CITY LIVING ROOMS

Varna Library, Bulgaria

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ABSTRACT

This report is the product of the 4th master semester project focusing on sustainable architecture and tectonics. The outline of the project is the competition for Varna Public Library in Bulgaria. Varna Library Building aims to combine traditional function of library- storage of digital and physical resources, with a social function of meeting and working. With a strong focus on social sustainability, this project attempts to create a new attractive alternative for gaining knowledge and spending free time for all members of community and incorporate additional functions into the library program.

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INTRODUCTION

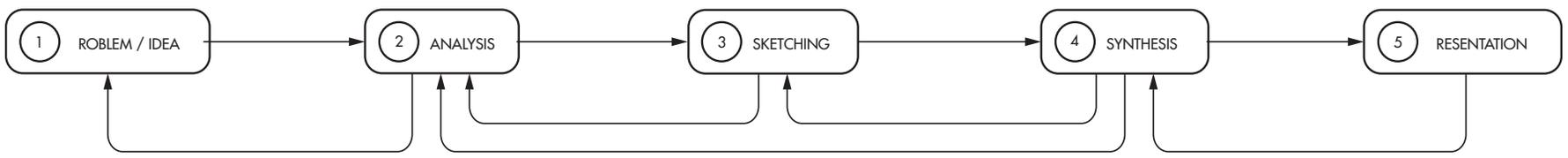
The focus of our master thesis project is aimed towards the design of a new sustainable library building in the center of Varna, Bulgaria. Besides the architectural focus, there is a technical focus on creating a library building with good indoor environment. However, sustainability is more than a concern for resources and has to be viewed as a holistic concept between three aspects" social, environmental and economic ((DAC, 2014). Our project focuses on social aspect of sustainability and aims to answer a question about library role in Bulgarian community.
We aim for a designing a tectonic structure that express the idea of spatial flexibility and creates structural logic.

Our goal was to design a building which shows contemporary attitude towards librarian ship and books which provides a variety of functions in order to become an attractive space in the city structure. (GEHL,J. (2008) Life between Buildings:Using Public Space. Danish Architecture Press) "The institution of the traditional library should no longer be defined as a free information store but as a vital public space of encounter in the city." (BOCK, I.KOOLHAAS, R.(2015) Six Canonical Projects by rem Koolhaas:Essays on the History of Ideas. Jovis. p 263).

METHODOLOGY

This project, new Varna Library proposal, is designed by applying the integrated design method described by Mary – Ann Knudstrup (Knudstrup, 2005). The main concept of this integrated method is to combine an architectural and an engineering approach towards the design of the building. Integrated design process is an essential feature of a problem based learning. The whole process consists of non linear stages, which are: problem, analysis, sketching, synthesis and presentation.
First phase is problem or idea, the main problem is addressed and defined. In a preceding phase of analysis all the information about the site, users, climate etc. is gathered and registered. Information and knowledge collected during analysis lead to a distinct vision for a design and parameters, that will be used in the following phases of the process. Sketching phase is characterized by a variety of technical and design ideas, that are examined and many experimentations, simulations are carried out, to specify the final solution through narrowing down design parameters. Next phase which is synthesis of all the ideas derived from sketching phase are worked on detailed and consolidated in one clear and consistent project concept.

The final solution and expression is a logical result of improvements and calculations which optimized the first idea deriving from the analysis and sketching phases. The final phase- presentation concludes the design and it is presented in graphical materials, technical drawings, render, physical models, etc.
This process enables to go back and forth one phase to another, but in the same time it assures that the final solution is entirely integrated by compiling knowledge from diverse design stages in repeated process. In the following project the integrated design process was used and the relevant material is presented.



THEME ANALYSIS

History of libraries
Why do we need libraries?
Sustainability
Tectonics
Public spaces in Bulgaria
Library users and conditions in Varna
Positive effects of indoor plants
Case study: Sendai Mediatheque
Case study: Birmingham library
Conclusion

HISTORY OF LIBRARIES

Libraries have always played an important role in the development of human intelligence and culture. For centuries it has been a place for storing knowledge, experience and imagination in a written form.
In the first libraries around 2600 BC in Mesopotamia earliest forms of writing – clay tablets and cuneiform script were stored. There is also evidence of libraries in ancient Egypt and Babylon which consisted of correspondence, inventories and trade documents as well as written myths. First private libraries appeared in classical Greece around 500 BC, when books became a symbol of status which was also associated with literacy.

During the period of Roman Empire the number of public libraries in the region grew. Later after spread and of Christianity in Europe the libraries were overtaken by church and became even more extensive centers of thought, education and religion. In the libraries ran by monks most books were chained to the shelves (bookpresses) because of the great value although the libraries still loaned them if equal value deposit was provided in exchange. At that time typical book shelf organization system, also used today, appeared. Bookpresses were put on top of each other and orientated perpendicular to the walls in rows to increase the daylight in the room. Unfortunately, those libraries were only available for selected people from the church and the royalties.

In the renaissance books became more accessible because of the invention of a printed book. Humanists started establishing their own libraries around which their patrons and scholars would gather. Later during the enlightenment the golden age of libraries began and most of the world famous libraries were established (British Library, London, UK; Saint Genevieve Lib19rary, Paris, France). Also a new type of library emerged – national library. "This new institution was the first of a new kind of museum – national, belonging to neither church nor king, freely open to the public and aiming to collect everything." (DUNTON, L. (1896). *The World and Its People*. Silver, Burdett. p. 38.)

In the XIX century new public libraries started emerging in Europe. Also they became more divided according to the function (national libraries, science libraries, children libraries, reference libraries etc.). Smaller and bigger towns in Europe and North America started opening public loan libraries, as a result the majority of population started having access to books.

In the XX century the architecture of the libraries started focusing more on the interior spaces and the architects put a greater emphasis on daylight in the rooms and readers comfort. In the XIX century and earlier the function of the libraries was more static for storing books and in the begging of the XX century it changed dramatically. Libraries became more focused on circulation and accessibility of books, which was directly expressed through the design. The aisles between the shelves became wider, shelves lower, the skylights were introduces to provide more daylight. (DICKSON, P. (1986), *The Library in America: A Celebration in Words and Pictures,* Facts On File Publications, New York.).
In the second half of the XX century another shift in library architecture and planning happened. Libraries started being designed including more functions than just book storage and reading rooms. New functions like exhibition spaces, rooms for cultural events, restaurants and cafeterias were added to new libraries. Spaces become easily transformable and flexible, suitable for readying, studying, working in groups, collaborations etc. (WIGGINS, G (1997) *Louis I. Kahn The library at Phillips Exeter academy*, Wiley & Sons, Incorporated, John)

In the begging of the XXI century rapid development of technology changed the way libraries were organized and types of information they stored dramatically. Most of information nowadays is digitalized therefor new types of libraries (hybrid, digital, virtual) emerge. In digital and virtual libraries all information recourses are in digital form and no printed media is stored, it can be accessed from anywhere and a physical aspect of printed books storage disappears. Many argues that this is the future of libraries and that they will not be needed in a present form anymore. All information will be digitalized and we will be able to access it virtually. (VERHEUL, I. (2010) *Digital library futures: User perspectives and strategies,* IFLA Publications

Fig.1.1

The Long Room, an early 18th century university library in Trinity College, Dublin, Ireland.

Fig.1.2

Medieval bookpress. The books are chained to shelves in order to avoid theft.

WHY DO WE NEED LIBRARIES?

• HERITAGE

Books in a written form are valuable, because they are a source of collective knowledge and wisdom of our culture and have to be preserved for future generations.

• LITERACY PROMOTION

"We believe that libraries are uniquely situated to promote literacy and reading. It is a part oft heir mission." (IFLA/UNESCO Public Library Manifesto, 1994).

• POSITIVE IMPACT OF READING

Reading books in a paper form affects people positively. Research from the Stavanger University, Norway show that reading texts on paper instead of computer increases text comprehension.
(ACADEMIA (2013) *Mangen, A., Walgermo, B., & Brønnick, K. (2013). Reading linear texts on paper versus computer screen: Effects on reading comprehension,* available at: https://www.academia.edu/3055159/Mangen_A._Walgermo_B._and_Br%C3%B8nnick_K._2013_._Reading_linear_texts_on_paper_versus_computer_screen_Effects_on_reading_comprehension)

• INSPIRATION

Library architecture and atmosphere created by architecture inspire people. By creating spaces for learning we can influence people to be more productive and creative.

• EQUAL ACCESS TO INFORMATION

It provides equal access to information in general, because according to statistics compared to EU countries Bulgarian people have one of the poorest accesses to the Internet and public information as well as lowest computer literacy skills. (AGE PLATFORM (2013) *Media literacy, digital exclusion and older people* http://www.age-platform.eu/images/stories/ENpdf_AGE-media-A4-final-2.pdf

• MEETING AND WORKING PLACE

"The library can come to be, however, a good meeting place: public librarians… have responsibility to offer a physical as well as a virtual meeting place. Both types of space are important and must be nurtured".(MARCUM, D. B. (1998) *Redefining community through the public library*, p.204)

SUSTAINABILITY

The term "Sustainable Development" was introduced in 1987 by Word Commission on Environment and Development in the report titled Our Common Future. It states that:
"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT(1987), *Our Common Future,* pp. 4, Oxford University Press, New York), Sustainability represents a balance that accommodates human needs without diminishing the health and productivity of natural systems. (MENDLER, S., (2006). *The HOK guidebook to sustainable design*. Hoboken, N.J.: J. Wiley.) Sustainability requires simultaneous progress in three main dimensions environmental, social and economical. In order to design truly sustainable building these three aspects should be balanced in equal harmony.

Environmental dimension of sustainability can be expressed as the ability to maintain the qualities that are appreciated (valued) in the physical environment. (SUTTON, P., 2004. *A perspective on environmental sustainability. Paper on the Victorian Commissioner for Environmental Sustainability*) In building design it focus on reducing waste , effluent generation and emissions to the environment , reducing negative impact on human health, using the raw renewable materials and elimination of toxic substances. Economic Sustainability means creation of the new markets and opportunities for growth and sales in the area, reduction of costs through efficiency improvements and reducing energy and material inputs over the entire life cycle. Using different passive and active strategies in order to reduce energy demand of the building and increase ability to generate its own from pure, renewable sources is crucial in sustainable approach. The social factor of the Sustainability focuses on ensuring a strong, healthy and just society. The goal is to meet the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, creating equal opportunity for all. (SULLIVAN, L. (2012). *The RIBA Guide to Sustainability in Practice*. [online] Royal Institute of British Architects, p.7 Available at: https://www.architecture.com/Files/RIBAProfessionalServices/RIBAGuidetoSustainabilityinPractice.pdf [Accessed 5 Feb. 2016].) In Sustainability the important issue is adaptability. Sustainable Architecture must provide flexible solutions due to progressive technological development and consequently change of human behaviors and their expectation towards the space and function. Designing flexible structures is sustainable because when circumstances changes the design may be easily functionally readjusted without high financial consequences. (FOSTER, N. (2003). *Architecture and Sustainability. Foster + Partners*. Available at: http://www.fosterandpartners.com/media/546486/essay13.pdf [Accessed 5 Feb. 2016].)

SUSTAINABILITY IN LIBRARIES

Preservation of an environment should be a natural and compatible objective for a library as an institution which aims for resource sharing and enabling conservation. (DEWE, M. (2006). *Planning public library buildings.* Aldershot, England: Ashgate Pub., p.155.) There are many Sustainability aspects of library architecture that must be taken into consideration in order to design functional, efficient and safe building. The Library building must provide good working conditions what is strictly related to the indoor climate in the building. For instance the indoor temperature affects human performance at work. (SEPPÄNEN, O., FISK, W. AND LEI, Q. (2006). *Effect of Temperature on Task Performance in Offfice Environment*. 1st ed. [ebook] Lawrence Berkeley National Laboratory. Available at: https://indoor.lbl.gov/sites/all/files/lbnl-60946.pdf [Accessed 8 Feb. 2016].) Meeting requirements for lightning, acoustics, humidity and temperature well as using low-impact building materials are crucial as for creating healthy and pleasant environment in the building assuring avoidance of sick building syndrome. "Sick building syndrome is a situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified." (Indoor Air Facts No. 4 Sick Building Syndrome. (1991). 1st ed. United States Environmental Protection Agency.) As libraries play also important role in local communities. Gathering people, engaging them in social activities and providing the conditions for sharing the knowledge and discussion strengthen social cohesion and inclusion. Library should provide facilities for different age groups and be easily accessible for disabled people what is in the spirit of social sustainability which emphasize the importance of creating equal opportunities for all people. Due to technological development especially related to electronic information resources and the way to store them, library should be designed with the focus on adaptability. Flexibility assures meeting the needs of future generations regarding function with minimizing prospective financial input.

TECTONICS

Tectonic theory is one of the prime focus in the development of the architectural field- it refers to fundamental matter of how to coalesce aesthetics and technology.(SEMPER, G. (1989). *The four elements of architecture and other writing*s. Cambridge [England]: Cambridge University Press.) In order to achieve that the architectural quality should be considered in terms of method and not as a question of style. (BÖTTICHER, K. 1852, *The tectonics of the Hellenes,* Postdam) According to Frampton a term tectonics means a poetics of construction. He claims that the build in the first place is a construction, that develops into an abstract discussion on surfaces, volumes and plane. He also states that architecture is related to the building skin what accentuate the value of representational dimension. Considering architecture as a multifaceted assemblage. (FRAMPTON, K: *Studies in tectonic culture:The poetics of construction in nineteenth and twentieth century architecture.* John Cava (E.). Cambridge: MIT Press, 1995.) The importance of tectonic expression which is inseparable relation between artistic expression and constructive logic is as relevant and should be equally emphasized as the space and function concept. ((SEKLER, E. *Structure, construction, tectonics. In: KEPES, Gyorgy (Org.). Structure in art and in science.* NovaYork: George Braziller, 1965.)

Reconsideration of the character of tectonic theory seems to be essential when approaching issue of present everyday situation of the build environment. As we face the increasing floor space in public buildings that is dealt with as performative structural frameworks as a substitute for qualitative spaces for contemplation and habitation.(NORDIC JOURNAL OF ARCHITECTURAL RESEARCH, Vol. 27, No. 1 (2015): Everyday tectonics?) Tectonic as a concept is also related to Sustainable Architecture. These two fields complement each other and understanding the relation between them is a crucial while aiming for holistic approach towards architecture. Integration of these aspects requires rethinking the definition of tectonics. The definition of tectonic thinking introduced in research project - Towards a tectonic sustainable building practice, that is presently (2010- 2014) executed in collaboration between; The Royal Danish Academy of Fine Arts – School of Architecture, Aarhus School of Architecture, and The Danish Building Research Institute portray it as "a central attention towards the nature, the properties, and the application of building materials (construction) and how this attention forms a creative force in building constructions, structural features and architectural design (construing) – helps to identify and refine technology transfer in contemporary industrialized building construction'. Tectonic view takes into consideration material aspects as "an existing phenomenon on the human living and existence". (Frampton, Kenneth: Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture. John Cava (E.). Cambridge: MIT Press, 1995) Material relevance is inevitably linked to sustainable architecture. Since environmental sustainability focuses primarily on reduction of energy consumption and CO2 emission the choice of materials the and construction is crucial. So tectonic work influence sustainable solutions directly and requires thoughtful approach towards resources. Tectonic architecture based itself on materiality and structural form in order to achieve the performative architecture also promotes the thermal comfort, natural resources preservation as well as reduction of energy consumption. (PANTOJA, M., (2014). T*owards the performative architecture through the tectonic vision. Journal of Architecture and Engineering,* Vol. 1, p.http://architecture.scientific-journal.com/.)

TECTONICS IN LIBRARIES

Library building is a structural challenge due to its mixed-use program which requires functional flexibility. Public spaces should be easily adjustable and create many possibilities to furnish the space to meet needs of groups or individuals. There is also focus on adaptability to the future demands. Structure of the building should express idea of spatial flexibility, where everybody can shape the surroundings according to individual needs and also show the constructive logic. Tectonic approach include designing a structure that enables utilization of natural light creating conductive conditions and atmosphere to work, read and socialize. Book weight and shelves should be taken into account when thinking about the structure. As a main goal of library is to collect all the scattered physical and digital resources, the structure should reflect this concept. Integration of tectonics and sustainability is crucial when aiming for a designing a library for diverse users which provides quality working space as well as good environment to preserve books and promote them as a source of information and cultural heritage.

PUBLIC SPACES IN BULGARIA

Bulgaria due to its warm climate with long summer creates perfect conditions for people to spend their time outdoors. Therefor, there are many public spaces and parks that provide this opportunity. During our study trip we have investigated public spaces in Sofia and Varna but also how people occupy the space and what are the need of current citizens. Our observations resulted in many relevant for our project conclusions.

Bulgarians spend a lot of time in the parks and green spaces. It is a part of their culture, therefore people from different age groups occupy the space. Public parks and green spaces are frequently visited by families with children, so almost every park has at least one playground which is always full. There are a lot of playgrounds from Soviet era which are made of concrete and steel- materials which are perceived as cold and uninviting as well as dangerous. Public spaces are mainly organized around important monuments, statues and memorials. Elderly willingly spend their time among greenery and they use public space to gather and enjoy time during different activities- chess, playing music or talking. There is a lack of spaces adjusted to young people needs. Skate ramps, seats are in bad conditions. Public spaces do not offer variety of activities what is a disadvantage. There is a lot of greenery and park arrangements with flowers. In our opinion there is not enough public spaces that offer engaging activities. There are a lot of greenery that could be utilized better by designing an urban furniture or renovating old ones.

Fig.1.3, 4, 5

Green public spaces in Varna and Sofia. Green public spaces attract people to gather and engage in different activities together.

Fig.1.5, 6

In most public spaces the whole potential of the space is not used. Playgrounds are ofter old and dangerous in a dangerous condition.

LIBRARY USERS AND CONDITIONS IN VARNA

Varna Library is going to be the first modern library building in Bulgaria. Bulgarian libraries are mainly located in post Soviet buildings or they are a part of university buildings. One of the most important goals of Varna Library is to gather the books and sources scattered around Varna. According to Martin Hristov (the chairman of Bulgarian chamber of architects) the absence of main library building creates a problem- library does not fulfill the social function in the city what makes it a place of obtaining a source of information but not a pleasant space to spend free time. During our study trip to Varna we had a chance to interview students from University of Economics. The information we gathered confirmed that young people do not see library as an alternative for spending their time but rather as a place visited when they need specialist literature. Libraries in Varna are not easily accessible and due to control in the entrance and difficulties in obtaining an access to certain sections people do not perceive it as a friendly and inviting space. While visiting the library located in Varna Municipality building we could have seen that spaces do not offer good working conditions. Poor natural light conditions, narrow corridors, small hermetic spaces without sufficient ventilation and lack of computing equipment makes learning process less efficient. These conditions contribute to general lack of popularity of library spaces and creates a situation when a visit in library becomes unpleasant obligation Environment does not offer additional functions, attractive public spaces that are better than working conditions at home. Therefore, it is important to meet users needs but also by the design and hybrid function of the building- change their definition of Library and make it attractive alternative for spending a free time and socializing.

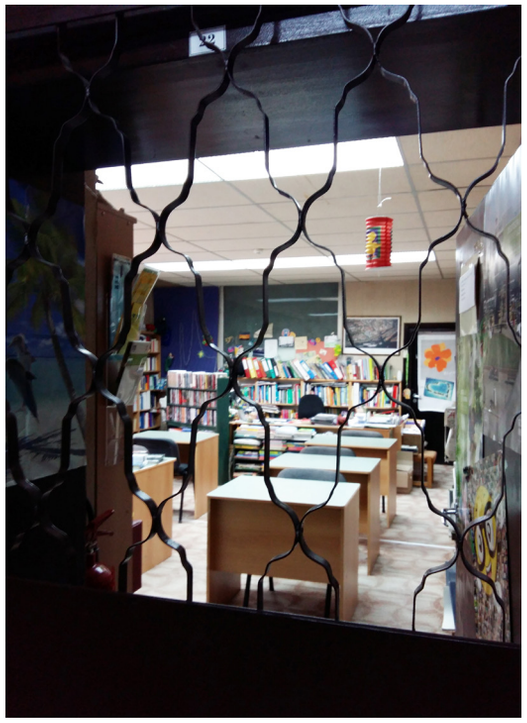


Fig.1.7, 8, 9

Varna Public library. The conditions in the library are unsatisfactory. The spaces are small and dark, not adapted to users' needs.

Fig.1.10

Varna University of Economics library is designed for students. It is small but filled with daylight.

POSITIVE EFFECTS OF INDOOR PLANTS

Introducing greenery in the building improves indoor environment and affects users of the building. Plants in the building may positively influence users experience and indoor climate.

• CARBON DIOXIDE REDUCTION

Elevated levels of carbon dioxide negatively affect humans productivity and ability to concentrate. During photosynthesis process plants extract CO_2 and exchange it with fresh oxygen. The effect is accelerated when plants have more access to natural light.

• INDOOR AIR PURIFICATION

Indoor plants filter the air in the building and they have the ability to remove compounds as benzene and hexane in the range of 50%-70% of a total volatile organic compounds. For PM10 , Bulgaria is the top polluted European country with 77 µg/m3 on the daily mean concentration when EU limit is 50 50 µg/m3. (EEA (2014). Air quality in Europe 2014 report)

• LOWERING STRESS

Studies suggest that presence of the plants has stress-reducing effects on people in the room what also causes an increase of productivity. (Dijkstra, K., Pieterse, M. and Pruyn, A. (2008). Stress-reducing effects of indoor plants in the built healthcare environment: the mediating role of perceived attractiveness. Preventive Medicine, 47(3), pp.279-283.)

• INSPIRING CREATIVITY

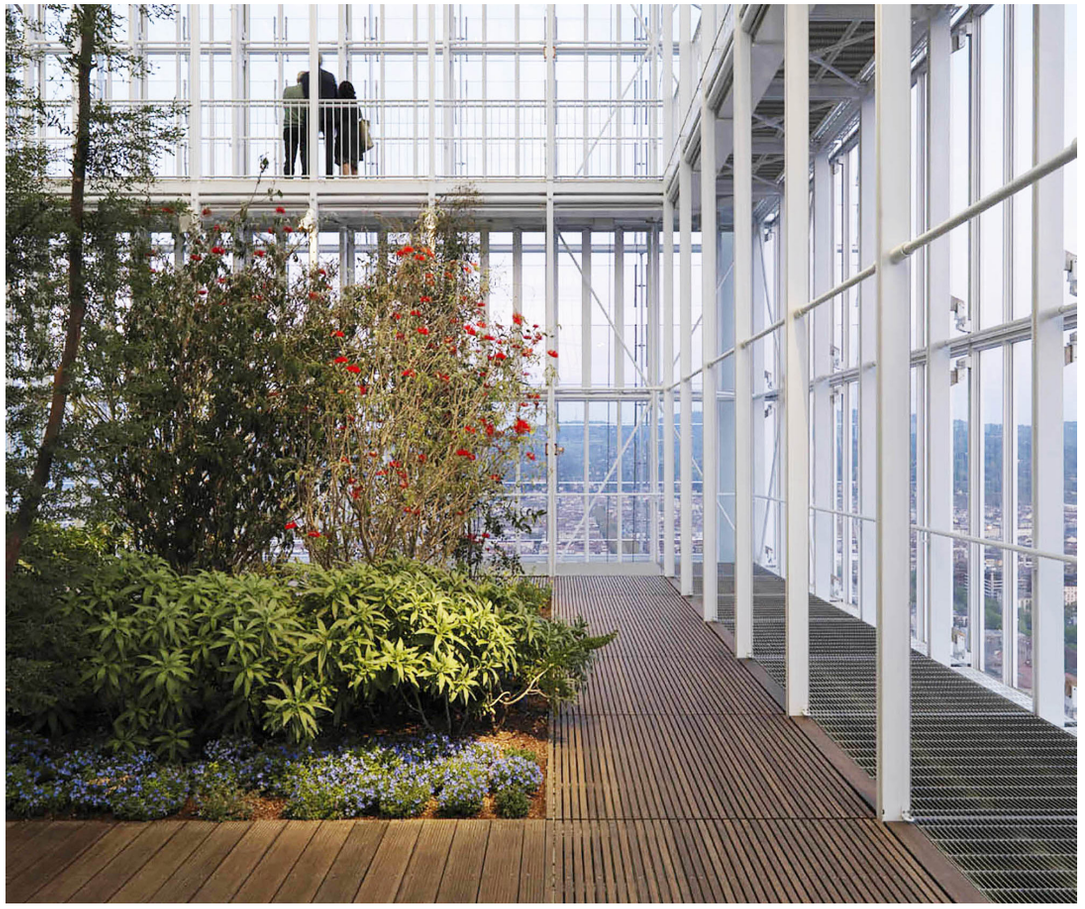
According to real life office studies, greenery in the working space affects intellectual performance of users. It is proven that people generate more innovative ideas and their problem solving skills increase while working in the space with plants or flowers.
Library environment should affect users in positive way and make learning process easier and more pleasant. The efefct of that is atmosphere enhancing creativity and concentration as well as good indoor air quality. Indoor greenery helps to fulfill these needs and is a sustainable natural solution. (SHIBATA, S. and SUZUKI, N. (2004). Effects of an indoor plant on creative task performance and mood. Scandinavian Journal of Psychology, 45(5), pp.373-381.)

> Fig.1.11

Visual connection with the plans in the building creates many positive effect on users. Hiroshi Senju Museum in Karuizawa (Japan).

> Fig.1.12

Intesa Sanpaolo Office Building in Turin (Italy) by Renzo Piano Architects. Light structure of the building emphasizes special mood provided by the plants..



CASE STUDY

CONCEPT

Sendai Mediatheque in Japan was designed by Toyo Ito and Associates Architects, who won the architectural competition in 1995. Ito's proposal is a mixed-use public facility combining library and art gallery functions. The building aims to express the idea of flexibility, fluidity and manifest sense of freedom. In order to achieve that Toyo Ito decided to remove architectural partitions which define the space and dictate how to occupy it. Reflectivity and transparency of materials gives the space 'fluid' spatial effect. This spatial and functional ideas are held by the structural solutions. The structure consists of three elements- 'plate', 'tube' and 'skin'. The different diameter tubular columns composed of steel pipes support floor slab plates covered with the skin with different architectural expression on five exposed sides. The building is aiming to embrace new media and computing by integrating this element into the modern urban environment ."In terms of architectural genre the Sendai Mediatheque was a pioneering example of attempts to use new notions of 'media' as an architectural concept." (Akira Suzuki. Smt 2.0 – Upgrading the Sendai Mediatheque to Produce an Archive for the Folksonomy Era. VOLUME, 15, (2008): 66-69.)

TECTONICS/ SUSTAINABILITY

Toyo Ito decided through the structure emphasize the concept of the blank space, vacuum nothingness taking an inspiration from Japanese concept of Ma- "the space between two structural parts." (Iimura, T. (2002). Note for MA: Space/Time in the Garden of Ryoan-Ji. Millennium Film Journal, 38 (Spring 2002): Winds From the East) . The structural idea of the building is expressing and embodying this concept which also enhance flexibility and adaptability of the design.
In sustainable manner Sendai Mediatheque aims for leaving a space for future users and functions that may arise. The 13 tubular steel-tube truss construction columns create transparent shafts in the building which accommodate the vertical circulation of air, water, electricity, light and people within the building. They assure rigidity and structural integrity. There is egalitarian relation between the floors- it is like 7 separate buildings piled one on top of the other. This relation is also in floor plan designed for each function. The furnishing makes a plan- the curves half walls, alignment of shelves, the leaf clover shaped seating. This arrangement helps disabled to shift around without any inconveniences. There are yellow lines on the floors helping to guide the once with limited sight. (Multimedia Library of Sendai by Toyo Ito. (2016). [video] Japan: Richard Copans.) Enhancing social equality through the concept of 'barrier-free" space makes a building put an emphasis on social sustainability. Due to open floor plan and structure applied, the ground floor is open to the street what makes it an integrated part of public space and enhance accessibility as well as acts as a source of natural air and light. The interaction between outside and inside is also through the southern transparent wall-free facade. This double skin facade acts as buffer zone against solar gains and also as an acoustic barrier. Due to occurring earthquakes structure is a seismic and was designed with help of structural analysis by computer simulation for the technological verification. Sendai Mediatheque express structural logic as well as poetics of the structure in relation to function and space what makes it a relevant exemplification of Tectonics. "Like trees in a forest glade the structure the scene in artificial nature, they polarize the space creating places in the middle of the shelving or wide circular areas for reading. These are supports that allow people and furniture to redefine space." (Multimedia Library of Sendai by Toyo Ito. (2016). [video] Japan: Richard Copans.)
Not only double-skin of the building makes a building sustainable. There are variety of strategies applied to increase it's efficiency. The tubes of the columns are used as a ventilation shafts pulling the natural air from the top to the bottom using the same principle as wind catcher. In the ground floor facade is articulated in eight large panels which can completely withdraw into itself providing natural ventilation especially during summer. (Multimedia Library of Sendai by Toyo Ito. (2016). [video] Japan: Richard Copans.)
The building is mostly ventilated naturally due to effective systems, very little mechanical ventilation is used. The natural light is introduced to the building through the facade and also dispersed through the hollow tubes. It is diffused into the inside spaces on each of the floor by means of prisms and lenses. Positive utilization of the natural light not only crucial in terms of energy efficiency and indoor climate but also in terms of atmosphere and working conditions in library. Program of the building is distributed in the way to locate the administrative functions, restrooms and offices are against northern stainless steel panels facade where natural light is not highly desired what prevents the building from overheating. (Coulter, C. (2004). Sendai Mediatheque. 1st ed. [PDF] California: University of Southern California School of Architecture, p.5. Available at: http://www-bcf.usc.edu/~kcoleman/Precedents/ALL%20PDFs/Ito_SendaiMediatheque.pdf [Accessed 18 Feb. 2016].)
The "open square" multi-purpose event venue and cafe on the ground floor enhance better usage of the space through the whole day by prolonging the opening hours until 10 p.m. what activates the area.

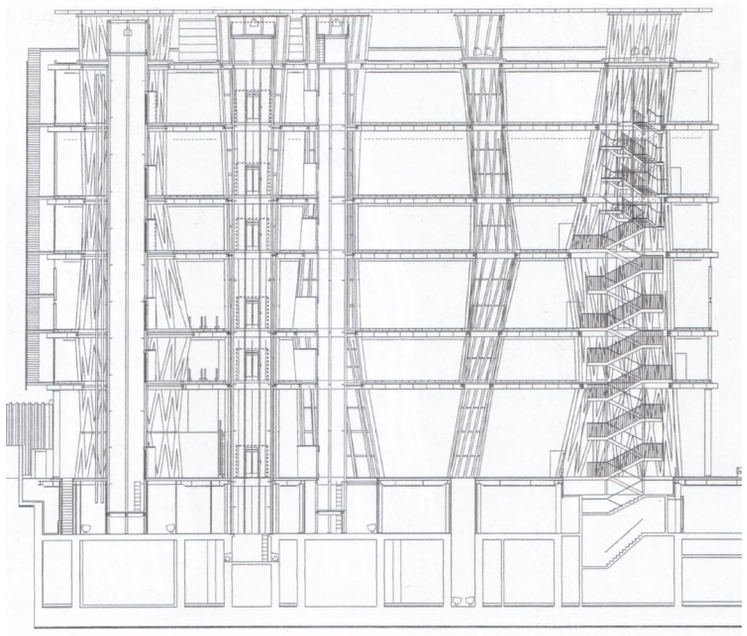
Fig.1.13

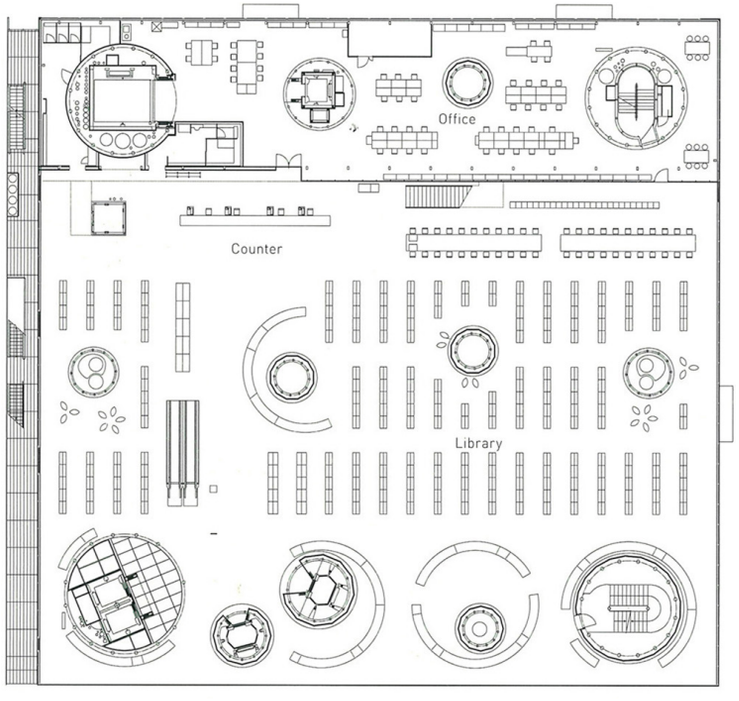
Clear glass Sendai Mediateque facade shows and emphasizes tectonic qualities of the structure.

CASE STUDY

RELEVANCE TO OUR PROJECT

The Sendai Mediatheque inspires us because of how its hybrid programming was integrated with tectonics and sustainability and consequently resulted in completely new quality in the city structure. Flexible organization of space and its adaptive quality achieved by adequate and optimized structure in tectonic manner is also something we are aiming for in Varna Library design. Maximizing utilization of the natural light through diversification of openings, levels of translucency and reflectivity of the materials is also our focus. Sendai Mediatheque combines traditional library with multimedia library that it creates integrated spaces where this two notions complement each other instead of placing them in juxtaposition.





