. The conclusions were gathered into the table for a better understanding (Table 4).

In addition, it was quite interesting to look at the facilities which the architect provided in these retirement institutions. A lot of seniors preferred to have specific spaces such as parks, common areas for social interaction. To have a better idea of what the elderly might need, the design ideas and desired areas were listed down in one table (Table 5).

However, it was quite interesting to notice that none of them has new technology involved in their designs. While seniors have consistently lower rates of adoption of technology than the general population, this number rising every year. More and more older adults are using laptops, tablets, and smartphones. Most of them enjoying the ability to connect with their family members and long-time friends through video calls. There is such a remarkable innovation, which many seniors will appreciate – Google Home. It is a voice-activated smart speaker. "Our transitional care (short-term rehabilitation) patients enjoy using it during their stays to get instant access to information such as the weather forecast, history, and current events, as well as where and when they need to be.
In short, it helps them stay connected to their hobbies and interests, and on top of their schedule", says mike king, a president, and CEO of Jewish Senior Life (Mike King, 2018). Moreover, it is becoming more popular to adjust the dwellings of older people with features of a smart home. A smart home refers to a versatile home system where objects around the house – from window shades to pet feeders – can be operated with a simple push of a button (or a voice command). For instance, smart lighting will ensure that the kitchens are softly illuminated while in operation, and living areas always have sufficient amount and brightness of lighting throughout the day, taking in a count of the weather conditions. One of the principal risks for seniors living alone is the risk of cooking-related fires. The iGuardStove system works for either gas or electric stoves, minimizing fire risk by shutting such devices off automatically after a fixed period of time (Ashlee Clark Thompson, 2017).
An additional case study that dealt with the interpretation of the spatial arrangements of the ground and first floor circulation spaces, based on the social interaction of the elderly. Further abbreviated as MECRI and EECRI were the selected institutions in Istanbul, Maltepe Elderly Care, and Rehabilitation Institute and Etiler Elderly Care and Rehabilitation Institutes. MECRI was built in 1975 for lower-middle-class residents in a suburban area of Istanbul, while EECRI was built in 1985 in a central upper-middle-class neighborhood. MECRI is a low-rise horizontal building connected by a linear circulation route in an extensive plot with three blocks. While EECRI is a vertical high rise building on a fairly small plot with restricted circulation routes within buildings. MECRI has its social block attached to the administrative units, while the social block split from the administration in EECRI. The research observation approach helped evaluate and identify the use of given spaces and interesting points for both facilities for the elderly (Esra Akan et al. 2017):

- In MECRI, users tend to spend time closer to their private room units in interconnected circulation spaces involving movement and dynamic activities. EECRI users, on the other hand, tend to behave with the built configuration as getting social in spaces of social activity and only use the circulation routes that are close to those socially interactive spaces.
- MECRI users prefer being alongside with each other while privacy protection is preferred in EECRI.
- As the level of education increases, movement by design increases, the structure can easily be decoded and used; however, the administrations' formal or versatile manners still play an essential role.
- Socio-economic factors also influence social interaction; relationships with neighboring users and the local community are gaining in significance as the level of income falls. Access to socio-cultural life outside, by contrast, increases parallel to the status level. Relatively lower social status found to be linked to typical rates of social contacts, such as street conversations with neighbors (Esra Akan et al. 2017).

Table 4. Analysis of 5 different institutions regarding universal design principles, focused on accommodating elderly people.

Project name, Architect	Retirement Home meier + associés architectes	Retirement & Nursing Home SRAP Sedlak Rissland+ Durschinger Architekten	De Bouwmeester LEVS Architecten	Hawkhead Center Page/Park Architects	Residential Care Home Dietger Wissouning Architekten
Equitable Use	Single grade entrance useable for all users, reception desk	Reception desk, sliding doors	Single grade entrance useable for all users	Single grade entrance useable for all users, reception desk	Single grade entrance useable for all users, reception desk
Flexibility in Use	Age friendly measurements, signages in hallway, multiple grab bars	Age friendly measurements, signages in hallway, multiple grab bars	Age friendly measurements	Age friendly measurements, multiple grab bars	Age friendly measurements, multiple grab bars
Simple and Intuitive Use	Simple design of the bedroom, easy readable floor plan	Simple design of the bedroom, easy readable floor plan	Simple design of the bedroom, easy readable floor plan	Easy readable floor plan	Simple design of the bedroom
Perceptible Information	Contrast in color of wall next to rooms	Contrast in color of wall next to rooms	-	Natural materials were used to provide the necessary visual contrast between elements	Contrast in materials were used to provide visual contrast between elements
Tolerance for Error	-	Nursery on each level	-	-	Nursery on each level
Low Physical Effort	Elevator, wide Doorway, double door lever	Elevator, wide Doorway, double door lever	Wide Doorway, double door lever	Wide Doorway, Holding bar	Elevator, wide Doorway, double door lever
Size and Space	Wide Hallways, Age friendly measurements (bathroom & hallways)	Wide Hallways, Age friendly measurements (bathroom & hallways)	Wide Hallways, Age friendly measurements (bathroom & hallways)	Wide Hallways, Age friendly measurements (bathroom & hallways)	Wide Hallways, Age friendly measurements (bathroom & hallways)

Table 5. Types of common spaces and facilities that are provided in retirement institutions.

Project name, Architect	Retirement Home meier + associés architectes	Retirement & Nursing Home SRAP Sedlak Rissland+ Durschinger Architekten	De Bouwmeester LEVS Architecten	Hawkhead Center Page/Park Architects	Residential Care Home Dietger Wissouning Architekten
Common Living Area	-	+	+	+	+
Park, Green area	-	-	+	-	+
Separate Kitchen	-	-	+	-	-
Cafeteria	+	+	+	+	+
Roof terrace, Balcony	-	-	+	-	+
The use of AI New Technology	-	-	-	-	-

In this research, it is demonstrated that by analyzing the spatial features of older care facilities, regulated choices, and convenient access to common areas are gaining significance in relation to the users' social status. The correlation between spatial configurations and socio-behavioral factors such as elderly users' aging, adaptation, and interaction depends on their spatial expectations and competencies based on patterns of movement (Esra Akan et al. 2017).

It is crucial to keep in mind that senior citizens' lives should not be restricted to the interior spaces of their homes or other retirement institutions. Therefore, open urban spaces become relevant in terms of the free and easy access provided to the elderly (especially those which surrounding spaces of housing units and creating its neighboring area and natural habitat), allowing them physical exercise, socialization, contact with nature and the sun, contributing to their physical and psychological well-

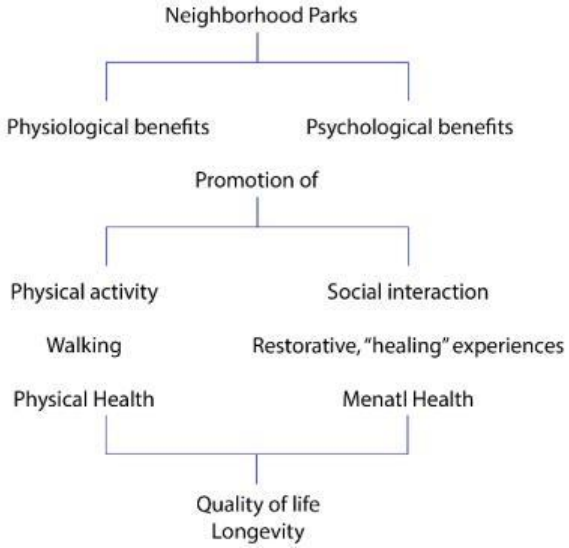


Figure 17. Neighborhood parks benefits, (Anastasia Loukaitou-Sideris et al. 2016).

being (Figure 17). During this research, a lot of observed parks that have just walking trails and some seating area which created for the elderly to use them. As well as simple walking trails, seniors need some additional features to make their life more comfortable and happier. Here are some interesting senior-friendly open spaces / urban areas:

Carbide Park, La Marque, Texas

The Carbide Park senior playground in La Marque, opened in 2014, features $36,000 of exercise equipment designed to help seniors maintain coordination and balance: including fitness steps, low and high chin-up bars, balance stools, curved balance beam, and stretching frame. One of the park's goals, cited in an Associated Press article by Galveston County Commissioner Stephen Holmes, is to become a social center for older adults. The concept provides an assessment of fall prevention and a training tool (Phillip Mena, 2014).

The John G and Phyllis W. Smale Riverfront Park, Cincinnati

Located nearby the city center, this park provides many recreational activities, including interactive ground-spray fountains, a sculpture play area, and public seasonal dockings and piers serving public and commercial cruise boat traffic.

Swinging benches, which suspended from sculptural steel, directed towards the water. A 1000-foot long boardwalk along the river and an integrated cycling hub complete a park's package that is truly an excellent destination for active seniors (Sasaki, 2014) (Figure 18).

Figure 18. The John G and Phillis W Smale riverfront park (Sasaki, 2014).

Presidio Park, San Diego

The park designated a National Historic Landmark in 1960. Park takes up about 40 acres and has a lot of different facilities not only for kids and their parents but also grandparents. The trail in Presidio Park offers scenic views and leads visitors through a eucalyptus grove, amongst many other types of

Figure 19. Presidio park, San Diego (CMG landscape architect, 2014).

trees and plants. The park has benches and picnic tables for resting, as well as public bathrooms. Presidio Park is like a connection between the new and old generations (Figure 19).
Here are some basic rules which will help to design senior-friendly urban spaces (Euroform,2016):

- Pleasant and clean environment
- Importance of green spaces: parks, green areas are available
- Somewhere to rest: seating possibilities are available
- Age-friendly pavements
- Safe pedestrian crossings
- Accessibility
- A secure environment
- Walkways and cycle paths
- Age-friendly buildings
- Adequate public toilets

Parks are important and beneficial places in urban neighborhoods for older adults. For low income, inner-city seniors in particular, who live in small apartments without private yards and outdoor space, neighborhood parks can offer respite and opportunities for contact with nature, walking, and exercise (Anastasia Loukaitou-Sideris et al. 2016).

1.4 Legal & government (political) documents regarding architecture for elderly

Throw out the years many politicians, architects and organizations made their input in development and improvement of the environment for the aging population. Numerous conferences were held to develop a set of rules and guidelines. United Nations held one of those conferences in Vienna in 1983. The first world assembly on aging - *Vienna International Plan of Action on Aging.* United Nations Commission for Social Development designed to review the implementation of the Vienna plan every four years and presented as a report. This conference focused on issues the elderly faced in developed countries: employment and income security, health, education, social welfare, and housing. It has around 118 items regarding all those issues. Nevertheless, for this research project we can look at only a few of them which speak about housing (Vienna):

Housing and environment.
64. Adequate living accommodation and agreeable physical surroundings are necessary for the well-being of all people, and it generally accepted that housing has a great influence on the quality of life of any age group in any country. Suitable housing is even more critical to the elderly; whose abodes are the Center of virtually all of their activities. Adaptations to the home, the provision of practical domestic aids to daily living and appropriately designed households for those elderly people whose mobility is restricted or who are otherwise disabled to continue to live in their own homes (Vienna, 1983).

Recommendation 19 (Vienna, 1983).
Housing for the elderly must be viewed as more than mere shelter. In addition to the physical, it has a psychological and social significance, which should be taken into account. National housing policies should pursue the following goals to create an independent environment for the elderly:

a) Helping the aged to continue to live in their own homes as long as possible, provision made for restoration and development and, where feasible and appropriate, the remodeling and improvement of homes and their adaptation to match the ability of the aged to get to and from them and use the facilities;
b) Planning and introducing--under a housing policy that also provides for public financing and agreements with the private sector--housing for the aged of various types to suit the status and degree of self-sufficiency of the aged themselves, following local traditions and customs;
c) Co-ordinating policies on housing with those concerned with community services (social, health, cultural, leisure, communications) to secure, whenever possible, aa uniquely favorable position for housing the aged vis-à-vis dwellings for the population at large (Vienna).

Evolve and enforce different strategies and programs to plan for the elderly to get around to secure them from traffic hazards. Furthermore, it is really imperative to provide guidelines to architects that will help to simplify life for seniors. One of those documents was created in 1990 and republished with new amendments in *2010 – ADA Standards for Accessible Design*. This document is a United States civil rights law that prohibits disability-based discrimination. Compliance is not optional because of its status as a law. Municipalities do not have to follow ADA in the way other building codes are adopted; it is already mandatory. What designers are adopting today is the latest edition of the design guidelines for the public spaces. The Americans with Disabilities Act (ADA) has given the idea of accessibility significant attention. ADA has the simplest laws, which will make life simpler for people with disabilities. One of the simplest parts is to put grab bars in the bathroom for additional help. (Figure 20). A sub-set of ADA grab bar guidelines are as follows:

- The diameter of grab bars should be 1¼ to 1½ inch (32–38 mm) (or the shape shall provide an equivalent gripping surface)
- There shall be a 1½ inch (38 mm) clearance from the wall.
- Grab bars should not rotate in their fittings.
- The required mounting height is universally 33 to 36 inches (840–910 mm) from top of the gripping surface of the grab bar to the finish floor. DOJ 2010 ADA standards 609.4.
- ADA-style grab bars and their mounting devices should withstand more than 250 pounds (1112 N) of force.
- In public toilet stalls, side grab bars must be a minimum of 42 inches long and mounted 12 inches from the rear wall. Rear grab bars must be a minimum of 36 inches long and mounted a maximum of 6 inches from the sidewall (Department of Justice, 2010).

Figure 20. Bathroom with grab bars (ADA Standards for accessible design Department of Justice, 2010).

Additionally, there is an aspect of inclusive design is tactile flooring, which provides cues for people who are blind or vision impaired with their orientation. The application of tactile ground surface indicators (TGSI) will not make an unsafe environment safe, it will provide clear information that

will be consistent and understandable. The document which provides architects with standards regarding tactile indicators is AS/NZS, Australian/New Zealand Standard. The requirements stating:

a) TGSIs shall be laid so that there is no likelihood of the edges lifting.
b) A TGSI along the direction of travel shall have a dimension of 300 mm to 400 mm. Where TGSIs are places across the direction of travel, to ensure they are detected, they shall have a dimension of 600 mm to 800 mm.
c) A TGSI shall de slip-resistance tested.
d) TGSIs shall have the top surface of bars or domes no more than 4 mm to 5 mm above the base surface (Figure 21).

Warning indicators application:

a) Railway, tramway platform, bus/tram stop.
b) Level transition between pedestrian areas and carriageways.
c) Escalators, stairs and steps, ramps and kerb ramps.
d) Water features or other items of features of significant risk.
e) A change in direction of directional indicators (AS/NZS 1428.4:2002).

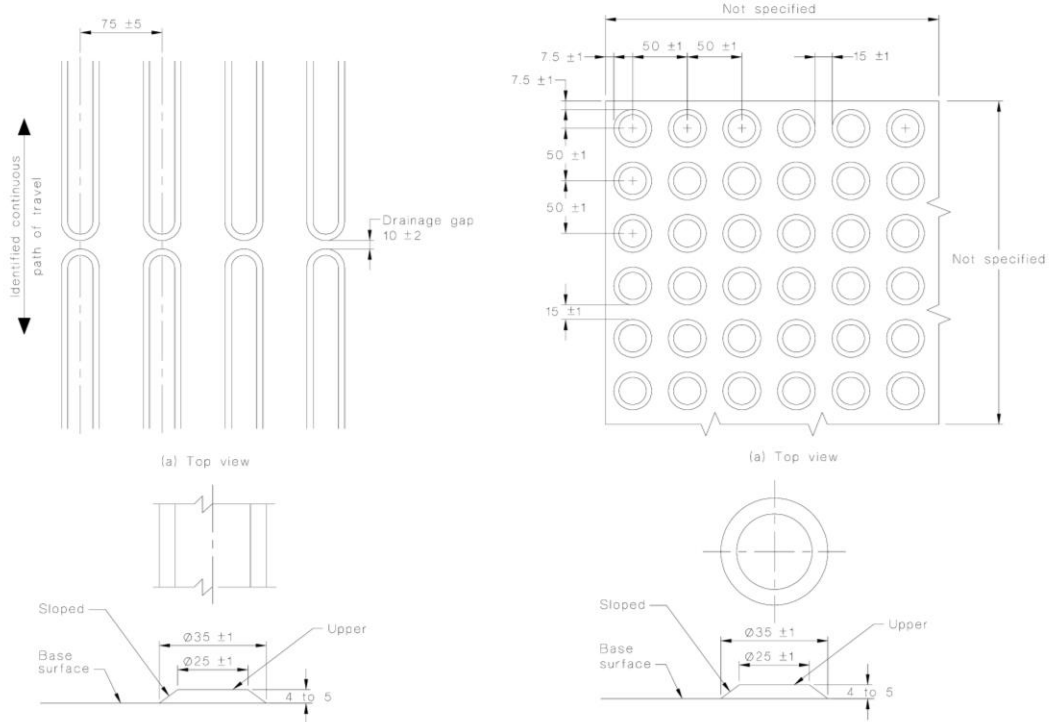


Figure 21. Typical warning indicator pattern, dimensions in millimeters (AS/NZS 1428.4:2002).

However, there is no specific rules on using tactile surface for interior. The only found information was in ADA Accessibility Guidelines for Buildings and Facilities (ADAAG), stating:

A4.30.1 General. In building complexes where finding locations independently on a routine basis may be a necessity (for example, college campuses), tactile maps or prerecorded instructions can be very helpful to visually impaired people. Several maps and auditory instructions have been developed and tested for specific applications. The type of map or instructions used must be based on the information to be communicated, which depends highly on the type of buildings or users.

There are also several regulation documents and plan for developing solutions for the existing situation which were created in Europe. In 1997, the Norwegian government began an effort to develop more integrated and comprehensive planning for accessibility and universal design. The

Norwegian government started to look into this situation, trying to find a strategy that would accelerate the implementation and quality of accessibility in the built environment on a national basis.

Government action plan for universal design.

The action plan focused on designing spaces with increased accessibility. The Ministry of the Environment and the Ministry of Labour and Social Affairs formulated it with help from other relevant ministries. The goal of this action plan to achieve a higher level of accessibility based on universal design principles. With the help of this action plan, a lot of equitable adjustment and regulation were created that became especially apparent in the development of the Planning Act, the Building Act, and the Discrimination and Accessibility Act (Wolfgang F. E. Preiser & Korydon H. Smith,2011). Measures implemented to improve the knowledge of how accessible buildings and outdoor areas are.

Measure B1. The New Planning and Building Act and new regulations issued according to it intended to help ensure universal design in new buildings, facilities, and outdoor areas.

This measure ensures that universal design will be a general consideration in the new Planning and Building Act through the new statement of legislative purpose. In addition, the responsibility for following up the accessibility requirements in building matters is made clear. The local authority's duty to supervise compliance with the accessibility requirement in building matters is also made clear. Tighter requirements introduced to lifts in new work buildings, new public buildings intended for use by the general public, and new multi-dwelling buildings (Anniken Huitfeldt et al. 2009).

Moreover, there is one non-profit, non-partisan AARP (American Association of Retired Persons) organization that helps people age 50 and improve the quality of their lives beyond. AARP, founded by Ethel Percy Andrus in 1958 (a retired educator from California) and Leonard Davis (later the founder of the insurance company the Colonial Penn Group). In 2015 they published a set of rules which showed basic and standard guidelines towards successful home design. The AARP HomeFit Guide was designed to help people turn their place of residence into a "lifelong home," ideal for themselves and everyone in their home. The manual provides solutions ranging from simple do-it-yourself fixes to improvements which require expertise (AARP, 2015).

1.5 Hypothetical solutions of universal design in the adaptation of the environment for elderly

Hypothetical modeling was used to finalize all the findings of this chapter. This methodology is an extensive process of composing hypotheses about the object of the study. The formation of a hypothesis involves forms of inference such as analogy, induction, and deduction. Analogy generally gives a starting point for creating a conjecture. Induction involves a process of generalization of collected data. Moreover, the deduction is an essential tool for further justification of the hypothesis. Throughout this chapter, there was enough collected data related to universal design and its' involvement in the environment for the elderly. From figure 22, you can see a graphical representation of all hypothetical solutions to an existing problem. The main idea of this model is to represent all the principles of universal design on one side and significant common problems that seniors face in the existing environment on the other side. The connections between these two aspects are solutions that were found from the literature review within aspects of universal and inclusive design and how they can be implemented or represented in architectural design. However, several of the proposed solutions,

which are represented below, derived from found results of the analysis of existing institutions and needs of the elderly.

The hypothetical model shows such common problems which the elderly face, such as decreased mobility, vision, memory loss, decreased physical abilities, and, most importantly, loneliness. Additionally, the lack of age-friendly urban spaces can influence to the social isolation of the seniors. Some of the solutions to make older people feel less alienated is to create more common spaces, gardens, and "playground" areas. However, these places for social interaction needs to be easily accessible via public transport, which gives us another solution that needed to be implemented: the facility needs to be located in the place with good transportation infrastructure.

As we age, our memory shows some changes, and it is harder to remember certain things that are especially new. To prevent confusion and make life more comfortable open planning can be implemented, with lots of signage and minimalistic, not overwhelming interior design.

Nevertheless, to implement a lot of these solutions, a crucial task was to find some of the legal documents which will prove and give some strict guidelines and rules. It is pretty common to see the good influence and involvement of the United Nations, EU, and different organizations such as WHO (World Health Organization) and AARP (American Association of Retired Persons). Several documents regarding accessible design, show the exact measurements for such small things as bathroom and grab bars.

This model is showing the found explications that need to be examined and analyzed further more in-depth to find out which one will be the most beneficial of them to improve the quality of life for the elderly in Lithuania.

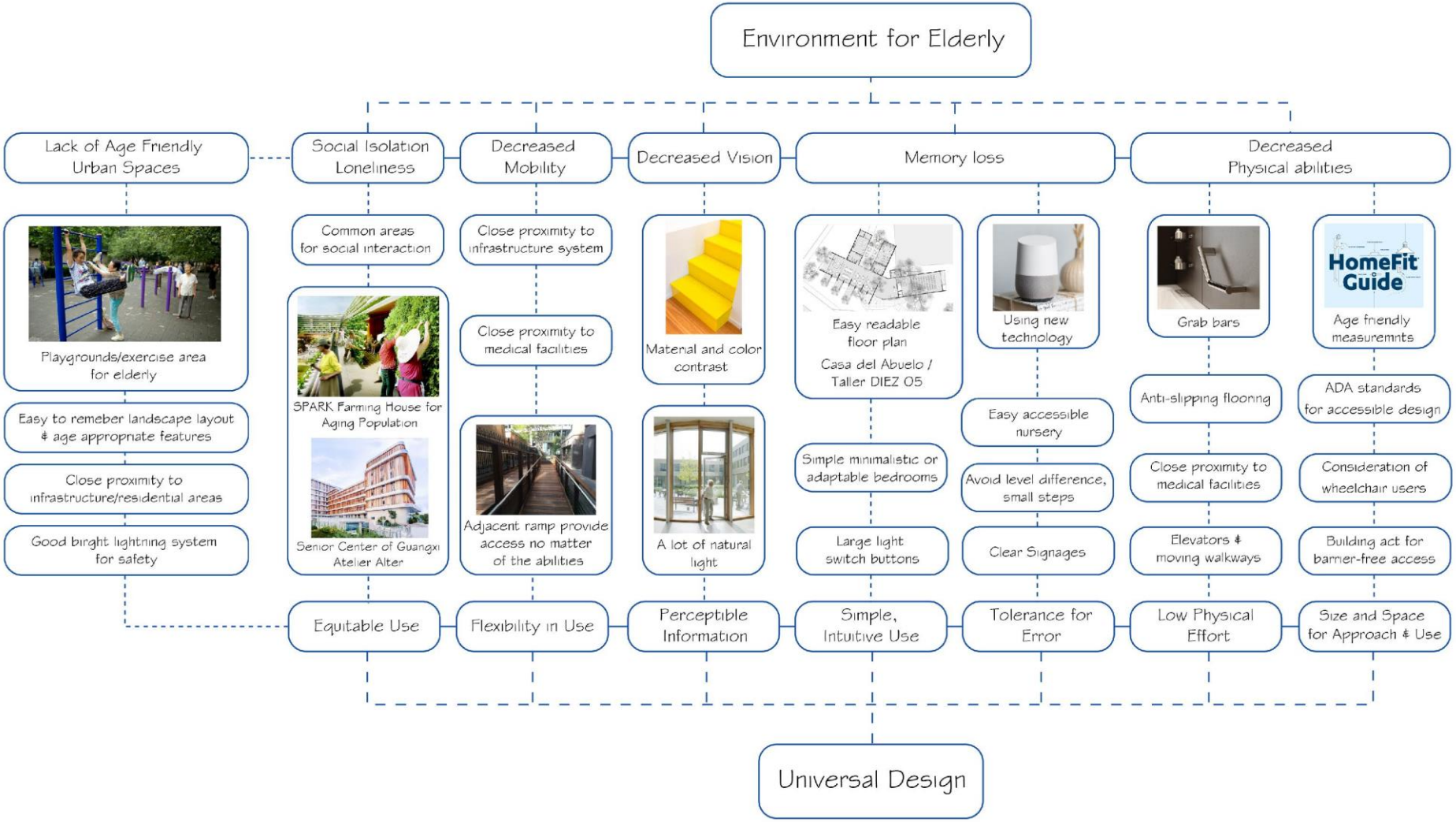


Figure 22. Hypothetical model.

2. Empirical research of universal design adapting living environments in Lithuania for elderly

2.1 Research methodology

The term empirical defines any knowledge collected through analysis, observation, or research. Some of the scientific method's main principle is that evidence requires to be observational, i.e., based on data that is visible to the senses. The crucial part of empirical research is a program, which will help to structuralize questions, object, and aims.

Lakatos's research program based on the hardcore of theoretical premises that cannot be abandoned or changed without abandoning the program as a whole. More modest and concrete theories that formulated to explain the evidence that threatens the "hardcore" are called auxiliary hypotheses. As empirical discoveries require to protect the 'hardcore, auxiliary hypotheses may be altered or abandoned (Lee Harvey, 2012-2019).

