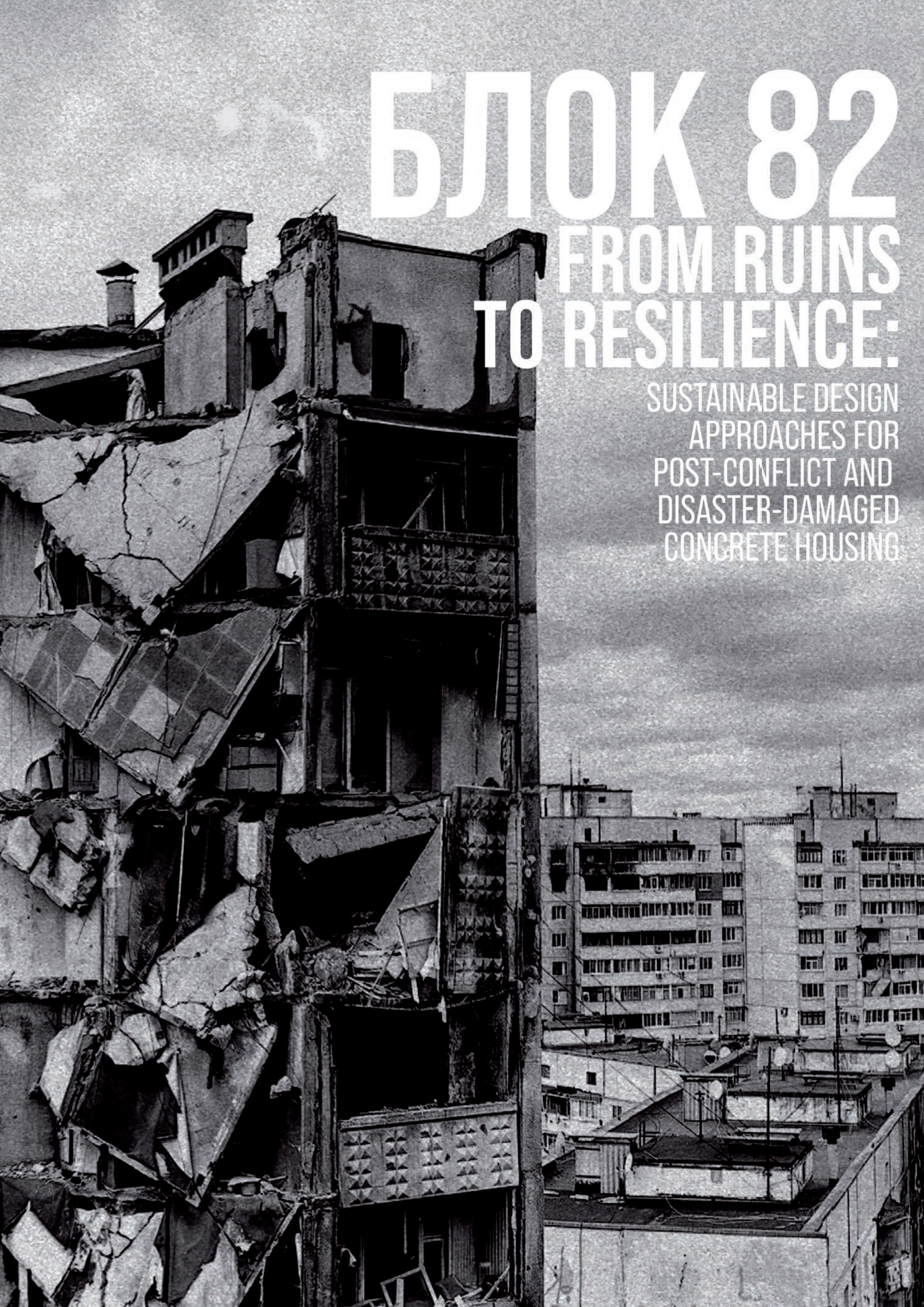
БЛОК 82

FROM RUINS TO RESILIENCE:

SUSTAINABLE DESIGN APPROACHES FOR POST-CONFLICT AND DISASTER-DAMAGED CONCRETE HOUSING



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Supervisor: Luìs Filipe Dos Santos.

Technical supervisor: Thomas Vang Lindberg.

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Fig. 001 / The thesis group

Victor Rosenkilde Jørgensen

Thor Møller Thoussaint

Frederik Sejling Nielsen

ABSTRACT

In an era of escalating climate crisis, the construction industry remains one of the world's largest contributors to global CO2 emissions, driven largely by a persistent cultural and economic tendency to demolish and rebuild rather than preserve and adapt. This inherently destructive mindset not only erases material resources and embodied carbon potential but also overlooks the potential for constructions to carry memory, identity and resilience. This thesis in architectural engineering challenges this paradigm by asking: What if structures in disaster-damaged and post-conflict zones around the world could become the foundation for a more sustainable future?

Taking point of departure in the war-torn "Block 82" situated in the district of Northern Saltivka, northern Kharkiv, the thesis explores how damaged post-conflict concrete housing, typically considered obsolete, can be systematically analysed, reimagined and renovated. Through a research-based design methodology, the thesis moves between structural performance, environmental impact, cultural relevance, and architectural expression. Using tools such as finite element modelling, daylight and thermal simulations, life cycle assessments (LCA), and ethnographic interviews, the design process responds to six critical research questions centered on longevity, adaptability, material reuse, and user needs.

What emerges is a proposal that neither idealizes the past nor overlooks the trauma embedded in the structure but instead seeks to transform it with care and intention. The reintroduction of rubble from the damaged building, as both aggregate in new concrete and as material for furniture, becomes a means of grounding the design in its own history. Alongside this, the project introduces adaptable spatial frameworks and optimizes environmental performance, presenting an approach to renovation that is not only performance based and environmentally optimized, but also poetic in nature. The results demonstrate that when addressed holistically—through analysis, empathy, and contextual sensitivity—salvaging damaged concrete housing can reduce emissions, conserve resources, and generate architecture that is not only functional, but deeply rooted in its place and time.

/ acknowledgements

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All the people who have shown interest and consideration in our project, who have taken the time to listen, shared their knowledge with us, and supported us in this journey. The warm-hearted people of Ukraine, our friends, family and mentors in life.

Thank you.

Дякую.

INTRODUCTION

“What if sustainability is not a compromise? What if it is not a sacrifice? What if it is actually simply the more desirable life choice” – Bjarke Ingels, 2022 (European Cultural Centre Italy, 2022)

What Ingels highlights here is a shift in mindset. From viewing sustainability as a compromise, something that requires settling for less or having to give something up, to recognizing the possibilities inherent in sustainable choices and solutions. What if the very compromises we believe we are making actually enhance the architecture, enrich the narrative, or elevate the spatial experience?

Architects carry an immense responsibility in shaping the world we live in. The way buildings are given form to has a profound impact on daily lives, providing spaces for rest, for recreation, for community, and for work. However, the act of building represents the largest human action in terms of both environmental and economic impact (Merlino, 2018). The building sector is the largest contributor to global greenhouse gasses emissions, responsible for 37% of total emissions (The United Nations Environment Programme (UNEP), 2023). In conjunction with this is the increasing number of armed conflicts across the globe (Uppsala University, 2024) , resulting in hundreds of millions of people being displaced from their homes (United Nations, no date a) (United Nations, no date a) (United Nations, no date a; Uppsala University, 2024)

This dual crisis places immense pressure on architects: How can the urgent need for rehousing for displaced populations be mitigated, while simultaneously responding to the environmental agenda?

Another vital role of architecture lies in its capacity to embody and reflect cultural, societal and historical narratives (Merlino, 2018). -This suggests that architecture is something that communicates. Acting as a mediator, architecture conveys stories that reminds us of what once was, what is, and potentially what will be. Winston Churchill stated in his 1943 speech: “*We shape our buildings and afterwards our buildings shape us.*” (Roosen, 2024), implying that architecture not only communicates stories but also transform and influence them through form and space.

Returning to Ingels notion confronting the contemporary perception of sustainability: What if the sustainable approach to the rehabilitation of people displaced by destructive conflicts holds significant potential not only to convey a powerful message and narrative of resilience, but also to actively shape and reinforce it?

These questions and considerations form the foundation of this master thesis, seeking to uncover the architectural and material potential buried beneath the debris of destruction. Focusing on post-conflict housing in Ukraine, the thesis investigates how such structures might be salvaged through a systematic approach, evaluating whether renovation can go beyond restoration of function to also embody powerful narratives of resilience and environmental sustainability. Ultimately, this thesis aims to answer and reflect upon one central question: Is it worth to salvage a building?

Fig. 002 / Render teaser 1

/ demarcations

Although this master thesis investigates reconstruction methods for post-conflict and disaster-struck concrete housing, it is confined within the boundaries and challenges of a specific context and case. The resulting strategies and design are developed in response to the selected case and does not extend to the application in other scenarios and locations. However, the thesis concludes by reflecting upon the potential of broader application. Furthermore, the thesis does not limit itself to the Ukrainian regulatory framework but draws on Danish and other national standards considered relevant to the investigation.

/ limitations

The destruction process of a concrete structure during conflict or disaster involves numerous complex factors. This thesis initially considered using particle physics simulations to accurately model the damage caused by a missile strike. However, such software is often expensive, time-consuming, and typically designed for specialized applications, making it impractical for this thesis. As a result, this thesis instead employs a combination of alternative methods of testing and simulating the destruction through 3D computer graphics software, 3D prints as well as visual assessment through available online material. To substitute for being physically present at the site in which the project builds, several other resources have been used. Here, interviews with several Ukrainian professionals within the fields of war-journalism, local politics, photojournalism, digital media and VR-technology have given the design team invaluable insight into relevant knowledge about the circumstances of designing in the context of the site, situated in Northern Kharkiv.

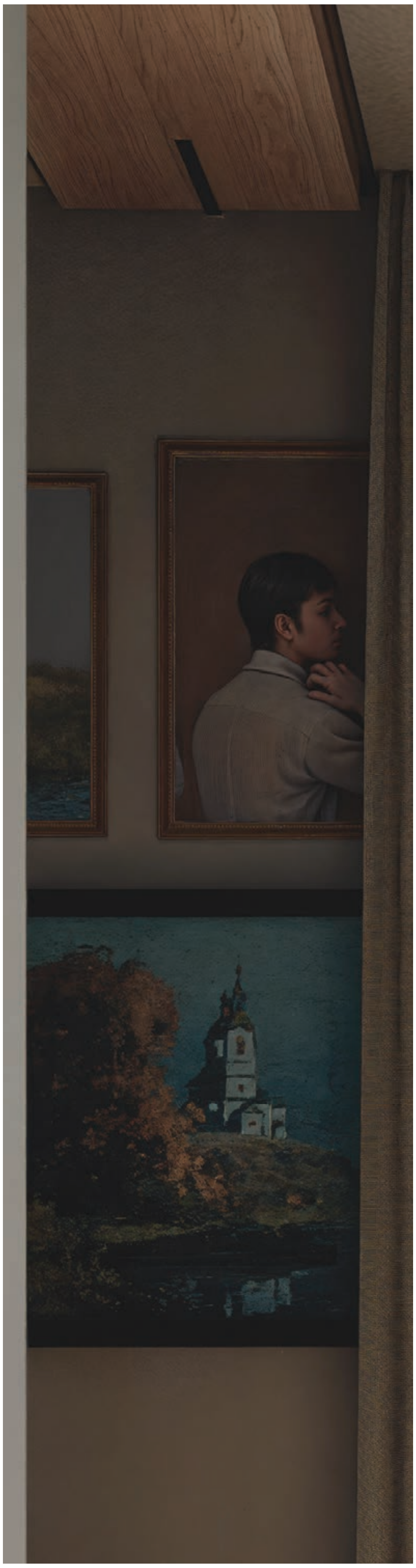


Fig. 003 / Render teaser 2

PREFACE

POINT OF DEPARTURE

STRUCTURAL INTEGRITY

CONTEMPORARY UKRAINIAN ARCHITECTURE

RUBBLE TO RESILIENCE

DESIGNING FOR LONGEVITY

DESIGN PROPOSAL

EPILOGUE

PREF

The framework providing the base of this master thesis is grounded in addressing the potential of salvaging and optimising post-conflict and disaster-struck concrete housing. Through a design-led research approach, this thesis aims to develop a sustainable design proposal for the renovation of the severely damaged residential complex, Блок 82 (Block 82), situated in the suburban area of Northern Saltivka in Kharkiv, Ukraine. By employing this specific case as a point of investigation, the thesis seeks to explore the social and environmental potentials in renovation as an alternative to demolition.

/ situation

As outlined in the introduction, the building sector is the largest contributor to global carbon emissions. While progress has been made in reducing operational emissions, and projections suggest a further 25% decrease in the coming decades, there is a pressing need to shift focus toward decarbonizing building materials to meet the goal of net-zero emissions by 2050 (The United Nations Environment Programme (UNEP), 2023).

Simultaneously, the global population is increasing at an exponential rate. Since the industrial revolution in the 1800's and until today, the human population has expanded eight-fold, from 1 billion to over 8 billion people (Ritchie et al., 2023) . According to United Nations projections, population rates will peak at 10.2 billion by the mid-2080s, resulting in an increase of approximately 2 billion from current estimates (United Nations, no date b; Worldometer, no date). This growth, coupled with the millions of people displaced by armed conflicts worldwide (United Nations, no date a), underscores an ever more urgent demand for new housing, and subsequent construction. To address both the housing shortage and the climate crisis, the construction industry must therefore adapt alternative and more sustainable solutions in the coming future.

FACE

/ potential

This trend in contemporary construction coupled with a rising population and general attitudes towards resource waste begs the question of more innovative and sustainable solutions in the construction industry, especially in parts of the world that experience frequent unrest, whether it be from natural disasters or conflict. Here, one of the fastest, most prevalent and subsequently most energy intensive means of construction is through concrete. The global production of concrete is substantial, with approximately 30 billion tonnes produced annually for construction purposes, making concrete the second most consumed material after water. In terms of volume, this means that circa 14 billion cubic metres of concrete are produced each year (GCCA, 2021; 2150, 2022). To put this into perspective, 120,000 tons of concrete were utilized in the construction of the Sydney Opera House. Given that one cubic meter of concrete weighs approximately 2,4 tons, this equates to roughly 50,000 cubic meters of concrete. With an estimated 14 billion cubic meters of concrete produced globally each year, this equates to building roughly 280,000 new Sydney Opera Houses each year (‘Sydney Opera House’, 1967).

With cement relying on energy intensive processes, this means that concrete structures contain a significant amount of embodied carbon (Hottle et al., 2022). In regions affected by conflict or natural disasters, many of these buildings are significantly damaged before the end of their intended service life, yet they often retain structural and material value. Demolishing them prematurely not only wastes this potential but also increases their overall carbon footprint, as the emissions tied to their construction are never fully offset through use. Here, the issues explored in this thesis are therefore both current and retain significant potential, not only in the world of construction, but also in broader political discussions.

Fig. 004 / Sydney opera, silhouette

/ russian invasion of ukraine

Over the course of now more than three years of war in Ukraine, caused by the Russian invasion, the country has endured numerous attacks of varying nature on a national scale. Beginning with hundreds of aerial attacks, cities throughout Ukraine has suffered significant destruction. In addition to aerial strikes, both Ukrainian and Russian infantry have engaged in ground combat claiming and reclaiming territories (Bailey et al. 2025). Fig. 05, which is based on data from The Map of Recovery made by Anti-Corruption headquarters, highlights the extensive amount of damage the war has inflicted on Ukrainian infrastructure, resulting in a large and increasing number of buildings and other structures either destroyed or damaged (reukraine.shtab.net 2025). This situation underscores the urgent need for large-scale restoration of houses, roads and other infrastructure.

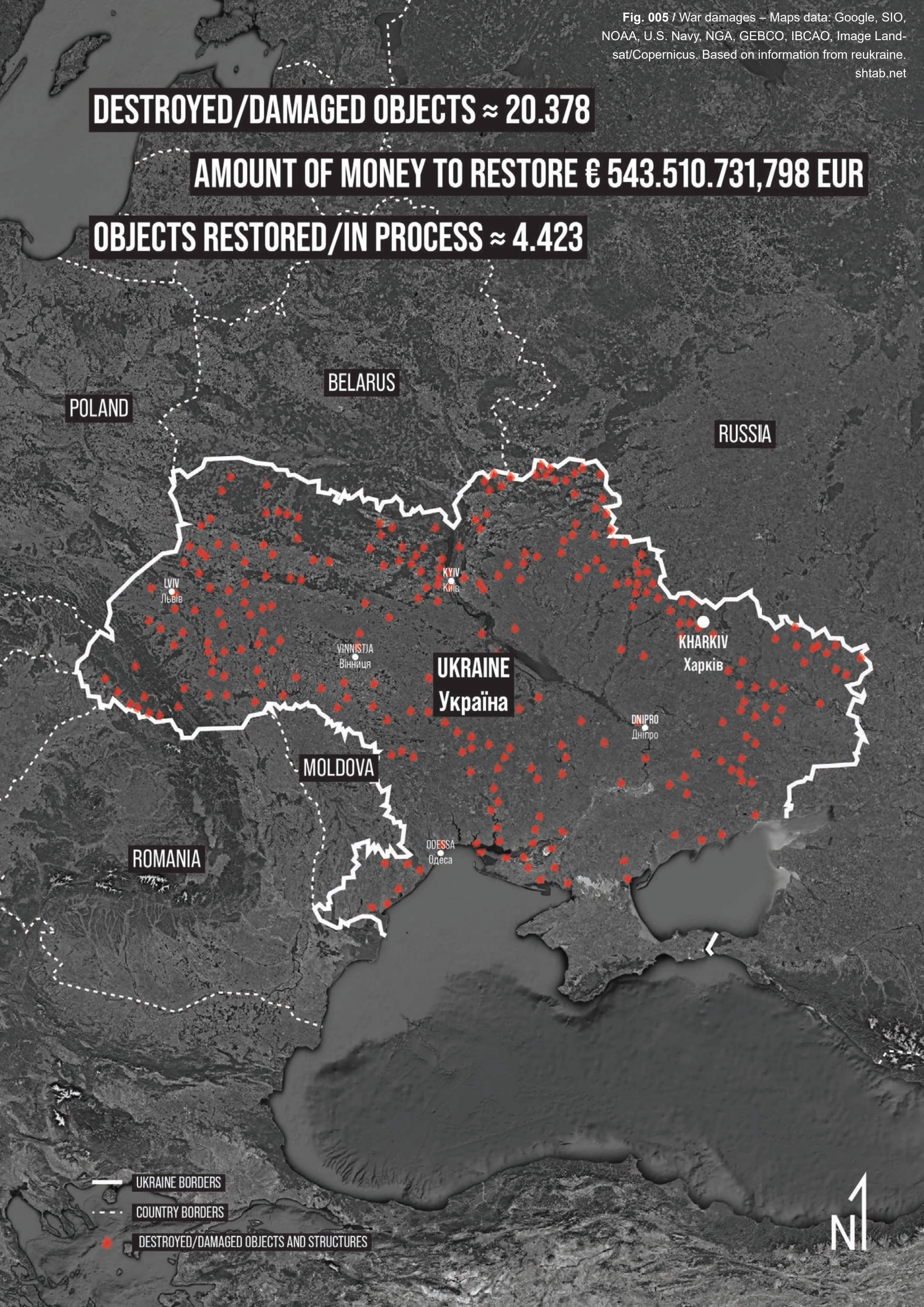


Fig. 005 / War damages – Maps data: Google, SIO, NOAA, U.S. Navy, NGA, GEBCO, IBCAO, Image Landsat/Copernicus. Based on information from reukraine.shtab.net

/ kharkiv

Харків (Kharkiv), the former capital of Ukraine, is the second largest city of the nation. It comprises several satellite towns, as the centre of metropolitan area, and serves as a fundamental centre of culture and education, hosting numerous institutions of higher education as well as research institutions. Being a node of the Russian and Ukrainian highway system, railways and trunklines, the city also plays a role as communication centre. As a result of World War II, Kharkiv was rebuilt into a city characterised by large and tall apartment blocks and broad roads (The Editors of Encyclopaedia Britannica 2025).

