DISSERTATION

IMPROVING TURKISH HOUSING QUALITY THROUGH HOLISTIC ARCHITECTURE

Assessment Framework / Guidelines / Lessons from Vienna

Ausgeführt zum Zwecke der Erlangung des akademischen Grades eines Doktors der technischen Wissenschaften unter der Leitung von

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Am Institut für Architektur und Entwerfen

Abteilung Hochbau und Entwerfen 253/4

eingereicht an der Technischen Universität Wien Fakultät für Raumplanung und Architektur

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Wien, am April 2016

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Acknowledgements

Without the material and spiritual support and motivation of my husband Atilla, who is also an architect, this work would not have been possible. Therefore, first and foremost, special thanks go to Atilla and to my daughter Rana who motivated and encouraged me with patience and were deprived of my time and presence.

I gratefully thank Professor William Alsop who has not only been a supervisor but also has encouraged me to push my ideas wider with his inspiration, motivation and constructive comments.

I would also like to thank my dear mother, father and brothers Esat and Sami who have always supported and inspired me throughout my life.

Last but not least, I would like to thank Mark Dickinson, Naomi Morishita and Murat Gürol for proofreading the text.

English Summary

The aim of this study is to contribute to the development of sustainable (mass) housing quality in Turkey. Sustainable housing design should be expressed through exciting projects that conserve, create energy and inspire. They must also be coherent, dynamic and liveable. Sustainable development is about ensuring a better quality of life and housing for today and generations to come. There is a strong relationship between sustainability and quality. Sustainable buildings not only have a less harmful effect on the environment, but they also improve architectural quality with a holistic approach.

The provision of a higher quality of life is a substantial challenge. Designing a better quality residential area can contribute to improving quality of life because a change in lifestyle cannot be imposed, but it can be encouraged by good design[1]. Achieving a good quality sustainable residential design depends on the harmony of different indicators. This design should have a holistic approach, which encompasses technical, functional, social and aesthetic qualities, and considers the limitation of energy resources.

Sustainability and liveability practices in developed countries, especially European countries, have provided significant progress towards good quality residential projects. In this way, Europe has managed to take important steps to offer everyone equal, liveable and sustainable spaces. Importantly, previous mistakes have been seen as significant issues to be considered and corrected. Hence, political actions and infrastructural developments have been based on the norms of sustainability and future viability. In Turkey, concerns about sustainability and good housing quality have not yet reached the same level as that in Europe, in terms of either social awareness or planning and construction regulations.

The aim of this study is to seek planning strategies and concepts of sustainable housing projects, and to create proposals with a guideline, which defines a high quality housing complex ('toplu konut' in Turkish) using a holistic approach of sustainability. The intent is to contribute to the development of housing projects in Turkey, which according to the perception of the writer has lower quality than Viennese housing examples. By evaluating and comparing housing in Vienna, Austria and Konya, Turkey, the current level of residential quality in different cities of Turkey and in Vienna are demonstrated in relation to holistic sustainable architecture including social-functional and aesthetic qualities, as well as energy performance. Vienna, which was voted seven times as the most liveable city of the world and the capital of Austria is used as a benchmark country. It follows high EU standards and provides fair opportunities for its society. Hence, the writer thinks that it is a perfect choice to be an example for the identification of potential improvements and weaknesses in (mass) housing, and to determine a suitable model of good quality sustainable housing for Turkey. Furthermore, the purpose of this study is to demonstrate that sustainability is a solution to provide holistic architecture, and develops a framework (SHQ) with the criteria of sustainable housing quality in the light of holistic thinking to achieve better sustainable housing quality (in Turkey). These guiding criteria for sustainable housing quality facilitate the implementation of indicators, which each architect should consider regarding qualities of sustainability and for a holistic approach to the housing settlements in order to ensure a practical dimension which has remained in theory until now. To provide this goal, the Viennese 'Wohnsiedlungen'2 are taken as an exemplary reference which have more improved quality standards and more sustainable according to the hypothesis of the writer. Additionally, some examples of policies and best practices that might help guide the process of improvement, have been presented.

In addition, the findings provide a basis for certain proposals on planning new high quality residential areas in Turkey within the determined criteria of sustainable housing, which form holistic architecture. The proposals target actors involved in the building process, especially architects and governmental policies. Furthermore, the case studies are evaluated using

1 Edwards, B., Turrent, D., Sustainable Housing: Principles and Practice, E&FN Spon, London 2000.

2 Term 'Wohnsiedlung' in German is used as "housing complex" which is composed from building blocks and is a form of unified living in housing developments.

these criteria, demonstrating how best practices are to be implemented.

The focus of this research is on “middle-class housing”, not on “luxury housing”. The case studies are chosen from current housing complexes built after 2008.

Deutsche Kurzzusammenfassung

Ziel dieser Arbeit ist es, zur Entwicklung nachhaltiger Wohnqualität in der Türkei beizutragen. Nachhaltiges Wohnen sollte in Form von spannenden, inspirierenden und energieeffizienten Projekten ausgedrückt werden. Sie müssen also lebenswertes und dynamisches Leben gewährleisten. Nachhaltige Entwicklung gewährleistet besseres Wohnen und bessere Lebensqualität für heutige und künftige Generationen. Es besteht eine enge Beziehung zwischen Nachhaltigkeit und Qualität – nachhaltige Gebäude belasten die Umwelt weniger –, welche unter dem ganzheitlichen Blick auch eine bessere architektonische Qualität zur Folge hat.

Die Gewährleistung einer höheren und zukunftfähigen Lebensqualität ist eine wesentliche Herausforderung. Entwürfe hochwertiger Wohnsiedlungen können zu einer Verbesserung der Lebensqualität beitragen, weil eine Veränderung des Lebensstils nicht aufgezwungen werden, aber durch gute Entwürfe gefördert werden kann. Hochwertige, nachhaltige Wohnungsentwürfe sind abhängig von der Harmonie verschiedener Indikatoren, die ebenso einem ganzheitlichen Ansatz folgen sollten und die technische, funktionale, soziale und ästhetische Qualitätsmerkmale umfassen und auch einen verantwortungsvollen Umgang mit Ressourcen beinhalten.

Praktische Umsetzungen in den Industrienationen, speziell in Europa, führten bereits zu einem signifikanten Fortschritt hin zu mehr Wohnqualität und hochwertigen Wohnprojekten. Es gelang auf diese Weise, lebenswerte und nachhaltige Räume für alle zu schaffen. Vorausgegange Fehler wurden als herausragende Probleme betrachtet und konnten korrigiert werden. Entsprechend basieren politische (Infrastruktur-) Maßnahmen auf den Prinzipien der Nachhaltigkeit und Zukunftsfähigkeit. In der Türkei sind Bedenken über Nachhaltigkeit und Wohnqualität noch nicht auf dem Niveau wie in Europa – weder in Bezug auf gesellschaftliches Bewusstsein noch hinsichtlich Planung und Bauvorschriften.

Ausgangspunkt dieser Studie liegt in der Suche nach Planungsstrategien und Konzepten nachhaltiger und zukunftfähiger Wohnprojekte und

Vorschläge, die qualitativ hochwertige Wohnsiedlungen (türkisch: toplu konut) definieren und einem ganzheitlichen Ansatz der Nachhaltigkeit folgen . Ziel ist es, einen Beitrag zu leisten zur Entwicklung von Wohnsiedlungsprojekten in der Türkei, die gemäß der Wahrnehmung der Autorin eine geringere Qualität aufweisen als vergleichbare Projekte in Wien. Durch Auswertung und Vergleich des Siedlungswohnbaus in Wien und Konya in der Türkei wird der gegenwärtige Stand der Wohnqualität in verschiedenen Städten der Türkei und Wiens aufgezeigt hinsichtlich ganzheitlicher, nachhaltiger Architektur und einschließlich sozio-funktionaler als auch ästhetischer Qualitätsfaktoren und Energieeffizienz. Wien – sieben Mal als die Stadt mit der höchsten Lebenqualität befunden und Hauptstadt Österreichs – wird als Maßstab verwendet. Die Stadt folgt höchsten EU-Standards und gewährt höchstmögliche Chancengleichheit für ihre Gesellschaft. Entsprechend wird angenommen, dass Wien als ein gutes Beispiel dient für die Identifikation möglicher Verbesserungen und Schwachpunkte im (Massen-)Wohnungsbau, um daraus ein Modell für hochwertigen und nachhaltigen Wohnbau in der Türkei abzuleiten. Weiteres Ziel dieser Arbeit ist es zu zeigen, dass Nachhaltigkeit ein Ansatz ist, um ganzheitliche Architektur zu generieren. Es wird entsprechend ein (SHQ-) Rahmen entwickelt mit Kriterien für nachhaltige Wohnqualität im Licht ganzheitlichen Denkens, um eine bessere Wohnqualität im Wohnungsbau (in der Türkei) zu erreichen. Diese Leitkriterien für nachhaltige Wohnqualität ermöglichen die Implementierung von Indikatoren, die jedem Architekten, der nach Nachhaltigkeit und Ganzheitlichkeit von Wohnbausiedlungen strebt, zur Verfügung stehen, und die eine praktische Handhabe gewährleisten, was bislang lediglich in der Theorie existiert. Um dieses Ziel zu erreichen, werden die Wiener „Wohnsiedlungen“[3] als exemplarische Referenz herangezogen, weil diese gemäß Hypothese der Autorin einen bereits weiter entwickelten Stand hinsichtlich Wohnqualität und Nachhaltigkeit aufweisen. Zusätzlich werden einige Beispiele von Richtlinien und „Best Practices“ vorgestellt, die einen Verbesserungsprozess führen helfen könnten.

Die Ergebnisse liefern eine Grundlage für bestimmte Vorschläge für die Planung von hochwertigen Wohngebieten in der Türkei im Rahmen dieser Arbeit erarbeiteten Kriterien für nachhaltiges Wohnen und ganzheitliche Architektur. Die erarbeiteten Vorschläge richten sich an die Teilnehmer am Bauprozess, speziell Architekten, und an die staatlichen Richtlinien im (Wohnungs-)Bau. Außerdem werden die Fallbeispiele unter Anwendung dieser Kriterien ausgewertet, wobei gezeigt wird, wie diese „Best Practices“ umgesetzt werden können.

Hauptaugenmerk dieser Forschungsarbeit ist der „Mittelklasse-Wohnungsbau“, nicht der Luxuswohnraum. Die Fallballspiele entstammen allesamt aktuellen Wohnbauprojekten, die nach 2008 entstanden sind.

3 Term ‘Wohnsiedlung’ in German is used as “housing complex“ which is composed from building blocks and is a form of unified living in housing developments.

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„in the middle of difficulty lies the opportunity“ - Albert Einstein

it is important to discover, „How?“

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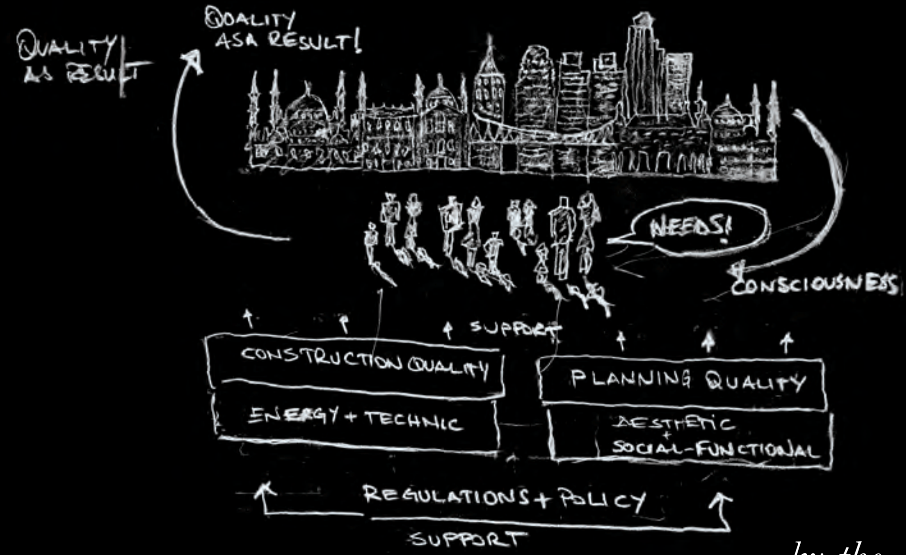


by the author

“not that architecture can transform society, but that it can transform itself, so that perhaps it can offer other forms of production” Susannah Hagan

Are you prepared to transform ?

I. INTRODUCTION

1. Motivation and Background

My initial starting point was to improve Turkish housing, which according to my perception has much lower quality when compared with the Viennese housing examples. Although these two different places have different contexts, the humanity in both places is striving for the same issues: higher quality and liveability in a better world. If there are solutions to improve this quality, the lessons learnt in architecture can be translated and adapted according to the requirements of a different context.

The construction industry in Turkey is booming, especially in the housing sector, and most housing projects lack a clear vision and are designed by chaotic mass architectural production. On the other hand, Vienna follows EU standards and provides fair societal opportunities and has been voted seven times as the most liveable city of the world; thus, it is a perfect choice to study the concept of "quality".[1] Quality has been mentioned and debated very early in Vienna, and subsidies are provided to reach quality levels and assessment systems have been developed to assess these qualities, which is lacking in Turkey. If our concern is quality, we have to consider economic, ecologic, aesthetic and social aspects together in a holistic approach. The writer of this work thinks that this quality can be ensured with sustainability, which means utilizing a holistic approach and the sum of architectural qualities.

During the first years of my architecture education, as every architecture student I wondered what sustainability is and tried to understand. Asking questions is a very important step to understand the issue, so I did. When I had a look to the meanings, what I saw was the same as "complexity". The term "sustainability" and my ambition to solve and understand the complexity of it remain from these first years in my subconscious. This research, through which I intend to improve housing quality in Turkey, has given me the possibility to understand and internalize it.

The meaning of the "sustain" is described in Oxford Dictionary: "1. Strengthen or support physically or mentally; 2. Cause to continue for an extended period or without interruption; 3. Uphold, affirm, or confirm the justice or validity of"[2]. Architecture has to sustain, because it is a messenger of the values of a society, and it has duty to transmit the value and lifestyle of people to the future. Although "sustainability" was not mentioned until the 1980s, it is as old as "human" and "architecture". If architecture is struggling to face the problems of the current period, and meeting its requirements, which is changing and increasing permanently, the term "sustainability" came to birth to remind us of its forgotten role in architecture, which had always been in the essence of architecture; to sustain people, nature and architecture itself, which means protecting resources and balancing nature, humans and technology.

"For centuries, building has largely been seen as a way of living apart from the environment and dominating nature. It has turned out to be a pyrrhic supremacy, but the current ecological crisis has motivated many professionals and academics to re-evaluate the fundamental premises of how buildings are designed and produced. Underscoring technical efforts to reconstitute the built environment is an elusive but critically important concept of sustainable development. Across a wide range of disciplines, including architecture, conjecturing a built environment that mimics and complements rather than conflicts with nature is emerging as a vital goal."[3]

Approximately 20 years ago, an environmentally friendly, ecological, green building paradigm caused a leap from "hard-system thinking" to soft-system thinking.[4] Along with energy and the economic crises, the pressures of living space and city stress on human psychology led to the rise of a rescuing concept called "sustainability". Sustainability is a concept that has been around long before it was named due to the necessity of current lifestyles. By building the first ever energy conserving structure without yet naming it, the concept of sustainability, which had already been

1 https://www.wien.info/en/lifestyle-scene/most-livable-city, access: 28.02.2015.

2 http://www.oxforddictionaries.com/definition/english/sustain, retrieved: 08.10.2015.

3 Slessor, C., The Quest for Ecological Propriety, in "The Architectural Review", No.1, January 2002.

4 Kaltenbrunner R., Auf dem Weg zum nachhaltigen Bauen?: über die unscharfe Relation von Ökologie, Architektur und gesellschaftlichem Wandel, ed. By Bundesamt für Bauwesen und Raumordnung in: IzR-Informationen zur Raumentwicklung, Heft 1/2, Bonn, 2002, p.1-10

occupying experts' minds, finally revived. In the recent past, there was an attempt to build green cities with utopic ideas and visions, but it failed to have a significant progressive effect. Sustainability as a wide-reaching concept acted as a signifier for public awareness. Sustainability rests on a three-column model: ecology, economy and society. It is defined using the following criteria: 1) to design without negatively impacting future generations (for all living things), and 2) to supply daily needs as best as possible.[5] After these definitions, "building structure and architecture" as one of the most effective field of sustainability, remains still ambiguous. In early times, modernization brought the master masses, which became the norm: By improving light and airflow, a healthier environment in buildings was promised, however, it was not able to provide its promised comfort, and its architecture is one that holds the social life, residents and nature as secondary factors.[6] The modern man became lonelier through independence and selfishness. The architecture of these structures encouraged this egocentric lifestyle even more.

There are some realities, which determine whether we have a future worth living such as global warming, changes in lifestyles and in the world, globalization, possibilities of having an imbalance between nature and technology and unstable possibilities of having liveable spaces for our physical and psychological well-being. [7] Scientific research warns people against possible global warming of more than 2 degrees in the case that GHG remains unchanged and a possible rise in sea level of at least 2 meters by 2050.[8]

Turkey, together with large cities around the world, demonstrates a necessity for a rapid increase in housing after industrialization in the 1960s. An unsuccessful attempt was made to solve the demand for public housing by first introducing tiny flats, then multi-floored apartments that later turned into public housing in forms of complexes when the former was deemed insufficient. The rapid change seen worldwide had an impact on social life, structures, and cities. Ever since the Age of Enlightenment, western culture has pursued Descartes and the Bible as exemplars[9] and embraced a Cartesian world. With growth of technology, people's state changed from occupants of nature to managers of nature.[10] Technology's progression was heedlessly accepted as allegedly improving life standards without carefully weighing the impacts of the innovations it brought.

"Architectural design is a complex process. It requires prerequisites, knowledge, analytical thought, and design capability. A holistic approach helps overcome this complex process."[11] The creative and empathetic right-brain should work together with the analytic left-brain.[12] *"Architecture is sustainable when it has special design qualities, is technically up to date and is socially and functionally compatible. It is important that sustainability is understood by the architecture profession as a contribution to good architecture and not as a hindrance."*[13] Some architects believe that sustainability is not a style, but rather is an ideology that every architect should take into consideration. Architecture has always dealt with aesthetic, functional and economic challenges. Climate change and demolition of the resources added a new dimension to the responsibility of every architect. Architecture is not a free art, but an applied art. Hence architects should take more responsibility when designing buildings. Sustainable architecture is noticeably higher in quality in terms of use, aesthetics and well-being, hence, it provides a special opportunity of the architectural discipline.

5 Bruntland, G., (Eds), Our Common Future: The World Commission on Environment and Development, Oxford University Press, Oxford., 1987 , p. 51

6 McDonough W. and Braungart M., Fundamental of Sustainable Design in Holistic Housing: Concepts, Design Strategies and Processes, Edition Detail, Munich, 2012, p.30.

7 Gysin B., Sustainable Design. A Statement, in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.20

8 Climate Change 2014 Synthesis Report, Summary for Policymakers, in Climate Change, 2014, p.4, available at: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf, access: 10.07.2015

9 Genesis, 1 Mo 1:28. '... and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth' cited from Gauzin M. D., A Short History of Sustainable Architecture in Drexler H., El khouli S., eds. Holistic Thinking, Detail Edition, Munich, 2012, p.10.

10 René Descartes, Discours de la mèthode pour bien conduire sa raison et cherecher la verité dans le sciences, Leiden, 1637.

11 Gysin Bob, Sustainable Design. A Statement, in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.20.

12 Gauzin M. D., A Short History of Sustainable Architecture in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.18.

13 Gysin Bob, Sustainable Design. A Statement, in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, pp.20-25.

Human, nature and liveability concepts will be reintroduced to the monumental architecture core through sustainable management criteria. Architecture with sustainable design presents more pleasant rooms that protects the public and individual's benefits, introduces functionality, provides an aesthetic expression, and therefore brings an identity which is ecological, economical and socially supported. This kind of architecture provides a high quality living place. When we consider architecture from this perspective, we better comprehend how sustainability can actually meets people's needs in the best way possible.

Sustainable housing is effectively high quality housing, which can help create a sense of space, improve the urban environment and making peoples' lives easier, more comfortable and enjoyable. A step towards architectural sustainability is a key element in improving people's lives.

Last but not least, to reach the essence of architecture, we should try to communicate the qualities of sustainable residential buildings. Architecture can contribute to change society. One can only hope to change society by altering the living spaces of that society. This concludes an ideological message: "*not that architecture can transform society directly, but that it can transform itself, hence, perhaps offer other forms of production.*"[14]

No universal principles or simple recipes to design sustainable buildings exist; however, there are descriptions of some methods and processes to achieve this result. Focusing on ecological and economical aspects alone is not the solution, social and functionality, even aesthetic factors must also be taken into consideration.

Sustainable practices and liveability in developed countries - particularly of those carried out in Europe - have provided significant attempts towards high quality residential projects.

Europe acknowledged the influence of cities and locations on economic and ecologic crises and began supporting an initiative congruent with Goethe's anthroposophy, which aims for the compatibility between humans and natural life.[15] At the beginning of the 20th Century, Rudolf Steiner who follows the footsteps of Johann Wolfgang von Goethe, introduced a philosophy of anthroposophy with the aim of restoring harmony between humans and nature. His philosophy found expression in many disciplines including architecture.[16] With such developments, Europe managed to take important steps towards establishing equally liveable and sustainable spaces for everyone. Another significant move towards this goal was the consideration and attempt to correct previous mistakes. Hence political actions and infrastructural developments have been based on the norms of sustainability and future viability. A concern regarding the provision of housing with lower energy consumption, less damage to the nature, and a more liveable environment in terms of socially and functionality has become more prominent over time. On the contrary, neither the concerns about sustainability nor good quality housing in Turkey have reached this level. In addition, social awareness, initiatives and policy are also lacking. This situation brought about yet another problem in Turkey: an increase of mass housing in the name of eliminating housing quality problems. Thereby bringing a prototype without any uniqueness causing a lack of identity. It is worthwhile to try and learn from the experiences of countries like Austria, which has followed EU standards to reach a high standard for energy saving regulations for over 20 years, and has well-established practices for achieving high quality sustainable liveable housing.

There is a lack of sensitivity and consideration about housing quality and sustainability in Turkey which is a result of lack of holistic design. A more liveable Turkey for future generations with better-designed houses must be designed both on micro and macro scale perspectives. This study demonstrates that sustainability is a solution to provide holistic architecture and determine the criteria of sustainable housing quality in the light of holistic thinking to achieve better sustainable housing quality in Turkey. To show implementations of this better holistic architecture quality, the

14 Hagan, S., Taking Shape. A New Contract bet- ween Architecture and Nature, Oxford, 2001, p. 11.

15 Seamon, D., Zajonc, A., Goethe´s Way of Science, State University of New York Press, Albany,NY, 1998.

16 Gauzin M. D., A Short History of Sustainable Architecture in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.10.

Viennese "Wohnsiedlungen"[17] are taken as an exemplary reference to improve the quality standards of Turkish mass-housing and become more sustainable.

Sustainability is the way of holistic architecture, which takes all the important issues into consideration to provide a good quality of life without demolishing nature, resources and the essence of architecture in order to create the better designed, and beautiful world we need. It is a complex challenge to measure and implement all these qualities, and now it is important to determine how to transform this difficulty into an opportunity.

The author of This study has demonstrated it as "sustainable housing quality-SHQ".

2. Problem Definition and State of Discussion

The study addresses housing quality towards sustainability in order to improve the mass housing quality in Turkey. In this context, the knowledge state of the research is presented in relation to the need for sustainability for housing quality for today and tomorrow's generations, and the criteria /indicators for assessing housing quality and the sustainability of the residential buildings.

Much research has been conducted about the descriptions, operational models, sustainability assessment methods and sustainable architecture. Cooper has identified four principles of sustainability, which are futurity, participation, environment and equity.[18] These principles were later diagrammed by Palmer, Cooper, & Van der Vorst providing a useful qualitative guide for architects to practise in their designs. Bauer et al. searched green buildings and concepts for sustainable architecture.[19] Guy and Farmer searched about the properties of green buildings and indicated six competing aspects: ecological, smart, aesthetic, symbolic, comfort and community.[20] Sassi searched strategies for sustainable architecture and his studies illustrate many different approaches to sustainability with several case studies showing how sustainable design principles could be implemented within the wide spectrum of sustainable design[21].

Macmillan, the editor of the book "*Designing Better Buildings: Quality and Value in the Built Environment*", searched about measuring and improving the quality in buildings, and described the indicators to achieve a housing quality.[22] Van der Voordt and van Wegen indicated the criteria and methods to evaluate buildings.[23] Riccabona and Wachberger analysed fundamentals of assessing housing quality in 1970s.[24] Their study is one of the first studies of housing quality criteria. Weeber and Bosch conducted research about sustainable good housing quality and analysed the requirements for a good house, residential quality and sustainability. According to the leading criteria of their research, they have created a documentation study of some single-family houses to analyse their sustainable quality in their book, Sustainable Good Housing Quality (Nachhaltig Gute Wohnqualität).[25] Drexler and El khouli have indicated the sustainable architecture, basics and strategies, and assessment methods which are connected to a project entitled, A Survey and Rating System for Sustainable Housing Quality (Erfassungs- und Bewertungssystem nachhaltiger Wohnbauqualität), which was developed by the Department of Design and Energy-Efficient Construction at the

17 Term 'Wohnsiedlung' in German is used as "housing complex" which is composed from building blocks and is a form of unified living in housing developments.

18 Cooper, I., "Environmental assessment methods for use at the building and city scales: constructing bridges and identifying common ground". In P.S. Brandon, P.L. Lombardi, V.Bentivegna (Eds.), Evaluation of the Built Environment for Sustainability, E&FN Spon, London, 1997

19 Bauer, M., Mösle, P. and Schwarz M., Green Building- Konzepte für nachhaltige Architektur (Concepts for Sustainable Architecture), Callway publisher, Germany, 2007.

20 Guy, S., and Farmer, G. (2000), The competing logics of green buidings and ethics. In W.Fox (Ed.), Ethics and the Built Environment. London: Routledge, 2000.

21 Sassi P., Strategies for Sustainable Architecture, Taylor&Francis e-Library, 2006.

22 Macmillan S. , Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004.

23 Theo JM van der Voordt und Herman BR van Wegen, Architecture in Use: An introduction to the Programming, Design and Evaluation of Buildings, Netherland, 2005.

24 Riccabona C. and Wachberger M., Wohnqualität: Bewertungsmodell für Wohnungen, Wohnanlagen und Standorte, Österreichisches Institut für Bauforschung (OIB), Wien, 1977.

25 Weeber, H. and Bosch S., Nachhaltig gute Wohnqualität: Beispielhafte Einfamilienhäuser in verdichteter Bebauung, Bauforschung für die Praxis, Band 64, Fraunhofer IRB Verlag, Stuttgart, 2004.

Technische Universität Darmstadt in 2009. An assessment tool, "*Housing Quality Barometer (Wohnwert-Barometer- WWB)*", has been developed with a comprehensive analysis of more than 25 international certification system including LEED, BREEAM, CASBEE, DGNB and WBS in order to evaluate the quality of residential buildings. This tool has produced various approaches to quantifying the criteria of the assessment tool. Despite its systematic approach, it has some inadequacies to be practiced in the design phase by architects. These assessments need to be supported with presentation of the projects in the form of floor plans, images and analyses, which also represent design approaches and strategies to be implemented by architects. The research of Orso and Pitro constitutes an attempt to assess residential buildings according to currently relevant criteria.[26] Moherndl searched housing analyses and assessments with a different approach based on syntactic values.[27]

Tekeli has conducted research about how the housing problems in Turkey have tried to be solved.[28] Guloksuz indicates that urban transformation projects are especially designed by considering the income from rents rather than housing needs.[29] Yuksel and Turkmen have published the policy of POPLAR H.A.R.C.A., a Housing and Regeneration Community Association founded in the south region of London, England that considers sustainability. They argue that the examples from POPLAR H.A.R.C.A. could be a good example for Turkish Mass Housing Administration (TOKI) in their report.[30] Some very general improvement recommendations have been developed, which do not provide real support for architectural practice. Sarioglu researched the Turkish Housing system, and analysed debates in comparison with several EU countries.[31] Gokmen and Ozsoy analysed emerging trends and problems of the housing supply in urban housing transformations in Istanbul.[32] Kumkale researched the sustainability of housing from management and renovation perspectives.[33] Hacaloglu has studied environmentally conscious Architectural Design as an alternative strategy in Ankara.[34] Ercoskun has studied eco-tech Design for a Sustainable City in a case study in Ankara[35], which concentrates mostly on urban scale. Oxley has searched about the problems in housing research and comparative housing studies.[36] In this study, she mentions the importance and effectiveness of comparative international analysis, and tries to analyse theoretical and practical issues in comparative international housing studies.

Sustainability is a very popular subject lately in Turkey as it is all over the world. Although there are more than 300 definitions of sustainability, most definitions are complex and difficult to be adapted to practice. The Brundtland Report has a definition of sustainability, which is most often quoted: "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*"[37], which is a very general definition and it is difficult to define and understand the term "needs". Williamson et al., indicate that the term does not apply to the basic requirements of people,

26 Orso F. and Pitro U., Kriterien für zukunftsfähiges Stadtwohnen, 2008.

27 Moherndl, P., Architekturessenzen: Analyse und Bewertung von Wohnbauten, Master Thesis, Technical University of Vienna, Vienna, 2013.

28 Tekeli, I. How has it been tried to solve the housing problem of Turkey, Housing research Symposium, TOKI Housing Research Series, No:1, 1996.

29 Gülöksüz, E. (2010). Transformations in the Social Housing Policies of the HousingAdministration of Turkey, 22. International Housing Research Conference, 4-7 Temmuz2010, İstanbul.

30 Yüksel, N., Türkmen, C., "Bir Sürdürülebilirlik Deneyimi: Poplar H.A.R.C.A", ARCH 415 Final Report, Middle East Technical University, Department of Architecture, 2014.

31 Sarıoğlu, G. P.(2007). Turkish Housing system: history and current debates in comparison with several EU countries, ENHR Working Group Comparative Housing Policy Seminar,20-21 April, 2007, Dublin.

32 Gokmen P.G. and Ozsoy A. (2008), Emerging Trends and Problems of housing Supply in Urban Housing Transformations in Istanbul, Paper presented to IAG Conference, University of Tasmania, Book of abstracts, Hobart, Australia, 2008.

33 Kumkale, E., (2009), Sustainability of Housing: „Houses" Thematic Network as a Management and Renovation Research. File: Mass Housing Architecture: Experiences, Opportunities, and Possibilities, Mimarlik Magazine, No:345 January-February, Ankara, 2009.

34 Hacaloğlu, A.; "Environmentally Conscious Architectural Design as an Alternative Strategy in Ankara, Turkey", Master thesis, University of Oregon, 1988.

35 Ercoskun, Ö.Y., Ecological and Technological (Eco-Tech) Design for a sustainable City: A case Stdy on Gudul, Ankara, Ph.D. thesis, Gazi University, Institute of atural and Applied Sciences, Urban and Regional Planning Doctorate Program, Ankara, 2007.

36 Oxley, M., "The Aims and Methods of Comparative Housing Research", Scandinavian Housing and Planning Research, 1991.

37 Bruntland, G., (Eds), Our Common Future: The World Commission on Environment and Development, Oxford University Press, Oxford., 1987 , p. 51

and furthermore allows "*a reasonably comfortable way of life*".[38] At the same time, the Bruntland Report formed the basis for the 3-pillars model. Later on, he described sustainability in terms of a three-dimension model, which is divided into economical, ecological and social quality in the German Parliament in 1995.[39]

Assessing architectural design quality is a complex process. It has been mentioned in the Treasury Task Force in England; to measure good design, we can summarize it as the sum of functionality, whole-life costing, service enhancement and aesthetics. These terms are included in sustainability. The sense of sustainability in architecture, especially in housing, has been a very important subject due to the fact that the built environment has great influence on life quality, comfort, security, health, etc. Construction, maintenance, and updating the constructed environment have potential effects on the environment. Buildings consume most of the unrecoverable resources and create great amount of waste. Buildings create half of the total carbon dioxide emissions. On a global level, the sector uses about 40% of material and energy resources.[40] Williams describes sustainable architecture as, "*an architecture replying and interacting with environmental and local conditions and it is trying to apply contexts ecological abilities to create desirable environmental conditions; consequently, it is ecological equilibrium means it has minimum damages on ecology in addition to its flexibility, adaptability and continuity to changes and needs, and it is distinctive since it has some local attributes.*"[41]

In recent years, there has been a construction boom in Turkey. Urban regeneration of slums and old districts is a significant reason for these intensive construction activities. "Mass-housing" has emerged in order to meet emerging housing needs. Housing problems have been tackled many times and heavily criticized in Turkey. However, some people focused upon cultural sustainability, some on earthquake resistance, and some on aesthetic ugliness and standardization. While examining this issue, the focus has been put either on the local governments or on the policy failures. Sustainability has been restricted to economic and cultural concerns, and it has not been emphasized that the qualities of sustainability are essential to solve this problem. Sustainability is possible through the design made by the architects using a holistic approach, in other words, through ecological, economic, social, functional and aesthetic qualities. A link between housing quality and sustainability has not been established in terms of housing quality criteria or indicators. Moreover no link has been made about how these qualities will be measured and improved. The housing assessment system and the indicators have not been studied with a scientific attitude neither by the state nor by the architects. Even though some available studies have offered theoretical and very general suggestions about how sustainable building or housing should be, there is a lack of clear definitions about what sustainable housing quality should look like. They do not provide any effective or concrete design solutions. Furthermore, they prefer to pose a series of questions. Some definitions are also removed from everyday architectural practice. In fact, as in the whole world, it has not been understood that sustainable architecture is not a style[42], but rather that it is an ideology about which every architect should be concerned, and reflect upon her/his designs. As Cook and Golton explore, sustainable architecture means raising awareness of all the issues that can be considered.[43]

As a result, the necessity of this argument has not yet been considered comprehensively in Turkey, especially when compared to Europe. In Turkey action has been very limited, despite many actors in the construction industry who pay lip service to the idea. Deyan Sudjic, an architecture critic in The Guardian newspaper in the U.K. states "*..for any architect not to profess a passionate commitment to 'green buildings' is professional suicide*".[44]

38 Williamson, T., Radford, A., & Bennetts, H., Understanding Sustainable Architecture. London: Spon Press., 2003.

39 Wissenschaftliche Dienste des Deutschen Bundestages, Der Aktuelle Begriff „Nachhaltigkeit", Nr. 06/2004, S. 1,2.

40 Roodman, D.M., Lenssen,N., A Building Revolution: How Ecology and Health Concerns Are Transforming Construction, Worldwatch Institute Publish, Washington DC, 1995.

41 Williams, D, E. FAIA. "Sustainable design (Ecology, Architecture, and Planning)". Wiley publisher. USA, 2007.

42 Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.9.

43 Sara J. Cook and Bryn L. Golton, "Sustainable Development: Concepts and Practice in the Built Environment," Sustainable Construction CIB TG 16, 1994, p.684.

44 Sudjic, 1996; cited in Guy, S., and Farmer, G. (2000), The competing logics of green buidings and ethics. In W.Fox (Ed.), Ethics and the Built Environment. London: Routledge, 2000.

However, in Turkey, this is as far as the situation has progressed with very little improvement in the actual production of sustainable units. This study will seek solutions in terms of qualities of sustainable architecture, which provide a holistic view to the housing problem in Turkey. The guiding criteria for sustainable housing quality will be determined by considering the needs and problems of Turkey. The weak points of mass housing in Turkey will be identified and analysed by comparing the concrete examples in Vienna, a capital city in Europe and one of the leading cities in the fields of sustainability and social housing. Furthermore, this study will be a guideline for housing actors, especially for architects and policymakers and, will provide suggestions for further studies of future improvements. In addition, the concrete analysis of these evaluations will facilitate the implementation of indicators, of which each architect in practice should take into account when considering sustainability, and will provide a definition for sustainable quality making sustainability more understandable while remaining on a theoretical level.

3. Aim

Sustainability and quality concepts are central to the construction sector; the entire world is in an effort to design more self-sustainable and higher quality liveable residences and housing. The motivation of this study is to alleviate the worry that the rapidly increasing quantities of mass housing in Turkey which havebecome a lifestyle. It has been intended to approach this issue using holistic architecture, and taking people and their human needs as the central theme while still protecting the environment. Putting this together with nature to design comfortable and liveable buildings provides a key means to communicate qualities of housing, and even architecture. The fundamental questions to be answered in this study are,

1) Which criteria are related to improve mass-housing quality using a holistic approach that provides both design and planning of good quality and sustainable residential areas?

2) Does Turkey have enough sensitivity/concern about sustainability considering its rapid and poor planned structural construction? Do constructions/buildings actually show this concern? What are the weak points of sustainable mass-housing quality?

3) Can Vienna, the capital of a European country that was spread throughout an empire, be a leading example for creating sustainable development of mass housing in the cities of Turkey?

4) How can the holistic design approach of sustainable architecture be encouraged to improve housing complexes, also called as 'mass housing'- in Turkey? What are the proposals to the actors?

The aim of this study is to seek qualified sustainable multi-unithousing architecture in Turkey, which provides holistic thinking to create proposals congruent with the criteria defining sustainable high-quality housinges. In order to answer the aforementioned questions, the purpose of the study is to define guiding criteria to assess sustainable housing quality in order to contribute to the development of housing complexes. Furthermore, this study represents a comparison between housing quality in terms of sustainability and future viability in cities of Turkey and Vienna according to the developed assessment criteria. By evaluating and comparing housing in Vienna and in the Turkish city of Konya, the planning quality indicators including social, functional, and aesthetic quality and energy performance including building physics the state of the art in Konya and in Vienna have been analysed. Vienna, the capital of Austria, is used as a benchmark country following the high standards of the EU, and this comparison will allow for the identification of improvement potentials and to determine whether Vienna can provide a suitable model of sustainable housing planning for Turkey. The concrete analysis of the evaluations in case studies will facilitate the implementation of sustainable indicators, which each architect should take into consideration. This study provides a sustainable approach to housing remaining at a theoretical level, making it more understandable. It also lists some examples of policies and best practices that might help guide the improvement process.

In addition the findings aim to provide certain proposals on planning new high quality residential areas in Turkey, to architects, planners and government policy.

4. Methodology

The study has been designed as a case study evaluation according to the criteria determined about sustainable housing and planning qualities. Housing complex examples from Konya and Vienna have been analysed for the case studies. These case studies are assessed and compared according to the chosen criteria list.

The open-ended character of the research problem has been directed towards an explorative approach. It is not a direct methodology to assess qualities in architecture, but rather a holistic approach to develop a methodology to evaluate housing complexes. When performing this study, the deficiencies in mass public housing in Turkey have been considered, and the purpose is aimed to find the theoretical answer to the question, "Which criteria are related to design and planning of good quality sustainable residential areas?" An evaluation using some qualitative and quantitative aspects is developed with an iterative process of integrating findings from empirical material, existing theory and earlier research in the field. The development of such a method is approached from a holistic point of view to define the user of the building and harmony with nature as the central point of interest. Accordingly, indicators of good quality and sustainable housing are classified as:

- Social-functional Quality Analysis - SFQA
- Energy Performance and Construction quality of buildings - ECQA
- Aesthetical Quality Analysis - AQA

Some criteria are difficult to evaluate because they have been perceived subjectively. The method implies a plethora of data to be evaluated regarding how far the implementations provide quality and liveability depending upon both quantitative (i.e. use of documentations; ground plans, photos, spatial and structural analyses, and observations) and qualitative aspects. It has been intended to obtain some complementary technical solutions and strategies about energy and construction, social-functional, and aesthetic qualities. In addition, sub-criteria of these three main indicators have been developed consisting of qualitative analysis spatial and structural analysis about the projects as well as quantitative analyses. (See also Chapter IV/ SHQ Framework)

The evaluation of social-functional and aesthetic qualities includes the yes/no questions and density-diversity tables, prepared by the author, for each project according to the quantitative project data in addition to the qualitative data analysis of the housing project according to the principals of the criteria described.

HQI[45] and the ideas of Voordt and Wegen[46] about the evaluation of buildings have assisted the definition of the questions relating to social-functional quality and important principals related to the defined criteria. .

The evaluation of energy performance and construction quality analysis include quantitative methods, which are described in the following paragraph, in addition to data analysis of the project according to described criteria of energy and construction qualities.

GEQ energy performance software programme has been used to show the thermal conductivity of materials and components.[47] The GEQ programme does not have settings for the climate conditions in Turkey, thus for the building performance calculations of the buildings in Turkey, the ÖIB Excel Table[48] has been utilised and the local climate information has been taken from the "climate.data.org"[49] database. Acoustic insulation

45 721 Housing Quality Indicators (HQI) Form, The National Affordable Homes Agency, Housing Corporation, 2008

46 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005.

47 GEQ Version 2015, Zehentmayer Software GmbH, 1994-2015

48 www.oib.or.at/sites/default/files/ea-wgv-2012-01-01-v10b2.xls, access: 15.07.2015

49 Climate Date for Cities Worldwide. Available at: http://en.climate-data.org/, access: 07.07.2015.

of building components and summer overheating of rooms have also been measured and simulated in the GEQ software programme. The "u-wert-net"[50] software has been used to determine the U-values of building components and the materials of building components have been drawn as detail drawings by the author. The U-values required by OIB (Austrian Institute of Construction Engineering) Guidelines have been shown in each building component at the top of the drawing, and it is shown in a diagram where the U-values of the components range between "insufficient" and "excellent". Moreover, it is demonstrated at the bottom whether this required value is satisfied or not, and the needed heat insulation material thickness in order to satisfy the OIB Guidelines as well as other guidelines such as the EnEv new building standards, passive house standard etc. The "Passitherm pro" software has been used to calculate thermal bridges of building components.

The analyses from the simulations, qualitative data analyses partially including yes/no questions provide an evaluation of case studies which ensures a comparison between the two different contexts.

Due to the importance and essence of the policies of countries to support sustainable housing quality, the theoretical analysis has analysed initiatives and important measures taken in both countries to understand the background and current position of developing sustainable housing quality. Based on all these information, improvement potentials have been defined.

The following steps are taken for the study:

1. Literature definitions
2. Housing development and current housing analysis of two different contexts.
3. Criteria determination and description considered by the assessment
4. Case study project determination
5. Outcome measurements, analysis of relevant variables and evaluations
6. Comparisons
7. Results, proposals and guideline for Turkey

Figure 1: *SHQ - Assessment Criteria, made by the author*

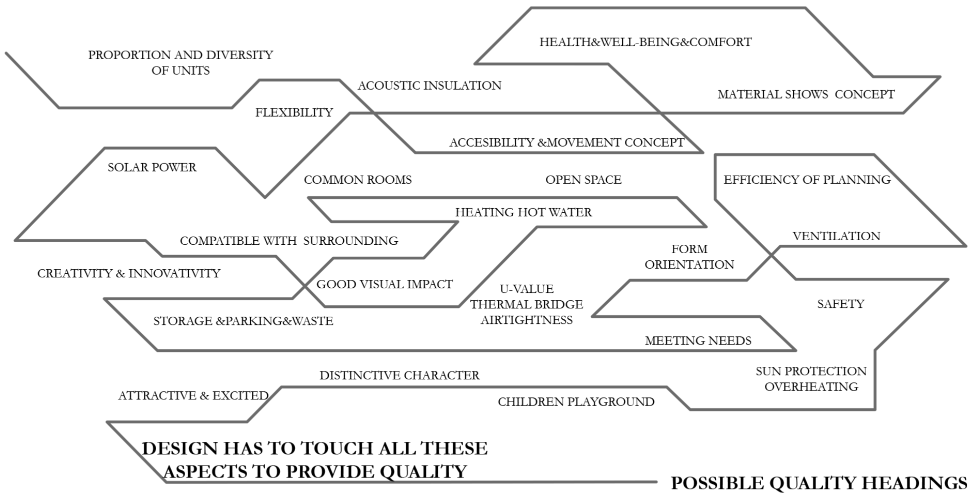


Figure 2: *Possible Quality Heading, made by the author*

50 U-Wert Rechner. Available at: https://www.u-wert.net/?lv=1

METHODOLOGY DIAGRAM

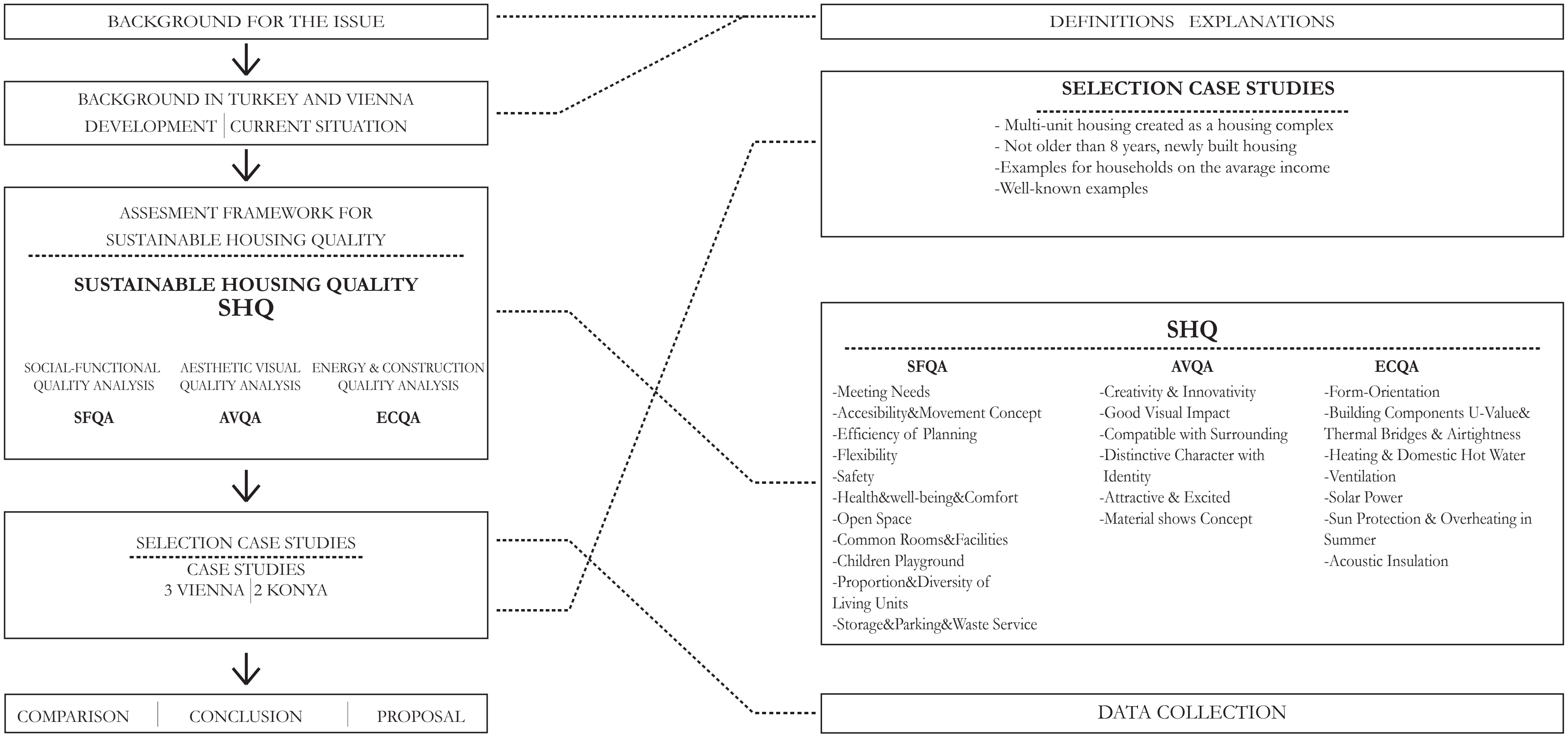


Figure 3: *Methodology Diagram, made by the author*

Figure 4: *Sustainable architecture provides quality for people and environment, a sketch of the author.*

5. Sense of Sustainable Architecture Referring to Holistic Thinking

Sustainable architecture has been put forward recently as a special phenomenon. Concepts like "energy efficiency" and "ecology" have been presented as a separate area, or a movement in the architectural discipline. Actually, sustainability is not a style, but an ideology that every designer and architect should take into consideration.[51] In order to influence society, the fact that all people feel themselves responsible for nature, and that they should consult the area of architecture when it comes to the implementation of sustainability so as to protect nature is very crucial. The built environment shapes society, which means if architecture transforms itself, it may also affect the lifestyle of society. This idea includes the message: "not that architecture can transform society, but that it can transform itself, and, if architecture does so, perhaps offer other forms of production".[52] The reason is given in the words of Rem Koolhaas: "*It is the task of architecture to create a plausible relationship between the formal and the social*".[53]

According to Aristotle, there is an equality between the body and the soul. For him, the idea is that a living being is recognized by the environment not according to his appearance, but according to his doings and reactions. This idea can also be a representation for construction.[54] And this idea leads us to sustainable building, and the negative impacts of the constructions to the nature should not be underestimated. The concerns today has to be in a direction to design healthy environments which increase life quality and reduce negative effects of constructions and technology. Technology and its achievements are the main aspects considered, and architecture converts from "part of the environment" to "separate from the environment".

51 Gysin B., Sustainable Design. A Statement, in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.9,

52 Hagan, S., Taking Shape. A New Contract between Architecture and Nature, Oxford, 2001, p. 11.

53 Rem Koolhaas and Sarah Whiting: Spot Check. A Conversation between Rem Koolhaas and Sarah Whiting, Assemblage 40, (December 1999), Cambridge, Massachusetts, 1999, p.50.

54 Kaltenbrunner R., Auf dem Weg zum nachhaltigen Bauen?: über die unscharfe Relation von Ökologie, Architektur und gesellschaftlichem Wandel, ed. By Bundesamt für Bauwesen und Raumordnung in: IzR-Informationen zur Raumentwicklung, Heft 1/2, Bonn, 2002, p.1-10

Thus, architecture destroys the environment, and it would be changing and also economically inefficient without adequate qualities.[55]

"*Across a wide range of disciplines, including architecture, conjecturing a built environment that mimics and complements rather than conflicts with nature is emerging as a vital goal.*"[56] The responsibility of architecture in this challenge is to design creative and innovative buildings and environments, which consider ecologic design and resource efficiency. The building sector is the reason for heavy pollution and demolition of resources. The sector uses about 40-50% of total energy, and causes 30-40% of all CO_2 emissions.[57] Sustainable architecture is integrating two aims: technology and human aims. In general, a comprehensive definition according to Slessor is given as, "*sustainable architecture is an architecture replying and interacting with environmental and local conditions and it is trying to apply contexts ecological abilities to create desirable environmental conditions; consequently, it is ecological equilibrium means it has minimum damages on ecology in addition to its flexibility, adaptability and continuity to changes and needs, and it is distinctive since it has some local attributes.*"[58]

There were such periods in history in which architecture made enormous changes in the community life. Although architecture has been both crucial and central to community life, its importance has declined in recent years as a result of economic growth and progress in technology. These concepts have come into prominence, and have begun to be more influential on culture and community. In the history of architecture, important innovations were always tied to two factors: progress in technology and social change.[59] New construction technologies such as concrete, glass-steel facades and new production methods have had an effect on the direction of architecture.

55 Mirsaeedie.L,"Industrialization Idea in Housing to Reach Sustainable Development", International Conference on Built Environment in Developing Countries (ICBEDC 2009), School of Housing Building and Planning,Universiti Sains, Malaysia, 2009, pp 1422-1433.

56 Slessor, C., The Quest for Ecological Propriety. In: The Architectural Review, No. 1, January 2002, p. 32f.

57 Gysin, B., Sustainable Design. A Statement, in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, p.20,

58 Williams, D, E. FAIA. "Sustainable design (Ecology, Architecture, and Planning)". Wiley publisher. USA, 2007.

59 McDonough W. and Braungart M., Fundamental of Sustainable Design in Holistic Housing: Concepts, Design Strategies and Processes, Edition Detail, Munich, 2012, p.30.

After industrialization, a new social lifestyle has been composed, also with contributions from architecture. Sustainability has also had a similar effect on architecture evolution. From food to the health sector, people try to find the most ecological products to ensure harmony between humans and nature. In this era, architecture has an opportunity to be a leader if it could be successful in implementing sustainable ideology and principles connecting people and their needs, as well as humans and nature. The main idea of sustainability is to concentrate on environmental conditions to achieve a designed product with maximum internal attributes of the environment so that it can minimize the undesirable aspects of these constructions. Especially after the industrial revolution, buildings have been perceived as detached from the natural environment. All the natural sources have been exploited by technology in order to attain more comfort and high quality of life. Only after the ecological crisis, has it been realized that large losses have been given up in the meantime. Many academics and scientists have begun to concentrate intensely on the concept of "sustainable development", and this subject has become the most current issue of recent years.

"*Sustainable architecture would be architecture for people and not architecture by architects for architects. We support architecture that is useful and has meaning for the individual because it offers pleasant spaces, because it gives aesthetic expression to the society, as a result of its common effort, and creates an identity for the society. This does not signify reduction to usefulness and functionality. Such an approach would be an inappropriate simplification because usefulness is fluid: it changes over time and according to the perspective of each user.*"[60] These demonstrations support holistic architecture which sustainability encourages. Because sustainable buildings minimize environmental impacts with their construction and their useful life leading to economic benefits with energy efficiency and better quality of use by answering needs like thermal and visual comfort, privacy, common rooms with less demolition of nature, and of course design and aesthetic quality. That means the buildings should contribute to the social environment they occupy by meeting the practical needs of people, enhancing their surroundings, and their psychological and physical

60 Ibid., p.31.

well being. Guy and Farmer suggest six competing qualities of green buildings, which have been an important part of sustainability: "*Ecological, smart, aesthetic, symbolic, comfort and community*".[61] In each case, a one-word description has been suggested to cover features of these six qualities.

This brings us to an idea: Sustainable architecture is the only future-oriented perspective, which has new demands from architecture, such as demands on the communication of the buildings, on the built-environment between the inhabitants and users, on waste prevention and emissions reductions, on healthy living and quality of life, and especially on waste reduction of energy and resources. To fulfil all these requirements, it will be necessary to have a fundamentally different attitude towards planning that endeavours to include holistically complex and multiple factors within architecture. Today, we perceive sustainability as a three-pillar model in which economic, environmental, and social requirements are brought together in a project. Therefore, architecture is able to develop concepts that fulfil all of these requirements.

As a result, the main idea of sustainable architecture is to protect the environment from undesirable negative effects of construction to achieve a designed product with maximum efficiency. When the designer begins to design from this perspective, s/he will recognize that a new approach to architecture has been represented. S/he will look at building conversions and new building projects with responsibility, and with a new perspective. But practically it is difficult to say when architecture becomes sustainable?

The ideas of Gysin can summarize the concept: when it has special design qualities, is contemporarily technical and is socially compatible, then it means that it is sustainable.[62] It is not sufficient to relate architecture only with technical, aesthetic, and social aspects. Aside from that, architecture must also be linked with cultural identity because architecture is a mirror of society. Creative designs should take ethics and social values into consideration. According to Collier, "sustainability in all its aspects - social, environmental and economic - is now the central moral imperative for architects."[63]

In order to achieve sustainable architecture, people have begun to be concerned about different ecological implementations of construction and living forms in the last 30 years. In the context of the environmental movement, pioneer projects have emerged in ecological living. The first eco-housing dealt not just with the realization of environmentally-friendly construction, but also often with alternative designs of communal living. These projects are mostly of the opinion that environmental protection is primarily a question of the right way of living. Especially due to two oil crises in the seventies, research and the impetus for ecological housing have been developed with the help of technology. The main concerns have been energy efficiency, healthy and ecological constructions and buildings. Implementations such as thermal insulation, thermally-insulating glazing, solar panels, and also other technical solutions have been applied in new construction and also partially in old buildings. A struggle in the construction sector has started to increase merchandise availability and material reliability while decrease the purchasing costs. Solar architectural concepts and winter gardens have gained greater popularity in housing. These technical measures in new residential construction have led to measurable successes. The thermal quality of the building envelope has been improved significantly, especially in countries in Europa and America. The energy consumption of today's new buildings is only a little bit more than around one-sixth of the average consumption in 1973.[64]

Design is the primary component of architecture. The definition of 'design' from Wikipedia reads in part as, "*[a] specification of an object, manifested by an agent, intended to accomplish goals, in a particular environment, using a set of primitive components, satisfying a set of requirements, subject to constraints. [...]*."[65] To design a building is a complicated process, which has to include

61 Guy, S., & Farmer, G., The competing logics of green buildings and ethics. In W. Fox (Ed.), Ethics and the Built Environment, Routledge, London, 2000.

62 Gysin, B., Sustainable Design. A Statement, in Drexler H., El khouli S., (eds), Holistic Thinking, Detail Edition, Munich, 2012, pp.20-25.

63 Collier, J., Moral imagination and the practice of architecture. In N. Ray (Ed.), Architecture and its Ethical Dilemmas, Taylor and Francis, London, 2005, p.89.

64 Nutzererfahrungen als Basis für nachhaltige Wohnkonzepte, Haus der Zukunft, BMVIT, Wien, 2001, p.3.

65 http://en.wikipedia.org/wiki/Design (01-02-2015).

essential knowledge of architecture and construction, analytical thought and design, and creative faculties as a strong relationship. Functional and environmental requirements have to be considered including all different design possibilities touching the essence and quality of architecture. Despite the fact that the assessment and evaluation of "sustainable architecture" is also very complicated, "sustainable architecture" is the conscious design of designers putting people and nature into the centre while trying to take the responsibility of preventing climate change and environmental destruction. In order to overcome this challenge, simplicity, farsightedness and more empathy are required. A transition is necessary from Cartesian Philosophy, which has been leading the world for approximately four centuries based on rational analyses and separate ideas, to a holistic world-view, which connects more strictly with nature and approaches problems holistically. The holistic approach derives from the aphorism of Aristotle: "*the whole is more than the sum of its parts*".[66] Here, this holistic view is the exact thought process required reach the sophistication of sustainability. Even internal planning is the combination of knowledge and networking of constantly increasing subfields. Today, all technical and renewable materials are available. It is a challenge today to bring these technological improvements into balance with natural conditions. The only thing needed is enthusiasm for a better and more liveable world, questioning improvement and lavish applications, and consistency in the direction of sustainability. Sustainability should not be a style, but a way of thinking.

As it is discussed before, sustainability is a way of holistic architecture to provide a quality. Architects should take into consideration the requirements of people, and face the real problems of the world determining the future of humanity without deceiving (releasing) the essence of architecture, which is a difficult and complex task. As Einstein says: "in the middle of difficulty lies the opportunity".[67] It is important to discover "how?"

66 Gauzin-Müller Dominique, A short history of Sustainable Architecture, in Drexler H.,El Khouli S. Holistic Thinking: Concepts, Design Strategies and Processes, Detail Edition, Munich, 2012, p.18.

67 DeFord, D., 1000 Brillant Achievement Quotes: Advices from the World´s Wisest, Omaha, 2004, p.139

"to dwell: to be content, to be pacified, to be safe from harm and menace

to be free, to be on Earth and under the sky"

"with a dwelling it is possible to kill a person as well as with an ax, though it takes much longer and is much more painful" - H.Zille

quality

II. HOUSING /SUSTAINABILITY/MEASURING QUALITY

1. Human – Space – Environment

"Time and space is the scene of life, to take place in that. Creatures are appointed a particular time range of existence. Their existence is bound to particular places that are favorable for their survival. Immobile life forms perish, if the living conditions of their existence space changes significantly. Mobile life forms can elude these consequences by changing their place. Space is one of the fundamental dimensions of life, which is defined by boundaries, partitions, structure. Without structuring, space is not experienceable. A second fundamental dimension in the utilization of space is time. Without movement in space, time is not experienceable. But movement happens in time." [68]

Movement is the symptom of life. Not only humans move, but also other creature and even atoms, the Earth, the seas, the whole universe is in a state of movement. Time and space are participators of this change. Seasons let the environment move, i.e. change, and humans also change the environment, who are themselves in motion. One generation disappears, and another one follows its predecessors.

There may be different definitions for environment. Sometimes, this may refer to the neighborhood beginning right next to your own fireside, sometimes to a whole housing area, and sometimes to the whole region. Initially, "home-living space" is not confined the own fireside. There exists an entire system; human, home and environment regarding their mutual influences and relations. A home is anchored in its special environment, and factors such as sun, wind, weather, influences of city, traffic and agrarian spaces, interact with humans and their dwellings the same way as humans interact with their environment.[69]

Under the concrete, experienced or lived space, we understand a space in which we live on a daily base, in which we move, we need to unfold our personal lives, in contrast to the mathematical definition of space taught in school. And as a contrast to the homogeneity of the mathematical space, the experienced space shows a rich inner partition. It points out particular, precedent directions and particular places, and each place is characterized by particular qualities having their own meanings and their own associations with human beings.[70]

Heidegger discusses the "spatiality"[71] of the human existence, and he refers not to the simple fact, that man, like anything else, is a spatially extended being, but that he is rather determined in his existence by his relation to his surrounding space. Humans create artificial conditions. This is architecture. He physically and mentally repeats, transforms, extends his physical and mental surrounding space, he determines "environment" in the broadest sense. As a consequence, this effect can be in a positive or negative direction.[72]

2. Housing

The use of a dwelling rises from basic human need. Man pursues a framework for particular activities and needs, expectations and visions, emotions and experiences.[73] Thus, housing, is more than just a place where a person fulfills basic requirements such as sleeping, eating etc. It is an expression of personality, life style, memories and emotional experiences.

Most human life takes place in closed rooms, especially in the homes which we spend most of our lives in. Heidegger makes a connection between the German word "wohnen", which means to dwell, and the Gothic word "wunian", which has the following meanings:

"*... to be content, to be pacified, to stay therein. That word means 'das Freie' [the outside],*

68 Curdes, G., Stadtstruktur und Stadtgestaltung - 2. Aufl. Stuttgart, Berlin, Köln, 1997.

69 Angerbauer, S., Zeitgemaeszer Sozialwohnbau, Master thesis, Technische Universität Graz, Institut für Städtebau und Umweltgestaltung, Graz, 2001.

70 Bollnow, O.F., der Mensch und der Raum, 1963

71 in German "Räumlichkeit"

72 Hollein Hans, "Alles ist Architektur", 1967

73 Schroeder U., Variabel nutzbare Häuser und Wohnungen, Wiesbaden – Berlin, 1979. p.9

and free means safe from harm and menace, where safe means to be spared [...]. The actual sparing [...] occurs, if we leave something in its nature, or if we particularly do bring something back to its nature. It is corresponding to 'to free': to en-free ['einfrieden', meaning to screen a property by fences]. 'Wohnen' [to dwell] means: to stay en-freed in the outside, which saves anything in its nature. The main feature of this dwelling is this sparing. It pulls through this dwelling in all its broadness. It arises, as soon as we think of dwelling as personhood, meaning the stay of the mortals on Earth."[74]

When Heidegger discusses dwell, he tells us that if we manage to find ourselves a residence, we are enabled to make buildings, and if we are able to make buildings, we can have residences. In other words, he describes the mutual relation between the ability to build and having habitations, saying that to reside is a consequence of "human existence (Dasein in German)", and to dwell means to be on Earth and under the sky. [75] He further suggests that in modern times these two actions have been forgotten. "Being human means to dwell"[76]he says, and adds, "Man has to learn again to build residences." [77]

According to Islamic life philosophy, the goal of "human existence (Menschliches Dasein)" is to live in harmony with the dynamic laws of the universe. A person can be happy and content when they are in harmony with their environment, fellow people and with other creatures. Additionally they have rights and responsibilities (obligations) in this environment. For Ibn Khaldoun, an Islamic philosopher, cities and living spaces are places which provide the possibility of a protected and enabled life. Living places are accordingly places, where human can satisfy existential needs and can continue their lives safely and happily.

74 Heidegger 1954, p.149: „[...] zufrieden sein, zum Frieden gebracht, in ihm bleiben. Das Wort Friede meint das Freie, das Frye, und fry bedeutet: bewahrt vor Schaden und Bedrohung, bewahrt – vor ... d.h. geschont. [...] Das eigentliche Schonen [...] geschieht dann, wenn wir etwas zum voraus in seinem Wesen belassen, wenn wir etwas eigens in sein Wesen zurückbergen, es entsprechend dem Wort freien: einfrieden. Wohnen [...] heißt: eingefriedet bleiben in das [...] Freie, das jegliches in sein Wesen schont. Der Grundzug des Wohnens ist dieses Schonen. Er durchzieht das Wohnen in seiner ganzen Weite. Sie zeigt sich uns, sobald wir daran denken, dass im Wohnen das Menschsein beruht und zwar im Sinne des Aufenthalts der Sterblichen auf der Erde"

75 Heidegger, Gesamtausgabe 7, p. 208.

76 "Mensch sein.. heisst wohnen"

77 Heidegger, Building, Dwelling, Thinking, 1951

When referring to Heidegger above, when he indicates that man has to learn again to build residences, it can be assumed that architects have been addressed particularly, because they are the main actors in planning living spaces. These living spaces are very important, as man wants his place called home to be worth living in, to be comfortable and to provide contentedness. As the architectural critic A. Behne cites from H. Zille[78], "*With a dwelling it is possible to kill a person as well as with an axe, though it takes much longer and is much more painful.*"[79] This sentence is attributed to the inhabitants of a dwelling in the same way as it is attributed to the following generations that inherit our buildings. Consequently, that is the point at which the term "sustainable housing" gains sense.

2.1. Housing Needs

Housing needs stand for those basic human needs that are directly attached to the living space of a person. And these are those human needs that are relevant for the planning of living space. Alexander Mitscherlich determined that the increase in human population has not changed the fact that the basic needs of individuals at all stages of their lives remain principally the same.[80]

The aim of human existence is, according to Islamic philosophy, the harmonic balancing with the dynamic laws of the universe, and in order to be happy, man needs to be in harmony with his environment, with other human beings and with the remaining creatures. Social rules determine man's rights, limits and duties. And the laws of nature determine the order of life of all creatures and their mutual dependencies.[81] According to the Islamic philosopher Ibn Khaldoun, cities provide for the exchange of

78 Zille H., (1858 – 1929) was one of the first great artists of the past century. His notoriety was not only because of numerous publications in journals and magazines, but because of his talent and popularity for advertising puposes of any kind.

79 Behne A., Neues Wohnen Neues Bauen, Prometheus Bücher, Hesse&Verlag, Leipzig, 1927

80 Alexander Mitscherlich: The Inhospitality of Our Cities. Theses for the City of the Future, Frankfurt am Main 1965 (in German). Cited in Drexler H., El Khouli S., Holistic Housing: Concepts, Design Strategies and Processes, Edition Detail, Munich, 2012, p.56

81 Chekkoury Idrissi, D., Anpassungsfähiges Wohnen, Phd thesis, Städtebau Insitut, Universität Stuttgart, 2006, p.15.

goods and services and also for a secure human life.[82] And a dwelling, where humans can fulfil the requirements for life, is a protective place for a single person as an individual and a composer of society.

Human needs are categorized into three according to the Islamic goals of the divine law; the essential - daruriyyat, the complementary, hajiyyat, and the embellishments, tahsiniyyat. The essential contains five components;the protection of religion or the ethical basic order, the protection of life or the provision of food and security, the protection of mind, the protection of property, and the protection of family and descent. The complementary is everything which is useful, but not essential. And under embellishments is understood everything which is leads to the perfection of senses, such as art, science or aesthetics.[83]

Something similar was developed by the Greek architect Doxiadis[84] 600 years later in his "Ekistics" or "The Science of Human Settlements".[85] According to him, the individual is in the center of human settlements, and their primary goal is to set up their individual living space. Cities and residences have the function to bring happiness into human life and to provide for security. According to Doxiadis the satisfaction of people depends on how far their physical, intellectual, psychological or social needs and abilities are fulfilled. These needs are classified in three categories; primary, secondary and tertiary. The primary needs provide survival, while secondary and tertiary treat social, cultural, technical, ecological, and political aspects.

Abraham Maslow described as a further classification, in his pyramid of needs, stages of needs and motivation of people.[86] In order to attain the things in the higher level of the pyramid, the needs of the basic level first have to be satisfied. The first need to be satisfied entails motivation. The needs on the first level are basic and lasting, such as eating, drinking, security. Needs in the higher level only arise after the lower level's needs have been satisfied, and they can never be entirely satisfied in contrast to the needs of the basic level. Just as a human being has a natural limit when eating, there is also a limit in the space requirement of a single individual. The need for recognition and egotism or for appreciation are requirements of the higher levels, for example rooms in luxury apartments that are never used, but only serve representative purposes. These "requirements" never end, they always produce more requirements and can never be satisfied.

The development in architecture is comparable to the hierarchy of Maslow. The first shelters were born due to the need for safety. When looking into the typology of native people, it can be seen that some building types represent the social status of their inhabitants and that these evolved only after the basic needs in society had been fulfilled. Weeber describes the change, "*Residential claims have grown and they have changed and also differentiated widely (...) An apartment shall be spacious and not have those tiny, predefined rooms. Large windows make them bright and create an open living atmosphere. The usable "green room" - preferably an ample terrace close to the kitchen or at least a large balcony - is a must. Families with little children appreciate a garden where the children can play without the need of direct supervision.*"[87]

82 Abderrahman ibn Khaldun (1332-1406): Islamic scholar, jurist, historian and sociologist; in his "Muqaddima", he has formed a comprehensive theory of human history first time and opens the way for the sociologists of the later European Renaissance. Characteristic of his works was the transfer of scientific laws to human settlements. Ibh Khaldun is regarded founder of sociology by some Westerners.

83 Chekkoury Idrissi, D., Anpassungsfähiges Wohnen, Phd thesis, Städtebau Insitut, Universität Stuttgart, 2006, p.15

84 A. Doxiadis hat die technologische Organisation Athens und das Athenzentrum für Ekistiks 1963 mit begründet. Er war ein Staatssekretär und Generaldirektor von 1945 bis 1948 sowie Koordinator des griechischen Wiederaufnahmenprogramms von 1948 bis 1951.

85 The concept of "Ekistics" was first derived by Doxiadis, Constantinos. He describes it as: "the science of human settlements" which is influenced by human parameters conditionally, and by "economic, social, political, administrative and technical sciences and artificial disciplines". According to Doxiadis, Ekistics differs (in terms of the Greek word Oikistikos - settlements) from architecture in that it goes beyond the specific interests of a building and includes all aspects of the human condition.

86 Maslow, A., "A Theory of Human Motivation", in: Psychological Review, Nr.50, 1943, p.370-396, reprinted in Juni 2001.

87 Weeber R., Ansprüche von Familien an das Wohnen in der Stadt, Symposium: Familiengerechtes Wohnen in der Stadt. Bundesministerium für Verkehr, Bau und Stadtentwicklung, Berlin, Bonn mit der Arbeitsgruppe Kooperation GdW- BDA-DST, Berlin, p.2:
Original Text: „Die Wohnansprüche sind stark gewachsen und haben sich auch verändert und weit differenziert (...) Die Wohnung soll also grosszügig sein, nicht die kleinen, festgelegten Zimmer haben. Grosse Fenster machen sie hell und schaffen die offene Wohnatmosphäre. Das gut nutzbare grüne Zimmer – am besten eine geräumige Terrasse nahe bei der Küche, zumindestens ein grosser Balkon- ist ein Muss. Familien mit kleinen Kindern schätzen einen Garten zum unkomplizierten Spielen ohne direkte Aufsicht"

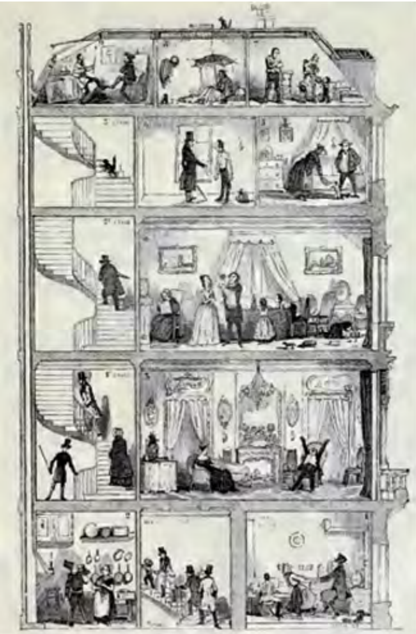


Figure 5: *Section through a Pariser Mietshaus , 1 January 1845*

Figure 6: *Elisha Otis presents the first elevator at Crystal Palace, 1853*

Similarly, the dwellings in which we live today meet the fulfillment of needs such as to become known, to level up the social status or to attract the attention of the others, as soon as our basic needs have been satisfied. If we have a look to the development of housing in history, we see that housing forms have also changed with changing conditions, such as social structures, technology etc (Figure 5).

With the industrial revolution housing forms first changed in England, followed by the rest of the world. A movement started in the cities and multi-unit housing became inevitable, bringing with it vertical densification. The invention of the elevator was a gift to vertical building (Figure 6). The lift has also provided a direct relationship between repetition and architectural quality, a lot of storeys of the same single form can be laid one over another without any problem.[88] Vertical building which had been inspired from dreams and fantasies of people, turned to an unavoidable reality with technological developments and the desire of people. The myth of Babylon can be subscribed from old vertical fantasies, the metaphor of the tower embodying the challenge for architects tirelessly fighting against the world to create a symbol.(Figure 7)

Today, in contrast, the dreams and fantasies of most people are preoccupied with silent low-rise housing away from cities, with nature, and a detached house, if possible.

Figure 7: *Myth of Babylon by Pieter Bruegel the Elder, 1563, Oil on Panel at Kunsthistorisches Museum, Vienna.*

As a result, the forms of the dwelling may change, but the constant needs

88 Koolhaas, R., Delirious New York, A Retroactive Manifesto for Manhattan, The Monacelli Press, New York, 1994

related to dwelling generally remain and can be summarised as follows: [89]

- According to sensory perception, sensations and experiences
- According to appropriation and design
- According to self-determination, regulation and control
- According to social interaction (affiliation, communication), extraversion and introversion
- According to activity and contemplation, stimulation and relaxation
- According to development and unfolding.

2.2. Good Design and Housing Quality

Housing quality is related to the definition of "good design" and "housing needs". It is important to reach set housing quality benchmarks for design quality, communicating design needs, emphasizing the importance of design to the procurement process. In the paper, "*Opportunities for Change: Sustainable Construction of DETR*" in 1998, it is determined the importance of relation of progress and quality.[90] One of the points raised is that to reach the appropriate quality, built environments should be designed durable, flexible and adaptable; another is the creation of buildings which are resource and energy efficient in their construction and whole life. These buildings should also provide efficient and pleasing atmosphere suitable for living, working etc. These features, all highlight the necessity of thinking of resource efficiency, construction quality and design quality, which contributes to human satisfaction, and also to housing quality.

In order to define good design we have to describe the term "design". We can define "design" as; a description of the main features of something. A plan is a design that shows how something should be arranged and

89 Deinsberger-Deinsweger H.(2012), "Functionality in housing (Funktionalität im Wohnbau)", Cloud-Cucko-Land (Wolkenkuckkucksheim), International Journal of Architectural Theory, Vol.32, p.165, 2012

90 DETR Consultation Paper (1998), Sustainable Development: Opportunities for change- sustainable construction, Department of Environment Transport and the Regions, London,1998

executed. Some other definitions of design:

"The formulation of a prescription or model for a finished work in advance of its embodiment, with the intention of embodiment as hardware, including the presence of a creative step."[91]

"The use of scientific principles, technical information and imagination in the definition of a structure, machine or system to perform prospected functions with the maximum economy and efficiency."[92]

"Design is a core problem-solving activity that not only determines the quality of the built environment- the buildings, public spaces, landscape and infrastructure- but also delivers many of the instruments for implementation of an urban renaissance."[93]

"Designing is devising and setting down geometry, materials and manufacturing techniques for a new product. This is more than just drawing. It is a goal- oriented mental process in which problems are analyzed, goals set and reset, proposed solutions developed and the properties of solutions assessed."[94]

"The translation of information in the form of requirements, constraints and experience into potential solutions, which are considered by the designer to meet required performance characteristics."[95]

"An efficient process for taking decisions on an original, ingenious, practical, physical and spatial solution to a spatial problem, from initiation to execution."[96]

"Design is the activity that brings together and integrates all the diverse contributions of

91 Archer, L.B., Systematic method for designers, The Design Council, 1965, London

92 Fielden, G.B.R. (ed) Engineering Design, HMSO, 1963, London

93 Macmillan S., "Design as a value generator", in Macmillan S. (Eds), Designing better Buildings, Spon Press, London, 2004, p.1

94 Roozenburg, N.F.M., J.Eekels, Product design, structure and methods. Lemma B.V., 1991, Utrecht

95 Luckman, J., "An approach to the management of design", in Operational Research Quarterly 18 (4), p.345-358, 1967

96 Eekhout, M., Inleiding over ontwerfen, ontwikkelen en onderzoeken (Introduction to design, development and research), Course on design methodology, October 1996

the construction industry to produce a product that meets the customer needs."[97]

We can say that in terms of buildings, it is taken to be that part of the process that lies between working with the client to identify requirements and aspirations on the one hand, and on the other putting together the components and systems to construct it. To evaluate good design, the following should be considered; functionality, whole-life costing, service enhancement and aesthetics.[98] This brings us to the point - building projects are like cocktails with are mix of competing factors. It can be argued that in any construction project the three most important aspects of the design are:[99]

- Ensuring an imaginative and visually attractive response to the brief
- Aiding the ease, reliability, safety of its construction
- Achieving maximum value and functionality with effectiveness, performance and efficiency in use.

It has now been described what 'good design' could be, and which qualities it brings with it. According to Treasury Task Force published, in 2000 in England[100]: "*At its broadest, design is the process in which intelligence and creativity are applied to a project in order to achieve an efficient and elegant solution. . . . Good design is not an 'optional extra', rather it is inherent in the way the brief is responded to from the very beginning. Design encompasses functional efficiency, structural integrity, sustainability, lifetime costing, and flexibility as well as responsiveness to the site and to its setting. . . . Good design involves creativity, and it should lead to simplification and to savings in cost. . . . It can increase outputs and add to the quality of service. It can also give the facility a competitive advantage in attracting both customers and staff. Good design can also contribute to wider policy objectives, such as those relating to the protection of the environment. Good design adds value in the following ways: functionality; reducing whole-life costs; service enhancement; architectural quality and wider social and environmental benefits.*"

Cabe´s emerging guides to good practice[101] identified and described the principles of good design for building and urban design (Figure 8).

Dickson describes designing the quality measurement process:"*To make some sense of a measurement system for the value of design, consideration has to be made*

What makes a good project?	Principles of good design	What is a well-designed building?	What is a well-designed place?
• order	• functionality in use	• appearance	• character
• clarity of organisation	• build quality	• context	• continuity and enclosure
• expression and representation	• efficiency and sustainability	• buildability	• quality of the public realm
• appropriateness of architectural ambition	• designing in context	• maintenance	• ease of movement legibility
• integrity and honesty	• aesthetic quality	• operation	• adaptability
• architectural language			• diversity
• conformity and contrast			
• orientation			
• detailing and materials			
• structure, environmental services and energy use			
• flexibility and adaptability			
• sustainability			
• beauty			

Figure 8: *Principles of good design at individual building and urban levels by CABE*

of the design process itself. There have been many descriptions of the design process, but the clearest is a series of stages which divide into analysis, synthesis, evaluation and communication. (See Figure 9)."[102]

Another report by RIBA Future Studies Group on the value of architecture, commissioned by Worpole and Loe, put forward four principal arguments regarding the contribution that architecture and design can make at the

97 Crisp: Construction Research and Innovation Strategy Panel, 1999

98 Treasury Task Force, How to Achieve Design Quality in PFI Projects, Technical Note 7, London, 2000

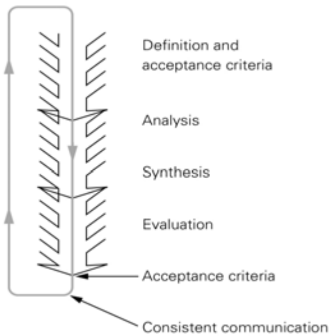
99 Trebilcock, P., "Managing design and construction" in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, London and New York, 2004, p.160.

100 Treasury Task Force, How to Achieve Design Quality in PFI Projects, Technical Note 7, London, 2000

101 CABE and DETR, By Design-Urban design in the planning system: towards better practice, Thomas Telford Press, London, 2000, cited in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, London and New York, 2004, p. 4

102 Dickson, M., "Achieving quality in building design by intention", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004, p. 191

Figure 9: *The design process*



urban level.[103] (See Figure 10)

It is important for residential areas that places in which people would wish to live are designed, creating a spirit of space, where they have opportunities to feel physically and psychologically well, and find easy to use. So the question is, what constitutes better housing quality, or what is housing quality? These questions are related with performance and functionality of residential areas.

The terms housing value and housing quality are in a significant relationship and it is meaningful to discuss these notions together. Sigrid Rughöft describes housing value, "*where dwelling conditions stand in relation to the residential requirements (Wohnansprüche) of their inhabitants. Dwelling conditions can be regarded as the attributes of an apartment, residential building and a living environment. Residential requirements result from the cumulation of the dwelling conditions and the concrete housing needs and formulate the demands of the inhabitants on their apartment, house and environment. The housing value 'Wohnwert" corresponds to the degree of accordance between dwelling conditions and residentual requirements. It can have influences on the behavior of its inhabitants.*"[104] Weeber and Bosch

103 Worpole, K., The Value of Architecture: design economy and the architectural imagination, London: RIBA Future Studies, 2000, cited in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, London and New York, 2004, p. 6

104 Rughöft, S., Wohnökologie – Grundwissen, Stuttgart 1992. Available at: http://www.wohnwert-barometer.de/informationen-wwb/nachhaltige-wohnqualitaet/was-ist-wohnqualitaet.html, access: 15.08.2015

Impact	Example
The wider economic impact of attractive buildings and settings	Flagship architectural projects that have clear economic impact on the towns and cities in which they are located.
Achieving greater value for money through technical and intellectual expertise	How the skills and expertise of the architect can provide cost-effective solutions to complex problems, not only saving money but providing extra benefits in terms of increased space, easier access, more efficient living and working conditions.
Enhanced individual and social well-being, and therefore quality of life	The ability of buildings and places to provide heat and coolness, light and shade, companionship and sanctuary, excitement and rest . . . safety and security, greater legibility and assurance, and a greater sense of locality, identity, civic pride and belonging . . . architecture can be a vital part of a wider notion of quality of life.
Greater adaptability, energy efficiency and environmental sustainability	Greater regard for the orientation of the site, local topographical and environmental factors . . . and designing and fine-tuning buildings that take advantage of these factors to minimise energy use – and therefore revenue costs – and provide comfortable and pleasant environments in which to work.

Figure 10: *Four principal arguments about the contribution that architecture and design can make at the urban level according to Worpole*

describe housing value almost identically.[105] But "Wohnwert" already contains the possibility of comparability in the sense of equivalents or as use in the material and immaterial sense. Four categories of housing values can be distinguished:[106]

- Use value and use utility. These include practical usability, healthy dwelling and an adequate durability.

105 Zu den Ausführungen über den Wohnwert, see Hannes Weeber und Simone Bosch: Nachhaltig gute Wohnqualität. Beispielhafte Einfamilienhäuser in verdichteter Bebauung, Stuttgart, 2004

106 Dammaschk, El khouli, Keller, Mahal, Nawaz, Petrov, Spitzner, Von Hegger (Eds), Wohnwert-Barometer. Erfassungs- und Bewertungssystem nachhaltiger Wohnqualität, Stuttgart 2004

- Emotional value - self-perception of the living situation. Aspects such as "to feel comfortable" or "to love being at one's home" are meant.
- Use for prestige - perception of others of the living situation. The owning of home serves as successful self-representation.
- Protection function and socio-spatial quality. Protection from physical impairments and interferences of privacy as well as the spatial possibilities for communication. This implies the volatility between protected privacy and casual external contact.

Weeber and Bosch incorporate the living environment (district, neighborhood, surroundings) and the residential area (settlement, landscape, infrastructure) to the housing value. Duo to the complexity of housing quality which has to react individual needs and requirements as well as objective factors, sustainable architecture with a holistic claim, cannot be reduced only to measurable aspects, but rather it has to deal with the whole of human needs and requirements with a holistic approach and ethics.[107]

2.3. Practical Aspects of good housing Complexes

There are some general practical aspects of good housing complexes which make them more usable and livable. They must not be designed as gated communities which isolate people as ghettos in the community (there are a lot of these examples in Turkey). They must provide security and visual privacy against the street, but also prevent the distinction between people in and outside a housing complex. Especially in city life, they have to offer enough green spaces for inhabitants, encourage social cohesion and communication between them with common rooms, and provide playing areas for children. A clear distinction between pedestrians-cycle and car paths is important for secure circulation.

107 Ibid.

The apartments of housing complexes have good sound insulation between each unit and to outside noise, also good heat insulation against summer and winter which provides energy efficiency. It is important to have sufficient storage for prams, bicycles and private stuffs. Accessibility for all is an important issue that must be taken into consideration.

Housing developments should offer a variety of different living options such as small-large dwellings, flats and marionettes, with gardens and terraces. This is a way to ensure living options for people with diverse needs and bring a mix of people of different ages and backgrounds together.

On an urban scale, they must have good transportation possibilities and public services near the complex. This helps discourage private car usage which reduces air pollution and traffic.

"The Ideal

Yes, that you want: A villa in the countryside with a large terrace,

From the Baltic, behind the Friedrich Street;

With nice views, country chic,

From the bathroom, the Zugspitze can be seen-

But you should not have far to the cinema, in the evenings.

The whole simple, full of humility."[108]

Kurt Tucholsky

108 Tabor, J., "Die Reglementierte Utopie , in Peichl, G.(Eds.), Wiener Wohnbau Beispiele Band 17, Architektur- und Baufachverlag Wien, Vienna, 1985, p. 26. Translated by the author, original Text: "Das Ideal: Ja, das möchste: Eine Villa im Grünen mit grosser Terrasse, vom die Ostsee, hinten die Friedrichstrasse; mit schooner Aussicht, ländlich mondän, vom Badezimmer ist die Zugspitze zu sehen- aber abends zum Kino hast du´s nicht weit. Das Ganze schlicht, voller Bescheidenheit

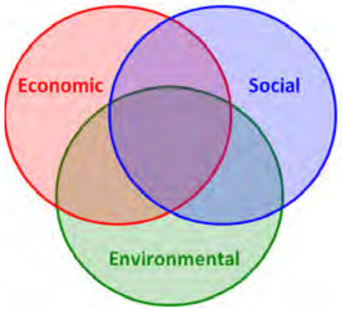


Figure 11: *3 pillar-model of Sustainability*

3. Sustainability

"Sustainability is not about global warming and recycling any more or less than it is about the responsibility of each and every one of us to pursue a more balanced life, a better life and a more meaningful life for all"[109]

3.1. Definition - Need

Usual definition: Sustainability means future generations should not be much worse off than present generations.[110]

The meaning of the word sustainability is 'to hold up' or 'to support from below'. This concept, sustainability, has been a very popular subject in symposiums, television programs, and magazines in recent years.

Even though sustainability has not always been recognised as a concept, it has been one of the underlying blocks of community since the beginning of civilization. However, especially after the age of enlightenment in western culture in the 18th century, after Descartes' philosophy adopted a Cartesian world-view which not only regards humans as the possessor of nature, but also put them in the position of being the master of animals as machines, all resources of nature have been at the service of technology with the goal of a more luxurious life quality and greater comfort. As a consequence, it was understood that just after an ecological crisis, heavy losses are suffered. Many academics and scientists started to be interested in the concept of sustainable development, and this issue has been the most contemporary subject of recent years. Due to industrialisation, beginning with the Industrial Revolution, constantly growing technology, and rapid urbanization in the 20th century, ecological destruction gained rapid acceleration, consequently creating critical problems to a global extent. Excessive consumption of energy resources has resulted in global warming, immediate climate changes and, consequently, natural disasters. Those problems make it compulsory to take precautions on a global scale. In the last quarter of the 20th century, the idea that humanity needs to consider future generations, and enable them to have the opportunities they had, became influential in almost all areas.

The concept of sustainability was mentioned first in general terms with the word "sustainable" in the Brundtland Report named "Our Common Future" (which is arranged by Gro Harlem Brundtland), and was first published in 1987 by the World Commission on Environment and Development. In that report, by taking into consideration the balance between humanity and nature, it was indicated that consumption of natural resources should be at minimum level and it should be compulsory to hand them down to future generations in that way. Furthermore, "sustainability" was defined as follows:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

1. The concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and

2. The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs".[111]

Sustainable development is essentially a transformational process, in which the use of resources, the objective of investments, and the orientation of technological development and institutional change interact harmoniously and expand both current and future potential to meet human needs and preferences.[112]

This report, at the same time, discusses the permanence of sustainable

109 Chapman J., Gant, N.(Eds), Designers, Visionaries and Other Stories: A Collection of Sustainable Design Essays, published by Earthscan, London, 2007

110 Küng, H., Das eine Ethos in der einen Welt, Ethische Begründung einer nachhaltigen Entwicklung. In Kastenholz, H.G. (Eds), Nachhaltige Entwicklung, Heidelberg, 1996

111 Bruntland, G., (Eds), Our Common Future: The World Commission on Environment and Development, Oxford University Press, Oxford, 1987, p. 51

112 Ibid., p.57

development and, while pointing out that existing potentials should grow and meet the needs of current and future generations by harmonizing consumption of resources, the purposes of investments, and the direction of technological development, sets out the structure of the 3 Pillar-Model definition of sustainability which is still used today. (See Figure 11) A German Parliament Commission of Inquiry has integrated this new definition of sustainable development into literature by looking at the Brundtland Report. This 3 Pillar-Model explains that sustainable development is possible only when economic, ecological and social targets are harmonized simultaneously and equally. It argues that only in this way are economic, ecological and social productivity of a community ensured and enabled.

The commission of inquiry was named "Protection of people and nature" and was arranged by the German Bundestag, developing the "Three Pillars Model" of sustainable development in 1995. It combines not only ecological but also economic and social goals and emphasises the interdisciplinary character of "sustainability". The model should be understood as a response to the prevalent discourse in Germany, which was fairly unbalanced and limited to the mere one-sided perspective of the environment. The three pillars of ecology, economy and social goals, thus, should be treated equally and be seen as equivalent to each other and should form a "three-dimensional perspective" towards sustainable social policies. The main goal thereby was to ensure and improve ecological, economic and social performance and productivity. These three fields were interdependent, the commission concluded, and cannot and should not be "partially optimised".[113]

The definitions of sustainability and sustainable development, which have been put forward by intellectuals of different branches, are built up basically on the decisions made in the Brundtland Report and the 3 Pillar-model named by the German Parliament Commission of Inquiry, and they comprise almost the same meanings. The World Summit on Sustainable Development ,which was executed with the participation of 20000 delegates in France in 2002, advocated that also cultural development needs to be integrated into sustainable development on top of this 3 Pillar-model; thus, the basic notion of the sustainable development 3 pillar-model began to be depicted as economic, ecological, and socio-cultural.

A different concept was developed by the researchers at the German Wuppertal Institute, a four dimensional conceptual model, 'the prism of sustainability', for the operationalization of sustainable development.[114] Sustainable development has been described with the institutional as a fourth dimension, this referring to societal and individual opportunity including public participation, democracy, and regulation. Kain has transformed this prism to MAINtetra with new concepts; mind artefact, institution, nature.[115] (See Figure 12)'Mind' refers to ethics, world-view, knowledge, skills and, awareness and perceptions of different actors; 'artefact' refers to works of art, instruments, buildings, and physical networks; 'institution' refers to information systems and codified knowledge; 'nature' refers to all kinds of natural elements from the environment.

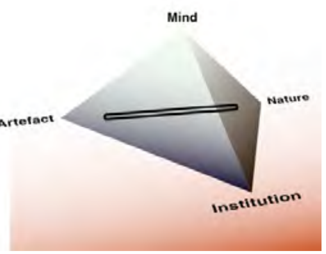


Figure 12: *Main tetra prism of Kain: The model of dynamic understanding of sustainable development.*

The goal of developing a sustainable future-oriented modus vivendi and economy can only be achieved through a general paradigm shift in all classes of society and, eventually, through modifying our economic system. Moreover, economy and ecology need to be intertwined more intensely. Thus, economic growth should no longer be the only primary concern, but also increasing, enhancing and improving living standards in terms of quality of life. However, this requires new, future-oriented and sustainable visions and strategies, as well as economic and technical instruments to transform them into reality.[116] The principles of sustainability concern the problems of environmental degradation and lack of human equality and

113 Wissenschaftliche Dienste des Deutschen Bundestages, Der Aktuelle Begriff "Nachhaltigkeit", Nr. 06/2004, p. 1,2

114 Valentin, A., Spangenberg, J.H., "Indicators for Sustainable Development, Assessment methodologies for urban Infrastructures", International Workshop, September 20-21, Stockholm, 1999.

115 Kain, J.H., "Sociotechnical Knowledge: An Operationalised Approach to Localised Infrastructure Planning and Sustainable Development", Chambers University of Technology, Göteborg, 2003, p.327. ISBN: 91-7291-304-5

116 Wegener, G. und Zimmer, B., 1999, p. 121, cited in Lee, Mi-Kyung, Untersuchung der Nachhaltigkeit von Wohnhochhäusern in Korea, Phd Thesis, Architecture and Urban Planning University of Stuttgart, 2012,p. 91

quality of life, by supporting development that is sustainable in economic and social terms, and is capable of retaining the benefits of a healthy stable environment in the long term.[117]

Sustainable development has been a fluid concept and has various definitions. Although there are various definitions of sustainability which are complex and overused there is not a real, universally accepted definition. Some researchers have tried to describe this term in more detail. According to Cooper[118] four main principles of sustainability are; "*futurity, environment, equity, and participation*", which were later used to provide a useful qualitative model for architects.

Sustainable development has to be an important concern because of current problems and conditions. Wilson indicates that "..*species of plants and animals are disappearing a hundred or more times faster than before the coming of humanity, and as many as half may be gone by the end of this century. An Armageddon is approaching at the beginning of the third millennium. But it is not the cosmic war and fiery collapse of mankind foretold in sacred scripture. It is the wreckage of the planet by an exuberantly plentiful and ingenious humanity.*"[119] This treatment of the environment refers not only to specific human activities, but their increasing occurrence. Currently up to two billion humans, without reliable access to safe food, urgently require resources to cover their basic needs, as well as several billion who rapidly aim to improve their living standards. Additionally, population growth and rising living standards increase the requirement for more resources, which produces more waste and heightens the impact on the natural environment.

In order to overcome the discussed problems, transition is necessary from Cartesian Philosophy, which has been leading world for approximately four centuries, and which is based on rational analyses and separate ideas, to a holistic world-view which connects with nature more strictly, approaches problems more holistically, and derives from the aphorism of Aristotle, "*The whole is more than the sum of its parts*".[120] This holistic view, which combines knowledge, creativity, ethics and responsibility, right brain and left brain, is what we need to achieve a better and more liveable world, to lead the sophistication of sustainability with concrete implementations to the direction of sustainable architecture. Moreover, it should always be taken into consideration that sustainability is a way of thinking, and not an architectural style. As has been demonstrated before, the focus of sustainability is to provide better quality of life for everyone, for today and in the future. According to the annual UK report, this requires meeting four key objectives in the world as a whole:[121]

- Social progress, which recognizes the needs of everyone;
- Effective protection of the environment;
- Prudent use of natural resources;
- Maintenance of high and stable levels of economic growth and employment.

To worry about tomorrow is essential if we remember the sentences of Michael et al. in "Design for Sustainable Building"; *"nature can go on without human culture, but any society or culture cannot exist without nature. Nevertheless, if we discuss sustainable development we must not only discuss how we can survive our future life, we must also decide how we want to live our lives."*[122]

As a result it may be meaningful to consider what Chamber and Conway indicate about sustainable livelihoods: *"Sustainable livelihood is one which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide . . . opportunities for the next generation; and which contributes net*

117 Sassi, P., Strategies for Sustainable Architecture, Taylor&Francis, 2006, p.2

118 Cooper, I., "Environmental assessment methods for use at the building and city scales: constructing bridges and identifying common ground". In P.S. Brandon, P.L. Lombardi, V.Bentivegna (Eds.), Evaluation of the Built Environment for Sustainability, E&FN Spon, London, 1997

119 Wilson, O. E., The Future of Life, First Vintage Books Edition, USA, March 2003, p.XXIII

120 Gauzin-Müller Dominique, A short history of Sustainable Architecture, in Drexler H.,El Khouli S. Holistic Thinking: Concepts, Design Strategies and Processes, Detail Edition, Munich, 2012, p.18

121 DEFRA, Achieving a Better Quality of life, Review of Progress towards Sustainable Development, Government Annual Report 2002, Department for the Environment, Food and Rural Affairs, London, 2003

122 Eden, M. et al., "Design for Sustainable Building- Development of a Conceptual Framework for Improved Design Processes", in the proceedings of Technology and management for sustainable building, Pretoria 26-30 May, 2003. p. 8

benefits to other livelihoods at local and global levels and in the short and long term".[123]

3.2. Environmental Issues

- **Global Warming and Climate Change**

Global warming is the gradual increase in temperature of Earth´s surface, oceans and atmosphere. UNFCCC (United Nations Framework Convention on Climate Change) describes climate change as "*a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods*".[124] The natural system of the greenhouse effect has been compromised and also enhanced by artificial greenhouse gases since the beginning of the industrial age. Since industrialisation, the earth´s average temperature has risen by 0.8 degrees Celsius. The oceans are also increasingly warmer. The main reason for the climate change is greenhouse gases. More of this gas, particularly carbon dioxide (CO_2), produces a greenhouse effect. The reason for this is consumption of fossil fuels particularly coal, burning of forests, and some other human activities.[125] Before the Industrial Revolution, the amount of CO_2 in the atmosphere was 280 ppm, but by 2015 it had increased to more than 400 ppm. This increase is 100 times faster than that when the last ice age ended, according to the National Oceanic and Atmosphere Administration (NOAA).[126]

Along with climate change, which is an outcome of global warming, there may be some disasters not only limited to extreme hot conditions in summer and winter. As a consequence of global warming, long-lasting changes in all systems occur; for example, changes in precipitation, storm patterns, and the level of the oceans. It may even indirectly increase the risk of violent conflicts in the form of civil war and inter-group violence.[127] Since 1850 the glaciers of the European Alps have lost about 30 to 40% of their surface area and about half of their volume.[128]. According to the 2014 annual Report of the Intergovernmental Panel on Climate Change (IPCC), "*Over the period 1992 to 2011, the Greenland and Antarctic ice sheets have been losing mass, likely at a larger rate over 2002 to 2011. Glaciers have continued to shrink almost worldwide. Northern Hemisphere spring snow cover has continued to decrease in extent. There is a high confidence that permafrost temperatures have increased in most regions since the early 1980s in response to increased surface temperature and changing snow cover"*[129] De-glaciated areas cause erosion and decreased stability, which could threaten buildings, roads, communication links, and other structures. Mountain glaciers and melting land ice sheets are a major reason for increasing sea level. Satellite measurements show that during the last century, the Global Mean Sea Level has risen by 10 to 20 centimetres. It has been estimated that sea level will rise by an additional 46 to 58 cm by 2100.[130]

The IPCC expects heating from 1.1 to 6.4 degrees Celsius in the 21st century. Low-lying coastal areas and coastal cities, especially in poor countries without extensive protective measures, will be at risk of flooding due to the rising sea level.[131]

According to the IPCC, the enhanced greenhouse effect has to be reduced by 50-70% from 1990 levels to keep the negative effects of climate change

123 Chambers, R. and Conway, G.R., "Sustainable rural livelihoods: practical concepts for the 21st century", Institute of Development Studies Discussion Paper 296, IDS, London, 1992, p.7-8

124 United Nations Framework Convention on Climate Change, United Nations, 1992, p.5, available at: https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf. Access: 09.08.2015

125 Earth Obwervatory NASA, available at: http://earthobservatory.nasa.gov/Features/WorldOfChange/decadaltemp.php. Access: 11.10.2015

126 Earth System Research Laboratory, available at: www.esrl.noaa.gov/gmd/news/7074.html, access:11.10.2015

127 Climate Change 2014 Synthesis Report, Summary for Policymakers, in Climate Change, 2014, p.16, available at: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf, access: 10.10.2015

128 Haeberli, W., and M. Beniston, Climate change and its impacts on glaciers and permafrost in the Alps, Ambio 27, 1998, 258-265

129 Climate Change 2014 Synthesis Report, Summary for Policymakers, in Climate Change, 2014, p.4, available at: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf, access: 10.10.2015

130 Warrick, R. A., C. L. Provost, M. F. Meier, J. Oerlemans, and P. L. Woodworth, 1996. "Changes in sea leve"l, in Climate Change 1995: The Science of Climate Change, p.359-405

131 Jürgen Paeger, Die Folgen der Erderwärmung, 2010, available at: www.klimawandel-verstehen.de/html/folgen-02.html, access: 05.08.2015

within manageable proportions.[132]

- **Limitation of Natural Resources**

There are three kinds of reserves of natural resources: Continuous resources such as sunlight and wind, the use of which does not lead to a reduction in their size; renewable resources, such as wood and crops that can be harvested, but not faster than their rate of replenishment; and non-renewable resources such as fossil fuels and minerals.[133] The non-renewable are created as a result of very slow geological processes.

The depletion of resources was first focused on by the Club of Rome at the beginning of 1970s. It was mentioned that various important natural resources such as oil and various metal ores were in a danger of being exhausted within a few decades.

In research from the WWF (World Wide Fund for Nature) it has been indicated that the health of the world ecosystem, based on measurements of the loss of forest area and freshwater and marine animal species, has been reduced by 30% in 25 years.[134] Almost 50% of the natural forest on the earth has vanished, 13% in the last 30 years. More soil erosion and loss of biodiversity has occurred because of cultivation due to the exhaustion of the productive agricultural land which has led to the usage of less suitable land. The great value of biodiversity will be lost because of the increasing demand for land for agriculture, forestry and buildings. The increase in the usage of biofuels is also a pressure on the reserves of suitable agricultural land which also leads an increase in the demand for land for the production of food.[135]

132 Watson R. et al. ,Land Use, Land Use Change and Forestry, Summary for Policy Makers , Intergovernmental Panel on Climate Change (IPCC), 2000. ISBN: 92-9169-114-3

133 Reijnders L., A normative strategy for sustainable resource choice and recycling, Resources Conservation and Recycling 28, 1999, p.121-133.

134 WWF International, New economics foundation. World conservation monitoring centre: Living Planet Report 1998. Gland: WWF International.

135 Muilerman H. and Blonk H., Towards a sustainable use of natural resources, January 2001, p.3. Available at: http://ec.europa.eu/environment/enveco/waste/pdf/muilerman.pdf. Access: 05.11.2015

25% of all fertile soils, which are the basis for agricultural production, have disappeared in the last 50 years. The poorer countries are more severely affected by this situation. Demand for fossil and mineral resources is also growing worldwide The extraction of fossil fuels can also cause disasters, as in Spain in 1998, in Romania in 1999, and the oil spills in Russian oilfields in 2000. Accidents in the marine environment during the transport and distribution add further pressures.[136]

As a result we are at threat from the declining of many reserves while the world population grows and the demand for raw materials rises. The increase in need for raw materials largely determines the rate of consumption of natural resources, which are responsible for environmental problems.

The approximately 20% of the world´s population who live in rich countries, consume about 50% of the world´s various reserves. If the population of the world consumes natural resources at the levels now enjoyed by the rich countries, in 2050, it would consume 2 to 7 times the present amount of natural resources. This would multiply current environmental problems by 2 to 7 times, while the goal is an absolute reduction in environmental impacts.[137]

- **History and Milestones of Sustainability**

When the history of sustainability is studied, one can see that for the first time, in 1713, Hans Carl von Carlowitz introduced the concept of sustainable forestry use in areas where the German languages were spoken.[34] Carlowitz argued that the forests needed to be sustainable, despite the need for wood, which had increased as a result of industrialization. It was long after, in the 20th century, that sustainability was used more clearly for the purpose of interpreting energy resources

At the turn of the 20th century Rudolf Steiner, brought into currency the ideas of Johann Wolfgang von Goethe and presented a philosophy

136 Ibid.

137 Ibid.

in order to rebalance the harmony of people and nature. His ideas found expression in several disciplines, including architecture.[138] The foundation of ecological thinking, as it is thought of today, occurred after the Second World War, with the establishment of several institutions, whilst Rachel Carson published the work "Silent Spring", which describes water and air pollution dangers.

The understanding of contemporary environmental policy was founded in the 1960s and 70s. In 1972, the Club of Rome, which discusses the various future world scenarios planted the first seeds of sustainable development when manifesting that their aim is to give voice to their common responsibility and worry about the future of humanity via the report named "*The Limits to Growth*".

The UN Conference on the Human Environment, held in Stockholm in 1972, which provided the possibility of discussing sustainability on the global scale for the first time, provided considerable momentum for sustainability with significant recommendations. The UN Environment Programme (UNEP) was established with the direction of this conference.[139] Barbara Ward and the French microbiologist and ecologist Renè Dubos coined a motto in 1972 that has been adopted many times since it was first published as: "*Think globally, act locally*". The ecological movement was followed also by architects.

Especially since 1970s, after the two oil crisis, Europe was sensitised to the energy issue. İnterest in solar building, bioclimatic houses, and the use of wood increased. Thomas Herzog was a professor at the University of Technology in Munich and he was one of the architects who developed bioclimatic architecture. The philosophy of the practice was thus described, "the task is to exercise social responsibility and to participate actively in scientific and technological progress as well as to integrate aspects relevant for the environmental in multiple ways- especially the possibilities of solar energy"[140]. Other pioneers of the yet unnamed term "sustainability" in Germany were: Peter Hübner, Günter Behnisch, and his son Stephan Behnisch.

- **Brundtland Comission**

The World Commission on Environment and Development (WCED) was founded in 1983 by the United Nations, and after 4 years in 1987, The Brundtland Report was published. This report named "Our Common Future" addressed sustainability with a holistic approach for the first time. It takes its name from the chairperson of the World Comission on Environment and Development, Gro Harlem Brundtland, and it led into a new age of environmental concern. Cayley, who critiqued the Brundtland Report, indicates that "The Brundtland Report struck a revolutionary message of action. Its purpose was to create a healthy balance between the interrelated and interconnected interests of the ecological and the socio-economic, proposing a threshold to protect the planet´s finite resources, and still provide equity."[141] While recognising the achievement of the Brundtland Report, the Brundtland definition of sustainability, which was quoted earlier, is criticised because of its vagueness[142]

- **Rio De Janeiro Conference- Earth Summit**

The theme of the conference executed in Rio de Janerio, in 1992, by the United Nations, was progress for sustainable development worldwide. This conference is a central event for the pursuit of sustainable development. The most significant outcome of the Rio Conference was Agenda 21, which includes a sustainable action program for 172 countries. Agenda 21 is a charter of 27 basic principles for sustainable development which includes

138 Gauzin-Müller Dominique, "A short history of Sustainable Architecture", in Drexler H.,El Khouli S. Holistic Thinking: Concepts, Design Strategies and Processes, Detail Edition, Munich, 2012, p.10

139 Murphy, D., Drexhage J., "Sustainable Development: From Brundtland to Rio 2012", International Institute for Sustainable Development (IISD), United Nations Headquarters, New York, September 2010

140 Herzog, T., Phiolosophy of the Practice. Available at: www.herzog-und-partner.de, access: 05.2011

141 Cayley M., The Brundtland Report: A Short Critique, p.1. Available at: https://www.academia.edu/7757839/The_Brundtland_Report_A_Short_Critique, access: 03.11.2015

142 Daly, H.E., Beyond Growth, Beacon Press, Boston, 1996

rights and responsibilities of states and their citizens. Consequently, the understanding of sustainable development and environmentalism has spread all around the world with many aspects embedding in economic, ecological, and socio-cultural areas. According to Adams, the view of this agenda is techno-centrist, built on information, science, and environmentally approached technology.[143] Agenda 21 proceeds with studies in different areas in different countries, with the name "Local Agenda 21" in local attempts. Until now, the "Local Agenda 21" institution has been leading sustainable development with declarations published in partnership with more than 500 towns, provinces, and states since 1997.

- **The Book "Factor Four" and Ecological Footprint**

Environmental activist Amory B. Lovins, and his wife, L. Hunter Lovins, the founders of the Rocky Mountains Institute in Colorado, published the book 'Factor Four' with Ernst-Ulrich von Weizsäcker. This account influences the report of the Club of Rome, The Limits to Growth.[144] In this book are 50 concrete suggestions to solve problems from all sectors of the economy, including the building sector. The passive-house concept by Wolfgang Feist was also described in the report. After these developments came the emergence of the term 'ecological footprint', which is defined as the amount of land which is necessary to produce the natural resources a human population consumes and to assimilate the waste that the population produces.[145]

143 Adams, William M. , Green Development: Environment and Sustainability in the Third World, 2nd Edition, Routledge Press, London, 2001

144 .Meadows, D.H. et al., TheLimitstoGrowth:A Report for the Club of Rome's Project on the Predicament of Mankind, Universe Books, New York, 1972

145 Rees W.E., Ecological footprint, concept of. In: Levin,S. (Eds), Encyclopedia of Biodiversity Vol.2 , Academic Press, San Diego, p.229-244

- **Kyoto Protocoll**

The Kyoto Protocol, an international agreement to ensure climate protection, was adopted in 1997, and came into force in 2005. A key objective was that the gases contributing to the greenhouse effect, which results in global warming, are to be taken under control and reduced to the level of 1990.[146] Kyoto protocol is the most significant struggle put up against global warming and climate change. This protocol involves 160 countries and a price of issue of 55% constituted by those countries.

- **Sustainable Architecture**

The interaction between the artificial environment and nature has a complex character. People have a huge impact on the environment at all points, from planning, and construction through to utilisation and demolition. Buildings are basic needs, but also a heavy polluter, and user of world resources. It is key to have measures to reduce these negative effects to the minimum. Gauzin Müller explains some of the negative effects that buildings can have on the environment:

"... buildings need about 50 percent of our natural resources, 40 per cent of the energy and 16% of the water. Construction and demolition of buildings causes more waste than household waste. Power in Germany comes mainly from co-generation plants. According to a study that was published in the Climate Protection Concept in Freiburg, the construction sector causes about 30% of CO_2 emissions and this percentage is more than the proportion that transportation and industry induce together."[147]

The concerns are not only about environmental issues, but also economic efficiency and cost effectiveness of building services. This, therefore, means a building does not only cause costs during construction, but also entails considerable operating costs during usage phase. Buildings that are used in the service sector have energy costs that represent approximately

146 http://unfccc.int/kyoto_protocol/items/2830.php, access: 20.10.2015

147 Gauzin-Müller, D., Nachhaltigkeit in architektur und städtebau: Kozepte, Technologien, Beispiele., Birkhäuser, Basel; Berlin; Boston, 2002, p.15. Translated by the author.

20-30% of the operating costs.[148]

Sustainable architecture is commonly referred to in relation to sustainable buildings, green buildings, and green architecture. The U.S. Environmental Protection Agency (EPA) describes green building as "*the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building´s life-cycle, from siting to design, construction, operation, maintenance, renovation, and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. A Green Building is also known as a sustainable or high performance building.*"[149] In these building concepts innovative technologies such as solar thermal, photovoltaic systems, energy storage, and heat recovery, have been developed in order to provide sustainable constructions.

According to the analysis of Guy and Farmer there are six logics of green buildings; ecological, smart, aesthetic, symbolic, comfort, and community. Falkheden emphasizes connections between people and nature and creating links between the local context and global processes.[150]

Even if the main concept of sustainability is founded upon the 3 pillar-model, all are very broad terms in themselves. Appropriate solutions over the long haul are necessary instead of individual accommodations in the short term. Hence, the concept that these broad terms constitute is both sophisticated and open-ended. Because of the complexity and wideness of the term "sustainability", it includes many values and redefinitions. It also reflects on architecture in this manner, due to the fact that it is open to interpretation. For instance, contrast an architect who applies sustainable architecture with a wall made up of adobe and stone, a chimney construction made up of simple wooden construction, and roof tiling by traditional materials in a low-tech system, with the architect of an energy-saving skyscraper, who uses highly thermal insulating glass curtain-wall, steel construction, and natural ventilation systems produced by the latest means of technology in a high-tech system, who also advocates that they embrace "sustainability" as the main concept in their projects. If regarded from this point, it is difficult to decide whether to compress sustainable architecture into an overarching framework bounded by factors such as technology, cost, material, and usage, or to decide how far it is sustainable by examining these factors independently. According to Williamson et al., sustainable building solutions do not come from prescriptions of duty, rules or regulations, but they are the conclusion of beautiful acts which stem from the logic of protecting of ourselves[151]

Sustainable architecture is an approach which aims to provide a constructive relationship between building activities in the built environment and the natural environment, and is concerned with influence on the social, human, and cultural spheres.

4. Measuring Quality

Over the last years there it has emerged a wide range of assessment systems to measure sustainability and quality. It is a complex task to measure this complexity and find out the contribution of sustainability to the building quality. Whether certain architectural aspects, such as quality of design can be assessed continued to remain as an open question to be answered.

When addressing sustainability in building and housing, the trio of social, economic and ecologic aspects have always been mentioned. Moreover discussion of sustainability has transformed into the term "quality" and a lot of assessment system which is based on assessment of sustainability, give certificates to quality of buildings.

148 Hörner, K.H.,1999, p.59 cited in Lee, Mi-Kyung, Untersuchung der Nachhaltigkeit von Wohnhochhäusern in Korea, Phd Thesis, Architecture and Urban Planning, University of Stuttgart, 2012,p. 95

149 U.S. Environmental Protection Agency (EPA), online: http://archive.epa.gov/greenbuilding/web/html/about.html, access: 29.11.2015

150 Falkheden, L., Lokalområdet som Strategi för en Hållbar Stadsutveckling: Fallstudier av tre Danska Exempel. Phd Thesis, Department of Urban Design and Planning, Chalmers University of Technology, Gothernburg-Sweden, 1999.

151 Wlliamson, T., Radford, A., Bennetts, H., Understanding Sustainable Architecture, Spon Press, London, 2003.

4.1. Value and Evaluation

The aim of evaluation is to determine the value of something, which is closely related to the determination of quality; the extent to which a product satisfies the specified needs and requirements. Evaluation provides recommendations which may lead to improving the quality of programming, designing, building, and management of the built environment. Besides such practical goals, scientific goals also can be targeted, such as contributing to the formation of new theories or tools.[152] Evaluation of a building or the planning and design process provides understanding of a better quality. This understanding leads to the interpretation of the result of this evaluation, and the design guidelines and policy recommendations derived from it.[153] Evaluation research teaches how to make a complex decision-making process understandable and how experiences and analysis of evaluations can be an orientation for new and future projects.

According to Burt, "Quality is the totality of attributes that enables the satisfaction of needs, including the way in which individual attributes are related, balanced and integrated in the whole building and its surroundings"[154]

In evaluation of buildings it is relevant to determine what to evaluate. From an architectural view, visual quality or architectonic quality, which can be understood form, function and technology, are considered important. Many attempts to evaluate building performance have been effected in recent years and a wide range of summaries can be found in the literature on evaluation. In each of them, indicators have been organised in different ways but have numerous common background points. Van der Voordt and Van Wegen organise these factors into four categories which refers to the Vitruvius´ traditional three-way division :[155] Functional (utility value, future value), aesthetic (experiential value), technical, economic and legal.

To design a building of quality is assumed to be the same as designing better buildings. Macmillan, the editor of the book "*Designing Better Buildings: Quality and Value in the Built Environment*", intended to measure and improve the quality of buildings. He says that design quality can be measured because if something cannot be measured, it means that does not exist. Prasad gives the example of 'judging vegetables' in the US magazine Kitchen Gardener[156]; it is not food value or taste when judging vegetables, in an inversion of the functionalist approach, visual appearance effects first. Prasad goes on: *"in a similar way consumers are able, through numerical analysis in specialist magazines, to inform themselves about the various aspects of goods- their functionality, their quality of build and manufacture, their performance, their appearance and style. They are presented with a sophisticated and differentiated range of numbers: hard measures, such as fuel consumption data; 'soft', often subjective assessments of experts; and survey data that converts 'soft' responses from customers into the hard fact of satisfaction levels…*"[157]

There are several methods to measure quality and sustainability, such as interviews, questionnaires, observation, experiments, and the use of assessment equipment, each of which may have advantages and disadvantages. The disadvantages can be reduced to the minimum in the case that several methods are used in a balanced combination.

4.2. International Sustainability and Quality Assessment Systems

152 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, pp. 142-149

153 Zimring, C., Post-occupancy evaluation and implicit theories of organizational decision-making. In:H.van Hoogdalem et al., (eds), Looking back to the future. Proceedings of Iaps 10. Delft University Press, 1988, p. 240-248

154 Burt, M.E., A Survey of Quality and Value in Buildings, Building Research Establishment, Walford, UK, 1978, cited in Giddings, B., Holness, A., Quality assessment of architectural design and the use of design award schemes, Environment by Design 1, 1996, p.53-68

155 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p. 151

156 Kitchen Gardner, no.23, Taunton Press, Connecticut, Oct/Nov 1999.

157 Prasad, S., "Inclusive Maps", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004, p. 177

International assessment system, such as LEED[158] from the USA, BREEAM[159] from Great Britain, or DGNB from Germany, have been developed,[160] representing a comprehensive work of architectural quality and sustainability, with some of the criteria used also extending to the planning process.

BREEAM is the oldest assessment system and was developed in 1990 by BRE (Building Research Establishment). The system is considered to be an ecological seal of approval and represents the overall environmental performance of a building in order to help construction professionals understand and respond to the environmental impacts of the building environments they design and build. This assessment is made by means of certification, which allows evidence of building quality.[161]

Criteria List and weighting for BREEAM are;[162]

- Management: 22
- Health&Wellbeing 10
- Energy 30
- Transport 9
- Water 9
- Materials 12
- Waste 7
- Land Use & Ecology 10
- Pollution 13
- TOTAL: 100
- Innovation(additional) 10

LEED Green Building Rating System is an assessment and certification system which supports and certifies successful Green Building design and construction in order to guide architects, engineers, building owners, and designers into sustainability. Currently it is used in 69 countries worldwide, including Canada, Brazil, Mexico, and India. The market for green buildings in the USA has been growing continuously. Beyond single and complete buildings, assessments for neighbourhoods, interior design, homes etc. have been developed. The goal of this assessment system is the standardization of green buildings. Following this lead, many international assessment system have been developed across the world.[163] Points amassed from 40-49 usually means standard certification, 50-59 silver, 60-79 gold, and 80-110 platinum.

Criteria List and weighting for Leed Homes for Multifamily Midrise:[164]

- Location and Transportation: 15
- Sustainable Sites: 7
- Water Efficiency 12
- Energy and Atmosphere 37
- Materials and Resources 9
- Indoor Environmental Quality 18
- Innovation 6
- Regional Priority 4
- TOTAL 110

158 LEED: Leadership in Energy and Environmental Design: U.S. Green Building Council

159 BREAAM: Building Research Establishment Environmental Assessment Method: Building Research Establishment (BRE)

160 DGNB: Deutsche Gesellschaft für Nachhaltiges Bauen: Deutsche Gesellschaft für Nachhaltiges Bauen e.V. (German Sustainable Building:German Sustainable Building Council)

161 Geissler, S., Bruck, M., Lechner, R., "Total Quality (TQ) Planung und Bewertung von Gebäuden, Berichte aus Energie- und Umweltforschung, Schriftenreihe 08/04, bm:vit, Wien, 2004

162 BREEAM UK New Construction, Technical Manual 2014, available at: http://www.breeam.com/filelibrary/BREEAM%20UK%20NC%202014%20Resources/SD5076_DRAFT_BREEAM_UK_New_Construction_2014_Technical_Manual_ISSUE_0.1.pdf, access: 10.12.2015

163 Geissler, S., Bruck, M., Lechner, R., "Total Quality (TQ) Planung und Bewertung von Gebäuden, Berichte aus Energie- und Umweltforschung, Schriftenreihe 08/04, bm:vit, Wien, 2004

164 http://www.usgbc.org/guide/homes, access: 10.12.2015

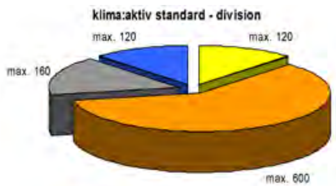


Figure 13: *Klima:aktiv Standard: categories and point system (left)*

Figure 14: *Klima:aktiv Standard: categories and point system (middle)*

Figure 15: *DGNB Certification System (rights).*

The assessment system DGNB (The German Sustainable Building Council) was first presented at the Congress of the DGNB in June, 2008 in Stuttgart, and it is characterized by the inclusion of economic and socio-cultural aspects, in addition to environmental topics. For this reason this system includes all three dimensions of sustainability. The goal is "*to create living environments that are environmentally compatible, resource-friendly and economical and that safeguard the health, comfort and performance of their users*"[165] The DGNB does not evaluate individual measures, but rather defines targets in order to contribute to the general performance of the building according to the degree of fulfilled criteria. (See Figure 15)

The quality of buildings is determined by the evaluation of six topics with their subcriteria; ecological quality, economic quality, socio-cultural and functional quality, technical quality, process quality, site (location) quality.[166]

4.3. Austrian Building Assessment Systems

Due to different national conditions, which have an impact on the construction sector, and different social backgrounds, national building assessment systems have been developed in Austria. The essential differences between the various national systems are among the evaluation criteria, the reference values, and the evaluation methods.

Figure 16: *TQB Indicators and points*

165 Bauer, M., Mösle, P., Schwarz, M., Green Buildig: Guidebook for Sustainable Architecture, Springer, Germany, 2010, p. 18

166 www.dgnb.de, access: 9.11.2015

- **Klima:Aktiv Building Standard**

Klimaaktiv building standard is Austria´s unique rating system for the sustainability of buildings and the involved climate change mitigation efforts. The requirements of these standards on energy efficiency provide the most stringent and cost-effective conditions in Europe.[167] It is a programme by the Federal Ministry of Agriculture, Forestry, Environment and Water Management, embedded in the Austrian federal climate strategy, which combines voluntary activities to reduce GHG emissions. Energy efficient construction and high quality renovation is the key to long-term effective climate protection. However, the climate active standard aims at more than just energy efficiency. With the climate active building standard, the assessment of a building is made in four categories: Planning and design, energy and supply, building material and construction, indoor air quality and comfort.

The evaluation of the building is assessed according to the list of criteria in three quality levels using a 1000 point system; gold, silver, bronze. Buildings with a score over 900 will receive a classification of klima:aktiv passive house.

- **TQB- Building Assessment System**

The "Total Quality Building" rating system is similar to the klima:aktiv system, and, although not mandatory, even more extensive. The system is a further development of the TQ Building Rating system and was the developed in conjunction with the "Green Building Challenge" in the early 2000s. The development of the system is based on the concepts and criteria of BREEAM and LEED.[168] The Austrian Sustainable Building Council (ÖGNB) further developed TQB in 2010 and TQB has been used by ÖGNB.

167 http://www.klimaaktiv.at/english/buildings/austriagreenbuilding.html, access: 9.11.2015

168 Geissler, S., Bruck, M., Lechner, R., "Total Quality (TQ) Planung und Bewertung von Gebäuden, Berichte aus Energie- und Umweltforschung, Schriftenreihe 08/04, bm:vit, Wien, 2004

- **4-Pillar-Modell of Wohnfonds**

In the context of Wohnfonds Wien, which is responsible for living, housing, and urban renewal in Vienna, and provides subsidies, a four pillar model has been developed to assess housing projects in these contexts. The criteria are:[169]

Economy: Land costs, total construction costs, user costs and contractual terms, cost relevance of construction outfit

Social sustainability: Everyday usefulness, cost reduction through planning, living in the community, adaptable housing for changing needs

Architecture: City structure, building structure, dwelling and housing structure, form and design

Ecology: Climate and resource efficient building, healthy and environmentally conscious living, spatially effective quality in green and open spaces, different possible uses of green and open spaces.

According to these criteria, every subsidised housing construction project is reviewed either by the Land Advisory Board or in a public property development competition (bauträgerwettbewerbe).

4.4. Assessment of Housing Quality

Other than these international assessment systems, there are also some studies and systems which are specified only for housing quality. One of the most relevant housing quality assessment systems is the 'Wohnwert-Barometer' which evaluates 'sustainable housing quality'. (R) This system has eleven main criteria. The Swiss housing evaluation system similarly has criteria which can rate evaluated reference projects as well as information about the buildings. Another assessment system, the "Wohnqualitätsindex", was developed in the 1980s in Austria and aimed to measure the satisfaction of tenants, renovations, and housing quality in order to to appraise measures and subsidies for renovations. Franziska Orso and Ulrike Pitro, with their research in Wien, "Kriterien für zukunftsfähiges Stadtwohnen", have also assessed the significant criteria for housing.

169 www.wohnfonds.wien.at

- **Wohnwert Barometer(Housing Quality Barometer)**

The system was developed in 2009 by the department of Design and Energy Efficient Construction at the Technische Universität Darmstadt to assess sustainable residential qualities This project was funded by the Federal Office for Building and Regional Planning for the Building and Housing Incentive Programme. The target audience are tenants, designers and planners, and operators. More than 25 international certification systems such as LEED, BREEAM, CASBEE, DGNB, WBS, GREEN STAR were analysed to create criteria and goals of sustainable residential qualities. The determination of the housing quality is based on 43 criteria in eleven topics which are evaluated in each case with the help of various assessment aspects and divided into a four action radius: apartment, home/environment, location, and process.[170] The eleven main criteria are: Comfort, flexibility and multi usage, spatial and design quality, functional quality, operation, user costs, building´s resource needs, building´s overall impact, process quality, accessibility, location quality and supplies.

The issues of assessment are functional, spatial and design quality, well-being, comfort, and quality of location, as well as resource requirements and overall impact of the building.