Research program needed to be created in terms of getting the best results for the future concept model (Table 6). It needed to include specifically what requires to be analyzed and checked, generate "schedule" for future actions and auxiliary hypotheses. Proposed statements divided into 3 categories: urban, architectural, and social. Each category asks 4 to 6 questions, which related not only to universal design within retirement and daycare institutions, including some general architectural and sociological information. Urban categories focused on urban spaces such as parks, green areas, and infrastructure and their use for the elderly population. The architectural category focused on defining universal design aspects and some fundamental architectural age-friendly features used in such institutions. Last but not least, the social category, which considered one of the crucial parts of this research project. As a future development directed on accommodating a specific layer of our society, it is essential to analyze and study their lifestyle, what they currently have, what they need and want to change. This social category of research project concentrated on getting data from seniors on their opinion and preferences of all of these categories above (urban, architectural, and social itself).

Table 6. Research program.

Questions		Methods	Objects	
Urban	Does the space organization(public spaces) in urban environment influence happy aging?	• Observation • Site analysis • Sociological survey	• Urban Spaces with equipment, parks • From 60 years old Lithuanians (30 people) • Infrastructure system	Park Azuolynas Confluence Park Kalniečių Park
	Do parks design to accommodate elderly population?			
	Do urban spaces (parks, community centers) follow principles of Universal Design?			
	Does infrastructure (bus stations, pedestrian way) developed enough for senior citizens?			
Architectural	Does the organization of architectural spaces influence happy aging?	• Observation • Site analysis • Sociological survey	• Retirement institutions and day centres in Lithuania • From 60 years old Lithuanians (30 people)	Senjoru dienos centras Keturlapis Dobilas Kauno Kartu namai Senjorų dienos centras „Atgaiva“ Kaunas Panemunė retirement homes
	Do retirement institutions follow principles of Universal Design?			
	Architectural similarity in retirement institutions in Lithuania.			
	Issues elderly face in day to day activates by living alone?			
	How often architectural standards measurements used in retirement institutions in Lithuania?			
	Does retirement institutions have simple, open and efficient floor plan?			
Social	Does new technology help to manage elderly's everyday life?	• Observation • Site analysis • Sociological survey	• From 60 years old Lithuanians (30 people) • Retirement institutions and day centres in Lithuania • Urban Spaces with equipment, parks	
	Issues elderly face in day to day activates by living alone?			
	What is a part of entertainment for seniors?			
	Does social interaction one of needed aspects of aging?			
	Does Universal Design principles help happy aging?			
	Issues elderly face in day to day activates by living in retirement institutions?			

2.1.1 Methods applied in the research

Besides statements, the research program requires other "tools," which assist in getting the best results. The whole analysis work was carried out by 3 main methods of research: observation, site analysis, and sociological survey.

Observation.

Observational research (or field study) is a correlational analysis (i.e., non-experimental) in which a researcher examines ongoing behavior and conditions. There are various types of observational approaches, and we need to differentiate between:

1. Controlled Observations
2. Naturalistic Observations
3. Participant Observations

Controlled observation is likely to happen in a laboratory of psychology. The researcher specifies when the experiment will take place, at what time, under what situations, with what participants, and uses a structured protocol. Participants randomly allocated to each independent variable group.

Naturalistic observation is a form of research widely used by psychologists and other social scientists. This approach includes observing and includes analyzing participants' spontaneous actions in the natural environment. The researcher documents what they see in every way that they can. Observation by participants is a variation of the regular observations. However, here the researcher correlates in a part of the group they are researching to obtain a more in-depth understanding of their lives (Saul McLeod, 2015).

In this research project, naturalistic observation is the main method. By visiting different institutions and urban spaces, information on seniors' behavior was collected and analyzed.

Site analysis.

Site analysis is a preliminary stage of architectural and urban design processes devoted to the study of a specific site's environment, geographical, historical, legal, and infrastructural background (Weber Thompson, 2013). This method is used in this research to check how retirement institutions designed, what are the most common aspects, as well as do they follow any principles of universal design.

For both methods above, checklists were created to assist in identifying and collecting information on the current situation of retirement institutions and urban spaces. In total, 3 different checklists were formed: based on Universal Design principles, based on architectural aspects and checklist, which is based on urban spaces and their use.

In the first checklist, the goal was to compare chosen retirement institutions based on Universal Design principles by evaluating them in the scale of 0 to 4 (0 - no existing; 1 - bad condition; 2 - average; 3 - above average; 4 – good). By doing this, it was easier to understand which of retirement institutions has the best and the worst design, according to Universal Design, which one of them is more or less age-friendly. Of course, this type of evaluation will slightly vary from person to person.

The second checklist is based on the general architectural and age-friendly aspects of design. With this list, institutions were evaluated by aspects that were found in the previous stage of research (literature review). Lastly, a checklist that helped to define the use and condition of urban spaces in Kaunas neighborhoods. In this case, out of various urban spaces, the most common locations were chosen, such as parks, squares, and green spaces.

Sociological survey.

A research approach that gathers data from respondents in the form of a questionnaire or an interview through a series of questions. The questionnaire has 3 main types of questions: open, closed, and half-closed questions. In this case, the created questionnaire includes 20 questions related to seniors' preferences, needs, and current situation (Appendix 1). Around 30 representatives of the elderly population of Lithuania (mostly Kaunas and Vilnius) were participating in the sociological survey. Mainly these surveys have closed and half-closed questions, as it is easier for an older person to mark the answer rather than write down a few sentences for each of 20 questions. However, each closed questions have a place for them to add their answer if they would like to.

2.1.2 Objects of the research

For the case study, four different retirement institutions were chosen: daycare centers and mixed-use institutions and 3 parks. The main idea of choosing these particular objects was to get the most famous and visited places in Kaunas and Vilnius.

Kaunas Panemunė retirement home.

Figure 23. Kaunas Panemune retirement home.

The project of famous Kaunas architect Algimantas Kančas, was built in 1987 in a wonderful corner of Panemunė nature. The whole complex located quite far from residential areas and surrounded by beautiful forest. The architecture of this veterans' home is distinctive, conceptual, with all the hints of postmodernist, monumental, and romantic decoration at the same time (Alge Jankeviciene et al., 1991). The modernistic, red brick building has a really interesting rounded shape floor plan with a great view not only to an inner courtyard but also to the surrounding nature (Figure 23 & 24). The building was built and set up to live for people of retirement age who need constant care and nursing. February

Figure 24. Kaunas Panemunė retirement home, courtyard.

1994, the name of the veterans' home was changed to "The House of the Elders of the Order of Kaunas Malta", in May 1998 to Kaunas Panemunė Elders' House. In October 2000, Kaunas Panemunė Elderly House Social Daycare Center started its activities. It was the first institution of this kind in Lithuania for elderly people (Kauno panemunės socialinės globos namai, 2019). The building consists of 3 levels: first two levels functioning as a retirement home, where elderly who need constant help lives, and third floor fully functioning as daycare center (Figure 25 & Appendix 1).

Figure 25. Kaunas Panemune retirement home aerial view.

Figure 26. Kauno Kartu Namai (Kartu Namai,2018).

Kauno Kartu namai – Kaunas Generation home.

The Kaunas Generation House was founded in 1996 on the initiative of Lithuanian Caritas and subordinated to the Social Services Division of Kaunas City Municipality. Generations House - a mixed social services institution, close to seniors and mothers with children in difficult personal situations. The institution is innovative and unique due to the services provided (Figure 26).

The purpose of the Kaunas Generation House is to organize activities efficiently, to improve the quality of the services provided, to adapt to the changing needs of society and the standards set by the European Union. The building of Kartu namai has an H-shape form, which mostly used as a home for seniors as well as single mothers with kids (Appendix 2). On the ground floor, they have small space for daycare center which is visited not only by residents of Kartu Namai and for people who stay nearby. The Generation House has 18 rooms (4 of which are single, 14 doubles) and has 32 residents. It employs 2 social workers, 6 assistants to social workers, 2 nurses, and 2 assistants to nurses (Kartu Namai,2018).

Senjoru dienos centras Keturlapis Dobilas.

The daycare center located near the Kaunas railway station in a small shared one-story building. The center founded approximately in 2017-2018 and currently working 3 days a week for 3-4 hours. As one of the employees said during the interview: we do not want to force activities on the seniors. That is why they have classes, workshops, and other activates not on a daily basis. It is not a workplace, it is place for their leisure and free time. The facility can

Figure 27. Senjoru dienos centras Keturlapis Dobilas.

accommodate 15-20 seniors. As well as workshops and just general gathering, the administration is organizing trips to museums, other community centers & etc (Figure 27 & Appendix 3).

Senjorų dienos centras „Atgaiva“.

Located in the center of residential neighborhood of Vilnius. Atgavia is governmental organization which approximately founded in 1999. The daycare center aim is to organize and provide social services for the elderly and disabled people in order to reduce their social exclusion - to participate in the community actively, to strengthen inter-generational relationships and to create the conditions for realizing their abilities and interests (Figure 28 & Appendix 4).

Figure 28. Atgavia daycare center.

Services provided:

- information;
- consultancy;
- mediation;
- socio-cultural services (leisure services: various hobby groups, thematic meetings, parties, celebrations, guest concerts, exhibitions, excursions);
- the organization of personal hygiene and care (laundry organization - for the visitors of the day center and the recipients of assistance to the home of Šeškinė eldership).

Besides architectural objects, few urban spaces were chosen for analysis. Two parks are chosen due to the amount of the elderly who visit it daily, which are located near residential areas (Kalnieciu and Azuolyno parks). And one park which is playing a crucial role in Kaunas city life as the meeting point, place where city administration organizing a lot of events and festivals (Santakos park). These parks may be having different values to the city but it is quite popular places among elderly.

Kalniečių park.

This park is located in Eiguliai eldership, a southern suburb, P. Lukšio and S. Žukausko streets. The park covers an area of 21.1 hectares and was renovated in 2018. In the north-eastern part, the pond, fed by underground springs, new pathways were created new sports equipment, and playgrounds were placed (Kalniečių park, 2018) (Figure 29).

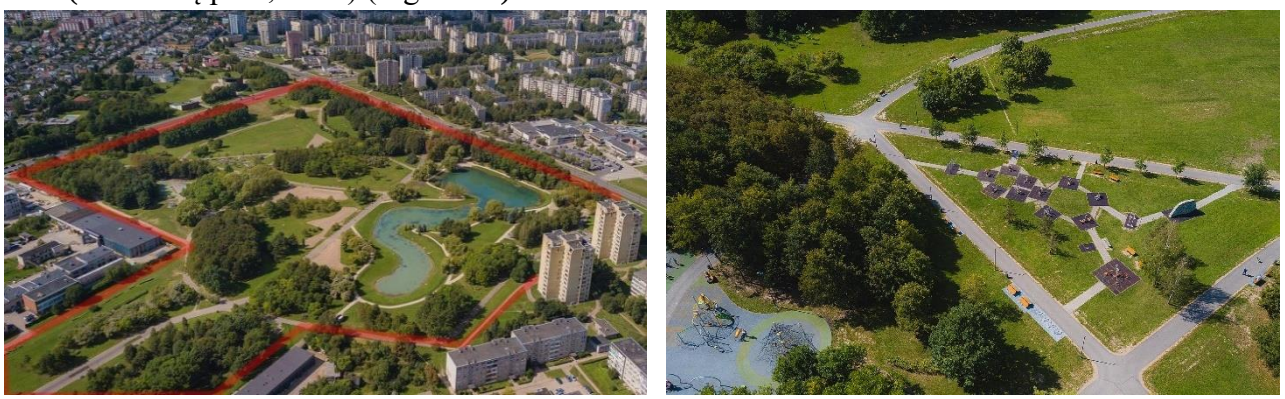


Figure 29. Kalnieciu park (Kauno parkai).

Azuolyno park.

Azuolyno park is the largest oak-tree park in the city, with an area of 84.42 hectares and the largest urban stand of mature oaks (100-320 years) in Europe. The green oasis next to the zoo is a popular recreational and sporting area for the Kaunas. You can meet the symbol of Kaunas city - the cup, stroll through the valley of the poet Adam Mickiewicz, admire the monument to commemorate the flight of legendary Lithuanian pilots Steponas Darius and Stasys Girenas (Azuolyno Parkas) (Figure 30).

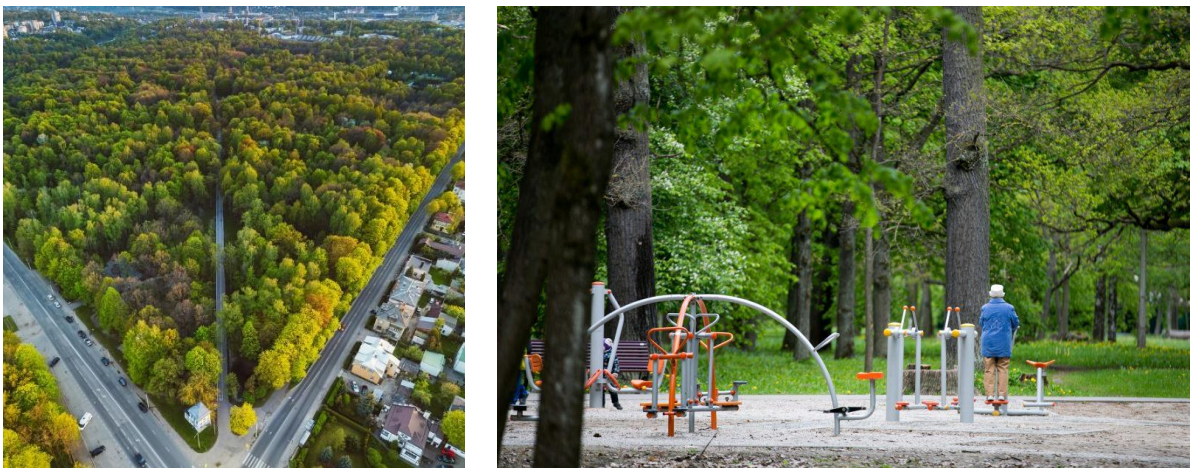


Figure 30. Azuolyno park (Kauno parkai).

Confluence / Santakos park.

The park is located right at the confluence of the Nemunas and the Neris rivers. The boundaries of Santaka Park were approved on 11th May 1993. It surrounded by unique historical objects - Kaunas Castle, St. Jurgis church and monastery buildings, as well as Kaunas Archdiocese Curia. Nearly 13 hectares of a green area which is visited by families with kids, young people as well as elderly of Kaunas. There are a few common areas such as playgrounds and sports equipment. Various public and military celebrations and historical events take place in this park (Santakos Parkas) (Figure 31).

Figure 31. Confluence / Santakos park (Kauno Aleja, 2018).

2.2 Results of empirical research of the application of universal design adapting living environments for aging population

2.2.1 Research on site results

The following part of this research project describing the findings and results of on-site experiments. By doing site visits, evaluation and analysis were executed for the existing conditions of four different

retirement institutions in Lithuania (mainly located in Kaunas and Vilnius). By using checklists which were created, it was easier to summarize the primary outcome of these on-site analyses.

First of all, the general architectural information about each of the objects was assembled together (Table 7): such as year of construction, address, the number of floors, etc. This table additionally shows the quality of infrastructure and green areas nearby, and are the features of these institutions are age-friendly. The red color in the checklist represents negative aspects, while black color showing general information or positive features in each institution.

After all the site visits and evaluation, it is fair to say that none of the objects has "perfect" age-friendly construction. Most commonly, if the building has more than one floor (the Panemunė retirement home and Kartu namai), it will have problems with the accessibility of natural lighting. The reason for that being the hallways been located in the middle of the building or either some rooms do not have any large openings. Besides, the same objects have confusing floor plans with narrow hallways. It is a well-known fact that artificial lightning may complicate the movement for seniors. As we age, not only our vision decreases but also memory, so when interior space as not brightly lighted up, it is sometimes difficult for an older person to remember the way from one point to another, especially if space is new for him/her.

One of the most crucial parts during the process of building a retirement institution is the accessibility by feet and by public transport, as not that many seniors able to walk further than 15-20 mins distance at once, besides not that many of them are still driving. Two out of four objects (Atgavia daycare center and Keturlapis Dobilas) have bus stations nearby (2-5 mins walking distance). It is quite helpful if the institution is located near residential areas or in the heart of it itself. This kind of placement can be seen in Atgavia and Kartu namai, which located in the center of residential areas of Kaunas and Vilnius. Due to that, the daycare centers have quite a high number of visitors among the elderly. However, even if the facility located not in the residential area but still has good accessibility by public transport, it can be a well-visited institution for the elderly, as an example can be Keturlapis Dobilas.

Aside from some of the negative aspects of those retirement institutions, there is something that can really benefit the elderly quality of life. As it was mention previously, the biggest problem for older people is the lack of shared space, all of the analyzed objects providing various common spaces for seniors. Small classrooms/ workshops areas for them to learn and develop new skills, from knitting to learning English, library, and multipurpose hall where often seniors create small concerts/ performances for family and friends (Figure 32, 33 & 34). In addition, these developments demonstrate age-friendliness in the materials choice. The flooring in each of the four institutions is non-slippery - linoleum flooring. As well as most of the age-friendly standard sizes were used in the constructions of these retirement institutions.

Table 7. Checklist based on architectural aspects of 4 different facilities for the elderly in Lithuania.

Name of institutions	**Kaunas Panemunė retirement homes**	**Kauno Kartu namai**	**Senjoru dienos centras Keturlapis Dobilas**	**Senjorų dienos centras „Atgaiva“**
Address	Kurtinių g. 1D, Kaunas	Sąjungos aikštė 13A, Kaunas; surrounded by residential buildings	M. K. Čiurlionio g. 18-2, Kaunas; next to Railway station.	Paberžės g. 6, Vilnius; surrounded by residential buildings
General architectural information	Post modernistic building, built in 1985 by A.Kancas	Founded in 1996	Founded approximetly in 2017	Founded approximetly in 1999
Number of floors	3	2 & 3	1	1
Uses of the institution	Retirement house + day care centre	Mixed social services institution (retirement house + home for single mothers + day care centre)	Day care center (with a lot of activities provided, such as trips, workshops, crafts, reading & etc.)	Day care center (activities provided: trips, english classes, workshops, crafts, reading, music classes & etc.)
Floor plan	Quite confusing with narrow hallways	H-shaped building with narrow hallways, quite easy to get around	Small building with sort of open plan, few rooms with big windows	Small building with really clear and understandable floor plan
Common spaces provided	Cafeteria, working rooms, performance hall, recreational room for patient with dementia, gym, library, chapel	Kitchen, working rooms, library, game room for kids, multipurpose hall (there are a lot of event happening every week)	Two common area rooms & kitchen/ lobby area	Kitchen; room for performances, seminars and classes; one small classroom
Infrastructure near by	There is not that many buses which reaching institution, the only way to get is by car (few buses but coming not that often).	10 min walk from bus stop to institution, buses pass every 5-10 mins	200 meters walk from bus stop, bus every few mins (a lot of different lines reaching this place)	Located in the middle of residential area, few bus stops near by, easy reachable from different parts of the city
Courtyards & green area nearby	Nice pine forest around institution but not being used at all, just as pretty view. The condition of the inner courtyard not that great, just few pathways, no benches for people to rest).	Inner courtyard in good condition, there are some playgrounds foor kids as well as arbor. Small park in 5 min walk from institution.	Locate near railway station, the nearest green area is across the road up on the hill, and park in 15 mins walk (name of the park?)	Small green ares as inner courtyards of residential buidlings, the nearest park is 20-30 min walk from center
Source of natural lighting	A lot of natural lighting in work areas and in day care centre. Lack of natural lighting - small windows in work spaces and hallways.	A lot of natural lighting- a lot of windows all around building, as well some curtain wall as internal partitions . Lack of natural lighting in stairway	A lot of natural light, one side of the building is full with windows which provide good lightining + good lightning on the ceiling	A lot of natural lighting in the rooms, hallways has no natural light and not so bright lamps
Elevators, ramps and grab bars	Have two elevators and few ramps, grab bars everywhere in hallway + outside in courtyard	Have grab bars in every hallway and stairway. Lack of ramps and no elevator.	No grab bars, the entrance has staircase with railing but no ramps.	The entrance has staircase and ramp with railings, no grab bars in the building, has small level change in the main entarnce
Materials	Not slippery flooring, colour scheme choice a bit hospital like (light yellow walls)	Not slippery flooring, bright colours in some rooms and hallway	Not slippery flooring, bright colours in rooms	Not slippery flooring, colour scheme choice a bit hospital like (light yellow walls)

Figure 33. Panemune retirement home's common areas, (top left) library, (top right) multipurpose hall, (bottom left) recreational room, (bottom right) hall for exercises.

Figure 32. (from left to right) Atgavia daycare centre, Keturlapis Dobilas daycare center.

Figure 34. Kartu namai, (from left to right) main room/multipurpose hall of daycare center, pantry, secondary classroom of a daycare center.

The second step of the on-site analysis was to evaluate those retirement institutions, according to Universal Design principles (Table 8). For better understanding, the scoring system of evaluation was implemented, each principle on a scale from 0 to 4, where 0 - no existing; 1 - bad condition; 2 - average; 3 -above average; 4 - good. The highest score by this scale equal to 24. Regrettably, none of the following institutions got the highest score. However, there is still one leader by this evaluation - Atgavia daycare center, in which the use of Universal Design principles was mostly average and above average. Two out of four institutions provide grab bars all around hallways and rooms, which is considered as one of the most essential aspects of Universal Design. But one retirement institution (Panemunė retirement home) went even a little bit more practical for every senior; they added grab bars on the pathways leading to the entrance of the building as well as in the courtyard (Figure 35).

Figure 35. Panemunė retirement home: grab bars in hallways and along the pathway.

Besides grab bars, it is pretty common for most of the objects to place ramps in the entrance, hallways, or even elevator if the building more than two-story height (Figure 36). One of the other helpful aspects, which is a part of Universal Design is wide doorways. Often seniors use walking sticks, sometimes even wheelchairs, so wide doorways or even open floor plans minimizing the stress level and making it easier to get from one space to another. All of the analyzed objects following this feature of Universal Design (Figure 37).

Figure 36. (from left to right) Atgavia daycare centre, Kartu namai & Panemunė retirement home.

The other thing is the changes in levels. In the previous part (literature review), it was noted that one of the features applies to almost every principle of Universal Design, and it is single grade entrance to the building and rooms. All four buildings, in a way, follow it and try to implement this feature into their design (Figure 38).

Figure 38. (from left to right) Atgavia daycare center, Kartu namai & Panemunė retirement home.

These on-site analysis work demonstrated that the simplest and the most understandable floor plans are in Atgavia and Keturlapis Dobilas daycare center. Simplicity in floor plans helps to minimize stress if the older person is visiting center for the first time. Besides all the useful features, all four objects barely using any features from the third & fourth principle of Universal Design – Simple & Intuitive use and Perceptible Information.

One of the other things which were interesting to check is urban spaces such as parks. So that left me with a third checklist of general information which consists of such information as an area of parks, common spaces provided, how often used by seniors, etc. (Table 9).

Most of them have standard features such as playgrounds where grandparents can spend time with their grandkids, gym equipment, and a fair amount of sitting areas (some more than others). One of the analyzed objects, Kalnieciu park, compared to others, has a variety of different common spaces: 3 different playgrounds, café near lake, gym with lots of good quality exercise machines, lots of benches, area for people to play chess and checkers and most important restrooms around the park (Figure 39).

Figure 39. Facilities provided in Kalnieciu park.

Table 8. Checklist based on universal design principles for 4 different retirement institutions in Lithuania.

Name of the institution	**Kaunas Panemunė retirement home**	**Score**	**Kauno Kartu namia**	**Score**	**Senjoru dienos centras Keturlapis Dobilas**	**Score**	**Senjorų dienos centras „Atgaiva“**	**Score**
Address	Kurtinių g. 1D, Kaunas		Sąjungos aikštė 13A, Kaunas		M. K. Čiurlionio g. 18-2, Kaunas		Paberžės g. 6, Vilnius	
Principle 1 - Equitable Use	Single grade main entrance useable for all users, reception desk , single grade entrance to rooms	2	Single grade entrance useable for all users	2	Reception area, single grade entrance to rooms	1	Single grade entrance to rooms	1
Principle 2 - Flexibility in Use	Age friendly measurements, ramps for wheelchair users	2	Few ramps next to entrance	1	Age friendly measurements	1	Age friendly measurements, ramps for wheelchair users	3
Principle 3 - Simple and Intuitive Use	-	0	-	0	Simple design of the interior, easy readable floor plan	3	Simple design of the interior, easy readable floor plan	3
Principle 4 - Perceptible Information	Semi-clear signages	1	-	0	Semi-clear signages	1	Semi-clear signages	2
Principle 5 - Tolerance for Error	Semi-clear signages, no difference in levels (small steps), nursery on each floor	2	Nursery and assistants always near by, no differences in levels	2	No difference in levels, one big space divided with partition walls	2	No difference in levels, nursery, semi-clear signages	2
Principle 6 - Low Physical Effort	Elevator, wide doorway, multiple grab bars in building and on the territory	3	Semi wide doorway, grab bars all around hallways	3	Wide doorways, distance to one seating area to another is really small	4	Wide doorways	2
Principle 7 - Size and Space	Age friendly measurements (bathrooms), grab bars in hallways	3	Grab bars in hallways	4	Wide hallways, age friendly measurements	2	Wide hallways, age friendly measurements, bathrooms with grab bars	3
Total		**13**		**12**		**14**		**16**

0 - no existing; 1 - bad condition; 2 - average; 3 -above average; 4 - good. The highest score by this scale equal to 24.

Table 9. Checklist for urban spaces (parks).