› Fig.1.14, 15

Section and plan shows the structure. Open plan created an opportunity for people to meet, work in groups and share knowledge.

› Fig.1.16, 17

The structure defines the caracter of interior spaces, becoming a vital part of aesthetics of it.

CASE STUDY

The Library of Birmingham designed by mecanoo and completed in 2013 is one of Birmingham landmarks. The building is 35,000 m2 hybrid library in the heart of Birmingham which creates an active public space and offers a variety of attractions. Therefore, it is called "People's Palace" what emphasizes the social dimension of the project. (Mecanoo.nl. (2016). Library of Birmingham. [online] Available at: http://www.mecanoo.nl/Projects/project/57/Library-of-Birmingham/t/0 [Accessed 19 May 2016].)

PROGRAMME

The Library of Birmingham has a unique and rich programme. The building isn't just a book storage but it combines additional functions like community health center, music library, cafe and a lounge space, roof terraces, auditorium shared with neighbouring of REP Theater, renovation of the Theater. The important part of the project is also the urban plan for Centenary Square what makes a library a part of urban city structure and a lively part of the city attracting people with variety of outside and inside activities. The most public functions are located on the ground floor to provide maximum public accessibility. (Dezeen. (2013). Library of Birmingham by Mecanoo. [online] Available at: http://www.dezeen.com/2013/08/29/library-of-birmingham-by-mecanoo/ [Accessed 19 May 2016].)

A SEQUENCE OF ROTUNDAS

Interlocking atrium shaped by a sequence of rotundas distributes light in the building, organizes the space around it and plays an important role in vertical communication. Main staircase in the atrium distributes people on the first 4 floors which are more public. The stairs also create spatial experience because of their irregular shape and shift in the atrium space. Every rotunda has its own character what emphasizes the division of the building according to function. The sequence of rotundas helps visitors navigate through the building and makes a visit in the library a journey.

FACADE

Filigree facade of interlocking metallic circles allows visual connection with outside. The frieze is comprised of two sizes of circles- diameter of 5,4 m and 1,8 m. Shadows of this geometric facade give a special mood inside the building during the day and during the night the light from inside transforms the building into a massive light sculpture. The closed parts of the facade mark the location of archival collections. They are covered with shimmering, golden panels contrasting with geometrical pattern of the geometrical screen. Two layers of high performance insulation of mineral wool and a steel faced composite panel sit behind an anodised, unitised rainscreen system. (Dezeen. (2013). Library of Birmingham by Mecanoo. [online] Available at: http://www.dezeen.com/2013/08/29/library-of-birmingham-by-mecanoo/ [Accessed 19 May 2016].)

Fig.1.18

Atrium works as a conection and brings daylight furter into the building.

Fig.1.19

Perforated facade of the library helps to diffuse daylight as well as makes a completelly different impression of the building in the night.

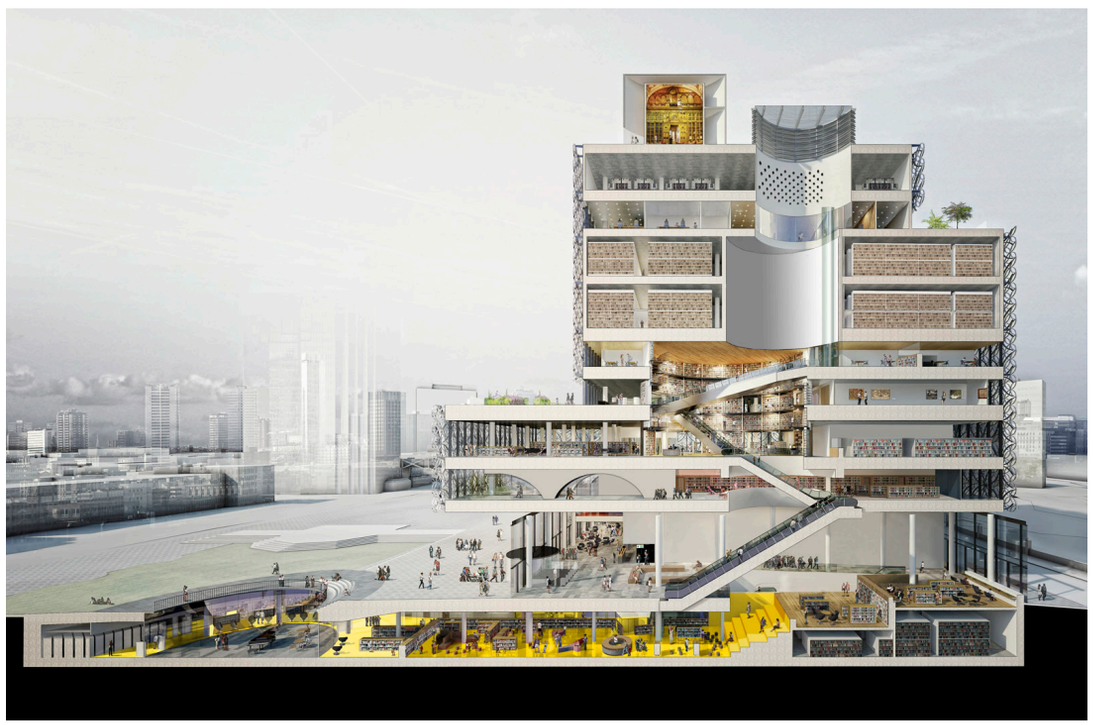


Fig.1.20

The library houses many unexpected functions like a health center and a connection with a theater.

CONCLUSION

In the theme analysis chapter we investigated and researched topics that we believe are crucial for designing a library in Varna that not only meets local community needs but also provides new quality in the city structure.

In order to achieve that it is necessary to answer the question about the role of library today and how the concept of library transformed during the centuries. Development of library from elitist function to a public one, from repository function to hybrid solution, from physical storage to virtual one gives us a relevant consideration of library as a constantly evolving concept requiring a highly flexible space. Understanding book as a source of knowledge and consequently a library as an institution assuring it's accessibility and circulation gives a foundation to designing a library building that is a respecter of heritage and cultural values. In times of exponential technological development the library needs to go with the spirit of the times in order to explore it's full potential but also it should not be detached from the tradition built through the centuries.

Varna Library aims to be environmentally and socially and sustainable. Complexity of sustainability and its different aspects should be understood in order to meet present requirements but also thr ones which may arise in the future. The importance of climate factors and minimizing their negative impact on the building as well as finding a way to utilize natural resources is crucial for its energy efficiency and indoor climate. Library of Varna should provide meeting place for local community which enhance equality, promotes the knowledge and makes it accessible and attractive. Considerations about the future needs results with the conclusion that the design must be adaptable in order to be sustainable. From the requirement of flexibility derives demand to understand concept of Tectonics. The structure should be expressing adaptability and providing quality spaces related to all the functions and answering a question about the role of library today.

Public spaces in Bulgaria play an important role for social life of citizens. The majority of the spaces are neglected and in a bad shape. Existing public spaces do not provide an opportunity to spend time actively and do not engage young people. Therefore, there is a need to design a modern public space that would activate a life of a city.

The library function for Varna citizens is mainly associated with book storage. The main users are students who visit library in order to acquire specific source. Conditions in Varna libraries- lack of daylight, poor indoor climate, limited accessibility and scattered locations, do not encourage people to come and use it as a working space. It is important to centralize the library and introduce a concept of library as a "living room" of the city where people enjoy spending free time.

Research about positive impact of indoor plants for users of the space and quality of air helped us to find a sustainable strategy that can improve indoor climate and users experience.

Case studies of Toyo Ito's Sendai Mediatheque brings Sustainability and Tectonics to Library building. Investigating Sendai Mediatheque helps to understand the need for finding new ways of integrating the multimedia library in the building through the architectural design without compromising traditional library function. Sustainable strategies and Tectonic structure makes building efficient as well as attractive as a city public space.

Birmingham Library by Mecanoo is an important spot in the city structure and revolutionized the notion of library. It became a multi-functional platform where the life of the city concentrates. The architectural elements like atrium and facade of Birmingham Library became a highlight of the project. Atrium that organizes the space inside and connects all the building functions and facades, that affect not only outside but also atmosphere inside of the building inspired us and emphasized the importance of architecture in creating new quality in urban city structure.

Reflecting on all above mentioned themes gives a foundation for designing a library building in Varna that will not only answer a questions about the character of library function in modern society but also address relevant issues related to local climate conditions, history and community..

SITE ANALYSIS

Site
Sense of place
Typologies
Green public spaces
Noise
Climate
Sun
Conclusion

SITE

The site is located in the southern part of the city of Varna in Bulgaria. A couple of kilometers away from the site there is the Black sea. It is surrounded mostly with residential buildings which were built during the communist times. Varna Municipality building is located next to the site. It is an important landmark and is one of the highest buildings in Varna. There area a few greenery patches on the site.

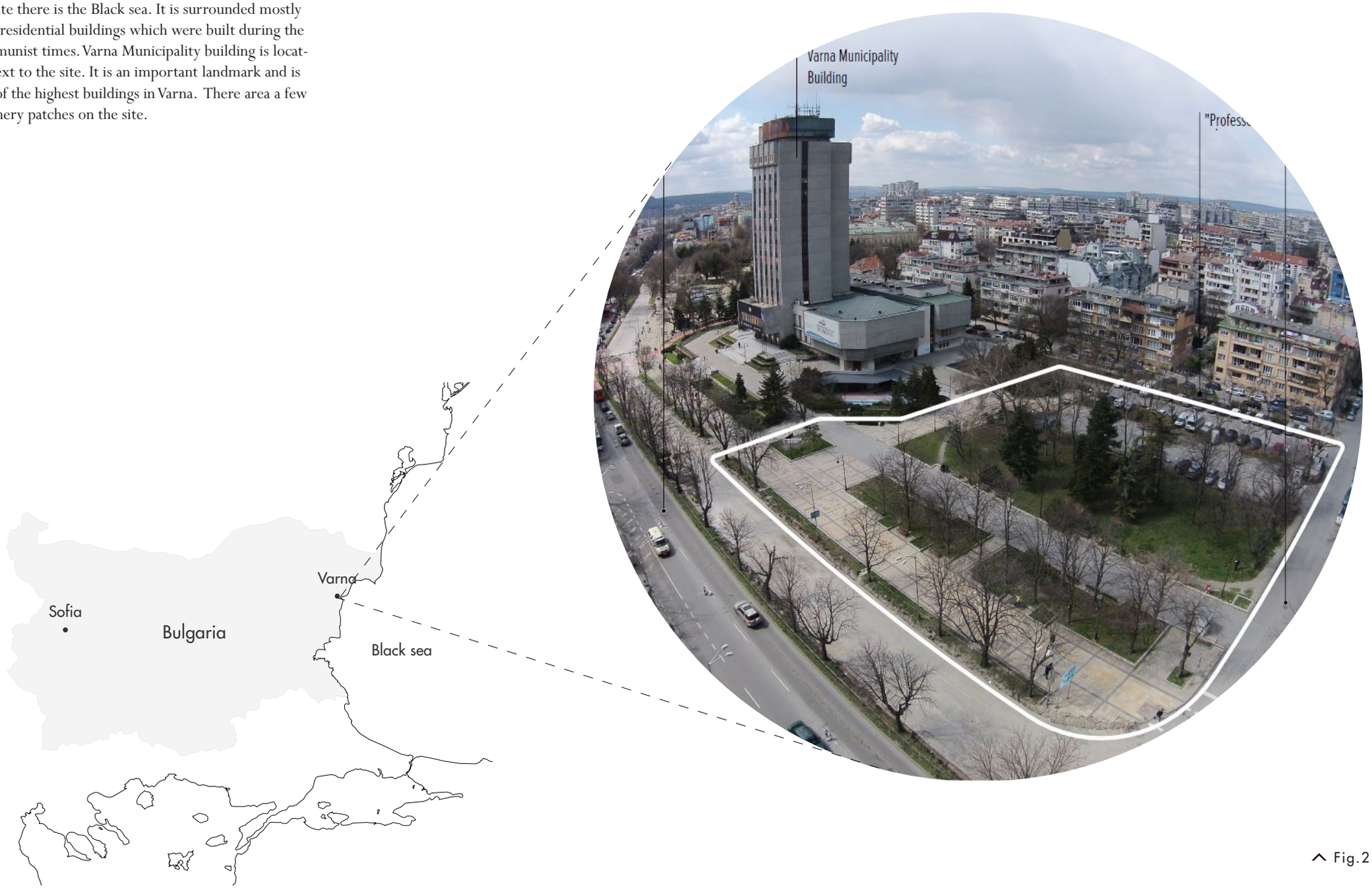


Fig.2.1

SENSE OF PLACE

At present the site is covered with prolific greenery and combines a small park and parking lot for the needs of Municipality Hall. During the spring and summer period vivid greenery obstructs the view to poorly maintained Soviet residential buildings on Marin Drinov and Bratya Miladinovi streets, while looking from Osmi Primorski Polk Boulevard (the main transport artery in Varna). In autumn and winter the views of the place are dominated by a parking in front of the buildings and old and cracked pavements. The urban facade adjacent to Osmi Primorski Polk Boulevard consists of relatively new mixed use high-standing (when compared to the neighboring skyline) buildings. Municipality Hall of Varna is the main architectural landmark dominating perception in the surrounding area. There is a well developed space around the building with lowered levels affecting the atmosphere of the site.
The materiality of the place plays an important role in creating the mood. The presence of asphalt and structural concrete of the Municipality is contrasted with greenery as well as with painted parts of recessed square (turquoise and red). Depending on weather conditions the perception of space changes. During the periods without the sun these materials make the site rough and uninviting. Urban facades are diversified with many colors and architectural expression. What makes it a bit chaotic and emphasize lack of coherency.

Fig.2.2

The view to the site from Bratya Miladinovi street, shows rough facades of the surrounding buildings.

Fig.2.3

Osmi Primorski Polk Boulevard is one of the main streets of Varna. The site on this side has a fair amount of greenery.

Fig.2.4

Threes on the site help to improve shabby mood of the surrounding facades.

Fig.2.5

Post communist streets-cape of Marin Drinov street.

TYPOLOGIES

The map shows the typologies, which are around the site. The site is highly surrounded by education buildings. There are 2 schools and a university near by. Therefor a big part of library visitors will be young school or university students. The are is mostly surrounded with different types high and low residential buildings, some of them are also mixed used, having retail function on the ground floor.

There is a significant number of hotels in the area, since the city has attractive beaches and is the main holiday destination in Bulgaria. For this reason the amount of residents in the city is different during the periods of summer and winter. Therefor the building should adapt to a higher number of visitors in summer and well as local residents. The site is surrounded by one of the most important buildings of the city Municipality and a museum, which also have a distinct architectural quality. Therefor when designing the library it is important to consider those buildings and how they affect the site, the streets cape and the cityscape.

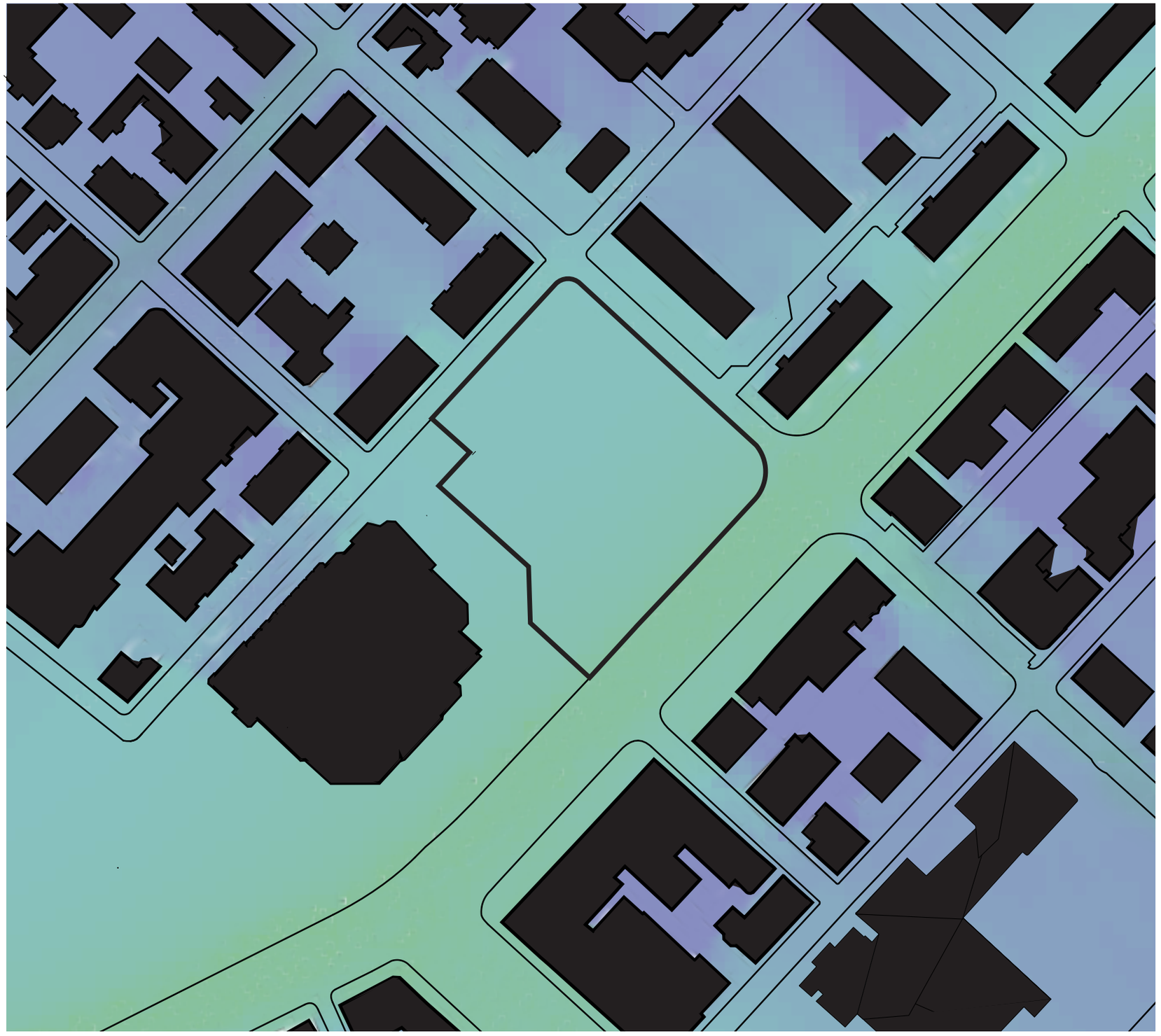
- Residential/ mixed use residential
- Offices
- Hotels
- Education
- Museums and theaters/ culture
- Shopping and entertainment
- Law/ government

GREEN PUBLIC SPACES

Municipality Hall is the main dominant in the surrounding of the competition area. The competition area is currently a public space functionally associated with Municipality. There is an open air parking mixed with a small park function. The site is located in the crossing of two city's main arteries- axis to the sea coast via Slivnitsa Boulevard and the Osmi Primorski Polk Boulevard which connects the southern industrial zone with the center. In walkable distance there are important public buildings- Archaeological Museum, City Art Gallery, Cathedral , Festival and Congress Centre and Drama and Opera Theatre. Public green spaces popular among locals and tourists are in the vicinity- Sevastopol Park and Archaeological Museum Park are in immediate proximity. Educational institutions like University of Economics, Varna Trade School, high schools and elementary schools makes the site a perfect spot to gather students from different fields and through the design enhance exchange of the knowledge.

NOISE

The diagram shows the noise levels during busiest hours of the day. There are three streets adjacent to the site that effect the noise distribution in the area. The traffic noise from the „Osmi Primorski Polk“ Boulevard makes southeast border the one with the highest noise level, The noise from Bratya Miladinovi or Professor Marin Drinov is not that intense since the traffic on that streets is smaller. The sound exposure from boulevard is an important factor to take into consideration during the design process. Library aims to provide working spaces and good studying atmosphere. There is a need to use architectural strategies that will not allow noise to be an obstacle for good working environment. Consideration about the location of working spaces and appliance of sound barriers and soundproof materials needs to be conducted.



CLIMATE

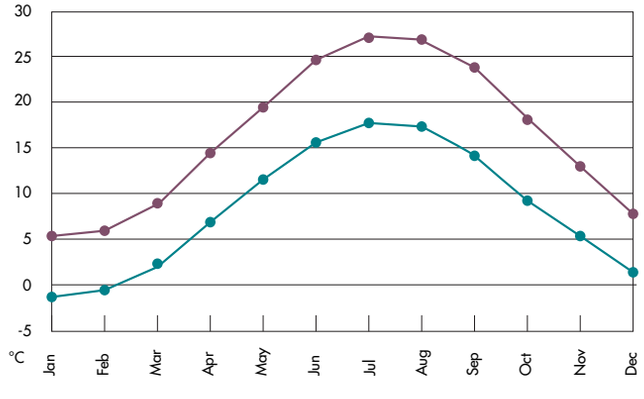


Fig.2.6

Average high and average low temperatures throughout the year.

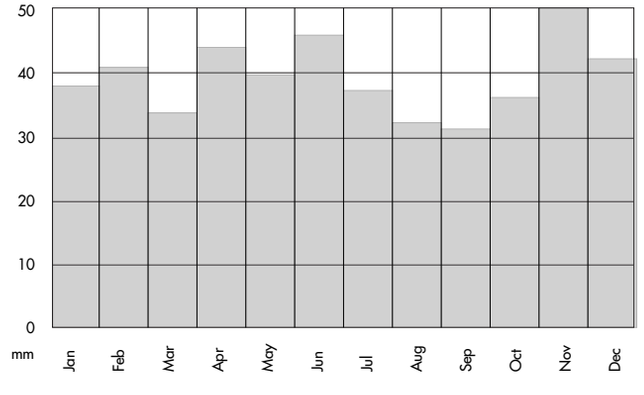


Fig.2.7

Average percipitation diagram.

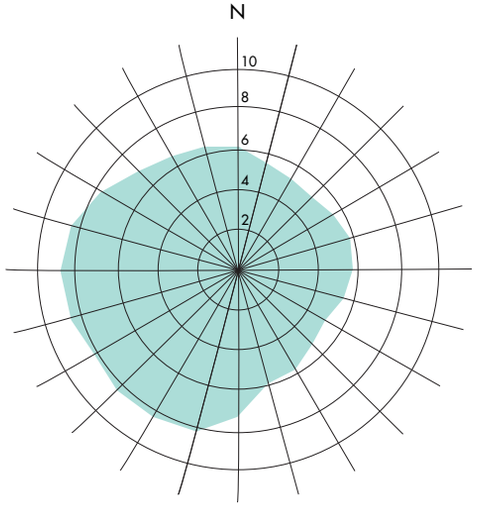


Fig.2.8

Yearly wind diagram.

TEMPERATURE

The temperature diagram shows that the temperature difference is quite high between winter and summer. Due to this conditions overheating can appear and in summer and heat loss in the winter. To avoid these situations it is important to have an optimal balance between windows and solid walls and choosing the right covering materials but also well designed plan of the building. Also the temperature standards for reading rooms is 20^{0} - 22^{o} C in summer and 17 - 22^{o} C (vVarna Library competition brief) there for there will be a need for cooling the rooms in the summer.
(WEATHER ONLINE (2016) online, available at:http://www.weather-online.co.uk/Bulgaria/Varna.htm)

PRECIPITATION

The rainfall diagram shows that mostly it rains during the months of November and June. High amounts of rain can cause too high moisture levels in the building, also not enough moisture can make the air too dry. Due to these strict conditions its important to focus on ventilation, choosing right materials etc. Moreover, it is important to collect rain water during all months and especially during the most moist ones. The rain water could be reused for different purposes, for example watering the plants on the terraces of the building or for sanitary services like sinks and bathrooms.
(WETAHER ONLINE (2016) online, available at:http://www.weather-online.co.uk/Bulgaria/Varna.htm)

WIND

Wind in Varna mostly comes from south and west. It is important to focus on wind conditions in order to optimize natural ventilation. Inward side of the building can face ideally south west and leeward side north east.

Moreover, wind has to be considered when designing pleasant public spaces and spaces in between the buildings. The speed of wind especially increases next to high buildings like Varna municipality building nearby.
(WETAHER ONLINE (2016) online, available at:http://www.weather-online.co.uk/Bulgaria/Varna.htm)

SUN

Geographic location of Bulgaria assures that the country has good sun conditions, meaning many hours of sunlight in the summer and also winter.

The sun shadow diagrams show how shadows moves-through the site in the year. The north east part of the site is shaded the least. Getting more sunlight this becomes an attractive location for public spaces outside the library or open public spaces, terraces in the library building. It is also important to highly conciser the city Municipality building which is in the western part of the site as it is fairly high, there for it brings the longest shadows to the site.

It is crucial to use this quality in designing the library because daylight in library is important, especially in the rooms where people spend a lot of time reading. Moreover, it is important to consiser that the books need protection from sun because sun light weakens cellulose fibers- main component of the paper. Therefor it is better to design main book storages on the western or northern parts of the site, because in winter the municipality building would shade most of the time and in the north there would be no direct sun ight. On the other hand shading is not always bad. It helps to prevent the building from overheating in summer, when the sun at the highest points in the year. Moreover, having some shaded spaces in the public spaces can help people to cover and hide from the sun during summer.

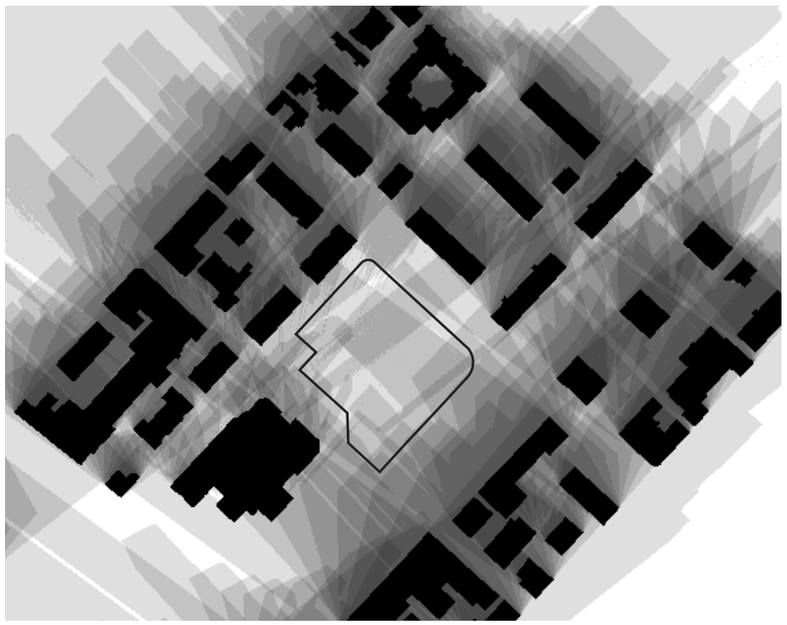


Fig.2.9

Shadows diagram during winter solstice

Fig.2.10

Shadows diagram during spring equanox

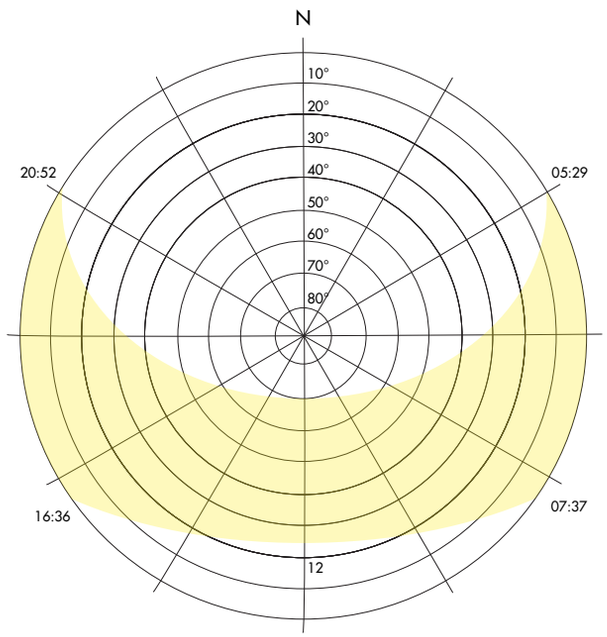


Fig.2.11

Annual sun path diagram

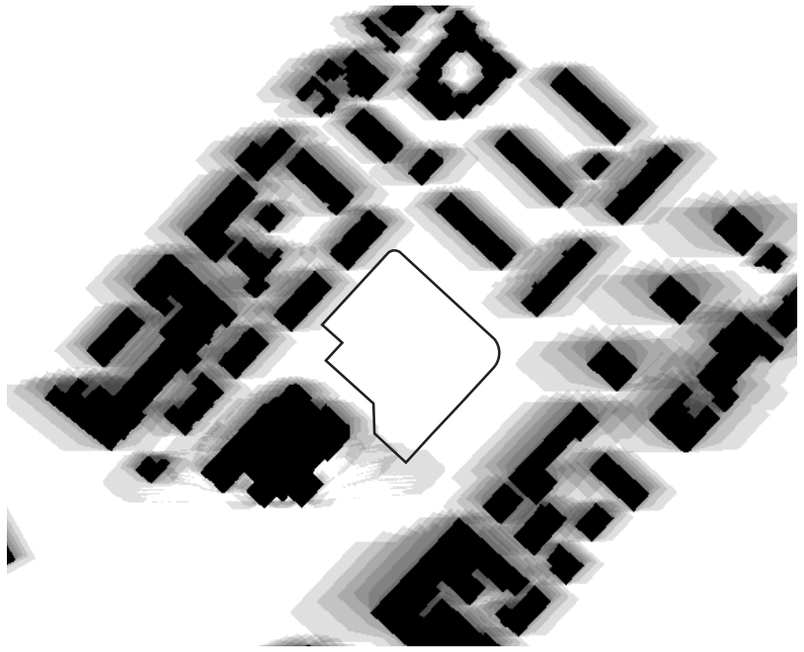


Fig.2.12

Shadow diagram during summer solstice

CONCLUSION

The site is located in the central area of Varna and is surrounded mostly with mixed- use residential buildings. There is also one of the main landmarks of Varna nearby - Varna Municipality buildings which influences the site in many ways. It's architectural expression dictates the mood of the site and it also brings long shadows. It has to be highly considered when designing the building. The site is surrounded by rough facades of the neighboring buildings, there for the mood of the site is not inviting.

There is a wide network of open public spaces near the site. The park of Varna museum is the closest open pubic space. Also the green open public connection arrives almost next to the site from the south east, where the park next to the sea is. This connection can be extended through the site and become a pleasant and inviting walking path through the city to the library.

Location of the site in the city center requires noise consideration and relevant means to minimize a negative impact on indoor environment which is crucial when aiming for designing an effective and attractive working which enhancing concentration and creativity.

The climate in varna is semi continental where the summers are quite hot and winters cold. It has a high number of annual sunshine hours compared with the other European countries - 2253. It has to be considered when assuring the daylight in the building, as well as removing overheating and heat loss during the periods of summer and winter. The levels of precipitation have to be considered when designing the storages for the books because it has extremely strict regulations. Wind in the site is mostly from southwest and has to be considered when designing ventilation etc.

During summer and spring the biggest part of the site is not shadowed. It becomes an attractive area for a public space as well as has to be considered when designing open terraces in the building. It is also crucial to consiser when designing interior spaces for reading and working.

USERS

Users
Functional diagram

USERS

The Library aims to be not only space where books are stored but also a meeting and working space for all citizens of Varna. It is important for library building to satisfy needs of people from different age groups. Therefor program of Varna Library focuses on three main groupS- children, young people and adults. There is a special focus on young people. Students of Varna lack friendly working spaces. The library goal is to become a place where they can study and socialize in a inspiring atmosphere.

In order to design a socially sustainable library, the program offers activities for all the age groups according to their need but also aims for mixing users and encouraging the process of learning from each other.

CHILDREN

The Library provides safe environment for learning and playing for the youngest users. They can play safely under supervision of their parents who also have space to work there while keeping an eye on their children. The space provides an opportunity for children to play with peers and promotes learning through play. There are flexible spaces with easily movable furniture designed to read books out-loud, play different games, draw. There is also a safe outdoor space for playing.

YOUNG PEOPLE

The library would attract young people by creating a social space that give an opportunity for them to communicate with their peers. More private and open study spaces provide possibility to study individually or in groups. There are more computer stands so they can easily access online resources and increase learning efficiency. The space is flexible and could be adjusted to individual needs by moving furniture and creating own, customized working space. The design is oriented towards a group work, therefore, closed and quiet group rooms are scattered between bookshelves. Specialized reading areas and hobby zones are easily accessible on young people floors. Thus students can effortlessly reach the sources and materials needed for their education. They can also relax and spend time listening to music, reading magazines or play video games in the Arts and Media Center. They have a possibility of developing individual skills in hobby zones. Young people spaces cover a wide variety of needs they may have.

ADULTS

Adults need individual closed off reading spaces as well as open spaces where they could meet members of the community of Varna. The adult reading space is located on the top floors with a view towards the city and higher level of individual privacy. Working environment aids concentration and focus. The specialized reading areas and Arts and Media Center are easily accessible what creates opportunity for adults to use new technology and access digital resources easily. The big social reading room which opens towards the city creates a favorable reading space with a lot of daylight. People can relax there, work or have lunch and enjoy the view towards the Black Sea. Adults (especially elderly people) need balanced spaces which would offer privacy for individual work as well as possibility to be engaged in community life. Varna library offers both of these functions - has closed of spaces for individual work as well as great social reading rooms which can also be used for community meetings and events.