- **Wohnungs-Bewertungssystem WBS – The Swiss Housing Evaluation System**

WBS is an instrument to plan, assess and compare residential buildings. It was first published in 1975, and in 2000 the WBS was revised to include new housing requirements. The assessment is based on thirty-nine criteria in

170 http://www.wohnwert-barometer.de/informationen-wwb/wie-funktioniert-das-wwb/wie-wird-mit-dem-wwb-bewertet/, access: 08.11.2015

Housing planning evaluating and comparing

Wohnungs-Bewertungs-System (Housing evaluation system-(WBS), Edition 2000

Building

Dwelling　　Number of rooms:　　Area:　　PHH:

Beurteilungskriterien		Points	Gewichte	Weighted points	Measured values
W1	**Wohnung**				
B 1	Net surface area		3	0,0	
B 2	Number of rooms		3	0,0	
B 3	Vielfältige Nutzbarkeit		3	0,0	
B 4	Furnishabbility of rooms		3	0,0	
B 5	Windows in rooms		2	0,0	
B 6	Placement of dining space		2	0,0	
B 7	Furnishabbiity of dining space		2	0,0	
B 8	Connection to the cooking area		2	0,0	
B 9	Windows in cooking area		1	0,0	
B 10	Equipments of sanitary		1	0,0	
B 11	Windows in sanitary		1	0,0	
B 12	Storage possibilities		4	0,0	
B 13	Flexible organisation of rooms		2	0,0	
B 14	Flexible floor plan		2	0,0	
B 15	Selectable paths		2	0,0	
B 16	Private outside area		3	0,0	
W1	Total weight		36	0,0	
	Utility Value W1	**0,00**	= total weighted points W1 / 36		
W2	**Estate**				
B 17	Range and types of flats		2	0,0	
B 18	Additional rentable housing and working spaces		3	0,0	
B 19	Flexible flat sizes		2	0,0	
B 20	Access of flats		2	0,0	
B 21	Access of the building		2	0,0	
B 22	Sanitary of the building		3	0,0	
B 23	Private storage		2	0,0	
B 24	Common storage		1	0,0	
B 25	Multipurpose and community rooms		1	0,0	
B 26	Communal open space		4	0,0	
B 27	Pedestrian and bicycle circulation		2	0,0	
B 28	Car parking		1	0,0	
B 29	Graduated esposure to the public		1	0,0	
B 30	Noise exposure and sound insulation		2	0,0	
W2	Total weight		28	0,0	
	Utility Value W2	**0,00**	= Total weighted points W2 / 28		
W3	**Location**				
B 31	Playgrounds		3	0,0	
B 32	Parks and forests		2	0,0	
B 33	Public transport stop		8	0,0	
B 34	Town or village centre		8	0,0	
B 35	Kindergarten and primary school		3	0,0	
B 36	Availability of secondary school		1	0,0	
B 37	Social facilities		1	0,0	
B 38	Nearby recreation area		3	0,0	
B 39	Regionalzentrum		7	0,0	
W3	Gesamtgewicht		36	0,0	
	Utility Value W3	**0,00**	= Total weighted points W3 / 36		
	Utility Value W1 + W2	**0,00**	= Total weighted points W1 + W2 / 64		
	Utility Value W1 + W2 + W3	**0,00**	= Total weighted points W1 + W2 + W3 / 100		

Figure 17: *WBS Assessment and Point System*

three main categories; flat (W1), estate (W2) and location (W3).(See Figure 17) This checklist allows the planner a systematic approach in the planning process and provides a clear decision-making basis. The criteria of the assessment has compliance levels 1 to 3. The sum of the weighted points is divided by the total weight of the resulting use value. The comparison of the achieved values determines the relative quality of the housing object. The quality of a project is assessed according to the its respond to the requirements and its comparison with other projects

Advantages of the WBS are the rational, comprehensible assessment of all major aspects of housing quality and comparability of the quality levels of different apartment layouts, housing types and residential locations.[171]

- **Kriterien für Zukunftsfähiges Stadtwohnen Wien/ Criteria for Viable and Sustainable City Housing Vienna**

This research was founded in the framework of the Roland-Rainer research fellowship 2008, which was awarded by the City of Vienna and the Federal Chamber of Architects and Consulting Engineers. It was aimed at establishing "criteria for sustainable city housing /living"and to integrate a system for the assessment of housing. In the production of housing a variety of disciplines and stakeholders are involved and affected. It is necessary to involve them in the process in order to further development of the project. The development of this system aims to accelerate continuous development for housing actors. This can be achieved through an enhanced processing of the objectives, as well as carrying out the weighting of the resulting criteria in expert groups.[172]

The assessment of housing includes a range of issues which makes it necessary to create a tool that allows the setting different values in

171 Meyer-Meierling, P., Wohnbauten im Vergleich: Wohnqualität, Kosten, Aspekte der Konstruktion und der Energie, Gesamtbericht Bände 1-50, Zürich, 2000, p.27

172 Orso, F., Pitro, U., Kriterien für zukunftsfähiges Stadtwohnen Roland-Rainer-Forschungsstipendium 2008, Bundeskammer der Architekten und Ingenieurkonsulenten, 2008

relationship to each other. This assessment framework has six target levels; city function, space quality, pluralism, ecological sustainability, economic sustainability, social sustainability. It has also six investigation (observation) levels; city structure, building development, dwellings, common spaces, open spaces, parking. A matrix from these levels which is used as assessment framework has been developed.

- **Kriterien für Nachhaltiges Bauten /Criteria for Sustainable Building- Aspects and Evaluation Criteria in Housing- Switzerland**

The Swiss Engineers and Architects Foundation SIA demonstrated sustainability as one of its priorities in 1997. The first goal was detailed specification of sustainability for the residential sector. The coordination group sustainability of the SIA described aspects and criteria of sustainability. The aim was not creating a rating system, but a qualitative overview.[173]

The criteria raster of SIA is published in a CD "Sustainability and Housing". The criteria list in the CD are:[174]

- Social; well-being, utilisation, aesthetic, community
- Environment; materials, energy, landscape, infrastructure
- Economy; building stock, production costs, operating costs, flexibility

- **DQI (Design Quality Indicator) and HQI (Housing Quality Indicators) in the UK**

DQI (Design Quality Indicator)

In 1999, in order to find solutions for the weaknesses of design in buildings, a gathering of the Construction Industry Council was organised in the UK. This organization was supported by the Commission for Architecture and the Built Environment, the Department of Trade and Industry, the Office of Government Commerce, Constructing Excellence, and the Strategic Forum of Construction. After several years it developed the DQI (Design Quality Indicator) to eliminate the poor quality design of the buildings.[175] The former Department of the Environment, Transport and Regions (DETR) funded the project.

The principles of this indicator were divided into three factors; functionality, build quality, and impact which had been developed from the Vitruvian principles. These indicators are not used to work out in any absolute sense which is the best design in any given context, but to allow people to compare buildings. The prime aims are; to provide a framework to guide the setting of a holistic vision and intent for a building, to test the process of the design and the product, to help perform evaluations of buildings in use. Influences on the occurrence of DQIs was a framework for assessing quality prepared by Susan Francis of the Medical Architecture Research Unit (MARU).[176] The overall Framework was constructed from consideration of any elements contributing to design quality and every building requires some constraints to be built to a successful standard factors such as whole value life, finances, time, and resources have an effect on a successfull construction.[177]

The overlapping features of delight, function, and sustainability (resources) have been described: delight related to user perception, to psychology, and to the appeal of form and space; function as used for health care, of the site and satisfactory operation, sustainability to social purpose, economics and environmental performance.

173 Weeber, H., Bosch, S., Nachhaltig gute Wohnqualität, Beispielhafte Einfamilienhäuser in verdichteter Bebauung, Bauforschung für die Praxis, Band 64, Fraunhofer IRB Verlag, Stuttgart, 2004, p.28

174 Bundesamt für Wohnungswesen, Nachhaltigkeit und Wohnen, Begriffe- Literatur- Werkzeuge. CD-ROM, Grenchen(Schweiz), 2000

175 http://www.dqi.org.uk/howdoesdqiwork.php, access: 10.06.2015

176 Macmillan, S., Report of the CRISP Design Task Group Workshop, CRISP Design Task Group Workshop, CRISP reference 99/18. Available at: www.crisp-uk.org.uk, access: 08.06.2015

177 Dickson, M., "Achieving quality in building design by intention", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004, p. 191.

The DQI project aims to measure the quality of design in different stages: inception, design, construction, and use, and is designed to be used by anybody involved in the process due to its brevity, clarity and simplicity.[178] It is essential to construct a framework for the judgment of a design, relating subjective indicators with objective indicators. The tool was composed so as to consist of three parts: a conceptual framework, a data gathering tool, and a weighting mechanism.[179]

HQI (Housing Quality Indicator)

The Housing Quality Indicator (HQI) was developed as a measurement and assessment system in the UK, by DEGW on behalf of the Department for the Environment, Transport and the Regions, and the Housing Corporation. This program incorporated design standards for affordable housing providers who want to receive funding. The first version of the HQI system was offered in 1999. The motto of the UK Government has been: "*our homes can influence our well-being, our sense of worth and our ties to our families, the local community and work*".[180] The aim has been to ensure that housing quality today and in the future contributes positively to the goal. The HQI system offers an assessment of a housing quality by evaluating key features of housing projects regarding location, design, and performance. The HQI system was developed with ease of use in mind. The analysis is based on plans and other information. There are ten quality indicators and these are: Location, site, visual impact, layout/landscaping, open space, routes and movement, unit size, unit layout, unit noise control- light quality- services, accessibility within the unit, energy-green and sustainable issues, performance in use.

For each indicator there are questions to be completed by an assessor. In pilot trials, the research team visited each development to make an independent quality judgement, before the assessments were completed. These perceptions were recorded, together with photographs of various features contributing to the judgement, and questionnaires asking a wide range of questions about residents´ perceptions of quality. It came to a conclusion that the correlation between researchers´ perceptions of scheme quality and the survey result was high. The development of the HQI system represents a step forward in the struggle to improve the quality of housing and the built environment in general.[181]

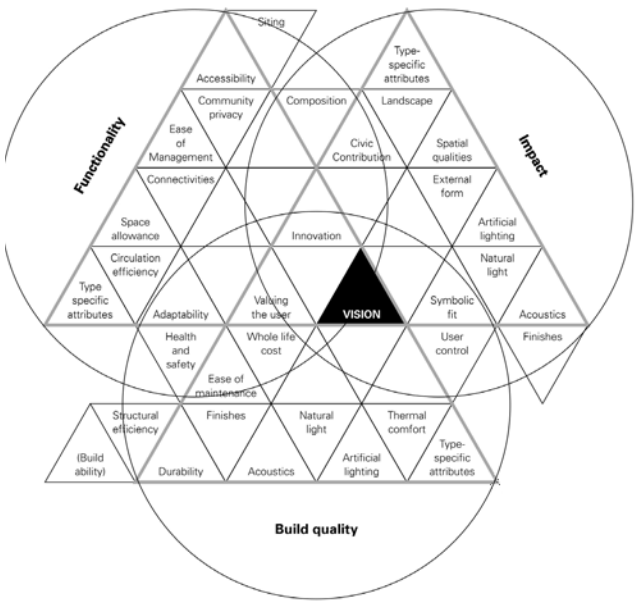


Figure 18: *Overall Framework of DQI*

178 Whyte, J., Gann, D., and Salter, A., "Building Indicators of Design Quality", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004, p. 191

179 Whyte, J., Gann, D., and Salter, A., "Building Indicators of Design Quality", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004, pp. 198-199

180 DTLR, Best Value in Housing Framework, London, DTLR, 2000

181 Wheeler, P., "Housing Quality Indicators in Practice", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, New York, 2004, pp. 210-214

4.5. Energy Performance Certification of Sustainable Buildings

Energy Performance Certificate is a typical certification system to enhance energy performance of the buildings which is a usual implementation in most of the countries.

There has been an increase in energy prices and, accordingly, also in heating costs in recent years. Particularly the rise of natural gas and fuel oil prices has affected utilities and overall building costs. The energy needed for heating and hot water correlates to 30% of primary energy. [182] Low quality insulation materials on the one hand and the defective use of heating, cooling, hot water, and ventilation systems on the other hand, have negative effects on the consumer as well as on the environment. This leads to the necessity to control the energy systems of facilities and, depending on that, to control their environmental effects. The conviction to create a transparent means with which the consumer can easily read his energy consumption, such as the one that is already in place for cars and domestic appliances, arose from the climate change that has been observed in the last years. Accordingly, steps to render buildings' energy performance certificates obligatory on an international basis have been taken since the beginning of the millennium, especially by the European Union.

An energy performance certificate comprises a detailed calculation of the energy data of a building, its energy consumption, and its energy efficiency. The actual purpose of such a certificate is to maintain a certain quality during renovation and construction of buildings in order to minimize negative environmental impacts. It is possible to take countermeasures and make changes to the insulation and installations of a building, using the data provided by the energy performance certificate and calculating the energy efficiency while still in the planning phase. The calculations of an energy efficiency certificate cover the building envelope, heating, ventilation, hot water, and energy source. Thus, the building's envelope, its orientation, the quality of its building elements, environmental factors, and its energy systems have direct effects on energy efficiency. In order to be able to make energy efficiency certificate calculations, it is necessary to have valid plans and installation data. The information provided by the plan, the form of the building, its orientation, its position, and the quality of its building elements, are inputted into software for the calculation of energy efficiency. Also, the heating system, the hot water system, and the energy source, which are provided by the installation plan, are inputted. An energy efficiency certificate proves the quality of a building's energy efficiency and it facilitates an objective comparison of buildings based on their calculated energy requirements. Energy efficiency certificates can be used for new buildings as well as for existing ones. From this point of view, it is possible for house owners and investors to predetermine appropriate renovations and to calculate expenses in advance.

182 Weglage, A., Energieausweis-Das grosse Kompendium, 2008, p. 27

The translation of ideas and technology is very possible in the field of architecture considering that human is human all over the world and their needs do not change according the differences in cultures and backgrounds..

“housing is more than a place in closed rooms, is an expression of our
personality, life style, memories an emotional experiences.”

III. HOUSING HERE AND THERE

1. Housing Development in Turkey over the Last Century

The development of apartment buildings in Turkey is in parallel with the development of industrialization across the world. According to Tekeli, housing provision is divided into seven groups, six of which are described below:[1]

1-Individual housing provision (Bireysel konut): in this type the owner and builder of the house finance the project and get permission from local governments.

2-Developers´housing provision (Yapsatci and large-capital builders): Small-capital house builders who are the builder and seller of the project, building multi-storey apartment housing . The builder is responsible from the whole accomplishment of the process including provision of land, planning, marketing and implementation.[2] This builder builds on the land of another person which is either empty land or obtained by refurbishment of an old structure. After beginning construction of the building, the builder has the possibility to sell some apartments from his share. This housing provision widely emerged towards the end of 1950s in Turkey. From the 1980s, these type of builders started to build mass housing on a large scale.

3-Housing Provision of Cooperatives (Konut Kooperatifleri): The process of Cooperative Housing has resulted from world industrialization and urbanization processes, which has been experienced in developed countries, beginning in Britain. Cooperative development started in Turkey as a top down movement, while it was a bottom up movement in Europe.[3] This indicates that the initiation of cooperative movement in Turkey was different in context from Europe in that it appeared as a result of socio-economic needs. Because of the economic crisis in the 1930s, a decrease in housing production led to the increased requirement of housing in cities. During these years cooperatives were regarded as an alternative type of housing for tenants. Between the years 1960-1980, government policy was to support mass housing production. According to Tekeli housing cooperatives can be included in mass housing solutions.[4] In fact, at the end of 1970s cooperatives can be perceived as the only producers of large scale housing projects which reference mass-housing.[5] Local governments got involved in the housing market by planning projects, giving sites and granting permission for buildings. Therefore mass housing discourse in cooperative development was introduced for the first time with the Second Five Year Development Plan, which accelerated mass housing development in these years.

During the 1980s the number of cooperatives increased sharply because of the housing development fund. The target group of this type was mainly middle-income group.

4-Mass-housing Corporations´ Production: Firms of Mass-Housing Construction are the main actors in this type of production and the scale of the projects is large, which ensures the production of many houses. The entrepreneur is the owner of the land, creating a new settlement area as large capital builders. The use of new construction technology is a significant speciality in these developments, enabling rapid production in a short time.

5-Public Housing Lojman: This type of housing ensures opportunities for the employees and workers of certain companies. These apartments can be given to the employees of companies for very low rent or for free. These institutions may include: hospitals, police, military or other public

1 Tekeli, I., Türkiye´de Konut Sunumunun Davranissal Nitelikleri ve Konut Kesiminde Bunalim, 1982, p.61

2 Türel, A., Organization of Building and Marketing of Housing by Housebuilders in Turkey, 1998, p.3

3 Tuna, O., Bizde Kooperatifcilik ve Kooperatif Kanunlari, Iş, No:26, 1944

4 Tekeli, I., "Yetmiş Yıl İçinde Türkiye`nin Konut Sorununa Nasıl Çözüm Arandı" T.C. Toplu Konut İdaresi Başkanlığı – Housing Research Center, Ankara, 1995

5 Türel, A., "The Contribution of Housing Co-Operatives to Housing Provision in Turkey. Keynote Address", Paper Presented to Colloquium on Contribution of Cooperative Sector to Housing Development, Ankara, 2002.

administrative offices.

6-Shanty housing (Gecekondu): These house squatters, which relates back to population growth due to urbanization and migration. The number of existing housing does not cover the growing demand and it is not easy to afford a flat in cities because of unequal distribution of income, unexpected high prices and unemployment. Therefore some people find their own self-organised solution: Gecekondu. The meaning of "Gecekodu" can be translated as "built or landed in night". These are usually built by their future owners illegally on occupied empty public land. Construction material for most gecekondus is bricks, and generally many of them have been built without statistical calculations. Such proliferation of squatter housing has caused many socio-economic and environmental problems for cities. Many laws and regulations were enacted regarding these housing issue, however these laws were not sufficient to manage the emerging problems.[6]

1.1. 1923-1950

A new era began with the foundation of the Turkish Republic in 1923. A range of regulations in different fields was brought to act in order to create a modern society. With its recognition as capital, great attention was paid to the urban development of Ankara. The first examples of apartment buildings in Turkey began to be constructed in the Ottoman Empire when The Rescript of Gülhane was declared in 1839. With The Rescript of Gülhane, the restrictions for non-Muslims who lived in the Ottoman territories were removed, and then multi-storey apartments began to be built. The facade and decorative features of the apartments, which were built in very small numbers, imitated Western culture; nevertheless, the "sofa"[7], which is one of the most important parts of Turkish housing system, was used on plans and schemes.[8]

Doğan Apartment (Naib Bey Apartment) is regarded as one of the most important examples of this era and it truly is remarkable, with its facade features, the usage of parcels, and planning of applications. The apartment, that was built by the family Helbig in 1893 in Galata, İstanbul, is different from other apartments due to its French window and embellishments located in front of the baroque. This housing has a kind plan scheme with its two entrances and a middle courtyard.[9]

In this era, architects built cost-efficient houses for workmen, teachers, civil servants, and country houses, next-door houses and designed floor houses.[10]

After Ankara was made capital in the early years of Republic, bureaucrats and civil servants who moved to the city needed housing. As a result, civil servants' houses became the focus of fashion. The first approaches were towards the spatial development of the capital. In accordance with law No. 586 in 1925, civil servants were advanced to be able to establish cooperatives, and the municipal authority built 198 houses in Yenişehir, which was the first project in the capital. Emlak Bank (Real Estate Bank) was established in 1926 as a state economic enterprise in order to support public housing in Turkey by providing housing purchase and related loans. The founding of the bank was intended to promote the building material industry and building sector.[11] Vakıflar Başmüdürlüğü (The Regional Directorate of Foundations) manufactured housing, yet it was for luxury and upper-income groups. In accordance with the law No. 1352 in 1928, manufacturing of civil servants houses was subsequently targeted.[12] In the period between the years 1923-1950, Emlak Kredi Bankası (Real Estate Credit Bank) and organizations such as Sosyal Sigortalar Kurumu (the Social Insurance Institution), provided loans in an attempt to practice economy while building houses.

6 Keles, R., Turkish Urbanization, Housing and Gecekondu in Ten Questions, 3rd Edition, Gercek Publication (in Turkish), 1983

7 Inside traditional Turkish houses the rooms have been placed around a common room called "sofa".

8 Öncel, A.D., Apartman: Galata' ya Yeni Bir Konut Tipi, İstanbul, Kitap Yayınevi, 2010, p. 380

9 Öncel, A.D., Apartman: Galata' ya Yeni Bir Konut Tipi, İstanbul, Kitap Yayınevi, 2010, p. 404

10 Alsaç, Ü., Türk kent düzenlemesi ve konut mimarlığı, İletişim Yayınları, İstanbul, 1993

11 Keleş, R., "Housing Policy in Turkey". In G.Shildo, (Eds), Housing Policy in Developing Countries, (pp.140-172). Routledge, London and New York,1990, p.146

12 Yürekli, H. And Alkışer Yasemin, Türkiye'de "Devlet Konutu"nun Dünü, Bugünü, Yarını, 2004

In 1927, the work permit was given to the foreigners (with the law for the encouragement of industry).[13] Owing to this permission, a lot of expert architects fled from conditions in Europe and came to Turkey. As a result of this, architectural works were realized which synthesized the Turkish-European culture.[14]

Dominant comprehension was negative for the apartments during the early Republic Period. At these times, the necessary means, such as funds, materials, and technology were not available. Social values, the professional ideology, and official discourse were against this type of building between 1930 and 1950. It is understood that Istanbul apartment buildings were generally used by minorities, were underestimated, and turned into a symbol of the culture and lifestyle of differences and segregation.[15]

In accordance with the Officer Housing Law No. 4626, the state was responsible for the housing of civil servants, and The Ministry of Public Works took charge of building these houses. Saraçoğlu Civil Servant Houses in Namık Kemal Neighbourhood, an important multi-unit housing implementation composed of 400 housing units, was built between 1944 and 1946 in Ankara.(see Figure 19, Figure 20) P. Bonatz designed these residences which had influences from traditional Turkish house. This housing was criticised for the reason that they were superficial.[16] These houses were also influenced by the social housing implementations of Europe built during the same period.

Figure 19: *Saracoglu Civil Servant Houses, Ankara, 1945-46, Architect_Paul Bonatz*

Figure 20: *Saracoglu Civil Servant Houses, Ankara, 1945-46, Architect_Paul Bonatz*

In the early years of the Republic, the governments made laws, especially for low-income people, to be able to meet housing needs with favourable intentions. The state had an active role in providing housing for workmen and civil servants with a limited income. In that era, the houses were few in number; however, they were valuable examples in terms of architectural quality[17]. The main reason for the transformation of these efforts towards the trend of housing for the upper income groups is related to the social structure of the era. If it is taken into consideration that civil servants were regarded as one of the upper classes of the society, it is obvious that the civil servants' houses of this era appealed to the upper classes. From a different viewpoint, the opinion opposing apartment blocks period in that era increased the amount of single garden housing or low-rise housing, which is regarded as luxury residential house types today.[18]

Rapid development was intended after the 1945s, however population growth and the need for housing as a result of urbanization caused the formation of slum areas, leading to the issue of shanty housing. The neighbourhoods for the low-income groups, which were planned in urban planning projects, could not be established. Housing problems could not be solved, and as a consequence, the low-income group found their own solution, resulting in the emergence of the slum.[19] The first slum areas were founded in Ankara in the 1930s, and then also appeared and increased rapidly in suburbs of other cities.

Different changes were made by various organizations in 1945 in Turkey,

13 Teşvik-i sanayi yasası

14 Sözen, M. (1984) Cumhuriyet Dönemi Türk Mimarlığı, Ankara: Türkiye İş Bankası Kültür Yayınları, 1984, p.38

15 Yürekli, H. And Alkışer, Y., Türkiye'de "Devlet Konutu"nun Dünü, Bugünü, Yarını, 2004

16 Alsaç, Ü., Türk Kent Düzenlemesi ve Konut Mimarlığı,112sh, İletişim Yayınları, İstanbul, 1993

17 Yürekli, H. And Alkışer, Y., Türkiye'de "Devlet Konutu"nun Dünü, Bugünü, Yarını, 2004

18 Ibid.

19 Pulat, G., Dar Gelirli Kentlilerin Konut Sorunu ve Soruna Sosyal İçerikli Mekansal Çözüm Arayışları , 327, Kent-Koop Yayınları, Ankara, 1992, p.327

and these changes influenced architecture and urban planning. Several unions were established and new social projects led to several changes in the residential area. Trade unions, the Social Insurance Institution[20], the Ministry of Construction and Housing, and the Real Estate and Credit Bank[21] of Turkey started to support co-operative housing.[22] Real Estate and Credit Bank redefined their targets in 1956; providing cheap loans, building and selling housing, and supporting cooperatives.

However the credit provided by these institutions could not achieve essential affordable housing because they only offered short term credit with high interest rates that could only be used by a small group of higher income families.[23] Sengül takes this position because the urbanization rate was so low in this period that housing and other urban policies were not an essential part of the central government´s priorities.[24]

1.2. 1950-1963

The Second World War was a breaking point for the urbanization process of Turkey and a lot of economic and political transformations had a significant effect on housing. After the Republic, the idea of creating modern cities was interrupted by the migration of poor people to the cities after the Second World War. This rapid mass migration movement from rural areas to cities increased the urban population dramatically. This migration was also directed to shanty towns, which threatened local authority and was the most significant determiner of urban and housing policy from 1950 to 1980.[25] Rural-urban migration became inevitable for most families because of the development of industry in big cities with working possibilities and the incorporation of attractive factors in urban life and the push factors of rural life. Although people migrated to the cities by selling all of the assets they owned, with the hope of working in these developing industries, they could not afford housing in the city centre. Thus, the available housing was inadequate to meet the housing requirement of this increasing population and a housing provision problem emerged because of the increase in the population. Essential housing policies did not respond effectively to the requirements of this growing urban population during this period and only a small proportion of city tenants were able to live in standard quality apartments. The urban population increased up to 80% relative to the total population of the country between the years 1950-1960, and this increase reached its highest level between 1965 and 1970.[26]

People who cannot legally afford their housing needs tried to meet them illegally in suburbs and the formation of "Gecekondu (slums)" accelerated rapidly in this era. In addition, new residential areas with an infrastructure could not be produced which resulted in the occurrence of land speculation. Moreover, the transformation of old buildings to high density buildings by small building developers (müteahhit) proliferated "yap-satçılık".[27] Senyel indicates that the efforts to solve these problems were not successful, "*In order to overcome these troubles and discourage unauthorized housing, the government put Amnesty Laws into practice in the 1960s and 1980s. Although the attempts aimed to upgrade the existing stock and prevent new gecekondu areas, they ended up with condoned unauthorized housing units, increased land invasion and unsolved urban problems*".[28]

While this struggle with slums was going on, problems related to the provision of housing for the middle class was being addressed with some legal regulations that allowed multi-storey building blocks and the creation

20 Sosyal Sigortalar Kurumu

21 Türkiye Emlak ve Kredi Bankasi

22 Türkoğlu, H., "Housing for the urban poor, Proceedings", ENHR International Symposium, Changes in the Provision of Housing in Turkey During 1980s, A106-A118, İstanbul, 1991

23 Akcay, B., "An Assessment of the Housing Finance Strategies in Turkey", The Journal of Academic Research, 5(18), 2003, p.50 (in Turkish)

24 Sengul, T., "Urban Irony and Politics: The Process of Capitalist Urbanization", Istanbul, WALD, 2001 [in Turkish]. Cited in Sarica, S.Ö., Turkish Housing Policies: A Case Study on Mass Housing Provision in the Last Decade, Master Thesis, University of Louisville, Kentucky, 2012, p.9

25 Şengül, M., Türkiyede Kentsel Dönüşüm ve hukuksal Boyutları, İktisat Magazin Special, Vol:499, Sep/Oct 2008, p.59-69.

26 OSMAY, S., 1923'ten Bugüne Kent Merkezlerinin Dönüşümü: 75 yılda Köylerden Şehirlere, Tarih Vakfı Yayını, İstanbul, 1999, p.143.

27 Pulat, G., Dar Gelirli Kentlilerin Konut Sorunu ve Soruna Sosyal İçerikli Mekansal Çözüm Arayışları, Kent-Koop Yayınları, Ankara, 1992, p.327.

28 Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p.56.

of new planned urban areas. Real Estate and Credit bank played an active role in this provision, but these efforts have been criticized due to their luxurious conditions and insufficiency in accommodating affordable apartment types.[29]

The effect of the rapid modernization was being heavily felt in the city centre, while such a transformation was been realised in the suburbs. Due to the increasing population, the transformation of smaller housing units to multi-storey buildings created a system which gave a dwelling to the site owner in return that it was developed by the builder. Governments introduced a set of laws in order to meet the needs of developing cities as well as to control urban development. The most effective one was the Condominium Law (Kat Mülkiyeti Kanunu) which was brought into being in 1965. The number of storeys were increased under the influence of this law. The main actors in this transformation were the small scale house builders, named "yapsatçı".[30] Owing to this law, some work, which had required a fairly long procedure process before the law, were carried out accelerated and easily and the historical character of many cities was transformed very rapidly.[31]As a result, over a short period of time, multi-storey apartment buildings took the place of many of the historical buildings which led to the loss of identity and several social problems.

From the 1960s the housing policy of Turkey developed in a way designed to build a high number of housing units with minimal investment.[32] Reconstruction operations between 1955 and 1970 began to change the face of cities, especially in Istanbul. State supported housing construction slowed down, easy credit and housing construction provided by other public agencies increased. Thus, housing production was tilted more towards the local municipality. Cooperatives became the main actors with regard to the housing provision of middle income groups. During this period, 40-45% of the total housing provision was met by the "yap-satci: build-and-sell" housing production system, 10% of them with cooperatives and 40-45% of them with slums.[33]

One of the most important examples of this era was the "Hukukçular Apartment" which was 12-storey and 66-family. It was built by Haluk Baysal and Melih Birsel in Şişli in 1961, and it is considered to have been inspired by Unite d'Habitation of Le Corbusier. It offers the first example of life in "Site" in the era. (see Figure 21)

Squatter Housing Law in 1966 was another intervention to order the urban structural pattern. The aim of this Law was to upgrade the existing unauthorised housing areas (or to clean them whether it was not possible to upgrade) and to prevent further squatter developments by creating "Gecekondu Prevention Areas". With this law gecekondu, which had not

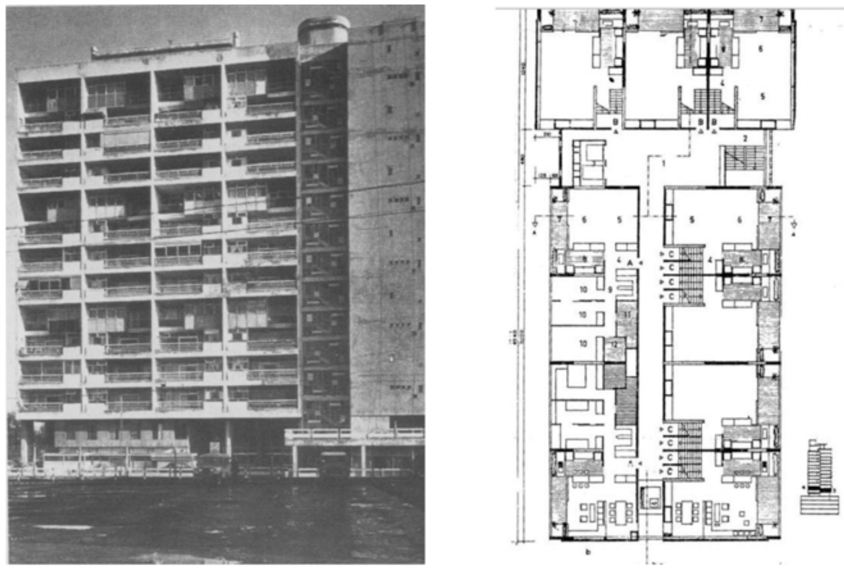


Figure 21: *Hukukcular Apartment, view from outside and the floor plan,*

29 Yürekli, H. And Alkışer, Y., "Türkiye'de "Devlet Konutu"nun Dünü, Bugünü, Yarını", in ITÜ Dergisi/a Mimarlik, Planlama, Tasarim, Vol:3, No:1, March 2004, p.63-74.

30 Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p.57.

31 Eraslan, I.G.,Yönetim Mekanizmalarinin Kentsel Dönüsüm Algisi ve Uygulamalari Üzerindeki Etkisi, published Master Thesis, Yildiz Technical University, 2007.

32 Tekeli, İ., Türkiye'de Yaşamda ve Yazında Konutun Öyküsü, Tarih Vakfı Yurt Yayınları, Istanbul, 2012, p. 68.

33 Şenyapılı, T.,Yeni Sorunlar Eski Çözümler: Kentsel Mekanda Bir Gecekondu Yolculuğu,Tarihten Günümüze Anadolu'da Konut ve Yerleşme, Tarih Vakfı Yayınları, İstanbul, 1996, p. 347.

yet been discussed as legal problem, was first recognized as a threat.[34]

1.3. 1970-1980

Some institutions contributed to providing housing mortgages in this era. For instance SSK, which built more than 230.000 dwelling units and provided a large number of subsidies with very low fixed interest rates, provided mortgage credit for dwellings smaller than 100 square meters.[35] Bağ-Kur was a further organization financing mortgages in similar fashion in these years.

Between 1973 and 1979, the share of total investment in housing did not increase, and the majority was left to the private sector. Under the title of "Problems" housing had not been an issue until that era, so a housing count was not undertaken in this period. Therefore the quality of housing, construction materials, age and health status of compliance are unknown. However, this period saw a sharp rise in the prices of construction material[36] In the period up to 1980, four "five-year development plans" were set. The first, second and third aimed to support loans for housing with the target being an increase in housing production. In the fourth development plan, some social circumstances were taken into consideration while calculating housing need, such as,; population growth, decreasing tendency of families, regeneration factors. It was stipulated that a housing provision, realized through cooperatives and public lands and parcels, was to be given to the local authorities for housing production.[37] On 1st July of 1980, the interest was allowed to be set by lenders, and there was an increase in interest rates. Thus the account owners began to reserve their estimate in interest-bearing facilities.

34 Satilmis, E., The Contribution of the Housing Production of the Housing Development Administration (TOKI) in Meeting Housing Need in Turkey by Provinces, Master Thesis, Middle East Technical University, Ankara, 2011, p.80

35 Keleş, R., "Housing Policy in Turkey". In G.Shildo, (Eds), Housing Policy in Developing Countries, (pp.140-172). Routledge, London and New York,1990, p.146

36 Öztürk, B., Türkiye'de Konut Sorunu ve Konut Finansman Sistemi (Mortgage), Master Thesis, Anadolu Üniversitesi, Institute for Social Sciences, Eskişehir,2008

37 Demir, H., Palabıyık, V.K., "Konut Ediniminde Uzun Vadeli İpotek Kredisi Sistemi", Jeodezi Jeoinformasyon ve Arazi Yönetimi Dergisi, İstanbul, 2005

With the rise in credit costs and price of building materials, the construction industry entered a challenging period, and housing production came to a standstill point. In this period, an increase was observed in construction costs of housing production as well as a shortage in housing provision.[38]

1.4. From the 1980s

The period of the 1980s was affected by the liberalization of the bigger cities and globalisation in general. Starting in the 1960s, housing cooperatives and newly emerged real estate companies produced apartment buildings on a mass scale. The number of legal and illegal housing projects increased and residential areas sprawled into the periphery, which was composed of satellite cities. These newly built satellite cities induced a decrease in living quality, renewal, and recreation projects in areas with disaster risks and in industrial areas.[39] A lot of urban transformation projects were realised in city centres in the form of gentrification. These years contribute to the period in which housing development policies by government started. Until that time, some state institutions and public organizations had been provided finance from state funds, such as the Real Estate Public Bank (Emlak Bank), Social Security for employees (SSK), Social Security for self-employment (Bag-Kur), as well as Turkish Army Members Solidarity Fund (OYAK). Although these institutions provide credit through mortgages to their members, according to their legislation conditions[40], they could not sustain this support duo to their limited revenue and other economic reasons, such as inflation.[41] Housing sector and investments were not taken seriously in terms of formulation of a systematic government housing policy. Private sector and gecekondu builders were the main actors in housing, and public housing projects carried out by the state were extremely limited.

38 Öztürk, B., Türkiye'de Konut Sorunu ve Konut Finansman Sistemi (Mortgage), Master Thesis, Anadolu Üniversitesi Sosyal Bilimler Enstitüsü, Eskişehir,2008

39 Ataöv, A. and Osmay, S., Türkiye´de Kentsel Dönüsüme Yöntemsel Bir Yaklasim, A methodological Approach to Urban Renewal in Turkey, 2007

40 Erözgün Satilmis, E., „The Contribution of the Housing Production of the Housing Development Administration (TOKI) in Meeting Housing Need in Turkey by Provinces", 2011, p.30

41 Özkan, M., A General Overview on Turkish Housing Finance System, The Journal of Budgetary World (32):4-19 (in Turkish), 2009.

At the beginning of 1980s, the state was an important actor in respect of stipulating the rules of the new order and establishing mechanisms, and the military government of the time enacted the first Mass Housing Law.[42] This mass housing act determined the rules and process regarding the mass housing fund and its implementations. Although cooperatives obtained finance according to this law, the system could not work properly due to the transfer problems of regional funds. Following the first law, the second Mass Housing Law (No: 2985) was enacted in 1984 and the Mass Housing Fund was created as financial support for housing credits. According to this law, the minimum area should be one housing block within the planned boundaries and should cover a minimum of population requiring an elementary school beyond the planned area.[43] Housing policy in Turkey seemed to take a new turn with the establishment of the Mass Housing Fund and with the Mass Housing Administration-MHA (TOKI). By 1984, and these institutions had taken a centralized role in the housing sector. The concern to establish an institution which was responsible for the central planning of housing started to be discussed widely towards the end of the 1970s particularly due to the generation of new demand, and generally because of the increasing population. Urban areas received more rural migrants which caused housing problems as they could not provide affordable housing without subsidies, especially for the lower income population. This issue emerged to be discussed in terms of the role of government in respect to engagement in mass housing projects.

Large areas of houses constructed by the Mass Housing Fund transformed the appearance of the big cities, empty areas were built on with the mass housing acts. The emphasis was on large scale projects, including almost 750-1000 dwelling units; the priority of the projects focused on social housing in rapidly growing city centres.

"*The mass housing organizations were defined as housing cooperatives, unions of cooperatives and the social security organizations by the law. Thus, all construction firms in the private sector were excluded from that category and were unable to benefit from the Public Housing Fund. The leading role in the implementation of the law was given to the central government, namely the Ministry of Public Works and Settlements. There was no reference at all to the local authorities for their likely involvement in the construction of social housing. The lawW established a Public Housing Fund, by an appropriation of 5 per cent from the national budget per year in order to finance mass housing organizations to increase the construction of housing units.*"[44]

Originally the fund was established to solve the problem of housing for the middle and low income groups, however it could not eventually achieve this role. The credit requirements could only be met by the middle and higher income class who could afford the initial costs of the mass housing construction and could own their houses by completing the full payment in the short term.[45] As a result of the second mass housing law (mass-housing Fund) which large number of individuals and cooperatives applied to, the number of new housing starts increased quickly in a short period of time, which led to boom for housing cooperatives.[46]

The number of cooperatives showed a significant increase after the mass housing laws and Mass Housing Fund. Berkman and Osmay indicated in their studies the distribution of Housing Cooperatives according to the years.[47]

Nevertheless these laws could not be implemented efficiently to respond to the needs of residential areas. According to Türel[48], the government was not capable of establishing a sustainable and functional housing finance system. The Mass Housing Fund lost its power to provide loans to the housing cooperatives and was deactivated at the end of 2001 due to its

42 First Mass-Housing Act, Law No:2487

43 Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p.62.

44 Keleş, R., "Housing Policy in Turkey". In G.Shildo, (Eds), Housing Policy in Developing Countries, (pp.140-172). Routledge, London and New York,1990, p.152.

45 Sarica, S.Ö., Turkish Housing Policies: A Case Study on Mass Housing Provision in the Last Decade, Master Thesis, University of Louisville, Kentucky, 2012, p.19.

46 Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p.62.

47 Berkman, G., Osmay, S. , 1984 Sonrası Konut Kooperatifçiliği, Toplu Konut İdaresi Başkanlığı, Ankara, 1996.

48 Türel, A., "Ankara´da Konut Pazari Analizi". In Gülöksüz, Y., (Eds), Türkiye Birinci Şehircilik Kongresi-1. Book, Ankara, 1982, p.2.

ineffectiveness.

Housing has been a visible dimension of social hierarchies with a significant

Years	Number of Housing Coop. Founded	Number of Housing Coop. with Construction Permit	Number of Housing Coop. with Occupation Permit
Before 1984	6010 (21%)	6328 (32%)	3724 (46%)
1984-1989	17475 (62%)	12042 (61%)	3727 (46%)
1990-1991	4822 (17%)	1474 (7%)	709 (9%)
Total*	28307 (100%)	19844	8160

*Since the foundation years of 24.3% of cooperatives are not known these are not represented in both before 1984 period and the grand total

Figure 22: *Distribution of Housing Cooperatives According to the years*

source of segregation and organisation of city space in the form of isolated spheres of social and economic activity.[49] This policy became a tool of cleaning the cities of the poor with the urban rent increases in the city centres, and forces the poor to find shelter in the new, poorer areas at the periphery of the urban area.

The concept of mass-housing started to have an important influence on cities especially during the 1980s. Tekeli indicates that although mass-housing satisfies with respect to quantity of housing, it created a housing problem with regard to having serious quality insufficiencies.[50] Most of the solutions brought with mass housing to eliminate the housing problem did not succeed in terms of developing living standards and creating qualitative and liveable environments.

On the other hand, despite housing cooperatives, which were expected to bring a solution to the housing problem, and were working well between 1984 and 1989, went beyond their purpose of existence and started to service the upper class with houses in the high-rent regions of the city.[51] As a result, the housing problem of people with low and middle incomes continued to remain unresolved.

As the 1980s progressed, the effect of globalization became more significant on the housing sector. The private sector became dominant in housing production. In addition to this privatization, spatial segregation emerged as a negative outcome of globalization. Housing estates called "site"[52] in Turkish were the major pioneer of this segregation, which, especially during 1990s, became the dominant living type in housing. These were very popular and people desired to live in them, and they were occupied by the high and middle income groups generally. These also represented gated communities with features such as guided entrances and isolated gardens. Inadequacy of affordable housing, unauthorized housing, and low quality urban housing also emerged during these years. House builders did not considere low income groups. Although there were a large amount of alternatives in luxurious housing stock, the opportunities for affordable housing remained quite limited.[53]

Although housing formats with many different presentation styles were developed in this period, a major proportion of housing production in Turkey belonged to TOKI. Besides this, from the early 1990s metropolitans started to focus housing construction by means of companies incorporated by municipalities.[54] After the crises hit in 1991 and 2001, which affected the construction sector dramatically, the fluctuations ended, and housing production boomed, reaching its highest level after 2002. The private sector has sustained its high share when compared with the public sector and cooperatives.

49 Türkün, A., and Kurtuluş, H., "Giriş". In Kurtulus, H. (Eds), Istanbul'da Kentsel Ayrışma, Bağlam Yayinlari, Istanbul:, 2005.

50 Tekeli, İ., Konut Sorununu Konut Biçimleriyle Düşünmek, Ilhan Tekeli Toplu Eserleri 13, İstanbul, Tarih Vakfı Yurt Yayınlari, p.250

51 Karasu, M.A, "Türkiye'de Konut Sorununun Çözümünde Farklı Bir Yaklaşım: Belediye-Toplu Konut İdaresi-Konut Kooperatifleri İşbirliği Modeli", Ekonomik ve Sosyal Araştırmalar Dergisi, Ankara, 2005

52 "Site" is a kind of cluster of housing units and/or apartments while some of which may serve some common facilities as sport centers, playgrounds for the use of their own residents.

53 Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p.70

54 Turk, S.S. and Korthas Altes, W.K., "The Planning System and Land Provision for Social Housing in Turkey", in Housing Finance International Autumn 2010, International Union for Housing Finance Publish, Belgium, 2010, p. 26

After the earthquake in 1999 in Marmara, urban renewal projects started to be applied. In the period after 2000, urban renewal projects continued to be accelerated because of different reasons such as earthquake resistance, rehabilitation of the debris areas, and restoration of historic sites. These projects were carried out in such a manner that could change the texture of the city, as well as the living standard of the citizens. In this period the authority of TOKI increased, and it started to build nearly all housing stock in Turkey. Although housing formats started in previous periods continued, enclave campuses ("site"), offering a new way of life, increased.

As a result, after the 2000s, housing has become a way of investment for some and a statue determiner for some others, instead of being only an accommodation possibility for people which gives people the opportunity to make profit.[55] Architectural projects are also evaluated and preferred based on their investment values. During and after these periods the most obvious form of housing was provided with block groups in the format of gated communities, which were called "site". The rise of enclave "site" campuses caused enormous differences in social relations. In this case, construction features and designs of which were especially appealing to high income groups emerged, despite the aim of aiding lower income groups. Actually most of this housing has the features which were criticized in TOKI. Because of the gaps in legal regulations and the opportunity to provide unearned income, high housing became an evident feature of all living places of all income groups and, while having some advantages, it has created many disadvantages such as loss of neighborhood and contradiction to the human proportion. Additionally, identity has been lost in these buildings and housing estates consisting of same block styles represent a kind of mass-production, with their resemblance to the constructions around them.

1.5. Mass Housing Administration/MHA (TOKI)

55 Koca, D., "Türkiye'de 2000 sonrası Toplu Konut Üretimine Genel Bir Bakış" in Cengizkan, A. Derin İnan, N., Cengizkan, M., (Eds). Zeki Sayar Anma Programı Dizisi/ Zeki Sayar'a Armağan: Türkiye Mimarlığı ve Eleştiri., TMMOB Mimarlar Odası, Ankara, 2012, p.43-52.

As stated above, Mass Housing Administration (TOKI) was established in 1984 to provide housing supply for low- and middle income groups. Between 1984 and 2003, the basic strategy of TOKI was to respond to affordable loans for individuals and housing cooperatives. After this period it has began to produce its own housing and became one of the main actors in the housing sector. Through legal adjustments and inter-governmental partnerships in the 2000s, TOKI became the only responsible public foundation for housing on a large scale, which is described as "Mass Housing". Changes of law in 2003, were executed in the law Nr.2985 and the duties of Toki were redefined as:[56]

- Establishing companies in the housing sector or participating in companies which have already been established
- Granting individual and collective housing loans; giving financial credit for development projects which are intend for rural architecture, urban transformation of squatter housing, preservation and restoration of historical and regional architecture, and subsidies for all such loans where considered necessary.
- Developing projects in Turkey and foreign countries as a project developer or through an agency
- Implementing or completing other projects in order to provide financial supply for the administration.
- Developing and supporting housing projects as well as social facilities and infrastructure in natural disaster areas.

By 2002, the real estate and monetary funds of the Real Estate Bank had been transferred to TOKI and these developments increased its financial power further.[57] TOKI´s funding and strategies for resource improvement aimed at minimizing the huge shortage in Turkish housing finance by providing middle and low income families an opportunity to benefit from

56 TOKI, "Background 2012", available at: www.toki.gov.tr, access: 29.11.2015

57 Yuksel, Y.D and Gokmen, G.P., "Changing of Mass Housing Production by the Government in Turkey", paper presented to ENHR International Conference of Changing Housing Markets: Integration and Segmentation, Prague, 2008, [in Turkish].

affordable home loans.[58] In fact, the affordability TOKI´s housing attracted a wide range of families, especially with middle and low incomes, providing the opportunity to have a house with an affordable home loan provided by government. Private financial institutions have also started offering home loans in the last twenty years. (see Figure 23)

With the support of functions and authorities through amendments, MHA has turned into a sort of national municipality and real estate corporation which has more power and advantages compared to other actors of housing sector. The years after 2002 are the years MHA has been involved in housing production and urban renewal projects directly as an active producer. Until 2003, Toki had produced only 43.145 housing units, but this has increased to 559.705 mass housing units with the support of legal empowerments and active involvement after 2002.[59]

With the assumption that squatter housing problems cannot be resolved by local authorities, urban renewal projects have been managed by TOKI in order to transform slum housing into liveable ,decent housing sites. 12 percent of mass housing projects have been these squatter areas.

These urban renewal projects have also recently involved high disaster risk areas. Poorly constructed old dwellings, especially those which stand on earthquake faults, are the also a theme for urban the renewal process.

"The whole transformation activity and socio-economic change have had a great impact on urban pattern. Turkey, as a newly industrializing country, has just started to confront the negative outcomes of the industrialization process and relatively mass migration from rural to urban areas at the same time. Authorities failed to predict different aspects of prospective problems and they interfere with the process only by putting some laws into effect." [60]

Company Name and (Year of Establishment)	TOKI's share (%)	Capital (in millions -TL, as of 2007)	Profit / (Loss)	Short-term Liabilities (in millions -TL, as of 2007)	Long-term Liabilities (in millions -TL, as of 2007)
Emlak Konut Real Estate Investment Trust- REIT (2006)	39.0	649.1	946.6	2,826.6	129.9
Emlak Real Estate Marketing, Construction, Project Management and Trading Co. Inc. (2001)	49.0	65.0	(0.8)	44.5	10.0
Metropolitan Municipality Construction, Real Estate and Project Co. Inc. (2004)	49.9	10.0	-	0.2	-
Real Estate Appraisal Valuation Co. Inc. (1998)	49.0	0.5	-	0.2	-
Vakif Real Estate Investment Trust Co. Inc-REIT (2004)	14.0	18.48	5.2	0.1	0.1
Vakif Construction, Restoration and Trade Co. Inc.(2005)	53.1	10.0	0.4	3.4	0.5
Bogazici Housing Services Administration Management Trade. Inc.	1.0	-	-	-	-

Figure 23: *Partnerships of TOKI*

"The Emergency Action Plan for Housing and Urban Development is passed on January 1, 2003, setting a five-year goal of 250,000 housing units to be built through renovation, transformation and production of quality housing, by the end of 2007. TOKİ aimed to reach the target of starting the constructions of 500 thousand housing units (in cumulative), with their social facilities, in the first period of 2011 and TOKİ has succeeded."[61]

58 Sarica, S.Ö., Turkish Housing Policies: A Case Study on Mass Housing Provision in the Last Decade, Master Thesis, University of Louisville, Kentucky, 2012, p.27

59 www.toki.gov.tr.

60 Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p. 59

61 TOKI, Background. Available at: http://www.toki.gov.tr/en/background.html, access: 17.11.2015.

Nevertheless, TOKI´s methods and practices have been criticized by scholars and civil associations. While it is commonly agreed that TOKI addresses housing needs, the discussions against the MHA are based on the methods used in its housing provision. Yüksel and Gökmen indicate that Toki is the only authority in terms of urban land, making decisions on planning and determining the value of sites which represents a monopoly of the housing sector.[62] A problem with TOKI projects is that it has been uniformly applied to all urban areas without effectively cooperating with local actors in urban planning matters. Although the quantitative success of TOKI in housing production cannot be denied, the qualitative aspects of mass housing production mostly have not been considered. According to a report of Turkish Government Control Institution about TOKI implementations, it has been demonstrated that it builts housing in all cities of Turkey but it has not considered economic conditions, housing needs, possible housing demands of settlement areas. This situation has

Figure 24: *Toki Tuzla, Istanbul.*

Figure 27: *Toki Kayasehir*

Figure 25: *Toki Doganbey Housing*

Figure 26: *Toki Bursa Doganbey Urban Transformation*

Figure 28: *A Toki Project*

62 Yuksel, Y.D and Gokmen, G.P., "Changing of Mass Housing Production by the Government in Turkey", paper presented to ENHR International Conference of Changing Housing Markets: Integration and Segmentation, Prague, 2008, [in Turkish]

Figure 29: *Gaziantep Mavikent Toki Housing 3D Modell*

Figure 30: *Gaziantep Mavikent Toki Housing.*

led encouragement of real estate investments for sale or rent, more than providing residences to meet the housing need.[63] Another criticism of the mass-housing projects in urban areas is the distance of these peripheral urban sites for low-income people,from their work places and social networks and this causes a remove of social housing projects from city centers[64]

63 Ibid.

1.6. Sustainable Building in Turkey

It has not taken enough measures to reduce CO^2 emissions of buildings in Turkey. According to the data of European EEA, the greenhouse gas emission in Turkey in 2012 is much more than twice of the value in 1990 while greenhouse gas emissions in Austria in 2012, decreases almost to the value in 1990 due to its sustainable policy.[65] Figure 31shows the comparison of the total greenhouse gas emissions of the two countries. Additionally the renewable energy potentials of Turkey were highlighted in the report. Moreover the usage of renewable resources is much below the potential.[66]

While 30% of energy is consumed by buildings in Turkey; with regulations concerned with the energy performance of buildings, nearly 50% of this consumption can be saved, as is obvious in the table.[67] (SeeFigure 32) 86% of the buildings in Turkey are houses. So precautions related to energy efficiency are very important for Turkey, as well as for the world.

With the TS 825 Heat Insulation Standard issued in 2000, the improvement of energy efficiency in newly constructed buildings in terms of heat insulation was targeted. With the Energy Efficiency Law (5627) issued in 2007, boosting and supporting energy efficiency in generation, transmission, distribution, and use phases of energy was targeted, and these duties were given to the Energy Efficiency Coordination Board.

64 Sezer, M., Housing as a Sustainable Architecture in Turkey: A Research on Toki Housing, Master Thesis, Middle East Technical University, Ankara, 2009, p.91.

65 European Environment Agency (EEA). http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_air_gge&lang=en. Access: 07.06.2015.

66 Celik, E., Yesil Bina Sertifika Sistemlerinin Incelenmesi ve Türkiye´de Uygulanabilirliklerinin Degerlendirilmesi, Master Thesis, Istanbul Technical University, Architecture Department, 2009., p.51

67 Özyurt, G., Enerji Verimliligi, Binalarin Enerji Performansi ve Türkiye´deki Durum, ODTÜ Building Engineering Department, 5/2009, available at: http://www.e-kutuphane.imo.org.tr/pdf/16431.pdf, access: 20.03.2015.

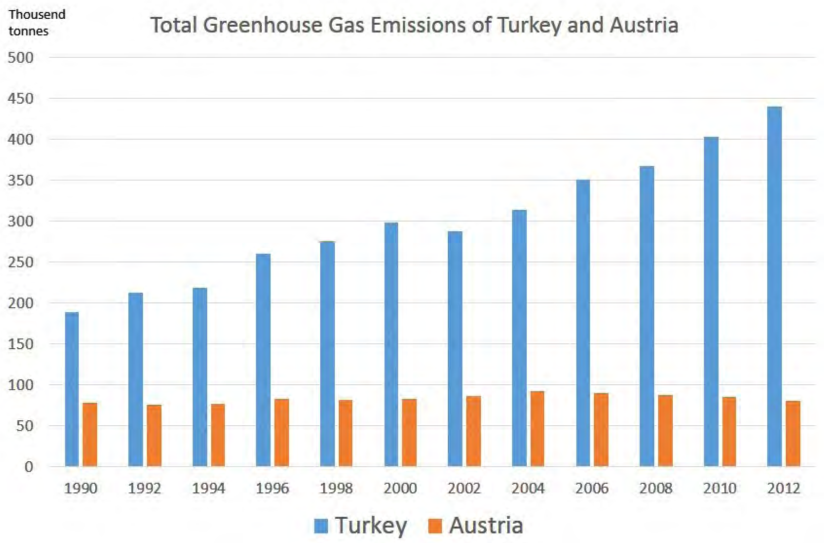


Figure 31: *Total Greenhouse gas emissions of Turkey and Austria between the years 1990 and 2012.*

Sector	Share in total consume	Saving potential
Industry	39%	%20-25
Buildings	30%	%20-25
Transport	21%	%20-25
Agriculture	5%	
Other purposes	5%	

Figure 32: *Energy consumption and saving potentials according to the sectors*

In December 2009, the Energy Performance of Buildings Directive was prepared to increase the energy efficiency and reduce the use of fossil fuels in buildings, with the most important concern of the regulation being energy identification.[68] Energy identification regulation of existing buildings will be required after 2017. However, this regulation did not come into operation until 2.4.2010 because of some objections and some content that needed clarification.

The Energy Efficiency Strategy Document of 2012-2023 aims to reduce the amount of energy consumed for per unit of Turkey's gross domestic product, at least 20% less than that of 2008. Reducing energy demand and the carbon emissions of buildings, and increasing sustainable and eco-friendly buildings that use renewable energy resources, are the main aims of this strategy.[69]

Although the targets for limitation of greenhouse gas emissions of buildings and promotion of use of renewable energies were identified in the action plan against climate change between 2011 and 2013, it did not in practice achieve significant progress and little attention has been paid at the national level.[70]

Turkey is a country whose economy is dependent on imported energy resources and, since 2012, 90% of primary energy consumption has been based on fossil fuels, which are mainly imported.[71] According to current predictions, there will be a 90% rise in primary energy demand between 2011-2023.[72] Under these conditions, the introduction of new production investments, diversification of energy resources, such as the need for domestic and renewable energy sources, and enhancing energy efficiency, should become prominent concerns for Turkey.

There are some implementations of recognition for some buildings with building scertificated by LEED and BREEAM. According to the Fifth Turkish Climate Change Report, there were approximately 70 buildings

68 Binalarda Enerji Performans Yönetmeligi- BEP Yönetmeligi

69 Türkiye Ulusal Yenilenebilir Enerji Eylem Plani (National Renewable Energy Action Plan of Turkey), Ministry of Energy and Natural Recources of Turkey, December 2014, p.18

70 Arsan, Z.D., A Critical View of Sustainable Architecture in Turkey: Proposal for the Municipality of Seyrek, Doctoral Thesis, Izmir Institute of Technology, Izmir, 2003.

71 BOTAS Strateji Gelistirme Daire Baskanligi, Botas Sector Report, 2014, p.17.

72 Türkiye Ulusal Yenilenebilir Enerji Eylem Plani(National Renewable Energy Action Plan of Turkey), Ministry of Energy and Natural Recources of Turkey, December 2014, p.8

which are built according to the green building perspective.[73] However, a national evaluation or certification system has not been generated, which is an concerning lack for Turkey.

Turkey has not undertaken real international research and development policy. The alternative and renewable energy resources are used less efficiently compared to the available potential. While developed countries have been struggling to find a solution to control carbon dioxide emissions and climate change for a long time, Turkey has not taken adequate precautions, which also cannot be blamed mainly on the building sector due to a deficiency of necessary measures.

I believe this clearly shows that although the targets and works which were done are realistic when the available infrastructure of Turkey is considered, they are inadequate when compared to works of the EU and USA. Because of the lack of infrastructure, implementations have become only stop gap in form, and there is an absence of incentives or sanctions intended to improve the energy performances of buildings.[74] These situations indicate that the improvement progress of sustainability, including energy efficiency, will be very slow in Turkey.

73 Environment and Urban Ministry of Turkey, Türkiye Iklim Degisikligi 5.Bildirimi (The Fifth Turkish Climate Change Report), Ankara, 2013, p.111.

74 See also Özmehmet, E., Türkiye´de ve Dünyada Sürdürülebilir Kalkinma Yaklasimlari, in Journal of Yasar University, Vol:3, No:12, 2012.

2. Housing Development in Vienna/Wien over the Last Century

2.1. Gründerzeit

The development of industry and accelerated growth of the population in the 19th century were parallel and ongoing phenomena. As was mentioned in the "Principles of Population" by Malthus, the problems of the modern age were problems of large numbers.[75] In the second half of the century hundreds of thousands came to the endless monotony of the tenements of all major cities which offered accommodation possibilities for flowing masses of unskilled workers. Vienna was one of these cities, which led to an increase in rental fees due to demand for housing. And it was these factors which lay the ground work for later mass-housing projects.

The development of the machine, industrialisation and hygiene had come from England where accelerated population growth and urbanisation had started in the second half of the 18th century. "Society for Improving the Dwelling of the Labouring Class" was founded in 1845 in England to provide money without interest for workers housing, which was a fore runner of the principle of subsidies for public housing.[76] On 19 December, 1890, 34 suburbs in Vienna adapted a new municipal statutes (Gemeindestatut) for "Greater Vienna".[77] Some measures were developed to create better conditions, such as foundations for workers; housing, but the problems were not fully solved.

Glück indicates that before 1914, more than three-quarters of the population in Vienna, and in most of Europe, lived in difficult conditions which seem to us unbearable today.[78] On the other hand, "Wiener Ringstrasse" which was the last bloom of representation feudal upper classes and noble houses of the rich middle class, represented an example of another form of living.[79]

Residential construction was managed entirely in the private sector and directed on purely economic benefits until 1918 (R). An important development was the tenant Protection Act (Mieterschutzgesetz) in 1917, which was declared applicable in Vienna immediately.[80] But the housing conditions were still extremely bad and the housing shortage from before the war had become even more acute. Vienna had expensive, but poor, qualified housing. Workers and employees had to give approximately one fifth of their income to the rent of houses which did not satisfy the minimum health standards. Because of the high rates of the flats, tenants had to take a subtenant/night lodger (bedgeher/schlafburschen/Bettmädel), who paid for a bed but led to a very high population density. These dwellings offered no comfort and no refreshment, they had no incentive for the struggling worker. The people who sunk into these flats or were born into them, must have been physically and mentally stunted, and wilted or gone wild.[81]

Speiser described this housing misery: "Especially the workers´ districts outside the belt had the most terrible conditions. In thousands of basement flats the water dripped from the walls. Most of the largest tenements were narrow room-kitchen-corridor apartments which grouped around a lightless passage with several housing units."[82]

According to the official census of 1919:[83]

- 2.3% of all flats had an entrance foyer
- 92% had a WC outside of the flat

75 Malthus T., An Essay on the Principle of Population, London, 1798. Available at: http://www.esp.org/books/malthus/population/malthus.pdf

76 Glück, H., Freisitzer, K., Sozialer Wohnbau:Entstehung-Zustand-Alternativen, Molden Edition, Wien/München/Zurich, 1979, p.25

77 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.17-18

78 Glück, H., Freisitzer, K., Sozialer Wohnbau:Entstehung-Zustand-Alternativen, Molden Edition, Wien/München/Zurich, 1979, p.30

79 See also Förster W., 80 years of social housing Vienna. Available at: https://www.wien.gv.at/english/housing/promotion/pdf/socialhous.pdf, p.2, access:05.08.2015.

80 Reichsgesetzblatt für die im Reichsrat vertretenen Königreiche und Länder No.34 and 36/1917.

81 Hautmann H., Hautmann R., Die Gemeindebauten des Roten Wien 1919-1934, 1980, Wien, p.322

82 Speiser W., Paul Speiser und das Rote Wien, München/Wien, 1979, p.51. Translated by the author.

83 Festschrift Wohnhausanlage Favoriten, 1926, p.22

- 95% of water pipes were in the corridor of the building
- 14% had a gas supply
- 7 % had electric lights

2.2. Inter-War Period (Zwischen Kriegszeit) 1918-1934

After the World War 1, there were two main strategies to manage housing problems: The Vienna Settlers´ Movement (Wiener Siedlerbewegung) and communal housing.

- **Wiener Siedlerbewegung (Vienna Settlers´ Movement)**

The Vienna settlers´ movement was contrary to the municipal housing program (kommunalen Wohnbauprogramm) of Red Vienna and is often called "housing reform from below", because it emerged from the intention of the residents.[84]

The emergence of the movement came about because of the housing shortage, and illegal structures, such as small cabins built in gardens, were built by settlers. Settlers made several protests for the legitimation of the settlements. After a demonstration, mayor Jacob Reumann promised the purchase and development of land, supply of building materials and professional assistance. The city established its own Siedlungsamt (municipal settlement office), and the city-owned GESIBA (Gemeinschaftliche Siedlungs- und Baustoffanstalt) had the mission to deliver building materials.[85] This company was commissioned by the municipality to build and manage privately owned housing.

The settler movement was a form of housing that originated directly from the people and was implemented with the theoretical support of innovative architects. Settler colonies decided to build houses in management of municipality. The percentage of houses in settlement colonies was 55% of the whole housing stock in 1921. It had a positive effect by reducing the need of a housing programme of Vienna.[86]

These developments prepared the roots for the housing policies of "Red Vienna".

- **Das Rote Wien – Red Vienna**[87]

After social democrats took over the management of the city council by a majority (with universal suffrage), a fundamental change in residential construction was experienced in Vienna. Housing construction was re-designated as a primary political program, and this new building policy should be understood as a product of the social democratic idea. In this sense, housing for "community purpose" was declared a social product, which provide all requirements according to necessity.[88] Weihsmann describes this social program in his publication "Das rote Wien", stating that the great reforms in housing and communal politics of the city of Vienna during the reign of the Social Democrats were in no way a completely new creation, they primarily expanded on the nationalized network enterprises established under Karl Lueger, such as power stations, the central water supply running from the two mountain spring water sources and the community-owned natural gas companies. Weihsmann states about this era: "The former weak points were improved, and the qualitative developed Christian-social experiences in Red Vienna were reflected".[89]

84 Six, K.M., Sozialer Wohnbau in Wien-Partizipation als Auswirkung Veränderter Wohnbedürfnisse, Master Thesis, Technical University of Vienna, Institute for History of Art, Building Research and Preservation, Vienna, 2011, p.16

85 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.41

86 Six, K.M., Sozialer Wohnbau in Wien-Partizipation als Auswirkung Veränderter Wohnbedürfnisse, Master Thesis, Technical University of Vienna, Institute for History of Art, Building Research and Preservation, Vienna, 2011, p.17

87 Red Vienna (German: Rotes Wien) was the era between 1918 and 1934, when the social democrats had the majority to govern the city democratically for the first time.

88 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.18

89 Weihsmann, H., Das Rote Wien, Wien, 2002, p.15

The federal government adopted the Housing Requirement Act (Wohnanforderungsgesetz) to enhance the efficiency of existing housing structures. The aim of the city administration was low private demand for building land and low building costs in public housing planning. Since then, "Gemeindebau" (council housing) has become the nucleus of society and transformed housing from a simple dwelling to a multifunctional structure with education, health and culture, which also employs architecture as a medium to realise a social utopia.[90]

Although "Siedlungen"[91] continued to be built, the Social Democratic municipal administration shifted the emphasis of housing development from Siedlung construction to large block construction. In the meantime the housing movement changed to a mass-housing movement which was realised in different forms of organisations, for instance foundations and cooperatives.

To solve the financial conditions of social housing a series of regulations was introduced in 1923; new land tax, the increment-value tax, and new housing tax, according to which a simple worker´s apartment tax was at an average of 2.083% of the rent before the war.[92] Danneberg indicates that the rent in the council housing was about 1/25 of the rent which would be needed to refinance the current building costs and the current bank interest rate (13%), without taking into consideration the value of land.[93]

The first housing program of municipal council built 25000 council apartments between 1924 and 1928 in the context of mass housing or Siedlungshäuser (settlement houses).[94] A second program for 30000 apartments was set up between 1929 and 1933. These were high buildings with a tendency to densely built island blocks in order to save land and provide cheaper construction than detached and terrace houses.[95]

By 1934, the City Council (Gemeinde Wien) had built 61175 apartments in 348 council projects. In 1934 10% of the Viennese population lived in Gemeindewohnungen (Council Housing).[96] These council housings had common rooms, kindergarten, laundry, library etc. which present important steps in the development of social and democratic principles in residential projects and acted as a city in the city. The living standards of municipal dwellings (kommunalen Wohnungen) differed qualitatively enormously from the dwellings before the First World War. The increase in size of dwellings was not significant, but large steps were taken in new infrastructural and hygienic achievements. Approximately 75% of the apartments, which were built during the first construction program possessed a size of only 38 m2, and the remaining 25% had a size of 48 m2 with an additional room.[97]

The housing constructions of Red Vienna was named "Superblock" by some authors. The settlements had huge sizes and numbers of building blocks, built as perimeter block developments (Blockrandbebauung) with a high density. The architectural historian Helmut Weihsmann defines the superblock in his book "Red Vienna" with the following words: "both centralized architectural unity and relatively self-sufficient community centre, largely independent of the rest of the city"[98]

The Karl-Marx-Hof is one of the symbols of Red Vienna, a monumental building which covers only 30% of the total site.[99] This housing project was designed by Karl Ehn with 1200 apartments, and has a huge courtyard with playgrounds, communal facilities; laundry, kindergarten, library,

90 Förster W., 80 years of social housing Vienna, available at: https://www.wien.gv.at/english/housing/promotion/pdf/socialhous.pdf

91 In architecture and urban planning "Siedlung" is a residential area, which represent a unity, with similar buildings. In this era, mentioned Siedlungs are mostly small scaled in vertical dimension.

92 Förster W., 80 years of social housing Vienna, available at: https://www.wien.gv.at/english/housing/promotion/pdf/socialhous.pdf, p.6

93 Danneberg, R., Das Neue Wien, Vienna, 1930, p.35

94 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.22

95 Weihsmann H., Das Rote Wien, Wien, 2002, p.117

96 Förster W., das erfolgreiche Modell der Wiener Wohnungspolitik-seine Geschichte und sein Weg ins 21.Jhd., in Wiener Wohnbau Innovativ, sozial, ökologisch, , Arhichtektur zentrum Wien, Wien, 2008, p.14

97 Schaffhauser S., Die Wohnbauentwicklung der Stadt Wien Die Wohnbauentwicklung der Stadt Wien von den Anfängen bis zur Jahrhundertwende und der kommunale Wohnbau der Zwischenkriegszeit – „Rotes Wien", Dipl. (unpubl.), Graz, 1993, p.150

98 Weihsmann H., Das Rote Wien, Wien, 2002, p.114

99 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.23

accommodation council for advice. Well-known architects of these times are Peter Behrens, Josef Frank, Hubert Gessner, Josef Hoffmann, Clemens Holzmeister and Adolf Loos.

2.3. Austro-fascism and World War 2

After the dissolution of parliament all parties were prohibited except the Christian Social Vaterländische Front, and a civil war started between the Social Democrats and the Christian Social Hemwehr in 1934.[100] The violent end of Red Vienna also meant a recess for its social housing policy.

In the National Socialist period housing projects were not readily undertaken. Up until 1941, only 2000 apartments had been built. The war eventually led to the destruction of 87000 homes, around 20% of the existing building which corresponds to more than Red Vienna had built.[101]

2.4. Social Housing after 1945

Because of the huge loss of living space, the city of Vienna had to act quickly and called for a "Study For the Reconstruction of the City of Vienna" shortly after the end of hostilities. To reduce the density in inner city areas and increase the density of suburban areas using garden cities was included in defined general objectives of this conference. The highest priority was put on solving housing problem less by necessity and more by existing opportunities.[102]

The first major construction project of the city of Vienna after the Second World War was by Franz Schuster planned Per-Albin-Hansson- Reihenhaus (row terraced houses). Settlement which was required was inspired by the garden city idea of the interwar period.[103] More than 1000 terraced houses and apartments were planned, a kindergarten, a school, and a multipurpose common building. The project had the name Swedish Prime Minister Per Albin Hansson, who supported this project with a Swedish aid programme. Within this support, the City of Vienna obtained two vibro systems and it was for the first time possible to produce new building materials from the available rubble, which accelerated reconstruction. Other large housing estates such as Siemensstrasse and Hugo-Breitner-hof followed. Communal bathrooms were not built anymore and all new apartments were equipped with their own bathrooms and also, gradually, with central heating. In 1954 the corner stone for the 100000th council flat was laid and by 1958 the reconstruction of Vienna was essentially completed.[104]

At the end of 1960s, rents were still very low and there was in general a significant improvement of the quality of apartments in Vienna, partly due to the help of industrialized housing production.

- **Prefabrication in social housing**

With the improving financial situation in the 1960s a booming build arrived.[105] After eliminating the emerging housing needs, the municipality concentrated on improving housing standards through new construction. It was considered to implement industrial building methods in order to accelerate housing provision. The municipality decided to found "Studiengesellschaft zur Vorbereitung des Fertigteilbaues", which conducted research into preparing prefabrication. In 1961, the first prefabrication plant was founded and implemented in Grossfeldsiedlung, with 5300 apartments being created in a style similar to panel housing construction. Oskar and Peter Payer, who won the competition for this project, designed a typical floor plan which can be used for prefabrication projects. But the construction with prefabrication led to criticisms mostly

100 Förster W., das erfolgreiche Modell der Wiener Wohnungspolitik-seine Geschichte und sein Weg ins 21.Jhd., in Wiener Wohnbau Innovativ, sozial, ökologisch, , Arhichtektur zentrum Wien, Wien, 2008.

101 Förster W., das erfolgreiche Modell der Wiener Wohnungspolitik-seine Geschichte und sein Weg ins 21.Jhd., in Wiener Wohnbau Innovativ, sozial, ökologisch, , Arhichtektur zentrum Wien, Wien, 2008, p.16

102 Koch Ernst, Koch Robert, Wiener Wohnbau-Vielfalt, Wien (Wirtschafts- und Verlags-gesellschft), 1994,p.48

103 Friedrich Achleitner, Österreichische Architektur im 20. Jahrhundert, Ein Führer in vier Bänden, Band III/3 WIEN 1. 12. Bezirk, St.Pölten/Salzburg (Residenz Verlag), 2010, S. 271

104 Förster W., 80 years of social housing Vienna, p. 13. available at: https://www.wien.gv.at/english/housing/promotion/pdf/socialhous.pdf

105 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.43

concentrated on the monotony of the architectural design.[106] However, these apartments were accepted by the residents and have never became slums or ghettos as was predicted.[107]

- **Further development of "Gemeinnützige Wohnbau (non-profit housing)" and housing subsidies**

Gesiba's first collaboration was been representative of further developments in the Vienna housing market which followed the principle "that to strive for a style between municipal (communal) and cooperative (Genossenschaft) housing construction and to encourage the activities of non-profit residential building (Gemeinnützige wohnbau) as an advanced form of social residential building by the city of Vienna."[108]

After the institutionalisation of subsidized housing construction, this pure charity became part of the social program of the state.[109] The construction of worthwhile, affordable housing was no longer dependent on the will of wealthy investors, but could be realized with the help of state subsidies. The war damaged housing was urgently resolved by the principle of "focusing the whole subsidy on reconstruction of destroyed houses" in the "House-Reconstruction Act (Wohnhaus Wiederaufbaugesetz)" of 1949. This subsidy reduced construction costs by 75%.[110]

With the decision of the Housing Promotion Act (Wohnbauförderungsgesetz) in 1968 it was for the first time possible to have individual subsidies for low-income tenants. Another important milestone is the establishment of Wiener Wohnbaufonds (Vienna Housing Fund), which was based on the municipal council of the City of Vienna (Gemeinderatbeschluss) for the purpose of social housing subsidies. These support actions could be only used by the city council itself or by non-profit housing companies. It was the first to provide its own funds payment, which is called "Eigenmittel" ,within the framework "kommunalen wohnbau" and "Gemeinde (council Housing)".[111]

2.5. Wohnbau 1970-1980

Later, prefabrication accelerated construction, but it was not enough to provide the best technical and formal solutions for housing. This led to a rethink of other forms of construction in social housing. The planning was no more based on the rapid production of residential buildings and directed mostly according to people´s needs and requirements during the 1970s. By the mid 1970s, many participation projects emerged which took into consideration the requirements of families, old people and single households. There were first time intensive efforts by the city to increase the quality which did not mean only the quality of the property, but also the urban development and the architectural quality and the conceivability of tenants.[112] According to Bramhas development in these years lead to a rethink that focused overly on quality instead of quantity.[113]

New ideas emerged which focused on forms and structures. There were new forms of housing for instance; maisonette, split-level apartments and facilities to enable flexible living which needed some time to be accepted by the people[114].

This residential buildings with new concepts showed much more sophisticated and small-scale building design in contrast to the examples of the sixties. Urban concepts gained more importance than before. With the Wohnhausanlage "Am Schöpfwerk", housing complex, Viktor Hufnagl moved back to the urban conception of municipal residential buildings in the interwar period, which were called "kommunalen Wohnbauten"

106 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.76

107 Förster W., 80 years of social housing Vienna, p. 13. available at: https://www.wien.gv.at/english/housing/promotion/pdf/socialhous.pdf, p. 14

108 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.41

109 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984.

110 Ibid. P.39

111 Ibid.

112 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.35

113 cf. Bramhas, E., Der Wiener Gemeindebau, vom Karl Marx- Hof zum Hundertwasser, 1987, p. 87

114 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.43

and celebrated the "rebirth of the tradition of the Viennese courtyards (Wiener Höfe)".[115](see Figure 33, Figure 34)

Vienna´s City Planner Roland Rainer planned a dense council housing estate including small, private gardens. Another housing complex with apartments including intimate open spaces, which appears a bit radical, was designed by Raimund Abraham, Carl Pruscha and others in the south of Vienna.

Wienerberg is another complex with nearly 2500 blocks which represents, a successful urban expansion area. The planning process was realised within competitions by different developers and architects.

A different concept was developed by Harry Glück. The high density low rise building is closer to the dream of a single-family house for many, certainly, but it is located economically at the top level of social hosing. For this reason it can only be offered to a small group. As an alternative, which corresponds to the conditioning of people in preferences and also combines the qualities of the family house with all other mental and physical human needs, offering a form of living can be denoted as "gestapeltes Einfamilienhaus (stacked single family house)".[116] Moreover, this type has proved, among the constraints of medium European cities, to be feasible. Similar stepped housing had been built in Europe, but not in the form of social housing. Some projects as examples of social housing with terraces were realised in Vienna by Harry Glück and partners, which serves recreational living area for inhabitants with terraces, flower troughs, pool, saunas, and game rooms for different ages and with underground garages and green open spaces.

Terrassenhaus Inzersdorferstrasse (Figure 35,Figure 36) Maisonetteshaus Wien-Penzing, Hadikgasse Wohnpark Alt-Erlaa in the 23rd district was built in the 1970s by the non-profit GESIBA. Glück described the terraces

Figure 33: *Am Schöpfwerk, architect Viktor Hufnagl.*

Figure 34: *Am Schöpfwerk, site plan*

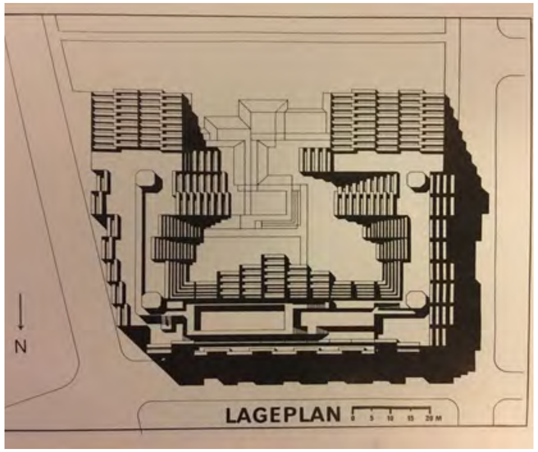


Figure 35: *Housing Inzersdorferstrasse, site plan*

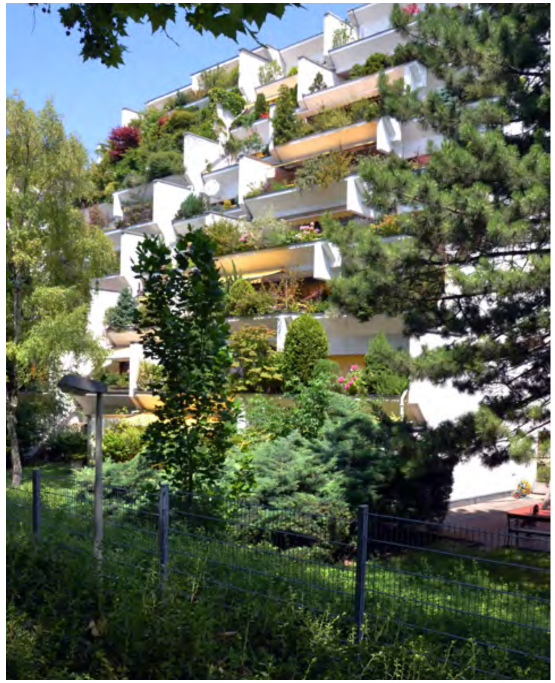


Figure 36: *Inzersdorferstrasse by Architect Glück*

115 Koch, E. and Koch, R., Wiener Wohnbau-Vielfalt, Wirtschafts- und Verlagsgesellschft, Vienna, 1994, p.69

116 Glück, H., Freisitzer, K., Sozialer Wohnbau:Entstehung-Zustand-Alternativen, Molden Edition, Wien/München/Zurich, 1979, p.75

as “hanging gardens”.(Figure 37) This project consists of a range of 35 different apartment types from 1- to 5 bedroom apartments some of which are maisonettes or hall apartments.(Figure 39) At the top of the buildings there are seven open pools. High cost of capital shares and rents of Alt Erlaa, when compared with other social housing, led to criticisms that disputed social character of the building, but the high living satisfaction of residents until now has been proven by various studies.[117]

Figure 37: *Housing Alt Erlaa, by Architect Glück.*

Figure 38: *Housing Maisonetteshaus Hadikgasse, a view from the lower building to the higher building of the housing.*

Figure 39: *Housing Alt Erlaa, standard floor plan.(top)*

Figure 40: *Wohnen Morgen, Wilhelm Holzbauer, 1976-84*

The housing estate “Wohnen Morgen” is the result of a competition project that Wilhelm Holzbauer was awarded. He used traditional features like edge development and back courtyards with a new interpretation of contemporary design. The lifted access zones defined the focus of the housing estate and enhanced courtyard character. The housing includes various types of different floor plans from classic to maisonette and split-level-houses. Another specific property of the project is the access routes which provide entrance from the street directly or through glazed deck access.[118]

While the city of Vienna was still largest building owner (bauherr) in the postwar period, building performance of the non-profit companies increased after 1973. In 1979 “Wohnungsgemeinnützigkeitsgesetz (Non-profit Housing Act)” was accepted, bringing together all non-profit building associations, among other instruWments of self-financing. An example

117 See also Glück, H., Freisitzer, K., Sozialer Wohnbau:Entstehung-Zustand-Alternativen, Molden Edition, Wien/München/Zurich, 1979, p.107

118 Achleitner, F., Österreichische Architektur im 20. Jahrhundert, Band III/2 WIEN 13.&18. Bezirk, Residenz Verlag, Salzburg/Wien, 2010, p. 143

for this is rescheduling profits. In this implementation the discontinuation annuity (final payment of state loans) was recognised as future costs for rental apartments.[119]

After the Housing Promotion Act in 1968 and foundation of Viennese Housing Funds, the private housing sector and non-profit organisations were able to benefit from subsidies and there was an increase in housing from these associations during the seventies. As a result "City Vienna" has lost its monopoly position in housing.[120] (See Figure 41)

2.6. 1980s

One characteristic of the architecture from the 1980s is their wide variation in terms of typology and morphology. The construction of new Gemeindebauten was carried out on the basis of urban planning competitions and new urban concepts again followed the traditional

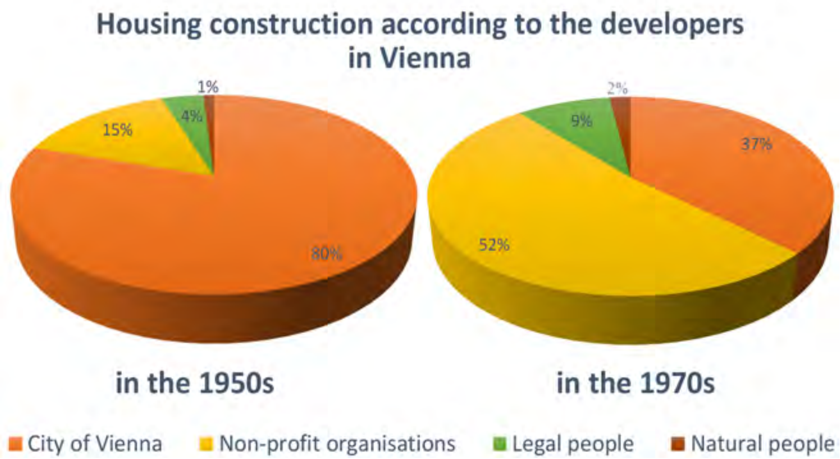


Figure 41: *Housing construction according to the developers in Vienna in the 1950s and 1970s, made bz the author according to Eigner P.*

concept of street, yard and square (Gasse-hof-platz).[121] Urban spaces such as courtyards were designed integrated with pedestrian paths and green belts. The addition of commercial uses to the housing, which had started in the seventies, also proceeded in these period.

Urban structures started to be designed as small divided lands by different architects and the combination of community rooms and different facilities (such as kindergarten, school etc.) was still a consideration for inhabitants within these housing structures.

After the crisis of the seventies, in the following decade there was a rethinking process related to the technical building conditions of residential buildings. As part of the revision, the planning and implementation guidelines for municipal residential buildings led to the definition of minimum requirements in terms of heat insulation which brought new regulations. These new norms related to the physical properties of the elements used and determined minimum standards with respect to their thermal insulation properties. From the mistakes of residential areas in the fifties and sixties, the importance of supporting architectural, ecological, economic and urban quality was understood. Instead of "sleeping cities" which relieve city centres and compact suburbs, there was an attempt to create mixed use estates with leisure facilities and lively neighbourhoods.[122]

Gemeinde Wien planned seven housing estates using domestic and foreign architects by 1984.[123] With the motto "Vollwertiges Wohnen (high quality living)" as the "Wiener Modell" declared, these projects aimed

119 Kirchner, J., Wohnungsversorgung für unterstützungsbedürrftige Haushalte. Deutsche Wohnungspolitik im europäischen Vergleich. Deutscher Universitätsverlag, Wiesbaden, 2006, p. 291

120 See also Eigner, P., Jahrbuch des Vereins für die Geschichte Wien, 1999, p.70

121 Eigner, P., Herbert, M., Resch, A., Sozialer Wohnbau in Wien-Eine Historische Bestandsaufnahme. In Jahrbuch des Vereins für die Geschichte der Stadt Wien 1999 (Eds.), Foundation for the History of City of Vienna, Vienna, 1999, pp.49-100. Translated by the author.

122 See also Schluder, M., 10 Jahre Bauträgerwettbewerb Veränderungen im Wohnbau, Studie beauftragt durch MA 50 Wohnbauforschung (Housing Research), Vienna, 2005, and Eigner, P., Herbert, M., Resch, A., Sozialer Wohnbau in Wien-Eine Historische Bestandsaufnahme. In Jahrbuch des Vereins für die Geschichte der Stadt Wien 1999, Eds. Foundation for the History of City of Vienna, Vienna, 1999, pp.49-100. Translated by the author.

123 Gehmacher, E., "Das Modell der menschengerechten Stadt (The Modell of human-oriented City) (, in Peichl, G.(Eds.), Wiener Wohnbau Beispiele Band 17, Architektur- und Baufachverlag Wien, Vienna, 1985, p. 113

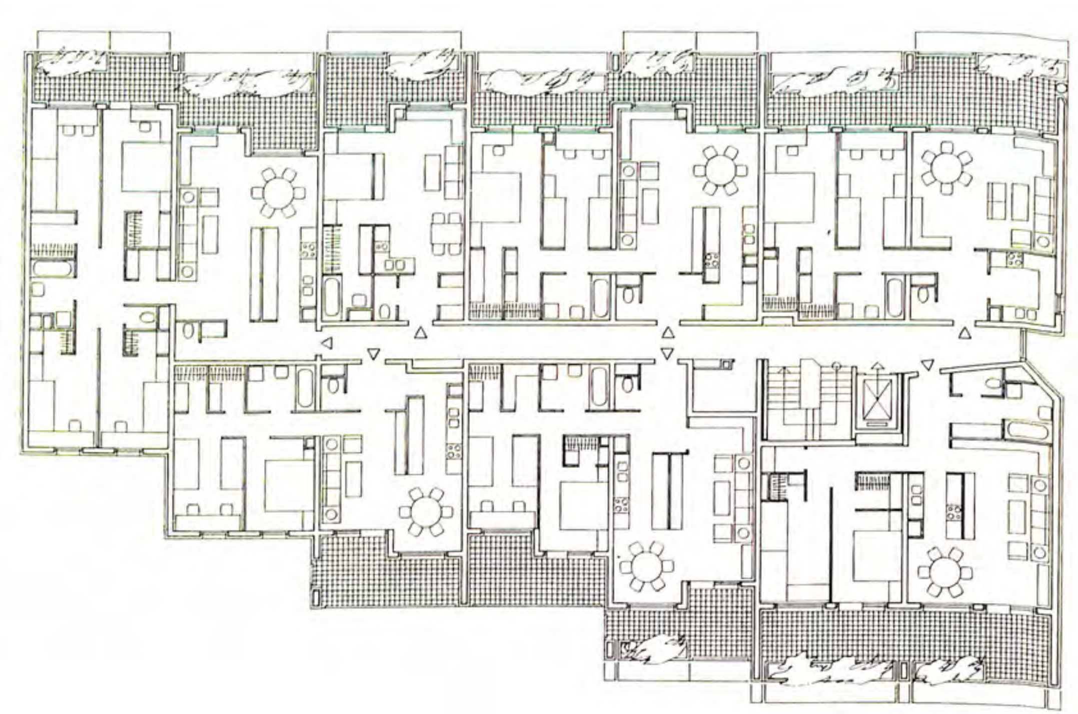


Figure 42: *Housing Project Hartlgasse-Dammstrasse-Pappenheimgasse, standard floor plan of the building design by architect Glück.*

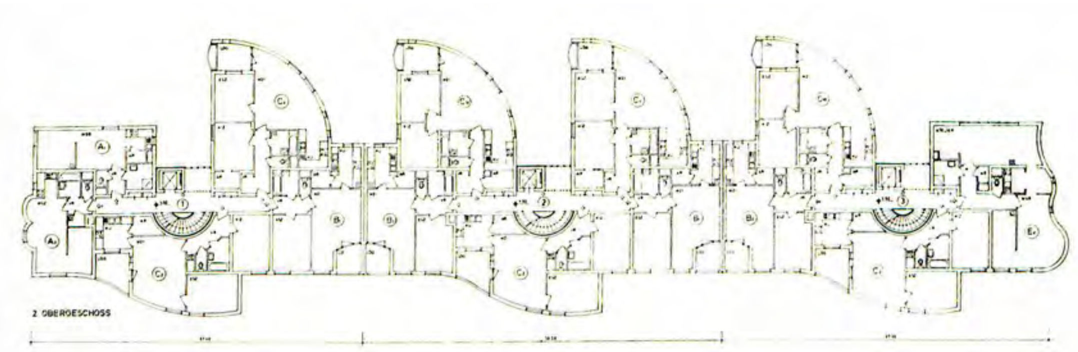


Figure 43: *Project Hutweidenhof Döbling, a floor plan from building designed by architect Peichl*

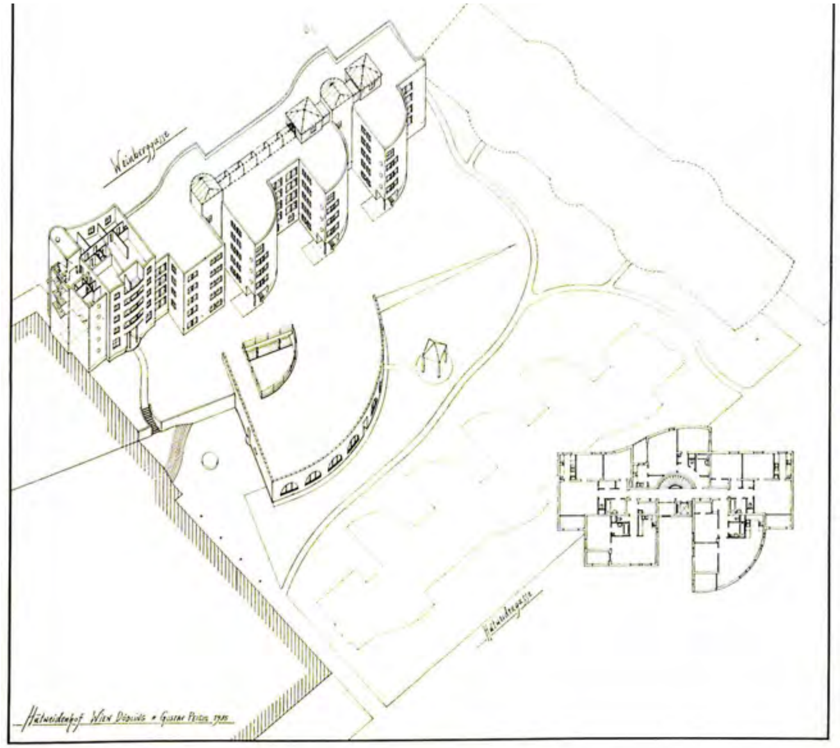


Figure 44: *Project Hutweidenhof Döbling, perspective of the component designed by architect Peichl*

to provide; living quality, satisfaction, and economic efficiency.[124] As a result these architects were required to produce housing design which provide social affordable housing with qualified infrastructure, including roof greenery, community rooms, loggias, terraces with greenery, winter gardens, sauna and swimming pools, children playgrounds, etc. Projects Hartlgasse-Dammstrasse-Pappenheimgasse, by architects Glück, Hilmer (from Munich), and Sattler (from Munich), and Hutweidenhof Döbling by Peichl, Spychala, and Valle are examples of projects from this program. The project are divided into different sites and each architect has its own

124 Gehmacher, E., "Das Modell der menschengerechten Stadt (The Modell of human-oriented City) ", in Peichl, G.(Eds.), Wiener Wohnbau Beispiele Band 17, Architektur- und Baufachverlag Wien, Vienna, 1985.

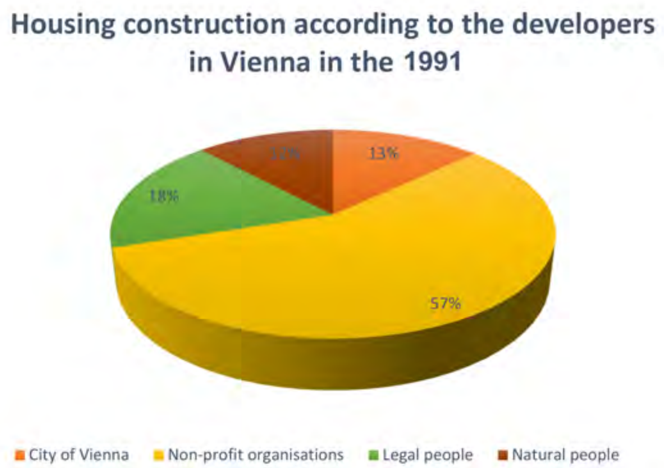


Figure 45: *Housing construction according to the developers in Vienna in the 1991s, made by the author*

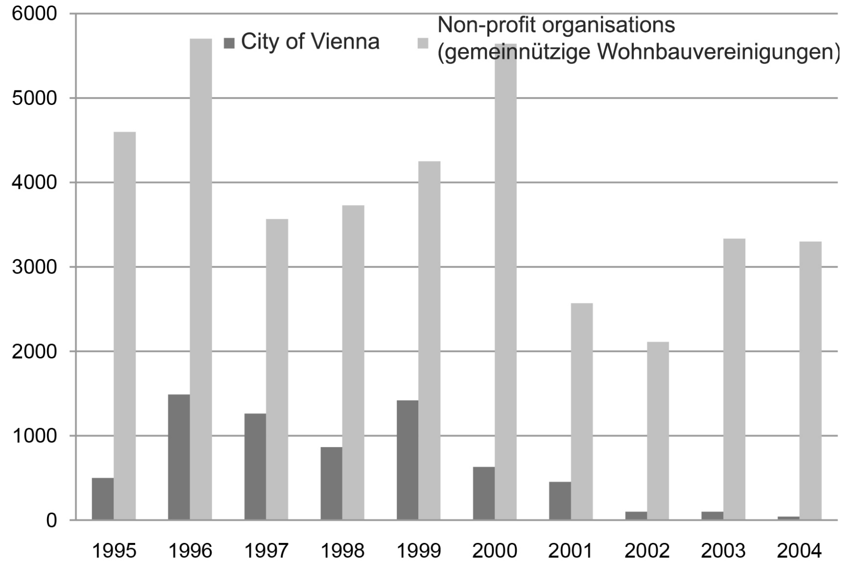


Figure 46: *Housing by City of Vienna (Gemeinde Wien) and non profit organisations (gemeinnützige Wohnbauvereinigungen)*

concept and design.

The decision of §28 para. 1 of WWFSG 1989 determined that all construction projects built with the help of public funding of the Province of Vienna had to be submitted for assessment by the Land Advisory Board before the assurance of funding. Another tool was introduced to manage the housing policy which desired a social mix of residential complexes and influenced the municipality in the contracting process. Applicants for these subsidies had to commit that one third of the apartments would be represented by the Wohnservice Vienna to receive the award.[125] These apartments remain the property of applicants, but the allocation is done by clearly defined social and economic criteria.[126]

As part of the current urban renewal and expansion projects in the Wiener Wohnbau (Vienna Housing), the Wiener Stadterneuerungs- und Bodenbereitstellungsfonds –WBSF (Vienna Land and Urban Renewal Fund) was established in 1984 and received access to all property for public subsidized housing and resold the funds to property developers (Bauträger).[127] In the same year the Housing Promotion Act was developed, and parallel to these regulations an urban development plan STEP 1984 was also brought into action. In 1991 in local council the guidelines for Urban Development Vienna was decided and an advisory council was constituted to ensure high quality standards in the planning and implementation of urban expansion projects.[128]

In the eighties, the first ecological tendencies in housing were also noticeable. The increase in oil prices was an important reason for this

125 https://www.wien.gv.at/rk/msg/2010/07/18001.html, access: 04.10.2015.

126 Six, K.M., Sozialer Wohnbau in Wien-Partizipation als Auswirkung Veränderter Wohnbedürfnisse, Master Thesis, Technical University of Vienna, Institute for History of Art, Building Research and Preservation, Vienna, 2011.

127 IS Wohnbau, Stadterneuerung versus Stadtentwicklung, 2007. Available at: http://www.iswb.at, access: 05.10.2015

128 Pirhofer, G., Stimmer, K., Theorie und Praxis der Wiener Stadtplanung von 1945 bis 2005, Stadtentwicklung Wien (Eds), Vienna, 2007, p. 117-118

awareness.[129] Participatory planning, which started to be a character in the 1970s, continued to be a consideration in the 1980s.

It has been developed a ten-year program for the renovations of old buildings by mayor Gratz.[130]

2.7. From the 1990s

The city of Vienna itself withdrew more and more from construction and after 1986, it was clear that the construction of residential buildings was carried out mainly by non-profit housing associations (gemeinnützige Wohnbauvereinigungen).[131](See Figure 45)

In the context of the Vienna urban renewal and ground deployment fund, a group of developers implemented new and attractive projects in urban expansion areas designed by renowned architects who had been invited to raise the image and prestige of Vienna. One project was undertaken in 1994 in Spittelau, with the invitation of world renowned architect Zaha Hadid by Hannes Swoboda, who was planning councillor, and Michael Häupl, who was environmental councillor, at the time.[132]

In 1995 Vienna´s housing policy was transformed due to two significant changes. The city of Vienna decided in the mid- nineties to withdraw gradually from active housing construction and transfer the establishment of new-subsidized dwellings mainly to the non-profit housing co-operatives (Wohnbaugenossenschaften). An important management tool was created with the introduction of "public property development competitions (Bauträgerwettbewerbe)", which would bring both an increase in quality and a reduction in costs. The tendering and evaluation of the competition entries via the Wohnfonds Wien, which is an office of the Land Advisory Board, and a successor organisation known as WBSF, started in 1984.

The active housing building by City of Vienna has a rapid decrease after 2000. Active housing building, has been transferred to non-profit organisations after 2004 and the responsibilities of city of Vienna have been management of housing sites and providing subsidies with prerequisites about ecological, economic and social sustainability and architectural quality.[133] (See Figure 46)

From the year 2000, the idea of the passive house has been an important issue in housing and a lot of passive houses have also been built within the program of public property development competition. In the current years, the passive house has developed into plus-energy house which actually produces more energy than needed.[134]

- **Wiener Wohnfonds and Bauträgerwettbewerbe (Public Property Development Competition)**

The Wohnfonds Wien was founded under the name Vienna Land and Urban Renewal Fund (Wiener Bodenbereitstellungs- und Stadterneuerungsfonds-WBSF) as a subsidiary of the City of Vienna in 1984.[135] Since 1995 it has had the mission to promote and award through the quality instrument Bauträgerwettbewerb (public property development competition) and Land Advisory Board in subsidized housing. Wohnfonds Wien coordinates property developers, house owners, municipal departments and service centres of the municipality of Vienna as a non-profit organisation and provide subsidies for new housing construction and also for renovation of old residential houses.[136]

129 Schluder, M., 10 Jahre Bauträgerwettbewerb Veränderungen im Wohnbau, Studie beauftragt durch MA 50 Wohnbauforschung (Housing Research), Vienna, 2005, p.10

130 Marchart P., Wohnbau in Wien 1923-1983, Compress Verlag, Wien, 1984, p.37

131 Stücker, F., Bauträgerwettbewerb-Eine Chance für Architekten? Zum Wettbewerbswesen im Sozialen Wohnbau der Stadt Wien von 1919 bis 2010 (Building Property Development Competitions, A Chance for Architects? Competitions in Social Housing of City of Vienna from 1919 until 2010), Master Thesis, Institute for Art and Design-Three Dimensional Design and Model Building, Technical University of Vienna, 2011, p.50.

132 https://www.wien.gv.at/rk/msg/1994/1214/002.html, access: 10.09.2015.

133 See also Roland Rainer Forschungsstipendium 2010. Available at: http://www.architekturwettbewerb.at/data/media/med_binary/original/1281333650.pdf, access: 12.18.2015

134 Bundesministerium für Verkehr, Innovation und Technologie (BMVIT), Gebäude maximaler Energieeffizienz mit integrierter erneuerbarer Energieerschliessung, Berichte aus Energie- und Umweltforschung (Reports from Energy and Environment Research), 56a/2012, Vienna, p.23

135 Schluder, M., 10 Jahre Bauträgerwettbewerb Veränderungen im Wohnbau, Studie beauftragt durch MA 50 Wohnbauforschung (Housing Research), Vienna, 2005, p.1

136 Wohnfonds_Wien, available at: www.wohnfonds.wien.at., access: 27.10.2015

In the course of amending the Viennese Housing Promotion Act in 1989 promoting facilities for the use of environmentally friendly forms of energy was added as an essential complement in 1992. Since 1996 the newly built projects have to reach low energy standard to obtain a grant.[137]

In the concept of Bauträgerwettbewerbe architects and property developers cooperate to participate in this competition. The goal is to increase planning, economic, ecological and social qualities in subsidized housing according to the information and circumstances of Wohnfonds Wien.[138] Wohnfonds Wien has implemented the `four-pillar-model`, comprising architecture, ecology, economy and social sustainability. Following these criteria, every subsidised housing construction project is reviewed either by the Land Advisory Board or in a public property development competition.[139]

"The "Bauträgerwettbewerb (public property development competitions)" as an instrument of the subsidized social housing in Vienna, represents a rewarded process. This provides the identification of project teams, who provide implementation of optimized design concept (architecture, ecological, economic concepts, also including social sustainability) convenient to the advertised building sites. As a result, these teams also implement the projects regarding property acquisition under the utilization of housing subsidies."[140]

As a result of the Vienna promotion system many benefits have been recorded. An active and successful housing policy strategy has been provided which defines and implements quality and sustainability criteria. This system also promotes the construction industry, ensures balanced private sector competitions and public control, and influences real estate market.

137 Schluder, M., 10 Jahre Bauträgerwettbewerb Veränderungen im Wohnbau, Studie beauftragt durch MA 50 Wohnbauforschung (Housing Research), Vienna, 2005, p.17

138 Ibid. p.1

139 Ibid.

140 Liske, H., Der Bauträgerwettbewerb als Instrument des geförderten sozialen Wohnbaus in Wien – verfahrenstechnische und inhaltliche Evaluierung, Baden bei Wien, 2008, p. 7. Translated by the author from German.

2.8. Transition to Sustainable building: Measures and Initiatives in Austria

After the oil crisis in the 1970s in Europe, a radical change in perspective and energy and environmental issues took place in all Europe countries. Austria, as one of the main actors following environmental trends in the EU, tried to develop concepts of energy efficiency in buildings. Houses with solar energy concepts and alternative energy resources have been implemented. House Fischer am Grundlsee was the first prototype of a sun house in Austria and was built from 1972 to1978.[141]

2.8.1. Passive House Era and Initiatives in Austria

Vorarlberg, with its ecological, economic, social, and innovative concepts is a very good example of sustainable development. In the 1960s it had already tried to implement these concepts, which were based on efficient structure, maximum usage of resources, usability, and the requirements of habitants, before the term "sustainability" was mentioned at the Brundlandt conference. Traditional principles were combined with innovative techniques, and the power which the region needs is produced by combining solar energy and biomass. The passive house roof and first passive house was also first designed in Vorarlberg. After the first passive house in 1996, two years a housing complex was designed with passive house technology by architect Unterreiner in Vorarlberg.[142] In 2015 there are more than 36000 passive housing units in Austria.[143] In order to support innovative, sustainable concepts for buildings, the Austrian Ministry of Transport, Innovation and Technology developed the "Haus der Zukunft, Building of Tomorrow" initiative. The most important developments are implemented in the low-energy approach and the passive house. The aim

141 https://www.tugraz.at/tu-graz/services/news-stories/tu-graz-news/aktuelle-news/einzelansicht/article/fwf-foerdert-architekturprojekte-der-tu-graz/, access:08.10.2015.

142 http://www.architekt-unterrainer.com/projects, access 05.05.2015.

143 IG Passivhaus. Available at: www.innovativegebaeude.at, access: 05.07.2015

of the program was described as:[144]

- To reduce energy and material use significantly
- To increase the use of renewable energy sources, especially solar energy
- To increase usage of ecological materials efficiently
- To support social aspects in buildings and improve quality of life

The Haus der Zukunft Initiative has been a leading actor for the passive house development in Austria. The second phase of the program was *"building of Tomorrow Plus"* to encourage buildings to produce more energy than they need during their life of operation. The Austrian Ministry of Transport, Innovation and Technology has provided more than 35 million euros in support since the beginning of 2010.[145] It has been due to this initiative that passive house density in Austria is very high relative to the rest of the world and that Austrian companies have become leading actors for technological construction of sustainable building in the world.[146] They have provided scientific expertise in the field and a background for the program *"klima: aktiv haus"*, which is an initiative to protect climate, and part of Austrian climate strategy.[147] It was launched in 2004 by the Austrian Ministry of Agriculture, Forestry, Environment and Water Management. The aim of the initiative is to contribute to the development of climate friendly technologies and services. It has established building standards as a benchmark for ecological buildings to assess the quality of the planning and execution, the building material and construction quality, comfort and air quality which also enhances the quality of life. The Klima aktiv standard has also been a quality benchmark for the Austrian State Awards for Architecture and Sustainability.

144 Bundesministerium für Verkehr, Innovation und Technologie (Austrian Ministry for Transport, Innovation and Technology), "10 Jahre Programmlinie Haus der Zukunft 1999-2009", Wien, 2009, p.5.

145 Bundesministerium für Verkehr, Innovation und Technologie (Austrian Ministry for Transport, Innovation and Technology) , "10 Jahre Programmlinie Haus der Zukunft 1999-2009", Wien, 2009, p.5.

146 Ibid.

147 Klima:aktiv Gebäudestandard. Available at: www.klimaaktiv.at, access: 08.05.2015.

The klima aktiv has achieved a great deal since 2004; transparent standards, advice and support for building and renovation, for heating systems and heating plants, on how to save energy, and won the award for best practice, EPSA, in the 2011.[148] klima:aktiv provided to optimize production processes for many companies and, by integrating other measures, CO_2 emissions have been decreased by 1.6 million tons a year.[149]

Another effective scheme to support initiative concepts and sustainability was "Smart City Wien", which was launched by Mayor Michael Häupl in 2011. The most important aim of the strategy is efficient use of resources and reduction of CO_2 emissions in order to provide resource conservation and also improvement of the quality of life for all people.[150] The program has constituted some objectives for the future:[151]

Building objectives:

- Zero-energy building standards for all new structures, renovations and refurbishments to optimize costs from 2018-2020 and to protect climate better by developing heat supply systems further
- To reduce energy consumption of existing buildings for heating/cooling/water by one percent per capita and year by comprehensive rehabilitation activities.

Energy objectives:

- Increase energy efficiency and decrease final energy consumption per capita in Vienna by 40% by 2050 (compared to 2005)
- Primary energy input per capita should be decreased to 2000 watt from 3000 watt.

148 Bundesministerium für ein Lebenswertes Österreich (The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management), Annual Report 2011- Netzwerk für den Wandel, Vienna, 2011, p.3

149 Ibid.

150 Smart City Wien, "Smart City Wien Framework Strategy", Vienna City Administration, Vienna, 2014

151 Kalfaoglu Hatipoglu, H., (2016), Austrian Sustainable Building PolicyLessons for Turkey, International Journal of Environmental Science and Development, Vol.7, No.5, May 2016.

- Over 20% of Vienna´s gross energy consumption will be gained from renewable resources in 2030, and over 50% in 2050.

CO_2 consumption was reduced by 3.7 million tons through the Vienna Climate Protection Program *(Klip:Klimaschutzprogramm)* at the end of 2011.[152]

This also initiated some assessment systems to measure quality and sustainability, which is very important in promoting sustainability. *The Austrian Society for Sustainable Building (Österreichische Gesellschaft für nachhaltiges Bauen-ÖGNB*), which was founded in 2009 by the Austrian Institute for Building Biology and Ecology and the Austrian Institute for Ecology, produced an assessment system TQB tool, including criteria catalogue, to define requirements for sustainable buildings,. Like many other international tools (LEED, BREEAM), this system provides assessment and energy performance certificates.

The Austrian Sustainable Building Council (Österreichische Gesellschaft für Nachhaltige Immobilienwirtschaft,ÖGNI) which was also founded in 2009 in order to search for building solutions through using and managing sustainable real estate, and is linked to German Sustainable Building Council (DGNB), adapted the DGNB assessment system to Austria.

2.8.2. Regulations and Strategies to support Sustainable Building Policy in Austria

The Austrian government adopted the *Austrian Strategy for Sustainable Development (NSTRAT-Österreichische Strategie für Nachhaltige Entwicklung*) in 2002. This includes 4 categories; quality of life in Austria, Austria as a dynamic business location, Austria as a living space and Austria´s responsibility. In 2010 this strategy was regenerated as *ÖSTRAT* to provide a guideline towards the sustainable development of Austria.

152 Smart City Wien, "Smart City Wien Framework Strategy", Vienna City Administration, Vienna, 2014, p.25

Another important development is "*the Building Energy Performance Directive-EPBD*" which was approved in 2002 to improve energy performance in buildings within the EU.[153] Austria brought the EU Energy Performance Certification into national law to harmonize building regulations in response to the "*Österreichisches Institut für Bautechnik, OIB (Austrian Institute of Construction Engineering)*" in Guideline 6: Energy saving and heat insulation.[154]

Between 2005 and 2009 a number of measures were taken through Austrian policy to reach energy policy objectives. The EU´s Climate and Energy policy 20/20/20 targeting; reduction in greenhouse gas emissions of at least 20% below 1990 levels, 20% of energy consumption to come from renewable resources, and an increase in energy efficiency by 20% by 2020, accelerated the energy efficiency strategy of Austria. In 2009 Austria developed measures for the energy efficiency strategy in nine different fields and made 370 recommendations, from180 experts in different fields. Austria's 2020 targets have been defined to include: 20% more energy efficiency, a 34% share of renewable energy, and a 16% reduction of GHG emissions in non-ETS sectors (a reduction by 39% compared with 2005).[155]

Energy efficiency and quality of life have been key points of Austrian sustainable building policy. In buildings to decrease heating and cooling demand and energy use in households, efficient mobility has been an important issues to address. A stimulus package for thermal improvements has been developed by the Austrian Minister of Economy and Minister of Environment which include renovation projects as well as new projects. It was provided about 100 million euro subsidy for the thermal rehabilitation of buildings until 2014.[156]

153 International Energy Agency, Transition to Sustainable Buildings: Strategies and Opportunities to 2050, IEA Publications, Paris, 2013. P.72.

154 Austrian Institute of Construction Engineering (Österreichische Institut für Bautechnik), OIB Guideline 6- Energy Saving and Heat Insulation, March 2015

155 Kalfaoglu Hatipoglu H., Austrian Sustainable Building PolicyLessons for Turkey, International Journal of Environmental Science and Development, Vol.7, No.5, May 2016.

156 Österreichische Parlament. Available at: www.parlament.gv.at/PAKT/VHG/XXIV/AB_08567/fnameorig_227295.html, access: 27.02.2016.

with holistic architecture; because *"the whole is more than the sum of its parts"* *(Aristotle)*.

more opportunities for the world and for the inhabitance

by the author

IV. A FRAMEWORK FOR ASSESSING SUSTAINABLE HOUSING QUALITY- SHQ

People recognize that good quality of life brings happiness and that happiness is more important than a whole range of factors including economic development. According to a questionnaire about housing densities, 74 per cent of respondents agreed that "quality of life is more important than economic development".[1] Living in a quality environment is a key element in improving people's lives, and the buildings they live in are the most important parts of this environment. The high quality environment engenders a feeling of belonging: a happy, attractive and healthy place for today and in the future. Due to the current environmental problems and concerns about our future, it is necessary to have a sustainability framework to design this high quality environment, which requires holistic thinking. While supplying liveable residences for inhabitants considering their needs and desires, negative environmental impacts should be minimised. These are prerequisites of sustainable communities that well-designed architecture can contribute to, and as mentioned before, "*lifestyle change cannot be imposed, but it can be encouraged by good design*".[2] This means that architecture is a key positive influence on society.

When greater consideration is given to the human-living-environment relationship, housing quality improves. If designers understand the influencing factors of this basic relationship and implement the ideas in the design, the residential areas are able to achieve a high quality of life. Following this concept, high-quality design of residential areas can be successful when the influencing factors have been well described and included in the design. According to Vitruvius, architectural quality is provided by the three features of "utilitas (convenience), venustas (beauty), firmitas (durability)".[3] Sir Henry Wotton translated this trio as "commodity, firmness and delight".[4] In this work, Vitruvius's philosophy has been modified and the three points are built upon to consider the current problems and challenges of the world. Planning quality housing is the sum of both design and construction quality. Possible quality headings are shown as a diagram in Figure 47. In order to design quality housing sustainably, the important indicators of design and planning quality are classified into three quality categories: social-functional quality, aesthetic quality and energy performance and construction quality. The chosen case studies are measured according to these aspects to determine the housing quality, and the quality criteria provide a crucial framework to guide the holistic vision for quality leading to sustainability.

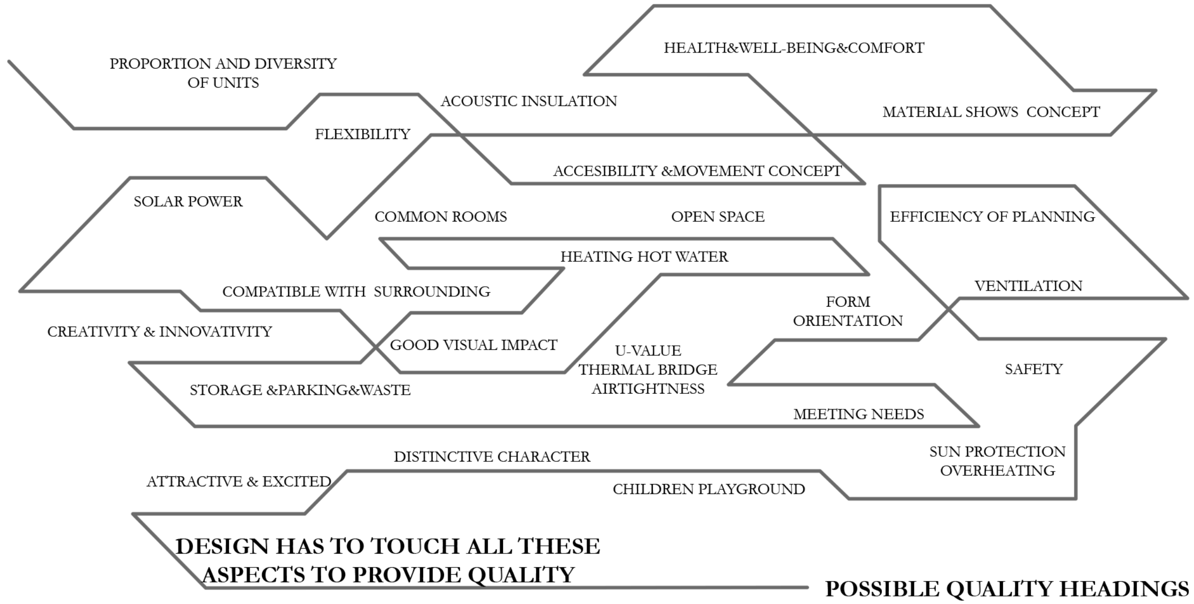


Figure 47: *Possible Quality Heading, made by the author*

The background work analyses the housing situation in both Vienna and Konya-Turkey and seeks to explain housing in relation to the context of both places. Information and necessity about housing quality, housing assessment and sustainability are also described in the previous section.

1 Platt, S. et.al., Housing Futures: Informed Public Opinion, York: Joseph Rowntree Foundation, 2004.

2 Edwards, B., Turrent, D., Sustainable Housing: Principles and Practice, London: E&FN Spon, 2000.

3 Morgan, M. (translated), Vitruvius-The Ten Books on Architecture, New York: Dover Publications, 1960.

4 Wotton H., The Elements of Architecture, London, 1624. Eds.by Charles Davis, Fontes 68 Edition, 2012. Available at: http://archiv.ub.uni-heidelberg.de/artdok/volltexte/2012/1870/urn:nbn:de:bsz:16-artdok-18707, access: 10.8.2015

Additional to these information, the selection criteria have been defined and explained as considerations to evaluate sustainable housing quality in this chapter (see Figure 49). This evaluation framework demonstrates important aspects that have to be taken into consideration in planning process of (large-scale) housing developments.

Sustainable architectural objectives which lead to a holistic thinking, can be summerised according to the author as; increasing economic measures, reducing the impact on environment, increasing social usefulness and consideration of user and nature as the core of design, increasing the quality and optimisation, increasing aesthetic and visual quality.

An appropriate assessment instrument was developed to carry out an investigation with three basic criteria: (see Figure 48)

- Social-functional Quality Analysis- SFQA
- Aesthetic Quality Analysis- AQA
- Energy Performance and Construction Quality Analysis – ECQA.

The evaluation analyses the project both qualitatively and quantitatively according to these three criteria. Various analysis methods were used, including data analysis of the project (plans, photos, and observations), yes/no questions, and quantitative analysis.

Figure 48: *SHQ - Assessment Criteria, made by the author*

METHODOLOGY DIAGRAM

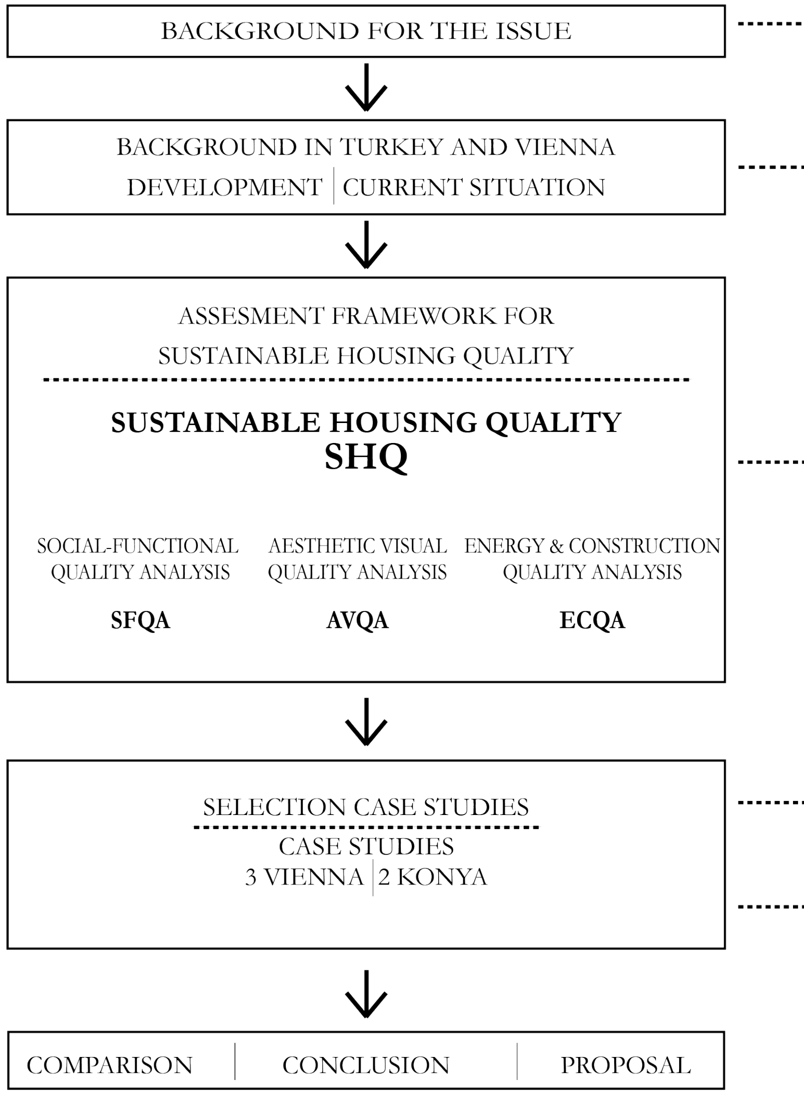


Figure 49: *Methodology Diagram, made by the author*

DEFINITIONS EXPLANATIONS

SELECTION CASE STUDIES

- Multi-unit housing created as a housing complex
- Not older than 8 years, newly built housing
-Examples for households on the avarage income
-Well-known examples

SHQ

SFQA

-Meeting Needs
-Accesibility&Movement Concept
-Efficiency of Planning
-Flexibility
-Safety
-Health&well-being&Comfort
-Open Space
-Common Rooms&Facilities
-Children Playground
-Proportion&Diversity of Living Units
-Storage&Parking&Waste Service

AVQA

-Creativity & Innovativity
-Good Visual Impact
-Compatible with Surrounding
-Distinctive Character with Identity
-Attractive & Excited
-Material shows Concept

ECQA

-Form-Orientation
-Building Components U-Value& Thermal Bridges & Airtightness
-Heating & Domestic Hot Water
-Ventilation
-Solar Power
-Sun Protection & Overheating in Summer
-Acoustic Insulation

DATA COLLECTION

The evaluation of social-functional and aesthetic qualities includes the yes/no questions and density-diversity tables, prepared by the author, for each project according to the quantitative project data in addition to the qualitative data analysis of the housing project according to the principals of the criteria described.

HQI[5] and the ideas of Voordt and Wegen[6] about the evaluation of buildings have assisted the definition of the questions relating to social-functional quality and important principals related to the defined criteria. .

The evaluation of energy performance and construction quality analysis include quantitative methods, which are described in the following paragraph, in addition to data analysis of the project according to criteria of energy and construction qualities of SHQ

GEQ energy performance software programme has been used to show the thermal conductivity of materials and components.[7] The GEQ programme does not have settings for the climate conditions in Turkey, thus for the building performance calculations of the buildings in Turkey, the ÖIB Excel Table[8] has been utilised and the local climate information has been taken from the "climate.data.org"[9] database. Acoustic insulation of building components and summer overheating of rooms have also been measured and simulated in the GEQ software programme.The "u-wert-net"[10] software has been used to determine the U-values of building components and the materials of building components have been drawn as detail drawings by the author. The U-values required by OIB (Austrian Institute of Construction Engineering) Guidelines have been shown in each building component at the top of the drawing, and it is shown in a diagram where the U-values of the components range between "insufficient" and "excellent". Moreover, it is demonstrated at the bottom whether this required value is satisfied or not, and the needed heat insulation material thickness in order to satisfy the OIB Guidelines as well as other guidelines such as the EnEv new building standards, passive house standard etc. The "Passitherm pro" software has been used to calculate thermal bridges of building components. The required data for the projects, such as the energy certificate, floor plans and sections, have been obtained from the project architects and the related municipal authorities.

The combined results from the simulations, qualitative data analyses partially including yes/no questions, and the information about the current context and policy of both cities, allow for a comparison of the case studies to see the differences and improvement potential in different residential complexes.

The case study examples allow for a deeper analysis of the concepts of sustainable housing quality. As was mentioned in the aim of this work, the goal of the project is to find a way to compare these examples in order to improve the housing quality in Turkey by learning from housing examples in Vienna.

The case studies are chosen from multi-unit housing complexes in Konya, Turkey and from Vienna based on subjective preferences. The multi-unit housing estates in Turkey are called "toplu konut", which translates into English as "mass-housing". In Vienna, the housing estates are called "Wohnsiedlungen" in German, which are similar to the Turkish examples and built for the same purpose as multi-unit housing, however, the housing is more social because of the positive social housing background of Vienna.

The chosen case studies from Konya represent the middle class, which are not really affordable to the average family. The government housing estate case study is more affordable than the privately developed residential case study. There are many examples of poorer quality multi-unit housing in Konya and throughout Turkey from both from government and private developers. The Viennese case studies are affordable within Vienna. Social housing is subsided housing by the government and is realized as a result

5 721 Housing Quality Indicators (HQI) Form, The National Affordable Homes Agency, Housing Corporation, 2008

6 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005.

7 GEQ Version 2015, Zehentmayer Software GmbH, 1994-2015

8 www.oib.or.at/sites/default/files/ea-wgv-2012-01-01-v10b2.xls, access: 15.07.2015

9 Climate Date for Cities Worldwide. Available at: http://en.climate-data.org/, access: 07.07.2015.

10 U-Wert Rechner. Available at: https://www.u-wert.net/?lv=1

of "Bauträgerwettbewerbe", a public property development competition.

Indicators of Sustainable Housing Quality – SHQ

In this study, the indicators of sustainable housing quality are classified and analysed in three main categories, which can also be used as a guideline to demonstrate housing quality towards sustainability. These planning strategies demonstrate a holistic approach in housing planning and are also criteria for the assessment and comparison of the housing estates of the case studies in Vienna and Konya.

It is difficult to measure sustainability or housing quality. However, it can be stated that progress has been made, thanks to a conscious design logic, placing people and nature in the centre and by staying away from standardization. The main principle of sustainable architecture is to design well by establishing connections between form and content, as well as form and aim. Actually, the main concept can exist as a morphological root, but necessary changes can be made in the environment, conditions, needs and requests according to the adjustments of each criterion after the necessary evaluations have been conducted.

"*Good design is an integral and essential part of rethinking construction. It is key to many of the performance targets, to reducing construction time and defects, to sustainability and to respect for the environment. In the broadest sense, good design is key to respecting people, whether they be users of a building or passers by...*"[11]. Accordingly, it can be understood that good design provides quality of life and all users should be able to benefit from better design and quality, which leads an equality. Sir John Egan's report, "Rethinking Construction"[12] demonstrated that best practice is integrating design and construction together, and that it delivers better value for money as well as better buildings, particularly when attention is paid to the full costs of a building over its whole lifetime. Defining good design as integrated design and construction makes it possible to achieve good design quality. It means that design is the process in which intelligence and creativity are applied to the planning process. A good design for providing housing quality includes factors such as functional quality (i.e. providing needs and requirements), structural quality, lifetime costing, sustainability, and creativity. Good design is also related to protection of the environment. Providing these qualities can increase outputs and contribute to the quality of life. We can summarize that good design adds value to the planning process by providing functionality (service enhancement), reducing life-cycle costs (energy efficiency), architectural quality and wider social and environmental benefits.[13]

As a consequence, the successful design of a good quality sustainable residential project depends on the balance between a range of factors. It requires a critical consciousness of societal requirements as a creative and intellectual performance so it must be socially compatible, providing liveable spaces for inhabitants, and must have technical, functional, social and aesthetic qualities. Moreover, economic and ecological aspects must be considered. It is not enough to create a structure, which is technically optimal; the structure should also meet the aesthetical, social, formal, creative design requirements. If we want to measure good design, we can summarize it as the sum of function, service enhancement, efficiency and aesthetics.[14] Design and creativity form part of the core architectural thinking but they must be expanded to include systematic supplements. Creative talent in combination with analytic and scientific knowledge (data) provides more healthy and qualified living spaces. Otl Aicher indicated this fact 30 years ago with his statement: "*The Virtue of science and knowledge is transferred to design. The virtue of science is curiosity, not knowledge. We design, because we are searching, not because we know*"[15] All that concludes that architectural design and planning occur and develop as a result of design and analyses process in a holistic architectural approach.