Name of urban space	**Park Azuolynas**	**Kalniečių Park**	**Confluence Park**
Address	Radvilėnų pl. 15, Kaunas	P. Lukšio g., Kaunas	Rotušės a., Kaunas
Area	**84.42 hectares**	**21.1 hectares**	**13 hectares**
Infrastructure near by	Few bus stops from different sides of the park	Several bus stops all around park	5-7 mins walk from nearest bus stop
Residential areas near by	Located quite near to residential area of Zalaikinas	Located quite near to residential area of Kalnieciai	Located in the heart of Old Town, not that many residential buildings around
Common spaces & equipment provided	Playground for kids; stadium; fair amount of benches, but located quite far from each other	Few playgrounds for kids, a lot of benches, tables for chess, 3 restrooms located around park, café next to the lack	Playground for kids; a lot of benches
Sport equipment for elderly	Outdoor gym provided with 10 exercise machines; lack of instructions	Outdoor gym providing 11 exercise machines; lack of instructions	Outdoor gym provided with 5-7 exercise machines; lack of instructions
How often used by seniors	Not that many seniors using sport equipments, 2-4 seniors (not everyday)	Daily in the morning sport equpments mostly been used by 8-10 seniors, evenings more young adults using it.	Daily in the morning sport equpments mostly been used by 3-5 seniors, evenings more young adults using it.
Outdoor lighting system	Not so bright light polls located in at minimum 5 meters from each other	Quite bright light polls located in at minimum 5-8 meters from each other	Quite bright light polls located in at minimum 8-10 meters from each other; from time to time additional source from light installations (fairy lights during festive seasons)

2.2.2 Sociological survey results

In total 33 participants conducted a questionnaire that helped to understand their thoughts, needs, and wishes regarding daycare centers, 28 females and 5 males of age 60 and above.

From all the participants, 21 was in the age from 70 to 80; 8 of seniors were from 60 to 70, and only 4 were 80 and above. Almost half of the participants (49%) are still married and living with their families, while 21% of the elderly are single, and 30% are widowed.

As we all know that with age, our physical abilities and health are decreasing, it was not a surprise for me to find out that around 41% of participants have decreased vision, 24% decreased hearing, and the

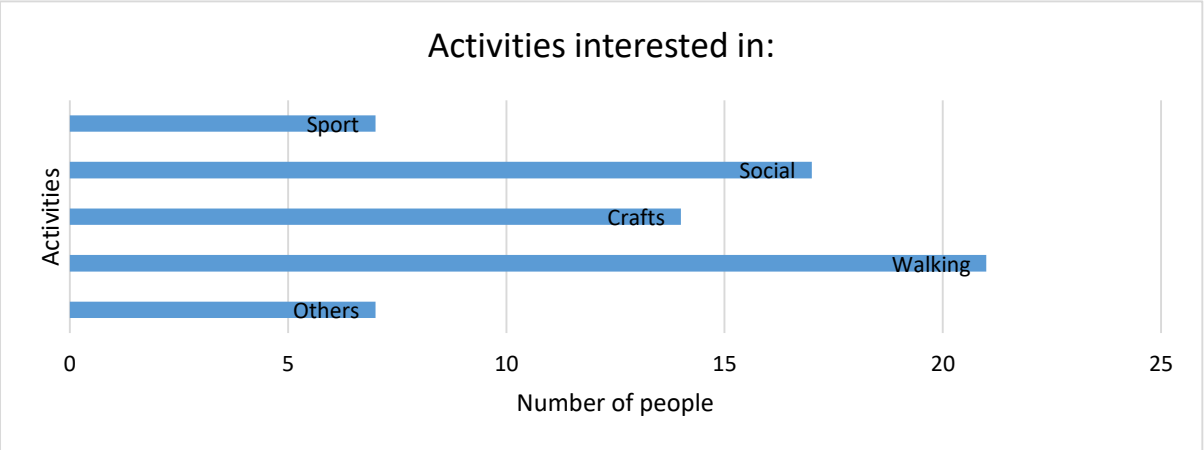


Figure 40. Result of question #6 in the sociological survey.

same amount has a bad memory. The rest 11% of elderly people have different health issues, such as injures, which decreasing their movement abilities.

By asking seniors what type of activities they are more interested in, the majority answered walking and socializing, in third place was crafts with 14 respondents, and only 7 people answered sport and others (reading, traveling, and music) (Figure 40).

As it was discussed before, public transportation for the aging population plays a crucial role in their life. By asking people how often they are using public transportation, it was identified that 50% of seniors using it daily, 30% using few times a week, 15% of seniors using it rarely or few times a month, and only 6% not using public transport at all.

Most of the time, retirement institutions interior contains sad, depressing, and hospital like colors, which often influence seniors' mood. During the sociological survey, there was a question asking which colors elderly people prefer to see in a daycare center, and as we can see from Figure 41 majority of people voted for pastel and green tones.

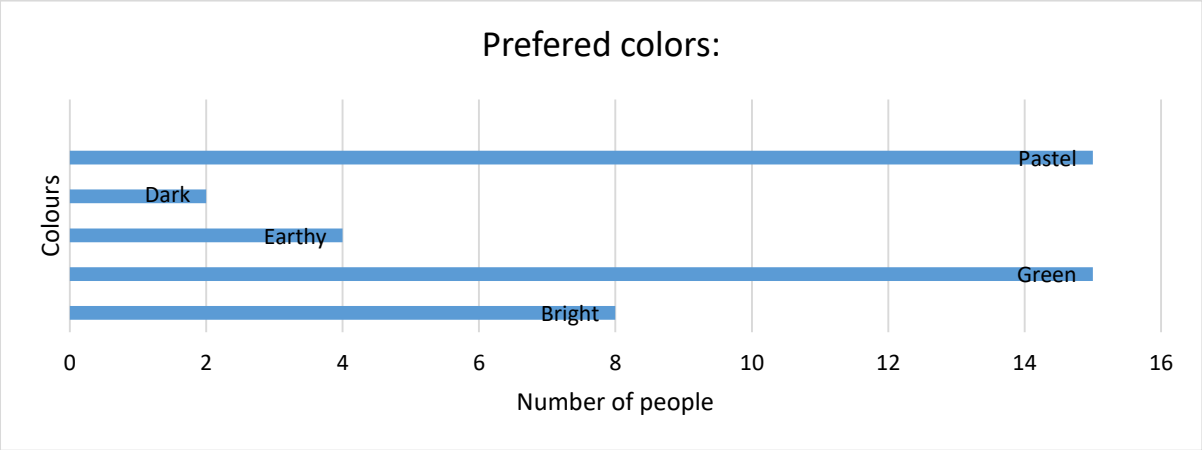


Figure 41. Result of question #9 in the sociological survey.

As it was mention several times previously, enclosed spaces accommodating seniors need to have a good source of lighting to make it easier for them to see. The majority of participants mention that natural lighting is the most preferable for their day to day activates, to be more specific 95% of seniors.

Stereotypically, it assumed that elderly people need a lot of additional help in their day to day activities. However, this survey shows that majority (68%) of seniors are quite independent and maybe the fact that they are going to daycare centers helps them in that. One of the universal design principles specifically saying that for the disabled or older people signages will provide necessary information effectively and help to reduce unnecessary complications. Another thing that stands out from the on-site analysis: every retirement institution using semi-clear signage. The lack of signage might be because the elderly does not need them much. However, it turned out that the majority of respondents pay attention to signage and consider them helpful (Figure 42). A lot of

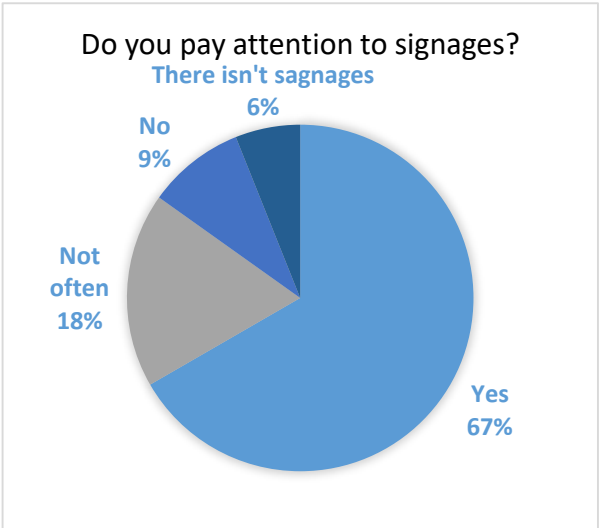


Figure 42. Result of question #13 in the sociological survey.

seniors, as we find out in the previous part of the research project, have health issues which make them visit medical facilities often than others: 26 participants out of 33, on the second place is daycare center with 22 seniors out of 33, parks were chosen only by 9 seniors, while cultural centers and work studios directly after that with 8 people for both (Figure 43). As most of participants were already attending daycare centers only 35% of seniors answered that they will attend daycare center twice a week if it was near their house. The maximum distance elderly would like to have daycare center is 10-15 min walk from their house (65% of respondents).

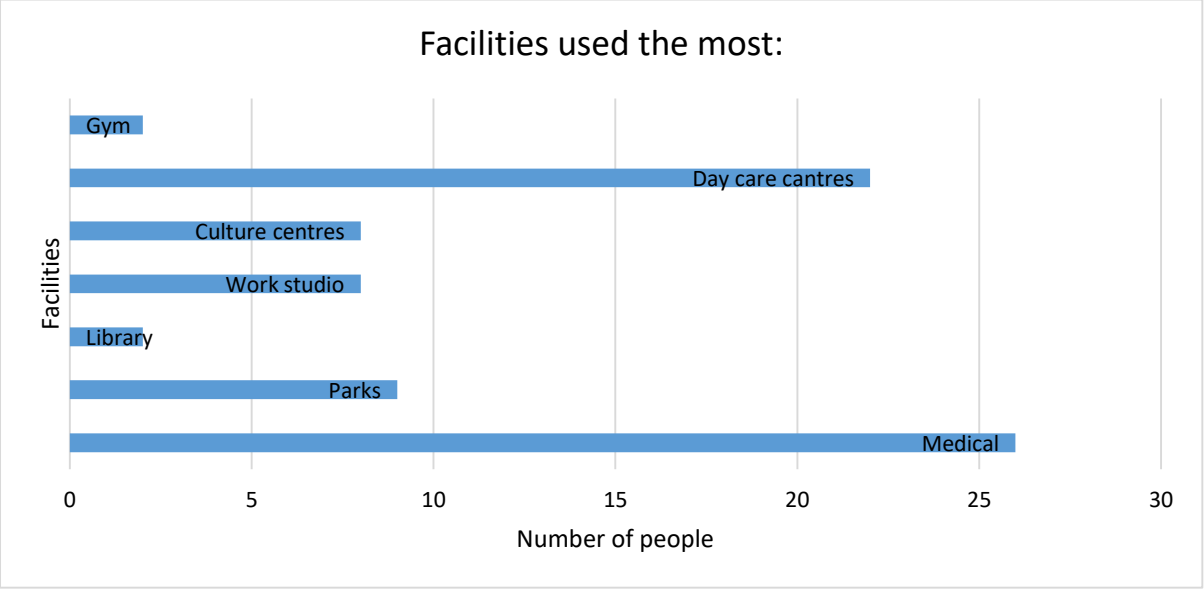


Figure 43. Result of question #15 in the sociological survey

This survey consisted of two open questions, which were asking about struggles that seniors face in day to day activates and what makes them happy (questions #12 and #14). Unfortunately, for a lot of participants, it was hard to write their opinion on that, due to low eye sight. Those who answered were saying that communication with family and friends, good health, traveling, being with grandkids make them happy. Besides, a few participants answer that with good public transport, they feel more independent, which makes them happy. Regarding struggles, few of the respondents answered that household (cooking food, buying groceries, and even cleaning) is quite difficult for them in old age. For others, their children and grandchildren usually help in day to day activities at home, so they do not have any difficulties in daily activities. This sociological survey helped, most importantly, to

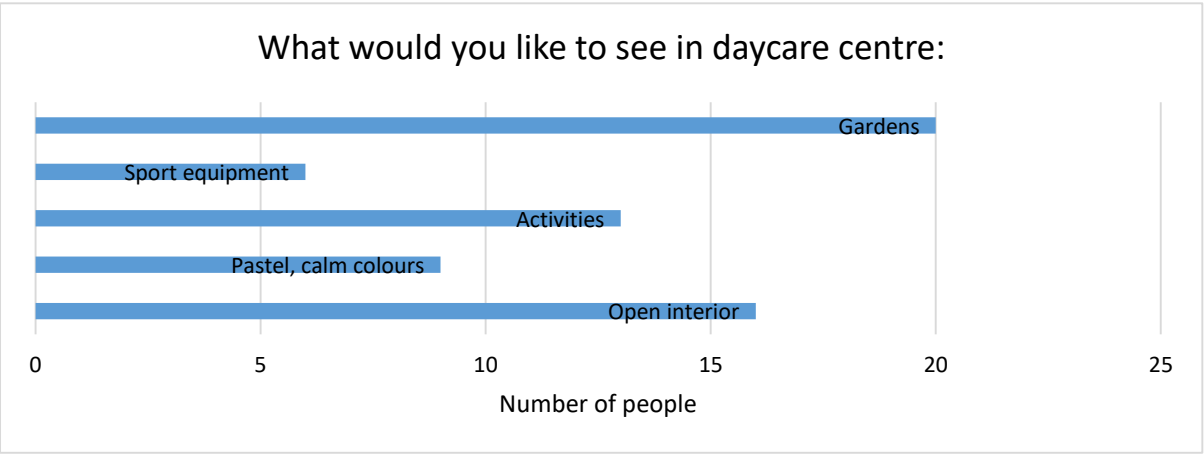


Figure 44. Result of question #19 in the sociological survey.

understand the needs of the aging population in Lithuania. As it is shown in the chart above (Figure 44), 60% of seniors would like to see gardens and recreation spaces in their daycare centers, 45% would like to have an open floor plan of the institution. Despite the fact that currently, all the daycare centers that were analyzed already providing different craft workshops, classes, and activities 50% of the elderly would like to see more activities. Unfortunately, sports equipment was not the most popular answer among seniors. The overall response to this question was surprisingly low, with only 6 participants feel the need of them.

Regarding equipment that elderly need in daycare institutions, seniors' opinions vary (Figure 45). As for answers to this question, not only age-friendly features were added but also aspects of universal & inclusive design. Even though most of the institutions already have non-slippery floor finishing (linoleum flooring) majority of seniors would like to see maybe different, but of course, non-slippery flooring (60%), 15 participants out of 33 would like to have a building that is easy to navigate around, and almost the same amount of people need wide hallways. Wheelchair friendly spaces, wide doorways, and clear signage in the building were chosen by approximately the same amount of people 18% to 27% of seniors. Surprisingly automatic doors which can provide easy access to the building was not the most popular answer, only 4 seniors chose it.

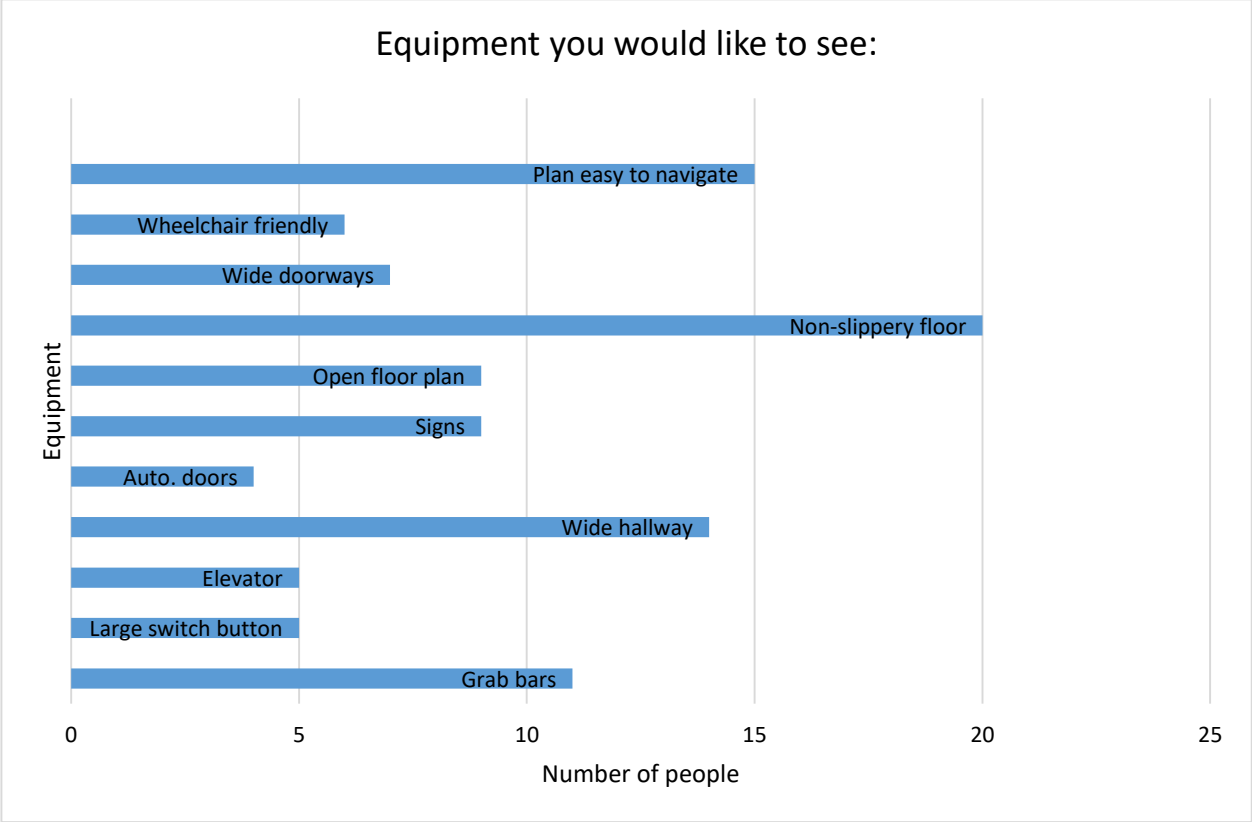


Figure 45. Result of question #20 in sociological survey.

2.3 Conceptual model of the application of universal design adapting living environments for aging population

As a result of this chapter's empirical research, the hypothetical model (Figure 22) was modified to a more detailed concept model (Figure 46) with proven aspects and solutions. The concept model created with the same logic as the hypothetical: solutions are playing the role of connections between universal design principles and aspects of the elderly's environment.

The main data which helped to prove and correct some of the previous hypothesizes was a sociological survey. From survey results, we can see that elderly would like to have more activities in their daycare center. That means more interior spaces needs to be provided, such as a few classrooms, music studio, multipurpose hall, and some other workshop areas. Second of all, to provide a desired amount of lighting (see above results of the survey: preferable a lot of natural light), big windows, as well as bright artificial lighting (due to shorter daylight periods during winter season) need to be provided.

Most of the seniors find it is more comfortable to have an age-friendly institution near their house. As a result, to solve this, the future development needs to be close to residential areas as well as excellent infrastructure nearby to make it more reachable and accessible for people who live further.

Although current retirement institutions have non-slippery flooring (linoleum), seniors still would prefer to have maybe a different type of non-slippery surface. That can be carpet, cork, rubber or vinyl. As for the color palette, it will be more suitable to use pastel or green tones in the interior, as after the survey, it was clear that these colors make seniors happier.

What else can provide happiness to the elderly? Communication is one of the main aspects which the elderly considers as a part of a happier lifestyle. That means that the future facility needs to provide a common living area where the elderly can gather. Besides, the outdoor area should provide specific places such as courtyards and recreational green spaces where seniors can relax and chat with their friends, to provide better communication.

Certainly, site visits helped to find common mistakes in used aspects of universal design in already existing facilities for the aging population of Lithuania. These results, in combination with the sociological survey, helped to create a graphical depiction of developed hypothetical solutions for the existing situation of the environment for the elderly. This concept model aims to help and be a set of clear guidelines for the further experimental design stage.

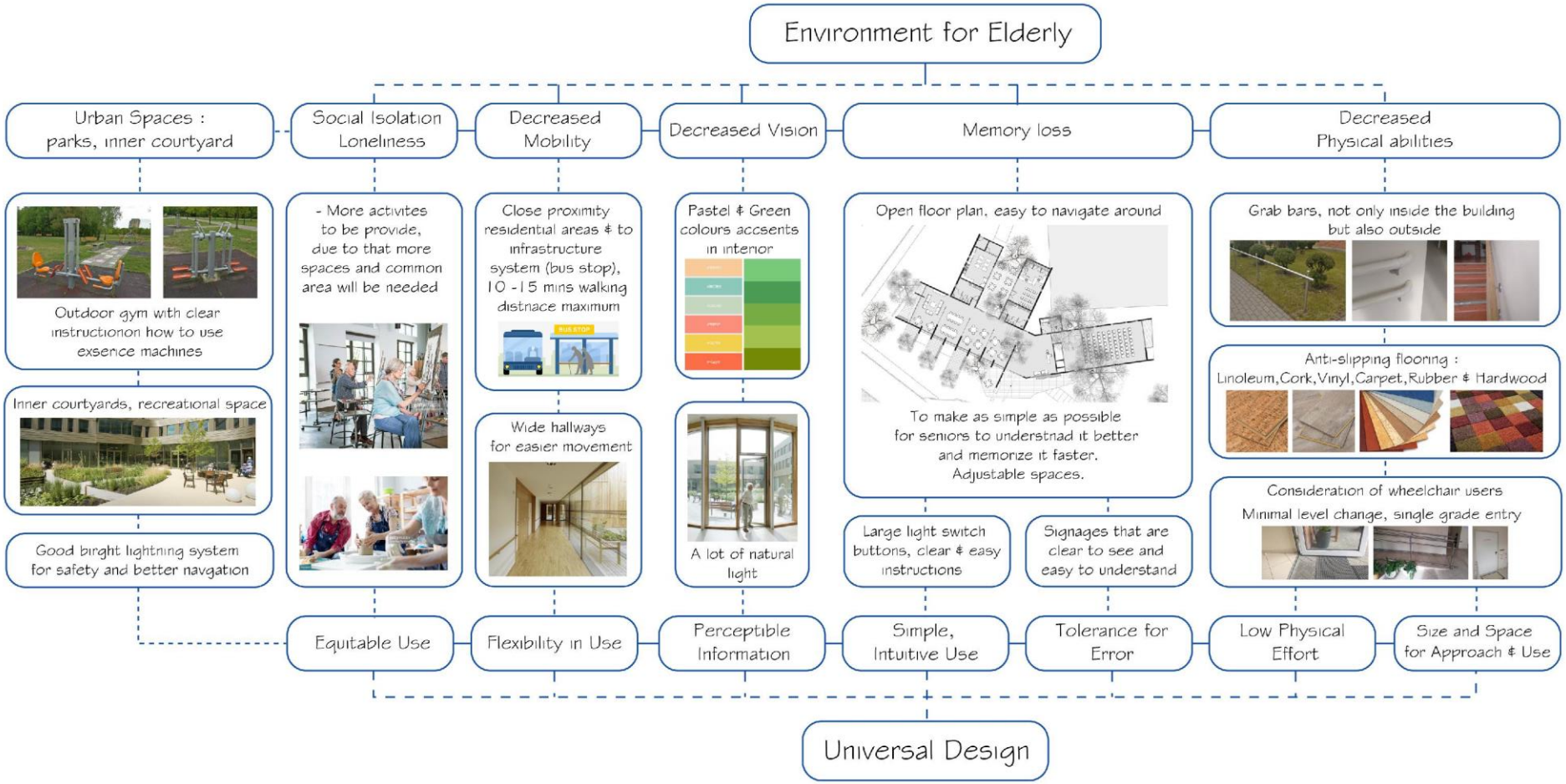


Figure 46. Concept model.

3. Experimental design of a daycare center located in Kaunas city

3.1 Site selection

Site selection is an essential aspect of architecture. The purpose of choosing a site is to find out how successful and advantageous the site will be after it turned to something and how it correlates to its environment. Having said that, any architecture, whether it is a school, hospital, shopping mall, or even a place of residence, needs a proper place where it can fit in, blend in or stand out in relation to the environment. A good site selection justifies the architecture and plays an important role in ensuring the success of architecture and usability.

General information of the selected residential areas of Kaunas.

The search for the plot expanded on several residential areas of Kaunas, such as Dainava, Zaliakalnis, Eiguliu, and Silainiu (Figure 47). All these territories have similarities as being the largest residential areas of Kaunas city by population and areas, with multi-story residential buildings dated to the Soviet Union period. additionally, these areas required facilities for seniors, as there are few of them in the city but not all of them quite easily reachable.

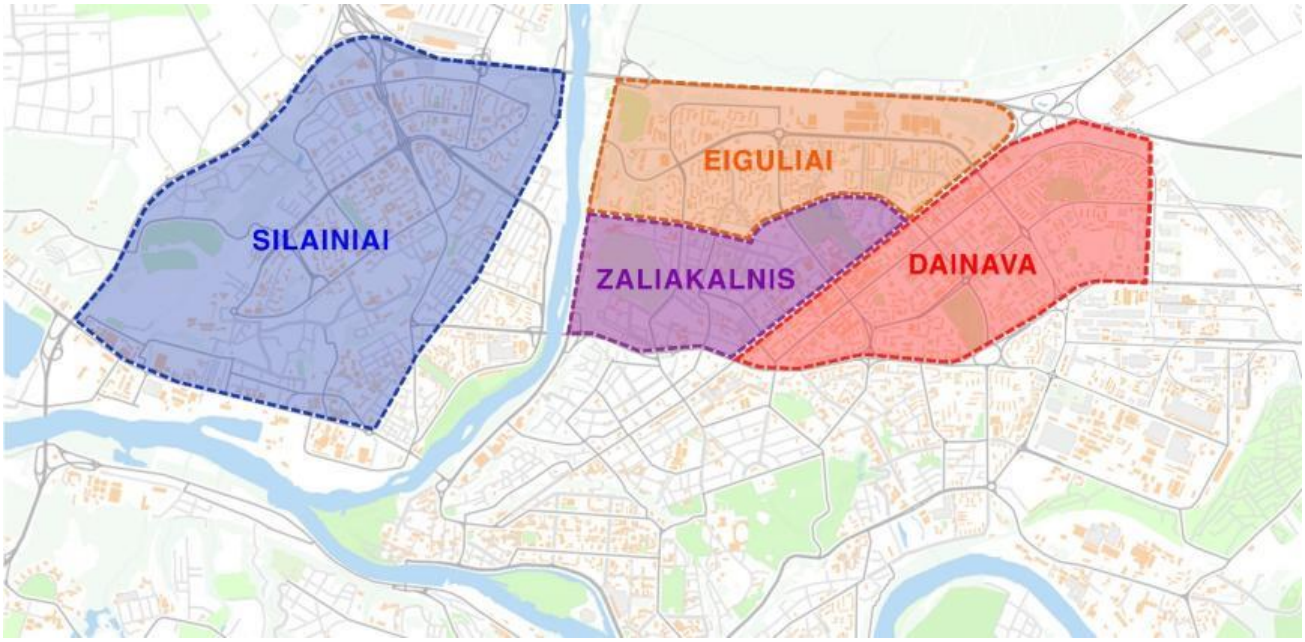


Figure 47. Kaunas city. Map of selected districts

Dainava district.