Due to Kharkiv's location on the frontlines and close proximity to the Russian border, the city has been a major victim of the ongoing conflict between Ukraine and Russia. The majority of the destruction seen today in Kharkiv is a result of the first Russian advance in the city. However, the city has since then endured frequent aerial attacks, including bombings, drone strikes and missile attacks.

Despite the ongoing conflict, daily life persists in Kharkiv. However, the cityscape remains a visual reminder of the conflict – from houses missing entire floors to military barriers in the streets (Goncharenko, 2024).

Fig. 006 / Kharkiv map – Maps data: Google, Maxar Technologies, CNES / Airbus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat/Copernicus. Based on information from en.mapy.cz

/ project case

Салтівка (Saltivka) is the largest residential area of Kharkiv and Ukraine, and, at its highest, accommodated a third of the population of Kharkiv, with around half a million residents (Gunter, 2022; Ilyin, 2023)

This area is characterized by its structural division in micro-districts, an element of the post-war Soviet city. These districts, in concept, compile large residential apartment blocks with associated administration, stores, clinics and other types of public services, within walking distance. However, the priority of establishing social and cultural facilities shifted to the construction of housing and industry elsewhere in Kharkiv (Ilyin 2023). According to Yuliia Zghurska, Deputy director of Kharkiv City Council, Saltivka is the heart of residential Kharkiv and reflects the simple and direct mentality of the city (Zghurska, 2025, see appendix B).

Північна Салтівка (Northern Saltivka) is a classic residential neighbourhood and is the most populated neighbourhood in the city. It was built in the period of 1970's and 1980's, and is characterized by tall apartment blocks of 9, 12 and 16 storeys. This area suffered the brunt of the Russian military offensive, as it became the main entry point for Russian forces advancing into the city (Zghurska, 2025, see appendix B).

Heavy fighting happened in this area, as the Russians tried to seize Kharkiv, while Ukrainian forces repelled the invasion (Palyvoda and Spirin, 2022). Since then, the area of Saltivka has been relentlessly bombarded by the Russians, leaving the area more and more destroyed. The attacks have been so frequent, that the residents recognise the sounds and debris from different shells and rockets (Gunter 2022). Despite the widespread destruction, people with nowhere else to go still reside in Saltivka (Tymchyshyn, 2025).

A notable structure in this area is a 16-storey apartment block on Natalii Uzhvii Street, 82, which gained recognition after being struck by an aerial bomb (Dubchak, 2023). As illustrated in the picture on Figure 07, the attack caused extensive damage, with nearly half of the building laying on the ground. Due to the scale of destruction and the building's compromised condition, it presents a valuable case study for this master thesis to investigate.

/ two key factors

This introduction highlights two central factors that underpin the focus of this master thesis: time and carbon emissions. The widespread displacement of populations, as exemplified by the situation in Saltivka, underscores the urgency of addressing time as a critical resource in post-conflict reconstruction. Simultaneously, the goal to reduce carbon emissions remains paramount, particularly in the context of a growing global population and escalating humanitarian crises. These interrelated challenges necessitate innovative architectural strategies that are both time-efficient and environmentally sustainable.

Fig. 007 / Northern Saltivka - Maps data: Google, ©2025, Maxar Technologies. Based on information from en.mapy.cz

Through the problems and challenges set forth in the introduction of the project, it becomes clear that the building industry needs to reconsider its approach to new construction and use of resources in general to reduce its substantial contribution to global carbon emissions.

Here, concrete structures pose a particular interest, as these structures are to be found in almost every climate and corner of the world, widely used for their ease of construction and cheap manufacturing potentials. However, it is also these types of structures that are some of the most energy intensive to produce, giving them a lot of embodied carbon. This broader issue frames the core inquiry of this project: How existing concrete structures, particularly in vulnerable, high-impact contexts, can be reimagined not as barriers, but as carbon-intensive assets worthy of renewal, which presents the hypothesis:

HYPOTHESIS

"Concrete structures in post-conflict zones and disaster-struck areas, which are often slated for demolition to accommodate new development, have the potential to be salvaged and renovated. By preserving the embodied carbon within the existing structure, this approach would significantly reduce the environmental impact compared to full reconstruction, provided that the remnants of the building undergo the right system of approach in terms of analyses and a well-defined reconstructive systems."

This hypothesis creates the foundation for several research questions that are examined in detail throughout the design process of this project. Starting from the first question, these inquiries essentially lead to the answer of the sixth and last question: “Is it worth to salvage a building?” and in doing so, will shape a final answer for this hypothesis. Here, of Block 82 acts as a case and demonstrator for this particular assumption. In answering the hypothesis, the first investigation delves into what sort of impact renovation might have, and if these changes are worth while:

1. What difference would renovation make?

In the context of Block 82, what impact would reconstruction have? -Not only in terms of carbon emissions and time, but also on the lives of the people who live there.

2. How do we ensure structural integrity of the building?

Establishing the status quo of the damaged structure is essential for developing a new structural system that can operate in harmony with the existing one. Here, the project inquires not only into the structural system with finite element modelling but also asks what role the structure plays in architectural expression.

3. What does a modern Ukrainian building look like?

In the renovation of the former Soviet-era residential block, how does the project reinterpret the structure to reflect the identity, needs, and aspirations of contemporary Ukrainians and their context?

4. How can we utilize the remains?

In the process of salvaging and renovating the ruins of Block 82, to what extent can the remnants, shaped by destruction, be reassessed, repurposed, and reintegrated into the new design, thereby further reducing the renovation’s carbon footprint?

5. How do we ensure longevity?

If the building is not built to last, its carbon efficiency inherently becomes irrelevant. Therefore, when aiming to reduce the carbon footprint in construction, longevity is paramount, both in terms of the durability of materials and the adaptability of the architectural design over time.

6. Is it worth to salvage a building?

In the last chapter, the thesis aims to answer the final research question, which leads into a presentation of approach, a discussion and subsequent summary of the thesis adressing the hypothesis.

"For research to be research, it necessarily involves reducing lived experience or observed phenomena into chunks of information that are noted and categorized in some way."

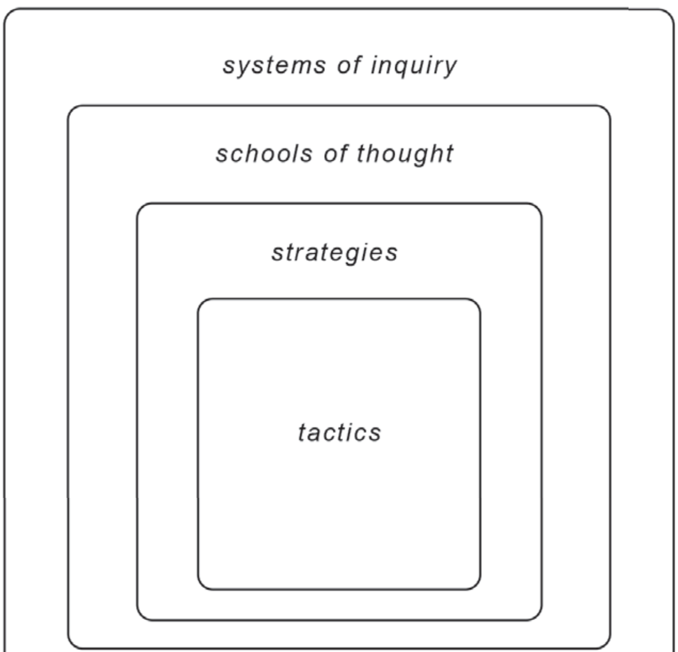
(Groat & Wang, 2013, p. 8)

METHODS & METHODOLOGY

When choosing what methods and which methodologies to apply in a project, the most important thing is to first be aware of what knowledge you wish to achieve. As Linda Groat and David Wang puts it in the book "Architectural Research Methods", every piece of research is essentially framed by a certain system of inquiry. Put into other words, everyone who conducts research is making assumptions about the nature of the world and how knowledge is acquired, whether explicitly stated or not. Creating an epistemological framework is therefore paramount, especially when conducting research that aspires to be self-aware of the demarcations that are bound to arise in the creation of new knowledge. It is, after all, precisely these demarcations that ensure that the phenomena observed are fragmented into chunks of information that can then be categorized in some way (Groat & Wang 2013).

This master's thesis finds itself in the convergence between the worlds of design, research and performance-based testing. Here, the thesis essentially inquiries into the validity of the process of tearing down and building anew once a concrete structure has been significantly damaged. In doing so, the project alternates between these three worlds of knowledge, continuously letting one influence the other. This constant flux needs certain boundaries and self-awareness in the demarcations set in order for the project to achieve a confident design that answers the problems and questions it asks. Here, Groat takes point of departure in Abraham Kaplan's definition of methods from the book "The Conduct of Inquiry", and derives a concentric framework for systems of inquiry in research (Groat & Wang 2013).

Fig. 008 / Groat & Wang's frames of inquiry

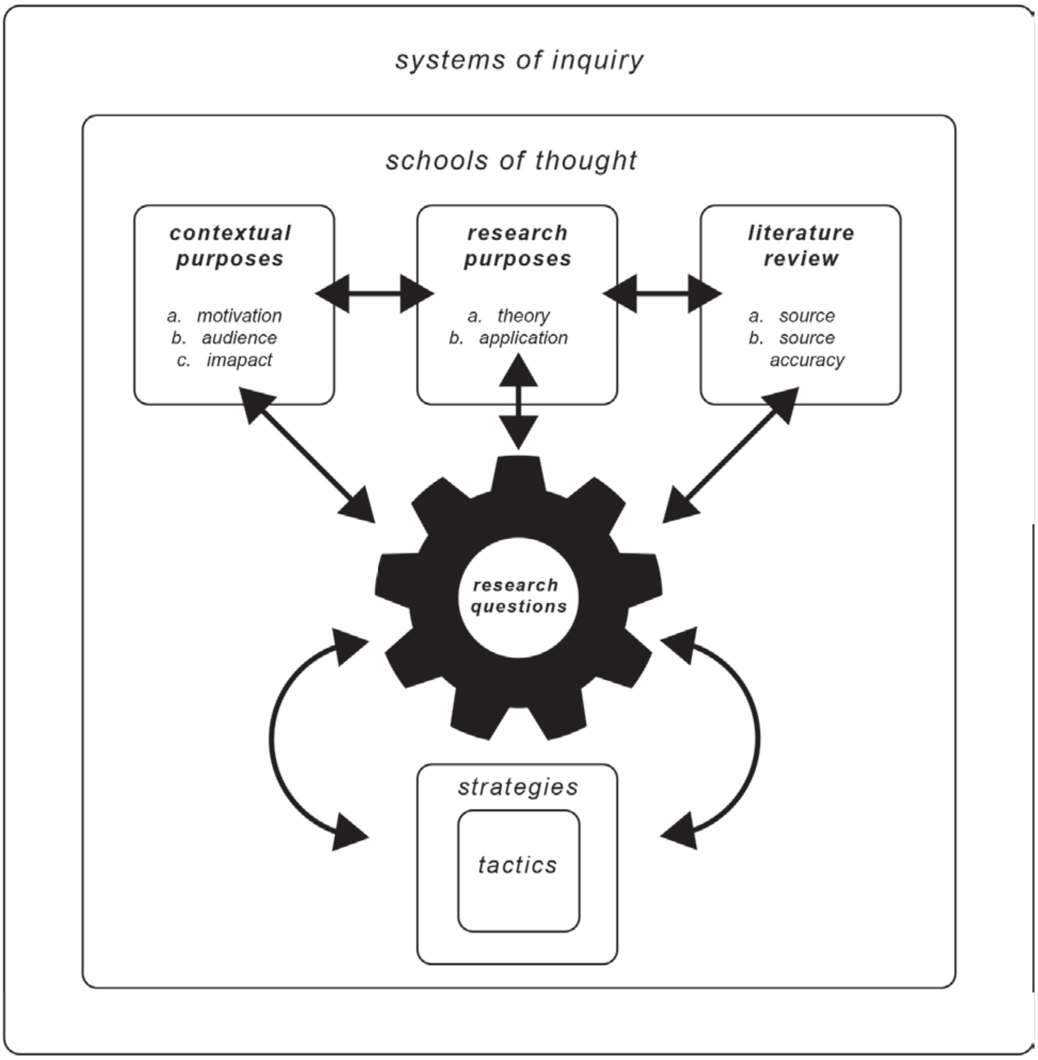


In this framework, Groat emphasizes Kaplan's approach to methods as the study of process rather than the product of inquiry. When creating a reconstructive system for salvaging ruined concrete structures, it is exactly this investigation into the process that is needed to emphasize a self-aware design approach.

In the illustration, Groat shows that within any system of inquiry (also referred to as a "worldview"), there is a multitude of choices in research methodologies (schools of thought) which similarly impact the choice of tactics. Again, multiple tactics are possible within any research strategy. This means that the adoption of a particular school of thought, whether done consciously or subconsciously, will likely influence the framing of different research questions, and subsequently what modes of analysis are employed to answer these questions (Groat & Wang 2013).

Within Groat's overview, it is important to define the different concentric frames within the diagram. A "System of Inquiry" entails broad assumptions about the nature of the world we live in, the knowledge we perceive and the general state of being. "Research Methodologies" are defined as broad theoretical perspectives that have defined different disciplines, say for example critical theory or phenomenology. Moving into the relationship between the "mid-range" of methodology and into the more specific techniques are "Strategies" and "Tactics". Here, Groat defines "Strategies" as general planning and structure of the study, while "Tactics" in contrast refer to the detailed deployment of specific methods and procedures (Groat & Wang 2013).

Fig. 009 / Groat & Wang's frames of inquiry expanded



Moving further into Groat's overview, she expands the diagram by introducing the role of the research questions as a focal axis within a study. Here, Groat argues that the research questions of a given study are connected to both the external factors that motivate the study (the contextual purposes) and the theoretical framework, as well as the intended applications of the research (research purposes). These aspects are then shaped by the researcher's alignment with a particular school of thought and subsequently system of inquiry. Here, the research questions also influence the strategies and tactics employed in the study, and vice versa (Groat & Wang 2013).

As stated in the beginning, it is crucial to understand how to navigate the world of research and the role this study plays within it. This thesis integrates both quantitative and qualitative data as it moves between the realms of design, research, and testing. Empirical research, which relies on measurable, objective data, is used when experimenting with concrete modules and their material properties. However, when creating architectural value, the study may also draw on phenomenological studies, ethnographic research, and other approaches that focus on subjective human experiences (Rasmussen, Kramer Vig & Cerqueira Donskov Iversen 2023). In doing so, the thesis aims to apply an integrated design process, where empirical research can inform the architectural values, and vice versa.

To navigate between the objective and subjective realms in research, Michael Joroff and Stanley Morse developed a conceptual framework for architectural research.

In this conceptual framework, Joroff and Morse distinguish between a subjective system of inquiry to the left side of the spectrum, and a more objective system of inquiry on the right side of the spectrum (Groat & Wang 2013), that this thesis aims to utilize when navigating the different worlds of research, design and testing.