FUNCTIONAL DIAGRAM

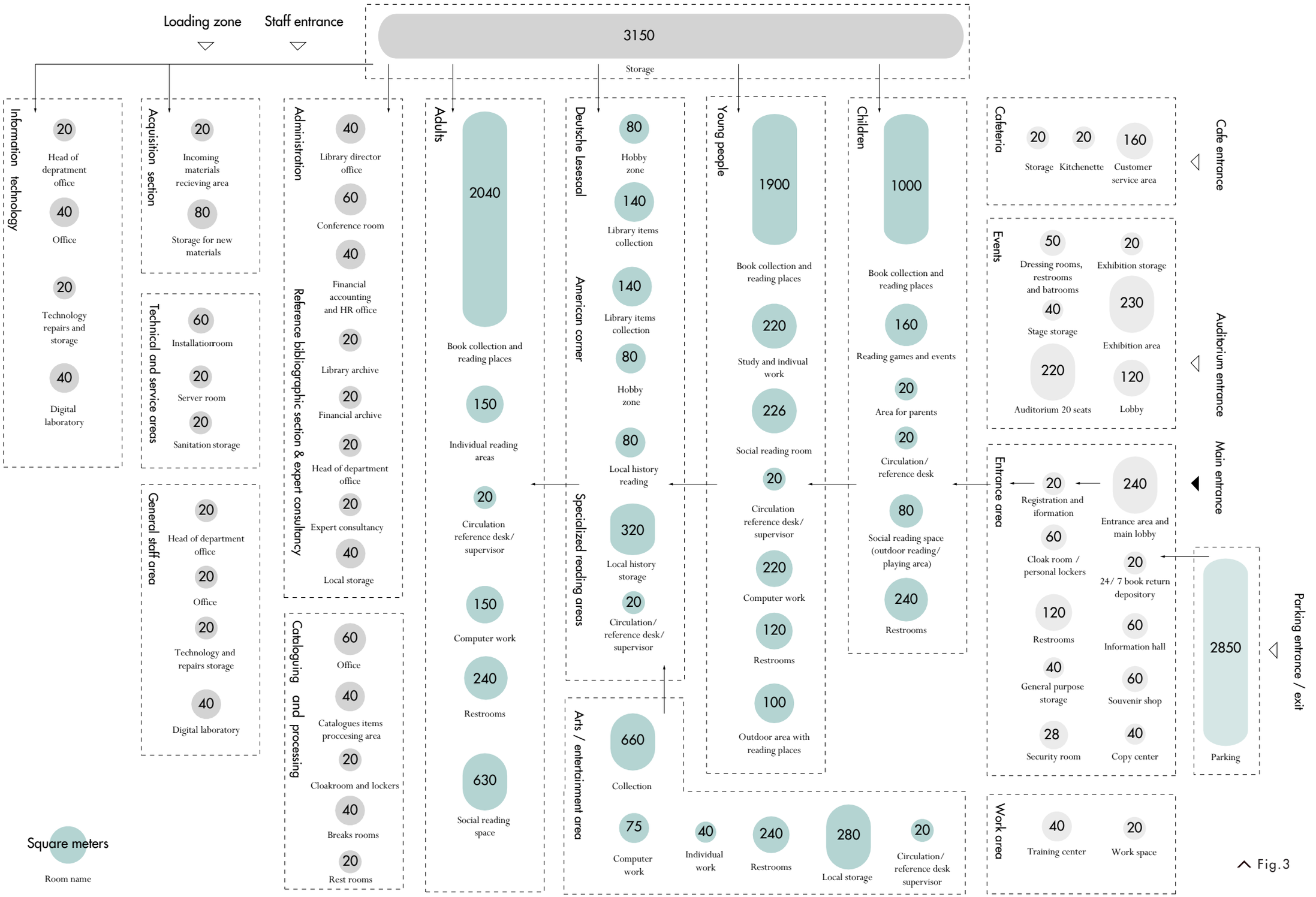


Fig.3

VISION

Vision

VISION

Vision of our project is to design a public library with a strong focus on the community and information access equality of all members of society.

With our project we aim to bring people back to libraries and to preserve traditional function and heritage of libraries without forgetting technology.

We aim to redefine a notion of library for people of Varna and make it an attractive alternative for spending free time.

The project focuses on environmental and social aspects of sustainability. Environmental part will cover indoor environment. The focal point of social sustainability is to create an attractive and flexible environment for reading and working, as well as to design spaces for people who normally do not use libraries.

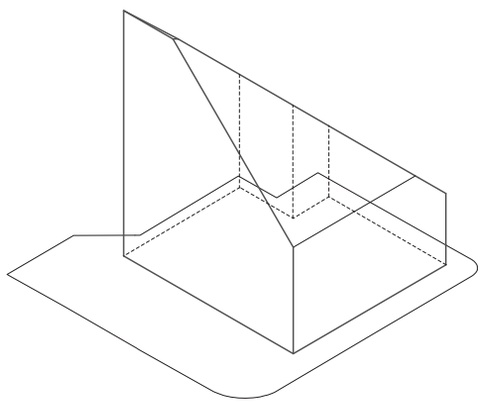
The library design should be tectonic. The structure will reflect our idea and spatial quality of the library.

The goal is to design a building and a new public space which are integral part of the city with a distinctive architectural expression and quality.

PRESENTATION

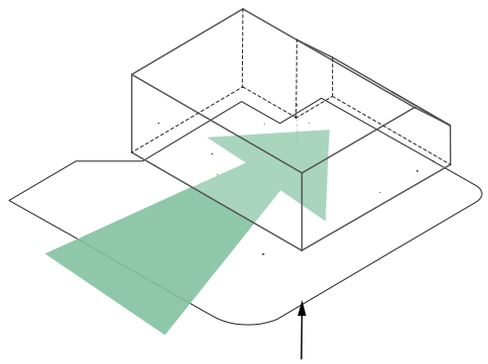
Concept
City living rooms
Function diagram
Masterplan
Plans
Sections
Details
Facades
Materials
Daylight
Indoor environment
Structure

CONCEPT



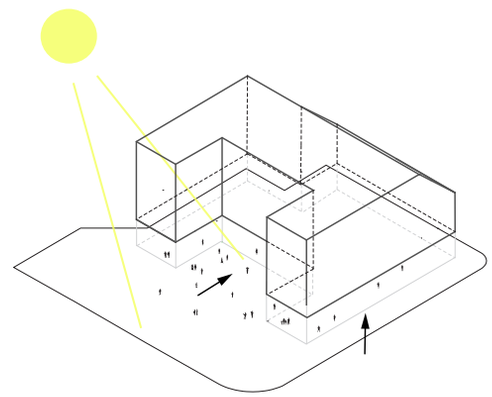
SITE BOUNDARY

The boundary of the site provided by Varna library competition brief.



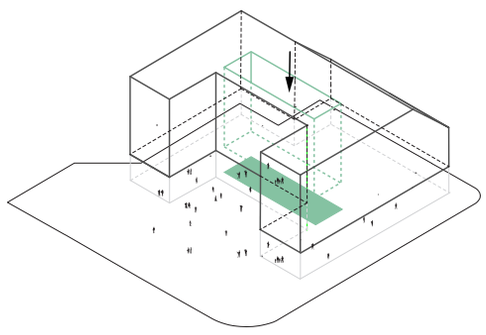
PUBLIC SPACE

The given volume boundary is raised to create a continuos public space.



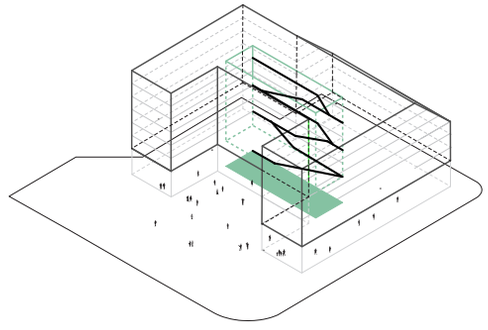
OPEN

The public space is opened up towards the Varna city to have better light conditions.



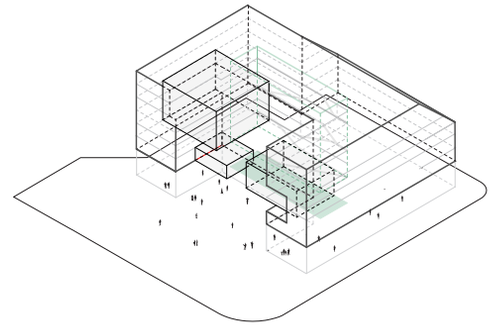
GARDEN

The garden on the ground floor has a connection with the entire library through the atrium.



STAIRS

Sculptural stairs leads visitors through the building.

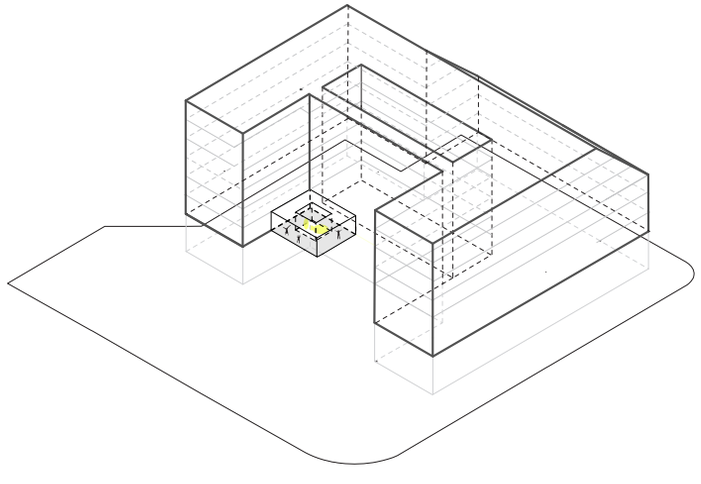


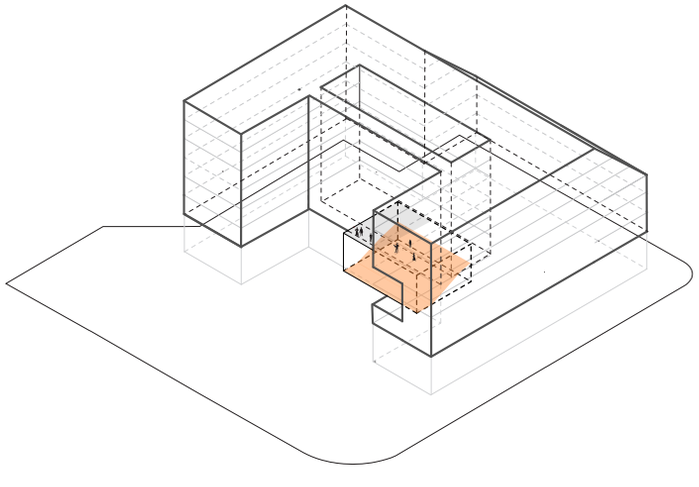
CITY LIVING ROOMS

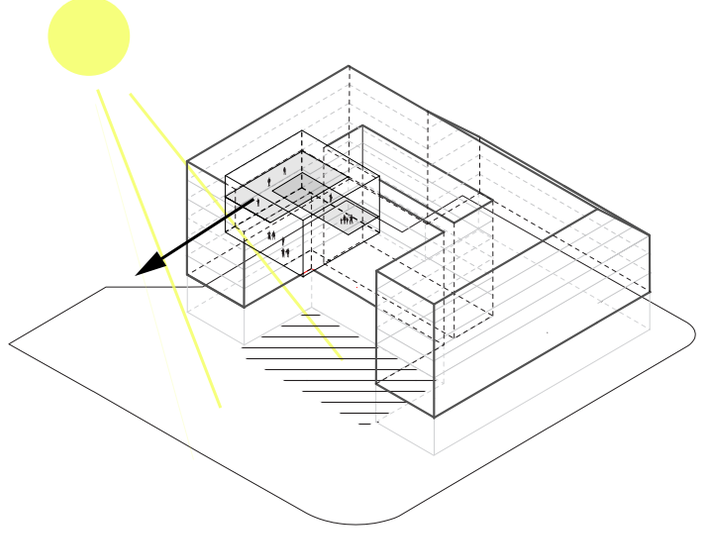
Special social reading spaces provide visitors with possibility of having a different library experience.

Black staircase in the atrium reflects through perforated screen of the front facade and make it more dynamic during the day but especially at night. Perforated facade provides users a sufficient level of privacy but still allows to keep visual connection with building surroundings. Overhanging social reading rooms create a spatial experience for people using a public space of plaza. Orange stairs in young people zone, yellow elements of children's overhanging playing room give the volume more customized identity. Greenery of the public space creates more private atmosphere and gives an opportunity to read a book in the shadow of a tree or have a picnic on the loan.

CITY LIVING ROOMS







CHILDREN LIVING ROOM

On the children floor there is a special outdoor space designed for playing and reading. Children can enjoy their time in fresh air while being safe.

YOUNG PEOPLE LIVING ROOM

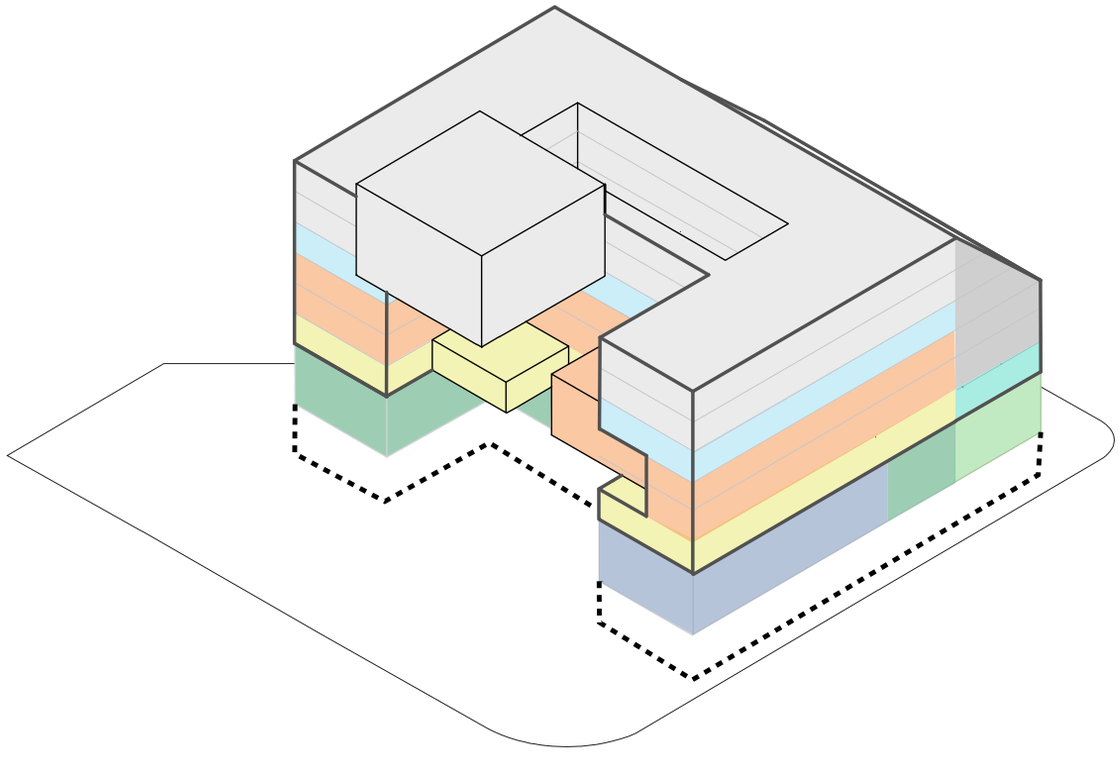
Young people spaces have a special stair which lets students to engage in group work or just read a book in more social environment, where they can also learn from each other. On top of this social reading space there is an open terrace for outdoor reading. The living room is placed strategically to have an open top terrace, which could be shaded in summer by the adult living room volume.

ADULT LIVING ROOM

The biggest library living room is in the adult section. It is located in a strategic area of the building to provide fascinating views of Varna and also shade the public space from the sun during hot spring and summer months. It is a perfect space not only for reading but also for community events and helps to bring people of Varna together.

FUNCTIONS

Varna library has an open ground floor which offers a number of different functions like events and exhibitions zone, a cafe, a bookshop, workshops and hobby zone, working and reading spaces and it is connected with the plaza. Especially in summer these spaces work together and that way the library become a part of a dynamic fabric of the city. Higher there are children reading rooms with open playing and reading space. On the higher floors young people and students reading rooms are located. In between young people and adult reading sections there is arts and media floor. It can be easily accessed from young people and adults floors as they are the most likely users of it. In the highest floors adult reading rooms are located. Under the ground floor there is underground parking for the visitors of the library. In the back of the building storage of books and other materials is designed. It offers even distribution of book to the whole building. The administration is also located in the back part of the building in order to be close to the storage as well as reading rooms and the ground floor. It is a strategic location in order to have the best management of the library.

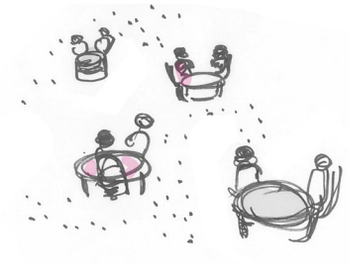


- Reading spaces for adults
- Reading spaces for young people
- Reading spaces for children
- Cafeteria
- Media and art
- Storage
- Administration
- Events
- Entrance space
- Underground parking

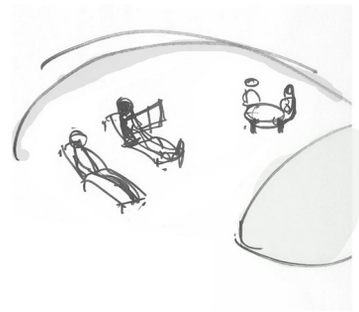
MASTERPLAN

The opening in the building volume creates a central plaza which invites people into the building. Public space attracts people to the site and becomes a vital part of a city urban structure. Visitors can have a picnic with family on one of the greenery patches, read a book from one of the outdoor bookshelfs, use public platform to meet with their friends. The are areas designed for children- small playground distanced from the main street and public fountains. Cafe located in the ground floor extends to the outside and merges with a public space. The variety of functions makes the plaza attractive for diverse people and the ones who are not interested in books or reading might feel the urge to come inside the library. It is closely connected and works together with the ground floor and also becomes an open part of the city.

1 PICNIC PLACE

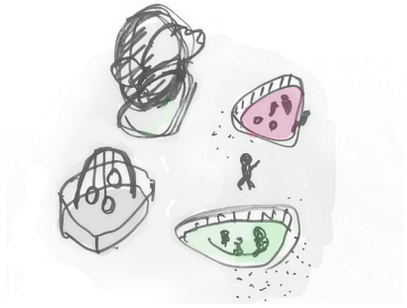


2 CAFETERIA

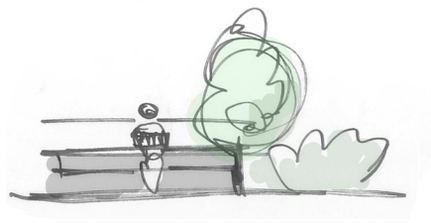


3 LOUNGE

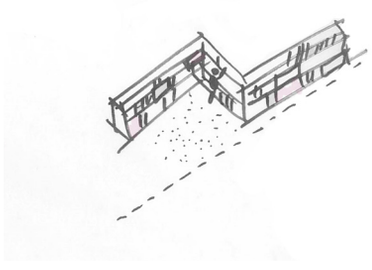
4 FOUNTAINS



5 PLAYGROUND



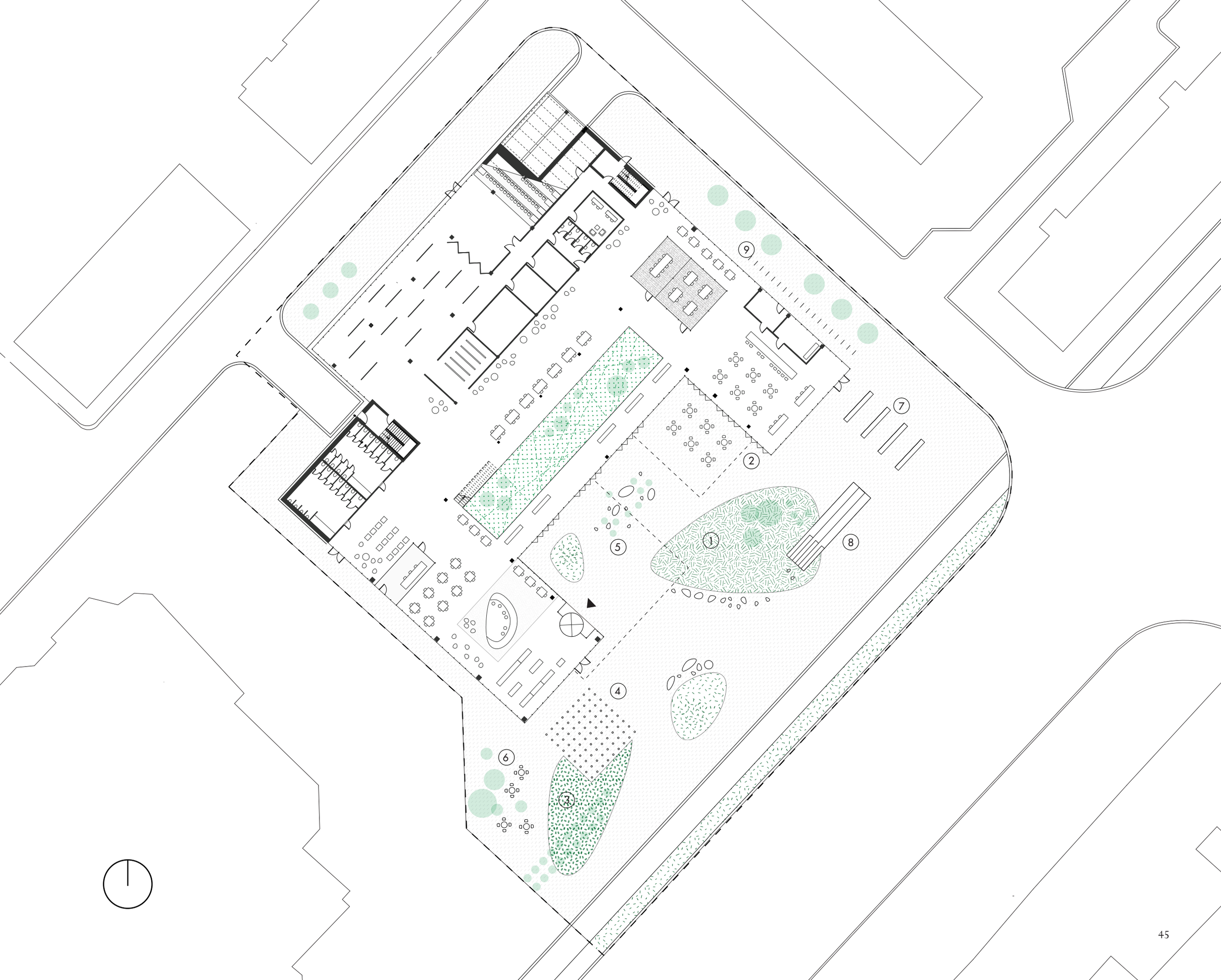
6 CALM READING



7 BOOKSHELVES

8 PODIUM

9 BIKE PARKING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PLANS

① ENTRANCE SPACE

Entrance space encloses many different functions like a bookshop, self check in, check out terminals, registration, information, working and relaxing spaces as well as a copy shop.

② GARDEN

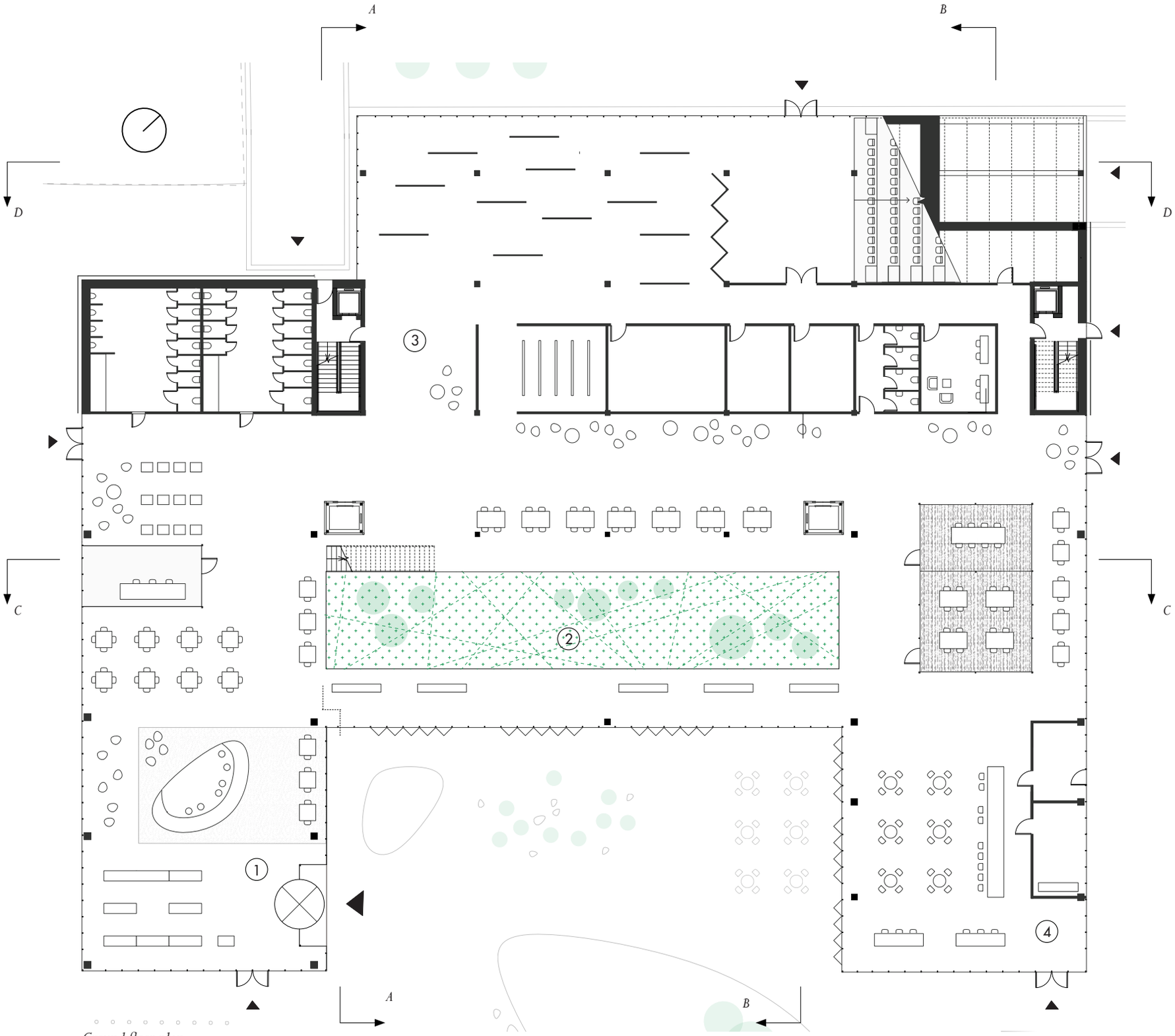
The indoor garden on the ground floor is the heart of the entire building. It creates the mood of the library. Greenery helps people to concentrate and work more efficiently. The plans have also calming and even inspiring effect on users.

③ EVENTS

Event zone consists of auditorium and exhibition spaces with service rooms. Auditorium is designed to have lectures, performances and other cultural events. It can work together with the exhibition space, because the spaces are only separated by a folding, flexible wall.

④ CAFETERIA

Cafeteria can work as a space to have coffee or read a book as well as for activities not related to reading. It can also be used together with the events area for conferences or banquets.



Ground floor plan

① STAIR

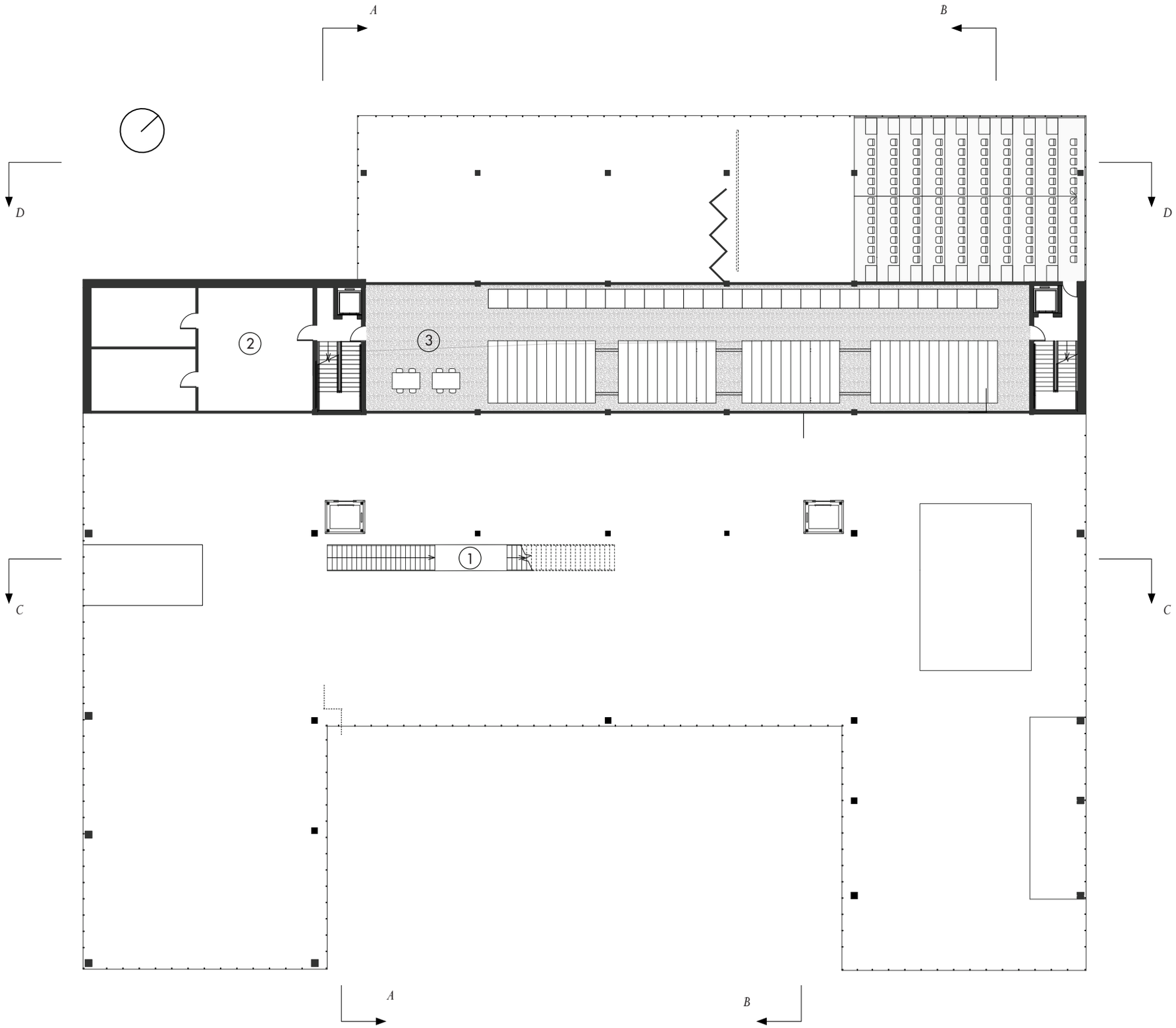
Free range stair leads into the reading rooms of the library from the ground floor. The stair is also a special sculptural connection of the building, which works together with the atrium and garden as a "core"of the library.

② TECHNICAL ROOMS

The technical corner contains of installation room, server room and sanitation storage.

③ STORAGE

On this floor the storage is designed for incoming materials as well as a regular storage. It is connected to the elevators through which the books are brought to the storages.