Dainava is one of the largest districts of Kaunas city, which is located in the northeastern part of the city, in the west it is leaning on Savanoriu Avenue, in the north - the highway Vilnius-Klaipeda. The construction of the area took several stages, extending into the 1970s, and some residential high-rise buildings were built after 1980. “At that time, it was planned that about 25 thousand people would live in all Dainava district neighborhoods” - says architectural architect Vaidas Petrulis. Typical 5-16 story dwellings and public buildings were built in the area. The area of Dainava eldership is 5.28 sqkm, and it has about 64,000 inhabitants. According to the area occupied by the eldership, residential neighborhoods dominate, with the majority of multi-story residential buildings occupying, 1.95 sqkm of eldership area (Laura Juozokaitė,2011).

Zaliakalnis district.

Zaliakalnis is a quite sizeable residential district with a population of 38,480 in 2006, which situated in the north of the old town and the city center area, between the Neris and Girstupis valleys. The territory of Zaliakalnis eldership is 7.35 sqkm makes up 4.7% of Kaunas city territory. Zaliakalnis functional structure is various. There is a multifunctional part near main streets (Savanoriu and others), with its offices, shops, and other developments. As well there is another part which is mono-functional: a large part is built low-rise residential buildings, and a small part is military and industrial areas. This district is home to several landmarks of Kaunas city, such as Resurrection church, funicular, museums, and picturesque parks. For the site selection, the focus fell on a small part of this district, which is located in the northern part and mostly consists of multi-story residential buildings. This area is also known as the inner micro-district (neighborhood) Kalnieciu (Zaliakalnis eldership, 2015).

Eiguliai district.

The settlement was a small town until it became a part of Kaunas in 1959, and a residential microdistrict was built in 1979. The area of Eiguliai eldership is 14.5 square kilometers.
It is located on the left bank of the Neris River and part of Kalniečiai neighborhoods. The territory of Eiguliai eldership is rich in green areas and greenery. There are no production companies, and the area is calm and unpolluted, it is good to live and rest there. On the southern edge of the eldership is Kalniecių Park and Kleboniski forest park, the northern part of the district. It has a population of 40,453, representing 13.82 percent of the population of the municipality of Kaunas (Eiguliai eldership,2018).

Silainiai district.

Covering an area of 25.33 sqkm with 50,598 inhabitants. It is located north of Vilijampolė and left bank of Neris River. There are 3033 residential houses in the eldership: 422 apartment buildings and 2061 private homes. Only part of the Silainiai district, which called Milikoniai and Smeliai, was chosen for the site selection study. The reason for this was the fact that in these areas prevail high rise residential buildings and contain the larger population compare to the other parts of this district.

Zoning and existing situation of selected residential areas of Kaunas.

Population.

After selecting these districts, zoning analysis and collecting general information on the existing situation were performed. First of all, during this research was found out that Dainava has the most substantial amount of residents of retirement age - 17,245. On second place is Eiguliai, with 10,849 people of retirement age. Zaliakalnis and Silainiai district has the least amount of seniors, 6,454 and 5,914, respectively (Kauno miesto bendrasis planas, 2011).

Public transport.

From the results of the sociological survey, we found out that public transportation for the aging population plays a crucial role in their life. They use busses and trams on a daily basis. After making a site analysis, it is clear to say that public transport infrastructure is quite well developed in Kaunas, at least for these 4 districts (Figure 48). From the map below, you can see that all districts are well connected. Black lines represent lanes for buses, and brown dots show us bus stops which used not

only for busses but for trolleybuses as well. Nevertheless, the diagram below shows clearly that the Dainava neighborhood has more points of reachability from different parts of the city, as well as good connections within the district itself.

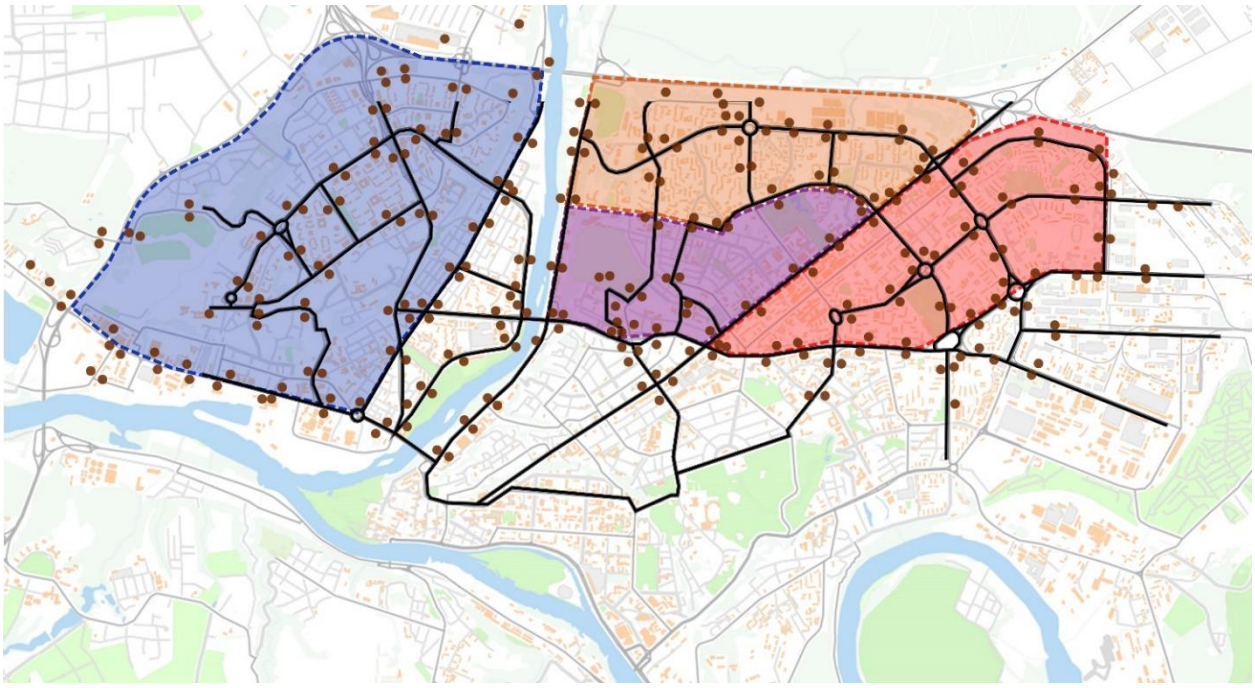


Figure 48. Public transport map (Kauno miesto bendrasis planas).

Public spaces.

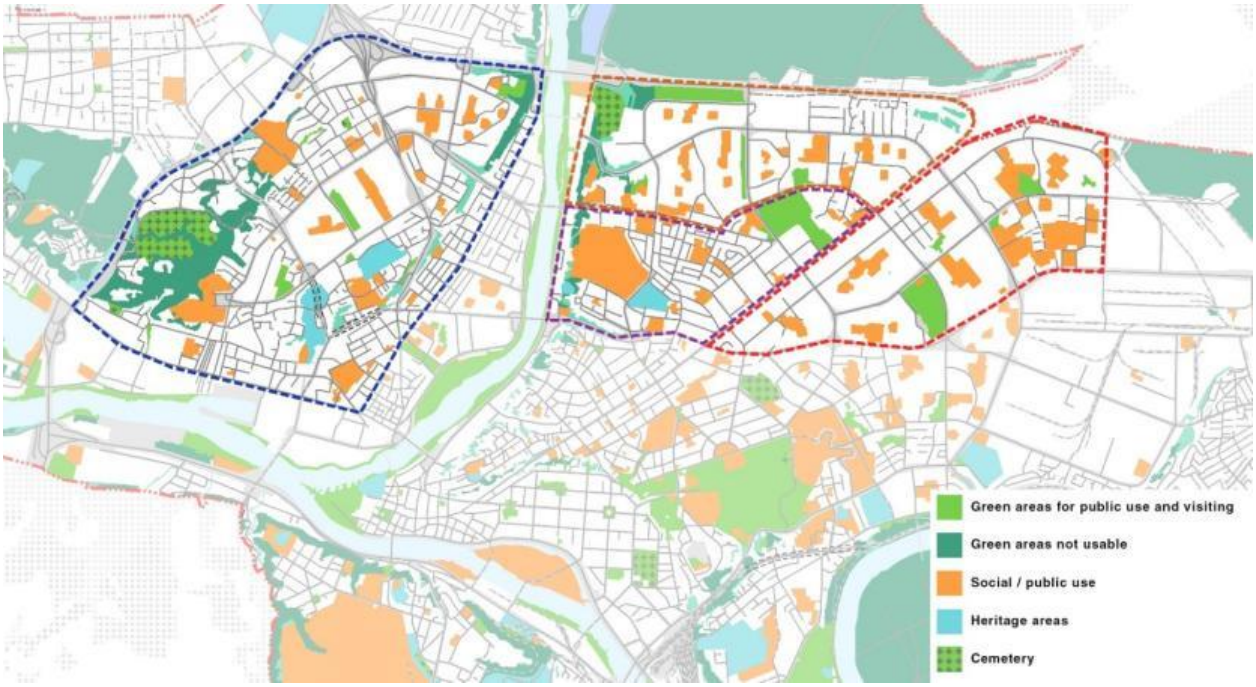


Figure 49. Green areas and public spaces (Kauno miesto bendrasis planas).

The map above (Figure 49) demonstrates that every district has a lot of social/public used areas (such as hospitals, schools, stadiums, etc.), and most of them distributed evenly among the area of all neighborhoods. Unfortunately, it is not the same thing for green areas which can be used for the public (parks, gardens, alleys and etc.). Dainava, Zaliakalnis, and Eiguliai have large parks such as Kalnieciu

and Friendship park, which accessible for public and been renovated not that long ago. As well there is huge woodland right near the northern part of Eiguliai district, Kleboniski park.

Recreational and wellness facilities.

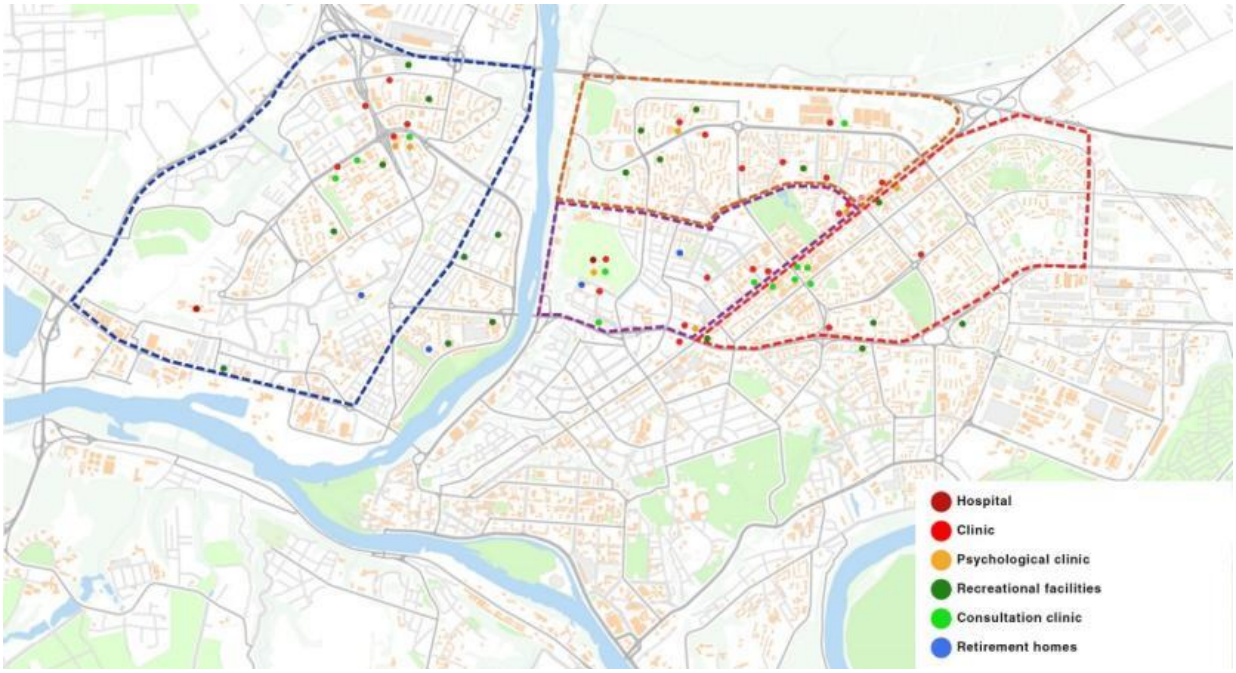


Figure 50. Distribution of recreational and wellness facilities (Kauno miesto bendrasis planas, 2011).

There are not that many retirement homes located in selected districts, and not many of them provide an option as a daycare for seniors, as it shows on the map above (Figure 50). On the other hand, recreational facilities distributed quite well, all around the selected districts. The natural environment is one of the most significant influences in shaping the distribution of leisure facilities. We can see that the most significant amount of recreational institutions located in Eiguliai, which equals to 5. There are 4 different recreational spaces in Dainava as well as in Silainiai, and unfortunately none in Zaliakalnis. The distribution and density of these institutions indicate the expansion of recreational

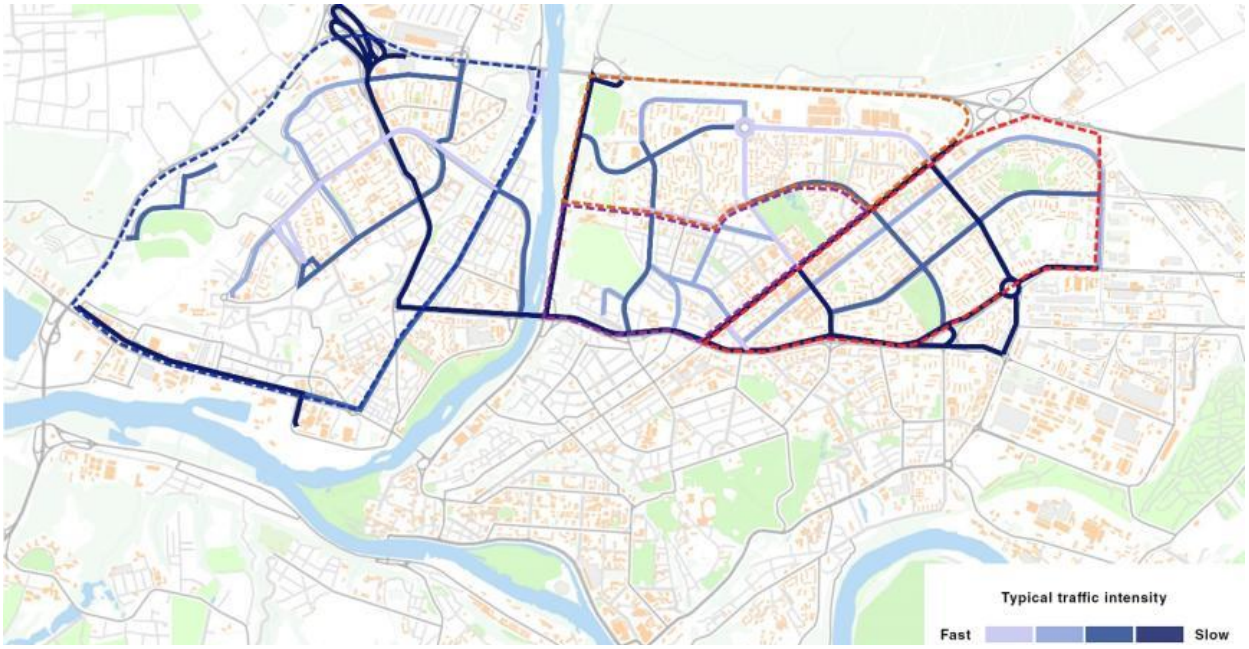


Figure 51. Traffic intensity diagram (Kauno miesto bendrasis planas).

services in the relevant urban areas, their need, and the direction of formation of the recreational environment of the territory (Kauno miesto bendrasis planas, 2011). In this context, analyzing the development of recreational facilities, it can be found that the areas located close proximity to the natural urban spaces (parks, forest, and greenery).
As for hospitals and clinics, they are located almost evenly in every single district, although many seniors have own family doctors which they attend.

Traffic intensity.
In the diagram above (Figure 51), traffic intensity distributed around those 4 districts shown. This data is the average date that was collected from several sources. The slowest traffic as expected is in the main streets of each district: Savanoriu, Taikos, Raudondvario, Zemaiciu, and Jonavos. While traffic within Zaliakalnis and Eiguliai district itself is pretty low, compared to traffic in Dainava and Silainiai, which is slightly higher.

Criteria of site selection and possible sites for future development.

After all analysis work of the existing situation in all 4 districts, it was valuable to propose suitable areas for future developments; in the case of this research project, it is a daycare center for seniors (Figure 52). Based on all of the collected information from sociological survey, literature review, and analysis of districts, 3 main categories of site selection were finalized:

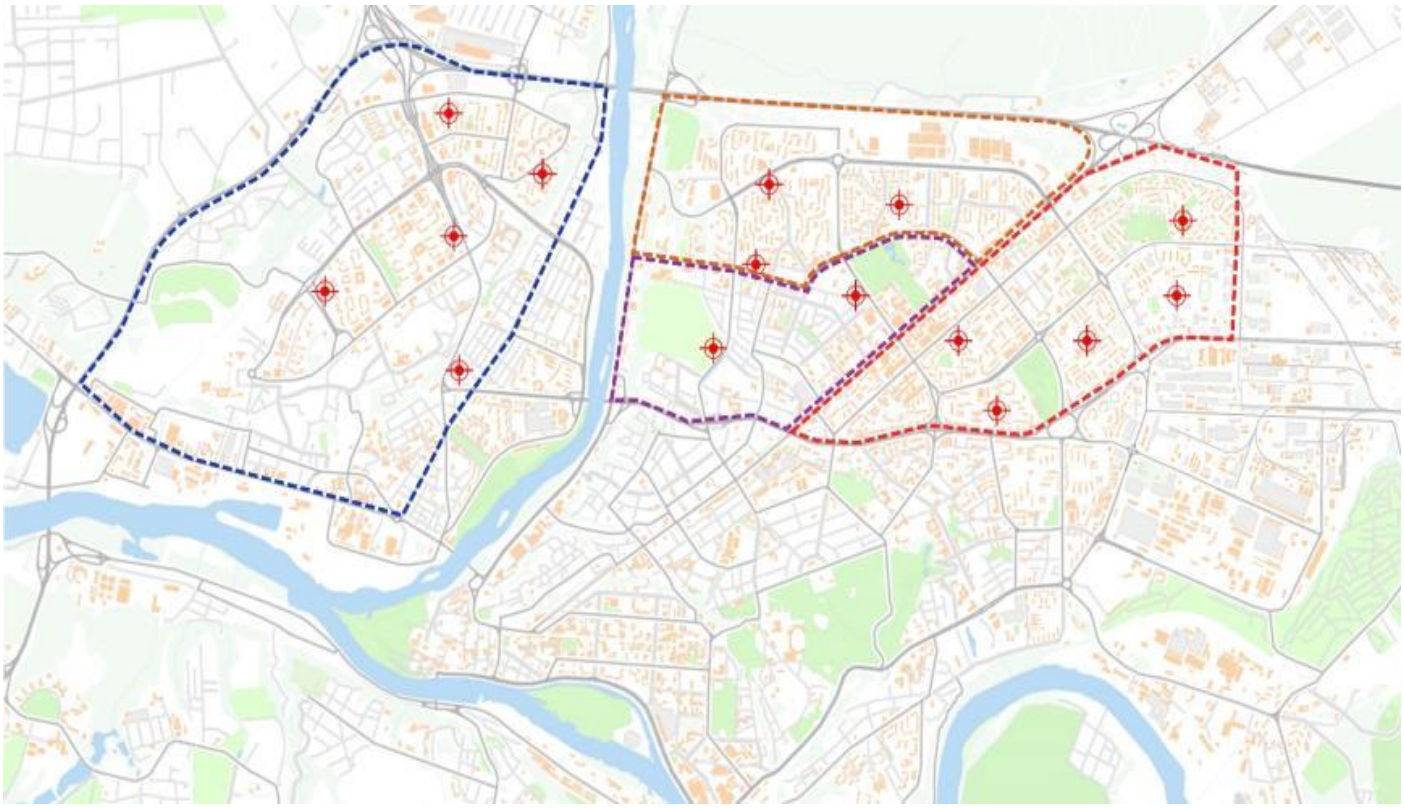


Figure 52. Plots option for future developments.

- Accessibility via public transport. Bus stops have to be located within 10-15 minutes of walking distance.
- Future development needs to be located in residential areas with medium to the high density of retirement population or 10-15 minutes of walking distance.

- Green spaces, in the plot or 5-10 minutes of walking distance.

Some of those plots might not follow all of the established criteria. However, it can be sufficient enough for the location of a daycare center. All the selected plots have good accessibility for seniors in adjacent residential houses, as well as from further neighborhoods due to locations of bus stops (10-15 minutes walking distance). Unfortunately, not all of them have a connection to picturesque green areas with some sports equipment as well as recreational facilities. Currently, some of the chosen plots are empty and not used (mostly just as unofficial pedestrian paths) besides some of the plots, at the moment, occupied as kindergarten. The reason for choosing such sites was that they could be transformed as a multi-generational facility which will benefit seniors in many aspects. Although, if the demographic situation in Lithuania will be constrictive, meaning there will be a lower percentage of younger people (Yolanda Williams, 2017), these chosen sites can be fully reused for the new structure of a daycare center. Both of these cases will be explained in more detail further in this research project.

3.2 Site analysis of selected plots

Site analysis is a preliminary stage in architectural and urban design processes responsible for the study of a given site's environment, geographic, historical, legal, and infrastructural context (G.Z. Brown, 1985). For further and more detailed analysis, two plots in Dainava area were chosen (Figure 53). Both of the sites located in the center of this district and surrounded by mostly high rise residential buildings. This neighborhood, due to done analysis and comparison, has an excellent potential for being a successful area for new development such as daycare center.

These two sites are well located and easily reachable by bus as well as by foot (Figure 54). The walking distance does not exceed 10 min, which is really important for seniors and their physical abilities.

Figure 53. Site location. Dianava district.

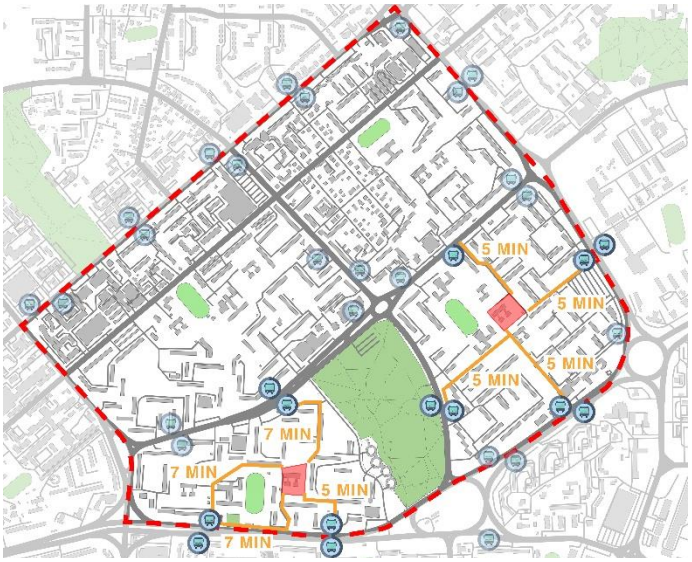


Figure 54. Distance from bus stops to plots by foot.

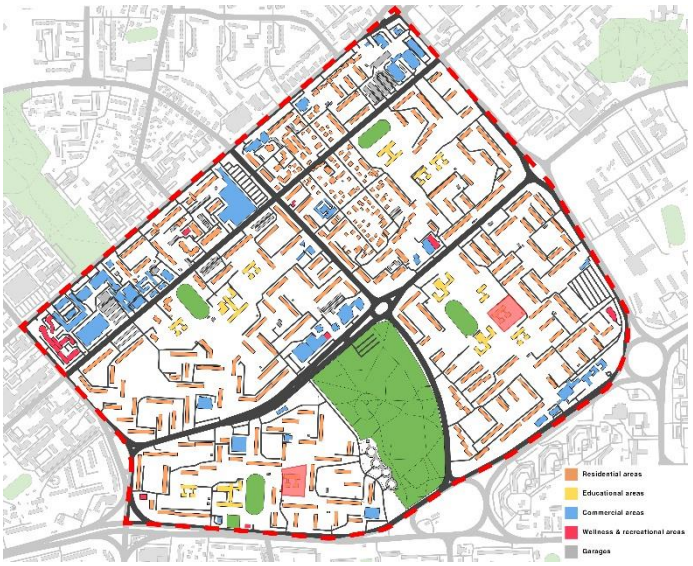


Figure 55. Building types around plots.