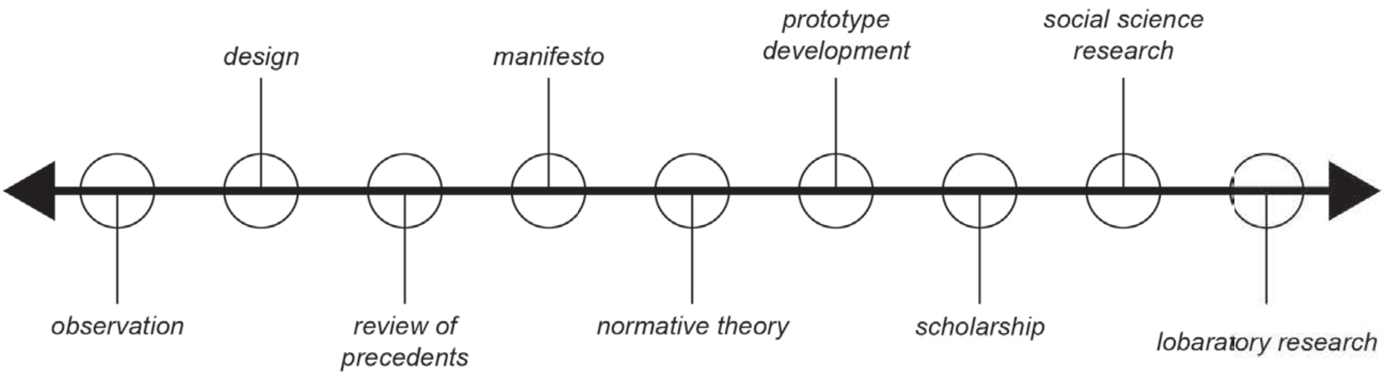


Fig. 010 / Joroff & More's conceptual framework for architectural research

Presenting the diagram as a general integrating context for divergent research efforts, Joroff and Stanley also recognize that this approach might be needed, as architectural research inherently diverges in activities ranging from academic research to subjective values (Groat and Wang, 2013). Although widely applicable, and a great tool for creating a self-aware design process, one crucial fact to reconcile with is that Joroff and Stanley wrote this approach in 1983 in a time where architectural research was relatively new compared to other sciences, and research procedures within the field of architectural research were still in some ways developing (Groat and Wang, 2013). Here, Joroff and Stanley invoke a range of qualifiers and cautions, none of which are applied to the objective (right) end of the scale, but only the subjective (left). Here, one might argue that Joroff and Stanley are essentially proclaiming a "true reality" and a "subjective reality", where real research and only exists at the objective end of the scale (Groat and Wang, 2013). Here, this project begs to differ, especially as design decisions are continuously grounded both qualitative and quantitative research to inform the design in the convergence between the worlds of design, research and testing. Building on this conceptual foundation, the design process adopted in this thesis can be seen as operating within a research-based framework, where design is not only the outcome of inquiry but also a vehicle for generating knowledge. Among the methodologies applied in this project, Research-Based Design plays a key role by enabling a continuous exchange between empirical investigation, contextual understanding, and architectural development

/ research based design (rbd)

In traditional professional practice, there are generally seven phases during the construction process of a building. Within these seven phases, there are three of which that relate to the architectural design process: Programming, Schematic Design and Design Development (Mosegaard, Nissen and Broch, 2022; Stone, 2023). When designing for disaster-struck and post-conflict concrete housing, an inherently unconventional construction context, the project must address the limitations found within this standard professional practice to develop a more holistic design which balances both structural logic and architectural values. In this thesis, Research-Based Design has been utilized as an iterative and integrative methodology that allows both qualitative and quantitative research to inform the design process. Rather than separating research from design, the two have been developed in parallel, essentially complementing the convergence between research, design and testing in which this thesis finds itself in.

Here, methods such as finite element simulations have guided decisions on how to stabilize, optimize and reuse damaged concrete elements, while environmental analyses, such as context mapping, energy consumption and daylight performance, have influenced spatial and material choices. Qualitative data from ethnographic studies, including interviews with Ukrainian professionals and residents, as well as studies on local culture and Soviet-era architectural heritage, have shaped the design's social and contextual relevance. Here, these diverse inputs in different fields of research have been continuously synthesised through modelling, sketching and testing, allowing the design to evolve as a direct response to both technical findings and human-centred insights.

/ integrated design process (idp)

Complementing the iterative nature of the Research-Based Design methodology, this thesis also adopts a general workflow based on the Integrated Design Process (IDP) developed by Mary-Ann Knudstrup. While RBD emphasizes a transdisciplinary approach that embraces complexity and the interplay of multiple layers of knowledge, the IDP offers an organizational framework that supports this by ensuring the process remains coherent, structured, and non-linear. The strength of the IDP lies in its iterative nature, which aligns well with RBD, recognizing that design solutions are not fixed or singular, but must be continuously revisited, refined, and evolved as new insights emerge across disciplines. This cyclical approach enables the integration of technical, environmental, social, and architectural considerations throughout all stages of the design process (Knudstrup and Ann, 2004).

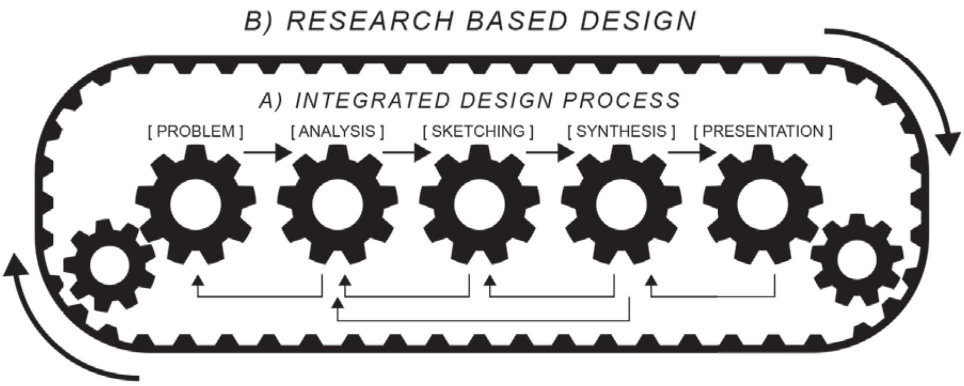


Fig. 011 / The integrated design process as the driving motor of research based design

DESIGNING THE INQUIRY

The foundation of this thesis lies in the hypothesis that damaged concrete structures in post-conflict and disaster-stricken areas may hold potential for sustainable renovation, provided they are approached with the right system of analyses and reconstruction strategies.

To explore this hypothesis, the structure of the thesis is guided by the six aforementioned research questions, each addressing a distinct aspect of the challenges and opportunities involved within the problems raised in the report. The first five questions unfold across five thematic chapters, each driven by a specific design investigation. Ensuring that the narrative of the thesis features all aspects of research, testing and design, each chapter also features several design-intensive chapters, presenting the design process as a ubiquitous part of the inquiry.

With a presentation of the final design proposal featured in the sixth chapter, the seventh and last chapter addresses the concluding research question: Is it worth to salvage a building? Acting as an epilogue, this chapter reflects on the entire process, evaluates the design outcome, and revisits the initial hypothesis, offering a final, critical perspective on the thesis.

/ artificial intelligence

Throughout this thesis, there are certain points in which AI has been utilized to improve the clarity and coherence of texts already written by the design team. Here, a simple prompt such as “improve clarity, coherence and grammar” has been used in a large language model. Here is an example of how this is utilized:

(Person): “This is a text written in my own words. While the coherence and clarity may be fine there are still ways to elevate them to highlight my indications. The grass is green, the skies are blue, and one day, I wish to see Block 82 built anew.”

(Artificial intelligence): “This text was originally written in my own words and refined with the help of artificial intelligence to enhance clarity and coherence, bringing greater focus to the ideas I wish to express. The grass is green, the skies are blue, and one day, I hope to see Block 82 rise anew.”

In the design process, image generative AI has also been used to reconstruct specific scenarios. It has served as a tool to recreate visualizations of Block 82 as it appeared before the bombardment. Additionally, it has been used to explore possibilities for repurposing rubble into new functional elements within the redesigned space. Prompts of these image generations can be found in appendix C.

“The creation of a single world comes from a huge number of fragments and chaos”

- ***Hayao Miyazaki***

POINT OF DEPAR

Before embarking on a major project such as the reconstruction of damaged Soviet-era residential buildings, designers must ask themselves a fundamental question: What difference would it truly make to renovate these buildings instead of demolishing them and starting anew? The benefits of renovation can often seem abstract or distant, and the effort required to repair and restore may appear disproportionate to the perceived outcome. This chapter explores the building's performance prior to the damage, the consequences of demolition, and the potential benefits of different choices regarding the buildings future. A holistic approach is employed, combining life cycle assessments of CO_2-equivalent emissions with an ethnographic investigation into what rebuilding means for the Ukrainian people.

#1 "WHAT DIFFERENCE WOULD RECONSTRUCITON MAKE?"

RTURE

SOVIET-ERA CONSTRUCTION PHILOSOPHY

Kharkiv has historically developed around its industrial significance during the Soviet era. The majority of the city's residential buildings were constructed during the period of Soviet occupation and thus closely resemble Russian typologies from the same time. Concrete residential buildings from this era are typically classified into three sub-categories: Stalinkas, Khrushchevkas, and Brezhnevkas, named after the political leaders in power during their respective periods (Sargisovna 2022).

Stalinkas refer to residential complexes constructed prior to the Khrushchevka and Brezhnevka periods. These buildings were often characterized by solid brick construction, generous ceiling heights, and decorative façades. Within the Stalinka typology, a distinction can be made between two types of occupancy: apartments allocated to the nomenklatura and those adapted into kommunalka dwellings.

The nomenklatura residences were intended for the Soviet elite, including party leaders, directors, and high-ranking officials. These apartments featured spacious layouts, often including separate kitchens, servant quarters, and occasionally private balconies. Buildings housing this demographic were typically located in prominent urban areas such as city squares and administrative centers. Many of these structures still stand today and are recognized as architectural landmarks or tourist attractions (Obrazkova 2013).

In contrast, the kommunalka or communal apartment was a response to severe post-war housing shortages. Rather than being a distinct architectural typology, the kommunalka was a form of occupancy in which multiple families shared a single apartment, with common areas such as kitchens and bathrooms. While some Stalinkas were originally designed for collective living, many were later subdivided to accommodate growing demand. As such, the Stalinka era became symbolic of the widening social divide under Stalin, with elite housing for some and overcrowded shared dwellings for others (Obrazkova 2013).

The Khrushchevka period marked a decisive shift in Soviet housing policy, driven by rapid urbanization and a critical housing shortage following World War II. Under Nikita Khrushchev's leadership, architectural practices were redefined to prioritize speed, economy, and mass production. A key outcome of this policy shift was the introduction of standardized, prefabricated residential buildings designed for rapid construction and minimal cost.

To reduce construction expenses, budgets were tightly constrained, and ornamental detailing was eliminated. One of the most significant cost-saving measures was the exclusion of elevators, limiting building height to a maximum of five stories—the tallest permitted under Soviet health and safety regulations without elevator access.

Architecturally, the Khrushchevka represented a move toward standardization and industrialization. Traditional brick construction was replaced with large, precast concrete panels, which were manufactured in regional casting plants throughout the Soviet Union. This network of production facilities enabled significant reductions in transportation and assembly time. The buildings were generally constructed in five main design variations, allowing urban planners some degree of flexibility while maintaining the efficiency of repeated modular forms (Meuser 2016).

Fig. 012 / Soviet-era residential blocks by Alex Ugolkov

The structural system relied on wet joints, where the precast panels were connected by pouring in-situ concrete into interlocking cavities. These joints typically included protruding reinforcement bars, allowing the rebar from adjacent panels to be lapped and tied, creating structural continuity between elements (Meuser 2016). While the system was highly efficient, it often resulted in insufficient thermal performance and poor acoustic properties, issues that became increasingly apparent in later decades.

During the subsequent Brezhnev era, advancements in building technology, particularly in elevator systems and concrete quality, allowed for the development of a new residential typology: the Brezhnevka. These buildings were conceived as an improved version of the Khrushchevka, addressing many of its spatial and technical shortcomings.

Brezhnevkas typically ranged from 9 to 17 stories, made possible by the inclusion of elevators. They featured wider staircases, marginally better insulation, and slightly larger kitchens and bathrooms. While still largely prefabricated, the Brezhnevka typology incorporated a broader range of panel sizes and a modest return to decorative façade treatments. However, insulation remained minimal by contemporary standards, and many of the core issues associated with prefabrication, such as cold bridges and poor airtightness, persisted (Andreevich, 2022).

Fig. 013 / Brezhnevka block by Mykhailo Volkov

PRE-EXISTING CONDITIONS

/ location

The case project of this thesis revolves around Block 82, located on Natalii Uzhvii Street in Saltivka, Kharkiv. Situated within one of the aforementioned micro-districts, Block 82 is a replica of its neighbouring structure and belongs to the Brezhnevka series III-162-2n (Buildner, 2024).

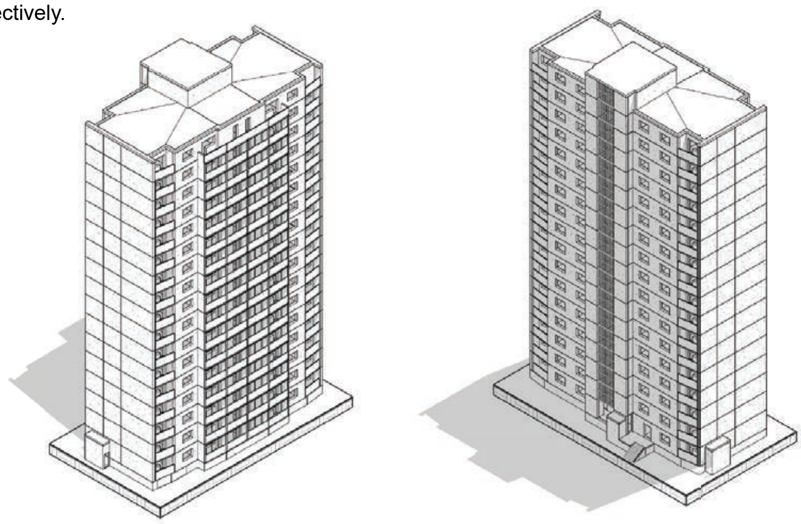
The building is positioned with its east-facing façade overlooking a public park, which includes a small playground and open green spaces. On the western side of the building lies the access road, connected via a network of smaller streets branching off from Natalii Uzhvii Street. These smaller roads are used by residents of the micro-district for parking.

/ exterior

With 16 floors and a total floor area of approximately 6100 square metres, the building represents a typical example of the Brezhnevka typology. It is constructed from prefabricated concrete panels, characteristic of this period. The otherwise monotonous appearance of the concrete is interrupted by colour variations among the panels, though much of the original colouration has since faded. A subtle decorative feature persists in the balconies: each balcony panel is adorned with textured squares, arranged across the surface (Buildner, 2024).

The balconies appear to have been altered from the original design drawings, as they are now enclosed. This modification was likely intended to improve the thermal performance of the adjacent interior spaces, compensating for the minimal insulation of the original exterior walls. The modifications appear to have been implemented at various times and by different contractors, as evidenced by the inconsistent window types and layouts—varying significantly in material and design.

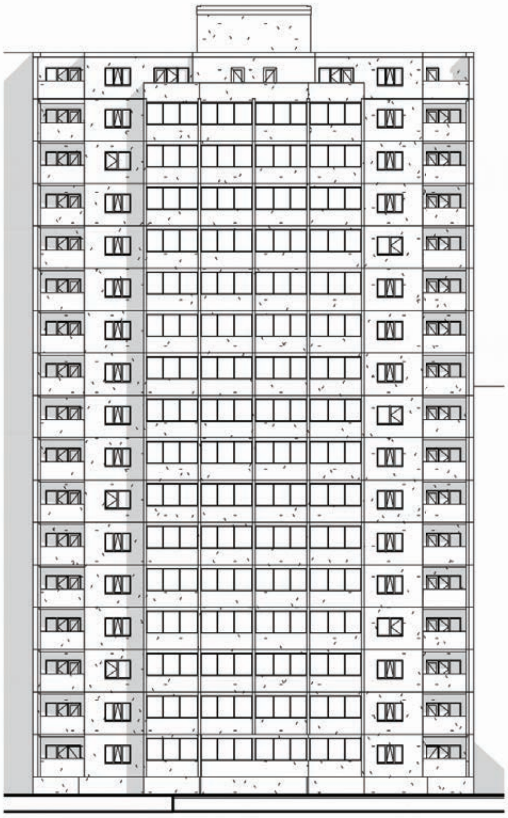
Fig. 014 / Block 82 isometrics from SE and SW respectively.



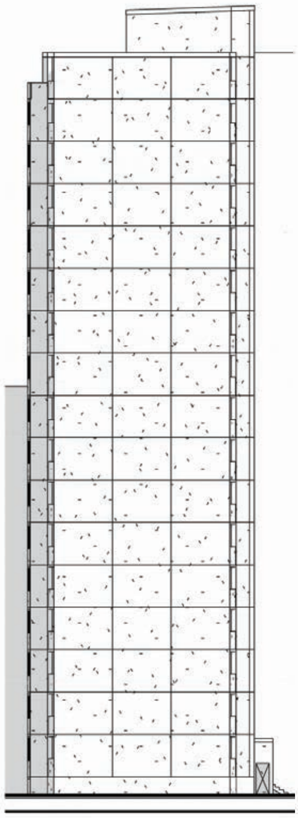
Another architectural feature, this time on the western façade, is a series of vertically aligned concrete mullions located centrally along the elevation. These vertical elements accentuate the height of the building, reinforcing its elongated appearance.

Fig. 015 / Block 82's east facade

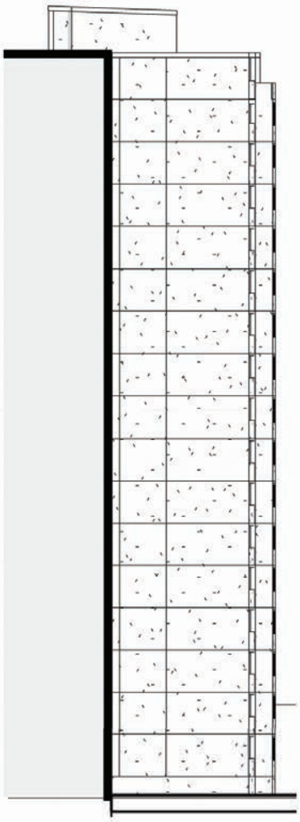
Fig. 016 / Block 82 elevations 1:500



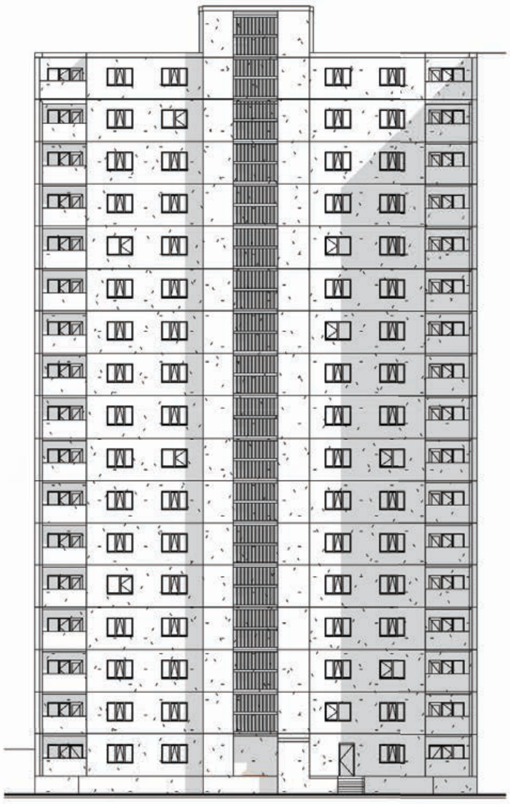
East facade
1:500



North facade
1:500



South facade
1:500



West facade
1:500

/ interior

On the ground floor of the building are four differently sized apartments: two two-bedroom apartments, one one-bedroom apartment, and a single three-bedroom apartment. All four feature a decently sized kitchen along with a separate toilet and bathroom and two balconies per apartment. The ground floor also includes a laundry room, a technical space, and a wet room for the janitor.