1st floor plan

① PLAY READ SPACE

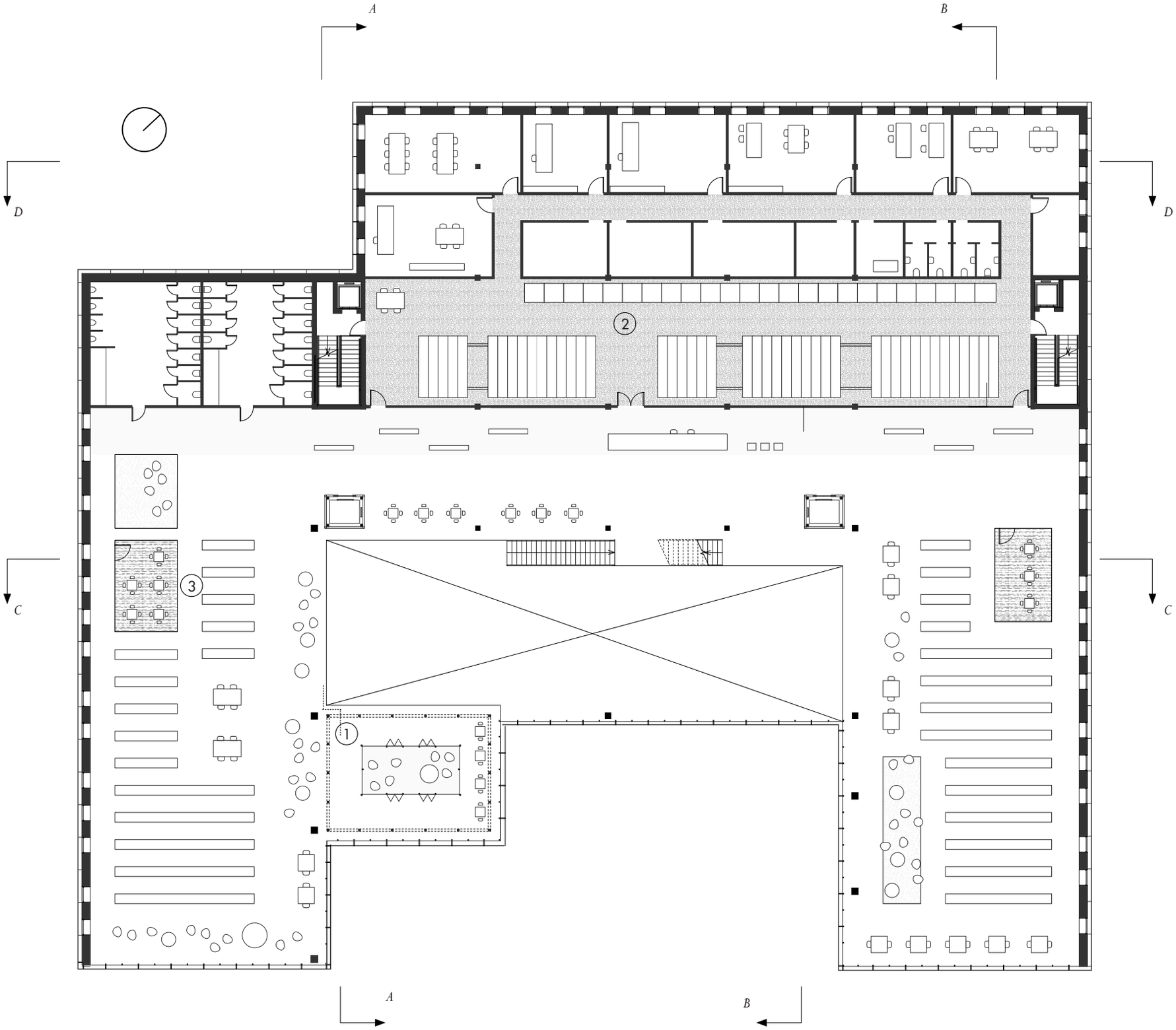
Outdoor playing and reading space provides children with possibility to be safe while still being outdoors and playing in fresh air. It can also work during winter when the inside courtyard is closed off and then it becomes a more calm reading space.

② ADMINISTRATION

The library administration is also connected with the storage and local smaller storages for a closer relationship. It consists of various departments like financing, bibliography, cataloging and processing as well as relaxation spaces for employees.

③ WORKSHOP

Closed workshop space can house different playing or learning activities for groups of children without being disturbed. It also contains a smaller special furniture for children and a small hobby zone next to it.



2nd floor plan

① COMPUTER WORK

The library part for young people has a greater amount of spaces for work with computers for students. They can use these spaces as an alternative of working only in their university or home. It enables them to work together and share knowledge and information.

② GROUP WORK

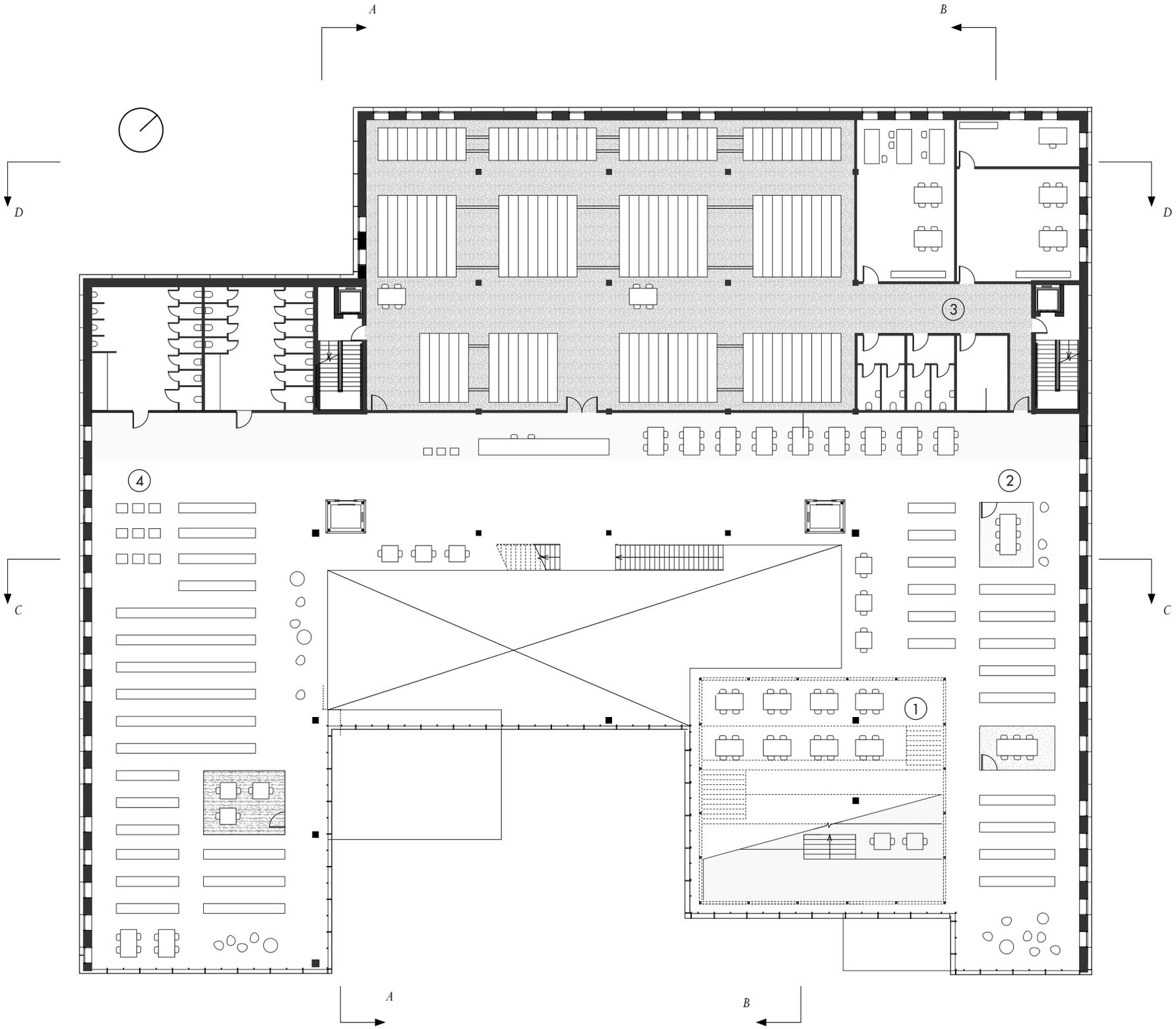
In closed group work spaces students can engage in this activity without being disturbed by the surroundings.

③ INFORMATION TECHNOLOGY

Information technology section consists of technology repairs part, offices and a digital laboratory.

④ PRINTERS

Printers and scanners are important to have in the library part designed for students because they are the ones using it the most for their school work. They have a convenience of having it on next to their working spaces rather than only the on ground floor



3rd floor plan

① SOCIAL READING SPACE

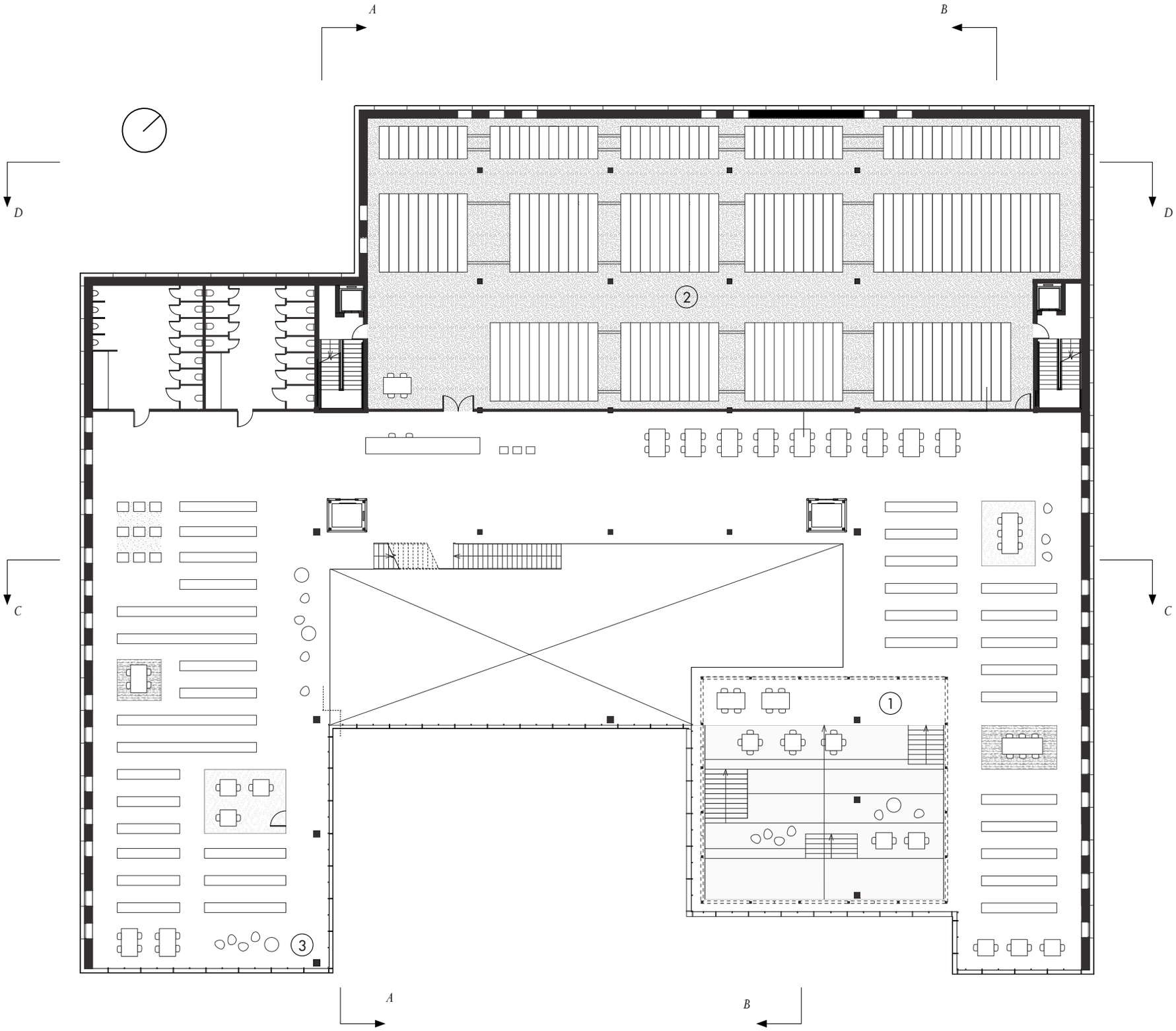
There is a special stair designed in one of the social reading spaces. Students can gather here, spend time together, make new fiends, and well as read and study. It also offers a nice view of the city.

② STORAGE

Books are stored in special storage units which can be slided on the rails. This system helps to save space in the storage areas and store more books. They also are better protected from effects of environment in this type of storage rather than in regular shelves.

③ RELAXED READING

Students need not only spaces for intensive and focused work but also spaces for just flipping through catalogue or magazines. Here they can relax from school or group work on special furniture.



4th floor plan

① AMERICAN CORNER

The area houses a collection of American literature, magazines and catalogs. It has its own reading spaces for concentrated and calm reading.

② DEUTSCHE LESESAAL

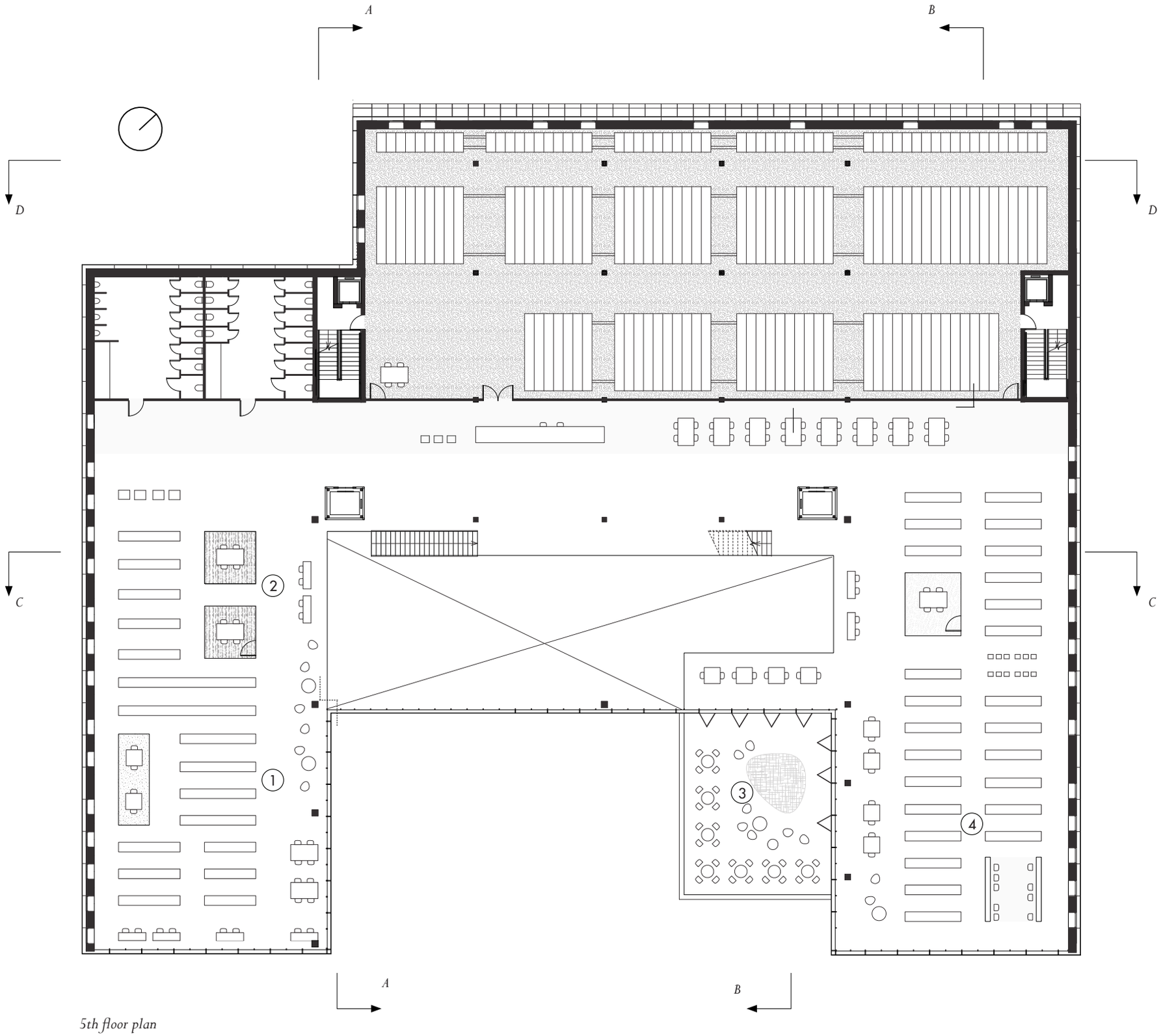
The corner of German books provides people with opportunity to read in German and find newest, most important German books and magazines.

③ TERRACE

Due to Bulgarian weather conditions people can engage in outdoor reading in most months of the year. The outdoor reading space has places not only for reading but also for just having lunch or spending time with friends or family. It also has a small space for greenery in the middle.

④ MEDIA AND ARTS

This part of the building is devoted specifically for media and arts. Users can find newest magazines, newspapers as well as latest films, DVD and music releases. There is a special section for relaxed listening to the music.



5th floor plan

① SOCIAL READING SPACE

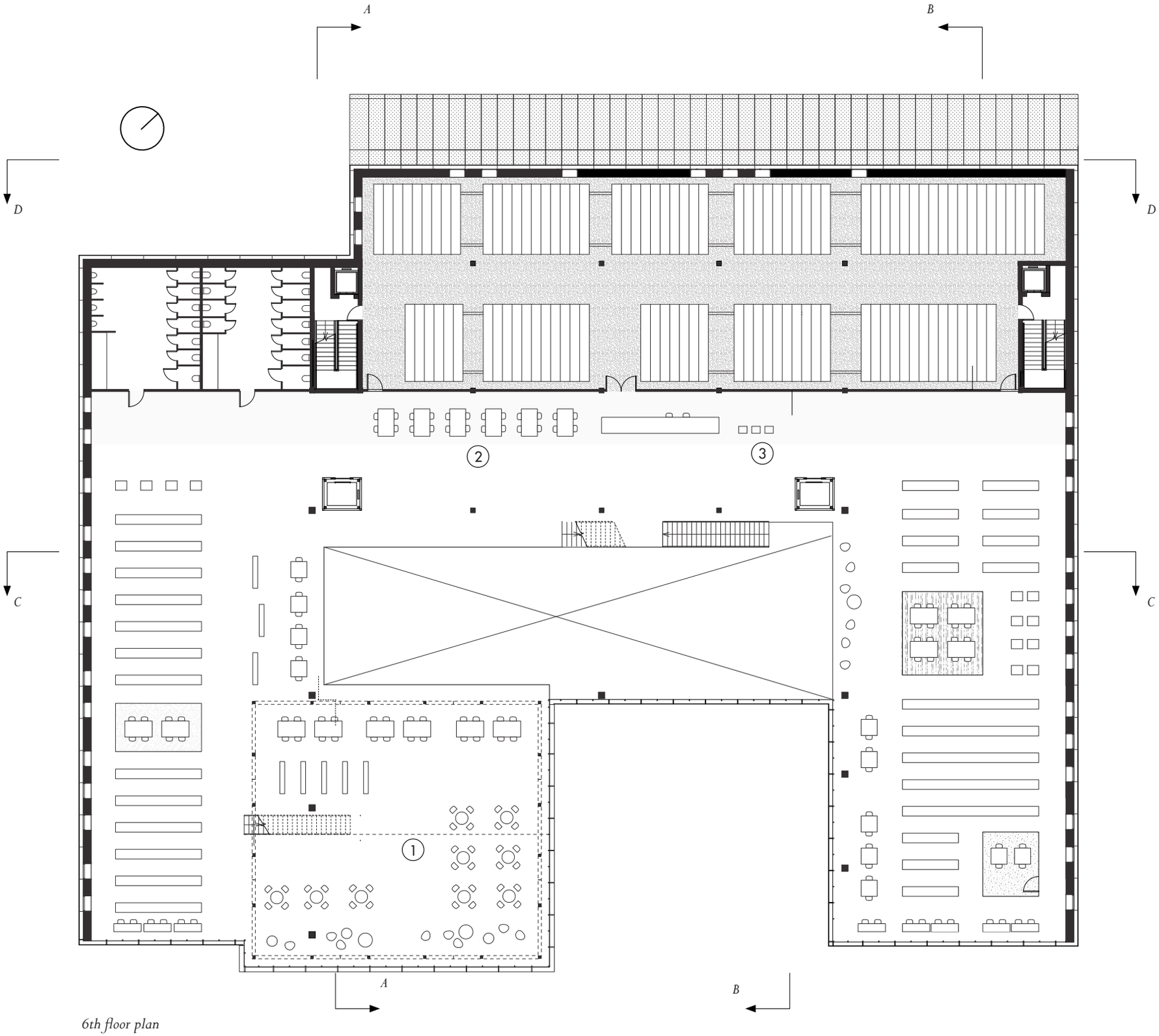
The biggest of all social reading spaces in the library lets people to enjoy a book and a cup of coffee in a more relaxed environment than just a regular library space.

② COMPUTER WORK

Special places for working with a computer are placed in a darker space of the building in order not to have direct glare into computer screens. The atrium and the surrounding windows provides with pleasant diffused light conditions.

③ SELF CHECK IN

Self check in, check out terminals enables users to borrow and give back books without any help from staff. For visitors convenience they are located on every floor.



6th floor plan

① STAIRS

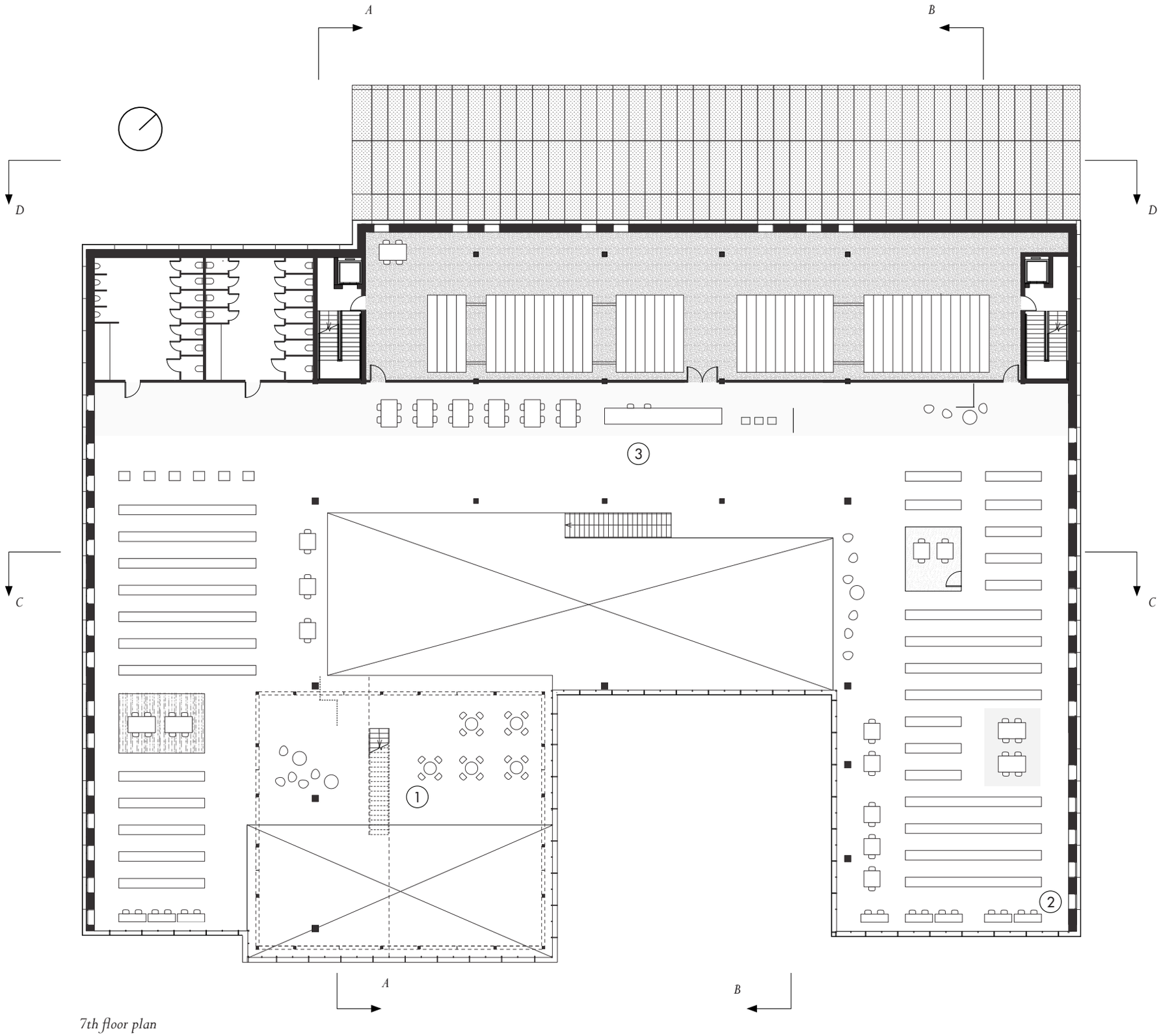
In the social reading area stairs lead to the highest level. They also work as a boundary that separated a space for relaxing and more remote working space in the reading room.

② INDIVIDUAL WORK

For work required concentration visitors can use individual working places. They are located in the remote corners of the library. The semi closed perforated metal facade diffuses light and therefor creates visually calm environment for best concentration.

③ INFORMATION

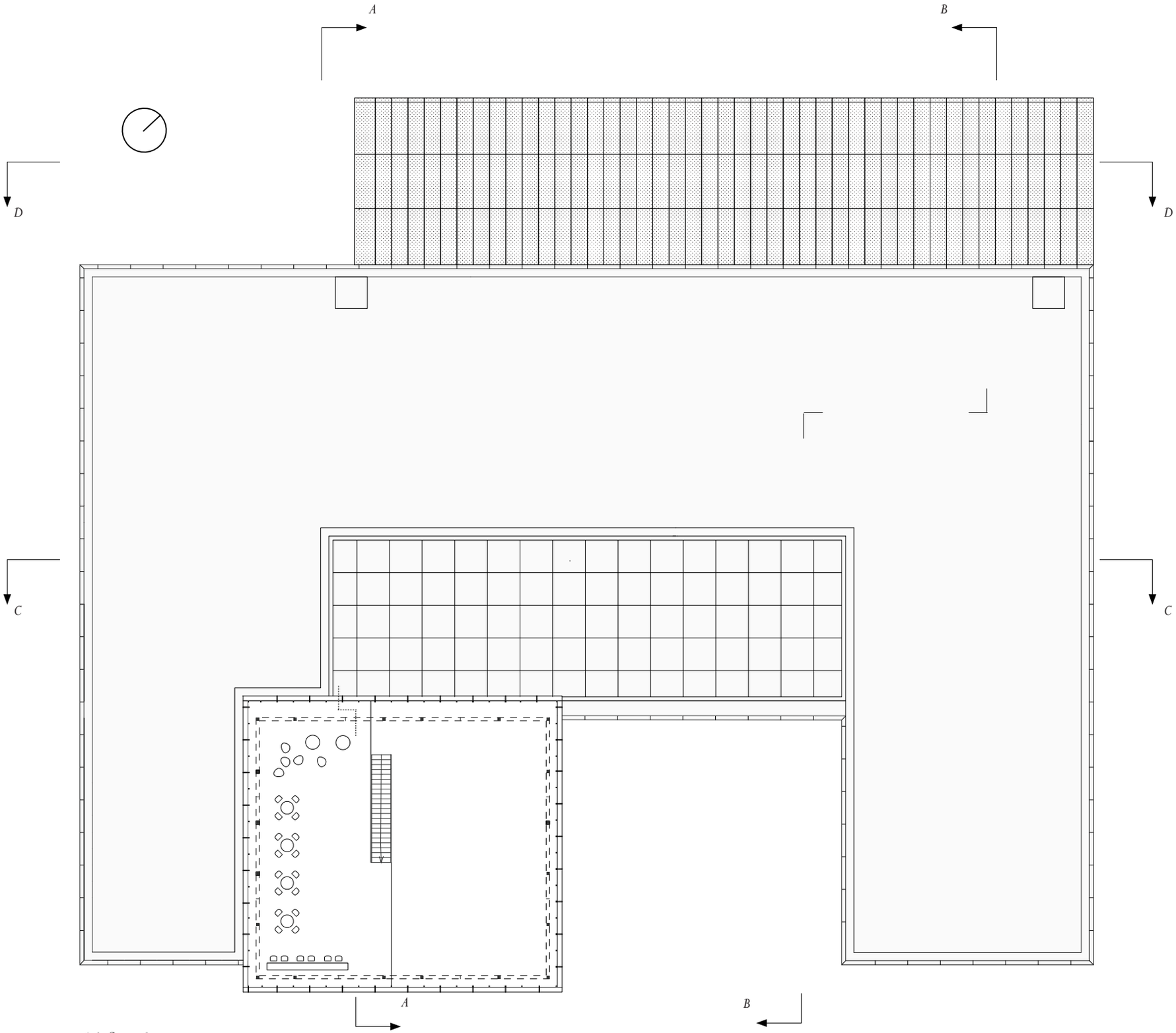
Each floor of the library has it's own librarian (supervisor), who can provide users with information about materials, how and where to find it etc. The space has a direct connection with storage.



7th floor plan

① VIEW PLATFORM

The highest point of the library building where users can enjoy beautiful views of the city of Varna and the Black sea which is nearby the site. There are seatings for reading, relaxation and light work.



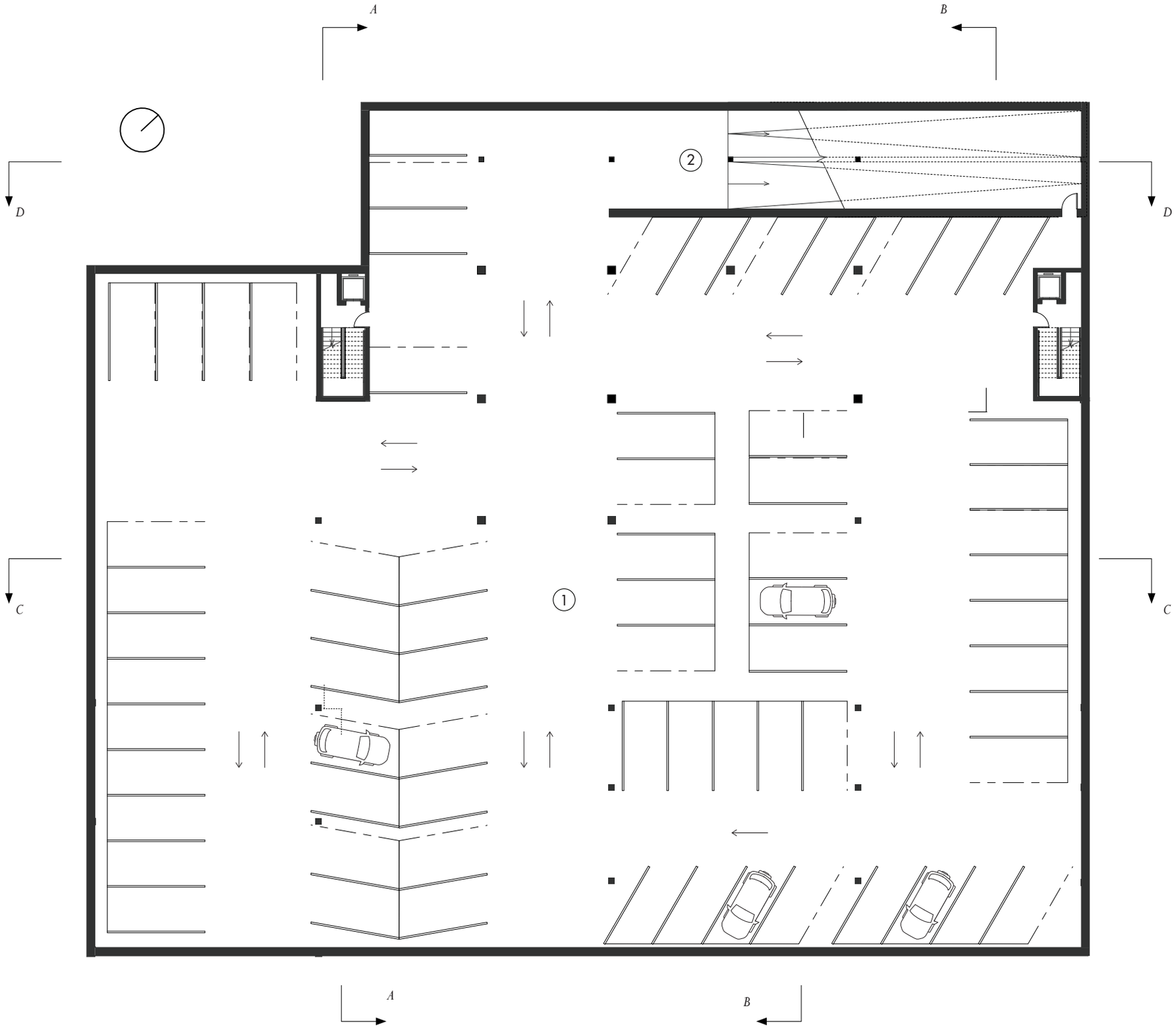
8th floor plan

① PARKING

Underground parking contains 65 parking spots for the visitors. It also has a connection with the ground floor of the library.

② RAMP

Ramp enables access to the underground parking facility.