Besides, both of these plots surrounded by many bus stops, which make it easily reachable for the elderly form different neighbourhoods.
Secondly, we can see that most of the surrounding buildings for two plots are Soviet high rise residential buildings (Figure 55). As well there are a lot of commercial areas such as grocery stores, restaurants, and shops.
As we already know from the sociological survey, the maximum preferable walking distance for the elderly is 10 to 15 min walk. From Figure 56, we can see that there are a lot of residential buildings in that radius, which will make daycare easily accessible for seniors who residence in that area.
Last but not least is green areas (Figure 57). Both sites have access to a recently renovated park (Friendship park), 7-10 min walking distance. In addition, there are a lot of different types of activities provided, such as an outdoor gym area, sports area and lots of places for resting.

Figure 56. Maximum walking distance radius.

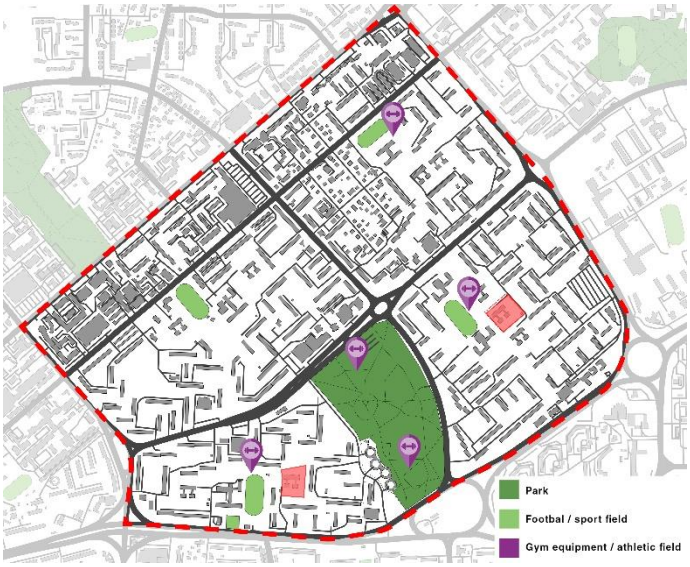


Figure 57. Green and sport areas.

Historical background and site formation.

Site A.
Located in the middle of the Dainava district, Taikos pr. 57. The site surrounded by Soviet residential buildings from north, south, and east sides and the school & sports field from the west side. The area of the plot is 8910 sqm and used to be a kindergarten from approximately 1970 till 2018 (Appendix 6). Kindergarten was built by a typical plan, which located all around Dainava and some other residential districts of Kaunas. Currently, the site is empty and abounded.

Site B.
Located at V. Krėvės pr. 56 the plot surrounded mostly by educational facilities, while the northeast side of the site is facing residential buildings. The plot area is approximately 10000 sqm. At the moment, Site B is occupied by pre-school / kindergarten "Sun"("Saulutė") with the same typical planning as demolished building on the site A. Opened in 1972, this kindergarten is still functional and able to accommodate 210 kids from 2 to 7 years old.

Physical and zoning analysis of the site

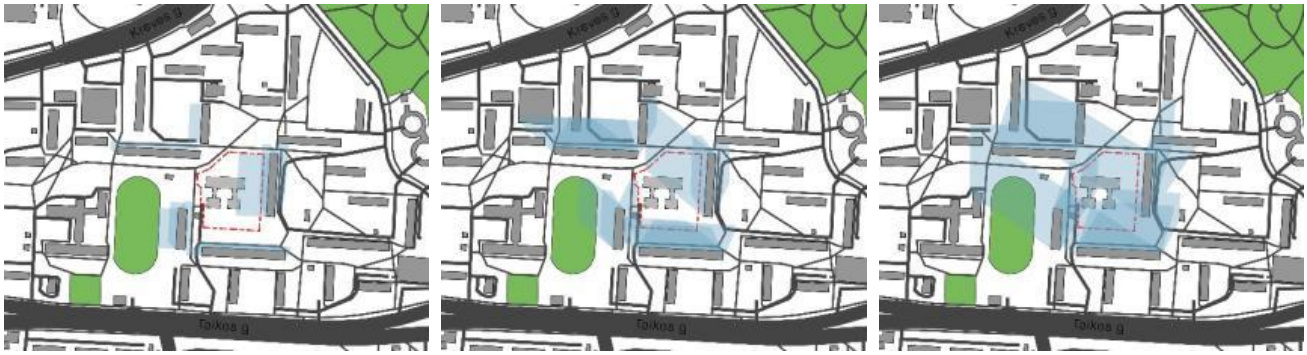
Site A.

Figure 58. Site A.

Currently, site A has a large pit from demolished kindergarten (Figure 58), which was approximately demolished around summer 2018. For a better understanding of the plot and surroundings, several on and off-site analysis were performed, such as sun & shadow study, pedestrian flow, site context, and vegetation.

Sun & shadow study.

For shadow study, morning, afternoon, and evening sun movements were taken (9am, 12am & 5pm respectively) to see how much of the natural lighting appears on the plot. Besides, it was really important to see the difference of casted shadows during different seasons, since day in the time of summer in Lithuania longer than during wintertime (Figure 59).



From this analysis, we can see that the area which is better lighted naturally is the middle of the site. However still have cast shadows from the high rise residential building.

Pedestrian flow.

The plot for future daycare center surrounded by a semi-quiet residential area. It has a lot of pedestrian paths that allow seniors to get to the plot from any side. Although due to school and kindergarten, which are located nearby, that area has high

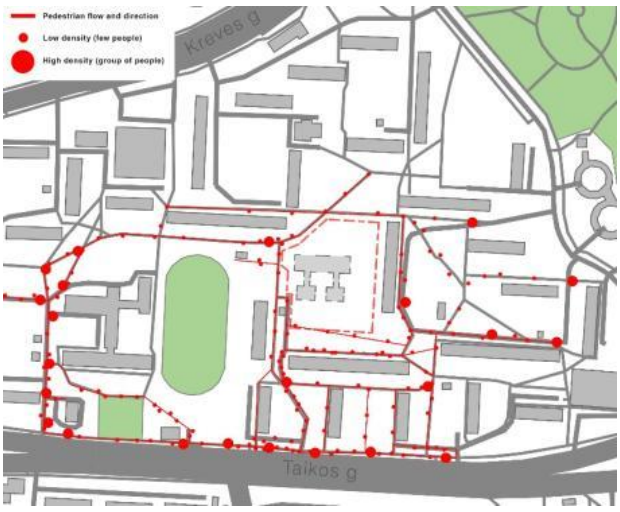


Figure 60. Site A – Pedestrian flow.

pedestrian flow in the morning and afternoon, which consists mostly of students and parents with kids (Figure 60). However, the high flow of people does not disturb the site and still keeping it quite.

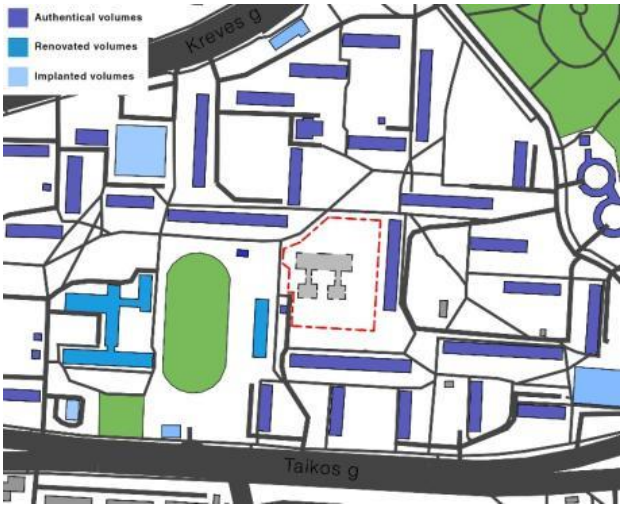


Figure 61. Site A context.

Site context.

Most of the buildings, which located around plot A are authentic soviet high rise residential buildings (5-9 story height), dated approximately to 1970s (Figure 61). The process of renovation starting to get over this district slowly but surely. For now, there are two buildings nearby the plot that were renovated not that long ago (approximately 2016-2018), school, and one 5-story residential building (Figure 62). As well there are few objects which were "implanted" due to change of the needs, expansion of the city and population, such objects like Maxima XX & Norfa grocery store, bank, fast food restaurant, and clinic.

Figure 62. Site A – Renovated residential building (left) & renovated school (right).

Vegetation.

As this plot abounded for quite some time, vegetation is in a bad and chaotic condition. There are a lot of unplanned bushes and plants in the middle of the site, due to lack of maintenance. However, the boundary of the site still has many trees of high and medium height, which play some sort of live fence (Figure 63 & 64).

Some of them located outside of the boundary line and still can be used to benefit the future design of the daycare center. The site dominated by tree species such as oak, rowan, birch, chestnut, and maple trees. Most of them are quite high 8 to 10 meters in height.

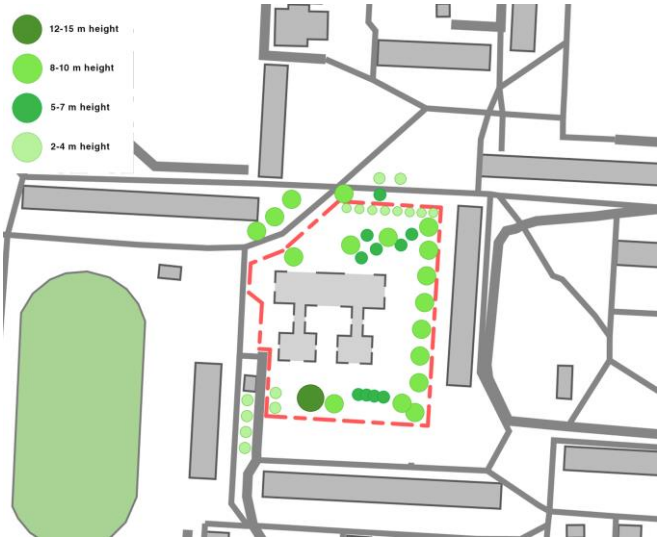


Figure 63. Site A – Vegetation plan.

Figure 64. Site A – Vegetation of the site.

Site B.

At the moment, site B occupied by kindergarten "Sun"("Saulutė"), which was built by the same, typical plan as demolished kindergarten on the plot A (Figure 66). The building was renovated in 2018. During the renovation, new doors and windows were installed, floor finishes were changed as well as exterior "shell" of the building (Figure 65 & 67).

Figure 65. Site B – Kindergarten "Sun".

The mission of this facility is to provide 2-7 year-old children pre-school education services, to develop a harmonious, healthy, motivated, creative, foster ethnic culture and ecology, mature school personality. Seek continuous development of teachers and in cooperation with the parents to help the child to experience a happy childhood (Kaunas kindergarten "Sun").

The site analysis for this plot was done in the same manner as analysis for site B: sun & shadow study, pedestrian flow, site context, and vegetation. It was interesting to see the similarities and differences between those two sites and how it will influence further actions.

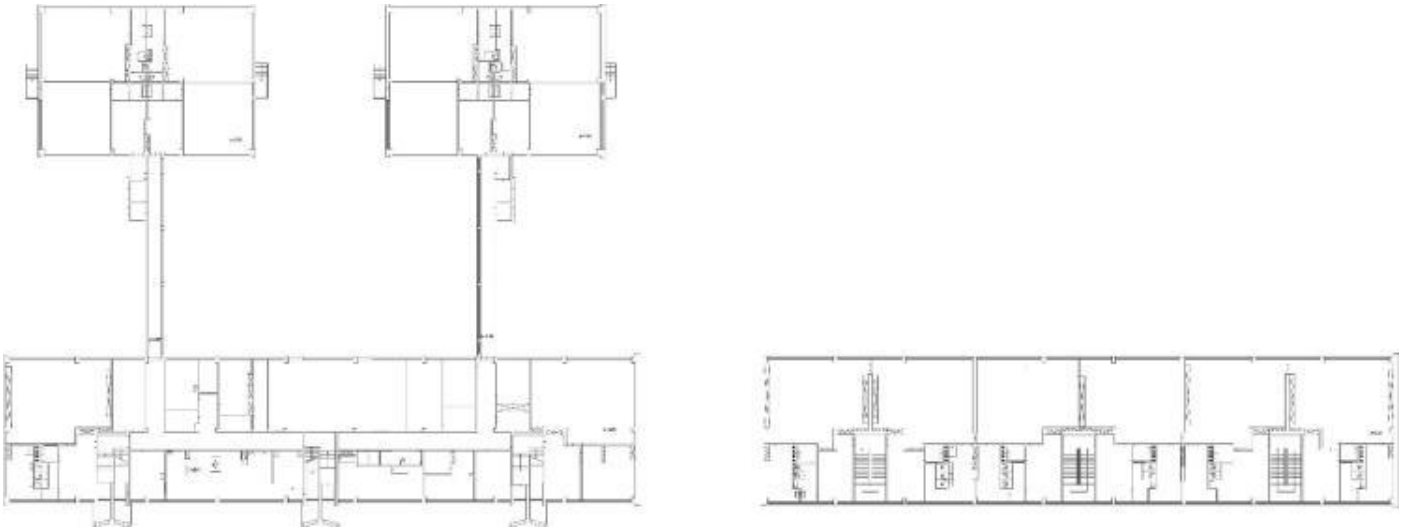


Figure 66. Kindergarten "Sun" existing ground and level floor plans (Kaunas kindergarten "Sun").

Figure 67. Interior spaces of kindergarten (from left to right): multipurpose hall, hallway from one block to another, typical room for one group.

Sun & shadow study.

Plot B is surrounded by a few high rise residential buildings from the northeast side, which cast most of the shadows on the site. However, compared to site A, this plot is more open and gets more natural lighting throughout the day (Figure 68).

Figure 68. Site B – sun & shadow study (from left to right): shadows during summer, during autumn & during winter.

Pedestrian flow.

Plot B as well located in between of few educational facilities, such as Kaunas Viktoras Kuprevičius gymnasium, music school of Miko Petrausko, and another kindergarten. As a result of such placement, pedestrian flow around the site is quite high. It is mostly used as a transit area by students who are going to/from school as well as parents who are dropping off/ picking up kids from kindergarten (Figure 69).

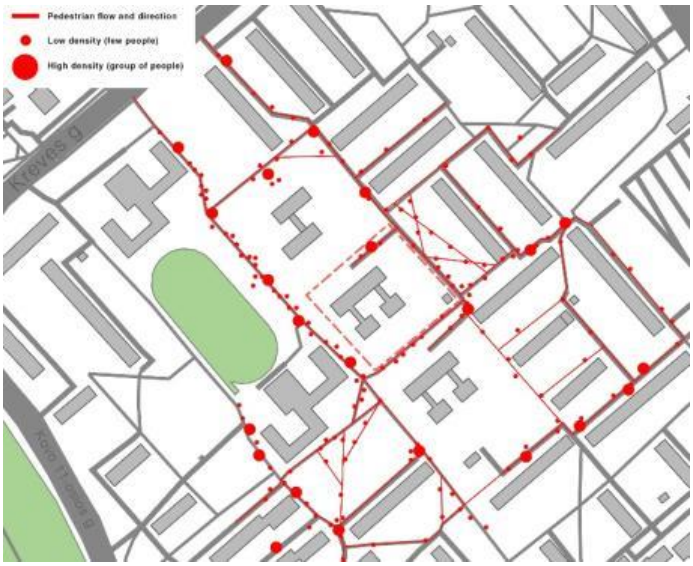


Figure 69. Site B – Pedestrian flow.

Site context.

Same as site A, plot B encircled by soviet style residential buildings, although implementation of renovation here is a little bit

higher compare to site A (Figure 70). As it was established earlier in this research project, the object on the plot B is renovated. Other educational facilities such as kindergarten across and gymnasium (Figure 71) also have been renovated not long ago (approximately 2017). Additionally, there is a new structure near by the plot B, 9 story residential building which was built in 2018.

Figure 71. Site B context.

Figure 70. Site B – Renovated gymnasium.

Vegetation.

The vegetation of the site B is properly organized and well maintained (Figure 72). It has a live fence from the south-east and north-west part, which consists of low planting. The south-west and east-north part have higher trees which play the role of a visual barrier for the playground area of the kindergarten (Figure 73).

The site's tree species are mostly rowan, apple and ash trees. Most of them are quite high 8 to 15 meters in height.

Figure 72. Site B – Vegetation plan.

Figure 73. Site B – Vegetation of the site.

3.3 Experimental design of a daycare center in Dainava district

An architectural concept is an idea, thought, or notion that forms the core and foundation of a design project and drives it forward. After all the collected information and zoning analysis of plots, a different approach was used for each of the plots. This part of the research will show in detail ideas, development, and implementations to the existing situation of the plots.
The main idea for both options is a multigenerational facility. The future development needs to be a place where the elderly can interact with their grandkids, as well as have their own time for entertainment. It is a well-known fact that multigenerational interaction benefits both kids and seniors in many different ways. Currently, it is quite popular all around the world to design two types of daycare centers together connected in one facility.
Advantages of such communication:

- Intergenerational interaction allows adults to be able to teach children things, such as how to fold a towel, how to dust handrails, or how to categorize things such as by seasons or colors.
- Additionally, interaction with older adults has shown benefits for the children involved, including fewer behavioral challenges and improved social development.
- Helps alleviate symptoms of loneliness and isolation
- Encourages the elderly to participate in physical activity while playing with children.
- Helps to feel valuable by teaching and transfer knowledge to the young generation.

3.3.1 Concept proposal for renovation/addition of a daycare center to an existing kindergarten “Sun” at V Kreves 56 street

The first concept for an experimental design of a daycare center located on the site B. As we see from site analysis, which was done earlier, the plot is already occupied by kindergarten. The main idea of this design was to see how we can combine these two functions (kindergarten & daycare center for the elderly) in an already existing facility. Additionally, this concept created by current trend point to a bigger population of elderly than kids in the future.

Design program of the building.

After several sketch ideas, the easiest, sufficient, and proportional solution will be to renovated two southeastern wings, which currently used for 4 groups of 8-10 kids (Figure 74). The additions can be implemented into floor plans with minimal recognition and interference. This option is focusing on more or less

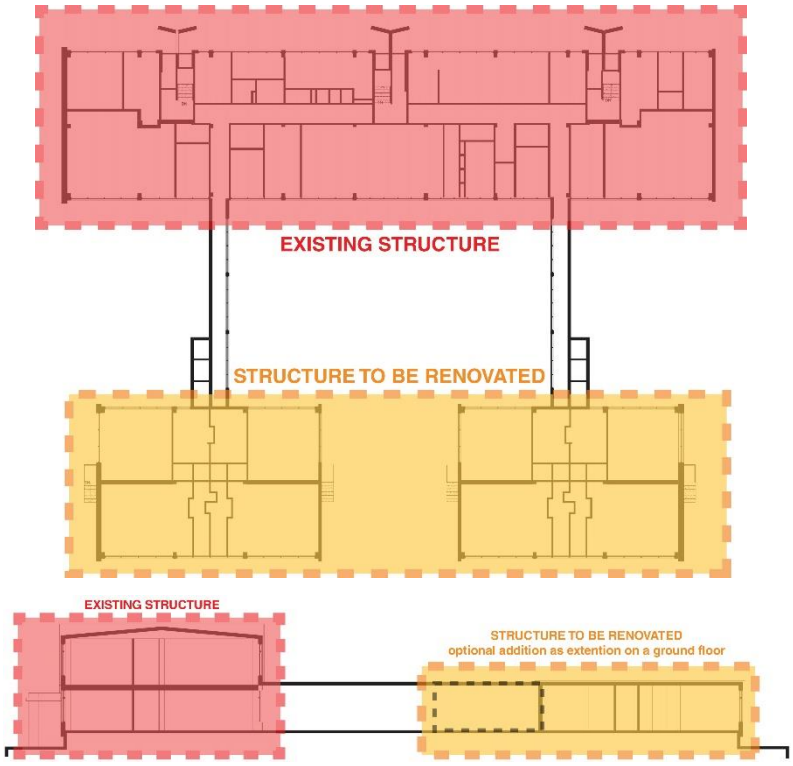


Figure 74. Diagram of the conceptual idea of which parts need to be renovated and worked on.

equal division for both generation's use. The building of kindergarten consists of 3 parts which interconnect with each other. In the same way, it is important to understand which type of functions will be necessary to include, due to restriction of a current building volume, site relation, and current areas, it is not possible to adapt as many functions. In Table 10 you can see that the total existing area which will be renovated is a little bit insufficient for required spaces, which means the additional structure will need to be added. Moreover, some of the spaces such as the kitchen for cafeteria, multipurpose hall, offices can be on a share basis with kindergarten.

Table 10. Building program.

Quantity	Rooms	Area per one (sqm)	Total area (sqm)
1	Office	30	30
2	Restroom	24	48
4	Workshop area (capacity 20 per)	45	180
1	Nursery	30	30
1	Therapy room	15	15
2	Storage	10	20
1	Cafeteria	35	35
1	Lounge / free area	95	95
1	Library	100	100
Total Area (sqm)			**553**
Existing area (sqm)			**464**

Massing study of the building.

On the subject of the 3D representation of this renovation, the concept is to create a better transition area for the inner courtyard, which is currently used for kids to play. This transition area can be used as an outdoor lounge area, where seniors can socialize, drink coffee, or read a book. Besides that, this area can be used as semi-outdoor connection between two existing blocks. As for additional structure with new functions, the best solution will be to create them from sides that are not used as anything (not a transition, parking, or play area). After different implementations of these solutions, several massing models were tested (Figure 76), which lead me to the outcome of this renovation (Figure 77).

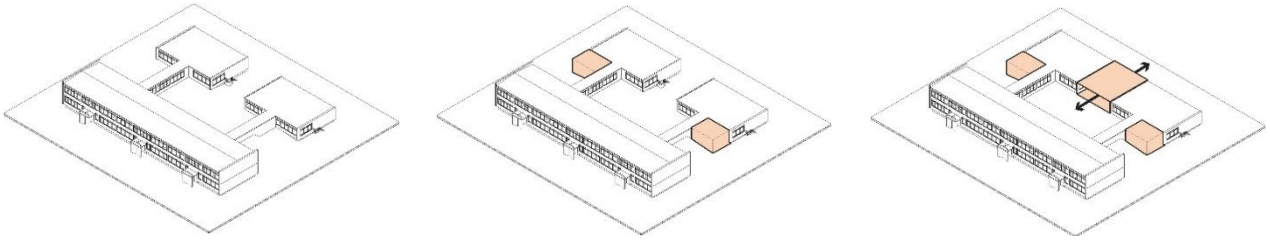


Figure 76. Massing model from left to right: existing kindergarten building; rooms of 45 sqm can be added from sides of the building on unusable areas; transition area connecting two blocks, as well as an inner courtyard with the backyard.

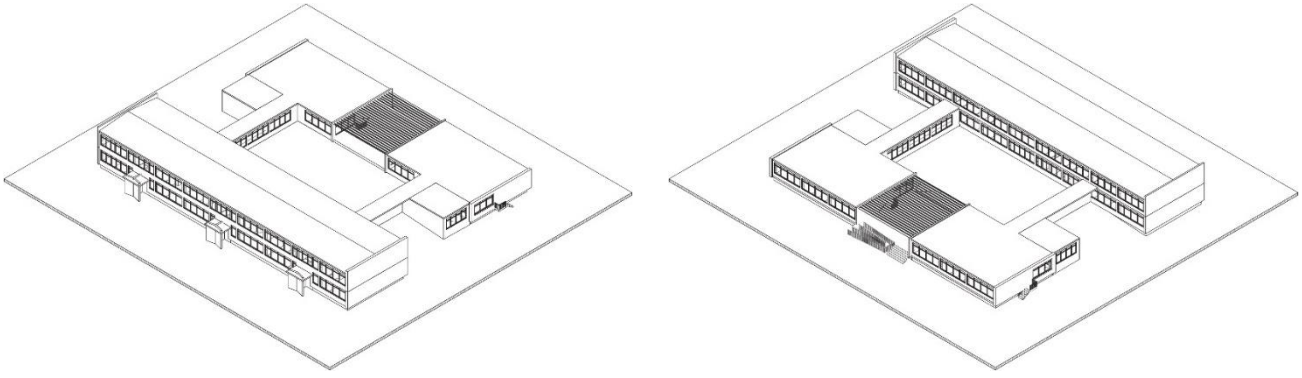


Figure 75. The final outcome of the conceptual renovation.

3.3.2 Concept proposal of a daycare center located on abounded plot, Taikos pr. 57.

This option of a daycare center located on the site A and will include an entirely new structure. There is a vast potential of this plot, as it is easily reachable but the same time quite hidden from prying eyes. The main idea of this new development is the connection of nature and surrounding neighborhood (Figure 77). Make a daycare center some sort of oasis, recreational space for the elderly in the middle of this concrete jungle.

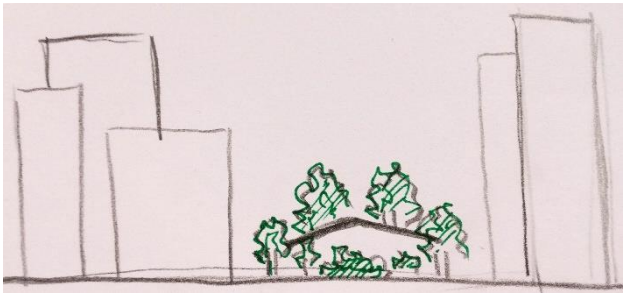


Figure 77. Concept sketch.

Design program of the building.