For circulation throughout the building, the ground floor has two lifts—one larger and one smaller—along with a staircase. These circulation elements are located at the centre of the building and are only accessible through a series of doors. All ground floor apartments benefit from terraces facing the park area to the east of the building. However, there is no direct access from the park to the ground floor.

The topography of the building area is relatively flat, though the ground floor sits approximately one metre above the surrounding ground level. This may have been done for several reasons, such as flood prevention or to enhance the privacy of the ground floor apartments. Raising the ground floor in this manner necessitates vertical access, provided in this case by an exterior staircase. While neighbouring buildings have implemented ramps to improve accessibility, no such installation exists for Block 82.

From the second floor to the sixteenth floor, the same floor plan is repeated. Each typical floor contains two three-bedroom apartments and two two-bedroom apartments. The three-bedroom apartments could accommodate a family of two parents with one or two children, as the relatively spacious rooms allow for flexible use. The two-bedroom apartments would typically be suitable for couples or single occupants, though they could also accommodate a small family due to the kitchen's capacity to incorporate a dining area.

The layout of the bathroom and toilet is consistent with that of the ground floor, with both located near the kitchen to facilitate shared use of the same service shaft for piping and gas lines.

The three-bedroom apartments benefit from the potential for cross-ventilation, as rooms extend to both the eastern and western façades. Similarly, they feature balconies on both sides, allowing for exposure to sunlight in the morning and evening.

In terms of circulation, the lifts open into a hallway that distributes access to the apartments. Before reaching their front doors, residents pass through a semi-public corridor where common items or footwear may be stored. The stairwell is somewhat concealed and is unlikely to be used by residents living above the third floor, except in the event of lift maintenance or an emergency such as a fire.

Fig. 017 / Groundfloor CAD drawing

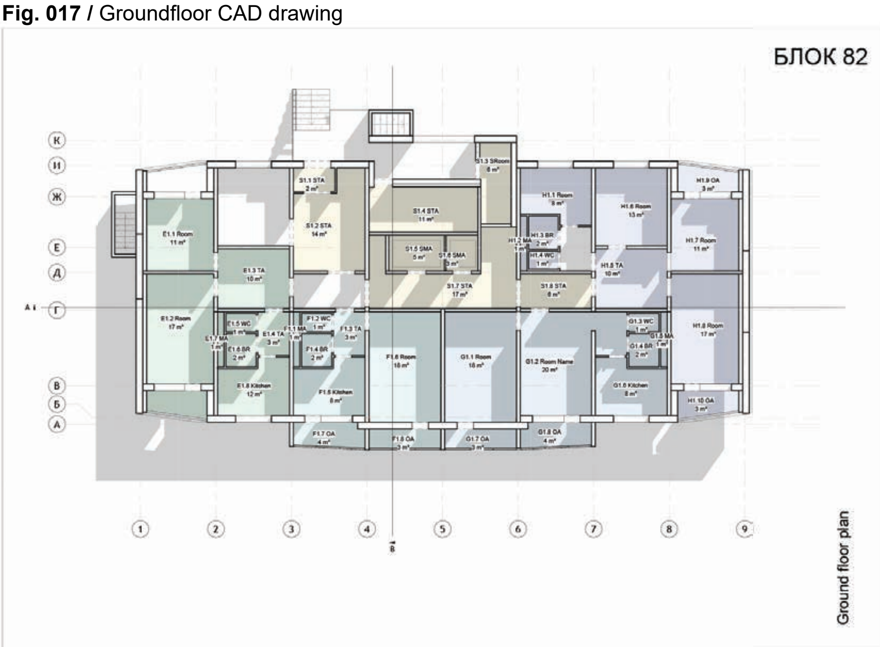
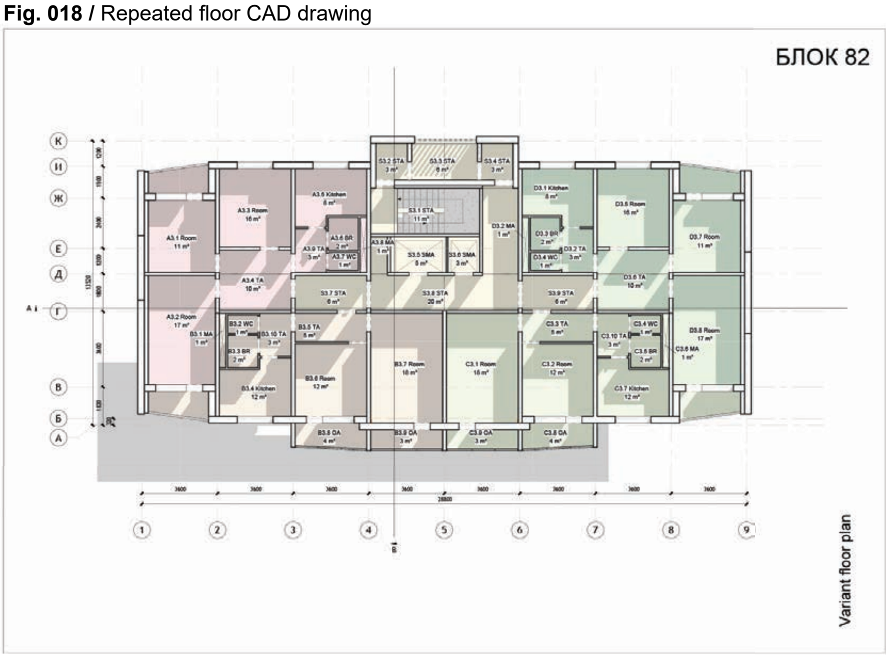


Fig. 018 / Repeated floor CAD drawing



/ energy efficiency

Reflecting a time when fossil fuels were cheaper, construction was faster, and industry demands were lower than today's standards, Block 82 was assumed from the outset to have poor and outdated energy efficiency. This energy simulation aims not only to estimate the building's approximate energy use intensity (EUI) but also to analyse its energy balance and identify which factors, such as heating, cooling, or artificial lighting, contribute most significantly to its total energy demand.

Created in Climate Studio's thermal analysis program, the energy model runs on a simplified version of one entire floor of the apartment block. Here, the floor is simplified into 5 different thermal zones:

Big East Room (Zone 1)

Circulation (Zone 2)

Kitchen and Room (Zone 3)

Small West Room (Zone 4)

Small East Room (Zone 5)

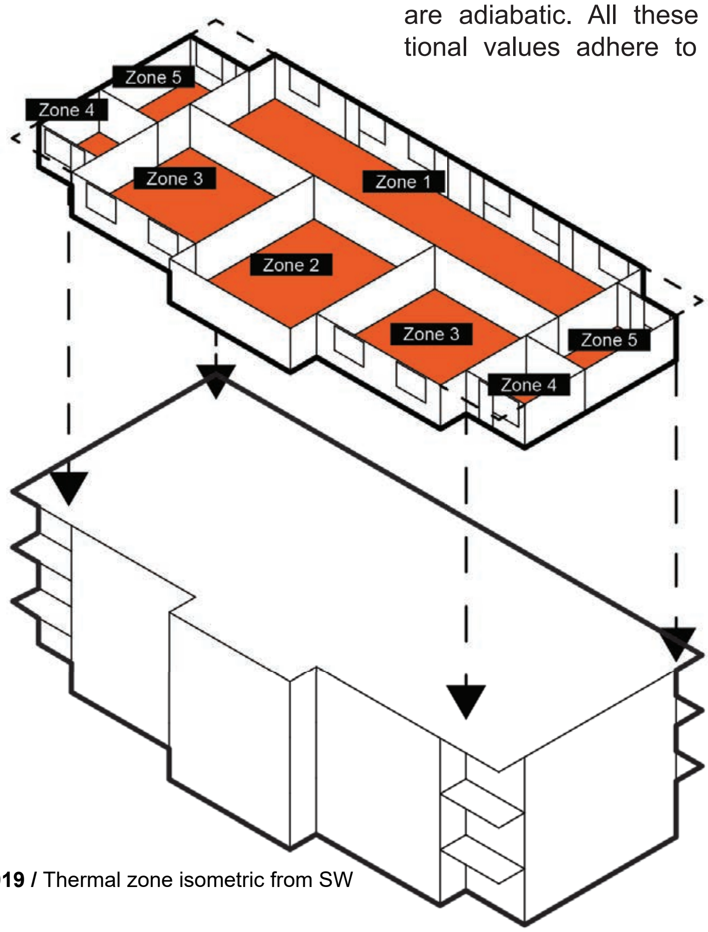


Fig. 019 / Thermal zone isometric from SW

These five zones represent generalized areas within the residential block and do not correspond to the building's actual floor plan. In Climate Studio, each thermal zone is treated as a distinct calculation area, generating five thermal profiles based on the model's orientation and the specified weather file. Within the energy model, window elements have been assumed to be standard, double-layered glass with a U value of 2,67 [W/m^{2}K]. Construction elements have been assumed to be the same exact specifications as for the actual construction of Block 82; however, slight U-value differences are taken into account as the different software inadvertently have slight variations in constructional values.

All exterior walls are modelled as 320 mm sandwich elements with a U-value of 0,955 W/m²K. Partition walls consist of 180 mm reinforced concrete and are treated as adiabatic surfaces, with a U-value of 0,862 W/m²K. Both floors and roofs are defined as 140 mm reinforced concrete slabs, each with a U-value of 0,962 W/m²K, where floors likewise are adiabatic. All these constructional values adhere to the original constructional evaluations set by the Norman Foster Foundation Kharkiv Housing Challenge (Buildner, 2024).

Within the energy simulation, an Ideal Air Load System (IAS) simulation for HVAC is assumed to prevent complex system behaviours from interfering with the simulation results. What this means is that within the simulation model's hypothetical HVAC, the system perfectly meets all heating and cooling demands without any equipment limitations, special system behaviour or inefficiencies. Additionally, factors such as cooling are accounted for in the simulation although not every apartment has a mechanical cooling system present. This is due to simulate the effects of possible overtemperatures within the building.

Currently, the simplified energy model shows a total EUI of 179 KWh/m^2/yr, which is above the Danish standard of 30 KWh/m^2/yr for new construction (Social- og Boligstyrelsen, 2023). Looking into the monthly distribution of energy use intensity (see appendix E), it becomes apparent that the largest contributor is heating during the winter months, responsible for keeping the conditioned areas at or above a set point of 20 degrees Celsius. Additionally, demands for artificial lighting rises slightly from approximately 4 to 6 KWh/m^2/yr from summer to winter months. Comparing these results to the energy balance simulation results (see appendix E), the same trends become apparent.

/ daylight conditions

One paramount precondition of Block 82 is how the preexisting daylight conditions were, highlighting which problems the old construction might have had. To analyse how the daylight conditions were before the building was struck by bombardments, a conceptual simulation export (CSE) was made from BIM (Revit) and transferred into CAD (Rhino 3D), where a Climate Studio daylight simulation was made.

To analyse daylight conditions, the 8th floor of the apartment block was chosen as a benchmark. Situated in the middle of the building, it receives neither the increased daylight exposure typical of upper floors nor the reduced levels often experienced on lower floors due to shading from surrounding structures. For every simulation made in the report, an occupancy schedule from 7am to 7pm with daylight savings is assumed as a general benchmark.

The daylight simulation of the existing conditions reveals that improvements need to be made to meet acceptable daylight standards in the reconstruction of Block 82. From the results of the annual Spatial Daylight Autonomy (sDA), the building achieves an annual an annual sDA of only 23,2% at 300 lux/50%, meaning just 23,2% of the floor area receives at least 300 lux of daylight for 50% of the occupied hours.

Comparing these results with a Useful Daylight Illuminance (UDI) analysis, it becomes possible to better assess how effectively this daylight is utilized in space. With an average annual UDI of 26,5%, it is safe to say that not a lot of useful illumination is penetrating the building. The simulation results reveal that the sheer depth of the rooms in the preexisting conditions significantly limits daylight penetration, leaving large areas without adequate daylight. This observation aligns with the previous energy assessments of Block 82, which highlights a reliance on artificial lighting, indicating a potential for improvement in the redesign.

While simply increasing window sizes might help, the challenge also lies in bringing in the right kind of light. Paradoxically, optimal daylight conditions typically occur between 9am and 3pm (see appendix D), a time when many residential spaces are least occupied. Introducing bay windows into the facades could offer a solution to this problem, capturing more daylight and reflecting it deeper into the volume.