Underground parking plan

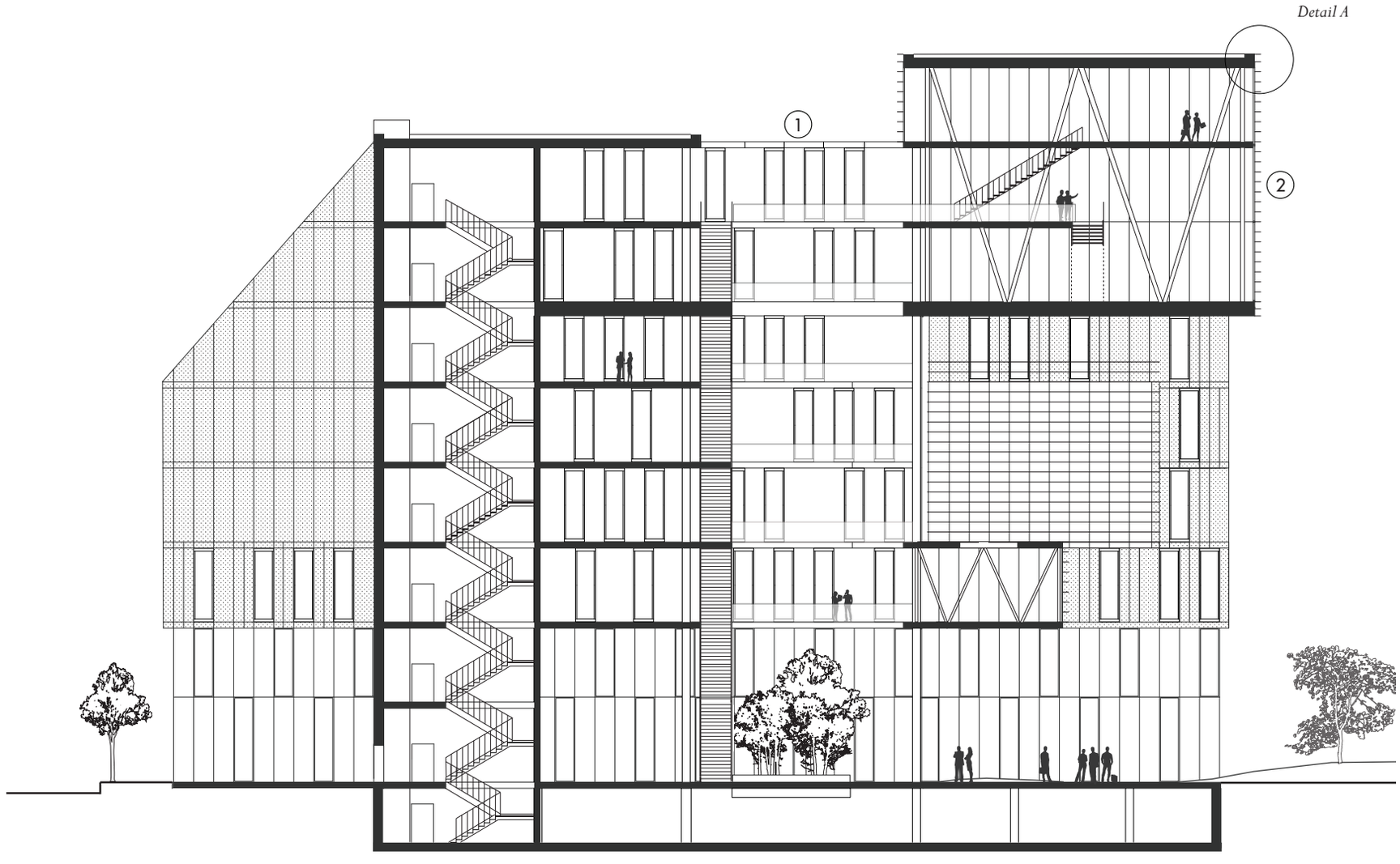
SECTIONS

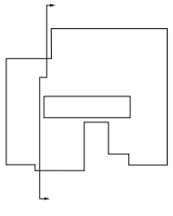
① ATRIUM

Atrium brings sunlight further into the building and creates library spaces filled with daylight. It also helps to provide plants on the ground floor with daylight.

② SHADING

Automatic shading on the facade of social reading spaces helps to prevent overheating., Without obstructing the views to the town and the Black sea. It is controlled by temperature.





Section A-A

① AUDITORIUM STORAGE

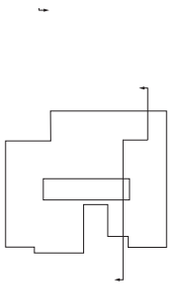
The space under the auditorium is used for extra storage. The equipment and materials of exhibition and auditorium stored there. The narrow space is especially convenient to store posters.

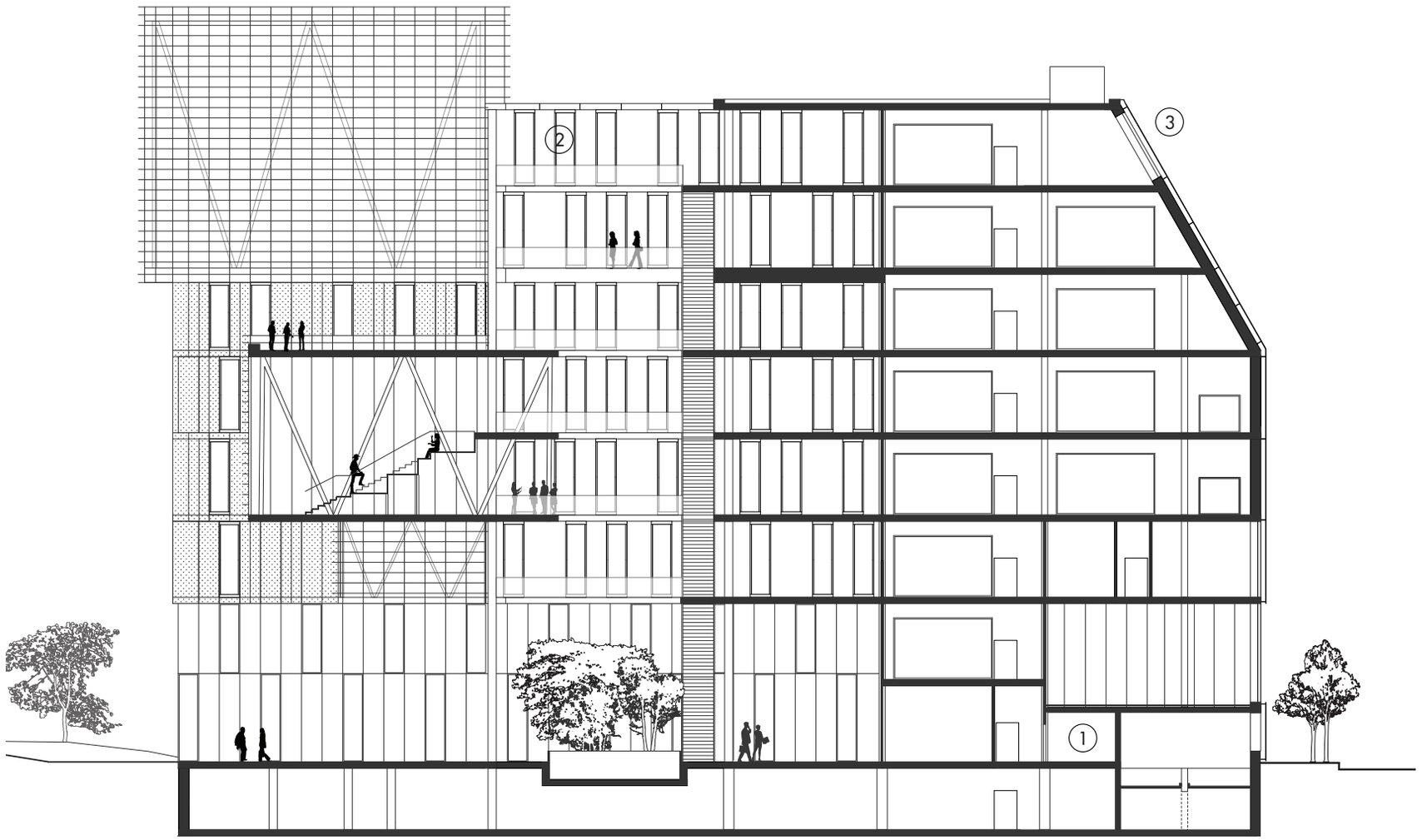
② WINDOWS

Windows have openings that enables natural cross and single sided (depending on a space) ventilation through them. The openings are on the bottom and top parts of the windows, that way clean and minimal look of windows is created.

③ PERFORATION

Perforation in the storage prevents books and other valuable materials from getting direct daylight, which is harmful for them.

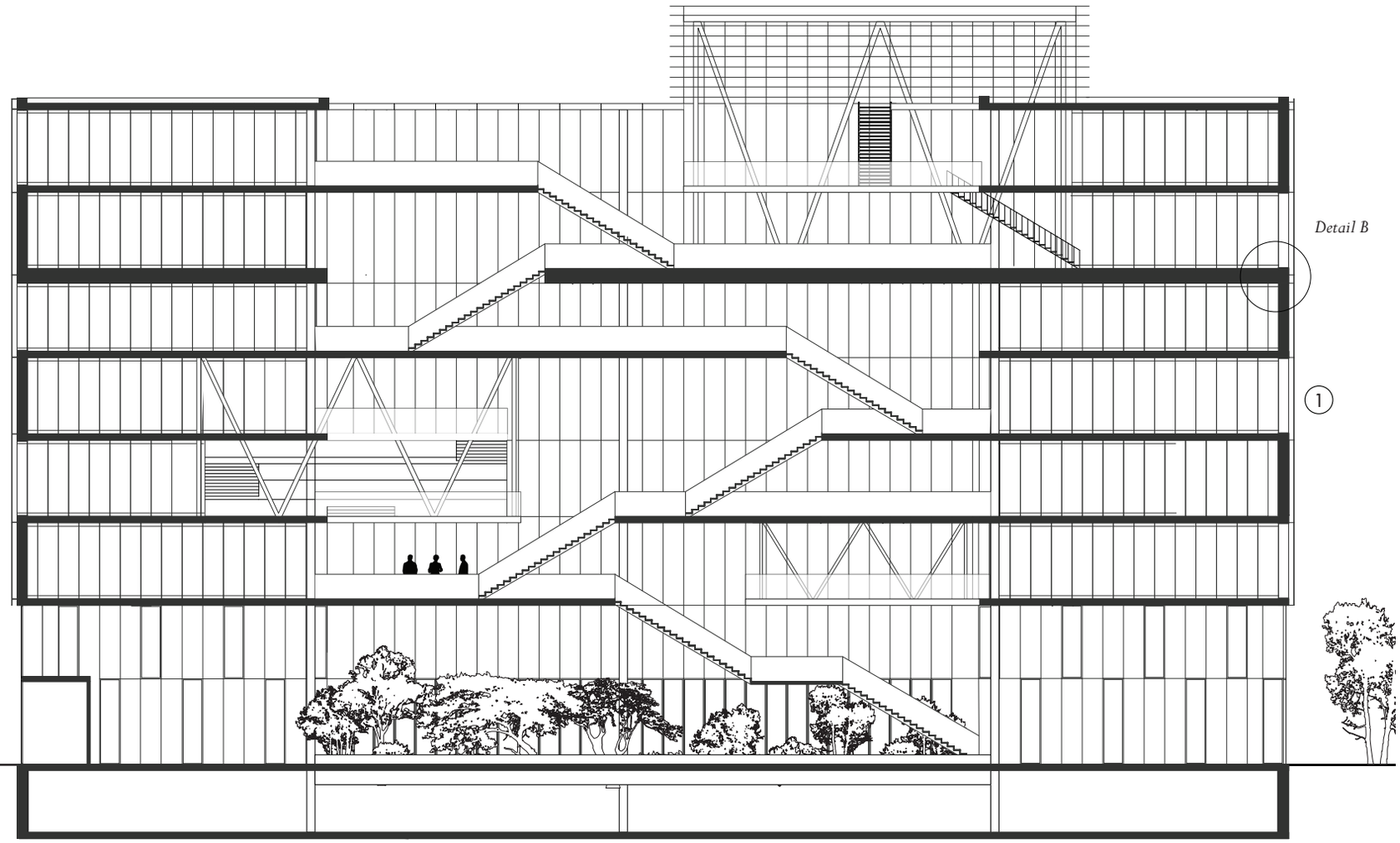


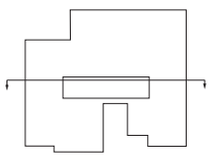


Section B-B

① PERFORATION

Perforation in the reading rooms diffuses daylight and creates pleasant working and reading environment. Some of the perforated panels are open-able there for people can have a visual connection with a public space on the ground floor when they wish.





Section C-C

① RAMP

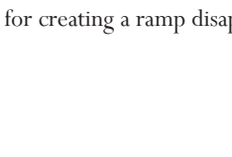
The ramp for parking is placed directly under auditorium, due to angles of both of them the need to make a cut in the building for creating a ramp disappears.

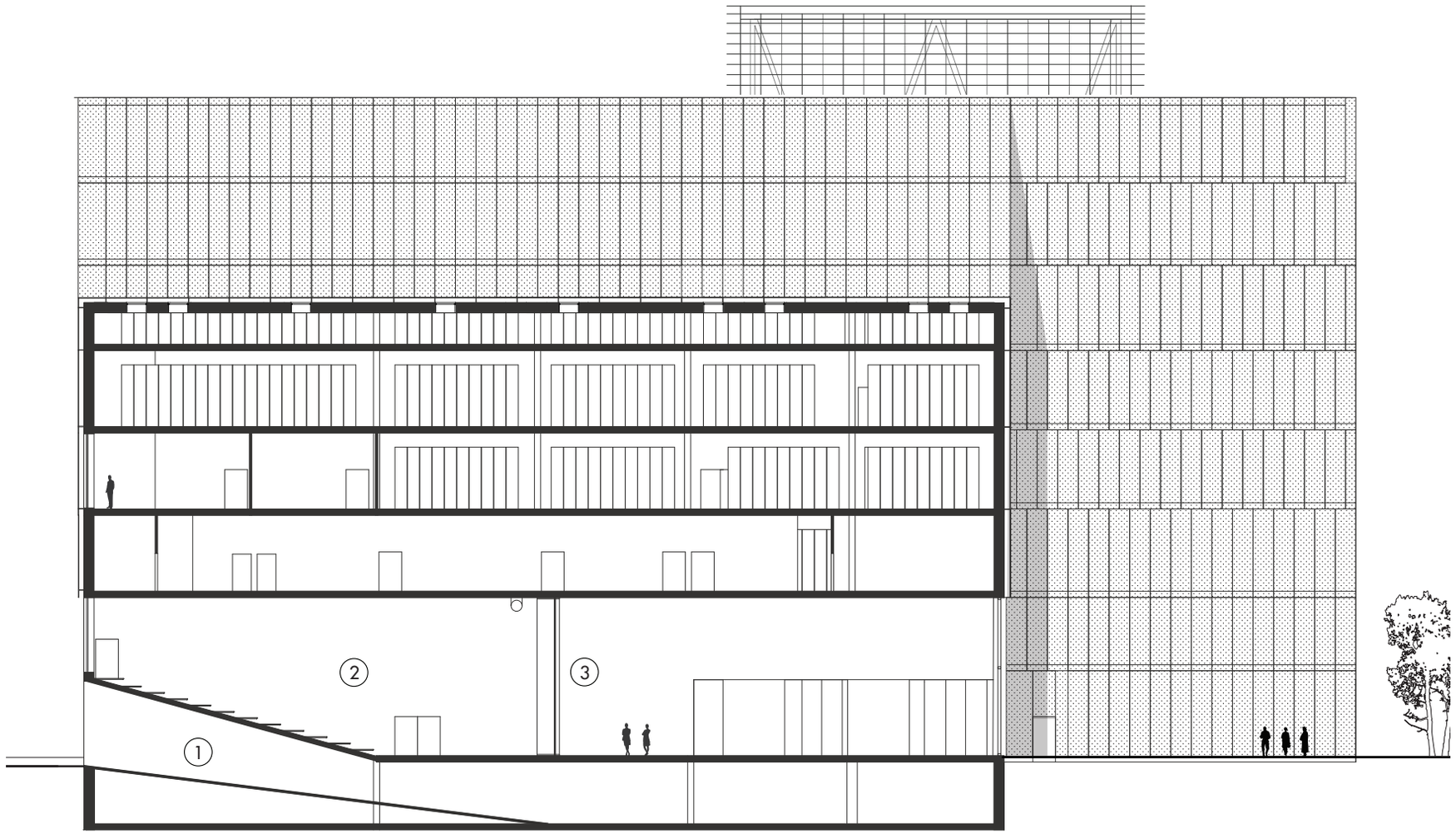
② AUDITORIUM

Double height ceiling in the auditorium creates a possibility to create a slope and therefor visitors can watch performances, speakers etc. Without obstructing each others vision.

③ FOLDABLE WALL

The foldable wall separates the auditorium from the exhibition spaces. It is flexible therefor both rooms can be connected and used for the same event,



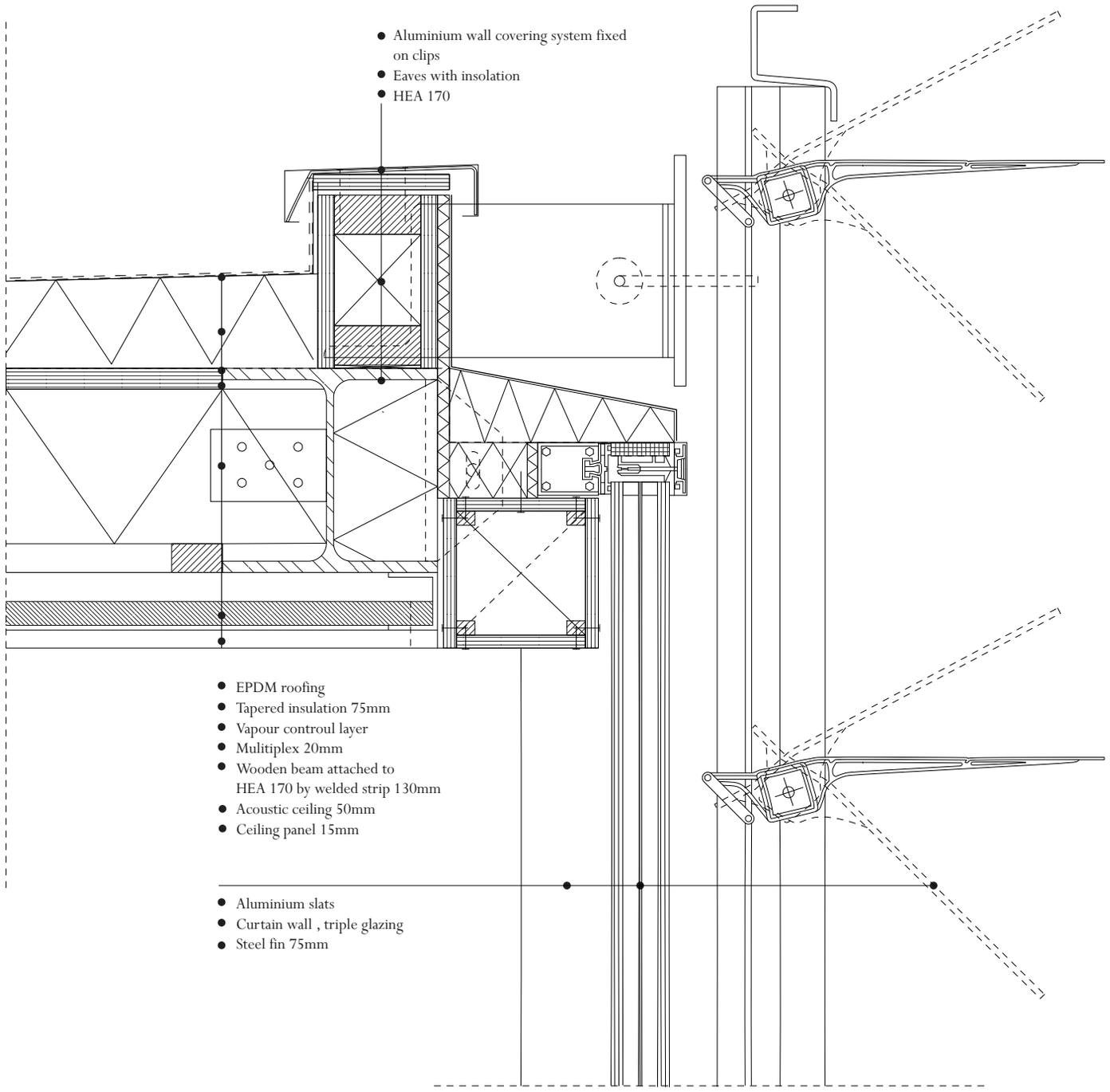


Section C-C

DETAIL

CONNECTION BETWEEN THE FACADE AND THE ROOF

In the chosen detail there is connection between the facade, the roof and lamellas system. Aluminum lamellas can be opened from 45^0 degrees (partly closed) to 120^0 degrees (to let in the light). This active facade including lamellas and triple glazing controls the amount of solar gains and sunlight.

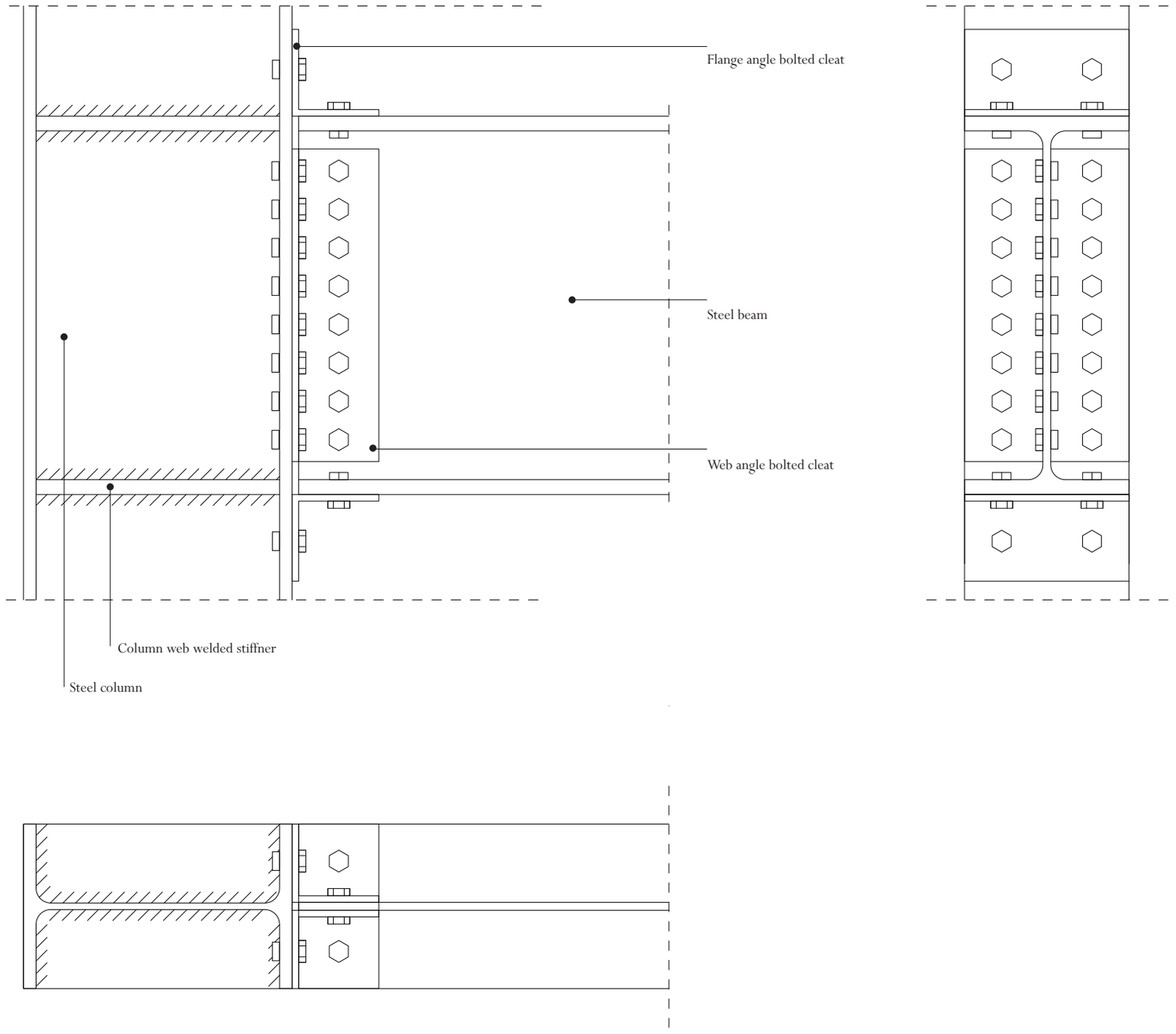


Detail A 1:5

DETAIL

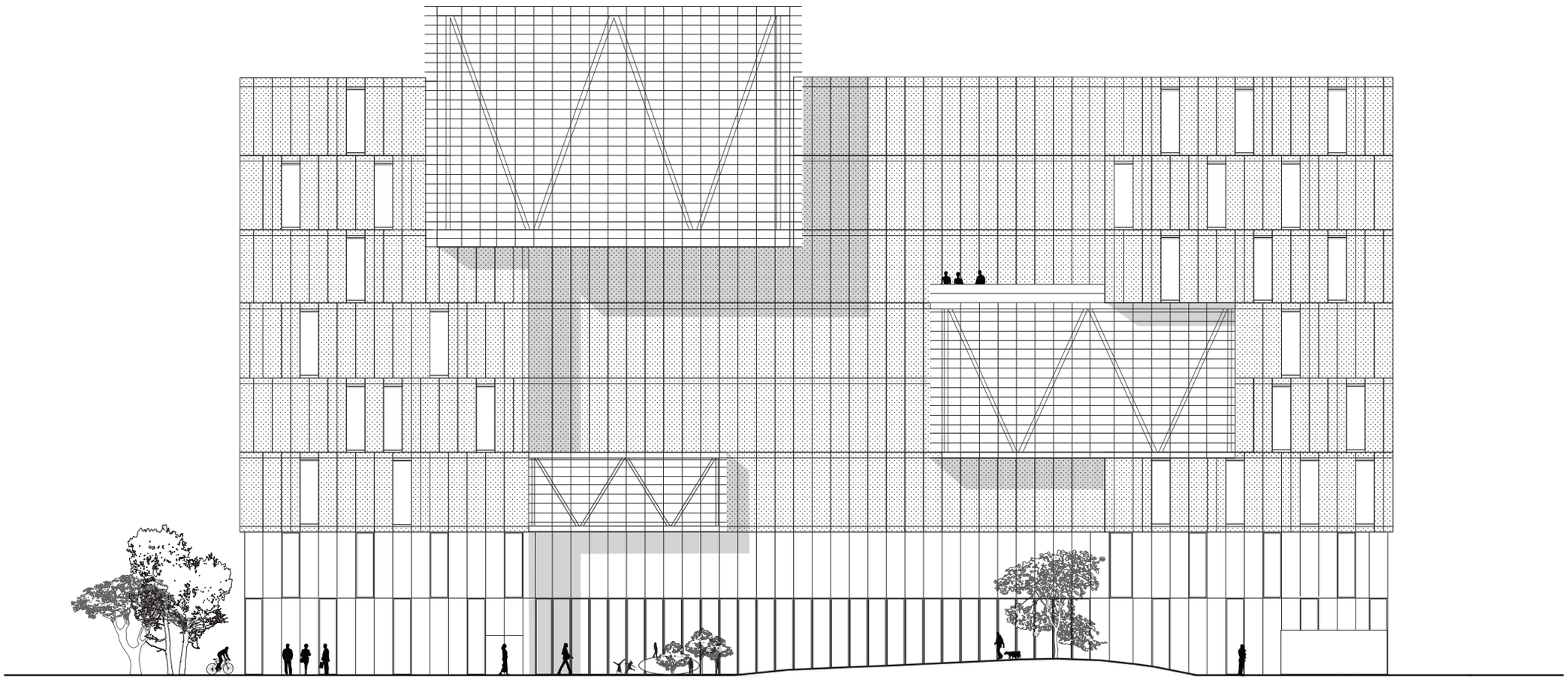
BOLTED BEAM TO COLUMN CONNECTION

The detail presents bolted angle bolted angle beam to column connection with flange angle cleats. Stiffener plates are used to strengthen the column flanges against the forces transmitted by beam.

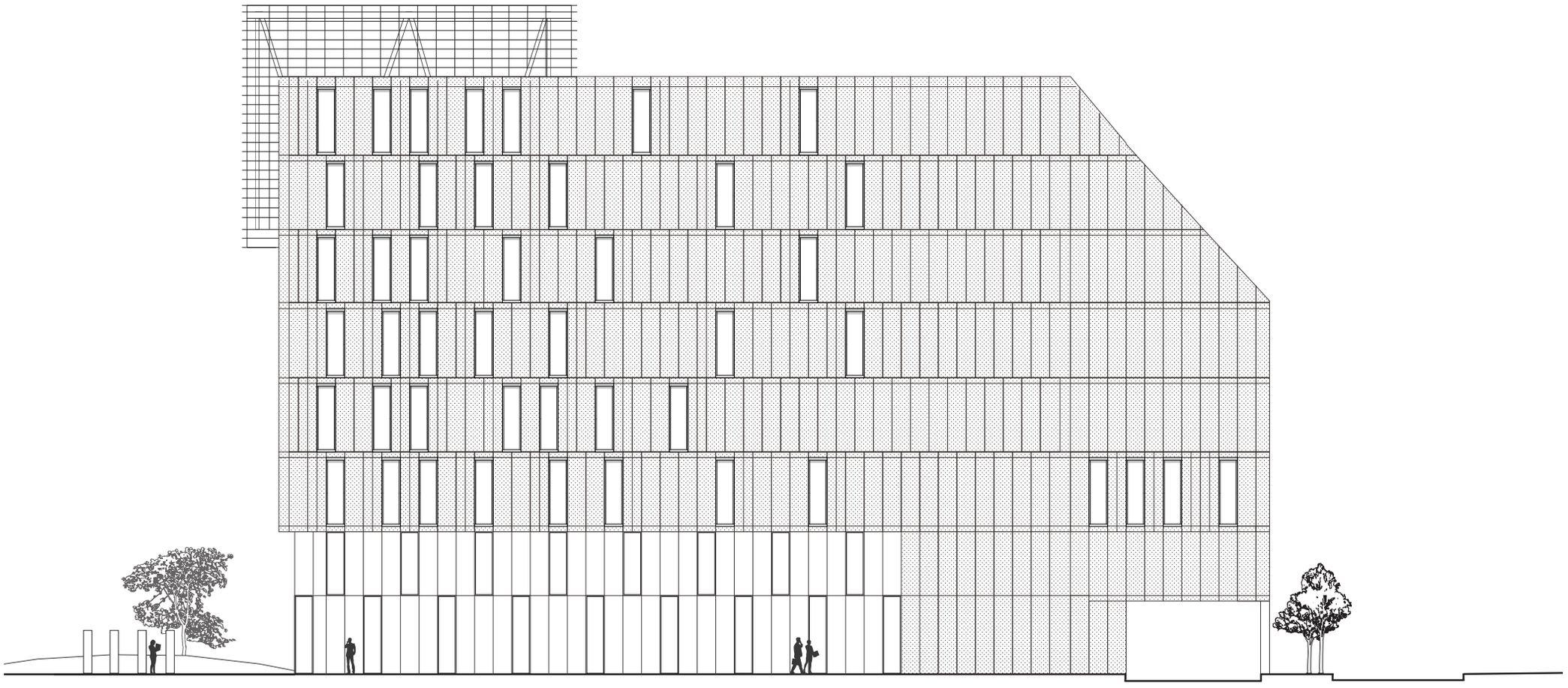


Detail B 1:10

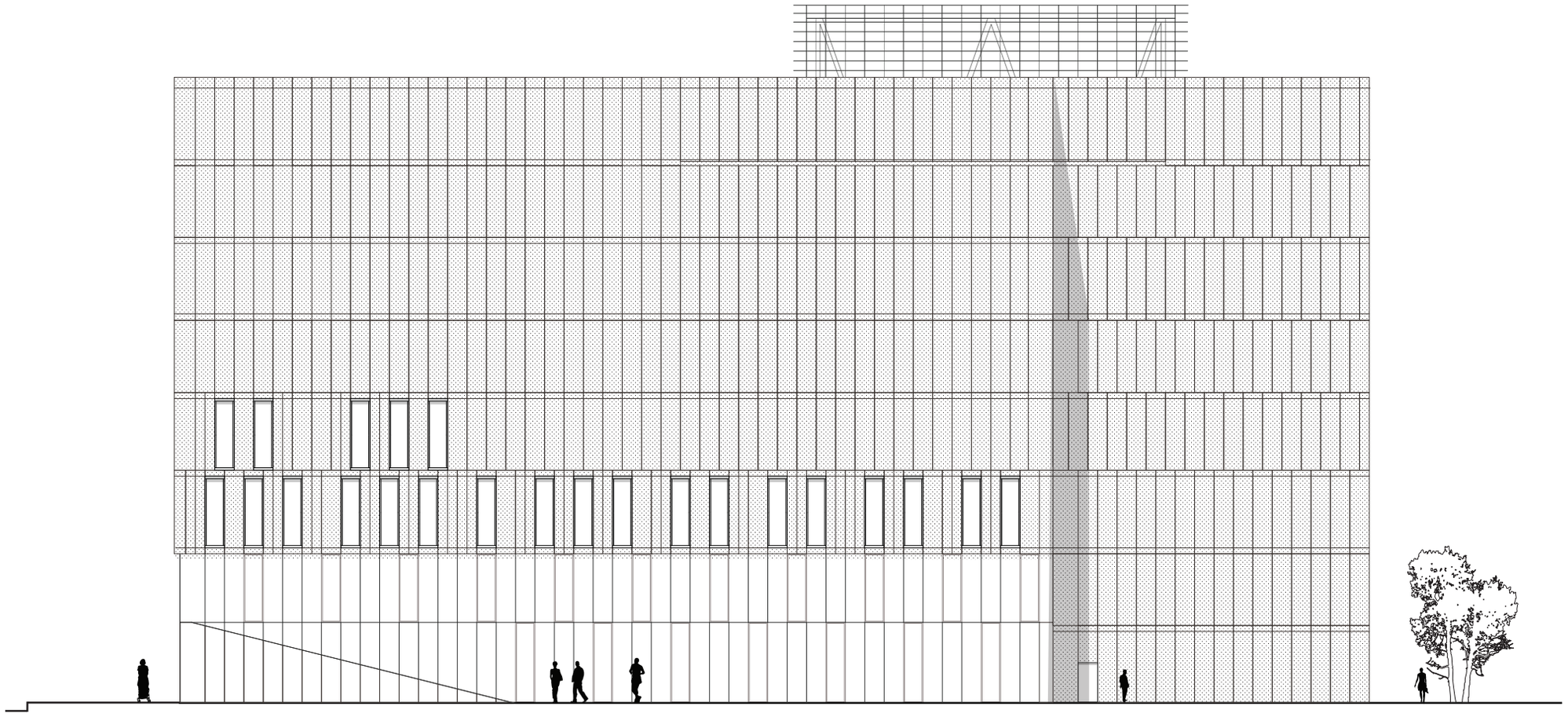
FACADES



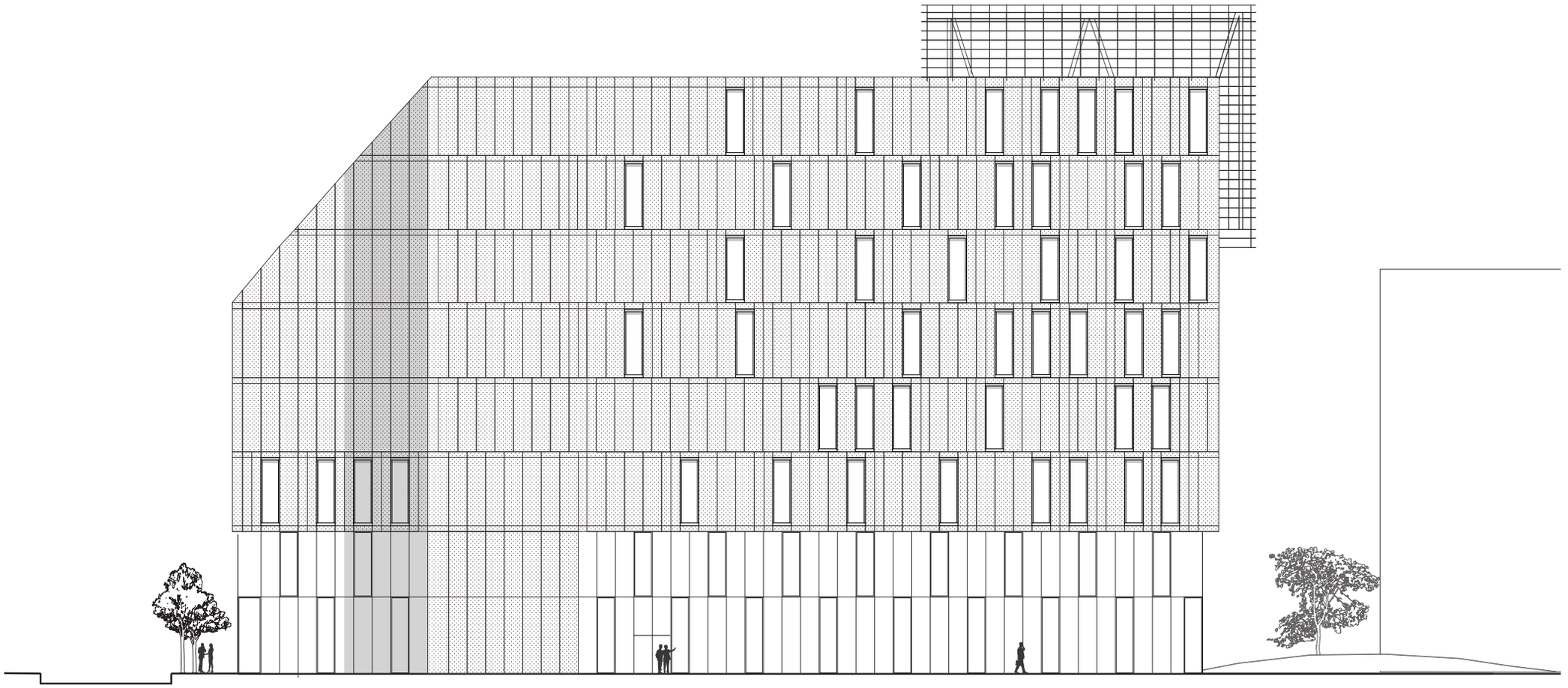
South east facade



North east facade



North west facade



South west facade

MATERIALS

Material diversity of neighbouring buildings and expressive form of Varna library building contrasts with the materiality of the design. The building aims to create a distinctive architectural identity but also through its transparency and lightness becomes an integrated part of a city structure.