11 RT Hon John Prescott (1999) DETR Press release, 19 July 1999. Prince of Wales.

12 Egan, J., Rethinking Construction: Report of the Construction Task Force, HMSO; London, 1998. Available at: http://constructingexcellence.org.uk/wp-content/uploads/2014/10/rethinking_construction_report.pdf.

13 Treasury Task Force, How to Achieve Design Quality in PFI Projects, Technical Note 7, HM Treasury, London, 2000

14 Treasury Task Force, How to Achieve Design Quality in PFI Projects, Technical Note 7, London, 2000.

15 Otl Aicher, Die Welt als Entwurf, Berlin, 1991. Translated by the author. Original text: "Die Tugend der Wissenschaft überträgt sich auf das Entwerfen. Die Tugend der Wissenschaft ist Neugier, nicht das Wissen. Wir entwerfen, weil wir suchen, nicht weil wir wissen.".

Additionally, the government and local authorities have to consider relevant measures for this challenge, and in order to solve this complexity "holistic thinking" is required. Holistic thinking is indicated in sustainability, which also includes the qualities of design processes.

SHQ Assessment Analysis

1. Social-Functional Quality Analysis - SFQA

Social quality is a concept related to the satisfaction level with building use, and to the encouragement of people's solidarity (communication). In other words, this concept is about human-centred planning.

Littig and Griessler describes social sustainability as *"Social sustainability is a quality of societies. It signifies the nature-society relationships, mediated by work, as well as relationships within the society. Social sustainability is given, if work within a society and the related institutional arrangements which satisfy an extended set of human needs and are shaped in a way that nature and its reproductive claims of social justice, human dignity and participation are full filled."*[16] According to the above definition, social sustainability is the organisation of social-natural relationships allowing for lasting environmental quality. Moreover, social sustainability promotes social integration in a way that improves the quality of life for all people equally.[17]

Social sustainability addresses to a quality which react to the requirements of society by ensuring nature-society-human relationship in a long term consideration. Social quality and sustainability make houses liveable, and links "the form of the city's public places and city dwellers social, emotional and physical well being".[18] Social quality emphasizes quality of life enhancement, the protection of mental and physical health, and the improvement of human relations. The actualization of this purpose is possible through human-centred (functional) living areas that meet people's needs. Therefore, it can be concluded that this concept is bound with the definitions of the needs and with the concept of "functional quality", which meets these needs. Therefore, in this section, social quality is analysed together with functional quality.

Function is one of the cornerstones of design. Functionality is described in the Merriam-Webster´s Dictionary as, *"the quality of having a practical use: the quality of being functional and the particular use of set of uses for which something is designed."* Voordt and Wegen describe the word as: *"… the function or functions performed by something, in this case a building. Thus, the functional quality of a building means its ability to fulfil the functions envisaged for it."*[19]

There have been a lot of debates about the priority of form or function, if form follows function or the opposite. The architect Louis Sullivan stated that, *"Form follows function… This is the law"*.[20] Frank Lloyd Wright built upon the ideas of Louis Sullivan and created a new statement about these terms and explained these as "Form and function are one, have we stated the case for architecture. That abstract saying form and function are one is the centre line of architecture."[21] Both of these features have an enormous effect on housing quality and the main determinants of the structure, also in a harmony with other features.

Functionality is the ability to fulfil certain functions that depend on needs or requirements, suitable for the activities for which it was intended. In the 1960s, De Bruijn, one of the founders of functional analysis as a discipline

16 Beate Littig, Erich Griessler, "Social Sustainability: A Catchword between Political Pragmatism and Social Theory", in International Journal of Sustainable Development, Vol.8, 2005, p 72.

17 Polese M, Stren R, The Social Sustainability of cities: Diversity and Management of change, University of Toronto Press, Toronto, 2000, P 15.

18 Crowhurst Lennard, S.H. and Lennard, H.L., Livable Cities: Social and Design Principles for the Future of the City, Gondolier Press, Southampton, New York, 1987.

19 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005.

20 Sullivan, L. H., Kindergarten Chats and Other Writings, New York, 1979

21 Lloyd, F.W., The Future of Architecture, New York, 1953. Cited in: Cesar, A.C., "Wright´s Organic Architecture: "Form follows Function to "form and function are one" in Journal Wolkenkuckucksheim, No:32, 2012.

at Delft's Faculty of Architecture, distinguished four different functions:[22]

- Protective function: the protection of people and property against harmful influences and dangers, e.g. wind and rain, inquisitive onlookers or interference.
- Domain or territorial function: buildings make it possible to operate in a place of one's own, without disturbance from others. Key words are privacy, safety, and security.
- Social function: buildings create spaces and places, in which people can carry on their activities optimally. Primary elements here are health, welfare, communication and quality of life.
- Cultural function: a building must also satisfy requirements relating to the form and character of the spatial environment. The cultural function involves aesthetic, architectonic, urban design, planning and environmental factors. Culture also includes the notion of civilization, one of whose implications are that buildings and the activities they accommodate should not be a nuisance or cause damage to the environment.

The architecture critics Hillier and Leaman also distinguish four main functions of a building, but divide them up differently as shown below.[23]

- Spatial organization of activities, which includes an organisation of space efficiency
- Climate regulation, which includes the optimal regulation of the interior climate for the user.
- Symbolic function, which includes specific ideas and requirements of designers and users and represents symbolic significance and meaning
- Economic function, which includes economic value (cost maintenance and management).

All these different classifications show that several functions benefitting users must be implemented for functional quality. Housing can be functional if the whole design concept, the assigned functions and spaces, detail and interior designs, infrastructural accessibility as well as the supply and disposal functions are optimized in relation to each other and the use demands referring back to holistic architecture.

The people inside the building must be able to function efficiently, comfortably, healthily and safely. This means that people must be able to reach and access the building easily and move around the building comfortably. The building must be sufficiently in harmony with human perceptions. People should also feel physically comfortable, which means that the building must not be too hot or too cold, dirty, dark, or noisy. People should be able to see how the parts of the building fit together and be able to find their way around. All kinds of psychological needs must be met, e.g. the needs for privacy, social contact, freedom, choice and autonomy. The building must also be capable of adapting to suit changing circumstances, new activities and different users.[24] The building also provides a functional framework, within which human activities can be carried out. These activities are socially-determined, thus giving buildings social meaning.

The criteria of social-functional quality are described in the following subsections.

1.1. Needs-Oriented Design

Defining needs, targets and qualities are essential for beginning the planning process for a qualified and successful design. It is very important to meet these needs and requirements. Reconsidering requirements and targets,

22 Zeeman, J., Funktionele analyse. Voorbereiding en methodiek bij het ontwerpen van gebouwen (Functional analysis. Preparation and methodology for the design of buildings). Lectures by W.N. de Bruijn. Faculty of Architecture, Delft University of Technology, 1980.

23 Hillieer, B., A. Leaman, "Architecture as a discipline", Journal of Architectural Research, Vol.5, No.1, 1976.

24 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005.

and critically examining and outlining the alternatives are elementary components of defining the task. Here the architect is in demand both as a professional and as an advisor. They should identify solutions, educate and inform their clients about the relevance of individual aspects and themes. Different methods and tools can be used to support this process: the quantitative targets for costs, energy consumption, and floor space complementing the qualitative aspects such as guidance, intimacy, calm, centrality, atmosphere and materiality through use of evaluation matrices allow for further interaction (comparison) of the individual housing ideas and housing needs of occupants.[25]

Human needs are very important to housing design. Through the recognition and description of the housing needs (partially housing quality and housing needs), it will be possible to define housing quality. These needs can be summarized and grouped as follows:[26]

Protection needs: Included in this category are protection against cold and heat, and protection of intimacy and privacy, protection of well being, protection against psychological impairments etc.

Communication needs: These needs include the need for social contact with other people and contact with the environment (extrasensory perception) and creative-interactive contacts (for example design of living rooms).

Control Needs[27]: People wish to control conditions and demands by themselves; for example, the regulation of room temperature, air exchange, sunlight, and the incidence of light.

Need for Activity and Rest: The need to be active includes activities such as work, hobbies, sports, and games, and the need for rest includes possibilities for relaxation and sleep.

The Brundland definition of sustainability is to "[meet] the needs without compromising the ability of future generations to meet their own needs", which is a very general definition and has been criticized due to its vagueness[28] because it can effectively allow "a comfortable way of life" and all the desires of architects and clients.[29]

Meeting our human needs does not justify a "business as usual" strategy. A consequence of different behaviour forms and different cultures, it has been comprised of various and multi-level lifestyles. However, it can be assumed that attitude and behaviour styles are shaped by a value system, which relates happiness with consumption and does not even generally provide satisfaction, both in Turkey and all over the world. The sentence by Erich Fromm, "*I am what I have and what I consume*"[30], describes this ideology and value of the consumptive lifestyle. This lifestyle corresponds to the fourth level of Maslow's Needs Pyramid, which is called "ego needs: self-esteem"[31]. Thus, transforming into a sustainably-oriented community has an important role to define these human and social needs in a reasonable and logical way. Architecture can support this reasonable change to a sustainable community by increasing energy efficiency, self-sufficiency and positioning humans and nature in the centre of design. The building users have to define themselves as "citizens" and not "consumers", question the exaggerated needs, decrease consumption of resources and take precautions to support this process.

It is very important for people to occupy places, as they are required in their living spaces. This is an important issue affecting the "ecological

25 Drexler und Khouli, Nachhaltige Wohnkonzepte, Detail Edition, München 2012, p 58.

26 Deinsberger-Densweger H., "Living Quality and Thermic Optimization from a Housing Psychological View", published and presented in "Ökosan 09" International Symposium in High Quality Thermal Retrofitting of Large-Volume Buildings, Weiz-Austria, October 2009, p. 2. Available at: http://www.wohnspektrum.at/index.php/angebote/publikationen-vortraege, access: 08.07.2015.

27 Fischer, M. & Stephan, E., „Kontrolle und Kontrollverlust", in Kruse / Graumann / Lantermann (Eds.), Ökologische Psychologie, Psychologie Verlags Union, Weinheim, 1996, p.166.

28 Daly, H.E., Beyond Growth, Beacon Press, Boston, 1996.

29 Fuller R., de Jong U., and Mellersh-Lucas S., "The Ethics of Sustainable Housing Design: The Dilemma for Practicing Architects" in Architectural Science Review, Vol:51.3, 2008, pp 231-238.

30 Fromm Eric, Sein und Haben, Stuttgart, 1976. Original Text in German: " Ich bin, was ich habe und was ich konsumiere".

31 Oliver, G., "Design Quality Needs-Conscious Values", in Macmillan S.,(Eds), Designing Better Buildings: Quality and Value in the Built Environment, Spon Press, London and New York, 2004, p.140.

footprint"[32], which is an important aspect of sustainability.

Another important issue of need-oriented planning is participation by the tenants and to provide flexible and diverse design, which is also described in criteria of social-functional quality. In a participative planning process, users decide and describe their own needs and requirements in the planning process as well as in the process of living inside the building.

1.2. Accessibility and Circulation Concept

We can describe accessibility as good if regular users and visitors have no difficulty in reaching their destinations, are able to participate in their anticipated activities and can use the facilities required for the purposes.[33] For something to be understood, it must be explicit, clear and definitive, which is very important. In a well-designed building, there is a wayfinding system with signs or abstract symbols and symbolic spatial guidance.

We can distinguish accessibility to two components:[34]

- Reachability, the ease with which access to the building is provided for users and visitors.
- Usability, the ease by which people are provided with the possibility to move through the building and make use of the rooms and services intended for them.

It is important to design for everyone. "Design for all" or "universal design" are concepts for the accessibility and usability of the built environment by everyone, regardless of physical and mental capacity or limitations.[35] Some people use mobility aids, some walk behind a pushchair or carry heavy bags or luggage. Everyone must be able to make equal and independent use of the built environment. "Access for all" and "thinking inclusively" are other expressions ensuring user-friendly and ergonomic designs at all levels. Service features must be usable for all. For example, slippery and uneven floors must be avoided to prevent accidents such as falls.

Universal design should consider some dimensional criteria related to optimum height for work surfaces, wall cupboards, and facilities for people with visual or auditory disabilities, minimum clear passages required for doors and corridors, sufficient turning radius needed for turning especially by people with luggage and wheeled equipment, and vertical accessibility (e.g. ramps and lifts). It has great significance when planning quick and safe egress routes in the event of danger as well as access for fire, ambulance, and other emergency services.

A good and safe vehicular-pedestrian concept is very important for the quality and ease of circulation. The needs of pedestrians, especially children, persons with impaired mobility and older people, should be accorded particular importance along with measures to facilitate cyclists. Routes for vehicles and pedestrian movement concepts must provide convenience, safety and security for all intended users. The divisions and hierarchy of routes must be clear.

According to Alexander C., open stairs are more wonderful than internal stairs because they have direct connection to the outside, which seem alive and internal staircases reduce the connection between upper stories and the life of the street to such an extent that they can do enormous social damage.[36]

There is a psychological dimension of accessibility, too. This is the inviting potential of buildings and open areas, and common rooms for people, which make the building attractive and useful. It should be a concern for

32 Rees described "ecological footprint" as, the amount of land which is necessary to produce the natural resources a human population consumes and to assimilate the waste that the population produces. See also part "Sustainability"

33 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p.172-173

34 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p.173

35 Preiser, W., E. Ostroff, Universal design handbook, McGraw-Hill, New York, 2001.

36 Alexander, C., A Pattern Language: Towns Buildings Construction, Oxford University Press, New York, 1977, p. 741.

the architects if the housing area is a pleasant and cognitive place or if people can find their way around easily. Consideration of accessibility is a legal issue as well as a technical issue.

The main sub criteria for the accessibility and mobility concept are as follows:

- Is it easy to understand how to enter and move about the site?
- Are there orientation tables?
- Are handrails for essential steps and communal stairs with a maximum rise of 170mm and a minimum run of 280mm?
- Is there a lighted canopy over the main entrance?
- Do circulation areas receive good daylight?
- Is adequate wheelchair access possible on the site, apartments, and dwellings? Are there ramps and/or lifts?
- If there is ramp, does it provide a maximum slope of 6%, 120 cm clear width, movement area at the end of 150 x 150cm and a handrail height of 85 cm?
- Is there enough manoeuvring space for wheeled equipment in entrances and corridors?
- Are there facilities for people with visual or auditory disabilities?
- Is access for fire, ambulance, and other services adequate?
- Is there a distinction and identification of functions (e.g. lighting, choice, and materials)?
- Is there a differentiation of architectural elements by colours or materials (e.g. walls and ceilings)?
- Is there figure-background contrast (e.g. symbols and letters)?
- Is there functional use of colours and materials to support spatial orientation, recognisability and identity?
- Does the movement concept aim to minimize vehicle flows and speeds within the housing estate and discourage through vehicular traffic?

Vehicles

- Is the hierarchy of routes clear?
- Are road, place and building names and unit numbers clear, visible, legible and sited appropriately in relation to buildings?
- Do routes take advantage of vistas/landmarks within or around the project site?
- Are appropriate traffic calming measures used to control vehicle speed?
- Is vehicle segregation possible to help pedestrians to use safe routes?
- Can large, emergency, or service vehicles come within 30m of all front doors of units or flats?
- Do routes facilitate and encourage cycling?

Pedestrians

- Are public spaces connected by clear, well lit, and hard surface routes?
- Is lighting appropriately related to buildings and easy to maintain?
- Are kerbs dropped where footpaths cross roads?
- Do pedestrian routes and garden paths have a minimum width of 900 mm?

Access to the Unit

- Do pedestrian routes and garden paths have a firm, even, slip-resistant finish, and distinctive texture and colour?
- Are kerbs dropped for main footpaths and access positions?
- Is convenient wheelchair access provided from park spaces?
- Are all slopes gentle provided with a level platform of 1200 x 1200

mm clear of door swing to external doors?

1.3. Efficiency

The word "efficiency" is generally used for construction or economic issues. But there is also a functional efficiency. An effective and suitable spatial organisation of required functions, can provide a building functional efficiency. Functional efficiency has to do with achieving a goal without using more resources than necessary. Efficiency can be described as "doing the right things" and "achieving the optimum (ratio)".[37] An important issue in designing a residential area is to choose a site appropriate for living, and the residential design and related functions must be considered in details. When planning functions, space efficiency is important to not use more area than required. If the ecological footprint has been taken into consideration an issue of sustainability, the place that we occupy in nature must be designed in a way that makes sense, housing design should be well planned in order to find an optimal ratio.

The important aspects according to the descriptions can be summarized in the following questions:

- Does the overall design have a challenge and a goal?
- Is the location favourable to housing with suitable functions for people?
- Are adequate facilities for universal access provided between floors with clear traffic routes?
- Is there sufficient capacity in corridors, stairs and lifts?
- Is there sufficient capacity for individual rooms (doors which open in a convenient direction without traffic routes through occupied areas)?
- Is an efficient layout provided, i.e. short walking distances because related functions are grouped near one another?
- Have functions requiring natural light been located against an outside wall?
- Has the space required to place and use furniture been an important attention point for both fixed and mobile furnishings?
- Are sufficient vertical dimensions provided for ceiling height, clear headroom for doors, height of worktops and kitchen cupboards?

As a result, efficiency is a term that covers a multitude of different aspects. Efficiency has a very large impact on the other main issues listed below.

1.4. Flexibility

Dwellings must be designed to meet requirements in the various life stages of its inhabitants. The cohabitation and working habits of people has caused fundamental changes in recent years, especially in terms of increasing the needs of our society for mobility and flexibility. This difference also has a significant impact on housing, which has to adapt to the changing demands of people more than ever.[38]

People need different living conditions during different phases of their lives, for example living alone, or in a shared apartment, as a couple or even together as a big family. Furthermore, the variation and change of social and economic conditions induce a change in lifestyle, spatial needs and space equipment. Flexibility is required for spaces and residences as consequences of the need for changing living conditions. In the case that this flexibility was offered, the user changes the space as much as possible. Otherwise, the user struggles to adjust themselves to the living space and the surroundings. Different design techniques for incorporating flexibility are shown in Figure 50. Meyer-Ehlers indicates this requirement

37 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p.177-178

38 Wettbewerbsunterlagen zum Wettbewerb Europäisch Leben- Europäisch Wohnen für das Jahresthema "Flexibles Wohnen" der KFW Bankengruppe. Berlin/Zürich 2003.

of flexibility in a lecture as,[39] "*Housing is not a consistent condition, but a changing activeness, in that the floor plan must be a relationship system that provides and reflects this active coexistence and cooperation*." Because of these changing requirements, designers should take into consideration possible flexible solutions for the future in design phase. Figure 52 shows examples of flexible solutions.

To deal with dynamism of society and living types, housing must be flexible internally and externally. Moreover, flexibility is more meaningful if it is possible to keep the costs and intervention of architectural elements to a minimum. This will increase the future value of the building. Conceptual framework for flexibility of buildings are shown in Figure 51. The terms that are related with flexibility are described by Voordt and Wegen as follows:[40]

Flexible: easily adjusted to suit changing circumstances.

Adjustable: the same, whether or not concentrating on a particular target group. In house building, an adjustable or adaptable building is not specialised for people with disabilities. This is designing in such a way which allows an easy, cheap adaptation when it is required.

Changeable: made so that it can be changed if so desired.

Variable: allowing changes to be made to dimensions, form, location, etc.; the opposite of fixed. But these changes should be implemented on non-load-bearing architectural elements and without high costs.

Multifunctional: suitable or able to be made suitable for different functions without requiring changes to the structure of built-in features.

Polyvalent: capable of being adjusted to changes, or differences in user preferences, or needs by changing the relationships between different spaces without the assistance of a builder (e.g. by the use of sliding doors or folding

39 G. Meyer-Ehlers: Text of lecture "Wohnerfahrungen, Ergebnisse einer Wohnungsuntersuchung". Frankfurt, Okt. 1965, p. 20. Original text: "Wohnen ist kein gleich bleibender Zustand, sondern ein wechselndes Tätigsein, der Wohnungsgrundriss somit ein Beziehungssystem, das dieses tätige Nebeneinander und Miteinander ermöglicht und widerspiegelt".

40 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p.180

Technique	Description
Arrangement neutrality	Extra floor area Generous length/breadth ratio Sufficient wall length to allow for furnishing units Extra ceiling height Extra electrical outlets Movable fittings
Arrangement flexibility	Demountable fittings
Arrangement variability	Provisions for future wiring
Polyvalent room boundaries	Sliding doors, sliding partitions, folding partitions
Flexible room boundaries	Movable or demountable partitions
Variable room boundaries	Removable partitions
Division neutrality	Division neutral spaces Neutral parapet height Wall finish to suit several functions Sound installation to suit several functions Extra wiring and services Zoning
Division flexibility	Separation of load-bearers from inbuilt features Demountable walls, elevation, roof Generous grid size for the shell Over-dimensioning of load-bearing structure
Division variability	Removable walls, elevation, roof Demountable wiring, placed accessibly Alternative methods of attaching walls/elevation Avoidance of differences in floor levels Neutral, flexible or variable shell Space or facilities for later addition of a lift

Figure 50: *Examples of design techniques for incorporating flexibility,*

Flexibility of:	Change requires:		
	No building operations	Moderate building operations not requiring the use of a builder	Building operations requiring the use of a builder
Arrangement of rooms	Arrangement neutrality Multifunctionality	Arrangement flexibility	Arrangement variability
Room boundaries	Polyvalent room boundaries	Flexible room boundaries	Variable room boundaries
Division of the building	Division neutrality Shell neutrality Function neutrality	Division flexibility Spatial flexibility Constructional flexibility	Division variability Variability of the shell

Figure 51: *Conceptual framework for flexibility of buildings in the use phase*

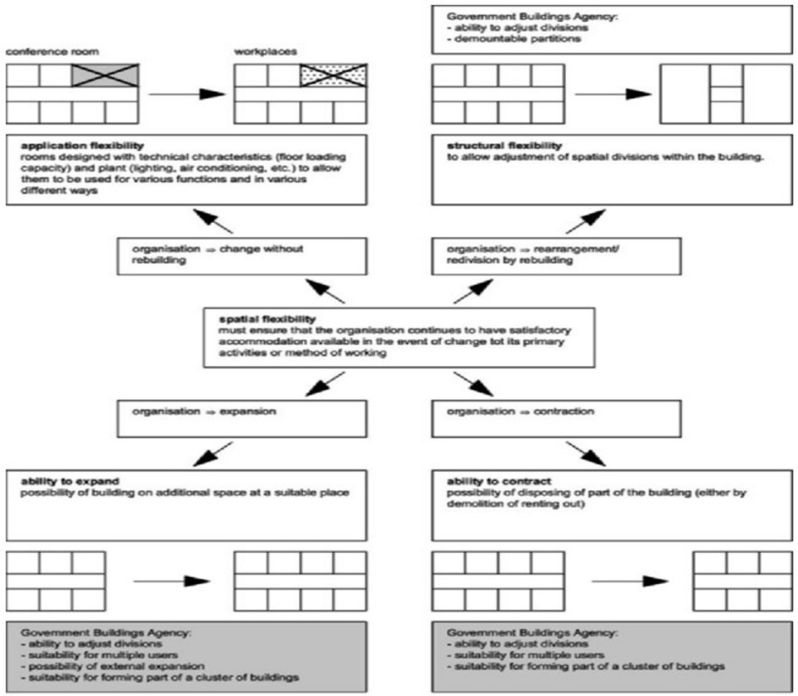


Figure 52: *Examples of flexible solutions*

partitions).

Neutral: capable of being adjusted to changes without changing the location of the various functions and without the architectural elements required by those functions needing to be moved, removed or augmented.

Important aspects according to the descriptions are summarized below:

- Has flexibility been a consideration in design?
- Can the plan of the units be adjusted to circumstances? Is it possible to make the rooms and dwellings larger or smaller than they are?
- If possible, can these changes be made easily without intervention of architectural elements (ceiling and floor)?
- Are different furnishings possible in the rooms?
- Is it possible to change the functions of the rooms?
- Are the load-bearing interior walls avoided as much as possible?

1.5. Safety

Safety in residential planning provides the people with a sense of security both physically and psychologically. Safety in housing estates can be distinguished as prevention of unauthorized entry, circulation and user safety, and fire safety. The safety criteria are detailed below:

Prevention of unauthorized entry: The risk of break-in and unauthorized access to the housing area providing secure entry against robbery and vandalism, should be reduced.[41] People must feel safe without being threatened in their houses and in the public spaces of the housing estate. As a measure main access points must be secured, public areas must be patrolled because if people are observed, they feel safer and more in control to anticipate possible dangers.[42]

Circulation and user safety: It is important to provide safe transportation of people and goods both vertically and horizontally. Some measures have to be considered during planning. For instance, should safety glass instead of ordinary glass be installed? Windows should be easy opened and cleaned. Window opening sections must have safety mechanisms allowing different ventilation purposes, which are also a measure to deter opening by children, or to allow the window to be opened quickly in an emergency. Also, all functions have to be designed with detailed attention to provide safety for people including safety on children's playgrounds. Some other measures have to be considered such as non-slip floor finishes, adequate lighting for corridors and stairs, and handrails and banisters where appropriate to

41 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p. 184.

42 Quality Housing for Sustainable Communities, Best Practice Guidelines for Delivering Homes and Sustaining Communities, Department of the Environment, Heritage and Local Government, Ireland, 2007, pp 30-38.

ensure the least possibility of falls, being trapped or injured. [43]

Fire safety: This is for the prevention of fire outbreak, which ensures quick and safe escape by window sizes, an alarm system, fire-resistant materials, and limitation of fire spread.

Important aspects according to these descriptions are summarized below:

- Are main access points secured (with an alarm, with guidance)?
- Are public areas overseen to make people feel safer and in control to anticipate possible dangers, especially within children playgrounds?
- Are balconies of dwellings safely protected against the risk of break-in?
- Are all external doors and windows sufficiently fixed?
- Is safe transportation of people and goods provided vertically and horizontally to manage and prevent the possibility of falls, being trapped or injured with: non-slip floor finishes /adequate lighting for corridors and stairs/ handrails and banisters where appropriate?
- Has it been considered that doors and windows do not open onto the circulation routes?
- Fire safety: Is prevention of fire outbreak with a quick and safe escape possible? / Are fire-resistant materials used to limit fire spread?
- Is safety glass used instead of ordinary glass?

1.6. Health, Well being and Comfort

According to the WHO (World Health Organisation) definition, "health is a state of complete physical, mental and social well being and not merely the absence of disease or infirmity."[44] This definition means that health is more than just "not being ill". The causes of illness can be addressed as a wide range of factors, one of which is the built environment. In 2002, 30 per cent of deaths resulted globally from communicable diseases, 60 per cent from non-communicable diseases, and 10 per cent from injuries. [45] Thus, 70 per cent of deaths are related to environmentally and socially linked aspects of life. Buildings have chemical, biological, and physical characteristics that affect the physiological and psychological health and well being of their inhabitants. The definition of environmental health, to be found in their 2001 document, "Healthy People 2010" states that,

"[i]n its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing, urban development, land-use and transportation, industry, and agriculture."[46]

We can understand from this statement that the environment has a huge effect on lifestyle choices, the potential for contact with viruses and bacteria, opportunities for social interaction, psychology of people, in other words on human well being and life quality. Some studies have researched the negative effects of poorly designed environments and the "Sick Building Syndrome" (SBS).[47] Several sick people suffer from symptoms, which do not appear to be connected. In most cases, SBS symptoms tend to increase when people are in a building, and will be relieved soon after the occupants leave the particular room or zone.[48] Air conditioning is thought

43 Van der Voordt, T. J.M., van Wegen H.B.R., Architecture in Use: An Introduction to the Programming, Design and Evaluation of Buildings, Architectural Press of Elsevier, Oxford, 2005, p. 183.

44 World Health Organization definition, 1946, www.who.int, access: 01.04.2015.

45 WHO, The World Health Report 2003, Geneva: World Health Organization, 2003.

46 Department of Health and Human Services (US), "Healthy People 2010", Volume 1, US Government Printing Office, Washington, DC, 2001.

47 Hedge et al., 1986; Burge et al., 1987; Molhave, 1987; Valjborn, 1989; Norback et al., 1990; De Boo, 1990; Ryan and Morrow, 1992.

48 "Sick Building Syndrome." National Safety Council. (2009) Retrieved April 27, 2009.

to be a reason for SBS, as are other building characteristics such as limited access to natural light, indoor air pollution, dry air-conditioned air, lack of views to the outside, lack of temperature or light control. On the other hand, problems such as cardiovascular disease or depression etc. may also be linked to the built environment they inhabit and affect the well being of people.[49] Illnesses linked to lifestyle and environmental health issues can often be prevented by the creation of healthy living centres, which encourage lifestyles through designing rooms for physical exercise and communication and activities like gardening with more greenery that provides space for walking, cycling and relaxation (more contact with nature). Having regulations and guidelines with respect to health and prevention of illness is also important. Healthy buildings indirectly benefit the community and make inhabitants happy and healthy.[50]

Comfort is described in The Oxford dictionary as "A state of physical ease".[51] A lack of comfort may not be seen as a reason for illness, but it indirectly affects the physiology of people (e.g. an unwanted and uncontrollable noise or uncontrollable temperature, lack of light etc.). There is not a clear line between uncomfortable and unhealthy buildings.[52] Comfort is related with a lot of parameters including psychological and physiological ones. The mains parameters are,

Sound: If sound is uncontrolled, it can cause a lot of problems like sleep problems, headaches, nausea, irritability, anxiety, reduced comprehension, hypertension etc.

Sound pressure level (dB):[53]

0-10	Threshold of hearing
20-30	Bedroom at night
30-40	Library-Study
40-50	Living room in suburbia

49 Jackson, R.; "The impact of the built environment on health: an emerging field", American Journal of Public Health, September 2003, Vol. 93, No. 9.

50 Sassi, P., Strategies for Sustainable Architecture, Taylor & Francis, New York, 2006, p. 99.

51 http://www.oxforddictionaries.com/definition/english/comfort, access: 02.04.2015.

52 Sassi, P., Strategies for Sustainable Architecture, Taylor & Francis, New York, 2006, p. 100.

53 Sassi, P., Strategies for Sustainable Architecture, Taylor & Francis, New York, 2006, p. 100.

But noise levels about 35 dB can disrubt sleep, above 45 dB can corrupt communication, above 55dB can be distracting and cause loss of concentration. Moreover sounds above level of about 85 dB are harmful and damage our hearing, sounds above 120 dB can be painful.[54]

Negative effects of noise levels in buildings can be reduced by insulating walls, ceilings and windows to ensure sound separation between buildings and to the outside (measures by the regulations are very important), plants can help absorb sound waves, orientation of buildings and planning activities can be considered according to the need for silence.

The well being and health of inhabitants are also affected by thermal comfort, materials and light levels in the building and open spaces related with the building. Some issues of thermal comfort have been discussed in the energy issue.

The important aspects according to these descriptions are summarized:

- Has sound insulation of walls been considered and applied?
- Has sound insulation of ceilings been considered and applied?
- Has sound insulation of windows been considered and applied?
- Are bedrooms placed so that they are not adjacent to shared internal areas?
- Are bedrooms protected so that they are not adjacent to the bathing/living areas of neighbouring units?
- Are noisy communal equipment placed farther than 3m away from doors or windows (e.g. lifts and plant equipment)?

54 Mommertz, E., Acoustics and Sound Insulation: Principles, Planning, Examples, Detail Practice, Birkhäuser, Basel, 2009, p. 10.

- Do living room windows receive good daylight?
- Do kitchen windows receive good daylight?
- Do all bathrooms have a window?
- Do corridors and stairs of apartments receive good daylight and natural ventilation?

1.7. Open Spaces

Open space is a very important issue in designing residential areas for both environmental and social quality. It is not possible to design buildings separate from their environments. Today's cities are very intensive and it is a type of loading people with complexity, which makes important to create greenery and allow open spaces for the built environment. They serve as a visual quality and also support communication by inhabitants. We can distinguish open space two categories; private and shared open space.

-Private open space, is open space accessible only to the resident like gardens, roof terraces, patios, yards and balconies.[55] More private open space has a positive effect on people, thus most of the residents appreciate their private open spaces. On the other hand, private open spaces serve as a safe toddler play area. Gardening is a popular activity, and these spaces are likely to increase opportunities for sunlight and views.

-Shared open space, is accessible to a restricted group of residents, like communal or shared gardens or courtyards. A garden is the place for lying in the grass, swinging, croquet, growing flowers or throwing a ball for the dog. People need a place to eat, to sit, to drink and talk together, and yet be outdoors for some moods, some times of day, some kinds of friendship.[56]

Important aspects according to these descriptions are summarized:

- Has a qualified landscape architect been employed to create or assess the landscape design?
- Has water (a pool, stream or a fountain) been incorporated into the site and appropriately protected?
- What is the ratio of open areas to the sum of dwellings?
- Does the general image of the open spaces seem natural and green?
- Do some flats have their own private garden?
- Is there a common roof terrace?
- Is there roof planting?
- Are the materials used in the open space natural?
- Is there any possibility for tenants to grow their own plants in the garden?
- Does the position of lighting prevent pools of darkness where people walk both outside and in communal areas of buildings?
- Are refuse and bin storage areas convenient and inconspicuous in the open spaces?

1.8. Common Rooms and Facilities

The development of common rooms in residential projects provides a place for intensive dialogue between the tenants of the housing. To extend the functions of open spaces, especially in winter, tenants need some indoor places to eat, to sit together, to talk together with the beauties of the outdoors and access to sun meaning a connection and attachment to the ground and air if possible.

The quality and variety of common rooms are important to create environments people want to live in and enhance the liveability of a place. It is also important to encourage social interaction. Housing estates should provide opportunities offering indoor and outdoor spaces for communication and activities.

55 721 Housing Quality Indicators (HQI) Form, The National Affordable Homes Agency, Housing Corporation, 2008, p.16

56 Alexander, C., A Pattern Language: Towns Buildings Construction, Oxford University Press, New York, 1977, p. 765.

Important aspects according to these descriptions are summarized:

- Is there a common room for inhabitants with a kitchen?
- Is there a closed playground for children?
- Is there a launderette?
- Is there a fitness area?
- Is there a sauna?
- Is there a cinema?
- Is there a theatre?
- Is there a library?
- Is there an atelier?
- Is there any play equipment or games room for young people (e.g. table tennis, ropeway)?
- Are there any other common rooms except those mentioned?

1.9. Children's Playground

Play spaces have great significance for mental freedom, allow leeway to deviate from the rules and also provide as a physical margin that enables movement between the different components of a construction or a machine. Empty spaces of a playground become meeting places, which bring people of various ages and backgrounds together and ensure communication.[57] In "The Play of Humans", Karl Groos says that 'play leads from what is easy to more difficult tasks, since only deliberate conquest can produce the feeling of pleasure in success', and that play plays has a great significance in the development of intelligence.[58] Childhood play is the source of creative thinking according to Sigmund Freud.[59] 'Learning by play' is an approach to education, which is more effective and important than rote learning[60] according to Jean Piaget who was a Swiss developmental psychologist who has had a significant impact on the education of children. According to a report from the American Academy of Pediatrics, it documents that play promotes not only behavioural development, but brain growth as well. In addition, the University of North Carolina's Abecedarian Early Child Intervention Program found that children who received an enriched, play-oriented parenting and early childhood program had significantly higher IQ's at age five than did a comparable group of children who were not in the program.[61] Children's playgrounds contribute to the liveliness of a housing complex together with the reinvention and communication of children and parents. Due to the importance of playgrounds for the development of children, playground design must be considered seriously from design to the material in housing complexes, and they have to present a quality. For residential areas, it is important to design indoor and outdoor playgrounds, which have an attractive, creative and distinctive character. Playground equipment should be built from healthy materials with creativity, which also develops the creativity of children, and should be located so that they can be overseen from the dwellings.

Important aspects according to these descriptions are summarized:

- Is the site location appropriate for children?
- Is the playground large enough for the whole residential area?
- Is there a sandbox?
- Have material / design creativity been considered?
- Are the materials healthy (plastic/wood)?
- Are playgrounds separated according to age groups?

57 Lefaivre L., Ground-up City Play as a design tool, 010 Publishers, Rotterdam, 2007, p. 28.

58 Groos K., Die Spiele der Menschen, 1899. English translation: The Play of Man, Baldwin, translated Baldwin, E.L., Applaton, New York, 1901.

59 Freud S., "Creative Writers and daydreaming", Complete Works of Sigmund Freud, translated. J. Strachey, 9: 141-153, London, 1965.

60 Piaget J., Play, Dreams and Imitation in Childhood, NY, Norton, 1990.

61 University of North Carolina´s Abecedarian Early Child Intervention program, available at: https://peacefulplaygrounds.com/importance-of-play, access: 2.10.2015.

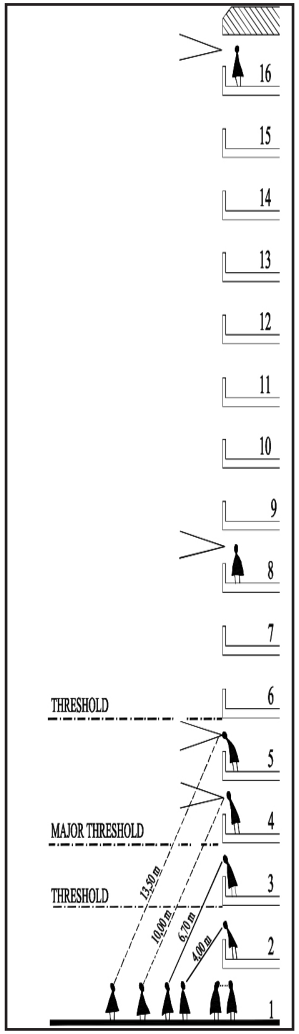


Figure 53: *Possibilities of communication of a multi-storey building with people on the ground*

- Are play areas provided within sight of families?
- Is energetic play provided for, e.g. by an adventure playground or cycle paths?
- Is there any other playground close to the site?

1.10. Proportion of Buildings, Diversity of Living Units and Density

Housing developments should offer a variety of different living options to ensure quality and option of choice for the inhabitants: for example, small and large dwellings, houses and flats, or with and without gardens. It can provide appropriate living options for users with diverse needs, and provide a mix of people with different ages and backgrounds with one area, which is an advantage for social quality. On the other hand, diversity is an opportunity to be away from monotony and can also provide an advantage for aesthetic quality.

Traditional cities have had characteristic high density and low-storey buildings. With the highly dense urban structure, it has been a transformation to high multi-story buildings, which give the possibility to have more apartments on the same ground floor. A trend of high buildings has started with this transformation, and with some regulations about distances between the buildings and efficient sunlight for the building, more open-space on the ground was obtained. If high and low multi-story buildings are compared regarding physical conditions, there are some advantages and disadvantages of both structural types. High multi-story buildings create more green and public spaces, but their negative effects are also significant. Nowadays, high building housing is very a dominant structure in all cities because of the high land prices. As a result, the problem of linking interior and exterior spaces occurs. That height difference has a negative effect on communication has been a consideration of urban developers. According to the analysis of Jan Gehl regarding height difference and communication, higher floors have less communication possibilities than ground floor (see Figure 53).[62]

There are sufficient clinical, anecdotal and intuitive observations to back-up the idea that high-rise apartment dwelling has adverse effects on mental and social health. It has been indicated in "A Pattern Language" by Christopher Alexander[63] that children in a high-rise are much more socially deprived of neighbourhood peers and activities than their single family dwelling counterparts. Mothers are also more anxious about their very young ones when they cannot see them from windows. He also thinks that there always has to be a vertical journey to reach the ground from high buildings, which is unnecessary and indicates that in buildings less than five-stories tall, one can still can feel part of the street scene from the window, can see details in the street, see people's faces and shops etc. He has set a four-storey limit, and above four stories, connections break down and visual detail is lost. The connection to the ground is lost, which was also mentioned in the previous paragraph.

Another disadvantage of high housing is accessibility: the connection between interior and exterior space. This link is possible with a lift and stairs, and the possibility of vertical connection with stairs is discouraged in high housing. If a building is more than nine or ten stories high, everyday vertical movement is dependent on the lift. Nothing is as flexible as walking, so high multi-story buildings make the vertical connection with the ground inflexible and undesirable. For example in a power outage, old people and children are caught in higher residential floors.

As a result, high housing discourages the possibility to use public and common rooms, and also contact children who are playing in an open space.

Important aspects according to these descriptions are summarized:

62 Gehl, J., Possibilities of communication from multi-storey buildings with people on the ground (Möglichkeiten der Kommunikation aus einem mehrgeschossigen Gebäude mit Leuten am Boden), 1987, p. 121.

63 Alexander, C., A Pattern Language: Towns Buildings Construction, Oxford University Press, New York, 1977, p. 117-118.

- Do the plans of different units have different sizes and characteristics for small/big families?
- Are there different floor plans of different blocks in the housing estate?
- Are different aged inhabitants encouraged in the project?
- Are there maisonettes?
- Are there dwellings with a garden or terrace?
- Do some dwellings have a balcony?
- Do the balconies of different dwellings have different sizes?
- Is the vertical proportion of buildings appropriate to the human scale, and is communication of buildings with the ground supported?
- Are the buildings not more than eight storeys high?

1.11. Storage, Parking and Waste Services

Availability of conveniently located parking spaces is a positive attribute. One car parking space per unit is assessed. In some housing estates, it may not be possible to provide parking for individual units due to location (inner city), building type, planning requirements, or due to increasing the environmentally sustainable qualities of the project. An underground garage is preferred to have more greenery and open spaces.

Car parking must provide security for vehicles and also for the residents. As a minimum standard, this would include good lighting and visibility, and clear line of sight. Some housing can have underground garages, too. They are watched and have secure access for residents only.

Bicycle storage is important especially for cities where bicycle use is encouraged with bicycle paths. Safe storage of prams out of the way of circulation routes is also an important point for housing projects.

Important aspects according to these descriptions are summarized:

- Are there storage spaces in dwellings?
- Is there separate storage for each unit outside of the dwelling?
- Is there bicycle storage and is it barrier-free for disabled people?
- Is there storage for prams, buggies and wheelchairs?
- Is the refuse and bin storage area convenient and well arranged?
- Is it encouraged through design to collect waste separately?
- Is there a minimum of one parking space per unit?
- Is there underground parking and is it secure?
- Is there any car parking available for disabled people?

2. Energy Performance and Construction Quality Analysis-ECQA

It is known that the contribution of carbon dioxide, which results from the combustion of fossil fuels, is linked to the greenhouse effect, and is the major factor that leads to global warming changes. It is the responsibility of the construction sector, as well as other sectors to reduce the damage of fossil fuel waste, especially the damages caused by natural gas, fuel oil and coal to the ecological system.

In addition, the amount of energy that buildings need for domestic hot water and heating in Europe corresponds to 1/3 of the total energy sale.[64] The most important task of an architect is to provide benefits to consumers and to contribute to the economies of the countries, which are dependent on other countries in terms of energy imports, by using renewable energy as much as possible. Another important task is to reduce energy demand in buildings to minimum levels with the quality of both the thermal insulation materials that are installed and the plumbing systems.

It is possible to erect consumer and environmentally friendly buildings, by taking necessary measures without losing any of the current comfort and the aesthetic qualities. It means that architects have to take on several responsibilities.

The technical principles for energy efficient buildings indicated below highlight the absolute technical principles, which must be obeyed in an architectural project. Even though the idea is prevalent, which claims that there is a contrast between the aesthetic qualities and building efficiency, it may only be possible through a real architectural understanding to provide the balance between them in an appropriate way. A product is considered to be a good and liveable architectural product when these principles are applied with a holistic approach in combination with social-functional and aesthetic qualities.(Other criteria of SHQ)

64 Pehnt, M., Energieeffizienz ein Lehr- und Handbuch, Springer Verlag, Heidelberg, 2010, p. 259, 260.ISBN 978-3-642-14250-5

2.1. Form and Orientation of the Building

In order to increase the energy efficiency in buildings, solar energy must be used at the maximum level. In this regard, the direction and form of the building are particularly important. Physically rotating the building to track the sun will enable the benefits from solar energy coming passively from the transparent building cells, from the solar panels that will be set, and from the photovoltaic systems, to come into play. The report "Very Low Energy House-Building for the Future" indicates that the annual passive heat gains from windows are far more than the heat losses when designed according to the sun's position at different times of the day and month. [65]

Orienting spaces such as children's bedrooms and the living room to the south provides great savings on heating and lighting of these rooms with the benefit of solar energy. The size of the transparent building components that are applied to the south front will enable the sun's rays in winter to penetrate into the interior. Another issue that should be considered during the planning phase is the use of spaces on the north facade for secondary uses. [66] A block should be created between the actual living space, the spaces such as the cellar, washroom and bathroom that need less lighting and heat, and where the cold comes from the north. These spaces should be designed to be as small as possible in order to guarantee that the heat loss is minimal. Because the parents' bedroom and the kitchen need less space heating, east and west directions should be preferred for these functions.

It is also important to note that the direction of the sun is also of great importance in the design of the roof. For the installation of photovoltaic and solar panel systems, the form of the roof in energy-efficient buildings should be designed so that the roof faces the southern direction as much as possible to ensure the maximum benefit from solar energy.

Maximum heat gain and minimum heat loss from solar energy should be

65 Energie Agentur Steiermark GmbH, Das Niedrigstenergiehaus Bauen für die Zukunft, 2014, p. 8.

66 See Pehnt, M., Energieeffizienz ein Lehr- und Handbuch, Kapitel 6.6: Solare Gewinne, Springer Verlag, Heidelberg, 2010.ISBN 978-3-642-14250-5

considered as well as the direction when selecting the form of the building. The effect of the building form on the energy efficiency is expressed as the term "compactness" in the energy performance certificate. The A/V (surface area/volume) ratio is related to the energy needs of the building and consequently is directly related to saving energy costs. In other words, the more compact a building is, the smaller the A/V ratio is, and the less energy it requires. Therefore, the compactness of the building affects the energy balance of the building positively. Because each shifting-protrusion (such as lodges and pavilions) in the building form increases the surface area of the building facade, heat losses take place on more surface areas.[67] In other words, a compact building is more efficient than a building that has the same amount of living area but has more facade surface area. In addition, a well-designed compact form is more economical in terms of construction costs than buildings with many protrusions and/or centilevers.

In this regard, the architect bears a large responsibility. It is a common dilemma for the architect when designing energy-efficient buildings that s/he should avoid protrusions for the building's energy efficiency, and also design an optically suitable form in order to avoid a monotonous front facade.

Proper arrangement of spaces in a hierarchical order according to the building's direction and form can only be obtained by a meticulous planning. Basic principles that are required to achieve this are outlined below:[68]

- Keeping the form as compact as possible which means a small A/V ratio;
- Designing the south facade to be as large as possible and the north facade to be as small as possible;
- To optimize the window surfaces and to minimize the north façade;
- Bevelled window reveals;
- To orient the living rooms to the south, and secondary rooms as well as storage rooms to the north;
- To orient unheated buffer rooms to the north, and orient them outside of the heated and insulated building envelope;
- To design the garage (parking) to the north side of the building;
- To design a winter garden on the south side;
- Blocks of adjacent buildings are more energy efficient than single standalone buildings.

67 Pregizer D., Grundlagen und Bau eines Passivhauses, D.F. Müller Verlag, Heidelberg, 2007, p.3
68 Pregizer D., Grundlagen und Bau eines Passivhauses, D.F. Müller Verlag, Heidelberg, 2007, p.3

2.2. Building Components' U-Value, Thermal Bridge and Airtightness

$$U = \frac{1}{h_{si} + \sum \frac{d_i}{\lambda_i} + h_{se}} \left[\frac{W}{m^2 \cdot K} \right]$$

Formula 1: *Thermal transmittance coefficient*

The envelope of a building performs the task of balancing the temperature difference between the interior climate and the exterior climate. Whereas the room temperature should be between 18°C and 22°C throughout the year, it has been observed that the winter temperatures can be as low as -10°C, and the summer temperatures can be above 40°C in Turkey and in central Europe.[69,70] The envelope of the building should be tightly covered with insulating materials in order to protect the interior heat from the external temperature difference. It is possible to say that compared to the heat insulations of the 1980s, which were installed in order to protect the building from physical disturbances, nowadays, heat insulation materials, which are used in energy-efficient buildings, are installed with the aims of preventing heat loss, and creating a comfortable and healthy interior atmosphere. [71] It would not be true to say that heat insulation is only used for preventing the heat loss of the buildings in cold climates because heat insulation is also needed in order to provide the comfort of the interior places such as in the Southern Europe and in the southern coast of Turkey, where there is no need for heating systems at all.[72]

The heat loss through building elements that surround the building is determined by thermal transmittance coefficient (U-value) of the structural elements. The U-value depends on the thickness of a material and on the thermal conductivity coefficient (λ) that represents the different values for each material. The lower the U-value is, the better the material is as a heat insulator. The main element that reduces the heat loss in building elements is the thermal insulation material. No matter how many new thermally insulated room dividers, such as high brick walls, are started to be produced with the advancement of technology, another thermal insulation material should be used in many other climate conditions. With an easy formula, the required thermal insulation values for structural elements and the related thickness of the material can be calculated.[73]

The most appropriate thermal insulation system among many others in terms of application is the exterior thermal sheathing.[74] Notwithstanding that the thickness of the thermal insulation material depends on the (λ) value of the material, the thickness of the thermal insulation materials, which are used in the facades of the residential buildings, is around 14-20 cm throughout Austria, and 5 cm in Turkey.[75,76] (Figure 54) The most commonly used materials on the market for exterior walls are EPS (expanded polystyrene, rigid polystyrene foam, Styrofoam), for the subfloor XPS (extruded polystyrene), and fibreglass or Rockwool for roofs. Increasing the thickness of the thermal insulation material will provide a large gain for the user in the medium and long-term; the increase in the cost of production would only occur once, therefore, the thickest possible thickness should be preferred in the planning stage.[77] The typical thermal insulation materials used in Austria and in Turkey, and the structural elements formed out of these materials are noted in the chart below.

Another point to be considered in building insulation is that non-transparent

69 TC Orman ve Su Isleri Bakanligi Meteoroloji Genel Müdürlügü, available at: http://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=KONYA, access 12.10.2015

70 TC Orman ve Su Isleri Bakanligi Meteoroloji Genel Müdürlügü, http://www.mgm.gov.tr/genel/sss.aspx?s=sicaklikenleri2, access 12.10.2015

71 Eicke-Hennig Werner, Kleine geschichte der Dämmstoffe, Zeitschrift für Wärmeschutz, Kälteschutz, Bradschutz, Erster und zweiter Teil, 66/2011, Zeittechnik-Verlag GmbH, Neu-Isenburg, 2011

72 Eicke-Hennig Werner, Kleine geschichte der Dämmstoffe, Zeitschrift für Wärmeschutz, Kälteschutz, Bradschutz, Erster und zweiter Teil, 66/2011, Zeittechnik-Verlag GmbH, Neu-Isenburg, 2011, p.14

73 Fischer H., Freymuth H., Häupl P., Homann M., Jenisch R., Richter E., Stohrer M., Lernbuch der Bauphysik, 2008, 6.Auflage, Vieweg+Teubner Verlag, Wiesbaden, p. 113-132.

74 Ing Krus Martin, Ing Klaus Sedlbauer and Ing Hartwig Künzel, "Innendämmung aus bauphysikalischer Sicht." presentation at the event Innerdämmung-eine Bauphysikalische Herausforderung 21, 2005

75 Es gibt viele Pfuscher auf dem Gebiet, available at: http://orf.at/stories/2214353/2213974/. Access: 27.01.2016.

76 Kürekci, A., et.al., Türkiye´nin Tüm Illeri icin Optimum Yailitim Kalinliginin Belirlenmesi, 2012.

77 XPS Isi Yalitimi Sanayicileri Dernegi, Türkiye Isi Yalitim Kalinliginda Avrupa Birligi´nin Gerisinde. Available at: http://xpsturkiye.org/haber-detay.asp?ID=18. Access: 25.01.2016.

			Thermal transmittance (circa U-Value) of building compenents		
AUSTRIA	Construction	Thickness of insulation	EPS F (0,040 W/mK)	EPS F+ (0,031 W/mK)	Mineral wool 0,032(W/mK)
	Bricks	10 cm	0,27 W/m²K	0,24 W/m²K	0,25 W/m²K
		16 cm	0,19 W/m²K	0,16 W/m²K	0,17 W/m²K
		20 cm	0,16 W/m²K	0,13 W/m²K	0,14 W/m²K
	Reinforced concrete	10 cm	0,35 W/m²K	0,29 W/m²K	0,30 W/m²K
		16 cm	0,23 W/m²K	0,18 W/m²K	0,19 W/m²K
		20 cm	0,19 W/m²K	0,14 W/m²K	0,15 W/m²K
	Wood frame	10 cm	-	-	-
		16 cm			0,32 W/m²K
		20 cm			0,26 W/m²K
TURKEY	Construction	Thickness of insulation	EPS (0,035 W/mK)	XPS (0,032 W/mK)	
	Bricks	5 cm	0,43 W/m²K	0,40 W/m²K	
	Reinforced concrete	5 cm	0,59 W/m²K	0,55 W/m²K	
	Pumice blocks	5 cm	0,37 W/m²K	0,35 W/m²K	

Figure 54: *Thermal transmittance values according to different material usage in Austria and Turkey, by the author.*

building elements should be covered by suitable heat-insulating materials from all sides without a gap, in accordance with the principle of minimizing heat loss. Each uninsulated space will lead to thermal bridges. Thermal bridges are the weakest points of the structure. During cold weather, the inside heated air will seek a way to escape with pressure through these bridges. The temperature at these surfaces is lower than on the insulated surfaces.[78] Therefore, condensation and then mould problems will arise on the surfaces where there is a thermal bridge. The heat losses due to the thermal bridges, which have negative effects on the physical characteristics of materials and on the comfort of the place, can reach up to 40% even within very well insulated buildings.[79] Architects must conduct detailed drawings, with special consideration especially of the building corners' asperities and niches. In order to ensure this, the measures to be taken against the thermal bridges and the heat loss that would result from these thermal bridges, are determined and indicated with calculations in Austria, based on the ÖNORM EN ISO 10211[80]. The typical thermal bridges that are encountered frequently are indicated below.[81]

- Connection of the balcony and the ceiling to the façade
- Cantilevers
- Change of materials in building components (reinforced concrete columns in brick masonry construction)
- Window and door connections (reveals and lintels)
- Missing or incorrectly executed vapour barriers on the roof
- The connection of the interior and exterior walls to the foundation slab
- The connection between the basement ceiling to the exterior wall
- The connection between exterior walls and the roof construction
- Niches in the outer wall

In order to measure the effect of thermal bridges on the temperature distribution on the surface of the building components and on the increased heat loss, sufficient experimental and calculative analyses must be provided. In the first case, the measurements are conducted either in the laboratory or in the finished project. Since experimental inquiries aiming at determining the thermal size and characteristics of building components usually require too much time, both in practical applications and in research, numerical analyses have always been preferred to the time-consuming experiments.[82]

The detection of the thermal bridges is possible through Blower Door Tests and through thermal imaging.[83] After the measurements are carried out and in the aftermath of the camera shootings, leakage pathways are detected and problem zones are repaired. Not only the incorrect installation, but

78 Fischer H., Freymuth H., Häupl P., Homann M., Jenisch R., Richter E., Stohrer M., Lernbuch der Bauphysik, 2008, 6.Auflage, Vieweg+Teubner Verlag, Wiesbaden, p. 180.

79 Kompetenzzentrum, Kostengünstig qualitätbewusst Bauen, Technsche Erneuerungen im Bauen und Wohnen, 2007, p. 14.

80 Austrian Standards- ÖNORM EN ISO 10211, Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211:2007)

81 Pregizer D., Grundlagen und Bau eines Passivhauses, D.F. Müller Verlag, Heidelberg, 2007.

82 Fischer H., Freymuth H., Häupl P., Homann M., Jenisch R., Richter E., Stohrer M., Lernbuch der Bauphysik, 2008, 6.Auflage, Vieweg+Teubner Verlag, Wiesbaden, p. 185.

83 Blower Door Test-Wärmebrücken aufdecken. Available at: http://www.massivhaus.de/ratgeber/blower-door-test-waermebruecken-aufdecken.html, access: 09.12.2015

also the detail solutions of the architectural project lead to the emergence of thermal bridges.

Transparent architectural elements allow for passive benefits from the solar energy in the building. These transparent architectural elements will result in large heat losses during the winter months and at night when the desirable benefit from the solar energy cannot be derived. For this reason, the size and the direction of building elements such as windows, require important consideration during the planning stage. Window systems consist of frames and glass modules, and the U-values of these two materials are different from each other. According to the OIB Guideline 6[84], the total thermal transmittance U-value of the window systems cannot exceed 1.4 W/(m²K). Moreover, the windows in Austria are manufactured with triple glazed panes including insulation between, and wood/aluminium framing in accordance with low-energy houses. The total U-value of these windows corresponds to approximately 1.0 W/(m²K). Through the new window systems, it is possible to reduce to the minimum 0.8 (W/m²K) U-value of passive houses[85], determined according to the OIB Guideline 6, to a value of 0.6 W/(m²K).[86]

The quality of the window installation and insulation tapes that are used should be chosen and applied carefully in order to avoid air leakages and also heat loss.

The erection techniques, which must be applied in order to avoid air leakages through doors and windows, are described in detail in ÖNORM B 5320.[87]

84 Austrian Institute of Construction Engineering (Österreichische Institut für Bautechnik), OIB Guideline 6- Energy Saving and Heat Insulation, March 2015, p. 6.

85 'Passive house' initially entered literature through the Passivhaus-Institut Darmstadt and it denotes a building standard of high level energy efficiency within comfortable, environment friendly, economic houses. Passive houses result from careful planning, the heating demand of which is entirely, or at least almost entirely, satisfied by solar energy or internal energy generation.

86 Internorm, Windows systeme. Available at: http://www.internorm.com/at/produkte/studio/studio-fenster/holzaluminium/system/show/hv-350.html. Access: 15.06.2015.

87 Austrian Standards- ÖNORM B5320,
Connection joints for windows, french doors and doors in external construction elements - Principles for design and execution of work.

Every low-energy construction needs an extra airtight insulation, as much as it needs heat insulation. Whereas heat insulations prevent heat loss, airtight insulations prevent the stack effect that may occur inside the building and the heat losses that arise as a result of the stack effect. Chimney effect/stack effect, which results from temperature differences, shortens the life cycle of structural elements and also influences the climate of the environment negatively.

Therefore, airtight insulations provide efficiency in heating of low-energy houses. As in the case of thermal bridges, the gaps of the buildings that result in heat loss will grow over time and new gaps will come out if suitable insulation is not installed in the corners of the buildings such as the connection points of the walls with doors and windows or between the different material applications. At the same time, the necessary fresh air circulating through rooms would not be distributed conveniently. This creates serious problems over time in terms of the user health. In addition, stack effect creates condensation around the gaps by constantly carrying the air humidity of the place.[88] Therefore, depreciations in the building construction may come out due to humidity.

While airtight insulations are installed inside the structural elements, measures need to be taken in the outer shell of the building envelope against the air leakage. The aim of airtightness is to hinder the air flowing into the building. A building´s air and wind insulation should be designed in a way that obstructs the air flow through the building as the airtightness of the building. External plaster or cladding on the walls, a vapour barrier on the roof, and air sealing (insulation) tapes on windows are key in this regard.

The application of the Blower Door Test provides opportunities to make the necessary modifications, when the building envelope is covered with a tight material. This means that, this test can be applied to the new constructions when the windows and the vapour barrier materials are

88 Rockwool, Luftdichtheit der Gebäudehülle, available at: http://www.rockwool.at/produkte/luftdichtsystem+rocktect/luftdichtheit+der+geb%C3%A4udeh%C3%BClle, access: 20.05.2015.

installed. 50 Pa atmospheric pressure (approximately 5kg/m²) is applied into the surrounded building with the help of a fan attached to a part of the external door in the building. A device that measures pressure difference

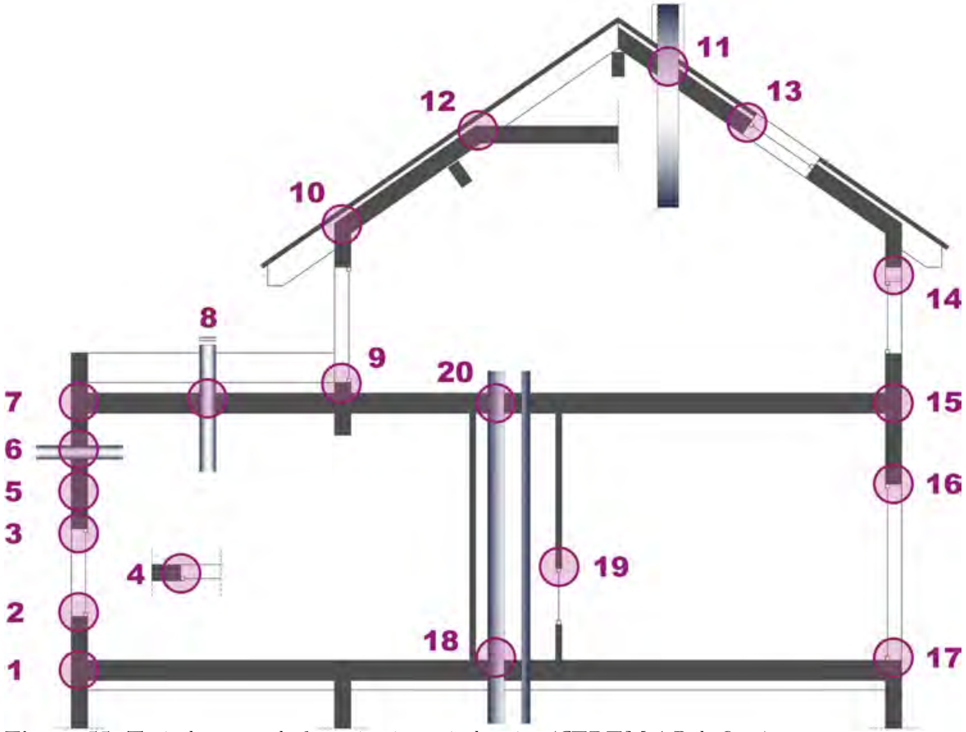


Figure 55: *Typical common leakage sites in vertical section (CEREMA-Pole Qera)*

controls the pressure. Air changes per hour are related to the volume of the space. This is expressed by the n_{L50} value. According to the OIB regulations and the specifications of the Austrian provinces, the n_{L50} value must not exceed, $3h^{-1}$ ($3h^{-1}$= 3 air pressure changes/hour) in buildings without mechanical ventilation, 1.5 h^{-1} in buildings with mechanical ventilation and 0.6 h^{-1} in passive house buildings.[89] This means that the insulation of many zones in the buildings has been controlled. In cases that the gaps cannot be precisely detected, point detection is possible through compressed air and mist created in the room.

Common leakage sites are listed below (see Figure 55):

1) Lower floor junction / vertical wall
2) Window sill junction / vertical wall
3) Window lintel junction / vertical wall
4) Window reveal junction / vertical wall (horizontal view)
5) Vertical wall (Cross section)
6) Perforated vertical wall
7) Top floor junction / vertical wall
8) Penetration of the top floor
9) French window junction / vertical wall
10) Inclined roof junction / vertical wall
11) Inclined roof penetration
12) Inclined roof junction / roof ridge
13) Inclined roof junction / window
14) Junction rolling blind / vertical wall
15) Intermediate floor junction / vertical wall
16) Exterior door lintel junction / vertical wall
17) Exterior door sill junction / sill
18) Penetration lower floor / crawlspace or basement
19) Service shaft junction / access door

Internal wall junction / intermediate floor

Airtightness must be applied to all structural elements that surround the building. In order to ensure this, protrusions need to be avoided as much as possible and details of the connection points of different structure materials must be considered carefully in the planning phase.

In conclusion, the U-values of the building components, airtightness and avoidance of thermal bridges are important features for energy efficiency and construction quality, even for the comfort and well-being of the user. For the evaluation and comparison of the case studies, the U-values of the building components are analysed and compared. Moreover, thermal bridge simulations of some section details have been conducted.

89 Austrian Institute of Construction Engineering (Österreichische Institut für Bautechnik), OIB Guideline 6- Energy Saving and Heat Insulation, March 2015, p. 7.

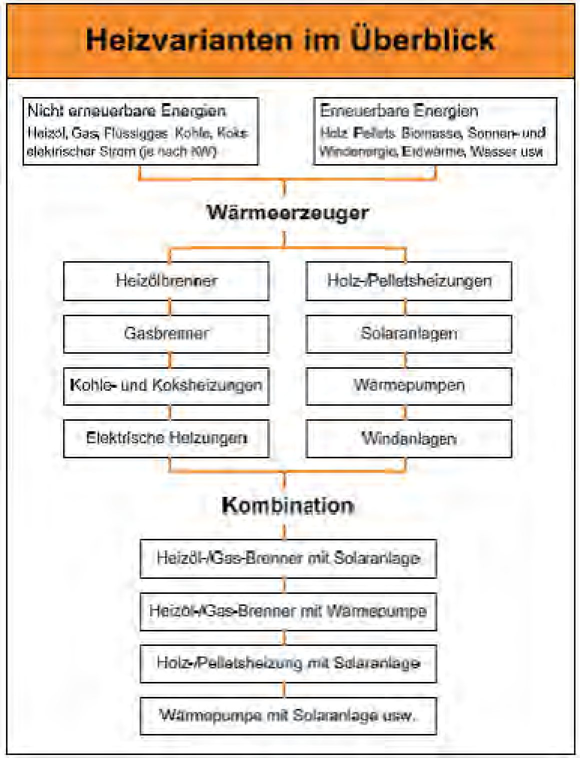


Figure 56: *An overview of heating system variants*

2.3. Heating – Domestic Hot Water

The technical equipment contributes to energy efficiency in buildings as much as the outer shell. Heating systems are of great significance in terms of the holistic building concept that constitutes the sustainable architecture. It is necessary to be very careful during the planning period because of the direct effect of the productive technical equipment on the final energy need, the contributions to the primary energy, and the CO_2 emission values. With the advancement of technology, there have been improvements in heating systems with higher energy efficiencies, which have made it possible to reduce both the heat losses in energy production and distribution, as well as their emissions to the environment. Common types of heating systems have been categorized as shown in Figure 56.[90]

The specific heating energy demand, which is an important indicator of the energy performance of a building, is the commonest reference value to describe the thermal quality of a building envelope. This energy indicator is expressed in kWh/m2 a, i.e. kilowatt-hours per square meter and year. It expresses a house's energy demand per square meter floor area in a year, if it stood at a reference site, i.e. based on a place with a reference climate. Thus, this value is very well suited for comparing the thermic quality of buildings. In order to be able to quickly evaluate this indicator, it is printed besides the coloured scale of the appropriate category

It is possible to divide the heating and cooling systems into two categories, which are renewable and non-renewable. [91] The most usual non-renewable resources used for heating the buildings are oil, natural gas and coal, and the most usual renewable resources used for heating the buildings are biomass (e.g. wooden pellets, heating boiler and biogas), geothermal (e.g. air pumps and geothermal heat pumps) and thermal solar energy (e.g. solar panels).

Fossil energy resources are not included in the category of renewable energy because they are formed through a conversion of organic material as a result of exposure to high temperatures and high pressure. These systems are not favourable in the heating and cooling systems of energy efficient buildings because they are restricted and have high CO2 emissions as a result of combustion. With these features, fossil energy resources are amongst the most important contributors of global warming.

Using renewable energy in buildings is a very important feature effecting sustainability. United Nations states this importance in the report of "About us": "..renewable energy sources are, in addition to their higher energy efficiency, the most important pillar of sustainable energy policy

90 Hanke, S., Schwarz, S., Wohnwelten- Der Ratgeber für Umbauer und Wohnfreaks, DokuMedia Schweiz GmbH, Rüschlikon, 2009.

91 Girmscheid G., Lunze D., Nachhaltig optimierte Gebäude, 2010, Springer Verlag Berlin Heidelberg, p. 113,114.

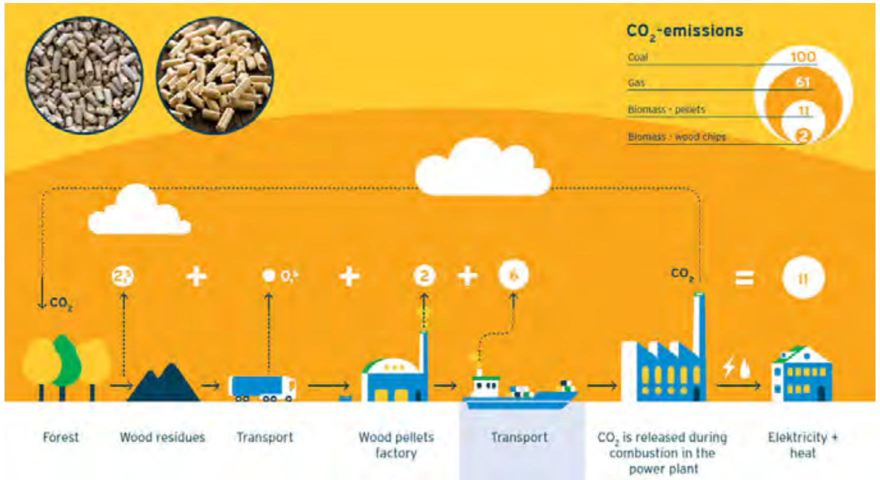


Figure 57: *Total CO_2 - emissions of wood pellets with district heating - compared with other fuels*

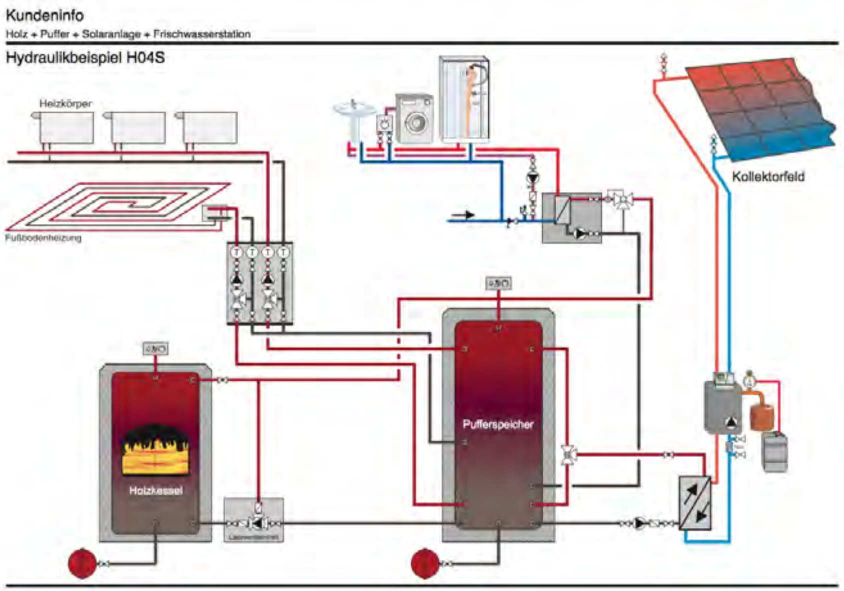


Figure 58: *Wood pellets with buffer storage and solar panels*

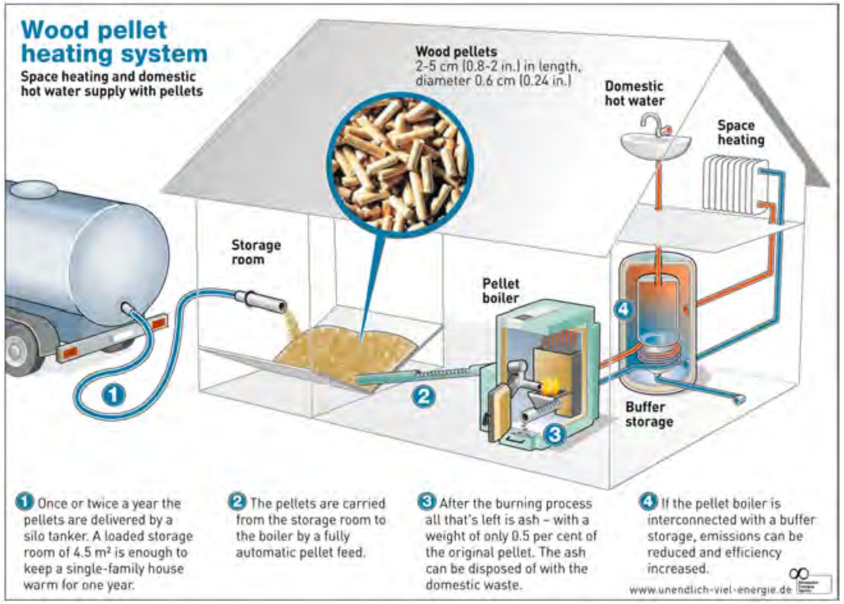


Figure 59: *Wood pellets heating system.*

and energy system."[92]

Typical prevalent renewable energy resources used for the heating of the buildings in Austria are described with details as follows:

Biomass

The solar energy stored in biomass can be converted for use as renewable energy in order to produce thermal energy. The biomass is used for this purpose as a fuel oil for the heating boiler. Possible forms of biomass, which can be used in the heating system are, solid biomass (e.g. wood pellets), gaseous biomass and liquid biomass (rapeseed oil) [93]

The very little if any emissions of the heating systems are released into

92 United Nations, "About Us" in Sustainable Energy for All, 19 June 2012. Translated by the author.

93 Girmscheid G., Lunze D., Nachhaltig optimierte Gebäude, 2010, Springer Verlag Berlin Heidelberg, p. 131.

the environment, which use pellet, wood dust or small wood particles because of the fact that they are CO2-neutral (see Figure 57). Biomass heating systems provide quite a high comfort level, and can be used as central heating or single stove systems in rooms during the winter. The biomass energy systems are a type of renewable energy, and are supplied in European countries from the immediate vicinity saving on unnecessary transportation costs.

The life span of the heating systems can be extended, and it would positively affect the emission values when solar panels and buffer storage units are used in addition to the biomass heating system because the frequency of cycling on/off would be reduced with their implementation. Moreover, an automatic control system is also utilized in these systems in order to keep the room temperature constant. As a consequence, there is no need for manual heating adjustments. 0.7m^3 storage is needed to store the little wood particles for 1 kW heat.[94]

The operating principle of wooden pellet ovens is schematically shown in Figure 58 and.Figure 59)

Biogas or Kompogas is produced during the fermentation of organic material in so-called biogas plants. Usually waste products such as plant remains, slurry, and compost from garden and kitchen waste are used as a fermentation substrate. The substrate serves as nutrients for microorganisms in the biogas plant.

Through the exclusion of oxygen, the biogas is produced with anaerobic bacteria and ferments as a biological decomposition product. Its main components are energy-rich methane (CH4) and carbon dioxide (CO2). This biogas is usually delivered into a directly connected heat-power cogeneration unit, in order to generate electricity and heat.[95]

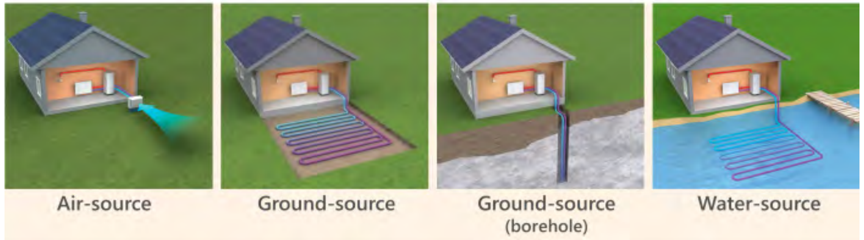


Figure 60: *Different sources of heat pumps*

In addition to this, the rapeseed oil extracted from the "colza" plant is used in heating systems of houses as a bio-fuel.

Heat Pumps

In recent years, heat pumps have become the most common heating system in single-family detached housing units. They operate with the help of three sources: air, soil, and underground water. The heat obtained through heat pumps is brought to the temperature that the house requires with the help of electrical energy.[96] The level of dependency on electricity differs according to the type of light source. For instance, the productivity of air-source heat pumps is lower than the soil-heat pumps during the winter months in places where the temperature is very low. Therefore, they are required to be supplied with more powerful electric motor. In such cases, the preference is for underground water, and holding the soil temperature stable increases the energy efficiency.

Because of the fact that heat pumps only consume renewable energy, there is no dependence on fossil fuels. In addition to this, in a case of a probable power outage, the heating and the hot water systems of the house would become completely dysfunctional.[97] This problem could be overcome through the use of solar or wind energy for electric consumption. Despite the high construction costs, the use of a photovoltaic system as a supplement to heat pumps has great benefits in terms of energy efficiency,

94 Energie Agentur Steiermark GmbH, Das Niedrigstenergiehaus Bauen für die Zukunft, 2014, p. 12.

95 Girmscheid G., Lunze D., Nachhaltig optimierte Gebäude, 2010, Springer Verlag Berlin Heidelberg, p. 133.

96 Energie Agentur Steiermark GmbH, Das Niedrigstenergiehaus Bauen für die Zukunft, 2014, p. 13.

97 Eiselt J., „Optimal Energie sparen beim Bauen, Sanieren und Wohnen", 2013, Springer Verlag Wiesbaden, p. 43.

especially for places that receive many hours of sun. By this means, creating electric energy from the sun provides benefits both for the environment and the user.

As stated above, heat pumps gain energy from 4 different sources. The operation principles of these are shown in Figure 60:

There are different variants of geothermal energy use, depending on where the geothermal energy is absorbed and the medium by which the geothermal heat is transported from its source to the heat pump. Geothermal heat pumps require a large amount of space to transfer heat pipes successfully. For this reason, garden planting possibilities are difficult to realize and often a sufficiently large garden is not available.

As part of the thermal use of groundwater with well systems, the heat that is found in the deep layers of the groundwater is made usable for heating the building. In order to realize it, wells are drilled at depths of 100-400 m in which groundwater is kept at a relatively constant temperature (8-14°C) over the year. The thermal energy contained in the groundwater is raised to a higher temperature level (about 50°C) by means of a heat pump. The thermal energy can then be delivered through a heat exchanger into the heating and hot water circuit of a building. The cold groundwater from which the thermal energy has been withdrawn is supplied back into the groundwater.[98]

Air heat pumps are dependent on high temperature differences and an appropriate installation location in order for the pumps to work on cold winter days and for the heating power and hot water supply to be guaranteed.[99]

Heat pumps can only offer economic benefits when the heat pumps are used in the long-term and in combination with photovoltaic systems because of the high initial investment costs and operational expenses related to electricity. Therefore, they are most often preferred in single-family detached housing units.[100]

98 Girmscheid G., Lunze D., Nachhaltig optimierte Gebäude, 2010, Springer Verlag Berlin Heidelberg, p. 128.

99 Eiselt J., Optimal Energie sparen beim Bauen, Sanieren und Wohnen, Springer Verlag, Wiesbaden, 2013, p. 44.

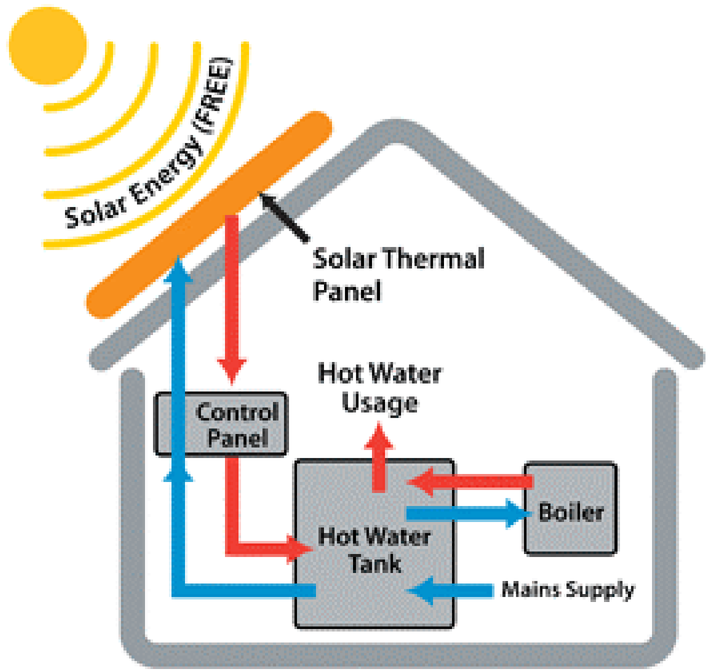


Figure 61: *Working principle of solar panel*

Solar Panels

Solar panels are systems, which are generally installed on the surfaces of roofs in order to produce hot water. The water and the anti-freeze compound, which are put into the solar collectors, are heated by the absorption of solar energy, and transferred to the buffer storage (see Figure 61). While it delivers significantly high performance during sunny summer

100 Panasonic, Lohnt sich die Kombination von Photovoltaik + Wärmepumpe, München, 2013. Available at: http://eu-solar.panasonic.net/fileadmin/user_upload/Messen_Events/20130206_PV_HP_Ecosolutions_Hausmesse_DE.pdf, access: 17.10.2015

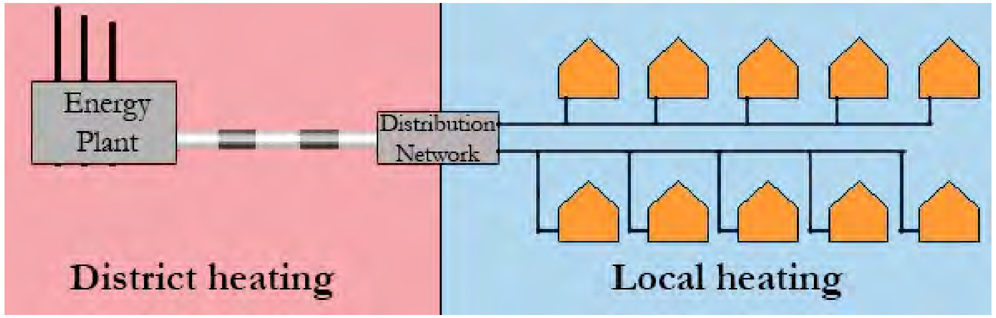


Figure 62: *District and local heating system*

days, it needs extra electricity during the winter months because the liquid in the collectors does not reach the required level for usage. Moreover, when the hot water system and the heating system function spontaneously, the collector power fails to satisfy the needs. Therefore, solar panels cannot meet the hot water and heating requirements of a house on their own.[101]

There is a marked increase in use of solar panels in Austria. The total area of solar panel collectors implemented in 2009 is more than 350,000 square meters.[102]

The incentive credits given by the government for solar panel installations in Austria differ from one province to another. For example, in Vienna a € 1400 incentive is given for 25% of the installation costs of solar panels, which are for the use of hot water, and a € 2100 incentive is given for the installation of the panels, which support the heating system. The amount of this incentive increases by 50% when solar panels and heat pumps are combined.[103] In addition to this, solar panels are not supported by means of credits in Turkey. Despite this fact, solar panels are frequently used as a heating system in Turkey, especially in housing. The use of solar panels can be interpreted as a positive development when their positive contribution to the emission values is considered compared to the widely used heating systems, which use natural gas and fossil fuels. The working principle of solar panels is illustrated below.

Local and District Heating Systems

The usage of district and local heating is an extremely user-friendly and comfortable heating system for the user. It is very space saving, since within the building itself only a small transfer station needs to be installed, which connects the district heating network with its own heat distribution system.[104] A schematic diagram of working principle of district heating is shown in Figure 62. The benefits stated below are received, thanks to the district and local heating plants.[105]

a) Heating boilers, fuel tanks and central heating chimneys are not required for each building. The initial cost of construction and installation is reduced. The spaces remained and can be utilized for other purposes.

b) Because no boiler room is in the buildings, fire and explosion hazards are eliminated.

c) The need for fuel deliveries, ash transportation problems, and boiler room operations are eliminated as a result of this. There is no need for a professional furnace man for each building. Operation costs in buildings would be reduced. The fuel, smoke, ash, and soot pollution would be prevented.

d) Environmental pollution is prevented through necessary filter plants, and emissions are only through a plant chimney designed at an ideal height in the district plant instead of many central heating systems.

e) By installing an incinerator in district heating plants, garbage disposal and the conversion of waste heat into the central heating network is made

101 RP-Energie-Lexikon, Solar Modul. Available at: https://www.energie-lexikon.info/solarmodul.html, access: 18.10.2015.

102 Faninger, G., "Der Solarmarkt in Österreich Rückblick und Ausblick", 2010. Available at: http://www.aee-intec.at/0uploads/dateien869.pdf

103 Solarwärme, Förderungen. Available at: http://www.solarwaerme.at/EFH/Foerderungen/, access: 18.10.2015.

104 Energie Agentur Steiermark GmbH, Das Niedrigstenergiehaus Bauen für die Zukunft, 2014, p. 13.

105 Gürdal E., Merkezi Sehir ve Bölgesel isitma sistemleri, p. 1.

possible.

f) The central heating network keeps the necessary heating capacity constantly ready both for space heating, and for the generation of domestic hot water.

g) By designing central heating systems in combination with electricity generation, allied power plants can be instituted. These explanations are not only valid for solid fuel and fuel oil, but also for natural gas. Although fuel storage and ash problems are also not an issue associated with natural gas usage, a heating room and a chimney are required in each building.

District heating is transported through closed hot water systems to the customers and is converted into central heating through heat exchangers. The most essential source for the district heating supply is the heat gained from the combined heat and power system (CHP).[106] The local and district heating utilities provide the heating transfer media with processes in case harmful substances are released due to the abundance. This occurs in the location of the local and district heating supply and not in the direct user vicinity, and thus does not affect the pollution output around the building that is to be supplied. This also enhances a liveable urban life for the people without negative effects.

Schmidt describes the working principal of the district heating system as,

"*[t]he supplier can provide the heat carriers with a heat provider such as a large boiler, solar collector, or with an electric power-heating coupling process such as an energy plant, or through heat extraction from an energy plant. The combined energy and heat generation has energetic advantages for two reasons. Firstly, this coupling generates high-quality electricity, secondly the waste heat from this process can be used as local or district heating, whereas it is released into the environment when solely generating electricity. Coupling processes can be used at the same time in which two coupling-products, in this case electrical energy and heat, are energetically favourable, and thus desirable. Local heating is provided in small conversion units, and the heat carriers are transported with relatively low temperatures, in order to be able to utilize relatively low-quality waste heat from energy plants and energy from thermal solar systems or geothermal plants. The expansion of district heating plays a major role in the forced thermal use of energy from renewable energy sources.*"[107]

Typical district heating plants have thermal capacities ranging between 100 kW and a few MW, and serve residential and commercial areas and small settlements. They are equipped with a central heat supply, a heat distribution system and connection stations.[108]

In many federal states in Austria, several heating systems are used. The most prominent amongst them is a biomass local heating supply; Biomass heating plants combined with solar systems and large solar plants are some other systems.[109]

The district heating system has been used in Austria since the 1950s. The number of apartments, which have been supplied by the district heating system, has increased from 83,000 (1980)[110] to 935,669 (2012) in the last 30 years.[111] More than one fifth (21%) of buildings in Austria are heated with local and district heating systems. 41% of local/ district heating is sold to households and agricultural companies. According to the BMWFW statistics, the length of the district heating line, which has been installed in Austria in the year 2013, has reached 4918km, and there have been plans to expand this system by 2023 with an average annual distance of 71 km.[112]

The first combined heat and power system (CHP) was applied to the Esenkent Project, a project with a natural gas-fired power plant in 1993.

106 Nahwaerme.at Energiecontracting, Heizen mit Fernwärme. Available at: https://www.gaswaerme.at/bfw/themen/index_html?uid=2654, 25.10.2015.

107 Schmidt M., "Auf dem Weg zum Nullemmissionsgebäude", Springer Vieweg Verlag, Wiesbaden, 2013, p. 128. Translated from German by the author

108 Witt J., "Nahwarme in Neubaugebieten", Oko-Institut Freiburg, 1995.

109 Nahwaerme.at Energiecontracting, Heizen mit Fernwärme. Available at: http://www.nahwaerme.net/cms/index.php/de/das-unternehmen/referenzprojekte?id=93, access: 09.08.2015

110 Fachverband der Gas- und Wärmeversorgunsunternehmungen. Available at: https://www.gaswaerme.at/bfw/themen/index_html?uid=2737, access: 10.07.2015.

111 Statistik Austria, Anteiliger Einsatz aller Energieträger aller Haushalte Insgesamt und nach Verwendungszwecken 2003-2012.

112 BMWFW, "Energieversorgung Fernwärme", 2015. Available at: http://www.bmwfw.gv.at/EnergieUndBergbau/Energieversorgung/Seiten/Fernwaerme.aspx, access: 11.07.2015

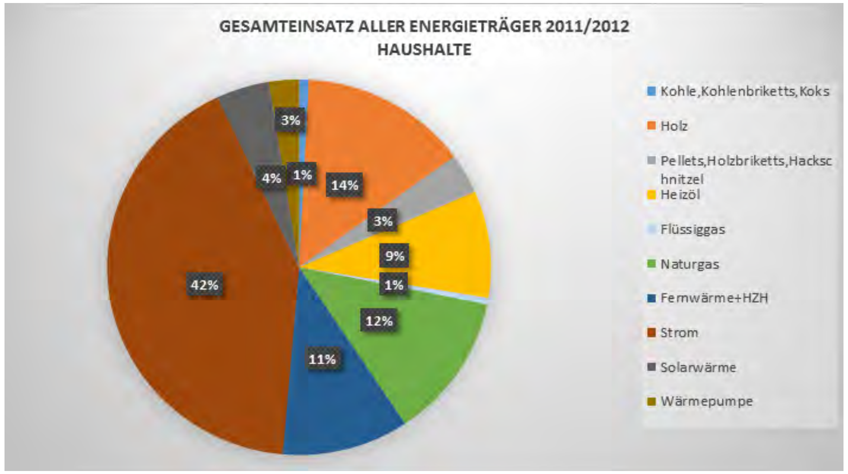


Figure 63: *Energy use of Buildings in Austria according to their resources, 2011-2012*

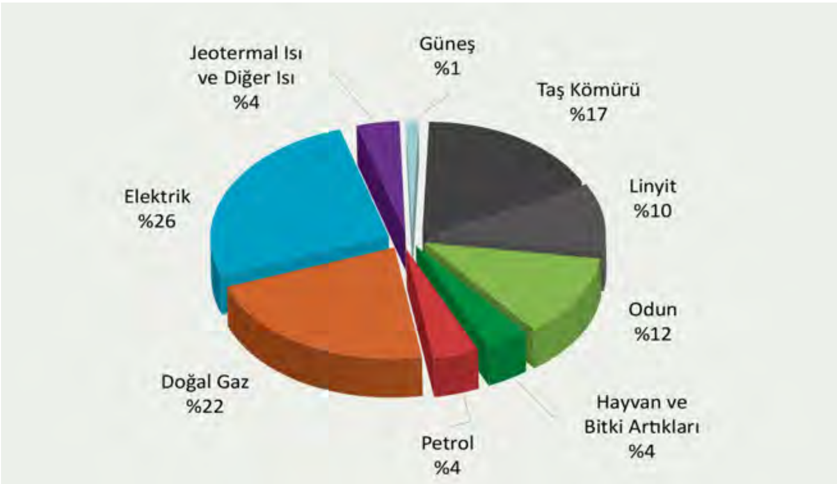


Figure 64: *Energy use of Buildings in Turkey according to their resources, 2010*

This plant, in the Istanbul/Esenyurt Municipality has been established with the aim of meeting the electrical and heating demand of the district.[113] As a result of the research started in 1983 in Izmir Dokuz Eylül University, a geothermal heating station has been first put into operation in Izmir, Balcova in 1996.[114] Turkey ranks 7th in the world and 5th in Europe in terms of geothermal heating capacity. The total heat capacity is 31,500 MWt. This allows the implementation of geothermal district heating systems.[115]

The rates of the required energy sources in Austria for heating and hot water have been indicated between the years 2011-2012 (see Figure 63).

In Turkey, 41% of energy consumption takes place in industrial plants, 31% in buildings, and 20% in transport.[116] According to the 2008 data of the General Directorate of Civil Registration and Nationality, there are more than 15.5 million apartments in Turkey.[117]

As a result, district heating is one of the most efficient environmentally friendly types of energy use with only low implementation losses. Moreover the district heating supply is more flexible and future-oriented when compared to the decentralized heating system.[118]

2.4. Solar Power Generation

In addition to the thermal use of solar energy for heating supply, the use of solar energy for the generation of electricity by means of photovoltaic

113 MMO Zonguldak Subesi, "Enerji Komisyon Raporu", 2009, p. 12.

114 Izmir Jeotermal Enerji San., Tarihce, available at: http://izmirjeotermal.com.tr/hakkimiz-da_balcova_narlidere_jeotermal_saha_isletmesi_, access: 25.10.2015.

115 Jeotermal Vakfi, Jeotermal Enerjisinin Türkiye ve Dünyadaki Önemi, available at: http://www.jeotermalvakfi.org.tr/jeoonem.html, access: 25.10.2015.

116 Karsli S., Güllüce H., Sarac H., Isitma ve sogutma sistemlerinde enerji maliyetlerinin karsilastir-ilmasi, 2012, p. 2.

117 Türkiye de kac konut var?, http://www.milliyetemlak.com/haber/Turkiyede-kac-konut-var/haber.html?haberID=3681, access: 26.10.2015.

118 Schmidt M., "Auf dem Weg zum Nullemmissionsgebäude", Springer Vieweg Verlag, Wiesbaden, 2013, p. 128.

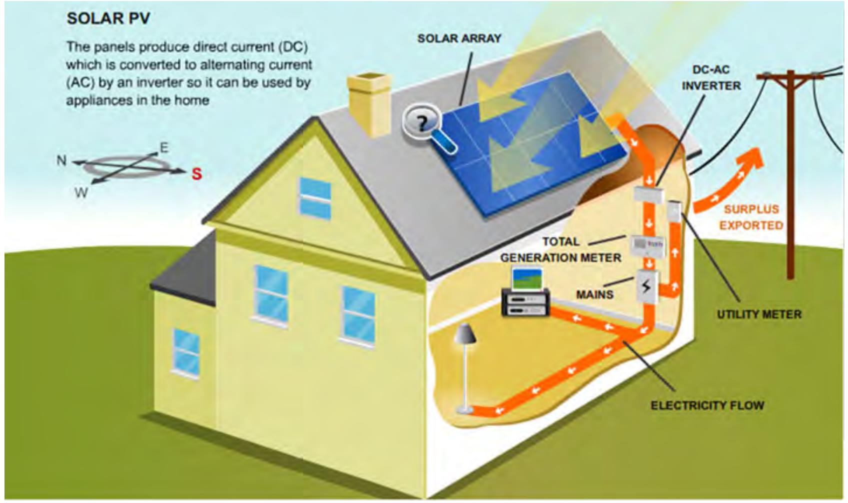


Figure 65: *Photovoltaic system scheme*

systems is another important case of the application of active solar energy use.

Photovoltaic (PV) can be defined as the direct conversion of solar energy into electrical energy.[119] Photovoltaic is used for power generation all over the world. Installations with different sizes are located in different places such as roofs and facades, ticket machines, soundproof walls, calculators or fields. Since 1995, the global photovoltaic market has grown by an average of more than 30% per year. In 2010, PV systems were installed worldwide with a total capacity of 16.6 million kilowatts.[120]

In PV system, the energy is technically transformed through solar cells that are connected to solar modules in a photovoltaic system. The electricity generated by the photovoltaic system can either be used locally / on-site or can be fed into the grid system ("Grid connected PV power system"). Before feeding into the power supply system, the direct voltage (DC) generated by the solar cells is converted into alternating voltage (AC) by means of an inverter. In areas without power supply systems, the entire power supply can also be executed by means of photovoltaic "Stand-alone power systems".[121] Working principle of PV system is shown in Figure 65.

Photovoltaic systems differ in their effectiveness depending on the quality of their components. The efficiency depends mainly on the cell material and the method of installation. The most usual material – monocrystalline silicone can convert 15 percentage of incident light into electricity. In practice, this means that for a plant with a capacity of 1000 Wp, a generator area of eight to ten square meters is required. 750 to 1200 kilowatt hours of electricity can be produced in one year depending on the installation site.[122]

The three most common forms of installations are installation on the roof, on the facade or a ground-mounted system.[123] Solar roofs and façades are preferably rear-ventilated, which promises up to 10% more gain per year. For roof pitches of 20 to 50 degrees, the solar modules are normally mounted parallel to the roof surface. The advantage of the pitched roof system arises from the use of a fallow surface, which also already has the proper slant. The parallel montage, in addition to the constructive efficiency, certainly also has an optical quality. For flat roofs or slightly sloping roofs, it is more productive to install the solar modules to be non-parallel to the roof surface at an angle of 25 to 35 degrees. When the solar modules are inclined at an angle less than 15 degrees, they would no longer be able to be sufficiently cleared from snow and rain.

A solar facade system is an integral part of the building face as design feature. Therefore, it is important to apply this system in a representative way according to the style and philosophy of architects. Moreover, it is also possible that the façade component may itself become a solar module.

119 https://en.wikipedia.org/wiki/Photovoltaics, access: 10.09.2015.

120 O.Ö. Energiesparverband, Informationsbroschüre "Photovoltaik, Strom aus Sonne", p. 2.

121 O.Ö. Energiesparverband, Informationsbroschüre "Photovoltaik, Strom aus Sonne", p. 2.

122 Verbraucher Zentrale Energieberatung, "Photovoltaik, Strom aus Sonnenlicht", Verbraucherzentrale Bundesverband, p. 3, 4.

123 German Energy Society, Planning and Installing Photovoltaic Systems: A Guide for Installers, Architects and Engineers, Earthscan, London, 2008, p.199.

BIPV, building-integrated photovoltaic, is the constructive integration of photovoltaic cells into the building envelope. Here the solar modules not only produce electricity but assume a building function as simultaneous weather protection, sun protection or other construction tasks simultaneously. [124] Vertical façade modules facing toward the southeast or southwest only provide 65% energy efficiency. Vertically-mounted, oriented towards the south and adequately ventilated systems reduce the yield to 70% compared with solar panels which are inclined at an angle of 30 degrees and as an overhangto the front door that has a structural function.[125]

Ground-mounted systems are photovoltaic installations that are not installed on a building, but in an open area within the help of frames or racks. A ground-mounted system can be rigidly mounted or repositioned towards the sun.

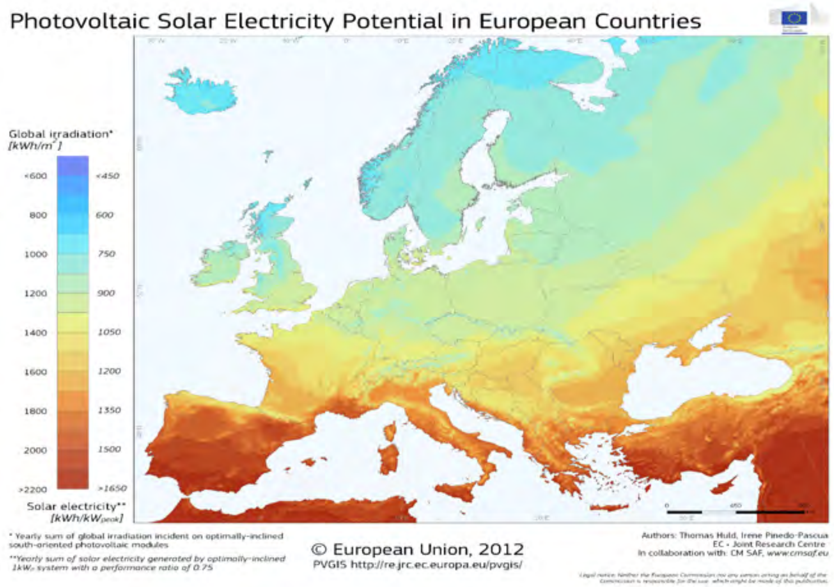


Figure 66: *Photovoltaic Solar Electricity Potential in European Countries, 2012*

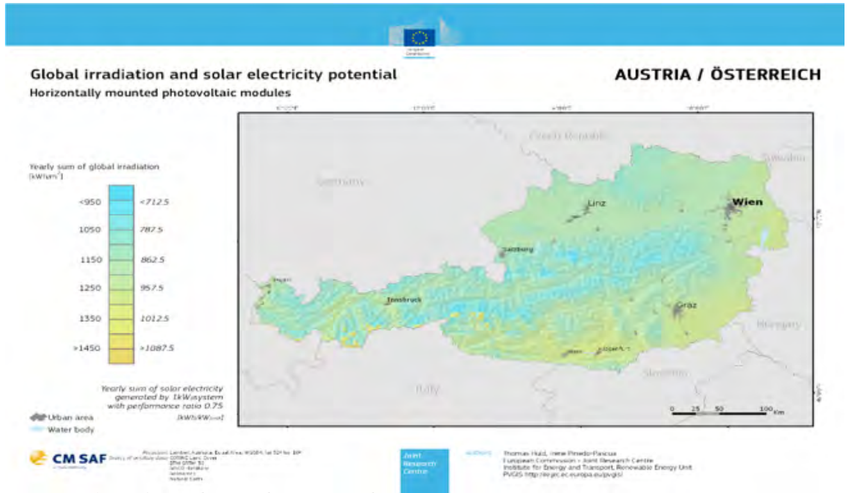


Figure 67: *Photovoltaic Solar Potential in Austria, 2012*

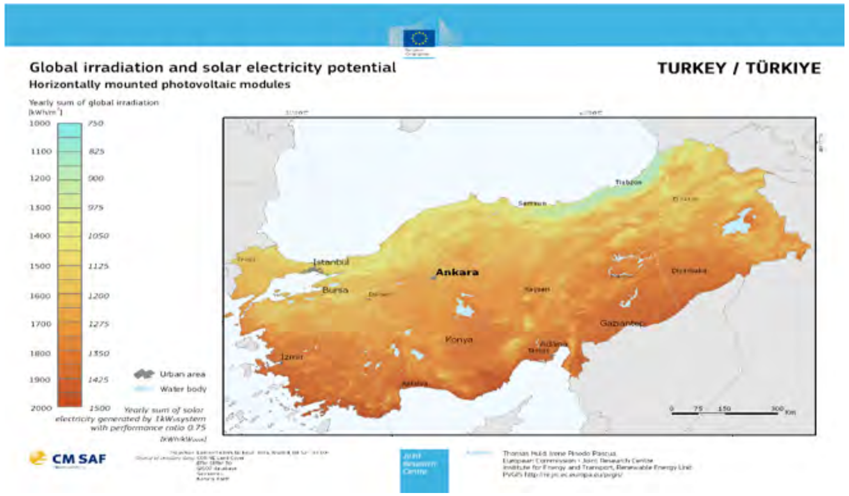


Figure 68: *Photovoltaic Solar Potential in Turkey, 2012*

124 Klima- und Energiefonds, “Photovoltaik-Fibel”, Wien, 2015, p. 12, 13.
125 Klima- und Energiefonds, “Photovoltaik-Fibel”, Wien, 2015, p. 12, 13.

According to the 2012 energy statistics of the Austrian National Statistical Office, the total annual energy need is 3373 kWh for a dwelling with one household, 4476 kWh for a dwelling with two households, 5103 kWh for a dwelling with three households, 5777 kWh for a dwelling with four households, and the total annual energy need for a dwelling with five or more households is 7216 kWh.[126] Accordingly, it is possible to conclude that a 10 m² photovoltaic system can meet between 13% and 21% of the energy needs of a family with four households.

The amount of solar energy produced in the ground is several thousand times larger than the entire energy needs of humanity. The solar radiation incident perpendicular to the Earth's atmosphere is 1367 W/m² (solar constant). From these values, 50 W/m² (heavy cloud) to 1000 W/m² (optimal sunny day) reach the atmosphere. The annual sum of global radiation in Austria, depending on the region, lies between 900 and 1300 kWh/m² and year. In the Sahara, this value can reach up to 2500 kWh/m² and year.[127] (see Figure 66).

The annual sum of global radiation in Turkey is between 1000 und 1900 kWh/m² and year varied by region according to the European Commission Joint Research Centre.[128]

According to these statistics, it is possible to say that the installations of the photovoltaic systems in countries such as Austria and Turkey have many benefits in terms of energy efficiency in buildings. (Figure 67, Figure 68)

The solar power generation in Europe has currently reached about 3 per cent of electricity production, and Austria lags behind the European trend with about 1%. Moreover, for the study of photovoltaic systems, the Climate and Energy Funds Institution has invested approximately 21 million Euros since 2007.[129] The installation of photovoltaic systems differs according to the Austrian province, and various governmental institutions also support them. An incentive of €275/kW peak is provided for freestanding rooftop installations, which include up to 5 kW peak production, and an incentive of €375/kW peak is provided for building-integrated installations, which include up to 5kW peak production.[130]

According to the improvement of Energy Regulation Law on 8 January 2011 in Turkey, electricity produced by solar energy systems is subjected to the government's guarantee of purchase.[131] According to this, 13.3 USD/cent is provided per kWh produced by the solar energy systems, and if domestic products are utilized in the system components supplementary supports are provided. The total support equals 16 USD/cent per kWh at the end of the module production in Turkey provided that no PV cell is attached. This support mechanism is valid for 10 years beginning from the system setup, and the validity period of the supplementary support is the first 5 years.[132]

As a result, solar power generation in buildings is an important issue for sustainability. Housing with solar power generation provides benefits both for the user and environment.

2.5. Ventilation

Sufficient fresh air is important for a high comfort in the home. Ventilation is the most important aspect in respect to fresh air provision, since without sufficient fresh air no homeliness can occur either.

126 Statistik Austria, Direktion Raumwirtschaft, Energie, Modellierung des Stromverbrauchs in den Privaten Haushalten Österreichs nach unterschiedlichen Verwendungszwecken, 2011, p. 24, 25.

127 Strahlungsdichte im erdnahem Raum, http://www.pvaustria.at/daten-fakten/technologie/pv-auslegung/, access: 01.11.2015.

128 European Commission, Joint Research Center, Institute for Energy and Transport, Solar Radiation and Photovoltaic Electricity Potential Country and Regional Maps for Europe. Available at: http://re.jrc.ec.europa.eu/pvgis/cmaps/eu_cmsaf_hor/G_hor_at.png, access: 01.10.2015.

129 Österreichische Technologie Platform Photovoltaik, Photovoltaics Industry and Research in Austria, Wien, 2014, p. 2.

130 Eine Förderaktion des Klima- und Energiefonds der Österreichischen Bundesregierung, "Leitfaden Photovoltaikanlagen", 2015, p. 2-3- Available at: https://www.umweltfoerderung.at/fileadmin/user_upload/media/umweltfoerderung/Dokumente_Private/ENV_private/leitfaden_pv_2015.pdf, access: 09.11.2015

131 Yenilenebilir Enerji Kaynaklarinin Elektrik Enerjisi Üretimi Amacli Kullanimina iliskin Kanun,- No: 5346.

132 Türkiye'de PV güneş enerjisi sistemleri, available at: http://www.guneshaber.net/haber/1612-guncel-haberler-turkiye39de-pv-gunes-enerjisi-sistemleri.html, access: 01.11.2015.

Ventilation of residential buildings can be implemented naturally (windows) or by machine power (mechanically). In natural or free ventilation, the exchange of the polluted or consumed air with fresh outside air happens through leaks in the building hull through windows.

Due to the dependency on meteorological random factors, greater airtightness of the building hulls, and the dependency upon user participation resulting from the first, free ventilation does not work properly in an apartment without further measures. Problems arise particularly in rooms where people sleep. This is related to the relative high amount of humidity released, and at the same time the lack of the possibility of inrush airing. Often, tilting windows is not possible due to exposure to noise or draft, which is energetically not ideal. These factors can lead to deterioration of room air and an increased heating energy demand, which is reflected in additional costs in the next settlement.[133]

Values for approximate air change rates of window ventilation according to the TU Dresden.[134]

Type of window ventilation	Exchange of fresh air in h^{-1}
Closed windows and doors	0 - 0.5
Window tilted, shutters closed	0.3 - 1.5
Window tilted, no shutters (continuous airing)	0.8 - 4.0
Window half opened	5.0 - 10
Window fully open for 6 minutes (inrush airing)	0.9 - 1.5
Window and doors open, directly opposite	25 – 45

133 Kompetenzzentrum „Kostengünstig qualitätsbewusst Bauen“, „Technologische Neuerungen im Bauen und Wohnen“, 2007, p. 67.

134 Schmidt M., Auf dem Weg zum Nullemissionsgebäude, Springer edition, Wiesbaden, 2013, p. 58.

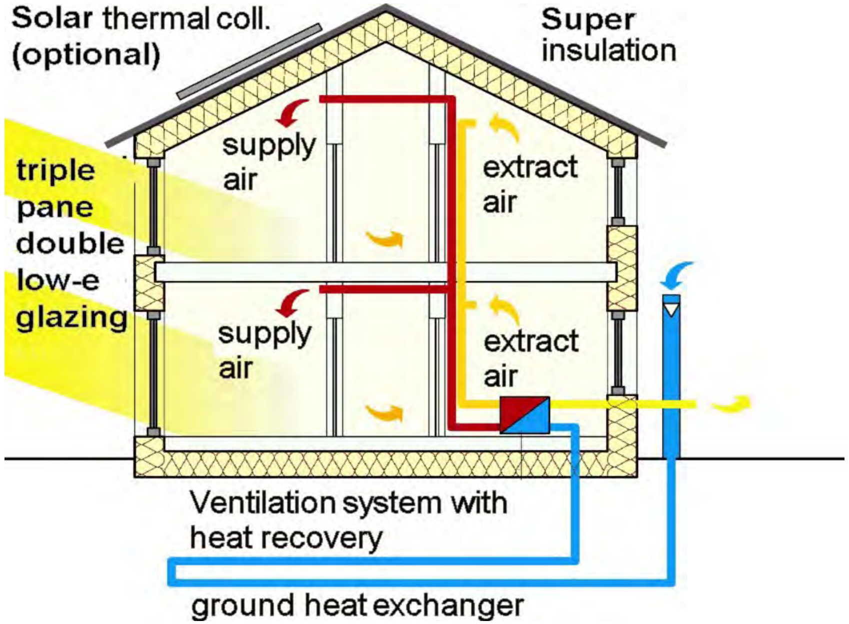


Figure 69: *Representation of a ventilation system with heat recovery.*

Another method for airing the primary rooms of living spaces is the method of mechanical ventilation, such as for living rooms, bedrooms and kitchens, which is referred to as controlled ventilation. Controlled ventilation is often understood as a means to reduce ventilation heat losses of buildings.[135] But mechanical ventilation per se is not a method for energy recovery, if an energy recovery system is not integrated. Accordingly, controlled ventilation will only be efficient if an energy recovery system is available. Figure 69 shows schematic diagram of a ventilation system with heat recovery. But even in systems with energy recovery, the role of user participation has a great importance and is not negligible. Even the best system with energy recovery will be rendered useless if the windows are kept open. That’s why it is necessary to train the inhabitants of such buildings so that they are able to reap the benefits. Of course, this does not mean that the windows of buildings with controlled ventilation and heat

135 Hartmann, T., “Bedarfsgeregelte Wohnungslüftung”. AIRTec, Internationale Fachzeitschrift für Wohnungslüftung und moderne, energieeffiziente Haustechnik, Nr. 1, März 2006, p. 16–20.

recovery are unusable. Such systems are set up using the minimum demand for fresh air, and in case of intensive use cases, windows can be used to provide additional fresh air with natural ventilation.

A controlled ventilation system consists in principle of a central ventilation unit with an integrated heat exchanger and a duct system for air distribution. Fresh air is being sucked in centrally, filtered and then led through the heat exchanger. The exhaust from the interior is also led through the heat exchanger and heats the incoming air. This preheated air is then distributed via the duct system in the building.[136]

The fresh air is led through a longer tube inside the ground into the house. Thereby, the outside air can absorb the heat from the ground. With a geothermal heat exchanger (GTE) the outside air can be preheated to approximately 0° C in winter and cooled down to 20° C in summer. The GTE is situated between the fresh air intake and a ventilation unit. There are two types of GTE, air-source GTE and ground coupled GTE. In an air-source GTE, the fresh air is led in at a depth of about 1.5 meters for about 20 meters through the ground and thereby tempered. Air-source geothermal heat exchangers are no longer recommended for hygienic reasons. The second option is to use a brine (sole) geothermal heat exchanger. In this case, air is not sent through the ground, but rather there is a circuit with a water-antifreeze mixture. The energy of the soil is then transferred to the intake outside air using a heat exchanger right before the ventilation unit.[137]

The advantages of air-source GTE are listed below:[138]

- No power demand for the pump or regulation; power may be needed only for the increased energy requirement due to the higher pressure drop of about 10 Pa on the air side compared to the brine GTE),
- High reliability,
- Cost advantages in small houses (detached houses), if the underground tubes can be installed without extra excavation.

The advantages of brine GTE are listed below:[139]

- It is more hygienic.
- - It is easier to install due to smaller diameters and gradients.
- It has a variable pump and less pressure drop compared to an aerial GTE (1 to 3 Pa instead of 10 to 15 Pa),
- A fresh air filter can be installed in the building.
- There are cost advantages in larger buildings.

Controlled ventilation systems with heat recovery can greatly reduce ventilation heat losses. These systems can also be applied to existing buildings. But it is important to consider, in implementation, the aspects of demand oriented ventilation, filtering of the fresh air, and noise protection in necessary conditions. State of the art technology allows recovery levels of 80% to over 90%.[140] For buildings with low heat demands such as passive houses, supply and exhaust air systems with heat recovery are imperative.

Controlled ventilation systems are prevalent in single family houses and multi-unit houses in Austria. (See Chapter V). However in Turkey, there is negligible interest in controlled ventilation systems except in a few private residences because of the high investment and operating costs.

136 Das Niedrigstenergiehaus, Bauen für die Zukunft, Document of Projektteam Energie Agentur Steiermark GmbH, 2014, p. 15. Available at: http://www.ea-stmk.at/download/NZEB_Broschuere_Sep2014_web.pdf., access: 08.10.2015

137 Komfortlüftung.at Gesund und Energieeffizient, http://www.komfortlüftung.at/was-ist-eine.komfortlueftung/bestandteile/erdwaermetauscher/, access: 02.11.2015.

138 Komfortlüftung.at Gesund und Energieeffizient, http://www.komfortlüftung.at/was-ist-eine.komfortlueftung/bestandteile/erdwaermetauscher/, access: 02.11.2015.

139 Komfortlüftung.at Gesund und Energieeffizient, http://www.komfortlüftung.at/was-ist-eine.komfortlueftung/bestandteile/erdwaermetauscher/, 02.11.2015.

140 Glombik M. B., Stand der Technik bei der energetischen Modernisierung, Aachen, January 2008, p. 102.

2.6. Sun Shading - Overheating in Summer

As aforementioned, the outer shells of buildings have the task to preserve internal heat gains in winter, and to hinder the entrance of heat into the building in summer. The most important measurement to be taken in the summer months is the prevention of solar gains in the building. This is directly possible with the protection of transparent construction elements through the help of component elements such as sun visors, jalousies, and also through elements such as balconies, canopies and eaves. The aim is to provide protection from the sun's rays in hot weather in order to minimize the cooling energy need by using solar shading, which are conducted according to the sun orientation calculations. Not only the sun's rays, but also other factors such as internal heat gains from lighting, people, and machines also contribute to heating the space.[141]

In Figure 70 heat factors are described, which affect the space.

The energy efficiency in buildings must have qualifications, which are appropriate for summer conditions, in a way to minimize or eliminate the need for an air conditioning system. Otherwise, extra measures must be taken in order to cool the spaces that are heated by the sun's rays. Air conditioning appliances, which are used for space cooling, require quite a lot of electricity. On the one hand, it negatively affects the budget of the consumer, and it also has a negative impact on the economy of the countries, which are dependent on energy imports. At the same time, air conditioners emit quite intense greenhouse gases into the environment.

For example according to the Figure 71, the energy consumed by air conditioning appliances corresponds to the 15% of the total energy consumption.[142] This ratio increases significantly in southeaster Anatolia, and in the Mediterranean region where the sun reaches the buildings at a steeper angle.

In order to address the problem of overheating, solar light and heat input should be considered and also checked by calculations by architect during the planning phase. The amount of glass, orientation to the sun and energy transmittance values are important factors to be considered to prevent

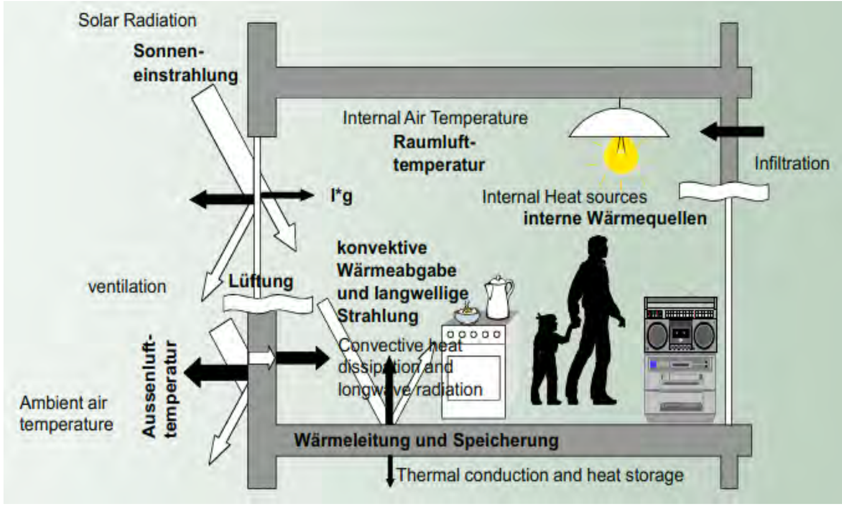


Figure 70: *Representation of heat gains of a space*

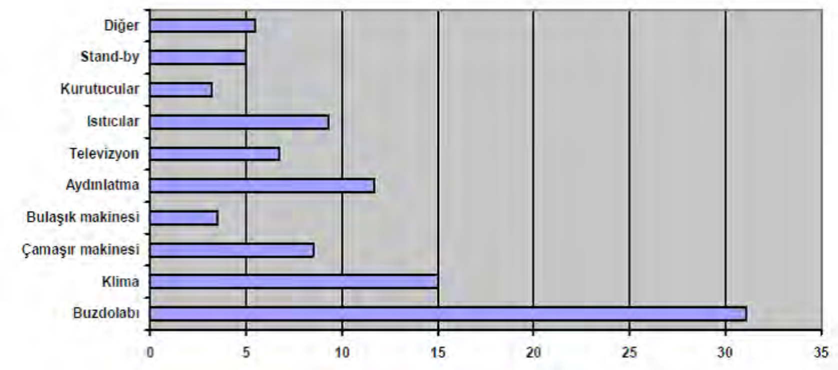


Figure 71: *Consumption of electrical household appliances*

energy losses in winter and excessive overheating in summer. In built-up attic constructions it is of great importance to impleWment measures so

141 Zürchner C., Bau und Energie - Leitfaden für Planung und Praxis, Vieweg+Teubner Verlag, 1998, p. 143.

142 Mutlu M., Elektrikli ev aletlerinin enerji etiketlemesinin incelenmesi. Ulusal İklimlendirme Kongresi, 2011, p.529-537, Antalya, p.2.

that the roof windows are protected against overheating in summer, and solar shading has special consideration. They provide much higher energy input than vertical south glazing.

The total energy transmittance value which is called as "g-value" impose a significant influence on overheating as well the U-value of the window. The g-value indicates the amount of solar energy that passes through the glazing into the building. A value of 0.55 means for example, that 55% of radiant energy will reach the room interior. In winter season, a high g-value is an advantage, but may lead to overheating in the summer. The U-value provides information about heat losses. In practice, highly insulated windows have low U-values but also low g-values. [143] The planning office should be responsible for creating a balance of these values in relation to the proportion of window area. While taking measures the diagram of the position of the sun during the year and during the day has to be considered to provide the optimum sun shading.

Figure 72 shows solar altitude for city of Vienna. When looking at this chart, it is possible to see the angle at which the sun is located during the respective season and time, both horizontally and vertically.[144]

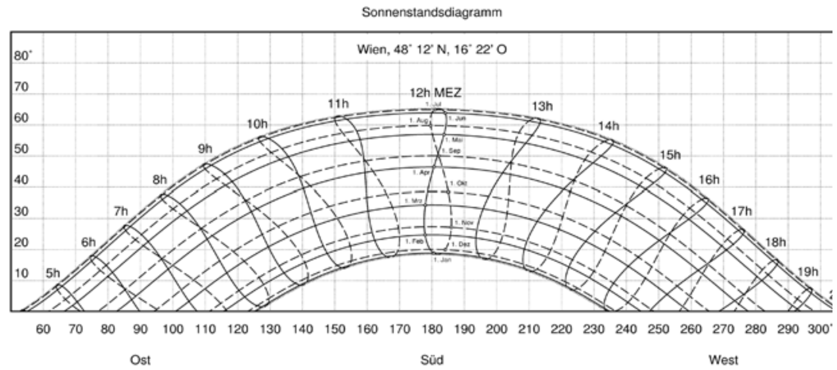


Figure 72: *Solar altitude for Vienna*

In order to prevent overheating of the building, another significant factor is the heat storage capacity of the building components. A component with high heat capacity also has a high thermal storage capacity, which acts both on the exploitability of the heat gains as well as the heating performance of an area.[145] Massive components (such as concrete, brick and concrete screed) are especially advantageous in summer. Thermal storage masses have the advantage that they are able to compensate for day and night temperature differences. It becomes more advantageous when nocturnal temperatures are able to be stored in the room by activated heat storage masses for a longer period of time. Therefore, it allows as little summer heat into the building as possible. Solar shading is essential in order to achieve this.[146]

Closed and shaded areas of glass also block the heat. Proper ventilation occurs only at night. In the night, as many windows as possible should be tilted in order to achieve efficient cross-ventilation. With mechanical ventilation, night ventilation can be carried out more efficiently by higher air change rates. The air is additionally cooled by an upstream geothermal heat exchanger. However, ventilating the living space can only reduce overheating. Consistent shading has a much stronger cooling influence.[147]

One of the measures to prevent sun rays is using shading devices. The effectiveness of shading devices with respect to energy input is defined by the reduction factor Fc (formerly Fz) in the DIN 4108-2 Norm.[148] This factor can be between 0 (theoretically this is the best sun protection) and 1 (no protection). A Fc of 0.75, as is the case with curtains, means that 75% of solar energy can penetrate into the interior of the room.[149]

143 Energie- und Umweltagentur Niederösterreich, "Sommerliche Überwärmung", 2010, p. 1.

144 Wikipedia, Sonnenstandsdiagram für Wien, https://upload.wikimedia.org/wikipedia/commons/1/18/Sonnenstandsdiagramm_Wien.png, access: 06.11.2015.

145 http://volland.userweb.mwn.de/vhb/bautop/html/simulationen/energie/waermespeicherung.pdf, access:07.11.2015

146 Treberspurg M., Streicher W., Reim T., Hofbauer W., „Sommertauglichkeit im Wohnbau Teil 1", 2007, p. 33.

147 Energie- und Umweltagentur Niederösterreich, „Sommerliche Überwärmung", 2010, p. 1.

148 The German Institute for Standardisation (Deutsches Institut für Normung), DIN 4108-2, Thermal Protection and Energy Economy in Buildings – Part 2, Minimum Energy Requirements to Thermal Insulation, February 2013

149 Energie- und Umweltagentur Niederösterreich, "Sommerliche Überwärmung", 2010, p. 1.

Shading devices for hindering solar gains into the building have been classified by Horst as fixed solar shading (houses, hills or trees, horizontal, fixed lamella panels, large components such as canopies, balconies or loggias, and thermal insulated glazing).and movable solar shading (exterior blinds, rolling shutters, awnings, internal shutters, interior blinds and curtains).[150] Shading is not only necessary for window areas, but also the entire building. The most effective technique is to block the direct solar irradiation in front of the building. Shading can consist of components of the building itself such as, other buildings or trees. These are more effective than front transparent components. If shading is positioned outside the transparent components, they can block all the direct solar irradiation and lessen the diffuse irradiation depending on the solar shading system and regulation.[151] Building fixtures on the south side such as balconies and cantilevers are other effective shading techniques which should be implemented in design phase.

Other than through fixed shading devices, adjustable shading devices control solar radiation penetration. The reflective properties and absorption properties do not matter for external shading. The absorption properties only play a role if the heated air on the shading devices reaches the interior. If free window ventilation is used with external shading, the shading device must not function as a heat exchanger for the air supply. In this case, the shading device should be positioned far from the vent and window ventilation during the day, which remains disadvantageous in the summer since room temperatures will always be below the outdoor temperatures.[152]

According to the Fc values of different shading systems, the best solar shading system is an external blind system applied to the exterior window surface.[153]

To avoid summer overheating in Austria, ÖNORM B 8110-3[154], "Thermal protection in building construction — Part 3: Prevention of summerly overheating" is applied in buildings, where heat storage and solar influences are the focus of the summer calculations.

Protection against overheating in summer is achieved in the ÖNORM via the detection of sufficient thermal inertia, considering inhibitory emission effects (e.g. shading, g-value), as well as the heat dissipation through ventilation. In summer and transitional periods, sun screening makes the ventilation system, especially the night ventilation the thermal storage by the building's mass of the space-enclosing components, and the selected orientation of the radiation-permeable surfaces an effective (structural engineering) means to avoid room overheating by solar radiation. The possible overheating by internal heat sources (e.g. persons, lighting and appliance and heat) should be considered separately.[155] "Summer overheating is prevented if the perceived room temperature does not exceed temperatures in the area set during a heat wave. This limit temperature t* is set at + 27 ° C during the day + 25 ° C at night."[156]

This validation can be fulfilled either through by using a simulation program that meets the requirements of ÖNORM EN ISO 13792, "Thermal performance of buildings - Simplified methods - Calculation of summer temperatures of a room without mechanical cooling"[157], or by identifying the minimum necessary thermal storage by the building's mass calculated according to the ÖNORM B 8110-3.[158] According to this norm new

150 Horst B., Sommerlicher Wärmeschutz, Kommunals Energiekonzept Graz, Report No 27, March 2000, Graz, p.21,22.

151 Treberspurg M., Streicher W., Reim T., Hofbauer W., „Sommertauglichkeit im Wohnbau Teil 1", 2007, p. 37.

152 Ibid, p. 40.

153 Horst B., Sommerlicher Wärmeschutz, Kommunals Energiekonzept Graz, Report No 27, March 2000, Graz, p.21

154 Austrian Standards - ÖNORM B 8110-3, Thermal protection in building construction, Part 3:Prevention of summerly overheating, 2012

155 Ibid.

156 Ibid.

157 Austrian Standards- ÖNORM EN ISO 13792, Thermal performance of buildings-Simplified methods- Calculation of summer temperatures of a room without mechanical cooling, 2012.