The beginning stage in architecture is the building's program. The program is a list that defines the spaces to be created within the building. It acts as an overview of the building specifications and defines spaces with allocated square footage and purpose, usage, or operation descriptions. With the help of several site visits and sociological survey, which was held during the previous stages of this research project, the list of all spaces which seniors might need was created. It included areas for workshops, restrooms, multipurpose hall, and lounge zone for resting, gathering and socializing. However,

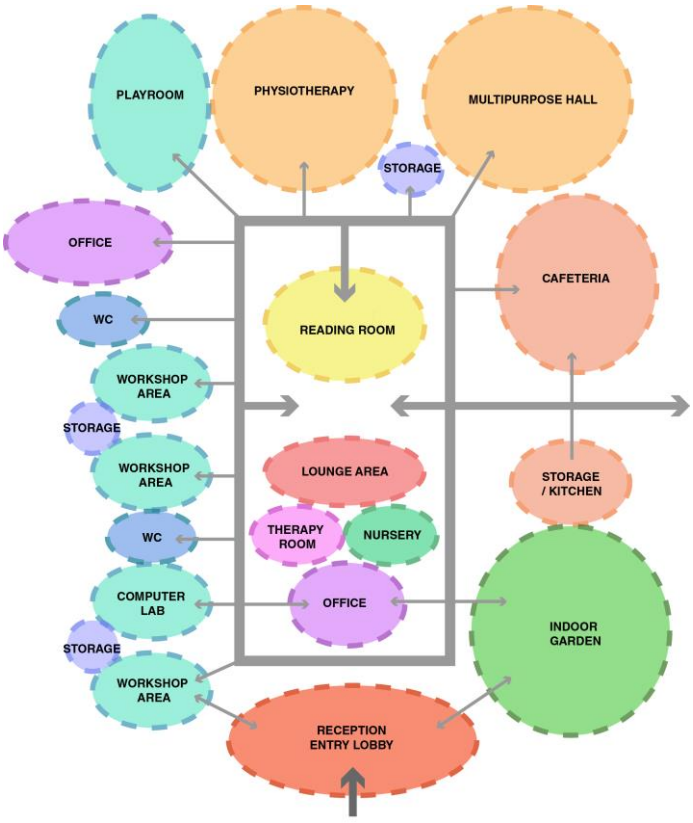


Table 11. Building program of a future daycare center.

Quantity	Rooms	Total area (sqm)
1	Entry / Reception area	145
1	Cloakroom	20
2	Office	82
1	Multiourpose hall (capacity 50 per)	200
3	Workshop area (capacity 20 per)	200
1	Computer lab	56
1	Reading room	82
1	Lounge (indoor)	110
1	Lounge (outdoor)	225
1	Cafeteria (seating area)	195
1	Kitchen / Pantry	42
2	Restroom	53
1	Playroom	122
1	Nursery	23
1	Therapy room	11
1	Physio therapy / Gym	120
1	Indoor garden	146
1	Outdoor garden	278
3	Storage	31
1	Service	25
1	Circulation	319
Total Area (sqm)		**2485**

what if we will go a bit further from typical and minimal space requirements for a daycare center? In the table (Table 11), you can see all the functions that were included after finalized research of case studies and survey results.

The daycare center should be a place of recreation, where seniors would want to go every day to feel valuable and active. It will include such spaces as a computer lab, so the elderly will keep up to date; indoor gardens where they can grow vegetables, flowers, and other plants not only during summer as well as during colder seasons. Although it is quite common to have a family doctor of their own, the future daycare center will still provide minimum medical procedures, such as shots, blood pressure tests, droppers, and even therapy sessions (example light therapy room).

Another aspect of the understanding building planning is to create an internal zoning division, which usually called bubble diagram (Figure 78). A bubble diagram's principal function is to help to translate the program into a strategy or shape. Bubble diagrams are describing the program graphically and allowing for simple statements, various configurations, and revisions. The created bubble diagram show, in general, the circulation and placement of rooms in the future development. Creating a relatively centralized plan, by arranging spaces around the main gathering area (lounge zone and reading room), as well helps to make the space easier to navigate and get around for seniors.

The following step was to understand and study 2D volumes and different layouts of plans. From schemes below (Figure 79), you can see several layout plans that mostly follow the space division of the bubble diagram (colors of internal spaces follow colors of bubble diagram).

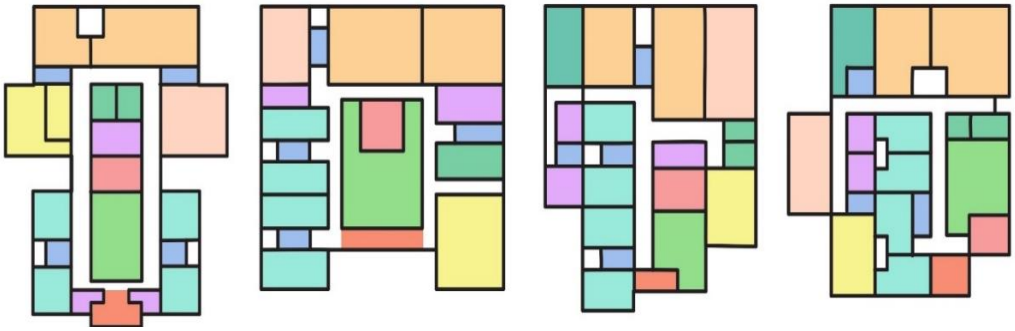


Figure 79. Schemes of internal layout.

The main idea for all the schemes was not only centrality but also a rule of thirds. This rule was applied by the division of plan into nine equal (or close enough) parts and aligning spaces within created grids. The result of this is a finalized scheme combining all of the previous concepts (Figure 80), you can see balanced symmetry and centralized open plan, which will help for the elderly to room around easily and socialize.

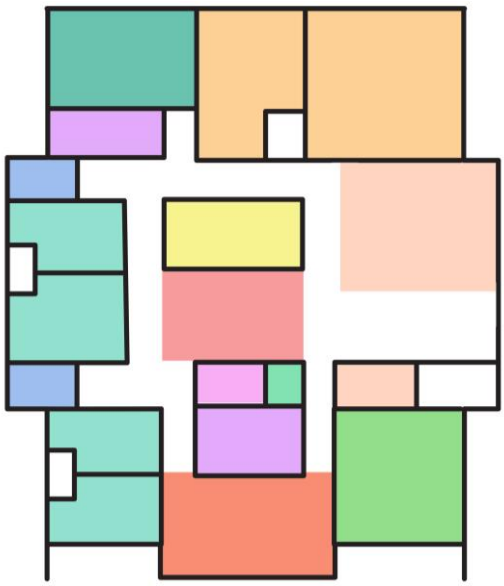


Figure 80. Finalized internal space division.

In addition to internal zoning, it is important to understand the layout of the whole plot and how outdoor functions cooperate with interior functions. To have a better understanding of an outdoor functionality, the zoning layout of the site was created with the help of site analysis results (Figure 81). As we can see from sun & shadow study diagram, the center - western part of the plot getting the most sunlight

throughout the year, due to that, that area will be much more suitable for development placement. However, privacy is an essential aspect for seniors who will attend this daycare center. Although the site surrounded by height rise residential buildings, it is possible to achieve it by using greenery as a visual barrier as well as some landscape solutions for the provided several zones for outdoor activities. (screens, trees, fencing, etc) (Figure 81). The areas for outdoor activities divided into 3 parts: the zone with sports equipment; the zone for such activities as yoga, dances, and celebrations; the zone for the outdoor lounge area. The plot will have several access points: for seniors who will use the daycare center, for parents to drop off their children and vehicle access (for both service and users' cars).

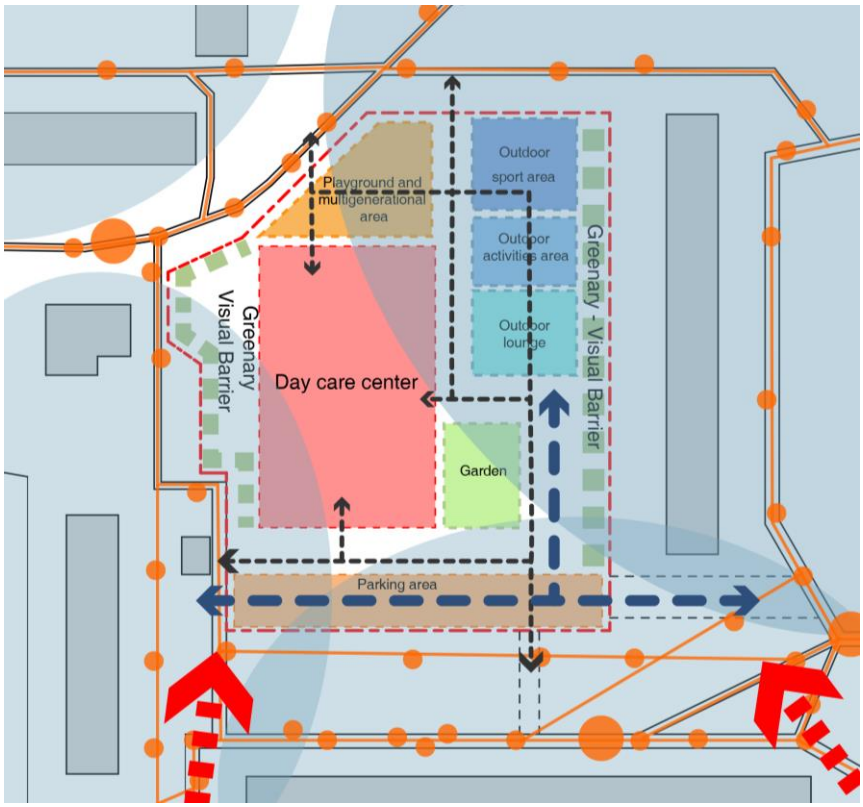


Figure 81. Zoning layout of the plot.

Massing study of the building.

The massing study enables the architect to see the project in a three-dimensional form in terms of masses, shapes, and sizes of blocks. This study lets the architect see how the elements work together. It was challenging to get the idea of how to make it open not only in 2D but also in 3D, and at the same time keep it in balance with surroundings. The process included the study of different types of volume, heights, natural light sources, and how it can be implemented into the design. Throughout this process, several scenarios were created and studied of how the outer shell can look like and be implemented to different plan layouts (Figure 82).

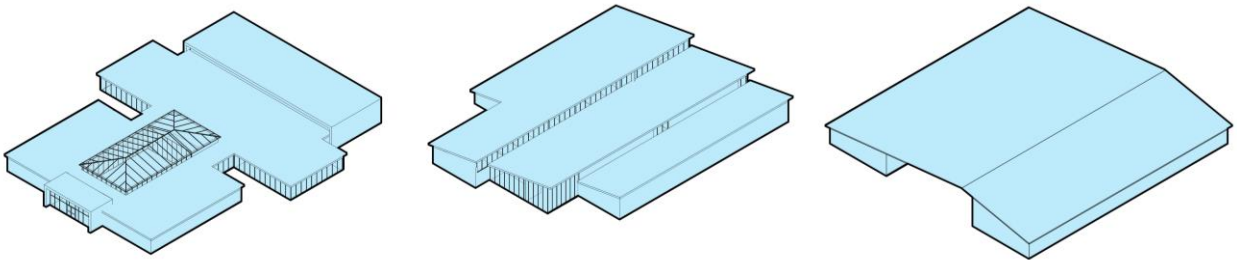


Figure 82. Concept ideas of building form/mass.

However, all of the created options looked raw and unbalanced. As a solution, the rule of thirds can be applied as well into the form of future development. The division can appear not only in the 2D plane but also be represented in the 3D volumes: heights of roofs and their shapes. Just as the finalized plan

has a similar proportion, the main volume of the whole development has a similar proportion: 3 sectors of plan represented by 3 sectors in the roof (Figure 83).

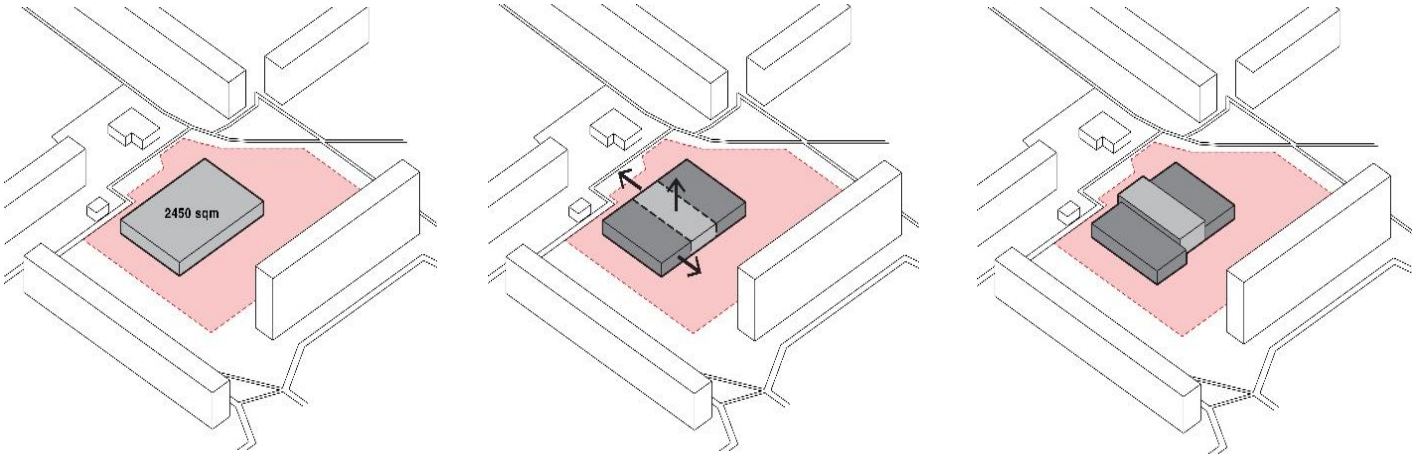


Figure 83. Massing study stages (from left to right: The future daycare center take up 27 % of the whole plot; The whole building divided into 3 more or less equally proportional parts; To brake monotone rhythm every part has a different volume to previous).

The front part of the building has the most significant volume in terms of height to give more natural light, spacious, and inviting feeling, as this area includes big entry lobby. The middle section of the building includes a cafeteria area, library, lounge, and two workshop areas (which as well can be connected). Additionally, these 3 segments of the building have large skylights to provide as much natural lighting as possible (Figure 84).

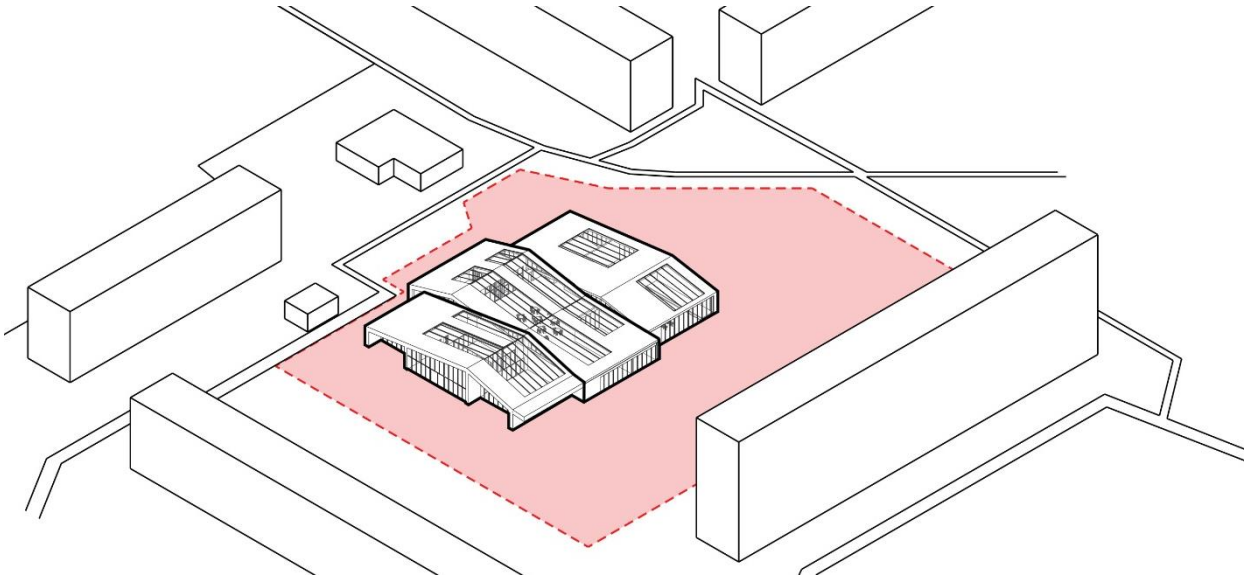


Figure 84. Massing study – finalized form of the daycare center.

3.4 Elaboration of conceptual idea

The following part of this research project includes the design development stage, structural details, landscape design, and other solutions for future development. In the design development stage, we are using the conceptual idea and taking it one step further. This phase involves finalizing the design and specifying such items as materials, window and door locations, and general structural details. In addition, this stage focusing on the detailed site plan (landscape design) as well as floor plans, elevations and section drawings with full dimensions, etc.

3.4.1 Overall details of spatial division and general envelope of the future facility

From site analysis and zoning, we can see that the placement of each function on the site logically connected to the surroundings. The whole plot has two access for vehicles from the west side entrance and east side exit; 4 pedestrian entrances from north, west & east sides. The daycare center has 3 different entrances: the main one from the south façade, secondary from east façade, and additional entrance for playroom from the north façade. The site plan (Figure 85) showing the vegetation, which in case of this plot most of the existing trees are better to be kept as they are not disturbing new structures as well as playing the role of a visual barrier (from east and north side of the plot). Additionally, as mentioned earlier, the main concept is to create a small oasis in the concrete jungle. One of the aspects which will represent the "oasis" is the greenery on-site as well as inside the daycare center, almost 33% of the site occupied by greenery, water features, and planters.

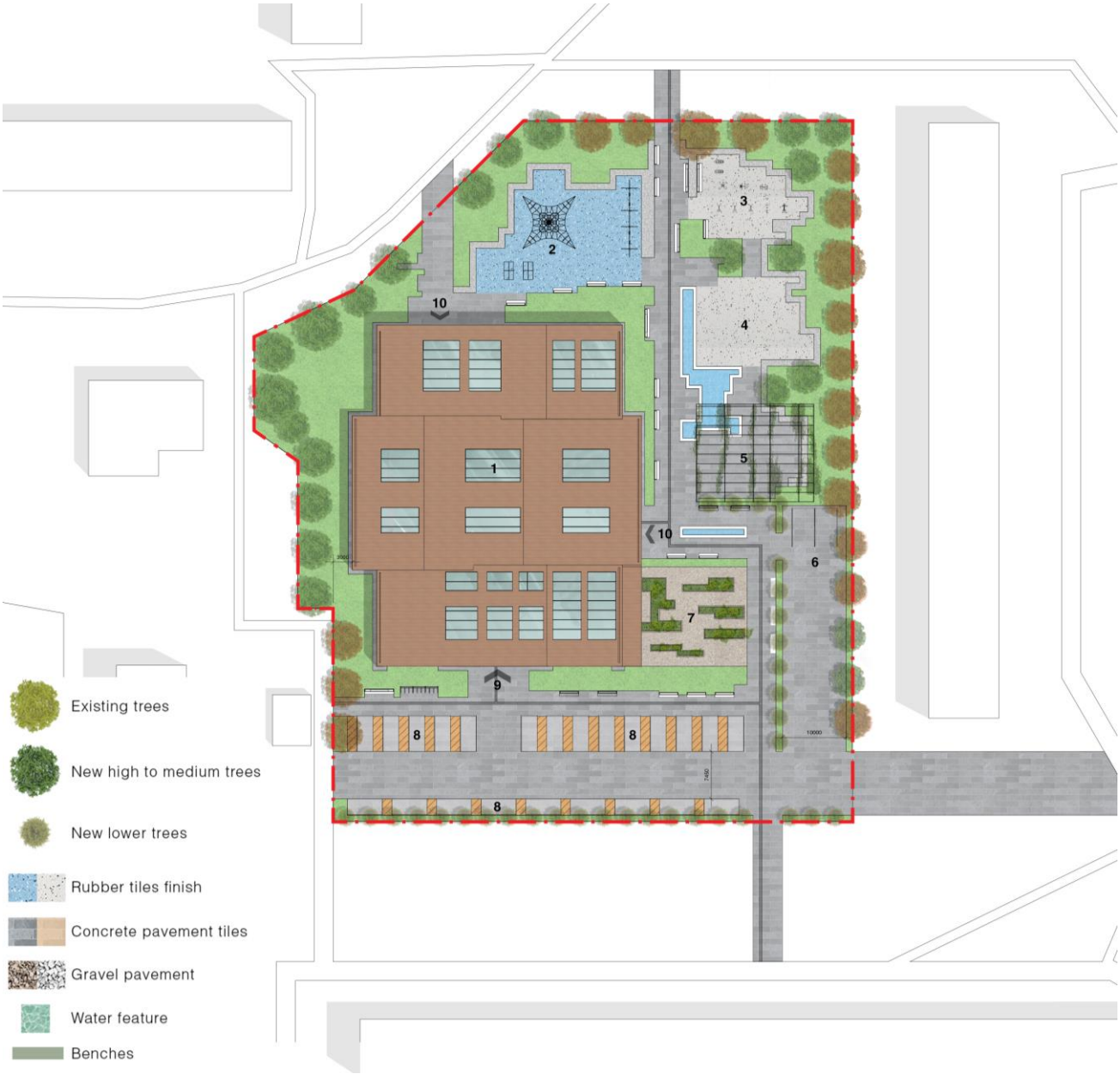


Figure 85. Site plan (not to scale): 1. Daycare center; 2. Outdoor playground; 3. Outdoor sports zone; 4. Outdoor area for other activities; 5. Outdoor lounge area; 6. Service car park; 7. Outdoor garden; 8. Parking area for visitors; 9. Main entrance; 10. Secondary entrance.

Besides, the whole site equipped with tactile ground surface indicators to make the daycare center accessible also for older people with decreased eyesight. It is providing information about entry points to the facility. For any further use of the outdoor spaces for activities, the elderly will require support provided form employees of the center.

The outdoor activity areas divided into 3 zones, as we can see from the zoning diagram of the site. The outdoor lounge area located closer to the (secondary) entry of the center to give visitors the possibility to have their lunch, read a book, or have some social time with others. As it is shown on the site plan, the lounge space covered by a pergola with weaving plants around it, as well as covered from the adjacent building by existing trees. Additionally, there is a water feature that acts not only as a decorative object of the plot but also gives a small physical boundary from the building (Appendix 7).

Regarding the plan of internal spaces (Figure 86), we can see that it is corresponding to the diagram of space zoning from the previous chapter as well as keeping the grid structure within the proportion to the rule of thirds. The finalized plan consists of a lot of different spaces with various uses:

1.	Reception / Entry	145 sqm.
2.	Cloakroom	20 sqm
3.	Office 1	39 sqm
4.	Nursery room	23 sqm
5.	Therapy room	12 sqm
6.	Classrom 1	57 sqm
7.	Storage 1	7 sqm
8.	Computer lab	56 sqm
9.	Male restroom	26 sqm
10.	Service 1	3 sqm
11.	Classroom 2	84 sqm
12.	Storage 2	9 sqm
13.	Classrom 3	59 sqm
14.	Female restroom	26 sqm
15.	Service 2	3 sqm
16.	Office 2	43 sqm
17.	Playroom	122 sqm
18.	Storage 3	11 sqm
19.	Physiotherapy room	120 sqm
20.	Multipurpose hall	200 sqm
21.	Circulation	320 sqm
22.	Reading room	82 sqm
23.	Lounge	111 sqm
24.	Cafeteria	196 sqm
25.	Kitchen	42 sqm
26.	Service 3	19 sqm
27.	Indoor garden	146 sqm

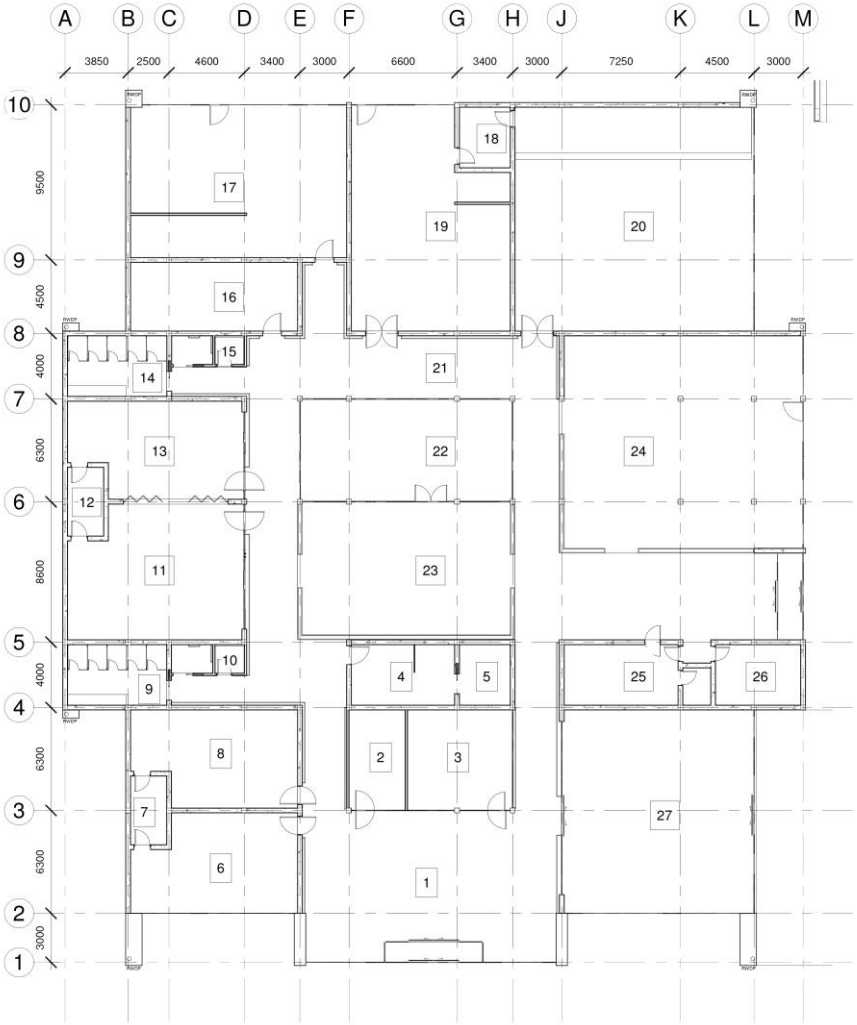


Figure 86. Level 1 plan (not to scale).