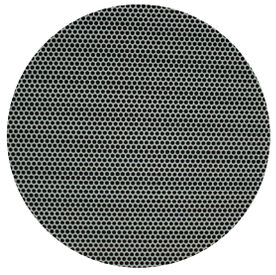


Fig.4.1

PERFORATED ALUMINIUM SHEETS

Perforated metal screen covers the building with a translucent mesh that not only filters the light and noise coming into the building but also gives it a feeling of fluidity. The perforated aluminium sheets reflect the sun during the day and makes the building illuminate during the night.

Fig.4.2

CONCRETE

Concrete in the public space contrasts with a greenery on the plaza and merges with a concrete floor on the ground floor. It makes the space more unified and the ground floor appears to be a part of the plaza. Light concrete floors in the building reflect light and also create a calm and neutral background for a color accents in the social living rooms as well as the garden on the ground floor.

Fig.4.3

BLACK PAINTED STEEL

Sculptural black staircase in the atrium creates an interesting spatial experience and leads people through the building. It is visible from outside due to the contrast between light interior and black material what makes it stand out.

Fig.4.4

GLASS

The border between outside and inside blurs because of the glass facade of the ground floor that exposes the garden and public functions. Glass facade keeps high level of daylight in the building and also is an important passive strategy during the winter to heat the building through solar gains.

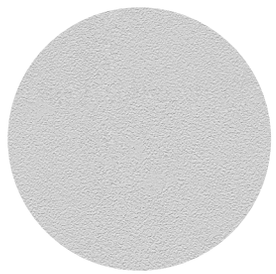


Fig.4.5

WHITE STUCCO

Walls and ceilings are covered with a white material to reflect the light and introduce it to the deeper parts of the buildings. White color gives the space a light atmosphere which contributes to better user experience and visual comfort while reading or studying.

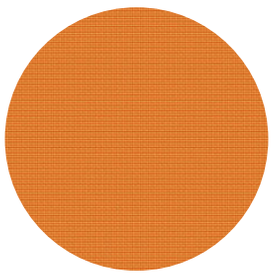


Fig.4.6

VYNIL

There is a vinyl flooring covering stair in a social reading room in young people area. Orange color contrasts with concrete texture of the flooring and white walls. The material is highly durable and has a good scratch resistance and acoustic performance. It is also suitable for sitting.

Openable glass facade makes an outdoor and indoor space unified and filled with light. Possibility of extending public plaza to the ground floor of the building activates a space inside and makes the library appear accessible and inviting. Green garden inside the building creates pleasant atmosphere enhancing creativity and relaxation. Atrium provides daylight for the greenery and distributes it across all floors. Black staircase leads through the building and makes climbing up the stairs an experience and a journey. Social reading rooms become an integral part of the atrium space.

DAYLIGHT

The quality and quantity of natural light in the library building is crucial for user experience and performance. In order to utilize natural light and create convenient working conditions for reading, studying but also using computer equipment we applied passive strategies to increase visual comfort of users.
The atrium with a skylight distributes natural light across the floors and provides higher daylight levels in spaces adjoining atrium. Therefore working stands and tables are located around the atrium. The skylight is also a source of natural light for a garden on the ground floor and main staircase. The shifting in the floors due to not aligned flights of staircase allows more natural light to deeper parts of the building. White ceilings reflect the light and distributes it through the floors. Perforated metal panels are used to control the light entering the building. Perforation reduces the glare of sunlight and increase the visual comfort of library users. It offers atmosphere of privacy without compromising visual connection with outside what enhances concentration and provides comfortable working atmosphere. The perforation gradually changes from 25% of light transmittance in front of the building to 65% what creates more balanced light conditions across the floor and controls sun glare in the reading areas adjoined to south -west facade. The area in the back of the building is designed for a computer stands and electronic equipment where the daylight factor is lower. Perforated metal screen have openable panels so natural light could be adjusted to user's needs and sunlight conditions.

The ground floor is two levels high what provides convenient natural light level for plants in the garden but also gives an impression of merging of outside and inside space what makes it more open and accessible- a part of a public plaza.
Daylight in the storage area is limited due to its negative impact on the books.

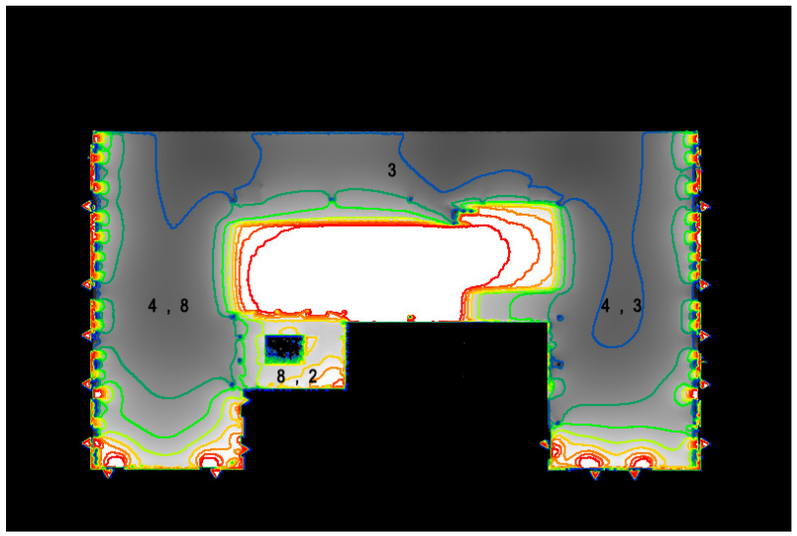


Fig.4.7

Daylight factors on the 3rd floor, children reading spaces.

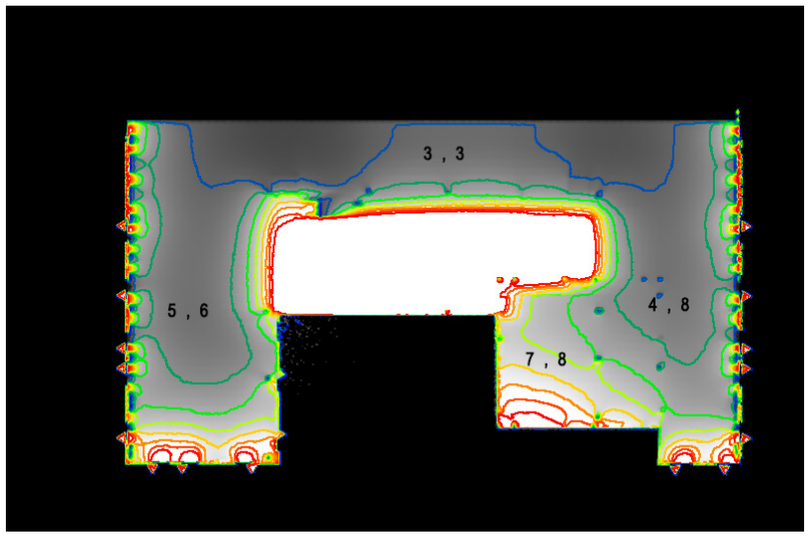
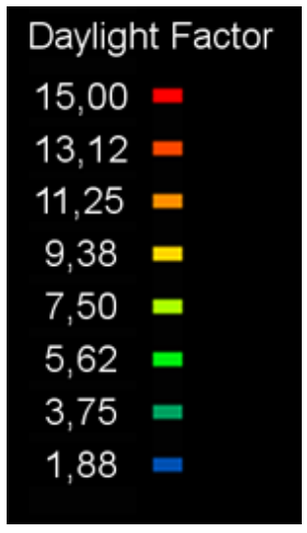


Fig.4.8

Daylight factors on the 5th floor, young people reading spaces.



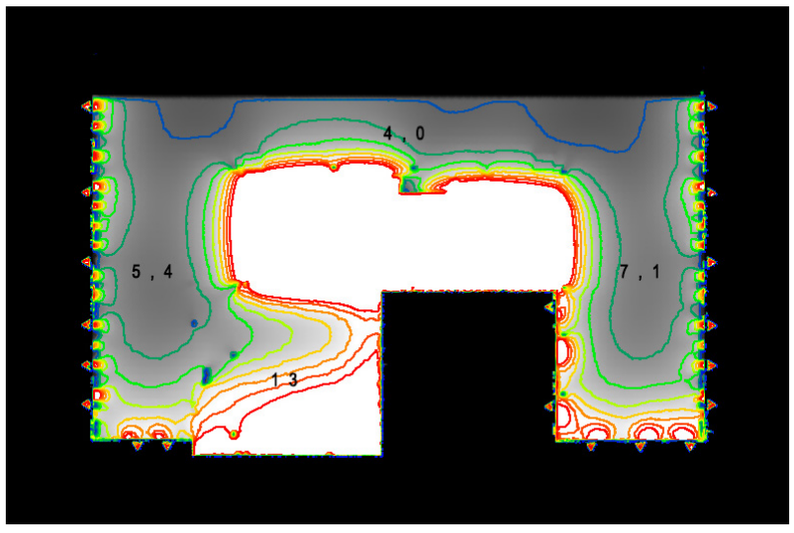


Fig.4.9

Daylight factors on the 7th floor,adult reading spaces.

INDOOR ENVIRONMENT

Thermal and atmospheric comfort of the biggest social reading room in the adult section is optimized and verified through simulations in Bsim. This part of this building is chosen because it is exposed to solar radiation the most due to it's location in the building as well as design solutions, like glass facade.

NATURAL VENTILATION

Atrium in the library provides the possibility of having natural stack ventilation (fig.4.11). The spaces have openings on the south and northern sides, there for we also have cross natural ventilation (fig.4.10). In the storages single sided natural ventilation (fig.4.11) is implemented. During the night cold air can be let in through the ground floor and come out through the atrium that way the whole building would be cooled down.

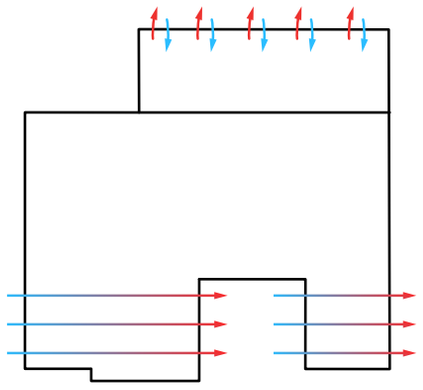


Fig.4.10

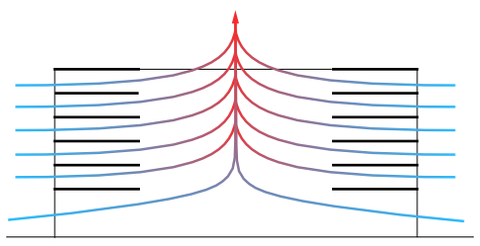


Fig.4.11

OVERHEATING

The biggest social reading room has a huge facade made of glass panels there for its extremely sensitive to overheating. By implementing shading into our design and having mechanical and natural ventilation and cooling we managed to reduce hours of overheating per year to 58 above 26 °C and 7 above 27 °C (fig. 4.12).

CO_2 CONCENTRATION

CO_2 concentration remains constant during the months with mechanical ventilation and slightly decreases when natural ventilation starts (fig.4.13). It happened due to higher air change rate in those months as well. The maximum CO_2 level is 558 ppm which is still smaller that the maximum allowed.

MEAN TEMPERATURE

The lowest temperatures of 18 °C occur in winter months as it is expected. It is still above the minimum of 17 °C which is required in the competition brief in winter months. In spring and summer the temperatures continue to rise due to rising outdoor temperature and it reaches maximum of 22, 7 °C in July and does not increase due to cooling and natural ventilation and flexible shading implementation. The maximum temperatures of 27 °C and 28°C appear only few hours in a year (fig.4.14).

AIR CHANGE

The mean air change rate keeps constant during heating season months due to control of mechanical ventilation. In May the air change rate increases because then natural ventilation starts. The increase is also affected by the fact that the building (as well as social reading room) has many openings and the atrium for natural ventilation. Natural ventilation is controlled by temperature and CO_2 levels. Maximum air change occurs during July when the outdoor temperature is the highest. In October the air change rate decreases again because of the switch from natural to mechanical ventilation (fig.4.15).

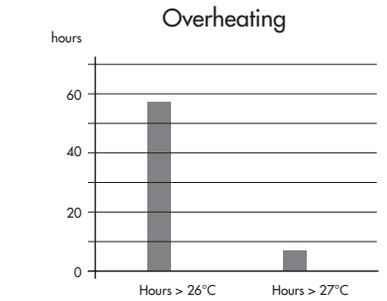


Fig.4.12

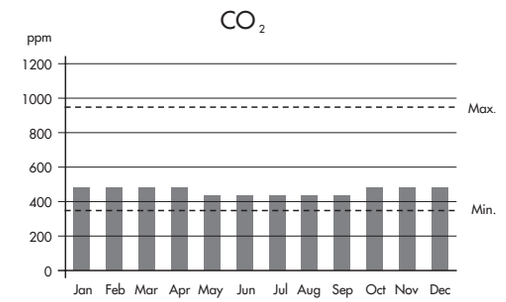


Fig.4.13

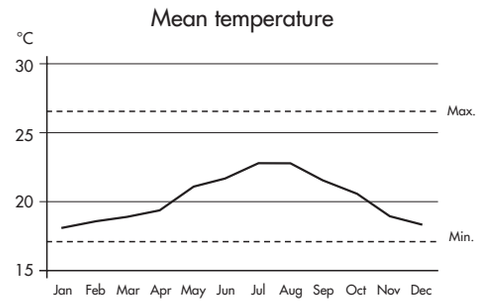


Fig.4.14

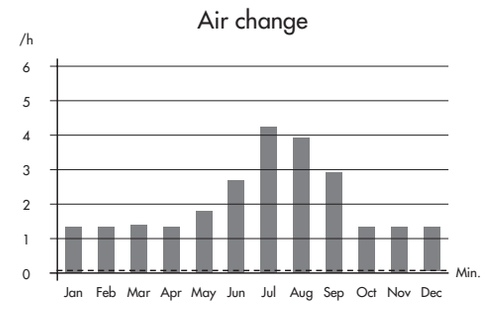


Fig.4.15

STRUCTURE

The structure of the library shows the expressive potential of structure and construction in the tectonic manner. The concept of merging tradition and modernity, work and leisure in one building is represented by structure of Varna Library. Column and beam system in the main building and cantilevered beam structure of overhanging social reading room show the difference between these two spaces. Trusses supporting roofs of overhanging boxes create fluid boundary between these spaces and emphasize a playful character of social reading rooms.

Structure of the main building is steel frame structure. The overhanging structure is a simply supported cantilevered beam. The magnitude of the bending moments and shear forces in a beam as well as its support reactions vary depending on the loading distribution along its length. The dead load will be constant, but live loads will be different in location during the use of the building. There is an uplift force while live load is applied only on cantilever but also in case of load applied on the whole length of beam.

The bending moment and shear forces diagram have been calculated for load cases on a simply supported cantilevered beam- HEA 1000.
The beam needs to support 8 m of width floors. Self weight of the structure was used as a dead load and value of 3 kN/m2 (C1) (EC1 Eurocode) as a live load. In load case 4 the value of 2,5 kN/m2 (reading areas with no storage) was imposed on the cantilever and value of 4 kN/m2(reading rooms with storage) was imposed on backspan. The backspan measures 13 m and the cantilever 15m. Factors of safety are 1,35 for dead loads and 1,5 for live loads.

Maximum reaction appears in the front supports- near cantilever. Front support is always in compression. There is an uplift force in case of load applied on the whole length of beam. This situation requires anchoring the foundation but another less expensive solution is to increase the weight of the back supports and the difference between loads imposed on cantilever and backspan. Finding a strategy to increase the load transfer to the main supports could eliminate uplift forces. The strategy to increase stability of the structure could be changing the ratio between backspan and cantilever, choosing beam with a bigger section and finding the way to decrease the floor spans in order to reduce their weight.

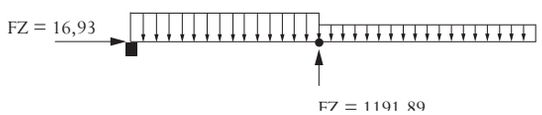


Fig.4.16

Reaction diagram

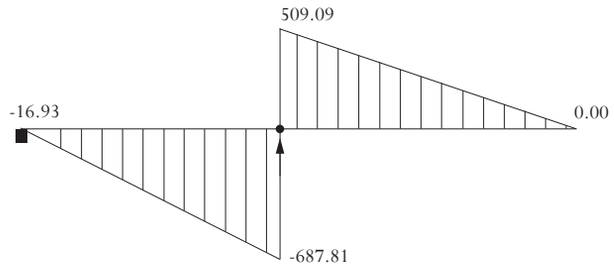


Fig.4.17

Shear force diagram

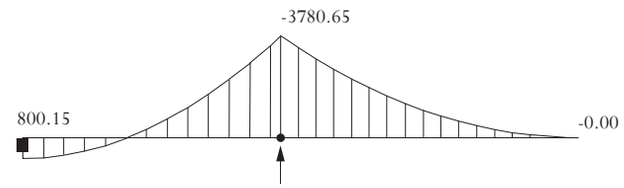


Fig.4.18

Bending moment diagram

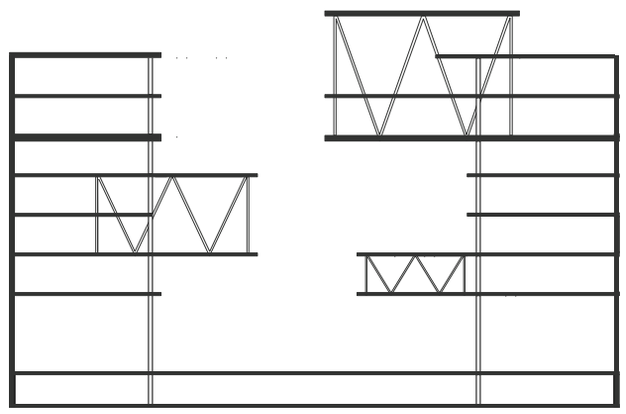


Fig.4.19

Structural system diagram

Overhanging social room on the highest floor creates an observation deck with a view towards the Black Sea. People can meet and socialize or study while enjoying the sun. Atrium skylight creates good daylight conditions for studying and allows visual connection with the other floors. Bookshelves, positioned perpendicularly to the facade, let the sun in, organize the space and create a good working mood alluding to atmosphere of traditional libraries.

PROCESS

Masterplan
Concept
Volume study
Indoor environment
Plan layouts
Structure
Facades
Conclusion
Reflection
Literature list
Image list

MASTERPLAN

Investigation of city urban structure and our visit to Varna made us realize that there is a well-developed network of green public spaces and a number of cultural and educational building in proximity of the site. Therefore, our considerations in relation to master planning arises from a concept of continuation of existing city structure and integrating it with an urban tissue. We investigated different ways of this incorporation - public space as a "climbing up" vertical extension of the city or opening the ground floor to make a space more public and integrated with a surrounding. Together with volumetric and massing studies the idea of open central plaza crystallized. Public outdoor space design has as a goal to invite people to library, and in combination with an open ground floor and its public function becomes a natural prolongation of the city. We were investigating different settings and elements that would shape the space to meet this goal and we decided that curved and relatively low elements of plaza do not obstruct the view of the library building and due to lack of angles they create a fluid and inviting space. Scattered around the site with a different size and texture they can easily accommodate various functions and create a pleasant spatial experience.

Fig.5.2

City public space continuing in vertical direction.

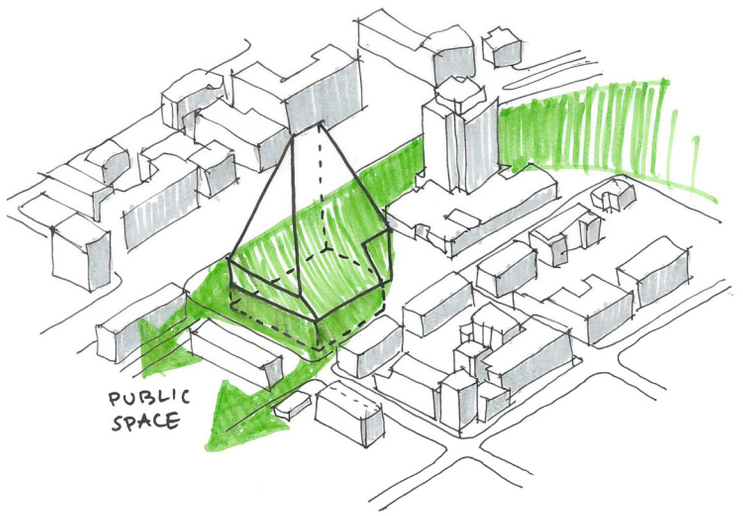
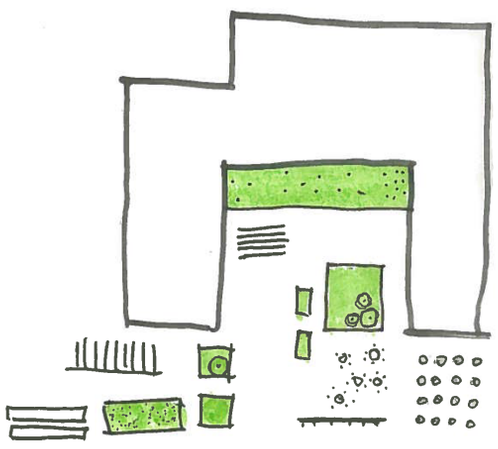


Fig.5.3

Raising the building in order to merge it with urban structure.



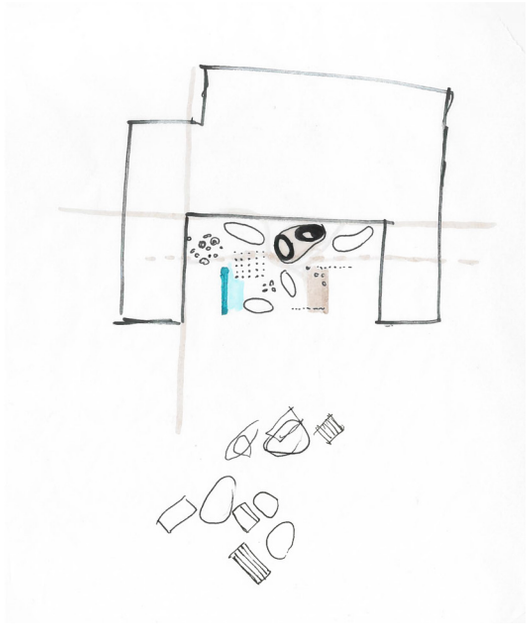


Fig.5.1

Master plan diagrams presenting different means to organize the public plaza.

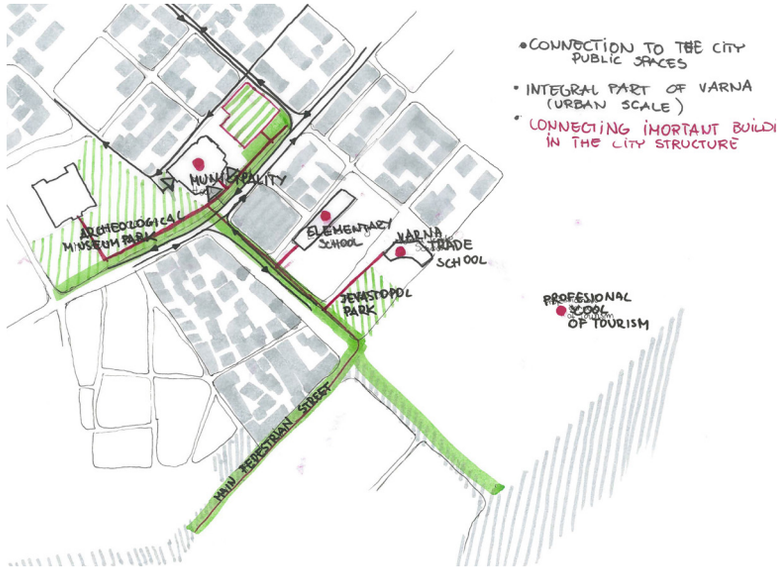


Fig.5.4

Connecting the site and library with an important educational and cultural building and with network of public green spaces.

CONCEPT

We explored different ideas to bring people in to the site. The ideas as curved roof volume, solid volume standing on an open and less massive base or gradual increasing of density along with a level appeared. Concept of atrium as an element providing daylight, organizing the space and giving an interior a strong spatial expression was also investigated. The concept behind a library is to merge tradition and modernity in one building- respect the book heritage but also create a "living room" space for Varna community. We wanted to find a way to make an architecture of the building reflect this idea. The concept developed along with volumetric studies and average sunlight hours calculations. Cutting out the central part of the raised volume and creating a plaza and one side open atrium allowed us to implement our earlier ideas and considerations. Addition of different size volumes goes along with a concept and aims for creating a diversified spaces inside the library as well as distinctive architectural expression.

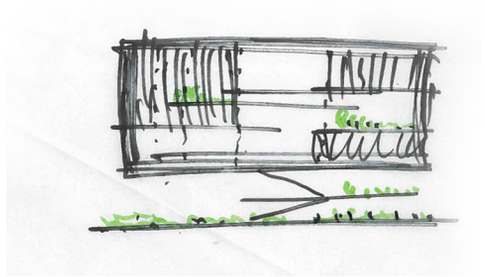


Fig.5.5

Concept of raising the main volume is explored.

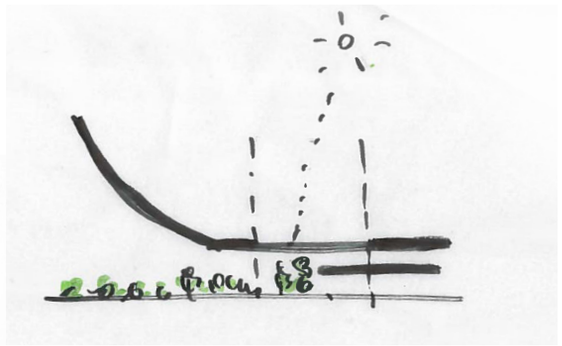


Fig.5.6

Atrium brings the light inside the building,

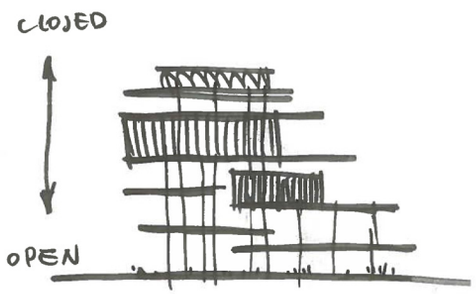


Fig.5.7

Closed and calmer spaces are higher in the building whereas open and more active ones lower.

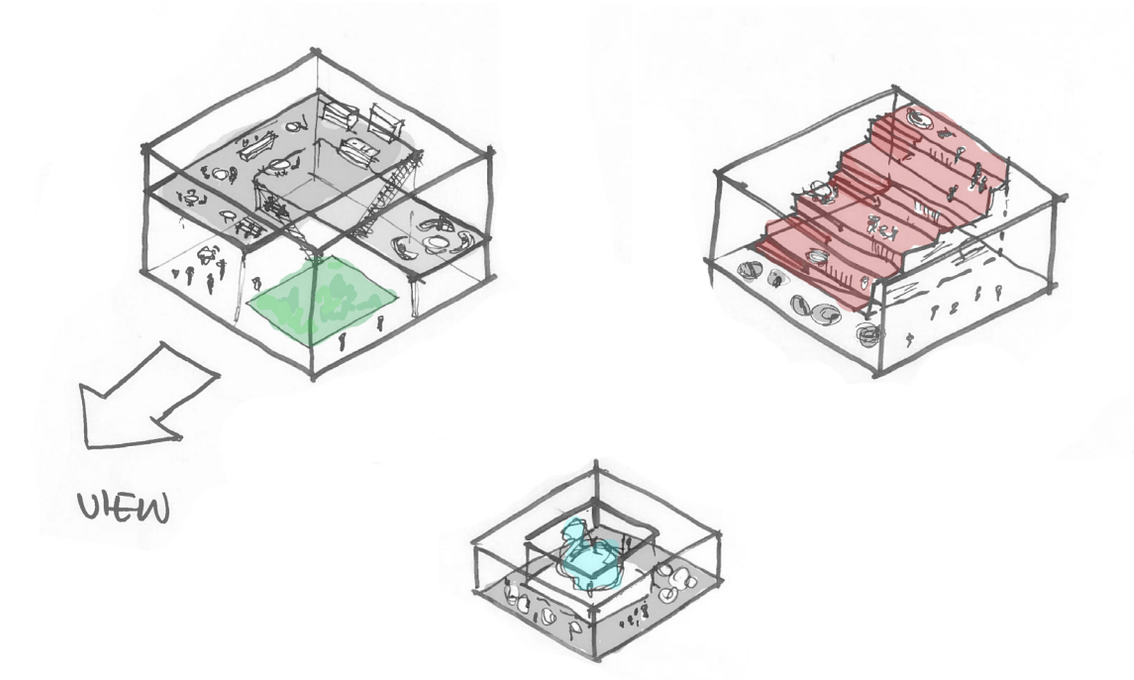


Fig.5.8

Social reading rooms provide the possibility of community gatherings in all age groups.