158 Doubek M., Vermeidung von sommerlicher Überwärmung Entwurf eines vereinfachten Rechenmodells, 2008, p. 26.

residences in Austria have to be designed with proof that the summertime overheating calculations have been carried out, with an energy certificate in order to take necessary measures in the planning stage (see Figure 73). Accordingly, the room temperature of the living room is allowed to reach a maximum of 27°C. Figure 74 shows an example of the simulation of a dwelling for overheating in summer. Solar protection systems, which are needed for the prevention of overheating, are also included and calculated with the help of simulations.

In contrast with the calculations of summertime overheating, the calculations are not obligatory in Turkey and are according to insulation regulations and other regulations.

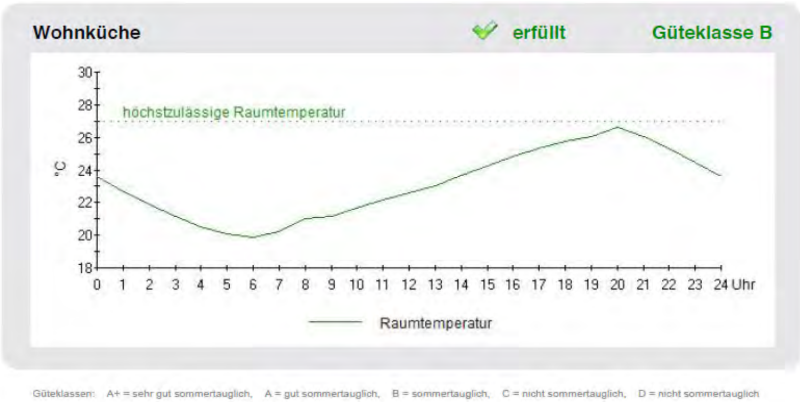
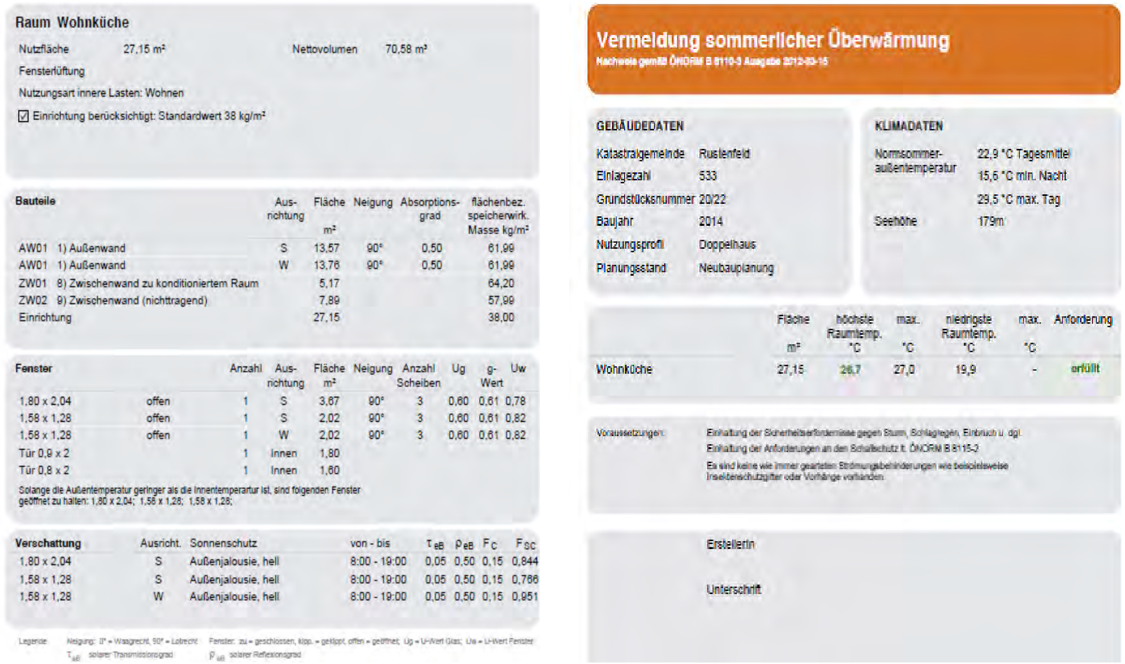


Figure 73: *Simulation of a dwelling for the overheating in summer in GEQ Energy Certificate Pass Programme, by Atilla Hatipoglu*

2.7. Acoustic Insulation

Acoustic, sound and noise are similar terms which are thinly separated. The definition of sound, according to the Szokolay, "is the sensation caused by a vibrating medium as it acts to the human ear".[159] Noise is random



Raum Wohnküche

Nutzfläche 27,15 m² Nettovolumen 70,58 m³

Fensterlüftung

Nutzungsart innere Lasten: Wohnen

☑ Einrichtung berücksichtigt: Standardwert 38 kg/m²

Bauteile	Aus-richtung	Fläche m²	Neigung	Absorptions-grad	flächenbez. speicherwirk. Masse kg/m²
AW01 1) Außenwand	S	13,57	90°	0,50	61,99
AW01 1) Außenwand	W	13,76	90°	0,50	61,99
ZW01 8) Zwischenwand zu konditioniertem Raum		5,17			64,20
ZW02 9) Zwischenwand (nichttragend)		7,89			57,99
Einrichtung		27,15			38,00

Fenster		Anzahl	Aus-richtung	Fläche m²	Neigung	Anzahl Scheiben	Ug	g-Wert	Uw
1,80 x 2,04	offen	1	S	3,67	90°	3	0,60	0,61	0,78
1,58 x 1,28	offen	1	S	2,02	90°	3	0,60	0,61	0,82
1,58 x 1,28	offen	1	W	2,02	90°	3	0,60	0,61	0,82
Tür 0,9 x 2		1	Innen	1,80					
Tür 0,8 x 2		1	Innen	1,60					

Solange die Außentemperatur geringer als die Innentemperartur ist, sind folgenden Fenster geöffnet zu halten: 1,80 x 2,04; 1,58 x 1,28; 1,58 x 1,28;

Verschattung	Ausricht.	Sonnenschutz	von - bis	τ_{eB}	ρ_{eB}	F_C	F_{SC}
1,80 x 2,04	S	Außenjalousie, hell	8:00 - 19:00	0,05	0,50	0,15	0,844
1,58 x 1,28	S	Außenjalousie, hell	8:00 - 19:00	0,05	0,50	0,15	0,766
1,58 x 1,28	W	Außenjalousie, hell	8:00 - 19:00	0,05	0,50	0,15	0,951

Legende Neigung: 0° = Waagrecht, 90° = Lotrecht Fenster: zu = geschlossen, kipp. = gekippt, offen = geöffnet; Ug = U-Wert Glas; Uw = U-Wert Fenster
τ_{eB} solarer Transmissionsgrad ρ_{eB} solarer Reflexionsgrad

Vermeidung sommerlicher Überwärmung
Nachweis gemäß ÖNORM B 8110-3 Ausgabe 2012-03-15

GEBÄUDEDATEN	
Katastralgemeinde	Ruslenfeld
Einlagezahl	533
Grundstücksnummer	20/22
Baujahr	2014
Nutzungsprofil	Doppelhaus
Planungsstand	Neubauplanung

KLIMADATEN	
Normsommer-außentemperatur	22,9 °C Tagesmittel
	15,6 °C min. Nacht
	29,5 °C max. Tag
Seehöhe	179m

	Fläche m²	höchste Raumtemp. °C	max. °C	niedrigste Raumtemp. °C	max. °C	Anforderung
Wohnküche	27,15	26,7	27,0	19,9	-	erfüllt

Voraussetzungen: Einhaltung der Sicherheitserfordernisse gegen Sturm, Schlagregen, Einbruch u. dgl.
Einhaltung der Anforderungen an den Schallschutz lt. ÖNORM B 8115-2
Es sind keine wie immer gearteten Strömungsbehinderungen wie beispielsweise Insektenschutzgitter oder Vorhänge vorhanden.

ErstellerIn

Unterschrift

Figure 74: *Example of a calculation of overheating in summer, in GEQ energy certificate programme, by Atilla Hatipoglu*

vibrations without regular patterns.[160] But a more meaningful definition of noise is undesirable sounds which annoy people. "Acoustic" is a term from Greek, which means hearing, expresses the science of sound. With a good building acoustic the prevention of sound overcoming a space can

159 Szokolay, S.V., Introduction to Architectural Science: The Basis of Sustainable Design, Architectural Press of Elsevier, Oxford, 2009, p. 145.

160 Ibid., p. 153.

be demonstrated.[161]

An important feature of a sustainable living space is sound insulation, especially in housing. Mommertz indicates that the living area should be designed to provide the possibility of withdrawing which means ensuring a private sphere against the noises from our neighbours.[162] Moreover sound protection is necessary for the comfort and health of the user although the obligatory measures are underestimated in a lot of countries. (See Chapter IV, 1.6).

Soundproofing provides reduced sound pressure between the source and listener, and sound insulation refers to measures used to reduce sound transmission from a sound source to a receiver. In order to protect the user of a space from undesirable sounds, from the outside or adjacent neighbours, suitable measures in buildings should be taken.

Sound transmission occurs on flanking components as well as separate elements (see Figure 75). By using elastic surfaces, mass, and separation of components, these sound transmissions can be avoided or mitigated.[163] For flanking components the flanking sound level difference Dnt is used. Sound Reduction Index R describes the insulation of building components, such as walls, floors, and doors, against airborne sound, showing how much decibel sound is restricted by the component during the transmission. Higher Sound Reduction Indexes provide better sound insulation. Weighted Apparent Sound Reduction Index, R'w, is used to designate sound insulation in a construction, and does not concern only separating components, but also takes into consideration all transmission paths, such as flanking transmissions.[164] The sound insulation of external components is valued, using the in construction weighted Weighted Apparent Sound Reduction Index, R'w, whereas at a facade, it consists

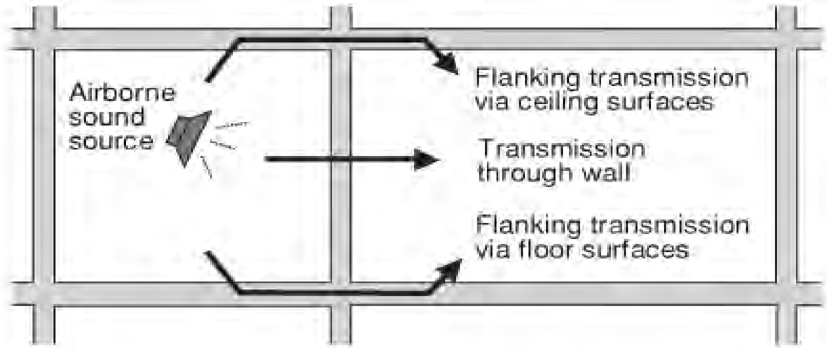


Figure 75: *Sound transmission passing through building components*

of several parts (window, wall, door etc.), and the resulting Weighted Apparent Sound Reduction, R'res,w is used. This evaluation is carried out for individual frequencies and provides sound insulation.

Airborne Sound Insulation

Sound is produced into the air and causes vibrations which hit upon dividing components in different spaces, and are transmitted by these components. [165] The measures which are implemented in this situation are called airborne sound insulation. When determining the requirements for airborne sound insulation between rooms, one aspect is in the foreground: If a steady sound of a particular frequency is generated in a source room, to what extent can this sound be heard or understood in a second receiving room.[166]

Weighted standardised level difference Dnt,w is the field measurement of airborne sound transmission. Whether the sound insulation of a wall or ceiling is felt to be sufficient in practice, depends heavily on the existing

161 Mommertz, E., Acoustics and Sound Insulation: Principles, Planning, Examples, Detail Practice, Birkhäuser, Basel, 2009, p. 49.

162 Ibid, p. 49.

163 Szokolay, S.V., Introduction to Architectural Science: The Basis of Sustainable Design, Architectural Press of Elsevier, Oxford, 2009, p. 162.

164 Mommertz, E., Acoustics and Sound Insulation: Principles, Planning, Examples, Detail Practice, Birkhäuser, Basel, 2009, p.27.

165 Ibid.

166 SteelConstruction.info, Introduction to acoustics. Available at : http://www.steelconstruction.info/Introduction_to_acoustics, access: 11.11.2015

noise level. For a very low noise level, discussions from the neighbouring apartment are better understood than at a higher noise level. For solid components, reduction index depends only on the mass per unit area (kg / m²). The greater the mass is, the higher the sound insulation and vice versa.

Impact Sound Insulation

Walking or other impact sources which occur directly on building elements cause vibration of construction components. Thereby air particles are moved in the next room, and result in airborne sound.

After an impact, sound reaches the receiving room, it is measured and it is recorded as impact sound pressure level L. Field measurements in buildings are standardised to a reverberation time of 0.5 seconds, and they determine the standardised impact sound pressure level L'nT. Tests in laboratories, which are normalised for area and absorption, give the normalised impact sound pressure level Ln.[167] Weighted normalised impact sound pressure level, Ln,w is the laboratory measurement of a building component without flanking transmissions, and L'n,w is the field measurement of this value, which does include flanking transmissions.[168] Weighted Standardized Impact Sound Pressure Level L'nT,w is another value which is obtained from L'n,w to determine the impact sound insulation. An effective impact sound insulation is achieved with the following measures:[169]

- Large bulk of the ceiling (kg / m2)
- Footfall sound insulating boards under the screed and completely misplaced angle edge strip along all walls and doors (floating screed)
- Floating floor construction in dry construction (dry screed or wooden structure)

167 Acoustic Glossary. Available at: http://www.acoustic-glossary.co.uk/sound-insulation.htm, access: 10.11.2015.

168 Mommertz, E., Acoustics and Sound Insulation: Principles, Planning, Examples, Detail Practice, Birkhäuser, Basel, 2009, p.27-28.

169 Land Oberösterreich, Schallschutz im Wohnbau, April 2014, p. 8.

Glass wool, coconut fibre, and rock wool are included amongst the forms of effective impact sound insulation. These materials have been applied very often in Austria, but only heat insulation materials, such as XPS, have been used in Turkey, and no other sound insulation materials have been applied.

Although sound insulation in the building components is very significant, there are also other important features to restrict sound transmission to the living spaces. These features, which should be considered by architects, can be summerised as below:[170]

1. The orientation of transparent exterior building components such as windows, and orientation of bedrooms and living rooms should be designed to be averted from external noise sources.

2. Layout arrangements of floor plans: Sound sources such as baths and lifts should not be adjacent to bedrooms.

3. Type of construction (massive, medium or light construction).

4. Determination of separating components and flanking components (Impact of the flanking sound transfer is decisive for the achievable sound insulation).

5. Water installations (For example, fittings and pipes should be installed only on walls with m' ≥ 220 kg/m2 or prefabricated components should be used)

6. Technical building equipment arrangement and application (for example, lift, heating devices, etc.)

A comprehensive study in the field of sound insulation for buildings does not exist yet in Turkey. The measures, which should be taken in order to reduce environmental noise, are carried out according to the Regulation

170 Fischer H., Freymuth H., Häupl P., Homann M., Jenisch R., Richter E., Stohrer M., ‚Lernbuch der Bauphysik, 2008, 6.Auflage, Wiesbaden: Vieweg+Teubner Verlag, p. 3.

on the Assessment and Management of Environmental Noise, dated 2002/49/EC, of the Ministry of Environment and Forestry.[171]

On the other hand, in 2007, in Austria, the OIB Guideline 5 Regulation came into force[172], in order to control the sound insulation in buildings. The sound insulation values of buildings, which are included in the important structure categories, especially residences, operating bases, dorms, schools, and hospitals, has been handled in detail within the scope of the regulations, which were updated in 2011 and also in 2015. The specified requirements serve to ensure sufficient protection of the listed rooms for people with normal sensitivities against sound emissions that come from outside, and other living units from the same building and adjacent buildings. According to article 2.2.3 of this regulation, in buildings such as residences, kindergartens, hotels, and dorms, the minimum sound insulation of the surrounding elements of the rooms, such as external walls, windows, floors, and ceilings, cannot exceed the values indicated in the table below.[173] (See Figure 76)

According to Article 2.5 of this regulation, the maximum values of another type of sound insulation, which has the goal to attenuate the sound of footsteps, are shown in Figure 77.[174]

Mindesterforderliche Schalldämmung von Außenbauteilen für Wohngebäude, -heime, Hotels, Schulen, Kindergärten, Krankenhäuser, Kurgebäude u. dgl.								
Maßgeblicher Außenlärmpegel [dB]		Außen-bauteile gesamt [dB]	Außen-bauteile opak [dB]	Fenster und Außentüren [dB]		Decken und Wände gegen nicht ausgebaute Dachräume [dB]	Decken und Wände gegen Durchfahrten und Garagen [dB]	Gebäude-trennwände (je Wand) [dB]
Tag	Nacht	$R'_{res,w}$	R_w	R_w	R_w+C_{tr}	R'_w	R'_w	R_w
≤ 45	≤ 35	33	43	28	23	42	60	52
46 - 50	36 - 40	33	43	28	23	42	60	52
51 - 60	41 - 50	38	43	33	28	42	60	52
61	51	38,5	43,5	33,5	28,5	47	60	52
62	52	39	44	34	29	47	60	52
63	53	39,5	44,5	34,5	29,5	47	60	52
64	54	40	45	35	30	47	60	52
65	55	40,5	45,5	35,5	30,5	47	60	52
66	56	41	46	36	31	47	60	52
67	57	41,5	46,5	36,5	31,5	47	60	52
68	58	42	47	37	32	47	60	52
69	59	42,5	47,5	37,5	32,5	47	60	52
70	60	43	48	38	33	47	60	52
71	61	44	49	39	34	47	60	52
72	62	45	50	40	35	47	60	52
73	63	46	51	41	36	47	60	52
74	64	47	52	42	37	47	60	52
75	65	48	53	43	38	47	60	52
76	66	49	54	44	39	47	60	52
77	67	50	55	45	40	47	60	52
78	68	51	56	46	41	47	60	52
79	69	52	57	47	42	47	60	52
≥ 80	≥ 70	53	58	48	43	47	60	52

Figure 76: *Minimum sound insulation values of the building components in residential buildings, kindergartens, hotels etc.*

Höchst zulässiger bewerteter Standard-Trittschallpegel $L'_{nT,w}$			
in		aus	$L'_{nT,w}$ [dB]
1	Aufenthaltsräumen	Räumen anderer Nutzungseinheiten (Wohnungen, Schulen, Kindergärten, Krankenhäuser, Hotels, Heime, Verwaltungs- und Bürogebäude und vergleichbare Nutzungen)	48
		allgemein zugänglichen Terrassen, Dachgärten, Balkonen, Loggien und Dachböden	48
		allgemein zugänglichen Bereichen (z.B. Treppenhäuser, Laubengänge)	50
		nutzbaren Terrassen, Dachgärten, Balkonen, Loggien und Dachböden	53
2	Nebenräumen	Räumen anderer Nutzungseinheiten (Wohnungen, Schulen, Kindergärten, Krankenhäuser, Hotels, Heime, Verwaltungs- und Bürogebäude und vergleichbare Nutzungen)	53
		allgemein zugänglichen Terrassen, Dachgärten, Balkonen, Loggien und Dachböden	53
		allgemein zugänglichen Bereichen (z.B. Treppenhäuser, Laubengänge)	55
		nutzbaren Terrassen, Dachgärten, Balkonen, Loggien und Dachböden	58

Figure 77: *Sound transmission passing through building components*

171 TC Cevre ve Orman Bakanligi, Çevresel Gürültünün Değerlendirilmesi ve Yönetimi Yönetmeliği 2002/49/EC, 19.04.2006, p. 1.

172 Austrian Institute of Construction Engineering (Österreichische Institut für Bautechnik), OIB Guideline 5- Protection against Noise

173 Ibid., p. 2.

174 Ibid., p. 4.

3. Aesthetics – Visual Quality Analysis - AVQA

Aesthetics, from a Greek word meaning "perception," comes to us from German philosophers who used it for a theory of the beautiful. From this technical sense, it soon came to refer to good taste and to artistry in general; if something has "aesthetic value," it has value as a work of art.[175]

The Shorter Oxford Dictionary describes the meaning of aesthetics in 1798 as "received by the senses"; in 1831, "of or pertaining to the appreciation or criticism with good taste" and in 1871 with an evolution, as "having or showing refined taste; in accordance with good taste".[176]

Mandoki expresses about the term aesthetic:

"*it has been used to designate an experience, the quality of an object, a feeling of pleasure, classicism in art, a judgment of taste, the capacity of perception, a value, attitude, the theory of art, the doctrine of beauty, a state of the spirit, contemplative receptivity, an emotion, an intention, a way of life, the faculty of sensibility, a branch of philosophy, a type of subjectivity, the merit of certain forms, and an act of expression.*"[177]

According to Alexander Gottlieb Baumgarten, who was an 18th Century philosopher, aesthetics is a form of knowledge that is gained from that which is sensed.[178] He develops a position that knowledge is produced and then aesthetics is formulated as a researched work on art and beauty. That means, we sense and perceive an object, and that leads to reveal of its interiority. The connection between them provides us a certain kind of knowledge.

Architecture has been defined by the three Vitruvian canons: utility, durability and beauty[179], and it is also applied for the current architectural view. The term aesthetics arrives with modernity. In pre-modernity, for a thing to be beautiful it must appropriately reflect the givenness of the moral order of a tradition, or of God. Thus Vitruvius insists that architectural beauty is achieved through proportion, which embodies an order.[180] Sir Henry Wotton's seventeenth century translation of the Vitruvian term, "venustas" (Latin, meaning beauty), as "delight" is symptomatic of the shift toward the modern sensorial notion of aesthetics.[181]

Lee describes the aesthetics of architecture:

"*Aesthetics of architecture refers to the expressions in built form that closely relate to the way in which the form is not only conceived but also produced in relation to a certain purpose and its context. In regard to the relationship among form, function and context, a built form should inform and express the principles of its programmatic, structural, material and spatial qualities. And an aesthetic is supposed to emerge from, as well as be embodied in, the order that ties them together as an indivisible whole... in the present of a work, it should be perceivable and/or understandable that it serves and fits such a purpose*".[182]

This description again addresses the importance of holistic thinking in the planning process. If it has been attended for consideration of sustainability, the planning aesthetic has to refer to sustainability.

Sustainable planning, which means that a sustaining process will be available, takes a long-term view into consideration. Because of the sustainable holistic approach, sustainable housing estates should have their own aesthetics. Planners are thus faced with special challenges in terms of design aspects because sustainability means that the design quality, which is linked to the aesthetic quality, has to be ensured for the entire life of the

175 http://www.vocabulary.com/dictionary/aesthetic, access: 28.10.2015.

176 William Little, The Shorter Oxford English Dictionary on Historical Principles, Third Edition Revised with Addenda, Oxford University Press, 1968.

177 Mandoki Katya, Everyday Aesthetics: Prosaics, the play of Culture and Social Identities, Ashgate, Aldershot, 2007, p.3.

178 Alexander Gottlieb Baumgarten published Aesthetica in 1735. It was coined after his construction in Greek, episteme aisthetike, the kind of knowledge that is gained through senses. See Patrick Healy, Beauty and the Sublime, Sun Publishers, Amsterdam, 2003, p.7-8.

179 Vitruvius, On Architecture, Penguin Books, London, 2009, with a translation by Schofield Richard.

180 Hill Glen,"The Aesthetics of Architectural Consumption", in Aesthetics of Sustainable Architecture edited by Lee Sang, 010 Publishers, Rotterdam, 2011, p.27-28.

181 Henry Wootton, The Elements of Architecture, Farnborough, 1969. First published 1624.

182 Lee Sang, Aesthetics of Sustainable Architecture, 010 Publishers, Rotterdam, 2011, p.11.

building.

Today there is an assumption that sustainable architecture is badly designed architecture. Some architects especially see sustainability as an obstacle to design. Current debates on the aesthetic possibilities of sustainability in architecture can conclude that there is no consensus as to what these possibilities are, and even whether they exist at all.[183] For example, one of the most prominent architects, Wolf Prix, co-founder of the Coop Himmelb(l)au in Vienna, presented a statement during the opening lecture for the 2009 Münchner Opernfestspiele (Munich Opera Festival):

"*Sustainability belies signification- and it is therefore not possible to generate 'aesthetics' from the term sustainability. There is no such living aesthetics of sustainability as that of modernist architecture.*"[184,185]

But it must be understood that sustainable design is not an obstacle to good architecture. Sustainable design is a responsibility that every architect should take into consideration and that should be added to the other qualities of architecture. Architecture has to deal with nature and humanity to contribute to the beauty of the world, which is an important mission.

Contemporary aesthetic approaches to may refer either too subjective experience or the qualities of the object. Experience of current aesthetic is more, delight and be noticed from the look, feel, sound, taste or smell of something. In addition creative, innovative, excited places support beauty of a space so does aesthetic and architectural quality.

The harmony between the housing complexes and their environments is the indication of aesthetic quality. A building is not an independent design, but a member of urban design by forming unity with its surroundings. The design, which is made according to the proportions that fit to the surroundings and to the human scale, is an aesthetic quality, especially in housing projects, which provide a liveable habitat for people. The choice of material for attractiveness, the aesthetics of the building, and seeking alternatives enhance aesthetic quality. Furthermore, aesthetic quality is in a strong relationship with architectural quality.

Although the assessment of aesthetic quality is, and will always be strongly subjective and difficult, a more scientific evaluation of relevant criteria and definitions also make this aspect easier to deal with, or easier to discuss. For instance, the use of polar scales may be helpful which may be: beautiful/ugly, exciting/dull, original/traditional, monotonous/attractive & creative, compatible with surroundings/not compatible, innovative & creative/ordinary, visible aesthetic concern/spontaneously occurred, consideration of only functional elements/consideration of aesthetic concerns in planning process and identity/reputation. Even though there is an assumption that beauty concept is very subjective, having a distinctive design character and an urge to create one's own beauty equals a unique aesthetic design value. Therefore, it is assumed in this research that these features provide to the designer with variety, and is a contributing value for the aesthetic quality, which also enhances the architectural quality.

It has been attempted to address some questions about the site and buildings of housing complexes in light of the aforementioned aspects; if they offer original, enjoyable, exciting, creative, innovative spaces to evaluate the visual impact and aesthetic quality.

Important aspects summarized according to these descriptions are,

- Does the scheme feel like a place with a distinctive character with an identity, or does it seem like a repetition of other buildings in the surroundings?
- Is the settlement monotonous or attractive & exciting?
- Is it a place, which has a good visual impact?

183 Jauslin Daniel, "Landscape Aesthetics for Sustainable Architecture" in Aesthetics of Sustainable Architecture edited by Lee Sang, 010 Publishers, Rotterdam, 2011, p.27-28.

184 "Nachhaltigkeit verleugnet Zeichenhaftigkeit-und daher ist es nicht möglich, aus dem Begriff Nachhaltigkeit Ästhetik zu generieren. Eine lebendige 'Ästhetik' der Nachhaltigkeit gibt es nicht" Translation by the author, original German text courtesy of Coop Himmelb(l)au., Translation by the author, original German text courtesy of Coop Himmelb(l)au. dem Begriff Nachhaltigkeit „ the 2009 Münchner.

185 Wolf D.Prix, 'Vom Werden und Entstehen Vortrag Zur Eröffnung der Münchner Opernfestspiele:2009,' in Süddeutsche Zeitung, München, 2009.

- Has a landscape architect designed the open space, and does it seem that there is consideration of open space quality?
- Is the housing area innovative, original, and creative, or ordinary?
- Is an aesthetic concern visible inside and outside of the buildings? Do the materials inside have a distinctive character?
- Are there some elements on the façade considered and designed especially because of aesthetic (concerns) in additional to the functional needs, or is the building just functional?
- Is an architectural aesthetic provided through a visual impact in corridors and staircases of buildings with innovative space concepts, geometry movements or some other elements?
- Are sustainable and healthy materials used, and consideration of environmental design expression implemented apparent to the façade and general view of the design?
- Is the housing estate scale and concept compatible with surroundings (proportionally)?

V. CASE STUDIES

1. The Main Characteristics of Current Housing Projects in Vienna-Austria

According to Statistics Austria, the average number of rooms in dwellings is 3.3 in Vienna, and 4.2 in Austria, and the number of room per person in dwellings was 1.8 in 2011.[1] The dwelling size of family households (couples) with children is about 126 m2, which corresponds to 33 m2 per person and the average household size (number of persons) in Austria is 2.26.[2]

In Figure 78, the division of dwellings according to their number of rooms is presented. Accordingly it can be said that most of the residents have 3-5 rooms.

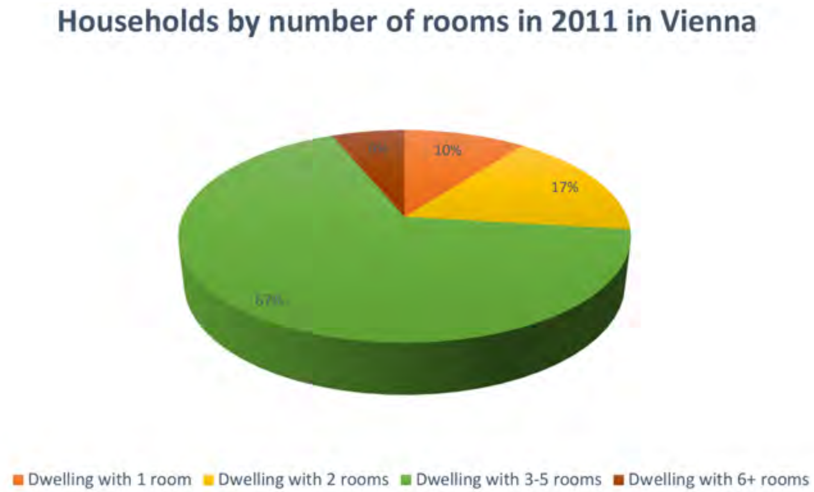


Figure 78: *Households by number of rooms in 2011 in Vienna, made by the author.*

It is obvious that in Vienna most of the residences live as one or two person households.(See Figure 79) Although there is a housing provision

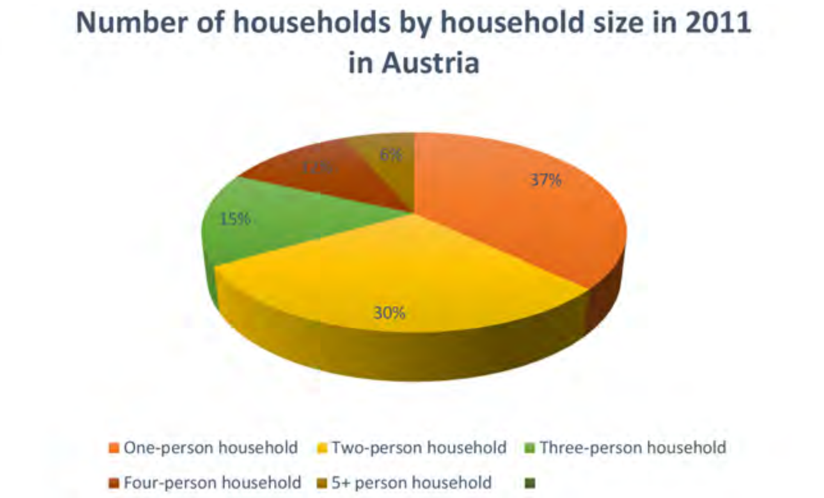


Figure 79: *Number of households by household size in 2011 in Vienna, made by the author*

problem in the old city, the new affordable, qualified, sustainable housing provision policy of the government is very effective. It has not been an extreme increase in building activities over the last 30 years.(See Figure 80)

As an important complementary funding instrument "Wohnbauinitiative (housing initiative) was created in 2011. An initial focus of this housing initiative, formed in the spring of 2012 was a 6.5-hectare portion of the airfield Aspern, on which the approximately 1500 apartments were provided. Parallel to this development, Wohnfonds-Wien has arranged a public property development competition for "Aspern –Die Seestadt Wiens" with 6 building sites and 800 apartments included. The main emphasizes of the projects have been;[3]

- Affordability and social sustainability
- Functional mixing and urban identity
- Benchmark carbon-neutral city

1 Statistics Austria. Available at: http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/wohnen/wohnungs_und_gebaeudebestand/wohnungen/index.html, access 12.11.2015
2 Statistics Austria, 2014. Available at: http://www.statistik.at/wcm/idc/idcplg?IdcService=GET_PDF_FILE&RevisionSelectionMethod=LatestReleased&dDocName=079376, access 12.11.2015

3 Liske, H., Vergleichende Analyse angebotener Qualitäten und Standards von Projekten der "Wohnbauinitiative 2011-Wien 22., Seestadt Aspern" bzw. Des Bauträgerwettbewerbes "Wien 22., aspern+Die Seestadt Wien" with the support of MA50 Magistrat der Stadt Wien, Vienna, 2012, p.4

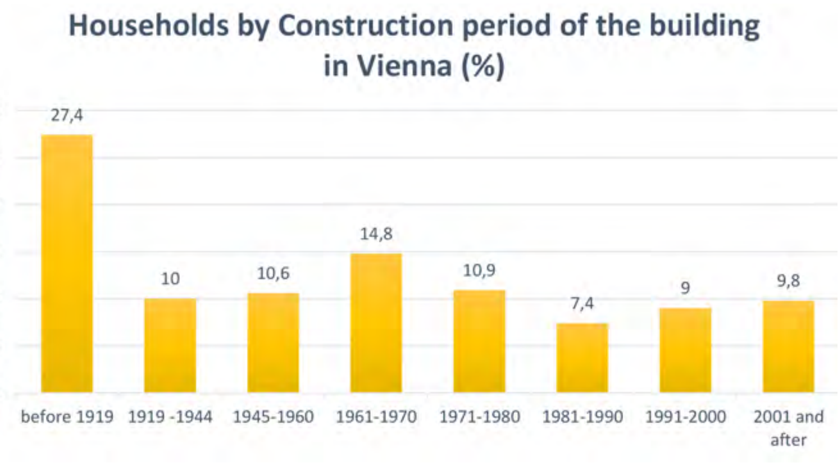


Figure 80: *Households by construction period of the building in Vienna, made by the author.*

In the year 2012 the SMART housing construction program was introduced by the municipal councilor for housing construction, Dr. Michael Ludwig. The "SMART Housing program", which creates affordable housing within subsidized housing complexes, provided well-planned affordable housing for low income people such as young families, couples and, also, singles.[4]

This initiative, through subsidies and competitions, contributes to affordable housing, quality of life, high standards of living, architecture and urban quality and sustainability.

Social housing, as an important actor within the housing sector, is distributed across the whole city landscape, and social and spatial inequalities and segregation are not very distinctive. As a result social subsidized housing in Vienna aims to be more than just the construction of housing. It must provide contemporary (up-to date) offers that meet social developments and the current needs of the people.[5] Bauträgerwettbewerbe and Wohnfonds Wien are very important in the determination of this housing quality and provision. Due to the division of big fields and competitions, including also themes such as integration, sustainability, energy efficiency, auto-free concept, and participation, in the context of Bauträgerwettbewerb the variety and quality of architectural projects have been supported. Some projects are subsidied by government and, in the same area, some are not, which provides for the equality of different income people. These residential areas may include some passive housing complexes which also allow for a diversity of energy concepts among buildings.

The City promotes the private financed housing construction through low-interest loans, provided that capital, rent ceilings, and other established quality criteria are met. As part of a wider strategy within housing projects, they have themes such as bicycle-friendly housing developments (Bike City, Autofreie Mustersiedlung, Wohnen am Park), participative housing developments etc. According to a study of "Wiener Wohnbauforschung (Viennese Housing Research)" which conducts research related to the housing situation of Vienna in 2010, the subjective satisfaction and objective housing quality have increased gradually.[6]

Ecology and energy are important keywords as a part of housing quality. Energy consumption has been transformed from low-energy houses, to passive houses, and then plus-energy houses. Only 30 per cent of district heating is provided from fossil fuels. Daylight provided staircases and access routes are supported in planning to reduce power consumption. Some other measures are taken to ensure sustainability such as using rain water, using photovoltaic and heating pumps, reduction of surface sealing, and green roofs and facades.[7]

Eurogate, which is also a result of public property development competition is the largest passive housing project, is an example of energy efficiency concern, including 824 dwellings with passive house technology in the centre of the city. (Figure 81) Following the urban plans of an architect from London, Sir Norman Foster, and an idea competition, Wohnfonds Wien advertised a public property development competition with special focus

4 http://www.wien.gv.at/bauen-wohnen/smar t.html, access 02.11.2015
5 https://www.wien.gv.at/bauen-wohnen/smart.html, access 02.11.2015

6 http://www.wohnbauforschung.at/index.php?id=339, access 03.11.2015
7 Förster, W., Wohnbau in Wien- Aktuelle Herausforderungen, MA50 Wohnbauforschung, available at: http://www.oegut.at/downloads/pdf/nk_orasteig_praes_foerster.pdf, access 03.12.2015

Figure 81: *Eurogate Housing Project as a result of Bauträgerwettbewerb*

Figure 82: *Sonnwendviertel Master Plan*

Figure 83: *Eurogate, A view to the site from the housing designed by Feichtinger Architects, by the author.*

Figure 84: *Eurogate, housing by Feichtinger Architects, by the author.*

Figure 85: *Nordbahnhof, Bike City Facade*

Figure 86: *Nordbahnhof, Bike City from the garden, photo by Rupert Steiner.*

Figure 87: *Nordbahnhof, Bike City Sand box with wooden water play equipment.*

on "low-energy and passive houses and its typological advancement in large volumes"[8] For example the building in Figure 84, which is designed by Feichtinger Architects, is in passive house standards.

Some other important projects related to these competitions are; Nordbahnhof, Hauptbahnof Sonnwendviertel. Im sonnwendviertel Bauplatz (site) C01, the buildings are in passive house standards and a great quality of community rooms such as cinema, theater, young room, fitness with swimming pool and sauna, a ladies room, a big indoor playground including climbing equipments and a big slide etc. (See Figure 89-Figure 95) Figure 88 shows another project designed by Delugan Meissl in Sonnwendviertel which has pretty good quality. This building includes dwellings with roof terraces, garden terraces and some dwellings are maisonettes.

Bike City, which demonstrates the theme cycling, is another project in Nordbahnhof. It has a beautiful courtyard garden which provides also opportunities for children.(See Figure 85, Figure 86)

As a result the new government housing supply can be assumed accomplished, and optimised as a model for private sector. The social housing policy aim is to incorporate the private sector into the design project, especially through public property development competitions:

"There is enough affordable accommodation for a large portion of the population;

8 http://derstandard.at/1269449663789/Passivhaus-Siedlung-Europas-groesste-Passivhauss-iedlung-nimmt-Formen-an, access 04.01.2016

Figure 88: *Sonnwendviertel, housing by Delugan Meissl, by the author*

Figure 89: *Sonnwendviertel, a view from the top to the site C01, by the author*

Figure 90: *Sonnwendviertel site C01.*

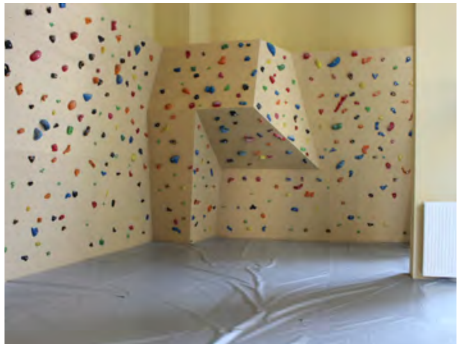


Figure 91: *Sonnwendviertel site C01, playground, by the author*

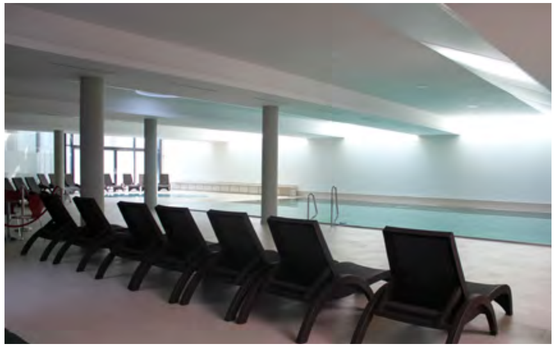


Figure 92: *Sonnwendviertel, Site C01, Fitness with swimming pool and sauna, by the author.*

Figure 93: *Site C01, bicycle storage, by the author*

Figure 94: *Sonnwendviertel, site C01, by the author.*

the municipality actually owns 27 per cent of the city's housing stock, and indirectly controls and influences another 21 per cent, which is owned by limited-profit housing developers, resulting in a so-called 'integrated market'. This means that social housing is not considered to be a supplementary, discrete market for a specific user group, such as 'the poor', but rather that social housing in Vienna competes with the free market for the same share of potential clients. The recent model of social housing provision has yielded some highly interesting architectural projects that are in various ways acting intelligently within the system, applying complex machanisms in creative ways and by doing so altering and shifting its otherwise predetermined technocratic results"[9]

9 Rumpfhuber, A., Klein, M. and Kolmayr, G., Allmost All Right: Vienna´s Social Housing Provision, 2012, John Wiley &Sons Ltd, pp. 91-93. Available at: http://publik.tuwien.ac.at/files/PubDat_215847.pdf, access: 10.12.2015

Figure 95: *Staircases in Sonnwendviertel site C01, by the author*

2. The Main Characteristics of Current Housing Projects in Konya-Turkey

In Turkey, it is mostly preferred dwellings which have four rooms. (See Figure 98, Figure 99).The average number of rooms in dwellings is 3,5 in Turkey and 3,8 in Konya. Additionally the number of persons per room in dwellings is 1.1 in Turkey and 1.0 in Konya, in 2011.[10]

The number three, four and more than five person households has almost an equal division in Turkey, but the number of more than five person households has the highest rate in Konya.[11] (see Figure 96, Figure 97).

There is a rapid production boom in housing also because of urban renewal areas. Construction activities have been increasing for some time at an incredible rate.[12] Monotonous isolated blocks and the mass production of housing are the main drivers of the new landscape, which losses the appropriate density[13] There are big private building companies which produce cooperative houses and the government also try to support

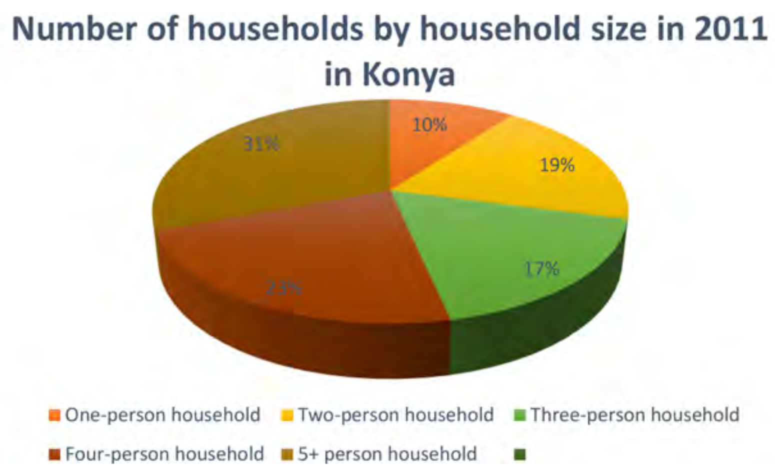


Figure 96: *Number of households by household size in 2011 in Konya, made by the author*

10 Turkish Statistical Institute, www.tuik.gov.tr..
11 Ibid.
12 http://www.primeproperty-tr.com/turk-yapi-sektorundeki-istikrarli-buyume-2015-yilinda-da-devam-ediyor/. Access: 25.03.2016

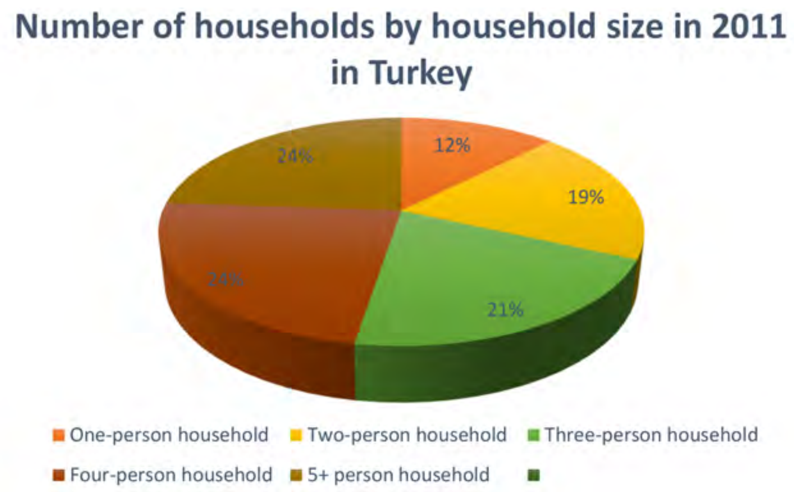


Figure 97: *Number of households by household size in 2011 in Turkey, made by the author*

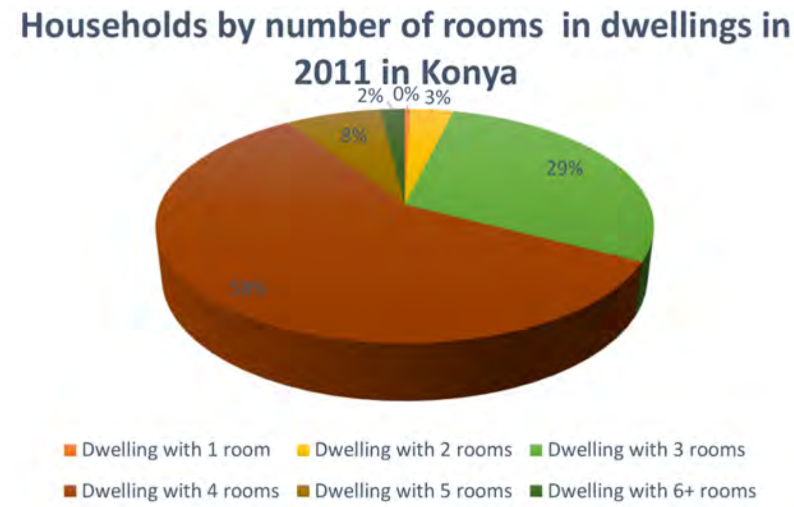


Figure 98: *Households by number of rooms in dwellings in 2011 in Konya, made by the author*

13 See also Oktay, D., "Urban Density for Sustainability: A Study on the Turkish City", in International Journal of Sustainable Development World Ecology, Vol.11, 2004, pp.24-35

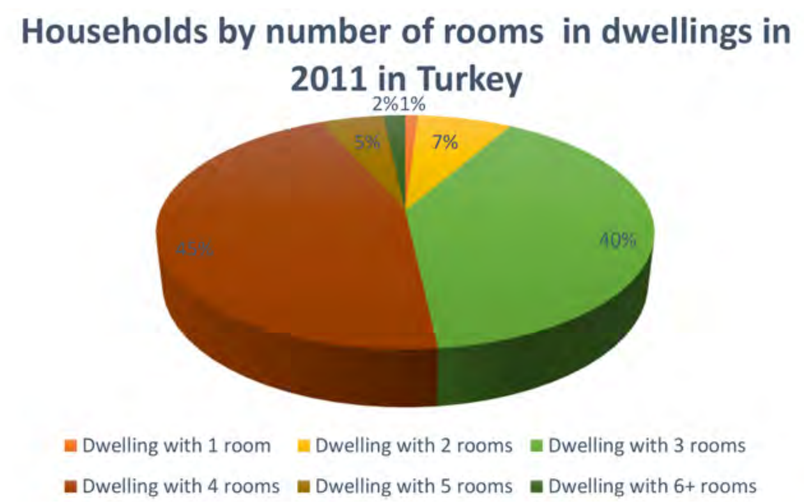


Figure 99: *Households by number of rooms in dwellings in 2011 in Turkey, made by the author*

"social housing" with affordable housing, but these are characterised by chaotic unstructured buildings and focuses on quantity and mass-produced housing architecture, which represents a lack of quality. [14] Housing block sizes in Sites have enormous sizes horizontally, vertically, and in densities, with segregated gardens as gated communities.[15] As is discussed in other areas of this study, the most common type of multi-unit housing is based on "closed ghettos" (site), not accessible freely to outsiders, which has been a characteristic phenomenon of the Turkish urban landscape. More importantly, this has led to social segregation between people. Because according to Andersen, social segregation is ".. *a spatial separation of ethnic or socially different groups leading to increasing social or cultural differences between these groups*".[16] Moreover in these housing estates distinction between pedestrians and cars are generally not provided which can cause safety problems for

Figure 100: *Number of building storeys in 2011 in Turkey, made by the author.*

people and affordability is not a real consideration.

Investors and contractors decide the appearance of housing and planning, and participative projects are not a real issue in housing projects. Instead of

Figure 101: *Bahcesehir Housing, Konya, by the author.*

14 See also Cengizkan, A., "Kültür Nesnesi Olarak Konut ve Politik Aktörlerin Arka Bahcesi Olarak Konut Üretimi", (Home as a Cultural Object, Housing Production as Backyard of Political Actors), In Mimarlik 345, Dosya: Toplu Konut Mimarligi: Deneyimler, Olanaklar, Olasiiklar, Ed. Kahvecioglu, H., January-February 2009, Ankara, pp.25-27.
15 See also Şenyel, A., Low Rise Housing Development in Ankara, published Master Thesis, Middle East Technical University, Ankara, 2006, p.69.
16 Andersen, H.S., Urban Stores, On the Interation Between Segregation, Urban Decay and Deprived Neighbourhoods, Aldershot, Ashgate, 2003, p.13.

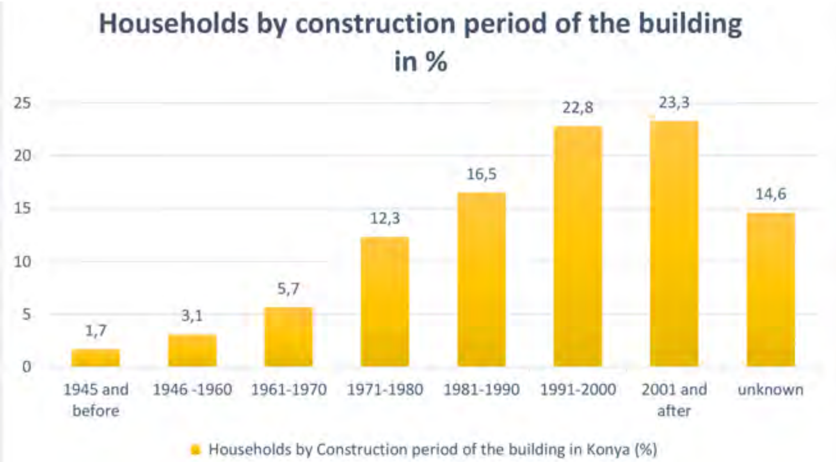


Figure 102: *Households by construction period of the building in Konya, made by the author.*

being a need, housing became a way of investment and getting income.[17] Great emphasis is on the amount of usable area and income of the constructors, rather than aesthetic, functional and sustainable solutions.

There is a real difficulty in adopting innovative and ethical solutions during the planning and constructing process, and also in terms of sustainability. The dwellings generally have enormous sizes except in Istanbul, which has a huge population problem. Different family sizes live in the same units. Having a big-sized dwelling is a desire for Turkish people, who often disagree with the ecological footprint of sustainability. Moreover, these same sized dwellings also have the same floor plans, like copies or mirrors, which leads to a lack of maisonettes, variety of plan types, creativity ,and productivity. (See Chapter V, 3.Case studies).

Although the luxurious residencies seem more desirable and liveable, affordable housing, including for low and middle income people, has a real quality problem in terms of aesthetic, sustainability, and infrastructure, which also has been partially a problem of luxury residencies, although they seem more desirable and liveable because of their charming popularity.

Figure 103 - Figure 114 show housing projects from Konya.

17 Koca, D., Türkiye'de 2000 sonrası Toplu Konut Üretimine Genel Bir Bakış. Ed. Ali Cengizkan, A. Derin İnan, N. Müge Cengizkan. Zeki Sayar Anma Programı Dizisi/ Zeki Sayar'a Armağan: Türkiye Mimarlığı ve Eleştiri. Ankara, TMMOB Mimarlar Odası, 2012, p.43-52.

Current Housing Examples from Konya:

Figure 103: *Households by construction period of the building in Konya, by the author*

Figure 104: *A view of a housing estate from the street in Konya, by the author*

Figure 105: *Seha Mimoza Housing in Konya, by the author.*

Figure 106: *Mavisehir Housing garden, Konya, by the author.*

Figure 107: *Bahcesehir Housing, Konya, by the author.*

Figure 109: *Mavisehir Housing, access to building, by the author.*

Figure 108: *Seha Mimoza Housing circulation, by the author.*

Figure 110: *Seha Mimoza, ramp without handrail, by the author.*

Figure 111: *Seha Mimoza, ramp without handrail, by the author.*

Figure 114: *Mavisehir, by the author.*

Figure 112: *Bahcesehir, entrance with a steep ramp, by the author*

Figure 113: *Seha Mimoza stairs with bicycles and prams*

Figure 116: *Site Plan*

Figure 115: *Wohnen mit alles (Photo by Einszueins Architecture Office)*

3. CS I WMU- WMS

Wohnprojekt Wien "Wohnen mit alles"

(Project with State Award Architecture and Sustainability 2014)

SUPERBLOCK & einszueins architektur: Intercultural living, Vienna-reaching more together

Open space design: dnd Landschaftsplanung.

Bauträgerwettbewerb (Public Property Development Competition) Nordbahnhof 2. Phase – Building site 15C

The project came to life as a result of a housing developer competition in 2010 as "Wohnen mit alles (Housing with all)" from the cooperation between a property developer and two architectural offices.(Figure 116) . The winner of the Bauträgerwettbewerb (public property development competition) of building site 15C on the Nordbahnhof site in the second district of Vienna offers two different habitations in two building structures: Wohnen mit uns (living with us) and wohnen mit scharf (living with hot).(Figure 117) The whole project site in the second district is considered one of the largest inner-city development areas in Vienna. The building "wohnen mit scharf" by SUPERBLOCK Architects emphasizes individual and intergenerational functionality, the building "Wohnen mit uns" focuses on participation and communication between inhabitants. These two buildings have different concepts but look similar in structure. Both projects are subsidized housing and exemplary projects with their aesthetic and architectural qualities. The idea and concept of cooperation belongs to the Wohnprojekt Wien (Housing Project Vienna - Association for a Sustainable life). It began with a small group of apartment seekers who wanted to take their concerns into their own hands. Heinz Feldmann, one of the initiators, remembers the jury tour: "*We sent an e-mail to the group with a question: How can we live well in a social community life while reducing our CO2 emissions and our ecological footprint, and how can we create it in an urban environment?*"[18] Following this perspective, a dozen engaged people founded an association. The project started together with the office "Raum&Kommunikation", the non-profit public housing cooperative, Schwarzatal, and with the planning teams "SUPERBLOCK" and "Einszueins".

They participated in the building developer competition based on the theme, "*Intercultural housing in the Northern Train Station*", and they won.[19] The building "Wohnen mit scharf" of SUPERBLOCK contains 51 rental apartments, which qualify for super subsidies from the City of Vienna making it easier for tenants, especially with an immigration background, to take part in the project. The name comes from the kebab stand jargon, which the architects think such an idiom expresses the emotions of young

18 "Ein weiter Schritt über technische Werte Hinaus: Wohnhaus Wohnprojekt Wien, Wien Leopoldstadt" in Federal Ministry of Agriculture, Forestry, Environment and Water Management (Eds), State Award 2014 Architecture and Sustainability (Staatspreis 2014 Architektur und Nachhaltigkeit),Vienna/Austria, 2014 , p.22-23
19 Ibid.

residents.[20] The building consists of a public area at the ground floor with a restaurant, single-story units and maisonette apartments. The other building by the architecture office Einszueins, has a different concept of living together by a residential group that develops these aims: together living in their own properties and self-management of the building. Beyond the participative and sustainable architecture, the project integrates many other ideas, which bring different concepts such as "Car sharing" providing efficient use of garage space. Instead of a garage in basement, collective rooms have been designed: a multipurpose room, an atelier, and a rehearsal room which reach daylight through a sunken courtyard. At the ground floor there are: a big common kitchen, a grocery store, scope (indoor playground), offices, bicycle storage for 116 bicycles. At the roof floor there are three guest apartments, a common library with panorama window, a sauna, a meditation room and a big common terrace with raised bed and panorama view to the city.[21] The two housing blocks use common rooms and spacious outdoor area together. As a result the project has various community rooms which ensure opportunities for communication and allows possibilities for free time.

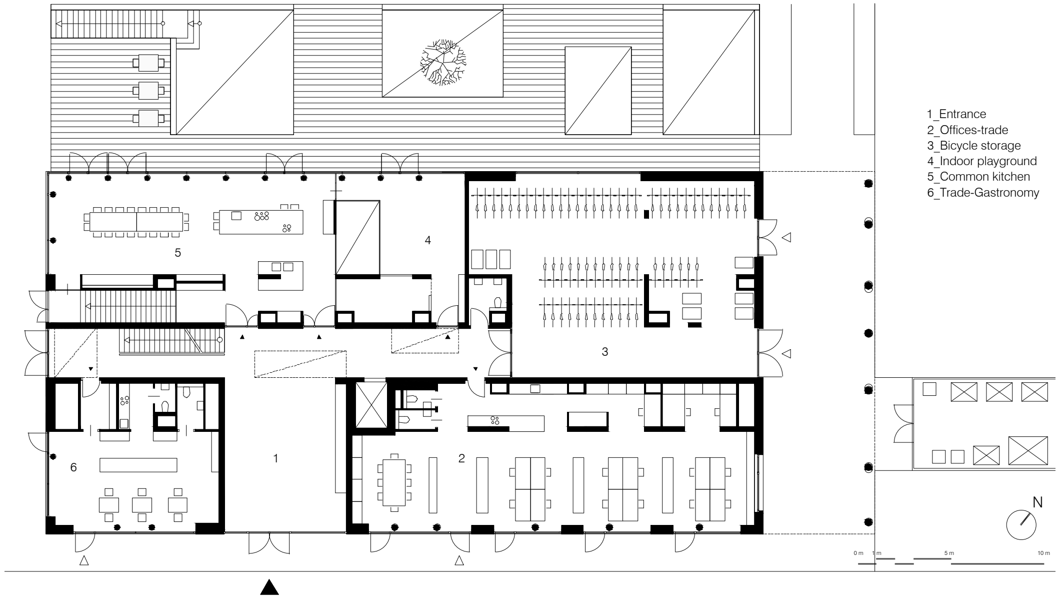
As e result, the focus of the project "Wohnproject Wien-Wohnen mit uns" is participation, self-management and further thinking and living sustainability.(Figure 115) The project sums up different generations, languages and cultures together under one roof. There was a very intensive and deliberate planning process which considered the ideas of tenants, the structural concept of the building and innovative methods allowing a high level of participation by them. Everybody could plan his or her apartment individually according to the needs with some workshops held for community spaces and contribution of flats. DI Katharina Bayer, one of the architects of the building, expresses the importance of participation with her sentences "*There aren´t any standard families, we understand their needs with this process. Participation changes the user from victims to participants.*"[22] In this project, the architects tried to reach two aims: to promote solidarity and connection to life, and to create living spaces and cities. The project has a lot of contributions for a future-orientated way of life.

Figure 117: *Wohnen mit uns (by Einszueins Architectuer)*

Figure 118: *A drawing of a tenant hanging on the wall of the entrance.. (Photo by the author)*

20 Leeb, F., "Intercultural housing, Vienna- Achieving more together", in architektur.aktuell Magazine, No:410, 05.2014, pp.104-115.
21 "Ein weiter Schritt über technische Werte Hinaus: Wohnhaus Wohnprojekt Wien, Wien Leopoldstadt" in Federal Ministry of Agriculture, Forestry, Environment and Water Management (Eds), State Award 2014 Architecture and Sustainability (Staatspreis 2014 Architektur und Nachhaltigkeit), Vienna/Austria, 2014.

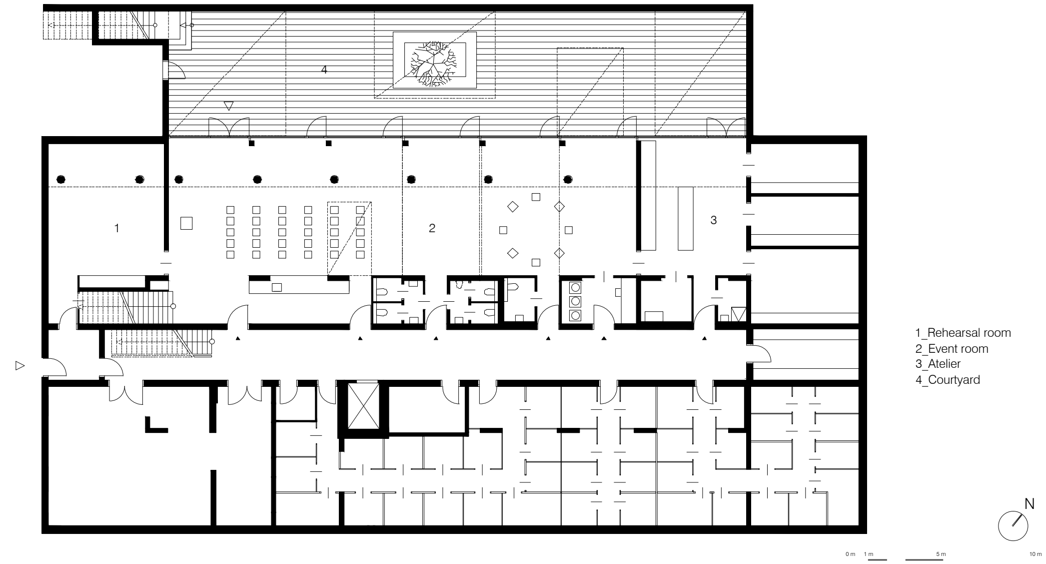
22 Bayer, K., in Architektur Stiftung Österreich (Organiser),Turn On Architektur Festival 2015: Vorträge nonstop im RadioKulturhaus (CD), Themenblock Wohnen, Raum.Film Filmproduktion, Vienna, 7 March 2015.



1_Entrance
2_Offices-trade
3_Bicycle storage
4_Indoor playground
5_Common kitchen
6_Trade-Gastronomy

GROUND FLOOR PLAN

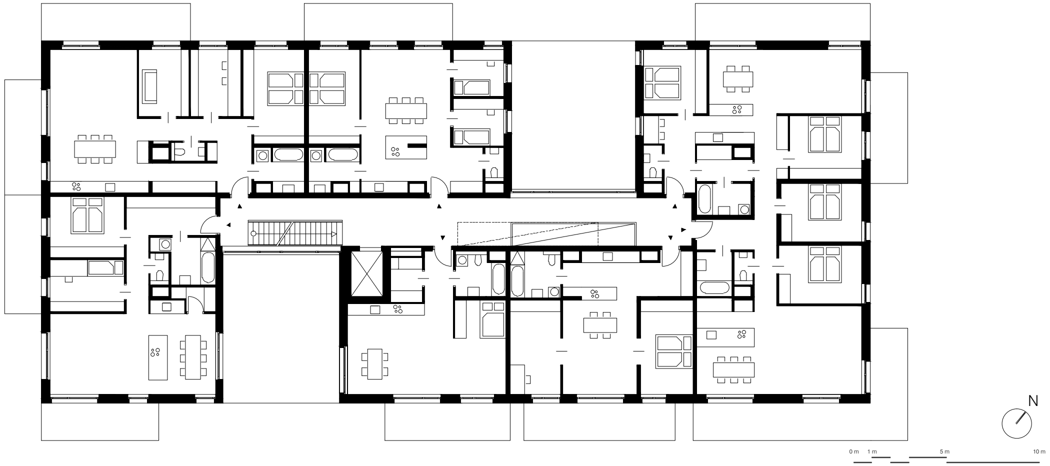
SECOND FLOOR PLAN



1_Rehearsal room
2_Event room
3_Atelier
4_Courtyard

UNDERGROUND FLOOR PLAN

FIRST FLOOR PLAN



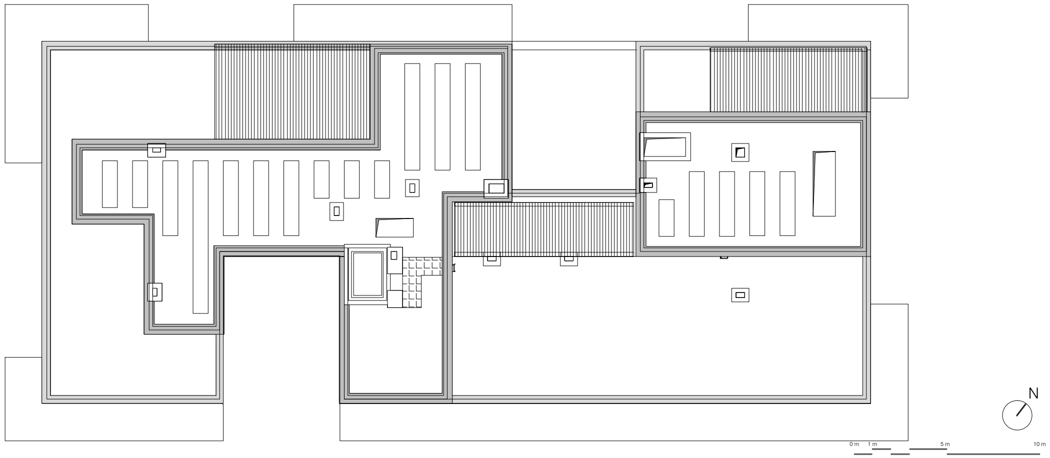
FOURTH FLOOR PLAN

FOURTH FLOOR PLAN

THIRD FLOOR PLAN

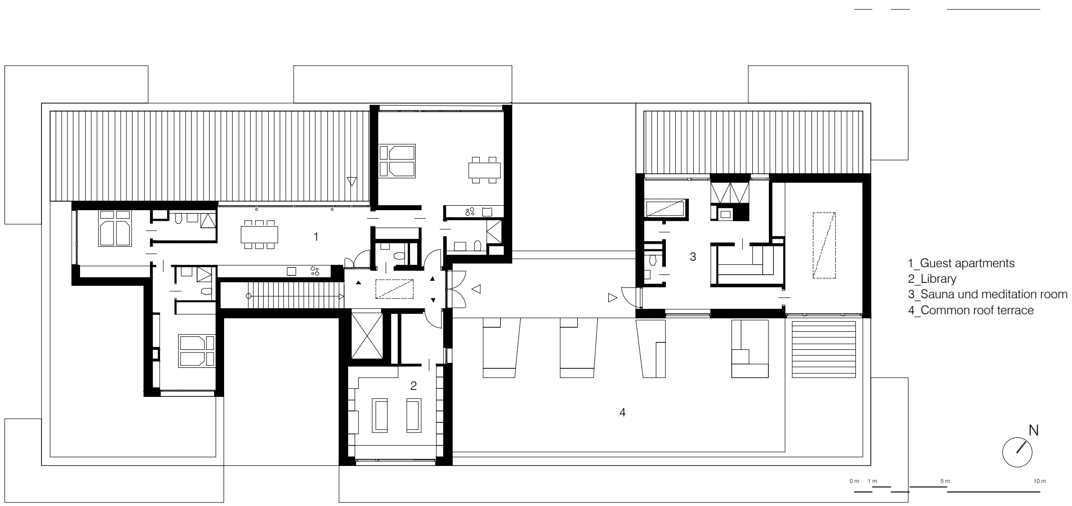
THIRD FLOOR PLAN

Figure 119: *Floor Plans (Einszueins Architecture Office)*

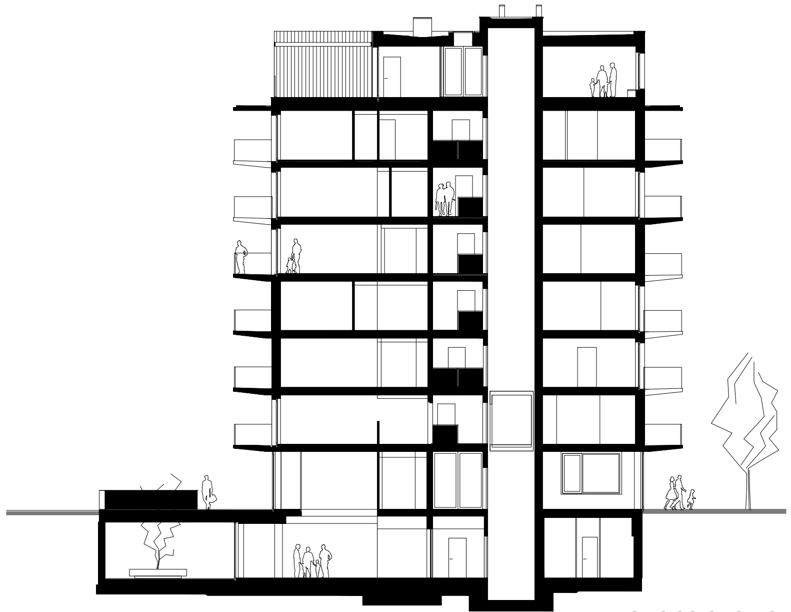


ROOF TOP VIEW

LONGITUDINAL SECTION

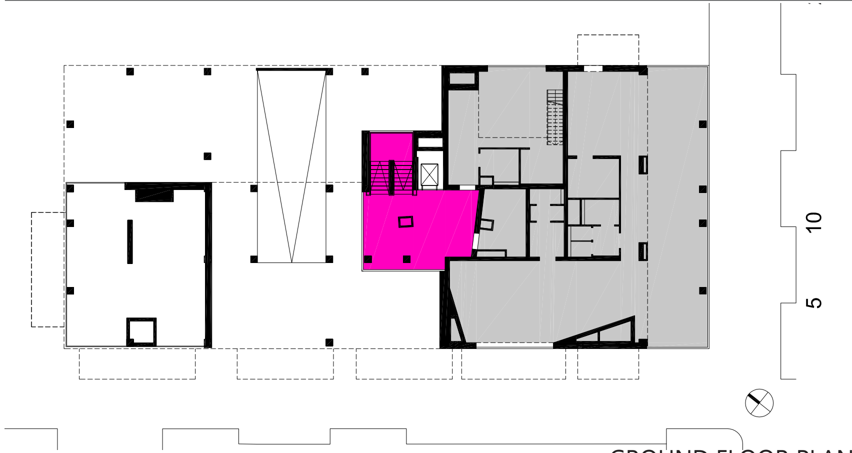


ROOF FLOOR PLAN

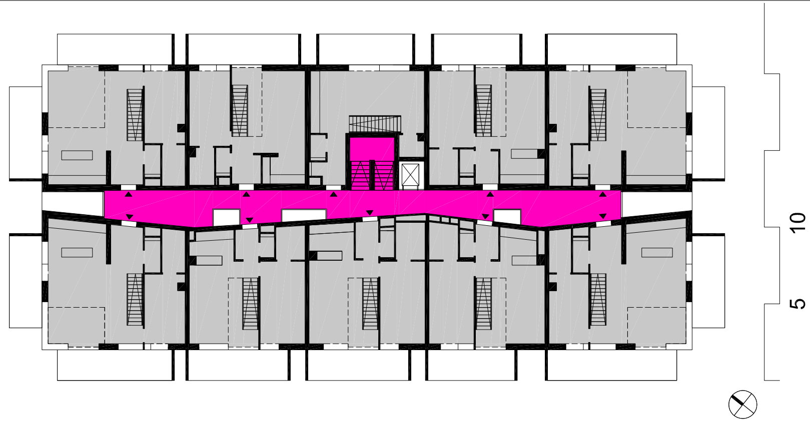


CROSS SECTION

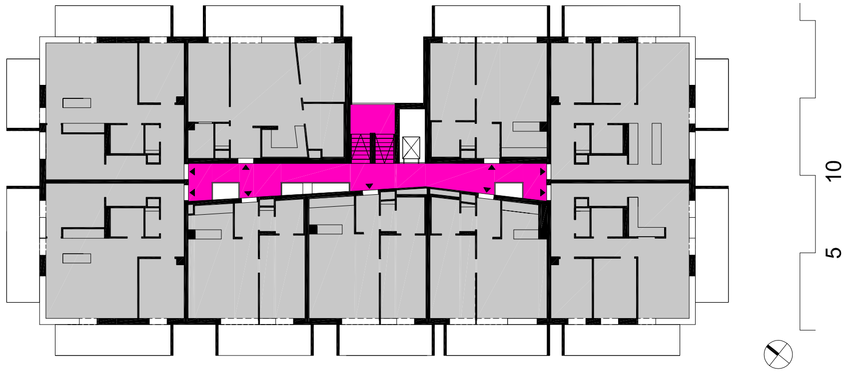
Figure 120: *Sections (Einszueins Architecture Office)*



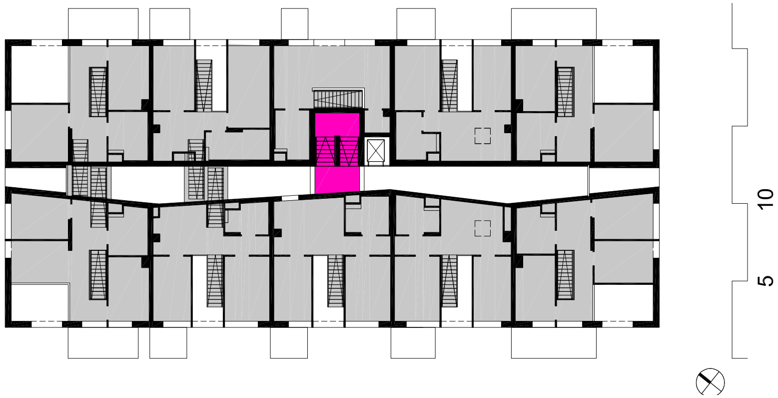
GROUND FLOOR PLAN



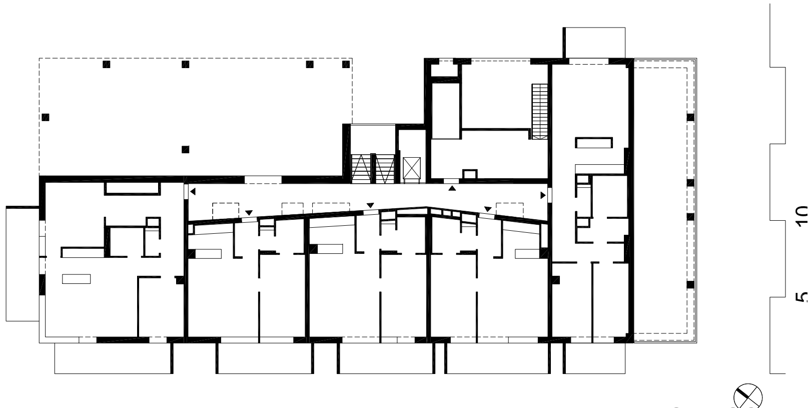
SIXTH FLOOR PLAN



TYPICAL FLOOR PLAN



SIXTH FLOOR PLAN



FIRST FLOOR PLAN

ELEVATION

Figure 121: *Plans and elevation (SUPERBLOCK Architecture Office)*

LONGITUDINAL SECTION

CROSS SECTION

Figure 123: *Sections (SUPERBLOCK Architecture Office)*

WOHNEN MIT SCHARF

BLOCK TYPE		NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING TYPE B WITH 2 ROOMS	NUMBER OF DWELLING TYPE C WITH 3 ROOMS	MAISONETTE TYPE 1 73,46 m2	MAISONETTE TYPE 2 97-100 m2	MAISONETTE TYPE 3 more than 100m2	DWELLING WITH ROOF-TERRACE	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
WOHNEN MIT SCHARF		8	19	22	1	4	5	4	1	51	51

BLOCK TYPE		EACH DWELLING HAS A DIFFERENT PLAN DUE TO THE PARTICIPATION	GUEST APARTMENTS AT ROOF FLOOR	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
WOHNEN MIT UNS		39	3	1	39	39

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS WMU + WMS*	OPEN SPACE incl. common terraces and	TOTAL NUMBER OF DWELLING
4783 m2	7200 m2	773,18 m2	3772	90

*WMU: Wohnen mit uns, WMS: Wohnen mit Scharf

Figure 122: *Project diversity and density informations by the author according to the data*

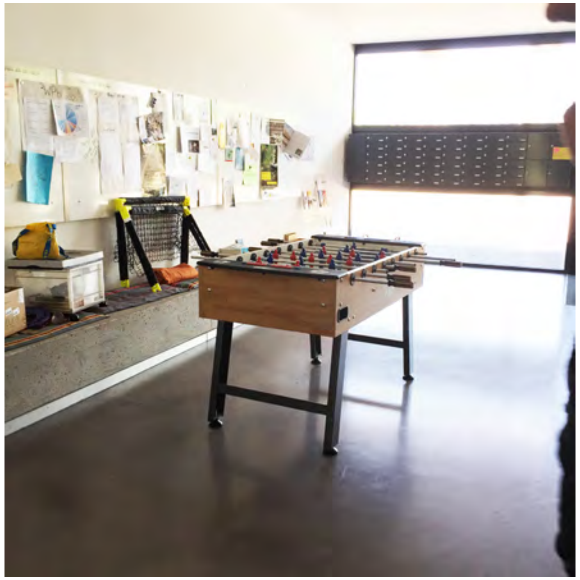
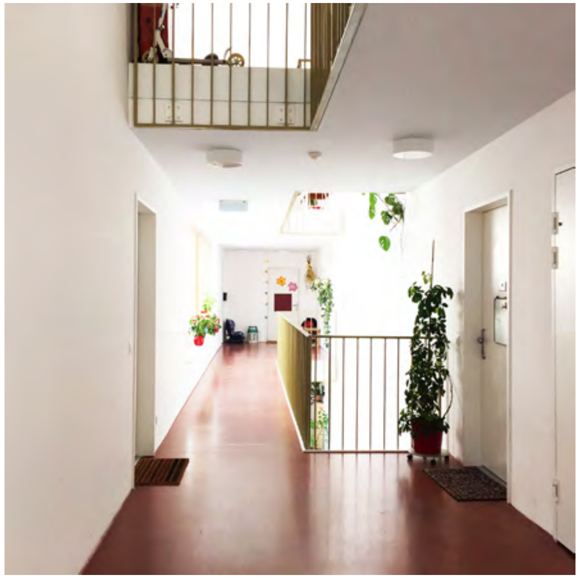




Figure 124: *Photos from circulation routes of WMU, by the author. (Top three photos)*

3.1. Social-Functional Quality Analysis / SFQA

3.1.1. Needs-Oriented Design

The projects of building developer competitions are strongly "housing needs"-oriented, and affordability is a factor that has to be considered. Especially because of the participation of the inhabitants in "Wohnen mit uns", the housing blocks meet housing needs very well, and the dwelling sizes are also designed according to the requirements and sizes of the families leading to space efficiency. The main challenge of the project has been to give a natural and sustainable home with a good neighbourhood in an urban life, which responses as a solution to the main concern of people living in cities.

Figure 125: *Circulation of building WMS*

Figure 126: *Photo of the site.*

3.1.2. Accessibility and Movement Circulation Concept

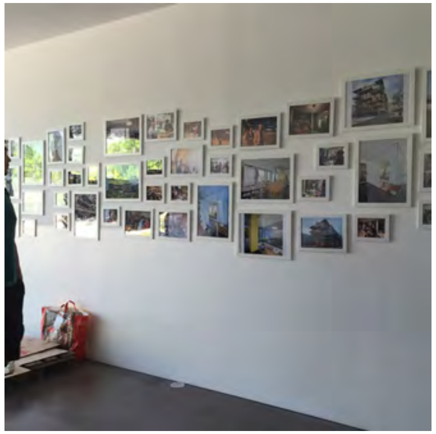


Figure 127: *Photos from circulation routes WMU (by the author)*

There is an understandable and adequate circulation concept in the building and site. To support wheeled equipment for disabilities and buggies, important measures were taken in the design phase. The entrance has a comfortable and familiar atmosphere with its wide area, information boards, diagrams that give information about the building services and a game. Pedestrians and bicycle circulation are encouraged, vehicle flow is minimized by using a car sharing system and the absence of an individual underground garage. Clear descriptions and contrary architectural elements and materials in and surrounding the blocks provide clear distinction and orientation. (Figure 124, Figure 127)

- Is it easy to understand how to enter and move about the site? Y
- Are there orientation tables? Y
- Are rails for essential steps and communal stairs with rise maximal 170mm plus going min.280mm? Y
- Is there a canopy over main entrance with light? Y
- Does circulation get good daylight? Y
- Is adequate access possible with wheelchair to the site, apartments, and dwellings? Ramps/lifting? Y
- If there is ramp, does it provide; max slope of %6, 120 cm clear width, movement area at the end 150x150cm, handrail height 85 cm? Y
- Is there enough manoeuvring space for wheeled equipment for entrances and corridors? Y
- Are there facilities for people with a visual or auditory disabilities? Y
- Is access for fire, ambulance and other services adequate? Y
- Is there a distinction and identification of functions (lighting, choice, materials)? Y
- Note: Materials are chosen which let distinction and there is a good description in ground floor about the functions in the building with some photos and scheme. The names of functions are all written on the doors with a familiar style.
- Is there a differentiation of architectural elements by colours or materials (walls, ceilings)? Y
- Is there figure-background contrariness (symbols, letters)? Y
- Functional use of colours and materials to support spatial orientation, recognisability and identity? Y
- Does the movement concept aim to minimise vehicle flows and speeds within the housing scheme and

to discourage through vehicular traffic? Y

- Note: Building is designed with car sharing concept to discourage vehicle flow. There is not real traffic around the site. There is not any parking garages for guests to minimize the traffic.

Vehicles

- Is the hierarchy of routes clear? Y
- Are road, place and building names and unit numbers clear, visible, legible and sited appropriately in relation to buildings? Y
- Do routes take advantage of vistas/landmarks within or around the project site? Y, very well
- Are appropriate traffic calming measures used to control vehicle speed? Y
- Is vehicle segregation possible to help pedestrians to use safe routes? Y
- Can large, emergency or service vehicles come within 30m of all front doors of units or flats? Y
- Do routes facilitate and encourage cycling? Y

Pedestrians

- Are public spaces connected by clear, well lit and hard surface routes? Y
- -Is lighting appropriately related to buildings and easy to maintain? Y
- Are kerbs dropped where foot paths cross roads? Y
- Are pedestrian routes and garden paths width minimum 900 mm? Y

Access to the unit

- Pedestrian routes and garden paths – firm, even, slip-resistant

Figure 128: *View to the Bednarpark (Einszueins Architecture Office)*

Figure 129: *View from the roof floor if Wohnen mit uns (by the author)*

finish, distinctive texture/colour? Y

- Are kerbs dropped for main footpaths and access positions? Y
- Is convenient wheelchair access provided from park space? Y
- Is any slope provided to external doors to be gentle with level platform 1200x1200mm clear of door swing? Y

3.1.3. Efficiency of Planning

The site offers an efficient area for housing with its greenery and public transport possibilities.(Figure 128, Figure 129) A liveable urban structure with liveability and diversity has been achieved using the public property development competition for planning the whole Nordbahnhof site. All of the dwellings have a good perspective and lighting in the building. The design of the staircases and access routes allow a good daylight and atmosphere in these zones. The building offers possibilities for every age by including various functional spaces. Because of the participation of inhabitants, the planning of the living units are designed and divided according to their needs and furniture. It was made 1/50 models for the dwellings to show to users in the design phase which they can bring to home and decide about the issues they want to change.[23]

Does the whole design have a challenge and a goal? Y, provides a sustainable neighbourhood in the city, as a family in the whole building. Participation in the design phase provides that every dwelling is different from the others.

- Is it a favourable location to the housing with suitable functions for people? Y, location is efficient for a living area with its green surrounding and its huge park. Suitable functions from its grocery to its gardening possibilities.
- Are adequate moving facilities provided between floors, clear traffic routes? Y

23 Recheis, C., Video at Website of Einszueins Architektur, available at: http://www.einszueins.at/ueber-uns/, access: 02.03.2016

- Sufficient capacity in corridors, stairs, lifts? Y, the ambiance of corridors and stairs of the building is wide and relaxing with added greenery by habitants.
- Sufficient capacity for individual rooms (doors which open in a convenient direction, not traffic routes through occupied areas)? Y
- Is an efficient layout provided, e.g. short walking distances because related functions are grouped near one another? Y, either in housing units or in the building, good connections of different functions are well considered. It is really convenient for users. In common rooms the relations to the garden and outdoor facilities provide a good atmosphere in the building and a good connection to the nature.
- Have functions requiring natural light been located against an outside wall? Y, because of the courtyard at the back side of the building a good lighting is provided for the rooms under the ground.
- Has the space required to stand and use furniture, been an important attention point, whether fixed or mobile? Y, because of participation all users decided the planning of dwellings and the interior walls are not stabile and can be moved if wanted.
- Are sufficient vertical dimensions provided for ceiling height, clear headroom for doors, height of worktops, kitchen cupboards? Y, ceiling height could be more than it is to provide a wide space.

3.1.4. Flexibility

The interior walls of the building are non-load bearing to be easily changeable to different plan solutions if needed. This flexibility has started with participation by the inhabitants in the planning phase, attention was paid to the demands and requirements of inhabitants.

- Has flexibility been a consideration in designing? Y
- Can the plan of the units be adjusted to circumstances? Possible

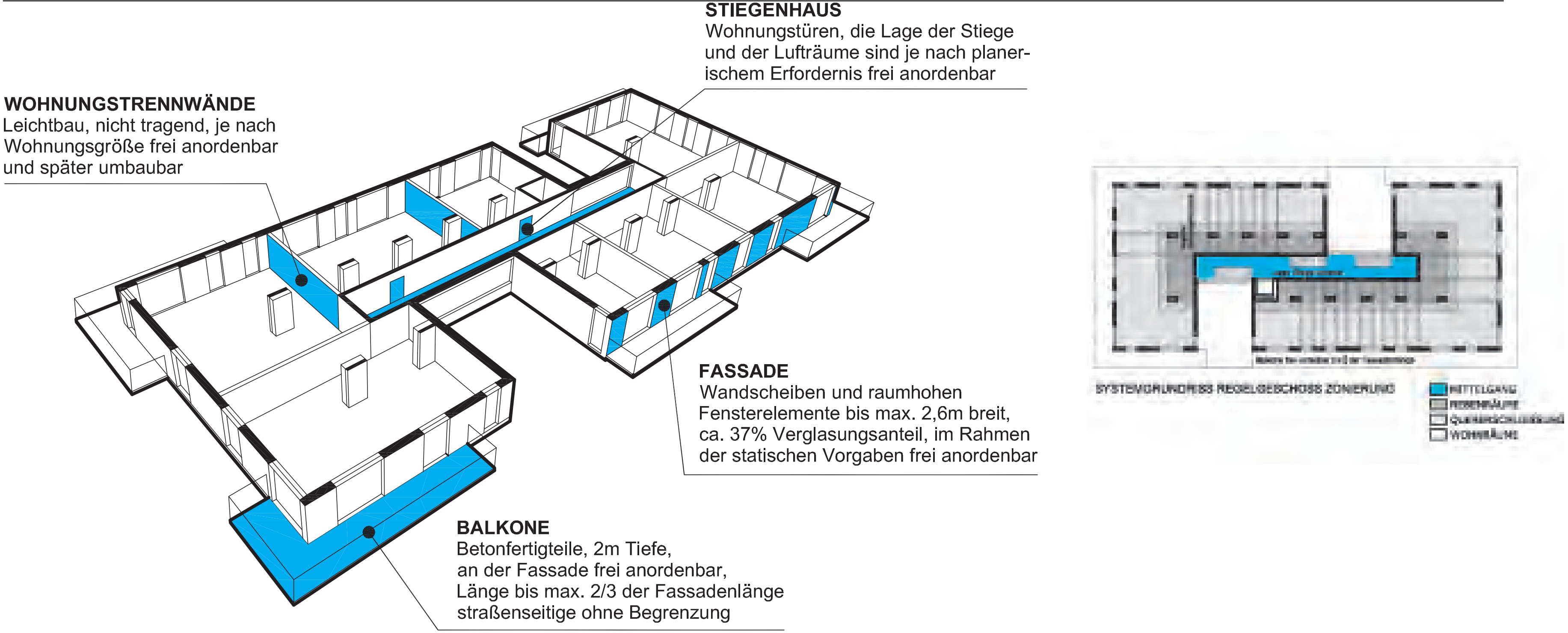


Figure 130: *Flexibility diagram (by Einszueins Architecture))*

to make the rooms and dwellings larger or smaller than they are? Y

- If possible, can these changes be made easily without intervention of architectural elements (ceiling and floor)? Y
- Are the rooms possible for different furnishing? Y
- Is it possible to change functions of the rooms? Y
- Are the load-bearing inner walls avoided as much as possible? Y

3.1.5. Safety

Building safety is provided, but there is lack of security outside where the vegetation is and children play. It is good that it is not a gated community, but it may not be appropriate for each place.

- Are main access points secured (with an alarm, a guidance)? N
- Are public areas overlooked to feel people safer and control to anticipate possible dangers, especially children playgrounds? Y
- Are all external door doors and windows are sufficient fixed? Y
- Is safe transportation of people and goods provided vertically and horizontally to manage and prevent the possibility of falls, being trapped or injured with: non-slip floor finishes /adequate

lighting for corridors and stairs/ handrails and banisters where appropriate? Y

- Has it been considered that doors and windows do not open to the circulation routes? Y
- Fire safety: Is prevention of fire outbreak with a quick and safe escape possible? / Are fire-resistant materials used to limit fire spread? Y
- Is safety glass used instead of ordinary glass? Y

3.1.6. Health, Well-Being and Comfort

The atmosphere of the building inside and outside supports the psychological well-being of people. In common rooms and sitting areas outside, people often come together and this leads to communal living. People garden in their garden plots outside and on the roof, which is a very relaxing activity for people to feel better. (Figure 131, Figure 132). The sauna and meditation room also contribute to the well-being and comfort. (Figure 133)

The area is away from main roads with traffic, as a result of discouraged car use. Moreover this provides prevention of possible noises from vehicles. As a result, it has been created a more liveable housing atmosphere

- Has sound insulation of walls been considered and applied? Y
- Has sound insulation of ceiling been considered and applied? Y
- Has sound insulation of window been considered and applied? Y
- Are sleeping areas been placed so that they are not adjacent to shared internal areas? Y
- Are bedrooms protected so that they are not adjacent to neighbours bath/living areas? Y
- Do windows have more than 3m horizontal distance from a public route or space? Y
- Are noisy communal equipment is placed to be more than 3m distance from doors/windows (e.g. Lifts, plant)? Y
- Do living room windows get good daylight? Y
- Do kitchen windows get good daylight? Y

Figure 131: *Garden plots with vegetables(by the author)*

Figure 132: *Common roof terrace(by the author)*

Figure 133: *Sauna at the roof floor (by the author)*

Figure 134: *A general view of the buildings with surrounding, 3D by Einszueins Arch.*

Figure 135: *The garden at the rear of the building with growing plants.*

Figure 136: *The Balconies of the buildings. (by the author)*

- Do all bathrooms have a window? N
- Do corridors and stairs of apartments get good daylight and natural ventilation? Y

3.1.7. Open Spaces

The balcony of each unit provides the possibility to breathe fresh air and feel the advantages of an open space. The balconies have a depth of 2 meters and range in size from 10 m2 to 18 m2.[24] In Wohnproject Wien "Wohnen mit uns", the user chose the size and balcony placement.(Figure 136, Figure 139, Figure 140) In "Wohnen mit scharf", the maisonettes at

24 Leeb, F., "Intercultural housing, Vienna- Achieving more together", in architektur.aktuell Magazine, No:410, 05.2014, pp.104-115.

Figure 137: *A view to the roof terrace, photo by the author*

Figure 139: *A view of a balcony, photo by the author*

Figure 138: *The sunken courtyard at the rear of the building, photo by the author*

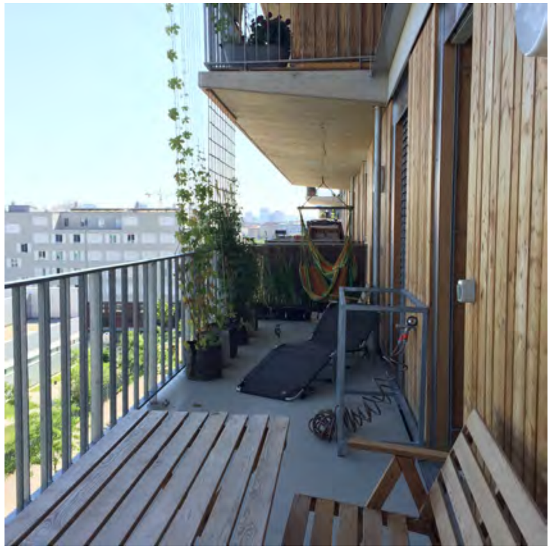


Figure 140: *A general view of a balcony, photo by the author.*

the top of the building have their own roof terraces, and the rest of the roof has solar shading for the use of all inhabitants. Another common roof garden is at the top of "Wohnen mit uns" with some raised flower beds and greenery. The outdoor areas were designed for play, recreation, celebrations and gardening. They have a common garden with areas for tenants to grow some plants and vegetables.(Figure 135) The design of outdoor spaces is in harmony with the Rudolf-Bednar Park in front of the building, thus supporting urban coherence. At the rear of building, there is an extra courtyard that lets light into the common rooms at the -1 Level and serves as an extra playing possibility for children.

- Has a qualified landscape architect been used to create or assess the landscape design? Y
- Has water (pool, stream, fountain) been incorporated into the site and appropriately protected? N
- What is the ratio of open areas to the sum of dwellings? 0.52.
- Does the general image of open space seem natural and green? Y
- Have some flats their own private garden? Y
- Is there a common roof-terrace? Y
- Is there roof planting? Y
- Are materials of open space natural? Y
- Is there any possibility to grow up their product in the garden? Y
- Does position of lighting prevent pools of darkness where people walk both outside and in common parts of flats? Y
- Are refuse and bin storage areas convenient and inconspicuous in open space? Y

3.1.8. Common Rooms and Facilities

The project has a great quality in communication and common rooms. There is a 350 m2 area for commercial uses. The eight inhabitants of the

Gemeinschaftsräume Wohnen mit uns!

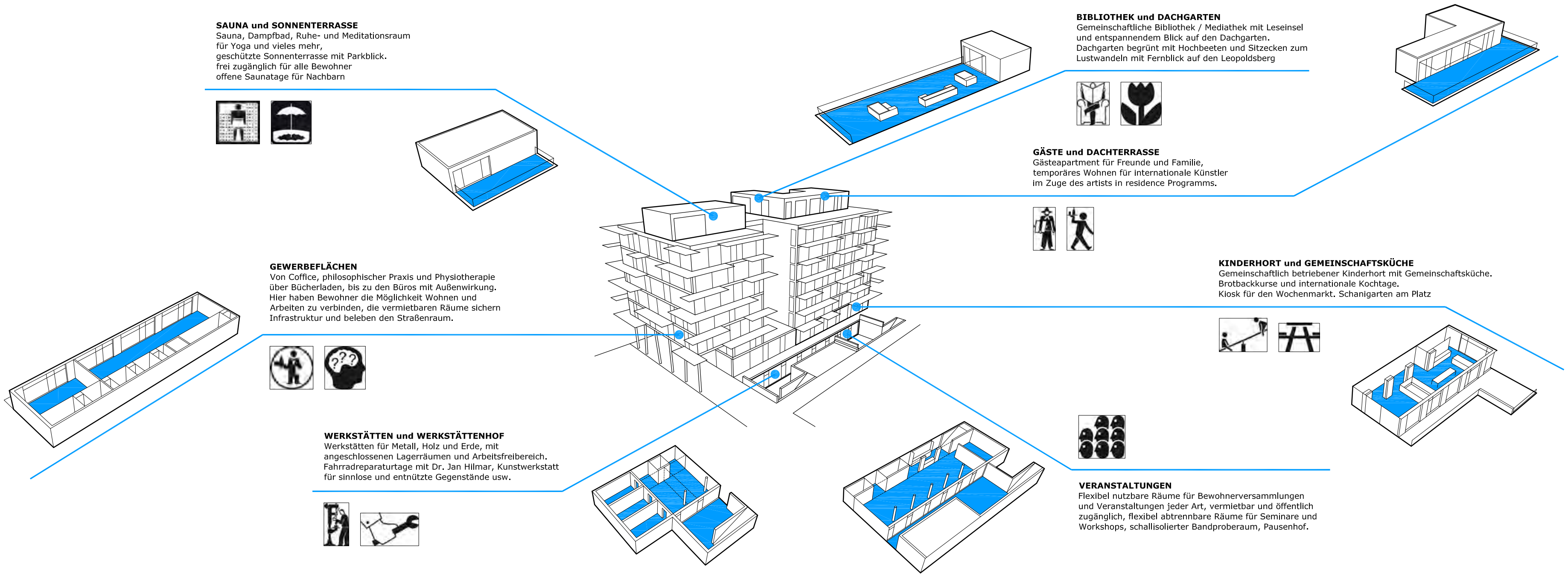


Figure 141: *A diagram showing community rooms and facilities (data from Einszueins Architecture))*

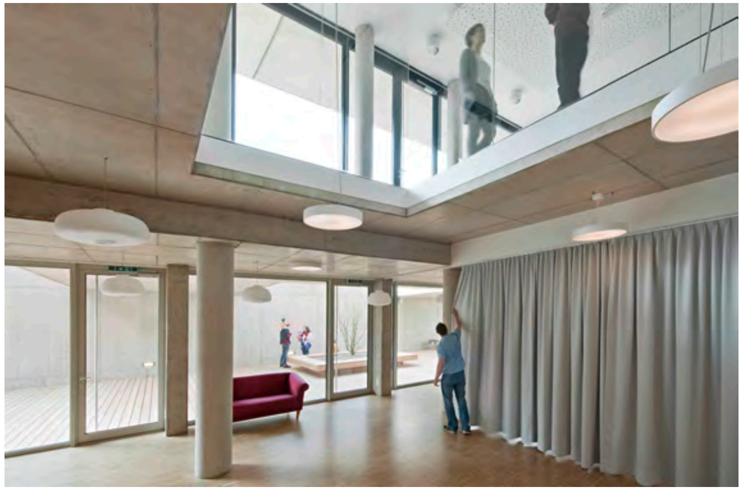


Figure 142: *Multifunctional room.*

Figure 143: *Common kitchen.*

Figure 144: *Rehearsal room*

Figure 145: *Interactions between the rooms*

Figure 146: *Library*

Figure 147: *A view to the window of the library*

Figure 148: *Connection between the kitchen and playground*

building manage a grocery store with café on the corner. A physiotherapy practice, a coaching office and the architecture office of the architects who built the building are other commercial establisments. There are also some inhabitants who work from their apartments.

There are 700 m^2 of community rooms concentrated in the basement, ground floor and top floor of "Wohnen mit uns".(Figure 141) They represent about 25% of the total floor area of the building, which is easily accessed and well linked with the surrounding.[25] These rooms are characterised with different functions and atmosphere by visual connections and spatial scope according to different user groups. On the lower ground floor of the garden side, there is a 200 m^2 event room which receives natural daylight from the sunken courtyard, and has direct garden access. There are 6-8 events per week such as celebrations, concerts, theatres, workshops, and presentations by internal and also external users.

Near the event room is the atelier, which contains many tools, and is used very often by the inhabitants. The inhabitants built the furnishings of the guest apartments on the top floor in this atelier.

The common kitchen on the ground floor next to the entrance is very intensively used. It has a dining room for about 30 people, and two cooking places with double equipment where two cooking teams can cook next to each other.(Figure 143) The kitchen has visual contact to the events room below. There is a regular meal team, where inhabitants who want to cook and eat together volunteer to cook. The meal has a 3 euro fixed price. One of the tenants, Elisabeth says, "..cook once, eat 10 times. Lunch organisation in this project facilitated my life and enriched my day with my child."[26] The indoor playground next to the kitchen also has visual contact to the events room below and to the kitchen through a glass wall.(Figure 145, Figure 148) One of the architects of the building, Markus Zilker, who also has an apartment in the building says, "I have always dreamt of a place where I can see my children but I don't hear them. Thus, a glass wall

25 Leeb, F., "Intercultural housing, Vienna- Achieving more together", in architektur.aktuell Magazine, No:410, 05.2014, pp.104-115.

26 http://www.energie-bau.at/images/stories/fachkongress_2015/downloads/zilker_behaglichkeit.pdf, access: 20.09.2015.

allows the children to be seen by the families in the events room from the kitchen."[27]

No private units are on the top floor, which is the best location of the building. There are three guest rooms, sauna, yoga and meditation room, library with donated books and a panorama view to Bednar Park.

- Is there a meeting room for inhabitants with kitchen? Y
- Is there a closed playground for children? Y
- Is there a launderette? Y
- Is there a fitness? N
- Is there a sauna? Y
- Is there a cinema? N
- Is there a theatre? N
- Is there a library? Y (See Figure 146, Figure 147)
- Is there an atelier? Y
- Is there any play equipment or room for young people (table tennis, ropeway etc.)? Y
- Is there any other common rooms except mentioned ones? Y

3.1.9. Children's Playground

There is a small open playground at the rear of the building with a swing and sandbox. The sunken courtyard next to it also offers play space for children. Bednar Park and the other playgrounds of other housing estates of Nordbahnhof are next to the site and also usable for the inhabitants of "Wohnen mit uns". There is also an indoor playground that is also contained in the common rooms. These rooms make it possible for parents to enjoy life with their children.

27 Zilker, M., in Architektur Stiftung Österreich (Organiser),Turn On Architektur Festival 2015: Vorträge nonstop im RadioKulturhaus (CD), Themenblock Wohnen, Raum.Film Filmproduktion, Vienna, 7 March 2015.

- Is the site located appropriate for children? Y
- Is playground enough for the whole residential area? Y
- Is there a sandbox Y
- Has materials / design creativity been considered? Y
- Are the materials healthy, plastic/wood? Y
- Are playgrounds separated according to age groups? N, but Bednar Park provides this need.
- Are play areas provided within sight of families? Y
- Is energetic play provided for e.g. by adventure playground, cycle paths? Y, in Bednarpark which lies in front of the building.
- Is there any other playground in the surrounding? Y, a lot of

Figure 149: *Playground*

3.1.10. Proportion of Buildings and Diversity of Living Units

The buildings have eight storeys including the entrance and the roof storey. The proportion of buildings is convenient for housing and the proportions are compatible with the surroundings. There is a range of different apartment types, which vary in size from 36 to 137 square metres in the building "Wohnen mit uns". These different types offer a four-room apartment with a floor area of 70 square metres, as well as one with 130 square metres. The plans of these apartments are designed according to the personal needs and requirements of tenants. They are very flexible with their structural system with non-load bearing interior walls, which ensure very different possibilities. Tenants of this building also decided the positioning of the structural elements along the facades with their individual requirements, in collaboration with architects. The planning process was a very good example of participation. The plans also allow easily adaptation according to the changing needs of inhabitants in the future. In the building "Wohnen mit scharf", the apartment sizes are between 54 and 119 square metres with a wide variety of tenants from singles to seven-person families. There are four maisonettes at the top with their own roof gardens. The rest of the roof is for use by the housing community, which also includes a sundeck. As a result, the project encourages bringing people with different ages and backgrounds together.

The proportion of the building supports stair use with its attractive staircase atmosphere. In the Superblock design, there is also an attractive colour, which gives energy to the people. There are openings in the ceiling, which allows daylight into the corridors and ensure communication between tenants.

- Are the plans of different units with different sizes and characters? For small/big families? Y
- Are there different floor plans of different blocks of the project? Y
- Are different aged inhabitants encouraged in the project? Y
- Are there maisonettes? Y
- Are there dwellings with garden or terrace? Y
- Have some dwellings balcony? Y
- Do the balconies of different dwellings have different sizes? Y
- Is the vertical proportion of buildings appropriate to the human sizes and support communication of buildings with the garden? Y
- Are the buildings not more than 8-stories? Y

3.1.11. Storage, Parking and Waste Services

In the building "Wohnen mit Scharf", there is an underground garage with parking spaces for disabled people. But the car-free concept of the building "Wohnen mit uns" developed a framework of a self-organised car-sharing facility. There are eight parking places; six of them are in the car-sharing system. Near this parking garage is bicycle parking, which provides space for 116 bicycles. There are also some parking places in front of the building. There are also rooms for baby buggies, which support the daily life of families.

The architects of the buildings believe that the topic of "mobility" is a very important issue in sustainability.

- Are there storages in dwellings? Y
- Is there separate storage for each unit out of the dwelling? Y
- Is there a bicycle storage and is barrier free for disabled people? Y
- Is there a storage for prams, buggies and wheeled chairs? Y
- Is refuse and bin storage area convenient and well arranged? Y
- Is it encouraged with design to collect waste separately? Y
- Is there minimum one parking space per unit? N , because of sustainability considerations it has not been designed.
- Is there an underground parking and is it secure? Y (in the building Wohnen mit Scharf)
- Is there any car parking area for disabled people? Y

3.2. Energy performance and Construction Quality Analysis / ECQA

3.2.1. Overview

	Building features	WOHNEN mit UNS!				
	Energy Reference area[m²]	**4857.04 m²**				
	Gross floor area[m²]	**6071.31 m²**				
	Brutto-Volumen[m³]	**19014.24 m³**				
	Building enveloping area [m²]	**5953.63 m³**				
	U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
	Average U-Values[W/m²K]	0.388 [W/m²K]				
Exterior Wall	AW01 Exterior ventilated concrete wall	0.201 [W/m²K]	65 [dB]			321.86 [kg/m²]
	AW02 Thermally insulated exterior concrete wall	0.153 [W/m²K]	61 [dB]			326.83 [kg/m²]
	AW03 Exterior wall against ground	0.264 [W/m²K]	61 [dB]			326.13 [kg/m²]
Roof - Terrace	FD01 Intensive green flat roof	0.130 [W/m²K]	70 [dB]	28 [dB]		291.88 [kg/m²]
	FD02 Extensive green flat roof	0.131 [W/m²K]	65 [dB]	34 [dB]		300.79 [kg/m²]
	FD03 Flat roof terrace top floor	0.127 [W/m²K]	64 [dB]	37 [dB]	37 [dB]	301.00 [kg/m²]
Ceiling	FP01 Foundation slab against heated rooms	0.213 [W/m²K]	76 [dB]	24 [dB]		127.44 [kg/m²]
	ID01 Dividing ceiling	0.440 [W/m²K]	65 [dB]	36 [dB]	36 [dB]	94.01 [kg/m²]
	AD01 Overhang ceiling to outside air	0.137 [W/m²K]	64 [dB]	38 [dB]		91.00 [kg/m²]
Interior Wall	IW01 Internal dividing wall	0.219 [W/m²K]	69 [dB]			20.86 [kg/m²]
	Glass	0.60 [W/m²K]				
	Windows	0.94 [W/m²K]				
	A/V	0.31 [1/m]				
	n50[1/h]	0.80 [1/h]				
	Ventilationtype	Domestic ventilation with heat recovery and geothermal heat excharger				
	Heating type	District heating (central), under floor heating, single-room control with thermostatic valve				
	Total heating demand[kWh/m²a]	**12.99 [kWh/m²a]**				

Figure 150: *Overviw of the quantitavie values of the building components of WMU, made by the author.*

3.2.2. Form and Orientation

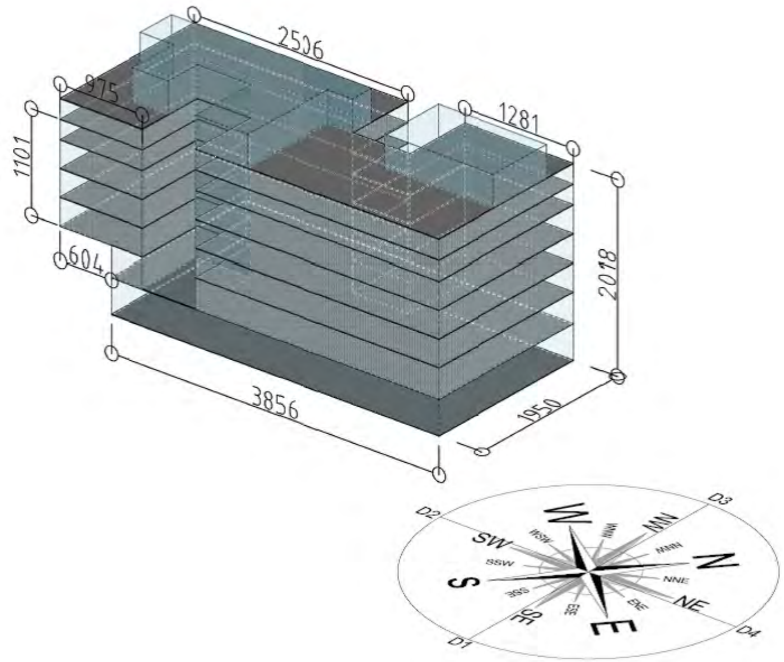


Figure 151: *Form and orientation, made by the author.*

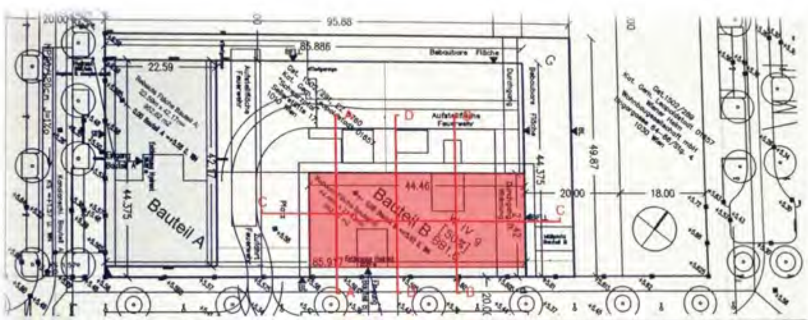


Figure 152: *Site plan.*

The building, designed by the architectural office, Einzueins, was placed in parallel with the lines of the land. The form of the building was obtained by means of removing a few small boxes from the box that has approximate dimensions of 44m x 19.5m. The long sides of the building are positioned towards to northeast and southwest. While the houses looking towards the southwest take advantage of the solar power, it is not possible to say the same for buildings oriented towards to northeast.

The stair enclosure that enables vertical access between the floors is at the centre of the building. The secondary rooms of the buildings like bathrooms, storerooms, and toilets, are positioned around the close circle of this core. As a consequence, the outer shell of the building includes the main usage areas like the living room and the bedrooms that have greater need of the heat and light of the sun.

Although there are some apartments at the north side of the aforementioned object, this fact might be perceived as acceptable if the fact that the building is a part of collective housing development is taken into account. The heat losses for the north-oriented apartments have been aimed to be held at minimum levels with heat insulation and high quality windows, because they cannot take much benefit from sunlight. This topic will be covered in detail in the next chapter.

The roof of the building was designed flat, making the installation of the photovoltaic systems at the top of the building possible. Moreover, planting areas on the roof have a positive impact on the environment as well as sustainability.

The compactness of the building also receives attention as much as the orientation of the building to the sun. The total facade area of the building, divided by the total heated volume is 0.311/m. Protrusions on façade have been avoided as much as possible in the building form. Despite the indentations on the façade generated for the purpose of illuminating the stair enclosure affect the compactness of the building in a negative way, the compactness ratio is pretty good for a housing project at this scale.