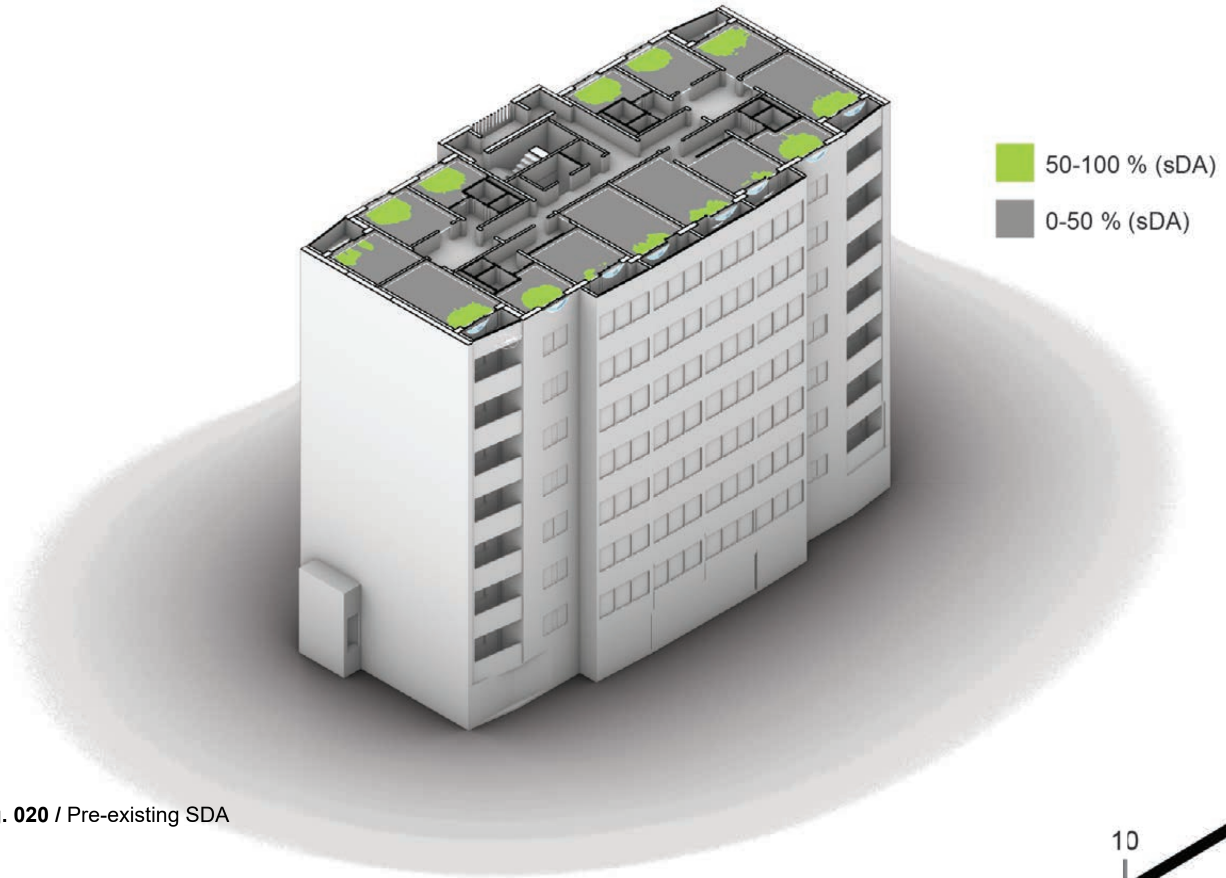


Fig. 020 / Pre-existing SDA

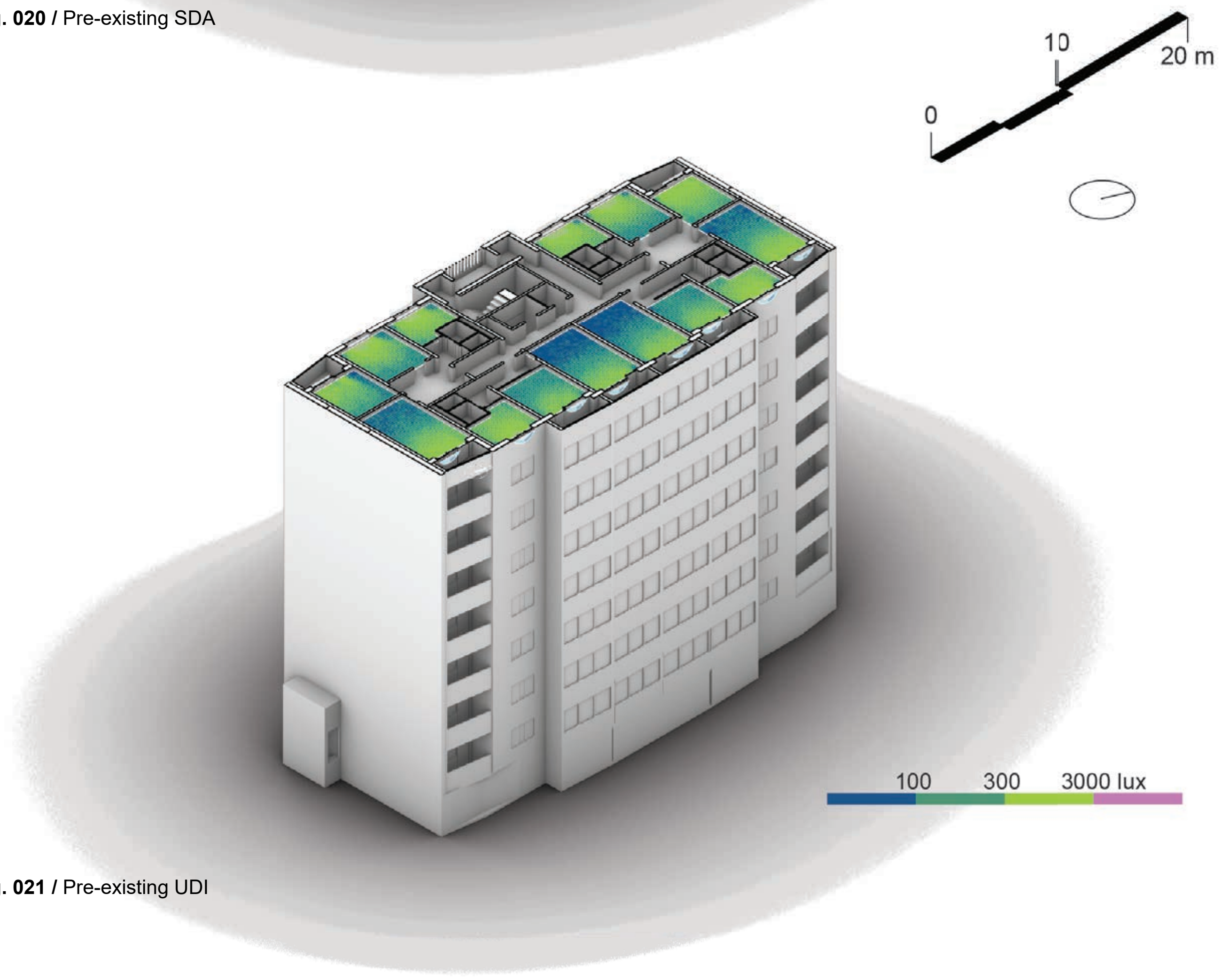


Fig. 021 / Pre-existing UDI

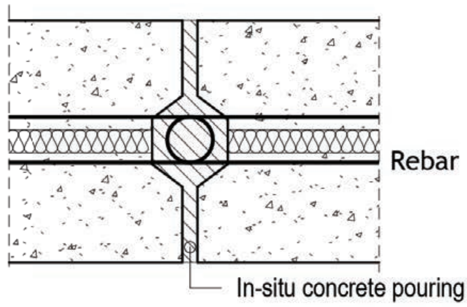
/ constructions & joints

As previously noted the joints between the load-bearing wall panels were formed by pouring concrete into cavities containing exposed reinforcement bars at the ends of the panels. Similarly, the floor panels were connected by casting concrete into the joints between adjacent panels. This construction method results in rigid, non-reversible joints that cannot be dismantled without damaging the components.

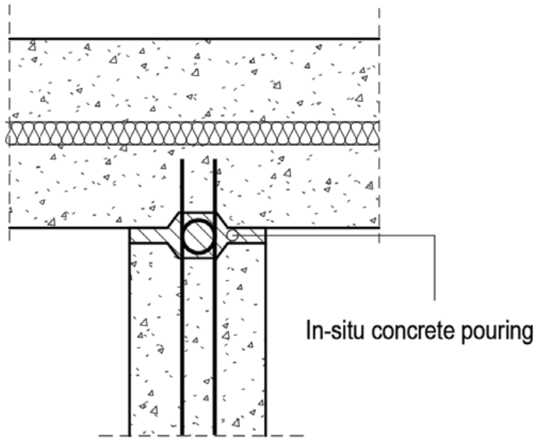
In recent years, technologies have emerged that enable these joints to be made reversible during construction. Such methods include the use of weaker binding concretes, designed to break away more easily during disassembly, thereby allowing the structural panels to be reused in other projects. However, given the period of construction, economic constraints, and the emphasis on rapid assembly, it is assumed that such reversible connections were not employed in the case of Block 82.

These types of joints commonly disrupt the insulation layer between panels, potentially resulting in significant thermal bridging within the façade. This issue warrants further investigation. The joints, as modelled using available building information, will be analysed through simulations in THERM, a thermal bridging simulation software, to assess the extent and impact of thermal bridging in the building envelope.

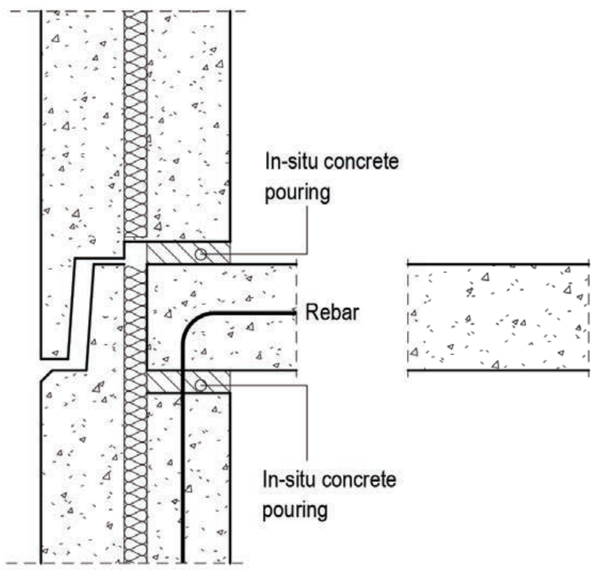
Fig. 022 / Joint details 1:10



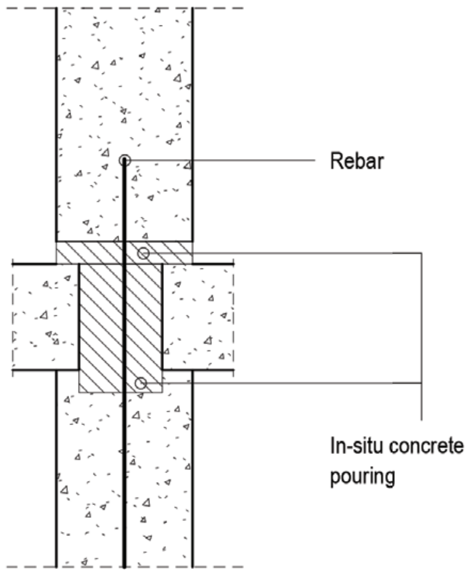
Panel joints
1:10 - plan view



Exterior panel to interior wall joint
1:10 - plan view



Exterior panels to internal floor joint
1:10 - section view



Indoor walls to deckings joint
1:10 - section view

/ thermal bridging

The thermal bridge analyses are based on the specific construction details (see previous page). Here, simulations were conducted on three distinct joints: Two horizontal sections and one vertical. The first horizontal section illustrates the thermal bridging done at a T-connection between the inner and outer walls, joined by one homogenous situ cast concrete joint. The second shows the horizontal joint between two adjacent outer wall panels, likewise, joined by the same type of in situ cast concrete. The vertical section highlights a thermal bridging done at the connection between an outer wall panel and the floor slab separating two levels.

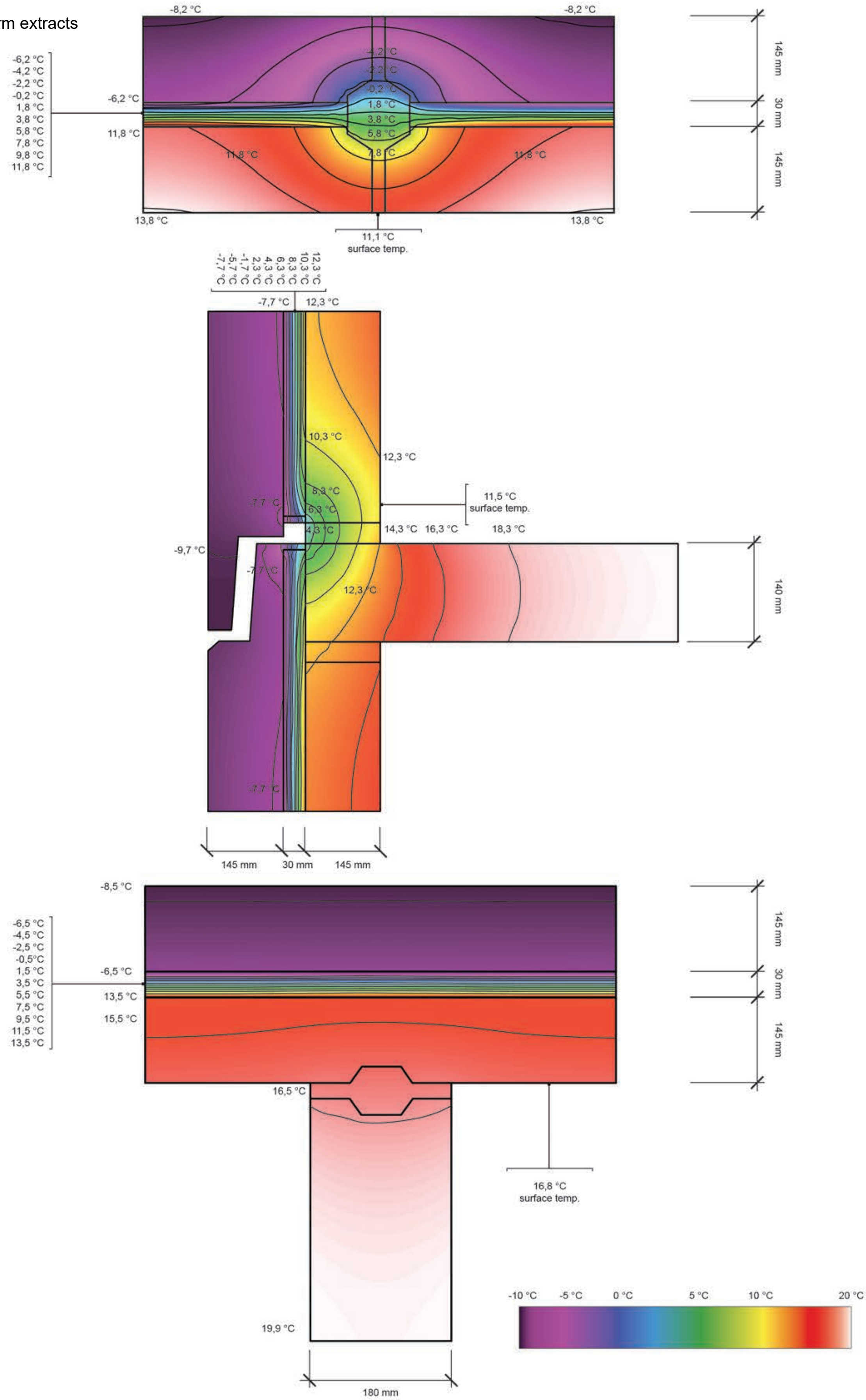
Looking at the T-connection joint, it does not create any immediate thermal bridge by itself, as it is simply joined at the interior surface of the outer wall. However, a surface temperature of 16,6 C° on the inside surface of the outer wall is not ideal. For areas where the existing construction may be poor, or the insulation is damaged, this surface temperature could drop even lower, allowing for the risk of condensation and/or cold spots.

The vertical connection between outer wall panels and interior slabs features one of the most prominent thermal bridges of the construction details shown. Creating a thermal bridge with an inside surface temperature of 11,5 C°, this point in the construction is at high risk of creating surface condensation. Assuming a temperature of 20C° and a relative humidity of 50% inside, the dew point is at 10 C°.

The horizontal connection between the outer wall panels, made by a homogeneous joint in in-situ cast concrete features the worst thermal bridging. With a surface temperature of 11,1 C° at the joint, this connection creates significant cold spots on the outer wall construction and is at high risk of creating surface condensation. Assuming a temperature of 20C° and a relative humidity of 50% inside, the dew point is at 10 C°.

Generally, the current joints between the outer wall panels pose a significant thermal bridge problem, that leads to cold-spots and in some cases might even result in condensation on the interior surfaces.

Fig. 023 / Therm extracts



DAMAGE ASSESSMENT

The aim of this subchapter is to provide an estimate of the destruction sustained by Block 82, to serve as a basis for further analyses, such as assessments of structural integrity and reconstruction potential.

In 2022, during the Russian offensive on Kharkiv, Block 82 was struck by an aerial attack, causing severe structural damage that brought the building to the brink of collapse and subsequently ignited the remaining structure (Map of Recovery, 2025) . The extent of the destruction is considerable, and satellite imagery of the block is frequently cited as a visual representation of the widespread devastation caused by the Russian invasion (Space Tech, 2023).

The damage can broadly be categorized into two distinct types: fire damages and rubble. Much of the western façade has been blackened by soot from the fire following the attack. The interior soot that maybe could be harmful for the residents should be cleaned away and the rooms repainted. The shockwave from the blast also destroyed the fenestration across the entire western façade, presenting an opportunity for essential upgrades to the building's window systems.

On the eastern facade of the building, the impact is manifested through widespread structural collapse. The attack appears to have struck inflicted damage upon central portion of the block, causing several floors to collapse in a cascading manner. The destruction on this side is severe: floor slabs cantilever precariously, load-bearing walls have broken at their joints, and a large volume of rubble has accumulated at the base of the structure. That any portion of the building remains standing is, in itself, remarkable.

A visual assessment has been carried out to determine which structural elements have been destroyed and which remain intact. This assessment was undertaken by comparing drone imagery, provided by the War Up Close team, with a building information model (BIM) developed from underlying CAD (computer aided design) data (Buildner, 2024).

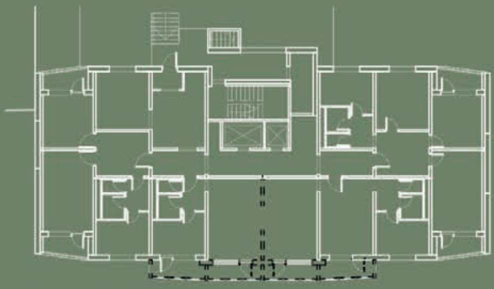
Although an on-site survey would have offered valuable insight, safety and time constraints rendered such an investigation unfeasible. In a practical reconstruction context, it is recommended that drone-based 3D scanning of the building's remnants be employed and compared with existing CAD and BIM models to inform design decisions.

The following pages present an overview of the damage, floor by floor. As illustrated, the lower section of the building appears largely intact, potentially providing a stable foundation for reconstruction. However, the presence of hairline fractures or other structural weaknesses must be considered. These could include rebar deterioration from high temperatures or desiccation of the concrete. Due to these possible vulnerabilities, it is advised that the structural design should not rely on the full load-bearing capacity of the surviving lower concrete walls.

Fig. 024 / West facade Block 82, @warupcloseteam

Fig. 025 / East facade Block 82, @warupcloseteam

Fig. 026 / East facade Block 82, @warupcloseteam



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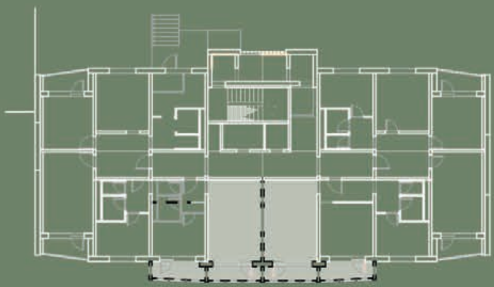

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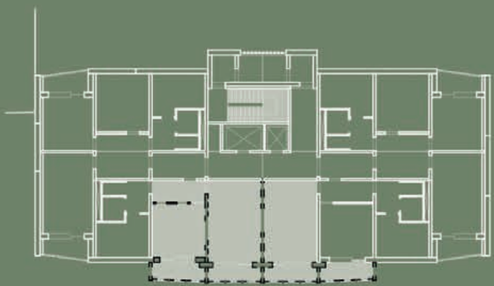

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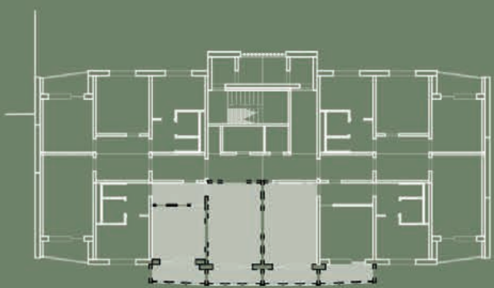

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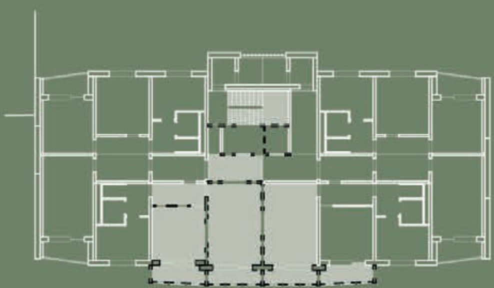

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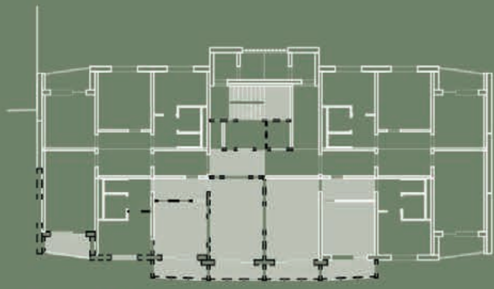

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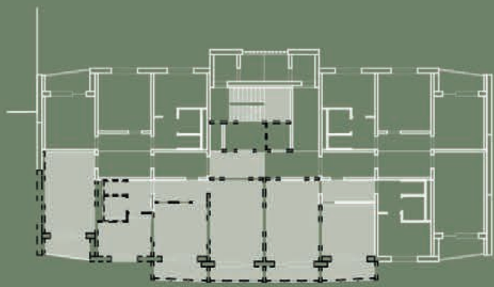