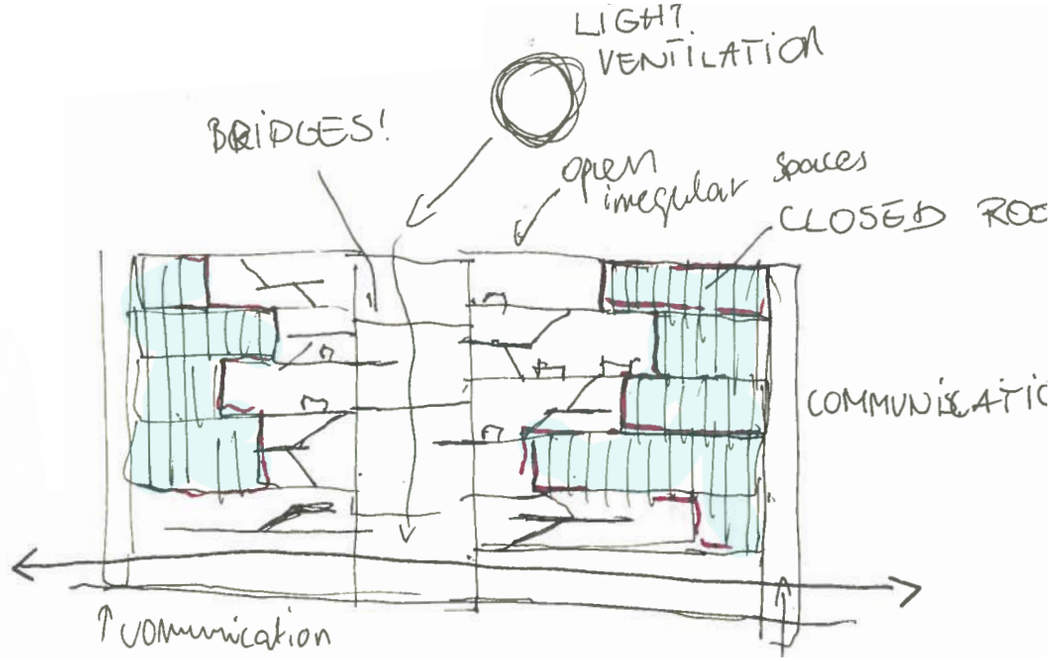


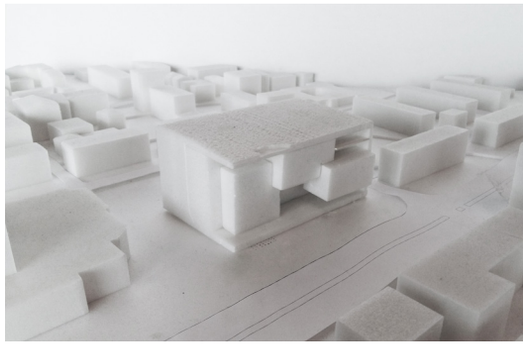
Fig.5.9

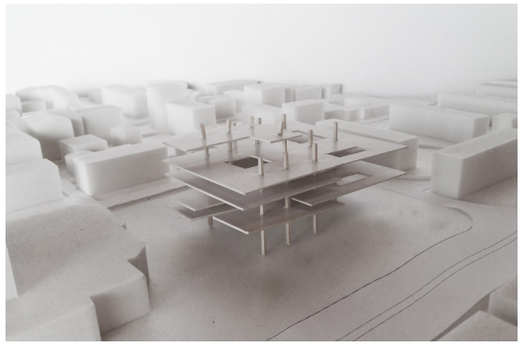
Different atrium qualities are investigated in the sketch.

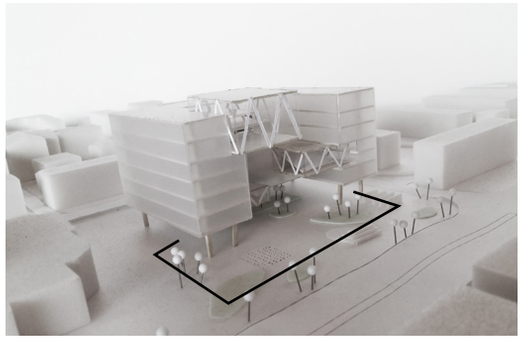
PROCESS

VOLUME STUDY

The idea of having a light and spacious ground floor with a greenery required calculation on average sunlight hours . We investigated different options- raised cuboid volume and with a curved cut, one atrium and three smaller, boxy volumes with a frame, floors supported by a grid of columns with three different size atria and opening the volume by cutting out the central part and creating open atrium. Opening the volume allowed the sunlight to penetrate the building. It decreased however the area of the usable floor. We decided to have semi closed atrium. We started from placing volumes and investigating how they affect conditions on the site and perception of the space inside the building. We found a way to emphasize a hierarchy and composition along with maximizing benefits for indoor climate, daylight conditions and spatial perception of interior space as well as its influence on shadow conditions on the site. We examined how the volumes affect the atrium space by moving them inside what makes them more integrated with the building and creates visual connection between different spaces what makes it more diversified and engaging.





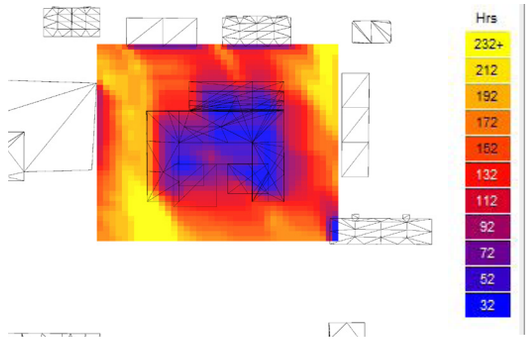


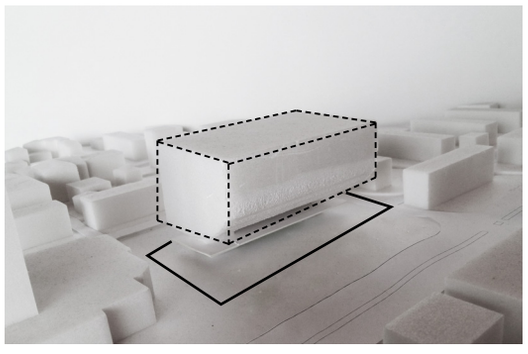
5.10

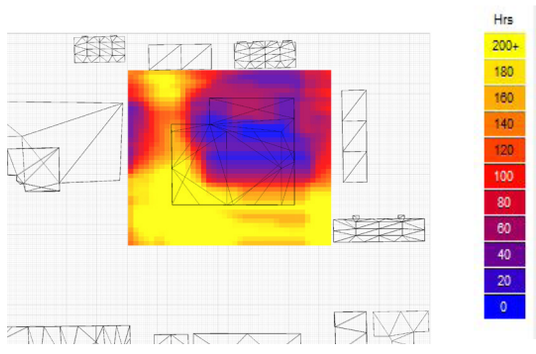
Different volume proposals and diagrams presenting average sun hours results from 21st June to 21st July. The public plaza sunlight conditions are investigated. The goal is to reach a balance between pleasant lit spaces and shading. The black line shows the investigation grid.

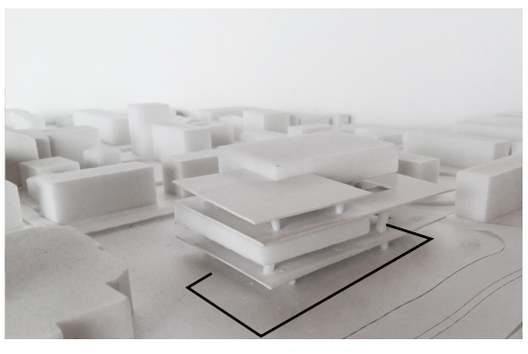
Fig.5.11

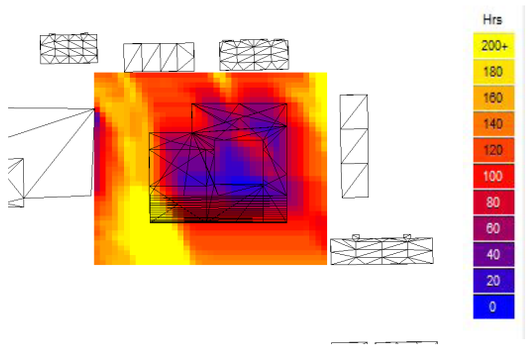
First models presenting considerations about volumes and structure

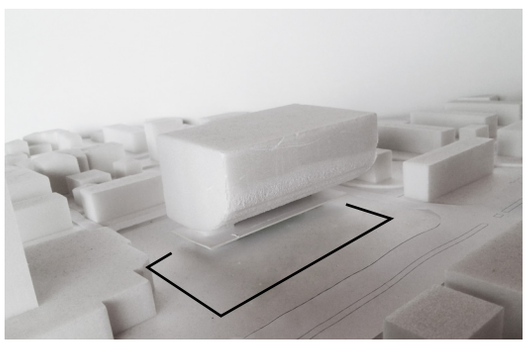


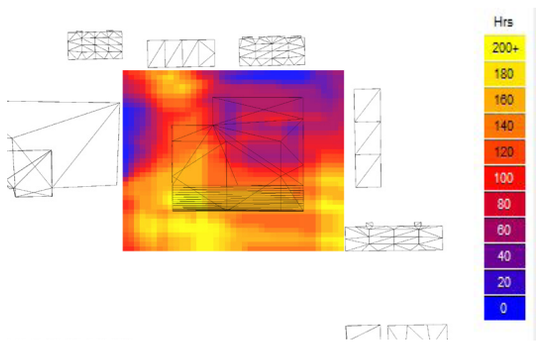


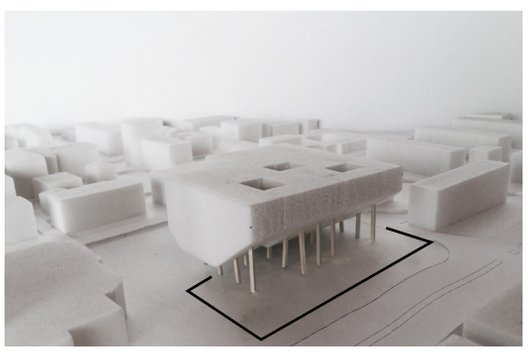


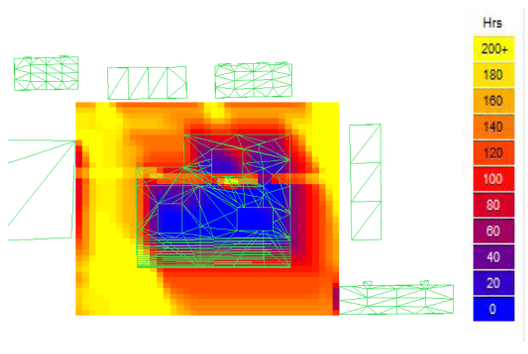




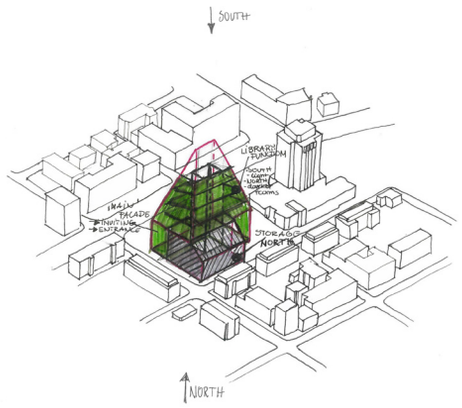


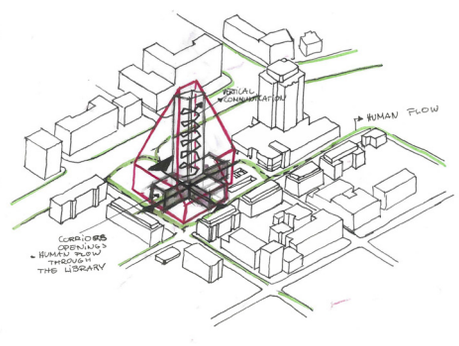






VOLUME STUDY





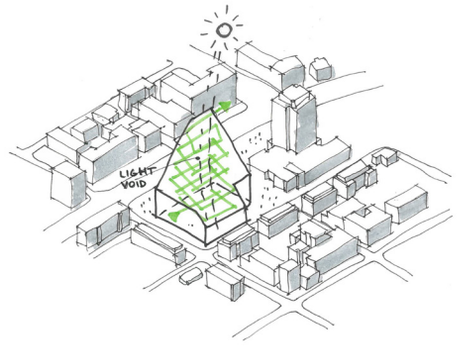


Fig.5.14

Different approaches to movement in the building and storage placing are investigated in the sketches.

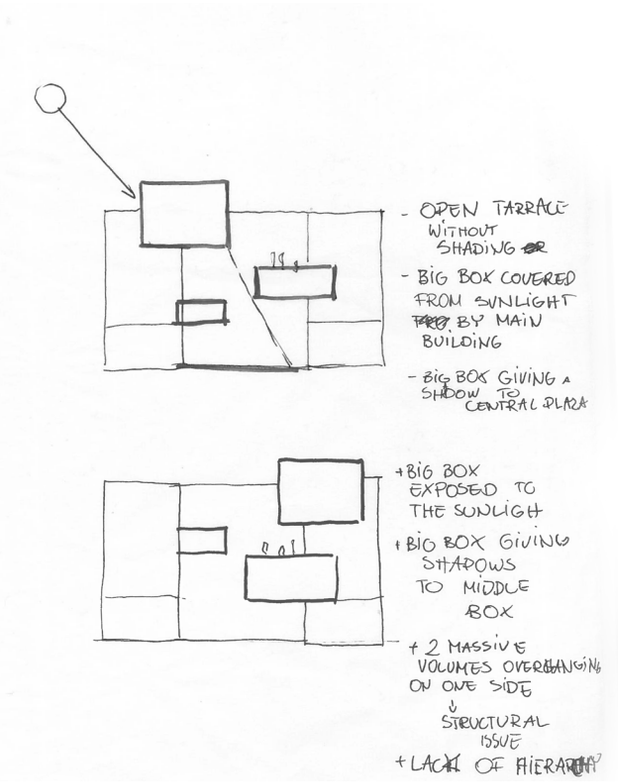


Fig.5.12

Cons and pros of different locations of the social reading rooms are explored.

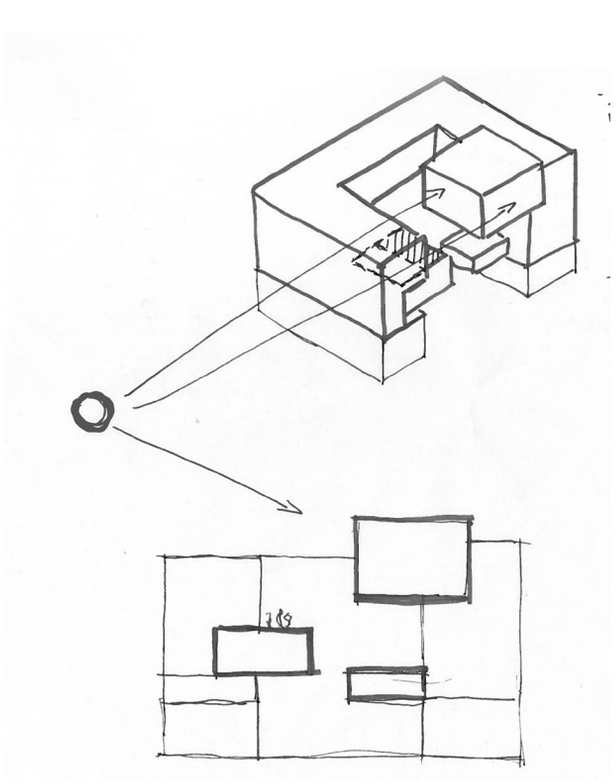


Fig.5.13

When mirroring the social reading spaces we found out that the biggest one receives more overheating than before.

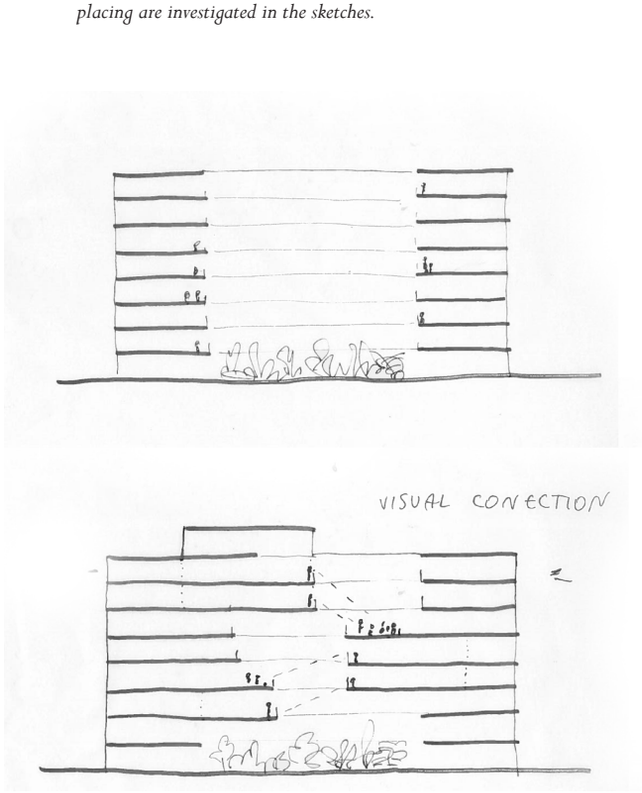
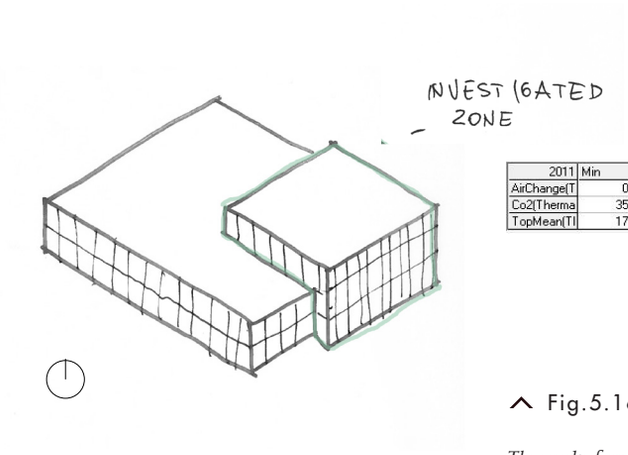


Fig.5.15

The spatial connection of different floors is expressed in the sketch.

INDOOR ENVIRONMENT

In order to optimize indoor environment in the library and make architectural solutions sustainable we optimized our building in indoor environment calculation program Bsim. We chose to optimize adult reading space because it was most prone to overheating and also is the biggest space in the library. (Apendix 1) First we thought to have curtain wall facade in the adult reading space as well as on the other facades. We also adapted some of the windows for natural ventilation. Fig.5.16 Shows that we got huge numbers of overheating hours as well as quite high CO_2 levels in winter and spring as well as too high mean temperatures in summer. To decrease the amount of overheating and temperatures we decided to introduce shading panels on the reading spaces, but still kept the main space with only curtain facade. The temperatures became closer to the allowable norm, which is 17-22 °C in winter and 20 - 22 °C degrees in summer (Varna Library competition brief). Also we experimented with increasing the openings and the air change rates became too high in summer because of natural ventilation being active. Fig.5.18. Shows a different location of the adult reading space. We investigated if changing the location of it changes the results and we found out that overheating and mean temperatures become higher, because then the "box" is more exposed to solar radiation as it is facing south. Air change rates also got bigger because the space was exposed to south east, which is the main direction of wind through a year. For these reasons as well as better views from that location we decided to move back the biggest social reading room to the first place. To reduce overheating and mean temperatures more we introduced venetian shading on the "box" (Fig. 5.19). It made an extreme difference and temperatures above 26 °C decreased to only 63 hours. Even though the numbers become allowable, the energy amount to heat and cool the building was high due to all over glass panel facade. Therefore we designed the windows on the "outer shell" of the library. It also slightly decreased the temperatures and hours above 26 °C. For the last step we decided to make venetian shading on the biggest space flexible and it increased the results even more to only 7 hours above 27 °C in a year. We have realized that even though the biggest adult reading space uses the biggest amount of energy to be heated, ventilated and cooled, the other spaces bring the amounts of energy down and keeps a balance of the entire building.

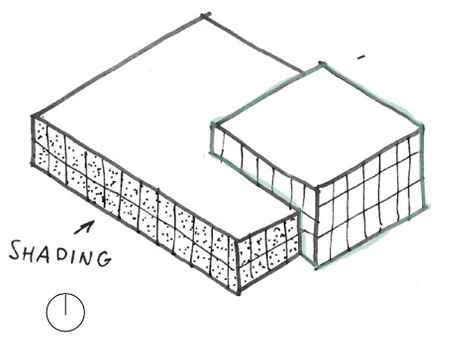


2011	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange[T	0.13	1.33	7.82	0.52	0.52	0.53	0.56	0.94	2.41	3.59	3.03	1.92	0.83	0.55	0.52
Co2[Therma	350.1	575.0	914.2	645.1	647.1	650.1	632.3	575.8	481.3	421.0	447.4	509.6	602.5	644.9	649.2
TopMean[TI	17.00	22.76	32.12	18.90	19.34	20.04	22.75	24.67	25.67	27.19	26.26	25.45	23.19	20.59	18.90

Hours > 26	1343	1343
Hours > 27	633	633

Fig.5.16

The results from Bsim show Air change rate, CO_2 levels top mean temperatures during all months of the year. It also shows that the biggest reading room (marked green in the illustration) has 1343 hours above 26 °C and 633 hours above 27 °C during a year. The numbers are too high, since allowable norm is 100 hours above 26 °C per year.

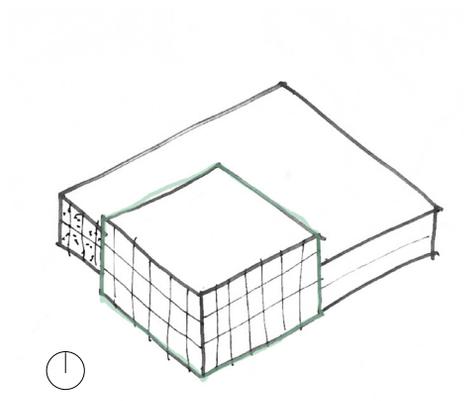


2011	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange[T	0.13	3.89	9.43	1.49	1.58	1.80	2.44	4.15	6.56	8.00	7.82	5.85	3.31	1.97	1.49
Co2[Therma	350.0	394.5	486.1	420.3	418.6	416.2	401.0	382.4	368.2	365.5	365.9	371.5	392.7	412.0	421.5
TopMean[TI	16.99	20.63	31.33	18.53	18.68	18.86	19.58	20.86	22.61	24.53	23.56	22.06	20.41	19.17	18.59

Hours > 26	582	582
Hours > 27	341	341

Fig.5.17

We introduce shading screens on the reading rooms surrounding the "big box".

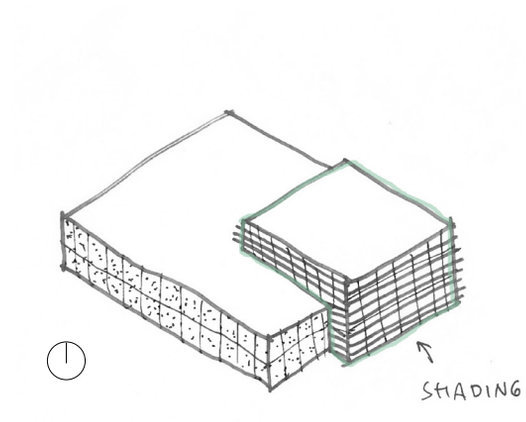


2011	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange[T	0.13	4.17	9.42	1.55	1.70	1.96	2.89	4.80	7.07	8.24	8.12	6.36	3.60	2.10	1.53
Co2[Therma	350.0	391.5	485.9	418.4	415.0	412.0	394.2	377.3	366.8	364.7	365.2	368.4	389.1	408.9	419.7
TopMean[TI	16.99	21.07	33.02	18.57	18.80	19.01	20.03	21.36	23.39	25.73	24.51	22.61	20.74	19.28	18.62

Hours > 26	953	953
Hours > 27	729	729

Fig.5.18

To investigate possibilities of our concept we move the social reading room to the opposite corner of the building, which exposes it to solar radiation a lot more that the first location.

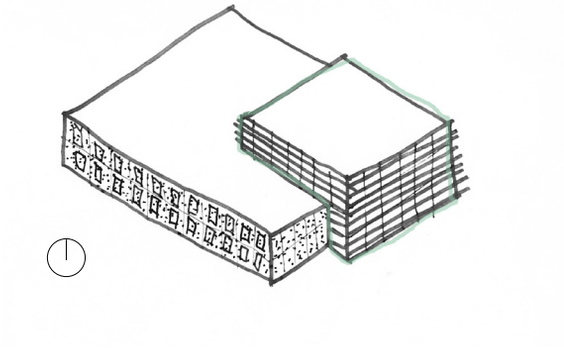


2011	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange[T	0.13	2.12	9.77	1.32	1.36	1.38	1.34	1.89	2.90	4.25	4.08	2.75	1.40	1.38	1.33
Co2[Therma	350.0	431.9	562.8	446.5	442.8	441.0	443.2	431.9	415.0	413.2	410.9	411.1	442.9	441.5	442.9
TopMean[TI	14.37	20.16	27.70	18.10	18.30	18.54	19.48	20.94	21.85	22.78	22.39	21.75	20.46	18.99	18.22

Hours > 26	63	63
Hours > 27	11	11

Fig.5.19

Venetian shading is introduced on the main box. It is fixed and runs every 0,4 meters, in order to keep beautiful view to the city. The results increase dramatically.

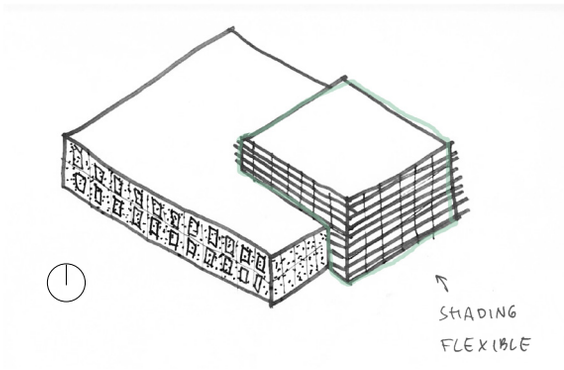


2011	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange[T	0.13	2.11	9.77	1.31	1.35	1.39	1.34	1.86	2.88	4.21	4.04	2.73	1.39	1.39	1.34
Co2[Therma	350.0	432.1	562.8	446.7	442.8	441.1	443.1	432.4	415.3	413.6	411.5	411.8	442.9	441.5	442.9
TopMean[TI	14.34	20.14	27.64	18.10	18.29	18.53	19.44	20.90	21.83	22.76	22.37	21.74	20.44	18.97	18.22

Hours > 26	66	66
Hours > 27	15	15

Fig.5.20

To make the library more sustainable we design windows on the facade. It protects the building with more insulation and saves energy for heating cooling and ventilating through the year.



2011	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange[T	0.13	2.09	9.77	1.31	1.36	1.39	1.34	1.85	2.82	4.19	3.96	2.62	1.38	1.38	1.34
Co2[Therma	350.0	432.4	562.9	446.7	442.7	440.9	443.0	432.8	415.7	413.9	412.6	413.4	443.3	441.5	442.9
TopMean[TI	14.27	20.12	27.62	18.08	18.26	18.49	19.38	20.86	21.82	22.74	22.35	21.72	20.39	18.95	18.21

Hours > 26	58	58
Hours > 27	7	7

Fig.5.21

The last step was to make the venetian shading flexible. It closes to 45° angle when solar radiation reaches 150W/m². The results do not change as much because the angle of shading is not as high. We did not make it to 90°, which would close them completely because the views from the social reading room would be obstructed.

PLAN LAYOUTS

We started our floor-plan considerations from storage positioning investigation. We analyzed different positions according to sunlight conditions, effect on shaping other spaces, accessibility from the street but also ability to distribute books across the building. We decided that position in north-east corner of the site is the most convenient when it comes to all mentioned above issues. Therefore we were able to think about the library space as a separated from the storage what gave us an opportunity to work with an open floor plan and this way enhance light conditions in the building. We wanted to organize the space but still keep a possibility of adjusting it to different events, social situations and individual needs. We provide spaces for more closed individual work as well as group work and community meetings. We have investigated plan solutions in a smaller reading space scale, the balance among closed and open spaces, reading areas, hobby zones. We aimed for highlighting the difference between controlled, more concentrated reading area of the main building and more diversified setting in social reading rooms where space would be also interesting due to special features in them.

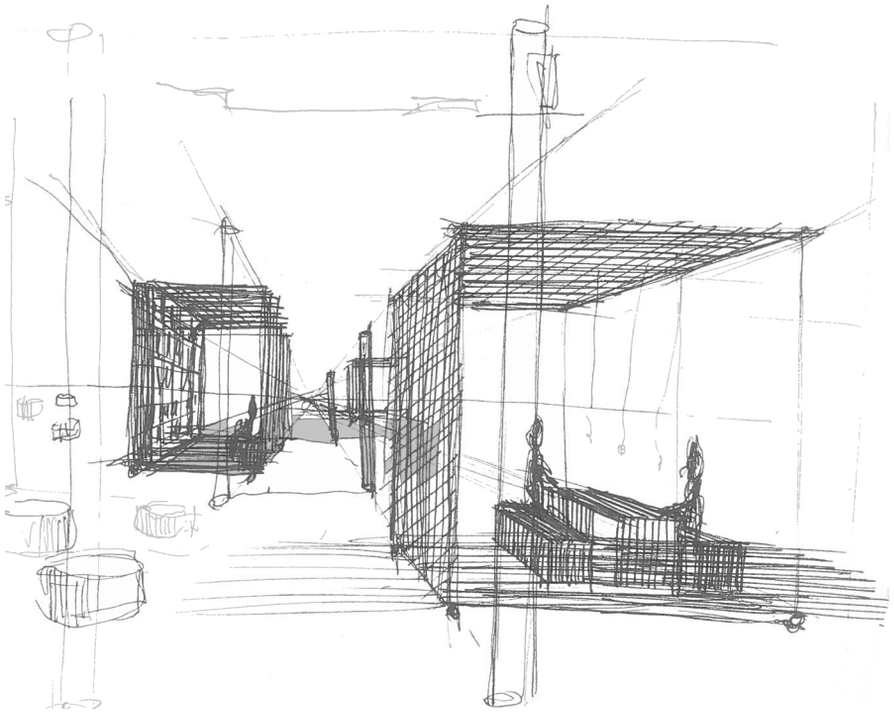
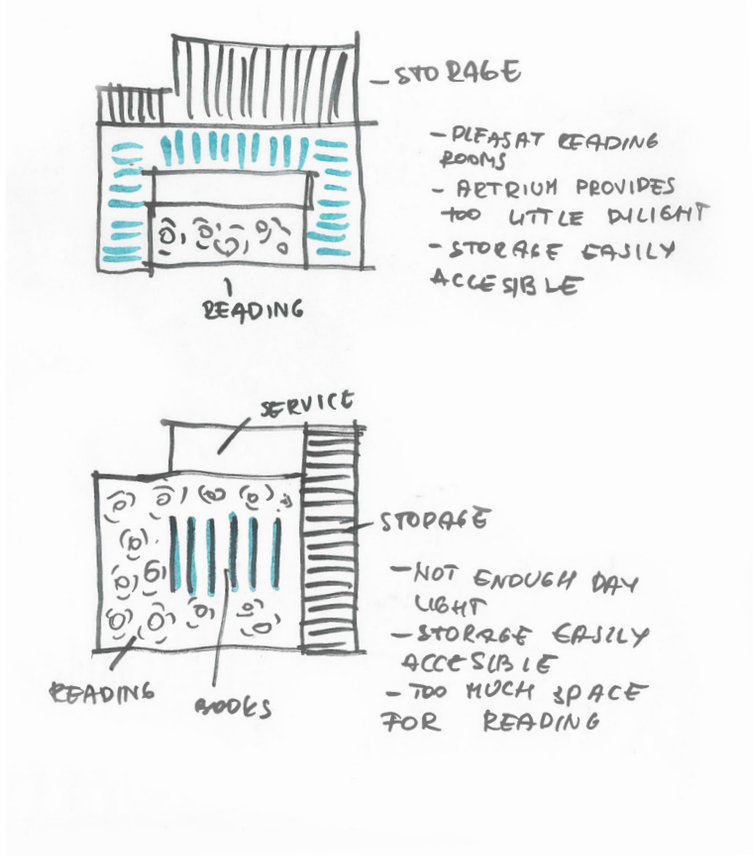


Fig.5.22

Open space with scattered private study rooms.



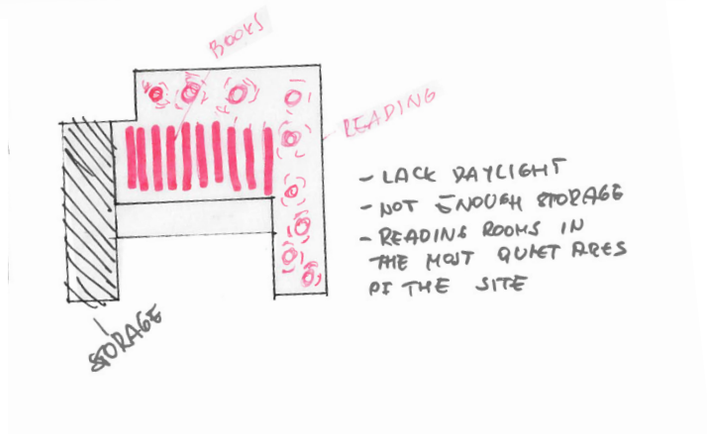


Fig.5.23

Diagrams showing various storage position.