3.2.3. Building Compenents U-Values, Thermal Bridges and Airtightness

- Building Components U-Values, Acoustic

1) AD01 Overhang Ceiling to Outside Air:

The total roof construction thickness is 61.2 cm. The top layer is laminate or ceramic tile. The under floor heating system has been installed in the screed at a depth of 5.5 cm. 3 cm EPS-T and 5 cm thick EPS-W acoustic insulation have been used. A 25 cm reinforced concrete slab bears the floor load. 18 cm mineral (rock) wool provides quite high insulation and is installed under the load-bearing system. Total U-value of the ceiling with full thermal insulation is calculated to be 0.137 W/m²K. The resulting value of the building construction has been decreased by 31% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.137 W/m²K

Weighted Sound reduction index Rw = 64 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 68 [dB]

Thermal storage by the building's mass m $_{w,B,A}$ = 91.00 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	1 cm	Lamination	1,000	0,010	20,0	20,0	5,0
2	5,5 cm	Cement screed	1,400	0,039	20,0	20,0	110,0
3	0,2 cm	PAE-Foil	2,300	0,001	20,0	20,0	3,0
4	3 cm	EPS - T	0,045	0,667	20,0	20,0	1,0
5	5 cm	EPS- W15	0,041	1,220	20,0	20,0	0,8
6	2,5 cm	Loose fill	1,400	0,018	20,0	20,0	10,0
7	25 cm	Reinforced concrete slab	2,300	0,109	20,0	20,0	600,0
8	0,5 cm	Adhesive filler	1,400	0,004	20,0	20,0	7,0
9	18 cm	Mineral wool	0,036	5,000	20,0	20,0	19,8
10	0,5 cm	External plaster	0,550	0,009	20,0	20,0	9,5
		Thermal contact resistance*		0,040	20,0	20,0	
	61,2 cm	Whole component		7,282			766,0

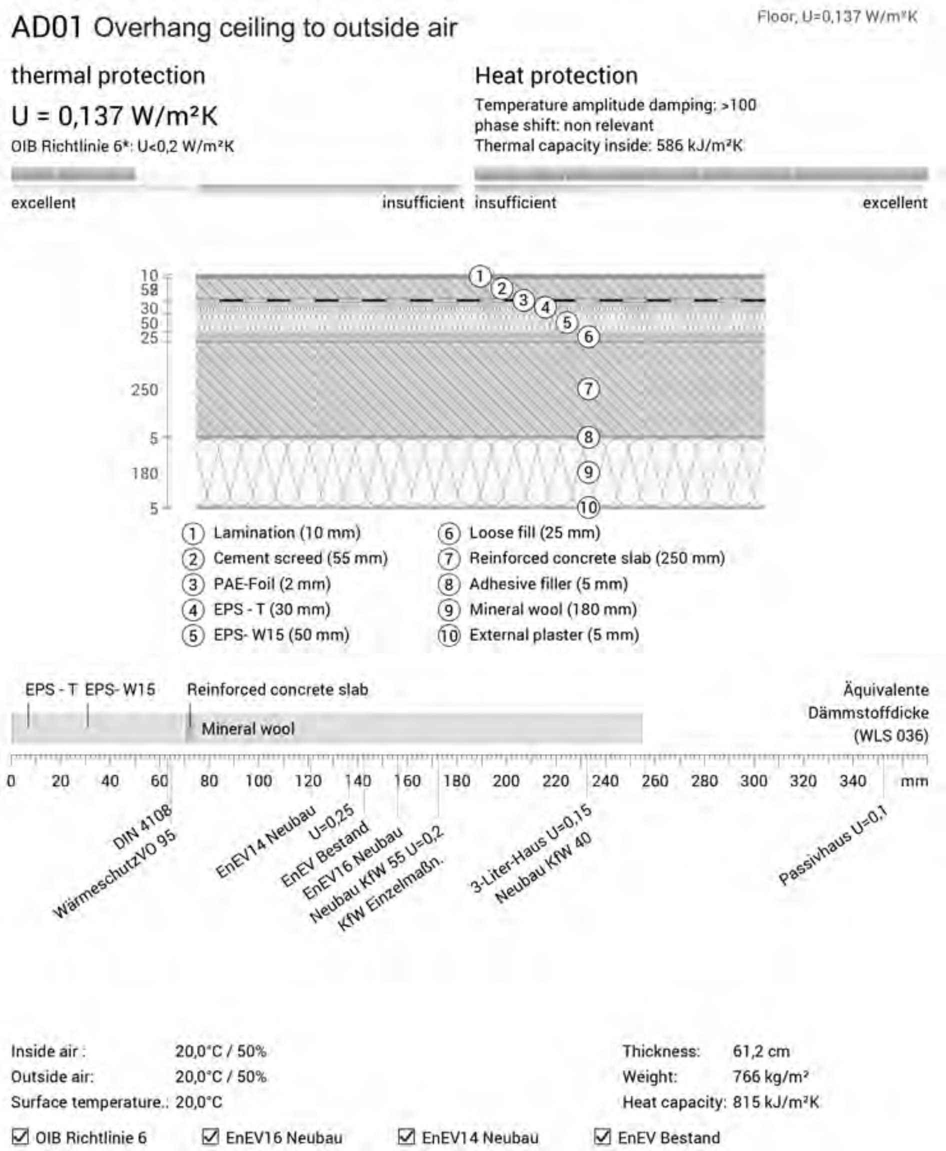


Figure 153: *Detail of the overhang ceiling to outside air, created by the author*

2) AW01 Exterior Ventilated Concrete Wall

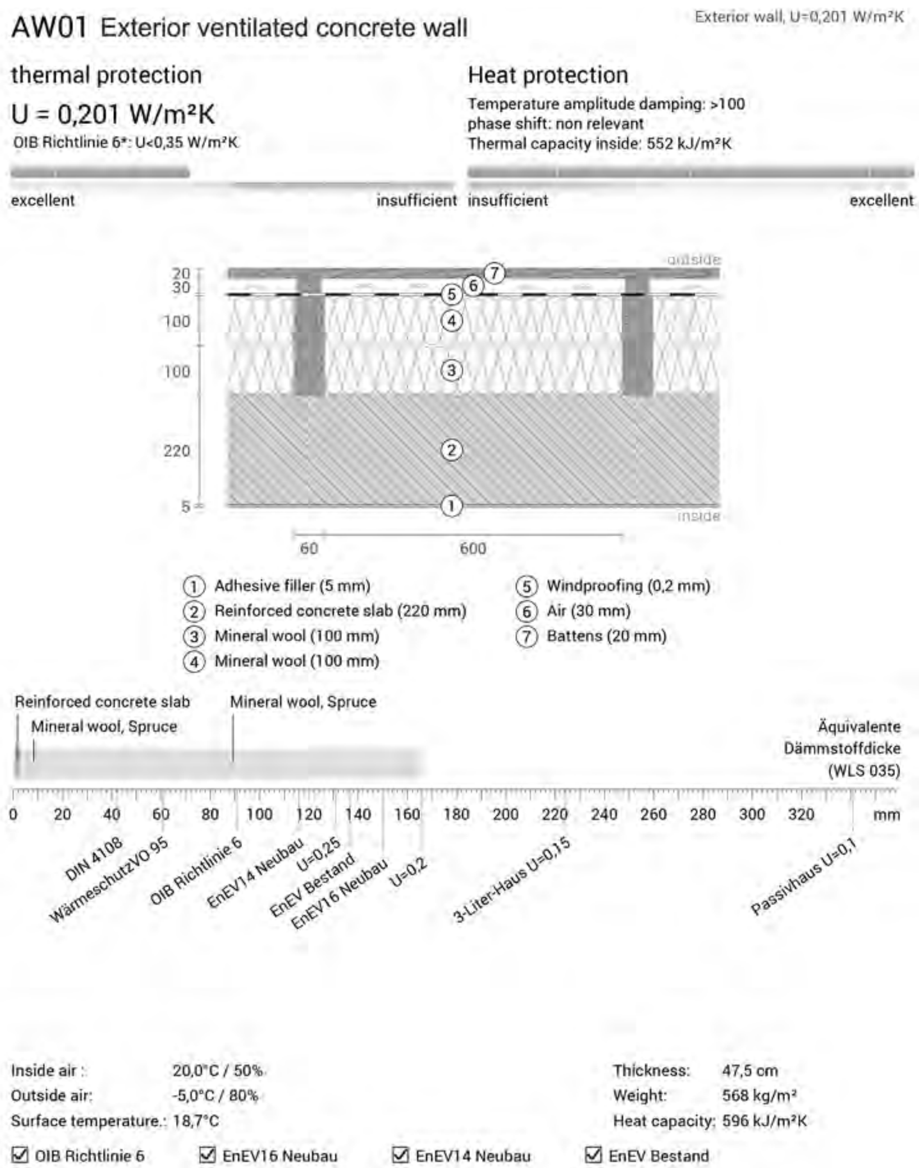
The total exterior wall structure thickness is 47.5 cm. The interior plaster is a single-layer gypsum/lime machine plaster. The load-bearing reinforced concrete wall is 22 cm thick. The rear-ventilated façade has been insulated with 20 cm mineral wool. 2 cm thick wooden battens clad the façade. The exterior wall thermal insulation is calculated as a total U-value of 0.201 W/m²K. The resulting value is approximately 43% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.201 W/m²K

Weighted Sound Reduction index Rw= 65 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 321.86 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,7	20,0	
1	0,5 cm	Adhesive filler	0,800	0,006	18,7	18,8	7,0
2	22 cm	Reinforced concrete slab	2,500	0,088	18,1	18,7	528,0
3	10 cm	Mineral wool	0,035	2,857	6,7	18,3	3,3
	10 cm	Spruce (9,1%)	0,130	0,769	6,8	18,1	4,1
4	10 cm	Mineral wool	0,035	2,857	-4,8	6,8	3,3
	10 cm	Spruce (9,1%)	0,130	0,769	-4,6	6,8	4,1
5	0,02 cm	Windproofing	0,220	0,001	-4,8	-4,4	0,0
		Thermal contact resistance*		0,130	-5,0	-4,5	
6	3 cm	Air (ventilated layer)			-5,0	-5,0	0,0
7	2 cm	Battens			-6,0	-6,0	18,7
	47,52 cm	Whole component		4,978			568,4

Figure 154: *Detail of the exterior ventilated concrete wall, created by the author*

3) AW02 Thermally Insulated Exterior Concrete Wall

The total thickness of the exterior wall is 42 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. 20 cm reinforced concrete wall carries the load of the building. The rear-ventilated façade has been insulated with 20 cm mineral wool. A double-layered exterior plaster with heat insulation as a coarse plaster has been used, and silicone resin-float finish as a fine plaster (finishing coat). The total U-value of the thermally insulated exterior wall is calculated as 0.153 W/m²K. The resulting value is approximately 57% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.153 W/m²K

Weighted Sound Reduction index Rw= 61 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 326.83 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	19,1	20,0	
1	0,5 cm	Adhesive filler	1,400	0,004	19,0	19,1	7,0
2	20 cm	Reinforced concrete slab	2,500	0,080	18,7	19,0	480,0
3	1 cm	Adhesive filler	0,800	0,013	18,7	18,7	14,0
4	20 cm	EPS F	0,032	6,250	-4,8	18,7	3,0
5	0,5 cm	Stucco	0,700	0,007	-4,8	-4,8	9,0
		Thermal contact resistance*		0,040	-5,0	-4,8	
	42 cm	Whole component		6,523			513,0

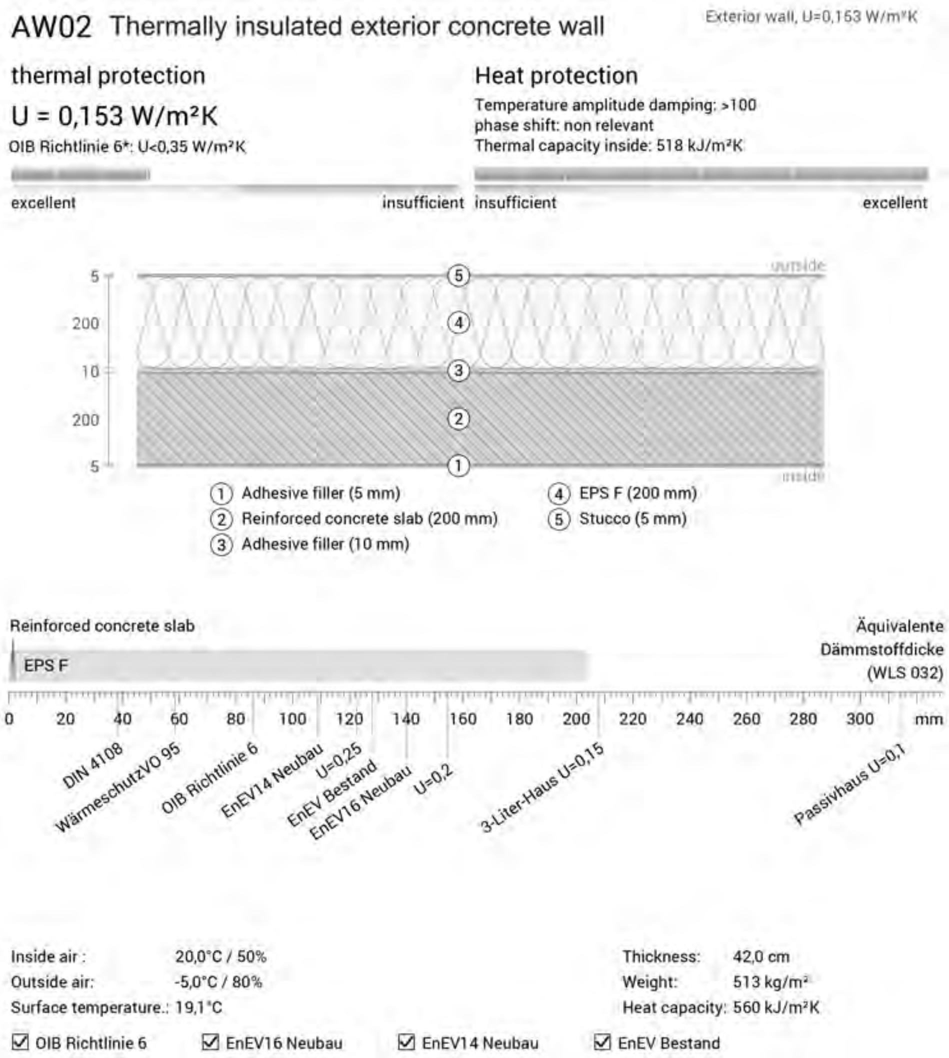


Figure 155: *Detail of the exterior concrete wall, created by the author*

4) AW03 Exterior Wall against Ground

The exterior wall is 45.4 cm thick in total. The interior plaster is executed on a cement base as a single-layer machine plaster. 30 cm of reinforced concrete bears the load of the wall. A double-layered E-KV-4 2 has been used to seal the exterior wall. The façade is insulated with 15 cm XPS-G. A double-layered exterior plaster with heat insulation plaster has been used as a coarse plaster and silicone resin-float finish as fine plaster (finishing coat). The total U-value of the thermally insulated exterior wall has been calculated as a U-value of 0.264 W/m²K. The resulting value is about 25% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.264 W/m²K

Weighted Sound Reduction index Rw= 61 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 326.13 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,7	20,0	
1	0,5 cm	Adhesive filler	1,400	0,004	18,7	18,7	7,0
2	30 cm	Reinforced concrete slab	2,500	0,120	18,1	18,7	720,0
3	0,9 cm	E-KV-4 sealing sheet	0,230	0,039	17,9	18,1	9,9
4	14 cm	XPS-G	0,040	3,500	0,2	17,9	6,3
		Thermal contact resistance*		0,000	0,0	0,2	
5		Erdreich			0,0	0,0	77,2
	45,4 cm	Whole component		3,794			743,2

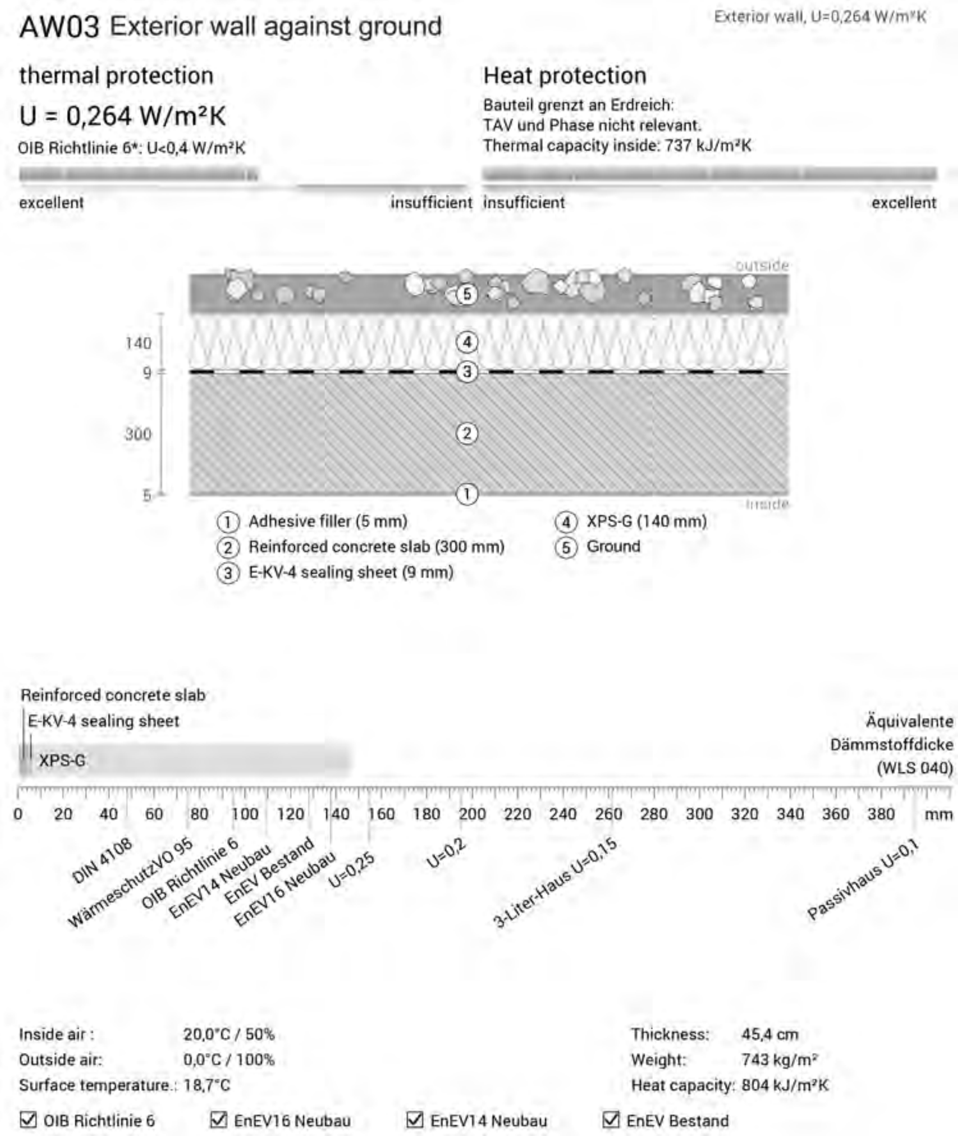


Figure 156: *Detail of the exterior wall against ground, created by the author*

5) FD01 Intensive Green Flat Roof

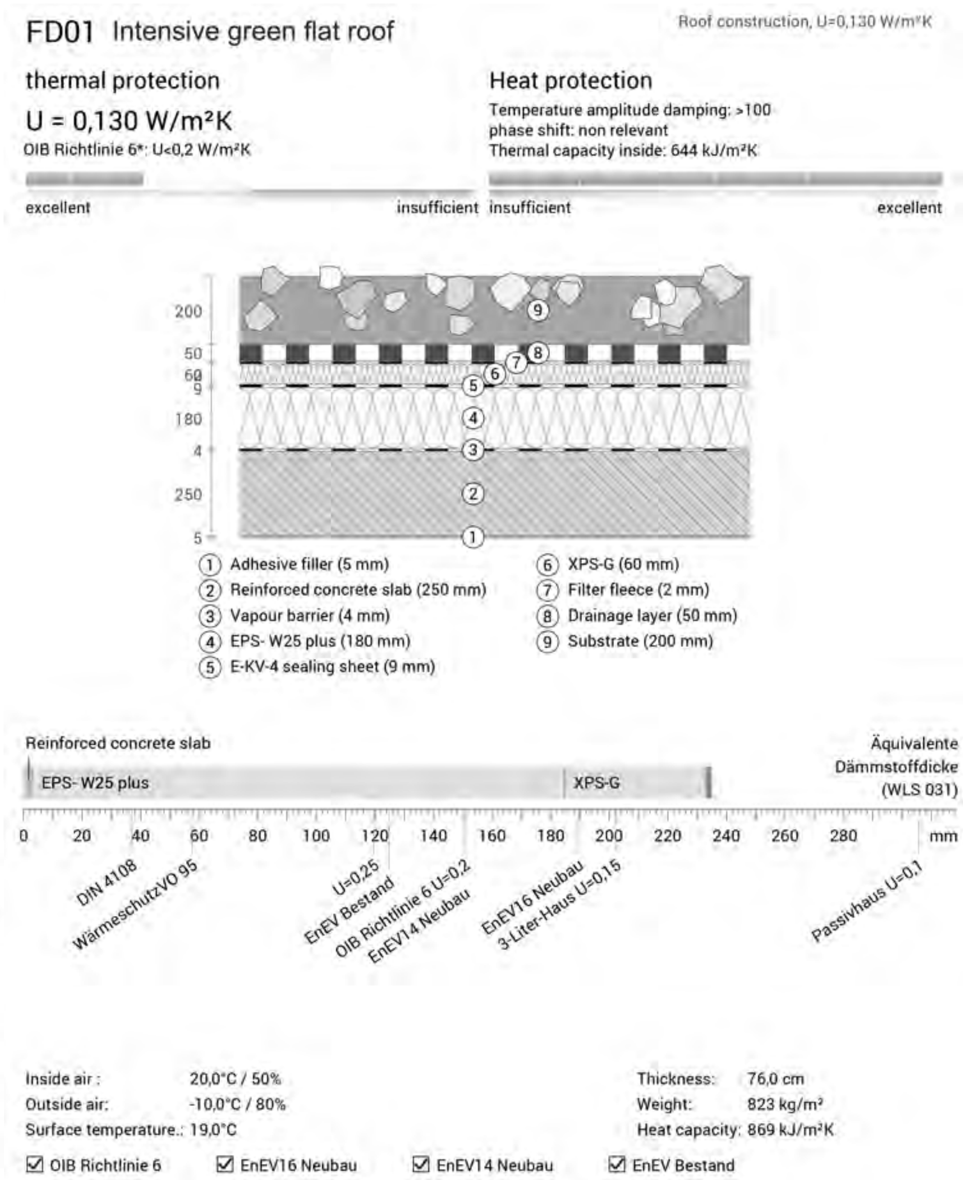
The total roof structure is 45.4 cm thick. The top roof layer is a 20 cm thick substrate. 6 cm XPS-G thermal insulation has been used together with 18 cm EPS-W25 insulation. A 25 cm reinforced concrete slab carries the roof load. The interior ceiling plaster is executed as single layer on a gypsum/lime base. The total U-value calculation of the roof with full thermal insulation results in a U-Value of 0.13 W/m²K. The resulting value is about 35% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.130 W/m²K

Weighted Sound Reduction index Rw= 70 [dB]

Required Weighted Sound reduction index Rw= 28 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 291.88 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	19,0	20,0	
1	0,5 cm	Adhesive filler	1,400	0,004	19,0	19,0	7,0
2	25 cm	Reinforced concrete slab	2,300	0,109	18,6	19,0	600,0
3	0,4 cm	Vapour barrier	0,250	0,016	18,6	18,6	10,8
4	18 cm	EPS- W25 plus	0,031	5,806	-3,6	18,6	2,7
5	0,9 cm	E-KV-4 sealing sheet	0,170	0,053	-3,8	-3,6	9,9
6	6 cm	XPS-G	0,040	1,500	-9,5	-3,8	2,7
7	0,2 cm	Filter fleece	1,000	0,002	-9,5	-9,5	0,0
8	5 cm	Drainage layer	3,000	0,017	-9,6	-9,5	0,1
9	20 cm	Substrate	3,000	0,067	-9,8	-9,6	190,0
		Thermal contact resistance*		0,040	-10,0	-9,8	
	76 cm	Whole component		7,713			823,2

Figure 157: *Detail of the intensive green flat roof created by the author*

6) FD02 Extensive Green Flat Roof

The total roof structure is around 61 cm thick. The top layer of the roof is an 8 cm thick substrate. 6 cm XPS-G and 18 cm EPS-W25 thermal insulation have been used. 22 cm reinforced concrete slab carries the roof load. The interior plaster is executed as a single layer on gypsum/lime base. The total roof U-value with full thermal insulation results in a U-value of 0.131 W/m²K. The resulting value is about 35% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.131 W/m²K

Weighted Sound Reduction index Rw= 65 [dB]

Required Weighted Sound reduction index Rw= 34 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 300.79 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	19,0	20,0	
1	0,5 cm	Adhesive filler	1,400	0,004	19,0	19,0	7,0
2	22 cm	Reinforced concrete slab	2,300	0,096	18,7	19,0	528,0
3	0,4 cm	Vapour barrier	0,250	0,016	18,6	18,7	10,8
4	18 cm	EPS- W25 plus	0,031	5,806	-3,7	18,6	2,7
5	0,9 cm	E-KV-4 sealing sheet	0,170	0,053	-3,9	-3,7	9,9
6	6 cm	XPS-G	0,040	1,500	-9,7	-3,9	2,7
7	0,2 cm	Filter fleece	1,000	0,002	-9,7	-9,7	0,0
8	5 cm	Drainage layer	3,000	0,017	-9,7	-9,7	0,1
9	8 cm	Substrate	3,000	0,027	-9,8	-9,7	76,0
		Thermal contact resistance*		0,040	-10,0	-9,8	
	61 cm	Whole component		7,660			637,2

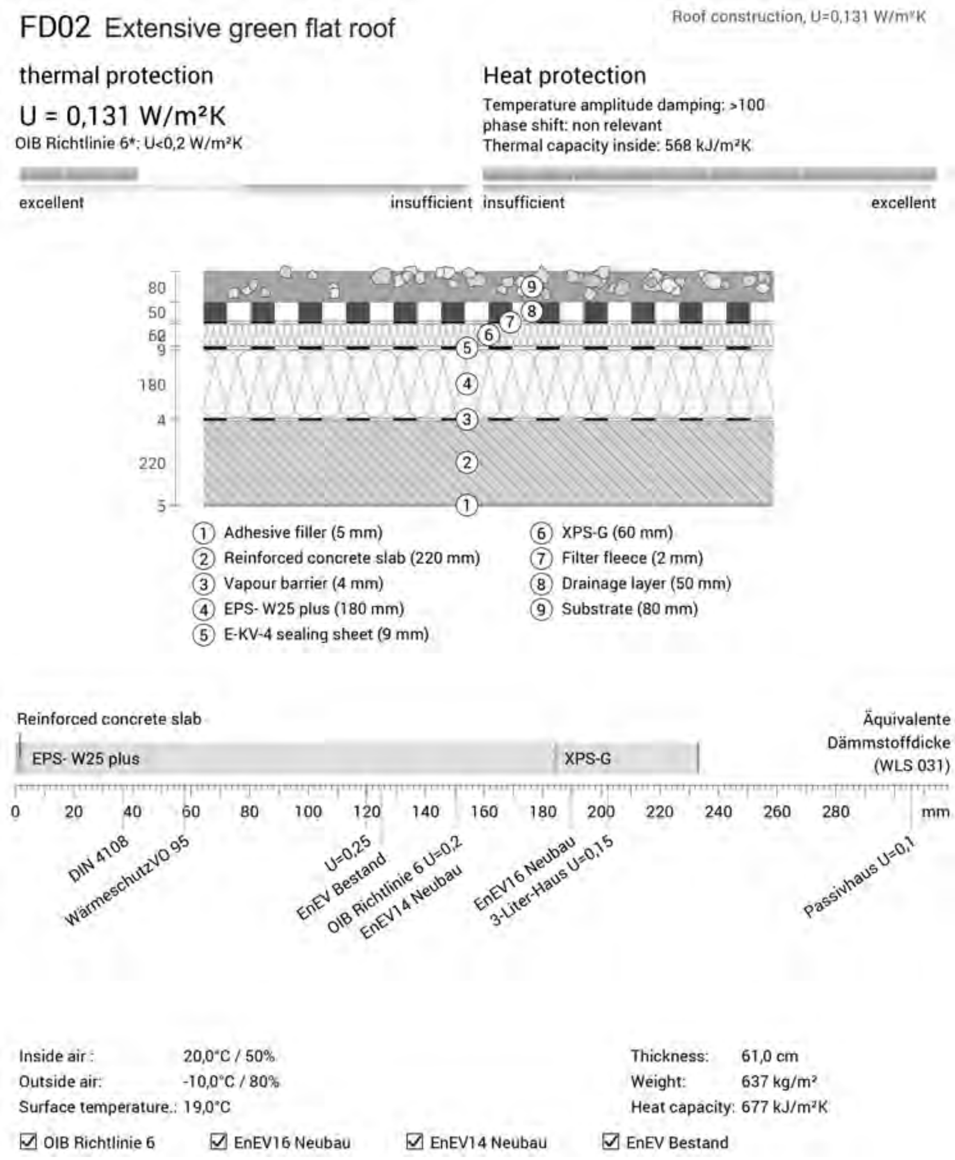


Figure 158: *Detail of the extensive green flat roof created by the author*

7) FD03 Flat Roof Terrace Top Floor

The total roof ceiling structure thickness is about 61 cm. The top layer of the accessible roof is a 2 cm wood cladding. 6 cm XPS-G and 18 cm EPS-W25 thermal insulations have been used. The roof load is borne by the 25 cm reinforced concrete roof slab. The interior plaster is executed as single layer on a gypsum/lime base. The total calculated U-value of the roof with full thermal insulation results in a U-value of 0.127 W/m²K. The resulting value is about 36% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.127 W/m²K

Weighted Sound Reduction index Rw= 64 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =37 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 301.00 kg/m²

Weighted Standardized Impact Sound Pressure Level L`nT,w = 37 [dB]

Required Weighted Standardized Impact Sound Pressure Level according to ÖNORM L`nT,w = 48 [dB]

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	19,1	20,0	
1	0,5 cm	Adhesive filler	1,400	0,004	19,1	19,1	7,0
2	25 cm	Reinforced concrete slab	2,300	0,109	18,6	19,1	600,0
3	0,4 cm	Vapour barrier	0,250	0,016	18,6	18,6	10,8
4	18 cm	EPS- W25 plus	0,031	5,806	-3,1	18,6	2,7
5	0,9 cm	E-KV-4 sealing sheet	0,170	0,053	-3,3	-3,1	9,9
6	6 cm	XPS-G	0,040	1,500	-8,9	-3,3	2,7
7	0,2 cm	Filter fleece	1,000	0,002	-8,9	-8,9	0,0
8	2 cm	Drainage layer	3,000	0,007	-9,0	-8,9	0,0
9	6 cm	Gravel bed	0,700	0,086	-9,3	-9,0	108,0
10	2 cm	Larch	0,130	0,154	-9,9	-9,3	9,2
		Thermal contact resistance*		0,040	-10,0	-9,9	
	61 cm	Whole component		7,876			750,3

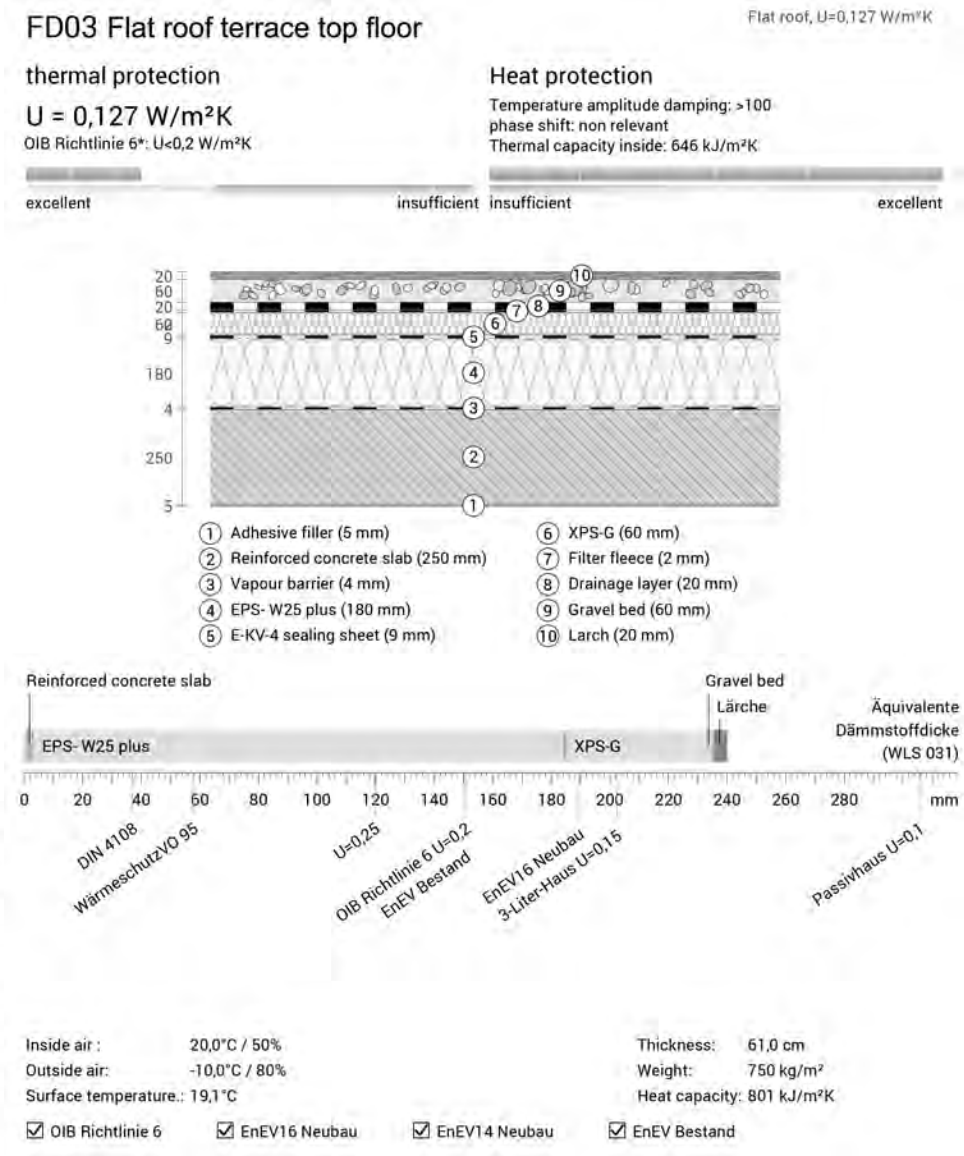


Figure 159: *Detail of the flat roof terrace top floor created by the author*

8) FP01 Foundation Slab Against Heated Rooms

The floor slab is 61 cm in total. The top layer of the foundation slab construction is 1 cm wooden floor finish. An under floor heating system has been placed at a 5.5 cm depth in the screed. 3 cm EPS-T acoustic insulation has been installed. A 50 cm reinforced concrete floor slab bears the load. 8 cm XPS-G thermal insulation has been installed under the floor slab in order to ensure heat insulation. The total U-value calculation of the floor slab with full thermal insulation has resulted in a U-value of 0.213 W/m²K. The resulting value is about 47% lower than the required U-value of 0.40 W/m²K.

U-Value= 0.213 W/m²K

Weighted Sound Reduction index Rw= 76 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =24 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 127.44 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	18,4	20,0	
1	1 cm	Lamination	0,130	0,077	17,9	18,4	5,0
2	6 cm	Screed	1,400	0,043	17,6	17,9	120,0
3	0,2 cm	PAE-Foil	0,230	0,009	17,6	17,6	3,0
4	3 cm	EPS - T	0,033	0,909	11,7	17,6	1,0
5	5 cm	Loose fill	0,050	1,000	5,2	11,7	1,1
6	0,9 cm	E-KV-4 sealing sheet	0,170	0,053	4,9	5,2	9,9
7	0,2 cm	Bitumen coating	0,230	0,009	4,8	4,9	2,4
8	50 cm	Reinforced concrete slab	2,300	0,217	3,4	4,8	1.200,0
9	8 cm	XPS-G	0,040	2,000	-9,5	3,4	3,6
10	10 cm	Concrete	10,000	0,010	-9,6	-9,5	200,0
11	0,2 cm	PAE-Foil	0,350	0,006	-9,6	-9,6	3,0
12	15 cm	Gravel	10,000	0,015	-9,7	-9,6	330,0
		Thermal contact resistance*		0,170	-10,0	-9,7	
	99,5 cm	Whole component		4,687			1.879,0

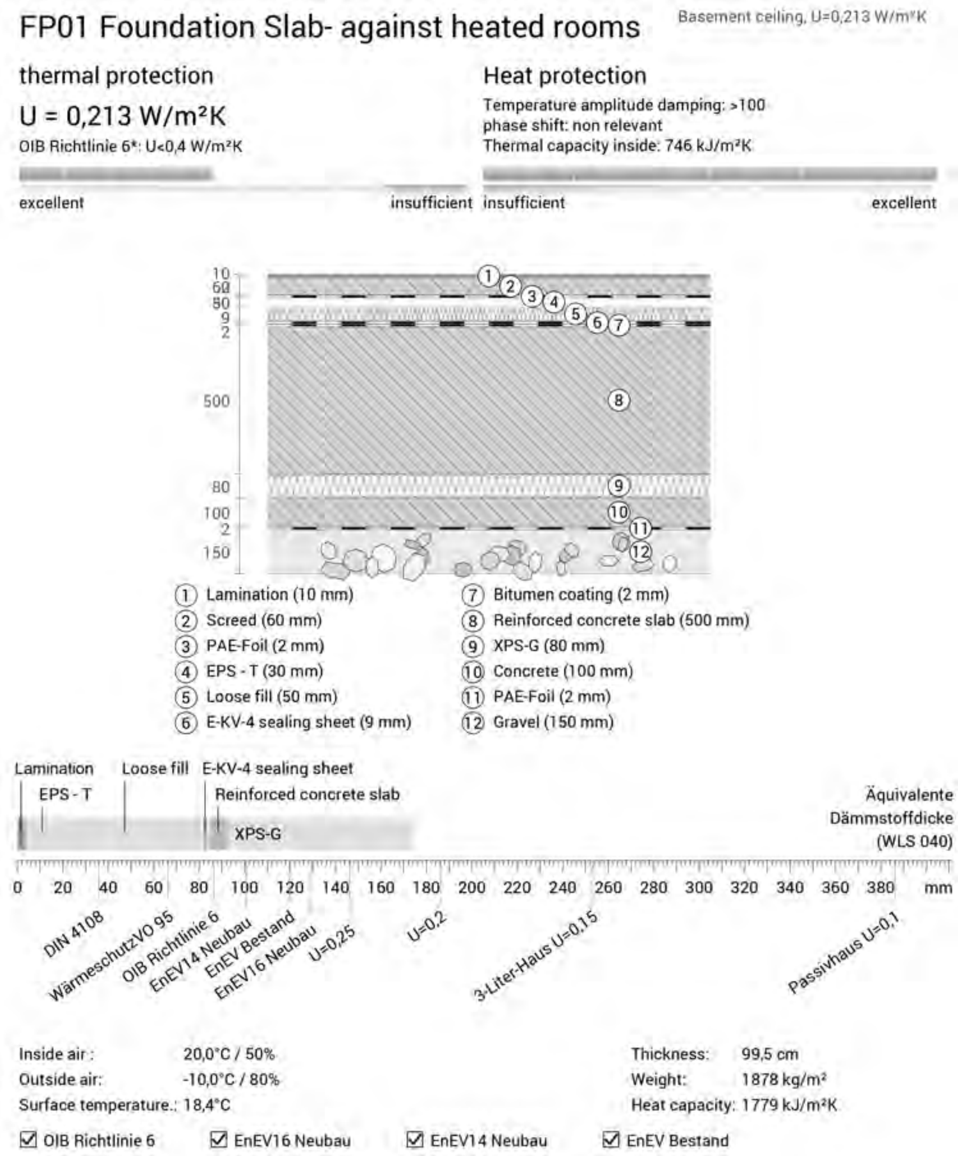


Figure 160: *Detail of the foundation slab against heated rooms, made by the author.*

9) ID01 Dividing Ceiling

The total ceiling structure thickness is 39.7 cm. The ceiling is clad with 1 cm thick wooden cladding. The under floor heating system has been built into the screed at a depth of 5.5 cm. 3 cm thick EPS-T and 5cm thick EPS-W15 acoustic insulation have been built into the construction. A 22 cm load-bearing reinforced concrete slab carries the weight of the construction. The total U-value calculation of the ceiling with full thermal insulation is 0.44 W/m²K. No U-Value is required for dividing ceilings.

U-Value= 0.44 W/m²K

Weighted Sound Reduction index Rw= 65 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =36 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 94.01 kg/m²

Weighted Standardized Impact Sound Pressure Level L`nT,w = 36 [dB]

Required Weighted Standardized Impact Sound Pressure Level laut ÖNORM L`nT,w = 48 [dB]

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	1 cm	Lamination	1,000	0,010	20,0	20,0	5,0
2	5,5 cm	Cement screed	1,400	0,039	20,0	20,0	110,0
3	0,2 cm	PAE-Foil	2,300	0,001	20,0	20,0	3,0
4	3 cm	EPS - T	0,045	0,667	20,0	20,0	1,0
5	5 cm	EPS- W15	0,041	1,220	20,0	20,0	0,8
6	2,5 cm	Loose fill	1,400	0,018	20,0	20,0	10,0
7	22 cm	Reinforced concrete slab	2,300	0,096	20,0	20,0	528,0
8	0,5 cm	Adhesive filler	1,400	0,004	20,0	20,0	7,0
		Thermal contact resistance*		0,040	20,0	20,0	
	39,7 cm	Whole component		2,264			664,7

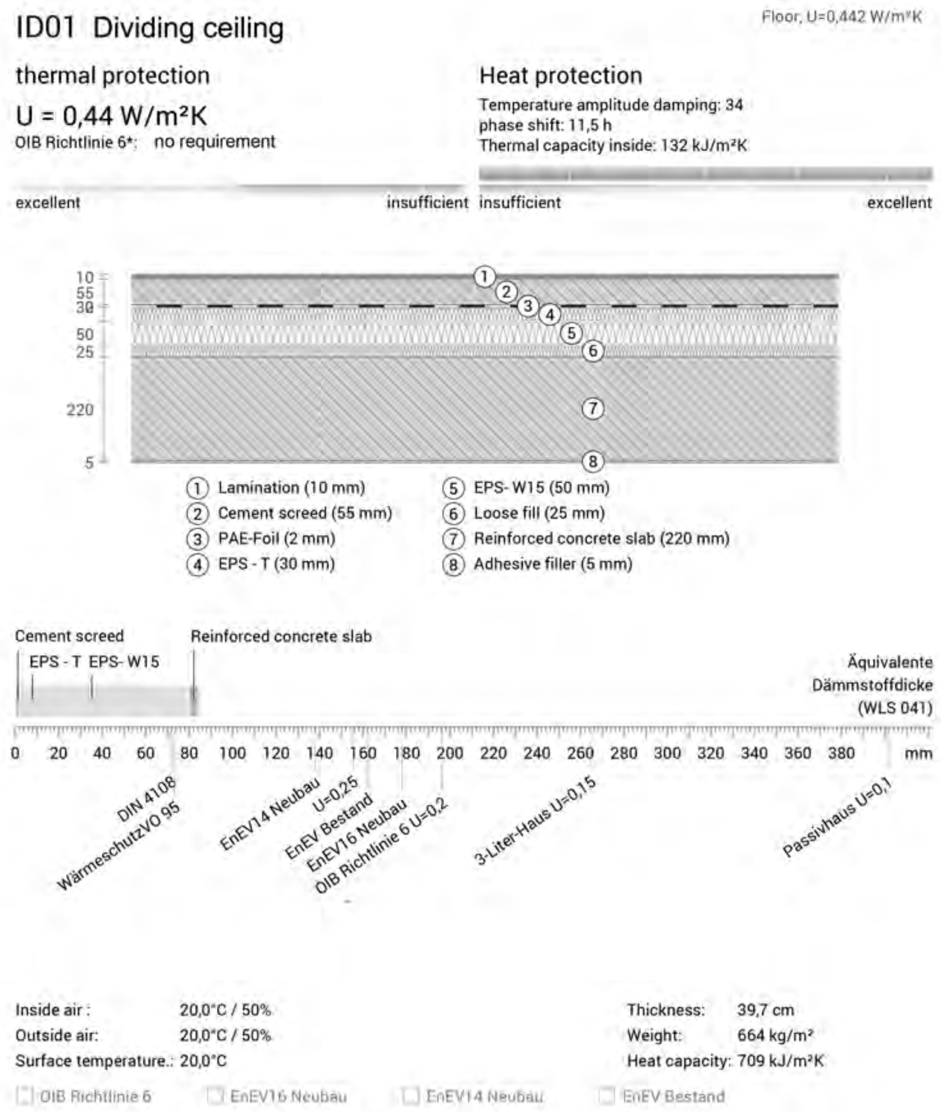


Figure 161: *Detail of the Interior ceiling created by the author.*

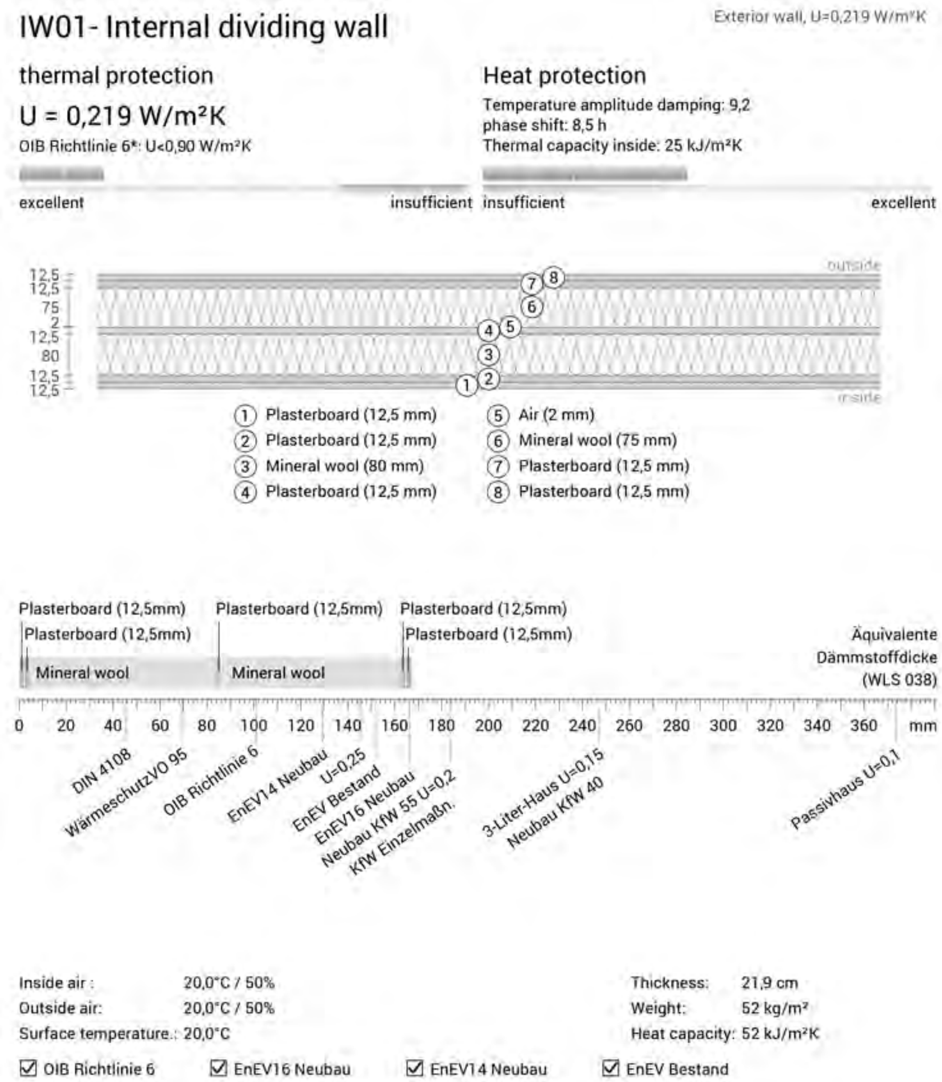
10) IW01 Internal Dividing Wall

The total thickness of dividing walls is 21.9 cm. The wall surfaces are plastered. The 7.5 cm C-profile plasterboard panels are load bearing. The space between the wall studs is filled with 7.5 cm of mineral wool. The total calculated U-value of the dividing wall with mineral wool results in a U-value of 0.219 W/m²K. The resulting value is about 76% lower than the required U-value of 0.90 W/m²K.

U-Value= 0.219 W/m²K

Weighted Sound Reduction index Rw= 69 [dB]

Thermal storage by the building's mass m w,B,A = 20.86 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	20,0	20,0	
1	1,25 cm	Plasterboard (12,5mm)	0,210	0,060	20,0	20,0	9,9
2	1,25 cm	Plasterboard (12,5mm)	0,210	0,060	20,0	20,0	9,9
3	8 cm	Mineral wool	0,038	2,105	20,0	20,0	1,6
4	1,25 cm	Plasterboard (12,5mm)	0,210	0,060	20,0	20,0	9,9
5	0,2 cm	Air (unventilated layer)	0,045	0,044	20,0	20,0	0,0
6	7,5 cm	Mineral wool	0,038	1,974	20,0	20,0	1,5
7	1,25 cm	Plasterboard (12,5mm)	0,210	0,060	20,0	20,0	9,9
8	1,25 cm	Plasterboard (12,5mm)	0,210	0,060	20,0	20,0	9,9
		Thermal contact resistance*		0,040	20,0	20,0	
	21,95 cm	Whole component		4,561			52,5

Figure 162: *Detail of internal dividing wall. detail by the author.*

- Thermal Bridges

1) Paraphet for Flat Roof

The load-bearing system of the flat roof and external walls is composed of reinforced concrete. The protrusions that compose the attic have been completely covered with thermal insulation. As a consequence, a bridge has been created in a way that there is no space between the thermal insulation of the reinforced concrete roof and the thermal insulation of the external walls. The cold air is kept as far as possible away from the interior by extending the attic about 50cm above the interior. According to the 2D thermal bridge simulations, it is observed that there is a negligible thermal difference at the corners of indoor spaces.

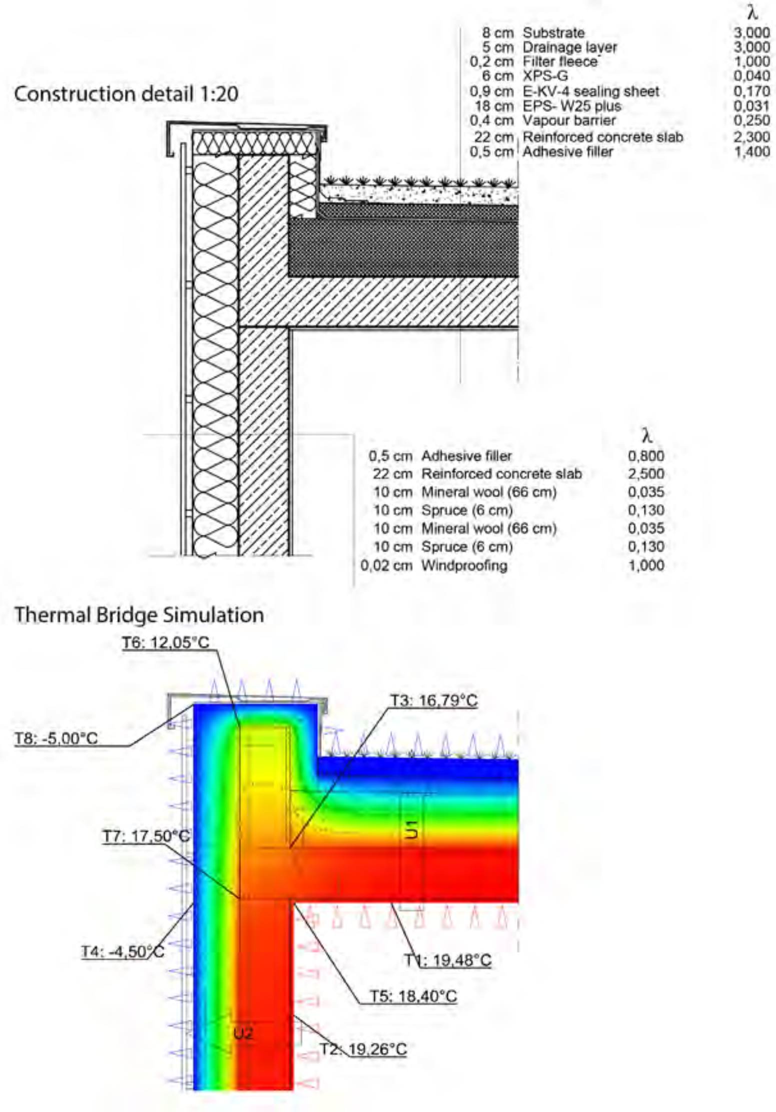


Figure 163: *Thermal Bridge Simulation showing the connection between the flat roof and the external wall, made by the author.*

2) Foundation Slab and External Wall

XPS-G materials have been installed under the reinforced concrete foundation slab of the building and also covers the external walls in contact with the ground. It provides heat insulation by wrapping the building all around from the outside. As a result, the coldness of the ground that reaches -5 C° is hindered from flowing into the building according to 2D thermal bridge simulations. There is an approximate 3.8 C° temperature loss with a room temperature of 20 C° at the corner junction of the wall and foundation slab. A greater decrease in heat loss would result from applying a thicker layer of thermal insulation than 8 cm under the reinforced concrete slab.

Thermal bridge simulation showing the connection between foundation slab and external wall.

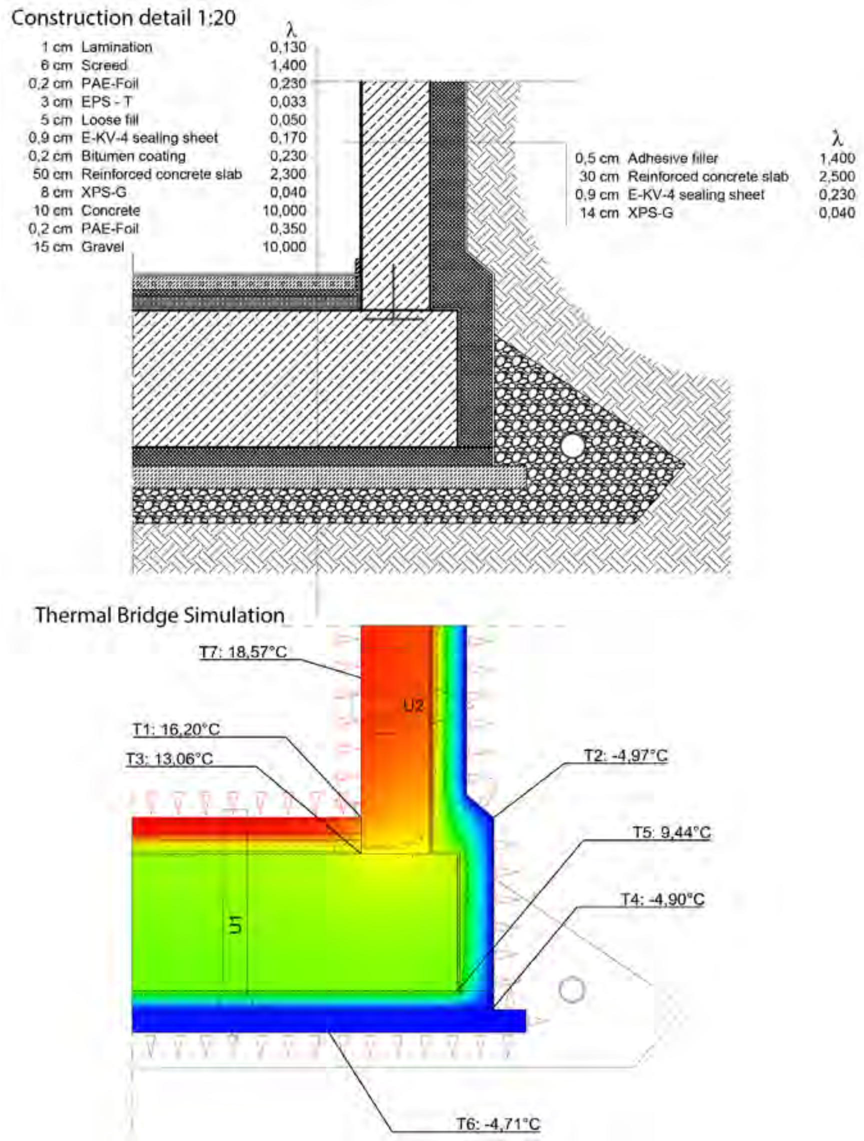


Figure 164: *Thermal Bridge Simulation showing the connection between the foundation slab and the external wall, made by the author.*

3) Balcony and External Wall

The balcony detail is one of the most susceptible thermal bridge points in the building. The plan designed by the Einzueins architecture office demonstrates that the contact between the balcony slab and the floor slab has been ensured by means of isokorbs, structural thermal breaks. The load-bearing system of the balcony was designed without the need of any column thanks to isokorbs supported by reinforcements. As seen from the simulation, the bridge has been generated between the thermal insulation of the external walls and thermal insulation of the bottom layer of the cantilever in a way that does not allow the formation of thermal bridges.

Thermal bridge simulation showing the connection between the balcony, external wall and ceiling to outside air.

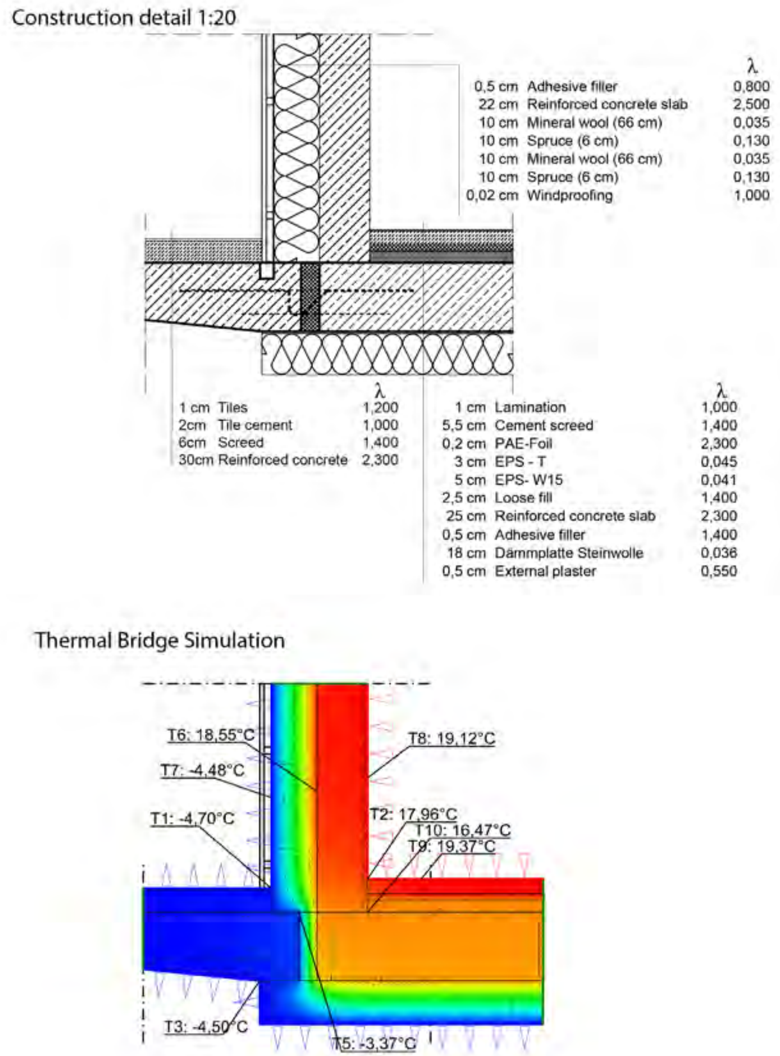


Figure 165: *Thermal Bridge Simulation showing the connection between the balcony, the external wall and the ceiling to outside air, made by the author.*

3.2.4. Heating-Hot Water

The heating and hot water needs of the building are fulfilled by district heating. A large mechanical room for heating in the building has been saved owing to this system. Moreover, separate hot water storage was not regarded as necessary because of this system. The fact that 134 kW power is requisite to satisfy the heating and hot water needs of the total 6071 m^2 space has been pointed out in the energy report. It has been calculated that 91,744 kWh is necessary for the total heating need and 162,000 kWh for the hot water energy need is required per year. Reducing the heat energy losses caused by the distribution of hot water was aimed in wrapping the installation pipes with heat insulation. A thermostat regulating the temperature level has been installed in each room in order to save energy.

A photovoltaic system has not been used in the building.

3.2.5. Ventilation

Controlled domestic ventilation with system heat recovery has been utilized in the building.

By means of this system, the clean air can be obtained without the need of any natural ventilation system according to the conditions of daily usage. This system has been supported by natural ventilation via windows in accordance with the Energy Performance Certificate. The heat of the room air exhaust is transferred to the colder fresh air supply in this system, which is supported by a geothermal heat exchanger. Therefore, heat losses have been reduced.

The distribution between the natural and mechanical ventilation system is calculated according to the data of energy performance certificate is as below:

a) Window Ventilation :

Reference gross floor area = 1214.26 m^2 von 6071.31m^2

Ventilation conductance = 343.49 W/K

Ventilation volume VL= 2525.67 m^3

Air change rate n= 0.40 1/h

b) Controlled Domestic Ventilation with Heat Recovery:

Reference gross floor area = 4857.04 m^2 von 6071.31 m^2

Ventilation conductance = 377.83 W/K

Ventilation Volume VL= 10,102.64 m^3

Mechanically determined air exchange rate n= 0.40 1/h

Air exchange in airtightness test n50= 0.80 1/h

Additional air exchange rate nx= 0.05 1/h

Heat efficiency of the entire system eta= 86.50 %

Heat recovery = 85 %

Heat exchanger= 10%

3.2.6. Solar Shading-Overheating in Summer

In order to protect the internal rooms from the effects sunlight, integrated exterior blinds have been utilized. In addition, eaves formed by cantilevered elements like balconies and terraces, protect indoor spaces from the strong summer sunlight at a structural level.

Figure 166: *Overheating calculations of the rooms in summer, made by the author.*

The Z-values of the solar blinds in accordance with the Energy Performance Certificate are below:

Internal Shading z= 0.75

Balconies, overhangs z= 0.32

External shading z= 0.27

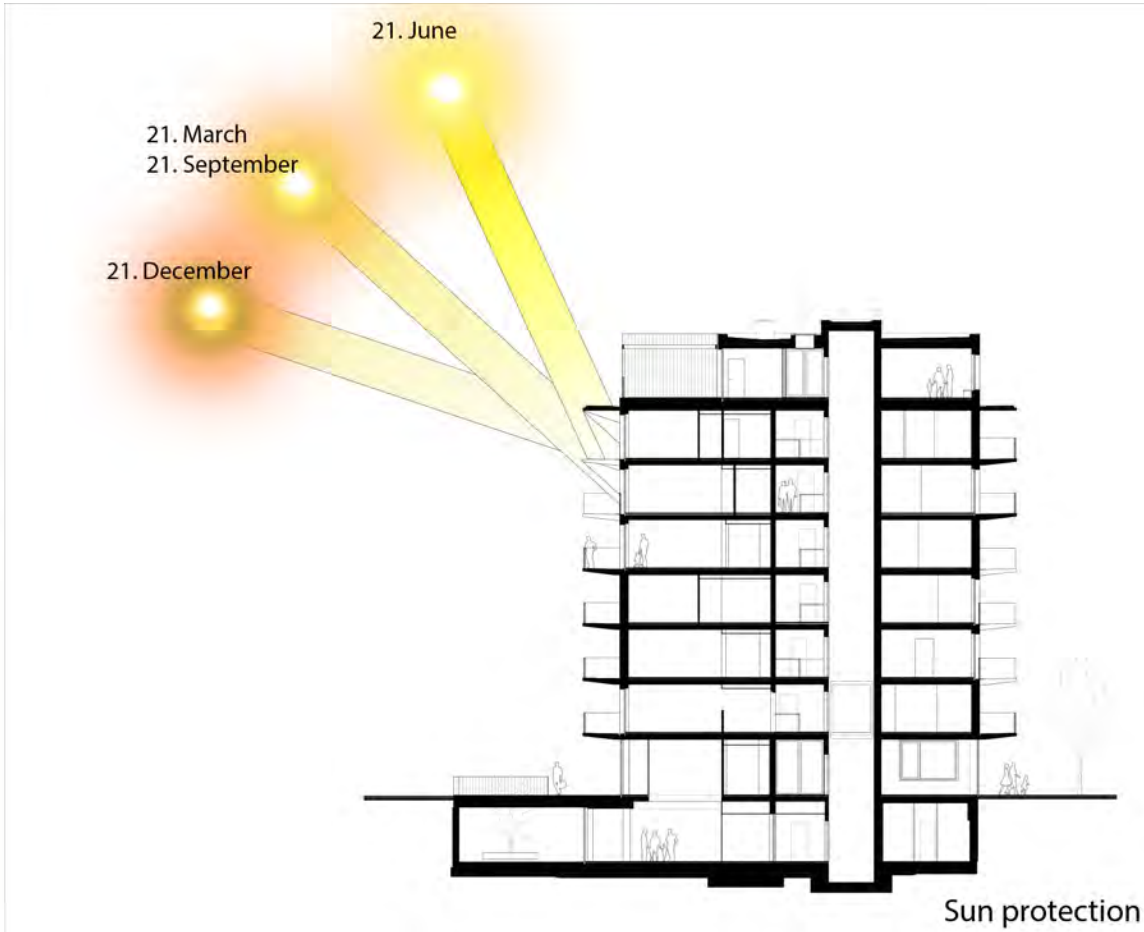


Figure 167: *Schematic representation of the position of the sun at different times, made by the author*

3.3. Aesthetic -Visual Quality Analysis /AVQA

This project has won a lot of awards as a proof of its quality. Both buildings of the project are designed as winning projects of the Nordbahnhof public property development competition in Vienna. This project was also honoured as the winner of the Best Architects 16 Award and has won a recognition award, the Viennese Housing Prize 2015. "Wohnprojekt Wien, Wohnen mit uns" has also been awarded the State Architecture and Sustainability Prize 2014.

The project presents a special, distinctive characteristic both in planning and visual impact. The two building blocks of the project have original concepts, different ideas that qualify them as liveable and sustainable housing . The two buildings are in the same project but nevertheless have different identities in themselves. There are space connections in community rooms and staircases, which are designed to be innovative and creative, special in this case and are different than usual projects. The design of the project has important goals and when we analyse these buildings it can be realised that aesthetic quality has also been a consideration for the project. These features make project attractive and enjoyable as well as liveable and comfortable for the inhabitants.

- Does the scheme feel like a place with distinctive character with an identity or does it seem as a reputation of other buildings in the surrounding? Y, an identity and distinctive character
- Is settlement monotonous or attractive & excited? Attractive, exciting, different sized balconies hinder the monotonous. The sunken courtyard, the garden and the staircases are also attractive and exciting.
- Is it a place, which has a good visual impact? Y
- Has a landscape architect designed open space and does it seem that there is a consideration for quality in open space? Y
- Is the housing area innovative, original and creative or ordinary? Innovative, original and creative.
- Is an aesthetic concern visible inside and outside of the buildings? Do the materials inside have a distinctive character? Y
- Are there some elements on the façade considered and designed especially because of aesthetical (concerns) additionally to the functional needs or just functional? Y, especially the wood façade looks aesthetic and more than just functional with different displacement of balconies and windows.
- Is an architectural aesthetic through a visual impact provided (confirmed) in corridors and stair enclosure of buildings with innovative space geometry plays or some elements? Y, Staircases provide a movement with different openings on the ceiling, the community rooms have also provide space connections, which presents geometry plays.
- Are sustainable and healthy material use and considerations of environmental design expression implemented apparent to the façade and general view of the design conveniently? The main concept of the estate has been sustainability and the visual impact of the buildings presents this idea with wood and the greenery additions by tenants.
- Is the housing estate scale and concept compatible with surrounding (proportionally)? Y

4. CS II Holzwohnbau Seestadt Aspern / LMH

"Leben mit Holz (Living with wood)"

Querkraft & Berger+Parkkinen Architekten

Open Space Design:Idealice Office for Architecture and Landscape Design

Bauträgerwettbewerb (Public Property Development Competition) Aspern* Die seestadt Wiens- Building site D12.

Figure 168: *A view from the street*

The project was the winner of Bauträgerwettbewerbe (public property development competition) in 2012 "Aspern* Die seestadt Wiens", building site 12D. The site is a part of the largest urban development initiative in Vienna and one of the largest in Europa.[28] The lake-side town of Aspern, in the 22nd district at Vienna, was started in May 2013. Six sites were open in competition to the participants. The conceptual formulation of the project is to realise a qualitative, innovative and ecological housing project. The aims of the competition were to provide;

- Affordability and social sustainability
- Functional variety and urban identity
- Benchmark climate-neutral city

In this contribution, the team of two architects, with cooperation from EBG property and Idealice Landscape Design, wanted to challenge environmental and socio-political development with new concepts and solutions. The architectural office Berger+Parkkinen planned the underground car park storeys and the first floor and the architectural office querkraft designed the floors between the 2nd and 6th - the area which is covered by the wood façade.

The site is a rectangular property. In the buildings there is a two storey underground car park, a mineral plinth area from the ground to the first floor and a wood façade between the 2nd and 6th floor. On the ground floor; a multifunctional ring has been developed around a core. In this ring there are 830 square metres for commercial use, home offices, and small offices.

There are three access lines which are composed of a varied space with flooded daylight. These partially open and closed access zones are attached to common terraces. There are six staircases in the housing. The arcades, in three rows, connect the staircases of buildings. Between the l-form blocks attractive and exciting interspaces have been created. The pedestrian zone is broken up to the south so as to have a semi-public area, a wooden canyon space, which is a communication zone with tribune and seating places, as well as a youth playground used for climbing, relaxing etc. This open space

28 https://www.wien.gv.at/stadtentwicklung/projekte/aspern-seestadt/projekt/index.html, access: 25.03.2016.

Figure 171: *Site plan*

Figure 169: *A view of the Facade, photo by the author*

Figure 170: *A general view to the site, canyon and circulation routes*

ensures an alive urban atmosphere with open air access lines and balconies. Behind these seat steps there are common rooms including playground, club room, fitness, and laundries. “The superimposition of open space with wooden cubes created an energised and excited atmosphere” says Alfred Berger, one of the architects of the project from Berger+Parkkinen Architects.[29]

These up to seven storey buildings, with a height of 21 metres, are oriented to the sun to let daylight inside as much as possible. The building lines are cut in some places to create cross connections as well as visual contact.

The line form of the blocks allows variety and flexibility in the planning, which can provide for a mix of inhabitants. There is an alive facade with variable windows, balconies, and loggia. There are one to five room apartments of between 48 and 108 m2, some of which are maisonettes. These maisonettes offer different use possibilities, perhaps to be used as an office or a housing unit.

29 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.11.

Using wood was one of the basic ideas of project. Robert Haranza, one of the project architects from Querkraft architecture office says, “*It was a great concern for us to make timber construction visible in the city. There is not any project on this scale, reaching 21 meters, with a wooden façade. As a result the team has developed with ambition to create a showcase project.*”[30]

Wood is the material used for insulation of the exterior walls. The walls are prefabricated by using local wood and wood based materials, which assure an efficient insulation quality. Through this level of prefabrication, environmental pollution is diminished and also exhaust gases are minimised by the sound and dust reducing property of material.

The site, D12, is a part of Aspern smart city research, ASCR, which aims to optimize energy demands and to reduce energy costs. Its research focuses are:[31]

- Smart buildings; intelligent management of buildings (consumption, creation and storage of energy)
- Smart Grid; intelligent management of energy distribution network
- Smart ICT; networking of buildings and energy distribution network by information and communication technologies.
- Smart citizen’ integration of tenants into energy usage goals.

The key points of these building concepts includes geothermal heat pumps, photovoltaic systems, hybrid collectors, controlled domestic ventilation system, and energy monitoring, which all obtain energy.

In the project; “..*An innovative and intelligent control system automatically identifies the heating demand at a given time and finds out which heat pump has the highest rate of efficiency at any given moment based on the determined framework conditions. This pump is then given preference. Should this heat pump lack the necessary performance, the pump with the second highest efficiency is also started. Furthermore, a thermal solar energy plant has also been installed at the building. In summertime, this plant can cover*

30 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.9.
31 available at: http://www.ascr.at/wp-content/uploads/2013/11/ASCR-Folder.pdf, access: 20.09.2015.

the entire hot water demand."[32] There is an earth storage system under the underground car park, which ensures hot water for the underfloor heating system, and cooling photovoltaic modules in a hybrid system.[33] Moreover the energy efficiency of the buildings is almost at passive house standards using a ventilation system with heat recovery.[34]

In addition to intelligent electricity meters (smart meters) the households are equipped with an intelligent home control system (Home Automation). These include a CO2 sensor that measures the air quality, as well as their own ventilation systems which can be controlled automatically. Through an "Eco" button it is also possible to turn off pre-defined sockets which is attractive to consumers who do not need permanent power (e.g., TV, radio, stereo). With this system, the lighting or the heating is controlled at home by smartphone.[35]

It was a challenge to connect timber prefabricated components to the concrete construction because the construction tolerance of timber and concrete construction strongly deviate from each other. With the cooperation of timber construction experts at LCB and the architects, it took almost half a year to perfect connection details between the timber facade and concrete components, fire protection, accessibility, waterproofing, and heat insulation, according to the necessary standards and aesthetics.[36]

With sophisticated solutions to important concepts like timber facade, loggias, landscape with common spaces, and the canyon, an architectural quality was achieved which brings huge benefits to the tenants.

Figure 172: *Ground floor*

32 Wusits, S., Lake-side town of Aspern, building site D12, World of PORR, 165/2014, p.4. Available at: http://worldofporr.porr-group.com/uploads/pdf/LakesidetownofAspernbuildingsiteD12.pdf., access: 10.09.2015.
33 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.13.
34 Wohnfonds Wien, Bauträgerwettbewerbe 2012 (Public Property Development Competition), Holzhausen Druck, Vienna, 2013, p.41.
35 Available at: http://futurezone.at/science/seestadt-aspern-erforscht-intelligente-nutzer/81.028.794, access: 20.09.2015
36 Hannappel L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.9

Figure 173: *Ground floor*

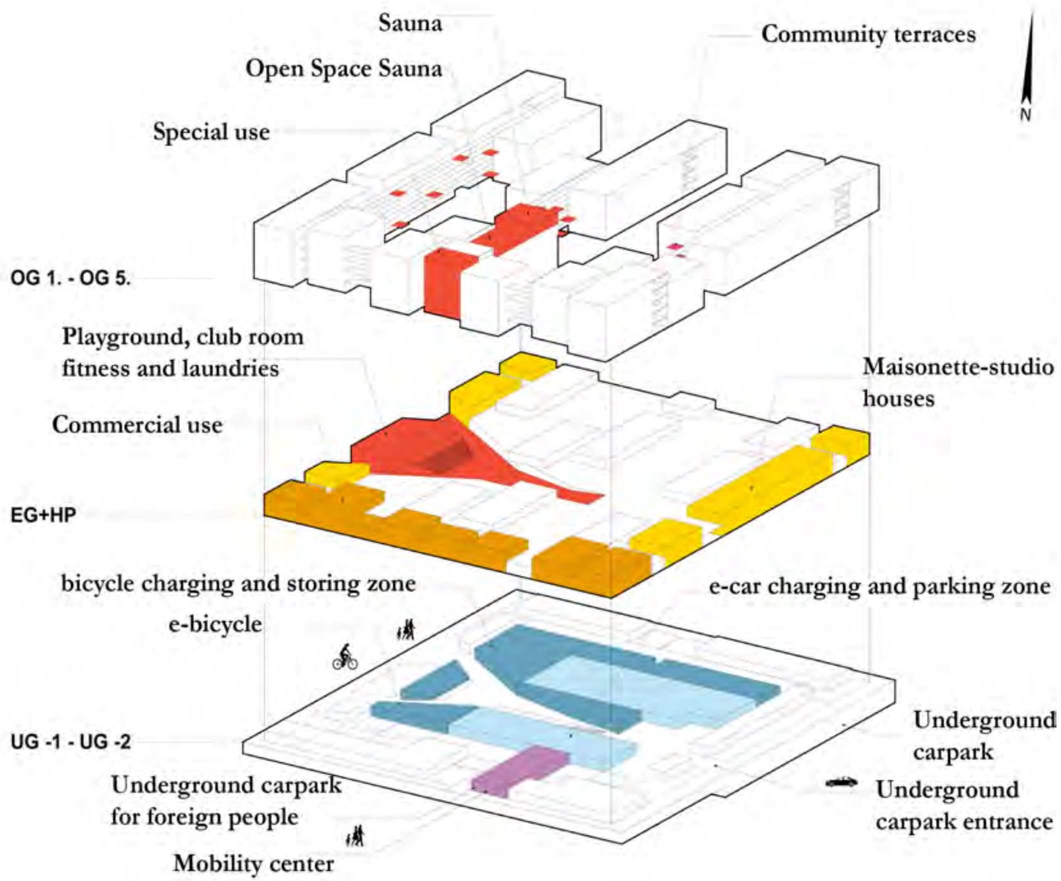


Figure 174: *Axonometrie showing the functions.*

Figure 175: *Section*

Figure 176: *Elevation*

Figure 177: *Elevation*

LEBEN MIT HOLZ-WOODE / ASPERN

BLOCK TYPE			NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING TYPE A FOR SINGLE	NUMBER OF DWELLING TYPE B WITH 2 ROOMS	NUMBER OF DWELLING TYPE C,C1,C2 WITH 3 ROOMS	NUMBER OF DWELLING TYPE D,D1,D2 WITH 4 ROOMS	NUMBER OF DWELLING TYPE E WITH 5 ROOMS	DWELLING WITH ROOF-TERRACE	NUMBER OF MAISONETTE WITH DIF.PLAN TYPES B,C,D	DWELLINGS WITH GARDEN TERRACE	TOTAL NUMBER OF DWELLINGS
FIRST LINE		STIEGE B	7	10	7	AS MAISONETTE	15	-	-	1	3	33
		STIEGE C	7	16	6	31	AS MAISONETTE	-	-	5	10	58
SECOND LINE		STIEGE A	7	7	1	22	5	-	-	-	4	35
		STIEGE D	6	-	4	22	1	4	-	-	11	31
THIRD LINE		STIEGE E	6	10	5	14	-	-	2	2	5	30
		STIEGE F	Partially 6, and 7	4	5	17	-	-	4	4	-	26
TOTAL								4	6	12	33	213

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE incl. common terraces and private gardens ground floor	TOTAL NUMBER OF DWELLING
7731 m2	14220 m2	213,47	3948 m2	213

Figure 178: *Aspern diversity and density informations by the author.(Open space are is calculated approximately)*

4.1. Social-Functional Quality Analysis / SFQA

4.1.1. Needs Oriented Design

The focus of the project is to meet housing standards to a high level. This is a part of smart city research which effects important affordable housing with comfortable living standards. It has provided a considerably variety of apartments and flexible floor plans which can be adapted according to needs, which leads to an efficient use of space for any given size of family. The open space design process was a participative process for inhabitants, enabling the project to try to meet social needs and provide the possibility for communication and neighbourhood, from stairs to the garden.

4.1.2. Accessibility and Movement Circulation Concept

There is a clear circulation concept of three buildings with three access routes.(see Figure 179) These access routes are particularly designed as open space routes with some attached communication terraces which make the access comfortable, natural, and attractive. (see Figure 181) The staircases have different colours to provide easy orientation and the design supports wheeled equipment access.[37]

In the surrounding area some general measures are taken to keep traffic at minimum. The construction site traffic is restricted to 20 km/h on unpaved tracks and 30 km/h on paved roads.[38] There is a mobility service centre with car sharing vehicles, and an e-charging station for e-cars and e-bicycles to promote sustainable mobility. There are also many walkways and bicycle paths crossing the site to support sustainable mobility, and the material choice of the buildings and open space allows for clear distinction and orientation.

37 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.13.
38 Wusits, S., Lake-side town of Aspern, building site D12, World of PORR, 165/2014, p.4. Available at: http://worldofporr.porr-group.com/uploads/pdf/LakesidetownofAspernbuildingsiteD12.pdf., access: 10.09.2015.

- Is it easy to understand how to enter and move about the site? Y
- Are there orientation tables? Y
- Are handrails for essential steps and communal stairs with a maximum rise of 170mm and minimum run of 280mm? Y
- Is there a lighted canopy over the main entrance? Y
- Do circulation areas receive good daylight? Y
- Is adequate wheelchair access possible on the site, apartments, and dwellings? Are there ramps or lifts? Y
- If there is ramp, does it provide a maximum slope of 6%, 120 cm clear width, movement area at the end of 150 x 150cm and a handrail height of 85 cm? Y
- Is there enough manoeuvring space for wheeled equipment in entrances and corridors? Y
- Are there facilities for people with visual or auditory disabilities? Y
- Is access for fire, ambulance, and other services adequate? Y

Figure 179: *Access routes, made by the author based on the floor plans*

Figure 180: *A view to the access route,*

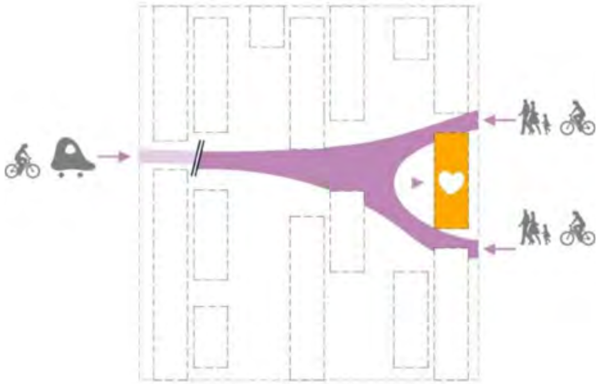


Figure 181: *A concept image of the common terraces which*

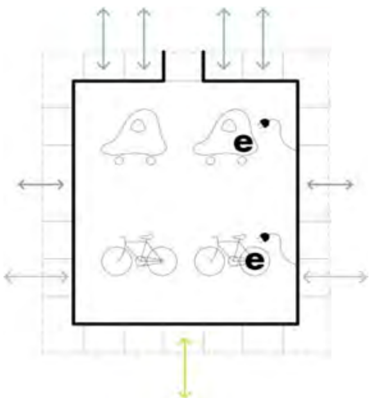


Figure 182: *A schematic representation of circulation (top)*

Figure 183: *E-car and e-bicycle concept representation*

- Is there a distinction and identification of functions (e.g. lighting, choice, and materials)? Y
- Is there a differentiation of architectural elements by colour or materials (e.g. walls and ceilings)? Y
- Is there figure-background contrast (e.g. symbols and letters)? Y
- Is there functional use of colours and materials to support spatial orientation, recognisability and identity? Y
- Does the movement concept aim to minimize vehicle flows and speeds within the housing estate and discourage through vehicular traffic? Y

Vehicles

- Is the hierarchy of routes clear? Y
- Are road, place and building names, and unit numbers clear, visible, legible, and sited appropriately in relation to buildings? Y
- Do routes take advantage of vistas/landmarks within or around the project site? Y
- Are appropriate traffic calming measures used to control vehicle speed? Y
- Is vehicle segregation possible to help pedestrians to use safe routes? Y
- Can large, emergency, or service vehicles come within 30m of all front doors of units or flats? Y
- Do routes facilitate and encourage cycling? Y

Pedestrians

- Are public spaces connected by clear, well lit, and hard surface routes? Y
- Is lighting appropriately related to buildings and easy to maintain? Y
- Are kerbs dropped where foot paths cross roads? Y
- Do pedestrian routes and garden paths have a minimum width of 900 mm? Y

Access to the unit

- Do pedestrian routes and garden paths have a firm, even, slip-resistant finish, and distinctive texture and colour? Y
- Are kerbs dropped for main footpaths and access positions? Y
- Is convenient wheelchair access provided from parking spaces? Y
- Are all slopes gentle provided with a level platform of 1200 x 1200 mm clear of door swing to external doors? Y

4.1.3. Efficiency of Planning

The site is being developed as an urban development project in Aspern, Wien. The U2 metro station U2 is close to the site, and other public transport possibilities are also offered. The area provides huge possibilities for housing and this project aims to create a benchmark for a climate neutral city, a liveable quarter with linked living and working spaces, to realise sustainable development through affordable housing, and functional and social variety. Authorities supply projects which implement these aims with comprehensive ecological, economic, social, and innovative concepts. As a result, this area is planned to be efficient for living and this project, which is recognised on the D12 site as the winner of property development competition, represents these aims on a micro scale. It offers spaces for communication and greenery for social quality.

The west and north façades also have the function of protecting the site against sound.[39] The use of wood on and outside of the building creates a natural and ecological atmosphere which relieves daily stress. The internal courtyards provide a liveable, natural, and enjoyable space for all ages.

- Does the overall design have a challenge and a goal? Y: Functional variety and smart housing (they present 'smart wohnen' programme of City of Vienna). The buildings have open access which supports communication and the wooden façade was a challenge for the project due to the large proportions.
- Is the location favourable to housing with suitable functions for people? Y
- Are adequate facilities for universal access provided between floors with clear traffic routes? Y
- Is there sufficient capacity in corridors, stairs and lifts? Y
- Is there sufficient capacity for individual rooms (doors which open in a convenient direction without traffic routes through occupied areas)? Y
- Is an efficient layout provided, i.e. short walking distances because related functions are grouped near one another? Y
- Have functions requiring natural light been located against an outside wall? Y
- Has the space required to place and use furniture been an important attention point for both fixed and mobile furnishings? Y
- Are sufficient vertical dimensions provided for ceiling height, clear headroom for doors, height of worktops and kitchen cupboards? Y, but ceiling height could be more than it is to provide a wide space.

4.1.4. Flexibility

The inner walls of the building are available to be moved and reversible. As a result of this structure a flexibility and multi-functionality occurs which provides different possibilities according to the needs of tenants.[40] For example, if a family gets bigger and needs an extra room, or a person wants to use his/her own house as a working place, the design allows possible changes.(Figure 186) A combination of a working – living unit is adaptable. It has been considered which different requirements (living, office, loft, and apartments) would be possible on a floor plan. (See also 2.10, diversity of living units).

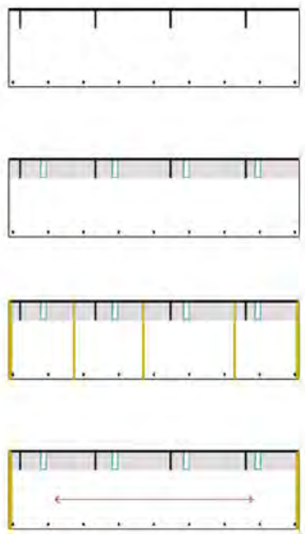


Figure 184: *Diagram showing flexibility*

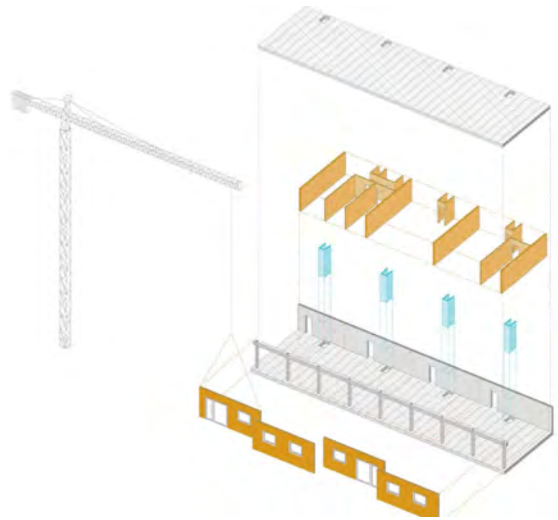


Figure 185: *Diagram showing construction*

39 Wohnfonds Wien, Bauträgerwettbewerbe 2012 (Public Property Development Competition), Holzhausen Druck, Vienna, 2013, p.42.

40 Wohnfonds Wien, Bauträgerwettbewerbe 2012 (Public Property Development Competition), Holzhausen Druck, Vienna, 2013, p.45.

Figure 186: *A consideration of a flat as a working unit or living unit*

- Has flexibility been a consideration in design? Y, very much. (Figure 184, Figure 185)
- Can the plan of the units be adjusted to circumstances? Is it possible to make the rooms and dwellings larger or smaller than they are? Y
- If possible, can these changes be made easily without intervention of architectural elements (ceiling and floor)? Y
- Are different furnishings possible in the rooms? Y
- Is it possible to change the functions of the rooms? Y
- Are the load-bearing interior walls avoided as much as possible? Y

4.1.5. Safety

Open space in the site is semi-public which allows the entrance of unknown people. The security starts at the entrances of buildings. Playgrounds in the site are overlooked and there is eye contact to the laundry and access routes.

A "total protection" type fire alarm system is installed which is based on TRVB 123 S and is according to the requirements of Vienna Fire Department in order to prevent fire spreading over the larch (large?) façade. Among others, this requirement stipulates a master key which is to be kept in a designated key vault which allows the fire department access to all rooms and, thus, also all apartments.[41] The entire load-bearing structure and the necessary reinforcements were made to fire resistance class REI 90-cons, A2. On the facade of each storey plate shooters were attached. Moreover, stairwells and locks were designed as fire zones. The locks in the garage were equipped with a fire smoke dilution system with 30x hourly air exchange.[42]

- Are main access points secured (with an alarm, with guidance)? N

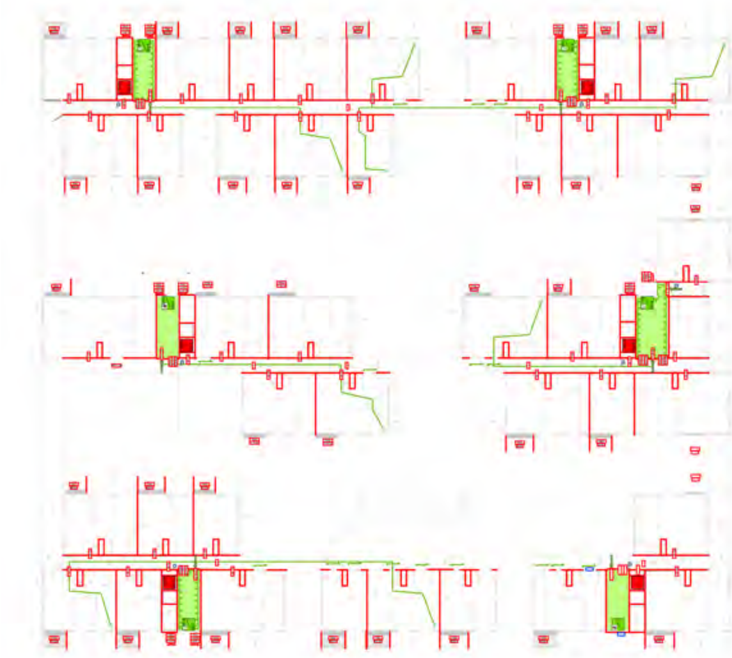


Figure 187: *Fire safety plan.*

41 Wusits, S., Lake-side town of Aspern, building site D12, World of PORR, 165/2014, p.4. Available at: http://worldofporr.porr-group.com/uploads/pdf/LakesidetownofAspernbuildingsiteD12.pdf., access: 10.09.2015.
42 Fire protection concept, provided by BrandRat ZT GMBH, Document with date 03.03.2014. Data from Querkraft Architecture Office.

- Are public areas overseen to make people feel safer and in control to anticipate possible dangers, especially within children playgrounds? Y
- Are balconies of dwellings safely protected against the risk of break-in? N
- Are all external doors and windows sufficiently fixed? Y
- Is safe transportation of people and goods provided vertically and horizontally to manage and prevent the possibility of falls, being trapped or injured with: non-slip floor finishes /adequate lighting for corridors and stairs/ handrails and banisters where appropriate? Y
- Has it been considered that doors and windows do not open onto the circulation routes? Y
- Fire safety: Is prevention of fire outbreak with a quick and safe escape possible? / Are fire-resistant materials used to limit fire spread? Y
- Is safety glass used instead of ordinary glass? Y

4.1.6. Health, physical well-being, and comfort

The general design of the building supports the well-being of people with greenery and open space design, communication spaces, heating system, orientation of buildings, accessibility etc. Sound and wind protection for the site is also provided through the west and north façades design. Essential sound insulation between adjacent apartments and to the outside is also provided.

- Has sound insulation of walls been considered and applied? Y
- Has sound insulation of ceilings been considered and applied? Y
- Has sound insulation of windows been considered and applied? Y
- Are bedrooms placed so that they are not adjacent to shared internal areas? Y
- Are bedrooms protected so that they are not adjacent to the bathing/living areas of neighbouring units? Y
- Are noisy communal equipment placed farther than 3m away from doors or windows (e.g. lifts and plant equipment)? Y
- Do living room windows receive good daylight? Y
- Do kitchen windows receive good daylight? Y
- Do all bathrooms have a window? N
- Do corridors and stairs of apartments receive good daylight and natural ventilation? Y

4.1.7. Open space

The landscape design of the housing project is designed by the Idealice office for architecture and landscape design. The green courtyards have

Figure 188: *A view of the open space.*


Figure 189: *A view from the roof to the courtyard, photo by the author*


Figure 190: *A view to the private garden terraces.*


Figure 191: *Design of the canyon at the courtyard*

calm design, with shapes which are similar to old planes.[43]

In the ground floor zone trellis are built into the façade for vertical greenery. This helps to give an impression that wood floats over the green plinth area after the growth of plants. The open space concept is in a wing shape which are rounded with lawn mounds representing an organic landscape. The wing shape is chosen to link to the previous airport on the site of Aspern.[44] Mounds and trees offer visual protection for terraces and meeting points. (Figure 189, Figure 190) Playgrounds are designed at possible cross points.

The canyon is an active zone in the housing project providing meeting points and playgrounds for youths.(Figure 191, Figure 193) The woods are freely distributed, like real canyon stones. The EPDM surface of the canyon contributes to sound protection. With its dynamic surface design, in some places sloping, it allows enjoyable possibilities such as climbing, lying, or sitting.[45]

43 Wohnfonds Wien, Bauträgerwettbewerbe 2012 (Public Property Development Competition), Holzhausen Druck, Vienna, 2013, p.44.
44 Jungwirt, M., Seestadt Aspern D12, Projektanalyse für Modul SS2015, Institut für architekturwissenschaften, Tragwerksplanung, und Ingeniersholzbau, 2015, Wien. Data from Architecture Office Querkraft.
45 Wohnfonds Wien, Bauträgerwettbewerbe 2012 (Public Property Development Competition), Holzhausen Druck, Vienna, 2013

Some apartments on the ground floor have their own terrace gardens. And others have their private open spaces as terraces, balconies and loggias. The surroundings of the site are also green and there are walkways and bicycle ways to the lakeside, which is close to the site.[46]

- Has a qualified landscape architect been employed to create or assess the landscape design? Y
- Is water (a pool, stream or a fountain) incorporated into the site and appropriately protected? N
- What is the ratio of open areas to the sum of dwellings? 0.28
- Does the general image of the open spaces seem natural and green? Y
- Do some flats have their own private garden? Y
- Is there a common roof terrace? N
- Is there roof planting? Y
- Are materials used in the open space natural? Y

46 Wusits, S., Lake-side town of Aspern, building site D12, World of PORR, 165/2014, p.4. Available at: http://worldofporr.porr-group.com/uploads/pdf/LakesidetownofAspernbuildingsiteD12.pdf., access: 10.09.2015, p.2.

- Is there any possibility for tenants to grow their own plants in the garden? Y
- Does the position of lighting prevent pools of darkness where people walk both outside and in communal areas of buildings? Y
- Are refuse and bin storage areas convenient and inconspicuous in the open space? Y

4.1.8. Common rooms and facilities

One of the projects great qualities is in communication and common rooms, using spaces inside and outside.(see Figure 174) The design of the project's open spaces has an important role, as common space, with green courtyards, canyon, open stair concepts (with open-deck-access), and common terraces, ensures a meeting point for communication of people of different ages. There is approximately 900 m2 area for commercial uses and behind the stairs of canyon there are common rooms; club room, fitness and sauna, playground, laundries.[47] (see Figure 192)

- Is there a common room for inhabitants with a kitchen? Y
- Is there a closed playground for children? Y
- Is there a launderette? Y
- Is there a fitness area? Y
- Is there a sauna? Y
- Is there a cinema? N
- Is there a theatre? N
- Is there a library? N
- Is there an atelier? N
- Is there any play equipment or games room for young people (e.g. table tennis, ropeway.)? Y

47 Housing topography, information from Querkraft Architects.

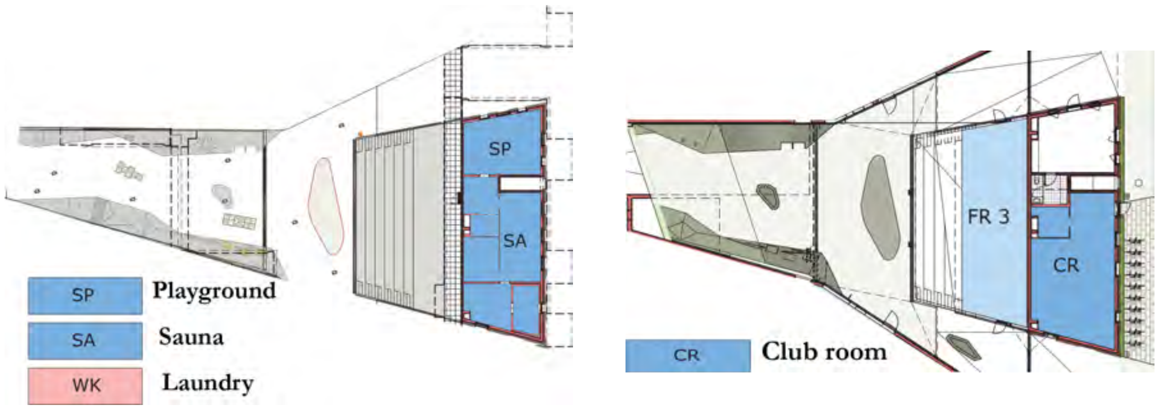


Figure 192: *Common rooms and facilities on the ground floor(rights) and on the 1st floor (left).*

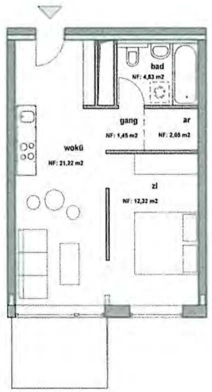
- Are there any other common rooms except those mentioned? Y

Figure 193: *A meeting at canyon*

4.1.9. Children's playground

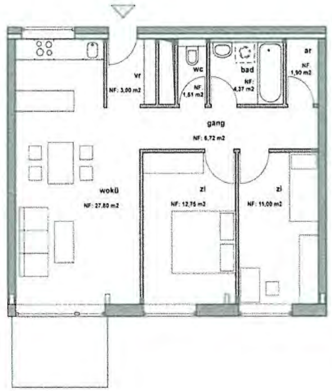
There are outdoor and indoor playgrounds on the site. The canyon offers possibilities, such as climbing, for the young and kids. With its attractive green design with mounds the open space ensures opportunity for children of different ages to enjoy the environment. Moreover, in the surrounding area, there are other playgrounds which are close to the site.

- Is the site location appropriate for children? Y
- Is the playground large enough for the whole residential area? Y
- Is there a sandbox? Y
- Have material / design creativity been considered? Y
- Are the materials healthy (plastic/wood)? Y
- Are playgrounds separated according to age groups? Y
- Are play areas provided within sight of families? Y
- Is energetic play provided for e.g. by an adventure playground or cycle paths? N
- Is there any other playground close to the site? Y



a-typ 41.9m2

b-typ 52.4m2

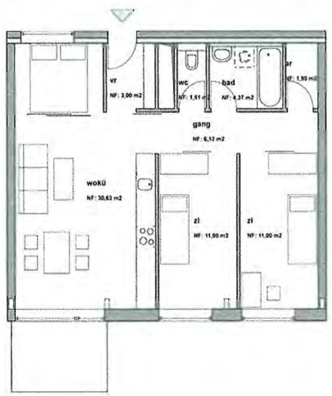


c-typ 69.1m2

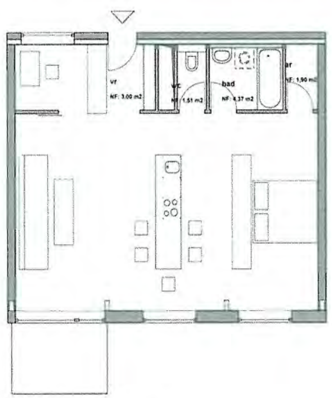
c+-typ 80.7m2

d-typ 85.5m2

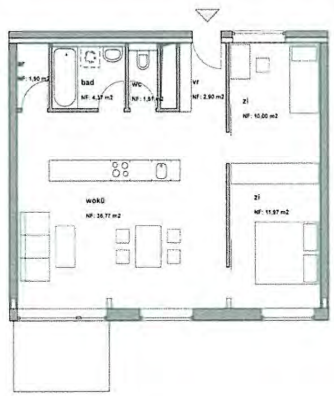
varianten c-typ



c-typ c/d



c-typ variante loft



c-typ laubengang

c-typ rollstuhlgerecht

Figure 194: *Different housing types and use possibilities.*

e-typ 107.6m2

Figure 195: *Studio houses as maisonette (atelierwohnungen)*

4.1.10. Proportion of buildings and diversity of Living Units

The building has two storeys which are for commercial uses and particularly open to the courtyard, and five storeys which are for housing. There are six types of apartments which vary in size from 42 to 110 square metres. Figure 194, Figure 195) The type C also differs in itself as alternatives; loft, with open access, and one designed especially for people with wheelchair. Different utilization options are also be considered. For example some units can be used with the aim living or working. There are also maisonettes and some units which have their own garden-terraces and some which offer working and living together. This diversity allows a good mix of tenants with different ages and backgrounds.[48]

The proportion of housing is convenient for neighbourhood and coherent with other buildings in the surrounding. With its scale, open staircases, and common terraces for communication on the open access routes to apartment units, the project supports a positive neighbourhood atmosphere.

- Do the plans of different units have different sizes and characteristics for small/big families? Y
- Are there different floor plans of different blocks in the housing estate? Y
- Are different aged inhabitants encouraged in the project? Y
- Are there maisonettes? Y
- Are there dwellings with a garden or terrace? Y
- Do some dwellings have a balcony? Y
- Do the balconies of different dwellings have different sizes? Y
- Is the vertical proportion of buildings appropriate to the human scale, and is communication of buildings with the ground supported? Y
- Are the buildings not more than eight storeys high? Y

48 According to the data information from Querkraft Architects.

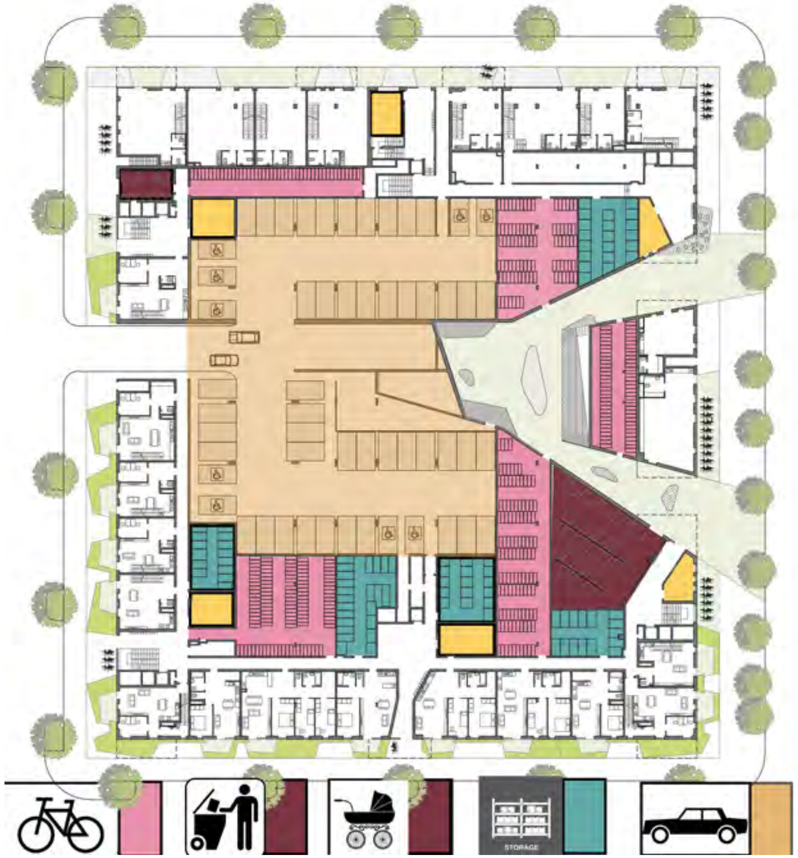


Figure 196: *Storage, parking, waste services, made by the author.*

4.1.11. Storage, parking and waste services

There is a two storey underground car park in the complex for 413 cars, which also provides parking possibilities for disabled people.[49] One of the commercial offices in the complex is mobility centre. It provides car sharing vehicles and an e-charging station to promote sustainable mobility. Near this parking garage there are generous storage rooms for bicycles and buggies. There are convenient storage spaces to collect waste separately.

- Are there storage spaces in dwellings? Y
- Is there separate storage for each unit outside of the dwelling? Y
- Is there a bicycle storage and is it barrier-free for disabled people? Y
- Is there storage for prams, buggies and wheel chairs? Y
- Is the refuse and bin storage area convenient and well arranged? Y
- Is it encouraged through design to collect waste separately? Y
- Is there a minimum of one parking space per unit? Y
- Is there underground parking and is it secure? Y
- Is there any car parking available for disabled people? Y

49 See also, Wusits, S., Lake-side town of Aspern, building site D12, World of PORR, 165/2014, p.4. Available at: http://worldofporr.porr-group.com/uploads/pdf/LakesidetownofAspernbuilding-siteD12.pdf., p.3, access: 10.09.2015.

4.2. Energy performance and Construction Quality Analysis/ ECQA

4.2.1. Overview

	Building features	ASPERN				
	Energy Reference area[m²]	**4540.62 m²**				
	Gross floor area[m²]	**5675.78 m²**				
	Brutto-Volumen[m³]	**18396.64 m³**				
	Building enveloping area [m²]	**6632.54 m³**				
	U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
	Average U-Values[W/m²K]	0.296 [W/m²K]				
Exterior Wall	AW01 Exterior wall wood cladded	0.207 [W/m²K]	49 [dB]			18.80 [kg/m²]
	AW03 Ext. concrete wall with wood cladding to deck access	0.330 [W/m²K]	63 [dB]			274.90 [kg/m²]
	AW04 Exterior concrete wall to deck access	0.310 [W/m²K]	57 [dB]			287.80 [kg/m²]
	AW05 Exterior concrete wall	0.215 [W/m²K]	62 [dB]			291.88 [kg/m²]
	AW06 Exterior concrete wall to deck access	0.178 [W/m²K]	57 [dB]			300.79 [kg/m²]
	D01 Flat roof	0.113 [W/m²K]	64 [dB]	37 [dB]	37 [dB]	301.00 [kg/m²]
Roof	D02 Dividing ceiling	0.700 [W/m²K]	76 [dB]	24 [dB]	23 [dB]	127.44 [kg/m²]
Ceiling	D03 Slab under the ground	0.135 [W/m²K]	65 [dB]	36 [dB]		94.01 [kg/m²]
	AD01 Overhang ceiling to outside air	0.184 [W/m²K]	75 [dB]	41 [dB]		36.60 [kg/m²]
Interior Wall	IW01 Internal dividing wall	0.320 [W/m²K]	69 [dB]			20.86 [kg/m²]
	Glass	0.6 - 0.70 [W/m²K]				
	Windows	0.94 [W/m²K]				
	A/V	0.31 [1/m]				
	n50[1/h]	0.80 [1/h]				
	Ventilationtype	Domestic ventilation with heat recovery, without geothermal heat excharger				
	Heating type	Ground, air and water heat pumps, under floor heating, home automation via Smartphone				
	Total heating demand[kWh/m²a]	**15.31 [kWh/m²a]**				

Figure 197: *Overviw of the quantitavie values of the building components of Aspern WMH, made by the author.*

4.2.2. Form and Orientation

The project, which has been designed by Berger-Parkkinen Architects ZT GmbH and Querkraft Architects, is to be built on D12 land and it consists of 15 boxes, which have been positioned in parallel and perpendicular with the lines of the site. The boxes have been divided into 3 parallel groups. The buildings have been designed in a way that creates wide spaces between them in order to benefit from sunlight and to create green areas.(Figure 198) Three corridors provide access routes inside the buildings that pass through the middle of the masses. While the shorter sides of the buildings face towards the north-south directions, the long sides face towards the east-west directions. In the simulation and measurements of this article, the 5th block of the project was analysed.

The 5th building is built on the southwest of the plot, and the corridor that passes through the middle of it connects the mass, which seems to be separated into three parts. Wet floored parts like bathrooms and toilettes have been placed to access corridors, and the parts that need sunlight are placed on the exterior façade. This building contains 6 floors, consisting of a mezzanine floor, ground floor and four upper floors.

The ratio of total surface area to the total heated volume of the building (A/V Ratio) is 0.361/m. The shifting on facades, indentations and protrusions was avoided in the form of the building. Timber claddings and concrete balconies on the facades are the most characteristic properties of the building. The ground and mezzanine floors have been constructed on columns with 5.4x8.0m and 8.0x8.0m spacing in between. The load bearing system of the other 4 floors has been ensured by the prefabricated concrete components. The interior walls have been made of drywall in order to provide flexibility.

Figure 198: *Orientation to the sun.*

4.2.3. Building Compenents U-Values, Thermal Bridges and Airtightness

- **Building Components, U-Values, Acoustic**

11) AD01 Overhang Ceiling to Outside Air:

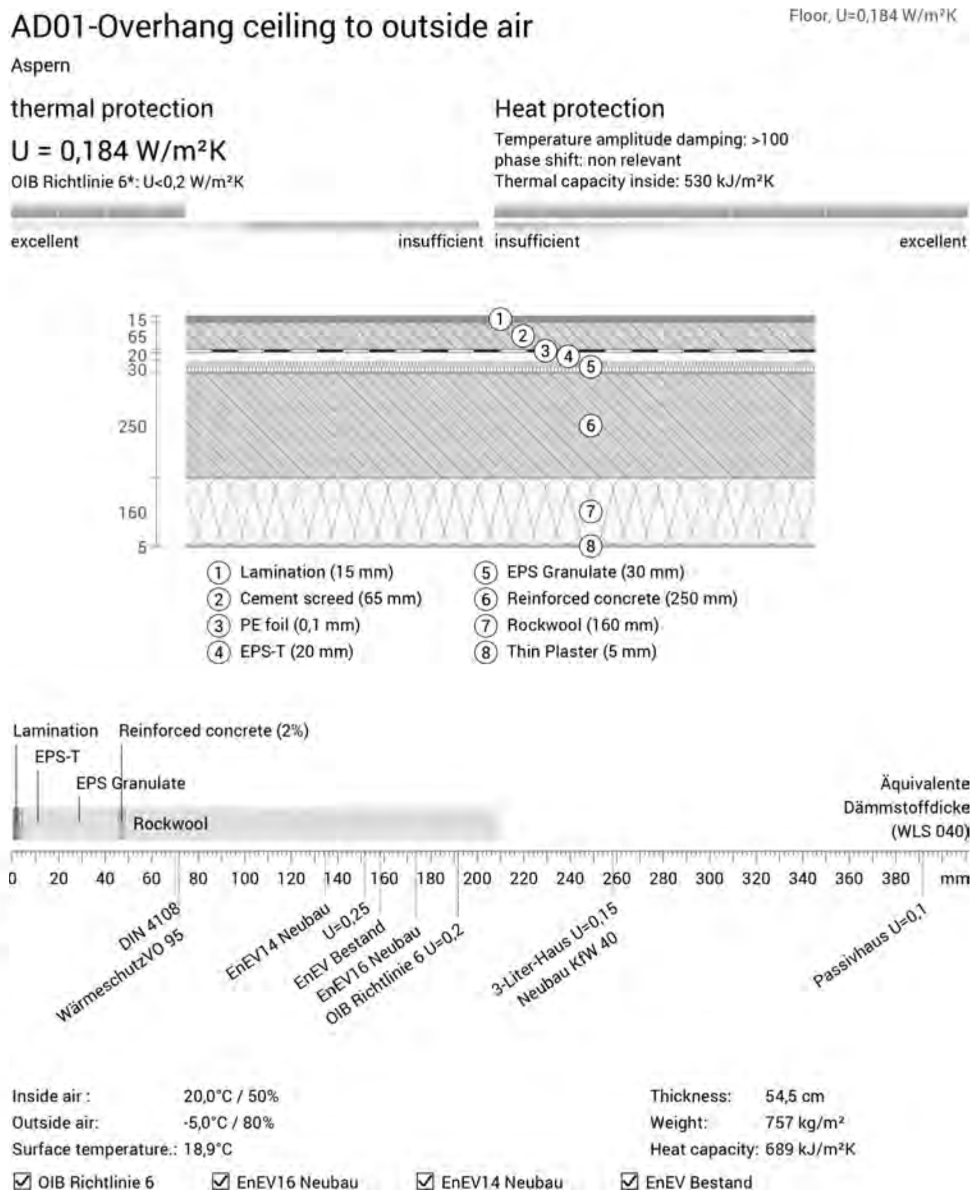
The total ceiling construction thickness is 54.6 cm. The top layer is laminate or ceramic till. The under floor heating system has been installed in the screed at a depth of 6.5 cm. 2 cm EPS-T and 3 cm thick EPS granules acoustic insulation have been used. A 25 cm reinforced concrete slab bears the floor load. 16 cm mineral (rock) wool provides quite high insulation and is installed under the load-bearing system. The ceiling with full thermal insulation total U-value is calculated to be 0.184 W/m²K. The resulting value of the building construction has been decreased by 8% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.184 W/m²K

Weighted Sound reduction index Rw = 75 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 41 [dB]

Thermal storage by the building's mass m w,B,A = 36.6 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	18,9	20,0	
1	1,5 cm	Lamination	0,180	0,083	18,5	18,9	7,5
2	6,5 cm	Cement screed	1,330	0,049	18,3	18,5	130,0
3	0,01 cm	PE foil	0,330	0,000	18,3	18,3	0,1
4	2 cm	EPS-T	0,045	0,444	16,3	18,3	0,6
5	3 cm	EPS Granulate	0,055	0,545	13,8	16,3	0,6
6	25 cm	Reinforced concrete (2%)	2,300	0,109	13,3	13,8	600,0
7	16 cm	Rockwool	0,040	4,000	-4,8	13,3	9,6
8	0,5 cm	Thin Plaster	1,000	0,005	-4,8	-4,8	9,0
		Thermal contact resistance*		0,040	-5,0	-4,8	
	54,51 cm	Whole component		5,446			757,4

Figure 199: *Detail of the overhang ceiling to outside air, created by the author*

12) AW01 Exterior Wall Wood Cladded

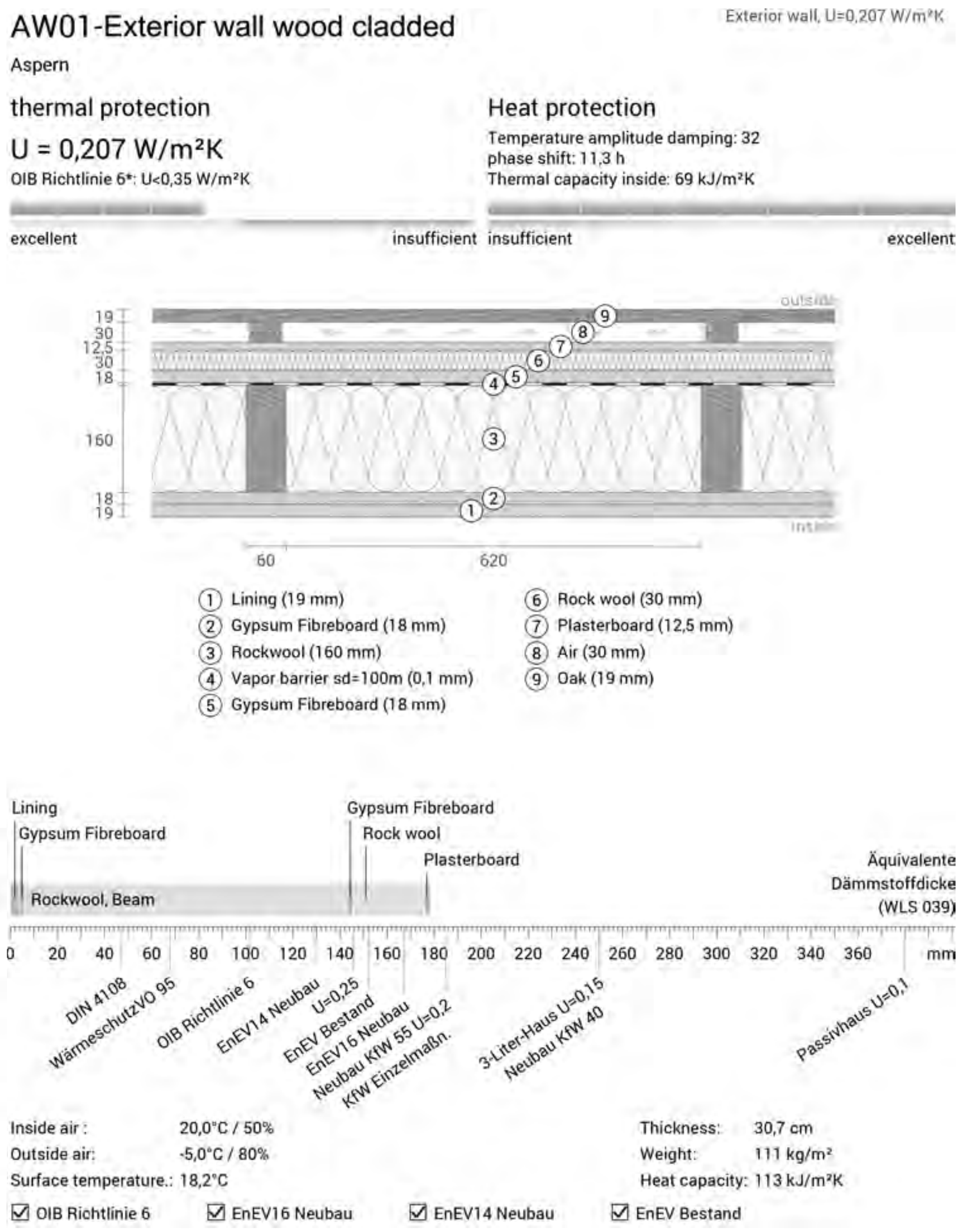
The total exterior wall structure thickness is 28.7 cm. The interior plaster is smoothed. Interior surface of the wall has been insulated with 3 cm Rockwool. The load-bearing timber construction wall is 16 cm. The rear-ventilated façade has been insulated with 16 cm mineral wool. 2cm thick wooden battens clad the façade. The exterior wall thermal insulation is calculated with a total U-value of 0.207 W/m²K. The resulting value is approximately 40% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.207 W/m²K

Weighted Sound Reduction index Rw= 49 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass m w,B,A = 18.8 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,2	20,0	
1	1,9 cm	Lining	0,200	0,095	17,5	18,8	26,6
2	1,8 cm	Gypsum Fibreboard	0,320	0,056	17,0	18,4	20,7
3	16 cm	Rockwool	0,039	4,103	-0,7	18,2	8,8
	16 cm	Beam (8,8%)	0,120	1,333	0,8	17,2	9,7
4	0,01 cm	Vapor barrier sd=100m	0,200	0,001	-0,7	1,2	0,0
5	1,8 cm	Gypsum Fibreboard	0,320	0,056	-1,0	1,2	20,7
6	3 cm	Rock wool	0,039	0,769	-4,6	0,7	3,0
7	1,25 cm	Plasterboard	0,250	0,050	-4,8	-4,4	8,5
		Thermal contact resistance*		0,130	-5,0	-4,7	
8	3 cm	Air (ventilated layer)			-5,0	-5,0	0,0
9	1,9 cm	Oak			-5,0	-5,0	13,1
	30,66 cm	Whole component		4,820			111,1

Figure 200: *Detail of the exterior wall wood clad created by the author*

13) AW03 Exterior Concrete Wall with Wood Cladding to Deck Access

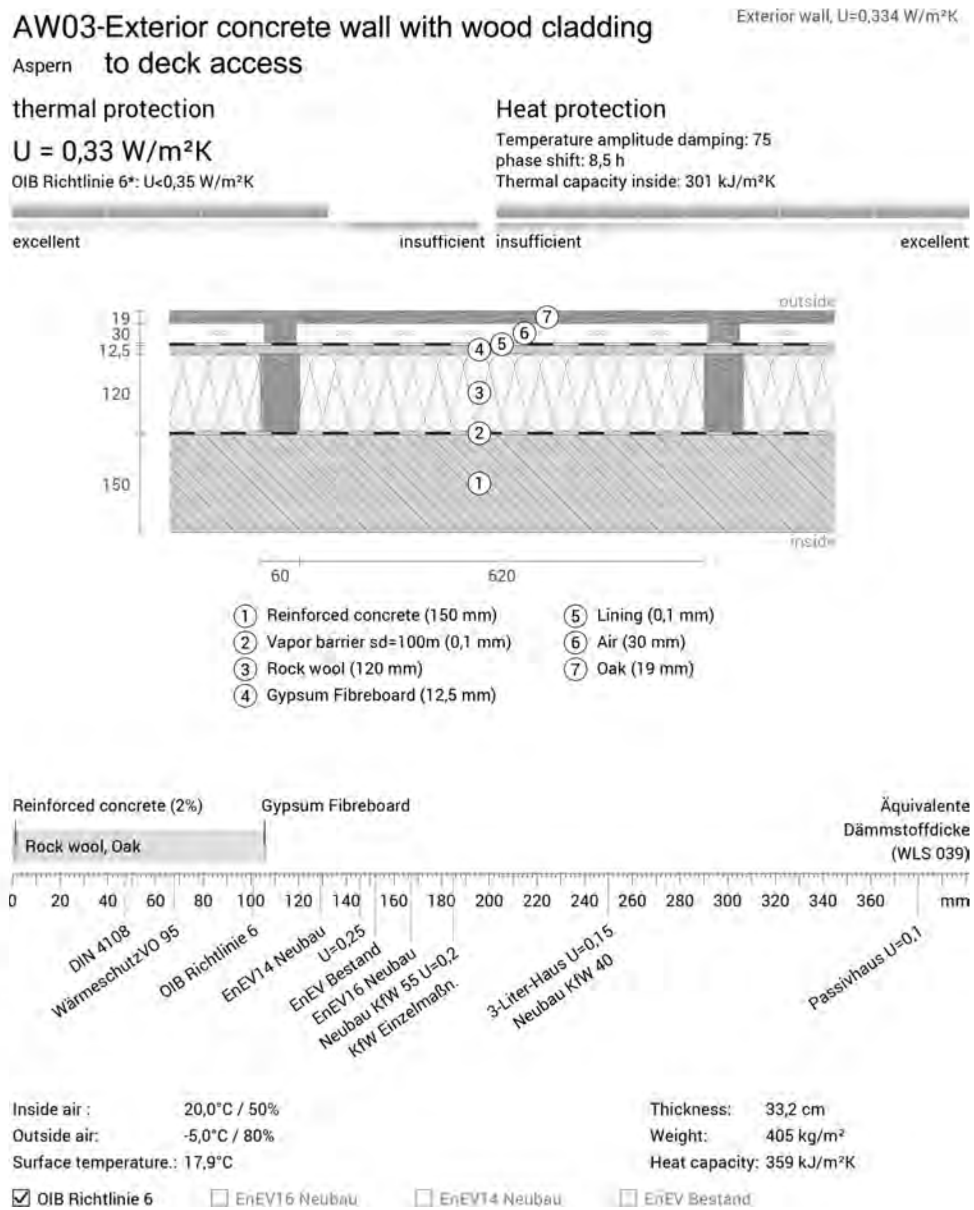
The total exterior wall structure thickness is 42 cm. The interior plaster is a single-layer gypsum/lime machine plaster. The load-bearing reinforced concrete wall is 15 cm thick . The rear-ventilated façade has been insulated with 12 cm mineral wool. 2 cm thick wooden battens clad the façade. The exterior wall thermal insulation is calculated with a total U-value of 0.33 W/m²K. The resulting value is approximately 6% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.33 W/m²K

Weighted Sound Reduction index Rw= 63 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass m w,B,A = 274.9 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	17,9	20,0	
1	15 cm	Reinforced concrete (2%)	2,300	0,065	17,1	18,0	360,0
2	0,01 cm	Vapor barrier sd=100m	0,200	0,001	17,1	17,5	0,0
3	12 cm	Rock wool	0,039	3,077	-4,4	17,5	10,9
	12 cm	Oak (8,8%)	0,120	1,000	-3,9	17,2	7,3
4	1,25 cm	Gypsum Fibreboard	0,320	0,039	-4,7	-3,6	14,4
5	0,01 cm	Lining	0,200	0,001	-4,7	-4,3	0,0
		Thermal contact resistance*		0,130	-5,0	-4,3	
6	3 cm	Air (ventilated layer)			-5,0	-5,0	0,0
7	1,9 cm	Oak			-5,0	-5,0	13,1
	33,17 cm	Whole component		2,991			405,8

Figure 201: *Detail of the exterior concrete wall wood clad created by the author*

14) AW04 Exterior Concrete Wall to Deck Access

The total thickness of the exterior wall is 29 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. 15 cm reinforced concrete carries the load of the building. The façade has been insulated with 12 cm mineral (rock) wool. Outer surface of the façade has been covered with a thin plaster. The total U-value of thermally insulated exterior wall is calculated as 0.31 W/m²K. The resulting value is approximately 12% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.31 W/m²K

Weighted Sound Reduction index Rw= 57 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass m w,B,A = 287.8 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,1	20,0	
1	15 cm	Reinforced concrete (2%)	2,300	0,065	17,7	18,1	360,0
2	12 cm	Rockwool	0,040	3,000	-4,7	17,7	7,2
3	0,5 cm	Thin Plaster	1,000	0,005	-4,7	-4,7	9,0
		Thermal contact resistance*		0,040	-5,0	-4,7	
	27,5 cm	Whole component		3,240			376,2

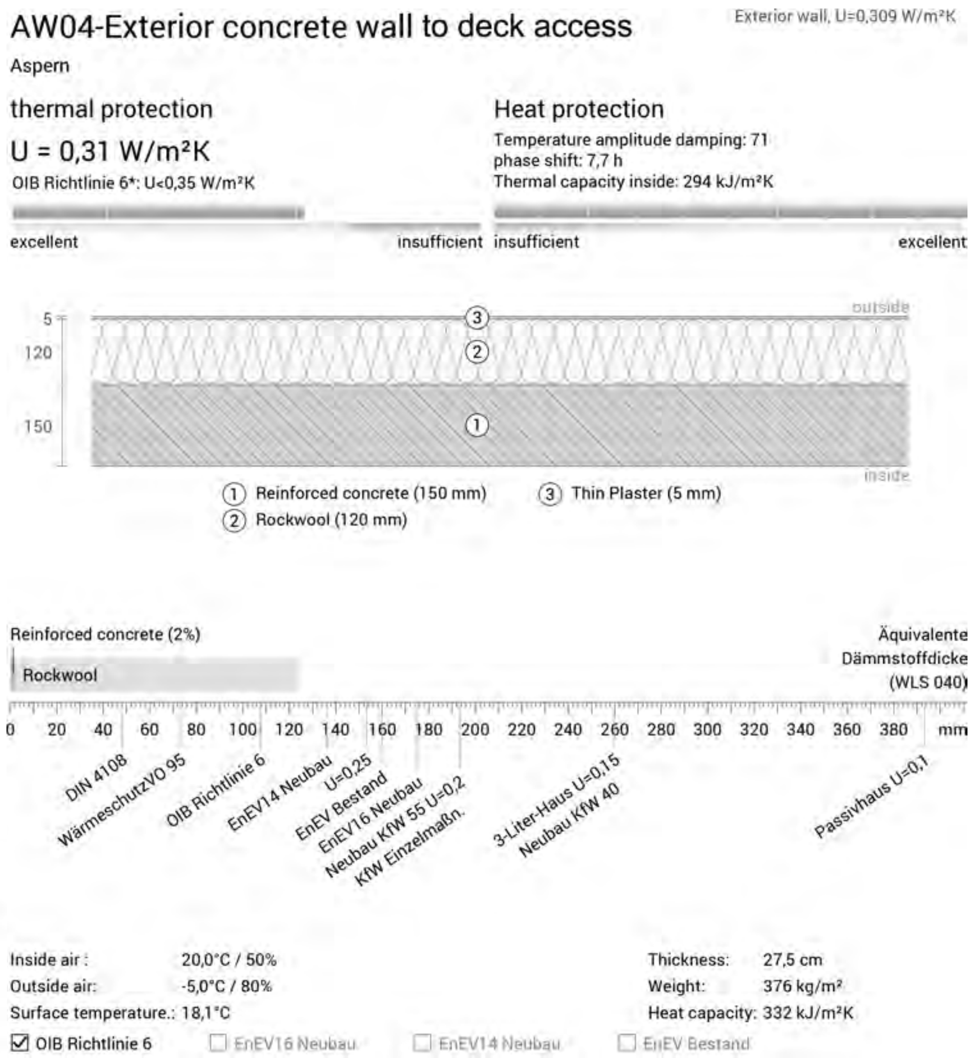


Figure 202: *Detail of the exterior concrete wall to deck access, created by the author*

15) AW05 Exterior Concrete Wall

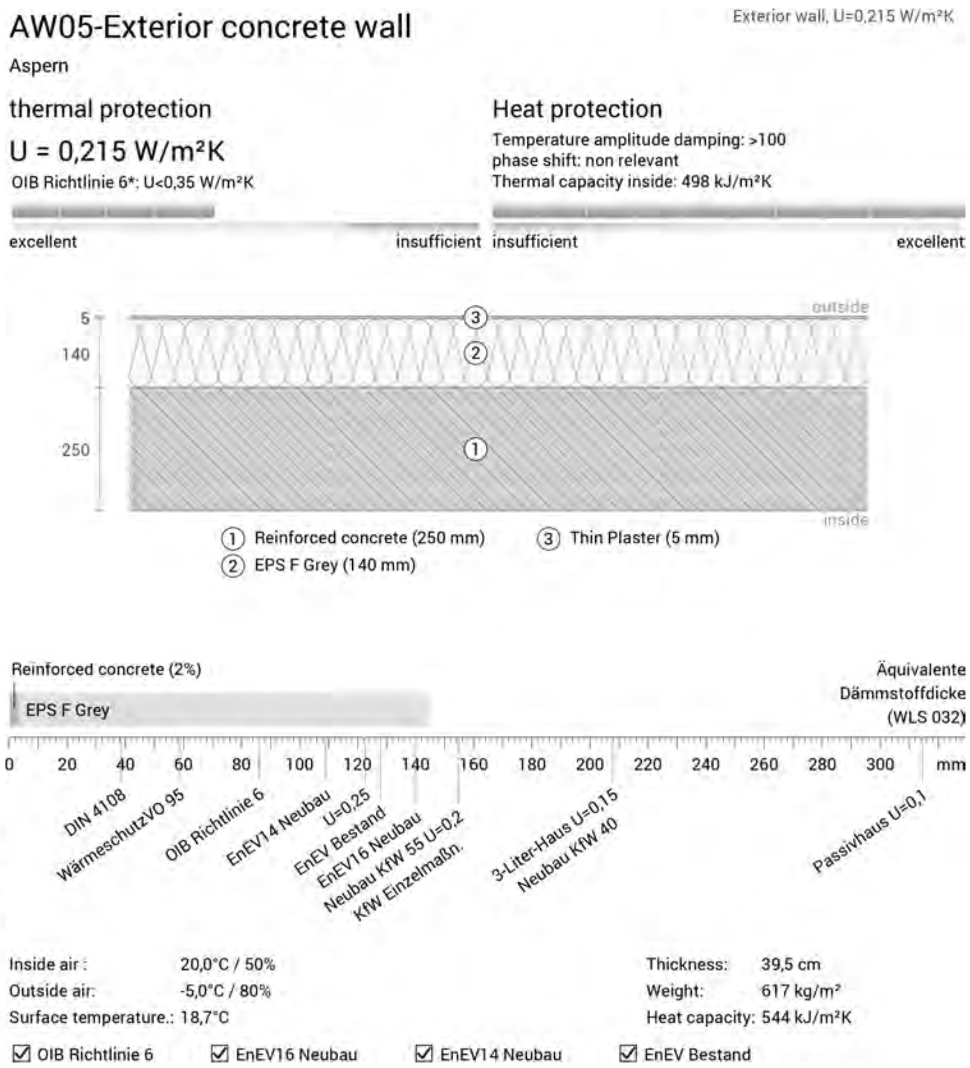
The total thickness of the exterior wall is 41 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. 25 cm reinforced concrete wall carries the load of the building. The rear-ventilated façade has been insulated with 14 cm mineral (rock) wool. Outer surface of the façade has been covered with a thin plaster. The total U-value of thermally insulated exterior wall is calculated as 0.215 W/m²K. The resulting value is approximately 39% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.215 W/m²K

Weighted Sound Reduction index Rw= 62 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass m w,B,A = 283.3 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,7	20,0	
1	25 cm	Reinforced concrete (2%)	2,300	0,109	18,1	18,7	600,0
2	14 cm	EPS F Grey	0,032	4,375	-4,8	18,1	8,4
3	0,5 cm	Thin Plaster	1,000	0,005	-4,8	-4,8	9,0
		Thermal contact resistance*		0,040	-5,0	-4,8	
	39,5 cm	Whole component		4,659			617,4

Figure 203: *Detail of the exterior concrete wall, created by the author*

16) AW06 Exterior Concrete Wall to Deck Access

The total thickness of the exterior wall is 41 cm. The interior plaster is smoothed. Interior surface of the wall has been insulated with 3 cm mineral (rock) wool. Above this layer, it has also been installed 7.5 cm mineral wool between 15 cm load bearing reinforced concrete and plasterboard. The façade has been insulated with 12 cm mineral wool. Thin plaster covers the outer surface of the façade. The total calculated U-value of the exterior wall with full thermal insulation has resulted in a U-value of 0.178 W/m²K. This U-value is about 49% lower than the required U-value of 0.35 W/m²K.

U-Value= 0.178 W/m²K

Weighted Sound Reduction index Rw= 57 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass m w,B,A = 7.6 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperature [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,4	20,0	
1	1,25 cm	Plasterboard	0,250	0,050	18,1	19,1	8,5
2	3 cm	Rockwool	0,035	0,857	11,9	18,9	1,8
3	0,01 cm	PE foil	0,400	0,000	11,9	15,9	0,1
4	1,25 cm	Plasterboard	0,250	0,050	11,3	15,9	8,5
5	7,5 cm	Rockwool	0,035	2,143	8,5	15,8	4,5
	7,5 cm	Steel (0,089%)	50,000	0,002	8,9	11,3	0,5
	0,5 cm	Steel (Width: 0.06 cm)	50,000	0,000	11,4	11,4	0,0
	0,5 cm	Steel (Width: 0.06 cm)	50,000	0,000	8,8	8,8	0,0
	0,06 cm	Steel (Width: 5 cm)	50,000	0,000	8,8	8,9	0,3
	0,06 cm	Steel (Width: 5 cm)	50,000	0,000	11,3	11,4	0,3
6	15 cm	Reinforced concrete (2%)	2,300	0,065	8,2	8,9	360,0
7	12 cm	Rockwool	0,040	3,000	-4,8	8,3	7,2
8	0,5 cm	Thin Plaster	1,000	0,005	-4,8	-4,8	9,0
		Thermal contact resistance*		0.040	-5.0	-4.8	

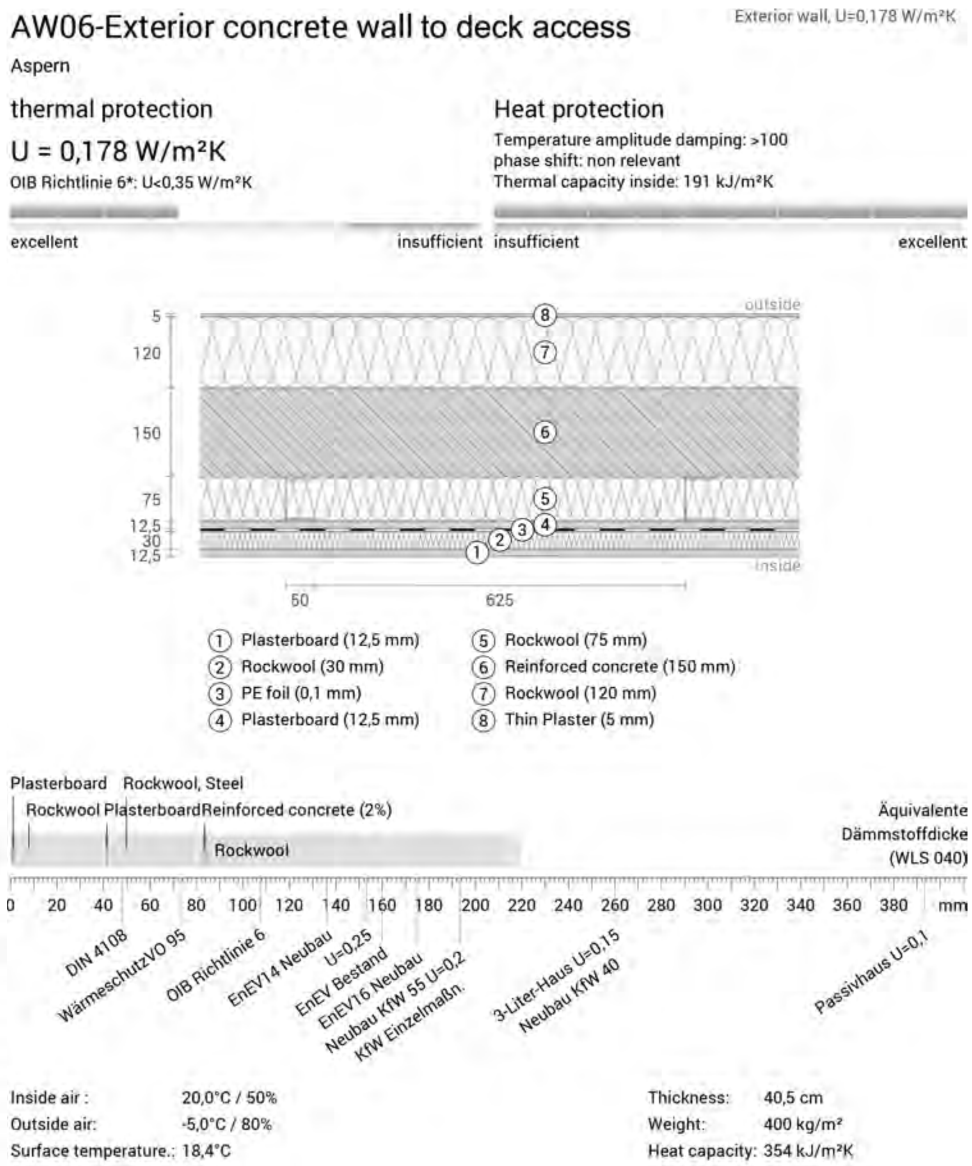


Figure 204: *Detail of the exterior concrete wall to deck access, created by the author*

17) D01 Flat Roof

The total roof structure is 64 cm thick in total. The top roof layer is a 6cm thick gravel. 9.5 cm and 20 cm EPS-W20 thermal insulation has been used. 25 cm thick reinforced concrete slab carries the roof load. The interior ceiling plaster is executed as single layer on a gypsum/lime base. The total U-value calculation of the roof with full thermal insulation resulted in a U-value of 0.113 W/m²K. The resulting value is approximately 43% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.113 W/m²K

Weighted Sound Reduction index Rw= 64 [dB]

Required Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass m w,B,A = 283.6 kg/m²

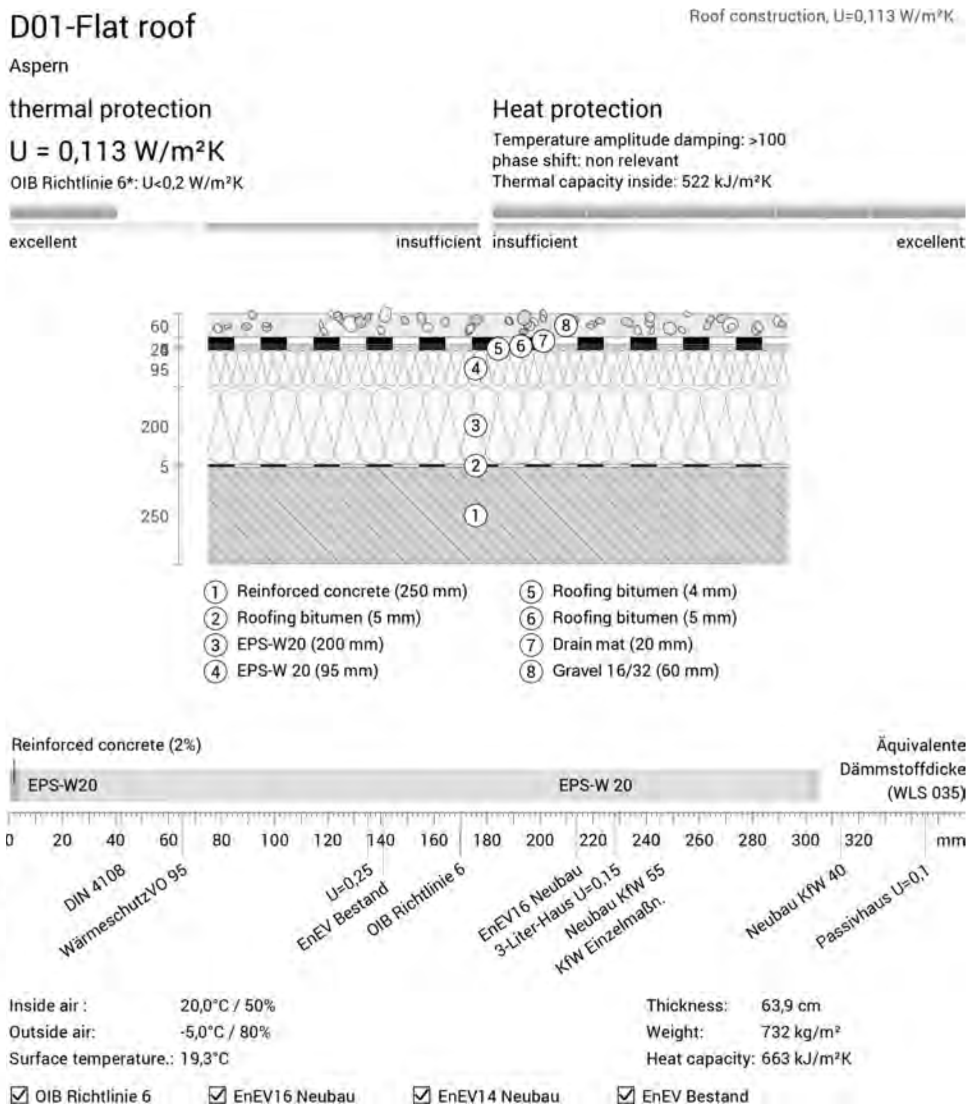


Figure 205: *Detail of the flat roof, created by the author*

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,100	19,3	20,0	
1	25 cm	Reinforced concrete (2%)	2,300	0,109	19,0	19,3	600,0
2	0,5 cm	Roofing bitumen	0,230	0,022	18,9	19,0	5,5
3	20 cm	EPS-W20	0,035	5,714	3,1	18,9	4,0
4	9,5 cm	EPS-W 20	0,035	2,714	-4,4	3,1	4,8
5	0,4 cm	Roofing bitumen	0,230	0,017	-4,5	-4,4	4,4
6	0,5 cm	Roofing bitumen	0,230	0,022	-4,6	-4,5	5,5
7	2 cm	Drain mat	0,600	0,033	-4,7	-4,6	0,8
8	6 cm	Gravel 16/32	0,700	0,086	-4,9	-4,7	108,0
		Thermal contact resistance*		0,040	-5,0	-4,9	
	63,9 cm	Whole component		8,857			733,0

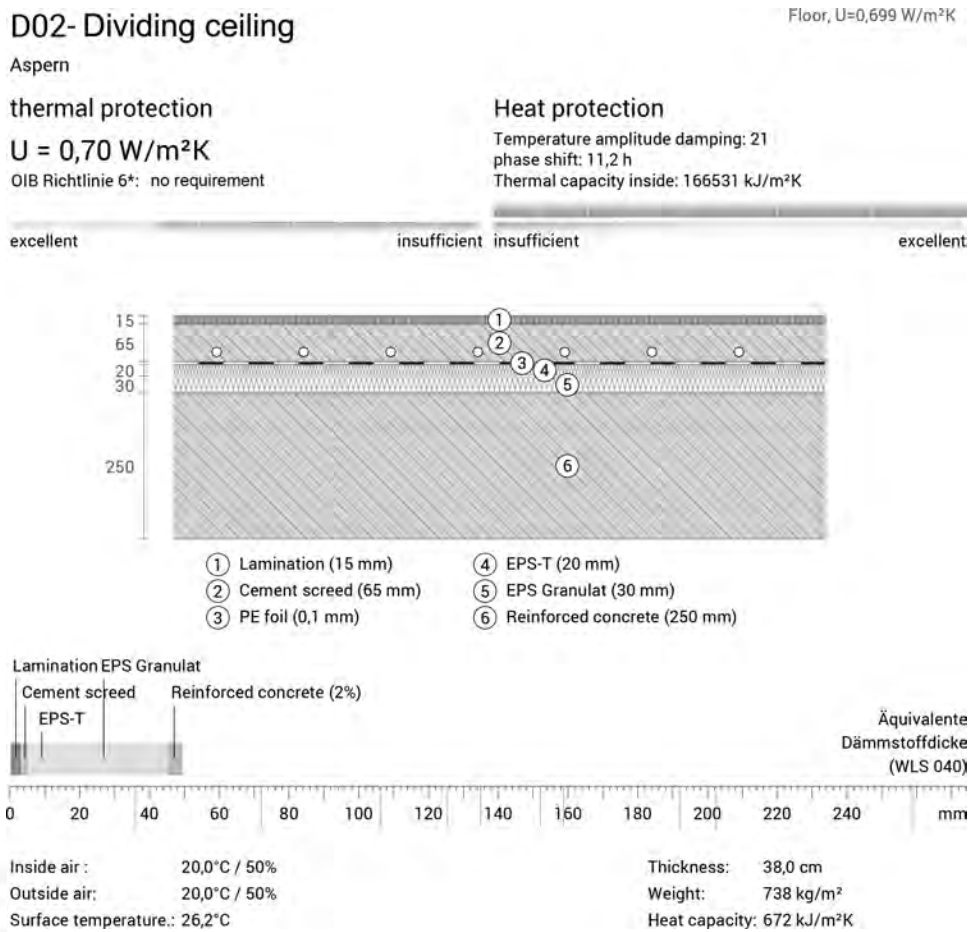
18) D02 Dividing Ceiling

The total ceiling structure thickness is 38cm. The top layer of the ceiling is clad with 1.5 cm wooden cladding. The under floor heating system has been built into the screed at a depth of 6.5 cm. 2 cm thick EPS-T and 3 cm thick EPS-Granules acoustic insulation have been built into the construction. A 25 cm load-bearing reinforced concrete slab carries the weight of the construction. The total U-value calculation of the ceiling with full thermal insulation resulted in a U-value of 0.70 W/m²K. No U-Value is required for interior ceilings.