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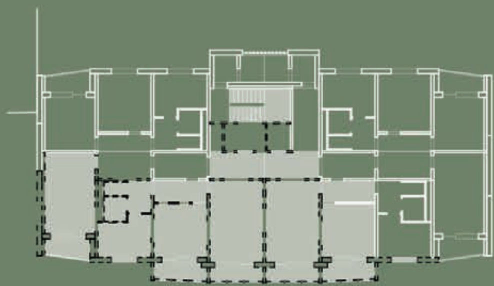

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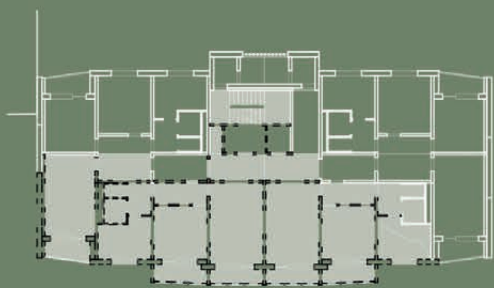

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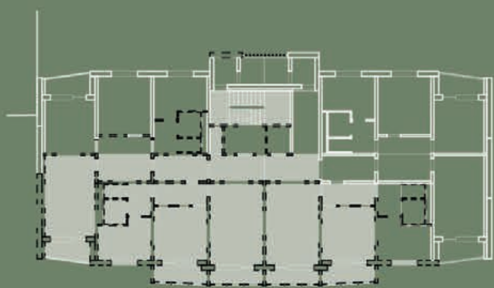


Level 10

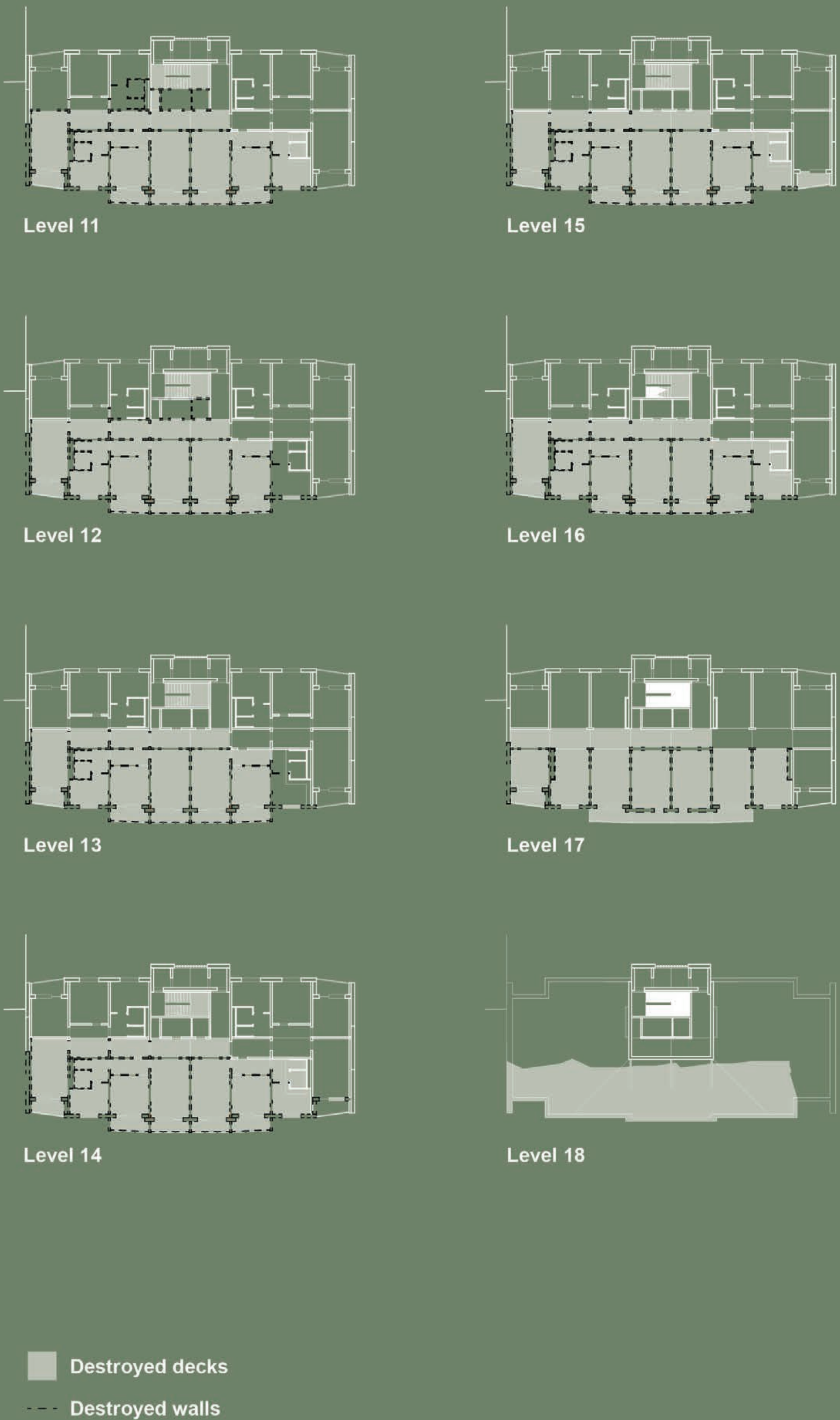


Fig. 027 / Floorplans destroyed, 1:500

LCA PATHS

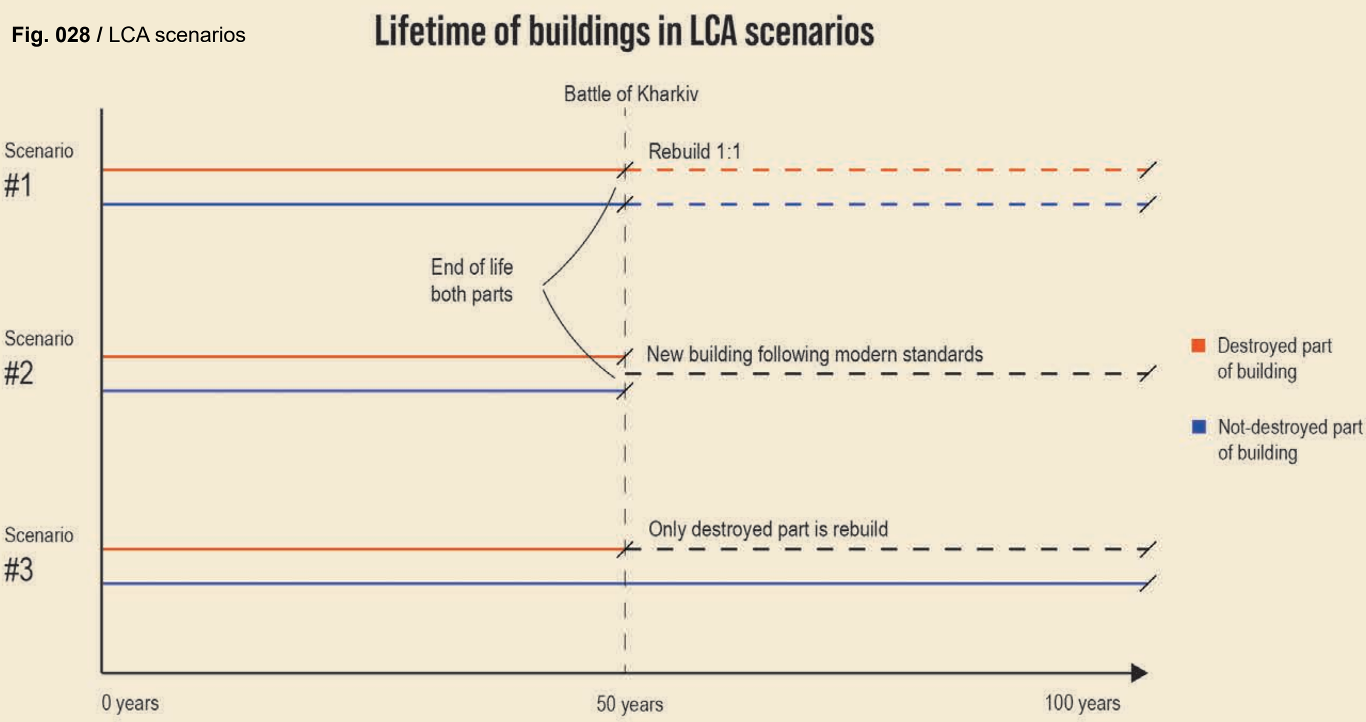
The damage sustained by Block 82 is, as previously noted, extensive. This raises a critical question central to the thesis: what would be the carbon footprint associated with reconstructing the building? This issue is addressed through life cycle assessment (LCA), beginning with an evaluation of the building in its original Soviet-era configuration. This initial analysis provides insight into which building components contributed most significantly to CO_2-equivalent emissions during construction.

Two alternative LCA scenarios are explored. In Scenario 1, the building is demolished after a 50-year lifespan (1972–2022), and an identical structure is erected in its place, assumed to last for another 50 years, resulting in a total reference period of 100 years. In Scenario 2, which is deemed more realistic, the original structure is again demolished after 50 years, but the replacement follows contemporary construction standards, with an assumed lifespan of 50 years. These two scenarios serve as benchmarks against which the proposed renovation strategy will be compared.

As discussed earlier, the original construction prioritised speed and cost-efficiency over environmental considerations. Concrete—the dominant construction material—has a high global warming potential due to the energy-intensive processes involved in cement production and virgin aggregate extraction. Additionally, the prefabricated concrete panels were likely produced off-site in specialised factories and transported by heavy vehicles, increasing emissions further. These panels were probably reinforced with additional rebar to withstand shear stresses during transportation, which also added to the embodied carbon.

Data for the LCAs is derived from CAD drawings accessed online (Buildner, 2024) and from energy performance simulations conducted earlier in the thesis. The building is assumed to have been connected to the national electricity grid and heated by gas. Due to its poor thermal performance, maintaining indoor thermal comfort during colder months required significant energy use, resulting in a high operational CO2-equivalent contribution.

Fig. 028 / LCA scenarios



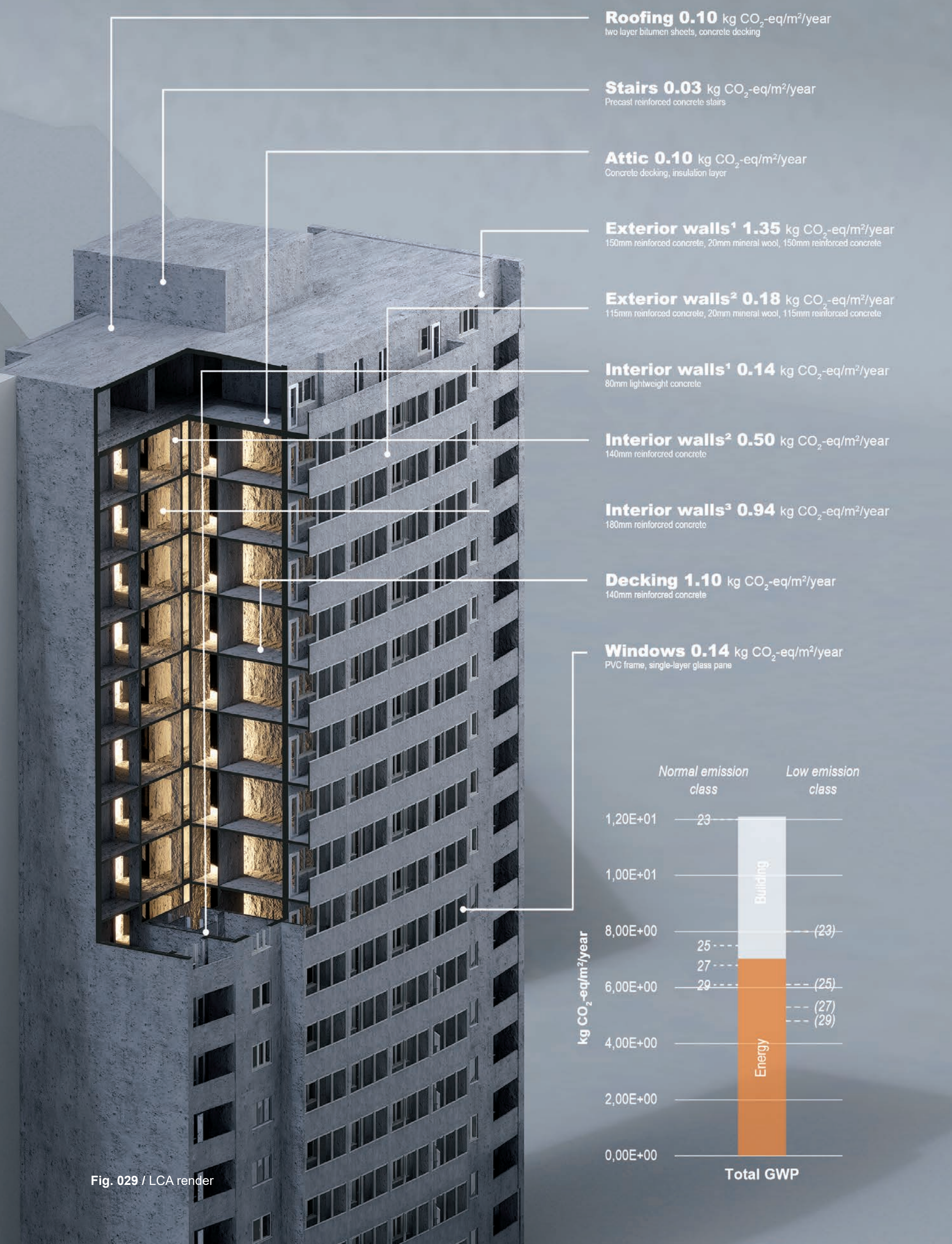


Fig. 029 / LCA render

/ the impact of todays standards

Under current assumptions, the building exhibits a Global Warming Potential (GWP) of 12.04 kg CO_2-eq/m²/year over a 50-year lifespan. It should be noted, however, that this figure likely underestimates the true GWP, as components such as wiring and foundations were excluded due to data limitations. When extending the calculation to 100 years, where the building is demolished and reconstructed as it originally was, the GWP drops slightly to 11,24 kg CO_2-eq/m²/year.

In contrast, Scenario 2 shows a lower increase in embodied emissions while significantly reducing operational emissions. The data for operational energy use was modelled according to Danish low-energy building standards, and embodied emissions were based on future low-emission construction targets for 2029 (Social- og Boligstyrelsen, 2023; Social-, Bolig- og Ældreministeriet, 2024).

These comparisons clearly illustrate the substantial environmental impact of poor thermal performance. The findings establish a benchmark for a potential renovation of Block 82: if the renovation project, when assessed over a 100-year life span, emits more than 8,93 kg CO_2-eq/m²/year, it would not be considered environmentally beneficial compared to demolition and reconstruction under current or future standards.