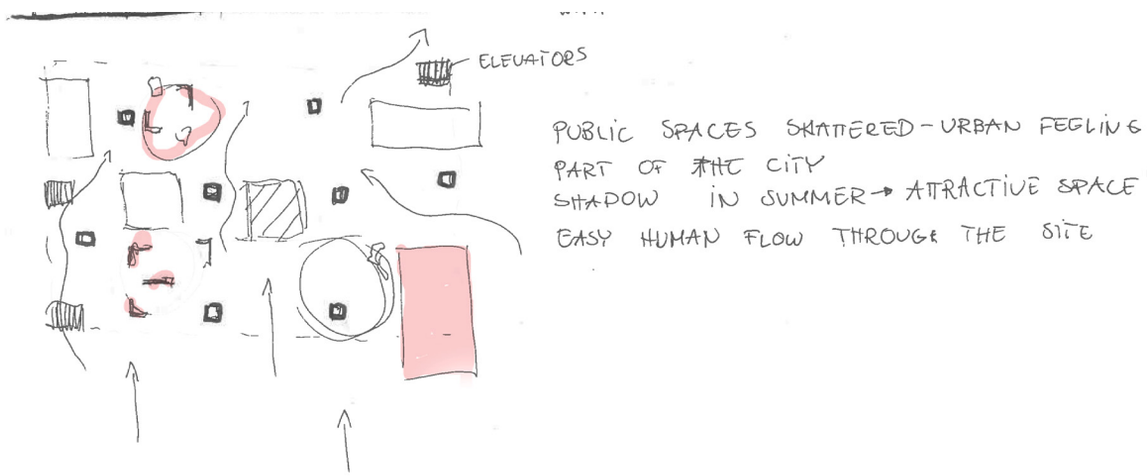


Fig.5.24

Open floor plan with different function "islands" allowing human flow and easy access of all the spaces.

STRUCTURE

We chose steel structure with a simply supported cantilevered beam and decided to investigate forces in the beam to understand the principle and optimize structural strategy. Introducing trusses emphasize a character of social reading rooms. They support roof of the biggest "box" and create a spatial feature. We started calculations on simply supported cantilevered beam in Karamba and investigated how backspan to cantilever span ratio affects forces in the beam. We decided to change the ratio by moving columns (front supports) closer to the facade so the beam deformation is smaller. In order to investigate the impact of loading patterns on bending moment and shear forces we used Robot structural analysis to calculate them what helped us to detect places where the structural problems may appear and think of strategies to prevent them.

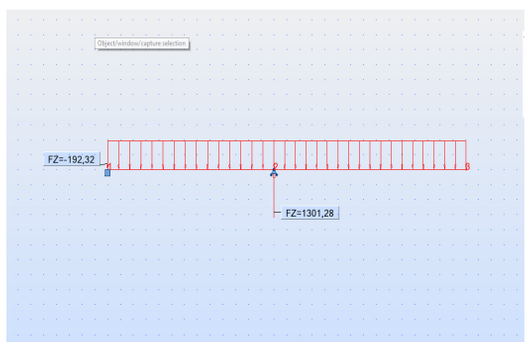


Fig.5.25

Fz reaction diagram- load case 1 (uniform load along whole length)

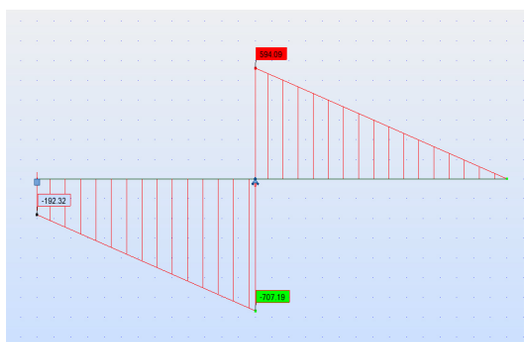


Fig.5.26

Shear force diagram for load case 1

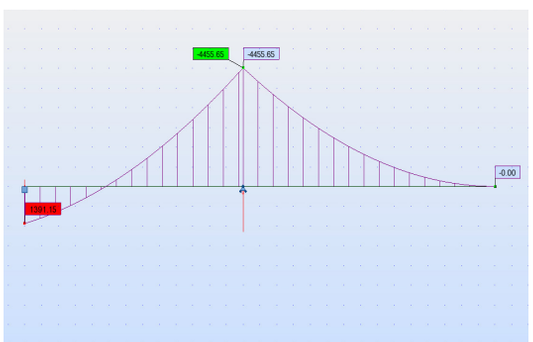


Fig.5.27

Shear force diagram for load case 1

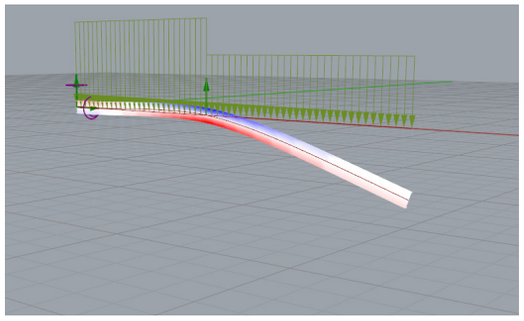


Fig.5.34

Cantilever with live load bigger in backspan than cantilever- backspan/cantilever ratio- 9/19

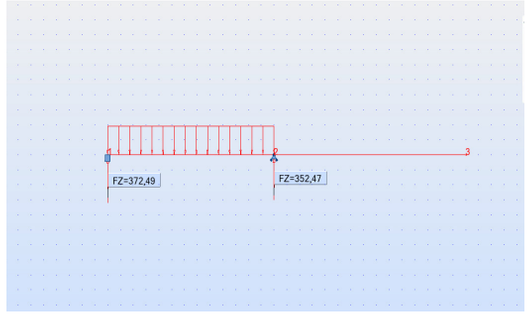


Fig.5.28

Fz reaction diagram- load case 2 (uniform load on backspan)

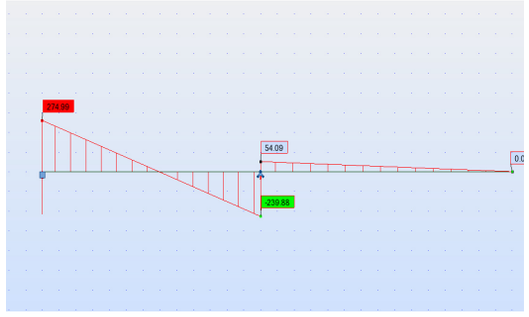


Fig.5.29

Shear force diagram for load case 2

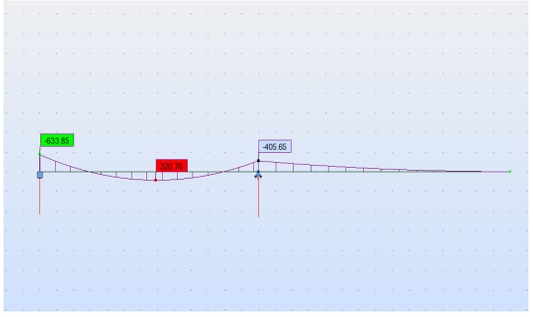


Fig.5.30

Bending moment diagram for load case 2

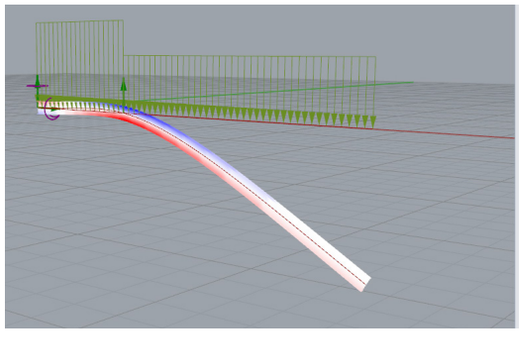


Fig.5.35

Cantilever with live load bigger in backspan than cantilever- backspan/cantilever ratio- 13/15

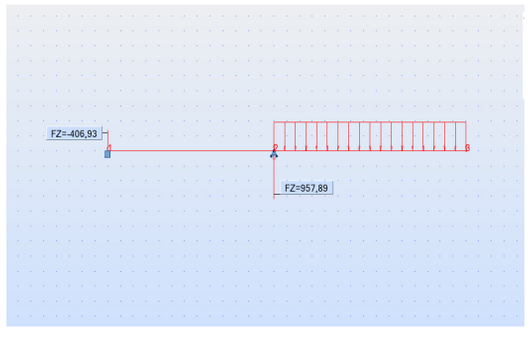


Fig.5.31

Fz reaction diagram- load case 3 (uniform load on cantilever)

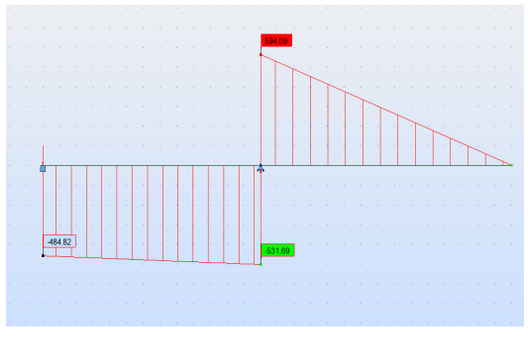


Fig.5.32

Shear force diagram for load case 3

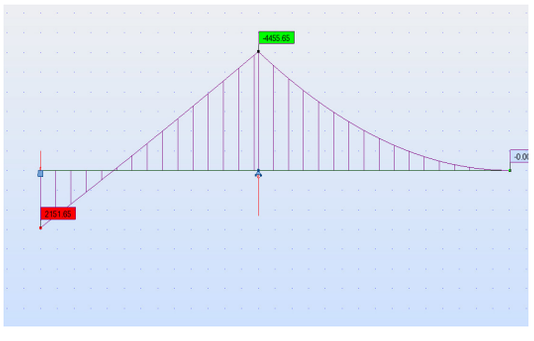
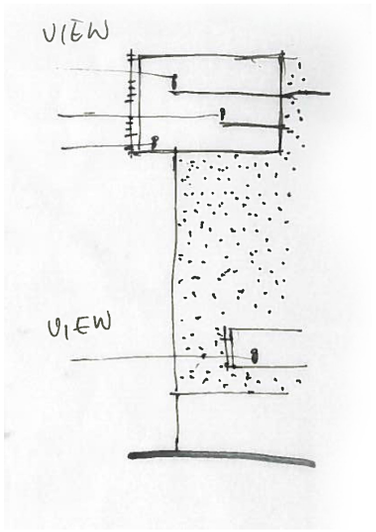


Fig.5.33

Bending moment diagram for load case 3

FACADES

In order to utilize daylight and create favorable reading and working conditions we decided to work with a glass facade. Daylight factor calculation showed that daylight levels in the building would be extremely high what was not a desirable state because of negative impact on visual comfort of users and direct sunlight glare. We introduced perforated screen as a strategy to control light inside and solar gains. We investigated screens with different light transmittance and gradually changing perforation to reach a desirable light levels according to the function. When we reached balanced daylight levels in the building we decided to introduce open-able panels to make it more adjustable to individual needs and in the same time interrupt a regularity of facade. We also calculated daylight level for a different positioning of volumes what helped us to make decision about its final location. Due to Bsim calculations we discovered a major overheating problem in the biggest social reading room we started to think about shading strategy and its influence on architectural expression on the facade. We researched venetian shading of social reading rooms creating different patterns and how it works with a perforated metal screen.



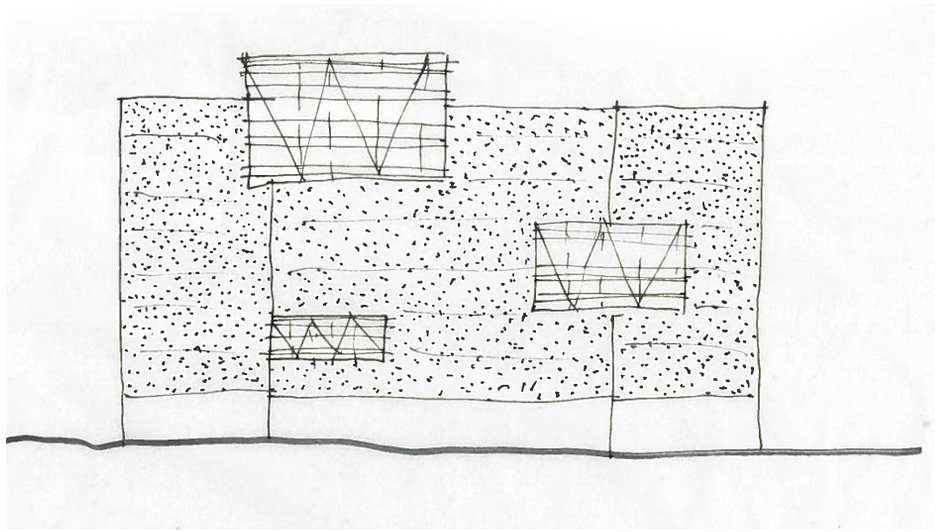


Fig.5.36

Horizontal venetian blinds pattern juxtaposed with perforated mesh of the facade

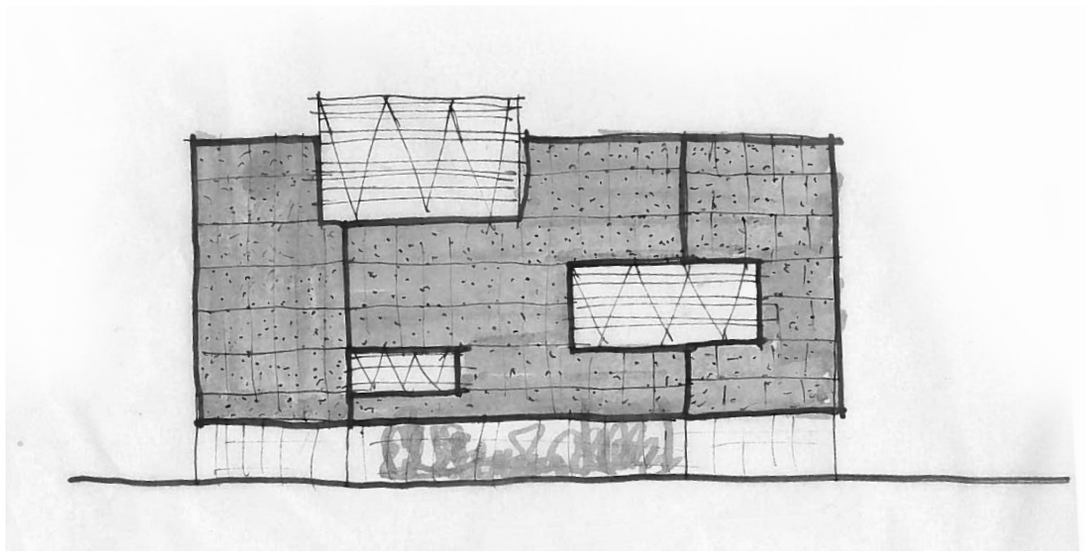


Fig.5.37

Horizontal white shading panels with a gray metallic perforated facade

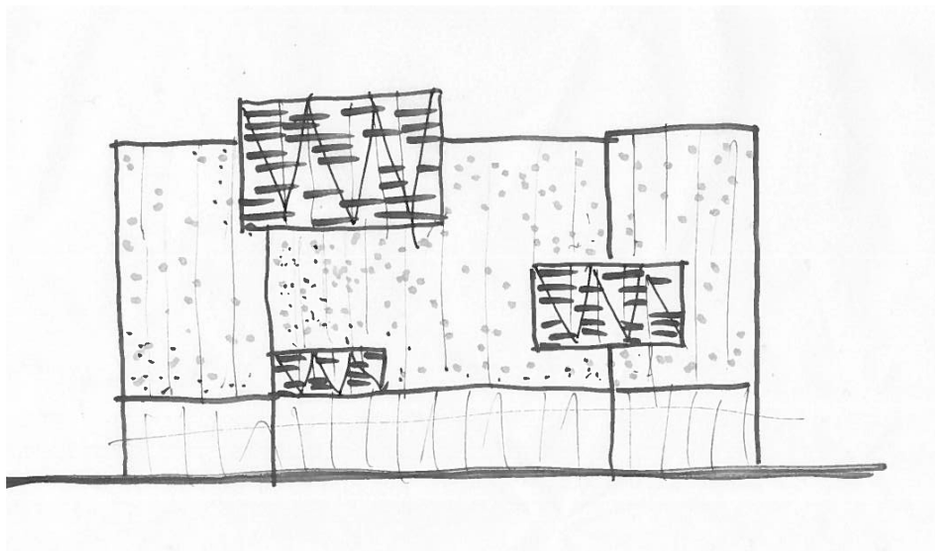


Fig.5.38

Lamellas of social reading rooms creating irregular patterns. Metal perforations gets less dense in the strategic places of the building.

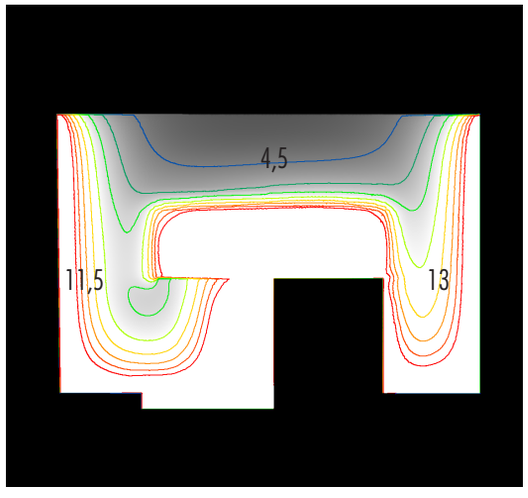


Fig.5.39

Glass facade- 6th floor

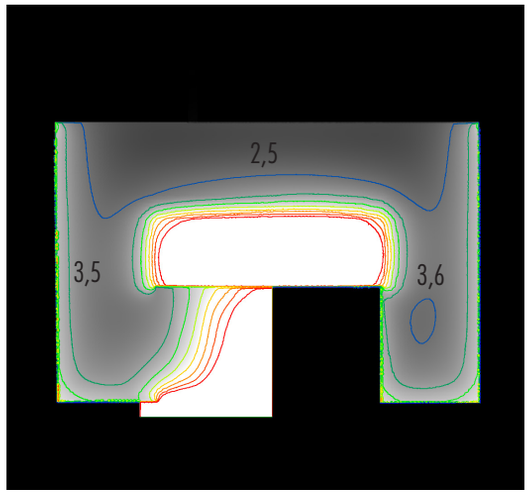


Fig.5.40

Perforated metal screen- 25% light transmittance

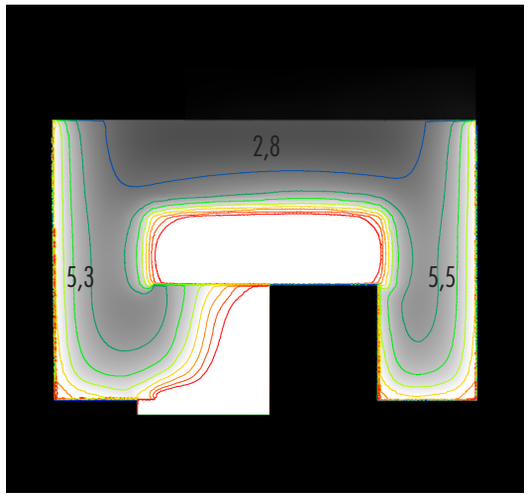


Fig.5.41

Perforated metal screen- 45% light transmittance

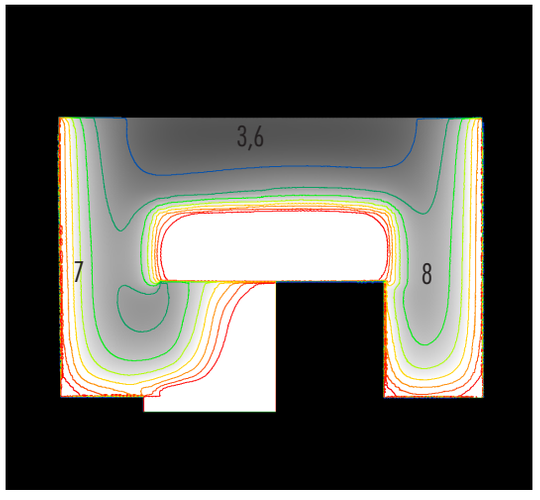


Fig.5.42

Perforated metal screen- 65% light transmittance

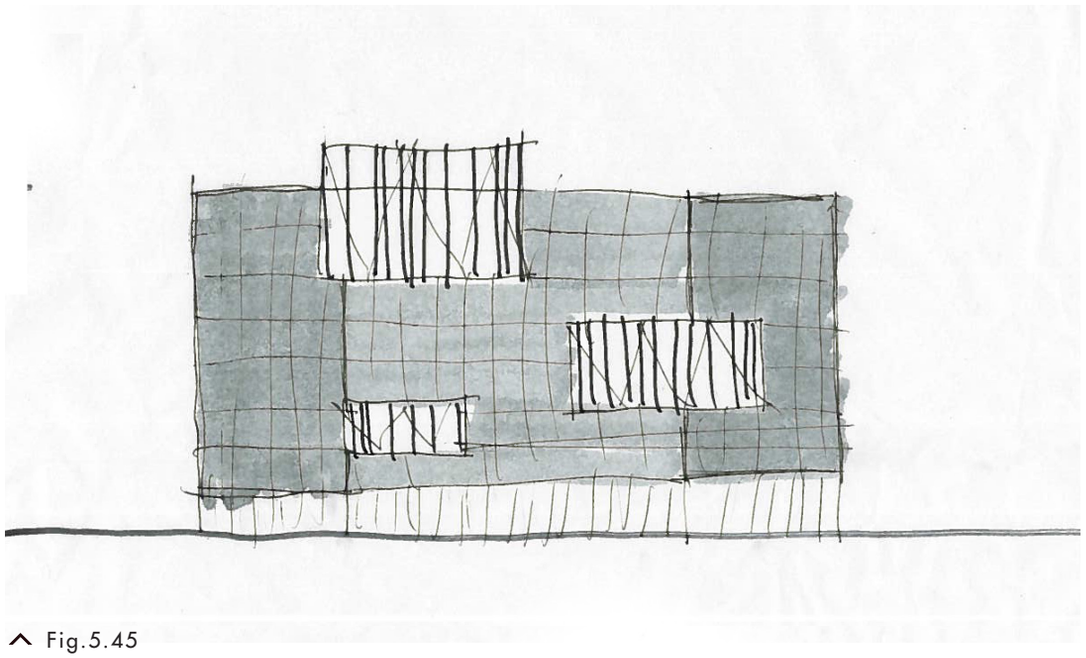


Fig.5.45

Vertical lamellas system with a grid of perforated metal panels and glass facade divisions on the ground floor.

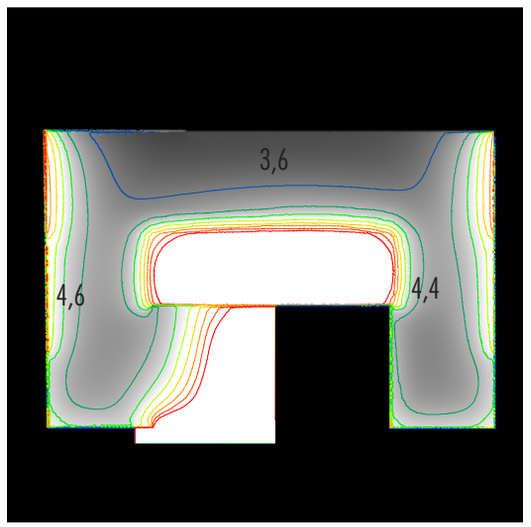


Fig.5.44

Gradual perforation from 25%- 65% from the front- 5th floor

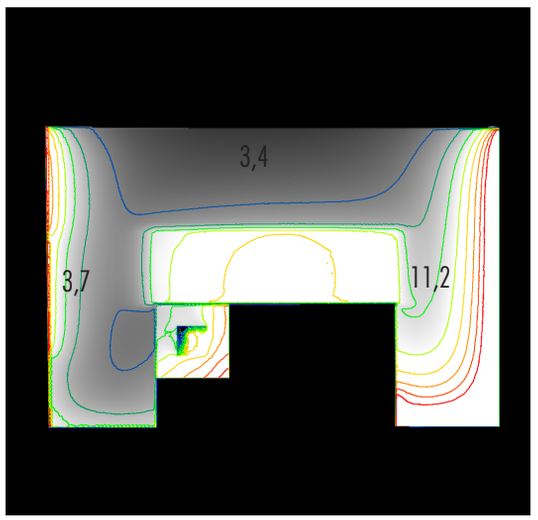


Fig.5.43

Gradual perforation from 25%- 65% from the front- 1st floor

CONCLUSION

This project sets out to create a first modern public library building in Varna that focuses on social aspect of community and information access equality. Creating a meeting space in the center of the city that attracts all members of society and tourists required a special attention to diverse people's needs as well as architectural expression that would make it a peculiar landmark inviting people to come in and spend their free time. Overhanging boxes of "social reading rooms" awake people's curiosity and draws their attention. Proximity of the main avenue of the city- Slivnica Boulevard, which is an important passage leading to the Black Sea but also a vibrant street with many restaurants and bars, makes a library location a perfect spot in a city structure to become an active part of the area. Public plaza in front of the building connects the library to a network of public spaces and creates a natural destination for people coming from Slivnica Boulevard. Public plaza offers a variety of activities that invite people to relax in the sun, but also, gives them a "sneak peek" of library experience. Open ground floor makes a building appear more accessible and integrated with a public space. Green garden inside and atrium with an sculptural staircase attracts people and invites them to explore the building.
We aimed for designing a building that could accommodate variety of functions but in the same time preserve a traditional function and respect the book heritage without compromising new technology.
The functions in Varna Library changes with the floor level- starting from more public as events area, lobby, souvenir shop or restaurant and becoming more private while proceeding to higher floors with traditional library function. The traditional library function with a convenient working atmosphere is balanced with additional "social reading rooms"- which favor humans interaction, gathering and group work.
Technological development and digitization of resources influenced the way how spaces in the building are shaped. Designing a spaces with different light conditions, levels of privacy and atmosphere according to its function was a goal of ours. Perforated metal screens with different levels of light transmittance allowed to control the light conditions. Locating the volumes and functions according to orientation allowed us to create desired natural light levels more daylight without a glare in the reading spaces and lower levels of natural light on the north-west side of the building where storage and computer working stands are located.
Our primary focus fell upon social and environmental sustainability. We focused on indoor climate and light conditions in the building what is essential for user experience and performance. Applying passive strategies like natural ventilation, shading, atrium and orientation of the building allowed us to reach desirable indoor climate and daylight conditions. Social dimmention is an aspect of sustainability we believe is essential for designing a library building.
We aimed to create socially sustainable building which cultivates the community spirit and access equality. The Library of Varna offers an activities to all community members and creates a common ground, a platform where they have a chance to confront their ideas and learn from each other. The building creates a suitable conditions for a group work and gives an opportunity to participate in social events, however, respects the needs of people from diverse age group and provides a favorable circumstances for development of individual. Space is flexible and easily adjustable what makes a library a place that can accommodate wide gamut events and social situations- gatherings, concerts, festivals. Overhanging social "living rooms" strengthen the feeling of community and aim to create a shared space where people can meet, gather and enjoy each other's company while looking at the city.
The structure reflects the main concept- merging tradition and modernity. The structure of "boxes" stands in juxtaposition to a column-beam structure of the main building. Cantilevers express the structural potential of steel structure and tells the story of how redefining a concept of library goes along with technological and societal change. Structure enhance flexibility of the building and allows an open plan solution by defining spaces.

REFLECTION

When we approached the topic of Varna Library we preceded design stage with the analysis of Bulgarian architectural tradition and influence of Communist Era on shaping image of Bulgarian city. Study trip to Bulgaria made us realize that soviet impact not only left visible mark on architectural expression but also resulted in inhibited development in many fields. Therefore, after very informative interviews with students in Varna and Vice-Chairman of the Chamber of Architects in Bulgaria Martin Hristov, we became more aware that the project aims for changing the current understanding of library notion in Bulgarian society. Social dimension, accessibility and friendly atmosphere are crucial for reclaiming positive image and trust towards library institution.

In our analysis we encountered two different aspects of sustainable architecture- environmental and social. Our primary focus, however, fell upon social sustainability and creating a comfortable, healthy indoor climate. Reduction of energy consumption and economic aspect of sustainability was not an object of our major considerations. The indoor climate calculations in Bsim were carried out on the biggest "social reading room" which, due to its orientation, volume and glass facade, was the part of the building at risk of overheating. Sustainable passive strategies were applied in the building but there is no calculations on different parts of the building. We believe that the chosen strategies are sufficient for creating a good indoor climate and they also contributes to reduction of energy consumption but in the further steps we would explore this topic along with application of active strategies as solar panels- especially relevant in Varna sunlight conditions.

We achieved desired levels of daylight with consideration of solar heat gains, however, more detailed considerations of perforation types and its influence on quality of light, glare reduction and visual connection with outer space could be proceed.

We aimed for designing a tectonic structural system. We believe that structural considerations should have been implemented in an earlier stage of the process and the calculations on cantilevered structure could be continued with application of knowledge that we gained from investigation on simply supported cantilevered beam. Extending the topic and treating the whole building as one structural system would be the next step. Introducing tensed wires could improve structural performance of the building what would require subsequent Robot and Karamba calculations. In the next steps we would also try to utilize the roof of the building.

Designing a library in Varna was a very educative experience. The difference between climate conditions, economical situation and social development between Denmark and Bulgaria required from us different approach and made understand more the complexity and challenges of architect profession.

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IMAGE LIST

GEHL, J. (2011). Life between buildings. Washington,
Fig. 1.1 Own illustration
Fig. 1.1 Iliff, D. (2015) The Long Room, an early 18th century university library in Trinity College, Dublin, Ireland [Photograph] Available at: https://en.wikipedia.org/wiki/Library#/media/File:Long_Room_Interior,_Trinity_College_Dublin,_Ireland_-_Diliff.jpg
Fig. 1.2 Available at: https://medievalbooks.files.wordpress.com/2015/07/hereford_chained_library.jpg
Fig .1.3-1.10 Own photograph
Fig. 1.11 Baan, I. Available at: http://www.baunetz.de/meldungen/Meldungen-Museum_von_Nishizawa_in_Japan_2433859.html
Fig. 1.12 Cano, I. Available at: http://www.archdaily.com/630496/intesa-sanpaolo-office-building-renzo-piano/55529b3ce58ece92c70002ba-intesa-sanpaolo-office-building-renzo-piano-photo
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Fig. 2.1-2.2 Competition brief
Fig. 2.3- 2.4 Own photograph
Fig. 2.5 Competition brief
Fig. 2.6-2.12 Own illustration
Fig. 3 Own illustration
Fig. 4.1 Available at: http://www.texturegen.com/free-textures/texture-260/
Fig. 4.2 Available at: http://seamless-pixels.blogspot.dk/p/free-seamless-concrete-textures.html
Fig. 4.3 Available at: http://www.render911.ru/metal.php
Fig. 4.4 Available at: http://www.mrdirectint.com/602-frosted-glass-vessel-sink.html
Fig. 4.5 Available at: http://www.eifsdepot.com/eifs-repair-kit/
Fig. 4.6 Available at: http://www.floormatshop.com/Premium-Soft-Floors-Interlocking-Mats-AL-PSF.aspx
Fig. 4.7- 4.18 Own illustration
Fig. 5.1-5.45 Own illustration

APPENDIX 1

Bsim analysis model. The zone (the biggest social reading room) highlighted red in the model is the one analised.

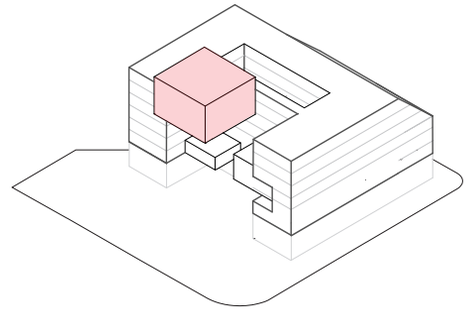

Fig.6.2

The analised space.

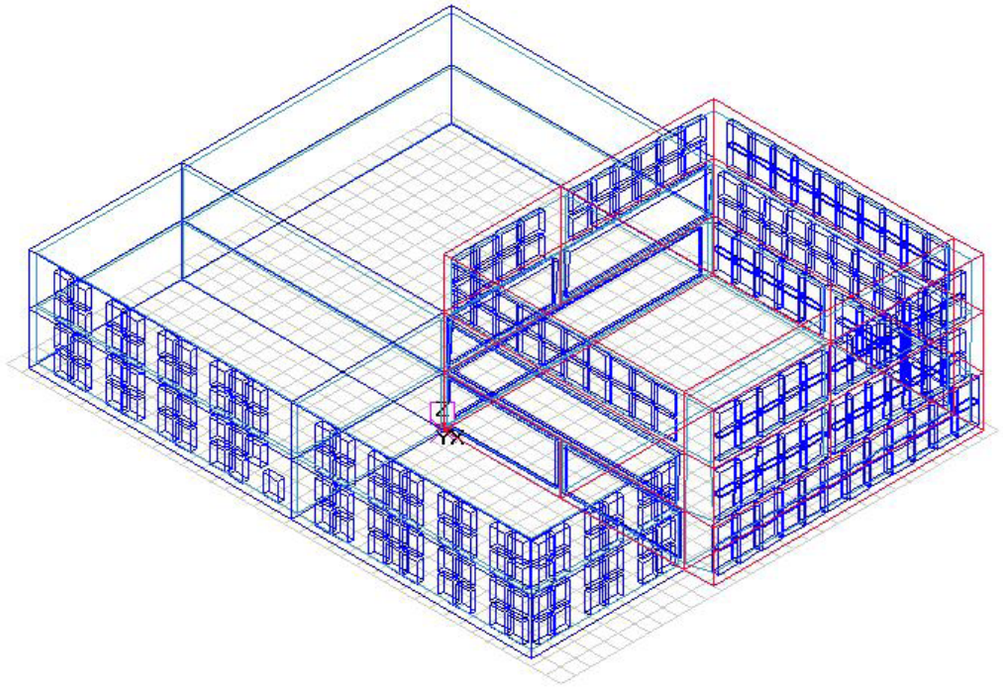

Fig.6.1

Bsim calculation model