U-Value= 0.70 W/m²K

Weighted Sound Reduction index Rw= 71 [dB]

Thermal storage by the building's mass m w,B,A = 127.44 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	20,0	26,5	
1	1,5 cm	Lamination	0,180	0,083	26,2	28,7	7,5
2	6,5 cm	Cement screed	1,330	0,049	28,3	30,0	130,0
3	0,01 cm	PE foil	0,330	0,000	28,8	29,9	0,1
4	2 cm	EPS-T	0,045	0,444	25,4	29,9	0,4
5	3 cm	EPS Granulat	0,055	0,545	21,2	25,8	0,6
6	25 cm	Reinforced concrete (2%)	2,300	0,109	20,3	21,2	600,0
		Thermal contact resistance*		0,100	20,0	20,3	
	38,01 cm	Whole component		1,431			738,6

Figure 206: *Detail of the dividing ceiling, created by the author*

19) D03 Slab Under the Ground

The total slab structure thickness is 99 cm. The top layer of the slab is planted ground with 22 cm thickness. Heat insulation has been provided by Steinodur UKD LD material with 25 cm thick. A 40 cm reinforced concrete slab bears the load. The total U-value calculation of the slab with full thermal insulation resulted in a U-value of 0.135 W/m²K. The resulting value is about 32% lower than the required U-value of 0,20 W/m²K.

U-Value= 0.135 W/m²K

Weighted Sound Reduction index Rw= 74 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 45 [dB]

Thermal storage by the building's mass m w,B,A = 257.2 kg/m²

Weighted Standardized Impact Sound Pressure Level L`nT,w = 45 [dB]

Required Weighted Standardized Impact Sound Pressure Level according to ÖNORM L`nT,w = 48 [dB]

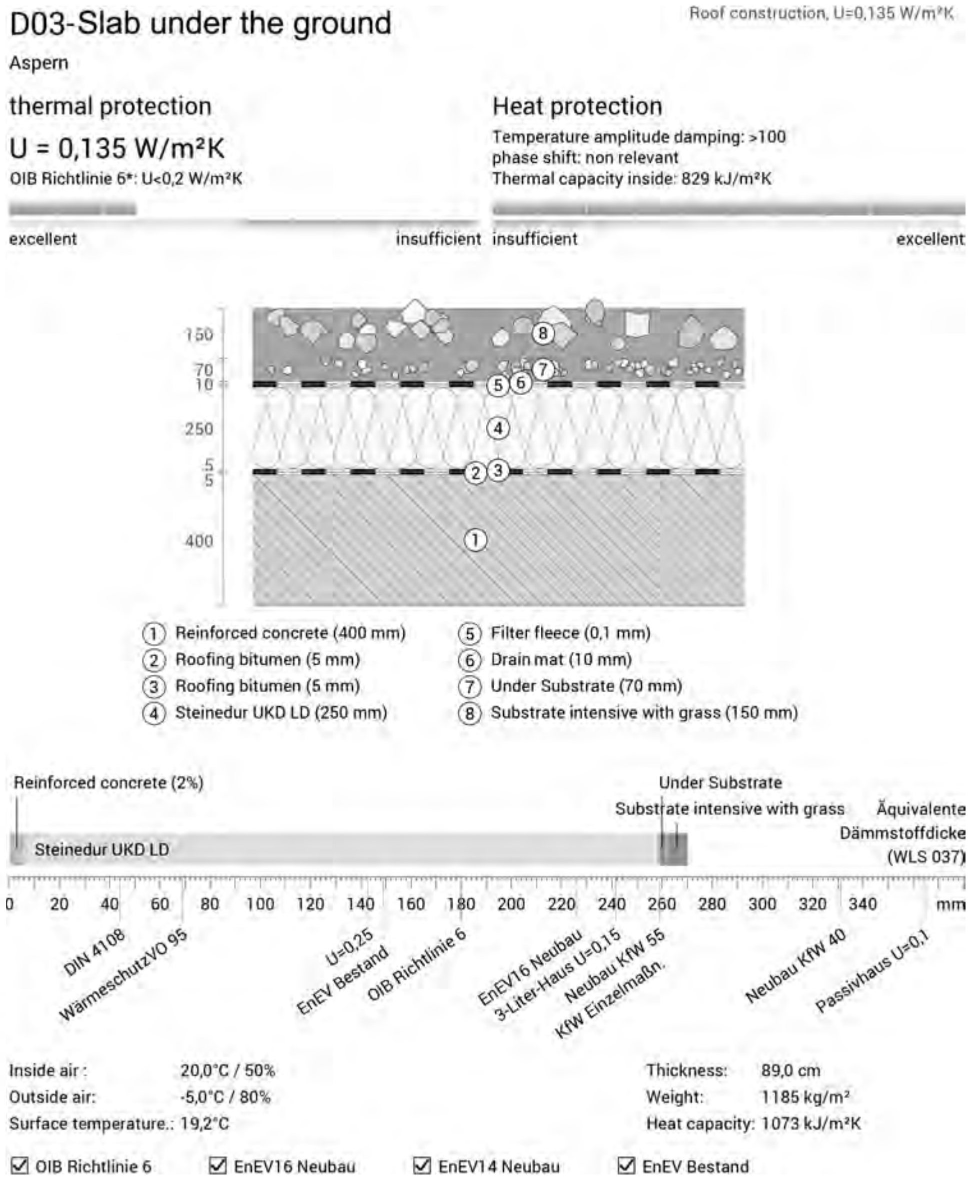


Figure 207: *Detail of the slab under the ground, created by the author*

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,100	19,2	20,0	
1	40 cm	Reinforced concrete (2%)	2,500	0,160	18,6	19,2	960,0
2	0,5 cm	Roofing bitumen	0,230	0,022	18,6	18,6	5,5
3	0,5 cm	Roofing bitumen	0,230	0,022	18,5	18,6	5,5
4	25 cm	Steinedur UKD LD	0,037	6,757	-3,8	18,5	5,0
5	0,01 cm	Filter fleece	1,000	0,000	-3,8	-3,8	0,0
6	1 cm	Drainagematte	0,600	0,017	-3,8	-3,8	0,4
7	7 cm	Under Substrate	0,700	0,100	-4,2	-3,8	66,5
8	15 cm	Substrate intensive with grass	0,700	0,214	-4,9	-4,2	142,5
		Thermal contact resistance*		0,040	-5,0	-4,9	
	89,01 cm	Whole component		7,431			1.185,4

20) IW01 Internal dividing wall

The total internal dividing wall structure thickness is 21.5 cm. The wall surfaces are plastered. The 7.5 cm thick C-profile plasterboard panels are load bearing. The space between the wall studs is filled with 7.5 cm of mineral wool. The total calculated U-value of the dividing wall with mineral wool results in a U-value of 0.32 W/m²K. The resulting value is about 64% lower than the required U-value of 0.90 W/m²K.

U-Value= 0.32 W/m²K

Weighted Sound Reduction index Rw= 70 [dB]

Thermal storage by the building's mass m w,B,A = 21.7 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	15,8	20,0	
1	1,25 cm	Plasterboard	0,250	0,050	14,8	18,6	8,5
2	1,25 cm	Plasterboard	0,250	0,050	13,6	18,3	8,5
3	7,5 cm	Rockwool	0,040	1,875	7,2	18,0	4,5
	7,5 cm	Steel (0,089%)	50,000	0,002	9,3	13,6	0,5
	0,5 cm	Steel (Width: 0.06 cm)	50,000	0,000	13,8	13,8	0,0
	0,5 cm	Steel (Width: 0.06 cm)	50,000	0,000	9,0	9,0	0,0
	0,06 cm	Steel (Width: 5 cm)	50,000	0,000	9,0	9,3	0,3
	0,06 cm	Steel (Width: 5 cm)	50,000	0,000	13,6	13,8	0,3
4	1,25 cm	Plasterboard	0,250	0,050	7,0	9,3	8,5
5	2,5 cm	air (unventilated layer)	0,139	0,180	2,8	7,8	0,0
6	7,5 cm	Rockwool	0,040	1,875	-4,2	6,2	4,5
	7,5 cm	Steel (0,089%)	50,000	0,002	-1,5	2,8	0,5
	0,5 cm	Steel (Width: 0.06 cm)	50,000	0,000	3,1	3,1	0,0
	0,5 cm	Steel (Width: 0.06 cm)	50,000	0,000	-1,7	-1,7	0,0

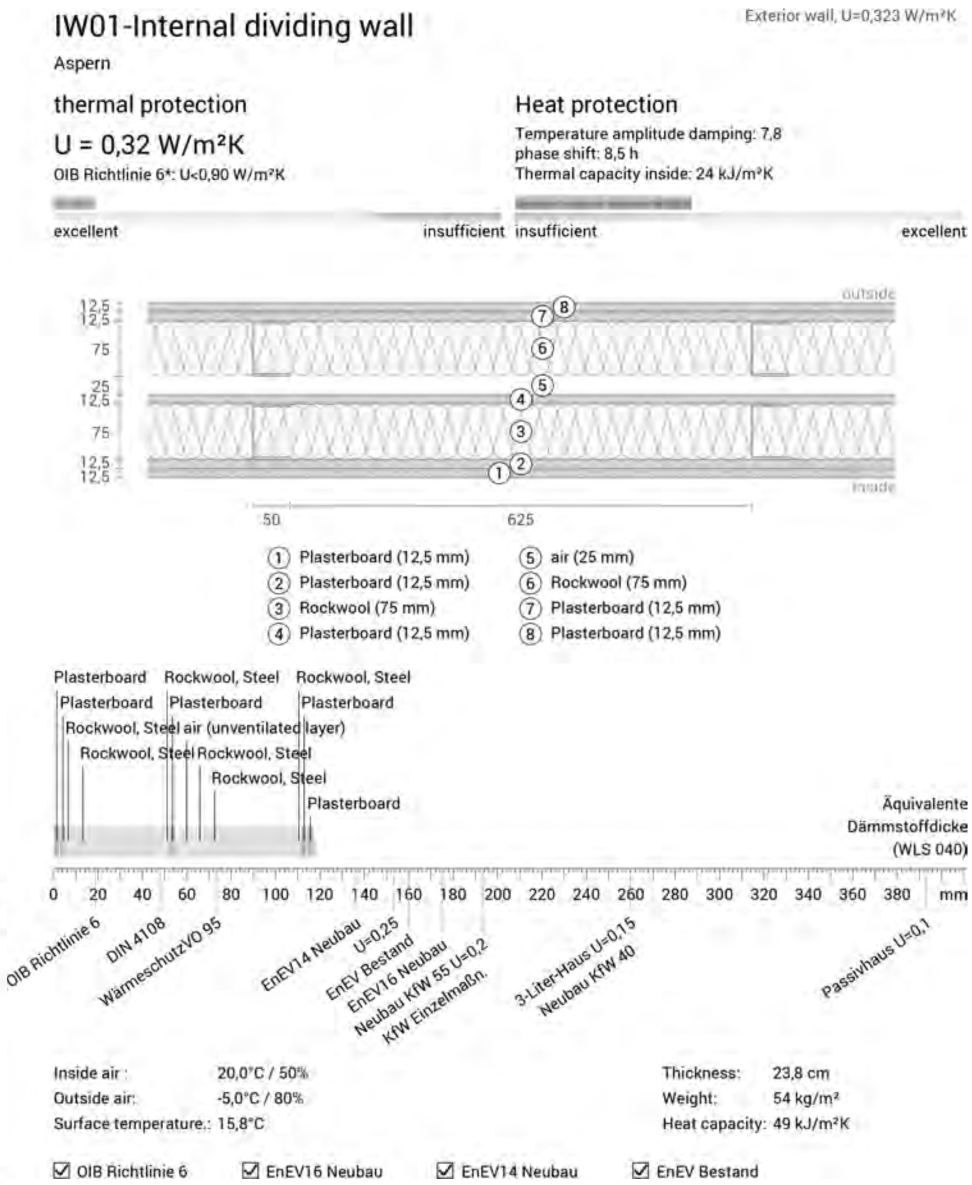


Figure 208: *Detail of the internal dividing wall, created by the author*

- **Thermal Bridges**

1) Parapet for Flat Roof

The structure of the flat roof is covered with a 30 cm EPS W20 insulation material from the top, and the exterior walls have a 12 cm mineral wool insulation material from the side. The protrusion, which forms the roof, is circumferentially covered with thermal insulation. With this, the bridge is created in a way that it does not allow any space between the thermal insulation of the external walls and the reinforced concrete of the roof. By extending the roof 50 cm above the slab, is attempted to keep the cold weather away from the interior as much as possible. As observed from the 2D thermal bridge simulation, there is a negligible thermal difference at the corners of the indoor spaces.

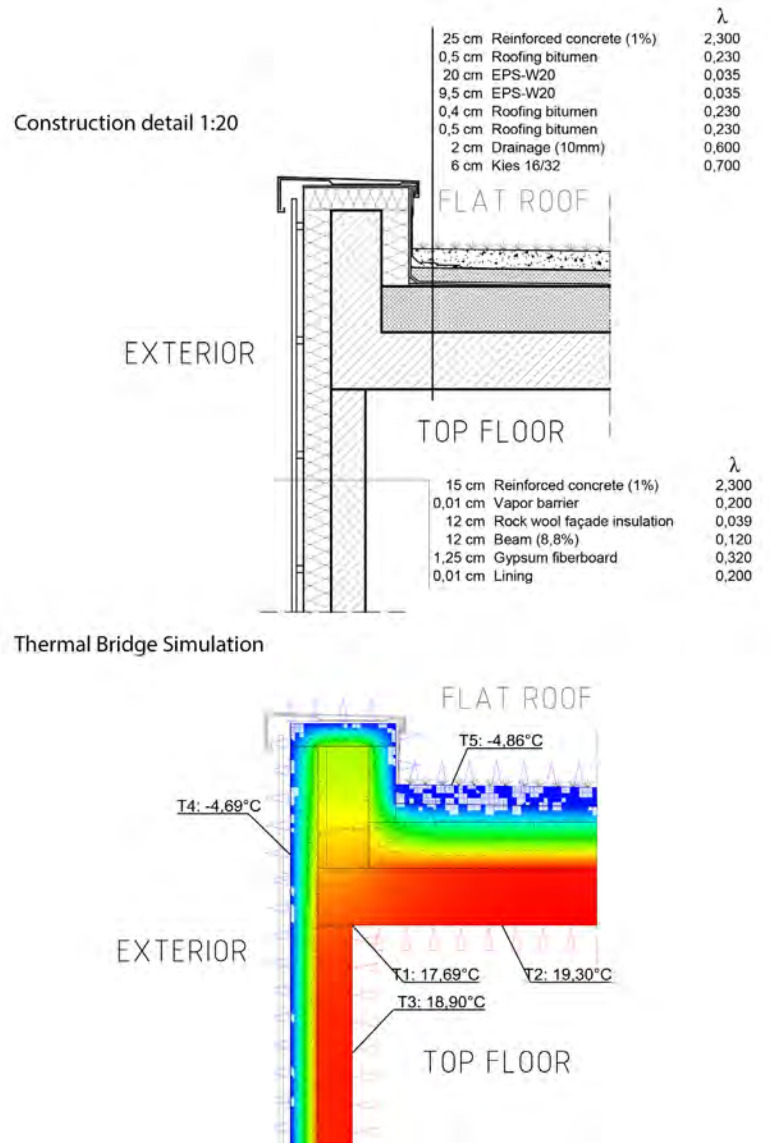


Figure 209: *Thermal Bridge Simulation showing the connection between the flat roof and the exterior wall, made by the author.*

2) Basement, Ground Floor and External Wall

The slab between the basement and the unheated cellar, is covered with 10 cm thick Paroc CGL insulation material from the bottom and with 13.5 cm thick EPS-T insulation material from the top. Herewith, the heated and unheated parts of the building is separated from each other with a very well insulated slab. The walls of the cellar floor are covered with 10 cm thick EPS-F insulation, where the walls are above ground, and with 10 cm thick XPS insulation, where they are below ground. As seen in the simulation, there are scarcely any heat losses at the surrounding corners of the indoor spaces.

3) Balcony and Interior ceiling

In the project, the balcony structure and the the load-bearing system of the slab are connected to each other with the help of the Isokorb structural thermal break. Thus, there is no need to wrap the balcony slab with thermal insulation. As seen in the simulation, thermal bridges are hindered by using Isokorbs.

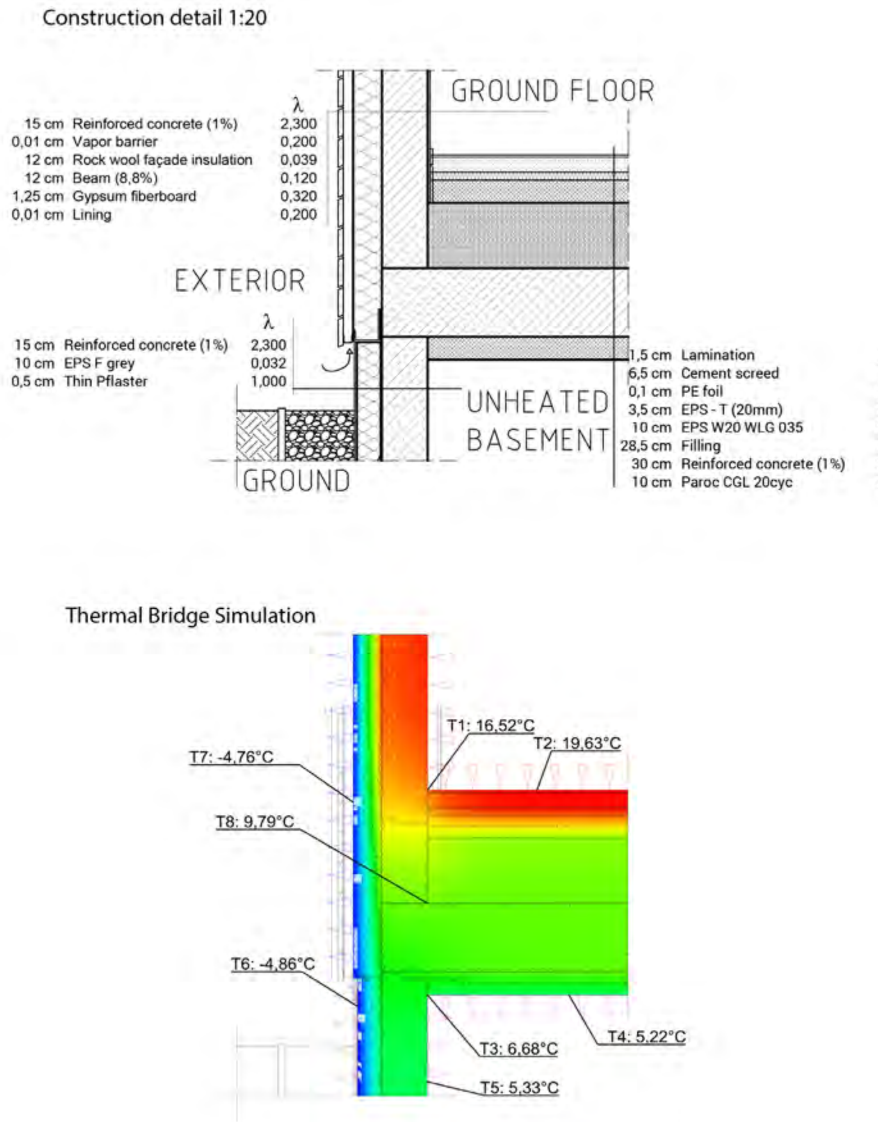


Figure 210: *Thermal Bridge Simulation showing the connection between the basement, ground floor and the exterior wall, made by the author.*

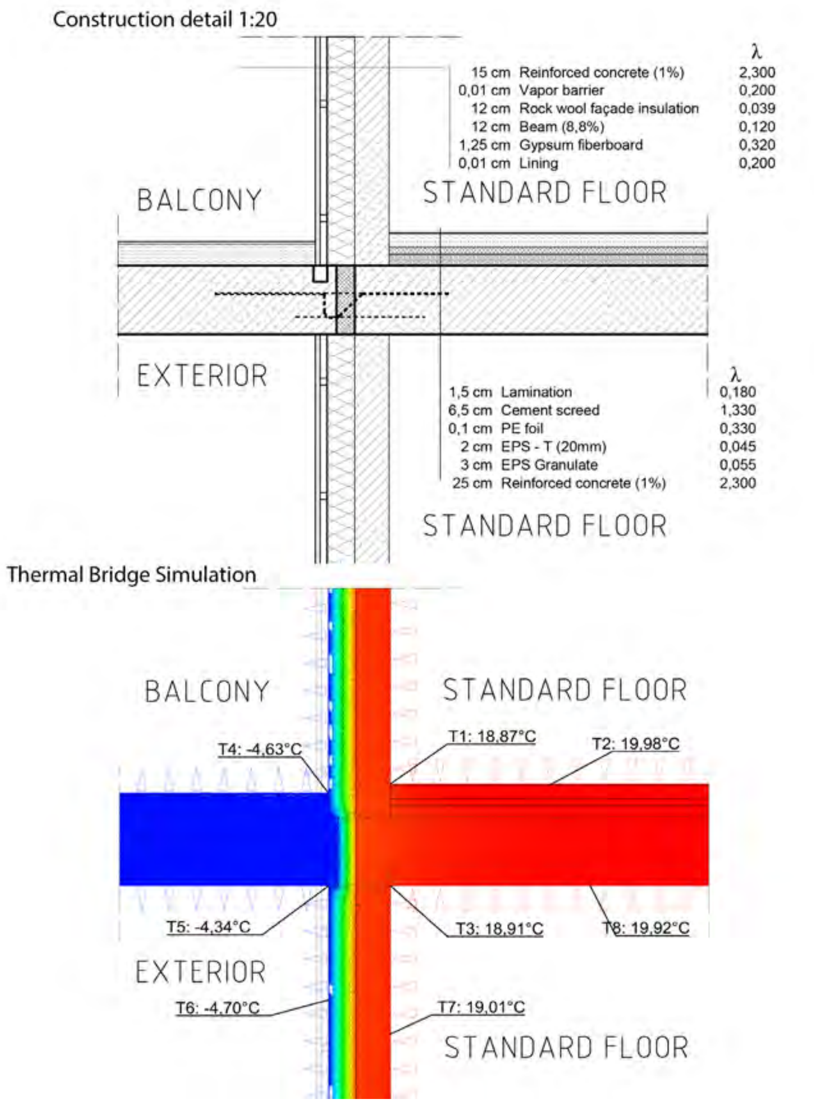


Figure 211: *Thermal Bridge Simulation showing the connection between the balcony and the interior ceiling, made by the author.*

4.2.4. Heating-Hot Water

The heating and the hot water needs of the building are satisfied by heat pumps and under floor heating system has been installed in the dwellings.

“An innovative and intelligent control system automatically identifies the heating demand at a given time and finds out which heat pump has the highest rate of efficiency at any given moment based on the determined framework conditions. This pump is then given preference. Should this heat pump lack the necessary performance, the pump with the second highest efficiency is also started”[50]

Hybrid collectors have also been installed, with a controlled domestic ventilation system and energy monitoring, which also do not require a connection to the district heating system.[51] Furthermore a thermal solar energy plant has been installed on the building, which can cover the entire hot water demand in summer.

Duo to the home automation system, which regulates the temperature of the room and can be controlled by smartphones, more energy efficiency has been provided. These include a CO2-sensor, which measures the air quality and ventilation systems. This system has also an “Eco” button, which makes possible to turn off pre-defined sockets.[52]

Consequently, the heating and cooling systems are only dependent on natural sources. It has been pointed out in the energy certificate that 228 kW power is necessary to fulfil the heating needs of the area of 5675 m^2. The total hot water energy need is calculated as 45,844 kWh. All the installation pipes are insulated with thermal insulation in order to decrease the heat losses by the distribution of hot water.

50 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.9.
51 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.11.
52 Available at: http://futurezone.at/science/seestadt-aspern-erforscht-intelligente-nutzer/81.028.794, access: 20.09.2015

4.2.5. Solar Power Generation

A PV plant (20 kW peak) as cooling photovoltaic modules in a hybrid system has been installed.[53]

4.2.6. Ventilation

Controlled domestic ventilation with heat recovery has been utilised in the building. This system can provide clean air inside the building without the need of any natural ventilation system. This system is supported by natural ventilation via windows in accordance with the energy performance certificate. By the geothermal heat exchanger supported ventilation system, the heat of the room air exhaust is transferred to the colder fresh air. As a consequence the heat losses have been reduced.

The distribution between the natural and mechanical ventilation system, which is calculated according to the data of energy performance certificate is shown below:

1) **Window ventilation:**

Reference gross floor area = 1135.16 m^2 von 5675.78 m^2

Ventilation conductance = 290.26 W/K

Ventilation volume VL= 2,134.32 m^3

Air exchange rate n= 0.40 1/h

2) **Controlled domestic ventilation with heat recovery:**

Reference gross floor area = 4540.62m^2 von 5675.78 m^2

Ventilation conductance = 335.40 W/K

Ventilation volume VL= 9671.31 m^3

Mechanically determined air exchange rate n= 0.40 1/h

Air exchange in airtightness test n50= 0.60 1/h

Additional Air exchange rate nx= 0.04 1/h

Heat efficiency of the entire system eta= 85.00 %

Heat recovery = 85 %

53 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.13.

4.2.7. Solar Shading-Overheating in Summer

In order to protect the indoor spaces from the effects of sunlight, integrated internal venetian blinds have been utilised. In addition, exterior venetian blinds have also been applied for the necessary windows, which requires extra shading, according to the calculations of overheating in summer. Moreover, overhangs like balconies and terraces protect rooms from the strong sunlight of the summer at a structural level.

The Z-values of the sunblinds in accordance with the energy performance data are below:

Internal shading z= 0.75

Balconies, overhangs z= 0.32

External shading z= 0.27

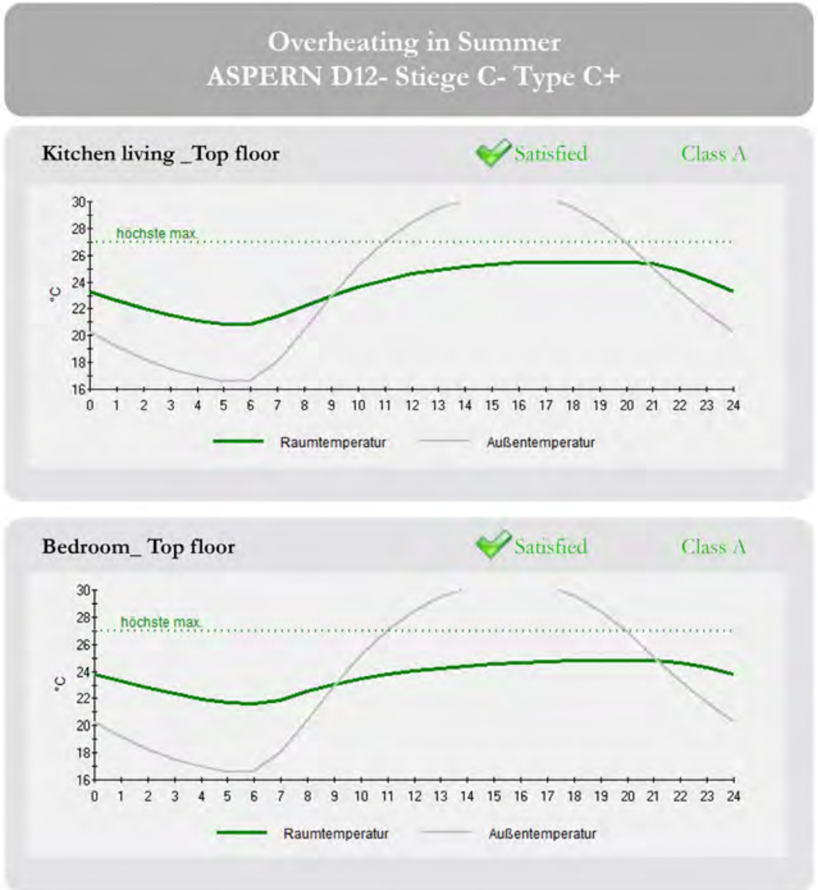


Figure 212: *Overheating calculations of the rooms in summer, made by the author.*

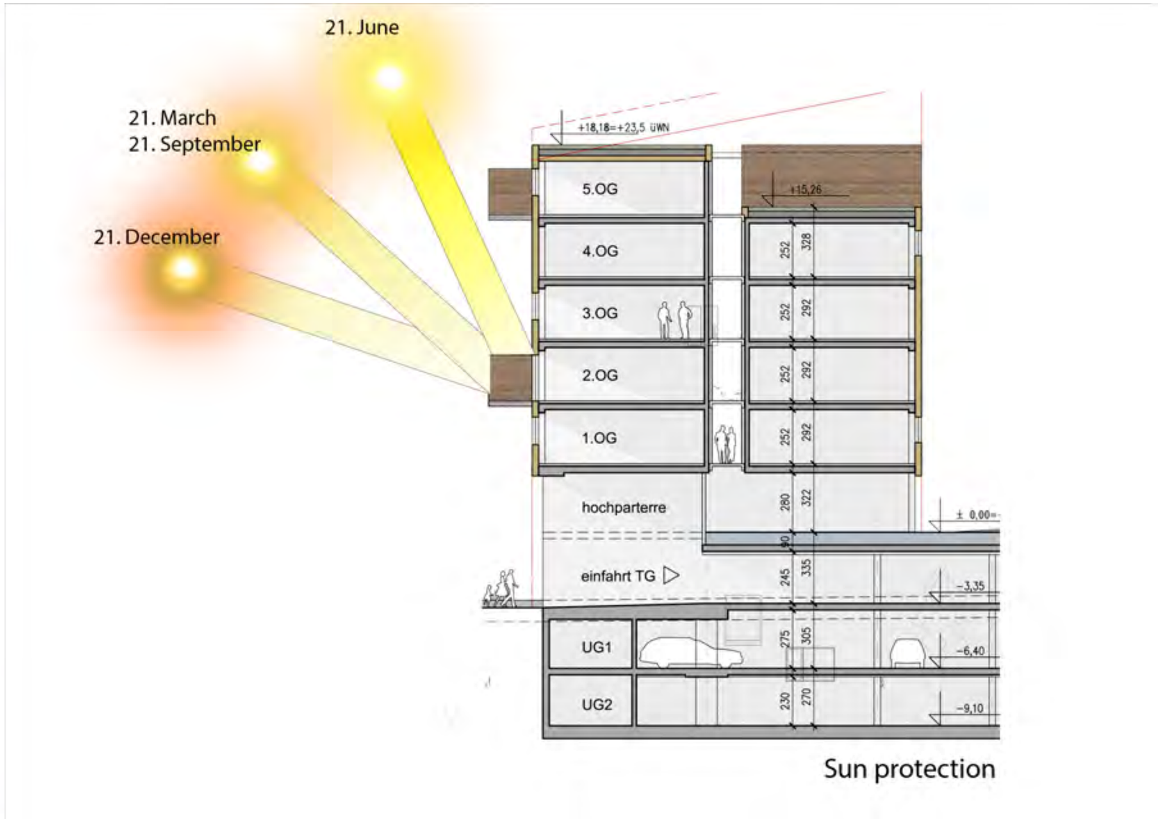


Figure 213: *Schematic representation of the position of the sun at different times, made by the author.*

4.3. Aesthetic - Visual Quality Analysis / AVQA

The project is the winning project of the public property development competition "Aspern-die Seestadt Wiens" on site D12, in 2012. The wood façade, in combination with concrete dynamic balconies and loggias, confer to this project its identity and character from the outside. Haranza indicates that this is the first project of this size with a wood façade in Vienna in building class 5 (up to 21 meters high).[54] Moreover and it was a challenge to work with wood in details like fire protection and insulation in combination with concrete.[55] Wood also provides an image of a natural and sustainable material. According to the goals of the project, original and specific solutions in both visual and material quality have been developed.

Three main access roads with common terraces, coloured staircases, with partially with deck-access, are also unusual and charismatic. These also give the feeling of interaction both inside and outside of the building. Additionally, the landscape design of the project also differs from standard projects, with its distinctive character including concepts like mounds and the canyon, which offers different possibilities with its variable surfaces.

These original ideas make the project, enjoyable, innovative and aesthetically qualified.

- Does the scheme feel like a place with a distinctive character with an identity or does it seem like a reputation of other buildings in the surrounding? Y
- Is the settlement monotonous or attractive & exciting? Attractive & exciting.
- Is it a place which has a good visual impact? Y
- Has a landscape architect designed the open space and does it seem that there is consideration of open space quality? Y
- Is the housing area innovative, original, and creative, or ordinary? Y, innovative, original and creative.
- Is an aesthetic concern visible inside and outside of the buildings? Do the materials inside have a distinctive character? Y
- Are there some elements on the façade considered and designed especially because of aesthetic (concerns) in addition to the functional needs, or is the building just functional? Y
- Is an architectural aesthetic provided through a visual impact in corridors and staircases of buildings with innovative space concepts, geometry movements or some other elements? Y
- Are sustainable and healthy materials used, and consideration of environmental design expression implemented apparent to the façade and general view of the design? Y
- Is the housing estate scale and concept compatible with surroundings (proportionally)? Y

54 Hannappel, L., Leben mit Holz (living with wood), Holzmagazin, 5/2015, p.13
55 Ibid.

5. CS III Wohnhausanlage Satzingerweg

Königlarch Architekten

Open Space Design: Rajek Barosch Landschaftsarchitektur.

Bauträgerwettbewerb (Public Property Development Competition)- Bombardierareal- Building site 3b and 4. / Satzingerweg 8-10

The project won the first place in the Urban Development Ideas competition 2006, under the title "Bombardierareal" , and chosen as fixed starter in the Bauträgerwettbewerb 2007 (Public Property Development competition), Bombardier-Gründe, on sites 3b and 4. There are 29 dwellings on site 3b and 165 dwellings on site 4, which equal 194 dwellings in total. The housing estate designed by Königlarch architecture office, takes place in suburban of Vienna, with its six-storey structure near open fields. This is a housing with some small private gardens and shared green open spaces including playgrounds. The density in the city penetrates to the periphery and the higher growth of the city requires a compact development. The complex consists of four point houses on the park side and five line houses which gradually rising in terraced form, on the west side of the project. These houses with their point and line structures are linked on a common axis

Figure 214: *A view to the housing, photo by Steiner Rupert.*

BOMBARDIER

BLOCK	TYPE		NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING TYPE B WITH 2 ROOMS	NUMBER OF DWELLING TYPE C WITH 3 ROOMS	NUMBER OF DWELLING TYPE D WITH 4 ROOMS	NUMBER OF DWELLING TYPE E WITH 5 ROOMS	DWELLINGS WITH GARDEN	DWELLING WITH ROOF-TERRACE	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
POINT BLOCK	TYPE 1 (ST.1)		4	3	3	2	-	1	1	1	8	8
	TYPE 2 (ST.12)		6	2	4	6	3	2	3	1	15	15
	TYPE 3 (ST.13)		6	8	5	6	-	2	3	1	19	19
	TYPE 4 (ST.4)		6	7	4	7	-	2	2	1	18	18
	TYPE 5 (ST.3)		5	3	4	3	1	1	1	1	11	11
LINE BLOCK	TYPE 1	ENTRANCE 1 (ST.2)	6	2	4	5	-	1	3	2	11	22
		ENTRANCE 2 (ST.3)	5	1	8	3	-	3	2	2	12	24
	TYPE 2	ENTRANCE 1 (ST.4)	6	4	3	5	-	2	3	3	12	36
		ENTRANCE 2 (ST.5)	6	2	8	3	-	3	2	3	13	39
TOTAL				31	43	40	4	17	20	10		194

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE incl. common terraces and private gardens ground floor	TOTAL NUMBER OF DWELLING
17705 m2	15200 m2	305 m2	15317.1 m2	194

Figure 215: *Satzingerweg diversity and density informations by the author. (Open space area is calculated according to the site plan*

Figure 216: *Site map (left)*

Figure 217: *Ground floor plan (right)*

which is north-south directed and designed to project a collective image, although they are different property developments. At the northernmost point of the site there is a three-storey building which also includes an underground parking entrance.

The site is alive and attractive through the organisation and interaction of common rooms and open spaces on the ground floor, which is often missing in suburbia.[56] Protrusions, balconies with wood sliding elements and vertical green elements adjacent to the façade also contribute to this alive and attractive atmosphere and to general image of the site.

5.1. Social-Functional Quality Analysis / SFQA

5.1.1. Needs Oriented Design

Building developer competitions are strongly "housing needs" oriented and affordability is a factor that has to be considered. It has been the goal of the project to provide a silent housing estate in nature, but, in combination, attractive and alive spaces. Different sized dwellings have been designed to meet different needs of tenants and the diversity of the units, on the other hand, ensures provision of different requirements for different types of family. This leads to efficient use of space and the possibility to choose a convenient dwelling type to avoid space consumption by people. There are also a plenty of multi-purpose community spaces to meet the varying requirements of tenants.

5.1.2. Accessibility and Movement Circulation Concept

There is a clear circulation concept outside, with a main axis which is north-south directed, and connections to the entrances are linked to this axis. The whole network including staircases is visible, clearly arranged and

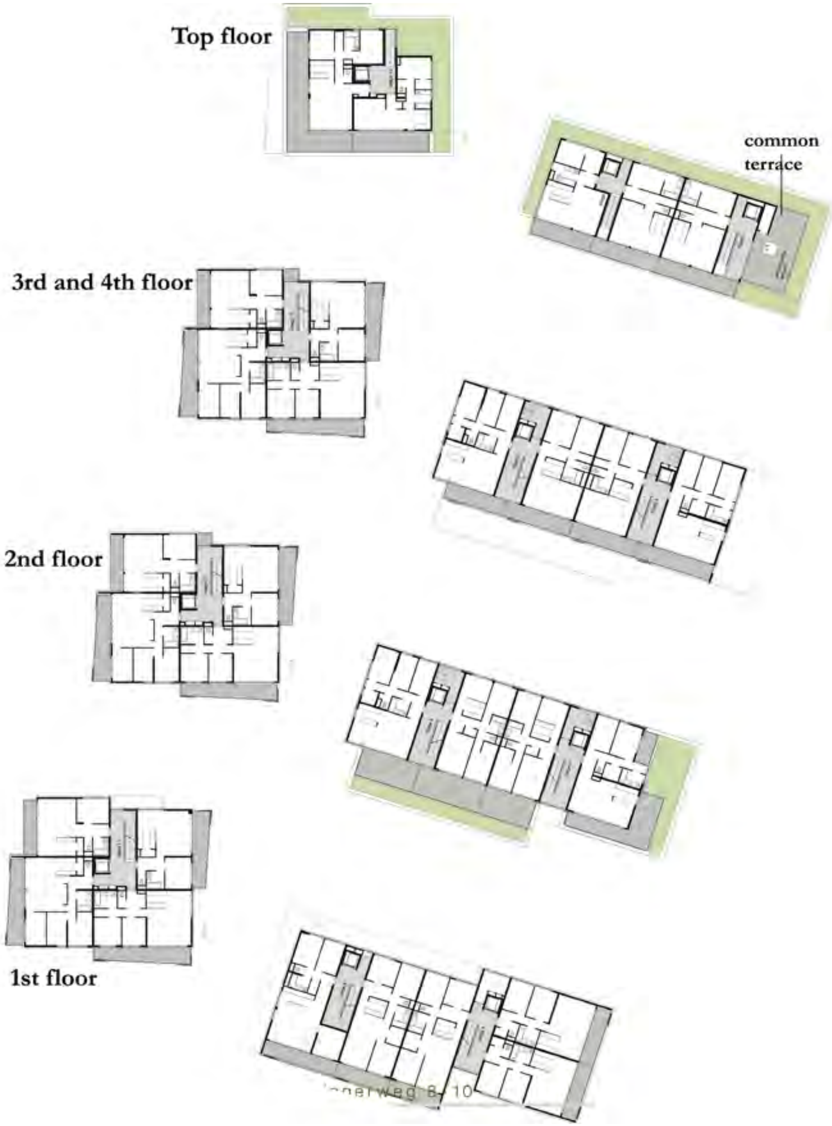


Figure 218: *Upper floor plans of the chosen buildings*

56 Information of the project from Königlarch Architecture Office.

reaches day light. Horizontal and vertical accessibility follows the short way principal, entrances and common rooms on the ground floor ensure barrier-free accessibility for wheeled equipment and buggies. Stairs in the buildings go on until the underground floor, and light slits bring daylight widely to the garage. Transparent doors and an orientation system with colours contribute to suitable and coherent accessibility.[57]

The common rooms, which are constantly frequented, are designed on interface points with pedestrian paths and staircases to ensure social control. Pedestrian and car routes have a clear distinction.

- Is it easy to understand how to enter and move about the site? Y
- Are there orientation tables? Y
- Are handrails for essential steps and communal stairs with a maximum rise of 170mm and minimum run of 280mm? Y
- Is there a lighted canopy over the main entrance? Y
- Do circulation areas receive good daylight? Y
- Is adequate wheelchair access possible on the site, apartments, and dwellings? Are there ramps or lifts? Y
- If there is ramp, does it provide a maximum slope of 6%, 120 cm clear width, movement area at the end of 150 x 150cm and a handrail height of 85 cm? Y
- Is there enough manoeuvring space for wheeled equipment in entrances and corridors? Y
- Are there facilities for people with visual or auditory disabilities? Y
- Is access for fire, ambulance, and other services adequate? Y
- Is there a distinction and identification of functions (e.g. lighting, choice, and materials)? Y
- Is there a differentiation of architectural elements by colour or materials (e.g. walls and ceilings)? Y

Figure 219: *Stairs and circulation routes (left), photo by Steiner Rupert*

Figure 220: *A view to the access of the site (top), by the author*

Figure 221: *Access to the building (bottom), by the author*

- Is there figure-background contrast (e.g. symbols and letters)? Y
- Is there functional use of colours and materials to support spatial orientation, recognisability and identity? Y
- Does the movement concept aim to minimize vehicle flows and speeds within the housing estate and discourage through vehicular traffic? Y

Vehicles

- Is the hierarchy of routes clear? Y

57 Wohnhausanlage Satzingerweg 8a und 10, in Architekturjournal Wettbewerbe No:304, Bohmann Druck & Verlag, Vienna, 3/2012, pp. 72-75.

- Are road, place and building names, and unit numbers clear, visible, legible, and sited appropriately in relation to buildings? Y
- Do routes take advantage of vistas/landmarks within or around the project site? Y
- Are appropriate traffic calming measures used to control vehicle speed? Y
- Is vehicle segregation possible to help pedestrians to use safe routes? Y
- Can large, emergency, or service vehicles come within 30m of all front doors of units or flats? Y
- Do routes facilitate and encourage cycling? Y

Pedestrians

- Are public spaces connected by clear, well lit, and hard surface routes? Y
- Is lighting appropriately related to buildings and easy to maintain? Y
- Are kerbs dropped where foot paths cross roads? Y
- Do pedestrian routes and garden paths have a minimum width of 900 mm? Y

Access to the unit

- Do pedestrian routes and garden paths have a firm, even, slip-resistant finish, and distinctive texture and colour? Y
- Are kerbs dropped for main footpaths and access positions? Y
- Is convenient wheelchair access provided from park space? Y
- Are all slopes gentle provided with a level platform of 1200 x 1200 mm clear of door swing to external doors? Y

5.1.3. Efficiency of Planning

The site is quiet and very convenient for housing. The general appearance of the project was composed mostly of freestanding individual buildings to react to the small houses and their gardens in the surrounding. The site offers an efficient area for housing with its greenery and public transport possibilities. Design of the open space with playgrounds, greenery and common rooms on the walk ways on the ground floor make the site liveable, enjoyable, and attractive. The staircases and apartments receive good daylight. A variety of apartments and common rooms make the communication of different aged and sized families possible. These different apartments are designed also to allow some other different scenarios for the future. Big loggias with movable shadow elements provide a good atmosphere in and out of the building.

- Does the overall design have a challenge and a goal? Y, creating an alive and attractive atmosphere with variable designs, which is a lack in suburbia
- Is the location favourable to housing with suitable functions for people? Y

Figure 222: *A view to the housing, photo by Steiner Rupert.*

- Are adequate facilities for universal access provided between floors with clear traffic routes? Y
- Is there sufficient capacity in corridors, stairs and lifts? Y
- Is there sufficient capacity for individual rooms (doors which open in a convenient direction without traffic routes through occupied areas)? Y
- Is an efficient layout provided, i.e. short walking distances because related functions are grouped near one another? Y
- Have functions requiring natural light been located against an outside wall? Y
- Has the space required to place and use furniture been an important attention point for both fixed and mobile furnishings? Y
- Are sufficient vertical dimensions provided for ceiling height, clear headroom for doors, height of worktops and kitchen cupboards? Y, but ceiling height could be more than it is to provide a wider space.

5.1.4. Flexibility

Adjustment and change of all building components in primary structure is possible. Five different extension variants are offered, from three-room flats to four room flats in the line formed blocks, without changing bearing structure. Moreover general design of apartments can react to the changing needs and requirements of people thanks to their flexible dwelling types. For example; a big dwelling near a small one for a future combination of two dwellings.[58] The shadow elements of loggias are also flexible through their mobility.

- Has flexibility been a consideration in designing? Y
- Can the plan of the units be adjusted to circumstances? Is it possible to make the rooms and dwellings larger or smaller than they are? Y

Figure 223: *Different floor plans of the same sized dwelling*

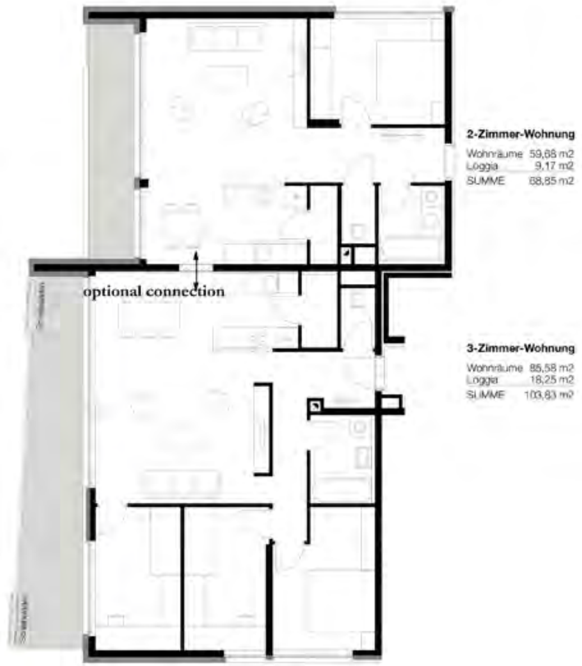


Figure 224: *Optional connection consideration of two different dwellings*

- If possible, can these changes be made easily without intervention of architectural elements (ceiling and floor)? Y
- Are different furnishings possible in the rooms? Y
- Is it possible to change the functions of the rooms? Y
- Are the load-bearing inner walls avoided as much as possible? Y

58 Information of the project from Königlarch Architecture Office.

Figure 225: *View to the garden of a dwelling, by the author.*

5.1.5. Safety

The safety of the each building is provided by a lock system, but the site is a semi-public area. There is a lack of safety in the open spaces which might be inappropriate in some other countries, like Turkey. All of the path network is open and visible which contributes to the safety of the site.[59] Common rooms on the ground floor, the pathways, and visual and spacial connections contribute to security and functionality.

- Are main access points secured (with an alarm, with guidance)? N
- Are public areas overseen to make people feel safer and in control to anticipate possible dangers, especially within children playgrounds? Y
- Are balconies of dwellings safely protected against the risk of break-in? Y
- Are all external doors and windows sufficiently fixed? Y
- Is safe transportation of people and goods provided vertically and horizontally to manage and prevent the possibility of falls, being trapped or injured with: non-slip floor finishes /adequate lighting for corridors and stairs/ handrails and banisters where appropriate? Y
- Has it been considered that doors and windows do not open onto the circulation routes? Y
- Fire safety: Is prevention of fire outbreak with a quick and safe escape possible? / Are fire-resistant materials used to limit fire spread? Y
- Is safety glass used instead of ordinary glass? Y

5.1.6. Health, Well-being and Comfort

The general projection of the housing complex is convenient for the well-being of people. The sufficient design of common rooms on access routes provides good communication and a healthy community life. Some people can garden in their gardens, which lowers stress levels. There is not a traffic load or sound from the surrounding buildings, and all the staircases and apartments get good daylight.[60]

- Has sound insulation of walls been considered and applied? Y
- Has sound insulation of ceilings been considered and applied? Y
- Has sound insulation of windows been considered and applied? Y
- Are bedrooms placed so that they are not adjacent to shared internal areas? Y
- Are bedrooms protected so that they are not adjacent to the bathing/living areas of neighbouring units? Y
- Are noisy communal equipment placed farther than 3m away from doors or windows (e.g. lifts and plant equipment)? Not always.
- Do living room windows receive good daylight? Y
- Do kitchen windows receive good daylight? Y

59 Wohnhausanlage Satzingerweg 8a und 10, in Architekturjournal Wettbewerbe No:304, Bohmann Druck & Verlag, Vienna, 3/2012, pp. 72-75.

60 Wohnhausanlage Satzingerweg 8a und 10, in Architekturjournal Wettbewerbe No:304, Bohmann Druck & Verlag, Vienna, 3/2012, pp. 72-75.

Figure 226: *View to the balconies, by the author.*

Figure 227: *Garden and balconies, by the author.*

Figure 228: *A general view to the site with buildings, by the author*

- Do all bathrooms have a window? N
- Do corridors and stairs of apartments receive good daylight and natural ventilation? Y

5.1.7. Open Space

Shared open spaces are designed by Rajek Barosch Landscape architecture. Two zones determine the open space of the site: a central, public park on the west site and the semi-public area in the point-line building structure. Both of these areas which are designed with the combination of greenery, as much as possible, flow into each other. Through their different functions and structures they have a common aim: promotion of social interactions and communication.[61]

Some small playgrounds, common rooms, and launderettes are linked to the internal network. Visual contact between furnished playgrounds and other common rooms was also taken into consideration. Low level changes and different materials enclose the spaces and these spaces correspond with internal facilities. All apartments on the ground floor have their own gardens. Private gardens are lifted up 60 centimetres from the adjacent green area to define the boundary between private and public open space.[62] (Figure 225 - Figure 227) All other apartments, most of which extend through the whole width of blocks, have big balconies. These balconies have wooden sliding elements which provide sun protection and also visual protection to ensure privacy in their own open spaces. The apartments on the top floor have their own terraces and there are public terraces for the use of inhabitants on the top of line shaped buildings. The roof which do not have the terrace function has also been planted.

The open spaces of project are designed as places of communication, interface, and meet with its differentiated concept aims. The diversity of these open spaces in form and functions expands the living space of tenants and is considered to serve as an integrative component of the housing complex.

- Has a qualified landscape architect been employed to create or assess the landscape design? Y
- Is water (a pool, stream or a fountain) incorporated into the site and appropriately protected? N

61 Information of the project from Königlarch Architecture Office.

62 Wohnhausanlage Satzingerweg 8a und 10, in Architekturjournal Wettbewerbe No:304, Bohmann Druck & Verlag, Vienna, 3/2012, pp. 72-75.

Figure 231: *The site from Community room, photo by Steiner Rupert*

- What is the ratio of open areas to the sum of dwellings? 1.00
- Does the general image of the open spaces seem natural and green? Y, Rajek Barosch Landschaftsarchitektur (Urban Planning)
- Do some flats have their own private garden? Y
- Is there a common roof terrace? Y
- Is there roof planting? Y
- Are materials used in the open space natural? Y
- Is there any possibility for tenants to grow their own plants in the garden? Y

Figure 232: *Community and storage rooms on floor plan.*

Figure 230: *Hobby room, by the author*

Figure 229: *Community room, photo by Steiner Rupert.*

- Does the position of lighting prevent pools of darkness where people walk both outside and in communal areas of buildings? Y
- Are refuse and bin storage areas convenient and inconspicuous in the open space? Y

5.1.8. Common Rooms and Facilities

The project has great communication potential with its attractive and ambient common rooms, which have been strung on the north-south directed axis. These rooms have functions such as multipurpose rooms, indoor playgrounds, and an attractive launderette, and are within the range of vision and hearing of the playgrounds. They ensure access for all.

Children's playgrounds and multipurpose rooms have a kitchen and sanitary facilities, and some of these rooms have wrapping tables. On the top of line formed buildings there are terraces for common use of inhabitants.

These common rooms provide support for a positive and welcoming neighbourhood.

- Is there a common room for inhabitants with a kitchen? Y
- Is there a closed playground for children? Y
- Is there a launderette? Y
- Is there a fitness area? N
- Is there a sauna? Y
- Is there a cinema? N
- Is there a theatre? N
- Is there a library? N
- Is there an atelier? N
- Is there any play equipment or games room for young people (e.g. table tennis, ropeway)? Y
- Are there any other common rooms except those mentioned? Y

Figure 233: *A view to the indoor playground, by the author.*

Figure 234: *Playground, by the author.*

Figure 235: *Playground, by the author.*

5.1.9. Children's Playground

Two open playgrounds between blocks are designed into the project, with differing concepts.(Figure 234, Figure 235) The park at the west side of the project provides a good space opportunity for children.(see Figure 214) It is very enjoyable with its huge sandbox with water possibility, and a wide range of other equipment. There are also indoor playgrounds, which are also designated common rooms. The different playground concepts of other Bombardier projects also extend the usage options of tenants in this project.

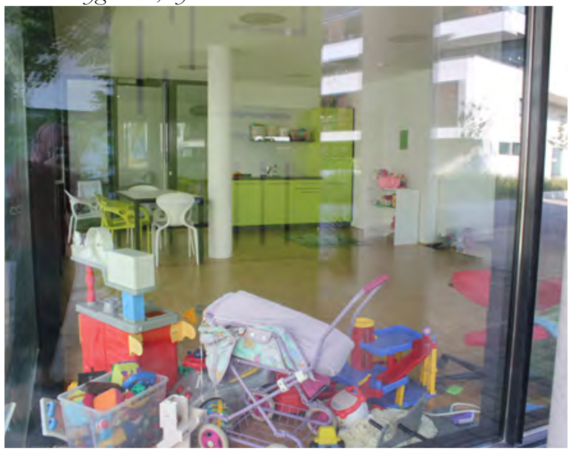


Figure 236: *Indoor playground 2, by the author.*

Figure 237: *Indoor playground 3, by the author.*

- Is the site location appropriate for children? Y
- Is the playground large enough for the whole residential area? Y
- Is there a sandbox? Y
- Have material / design creativity been considered? Y
- Are the materials healthy (plastic/wood)? Y
- Are playgrounds separated according to age groups? N, but in the playground near to the site it has been provided.
- Are play areas provided within sight of families? Y
- Is energetic play provided for e.g. by an adventure playground or cycle paths? Y
- Is there any other playground close to the site? Y

5.1.10. Proportion of Buildings and Diversity of Living Units

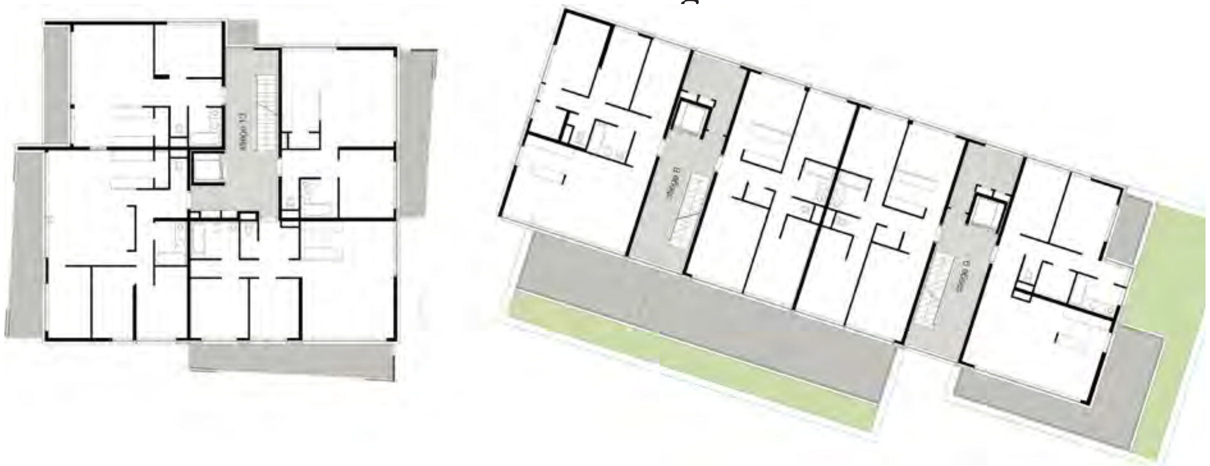


Figure 238: *Some of different floor plan types.*

Figure 239: *One of the waste storages, by the author.*

Figure 240: *Storage space for bicycles, by the author.*

There are 194 apartments in the housing complex. The project is very compatible with its surroundings, with its suitable scale and convenience for housing and living. There are different block types, most of which have different and characteristic solutions in their planning.(see Figure 238)

The project constructions have six storeys (including ground floor), utilising small sized buildings which provide opportunity for neighbourhood with gardening and common rooms supported. The low storey design provides opportunity to use stairs with daylight and allow communication between people.

The housing complex consists of small, medium and larger apartments. There are different size of apartments from two to four rooms.(see Figure 215) Some apartments of the same size also vary in planning. (see Figure 223)

- Do the plans of different units have different sizes and characteristics for small/big families? Y
- Are there different floor plans of different blocks in the housing estate? Y
- Are different aged inhabitants encouraged in the project? Y
- Are there maisonettes? N
- Are there dwellings with a garden or terrace? Y
- Do some dwellings have a balcony? Y
- Do the balconies of different dwellings have different sizes? Y
- Is the vertical proportion of buildings appropriate to the human scale, and is communication of buildings with the ground supported? Y
- Are the buildings not more than eight storeys high? Y, they are less.

5.1.11. Storage, Parking and Waste Services

The project has an underground garage which is also convenient for disabled people. The design of rooms for bicycles and buggies at the entrance of buildings is very convenient.(See Figure 232)

Waste services are properly provided and possible for waste separation and recycling.[63]

- Are there storage spaces in dwellings? Y
- Is there separate storage for each unit outside of the dwelling? Y
- Is there a bicycle storage and is it barrier-free for disabled people? Y
- Is there storage for prams, buggies and wheel chairs? Y
- Is the refuse and bin storage area convenient and well arranged? Y
- Is it encouraged through design to collect waste separately? Y
- Is there a minimum of one parking space per unit? Y
- Is there underground parking and is it secure? Y
- Is there any car parking available for disabled people? Y

63 Information of the project from Königlarch Architecture Office.

5.2. Energy performance and Construction Quality Analysis/ ECQA

5.2.1. Overview

	Building features	SATZINGERWEG				
	Energy Reference area[m²]	**2211.37 m²**				
	Gross floor area[m²]	**2764.21 m²**				
	Brutto-Volumen[m³]	**8325.36 m³**				
	Building enveloping area [m²]	**3457.97 m³**				
	U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
	Average U-Values[W/m²K]	0.420 [W/m²K]				
Exterior Wall	AW01 Exterior concrete wall	0.207 [W/m²K]	61 [dB]			313.27 [kg/m²]
	AW02 Exterior concrete wall façade panels	0.198 [W/m²K]	61 [dB]			313.64 [kg/m²]
Roof	FD01 Flat roof terrace top floor	0.229 [W/m²K]	62 [dB]	69 [dB]	37 [dB]	308.82 [kg/m²]
	FD02 Extensive green flat roof	0.174 [W/m²K]	62 [dB]	69 [dB]	37 [dB]	291.67 [kg/m²]
	D01 Ceiling over basement	0.280 [W/m²K]	64 [dB]	67 [dB]		103.69 [kg/m²]
	D02 Ceiling over plaground/ Hobby room	0.220 [W/m²K]	62 [dB]	69 [dB]		103.68 [kg/m²]
Ceiling	ID01 Interior dividing ceiling	0.760 [W/m²K]	62 [dB]	69 [dB]	15 [dB]	87.78 [kg/m²]
Interior Wall	IW01 Internal dividing wall	0.500 [W/m²K]	61 [dB]			15.46 [kg/m²]
	Glass	1.00 [W/m²K]				
	Windows	1.20 [W/m²K]				
	A/V	0.42 [1/m]				
	n50[1/h]	1.50 [1/h]				
	Ventilationtype	Natural ventilation				
	Heating type	District heating, radiators				
	Total heating demand[kWh/m²a]	**33.34 [kWh/m²a]**				

Figure 241: *Overviw of the quantitavie values of the building components of Housing Satzingerweg, made by the author.*

5.2.2. Form and Orientation

8 buildings were constructed as 3 different building typologies on the site designed by the Königreich architects' office. In this part, the building, "Stiege 13" have been investigated. The form of the building is made up of a box, which has approximate dimensions of 23 m x 21 m. The entrance to the building is through the north facade. The stair enclosure is located in the middle of the building. There are four apartments per floor. These apartments are oriented to two different facades. Secondary rooms of the buildings such as bathrooms, toilets are located in the core of the building. Therefore, living rooms and bedrooms are located at the facade to maximize sunlight exposure.

The roof construction is flat enabling a photovoltaic array to be applied soon. At the same time, the roof areas, which are partly planted, contribute to buildings in terms of sustainability.

The total facade area of the building, divided by the total heated volume, A to V ratio, is 0.421/m. Thanks to the balconies and protrusions, a dynamic form is obtained.

Figure 242: *Site plan and orientation*

5.2.3. Building Compenents U-Values, Thermal Bridges and Airtightness

- **Building Components, U-Values, Acoustic**

1) AD01 Overhang Ceiling to Outside Air:

The total roof construction thickness is 56.05 cm. The top layer is laminate or ceramic tile. Under this layer there is 5 cm thick screed. It has been used 3 cm MW-T for the acoustic insulation. A 22 cm reinforced concrete slab bears the load of the floor. 16 cm mineral wool provides thermal insulation, which is installed under the load-bearing system. The total U-value of the ceiling with full thermal insulation is calculated to be 0.144 W/m²K ergeben. The resulting value of the building construction has been decreased by 29% lower than the required U-value of 0.20 W/m²K.

U-Value= 0.144 W/m²K

Weighted Sound Reduction index Rw = 62 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 69 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 103.64 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperature [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	19,1	20,0	
1	1 cm	Lamination	0,130	0,077	18,8	19,1	5,0
2	5 cm	Cement screed	1,400	0,036	18,7	18,8	100,0
3	0,05 cm	Vapor barrier sd=100m	0,220	0,002	18,7	18,7	0,1
4	3 cm	Impact sound insulation board	0,035	0,857	15,7	18,7	2,7
5	6 cm	Bundled fill	1,100	0,055	15,5	15,7	1,2
6	22 cm	Reinforced concrete (2%)	2,500	0,088	15,2	15,5	528,0
7	18 cm	Mineral wool	0,032	5,625	-4,8	15,2	3,6
8	1 cm	External plaster	0,550	0,018	-4,9	-4,8	19,0
		Thermal contact resistance*		0,040	-5,0	-4,9	
	56,05 cm	Whole component		6,968			659,6

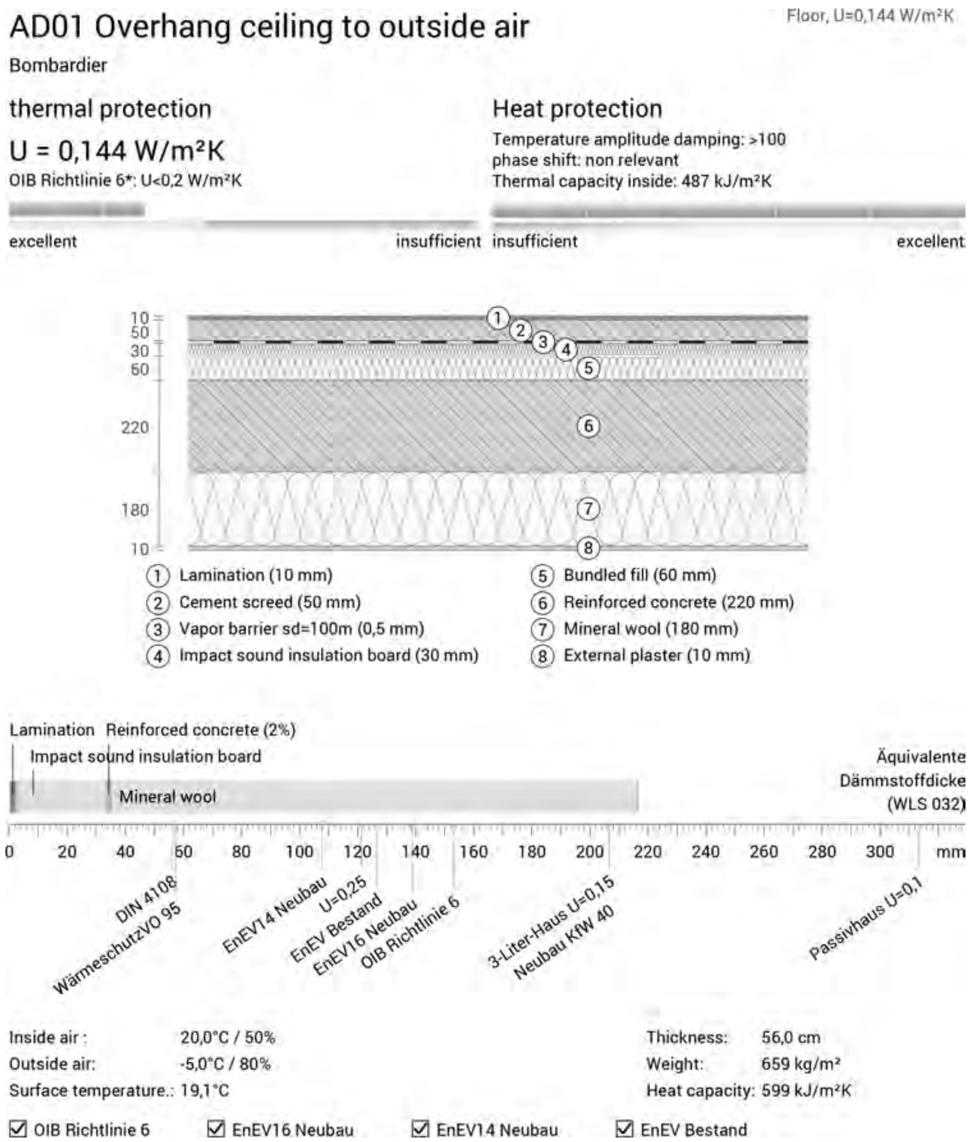


Figure 243: *Detail of the overhang ceiling to outside air, created by the author.*

2) AW01 Exterior Concrete Wall

The total thickness of the exterior wall is 36.5 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster20 cm reinforced concrete wall carries the load of the building. The façade is insulated with 14 cm mineral wool. A double-layered exterior plaster with heat insulation plaster has been used as a coarse plaster and silicone resin-float finish as fine plaster. The total U-value of the exterior wall with full thermal insulation is calculated as 0.207 W/m²K. The resulting value of the building construction has been decreased by 41 % lower than the required U-value of 0.35 W/m²K.

U-Value= 0.207 W/m²K

Weighted Sound Reduction index Rw = 61 [dB]

Required Weighted Sound reduction index Rw = 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 313.27 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,7	20,0	
1	0,5 cm	Surface plaster	0,111	0,045	18,5	18,7	7,0
2	20 cm	Reinforced concrete (2%)	2,500	0,080	18,1	18,5	480,0
3	1 cm	Adhesive mortar	1,000	0,010	18,1	18,1	20,0
4	14 cm	EPS F-Plus	0,031	4,516	-4,7	18,1	2,5
5	1 cm	External plaster	1,000	0,010	-4,8	-4,7	19,0
		Thermal contact resistance*		0,040	-5,0	-4,8	
	36,5 cm	Whole component		4,831			528,5

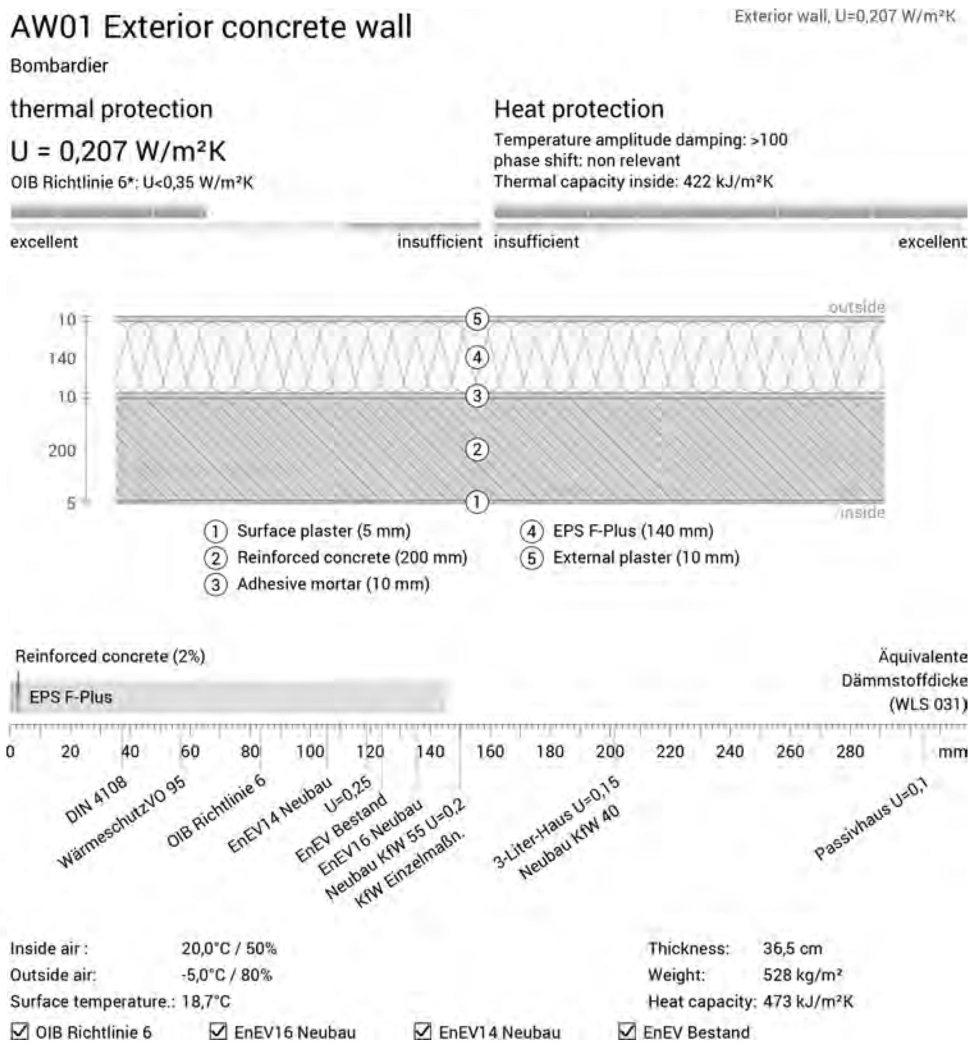


Figure 244: *Detail of the exterior concrete wall, by the author*

3) AW02 Exterior Concrete Wall- Façade Panels

The total thickness of the exterior wall is 39.5 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. 20 cm reinforced concrete wall carries the load of the building. The rear-ventilated façade has been insulated with 14 cm mineral wool. 1 cm thick eternit panels clad the façade. The total U-value of the exterior wall with full thermal insulation is calculated as 0.198 W/m²K. The resulting value of the building construction has been decreased by 43 % lower than the required U-value of 0.35 W/m²K.

U-Value= 0.198 W/m²K

Weighted Sound Reduction index Rw = 61 [dB]

Required Weighted Sound reduction index Rw = 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 313.64 kg/m²

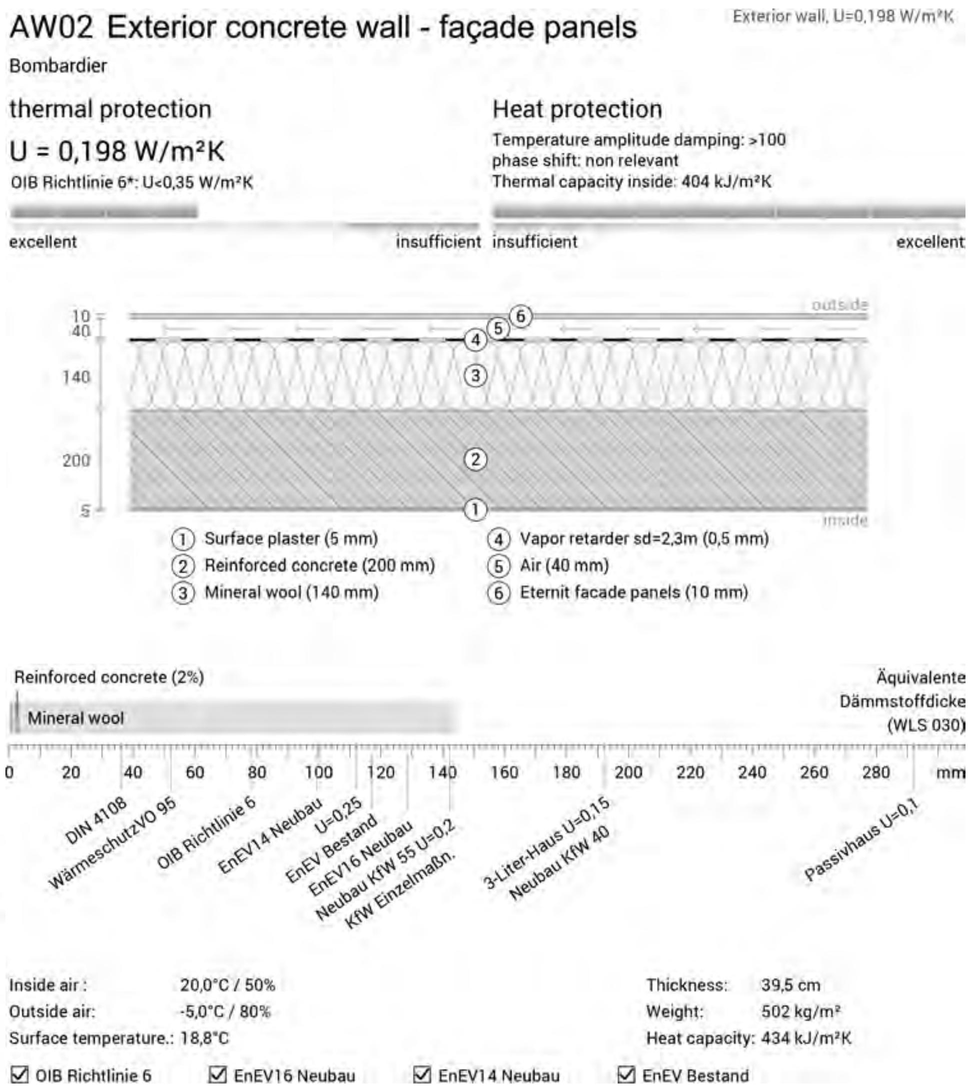


Figure 245: *Detail of the exterior concrete wall with facade panels, by the author*

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	18,8	20,0	
1	0,5 cm	Surface plaster	0,111	0,045	18,5	18,8	7,0
2	20 cm	Reinforced concrete (2%)	2,500	0,080	18,2	18,5	480,0
3	14 cm	Mineral wool	0,030	4,667	-4,8	18,2	2,5
4	0,05 cm	Vapor retarder sd=2,3m	0,220	0,002	-4,8	-4,8	0,1
		Thermal contact resistance*		0,130	-5,0	-4,8	
5	4 cm	Air (ventilated layer)			-5,0	-5,0	0,0
6	1 cm	Eternit facade panels			-5,0	-5,0	12,5
	39,55 cm	Whole component		5,054			502,2

4) FD01 Flat Roof Terrace Top Floor

The total roof ceiling structure thickness is 49 cm. The top layer of the accessible roof is a 4 cm thick wood cladding. 14 cm XPS-BG 30 thermal insulation material has been used. The roof load is borne by the 22 cm reinforced concrete slab. The interior plaster is executed as a single-layer gypsum/lime plaster. The total U-value calculation of the roof with full thermal insulation results in a U-value of 0.229 W/m²K. The resulting value has about 14% exceeded the required U-value of 0.20 W/m²K.

U-Value= 0.229 W/m²K

Weighted Sound Reduction index Rw = 62 [dB]

Required Weighted Sound reduction index Rw = 48 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =69 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 308,82 kg/m²

Weighted Standardized Impact Sound Pressure Level L`nT,w = 37 [dB]

Required Weighted Standardized Impact Sound Pressure Level according to ÖNORM L`nT,w = 48 [dB]

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	18,6	20,0	
1	0,3 cm	Plaster	0,370	0,008	18,6	18,6	3,0
2	22 cm	Reinforced concrete (2%)	2,500	0,088	18,1	18,6	528,0
3	0,5 cm	Roofing bitumen	0,230	0,022	18,0	18,1	5,5
4	0,5 cm	Roofing bitumen	0,230	0,022	17,8	18,0	5,5
5	0,5 cm	Roofing bitumen	0,230	0,022	17,7	17,8	5,5
6	1 cm	Granulate mat	0,600	0,017	17,6	17,7	12,0
7	14 cm	XPS BG 30	0,038	3,684	-2,7	17,6	4,2
8	6 cm	Gravel beds 4/8	1,000	0,060	-3,1	-2,7	132,0
9	4 cm	Wood plat	0,130	0,308	-4,8	-3,1	27,6
		Thermal contact resistance*		0,040	-5,0	-4,8	
	48,8 cm	Whole component		4,370			723,3

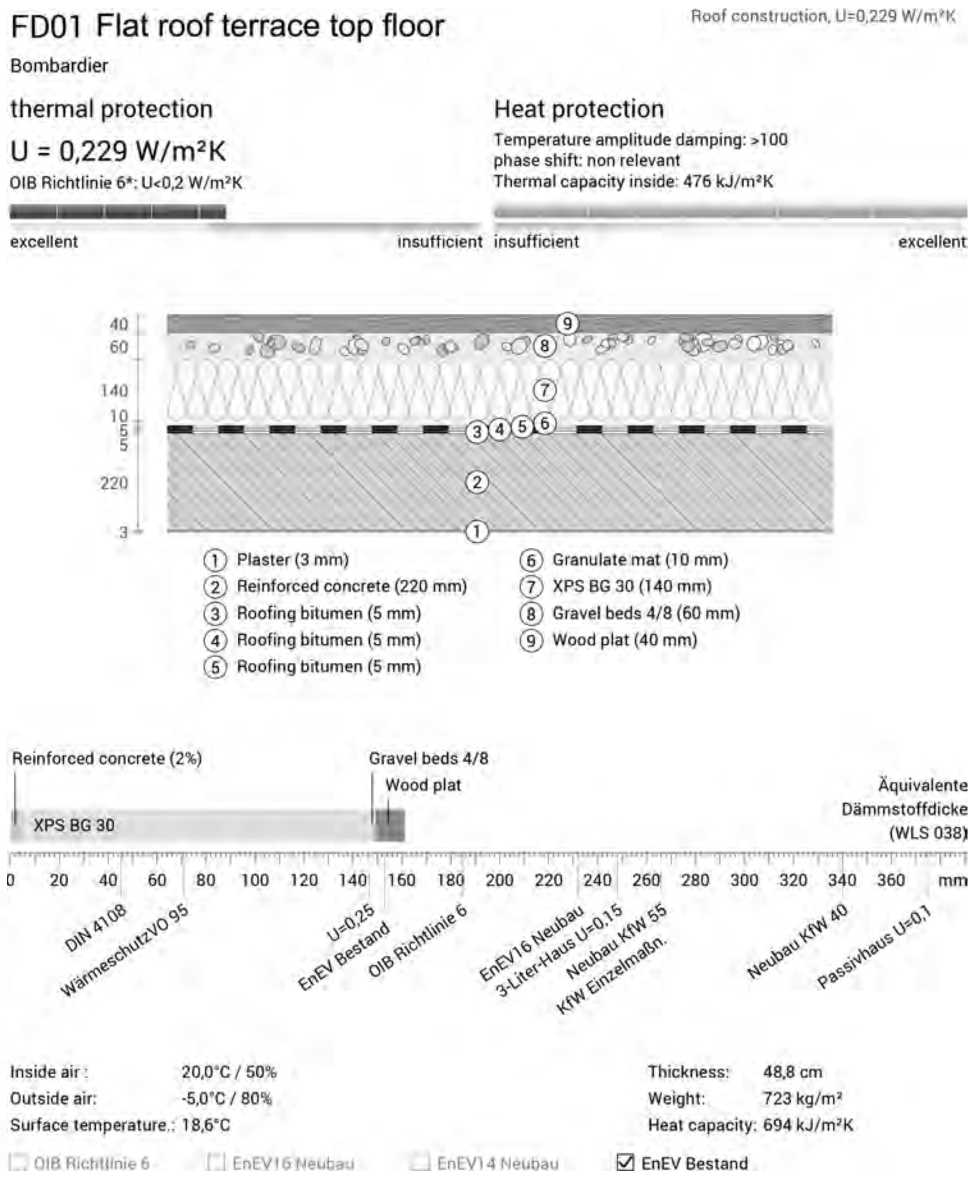


Figure 246: *Detail of the flat roof, by the author*

5) FD02 Extensive Green Flat Roof

The total roof structure is 61 cm thick. The top roof layer is a 10 cm thick substrate. 20 cm XPS-BG 30 material provides thermal insulation. A 20 cm reinforced concrete slab carries the roof load. The interior plaster is executed as a single-layer gypsum/lime plaster. The total U-value calculation of the roof with full thermal insulation results in a U-value of 0.174 W/m²K. The resulting value is about %13.5 lower than the required U-value of 0.20 W/m²K.

U-Value= 0.174 W/m²K

Weighted Sound Reduction index Rw = 62 [dB]

Required Weighted Sound reduction index Rw = 48 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =69 [dB]

Thermal storage by the building's mass m $_{w,B,A}$ = 291,67 kg/m

Weighted Standardized Impact Sound Pressure Level L`nT,w = 37 [dB]

Required Weighted Standardized Impact Sound Pressure Level according to ÖNORM L`nT,w = 48 [dB]

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	18,9	20,0	
1	0,3 cm	Plaster	0,370	0,008	18,9	18,9	3,0
2	22 cm	Reinforced concrete (2%)	2,500	0,088	18,5	18,9	528,0
3	8 cm	Concrete	2,000	0,040	18,4	18,5	192,0
4	0,5 cm	Roofing bitumen	0,230	0,022	18,3	18,4	5,5
5	0,5 cm	Roofing bitumen	0,230	0,022	18,2	18,3	5,5
6	0,5 cm	Roofing bitumen	0,230	0,022	18,1	18,2	5,5
7	20 cm	XPS BG 30	0,038	5,263	-4,2	18,1	6,0
8	0,5 cm	Filter fleece	1,000	0,005	-4,2	-4,2	0,0
9	4 cm	Drain mat	0,600	0,067	-4,5	-4,2	1,6
10	0,5 cm	Filter fleece	1,000	0,005	-4,5	-4,5	0,0
11	10 cm	Extensively planting	1,400	0,071	-4,8	-4,5	195,0
		Thermal contact resistance*		0,040	-5,0	-4,8	
	66,8 cm	Whole component		5,753			942,1

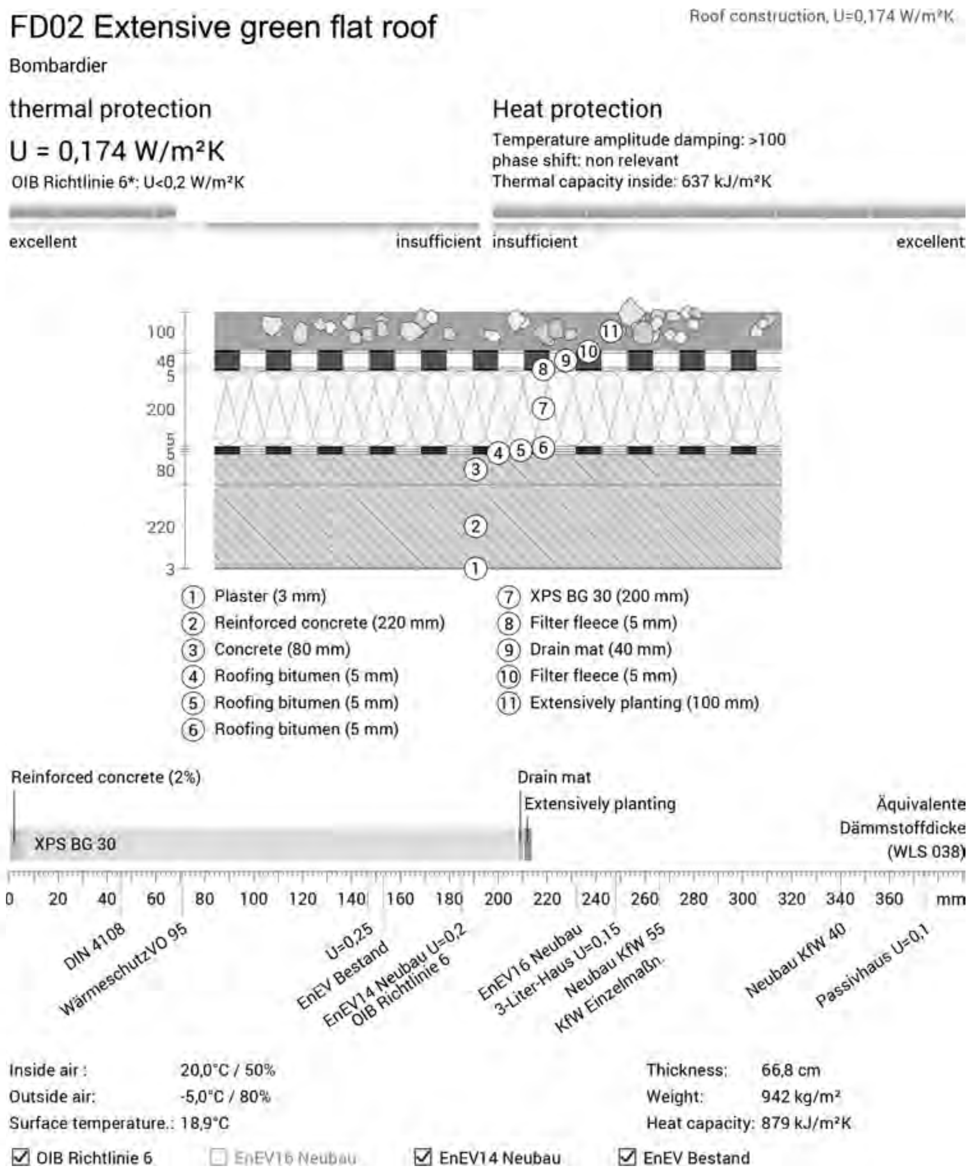


Figure 247: *Detail of the extensive green flat roof, by the author*

6) D01 Ceiling over Basement

The total ceiling is 48 cm. The top layer of the slab is 1 cm wooden floor finish. Under this layer there is 5 cm thick screed. 3 cm MW-T material provides acoustic insulation. A 25 cm reinforced concrete floor slab bears the load. 7.5 cm mineral wool thermal insulation has been installed under the load-bearing slab. The total U-value calculation of the floor slab with full thermal insulation has resulted in a U-value of 0.28 W/m²K ergeben. The resulting value has about 35% exceeded the required U-value of 0.20 W/m²K.

U-Value= 0.28 W/m²K

Weighted Sound Reduction index Rw = 64 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =67 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 103,69 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	20,0	26,7	
1	1 cm	Lamination	0,130	0,077	26,2	28,8	5,0
2	5 cm	Cement screed	1,400	0,036	28,1	30,0	100,0
3	0,05 cm	Vapor barrier sd=100m	0,220	0,002	28,3	30,0	0,1
4	3 cm	Impact sound insulation board	0,035	0,857	20,4	30,0	2,7
5	6 cm	Bundled fill	1,100	0,055	19,8	20,4	1,2
6	25 cm	Reinforced concrete (2%)	2,500	0,100	18,8	19,8	600,0
7	7,5 cm	Mineral wool	0,032	2,344	-4,6	18,8	1,5
8	0,03 cm	Plaster	0,370	0,001	-4,6	-4,6	0,3
		Thermal contact resistance*		0,040	-5,0	-4,6	
	47,58 cm	Whole component		3,611			710,8

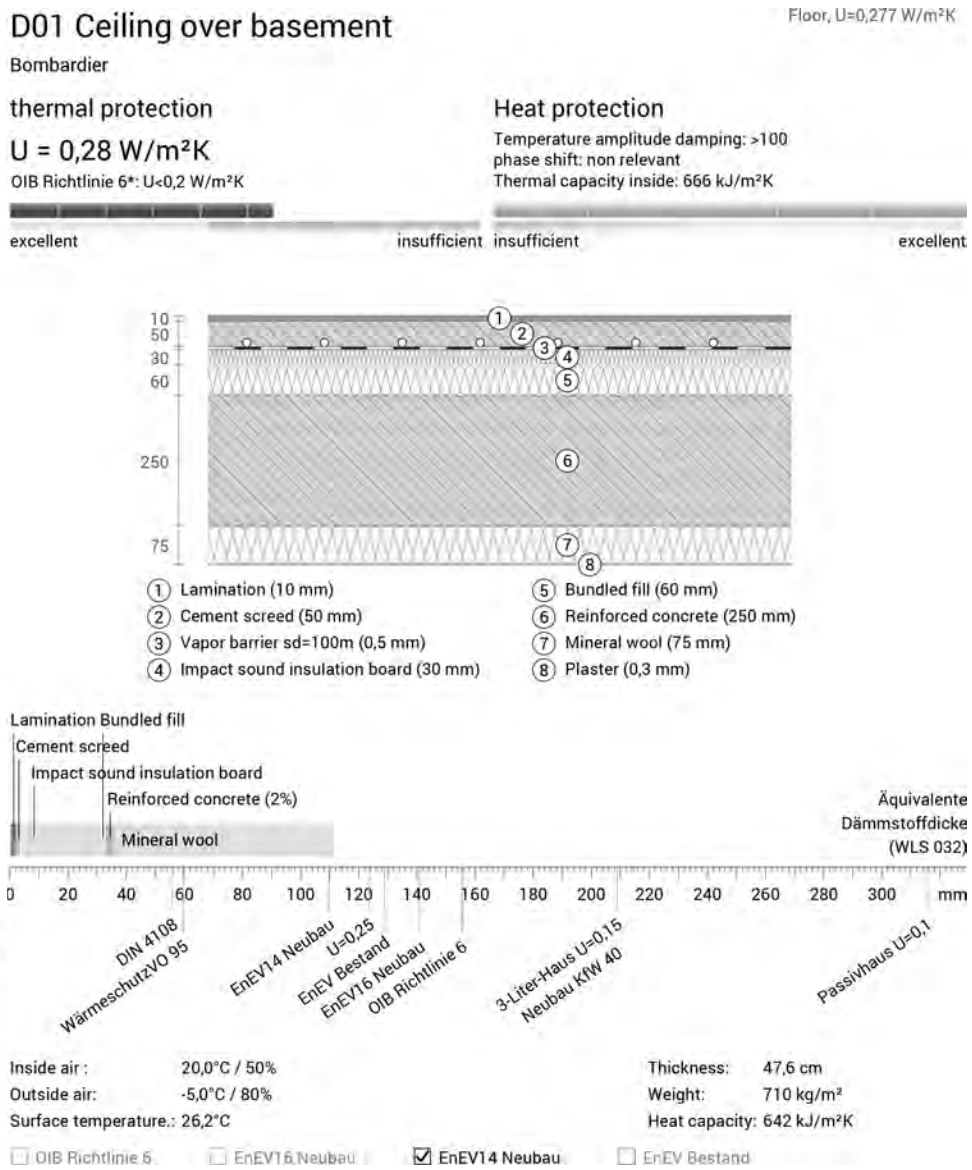


Figure 248: *Detail of the flat roof, by the author*

7) D02 Ceiling Over Playground / Hobby Room

The floor slab is 50 cm in total. The top layer of the slab is 1 cm wooden floor finish. Under this layer there is 5 cm thick screed. 3 cm MW-T provides acoustic insulation. A 22 cm reinforced concrete floor slab bears the load. 10 cm mineral wool has been installed under the load-bearing slab in order to provide thermal insulation. The total U-value calculation of the floor slab with full thermal insulation has resulted in a U-value of 0.22 W/m²K. The resulting value has about 10% exceeded the required U-value of 0.20 W/m²K.

U-Value= 0.22 W/m²K

Weighted Sound Reduction index Rw = 62 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =69 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 103,68 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperature [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	18,6	20,0	
1	1 cm	Lamination	0,130	0,077	18,2	18,6	5,0
2	5 cm	Cement screed	1,400	0,036	18,0	18,2	100,0
3	0,05 cm	Vapor barrier sd=100m	0,220	0,002	18,0	18,0	0,1
4	3 cm	Impact sound insulation board	0,035	0,857	13,4	18,0	2,7
5	6 cm	Bundled fill	1,100	0,055	13,1	13,4	1,2
6	22 cm	Reinforced concrete (2%)	2,500	0,088	12,6	13,1	528,0
7	10 cm	Mineral wool	0,032	3,125	-4,3	12,6	2,0
8	1,25 cm	Gypsum fibre board	0,320	0,039	-4,5	-4,3	14,4
9	1,25 cm	Gypsum fibre board	0,320	0,039	-4,7	-4,5	14,4
10	0,3 cm	Plaster	0,370	0,008	-4,8	-4,7	3,0
		Thermal contact resistance*		0,040	-5,0	-4,8	
	49,85 cm	Whole component		4,536			670,8

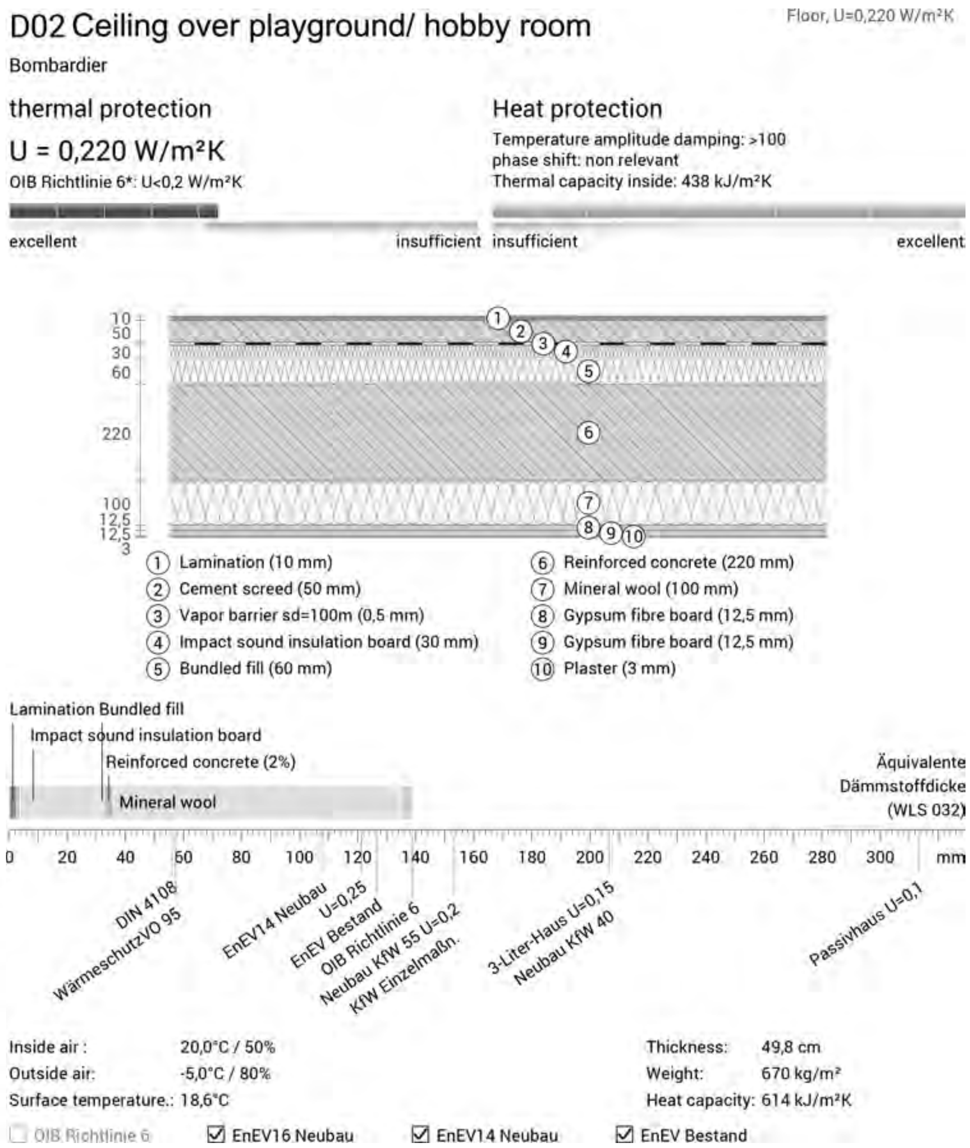


Figure 249: *Detail of the ceiling ovr playground/hobby room, by the author*

8) **ID01 Interior Dividing Ceiling**

The total ceiling structure thickness is 39.7 cm. The ceiling is clad with 1 cm thick wooden cladding. A 5 cm thick screed has been built under this layer. 3 cm MW-T provides acoustic insulation. A 22 cm load-bearing reinforced concrete slab carries the weight of the construction. The total U-value calculation of the ceiling with full thermal insulation is 0.76 W/m²K ergeben. No U-Value is required for interior ceilings.

U-Value= 0.76 W/m²K

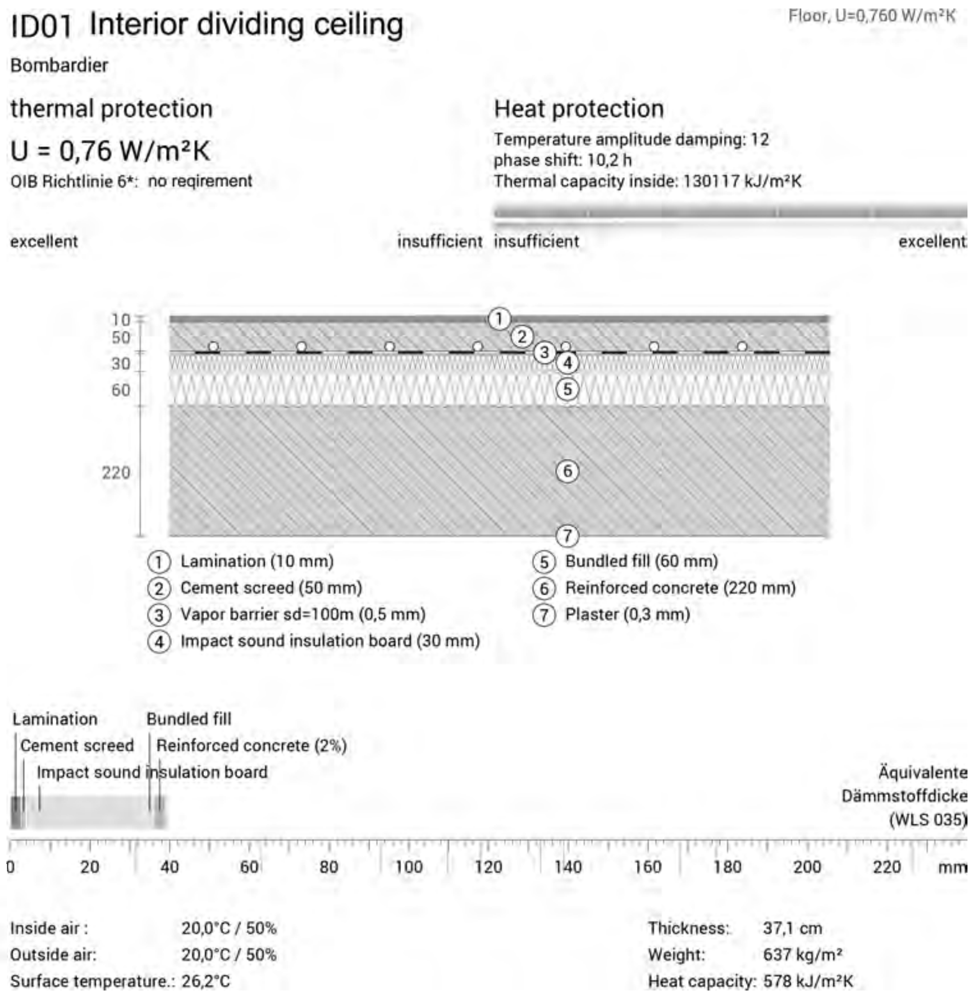
Weighted Sound Reduction index Rw = 62 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =69 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 87,78 kg/m²

Weighted Standardized Impact Sound Pressure Level L`nT,w = 20 [dB]

Required Weighted Standardized Impact Sound Pressure Level laut ÖNORM L`nT,w = 48 [dB]



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,100	20,0	26,6	
1	1 cm	Lamination	0,130	0,077	26,2	28,7	5,0
2	5 cm	Cement screed	1,400	0,036	28,1	30,0	100,0
3	0,05 cm	Vapor barrier sd=100m	0,220	0,002	28,4	30,0	0,1
4	3 cm	Impact sound insulation board	0,035	0,857	21,6	30,0	2,7
5	6 cm	Bundled fill	1,100	0,055	21,1	21,6	1,2
6	22 cm	Reinforced concrete (2%)	2,500	0,088	20,4	21,1	528,0
7	0,03 cm	Plaster	0,370	0,001	20,3	20,4	0,3
		Thermal contact resistance*		0,100	20,0	20,3	
	37,08 cm	Whole component		1,316			637,3

Figure 250: *Detail of the interior dividing ceiling, by the author*

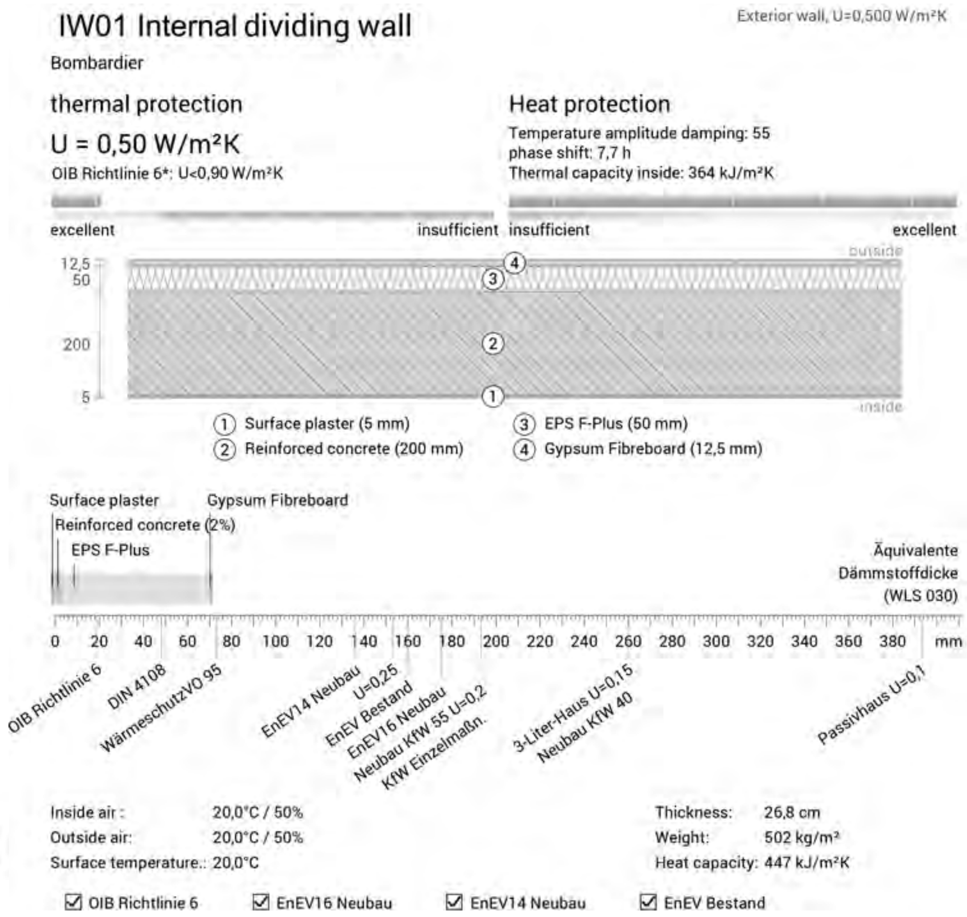
9) IW01 Internal Dividing Wall

The total thickness of dividing walls is 27 cm. The wall surfaces are plastered. A 20 cm thick reinforced concrete bears the load. It has been installed 5 cm thick mineral wool to the wall for thermal insulation. The total U-value calculation of the dividing wall with mineral wool between the dwellings results in a value of 0.50 W/m²K. The resulting value is about 45 % lower than the required U-value of 0.90 W/m²K.

U-Value= 0.50 W/m²K

Weighted Sound Reduction index Rw = 61 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 15,46 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	20,0	20,0	
1	0,5 cm	Surface plaster	0,111	0,045	20,0	20,0	7,0
2	20 cm	Reinforced concrete (2%)	2,500	0,080	20,0	20,0	480,0
3	5 cm	EPS F-Plus	0,030	1,667	20,0	20,0	0,9
4	1,25 cm	Gypsum Fibreboard	0,320	0,039	20,0	20,0	14,4
		Thermal contact resistance*		0,040	20,0	20,0	
	26,75 cm	Whole component		2,001			502,3

Figure 251: *Detail of the internal dividing wall, by the author*

- **Thermal Bridges**

1) Parapet For Flat Roof

The load-bearing system of the floor slab and the external walls is made up of reinforced concrete. The protrusion, which makes up the attic, is surrounded by thermal insulation. Thus, a protectionhas been created in a way to not allow any space between the insulation the reinforced concrete slab and the thermal insulation of the external wall. By extending the attic approximately 50 cm above the slab, the goal is to keep the cold air from the indoors. The external wall is covered with 14 cm thick EPS F-Plus insulation material, the slab to the unheated attic is covered with 20 cm thick XPS BG 30D insulation material. As observed from the 2D thermal bridge simulation, there is a negligible thermal difference at the corners of the indoor spaces.

2) Parapet for Terrace

The load-boarding system of the terrace and the external walls is made up of reinforced concrete. The protrusion, which makes up the attic, is surrounded by thermal insulation. Herewith, a protection has been generated in a way to not allow any space between the insulation of the reinforced concrete and the thermal insulation of the external wall. By extending the attic approximately 50 cm above, the goal is to keep the cold air from the indoors. The external wall is covered with 14 cm thick EPS F-Plus insulation material, the slab of the terrace is covered with 14 cm XPS BG 30 insulation material. As seen in the 2D thermal bridge simulation, there is negligible thermal difference at the corners of the indoor spaces.

3) Overhang Ceiling to Outside Air

As seen in the 2D heat simulation, the load-boarding system of the building is surrounded with thermal insulation. The 22 cm reinforced concrete slab is covered with 18 cm mineral wool insulation from the bottom, and the concrete wall is covered with 14 cm thick EPS F Plus insulation material. Thus, the heat losses are prevented, which would have resulted in thermal bridges at the interior corner junction between ceiling and wall.

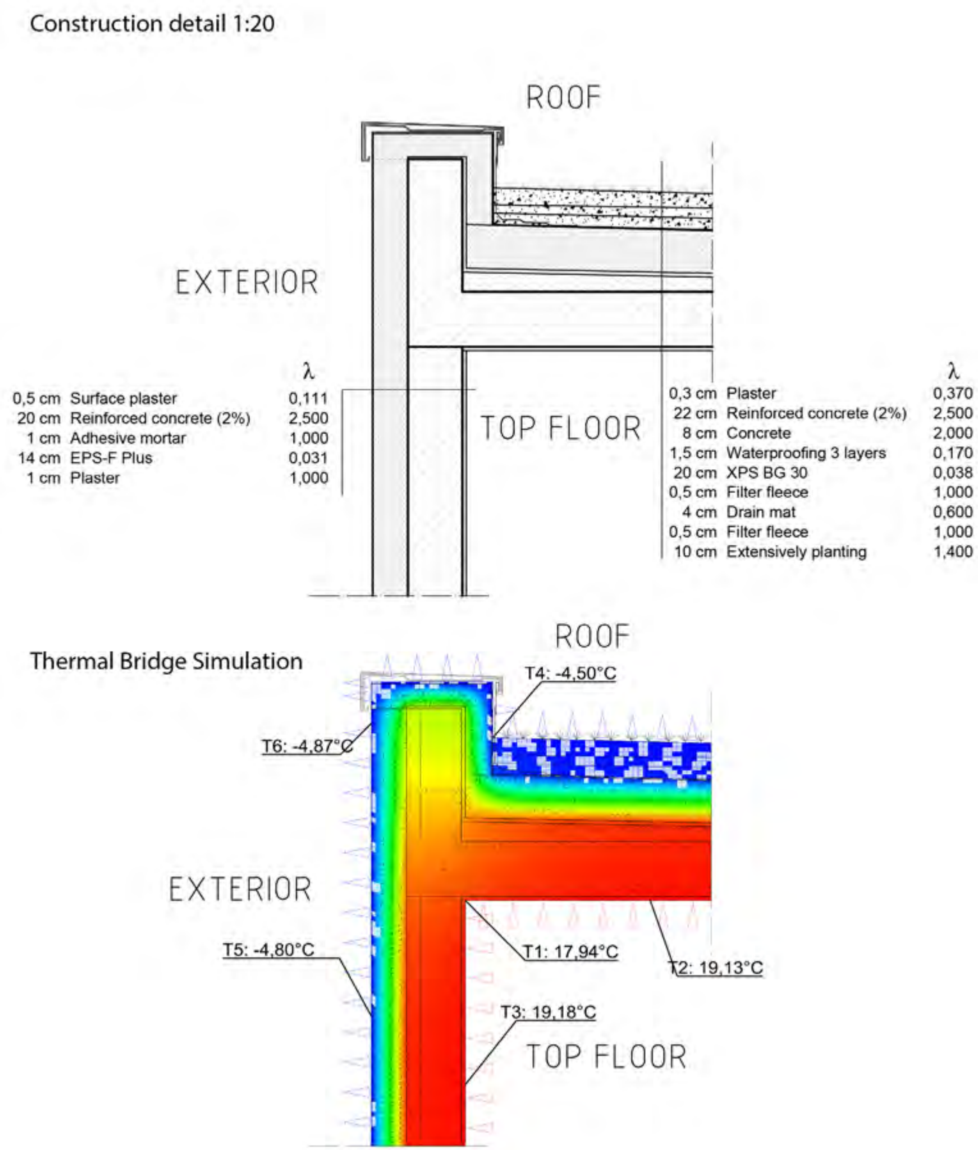


Figure 252: *Thermal Bridge Simulation, connection between flat roof and external wall, made by the author.*

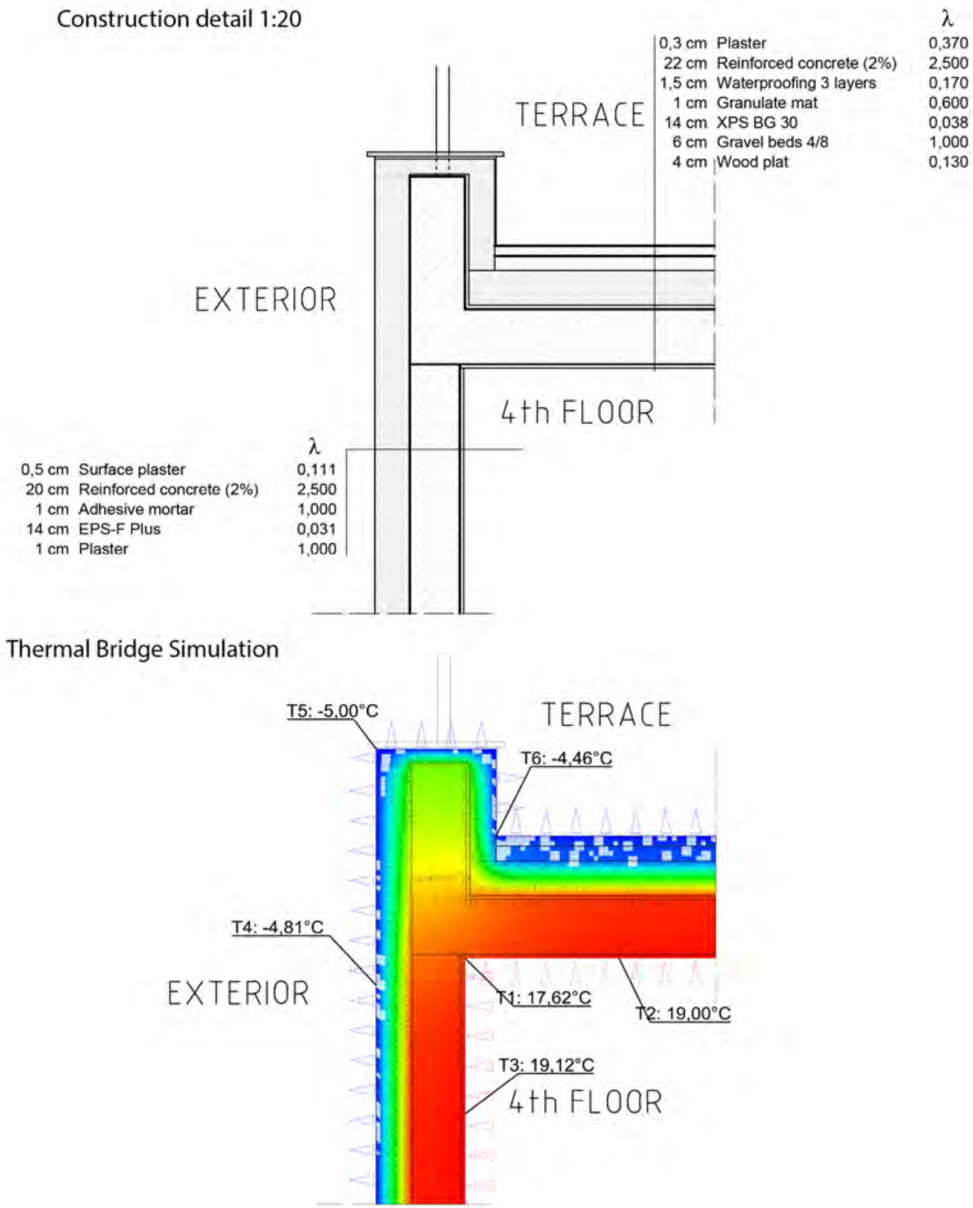


Figure 253: *Thermal Bridge Simulation, connection between terrace and exterior wall, made by the author*

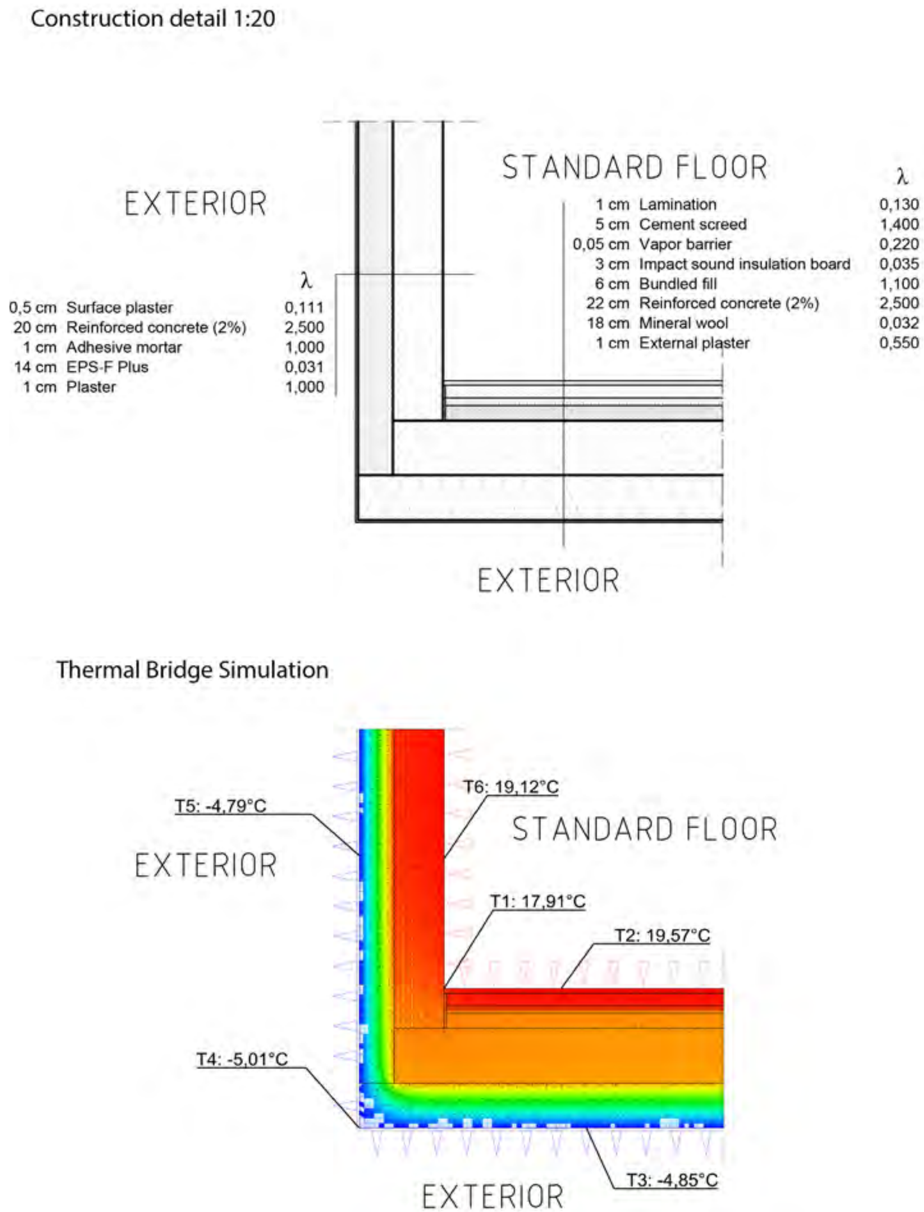


Figure 254: *Thermal Bridge Simulation, connection between overhang ceiling to outside air and exterior wall, made by the author.*

5.2.4. Heating- Hot Water

The building has been benefitted from district heating for space heating and for the domestic hot water demand. For the total building area of 2211.37 m², the annual domestic hot water and space heating demand is 96722.2 kWh/a. Heat losses from hot water distribution is prevented by insulating most of the hot water distribution pipes.

5.2.5. Solar Power Generation

No photovoltaic system has been used in the building.

5.2.6. Ventilation

Natural window ventilation has been foreseen and therefore no mechanical ventilation system is used in the building.

5.2.7. Solar Shading-Overheating in Summer

Jalousies , integrated in the windows are used in order to protect the indoors of the building. Moreover sliding wood panels of the balconies contribute to sun shading. In the summer, the indoor is protected structurally from the strong sun rays with the help of overhangs created by balconies or terraces. Overheating calculations and the position of the sun are shown in Figure 255, Figure 256)

Figure 255: *Overheating calculations of the rooms in summer, by the author*

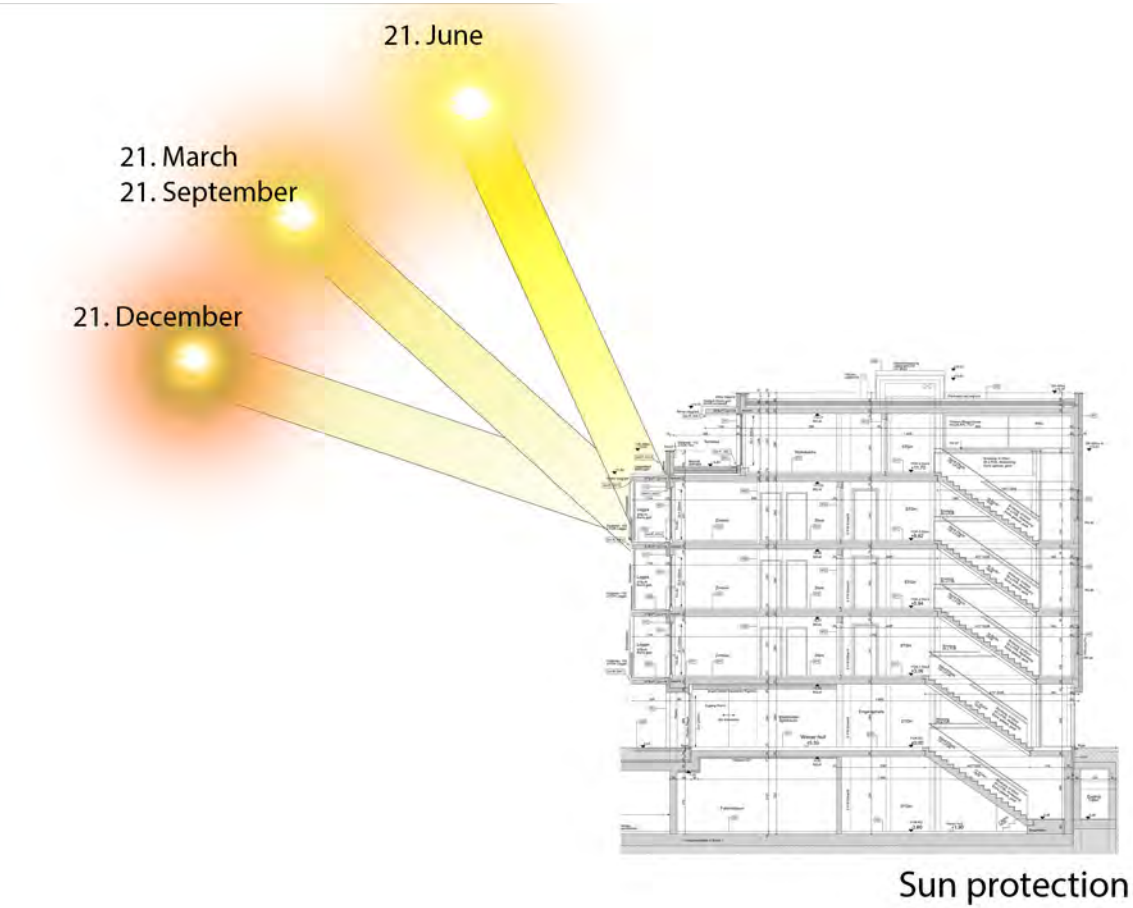


Figure 256: *Schematic representation of the position of the sun at different times., by the author*

Figure 257: *A view to the housing and the path in between, photo by Steiner Rupert*

Figure 258: *Housing, photo by Steiner Rupert*

5.3. Aesthetic - Visual Quality Analysis / AVQA

The Project won the Urban Development Ideas Competition 2006, "Bombardierareal", and was chosen as a fixed starter for the public property development competition "Bombardier Gründe".[64] The proportion and diversity of building blocks and sophisticated, differentiated garden design, led to a high degree of identity of the project. As a proof of its quality, the project has won many awards. The buildings have a dynamic facade with partially eternit clad, loggia cubes, some lifted geometries, and well-arranged windows. Moreover there is variety between the blocks themselves and also sliding wood panels of the balconies rescue the buildings from the danger of being monotonous. These sliding panels also present one prominent element which makes the project unique and attractive. (see Figure 257, Figure 258)

Some different vertical green elements of buildings are designed for aesthetic reasons, and accompany the side pathways and strengthen identification.