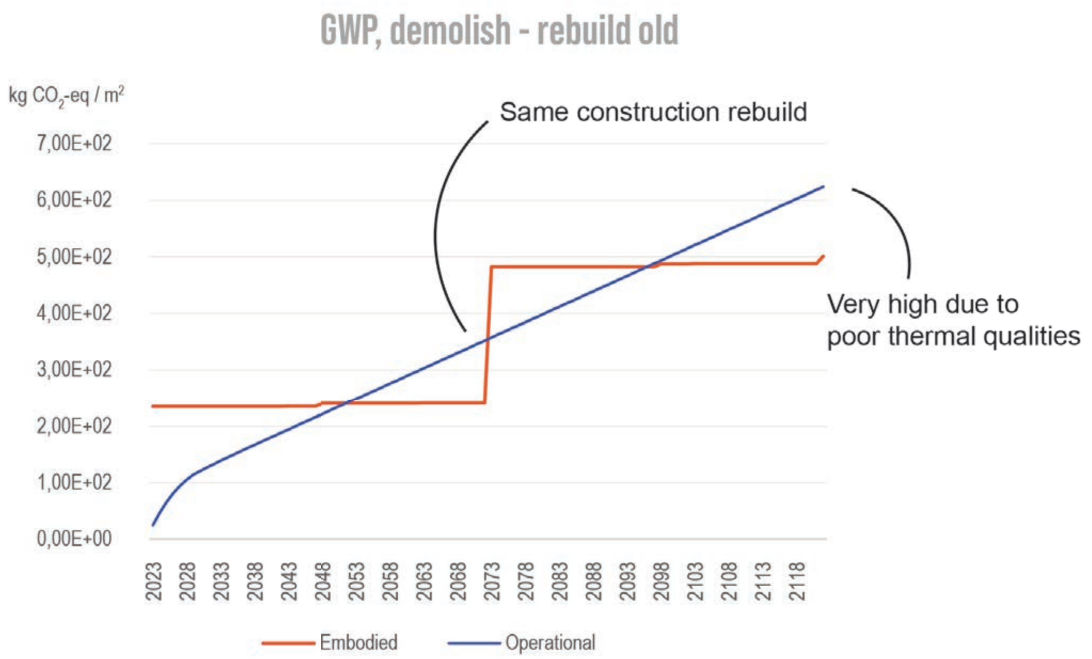


Fig. 030 / GWP scenario 1

11.24 kg CO_2-eq / m^2 / year

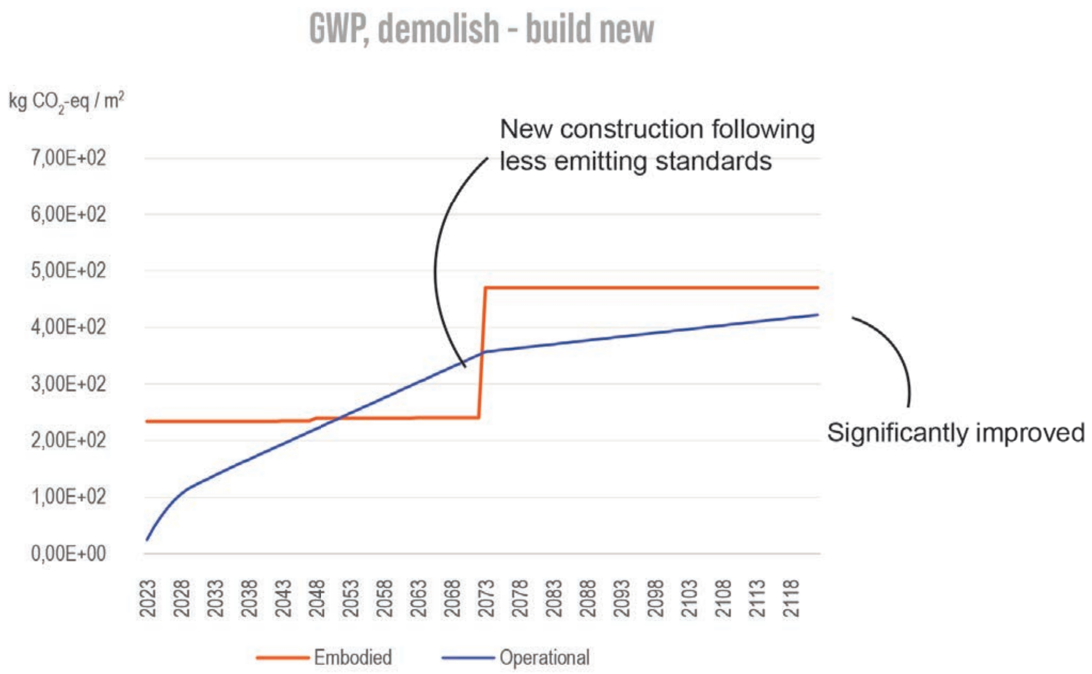


Fig. 031 / GWP scenario 2

8.93 kg CO_2-eq / m^2 / year

ETHNOGRAPHIC STUDIES #1

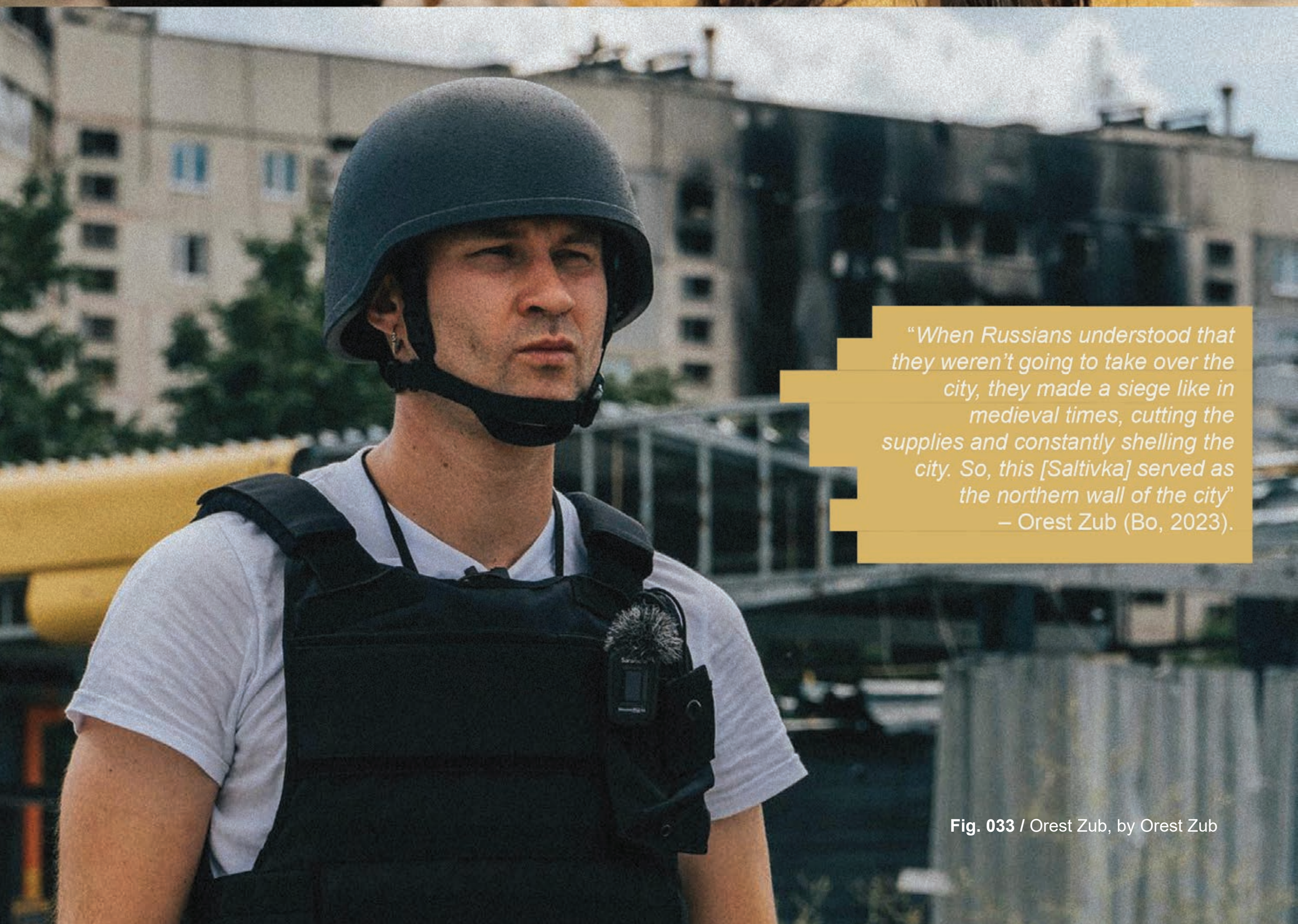
/ resilience retold by ukrainians

A graduated lawyer from Lviv, Orest Zub is a Ukrainian content creator, digital entrepreneur and war reporter who uses his voice to tell the tale of a world through his lens; a world closely focused on the people, places and its conflicts. Orest tells the tale of the man in the middle on his travels through now over 130 countries and counting. In an investigation into what difference reconstruction would make, Orest fills in a prominent void of the project: Treading the actual grounds of the project site, as he in 2022 returned to Ukraine amidst the ongoing war to document the area of Saltivka in detail along with several other war reporters:

Deputy director of Kharkiv City Council's cooperation office and head of the Kharkiv Tourism Board, Julia Zghurska is a local voice of the Kharkiv Oblast region. Here, she provides valuable information about the city and its surrounding region, telling a story through her knowledge of the locals, their struggles and efforts to rebuild what has been damaged during the bombardments.

“Saltivka is the largest residential area in Kharkiv, and one of the largest in Europe. (...) It embodies Kharkiv as a city with a simple, straightforward mentality. Since 2022, Saltivka became a symbol of resistance and suffering, as the neighbourhood was heavily damaged by shelling.”
– Julia Zghurska, 2025 (Appendix B)

Fig. 032 / Julia Zghurska ©Radio Vagabond



“When Russians understood that they weren’t going to take over the city, they made a siege like in medieval times, cutting the supplies and constantly shelling the city. So, this [Saltivka] served as the northern wall of the city”
– Orest Zub (Bo, 2023).

Fig. 033 / Orest Zub, by Orest Zub

Fig. 034 / Do we repair, or do we tear down?

/ who are we building for?

In accounting for what difference reconstruction would make, several factors are important. No ship sails without its crew, and likewise, no community can exist without its people. Therefore, accounting for the demography of Saltivka is paramount for the reconstruction of Block 82, not only in terms of form, but also function. Here, Orest gives us an unprecedented context through the interviews with him, both into the district of Saltivka, the greater city of Kharkiv, as well as what it means to be a Ukrainian, especially in the north-eastern regions of the country:

“Kharkiv is predominantly Russian-speaking—around 90% spoke Russian as their first language before the war. This isn’t just in Saltivka, it’s city-wide.” (Appendix A)

When inquiring into Orest’s experience with the sort of typology Block 82 is (see appendix B), he gives a broad demarcation as to who the typical resident might be:

“T*hey’re seen as entry-level housing—nothing luxurious, but not awful either. I wouldn’t compare them to Western-style social housing. Inside, they’re often well-maintained, with Wi-Fi and good infrastructure*.” (Appendix A)

Here, Orest adds that, although not pleasing, the visual presence of the Soviet concrete structures does not carry any significant negative connotations:

“*Nobody dreams of living in them, but they’re functional. Most Ukrainians don’t have strong feelings about them—neither particularly negative nor positive.*” (Appendix A)

Being unfamiliar with the context, one might think of these building typologies as eyesores, out of place in their surroundings and carrying a vague, if not clearly negative association. An association tied to the same occupying power that is once again trying to invade the country: Russia. However, as Orest explains, this view is misleading. These typologies are principles of eastern European urban planning. Just as the modernist apartment blocks of Vollsmose and Taastrupgaard reflect the urban development trends of the 1960’s Denmark, Ukraine’s Brezhnevkas have come to represent basic, accessible housing shaped by the soviet era.

Here, Julia adds another dimension to the question of rebuilding. Under the Soviet Union, Kharkiv was the capitol of Ukrainian Soviet Socialist Republic from 1919-1934, which sparked much development of the city (Bo, 2023). While she believes that the Stalinka, and in continuation of this the Brezhnevka, are typologies which are part of the city’s history, she is still not convinced that everybody feels the same way about the residential blocks:

“*As a part of our history we were the capitol of Soviet Ukraine (…) Now [today] we communicate a lot with our people, because some of them tell that ‘We should not remember about Soviet period.’ But the other part of Ukrainians says, ‘But it was our history (…) so we cannot forget it.’*” (Bo, 2023).

Over half of the residents of Kharkiv left the city at the start of the war, but since many have relocated again, with an estimated population 2.1 million as of 2023, subsequently making Kharkiv the second largest city after Kyiv (Bo, 2023). As residents have begun to move back, the city has been gradually rebuilding since 2023. Here, Julia adds that a dilemma arises:

“*The problem is, and we’ve discussed this very much, is reconstruction of ruined objects which were built during the Soviet period. What should we do? should we rebuild it as it was or should be build something else? This is part of our communication with the citizens. (…) We’re trying now to show that Kharkiv is a Ukrainian city, Kharkiv is a part of Ukrainian culture, [and that] Kharkiv is a city with Ukrainian cultural heritage*” (Bo, 2023).

One crucial factor that Orest mentions is that war changes the reality for the lives of those afflicted, not only presently, but also once the war is over. More specifically, the design of Block 82 must accommodate people with impaired mobilities to a higher degree than a regular residential block would, simply because of the physical consequences afflicted to people’s bodies during the war.

/ what used to be?

A review of the subdistrict's map reveals how the northern Saltivka facilitated community through various local functions. Within a 500-meter radius of Block 82, there were four institutions and three convenience stores prior to the attack. The area also featured several infrastructure points as well as leisure facilities.

Analyzing what once existed raises the question of what should be reestablished. Many of the institutions and shops are likely no longer operable and may stay that way for the foreseeable future. As Block 82 is reconstructed, it becomes apparent that reintegrating local functions into the fabric of the building could play a key role in accelerating community recovery and revitalization.

/ how can it be improved?

Accounting for the absent functions that existed prior to the attack, and inviting them into the fabric of the building, is a vital strategy for rebuilding the community rapidly. Within the building, it also becomes clear how accounting for disability access, not only in the circulation system, but within the apartments themselves, is a must-have in a post-war scenario, unfortunately.

"*It's hard to imagine when life can be brought back to this area. I've seen many post-conflict zones around the world, and it just takes much more time than what people expect.*" (Zub, 2022)

The people who left the area had no choice, likewise, the people who stayed did so out of patriotism or a sheer lack of alternative. When addressing reconstruction within the community, urgency becomes essential, as residents need viable alternatives to what has been destroyed by previous attacks.

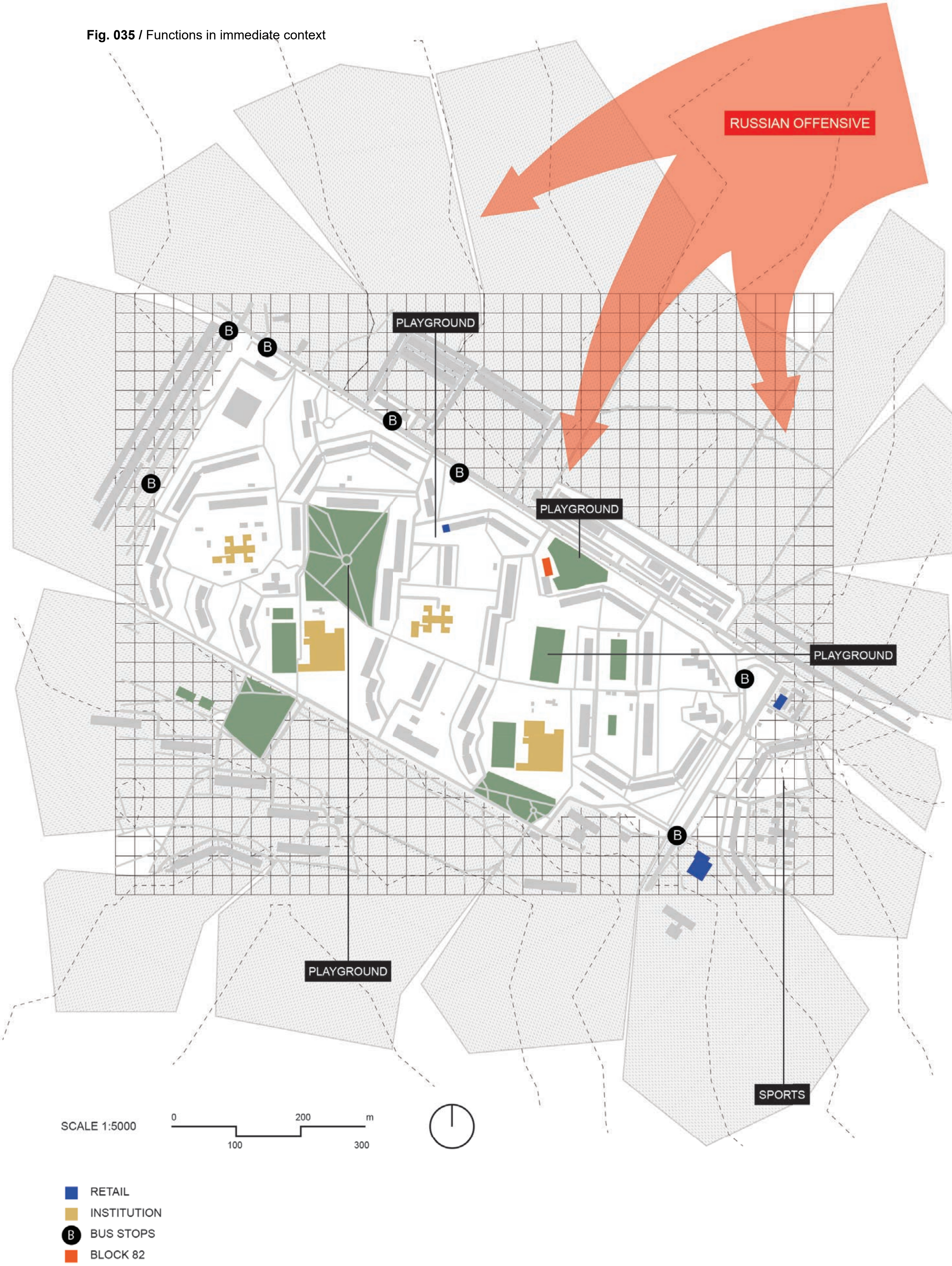
Similarly, the question of whether to rebuild these Soviet structures becomes a prevalent question. As Julia and Orest have highlighted, the opinions upon what to think are split. While the typology itself symbolises affordable housing much like the context of Danish modernist residential housing from the 1960's does, the structures also carry a symbolism that many Ukrainians want to abolish. Here, Julia mentions:

"*Our mayor said that we're not going to rebuild Soviet buildings in the style it was. We are looking for new approaches, we are looking for new buildings, we are looking for new emotions not connected to Russia*" (Bo, 2023).

Here, Orest adds that, while rebuilding is a good idea, both in practice and symbolically, overdoing the visual language of having "scars of war" may backfire into a negative connotation:

"*I think it's good. I think when rebuilding it is also difficult to hide something like that, especially if you need to work quickly and efficiently. So, in a way, it makes more sense to work with it. However, I think when you say "approach" to reconstruction, you shouldn't always include a visible scar. There are many buildings in the area that are also very damaged. Having scars on every building would be too big of a reminder of the war. Like the war zone is still there.*" (Appendix A)

Fig. 035 / Functions in immediate context



CASE:

igreja são domingos - the potential of reconstruction

Architect: [Various] (1241), Manuel C. de Sousa, João F. Ludovice (1791), José F. Canas (1994)

Construction: 1241, 1791 & 1994

Style: Mannerism-Baroque, modernism

Structural system: Load-bearing masonry, polychrome marble, steel ties and reinforced concrete.

Igreja São Domingos in Baixa de Lisboa is a seemingly unassuming yet distinct example of how ruin and reconstruction in symbiosis can elevate a building's architectural expression. Situated close to Rossio Station and Praça do Comércio, the church sits in the prominent downtown (Baixa) of Lisbon.

First constructed in 1241, the church was later destroyed in an earthquake in 1755, commencing the first of two reconstructions in the building's approximate 800-year life span. Contemporary accounts from the priest Bautista Castro read:

"*At its first shock, the oculus of the church's façade collapsed, killing many people who had fled to the forecourt. The tribune of the Chapel of Our Lady of the Rosary and that of St. Dominic also fell, as did the bell tower, which brought down everything in its path; large sections of the walls of the dormitories, the Novitiate Chapel, and the great library building, along with part of the upper dormitory walls facing Rossio, also collapsed*" (Grave, 2024).

A subsequent fire further destroyed the building, "*reducing everything to ashes*" as Castro puts it. Here, payments to workers for demolition and clearing the rubble of the ruins, made by the Dominican Order, continue up until April of 1761 (Grave, 2024).