The outer envelope and, in a way, the shell of the building, is following the model of the massing study stage. The building divided into 3 parts, geometrically and functionally. Additionally, each part has a pitched roof with equal slopes throughout the building 8° and 16°. Elevations of the building have

Elevation A-M

Elevation 1-10

Elevation M-A

Elevation 10-1

Figure 87. Elevations of the daycare center (not to scale).

similarities between each other. However, each of them has noticeable features such as the main entrance in the front, outdoor lounge and garden from the left side, sports area from the rear side of the building, etc. (Figure 87). The material for outer shell is the metal cladding in the shade closer to timber so that it will have an earthier feeling, but also will be resistant to weather changes. There are many benefits in this type of material, such as:

- Low Maintenance
- Protection and Strength – The cladding protects from changes in temperature, wind, water absorption, sunlight
- Lightweight Solution
- Aesthetics
- Environmentally Friendly – Metal cladding panels can be made of recycled materials, making them environmentally-friendly and reducing the amount of material that goes to landfill. And because they are made from common metals, at the end of their useful life as cladding, they can easily be recycled (Gilcrest Manufacturing, 2018).

Interior details

Concerning interior spaces, the main idea was to create an open & "light" space where the elderly will feel calm, comfortable, but at the same time will have some privacy (Appendix 8). As was mentioned previously, the whole daycare center divided into 3 zones. The front part of the building consists of a spacious lobby/reception area, as well as two classrooms/ workshops areas, office, cloakroom, and indoor garden. In the middle section of the development, we can see 2 more workshop areas, an enclosed reading room, kitchen, and secondary entry to the facility. Furthermore, the third part has more of an activity zone: multipurpose hall, physiotherapy hall, and playroom for kids. Aforementioned, one of the concepts for a future daycare center is to create a multigenerational facility. The provided playroom can be used for seniors' grandkids while their grandparents have their activities. The central points for seniors to gather during brakes are cafeteria and lounge areas, which also located in the middle section of the daycare center. However, the challenge was to create open spaces for socializing while still giving privacy to visitors. After testing different options, planter boxes turned out to be a valuable solution for physical boundaries. It is dividing interior spaces while still creating overall and open space. As well as it is providing an internal area with lots of greenery, which after the sociological survey, we found out will be an essential aspect for the older people.

Regarding the furniture layout, the main thing that needed to be taking into account is a seating area. As people age, it is harder to be continuously active and "on the go". The aim is to make simple, comfortable, and not an overwhelming furniture arrangement, so seniors who will use the daycare center will have a possibility to have some rest and have their own time with books or friends (Figure 88).

From the survey result, we can see that the elderly will want to see more activities provided in the center. Due to that, 4 different rooms provided: one computer lab; 3 other spaces that can be used for crafts workshops, language classes, seminars, and many more. Each of the workshop areas has different furniture layout to adjust to various possible uses. Additionally, two of the studio rooms can be adjusted to each other, creating a huge working area for bigger events.

The concept of an oasis assumes to have plenty of greenery. The daycare center will have not only plants as division objects, moreover an indoor garden/glasshouse. It is located right in the entry of the facility and closed with fully glassed walls, so the visitors who are waiting in the reception area will have a nice view of greenery. Indoor glasshouse has a place for seniors to grow flowers and plants all around the year, as well there is a lounge/chill area to have a rest while enjoying the greenery (Figure 89).

Figure 89. Furniture layout and materials of floor finishes.

Figure 88. Interior spaces (from top left to bottom right): entry lobby, cafeteria, workshop room 2, lounge area.

Indoor materials and color palette.

Mostly white colors for walls were used to make the interior brighter, as well as keeping spaces airy, spacious, and not overwhelming. However, each zone (educational, lounge, cafeteria, sport, entertaining, etc.) has colored accents, which make it easier to navigate around the facility. The majority of those who responded to the survey expressed their desire to have more of a pastel and green shades incorporated into interior space (Figure 90).

Every workshop area has accents on the walls and doors in yellow color, which are looking towards the hallway. The physiotherapy room and multipurpose hall have blue cladding with blue doors, which makes it outstanding for the decreased eyesight among the white walls around. As the cafeteria is going to be the "central" gathering point for seniors, the main accent color for this area is green. The green color is considered the most restful color for the eyesight, and when used in interior design, green can create a sense of calmness and peace.

Figure 90. Interior zones divided by colors (from left to right): entry to the workshop room, entry to a multipurpose hall, cafeteria area.

Choosing a flooring material for the facility for older people does not need to be complicated (Figure 91). There are five main factors/questions which need to be considered:

- Slip-resistance: Does the flooring material offer a non-slip surface even when wet?
- Ease of travel: Is the flooring material easy to move over for a person using a cane, walker, or wheelchair?
- Cleaning and maintenance: How much work does it require to maintain the flooring.
- Comfort: How does the flooring material feel underfoot?
- Cushion: Does the flooring offer some shock absorption in the event of a fall?

Figure 91. Floor finishes (from left to right): cork, linoleum, hardwood and carpet.

Furthermore, the flooring of the daycare center also has the tactile indicators for people with vision impairment, similar to one outside of the building. The tactile surface indicators created using Australian and New Zealand standards: 300 mm weight tiles with 600 mm by 600 mm tile for crossover directions.

3.4.2 Structural details

To make this development more age-friendly, it consists of a singular level, which helps to reduce the chances of elderly users to fall or slip. Due to that, the whole building has a pretty big built-up area considering the number of levels.
As you can see from elevations and the plan, the building required some strong structure system for roofing (Figure 92).

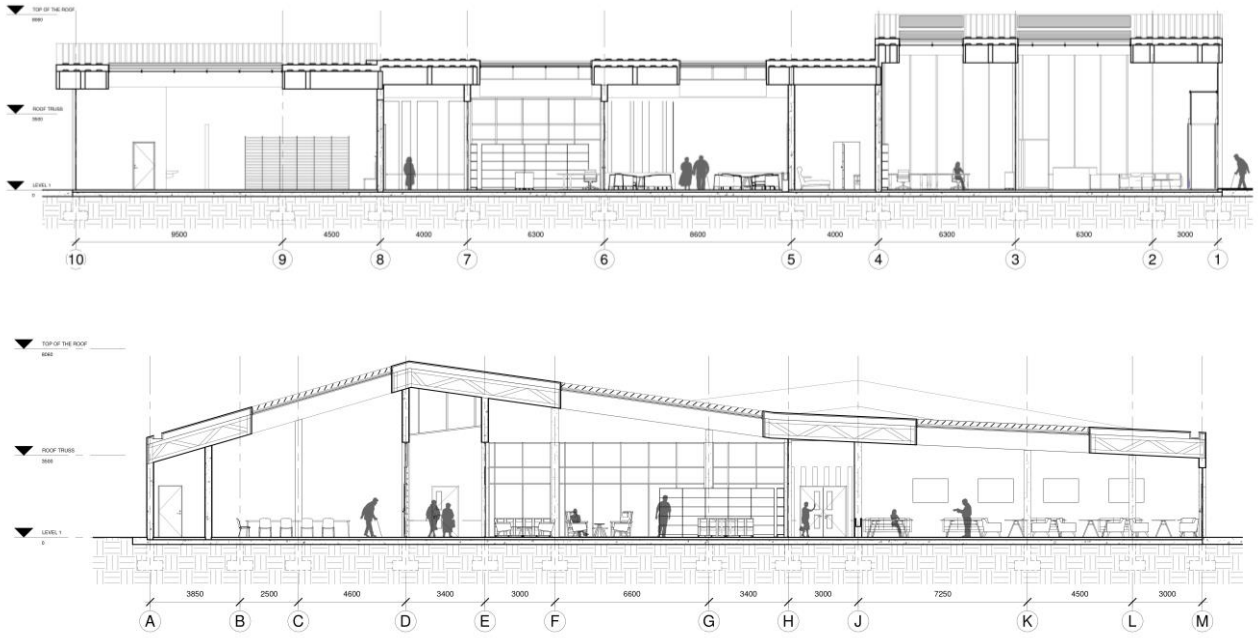


Figure 92. Sections of the daycare center A-A (top) & Section 1-1 (bottom) (not to scale).

After testing and consulting with the expert regarding the structural aspect of the building, the steel truss system was chosen as the most suitable solution. The truss system is covered with a plaster ceiling, which will provide some space for electrical wiring and ducting (Appendix 9). As well such roof will need additional support – columns, which are concealed in walls to create esthetically pleasing interior spaces.
For a more considerable amount of natural lighting, which will be very helpful to the elderly population, significantly sized skylights were added to all sections of the roof. Nevertheless, it gives a problem of overheating the indoor spaces. Few solutions were applied to improve the design: the use of low-emissivity glass and the use of automated louvers. Low-e glass is capable of reducing the amount of heat transmitted through the glass by about 30 percent compared to standard glass. Low-e glass further increases thermal quality by reducing glare and avoiding damage done by ultra-violet rays.
Secondly, the automated louver system can be implemented to protect from obtaining solar heat and obtained by automating the blinds to ensure maximum shading rates at all times. It is also can provide protection against glare due to the variable positions of louvers, as well as excellent light regulation. The shading louvers can be operated from the inside of the building using a simple touch-sensitive wall switch (single touch to fully open, fully close, or open to an intermediate position). The employees of the daycare center as well can set an automatic operation in response to the natural changes as well as to operate in the response of the building occupant's daily routine.

Flexibility in transformation and adaptation.

Due to the current world pandemic COVID-19 a lot of architectural standards will need to be adjusted. The future developments will require to have multifunctional structures which will be easily transformed and adjusted to provide sufficient space for social distancing. Joe Yacobellis, Greenvale's associate and design director, thinks public spaces are evolving. Some of the general planning requirements for public space design will change to better reflect a modern way of living that will require greater personal space (Jeffrey Steele, 2020). The main victims of this virus are the elderly population, for that reason the best solution will be to create structure which will be adaptable to an emergency facilities. Manhattan's Javits Convention Center has been turned into temporary hospitals while parking garages have been transformed into critical care facilities or emergency care stations. Architects also helped erect a tented emergency a field hospital in Central Park, New York City. Many buildings, formerly used for different purposes, now serve as quarantine sites for people exposed to the novel coronavirus.

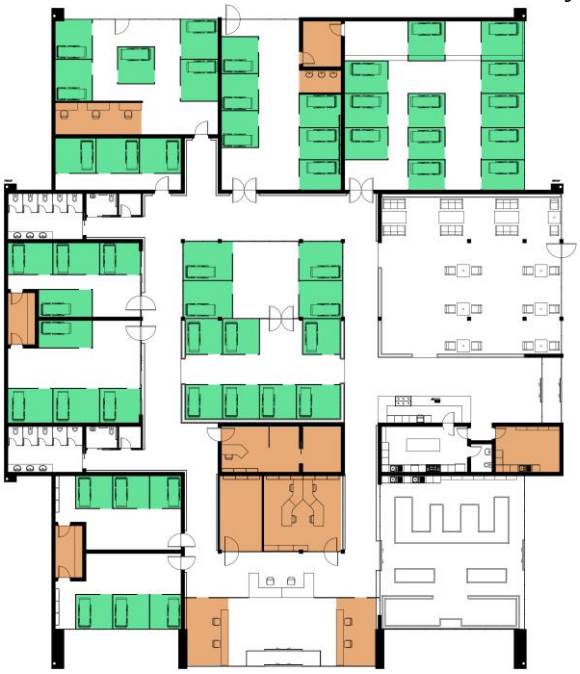


Figure 93. Diagram of an adaptation of the daycare to a medical center.

From the diagram you can see that with help of lightweight partitions the floor plan of the daycare center be transformed into a medical center helping to treat people and take some of the patients from overloaded hospitals (Figure 93). It will be able to accommodate around 50 people with corona virus (green color), additionally, the offices and staff spaces can be transformed and used as labs and facilities for medical employees (orange color).

3.4.3 Rainwater collection system.

Another aspect that would be beneficial to include in the design is sustainability. There are several different points of view about this concept and how it can be accomplished. Sustainability became a common solution in the architectural world. The main aim of this study is to get an understanding of how systems function, remain diverse, and produce everything to keep ecology in balance. Sustainability is a process by which people avoid the depletion of natural resources to keep the balance so that the quality of life does not decrease.

One of the most impactful solutions is a rainwater collection system. Rainwater harvesting is the process of collecting water from a structure or other surface in order to store it for later use. Harvesting rainwater from the roof is the most frequently used solution. The collected water will travel from gutter to storage by downpipes.

Rainwater collection has quite a few benefits:

- It is a relatively free and clean source of water.
- Full control over water supply, provide an excellent back-up source of water for emergencies.
- It promotes self-sufficiency and helps conserve water.

- Better for gardening, because it is non-chlorinated.
- Using the efficient, inexpensive and easy to operate technologies.
- The flexibility of the system, which allows for expansions, reconfigurations, and even relocations.

In this design, the main source of the rainwater collection are gutters and concealed downspouts which taking water into an underground storage tank, from which water been transmitted for:

- Restroom (toilet flushing, tap water)
- Hydronic radiant floor heating
- Gardening (indoor and outdoor)

The secondary source is a water feature, which directly collects rainwater and mostly used afterward for gardening purposes (Figure 94).

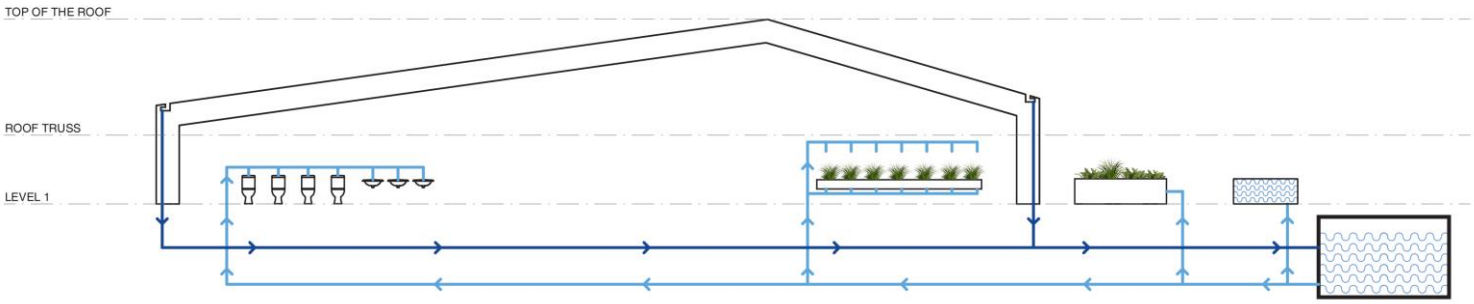


Figure 94. Rainwater collection system diagram.

3.4.4 Evaluation of experimental design results

It is not only important to create a delicate building with a charming design which elderly will like and visit, but it is also very crucial that the proposed design will respond and correlate with Universal Design principles, as it is the main aspect of this research project. The created a diagram expressing the solutions which were used in the design and how they relate to Universal Design (Figure 95).

As you can see from the image below, all of the solutions quite simple but same time increasing quality of life for elderly. From all of the previously done research, the main aspect which needed to be followed is single grade entrance and minimum level change. Therefore, a single story for the development for the elderly is a beneficial solution. Secondly, the principles of Universal Design suggested providing wide hallways to create equality in use, so everyone can use the space at the same time even if you using a wheelchair; it also can reduce the level of "errors" (in elderly situations is falling) and etc. In the proposed experimental design, there are only two hallways that only take a span of 3-4 meters; however, it is still considerably wide, so users are not putting the user into really tight space, still feel the spaciousness and can comfortably move around. The rest of the building more like an open-plan space, which will provide freedom in movement for seniors. As well open-plan spaces are beneficial for users as it is easy and simple to remember the way around, making space familiar faster.

There are as well such universal solutions that sometimes been ignored in building designs, which was made as well age-appropriate in this design:

- Double action door - seniors using less strength entering and exiting spaces
- Automatic doors into the restroom

- Grab bars all around the building
- Seating areas not only inside the building but also outside

Furthermore, while designing for the elderly, materials choice needs to be considered, especially for flooring. Aforementioned, all finishes which were used are age-friendly, non-slippery, low maintenance, and providing comfort.

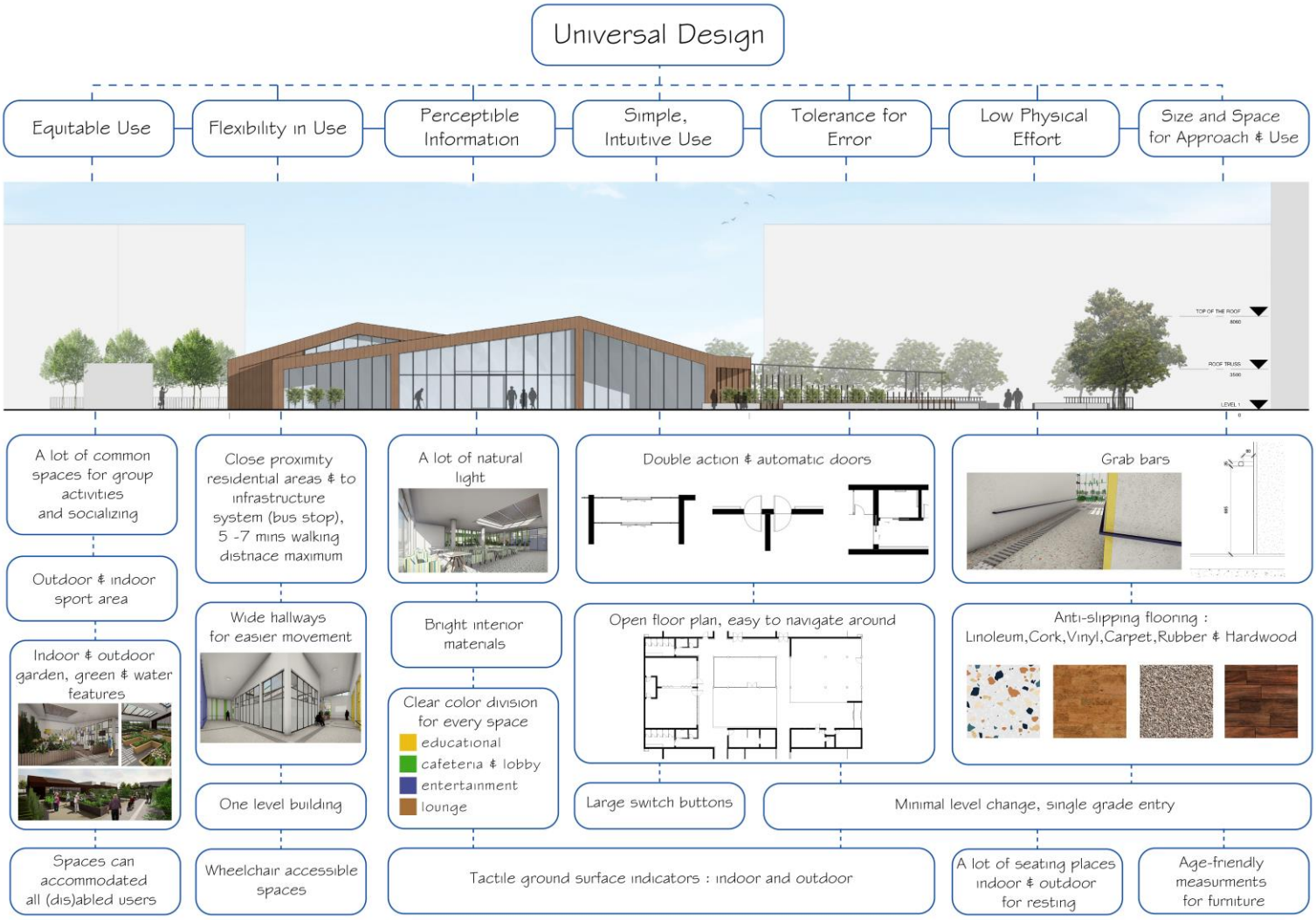


Figure 95. Evaluation of the proposed design.

General conclusions

1. The analysis of literature had demonstrated that birth rates are decreasing over the years while life expectancy is increasing. Therefore, the elderly population is growing at a faster rate than children. The changes we experience during aging may be difficult not only from the physical side but also from psychological. Sudden shifts as weakening of health, the deterioration of the family, and lack of care from society threaten the wellbeing of older people. Unfortunately, it is common in society that older age is seen as irritable, inactivity, and overly emotional. Due to these beliefs, stereotype and negative attitude appears. These stereotypes can follow with different types of complications, such as the shortage of acceptable architectural solutions for spaces for the elderly.
2. Universal design is one of the crucial tools which can help to improve design not only for disabled people but also for the elderly. The main philosophy is to create a design that fits all. In 1997 a group of specialists of North Carolina State University led by Ronald Mace drafted "Seven Principles of Universal Design":
    - Equitable Use;
    - Flexibility in Use;
    - Simple & Intuitive Use;
    - Perceptible Information;
    - Tolerance for Error;
    - Low Physical Effort;
    - Size and Space for Approach and Use.

    These principles help to create environments that meet the needs of people with mental, visionary, hearing, and mobility deterioration. Principles of universal design can be applied not only to architecture but also to product design. By using such simple things as grab bars and ramps, we can facilitate movement for seniors. With double-action or power doors, space can be easily accessible for anyone. However, it is not as recognized and well spread among specialists, and it is developing but not in the rapid direction. Consequently, a simple functionalist approach to architecture will not be enough for someone to capture genius loci. However, a combination of functionality and understanding is required to enhance the quality of life and places effectively.
3. The research on-site in the elderly care institutions in Lithuanian has demonstrated that these facilities are more concerned with keeping seniors healthier from the physical side but not from personal and emotional. The main mistake of architecture for the elderly is making facility medical looking, bland, and lamentable, which brings the elderly to a more isolation and loneliness state. Nevertheless, if we (society) care about our future and future of our seniors, we need to consider using more of universal and inclusive design aspects. By creating spaces that are easily accessible for all users despite their capabilities, we can eliminate unnecessary complications, make the elderly feel included. Universal design is equal to inclusion, and it helps to create a more independent and positive space, which will increase the quality of life.
4. The sociological survey of the elderly people in Lithuanian has demonstrated that most of the seniors had a strong belief that the current conditions of facilities for seniors need some improvement to accommodate their needs better. Most of their comments express the need to be integrated into the community rather than to be isolated. Several studies have shown that social interaction reducing cardiovascular problems, health issues such as depression, and even

lower blood pressure. Some seniors feel that looking after their grandkids makes them healthier, more active, and most importantly, valuable. There is a belief that elderly people do not need much, but after interviews, it was clear that seniors would love to participate in different types of workshops and activities. The main findings of this study are that architecture is not a substitute for social care, but when it is designed to meet the needs of its inhabitants, it is able to provide assistance and care for older people. Care for the elderly through architecture go beyond such issues as grab bars, ramps, and signage, and it also strives to meet the social and behavioral needs of the elderly.

5. Previously made research on-site shown the lack of age-friendly facilities in Lithuania. This study provides an analysis of residential areas of Kaunas for further consideration of development placements. The site selection process highlighted suitable arrangements for similar developments by taking in a count chosen criteria: accessibility via public transport, position in residential areas, green spaces within walking distance.
6. From all the collected information, it was clear that a daycare center will be a suitable solution for the elderly in Lithuania. Daycare center for seniors is designed to focus on enhancing the elderly's lives through socialization with others while receiving assistance, supervision, and daily activities. The proposed daycare center is a result of understanding seniors' needs and responding to them through the built form. The main concept was an oasis, recreational space with a wide variety of spaces for the elderly in the middle of the post-Soviet residential neighborhood. It includes a lot of greenery not only in outdoor spaces but also within the interior, a glasshouse, planters, and green screen (as a space divider in the cafeteria area). Additionally, the center has different workspaces, lounge area, library, multipurpose hall and even a playroom for seniors to bring their grandkids, which helps to introduce multigenerational activities. In the experimental design stage, the collected information was used in combination with a different implementation of universal design to see which one is more suitable and needed for seniors. Such universal design aspects as a minimum change of levels, grab bars, a lot of natural light, wide hallways, double-action door, and others were applied to the design of a daycare center. Besides, it was crucial to minimize the level of discomfiture by creating an open plan where seniors will move around quickly and comfortably.
7. Overall, the results of this research project demonstrated the following findings as solutions to how the elderly population environment can be improved:
    - Simplicity in the spatial organization;
    - Provision of simple circulation and navigation both inside and outside of the building;
    - Consider that spaces will be accommodated by all types of users who may have a disability or not;
    - Create spaces that will help the elderly to maintain independence and have the ability to be active outside of their homes for as long as they would like;
    - Create a strong and impressive relationship between people and places. A sense of place is an important topic that can improve human-place relationships and sustain environmental quality;
    - Wheelchair accessible spaces including restrooms;
    - Provide privacy and common space for socializing;

- Use of age-appropriate dimensions not only in the interior design and furniture placement but also in the space division;
- Creation of diversity in spatial design to meet the needs of all users, in order to allow them to choose the appropriate one;
- Ensuring safety for elderly by minimizing hazards and level of impediments;
- Provision of natural lighting sources.

Nowadays, universal design became a trend in architecture; everyone tries to use it but not to its full potential. Unfortunately, the only layer of society that getting affected by a lack of knowledge (of universal design) is the elderly. Well-designed space encourages seniors to be more active, happy, and inclusive with society.