As a result, the diversity in buildings, in geometries, in material choice and the some protrusions which also of the project contribute to the aesthetic quality of the project.

- Does the scheme feel like a place with a distinctive character with an identity or does it seem like a reputation of other buildings in the surrounding? Y
- Is the settlement monotonous or attractive & exciting? Attractive & exciting.
- Is it a place which has a good visual impact? Y
- Has a landscape architect designed the open space and does it seem that there is consideration of open space quality? Y
- Is the housing area innovative, original, and creative, or ordinary? Y, it is creative and not an ordinary estate. Especially with additional green elements on the facade and with its movable wood elements of the balcony lead an extraordinary.
- Is an aesthetic concern visible inside and outside of the buildings? Do the materials inside have a distinctive character? Y, distinction inside is clear and the material choice presents a consideration of material choice.
- Are there some elements on the façade considered and designed especially because of aesthetic (concerns) in addition to the functional needs, or is the building just functional? Y, especially green elements and movable elements of the terraces are the products of aesthetic concerns.
- Is an architectural aesthetic provided through a visual impact in corridors and staircases of buildings with innovative space concepts, geometry movements or some other elements? Y, it has been applied different geometries to the components of the staircases, additional sitting places, diagonal walls and windows etc.
- Are sustainable and healthy materials used, and consideration of environmental design expression implemented apparent to the façade and general view of the design? It is difficult to understand it from the facade except the greenery growing on the green elements and wood panels of the balconies.
- Is the housing estate scale and concept compatible with surroundings (proportionally)? Y

64 Wohnhausanlage Satzingerweg 8a und 10, in Architekturjournal Wettbewerbe No:304, Bohmann Druck & Verlag, Vienna, 3/2012, pp. 72-75.

6. CS IV Toki Konevi Housing

TOKI- Mass Housing Administration in cooperation with Municipality of Meram

Figure 259: *Toki Housing Estate*

This is an urban renewal project which was carried out incrementally by the Prime Ministry Mass Housing Development Administration (TOKI) in cooperation with the Municipality of Meram (Meram Belediyesi). In the 1st stage of project, there were 23 blocks of flats consisting of 100, 150 and 195 square meter apartments. As for 2nd stage, it was built to exactly the same concept in the adjacent field. It ranged from 10 to 15 floors.

This project varies in scale from the other samples, however, it is about the same size as Bauträgerwettbewerbe (Housing Property Development Competitions) in Vienna, which allow different concepts within various housing applications. (Different projects were designed in implementation of Bauträgerwettbewerbe by dividing different sites which were designed by different properties and architects, while, in Turkey, everything is copied from the same building). This type of housing implementation is a very common and dominant practice, and is problematic in Turkey. Thus, it seems meaningful that this project is taken to be a case study.

The location of the project area is a quiet place where there is no overcrowding. There is a transition from low-rise building to high multi-storey building due to urban transformation in the region. Apartment types offered by the project do not show the kind of diversity which a large-scale housing project such as this should offer. The density of the multi-storey housing structure has negative impacts on the neighbourhood, and communication with the ground floor and garden is difficult, a general problem in large scale public housing projects (See Chapter IV. 1.10. "Proportion and Diversity of Living Units" in SHQ framework).

The implementation of this type of housing, which consists of the same types of buildings so causing repetition, has been increased in Turkey. This repetition can be seen in planning, as well as from the outside of the building. The floors consist of flats designed from copies and mirrors of the same plan. Therefore, it is a problem that some flats benefit from the position of the sun whereas others do not.

The site is protected by security guards at the entrance. There are playgrounds and sitting places in the garden of the site which was built on a wide area. A striking feature of the project is that the circulation of the children who play in gardens and the cars entrancing and exiting are not described distinctively and clearly. Additionally, a serious problem of these housing estates is that vehicles and pedestrians enter the garden from the same entrance and continue on the same path, which is not appropriate for safety. This situation creates a problem, especially for the children who can easily be passing through while a car is moving.

Figure 260: *Site plan (left)*

Figure 261: *Entrance of the site*

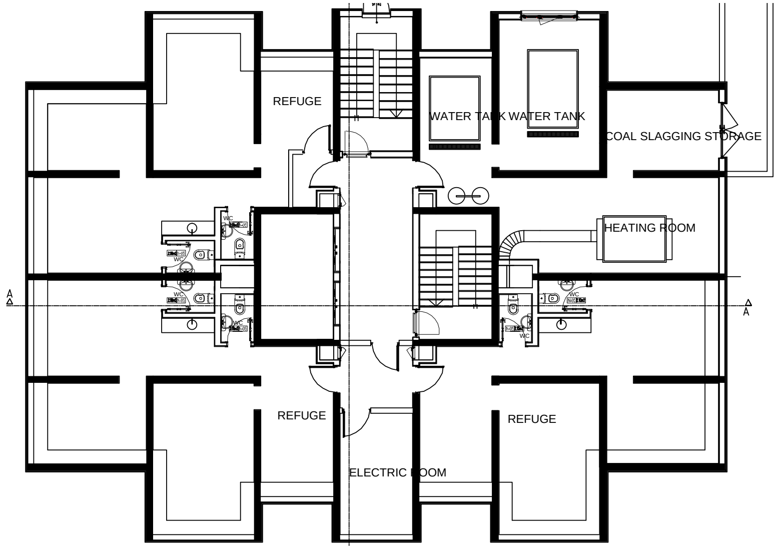


Figure 262: *Underground floor plan of the 100 m² dwellings*

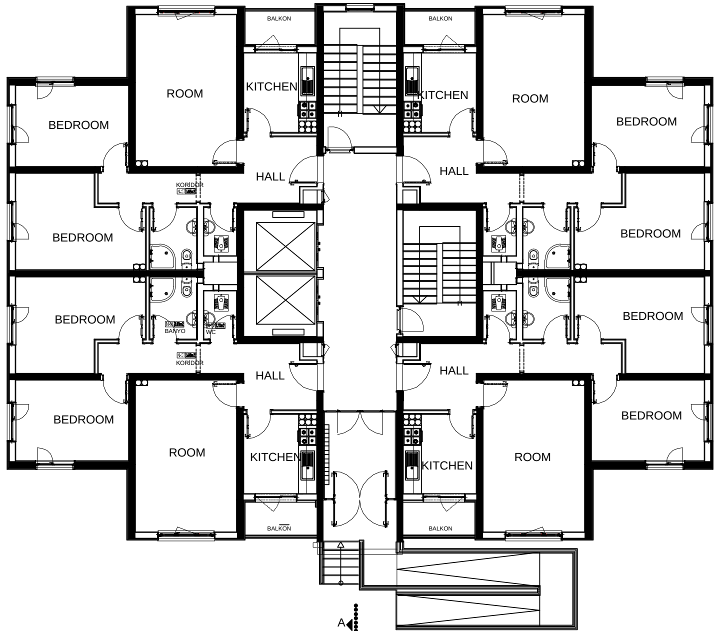


Figure 263: *Ground floor plan of the 100 m² dwellings*

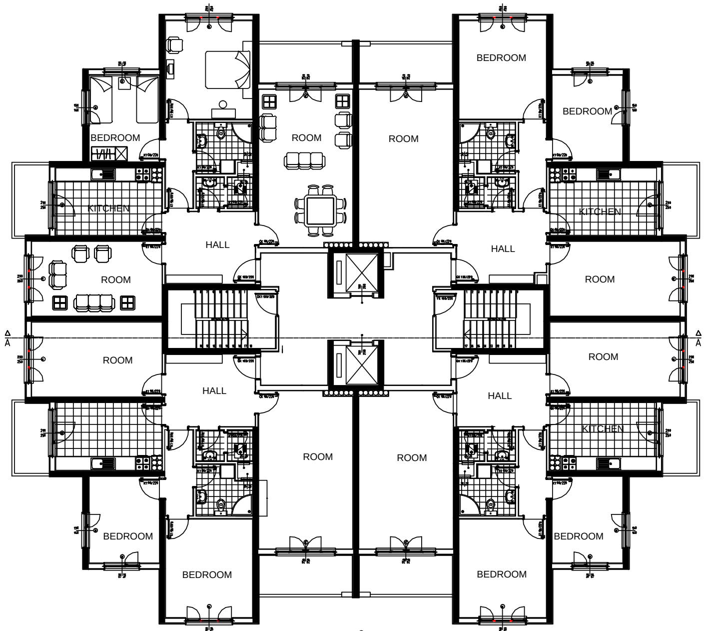


Figure 264: *Standard floor plan of the 150 m² dwellings*

Figure 265: *Standard floor plan of the 195 m² dwellings*

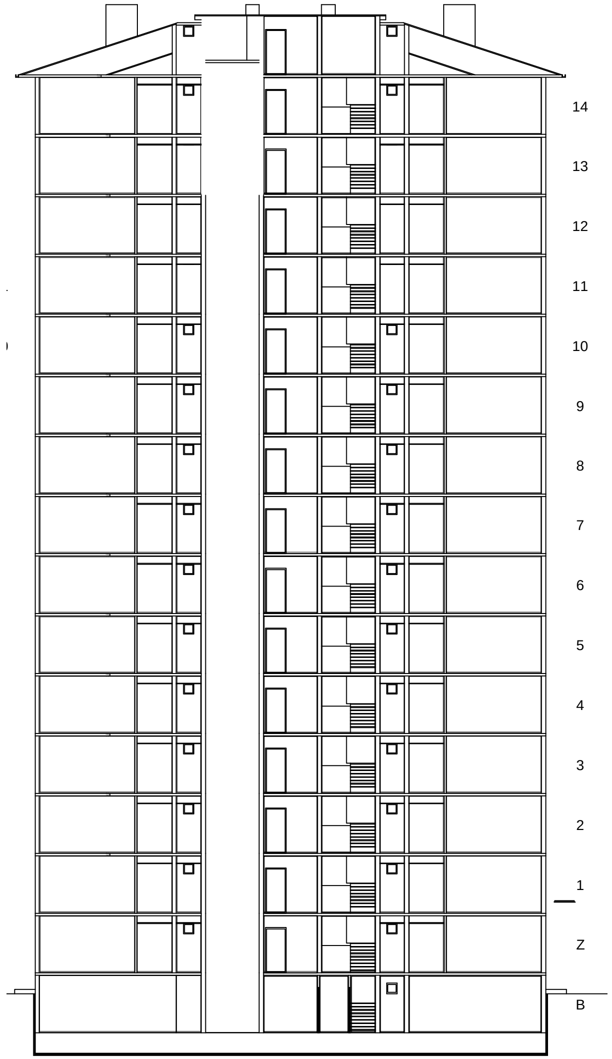


Figure 266: *Section of a building with 100m² dwellings*

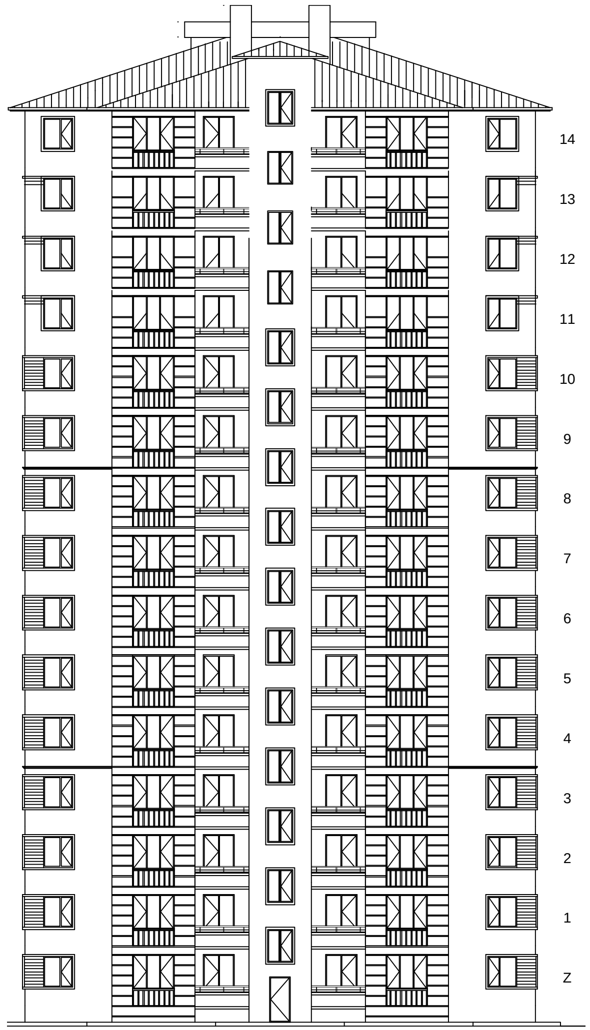


Figure 267: *Elevation of a building with 100m² dwellings*

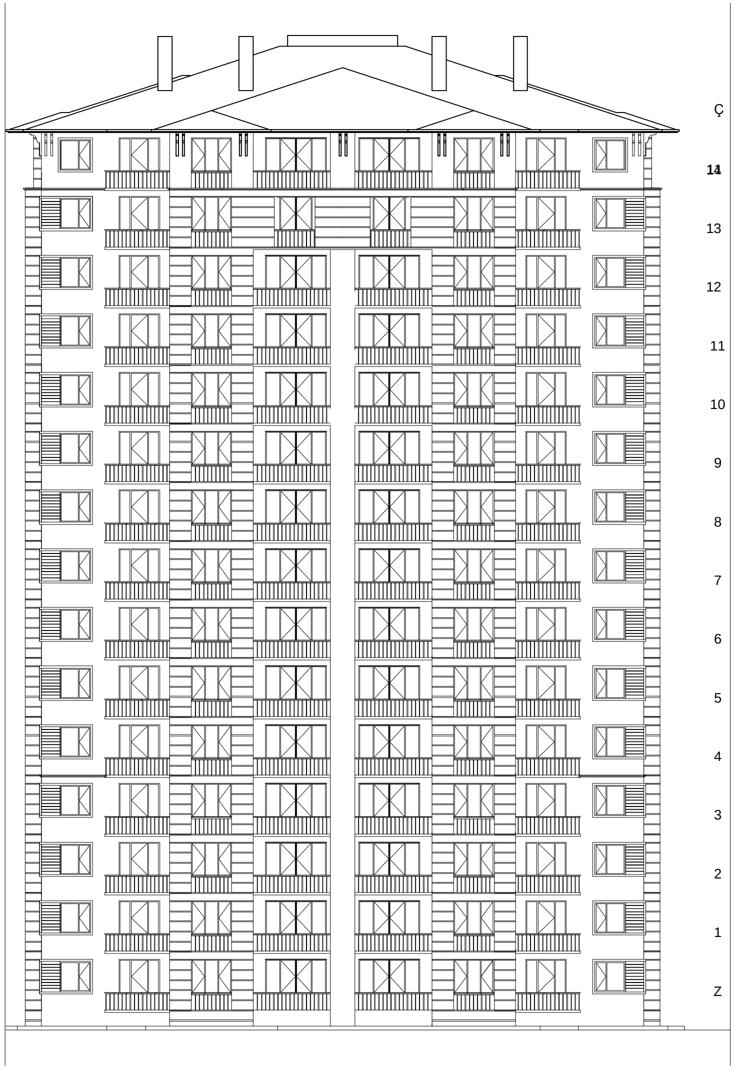


Figure 268: *Elevation of a building with 195m^2 dwellings*

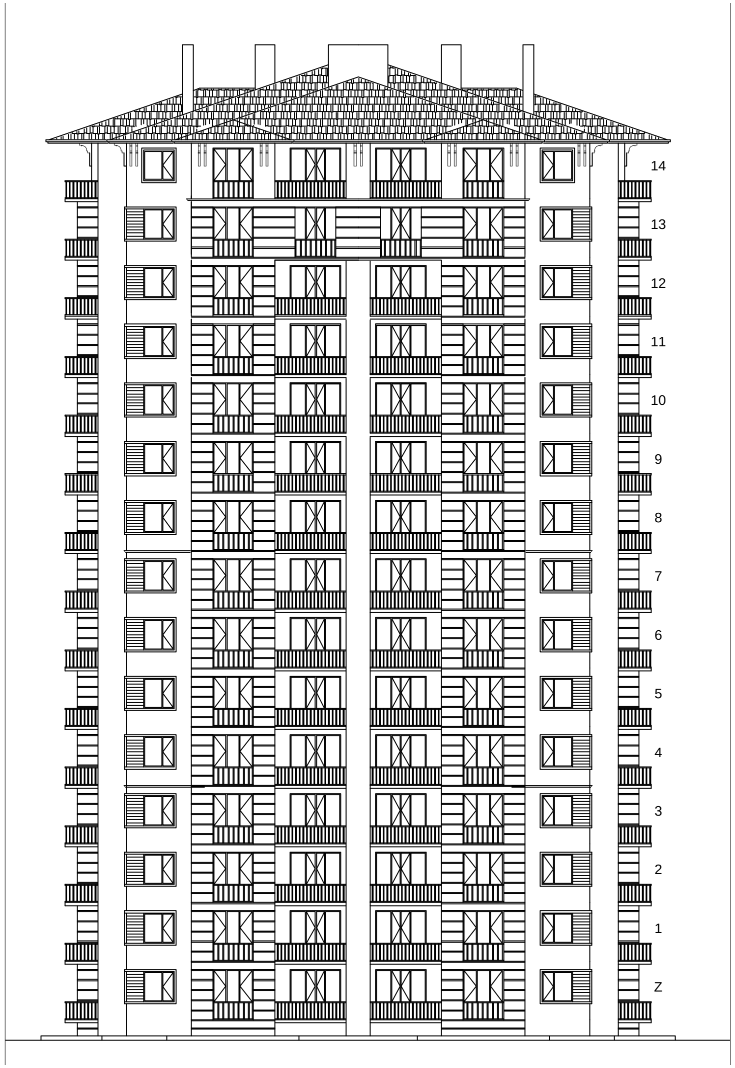
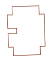
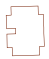
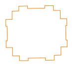
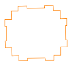
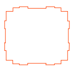
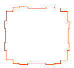


Figure 269: *Elevation of a building with 150m^2 dwellings*

TOKI KONEVI

BLOCK	TYPE	NUMBER OF STOREYS INC. GROUND FL.	NUMBER OF ROOMS IN A UNIT	UNIT SIZE	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
Block of 100 square meters dwellings		12	3	100 square meters	9	48	432
Block of 100 square meters dwellings		15	3	100 square meters	2	60	120
Block of 150 square meters dwellings		10	4	150 square meters	2	40	80
Block of 150 square meters dwellings		15	4	150 square meters	7	60	420
Block of 195 square meters dwellings		12	5	195 square meters	1	48	48
Block of 195 square meters dwellings		15	5	195 square meters	2	60	120
TOTAL					23		1220

TOTAL SITE AREA (exc. the roads between 3 housing group sites which compose big car parking area	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE Exc.private balconies	TOTAL NUMBER OF DWELLING
53124 m2	162960 m2	-	40814	1220

Figure 270: *TOKI diversity and density informations by the author. (Open space is calculated approximately according to the site plan).*

6.1. Social-Functional Quality Analysis / SFQA

6.1.1. Needs Oriented Design

It is a state-funded project, so reasonable prices have been presented with appropriate payment options, as with other TOKİ projects.[65] However, the diversity of unit types is lacking in the project, which leads to inefficient use of space. Big and small families live in the same housing types which leads to greater space consumption than necessary, which is a disadvantage for the ecological footprint. The planning of the flats was designed to meet the general needs of Turkish people, yet there are shortcomings in the project in terms of social-functional aspects, especially a lack of consideration regarding rooms for common uses.It is a necessary to diversify the functions of the common use areas, to consider and design better green and open spaces, and to provide some ease of use in order to improve the social-functional quality in such large-scale public housing. Unfortunately, this housing estate does not meet these requirements, perhaps partly because participation has not been a concept used to understand the different needs of different types of tenants.

Figure 272: *Stairs without daylight, by the author.*

6.1.2. Accessibility and Movement Circulation Concept

All of the buildings resemble each other and they were built amorphously thus creating a sense of loss after entering the site. Roads are not defined clearly and there are not any direction signs. Also, it is difficult to navigate if one cannot see the door numbers of buildings, because all of the buildings look like each other. The lack of safety for pedestrians and cyclists is a problem because they are on the vehicle road as soon as they enter the site. There is no traffic sign for vehicles to decrease their speed as a precaution.

Although kerbs are dropped where paths cross the road, especially for wheeled equipment, in some places, these are random, without infrastructure

Figure 271: *A ramp from car parking to the building entrance, by the author.*

and far from aesthetic. There have been some ramps built in an attempt to combat height differences of levels, but they are too steep and also do not have any handrails. Overall, there is a serious lack of accessibility.

As for the interiors of flats, the design of the corridors and stair enclosure do not benefit from natural lighting. The lack of daylight in these multi-storey buildings causes the loss of the attractiveness with regard to the stairs, and increases the use of elevators which, results in the reduction of dialogue and movement, and leads to social and physical adversities.

Materials used in the circulation routes of the buildings do not have a clear distinction. Materials and colours are designed in similar nature, and material order is not intended to affect guidance positively.

- Is it easy to understand how to enter and move about the site? N
- Are there orientation tables? N
- Are handrails for essential steps and communal stairs with a

65 http://www.toki.gov.tr/, access: 05.08.2015.

maximum rise of 170mm and minimum run of 280mm? Y

- Is there a lighted canopy over the main entrance? Y
- Do circulation areas receive good daylight? N(See Figure 281)
- Is adequate wheelchair access possible on the site, apartments, and dwellings? Are there ramps or lifts? N
- If there is ramp, does it provide a maximum slope of 6%, 120 cm clear width, movement area at the end of 150 x 150cm and a handrail height of 85 cm? N
- Is there enough manoeuvring space for wheeled equipment in entrances and corridors? Y
- Are there facilities for people with visual or auditory disabilities? N
- Is access for fire, ambulance, and other services adequate? Y
- Is there a distinction and identification of functions (e.g. lighting, choice, and materials)? N
- Is there a differentiation of architectural elements by colour or materials (e.g. walls and ceilings)? N
- Is there figure-background contrast (e.g. symbols and letters)? N
- Is there functional use of colours and materials to support spatial orientation, recognisability and identity? N
- Does the movement concept aim to minimize vehicle flows and speeds within the housing estate and discourage through vehicular traffic? N

Vehicles

- Is the hierarchy of routes clear? N
- Are road, place and building names, and unit numbers clear, visible, legible, and sited appropriately in relation to buildings? Y
- Do routes take advantage of vistas/landmarks within or around the project site? N

Figure 273: *Access routes with pedestrians and cars, by the author.*

Figure 274: *A view to the entrance of the building, by the author*

- Are appropriate traffic calming measures used to control vehicle speed? N
- Is vehicle segregation possible to help pedestrians to use safe routes? N
- Can large, emergency, or service vehicles come within 30m of all front doors of units or flats? Y
- Do routes facilitate and encourage cycling? N

Pedestrians

- Are public spaces connected by clear, well lit, and hard surface routes? N
- Is lighting appropriately related to buildings and easy to maintain? Y
- Are kerbs dropped where foot paths cross roads? N
- Do pedestrian routes and garden paths have a minimum width of 900 mm? Y

Access to the unit

- Do pedestrian routes and garden paths have a firm, even, slip-

Figure 275: *Entrance of a building, by the author*

Figure 276: *A car in the pedestrian route, by the author.*

Figure 277: *Entrance to the staircase, by the author*

resistant finish, and distinctive texture and colour? N

- Are kerbs dropped for main footpaths and access positions? Y
- Is convenient wheelchair access provided from park space? N
- Are all slopes gentle provided with a level platform of 1200 x 1200 mm clear of door swing to external doors? Y

6.1.3. Efficiency of Planning

The view of the flats is wide, hence the apartments get enough daylight. However this comfort could not be implemented in the circulation routes of the buildings which, in contrast, have no daylight.

Efficiency of planning can be positively affected if diversity of housing types is provided for a public housing project on this type of large scale. The increasingly common high mass-housing structure type in Turkey- also within the allowance of the housing laws- demonstrates itself prominently in this project. As a result of this overly intensive construction type, the neighbourhood is affected negatively, the amount of green space per capita decreases, and it becomes difficult to ensure the relief which should be provided in residences.

Gardens in this area does not present a well, maintained and defined space impression. A garden should create open space, but it is obvious in this case that this space is not a product and more effort should have been taken.

- Does the overall design have a challenge and a goal? N
- Is the location favourable to housing with suitable functions for people? N
- Are adequate facilities for universal access provided between floors with clear traffic routes? Y
- Is there sufficient capacity in corridors, stairs and lifts? Y
- Is there sufficient capacity for individual rooms (doors which open in a convenient direction without traffic routes through occupied

Figure 278: *View to the garden and car parking, by the author.*

Figure 279: *Environment of the site, by the author.*

areas)? N

- Is an efficient layout provided, i.e. short walking distances because related functions are grouped near one another? N
- Have functions requiring natural light been located against an outside wall? Y
- Has the space required to place and use furniture been an important attention point for both fixed and mobile furnishings? Y
- Are sufficient vertical dimensions provided for ceiling height, clear headroom for doors, height of worktops and kitchen cupboards? Y

6.1.4. Flexibility

The apartments are not suitable for possible changes in the future and they have not been designed in the planning stage according different circumstances of usage. The interior walls are not load-bearing, but also the material cannot easily be demolished without intrusive interventions. Variety of planning is not available in apartments, which have been designed in the same sizes and layout.

- Has flexibility been a consideration in designing? N
- Can the plan of the units be adjusted to circumstances? Is it possible to make the rooms and dwellings larger or smaller than

they are? N

- If possible, can these changes be made easily without intervention of architectural elements (ceiling and floor)? N
- Are different furnishings possible in the rooms? Y
- Is it possible to change the functions of the rooms? Y
- Are the load-bearing inner walls avoided as much as possible? Y

6.1.5. Safety

The building site is a gated community. The security guards in the entrance provide the security to the site. However, it is difficult to achieve a real safety coverage because of the large number of buildings on the site. The vehicle and pedestrian circulation is not distinct, posing a serious problems such as accidents in terms of security. After entering the site from the main road, the vehicular traffic continues, and this constitutes a disturbance. For example, the scenario of a child playing in the playground that may then pass across the road increases anxiety in the area.

- Are main access points secured (with an alarm, with guidance)? Y, but it does not work very well
- Are public areas overseen to make people feel safer and in control to anticipate possible dangers, especially within children playgrounds? Y
- Are balconies of dwellings safely protected against the risk of break-in? Y
- Are all external doors and windows sufficiently fixed? Y
- Is safe transportation of people and goods provided vertically and horizontally to manage and prevent the possibility of falls, being trapped or injured with: non-slip floor finishes /adequate lighting for corridors and stairs/ handrails and banisters where appropriate? N
- Has it been considered that doors and windows do not open onto the circulation routes? N
- Fire safety: Is prevention of fire outbreak with a quick and safe escape possible? / Are fire-resistant materials used to limit fire spread? Y, but fire resistant materials are used in fire escape zones.
- Is safety glass used instead of ordinary glass? N

6.1.6. Health, Well-being, and Comfort

When buildings were examined in detail in terms of energy and construction, it can be seen that the necessary sensitivity was not displayed for sound insulation (see also energy and construction quality analysis of the projects). That means, sound insulation has not been applied efficiently to building construction in order to muffle the sound coming from outside and other dwelling units.

The circulation routes, which also includes staircases, are in the core of the building. This leads to lack of daylight and natural ventilation. These circumstances are disadvantages for comfort and well-being.

The garden and open space of the housing estate does not have a relaxing effect because it has not been looked after well. The traffic on the street continues inside the site border and is a cause of stress through sound and sight.

- Has sound insulation of walls been considered and applied? N
- Has sound insulation of ceilings been considered and applied? N
- Has sound insulation of windows been considered and applied? N
- Are bedrooms placed so that they are not adjacent to shared internal areas? Y
- Are bedrooms protected so that they are not adjacent to the bathing/living areas of neighbouring units? Y
- Are noisy communal equipment placed farther than 3m away from


Figure 282: *Garden, by the author.*


Figure 280: *Garden, by the author.*


Figure 281: *Staircases in the core of the building*


Figure 284: *Sitting places in the garden.*


Figure 283: *Garden, by the author*

doors or windows (e.g. lifts and plant equipment)? N

- Do living room windows receive good daylight? Y
- Do kitchen windows receive good daylight? Y
- Do all bathrooms have a window? N
- Do corridors and stairs of apartments receive good daylight and natural ventilation? N

6.1.7. Open Space

The garden area has not benefited sufficiently. It is an advantage to have a few sitting places in the garden, but its surroundings are not well-maintained which leads to a lack of atmosphere and the feel of a liveable and relaxing open space. There is not enough green close vicinity to the project, and it does not have natural parks and playgrounds. Rubbish bins have been placed at the entrance of the blocks, which affects the ambience in a negative way.

The flats have balconies, and this is beneficial to bring the open space closer to the dwellings. Furthermore, it is effective for the continuation of the balcony culture that the public is used to. Nevertheless all balconies are mass production in the same sizes, there are not different types of private balconies regarding sizes and function, such as private terraces in upper floors and private terrace gardens at the ground floor. This could result in a diversity which the inhabitants would benefit from if it had been offered.

As a result, open space quality could be better with better care of gardens and with more planting possibilities including more trees, flowers, and even vegetables, benefiting greatly the inhabitants of the estate.

- Has a qualified landscape architect been employed to create or assess the landscape design? N
- Is water (a pool, stream or a fountain) incorporated into the site and appropriately protected? N
- What is the ratio of open areas to the sum of dwellings? 0.25 (But this open space includes a large amount of car parking areas)
- Does the general image of the open spaces seem natural and green? N
- Do some flats have their own private garden? N
- Is there a common roof terrace? N
- Is there roof planting? N
- Are materials used in the open space natural? N
- Is there any possibility for tenants to grow their own plants in the garden? N
- Does the position of lighting prevent pools of darkness where people walk both outside and in communal areas of buildings? Y
- Are refuse and bin storage areas convenient and inconspicuous in the open space? N

6.1.8. Common Rooms and Facilities

Sitting places and the playground in the garden are the only possibilities to support the communication of the people. Additional community rooms or facilities for people have not been designed and are, therefore, absent.

- Is there a common room for inhabitants with a kitchen? N
- Is there a closed playground for children? N
- Is there a launderette? N
- Is there a fitness area? N
- Is there a sauna? N
- Is there a cinema? N
- Is there a theatre? N
- Is there a library? N
- Is there an atelier? N
- Is there any play equipment or games room for young people (e.g. table tennis, ropeway.)? N
- Are there any other common rooms except those mentioned? N

6.1.9. Children's Playground

Playgrounds for children have been provided in the garden of the housing. There is various equipment in the playground, but the lack of a sandpit is an important deficiency. Designing sandpit in playgrounds is unusual in Turkey, but it should change because it is an important addition, especially for small babies and their families who are pleased to spend time there. Playgrounds are neither innovative, nor made from natural materials. They are made of plastic and their design is very standard and can easily be found in all housing estates in the city.

The paths around the parks and between the buildings allow activities for

Figure 285: *Playground 1, by the author.*

Figure 286: *Playground 2, by the author.*

Figure 287: *Playground placed near to the car park.*

children such as cycling and running. However, as before stated, the car entrance to the housing site is without distinction from pedestrian and some car parking are near to the playgrounds, which could be said to be inconvenient at best, and potentially dangerous at worst, for both children and residents.

Moreover the absence of an indoor playground is a major deficiency for such a large scaled and state-funded project.

- Is the site location appropriate for children? N
- Is the playground large enough for the whole residential area? N
- Is there a sandbox? N
- Have material / design creativity been considered? N
- Are the materials healthy (plastic/wood)? N, plastic
- Are playgrounds separated according to age groups? N
- Are play areas provided within sight of families? Y
- Is energetic play provided for e.g. by an adventure playground or cycle paths? Y
- Is there any other playground close to the site? N

6.1.10. Proportion of Buildings and Diversity of Living Units

The proportion of buildings is not convenient for housing because it has a huge density, with its vertical and horizontal high-density structure. With four apartments on every floor and the large number of storeys, there is an intensive density in every block which is a disadvantage for the neighbourhood. This huge density included in high building blocks does not provide a liveable habitat for tenants, decreases contact to the garden and communication between people, as stated in SHQ. Furthermore, high buildings do not encourage communication as well as low-density neighbourhoods, and the closed stair enclosure affects this negatively because it does not encourage stair use.(See Chapter IV, 1.10)

There are buildings with 10, 12, 15 stories which make up large numbers of the similar buildings, 23 in first phase, and almost the same in the second phase, which includes dwellings with sizes 100, 150, 195 m2.[66] However, these types are grouped in each building and do not mix. Because

66 Information according to the plans of the project.

of these horizontal and vertical copies and mirrors of the same types, architectural specific solutions and the right orientation to the sun have not been provided. Moreover due to this lack of design variety, bringing people together with different backgrounds has not been supported. This huge site with only three different floor plans, of which only one of each is offered in a building, have caused repetition in housing and a lack in architectural quality.

- Do the plans of different units have different sizes and characteristics for small/big families? N
- Are there different floor plans of different blocks in the housing estate? N
- Are different aged inhabitants encouraged in the project? N
- Are there maisonettes? N
- Are there dwellings with a garden or terrace? N
- Do some dwellings have a balcony? Y
- Do the balconies of different dwellings have different sizes? N
- Is the vertical proportion of buildings appropriate to the human scale, and is communication of buildings with the ground supported? N
- Are the buildings not more than eight storeys high? N, they are more than eight.

6.1.11. Storage, Parking and Waste Services

The basement floor of the buildings has a large refuge as it is obligatory for the housing projects in Turkey according to construction law, but buildings have no storages for the dwellings and no underground parking. There is an open car parking area which spreads across to the garden of housing. According to the interview with Gül Yel, who is a tenant from the housing, she indicates that they suffer from car-parking problems and it would be very convenient if an underground parking had been designed. She adds

Figure 288: *Parking bicycles on the pavement.*

Figure 289: *Dust bin in front of the entrance.*

Figure 291: *Car parking*

Figure 290: *Parking bicycles*

also that they do not have storage in the housing which she makes clear is essential.[67]

Also, many bicycles can be seen placed without order. Although there are some open bicycle parking places, there is not any closed room specifically for this function. The lack of a storage for buggies is also perceived.

Moreover, having garbage in front of the entrances of the buildings is not aesthetic and convenient. The janitor ,who has a dwelling at the top of the building block, collects and disposes of the waste which is put in front of the dwelling doors. Therefore, there is not a regular residential trash

67 A short interview of the author about the impressions of Gül Yel. Date: 17.07.2015.

Figure 292: *Car parking*

removal service.

- Are there storage spaces in dwellings? N
- Is there separate storage for each unit outside of the dwelling? N
- Is there a bicycle storage and is it barrier-free for disabled people? N
- Is there storage for prams, buggies and wheel chairs? N
- Is the refuse and bin storage area convenient and well arranged? N
- Is it encouraged through design to collect waste separately? N
- Is there a minimum of one parking space per unit? Y
- Is there underground parking and is it secure? N, there is not.
- Is there any car parking available for disabled people? N

6.2. Energy performance and Construction Quality Analysis/ ECQA

6.2.1. Overview

	Building features	TOKI				
	Energy Reference area[m²]	**8700.00 m²**				
	Gross floor area[m²]	**10875.00 m²**				
	Brutto-Volumen[m³]	**31755.00 m³**				
	Building enveloping area [m²]	**9452.12 m³**				
	U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
	Average U-Values[W/m²K]	1.35 [W/m²K]				
Exterior Wall	AW01 Exterior brick wall	0.39 [W/m²K]	51 [dB]			69.48 [kg/m²]
	AW02 Exterior concrete wall	0.47 [W/m²K]	51 [dB]			264.32 [kg/m²]
	AW03 Exterior concrete wall to the staircase	2.39 [W/m²K]	48 [dB]			76.52 [kg/m²]
Roof	OD01 Ceiling to attic	0.51 [W/m²K]	61 [dB]	70 [dB]		195.14 [kg/m²]
Ceiling	ID01 Interior ceiling against unheated basement tiles	0.47 [W/m²K]	55 [dB]	76 [dB]		66.09 [kg/m²]
	ID02 Interior ceiling against unheated basement lamination	0.44 [W/m²K]	45 [dB]	77 [dB]		101.15 [kg/m²]
	ID03 Interior Ceiling tiles	0.47 [W/m²K]	43 [dB]	79 [dB]	77 [dB]	102.21 [kg/m²]
	ID04 Interior Ceiling (laminate)	0.63 [W/m²K]	54 [dB]	78 [dB]	73 [dB]	67.62 [kg/m²]
Interior Wall	IW01 Internal dividing wall	2.39 [W/m²K]	62 [dB]			187.71 [kg/m²]
	Glass	2.30 [W/m²K]				
	Windows	2.20 [W/m²K]				
	A/V	0.3 [1/m]				
	n50[1/h]	2.5 [1/h]				
	Ventilationtype	Natural ventilation				
	Heating type	Natural gas, boilers, radiators				
	Total heating demand[kWh/m²a]	**74.07 [kWh/m²a]**				

Figure 293: *Overviw of the quantitavie values of the building components of Toki Konevi, made by the author.*

6.2.2. Form and Orientation

The mass housing project, which has been designed in 2013 by Toki, contains 23 buildings in 3 different sizes. There are 1220 flats in all 23 building blocks. The ground floor areas of the buildings are 406m², 607m² and 793m² respectively. The number of buildings floors varies as 10, 12 and 15, and are constructed on 76,062 m² of area. In this part, the biggest block of these buildings has been analyzed.

The buildings forms are not attached to each other, so they can receive sunlight from every side. The dimensions of the contour of the building are 31.35m x 27.95m, and there are many shifting (Indentations or protrusions) on the building facades . All 15 floors of the building have repeated the same floor plan, which results a straight style vertically. A pretty wide corridor connects two stair enclosures and two elevators, which are localized at the center of the building. 195 square meter dwellings exist around this corridor in a 2-axis symmetry. Four flats are copied on each floor, which have equal sizes. These dwellings get daylight from two main directions. Every room can benefit from daylight except bathrooms, toilets, and corridors.

The main load-bearing structure of the building are reinforced concrete shear walls. The dividing walls inside the building are made up of bricks.

The roof of the building has been designed in accordance with the protrusions on facades and in the form of a hipped-roof.

The ratio of surface area of the building to the volume (A/V Ratio) is 0.30.

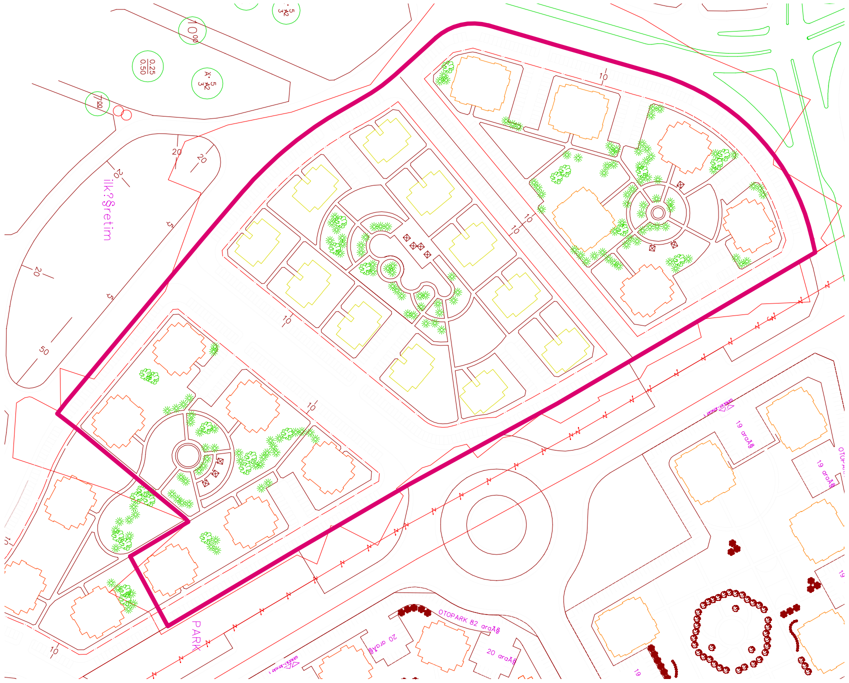


Figure 294: *Site plan*

6.2.3. Building Compenents U-Values, Thermal Bridges and Airtightness

- **Building Components, U-Values, Acoustic**

1) AW01 Exterior Brick Wall

The total thickness of the exterior wall is 29 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. The load bearing system has been designed as skeleton construction including reinforced concrete columns and 20 cm thick brick walls, which mainly have a dividing function. The façade has been insulated with 5 centimeter XPS. A single-layer exterior plaster has been used with a silicone resin float finish as a fine plaster. The total U-value of the thermally insulated exterior wall is calculated as 0.39 W/m²K. The resulting value is approximately 20% lower than the required U-value of 0.50 W/m²K.

U-Value= 0.39 W/m²K

Weighted Sound reduction index Rw= 51 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 69.48 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	17,7	20,0	
1	1 cm	Gypsum plaster	0,510	0,020	17,5	17,7	10,0
2	1,25 cm	Gypsum fibre board	0,320	0,039	17,1	17,5	14,4
3	20 cm	Brick	0,320	0,625	11,2	17,1	400,0
4	5 cm	XPS	0,030	1,667	-4,4	11,2	1,8
5	2 cm	Silicone Resin Plaster	1,000	0,020	-4,6	-4,4	36,0
		Thermal contact resistance*		0,040	-5,0	-4,6	
	29,25 cm	Whole component		2,540			462,1

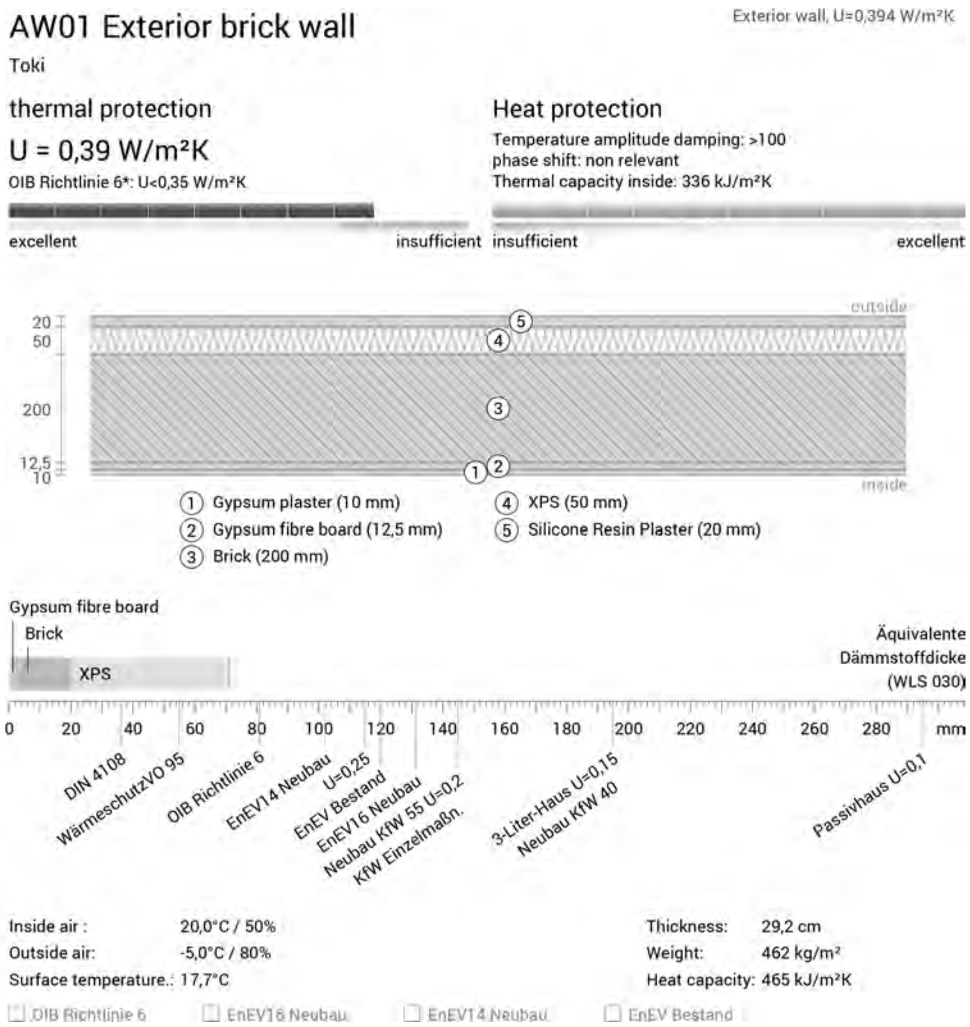


Figure 295: *Detail of the exterior brick wall, made by the author.*

2) AW02 Exterior Concrete Wall

The total thickness of the exterior wall structure is 29 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. The skeleton system including reinforced concrete columns bears the construction, so that 20 cm thick brick walls mainly have the function to divide the rooms. The façade is insulated with 5 cm XPS. A single-layer exterior plaster has been used with a silicone resin float finish as fine plaster. The exterior wall thermal insulation is calculated as a total U-value of 0.472 W/m²K. Accordingly the resulting value is approximately 6.4 % lower than the required U-value of 0.50 W/m²K.

U-Value= 0.472 W/m²K

Weighted Sound reduction index Rw= 51 [dB]

Thermal storage by the building's mass m w,B,A = 264.32 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	17,2	20,0	
1	1 cm	Gypsum plaster	0,510	0,020	17,0	17,2	10,0
2	1,25 cm	Gypsum fibre board	0,320	0,039	16,6	17,0	14,4
3	20 cm	Reinforced concrete (2%)	2,500	0,080	15,7	16,6	480,0
4	5 cm	XPS	0,030	1,667	-3,0	15,7	1,8
5	2 cm	Silicone Resin Plaster	0,140	0,143	-4,6	-3,0	36,0
		Thermal contact resistance*		0,040	-5,0	-4,6	
	29,25 cm	Whole component		2,118			542,1

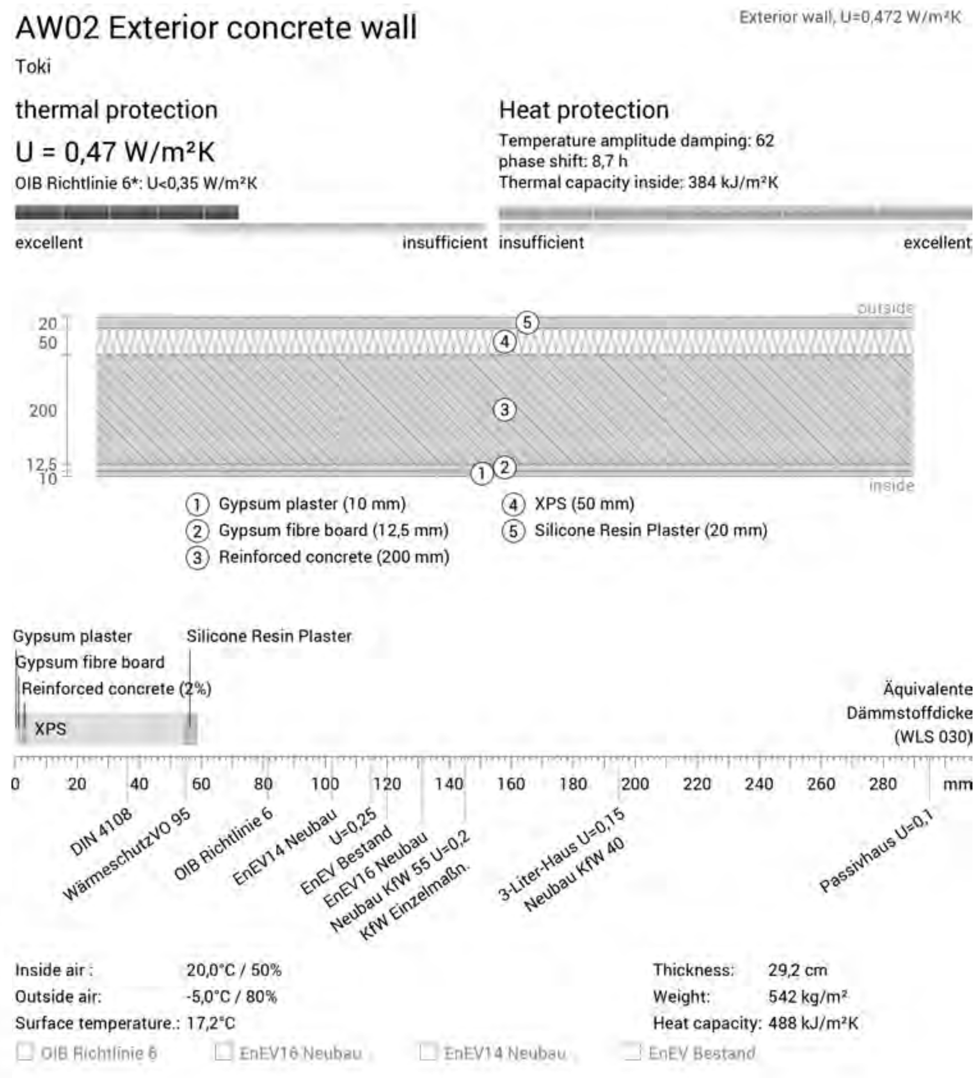


Figure 296: *Detail of the exterior concrete wall, made by the author.*

3) AW03 Exterior Concrete Wall to the Staircase

The total exterior wall structure thickness is 24 cm. The interior plaster is a single-layer gypsum/lime machine plaster. The skeleton system including reinforced concrete columns bears the construction, so that the 20 cm thick brick walls mainly have the function to divide the rooms. A single-layer exterior plaster has been used with a silicone resin float-finish as fine plaster. The total U-value of the thermally insulated exterior wall is calculated as a U-value of 2.39W/m²K. No U-Value is required for this building component.

U-Value= 2.39 W/m²K

Weighted Sound reduction index Rw= 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 76.52kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	2 cm	Tiles (ceramic)	2,300	0,009	20,0	20,0	40,0
2	3 cm	Cement screed	1,650	0,018	20,0	20,0	60,0
3	5 cm	XPS	0,030	1,667	20,0	20,0	1,5
4	12 cm	Reinforced concrete (2%)	2,500	0,048	20,0	20,0	288,0
5	2 cm	Gypsum plaster	0,510	0,039	20,0	20,0	20,0
		Thermal contact resistance*		0,170	20,0	20,0	
	24 cm	Whole component		2,123			409,5

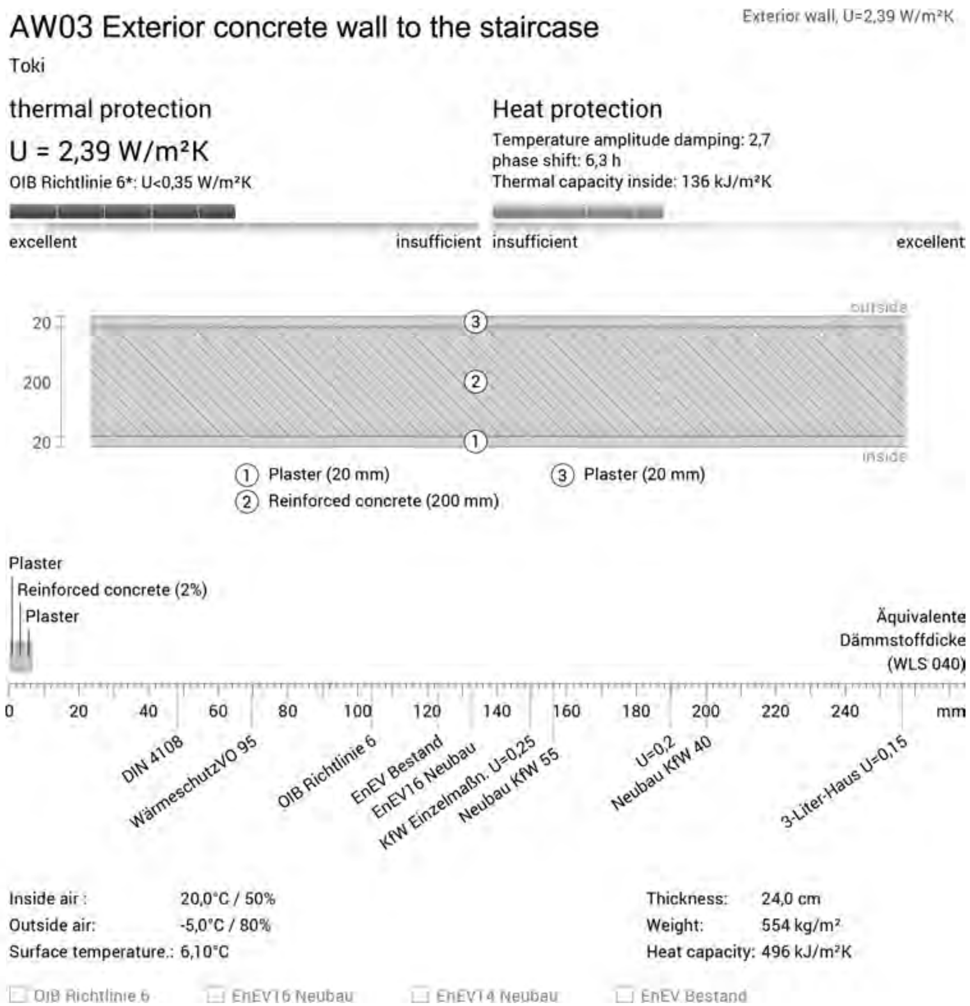


Figure 297: *Detail of the exterior concrete wall against staircase, made by the author.*

4) ID01 Interior Ceiling Against Unheated Basement- Tiles

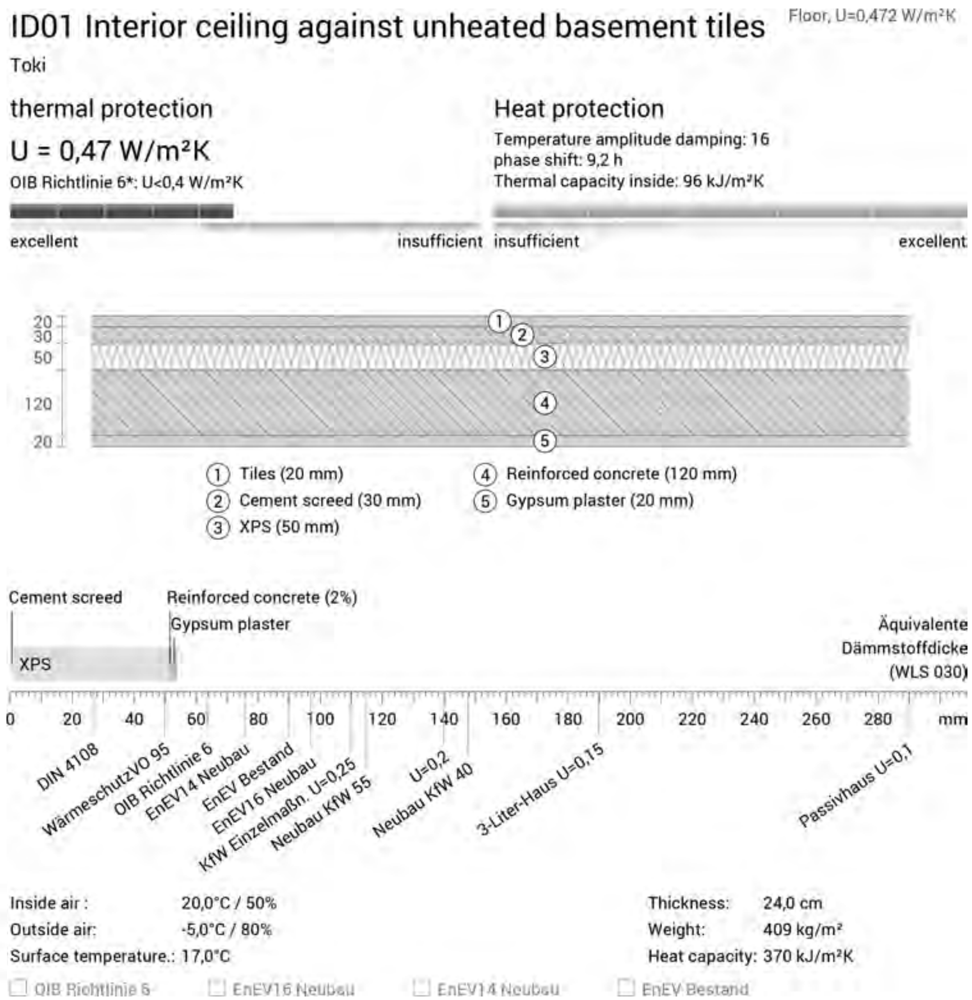
The total ceiling construction thickness is about 24 cm. The top layer is tile. 3 cm thick screed has been built to flatten the floor. There is no sound insulation applied to the ceiling. 5cm thick XPS has been placed to provide thermal insulation above the load-bearing system. The thickness of the load-bearing reinforced concrete slab is 12 cm. The total internal ceiling thermal insulation is calculated as a total U-Value of 0.47 W/m²K. The resulting value is approximately 4% higher than the required U-value of 0.45 W/m²K.

U-Value= 0.47 W/m²K

Weighted Sound reduction index Rw = 55 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 76 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 66.09 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	17,0	20,0	
1	2 cm	Tiles (ceramic)	2,300	0,009	16,9	17,0	40,0
2	3 cm	Cement screed	1,650	0,018	16,7	16,9	60,0
3	5 cm	XPS	0,030	1,667	-3,5	16,7	1,5
4	12 cm	Reinforced concrete (2%)	2,500	0,048	-4,0	-3,5	288,0
5	2 cm	Gypsum plaster	0,510	0,039	-4,5	-4,0	20,0
		Thermal contact resistance*		0,170	-5,0	-4,5	
	24 cm	Whole component		2,121			409,5

Figure 298: *Detail of the interior ceiling against unheated basement, made by the author.*

5) ID02 Interior Ceiling Against Unheated Basement- Lamination

The total ceiling structure thickness is 24 cm. The top layer is laminate. 3 cm thick screed has been built to flatten the floor. No sound insulation material applied to the ceiling. 5cm thick XPS has been placed to provide thermal insulation above the load-bearing system. The load-bearing reinforced concrete slab is 12 cm. The total U-value of the ceiling with full thermal insulation is calculated to be 0.44 W/m²K. The resulting value is approximately 3% lower than the required U-value of 0.45 W/m²K.

U-Value= 0.44 W/m²K

Weighted Sound reduction index Rw= 45 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =77 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 101.15 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	17,2	20,0	
1	2 cm	Lamination	0,130	0,154	15,4	17,2	10,0
2	3 cm	Cement screed	1,650	0,018	15,2	15,4	60,0
3	5 cm	XPS	0,030	1,667	-3,6	15,2	1,5
4	12 cm	Reinforced concrete (2%)	2,500	0,048	-4,1	-3,6	288,0
5	2 cm	Gypsum plaster	0,510	0,039	-4,5	-4,1	20,0
		Thermal contact resistance*		0,170	-5,0	-4,5	
	24 cm	Whole component		2,266			379,5

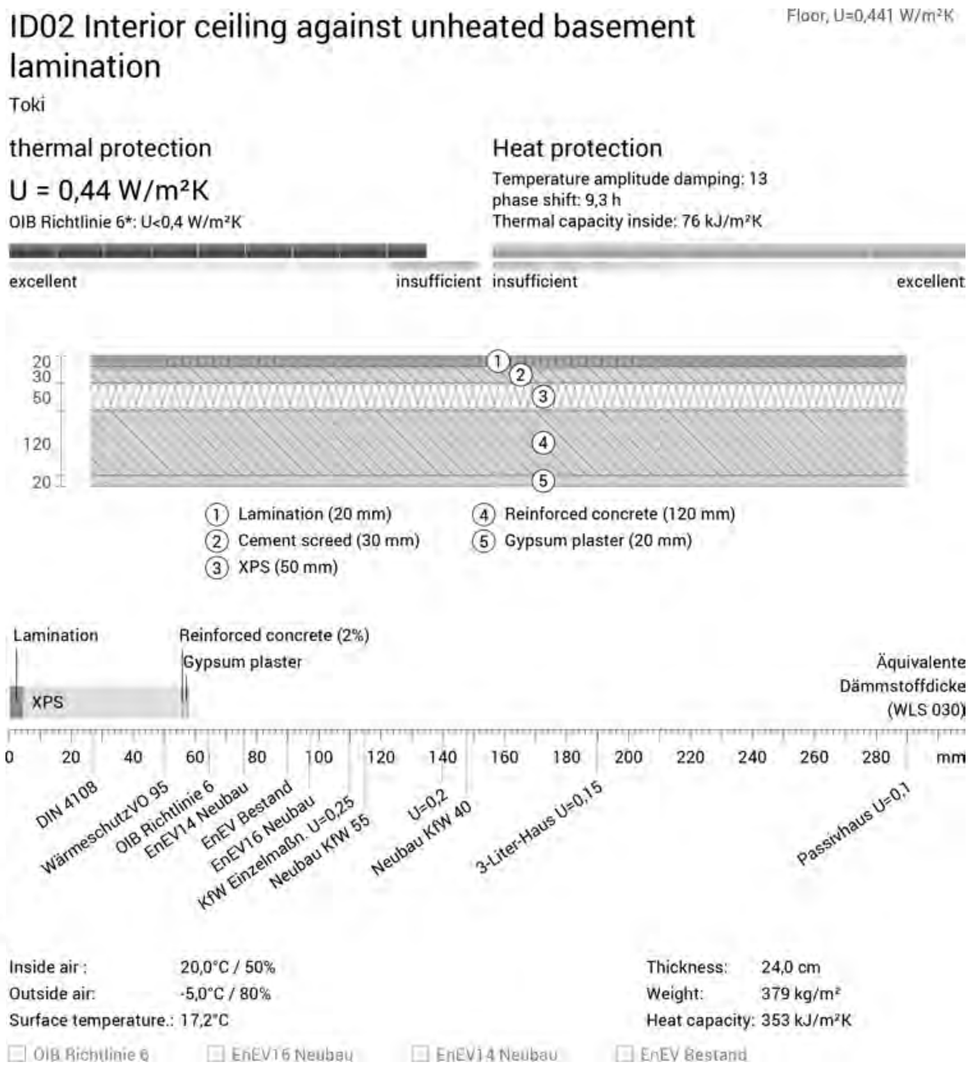


Figure 299: *Detail of the interior ceiling against unheated basement, made by the author.*

6) **ID03 Interior Ceiling- Tiles**

The total ceiling construction thickness is 22 cm. The top layer is tile. 3 cm thick screed has been built to flatten the floor. There is no sound insulation applied to the ceiling. 5cm thick XPS has been placed to provide thermal insulation above the load-bearing system. The thickness of the load-bearing reinforced concrete slab is 12 cm. The ceiling with full thermal insulation total U-Value is calculated to be 0.47 W/m²K. There is not an obligatory required value for this component.

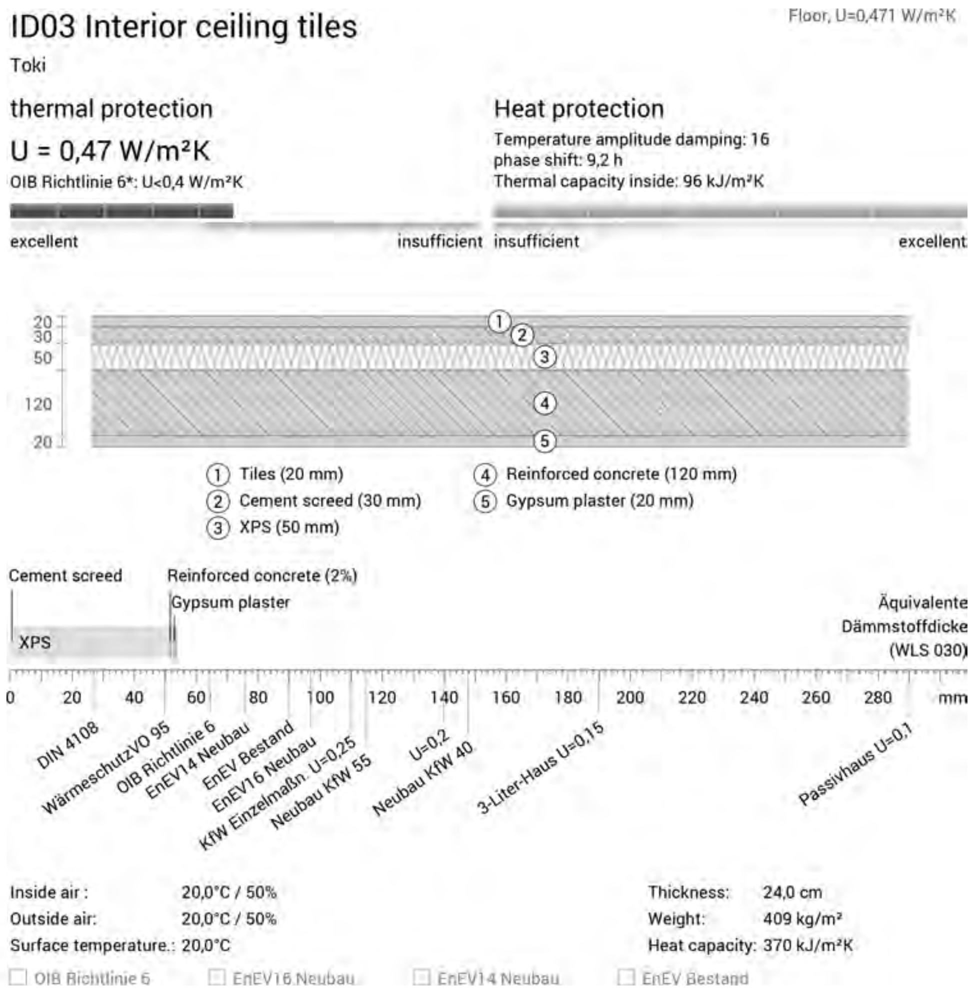
U-Value= 0.47 W/m²K

Weighted Sound reduction index Rw= 43 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =79 [dB]

Weighted Standardized Impact Sound Pressure Level L`nT,w= 77 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 102.21 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	2 cm	Tiles (ceramic)	2,300	0,009	20,0	20,0	40,0
2	3 cm	Cement screed	1,650	0,018	20,0	20,0	60,0
3	5 cm	XPS	0,030	1,667	20,0	20,0	1,5
4	12 cm	Reinforced concrete (2%)	2,500	0,048	20,0	20,0	288,0
5	2 cm	Gypsum plaster	0,510	0,039	20,0	20,0	20,0
		Thermal contact resistance*		0,170	20,0	20,0	
	24 cm	Whole component		2,123			409,5

Figure 300: *Detail of the interior tile ceiling, made by the author*

7) ID04 Interior Ceiling- Laminate

The ceiling is 22 cm in total. The top layer is laminate. 3 cm thick screed has been executed to flatten the floor. There is no sound insulation applied to the ceiling. 3cm thick XPS thick XPS has been applied to provide thermal insulation above the load-bearing system. A 12 cm reinforced concrete slab bears the load of the structure. The total calculated U-value of the ceiling with thermal insulation results in a U-Value of 0.44 W/m²K. There is not an obligatory required value for this component.

U-Value= 0.44 W/m²K

Weighted Sound reduction index Rw= 54 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 78 [dB]

Weighted Standardized Impact Sound Pressure Level L`nT,w= 73 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 67.62 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	2 cm	Lamination	0,130	0,154	20,0	20,0	10,0
2	3 cm	Cement screed	1,650	0,018	20,0	20,0	60,0
3	5 cm	XPS	0,030	1,667	20,0	20,0	1,5
4	12 cm	Reinforced concrete (2%)	2,500	0,048	20,0	20,0	288,0
5	2 cm	Gypsum plaster	0,510	0,039	20,0	20,0	20,0
		Thermal contact resistance*		0,170	20,0	20,0	
	24 cm	Whole component		2,261			379,5

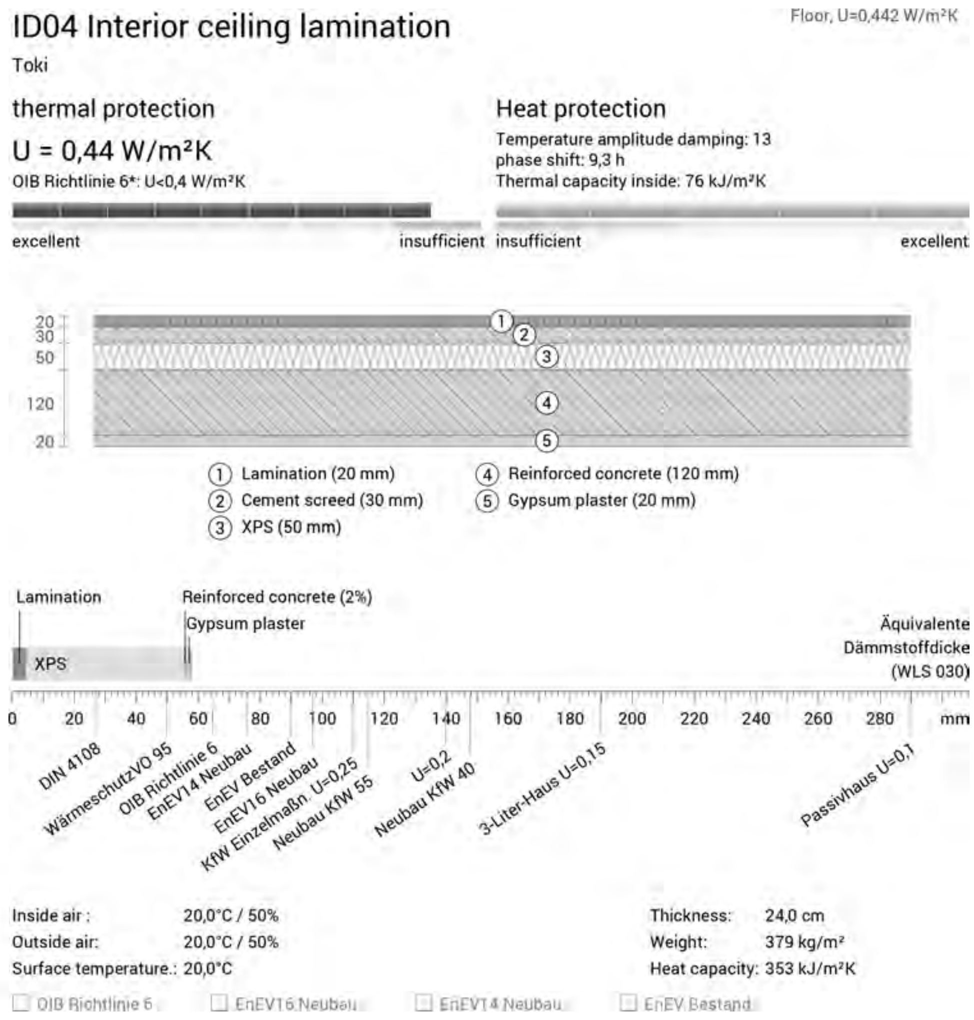


Figure 301: *Detail of the interior laminate ceiling, made by the author.*

8) IW01 Internal dividing wall between dwellings

The total thickness of dividing walls is 24 cm. The wall surfaces are plastered. Because that the load bearing function has been provided with reinforced concrete columns, 20 cm thick brick walls have only the function to divide the rooms. The total U-value of the internal walls is calculated as a U-value of 2.39 W/m²K. There is not an obligatory required value for this component.

U-Value= 2.39 W/m²K

Weighted Sound reduction index Rw= 62 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 187.71 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	20,0	20,0	
1	2 cm	Plaster	0,510	0,039	20,0	20,0	38,0
2	20 cm	Reinforced concrete (2%)	2,500	0,080	20,0	20,0	480,0
3	2 cm	Plaster	0,510	0,039	20,0	20,0	36,0
		Thermal contact resistance*		0,130	20,0	20,0	
	24 cm	Whole component		0,418			554,0

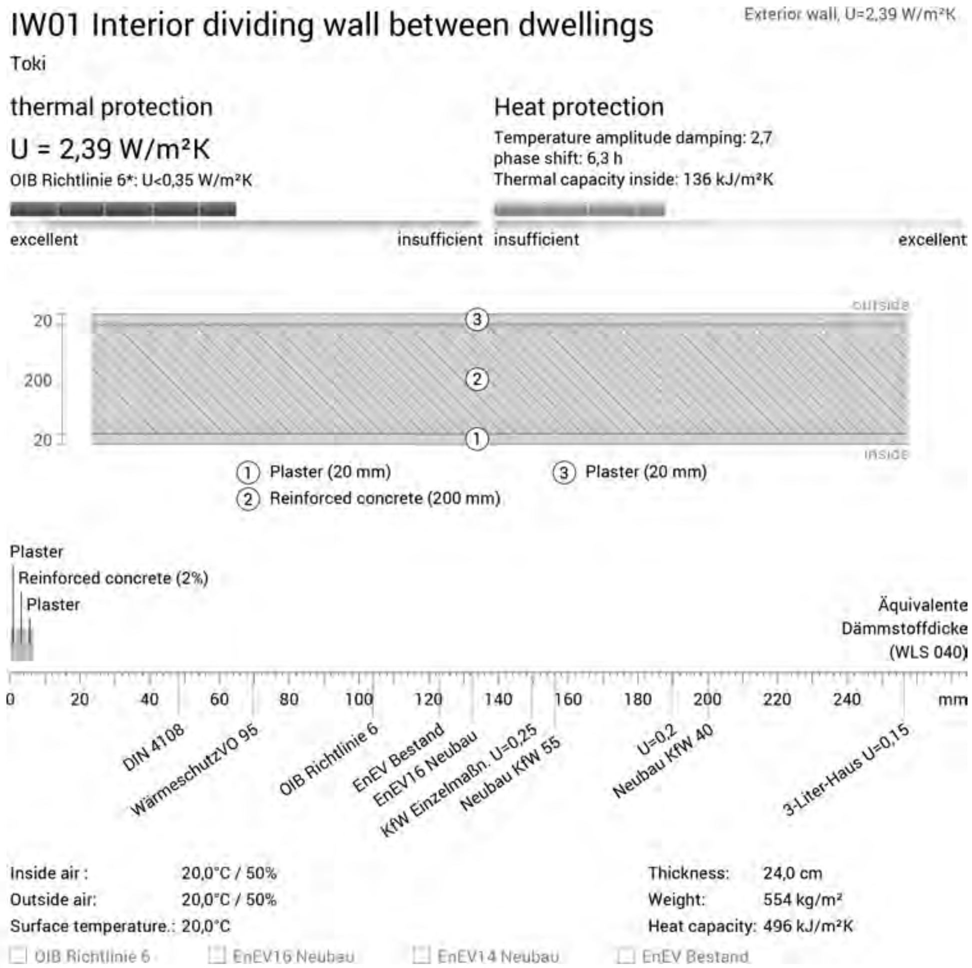


Figure 302: *Detail of the interior dividing wall between the dwellings, made by the author*

9) OD01 Upper ceiling

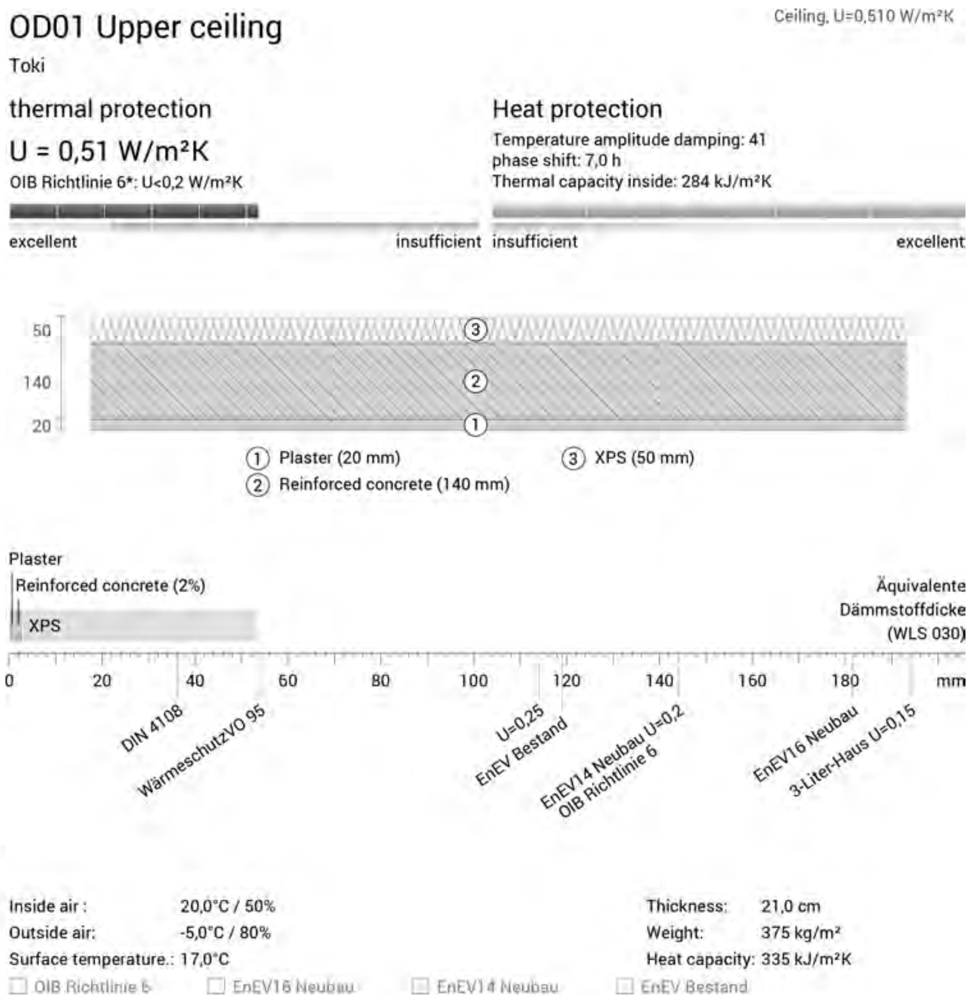
The total ceiling structure thickness is 21 cm. The top layer is 5cm thick XPS. There is no sound insulation applied to the ceiling. 14 cm thick reinforced concrete slab bears carries the structure. The lowest layer is 2cm thick plaster. The total U-Value calculation of ceiling results in a value of 0.51 W/m²K. Accordingly the resulting value is exceeds 70% the required U-value of 0.30 W/m²K.

U-Value= 0.51 W/m²K

Weighted Sound reduction index Rw= 61 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =70 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 195.14 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	17,0	20,0	
1	2 cm	Plaster	0,510	0,039	16,5	17,0	38,0
2	14 cm	Reinforced concrete (2%)	2,500	0,056	15,8	16,5	336,0
3	5 cm	XPS	0,030	1,667	-4,5	15,8	1,5
		Thermal contact resistance*		0,100	-5,0	-4,5	
	21 cm	Whole component		1,962			375,5

Figure 303: *Detail of the upper ceiling, made by the author.*

- **Thermal Bridges**

1. **Attic, Top Floor**

It is observed from the simulation that the slab, which is between the unheated roof and the top floor, is insulated with a 5 cm thick XPS insulation material. The thermal insulation material is installed along the external wall in a way to cover the bottom of the top slab. Hence, thermal bridges at the internal corners are attempt to keep in minimum. However, there are still heat losses at the corners.

2. **Basement and Ground Floor**

The slab, which is between the basement and the ground floor, is insulated with a 5 cm thick XPS insulation material, which is attached to the top of the load-bearing system. The external walls of the cellar floor are covered with the XPS insulation from the outside. Furthermore, the basement is approximately 1 meter above the ground. As observed from the 2D thermal bridge simulation, heat losses occurs at these junctions.

3. **Balcony and External Wall**

The load-bearing construction of the internal slab is not separated with any insulation plate or Isokorb structural thermal break. As it is seen in the simulation, since no heat insulation is applied to the top and the bottom of the balcony slab, heat losses occurs at the corner points.

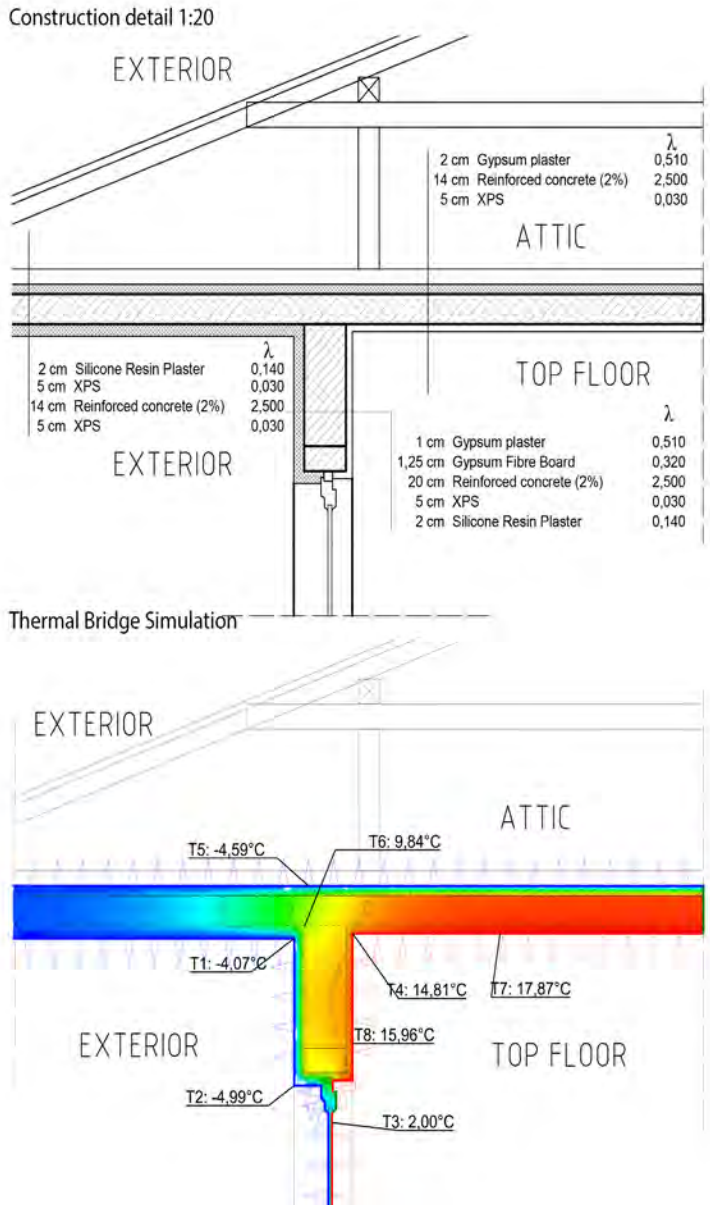


Figure 304: *Thermal Bridge Simulation showing the connection between the attic and the top floor, made by the author.*

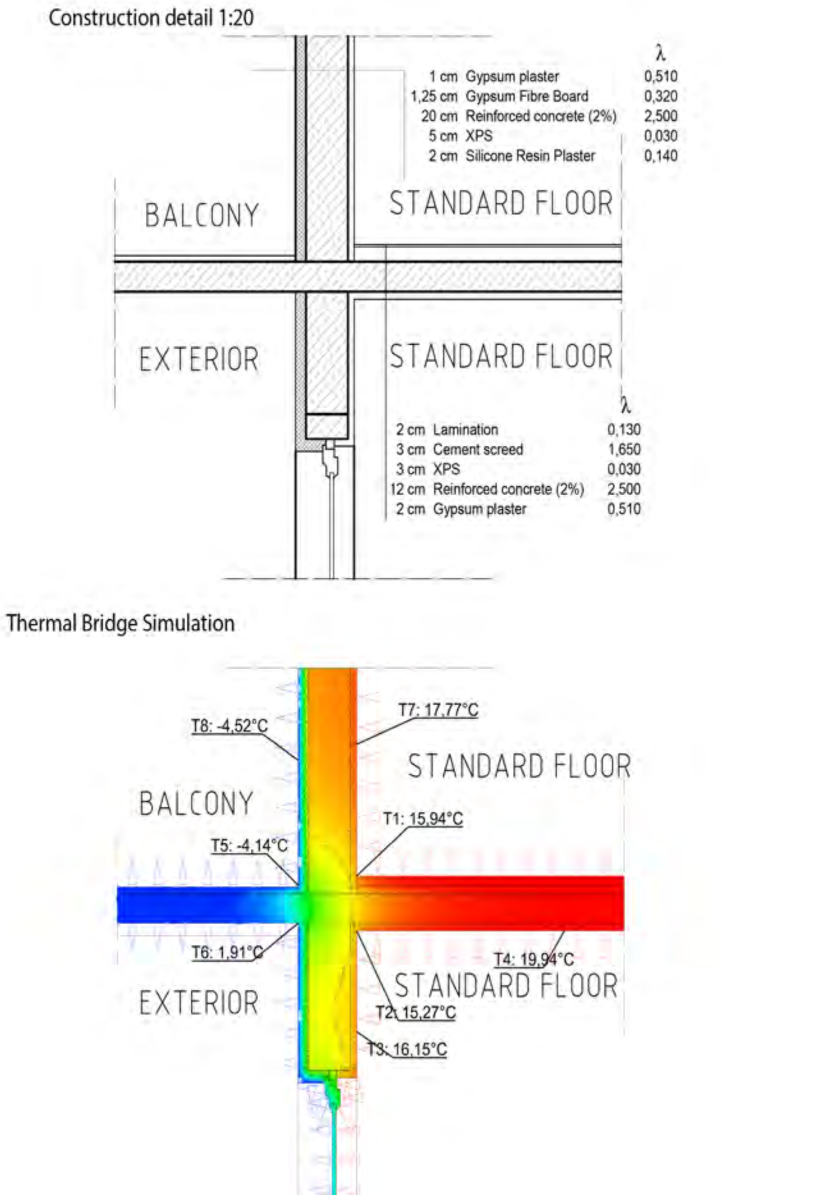


Figure 305: *Thermal Bridge Simulation showing the connection between unheated basement and ground floor, made by the author.*

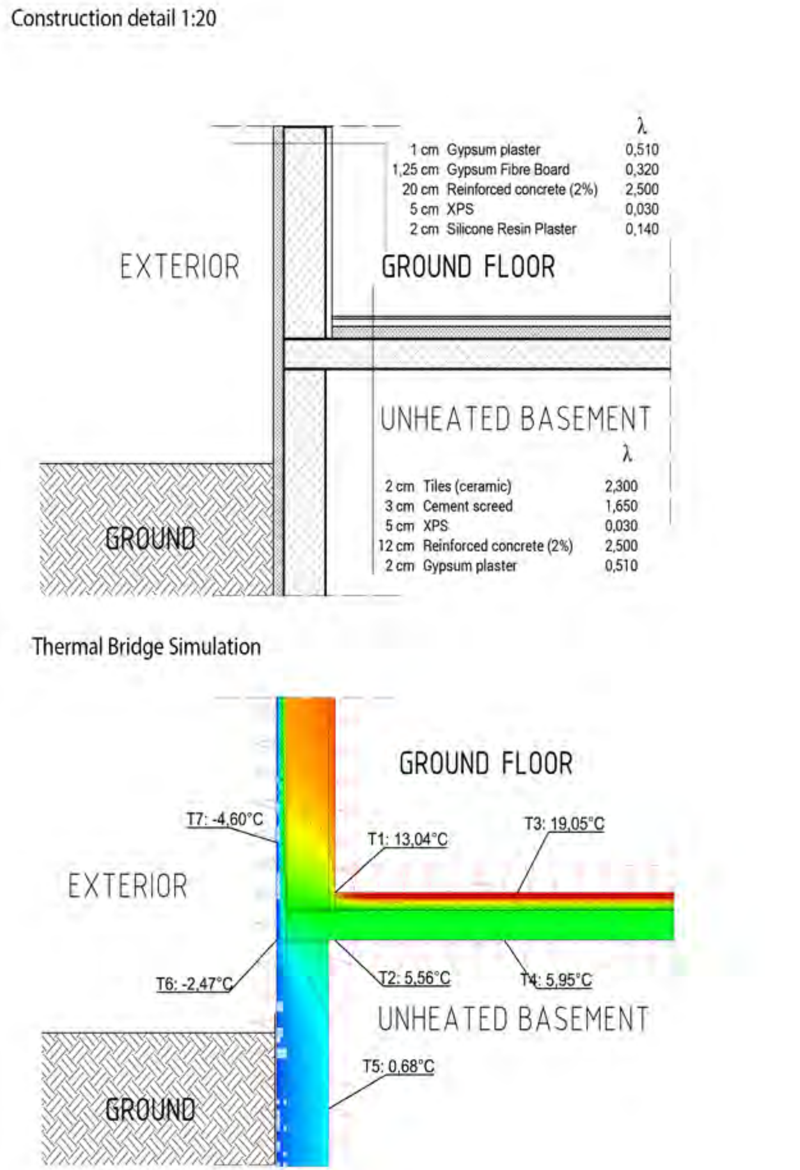


Figure 306: *Thermal Bridge Simulation showing the connection between balcony and external wall, made by the author.*

6.2.4. Heating- Hot Water

Boilers installed in every flat fulfill the heating and hot water needs. 24 kW boilers have been installed in 60 flats to satisfy the heating and hot water needs of the 8700 square meter area. The total annual energy required for the heating and hot water demands of the building have been calculated as 805,506 kWh. PVC hot water installation pipes have been installed inside the flats without heat insulation. Manually adjustable radiator units are used in the rooms.

6.2.5. Solar Power Generation

No photovoltaic system has been applied in the building.

6.2.6. Ventilation

It has been anticipated natural ventilation via windows in the buildings and a mechanical ventilation system has not been applied.

6.2.7. Solar Shading-Overheating in Summer

In order to protect the dwellings from sunlight, neither interior nor outer blinds have been utilized on windows. Curtains block sunlight that comes through windows. In addition, a small part of the windows and the balcony doors have been protected from sunlight by means of balcony protrusions. The large portion of the building gets the sunlight directly. The children's room and living room of the flat on the 15th floor are exposed to overheating in summer according to simulation results, which is shown below, because of the lack of sunblinds as protectors. This leads to disruptions in room comfort. The simulation results demonstrate that the room temperature exceeds 30 °C despite the 1.95 meter balcony depth in front of the living room façade. Furthermore, the temperature of the children's room exceeds 35 °C during the same time period.

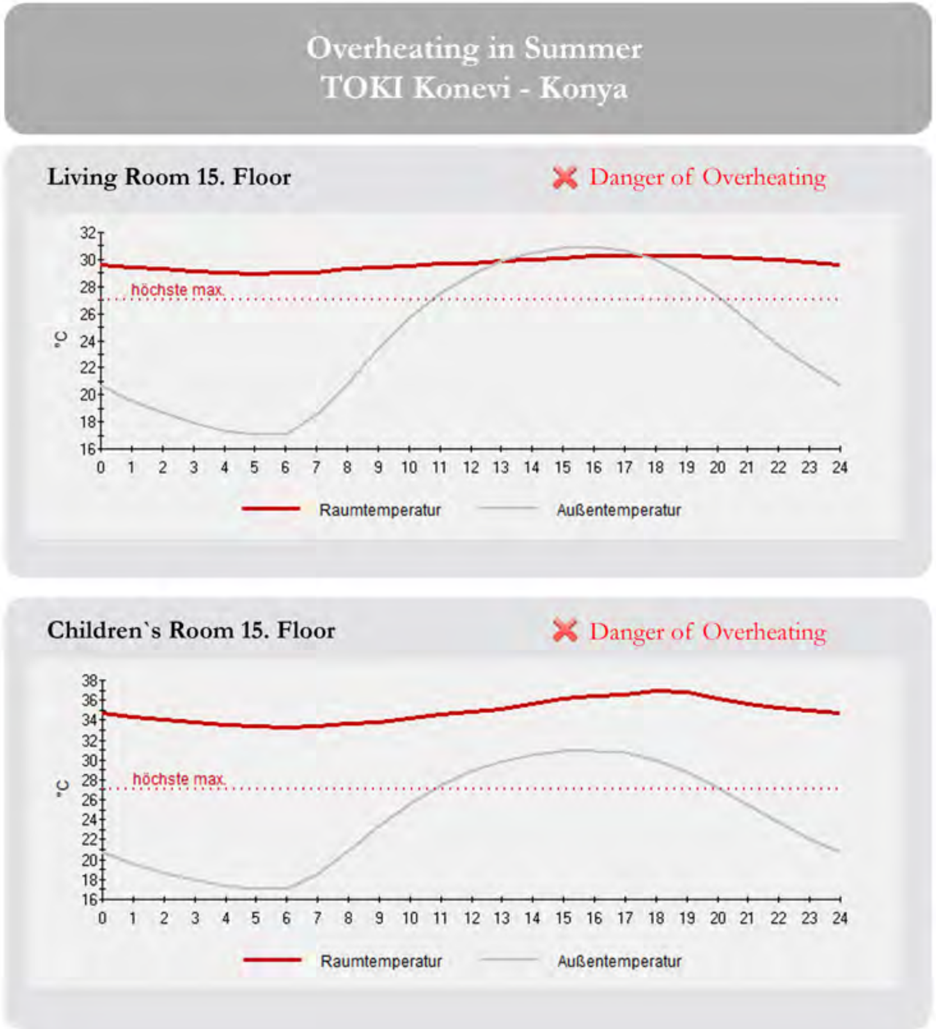


Figure 307: *Overheating calculations of the rooms in summer, made by the author.*

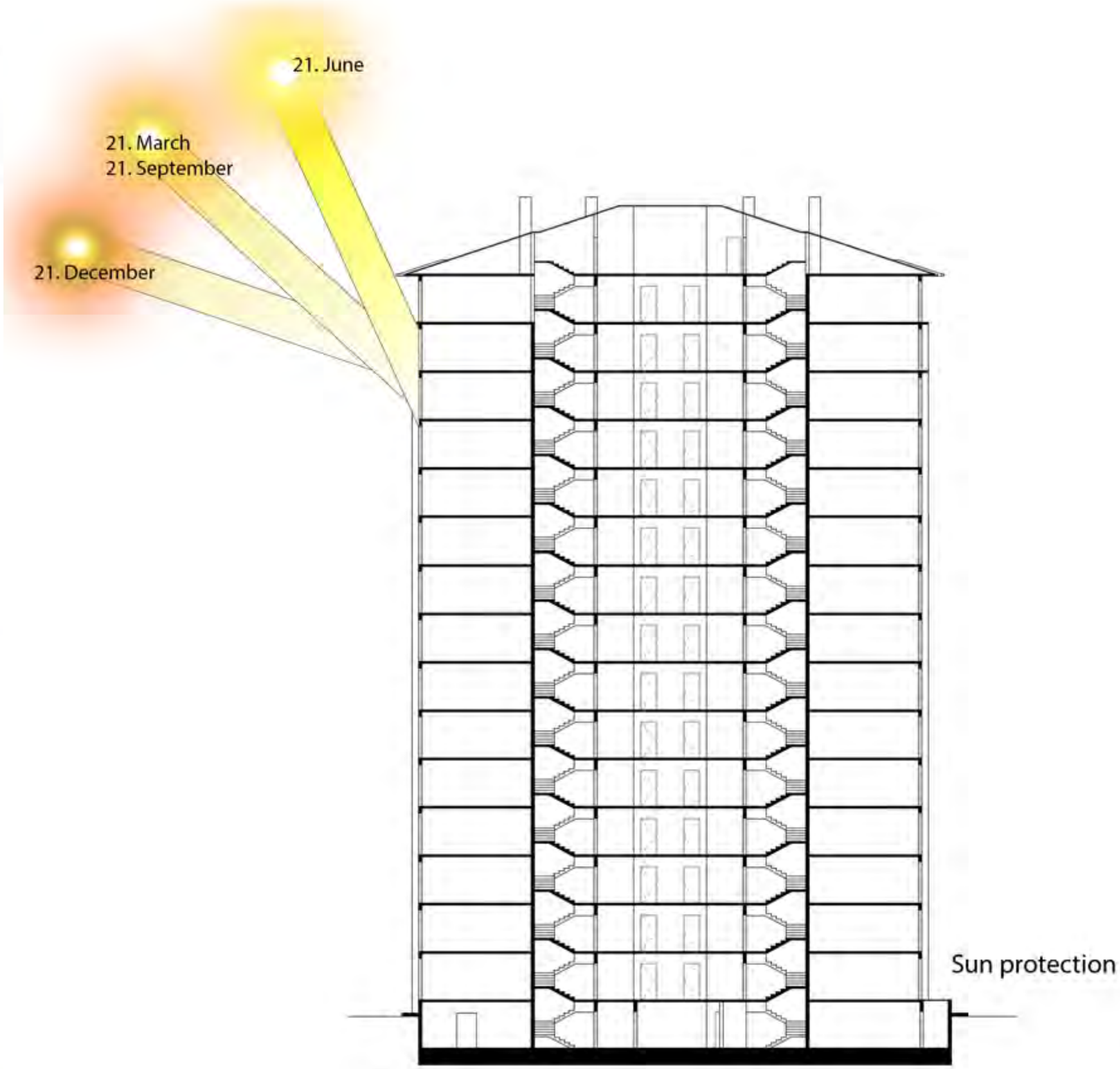


Figure 308: *Schematic representation of the position of the sun at different times, made by the author.*

6.3. Aesthetic - Visual Quality Analysis / AVQA

The buildings on the site reflect similar properties and external appearance which can be seen in all buildings made by TOKİ for middle and low income earners from Turkey›s east to west.[68] This is genuine mass production. The project was designed to be a solution with affordability, but quality was sacrificed. (See Chapter III, 1.5.MHA). The buildings are neither aesthetic, nor in a harmony with the surrounding. The repetitive multi-storey buildings cause a formation of monotony. The constitution of the housing in the form of high-storey buildings that repeat themselves in clear mass production has generated a monotonous repetition and symmetry which has become the most dominant feature of the project. In fact, this is the unique concept of the housing. This situation leads to a threat to architectural quality.

The housing has been scheduled to meet basic physical functions, thus it is not being built in an attempt to provide visual quality, richness, and innovation. The garden was not designed by a landscape architecture, and the paths in the garden seem to be designed randomly and spontaneously without natural view and greenery. Neither buildings nor the design of the garden seem to be considered in order to create a unique, different, and creative concept.

- Does the scheme feel like a place with a distinctive character with an identity or does it seem like a reputation of other buildings in the surrounding? Is a reputation
- Is the settlement monotonous or attractive & exciting? Monotonous
- Is it a place which has a good visual impact? N
- Has a landscape architect designed the open space and does it seem that there is consideration of open space quality? N
- Is the housing area innovative, original, and creative, or ordinary? Ordinary
- Is an aesthetic concern visible inside and outside of the buildings? Do the materials inside have a distinctive character? It has been tried to use good materials in the access routes of the buildings but these do not have a distinctive and clear character and present a mixture of materials
- Are there some elements on the façade considered and designed especially because of aesthetic (concerns) in addition to the functional needs, or is the building just functional? N
- Is an architectural aesthetic provided through a visual impact in corridors and staircases of buildings with innovative space concepts, geometry movements or some other elements? N
- Are sustainable and healthy materials used, and consideration of environmental design expression implemented apparent to the façade and general view of the design? N
- Is the housing estate scale and concept compatible with surroundings (proportionally)? N, The scale of the project is too inconvenient for the site. The site is an urban regeneration area hence these buildings are too high for this area.

68 See also website, http://www.toki.gov.tr/illere-gore-projeler

7. CS V Altinbasak Housing Complex

Tepekent Architecture and Construction Office

Figure 309: *Access to the site, by the author.*

The Altinbasak housing complex is a 220 flat housing estate with five buildings whose construction was completed in August 2011 by Tepekent Architecture office in Konya. The housing offered affordable payment options, but later because of the good situation in the centre and the spacious dwellings, the prices have been increased. They are not luxury apartments, but also not really social housing. Although it does not now offer affordability, it looks like social housing seventies Europe from the outside according to the idea of the author of this study.

It consists of 11 story-buildings that are arrayed around a large garden. There is a children's playground, green living areas, a small field for young people, a buffet next to the children's playground, and a small pool in this garden. This spacious green area provides the residents of the building a spectacular view. The security of the buildings is provided by the security guards who control the entrances and exits.

Although it is an advantage to be located in a good vicinity close to the city centre, there are few green areas and a lot of buildings with traffic congestion and the rush of everyday life. The transformer, which is located near to the site, has a detrimental effect on the housing estate.

Because it does not offer different housing types, residents are generally families with children with the same background. Even though the relationships between neighbours in multiple-story buildings are affected by the disadvantages of density, the relationships are indeed strong because of various reasons particular to the project. One of these reason is according to Elif Dülgeroglu – a tenant from the housing-, a large number of families who knew each other before they took up residence.[69] However, the interaction between people is limited to the garden.

There is a playground in the garden next to the car park, however, the in-between passage gate stays open. This creates a disturbance as a result of car noises and potential dangers in terms of children being hit by vehicles. All of this makes the location of the children's park undesirable. It is an advantage for the park that it is seen from everywhere, however, the too high structure of the housing effect the dialogue between children and families in dwellings in a negative way. Doormen exist for the buildings, and these doormen dwell in the small apartments on the roof part of buildings. They are responsible for taking care of the building and garden care.

This type of multi-unit-housing is a typical example of the public housing system which is prevalent in Turkey.

69 An interview about the impressions of Elif Dülgeroglu. Date: 16.07.2015.

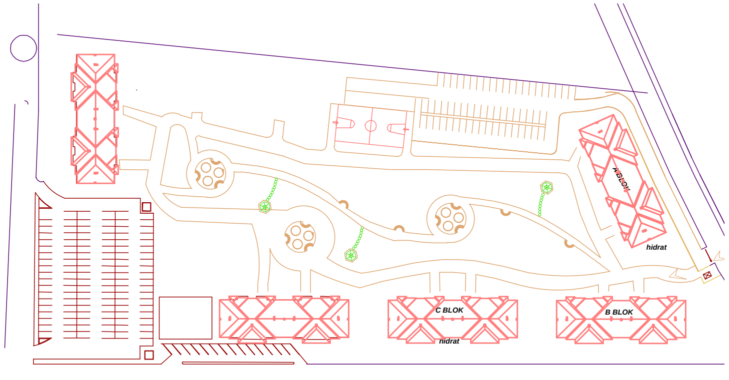


Figure 313: *Site plan*

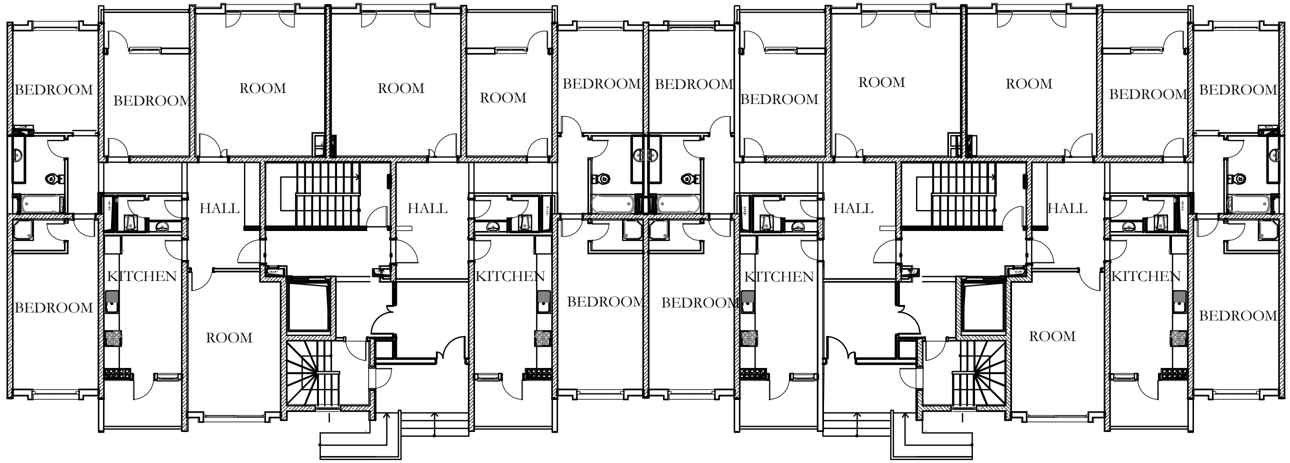


Figure 310: *Ground floor plan*

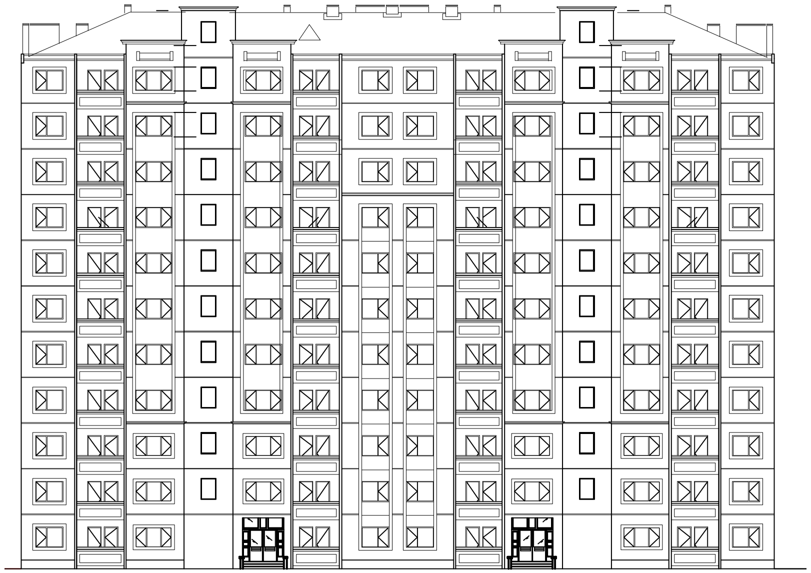


Figure 312: *Elevation*

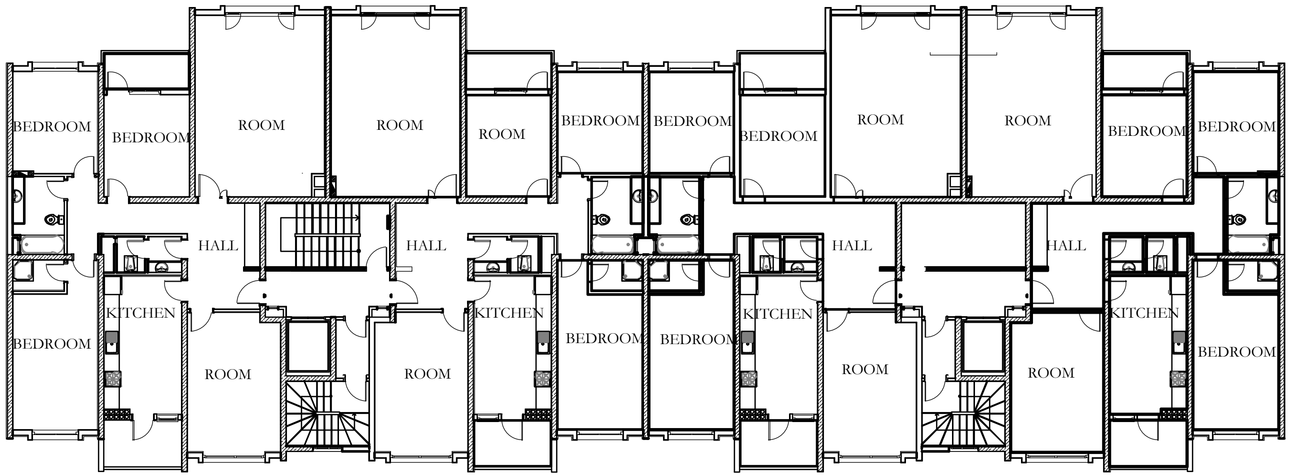


Figure 311: *Standard floor plan*

Figure 314: *Section*

ALTINBASAK

BLOCK TYPE			NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING MAIN TYPE WITH 5 ROOMS	NUMBER OF DWELLING NEAR ENTR. WITH 4 ROOMS	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
STANDARD BLOCK		ENTRANCE A	11+Roof	21	1	5	22	44
		ENTRANCE B	11+Roof	21	1		22	
TOTAL				210	10			220

At the roof it has been developed a doorman unit for each block which only allows for janitar usage.

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE Exc.private balconies	TOTAL NUMBER OF DWELLING
26500 m2	31848 m2	-	22550 exc. private balconies in ground floor	220

Figure 315: *Altinbasak density-diversity information, made by the author. (Open space are is calculated approximately according to the site plan*

Figure 316: *A view to the housing*

Figure 317: *Access routes*

7.1. Social-Functional Quality Analysis - SFQA

7.1.1. Needs Oriented Design

Although all of the flats have the same floor plan, the necessary conditions to meet the needs of the Turkish families are provided. But this one-type ground plan, which is limited in offering various types of dwelling, does not respond to the needs of different types of families.

On the other hand, if the "ecological footprint" is taken into consideration, the drawbacks of the project can be understood because if the users of the project would bea family with 2 people household, they occupy the place which a family with four people household can occupy. This prevents space efficiency which also an issue for sustainability.

Because of the central station of the housing, the prizes are slightly high.

Participation, the possibility of the expression of requirement of tenants in the planning phase, is not an issue in this project even though it has not been mentioned and implemented properly in housing in Turkey, except luxury housing estates.(See also Chapter III, 1)

7.1.2. Accessibility and Movement Circulation Concept

It is an advantage that the buildings are arrayed along the road which allows a clear orientation.(see Figure 317) Furthermore, the security at the entrance provide guidance so that you can find your way to the building easily. Because of that the distinction between the greenery and the road is obvious, the roads leading to the building have been clearly identified. The building entrances are spacious and suitable for wheeled equipment, but in the entrance from the underground car park the ramps have been built without handrails.

Another disadvantage of the movement concept is that the circulation routes in the building are completely away from sunlight. This situation threatens also security. The access to the staircase is available through the passage gate and the main staircase does not get any sunlight, affecting the circulation negatively.(Figure 319, Figure 321) In addition to this, there are also problems with natural ventilation. Because the ventilation is provided through the fire escape through two doors, ventilation is adversely affected when the doors are closed. People prefer to use the elevator because the musty and dark appearance of the stairs is not attractive, especiallyin an eleven-story building, which is considerably high. This results in deterioration in interpersonal communication, which could be improved with stair usage.

The materials in access routes do not create a clear contrast, however they still they create a healthy atmosphere. (Figure 318)

- Is it easy to understand how to enter and move about the site? Y
- Are there orientation tables? N
- Are handrails for essential steps and communal stairs with a maximum rise of 170mm and minimum run of 280mm? Y
- Is there a lighted canopy over the main entrance? Y
- Do circulation areas receive good daylight? N
- Is adequate wheelchair access possible on the site, apartments, and dwellings? Are there ramps or lifts? Y, but without handrail.(See Figure 320)
- If there is ramp, does it provide a maximum slope of 6%, 120 cm clear width, movement area at the end of 150 x 150cm and a handrail height of 85 cm? N
- Is there enough manoeuvring space for wheeled equipment in entrances and corridors? Y
- Are there facilities for people with visual or auditory disabilities? N
- Is access for fire, ambulance, and other services adequate? Y

Figure 318: *Entrance of the building*

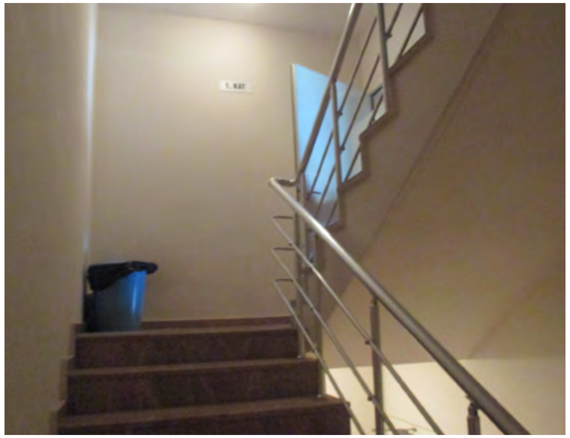


Figure 319: *Staircases closed with the doors*

Figure 320: *Access from the underground parking and a ramp without handrails*

- Is there a distinction and identification of functions (e.g. lighting, choice, and materials)? Y
- Is there a differentiation of architectural elements by colour or materials (e.g. walls and ceilings)? N
- Is there figure-background contrast (e.g. symbols and letters)? N
- Is there functional use of colours and materials to support spatial orientation, recognisability and identity? Y
- Does the movement concept aim to minimize vehicle flows and speeds within the housing estate and discourage through vehicular traffic? N

Vehicles

- Is the hierarchy of routes clear? Y
- Are road, place and building names, and unit numbers clear, visible, legible, and sited appropriately in relation to buildings? Y
- Do routes take advantage of vistas/landmarks within or around the project site? Y
- Are appropriate traffic calming measures used to control vehicle speed? Y
- Is vehicle segregation possible to help pedestrians to use safe routes? Y
- Can large, emergency, or service vehicles come within 30m of all front doors of units or flats? Y
- Do routes facilitate and encourage cycling? Y

Pedestrians

- Are public spaces connected by clear, well lit, and hard surface routes? Y
- Is lighting appropriately related to buildings and easy to maintain? Y
- Are kerbs dropped where foot paths cross roads? Y
- Do pedestrian routes and garden paths have a minimum width of 900 mm? Y

Access to the unit

- Do pedestrian routes and garden paths have a firm, even, slip-resistant finish, and distinctive texture and colour? N

- Are kerbs dropped for main footpaths and access positions? Y
- Is convenient wheelchair access provided from park space? N
- Are all slopes gentle provided with a level platform of 1200 x 1200 mm clear of door swing to external doors? Y

7.1.3. Efficiency of Planning

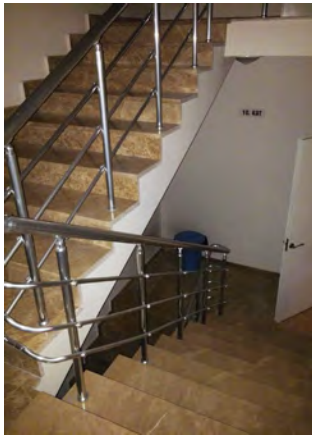


Figure 321: *Staircases*

Figure 323: *Transformer station and the garden*

Figure 322: *Access to the fire escape*

The area, with its green spaces inside, is convenient to live in. The houses have good perspectives and that they get good daylight, making the apartments feel spacious. When living standards are taken into account, big dwellings are advantageous, though, as stated before, lack of various dwelling designs and sizes often reduces the efficiency of planning. Dwellings, and also rooms, are designed as spaciously as possible, and there is little likelihood that problems like placing the furniture would emerge so there has not been any need to ponder upon such issues. However, the existence of the electricity transformer station, which is located near to the site, is a threat to the suitability of the living space.(Figure 323, Figure 324) The problems relating to circulation of the buildings (stated above) is also an issue which should be mentioned in efficiency.

On the other hand, the project could have been designed in such a way that the empty green areas would provide children with more facilities. The buildings', being very high and their design being in the form of dense building blocks, creates a negative impact in respect of neighbourhood.

- Does the overall design have a challenge and a goal? N
- Is the location favourable to housing with suitable functions for people? Y
- Are adequate facilities for universal access provided between floors

Figure 324: *A general view to the surrounding from the site.*

with clear traffic routes? N

- Is there sufficient capacity in corridors, stairs and lifts? Y
- Is there sufficient capacity for individual rooms (doors which open in a convenient direction without traffic routes through occupied areas)? Y
- Is an efficient layout provided, i.e. short walking distances because related functions are grouped near one another? Y
- Have functions requiring natural light been located against an outside wall? Y
- Has the space required to place and use furniture been an important

attention point for both fixed and mobile furnishings? N, it has not been needed because the rooms are enough big to furniture.

- Are sufficient vertical dimensions provided for ceiling height, clear headroom for doors, height of worktops and kitchen cupboards? Y

7.1.4. Flexibility

There has been no undertaking relating to concerns about possible changes in the circumstances of tenants. Flexibility is not generally a concept in current housing in Turkey. Most of the inner walls are load-bearing and made from reinforced concrete. Therefore it is difficult to make modifications in the dwelling without intervention of architectural elements. These implementations do not exist because of the quantity of work necessary. Unfortunately, inflexibility of the dwellings are not only because of the construction impossibilities, but also the design of the project does not allow to create bigger or smaller units. For example, the entrances are fixed which does not make realistic the production of a new entrance for a newly created unit.

- Has flexibility been a consideration in designing? N
- Can the plan of the units be adjusted to circumstances? Is it possible to make the rooms and dwellings larger or smaller than they are? N
- If possible, can these changes be made easily without intervention of architectural elements (ceiling and floor)? N
- Are different furnishings possible in the rooms? Y
- Is it possible to change the functions of the rooms? Y
- Are the load-bearing inner walls avoided as much as possible? N

7.1.5. Safety

Because there are security guards protecting the entrance to the apartment building, a system against the entry of strangers is provided and security is guaranteed. Although this system brings along the disadvantages of being in a gated community as a "site", it is used widely in current times in housing estates in Turkey. The probability of the passage of children to the car park of the site, points out a lack of planning in pedestrian safety which is thought to be provided within the destitution of vehicle entering the site.(Figure 325) When the site was newly built, there was not a security fence around the pool. However, after children began to fall into the pool, a swimming pool barrier was constructed.[70] (Figure 327)

- Are main access points secured (with an alarm, with guidance)? Y
- Are public areas overseen to make people feel safer and in control to anticipate possible dangers, especially within children playgrounds? Y
- Are balconies of dwellings safely protected against the risk of break-in? Y

Figure 325: *Open car parking area and the playground.*

70 An interview about the impressions of Elif Dülgeroglu. Date: 16.07.2015.

- Are all external doors and windows sufficiently fixed? Y
- Is safe transportation of people and goods provided vertically and horizontally to manage and prevent the possibility of falls, being trapped or injured with: non-slip floor finishes /adequate lighting for corridors and stairs/ handrails and banisters where appropriate? Particularly
- Has it been considered that doors and windows do not open onto the circulation routes? Not at all, for example lift door open to the circulation route.
- Fire safety: Is prevention of fire outbreak with a quick and safe escape possible? / Are fire-resistant materials used to limit fire spread? Y, but fire resistant materials are used in fire escape zones.
- Is safety glass used instead of ordinary glass? N

7.1.6. Health, Well-being, and comfort

The dwellings get good daylight, which is an important issue for this criteria. Unfortunately the circulation routes of the buildings have not been designed in a way that they receive plenty of daylight and natural ventilation.

Because sound insulation is not obligatory, there is a lack of sound protection against other dwellings and the outside.

The presence of green spaces for a walk, or just sitting and breathing the fresh air, has a positive impact on mood and mental health.

Many people have two cars in the area and there is usually heavy traffic around the site. Although there is tranquillity in the site, the atmosphere outside of the site tends to be more intense than inside.

- Has sound insulation of walls been considered and applied? N
- Has sound insulation of ceilings been considered and applied? N
- Has sound insulation of windows been considered and applied? N
- Are bedrooms placed so that they are not adjacent to shared internal areas? Y
- Are bedrooms protected so that they are not adjacent to the bathing/living areas of neighbouring units? Y
- Are noisy communal equipment placed farther than 3m away from doors or windows (e.g. lifts and plant equipment)? N
- Do living room windows receive good daylight? Y
- Do kitchen windows receive good daylight? Y
- Do all bathrooms have a window? N
- Do corridors and stairs of apartments receive good daylight and natural ventilation? N

7.1.7. Open Space

As it stated above, shared garden belongs only to the residents of the site and is inaccessible to the public. In this green space, a small buffet and sitting places have been built. In the immediate surroundings of the project, there are other such housing estates, and each of them has its own private green spaces. However, there are few open spaces that are accessible to the public.

Due to the fact that each apartment has several balconies, people have the opportunity to interact with the outside world. However, different sizes of balconies or different types of private open space, such as private terraces and gardens on the ground floor of residences, are not available.

- Has a qualified landscape architect been employed to create or assess the landscape design? N
- Is water (a pool, stream or a fountain) incorporated into the site and appropriately protected? Y, but the pool was not protected at the beginning, the fence has been applied later.
- What is the ratio of open areas to the sum of dwellings? 0.7 (But

Figure 326: *Sitting places in the garden.*

Figure 327: *Incorporated water in the garden.*

Figure 328: *A view of garden and buildings*

this space includes car parking areas which decrease usable open space)

- Does the general image of the open spaces seem natural and green? Y
- Do some flats have their own private garden? N
- Is there a common roof terrace? N
- Is there roof planting? N
- Are materials used in the open space natural? Particularly
- Is there any possibility for tenants to grow their own plants in the garden? N
- Does the position of lighting prevent pools of darkness where people walk both outside and in communal areas of buildings? Y
- Are refuse and bin storage areas convenient and inconspicuous in the open space? N

7.1.8. Common Rooms and Facilities

A private operating buffet is located in the middle of the project. Except for this buffet, there is not a room which provides meeting possibilities. This buffet has only outdoor seating places. Therefore, it has not a function to be a place for communication in the winter. Moreover, the existence of the buffet turns out to be a disadvantage for the children. Because unhealthy foods are offered in this buffet, the children can consume them unsupervised. Its contribution to social life is realised through supporting consumption.

- Is there a common room for inhabitants with a kitchen? N
- Is there a closed playground for children? N
- Is there a launderette? N
- Is there a fitness area? N
- Is there a sauna? N
- Is there a cinema? N
- Is there a theatre? N

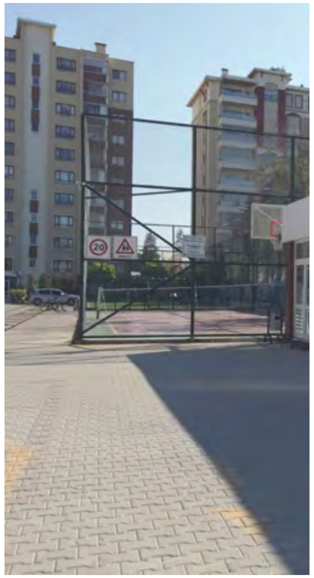


Figure 330: *Basketball site.*

Figure 329: *Children´s playground, by the author*

- Is there a library? N
- Is there an atelier? N
- Is there any play equipment or games room for young people (e.g. table tennis, ropeway)? Y
- Are there any other common rooms except those mentioned? N

7.1.9. Children's Playground

The children's playground is located in the garden, and an open sport area for basketball and football are offered for children and teens. The children's playground seems insufficient for housing with high density. This is even more obvious when it is taken into consideration that activities for people are limited generally because there are not a lot of possibilities in the vicinity. However, the rest of the garden diminishes this deficit by providing children suitable places for activities such as running, riding bikes etc. There is various equipment on the aforementioned playground, but the lack of a sandpit is a major disadvantage, especially for little kids who do not have the possibility of using the other equipment. The fact that the playground's surface is plastic, and the play equipment is also comprised of the plastic material, which is very normal in Turkey, makes the park extremely unhealthy.(Figure 329) In addition, the design is also uncreative and a typical reproduction of others.

As stated above, the car parking area threatens the security of children because of the lack of safety between car parking and playground.

Furthermore, because this park is not used much during the winter months, the lack of an indoor playground with equipment and convenient atmosphere for children is missed.

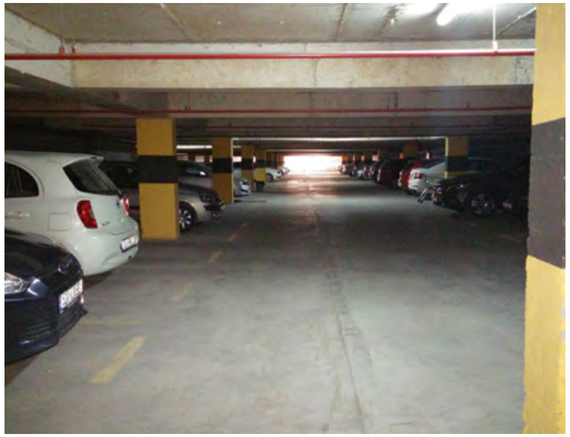
- Is the site location appropriate for children? Y
- Is the playground large enough for the whole residential area? N
- Is there a sandbox? N
- Have material / design creativity been considered? N
- Are the materials healthy (plastic/wood)? N
- Are playgrounds separated according to age groups? Y
- Are play areas provided within sight of families? Y
- Is energetic play provided for e.g. by an adventure playground or cycle paths? Y
- Is there any other playground close to the site? N.

7.1.10. Proportion of Buildings and Diversity of Living Units

The proportion of buildings is not sufficient for this housing because of its high and dense structure. The 5 buildings in the site have 11 storeys. As it is stated in SHQ, the residences of the buildings lose their contact with the garden, to the playground, and to the ground, as you move higher up the building. Also in this housing, stair usage is not encouraged due its unattractive stair enclosure which is lacking in daylight and natural ventilation. As a consequence, it causes loss of communication and contact between people, which is a general problem of high and dense housing.

As with all the blocks that have been designed in the same way, also all of the dwellings have the same design, composed by mirrors and copies, with five rooms, other than the ones in the entrance of the buildings.(Figure 332) Here, one room had to be sacrificed to the entrance so their room number was one less than the other dwellings, which caused an obligatory change in the regular floor plan. Also one room of the dwellings on ground floor have smaller size than the ones in upper floors. As was stated above dwelling plans cannot be changed easily. There are doorman apartments on the roof floor. With its one type floor plan design, the housing project does not respond to the challenge of bringing people with different ages and backgrounds together.

- Do the plans of different units have different sizes and characteristics for small/big families? N
- Are there different floor plans of different blocks in the housing estate? N
- Are different aged inhabitants encouraged in the project? N
- Are there maisonettes? N
- Are there dwellings with a garden or terrace? N
- Do some dwellings have a balcony? Y
- Do the balconies of different dwellings have different sizes? N
- Is the vertical proportion of buildings appropriate to the human scale, and is communication of buildings with the ground supported? N
- Are the buildings not more than eight storeys high? N, they are more than eight.



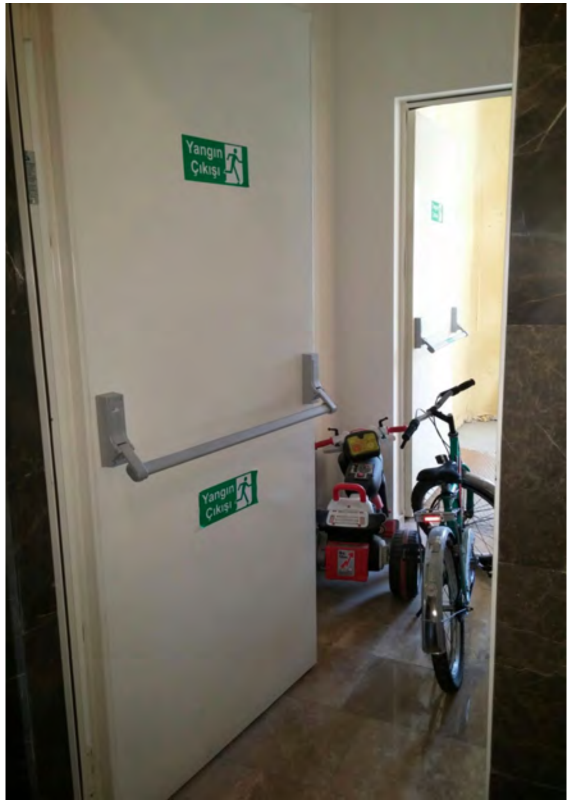


Figure 333: *Parking bicycles on access routes. (right)*

Figure 331: *Underground parking (top left)*

Figure 332: *A view of the adjacent street and the buildings.*

7.1.11. Storage, Parking, and Waste Services

The project provides underground parking as well as an open parking area. 220 car parking places are available underground and 110 in the open parking area. An important service that the site lacks is parking places for bicycles and buggies. This is typical in housing complexes in Turkey. But it is important to have storage rooms for bicycles and buggies to encourage bicycle use and provide comfort of families. Otherwise the bicycles and buggies have to be left on circulation routes and in unsecured areas. (Figure 333) So that security against rubbery cannot be provided.

There are storage rooms in the underground floor which every four housing units use together.

Each dwelling puts its garbage in front of the door, and the janitor collects and disposes of it. Therefore, there is not a regular residential trash removal service. The waste separation is executed by the municipality on certain days by collecting them from the site exit. However, the waste separation system does not operate well because generally each apartment puts its garbage outside their front doors every day without separating, and the janitor collects them in mixed form. It is not a system as efficiently as reminding people to collect waste separately with well-designed garbage which encourages waste separation.

- Are there storage spaces in dwellings? N
- Is there separate storage for each unit outside of the dwelling? N, each four unit has a storage.
- Is there a bicycle storage and is it barrier-free for disabled people? N
- Is there storage for prams, buggies and wheel chairs? N
- Is the refuse and bin storage area convenient and well arranged? N
- Is it encouraged through design to collect waste separately? N
- Is there a minimum of one parking space per unit? Y
- Is there underground parking and is it secure? Y
- Is there any car parking available for disabled people? N

Figure 334: *Access to underground parking and open car parking area.*

7.2. Energy performance and Construction Quality Analysis/ ECQA

7.2.1. Overview

	Building features	ALTIN BASAK				
	Energy Reference area[m²]	**6556.48 m²**				
	Gross floor area[m²]	**8195.60 m²**				
	Brutto-Volumen[m³]	**24585.00 m³**				
	Building enveloping area [m²]	**6511.00 m³**				
	U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
	Average U-Values[W/m²K]	0.720 [W/m²K]				
Exterior Wall	AW01 Exterior brick wall	0.400 [W/m²K]	51 [dB]			69.48 [kg/m²]
	AW02 Exterior concrete wall	0.480 [W/m²K]	60 [dB]			264.32 [kg/m²]
	AW03 Exterior brick wall against staircase	0.510 [W/m²K]	48 [dB]			76.52 [kg/m²]
	AW04 Exterior concrete wall against staircase	0.700 [W/m²K]	60 [dB]			221.84 [kg/m²]
Roof	OD01 Ceiling to attic	0.280 [W/m²K]	60 [dB]	71 [dB]		221.36 [kg/m²]
Ceiling	ID01 Interior ceiling against unheated basement lamination	0.420 [W/m²K]	56 [dB]	75 [dB]		282.08 [kg/m²]
	ID02 Interior ceiling against unheated basement tiles	0.448 [W/m²K]	55 [dB]	76 [dB]		238.33 [kg/m²]
	ID03 Interior Ceiling tiles	0.700 [W/m²K]	46 [dB]	76 [dB]	70 [dB]	101.72 [kg/m²]
	ID04 Interior Ceiling lamination	0.630 [W/m²K]	56 [dB]	75 [dB]	75 [dB]	67.94 [kg/m²]
	AD01 Overhang ceiling to outside air	0.310 [W/m²K]	57 [dB]	74 [dB]		62.99 [kg/m²]
Interior Wall	IW01 Internal dividing wall between dwellings	0.300 [W/m²K]	62 [dB]			28.19 [kg/m²]
	Glass	2.30 [W/m²K]				
	Windows	2.20 [W/m²K]				
	A/V	0.36 [1/m]				
	n50[1/h]	2.5 [1/h]				
	Ventilationtype	Natural ventilation				
	Heating type	Natural gas, boilers, under floor heating				
	Total heating demand[kWh/m²a]	**54.35[kWh/m²a]**				

Figure 335: *Overviw of the quantitavie values of the building components of Altinbasak, made by the author.*

7.2.2. Form and Orientation

The Altinbasak complex, designed by Tepekent Architecture Office in 2009, has been completed in 2011. The complex, constructed on a 26,577 square meter area, contains 3 blocks and each has approximately 692 m² floor space. 3 equal blocks are roughly 49.5m x 17.90m have been designed in parallel with the edges of the land. The long sides of one of the blocks are oriented towards the north-south directions, and the short sides of the blocks face towards east-west directions. The vertical access inside the buildings, whose short edges have no windows, has been provided by means of two elevators and two separate staircase enclosures, which are next to facades and have a depth of 4.5 meters. Every floor has 4 flats (2 in each stair enclosure).

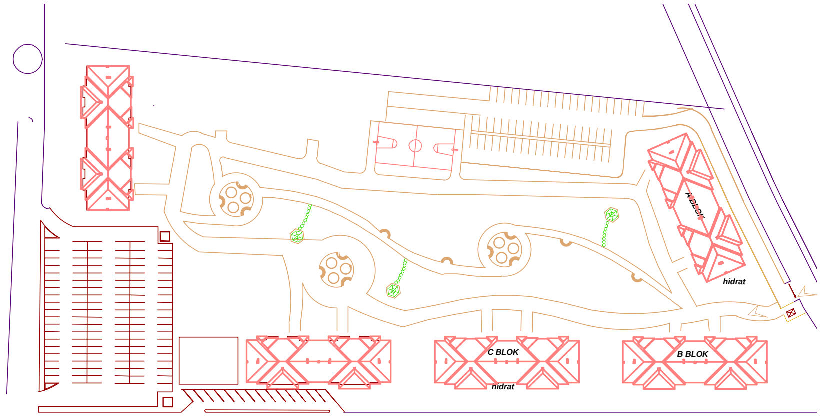


Figure 336: *Site plan*

The sections like WC and bathroom have been placed in the middle of the building, which makes it impossible to have daylight in these rooms. The parts that require sunlight and solar warmth such as living rooms and bedrooms have been positioned on the outermost parts of the building. The opposite directional facades of the flats significantly provide the rooms with ventilation and daylight.

The ferro-concrete shear walls play a crucial role in supporting the buildings. The walls that fill the gap inside the ferro-concrete structure is made up of bricks. The hipped roof has been used conveniently with the shifting on facades.

While the shorter facades display a flat and regular form, the long facades exhibit shifting horizontally but are straight vertically. The surface area to volume ratio yields 0.36.

7.2.3. Building Compenents U-Values, Thermal Bridges and Airtightness

- **Building Components, U-Values, Acoustic**

10) AD01 Overhang Ceiling to Outside Air:

The total ceiling construction thickness is 29 cm. The top layer is laminate. 3 cm thick screed has been built to flatten the floor. 3 cm XPS, which is a suitable material used for thermal insulation, has been placed in order to provide sound insulation primarily. 14 cm thick reinforced concrete slab loads the construction. Under the load-bearing system, 5 cm thick XPS has been placed to provide thermal insulation. The total calculated U-Value of ceiling with full insulation results in a value of 0.31 W/m²K. The resulting value is approximately 32% lower than the required U-value of 0.45 W/m²K.

U-Value= 0.31 W/m²K

Weighted Sound reduction index Rw = 57 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 74 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 62.99 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	18,1	20,0	
1	2 cm	Lamination	0,130	0,154	17,0	18,1	10,0
2	3 cm	Cement screed	1,650	0,018	16,8	17,0	60,0
3	3 cm	XPS	0,030	1,000	9,3	16,8	1,1
4	14 cm	Reinforced concrete (2%)	2,500	0,056	8,9	9,3	336,0
5	5 cm	XPS	0,030	1,667	-3,6	8,9	1,8
6	2 cm	Silicone resin plaster	0,140	0,143	-4,7	-3,6	36,0
		Thermal contact resistance*		0,040	-5,0	-4,7	
	29 cm	Whole component		3,248			444,8

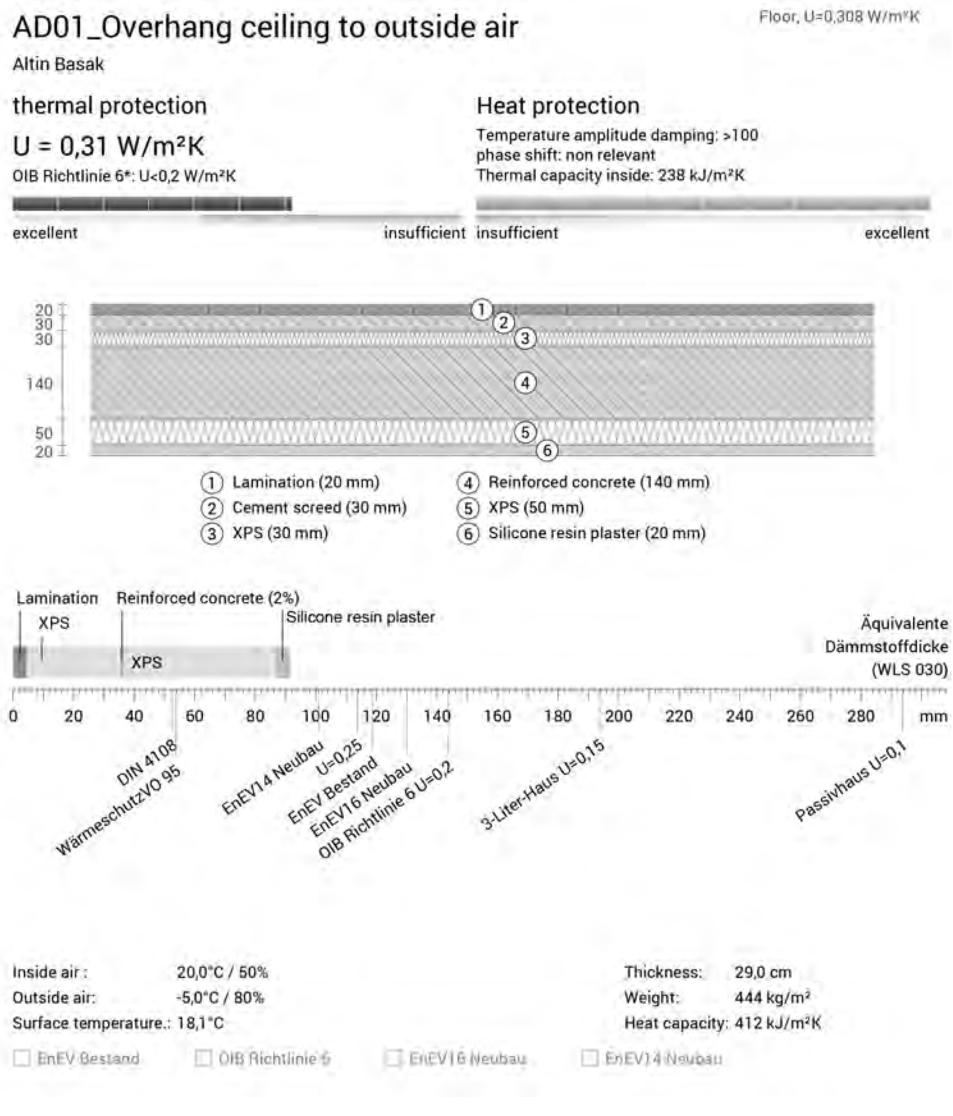


Figure 337: *Detail of the overhang ceiling to outside air, made by the author.*

11) AW01 Exterior Brick Wall

The total exterior wall structure thickness is 28 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. The load bearing system is designed with reinforced concrete columns and walls; therefore, 20 cm thick brick walls have a dividing function. The façade is insulated with 5 centimeter XPS. A single-layer exterior plaster has been used with a silicone resin float finish as a fine plaster. The total U-value of the thermally insulated exterior wall is calculated as 0.40W/m²K. Accordingly the resulting value is about 20 % lower than the required U-value of 0.50 W/m²K.

U-Value= 0.40 W/m²K

Weighted Sound reduction index Rw= 51 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 69.48 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	17,6	20,0	
1	1 cm	Gypsum plaster	0,510	0,020	17,4	17,6	10,0
2	20 cm	Brick	0,320	0,625	11,4	17,4	400,0
3	5 cm	XPS	0,030	1,667	-4,5	11,4	1,5
4	1 cm	Silicone resin plaster	1,000	0,010	-4,6	-4,5	18,0
		Thermal contact resistance*		0,040	-5,0	-4,6	
	27 cm	Whole component		2,491			429,5

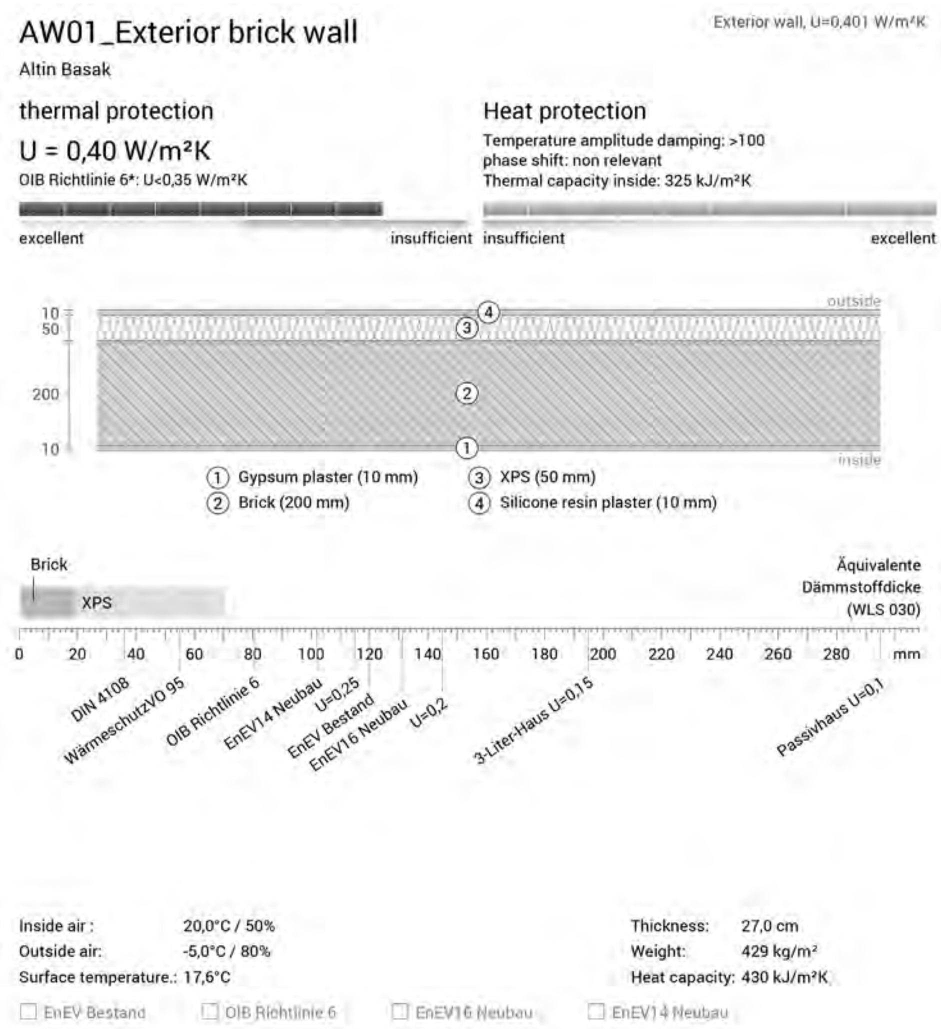


Figure 338: *Detail of the exterior brick wall, made by the author.*

12) AW02 Exterior Concrete Wall

The total exterior wall structure thickness is 28 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. 20 cm thick brick walls function as load-bearing. The façade is insulated with 5 centimeter XPS. A single-layer exterior plaster has been used with a silicone resin float finish as a fine plaster. The total U-value of the thermally insulated exterior wall is calculated as 0.48 W/m²K. Accordingly the result value is by about 3.8 % lower than the required U-value of 0.50 W/m²K.

U-Value= 0.48 W/m²K

Weighted Sound reduction index Rw= 60 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 264.32 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	17,2	20,0	
1	1 cm	Gypsum plaster	0,510	0,020	16,9	17,2	10,0
2	20 cm	Reinforced concrete (2%)	2,500	0,080	16,0	16,9	480,0
3	5 cm	XPS	0,030	1,667	-2,9	16,0	1,5
4	2 cm	Silicone resin plaster	0,140	0,143	-4,5	-2,9	36,0
		Thermal contact resistance*		0,040	-5,0	-4,5	
	28 cm	Whole component		2,079			527,5

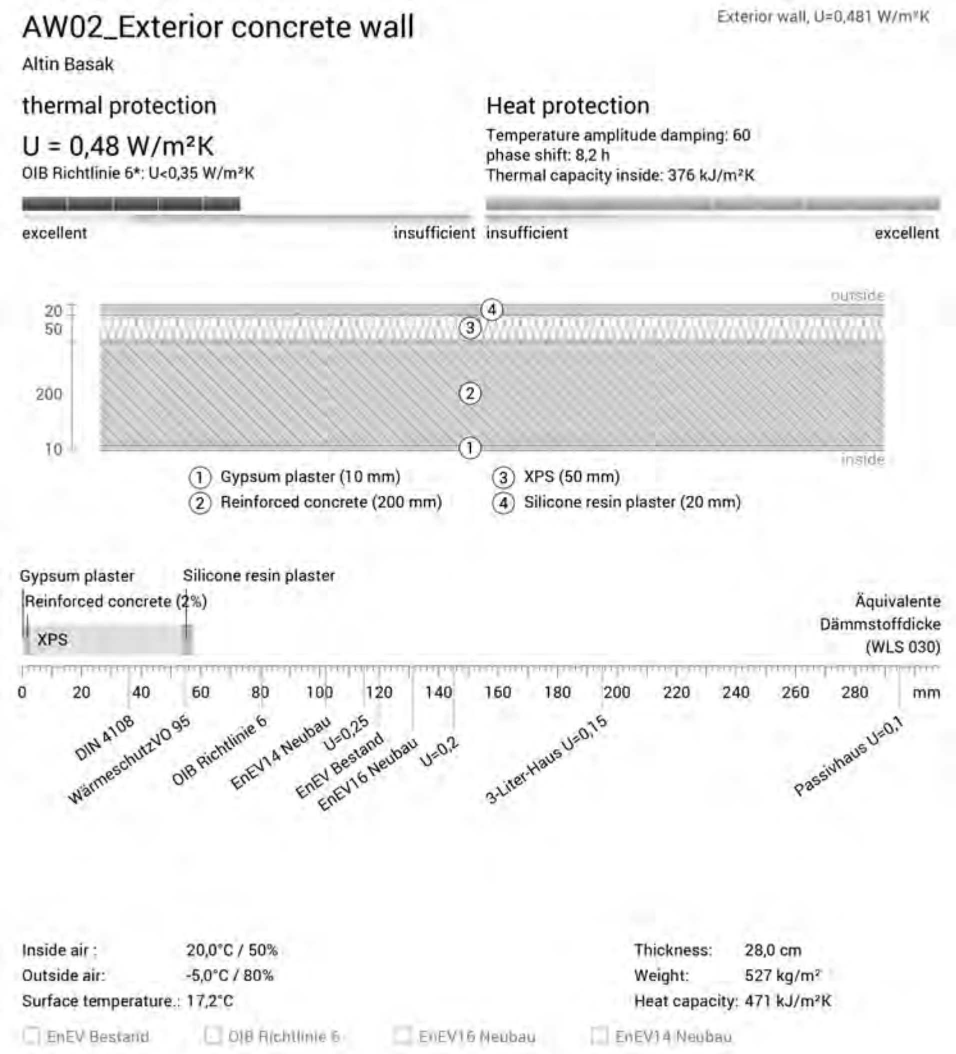


Figure 339: *Detail of the overhang ceiling to outside air, made by the author.*

13) AW03 Exterior Wall Against Staircase

The exterior wall structure is 27 cm thick. The interior plaster is executed as a single-layer gypsum/lime machine plaster. Reinforced concrete columns and walls carry the load, so that 20 cm thick brick walls have the function to divide the rooms. The wall has been insulated with 3 cm thick XPS. A single-layer exterior plaster has been used with a silicone resin float finish as a fine plaster. The total U-value calculation of the exterior wall with 3 cm thermal insulation results in a U-value of 0.51 W/m²K. There is no obligatory U-Value for this building component.

U-Value= 0.51 W/m²K

Weighted Sound reduction index Rw = 48 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 76.52 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	17,0	20,0	
1	2 cm	Gypsum plaster	0,510	0,039	16,6	17,0	20,0
2	20 cm	Brick	0,320	0,625	9,1	16,6	400,0
3	3 cm	XPS	0,030	1,000	-2,8	9,1	0,9
4	2 cm	Silicone resin plaster	0,140	0,143	-4,5	-2,8	36,0
		Thermal contact resistance*		0,040	-5,0	-4,5	
	27 cm	Whole component		1,977			456,9

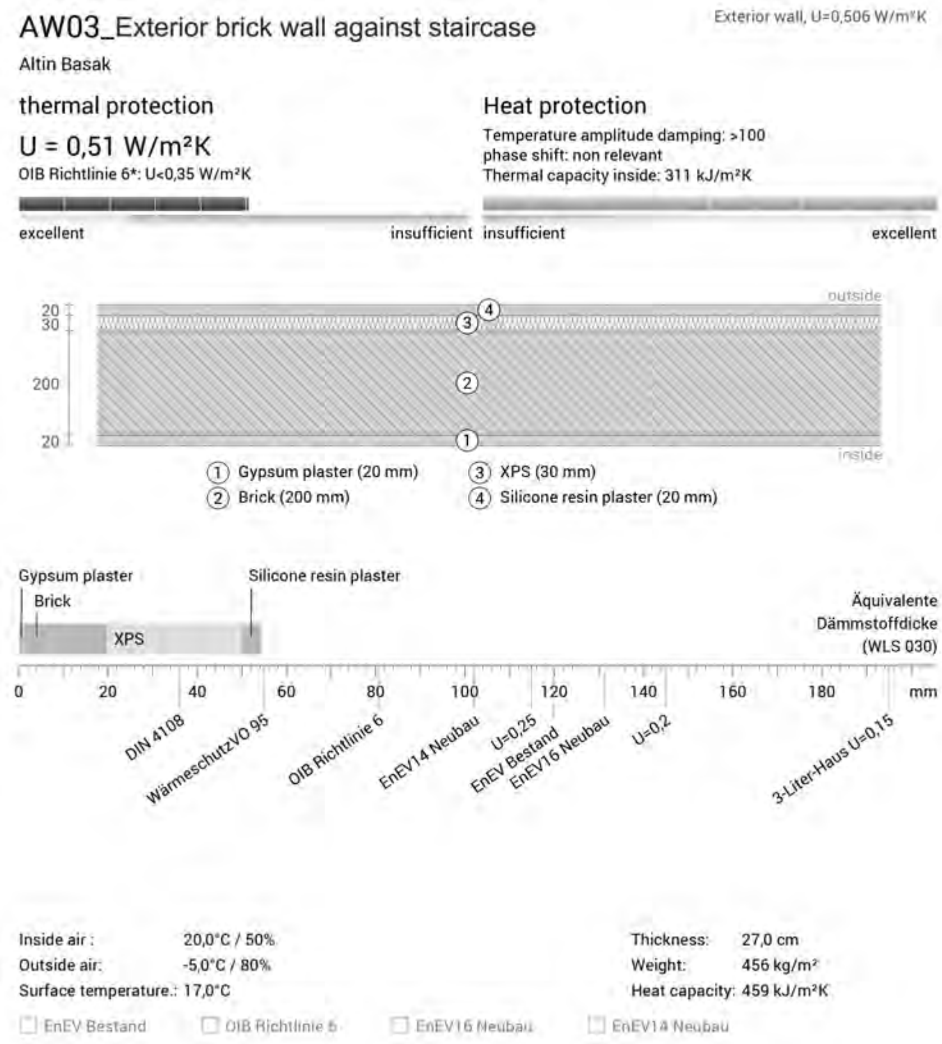


Figure 340: *Detail of the exterior wall against staircase, made by the author.*

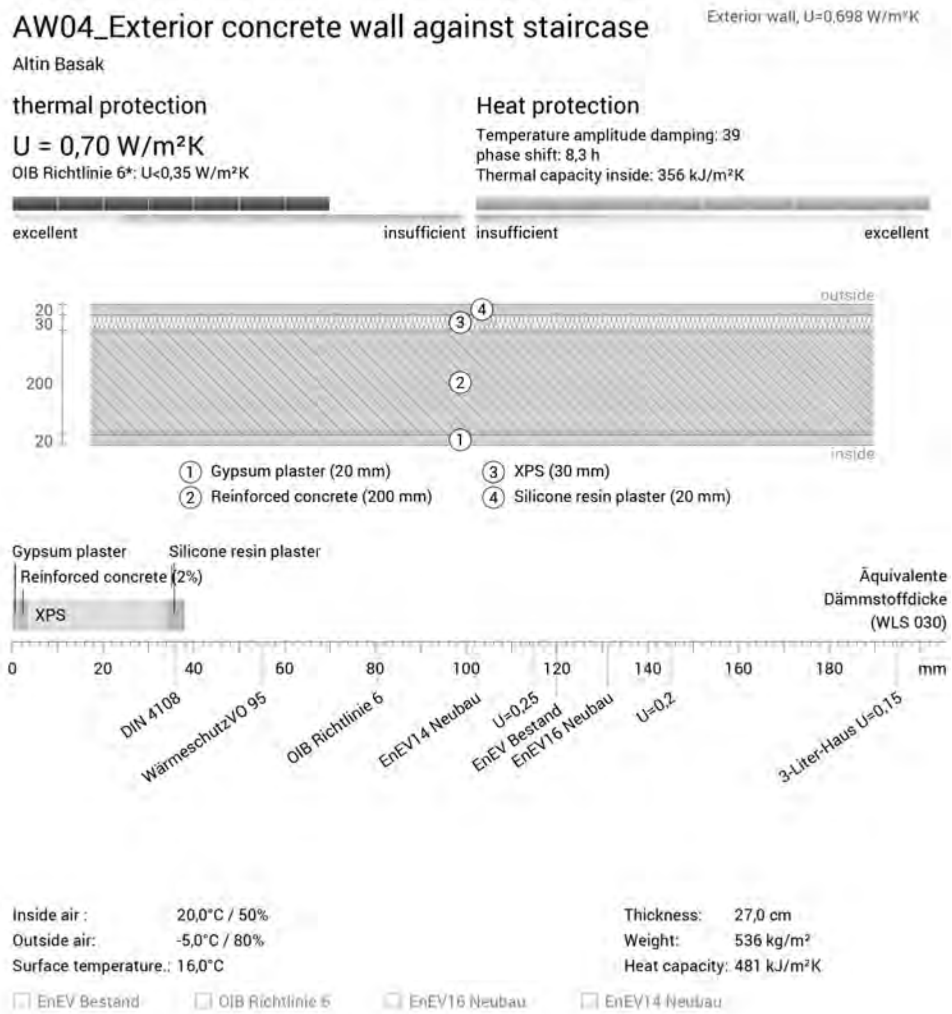
14) AW04 Exterior Concrete Wall Against Staircase

The total exterior wall structure thickness is 27 cm. The interior plaster is executed as a single-layer gypsum/lime machine plaster. 20 cm thick reinforced concrete walls carry the load of the structure. The wall has been insulated with 3 cm thick XPS. A single-layer exterior plaster has been used with a silicone resin float finish as a fine plaster. The total U-value calculation of the exterior wall results in a U-value of 0.70 W/m²K. There is no obligatory U-Value for this building component.

U-Value= 0.70 W/m²K

Weighted Sound reduction index Rw = 60 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 221,84 kg/m²



Layers (from inside to outside)

#		Material	λ (W/mK)	R (m²K/W)	Temperatur [°C] min	max	Weight (kg/m²)
		Thermal contact resistance*		0,130	16,0	20,0	
1	2 cm	Gypsum plaster	0,510	0,039	15,3	16,0	20,0
2	20 cm	Reinforced concrete (2%)	2,500	0,080	14,1	15,3	480,0
3	3 cm	XPS	0,030	1,000	-2,1	14,1	0,9
4	2 cm	Silicone resin plaster	0,140	0,143	-4,4	-2,1	36,0
		Thermal contact resistance*		0,040	-5,0	-4,4	
	27 cm	Whole component		1,432			536,9

Figure 341: *Detail of the exterior concrete wall against staircase, made by the author.*

15) ID01 Interior Ceiling Against Unheated Basement- Laminate

The total ceiling construction thickness is 26 cm. 3 cm thick screed has been executed to flatten the floor. The thickness of the load-bearing reinforced concrete slab is 14 cm. 5 cm thick XPS has been used to provide thermal insulation under the load-bearing system slab. The total U-value of the ceiling with full thermal is calculated as 0.421 W/m²K. The resulting value is about 6.5% lower than the required U-value of 0.45

U-Value= 0.421 W/m²K

Weighted Sound reduction index Rw = 56 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 75 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 282.08 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	17,3	20,0	
1	2 cm	Lamination	0,130	0,154	15,7	17,3	10,0
2	3 cm	Cement screed	1,650	0,018	15,5	15,7	60,0
3	14 cm	Reinforced concrete (2%)	2,500	0,056	14,9	15,5	336,0
4	5 cm	XPS	0,030	1,667	-3,0	14,9	1,8
5	2 cm	Silicone resin plaster	0,140	0,143	-4,6	-3,0	36,0
		Thermal contact resistance*		0,170	-5,0	-4,6	
	26 cm	Whole component		2,378			443,8

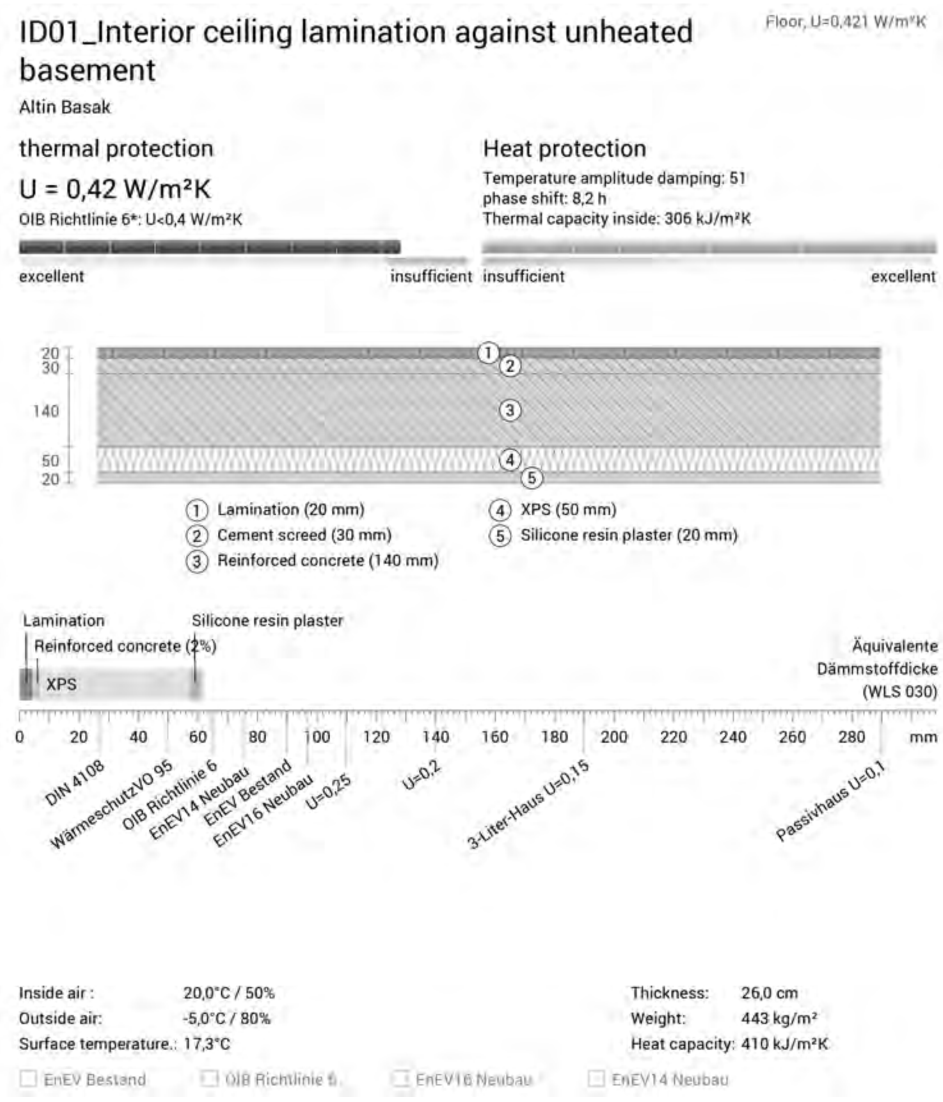


Figure 342: *Detail of the interior laminate ceiling against unheated basement, made by the author.*

16) ID02 Interior Ceiling Against Unheated Basement- Tiles

The total ceiling construction thickness is about 26 cm. The top layer is tile. 3 cm thick screed has been executed to flatten the floor. The thickness of the load-bearing reinforced concrete slab is 14 cm. Under the load-bearing system 5 cm thick XPS has been placed to provide thermal insulation. The total U-value calculation of ceiling with full heat insulation results in a value of 0.448 W/m²K. The resulting value is about 0.5 % lower than the required U-value of 0.45

U-Value= 0.448 W/m²K

Weighted Sound reduction index Rw= 55 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =76 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 238.33 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	17,1	20,0	
1	2 cm	Tiles (ceramic)	2,300	0,009	17,0	17,1	40,0
2	3 cm	Cement screed	1,650	0,018	16,8	17,0	60,0
3	14 cm	Reinforced concrete (2%)	2,500	0,056	16,2	16,8	336,0
4	5 cm	XPS	0,030	1,667	-2,9	16,2	1,8
5	2 cm	Silicone resin plaster	0,140	0,143	-4,5	-2,9	36,0
		Thermal contact resistance*		0,170	-5,0	-4,5	
	26 cm	Whole component		2,232			473,8

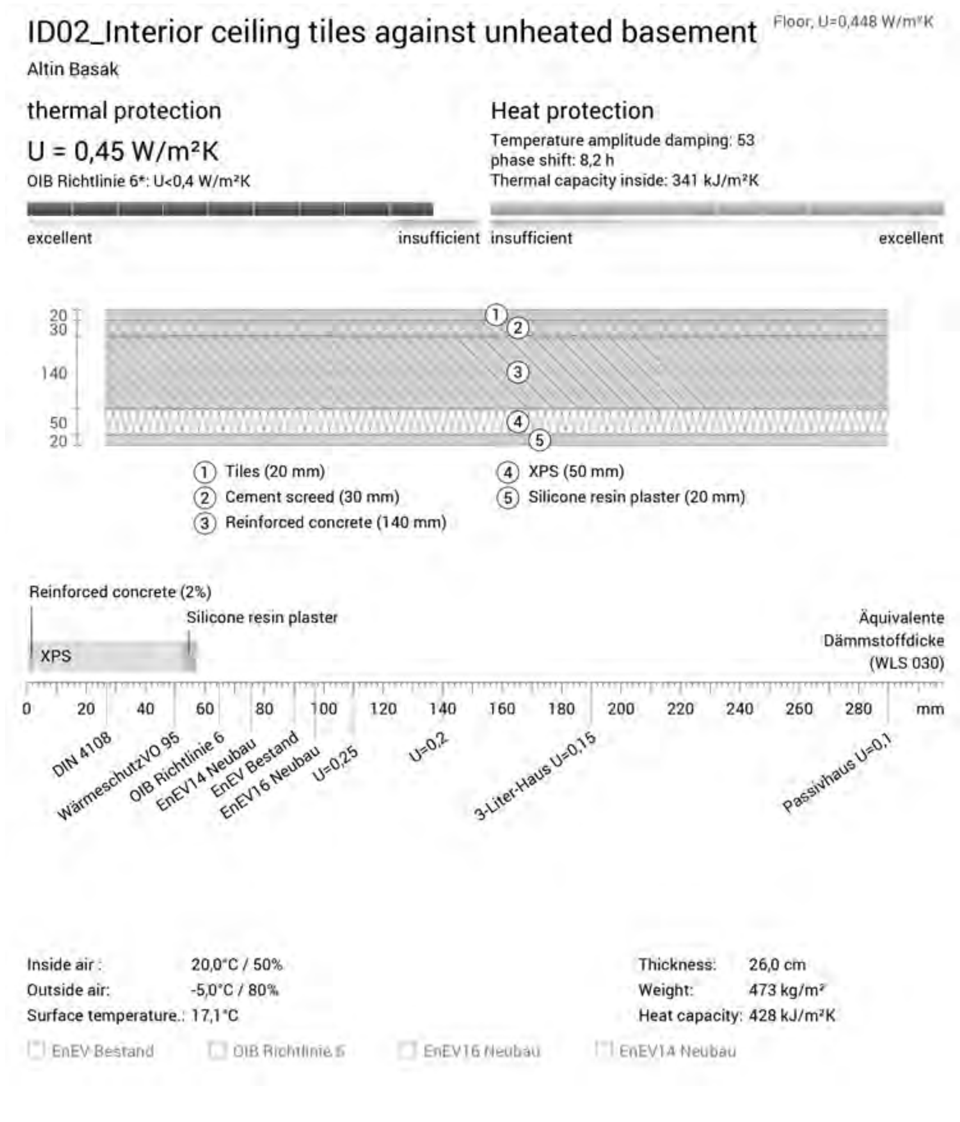


Figure 343: *Detail of the interior tile ceiling against unheated basement, made by the author.*

17) ID03 Interior Ceiling- Tiles

The total ceiling construction thickness is 24 cm. The top layer is tile. 3 cm thick screed has been executed to flatten the floor. It has not been applied any sound insulation to the ceiling. 3 cm thick XPS has been executed between floors in order to provide thermal insulation. 14 cm thick reinforced concrete bears the load of the structure. The total U-value calculation of ceiling results in a value of 0.70 W/m²K. There is not an obligatory value for this component.

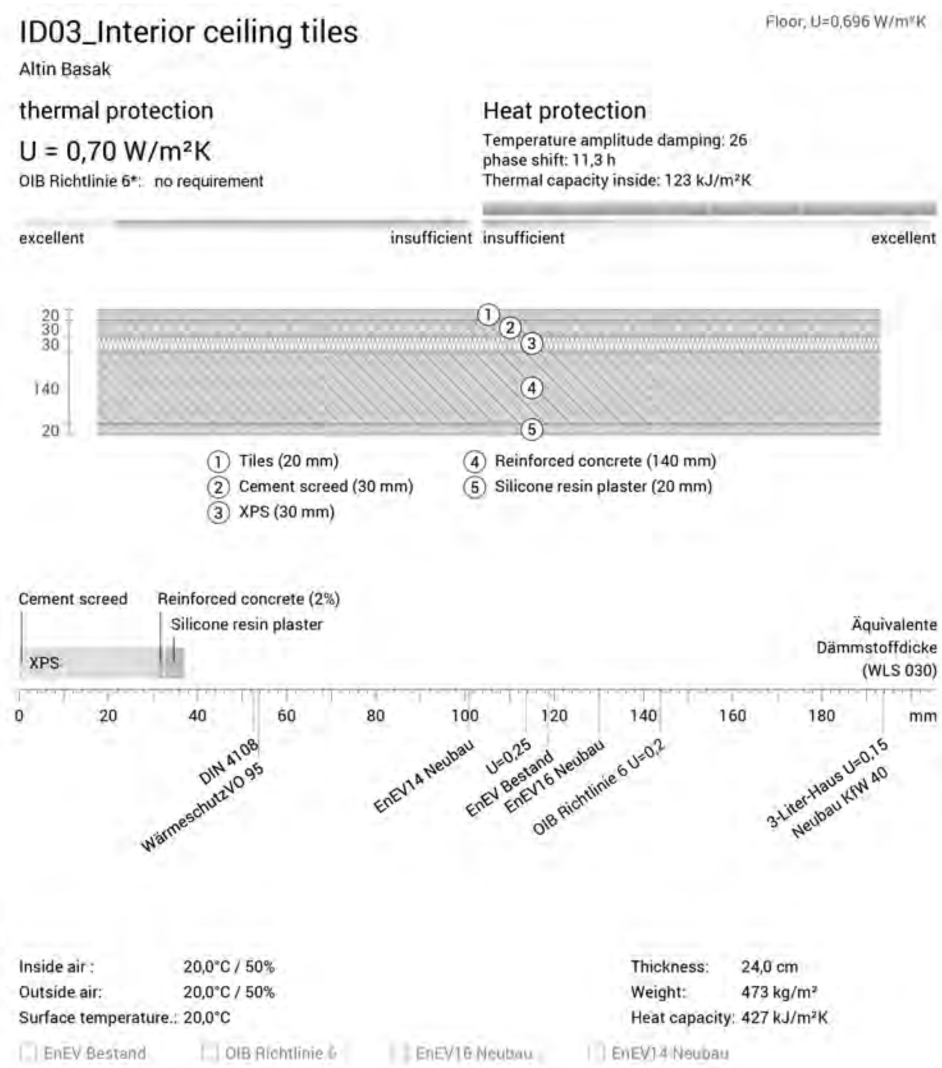
U-Value= 0.70 W/m²K

Weighted Sound reduction index Rw= 46 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =76 [dB]

Weighted Standardized Impact Sound Pressure Level L`nT,w =70 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 101.72 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	2 cm	Tiles (ceramic)	2,300	0,009	20,0	20,0	40,0
2	3 cm	Cement screed	1,650	0,018	20,0	20,0	60,0
3	3 cm	XPS	0,030	1,000	20,0	20,0	1,1
4	14 cm	Reinforced concrete (2%)	2,500	0,056	20,0	20,0	336,0
5	2 cm	Silicone resin plaster	0,140	0,143	20,0	20,0	36,0
		Thermal contact resistance*		0,040	20,0	20,0	
	24 cm	Whole component		1,437			473,1

Figure 344: *Detail of the interior tile ceiling, made by the author.*

18) ID04 Interior Ceiling- Laminate

The total ceiling construction thickness is 24 cm. The top layer is laminate. 3 cm thick screed has been executed to flatten the floor. Any sound insulation has not been applied to the ceiling. 3 cm thick XPS has been executed between floors in order to provide thermal insulation. The thickness of the load-bearing reinforced concrete is 14 cm. The total U-value of ceiling calculated to be 0.63 W/m²K. There is not an obligatory value for this component.

U-Value= 0.63 W/m²K

Weighted Sound reduction index Rw= 56 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw = 75 [dB]

Weighted Standardized Impact Sound Pressure Level L`nT,w =75 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 67.94 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,170	20,0	20,0	
1	2 cm	Lamination	0,130	0,154	20,0	20,0	10,0
2	3 cm	Cement screed	1,650	0,018	20,0	20,0	60,0
3	3 cm	XPS	0,030	1,000	20,0	20,0	1,1
4	14 cm	Reinforced concrete (2%)	2,500	0,056	20,0	20,0	336,0
5	2 cm	Silicone resin plaster	0,140	0,143	20,0	20,0	36,0
		Thermal contact resistance*		0,040	20,0	20,0	
	24 cm	Whole component		1,579			443,1

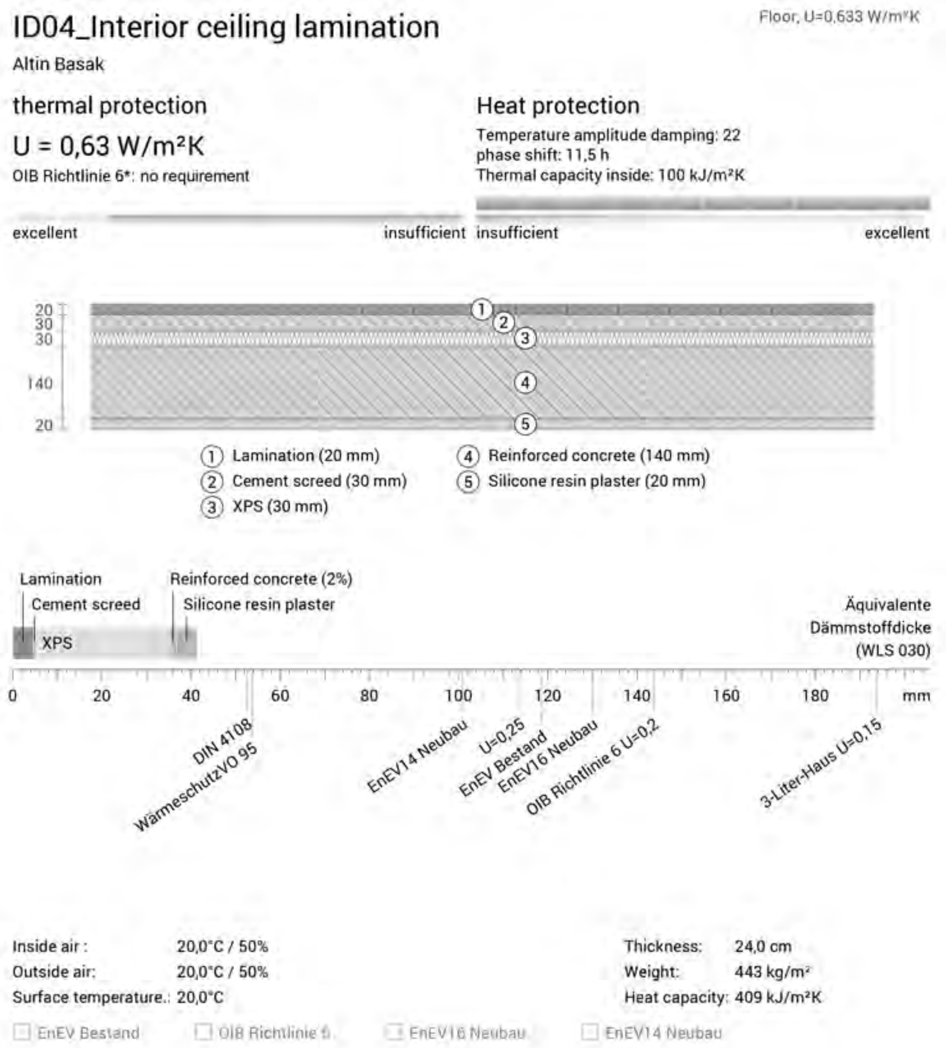


Figure 345: *Detail of the interior tile ceiling, made by the author.*

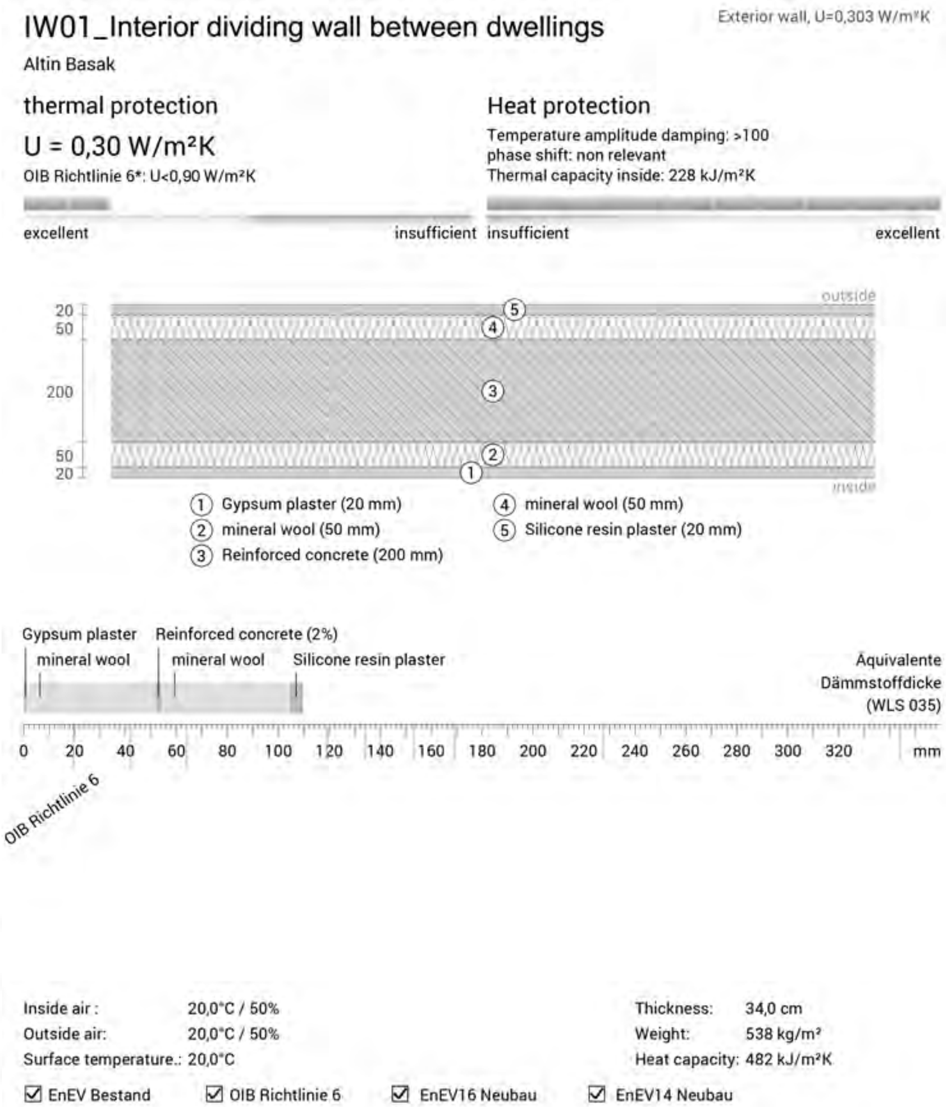
19) IW01 Interior Dividing Wall Between Dwellings

The total thickness of dividing walls is 34 cm. The wall surfaces have been smoothed. Because that the load bearing function has been provided with reinforced concrete columns and walls, 20 cm thick brick walls have only the function to divide the rooms. 5 cm mineral wool has been applied to both sides of the walls. The total U-value calculation of the dividing results in a U-value of 0.30 W/m²K. There is not an obligatory value for this component.

U-Value= 0.30 W/m²K

Weighted Sound reduction index Rw= 62 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 28.19 kg/m²



Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	20,0	20,0	
1	2 cm	Gypsum plaster	0,510	0,039	20,0	20,0	20,0
2	5 cm	mineral wool	0,035	1,429	20,0	20,0	1,0
3	20 cm	Reinforced concrete (2%)	2,500	0,080	20,0	20,0	480,0
4	5 cm	mineral wool	0,035	1,429	20,0	20,0	1,0
5	2 cm	Silicone resin plaster	0,140	0,143	20,0	20,0	36,0
		Thermal contact resistance*		0,040	20,0	20,0	
	34 cm	Whole component		3,297			538,0

Figure 346: *Detail of the interior dividing wall between the dwellings, made by the author.*

20) OD01 Upper ceiling against unheated attic

The total ceiling construction thickness is 26 cm. The top layer is 10 cm thick XPS. No sound insulation has been applied to the ceiling. 14 cm thick reinforced concrete slab bears the construction load. The lowest layer is 2cm thick plaster. The total U-value calculation of the ceiling results in a value of 0.276 W/m²K. The resulting value is about 38.7% lower than the required U-value of 0.45.

U-Value= 0.276 W/m²K

Weighted Sound reduction index Rw= 60 [dB]

Weighted Normalized Impact Sound Pressure Level Lnw =71 [dB]

Thermal storage by the building's mass $m_{w,B,A}$ = 221.36 kg/m²

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	18,3	20,0	
1	2 cm	Gypsum plaster	0,510	0,039	18,1	18,3	20,0
2	14 cm	Reinforced concrete (2%)	2,500	0,056	17,7	18,1	336,0
3	10 cm	XPS	0,030	3,333	-4,7	17,7	3,5
		Thermal contact resistance*		0,100	-5,0	-4,7	
	26 cm	Whole component		3,629			359,5

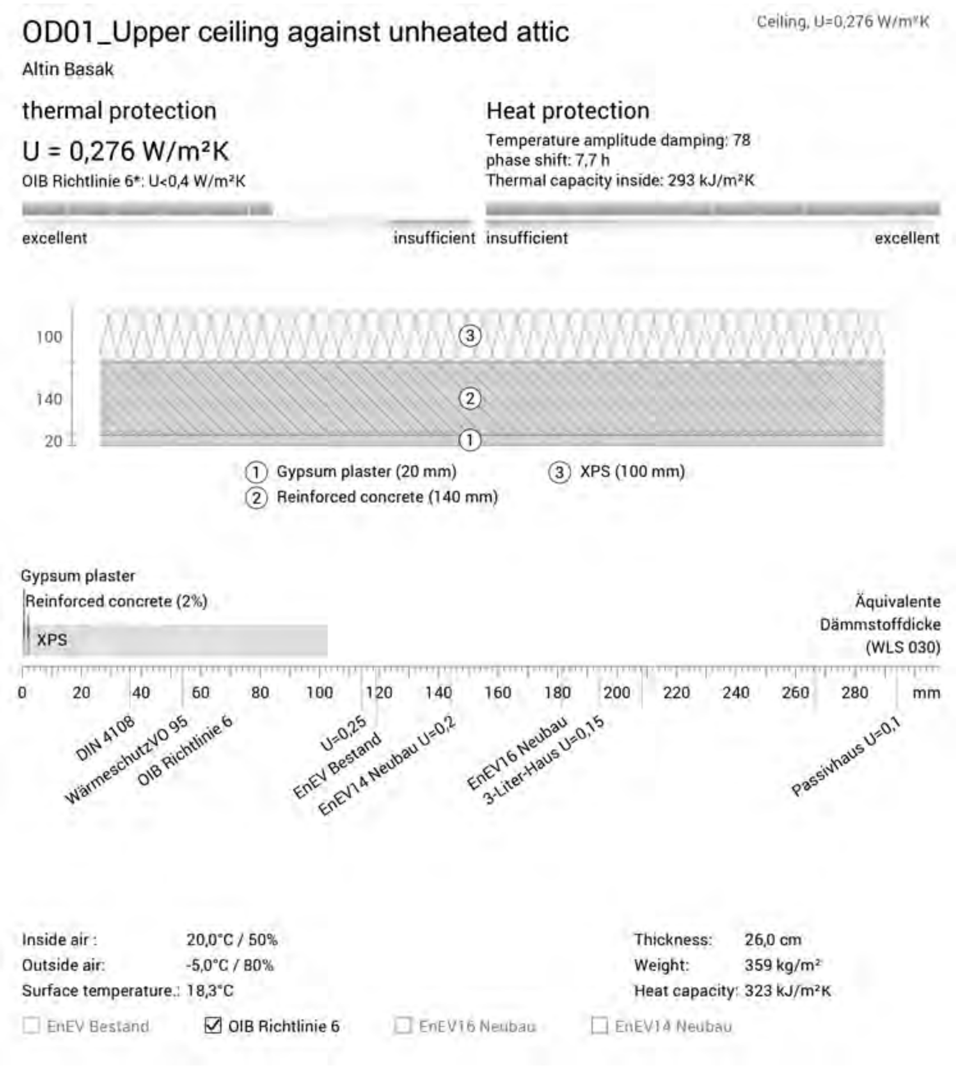


Figure 347: *Detail of upper ceiling, made by the author.*

- **Thermal Bridges**

1) Attic – Top Floor

A 10 cm XPS layer is used in the buildings between the unheated attic and the top floor, but as it is seen obviously in the detail, the attic finishes approximately 50 cm back from the facade. The reinforced concrete floor is insulated with a waterproof material and it no thermal insulation has been applied to the surface adjoining the facade. According to the 2D thermal bridge simulation, the heat losses at the intersection of the interior wall and the ceiling is very large.

2) Ceiling Between Basement and Ground Floor

No thermal insulation layer exists between the wall of unheated basement and the ground. The 5 cm XPS insulation is applied on the exterior wall only aboveground. Although the ground floor slab is insulated from below with XPS insulation to the unheated basement, there are large heat losses at the building corners as seen in the simulation results.

3) Balcony and External Wall

The load-bearing balcony construction is a continuation of the floor slab. No construction component such as an Isokorb was used as a structural thermal break between the balcony slab and the floor slab. Aside from that the simulation shows that heat losses occur at the corners because no thermal insulation is applied to the tops and the bottoms of the balcony slabs.

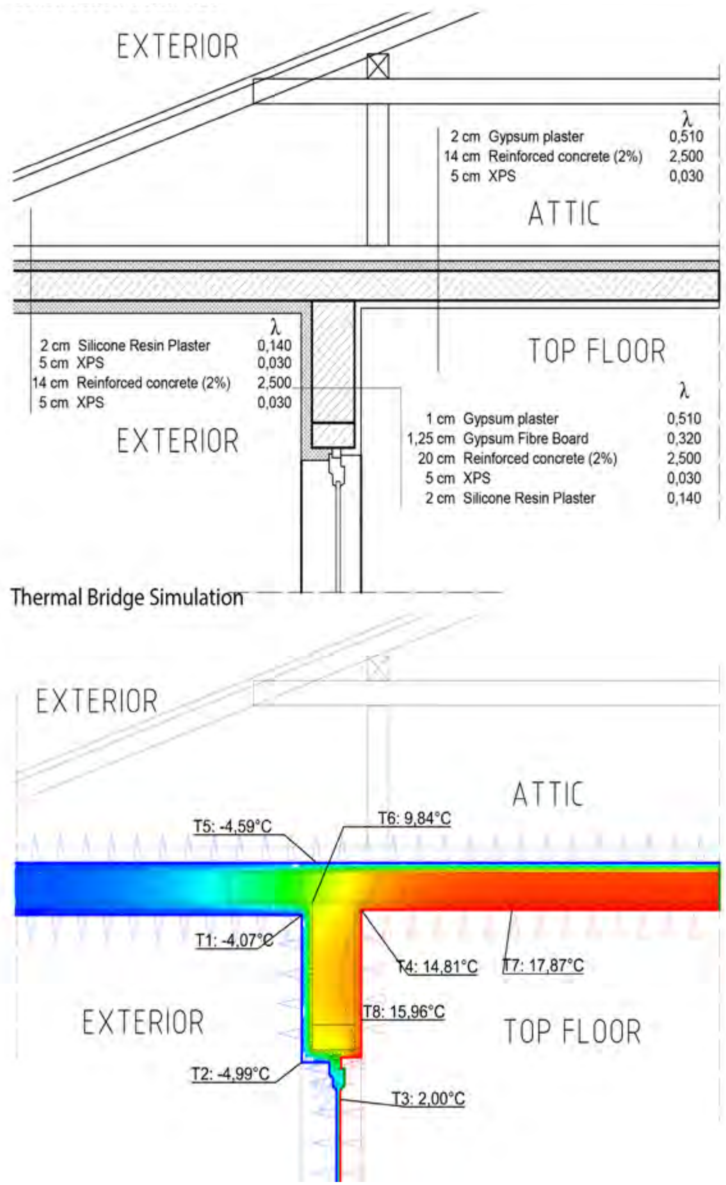


Figure 348: *Thermal Bridge Simulation showing the connection between the attic and the top floor, made by the author.*

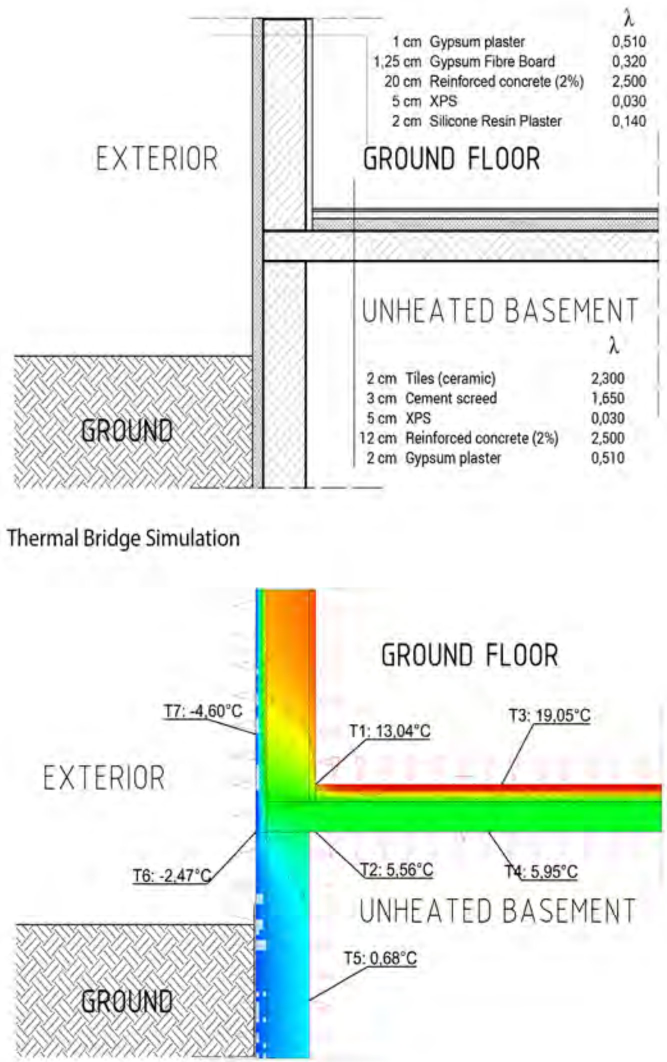


Figure 349: *Thermal Bridge Simulation showing the connection between unheated basement and ground floor, made by the author.*

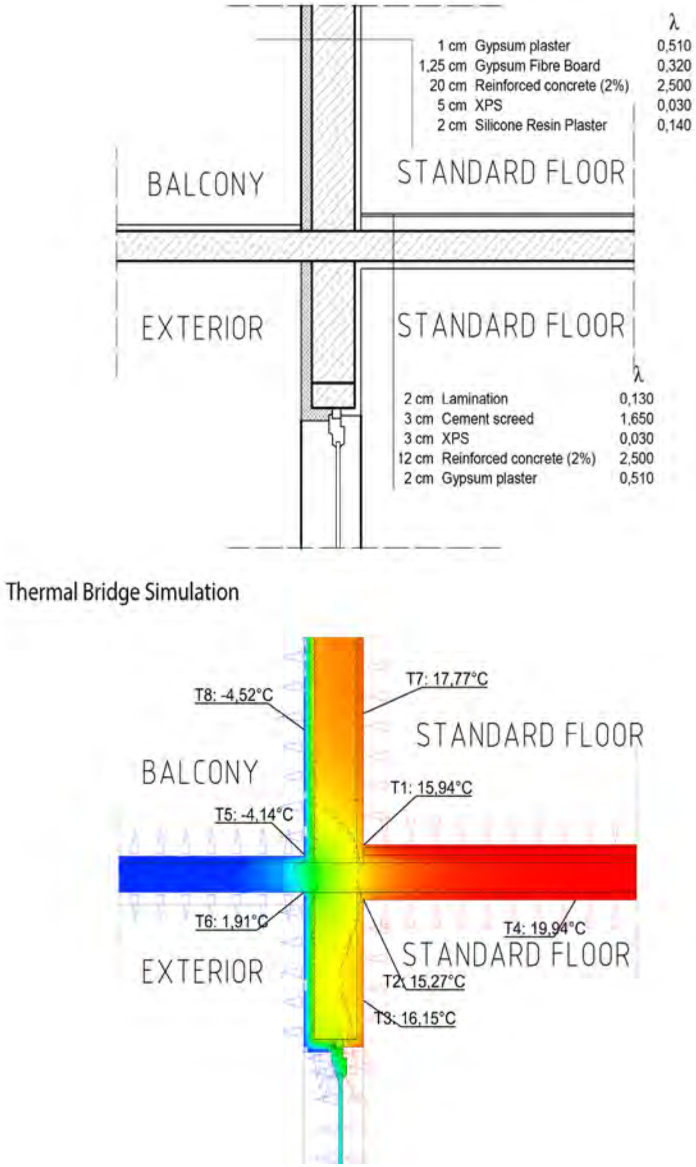


Figure 350: *Thermal Bridge Simulation showing the connection between balcony and interior ceiling, made by the author.*

7.2.4. Heating- Hot Water

Combination boilers are used in each flat in order to provide heating and hot water needs of the dwellings. 24 kW-powered boilers have been installed to every flat to satisfy the heating and hot water needs of 6551-square-meter total area of 44 flats. The total energy per year required for the heating and hot water demands has been calculated as 445,412 kWh. PVC hot water pipes have been installed inside the flats without heat insulation. An under floor heating system has been installed in the building.

7.2.5. Solar Power Generation

No photovoltaic system has been applied in the building.

7.2.6. Ventilation

Natural ventilation via windows has been used and a mechanical ventilation system in the buildings has not been applied.

7.2.7. Solar Shading-Overheating in Summer

To protect the indoors from sunlight, neither internal nor external venetian blinds on windows have been utilized. Curtains help to block sunlight that comes through windows. In addition, small portion of the windows and the balcony doors has been protected from sunlight by means of balcony protrusions. All of the floors are directly exposed to sunlight but the ground floor is protected with respect to other floors, because there is a 1.5-meter overhang which is constructed on the 1st floor. Overheating is observed in the simulation of the children's room and the living room, which are picked as examples of simulation, because of the lack of sun blinds, and this fact results in disruption of room comfort. Proof of overheating are temperatures in the children's room exceeding 30 °C and the temperature of the living room exceeding 35 °C in the afternoon.(See Figure 351,Figure 352)

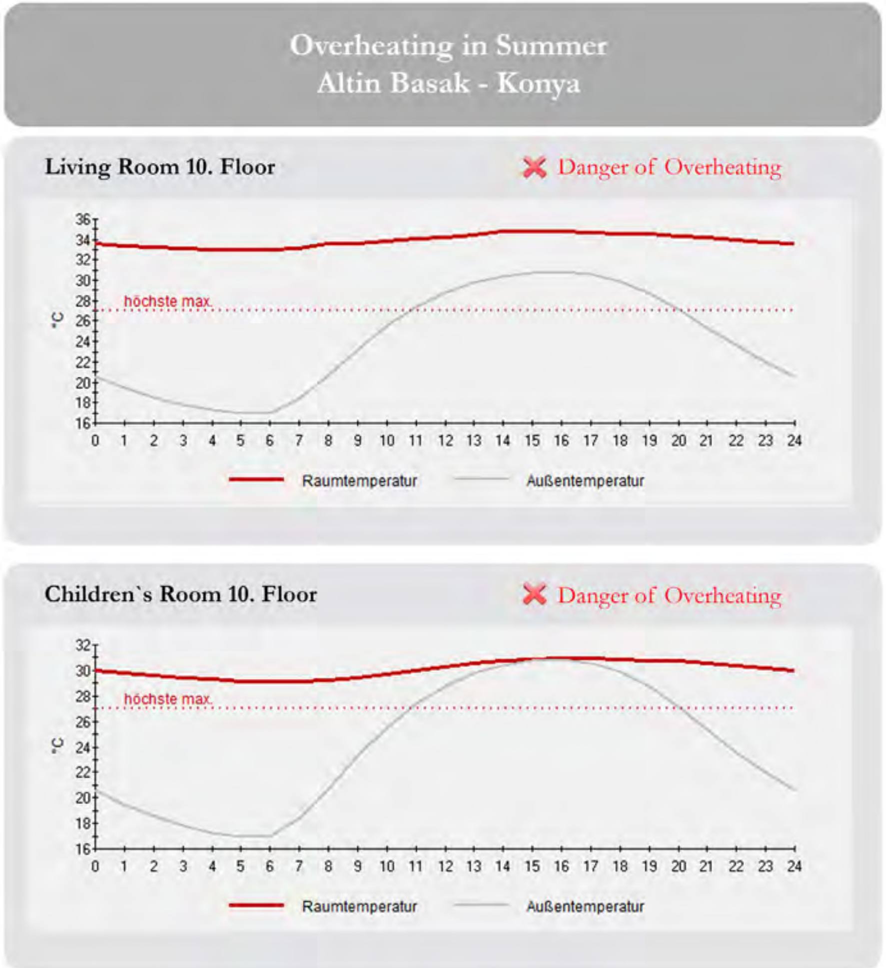


Figure 351: *Overheating calculations of the rooms in summer, made by the author.*

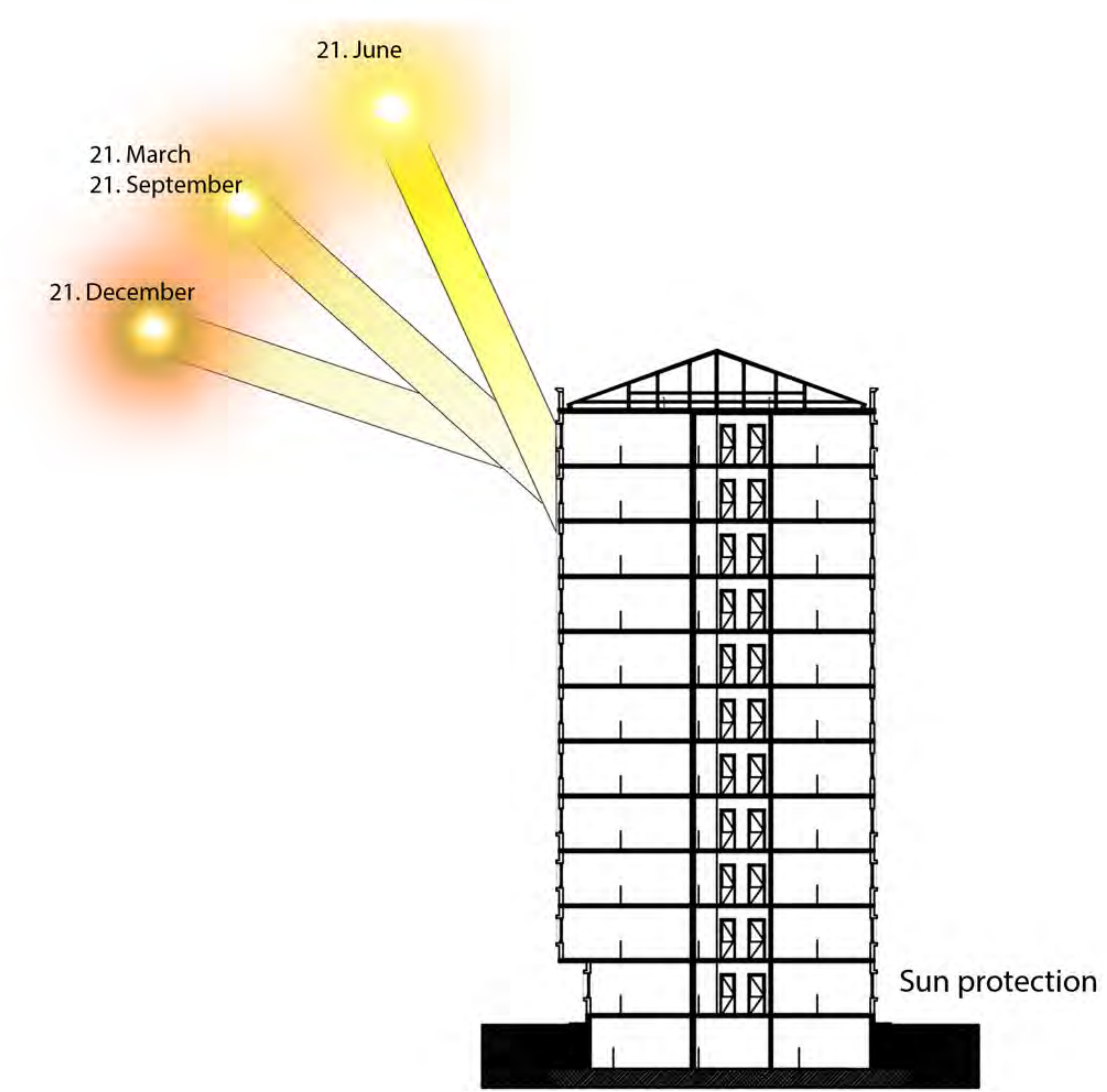


Figure 352: *Schematic representation of the position of the sun at different times, made by the author.*

7.3. Aesthetic - Visual Quality Analysis / AVQA

In terms of appearance, these buildings are a typical example of the prevalent types of housing projects in Turkey. The buildings being high, large blocks which repeat themselves. Furthermore the symmetry of the buildings gives a sense of monotony to the project. The garden fulfills the function of being a green garden, but it does not present enough different or innovative concepts and implementations. There is not a distinctive speciality that makes the concept and space different than other projects, or a case that confers the project an identity.(Figure 354) The new housing estates in the surrounding area have the same proportion as Altinbasak housing complex, but, similarly, compatibility with the human proportions is not fully supported by the planning of the buildings. (Figure 353)

- Does the scheme feel like a place with a distinctive character with an identity or does it seem like a reputation of other buildings in the surrounding? It is a reputation.
- Is the settlement monotonous or attractive & exciting? Monotonous.
- Is it a place which has a good visual impact? N
- Has a landscape architect designed the open space and does it seem that there is consideration of open space quality? N
- Is the housing area innovative, original, and creative, or ordinary? Ordinary.
- Is an aesthetic concern visible inside and outside of the buildings? Do the materials inside have a distinctive character? It has been tried to use good materials in the access routes of the buildings but these do not have a distinctive and clear character and present a mixture of materials.
- Are there some elements on the façade considered and designed especially because of aesthetic (concerns) in addition to the functional needs, or is the building just functional? N
- Is an architectural aesthetic provided through a visual impact in corridors and staircases of buildings with innovative space concepts, geometry movements or some other elements? N
- Are sustainable and healthy materials used, and consideration of environmental design expression implemented apparent to the façade and general view of the design? N
- Is the housing estate scale and concept compatible with surroundings (proportionally)? Y, compatible with the buildings in the surrounding but not with human scale.

Figure 353: *An elevation of One of the buildings in the housing*

Figure 354: *Other similar buildings in the surrounding.*

VI. COMPARISONS / FINDINGS

1. Results of Social- functional Quality Analyses

The results of the analysis of the SFQA including questions show that Viennese housing have generally better than cases in Konya. The cases in Vienna have better building proportions supporting housing and neighbourhood, various dwelling types and open spaces as well as several community rooms. Density-diversity tables prepared by the author between Figure 355 and Figure 359 show this difference between cases in both cities.

Regarding the issue of meeting housing needs: Basic needs of inhabitants are the same all over the world, however some social-cultural effects affect and influence specific environments. Viennese housing takes into consideration the requirements of inhabitants and tries to meet needs according to the tenant profile. Participation is an important issue and participative living has been a theme in housing for many decades. For instance, in the project Wohnen Mit Uns, participative housing is one of the main successes of the project. In other case studies of Viennese housing, although such specific parcticipation has not been a focus, the possible needs of different family types have been taken into consideration, which, generally, in housing projects in Turkey has not been of any concern. The sizes of Turkish housing units are considerably larger when compared with Viennese housing units. This has been an advantage for usage and furnishing, but Vienna is a capital struggling with housing and space problems, which has in turn led to positive measures to maximise space efficiency. The planning and size of Turkish housing may in general please Turkish people, nevertheless, if the subject is considered from the general conditions of scientific and architectural perspective, the dwellings are for a one-type, regular family leading to inflexibility when housing non-standard families. Space efficiency in the housing example of Konya was not contemplated, and this presents a significant lack regarding the ecological footprint. A wide variety of family sizes live in the same sized housing and, as in this event space efficiency was not discussed, it did not lead to innovative and smart solutions. Typically, and in this example, consideration of local needs is not addressed, and the usual habits and previous pattern of housing is replicated.

Regarding the concepts of accessibility and circulation: The Viennese housing examples present more clear distinctions and are better organised. The material choice of staircases and access routes are determined by taking into consideration orientation, which in Turkish housing does not go beyond subjective delight of decision-makers. Accessibility for disabled people and people with wheeled equipment is provided but not does not work as well as in Vienna. Handrails and the slope of ramps generally represent a lack of consideration across various examples of housing in Turkey, while Viennese examples are more accessible for disabled people and buggy carrying parents. Distinction of pedestrian-vehicle circulation in the Konya cases is not as clearly marked and designed as in Viennese cases.

Another lack in Turkish housing examples are the staircases. The staircases and access routes of case studies and in other implementations outside of these case studies, generally do not get daylight and do not allow natural ventilation. They are in the core of building. On the other hand the staircases in Viennese examples provide daylight and a good atmosphere. Moreover, circulation routes of all case studies in Vienna represent different specific solutions, while Turkish cases have similar circulation concepts.

Regarding efficiency of planning: The housing projects in Turkey do not have high aims, goals and challenges. Viennese case studies get subsidy from the government, and they have aims such as integration, smart solutions, communication, sustainability, flexibility, and livability, which have not been addressed with real concern in Turkey. The case “Wohnprojekt Wien-Wohnen mit uns” focuses on; participation, self-management, and further thinking and living of sustainability. The emergence of the project came through a question was focus of the most important concept of the project: “How can we reduce our CO2 emissions and our ecological footprint, and how can we do this in an urban environment?” The case “Satzingerweg-Bombardier” had the goal social of integration with different sized families and creating an alive and attractive atmosphere with variable designs, which is lacking in suburbia. The case “Aspern Leben mit holz“ had the aim of affordability, social sustainability, functional variety, and urban identity, and used some technical concepts to obtain energy and achieve a wood facade on such a grand scale. The project is also a representation of Smart City Vienna research, which aims at smart buildings, smart grids, smart information, and communication technologies.

Moreover Viennese cases are designed with different and various solutions, and give the impression that they have been planned according to the different circumstances and sites with consideration, while Turkish examples give the impression that they have been just mirrored and copied, and different solutions specific to the building sites have not been considered sufficiently.

The orientation of the rooms provide daylight in both examples. Turkish floor plans are generally composed from mirrored units which lead to different directions for the rooms of different dwellings. Bathrooms in Turkey generally do not get daylight, and natural ventilation of bathrooms is not as good as Viennese examples. The staircases are in the core of the buildings and simply aim to provide the function of movement in Turkish examples, without daylight or a positive atmosphere. However, these cases do have more room height, which makes the room wider and more spacious. In Vienna, because of the subsidy circumstances, and “smart housing”, room height is kept to a minimum.

Regarding flexibility: Turkish cases are built in the form of skeleton construction. In one case it is possible to demolish the inner walls but in Altinbasak, most of the interior walls are load bearing. In Viennese cases, the inner walls are generally not load-bearing, and the cases show that flexibility is a concern of these houses and the changing requirements of future circumstances are taken into consideration both within a dwelling and between the borders of different dwellings. The design and arrangement of different dwellings are planned to enlarge, reduce, or compound them. In all cases it is possible to change the functions of the rooms but in Turkish cases it is not usual to change the functions - bedrooms and living rooms usually remain usually the same.

Regarding safety: Turkish examples take more precaution against the entrance of non-residents, which leads to gated communities. It is a trend in housing complexes in Turkey to have security at the entrance of the housing, which has advantages and disadvantages. What puts them at a disadvantage is the fenced off nature of the entrance to the housing complex. Visitors have to enter through a gate and report to a security desk, which is detrimental to the genial atmosphere of the housing. The boundaries and intimacy between dwellings and the area outside the housing complex is more distinctive and protective compared with Vienna. Which concludes that the safety and boundaries between the balconies of multi-unit housing in Vienna have to be improved as in Turkey but it has to be found an alternative that does not allow them to be gated communities.

But the safety of residents in relation to accidents, and vertical and horizontal circulation of pedestrians, is better in Viennese cases. This can be seen especially in the lack of consideration of distinct pedestrian-car circulation in Turkey, the lack of convenience in designed ramps in Toki houses, and the danger for playing children in the playground of Altinbasak, which makes them cross the car park. In Altinbasak it was mentioned by a tenant that at the beginning there was not a protection fence around the pool in the garden, and this was only constructed after some kids got into the pool. This example is a case which shows that in Turkey there is a lack of infrastructure in the planning process, which is only sometimes addressed later after certain issues or dangers come to light.

Regarding health, well-being and comfort: The apartments in the case studies in both cities receive good daylight in their rooms, other than in bathrooms.

Concerning sound insulation, which is important for comfort and well-being, and also an issue for energy performance and construction quality, enough measures to ensure sound separation between building units and the outside has not been provided in Turkish examples, but is an important consideration in Viennese cases where the building law sanctions have a significant effect. Comfort in staircases is much better in Viennese examples because of the provided daylight and natural ventilation. Garden

WOHNEN MIT SCHARF

BLOCK TYPE		NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING TYPE B WITH 2 ROOMS	NUMBER OF DWELLING TYPE C WITH 3 ROOMS	MAISONETTE TYPE 1 73,46 m2	MAISONETTE TYPE 2 97-100 m2	MAISONETTE TYPE 3 more than 100m2	DWELLING WITH ROOF-TERRACE	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
WOHNEN MIT SCHARF		8	19	22	1	4	5	4	1	51	51

BLOCK TYPE		EACH DWELLING HAS A DIFFERENT PLAN DUE TO THE PARTICIPATION	GUEST APARTMENTS AT ROOF FLOOR	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
WOHNEN MIT UNS		39	3	1	39	39

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS WMU + WMS*	OPEN SPACE incl. common terraces and	TOTAL NUMBER OF DWELLING
4783 m2	7200 m2	773,18 m2	176,30+196,08+garden!!! m2	90

*WMU: Wohnen mit uns, WMS: Wohnen mit Scharf

Figure 355: *Density-diversity information of WMU, by the author.*

BLOCK TYPE			NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING TYPE A FOR SINGLE	NUMBER OF DWELLING TYPE B WITH 2 ROOMS	NUMBER OF DWELLING TYPE C,C1,C2 WITH 3 ROOMS	NUMBER OF DWELLING TYPE D,D1,D2 WITH 4 ROOMS	NUMBER OF DWELLING TYPE E WITH 5 ROOMS	DWELLING WITH ROOF-TERRACE	NUMBER OF MAISONETTE WITH DIF.PLAN TYPES B,C,D	DWELLINGS WITH GARDEN TERRACE	TOTAL NUMBER OF DWELLINGS
FIRST LINE		STIEGE B	7	10	7	AS MAISONETTE	15	-	-	1	3	33
		STIEGE C	7	16	6	31	AS MAISONETTE	-	-	5	10	58
SECOND LINE		STIEGE A	7	7	1	22	5	-	-	-	4	35
		STIEGE D	6	-	4	22	1	4	-	-	11	31
THIRD LINE		STIEGE E	6	10	5	14	-	-	2	2	5	30
		STIEGE F	Partially 6, and 7	4	5	17	-	-	4	4	-	26
TOTAL								4	6	12	33	213

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE incl. common terraces and private gardens ground floor	TOTAL NUMBER OF DWELLING
7731 m2	14220 m2	213,47	3948 m2	213

Figure 356: *Density-diversity information of Aspern-WMH, by the author.*

BOMBARDIER

BLOCK TYPE			NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING TYPE B WITH 2 ROOMS	NUMBER OF DWELLING TYPE C WITH 3 ROOMS	NUMBER OF DWELLING TYPE D WITH 4 ROOMS	NUMBER OF DWELLING TYPE E WITH 5 ROOMS	DWELLINGS WITH GARDEN	DWELLING WITH ROOF-TERRACE	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
POINT BLOCK	TYPE 1 (ST.1)		4	3	3	2	-	1	1	1	8	8
	TYPE 2 (ST.12)		6	2	4	6	3	2	3	1	15	15
	TYPE 3 (ST.13)		6	8	5	6	-	2	3	1	19	19
	TYPE 4 (ST.4)		6	7	4	7	-	2	2	1	18	18
	TYPE 5 (ST.3)		5	3	4	3	1	1	1	1	11	11
LINE BLOCK	TYPE 1	ENTRANCE 1 (ST.2)	6	2	4	5	-	1	3	2	11	22
		ENTRANCE 2 (ST.3)	5	1	8	3	-	3	2	2	12	24
	TYPE 2	ENTRANCE 1 (ST.4)	6	4	3	5	-	2	3	3	12	36
		ENTRANCE 2 (ST.5)	6	2	8	3	-	3	2	3	13	39
TOTAL				31	43	40	4	17	20	10		194

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE incl. common terraces and private gardens ground floor	TOTAL NUMBER OF DWELLING
17705 m2	15200 m2	305 m2	15317.1 m2	194

Figure 357: *Density-diversity information of Bombardierareal/Satzingerweg, by the author.*

TOKI KONEVI

BLOCK TYPE		NUMBER OF STOREYS INC. GROUND FL.	NUMBER OF ROOMS IN A UNIT	UNIT SIZE	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
Block of 100 square meters dwellings		12	3	100 square meters	9	48	432
Block of 100 square meters dwellings		15	3	100 square meters	2	60	120
Block of 150 square meters dwellings		10	4	150 square meters	2	40	80
Block of 150 square meters dwellings		15	4	150 square meters	7	60	420
Block of 195 square meters dwellings		12	5	195 square meters	1	48	48
Block of 195 square meters dwellings		15	5	195 square meters	2	60	120
TOTAL					23		1220

TOTAL SITE AREA (exc. the roads between 3 housing group sites which compose big car parking area	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE Exc.private balconies	TOTAL NUMBER OF DWELLING
53124 m2	162960 m2	-	40814	1220

Figure 358: *Density-diversity information of Toki Konevi, by the author.*

ALTINBASAK

BLOCK TYPE			NUMBER OF STOREY INC. GROUND FL.	NUMBER OF DWELLING MAIN TYPE WITH 5 ROOMS	NUMBER OF DWELLING NEAR ENTR. WITH 4 ROOMS	TOTAL NUMBER OF BLOCKS	NUMBER OF DWELLINGS IN ONE BLOCK	TOTAL NUMBER OF DWELLINGS
STANDARD BLOCK		ENTRANCE A	11+Roof	21	1	5	22	44
		ENTRANCE B	11+Roof	21	1		22	
TOTAL				210	10			220

At the roof it has been developed a doorman unit for each block which only allows for janitar usage.

TOTAL SITE AREA	TOTAL DWELLING AREA	COMMUNITY ROOMS	OPEN SPACE Exc.private balconies	TOTAL NUMBER OF DWELLING
26500 m2	31848 m2	-	22550 exc. private balconies in ground floor	220

Figure 359: *Density-diversity information of Altinbasak, by the author.*

activities which have positive effect on well-being are provided in Viennese cases better. (See also Chapter VI. 2, ECQA)

Regarding open space: In Turkish cases, landscape architects have not been included in the planning and design process. Other than the garden, they do not have shared open spaces, such as terraces or balconies, whereas Viennese examples often do have, with the possibility of access for a restricted group of residents. In Viennese cases, either privately or through sharing, people may be able to grow products in gardens, for example the hobby garden of case "wohnen mit uns" which provides the chance to grow flowers and vegetables to all tenants.

It is also an advantage that some flats have their own gardens and terraces, which is not the case in Turkey where all dwellings remain limited, with balconies of the same size. Imparticularly, the garden in the Toki case has low visual green quality with its ungreen and neglected view. Gardens of Viennese examples give the impression of being more defined and creative, especially the case of Aspern- Woode, which has some effective concepts behind its shaping process, with its lawn mounds representing an organic landscape and the canyon in this project also developing creativity and communication possibilities and a good atmosphere. The open access and staircases add to the open space and it is a positive quality that the doors of dwellings open as if on a street, as Alexander Christopher indicated.[1]

Common roof terraces which are partially planted are also designed in Viennese cases which contribute to the open space and also communication of the tenants.

Artificial additions to nature have also succeeded, with natural materials in all Viennese cases.

Regarding common rooms and facilities: Dwellings in Viennese cases have great quality in terms of communication and common rooms and spaces, both inside and outside. Case study "Wohnen mit uns", especially, has been given a very positive evaluation of these common rooms by the users of the building. With the support of these common rooms, a familiar atmosphere has been created across the whole building. Residents regularly eat lunch together in the common kitchen, they meet in the library, and they arrange meetings with the tenants. In Turkish cases such as "Altinbasak" there is a common room in the garden which is not well-defined or furnished, and also not large enough for housing on this scale. Generally, in Turkish examples it is difficult to find common rooms in affordable housing, which in Vienna is a very usual, and considered necessary, in affordable housing. In the case of "Aspern-Woode", within the access routes of the circulation network some meeting spaces have been created by simply widening the route. It is a creative use of space that is not defined by walls, yet is still definitive and serves as a common room, encouraging communication between residents.

Regarding children's playgrounds: The playgrounds in Viennese cases have been designed more appropriately and sensitively. The materials are also more healthy and seem natural and the design of the playgrounds vary in different projects, while Turkish cases present the same playground designs, generally made from plastic. Especially in the Toki case, the surroundings of the playgrounds are not convenient for children, and also not safe because of the deficiency in distinction between pedestrian and car circulation. In the Altinbasak case it is positive that place for sports, such as basketball and football, is provided, as it has been provided in the concept of social housing of Vienna since the 1970s. This possibility is actually provided by the parks outside the housing sites in Vienna, so it is not so important to provide areas for football and basketball in the Viennese context, although the case of Aspern does represents an exceptionally creative atmosphere for climbing and games activities for young people. In all cases in Vienna it is possible to find other parks in the surroundings, some of which belong to the municipality and some which belong to other housing estates, but which are accessible for residents of other estates. This chance is not provided in Turkish cases because generally playgrounds of housing estates are not accessible to the others, and serve only for their own residents.

1 Alexander, C., A Pattern Language: Towns Buildings Construction, Oxford University Press, New York, 1977, p. 741.

Indoor playgrounds have not been a concern for Turkish cases but are provided in Viennese cases, and they have been furnished well and advocated by tenants.

Regarding proportion of buildings and diversity of living units: The proportion of Viennese cases are a lower scale urban structure. Though there are advantages with high multi-storey buildings, they have many negative impacts on communication, neighborhood and urban structure. Due to concerns over income, there is a boom in high-rise housing in Turkey, which is evident in the cases in this study.

Housing cases in Vienna offer more variety regarding different living options than Turkish cases, and ensure quality options. For instance; small and large dwellings, flats, and maisonettes, with garden, terrace, or balcony. This ensures a mix of people with different ages and backgrounds which is an advantage for social quality. It is also a proof of architectural quality because different solutions and options have been created which culminate in diversification. In Turkish cases, the planning seems to be mirrored and copied and similar to all other housing estates. This monotony is reflected by the facade of the building blocks, which are also created in the same with copy and paste style. The size and views of the balconies also have the same problem, which seems to be evidence of this copied prototype.

The opportunity to obtain a garden-terrace in multi-unit housing provides an advantage for living conditions in city-life, and Turkish tenants would like to benefit from this. It provides an intention to be away from the stress of city-life and to cultivate by being engaged with the earth. This, in particularly, creates a good atmosphere for the children of the family.

Regarding storage, parking and waste services: Parking possibilities are better supplied in Turkish cases, but do not provide an advantage for sustainable communities. But there is still a lack of parking place for disabled people. In the Altinbasak case, people are not confronted with any difficulty, but in the Toki case they have no underground parking, which causes some parking problems. In Viennese cases they have underground parking, but not for each unit in all cases. Some measures to discourage car usage have been taken, which is a part of urban and planning strategy. Due to the accomplishment of public transport and bicycle paths and usage, this parking deprivation has become an opportunity for sustainability. In "Wohnprojekt Wien-Wohnen mit uns", solutions like "car-sharing system" have been considered to give people the opportunity to use the car in a more economical and efficient way, and reduce environmental pollution.

Although Viennese housing has smaller dwellings than Turkish, it storage in housing units has been designed to solve storage problems in a convenient form and manage usability of space. Outside of the buildings, each unit also has storage. These conditions have not been offered in Turkish cases, which is a disadvantage.

Waste services are also better managed in Viennese cases, with waste separation which supports eco friendship. Storage rooms or spaces for waste have been designed in a convenient way for all housing cases in Vienna, and this is lacking in Turkey, which is served by the inefficient solution of people who collect residential garbage.

Storage rooms for buggies and bicycles are also better designed in Viennese cases, and support accessibility and safety and release the circulation paths and from parked bicycles and buggies.

2. Results of Energy Performance and Construction Quality Analyses

The results of a the comparison between the energy demands of the case studies in Konya versus Vienna show a significant difference among the projects regarding indicators that directly affect energy performance of the house, particularly insulation techniques and materials, followed by heating and ventilation systems, solar heat gains and solar shading systems.

The differences are dramatically different, so much so that the energy demand of the projects in Turkey (Konya) are up to three to five times higher than projects in Vienna despite similar climates in both cities. Figures between Figure 360 and Figure 364 show the general overview of ECQA. This differences present significant handicaps for Konya. The buildings in Konya would have insufficient values and could not obtain a building permit in Vienna considering that regulations in Austria heavily emphasize energy performance as well as construction quality in buildings. Furthermore, the use of innovative techniques such as heat pumps, geothermal energy exchangers, district heating systems and controlled domestic ventilation are highly encouraged as they provide a significant increase in energy efficiency.

Various analyses have identified the lack of such beneficial systems in Konya while observing that the incorporation of such systems is commonplace in Austrian buildings.

The causes of these differences are analysed below in detail:

Regarding form and orientation: All projects except Satzingerweg CSIII are designed parallel to the landscape.

The Satzingerweg CSIII Project is the only project that takes the use of sunlight into full consideration. All balconies and flats are positioned to receive sunlight and are equally oriented to the south. In contrast, the defining factor in Konya for building placement in the landscape is not according to the sun's orientation, but instead the plan depends upon how well the surroundings around the building will be utilized even though many of these landscapes are wide enough and do not necessarily have a problem with situating the building. For instance, certain structures within the "Toki" project are situated on a diagonal axis while others are situated vertically. However in Aspern WMH in Vienna, all structures are built parallel to each other. Although this plan does not provide the same south facing front orientation to take full advantage of the sun's warmth, it does provide consistency with equal sun orientation to each façade.

In the case of Turkish buildings, sunlight has never been an issue to be resolved since the buildings are independent of the surrounding buildings and are all vertically dense, thereby causing no problems to receive sunlight.

The solutions in Vienna are not only designed for horizontal density but are also conceptualized for the use of maximum sunlight. Apartment buildings in Konya are built symmetrically following two axes. Both cases have symmetrical designs for all four flats on the same floor. The flats have two different façades, whereby the flats on the north side have a comparable disadvantage of receiving sunlight compared to its south-facing symmetrical flat on the same floor, which results in a significant difference between winter and summer conditions. Various precautions such as covering up the north facing façades, keeping openings as small as possible, or keeping these façades inactive along with overheating have been in place in Vienna. In addition, the disadvantages have been kept under control by a sound thermal insulation layer.

The A/V ratio of all case studies is quite similar.

Regarding building components' U-Values, thermal bridges and airtightness: Building components of buildings in Vienna contribute much more to total energy efficiency. The thickness of the thermal insulation material is a minimum of 15 cm in Vienna, whereas the maximum is only 5 cm in Konya. This results in two to three times more heat loss in the same type of building components in Konya. We observe a general preference towards the use of XPS for insulation material in almost all building components in Konya. However, in Vienna this material is commonly used in the outer parts of the building, where walls meet the ground and underneath the basement slab as this material is waterproof. In outer walls exposed to outdoor air, EPS and mineral wool are the preferred insulation materials. Mineral wool is relatively cheaper than XPS.

Moreover, Konya's case studies reveal a preference towards double-glazed window systems in comparison to Vienna, which prefers triple-glazed window systems. Due to the lower window frame quality in Konya, U-Values vary significantly to Vienna. Furthermore, findings show that larger glazing areas in apartment buildings in Konya already suffering from overwhelming heat loss contribute to further heat losses; the buildings in Konya experience four times more heat loss compared to Vienna's houses. Additionally, no difference in the window frame size is considered regarding orientation to north versus south.

Further, a lack of or an improper use of technical implementations in heat insulation techniques is observed in thermal bridge simulations. Thanks to these simulations, important findings were uncovered in the Turkish case studies' building components regarding significant heat losses due to thermal bridges and air leakages. However, projects in Vienna do not leave gaps for any possible thermal bridges because the buildings are tightly enclosed by thermal insulation materials. Along with this, roof ceilings in attics are being used as residential floors, and are covered with a vapour barrier to prevent air leakages causing dampness and moisture damage. Airtight adhesive tapes have also been applied to the transparent structural elements to prevent air leakages.

Regarding acoustic insulation: The study shows that the effect of Konya's building components' acoustic insulation is significantly lower than the projects in Vienna. It has been stated in this study that the XPS material used between floors, which is applied as a 3 cm thick layer in Konya, has no sound attenuation benefits. Moreover not using edge strips around the floor screed alongside XPS materials, further

Building features	WOHNEN mit UNS!				
Energy Reference area[m²]	**4857.04 m²**				
Gross floor area[m²]	**6071.31 m²**				
Brutto-Volumen[m³]	**19014.24 m³**				
Building enveloping area [m²]	**5953.63 m³**				
U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
Average U-Values[W/m²K]	0.388 [W/m²K]				
AW01 Exterior ventilated concrete wall	0.201 [W/m²K]	65 [dB]			321.86 [kg/m²]
AW02 Thermally insulated exterior concrete wall	0.153 [W/m²K]	61 [dB]			326.83 [kg/m²]
AW03 Exterior wall against ground	0.264 [W/m²K]	61 [dB]			326.13 [kg/m²]
FD01 Intensive green flat roof	0.130 [W/m²K]	70 [dB]	28 [dB]		291.88 [kg/m²]
FD02 Extensive green flat roof	0.131 [W/m²K]	65 [dB]	34 [dB]		300.79 [kg/m²]
FD03 Flat roof terrace top floor	0.127 [W/m²K]	64 [dB]	37 [dB]	37 [dB]	301.00 [kg/m²]
FP01 Foundation slab against heated rooms	0.213 [W/m²K]	76 [dB]	24 [dB]		127.44 [kg/m²]
ID01 Dividing ceiling	0.440 [W/m²K]	65 [dB]	36 [dB]	36 [dB]	94.01 [kg/m²]
AD01 Overhang ceiling to outside air	0.137 [W/m²K]	64 [dB]	38 [dB]		91.00 [kg/m²]
IW01 Internal dividing wall	0.219 [W/m²K]	69 [dB]			20.86 [kg/m²]
Glass	0.60 [W/m²K]				
Windows	0.94 [W/m²K]				
A/V	0.31 [1/m]				
n50[1/h]	0.80 [1/h]				
Ventilationtype	Domestic ventilation with heat recovery and geothermal heat exchanger				
Heating type	District heating (central), under floor heating, single-room control with thermostatic valve				
Total heating demand[kWh/m²a]	**12.99 [kWh/m²a]**				

Figure 360: *Overview ECQA of WMU, by the author.*

Building features	ASPERN				
Energy Reference area[m²]	**4540.62 m²**				
Gross floor area[m²]	**5675.78 m²**				
Brutto-Volumen[m³]	**18396.64 m³**				
Building enveloping area [m²]	**6632.54 m³**				
U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
Average U-Values[W/m²K]	0.296 [W/m²K]				
AW01 Exterior wall wood cladded	0.207 [W/m²K]	49 [dB]			18.80 [kg/m²]
AW03 Ext. concrete wall with wood cladding to deck access	0.330 [W/m²K]	63 [dB]			274.90 [kg/m²]
AW04 Exterior concrete wall to deck access	0.310 [W/m²K]	57 [dB]			287.80 [kg/m²]
AW05 Exterior concrete wall	0.215 [W/m²K]	62 [dB]			291.88 [kg/m²]
AW06 Exterior concrete wall to deck access	0.178 [W/m²K]	57 [dB]			300.79 [kg/m²]
D01 Flat roof	0.113 [W/m²K]	64 [dB]	37 [dB]	37 [dB]	301.00 [kg/m²]
D02 Dividing ceiling	0.700 [W/m²K]	76 [dB]	24 [dB]	23 [dB]	127.44 [kg/m²]
D03 Slab under the ground	0.135 [W/m²K]	65 [dB]	36 [dB]		94.01 [kg/m²]
AD01 Overhang ceiling to outside air	0.184 [W/m²K]	75 [dB]	41 [dB]		36.60 [kg/m²]
IW01 Internal dividing wall	0.320 [W/m²K]	69 [dB]			20.86 [kg/m²]
Glass	0.6 - 0.70 [W/m²K]				
Windows	0.94 [W/m²K]				
A/V	0.31 [1/m]				
n50[1/h]	0.80 [1/h]				
Ventilationtype	Domestic ventilation with heat recovery, without geothermal heat excharger				
Heating type	Ground, air and water heat pumps, under floor heating, home automation via Smartphone				
Total heating demand[kWh/m²a]	**15.31 [kWh/m²a]**				

Figure 361: *Overview ECQA of Aspern - WMH, by the author. (left)*

Building features	SATZINGERWEG				
Energy Reference area[m²]	**2211.37 m²**				
Gross floor area[m²]	**2764.21 m²**				
Brutto-Volumen[m³]	**8325.36 m³**				
Building enveloping area [m²]	**3457.97 m³**				
U-Values | Sound insulation | Thermal storage	U-Values[W/m²K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
Average U-Values[W/m²K]	0.420 [W/m²K]				
AW01 Exterior concrete wall	0.207 [W/m²K]	61 [dB]			313.27 [kg/m²]
AW02 Exterior concrete wall façade panels	0.198 [W/m²K]	61 [dB]			313.64 [kg/m²]
FD01 Flat roof terrace top floor	0.229 [W/m²K]	62 [dB]	69 [dB]	37 [dB]	308.82 [kg/m²]
FD02 Extensive green flat roof	0.174 [W/m²K]	62 [dB]	69 [dB]	37 [dB]	291.67 [kg/m²]
D01 Ceiling over basement	0.280 [W/m²K]	64 [dB]	67 [dB]		103.69 [kg/m²]
D02 Ceiling over plaground/ Hobby room	0.220 [W/m²K]	62 [dB]	69 [dB]		103.68 [kg/m²]
ID01 Interior dividing ceiling	0.760 [W/m²K]	62 [dB]	69 [dB]	15 [dB]	87.78 [kg/m²]
IW01 Internal dividing wall	0.500 [W/m²K]	61 [dB]			15.46 [kg/m²]
Glass	1.00 [W/m²K]				
Windows	1.20 [W/m²K]				
A/V	0.42 [1/m]				
n50[1/h]	1.50 [1/h]				
Ventilationtype	Natural ventilation				
Heating type	District heating, radiators				
Total heating demand[kWh/m²a]	**33.34 [kWh/m²a]**				

Figure 362: *Overview ECQA of Bombardierareal / Satzingerweg, by the author. (right)*

Building features	TOKI				
Energy Reference area[m^2]	**8700.00 m^2**				
Gross floor area[m^2]	**10875.00 m^2**				
Brutto-Volumen[m^3]	**31755.00 m^3**				
Building enveloping area [m^2]	**9452.12 m^3**				
U-Values | Sound insulation | Thermal storage	U-Values[W/m^2K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
Average U-Values[W/m^2K]	1.35 [W/m^2K]				
AW01 Exterior brick wall	0.39 [W/m^2K]	51 [dB]			69.48 [kg/m^2]
AW02 Exterior concrete wall	0.47 [W/m^2K]	51 [dB]			264.32 [kg/m^2]
AW03 Exterior concrete wall to the staircase	2.39 [W/m^2K]	48 [dB]			76.52 [kg/m^2]
OD01 Ceiling to attic	0.51 [W/m^2K]	61 [dB]	70 [dB]		195.14 [kg/m^2]
ID01 Interior ceiling against unheated basement tiles	0.47 [W/m^2K]	55 [dB]	76 [dB]		66.09 [kg/m^2]
ID02 Interior ceiling against unheated basement lamination	0.44 [W/m^2K]	45 [dB]	77 [dB]		101.15 [kg/m^2]
ID03 Interior Ceiling tiles	0.47 [W/m^2K]	43 [dB]	79 [dB]	77 [dB]	102.21 [kg/m^2]
ID04 Interior Ceiling (laminate)	0.63 [W/m^2K]	54 [dB]	78 [dB]	73 [dB]	67.62 [kg/m^2]
IW01 Internal dividing wall	2.39 [W/m^2K]	62 [dB]			187.71 [kg/m^2]
Glass	2.30 [W/m^2K]				
Windows	2.20 [W/m^2K]				
A/V	0.3 [1/m]				
n50[1/h]	2.5 [1/h]				
Ventilationtype	Natural ventilation				
Heating type	Natural gas, boilers, radiators				
Total heating demand[kWh/m^2a]	**74.07 [kWh/m^2a]**				

Figure 363: *Overview ECQA of Toki Konevi Housing, by the author. (left)*

Building features	ALTIN BASAK				
Energy Reference area[m^2]	**6556.48 m^2**				
Gross floor area[m^2]	**8195.60 m^2**				
Brutto-Volumen[m^3]	**24585.00 m^3**				
Building enveloping area [m^2]	**6511.00 m^3**				
U-Values | Sound insulation | Thermal storage	U-Values[W/m^2K]	Weighted Sound reduction index "R_w"	Weighted Normalized Impact Sound Pressure Level "L_{nw}"	Weighted Standardized Impact Sound Pressure Level "$L'_{nT,w}$"	Thermal storage by the building's mass "$m_{w,B,A}$"
Average U-Values[W/m^2K]	0.720 [W/m^2K]				
AW01 Exterior brick wall	0.400 [W/m^2K]	51 [dB]			69.48 [kg/m^2]
AW02 Exterior concrete wall	0.480 [W/m^2K]	60 [dB]			264.32 [kg/m^2]
AW03 Exterior brick wall against staircase	0.510 [W/m^2K]	48 [dB]			76.52 [kg/m^2]
AW04 Exterior concrete wall against staircase	0.700 [W/m^2K]	60 [dB]			221.84 [kg/m^2]
OD01 Ceiling to attic	0.280 [W/m^2K]	60 [dB]	71 [dB]		221.36 [kg/m^2]
ID01 Interior ceiling against unheated basement lamination	0.420 [W/m^2K]	56 [dB]	75 [dB]		282.08 [kg/m^2]
ID02 Interior ceiling against unheated basement tiles	0.448 [W/m^2K]	55 [dB]	76 [dB]		238.33 [kg/m^2]
ID03 Interior Ceiling tiles	0.700 [W/m^2K]	46 [dB]	76 [dB]	70 [dB]	101.72 [kg/m^2]
ID04 Interior Ceiling lamination	0.630 [W/m^2K]	56 [dB]	75 [dB]	75 [dB]	67.94 [kg/m^2]
AD01 Overhang ceiling to outside air	0.310 [W/m^2K]	57 [dB]	74 [dB]		62.99 [kg/m^2]
IW01 Internal dividing wall between dwellings	0.300 [W/m^2K]	62 [dB]			28.19 [kg/m^2]
Glass	2.30 [W/m^2K]				
Windows	2.20 [W/m^2K]				
A/V	0.36 [1/m]				
n50[1/h]	2.5 [1/h]				
Ventilationtype	Natural ventilation				
Heating type	Natural gas, boilers, under floor heating				
Total heating demand[kWh/m^2a]	**54.35[kWh/m^2a]**				

Figure 364: *Overview ECQA of Altinbasak, by the author. (right)*

creates a possibility of sound transmission to neighbouring rooms or even flats through floor coverings. These applications are provided under the framework of the ÖNORM, Austrian Standards Institute and technical specifications. Thereby, a minimum thickness of 2 cm acoustic insulation material is required between floors to absorb sound. The use of edge strips is encouraged in order to avoid sound transmission to neighbouring rooms. Additionally, triple-glazing with high thermal insulation quality also provides great sound insulation. Therefore, the building is isolated from external surrounding noises. On the other hand, double-glazed window systems in Turkey are not as effective as acoustic insulation as the triple-glazed ones in Vienna.

Regarding heating - hot water: It has been shown in the case studies that Vienna utilizes more renewable energy to meet heating and hot water needs in the buildings. The WMU and Satzingerweg projects employ district heating. In this way, most heating is provided through renewable energy sources and constitutes much less damage to its surroundings (See Chapter IV, 2.3). However in Aspern WMH, the heating system makes use of heat pumps. For the purpose of enhancing energy savings, innovative remote controlled smart-phone systems such as home automation are optimally engaged regulate each room's heating level . Furthermore, a thermal solar energy plant has been installed on the building, which can cover the entire hot water demand in summer. Due to the controlled domestic ventilation system and heat pumps, a district heating system has not been required, and efficient heating has been provided in this housing project. Consequently, the heating and cooling systems are only dependent on natural sources. Controlled domestic ventilation systems with heat recovery currently in use in WMU and Aspern projects reduce heat losses to the air, thereby amplifying energy efficiency. Thanks to this system, the output energy of 12.99 kWh/m2K is very close to the energy of a passive house in the WMU housing.

On the other hand, in cases in Konya, natural gas is used as a heat source for room heating radiators. Heating pumps and district heating systems were not applied in these projects (and generally in no projects in Turkey) due to lack of infrastructure as well as setup costs.

Regarding Solar Power Generation: Photovoltaic systems were applied in chosen projects except Aspern WMH. It is not preferred due to the high cost of the system installation. However, both Turkey and Austria have a high potential to benefit from sun energy. Therefore, the integration of these systems in housing projects will provide significant benefits in terms of energy performance.

Regarding Ventilation: WMU and Aspern WMH cases in Vienna benefit from controlled domestic ventilation systems with heat recovery. Geothermal heat exchangers also exist in the WMU. Through these implementations, 85% of heat losses caused by air exchange are prevented, significantly contributing to energy efficiency. Along with this, mechanical ventilation has a positive effect on room comfort, especially in the winter and at night. Other projects provide window ventilation. In Turkey, mechanical ventilation systems are applied in special residences and hotels and are not yet used in typical housing projects. Therefore, it is appropriate to state that window ventilation systems applied in the Konya's projects cause serious heat losses.

Regarding Solar Shading: With the aim of protecting projects in Vienna from extreme heat, structural and directional factors are considered alongside both indoor and outdoor solar shading devices that are installed on windows. The study illustrates that it is necessary to protect rooms from overheating in summer in the Austrian building regulations. According to the calculations, precautions should be taken to ensure that the room temperature does not exceed 27 degrees Celsius. While the external solar shading devices are especially effective in maintaining indoor comfort in the Viennese projects, the Konya projects fail to focus on this since there are no standards that regulate solar shading requirements in order to provide indoor comfort. Moreover windows are placed in standard sizes in all directions regardless of orientation and position. In conclusion, extreme overheating is experienced in the simulations of the study due to large window sizes without the consideration of sun orientation and lacking solar shading devices - especially in those rooms that are immediately exposed to the sun.

3. Results of Aesthetic-Visual Quality Analyses

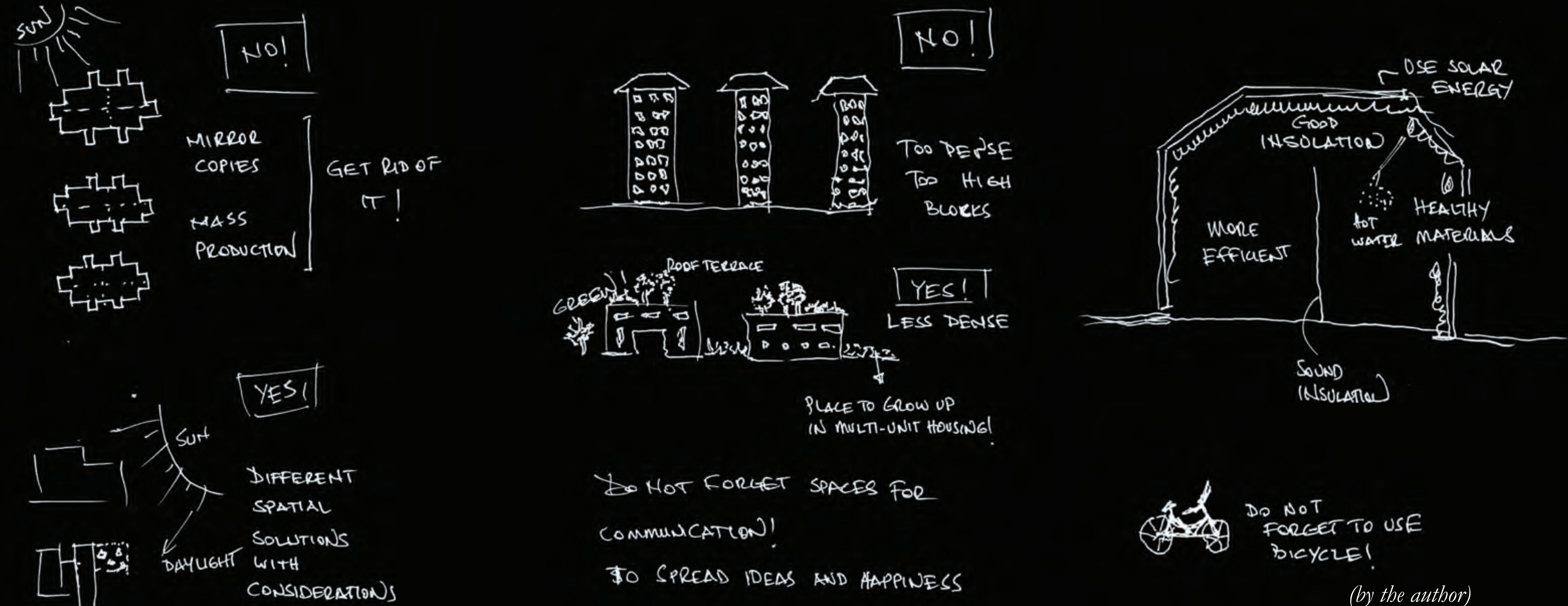
The Viennese cases are built as a result of competition which is an implementation of Wohnfonds Wien, a non-profit organization connected to the City of Vienna. This makes them chosen projects which have architectural quality including aesthetic and visual quality.

The projects chosen for case studies in Vienna have all distinctive characteristics in floor plan and visual qualities, different original concepts, and innovative solutions. For example case Wohnen mit Uns have two buildings which have similar concepts. But the details and design of the project have different ideas. Also in Bombardierareal there are different types of buildings with different floor plans. Aesthetic and visual quality have been a consideration as a part of architectural quality both inside of the building and at the façade of the projects in Vienna. Moreover the projects are not monotonous and it has been attempted to integrate attraction and excitement to the projects with their design. (i.e. see garden design and circulation routes of the case Aspern, dynamic and attractive geometry of circulation routes of Wohnen mit alles). Different ideas and concepts have come into life in details and the whole of the projects. The variety of ideas and consideration of sustainability also have been made apparent to the façade. For example the wooden façade of Wohnen mit Uns and Aspern cases give the impression of healthy and natural materials visually. Moreover, the garden designs and interactions with the nature outside (to the roof-terrace and to the garden, or open access of case Aspern), support this visual quality.

On the other hand, in Turkish cases (both in case studies and the context analysis) the projects do not have an identity and characteristic. They are mostly oriented to ensure basic functions and specific solutions in planning and at the façade have not been a consideration, at least it has not been reflected to the general image of the projects. They are mostly repetitions in layouts and facades. The dwellings repeat themselves, the balconies repeat themselves, the styles of the circulation repeat themselves, the buildings repeat themselves in each projects and different housing projects by different actors also repeat themselves. As a result it has caused a monotonous and lack of aesthetic and visual quality which lead to the lack of architectural quality. Because architectural solutions have to be products of creative, innovative ideas found specific to genius loci.2

The compatibility with the surrounding and human scale which contribute to the aesthetic and visual quality, is better provided in Viennese cases. As a result Viennese cases give the impression of a visual and aesthetic quality with their concepts while the cases in Konya remain as typical usual projects.

2 The Latin term genius loci literally means "the spirit of place".



(by the author)

"Lifestyle change cannot be imposed, but it can be encouraged by good design"

(Edwards, B., Turrent, D.)

VII. CONCLUSION & PROPOSALS

This study focuses and elaborates upon the significance and effect of "holistic thinking" that sustainability encompasses in terms of developing residential quality. Sustainability, in the field of architecture, means that architects and other actors play an active role in construction, and take action with awareness and consideration for a better future, rather than accepting sustainability simply as a trend. Architects have long been attempting to resolve society's problems. Perhaps the biggest challenge of this era in which natural resources are rapidly consumed and people are encouraged to live naturally and in an environmentally friendly manner while struggling to survive amongst technology and machines, is to create more liveable and refined living areas in big cities.

This is only possible through architecture with a holistic approach placing significance on the human being. It does not use technology against nature, and responds to needs while considering the long-term. An ethical and qualified architecture could potentially be a style that leaves behind an unforgettable mark on this century while adapting to nature without damaging it.

The translation of ideas and technology is very possible in the field of architecture considering that humanity is human all over the world, and people's needs do not change according to differences in culture and background. The interaction between architectural styles from different geographies in the past is apt evidence of this. Therefore, this study compares the architecture of the two different locations with the intention of improving living conditions in Turkey. Physical models (structures) from the case studies as well as analyses from the development of residential strategies and policy will provide additional significance. Furthermore, the study presents concepts such as liveability, sustainability, energy, and housing quality, which have long been a consideration in Vienna, and discusses many of the efforts and initiatives that have been employed. Yet another important part of this study is the value and evaluation of quality and sustainability. Measurement or evaluation systems widely used in many countries around the world were founded to ameliorate the concept of quality, which is lacking in Turkey. For this very reason, this study has defined the criteria influencing sustainable housing quality, has developed an assessment framework to highlight the important indicators and has implemented it in case studies. This assessment provides a guideline for the purposes of practical use for architects through concrete uses in case studies. The results from the case studies present and create an outline for professional assessments and law revisions, which is already applied in Vienna to ensure sustainable housing quality.

The results attained from the assessment framework criteria created to evaluate sustainable housing quality in Vienna confirms the hypothesis that Vienna, with its long-standing history of experience and infrastructure, can be a model for Turkey, for Konya and other cities, in terms of sustainable housing and housing quality. This is also true for the three main criteria of the study: social-functional quality, energy performance and construction quality, and aesthetic quality which provide suggestions intended for architects, building policies, regulation revisions, and even for lay people and tenants. The federal reconstruction laws and initiatives should also encourage sustainable housing through renewals of energy use, social functionality, and visual quality. Building policies must develop solutions for the revolution of reshaping architecture while supporting regulations for better quality sustainable housing

As observed from the hard evidence in the case studies the analyses show incomparable data between the two countries; Konya´s values are significantly behind Vienna´s. This is obvious in the building components examined in the "energy performance and construction quality" part of the study. Therefore, it is fair to state that structures in Turkey have made mistakes leading to energy losses from early construction planning stages. Negative effects on both tenants and the architectural quality of the house have been affected by the formation of thermal bridging at almost all building corners, usage of low-quality window frames and heat insulation materials, usage of overly thin thermal insulation materials, no attention to airtightness insulation and ventilation, and excessive heating issues. In the Viennese cases, innovative techniques such as heat pumps, district heating, domestic ventilation with heat recovery and geothermal heat exchangers have been implemented to provide more energy efficiency. Turkey, having been dependent on international sources for more than 70% of its energy, must bring in new regulations and incentives for buildings' energy consumption through the relevant authorities to benefit from renewable energy sources.

Regarding social-functional quality, the buildings in Vienna offer various dwelling types and flexibility which considers different requirements of different types of families, qualified and healthy open spaces and playgrounds, several community rooms, better storage possibilities, convenient building sizes in human scale, efficient layouts.

Regarding aesthetic and visual quality, the projects in Vienna have more unique, original and innovative concepts than the buildings in Konya, which are similar, ordinary, and mass productions.

According to the author of the study comparing the backgrounds of Turkish and Viennese housing, there is significant similarity between current Turkish architecture and Viennese architecture from 50 to 60 years ago, where dwellings were built with the intention of providing rapid and abundant housing to meet the needs of people following World War II. These policies prioritized quantity over quality, especially for the large-scaled projects.

If difficult housing conditions in the beginning of the 20th century are taken into consideration, the successful evaluation of Viennese housing is to be admired. The positive outcomes, based on many years of experience regarding sustainability and housing quality in Vienna, are physically evident in the case studies. "Passive houses" in Vienna and Austria are very prevalent applications; "low energy" and "zero energy" buildings are an even more recent application, yet are ever increasing in number along with "energy plus" buildings using innovative initiatives like the "Smart Housing Vienna". These are physical reflections of experience and effort put into housing quality considering sustainability. Another reason for these successful housing implementations in Vienna is its current housing policy, except experiences in social housing and sustainable building. Housing quality is ensured through essential measures in regulations and with several initiatives. Such radical alterations in developments and initiatives must also take place in Turkey for improving housing quality..

Moreover, housing developer competitions (Bauträgerwettbewerbe) and subsidies (Wiener Wohnfonds) have a significant influence on the success of this housing policy.

Especially after the 1980s, the City of Vienna has gradually withdrawn itself from actively building new residential projects and has taken on a role of organizing these construction activities alongside non-profit organisations.

The housing developer competition projects have contributed to the quality enhancement and holistic architecture in affordable housing. Similarly, TOKI, namely the Mass Housing Administration as the public face of the Turkish government's building policy in Turkey, must lead sustainable architecture (the housing concept) in Turkey by assigning a division of labour in the follow-up projects that the housing sector plans to implement instead of actively building the housing projects themselves. By supporting these concepts as national project competitions, areas such as participation, communication, flexibility, energy efficiency and auto-free housing can be focused on with clearly defined quality standards for subsidies. If TOKİ's primary mission is to meet the ever-rising housing needs in a well-planned way while especially meeting the medium and low-income consumers' needs, the strategy demonstrated above will provide TOKİ with a means to simultaneously increase housing quality, avoiding the mass housing stereotype whilst also setting up a new, exemplary model for other housing implementations.

On the other hand, some of Konya's features could be considered superior to Vienna, such as the stricter safety precautions and larger and higher room/space designs. However, these security precautions need to be re-evaluated due to problems of social segregation, issues such as a shift to ghetto-like structures and consideration of the different social and cultural characteristics between countries. The room height and area are kept to a minimum in Vienna, and could be explained using case studies in Vienna, which are sample models that are congruent with social/public housing. The reason is a concern for space efficiency, which is a result of applied smart city and smart housing programs, and might be considered an apt decision since it was designed with sustainability in mind as a prior issue to be resolved.

In order to achieve sustainable high-quality residential architecture in future Turkish projects, the following are almost always required except the measures discussed above:

- SHQ criteria must be adhered.
- Individual needs despite the flat size need to be considered leaving the idea of mirroring flat designs across from each other in apartment buildings.
- Bringing characteristic designs both for dwelling floor plans, buildings, and the site in accordance with their environment to provide architectural quality. More original and innovative concepts should also be developed.
- Building different dwelling types in different sizes with different terrace styles (gardens, roof terraces etc.). Moreover, some dwellings should be designed as maisonettes and some should have their own gardens like the examples implemented in Vienna.
- Precautions for building height need to be taken for building heights and accessibility. A height limitation must be enforced for a more human scale in housing and harmony with the environment. The study emphasizes the disadvantages of high building heights for residential buildings as well as its negative influence on contact with the ground, neighbourhood relations and communication. Children are also negatively affected in this kind of environment.
- Community rooms for communication of the inhabitants, indoor playgrounds and convenient storage possibilities should be designed in the projects. The materials and design of the playground should be more creative and healthy.
- In order to address energy performance and construction quality, similar technics as in Vienna should be encouraged in Turkey along with higher insulative values of building components to decrease heat losses with the support of building regulations. The regulations must be revised so that intentions to increase the energy performance of buildings are enforced.
- Preventative steps should be taken to address incorrect or insufficient heat insulation implementations. A primary goal should be to reduce the energy consumption of buildings to a minimum through a long-term strategic approach for construction materials and implementations. Therefore, along with energy identification calculations, consideration of details during the planning phase of the project is imperative such as overheating during the summertime, airtightness (buildings need to breathe/ventilation problems), sound insulation, and the inclusion of these factors into energy identification calculations as implemented in Austria. Regulations should supply developments supporting technical and ethical transformation to improve the quality of production.

At last, but not least, tenants and architects must both take responsibility for quality in sustainability; architects must reflect this responsibility in their work, and tenants need to demand this quality standard, as it is as important as policy regulation support. Simply put, case studies in Vienna present U-values that are better than the municipality requires. This positive improvement shows that in addition to government subsidy supports and incentives, both tenants and architects foresee and appreciate the long-term effects of planned developments. Demand and supply are certainly effective with this outcome. Architects avoiding unearned income and prioritizing responsibility and work ethics over their own economic profit will provide higher quality projects and thus, people will fully perceive that the core of sustainability derives from this kind of consideration and responsibility.

All of these efforts will have an effect on society making it more aware and sensitive to the person and the environment, the architectural variety and liveability, and its urban applications. Considering that architecture is about creating places that society lives in, it is a very powerful and valuable tool for the transformation of societies, even if it has not been fully understood yet. One must act with awareness and sensitivity at the point where humans and nature meet in the built environment.

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Abbreviations

SHQ: Sustainable Housing Quality

SFQA: Social-functional Qualtiy Analysis

AVQA: Aesthetic and Visual Quality Analysis

ECQA: Energy Performance and Construction Quality Analysis

WMU: Wohnen mit Uns (Living with us)

WMS: Wohnen mit Scharf (Living with hot)

WMH; Wohnen mit Holz (Living with wood)

CS: Case Study

OIB: Österreichisches Institut für Bautechnik (Austrian Institute of Construction Engineering)

EnEv: "Energieeinsparverordnung (Energy Saving Ordinance)" of Germany.

DIN: Deutsches Institut für Normung (German Institute of Standardisation)

MHA: Mass Housing Administration

TOKI: Toplu Konut Idaresi Baskanligi (Turkish Use of Mass Housing Administration)

EEA: European Environment Agency

GESIBA: Gemeinschaftliche Siedlungs- und Baustoffanstalt (The Institute of Communal Housing and Building Materials)

WBSF: Vienna Land and Urban Renewal Fund)

STEP 1984: Stadtentwicklungsplan für Wien 1984 (The Urban Development Plan)

EPSA: European Public Sector Award

ÖGNB: Österreichische Gesellschaft für nachhaltiges Bauen (The Austrian Society for Sustainable Building)

LEED: Leadership in Energy and Environmental Design

BREEAM: Building Research Establishment Environmental Assessment Methodology

HQI: Housing Quality Indicator

DQI: Design Quality Indicator

TQB: Total Quality Building

ÖGNI: Österreichische Gesellschaft für Nachhaltige Immobilienwirtschaft (The Austrian Sustainable Building Council.

NSTRAT: Österreichische Strategie für Nachhaltige Entwicklung (Austrian Strategy for Sustainable Development)

EPBD: The Building Energy Performance Directive

GHG: Greenhouse gas emissions.

IPCC: Intergovernmental Panel on Climate Change

WWF: Worldwide Fund for Nature

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