List of references

1. AARP. (2015). *Home fit Guide. Smart solutions for making your home comfortable, safe and a great fit. Publication of AARP Education & Outreach/Livable Communities.*
2. Aimi Hamraie. (2012). *Universal Design Research as a New Materialist Practice. Disability studies quarterly*, 32 (4), p. 5
3. Ann Heylighen, Matteo Bianchin. (2012). *How does inclusive design relate to good design? Designing as a deliberative enterprise*, p. 94
4. Anastasia Loukaitou-Sideris, Lené Levy-Storms, Lin Chen, and Madeline Brozen. (2016). *Parks for Aging Population, Needs and Preferences of Low-Income Seniors in Los Angeles*, p 2.
5. Anniken Huitfeldt, Magnhild Meltveit Kleppa,Erik Solheim, Liv Signe Navarsete & Heidi Grande Roys. (2009). *Action Plan. Norway universal designed by 2025. The Norwegian government's action plan for universal and increased accessibility 2009-2013*, pp.13-15
6. Amit Prasad, Megumi Kano, Paul Rosenberg, Stephanie Steels, Kendra Dagg, Jane Yao, Mizuki Sata, Atsuko Ito, Lotte van der Weijst, Saiya Sheth, Janet Chow and Sean Dalton; World Health Organization. (2015). *Measuring the age-friendliness of cities: a guide to using core indicators.*
7. AS/NZS 1428.4. (2002). *Design for access and mobility, Part 4: Tactile indicators*, pp. 10-12
8. Ashlee Clark Thompson. (2017). *IGuardStove Intelligent review*. Retrieved from: https://www.cnet.com/reviews/iguardstove-intelligent-review/ **(**accessed September 2018)
9. Alge Jankeviciene, Vytautas levandauskas, Algimantas Miskinis and Jonas Minkevicius. (1991). *Kauno Architektura. Publisher: Vilnius "Mokslas",* pp. 138-139
10. Azuolyno Parkas. Retrieved from: https://visit.kaunas.lt/index.php/lt/aplankykite/lankytinos-vietos/gamtos-objektai/azuolyno-parkas/ **(**accessed May 2019)
11. Anonyms (the Advocate). (2016). *Do colors influence a person with dementia?* Retrieved from: https://www.theadvocate.com/baton_rouge/entertainment_life/health_fitness/article_922b136a-84d5-11e6-8c00-fbc8ac72b472.html **(**accessed October 2018)
12. Departament of Justice. (2010). *ADA Standards for accessible design*, pp. 5-12
13. Designworkplan, Airport signage. Retrieved from: https://www.designworkplan.com/read/airport-signage-photo-inspiration **(**accessed October 2018)
14. CMG landscape architect (2014). *Competing designs revealed for presidio parklands project in san Francisco.* Retrieved from: https://www.designboom.com/architecture/presidio-parklands-project-snohetta-west-8-james-corner-san-francisco-09-05-2014/ **(**accessed October 2018)
15. Dietger Wissounig Architekten, ArchDaily. (2016). *Residential Care Home Andritz*. Retrieved from: https://www.archdaily.com/787044/residential-care-home-andritz-dietger-wissounig-architekten/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user (accessed October 2018)
16. Douglas E. Crews and Susan Zavotka. (2006). *Aging, disability and frailty: Implications for Universal Design, Journal of physiological anthropology*, pp. 113-117.

17. Esra Akan, Alper Unlu, Erincik Edgu. (2017). *11th International space syntax symposium: Social Interaction in Circulation spaces of elderly care institutions*, 3 – 7 July, Lisbon, Portugal: Instituto Superior Técnico, Departamento de Engenharia Civil.
18. Eurostat. (2018). *People in the EU – statistics on an aging society*. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=People_in_the_EU_-_statistics_on_an_aging_society (accessed November 2018)
19. Euroform. (2016). *Senior-friendly city planning*. Retrieved from: https://www.euroform-w.com/en/senior-friendly-city-planning/ (accessed December 2018)
20. Eiguliai eldership. (2018). Retrieved from: http://www.kaunas.lt/seniunijos/eiguliu-sen/ (accessed September 2019)
21. Finn Aslaksen, Steinar Bergh, Olav Rand Bringa, Edel Kristin Heggem. (1997). *Universal Design Planning and Design for All*, pp. 3 – 4
22. Gilcrest Manufacturing. (2018). *The Advantages of metal cladding*. Retrieved from: https://www.gilcrestmanufacturing.com/news/technical-news/advantages-metal-cladding-panels/ (accessed December 2019)
23. G.Z. Brown. (1985). Sun, Wind, and Light, architectural design strategies. Retrieved from: https://www.researchgate.net/publication/301625408_Sun_Wind_Light_architectural_design_strategies_3rd_edition (accessed October 2019)
24. Halime Demirkan. (2007, February 15). *Housing for the aging population*, pp. 33–38.
25. Harriet Baskas. (2016). *A short story of airport moving walkways*. Retrieved from: https://eu.usatoday.com/story/travel/flights/2016/09/28/airport-moving-walkways-history/91187032/ **(**accessed October 2018)
26. Howard Fletcher. (2006). *The principles of Inclusive design*, p. 16.
27. Jeffrey Steele (2020). *Architects forecast change for design in wake of COVID-19.* Retrieved from: https://www.forbes.com/sites/jeffsteele/2020/04/16/architects-forecast-change-for-design-in-wake-of-covid-19/#3809578e10ac **(**accessed May 2020)
28. Joan M. McGuire, Sally S. Scott and Stan F. Shaw. (2006). *Universal design and its applications in educational environments*, 27(3), pp 167 – 170
29. Jones, M. and Sanford, J. (1996). *People with mobility impairments in the United States today and in 2010. Assistive Technology*, 8(1), pp 43-53.
30. Kauno miesto bendrasis planas. (2011). *Esamos bukles analize*. Miesto aplinka, II tomas, pp. 13, 69, 74, 85-87. Retrieved from: http://kaunoplanas.lt/ **(**accessed April 2019)
31. Kauno miesto bendrasis planas. Retrieved from: http://www.kaunoplanas.lt/projektai (accessed October 2019)
32. Kauno Aleja. (2018). *Challenges of the Pope's visit to Kaunas: it is better not to go to the center next weekend.* Retrieved from: https://kaunoaleja.lt/popieziaus-vizito-issukiai-kaune-artejanti-savaitgali-i-centra-geriau-nevaziuoti/ **(**accessed October 2018)
33. Kaunas kindergarten "Sun". Retrieved from; https://www.kaunosaulute.lt (accessed October 2019)
34. Kauno panemunės socialinės globos namai. Retrieved from: http://kaunoseneliai.lt/apie-mus/ **(**accessed April 2019)
35. Kauno Parkai. Retrieved from: http://parkai.kaunas.lt/ **(**accessed May 2019)
36. Kartu Namia. (2018). Retrieved from: http://kartunamai.lt/test/ **(**accessed April 2019)

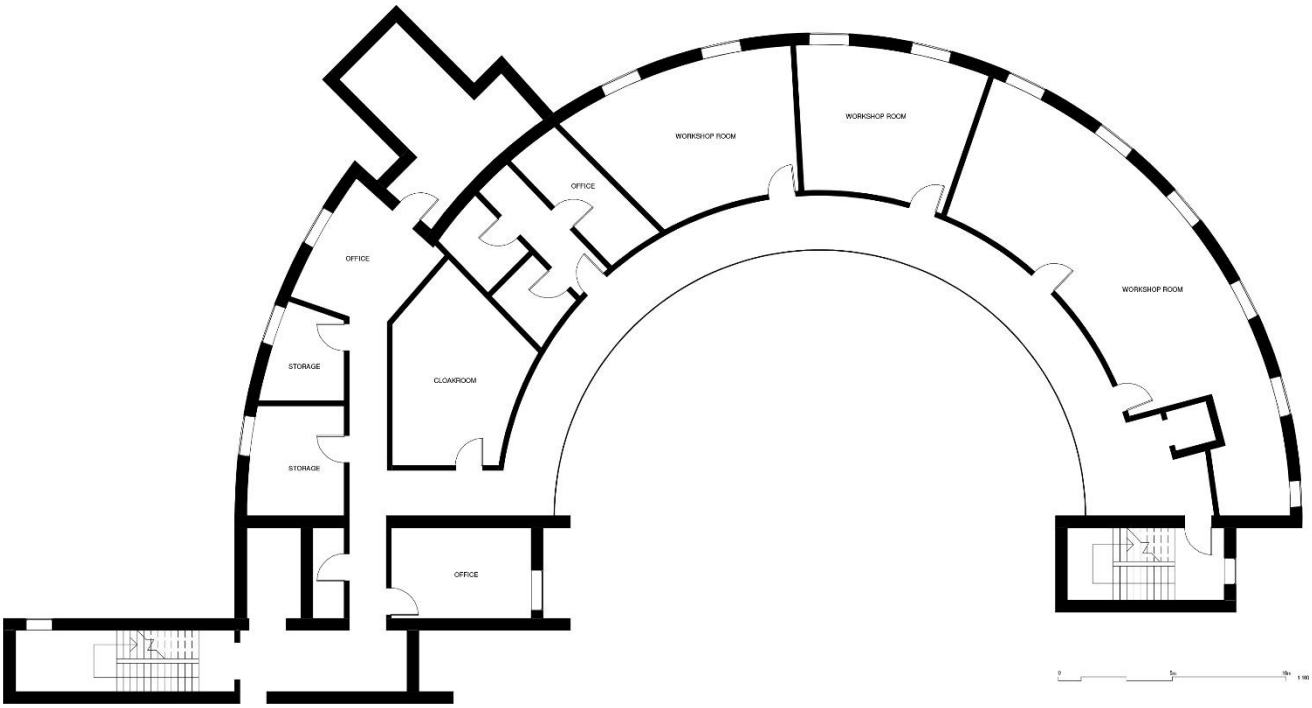
37. Kalniečių park. (2018). Retrieved from: http://parkai.kaunas.lt/kalnieciu-parkas/ **(**accessed May 2019)
38. Kee Safety. (2017-2020). *Products/Safety railing systems*. Retrieved from: https://www.keesafety.com/products/category/safety-railing-systems **(**accessed November 2018)
39. LEVS. *De Bouwmeester,Utrecht*. Retrieved from: https://www.levs.nl/projecten/#!de-bouwmeester-1 (accessed October 2018)
40. Laura Juozokaitė. (2011). *Kaunas. Dainava history and facts.* Retrieved from: https://www.delfi.lt/projektai/archive/kaunas-dainava-istorija-ir-faktai.d?id=52183681 (accessed September 2019)
41. Lee Harvey. (2012-2019). *Social Research Glossary, Quality Research International.* Retrieved from: http://www.qualityresearchinternational.com/socialresearch/methodologyofscientificresearchprogrammes.htm **(**accessed April 2019)
42. Meier + associés architects, ArchDaily. (2011). *Retirement Home.* Retrieved from: https://www.archdaily.com/156293/retirement-home-meier-associes-architectes/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user (accessed October 2018)
43. Michael A. Capuano & Camila Sainz De La Peña. (2015). *Accessible Design, past & present.* Retrieved from: https://kitchenofthefuture.wordpress.com/2015/05/09/accessible-kitchens-of-the-future/ **(**accessed October 2018)
44. Mike King. (2018). *Smart technology takes hold in retirement communities*. Retrieved from: https://www.nextavenue.org/smart-technology-retirement-communities/ (accessed December 2018)
45. Moyen M. Mustaquim. (2015). *A Study of Universal Design in Everyday Life of Elderly Adults, Procedia Computer Science* 67, pp. 57-66.
46. Natalia Pérez Liebergesell 1, Peter-Willem Vermeersch 1,2 and Ann Heylighen. (2018). *Designing from a Disabled Body: The Case of Architect Marta Bordas Eddy*, p. 6
47. NIH. (2016). *World's older population grows dramatically*; NIH-funded Census Bureau report offers details of global aging phenomenon. Retrieved from: https://www.nih.gov/news-events/news-releases/worlds-older-population-grows-dramatically **(**accessed November 2018)
48. NCU. (2008). *The center for Universal Design.* Retrieved from: https://projects.ncsu.edu/ncsu/design/cud/about_us/usronmace.htm **(**accessed September 2018)
49. Northshore. (2018). *Driveway rumble strip with antique finish*. Retrieved from: http://northshoreaggregate.com/project/driveway-rumble-strip-with-antique-finish/ **(**accessed September 2018)
50. Page\Park Architects, ArchDaily. (2018). *The Hawkhead Centre*. Retrieved from: https://www.archdaily.com/887435/the-hawkhead-centre-page-park-architects (accessed October 2018)
51. Phillip Mena. (2014). *LaMarque playground designed for scenior citizens*. Retrieved from: https://www.click2houston.com/news/lamarque-playground-designed-for-senior-citizens_2015112401500455 (accessed December 2018)

52. RK security solution. (2018). *Sensor sliding door*. Retrieved from: http://www.rksecuritysolution.com/sensor-sliding-door.aspx **(**accessed September 2018)
53. Sanjana Malhotra. (2015). *Architecture & Design for the disabled people.* Retrieved from: https://www.arch2o.com/architecture-design-disabled/ (accessed November 2018)
54. Sara Stevenson. (2015). *How to make senior friendly public spaces.* Retrieved from: https://www.aplaceformom.com/blog/6-8-15-senior-friendly-public-spaces/ (accessed December 2018)
55. Sasaki. (2014). *The John G and Phyllis W. Smale Riverfront Park, Cincinnati*. Retrieved from: http://www.sasaki.com/project/83/cincinnati-john-g-and-phyllis-w-smale-riverfront-park/ **(**accessed December 2018)
56. Shelley Little. (2014). *Freshome, How Architects Design for an Aging Population*. Retrieved from: https://freshome.com/inspiration/how-architects-design-for-an-aging-population/ **(**accessed October 2018)
57. SilverEco org. (2018). *2018 Aging report: Europe's population is getting older*. Retrieved from: http://www.silvereco.org/en/2018-aging-report-europes-population-is-getting-older/ **(**accessed November 2018)
58. SRAP Sedlak Rissland + Dürschinger Architekten, ArchDaily. (2018). *Retirement and Nursing Home Wilder Kaiser*. Retrieved from: https://www.archdaily.com/889737/retirement-and-nursing-home-wilder-kaiser-srap-sedlak-rissland-plus-durschinger-architekten/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user **(**accessed October 2018)
59. Story, Molly Follette; Mueller, James.L; Mace, Ronald L. (1998). *The universal design file: designing for people of all ages & abilities*, pp. 15-16, 34-83.
60. Steve Ongeri. (2009). *Housing Learning and Improvement*, pp. 3-5.
61. Syazwani Abdul Kadir & Mariam Jamaludin. (2013). *Universal Design as a Significant Component for Sustainable Life and Social Development*, p 184.
62. Saul McLeod. (2015). *Simply Psychology. Observation Methods.* Retrieved form: https://www.simplypsychology.org/observation.html **(**accessed April 2019)
63. Santakos Parkas. Retrieved form: https://visit.kaunas.lt/en/see-and-do/sights/nature/santakos-parkas/ **(**accessed May 2019)
64. Tara Bradley. (2018). *10 Ways to Improve an Elder's Quality of Life.* Retrieved from: https://www.kindlycare.com/10-ways-to-improve-an-elders-quality-of-life/ **(**accessed November 2018)
65. U.S. Department of Justice. (2014). *Civil Rights Division - Disability Rights Section.* Retrieved from: https://www.disabled-world.com/disability/discrimination/ada/ada-update.php **(**accessed November 2018)
66. Vienna. (1982, July 26 to August 6). *Vienna international plan of action on aging.* Vienna, Austria: United Nations New York. Retrieved from: http://www.un.org/en/events/elderabuse/pdf/vipaa.pdf **(**accessed October 2018)
67. Wadu Mesthrige Jayanthaa, Queena K. Qianb, Chan On Yia. (2018). *Applicability of 'Aging in Place' in redeveloped public rental housing estates in Hong Kong*, p. 4
68. Wolfgang F. E. Preiser, Korydon H. Smith,2011. *Universal Design Handbook, Second addition*, p. 35

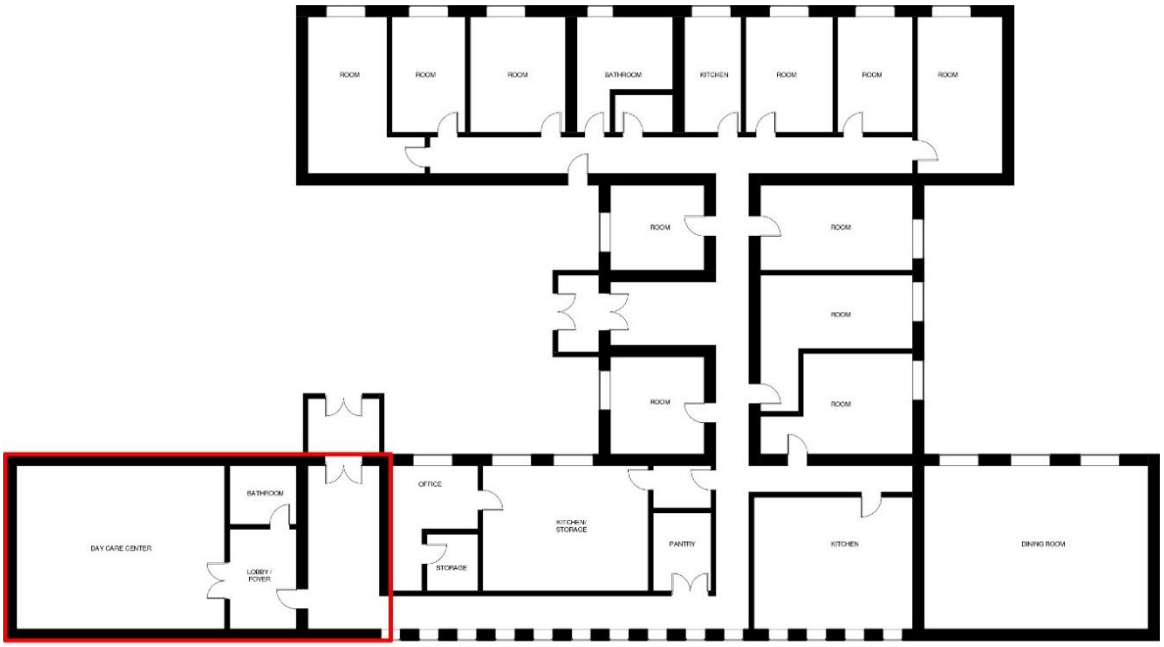
69. Weber Thompson. (2013). *Site Analysis: using it to inform site design.* WSU LID Technical workshop, May 21 2013
70. Zaliakalnis eldership. (2015). Retrieved from: http://www.kaunas.lt/administracija/struktura-ir-kontaktai/seniunijos/zaliakalnio-seniunija/ (accessed September 2019)
71. Yolanda Williams. (2017). *Population pyramids.* Retrieved from: https://study.com/academy/lesson/population-pyramids-definition-types-stages.html#lesson (accessed October 2019)

Appendix

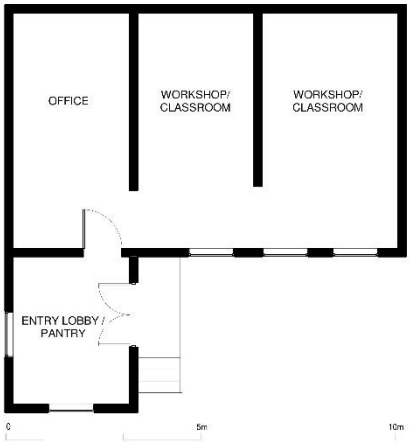
Appendix 1. Kaunas Panemunė retirement home, 3d level floor plan – Daycare center.



Appendix 2. Kartu Namai – Ground floor plan, where daycare center marked with red.

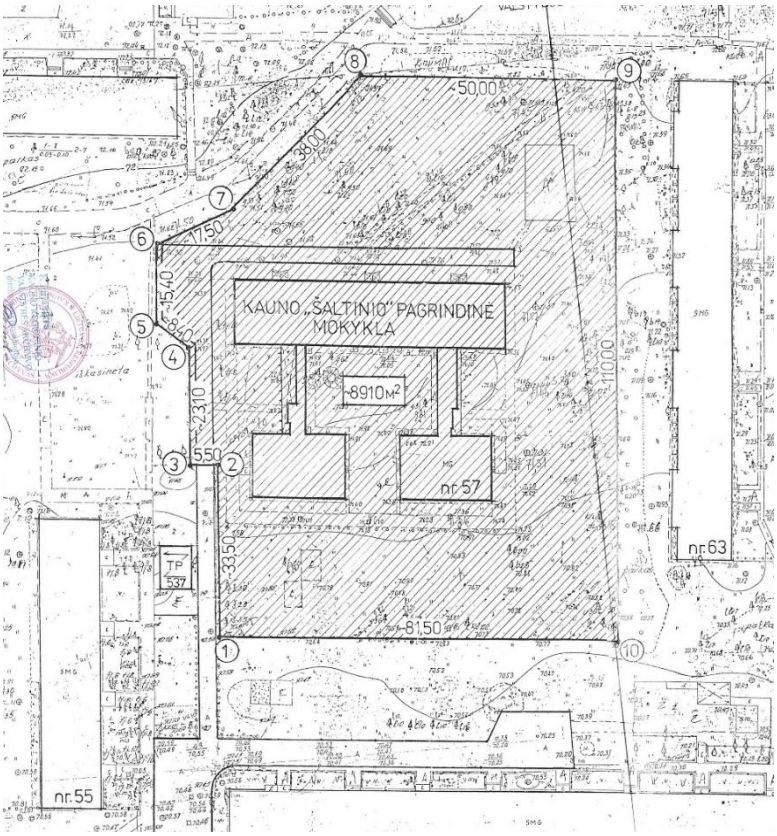


Appendix 3. Senjoru dienos centras Keturlapis Dobilas floor plan.



Appendix 4. Atgavia daycare center floor plan.

Appendix 5. Site A. Map from 1997 (https://map.tpdr.lt/tpdrgis/index.jsp?action=tpdrPortal).



Appendix 6. Questionnaire.

1. Gender:
    a. Male
    b. Female
2. Age:
    a. 60-70
    b. 70-80
    c. 80-90
    d. Above 90
3. Marital status
    a. Single
    b. Married
    c. Widowed
    d. Other: _____
4. Living situation
    a. With family (wife/husband, kids, grandkids etc.)
    b. Living alone
    c. In retirement institution
    d. Other: _____
5. Do you have any disabilities?
    a. Bad memory
    b. Decreased vision
    c. Decreased hearing
    d. Others: _____
6. Activities interested in:
    a. Sport activities
    b. Social activities
    c. Crafts
    d. Walking
    e. Others: _____

7. How often do you use public transport?
    a. Daily
    b. Once or few times in a week
    c. Once or few times in a month
    d. Very rarely
    e. Never
8. Do you use any new technology?
    a. Not really, I find it difficult
    b. Not really, I do not need it
    c. Sometimes, to be able to contact with my family and friends
    d. Yes, on a daily basis
    e. Others: _____
9. What colors do you prefer? Does it make you happier?
    a. Bright colors (red, yellow, blue)
    b. Pastel colors (beige, light blue, lavender, etc.)
    c. Dark colors (brown, black, dark blue, etc.)
    d. Earth colors (brown and shades of gray)
    e. Green colors and its shades
    f. Other: _____
10. What you prefer more:
    a. Natural lighting, daylight
    b. Muted natural lighting
    c. Artificial lighting
    d. Artificial lighting that I can adjust
    e. Artificial muted lighting
    f. Less lighting
    g. Other: _____
11. Do you require additional help in day to day activities?
    a. Yes, simple task quite hard for me
    b. No, I am pretty independent
    c. Sometimes
    d. Other: _____
12. What makes you happy?

13. Do you pay attention to signages?
    a. Yes, they help a lot
    b. Not often, as it hard to read them or see
    c. No, I do not use them
    d. There is no signages in my environment
    e. Other: _____
14. If you living alone, what kind of everyday struggles you face:
15. Which institutions, facilities or infrastructure you use the most?
    a. Medical (nursery, doctor, etc.)
    b. Parks
    c. Sport equipment in the parks
    d. Culture centers
    e. Work studios (craft classes, development classes and other social activities)
    f. Daycare centers
    g. Others: _____
16. How often do you visit daycare/ community center?
    a. Daily
    b. Weekly
    c. Sometimes
    d. Never
    e. There is no daycare/ community center near by
    f. Others: _____
17. Would you visit a community or daycare center if it was easily accessible? (choose one option):
    a. Yes, I visit every day
    b. Yes, I visit once a week
    c. I visit occasionally
    d. I only visit the community center
    e. I only visit the daycare center
    f. No, I wouldn't go, I don't need it
    g. Other: _____

18. At what distance should your community center or daycare center be located?
    a. 10 – 15 min walking distance
    b. Within few minutes by public transport
    c. Easy to reach by car
    d. Others: _____
19. What would you like to see in community center or daycare center?
    a. Open and bright interior spaces
    b. Lots of bright colors
    c. Pastel, calm colors
    d. Many different activities
    e. Sport equipment
    f. Garden with resting places, plants & water bodies
    g. Community garden
    h. Other: _____
20. What equipment would you like to see in the daycare/ community center?
    a. Grab bars
    b. Elevator
    c. Large switch buttons
    d. Wide hallways
    e. Automatic doors
    f. Clear presented building plan with links
    g. Well visible signs and links in spaces
    h. Non slippery floor
    i. Wide doorways
    j. Possibility of accessing space on a wheelchair
    k. Spaces that are easy to navigate
    l. Others:

Appendix 7. Exterior view of the proposed daycare center.

Main entrance of the daycare center

Pathway leading to the secondary entrance from south side of the plot

Secondary entrance

Outdoor lounge area

Appendix 8. Interior view of the proposed daycare center.

Indoor garden

Lounge area

Cafeteria area

Appendix 9. Fragment of the section 1-1 showing the details of roof trusses as well as the roof/wall/floor connection.