Reconstructed under oversight from the architects Manuel Caetano de Sousa and João Frederico Ludovice, and finished in 1791, the church underwent an architectural revival, creating the prominent mannerist-baroque features that characterize many of the church (Grave, 2024). Seen from the outside, the façade of the west-facing main entrance does not show any signs of its later minimalist reconstruction from 1994. On the contrary, the façade features a restrained, symmetrical baroque layout with vertical alignment centred around the central oculus, flanked by the pilasters on each corner, emphasizing the underlying constructions hierarchy and framed by a horizontal entablature. Crowning the façade is a triangular pediment with a cross at its peak. Although thorough accounts of the church's original, medieval design are hard to find, it is safe to say that the reconstruction featured prominent contemporary architectural features. Although very much revitalized in a contemporary fashion, the reconstruction by de Sousa and Ludovice did not abolish the medieval features of the church completely. Reconstructed still with a plan layout shaped as a Latin cross and with barrel vaults inside, the reconstruction adheres to its ruin and to the architectural doctrines of the specific building's typology.

For roughly 200 years, the church stood in its 1791 restoration state. However, in 1959, the construction underwent another destructive incident as the building was engulfed in fire. The interior, along with many of the furnishings and artwork made by the artisans employed by de Sousa were destroyed. The timber construction of the roof fell, and many of the polychrome marble arches cracked due to the extreme heat (Markowski, 2025). Rather than abolishing the history of the church after the fire of 1959, José Fernando Canas sought to tell a tale from the rubble of the building. The reconstruction, finished in 1994, was not a case of commensalism – where one element benefits while the other remains unaffected—but one of symbiosis: a deliberate dialogue between past and present. Canas introduced a new minimalist language that, while dissonant in tone, complemented the existing ruins rather than overshadowing them. On the contrary, the 1791 reconstruction by de Sousa and Ludovice, though integrating select features of the original 1241 structure, largely replaced it rather than coexisting with it. Their approach functioned more like commensalism – the earlier structure was neither preserved nor meaningfully engaged, but quietly overwritten.

Canas worked around the existing ruin, filling in the gaps and reviving the 1791 interior, but did so with a more contemporary palette of materials: Reinforced concrete and red-coloured plaster. The new structure reinvigorated the old baroque features with vaults and stuccos but did so with respect to the material palette's limits in terms of fine detail, resulting in a contemporary minimalist expression.

As another feature of expressing the church's marked history, sod markings remained present on the remaining polychrome marble structures, telling the tale of the fire of 1959. Upon examining Block 82, marks of fire are clearly present, both on the interior and exterior concrete surfaces. A potential approach to the reconstruction of the residential block could involve preserving these scars of the attack, rather than erasing them. Instead of hiding the damage, the design should work with these marks, emphasizing them as a testament to the building's history, however, as post-insulation may need to be added to the structure, these features may have to be highlighted differently.

Fig. 036 / Igreja de São Domingos main entrance by Uhooep, CC BY-SA 4.0

Fig. 037 / Igreja de São Domingos interior by Vitor Oliveira, CC BY-SA 2.0

SUMMARY

The state of the preexisting residential block leaves room for much improvement. Prolonging the life of the standing building mass would have several significant potentials.

Looking into the preexisting conditions of Block 82, it becomes clear that prolonging the life of the standing building mass in a case of renovation would make a significant difference in terms of carbon emissions as compared to a “business as usual” approach, where the building is torn down to make way for a similar type of new construction. Here, time is a substantial deciding factor, not only regarding extending the building’s lifespan, but also in enabling quicker resident rehousing and quicker reestablishing of local services under a reconstruction scenario.

When asking what difference reconstruction would make, these are the pivotal components. In analysing the preexisting building, it becomes clear how reconstruction should take shape.

- The renovation of Block 82 should have a GWP of less than 8,93 when analysing a 100 year period, with the destruction and improvement of remaining structure.
- Post-insulation should mitigate the potential thermal bridges and moderate the large expenditures on heating during winter.
- Daylight conditions should be improved.
- The rebuilding needs to accommodate mobility-impairment and other physical handicaps.
- Functions in the immediate context should be invited into the fabric of the building, ensuring recovery of the local community alongside rebuilding of the building.
- Do not overwrite the past. The new construction should create a symbiosis with the old, telling a story of what used to be, and potentially what happened, while simultaneously optimizing the construction.

Fig. 038 / Digital reconstruction of Block 82 made with AI

STRUC
INTEG

#2 “How do we ensure structural integrity of the building?”

This chapter delves into one of the central concerns in the renovation of war-damaged concrete structures: how to ensure structural integrity while embracing damage as a catalyst for architectural innovation. Rather than treating destruction as a purely technical problem to be erased, the approach explored here seeks to transform trauma into spatial and structural opportunity. Theoretical groundwork is first laid through the lens of Lebbeus Woods, whose work positions damage as a generative force within architecture. These ideas are then translated into a practical methodology through finite element modelling using the parametric tool Karamba3D.

TURAL GRITY

Through structural simulations, the chapter identifies areas of critical damage, suggests appropriate repair strategies, and evaluates suitable materials for reinforcing the existing frame. Simultaneously, each approach is assessed in terms of its environmental footprint, allowing for a nuanced comparison between structural viability and sustainability. In doing so, the chapter proposes a repair strategy that not only restores stability, but also reframes the scars of conflict as integral elements in the architectural expression of resilience

Fig. 039 / Architectural intervention in the style of Woods, AI-gen 9 @ChatGPT

LEBBEUS WOODS

restoring rupture

"*Between 'no place like home' and 'you can't go home again' – two mutually reinforcing statements that today affect only bodies endowed with rather old-fashioned psychic suffering – is where I spent August 1996 in Sarajevo.*" (Woods, 1997, p. 9).

Emeritus professor in sociology and Sarajevo native, Aleksandra Wagner travels back to her hometown in an essay titled "The Nature of Demand". Here, she passively observes as life in her city slowly returns to normalcy in a bittersweet marginalization of the recent traumatic events that took place not long before her arrival:

"*The quiescent hedonism of its citizens was visible everywhere. Smoking cigarettes with Bosnae and Taste of America labels and drinking coffee, beer, and lemonade, people were placing glass in window frames that had been closed by UNHCR plastic foil for the past four years, (…) cooking berries for winter, discussing future job opportunities, and counting losses*" (Woods, 1997, p. 9).

Demanding the reader to take a critical outlook on what normalcy is and what it needs to be in certain circumstances, Wagner essentially questions if returning to a status quo always is the right thing to do, especially when enduring traumatic events such as the Sarajevo Siege of 1992-96. In this inquiry, Wagner points the smoking gun at the architect, to which Lebbeus Woods' book "Radical Reconstruction" is directed. Here, Wagner states:

"*What is proposed is that architecture, itself an embodiment of knowledge, acknowledges the body that makes it possible – 'possible', not apparent; thought and drawn, not built. The body that makes architecture possible – the architect's belly, hands and idiosyncrasies, movements and their velocity, height, sight, skin's tactility and the memory of flesh (…) The difference between a liberal and a radical is that the former knows what may be good for others while the latter demands what is good for himself. This position, easily mistaken for mere selfishness, is the site on which construction and reconstruction should start.*" (Woods, 1997, p. 9).

During the height of the Siege of Sarajevo in 1993, Lebbeus Woods visits the city as a part of his broader investigation into the role of architecture in post-war reconstruction and the ethics of building in a landscape marked by violence and trauma. This visit subsequently became the basis of his proposition for architectural interventions that embraced rupture, ambiguity, and the scars of conflict rather than erasing them. (Woods, 1993, 1997).

Equally admired and critiqued by his peers, Woods was an architect who built very little, yet envisioned architecture so radical that few others have matched his conceptual reach. Working at the intersection of philosophy, politics, and speculative design, Woods essentially challenged the doctrine that architecture should always resolve, restore, and shelter. Instead, he used architecture to explore instability, whether social, spatial, or psychological, through his definition of "experimental space":

"*What is an experimental space? (…) It's space in which you don't know how to already behave. Space itself is abstract: It's geometry, it's lines, it's walls, it's a definition of boundaries. -And in a sense, space can be used for just about anything. (…) So, we define how to use it based on our habits of use, and on little labels that go onto doors. Space is just a box, so you look at the label that tells you how to behave.*" (European Graduate School, 2008).

Here, Woods' work existed primarily in theory and in provocative, meticulously constructed drawings which show private worlds freed from traditional logic yet governed by their own internal coherence (Woods, 1997). It is precisely this ambiguous approach to architecture that resonates so well with Wagner's resistance to returning to normalcy merely for the sake of familiarity, or, as she puts it, for the sake of what is best for others.

When asking the question "how do we reconstruct the building?" it is essential not only to consider the physical and structural needs, but also the emotional, psychological, and cultural ones embedded in the rubble of Block 82. Simply rebuilding to forget is not the answer:

"*Wherever buildings are broken by the explosion of bombs or artillery shells, by fire or structural collapse, their form must be respected as an integrity, embodying a history that must not be denied. (…) The new spaces of habitation constructed on the existential remnants of war do not celebrate the destruction of an established order (…) Rather they accept with a certain pride what has been suffered and lost, but also what has been gained.*" (Woods, 1993, p. 14).

Just as Woods sought to preserve the ruptures caused by war within the fabric of his architectural interventions, other movements throughout history have engaged with trauma in similar ways. Cubism, which emerged in the early 20th century, challenged conventional representation in response to a world fractured by industrialization, political unrest, and the growing threat of war. In Guernica, Picasso did not attempt to depict violence through realism or narrative clarity; instead, he shattered form and perspective to reveal the raw emotional truth of destruction. He created a sort of fractured reality, reflecting the emotional dissonance of violence. Created in response to the Nazi bombing of the Basque town of Guernica during the Spanish Civil War, the painting's disorganised composition reflects a reality destabilized by terror, mirroring Woods' own refusal to conceal architectural wounds, and his insistence that the memory of violence be made visible rather than repaired into silence.

In both Lebbeus Woods' vision and in Guernica's composition, we see a shared resistance to smoothing over trauma in the name of coherence. Wagner, too, warns against the uncritical return to normalcy. Her demand is not for repair as restoration, but for a reconstruction that acknowledges the weight of what has happened. Block 82 should not be rebuilt to erase its past, but to make that past legible. However, as Orest Zub mention in the previous chapter, overdoing the remnants of war may backfire. In other words, there is a balance between old and new that must be found, not only in terms of the structural integrity, but also in architectural expression.

"*Cities have always needed to accept the new, the strange, the unexpected, the upsetting, the disturbing. Today they need to engage the conflicts at their core at a higher pith of intensity, a more rapid tempo than ever, and at an unprecedented scale, but can only do this by engaging the crisis at their edges. The new walls to be built there must, paradoxically, not only separate, but connect*"

– Lebbeus Woods (Woods, 1997, p. 19).

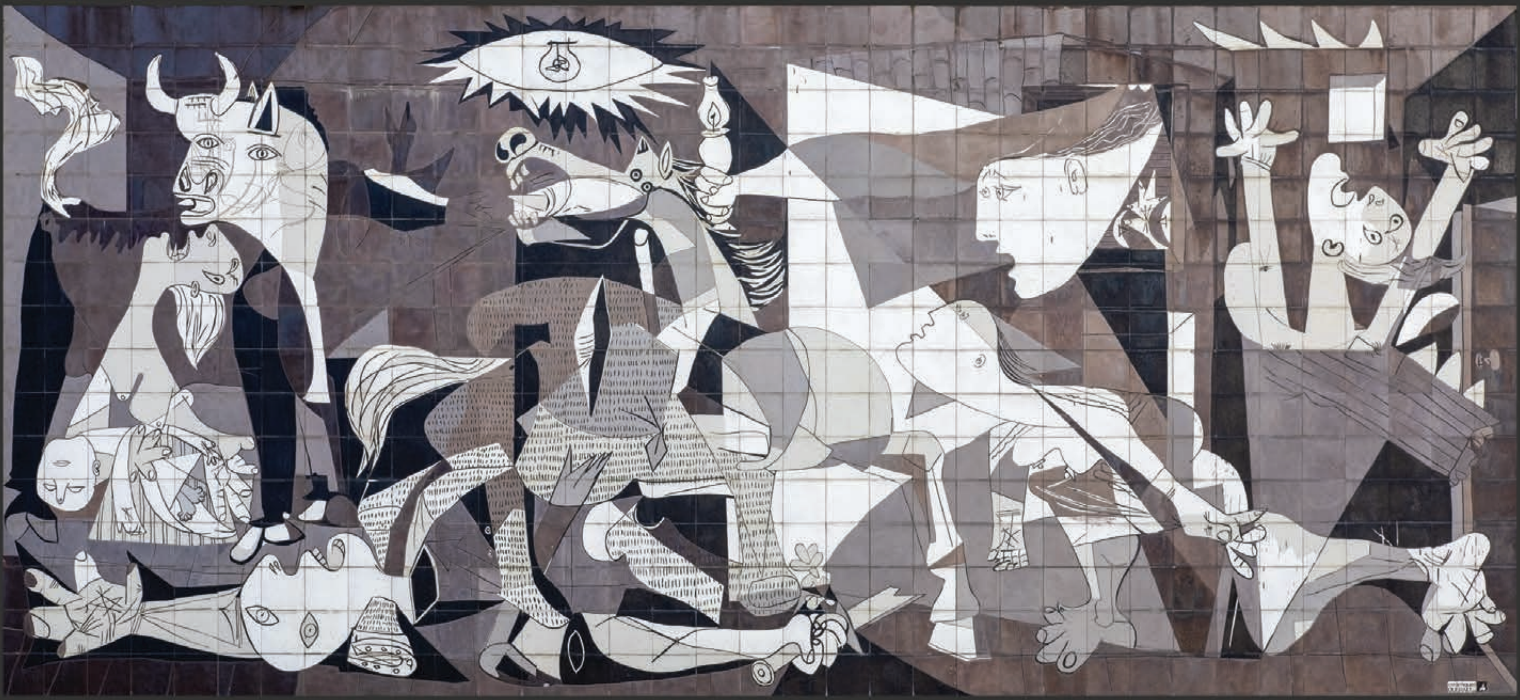


Fig. 040 / Guernica by Pablo Picasso, image by Jules Verne Times Two, CC-BY-SA-4.0

STRENGTH ASSUMPTIONS

To re-establish the structural integrity of Block 82, it is essential to understand, or at least estimate, the original strength of the building's surviving structural skeleton. While numerous methods exist for conducting on-site strength assessments, such approaches were not feasible for this thesis due to travel and safety constraints (Hearns, 2023). Instead, a reverse engineering method has been adopted, using structural simulation software Karamba3D to estimate the building's load-bearing performance.

The structure was divided into smaller analytical sections based on the module lines provided in the original CAD drawings. According to the competition brief, all interior walls were designed as load-bearing elements, and the floor slabs were constructed with multidirectional span, meaning they were rigidly connected to all intersecting walls. These fixed joints were previously examined in earlier chapters (Buildner, 2024).

Due to the complexity of accurately modelling plates and slabs and considering limitations in the thesis groups experience with advanced plate theory, the structural system was simplified for the purposes of simulation. Interior wall panels, 180 mm thick and spanning between two module lines, were modelled as vertical columns with dimensions of 3600 mm × 180 mm and a height of 2800 mm. Similarly, floor slabs were modelled as beams with a section of 3600 mm × 140 mm, spanning various distances depending on their location.

The central module of the building was selected for detailed simulation, as it contains the greatest density of walls and the longest floor spans, thereby representing the most structurally demanding part of the building. This module provides a critical test case for evaluating the residual load-bearing capacity of the structure.

Given that the joints between walls and floors are considered fixed, the load distribution is not uniform. Instead of a typical evenly distributed line load, a trapezoidal load distribution develops due to the multidirectional structural action.

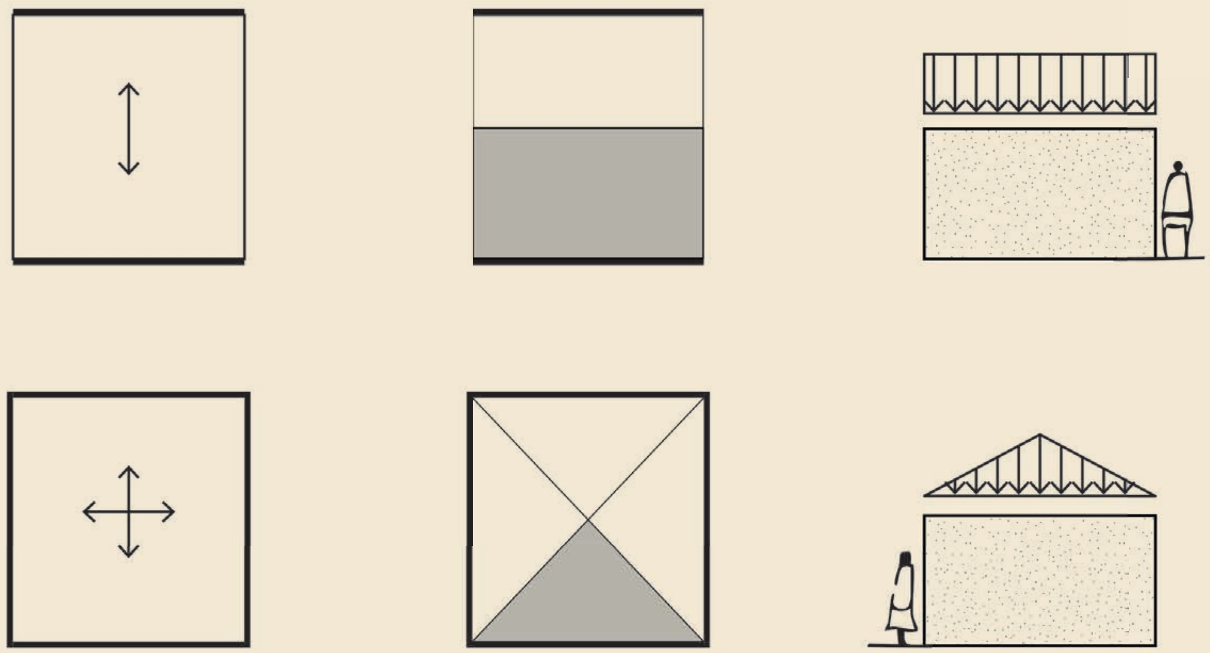


Fig. 041 / Load distribution diagram

Fig. 043 / Block 82, divided

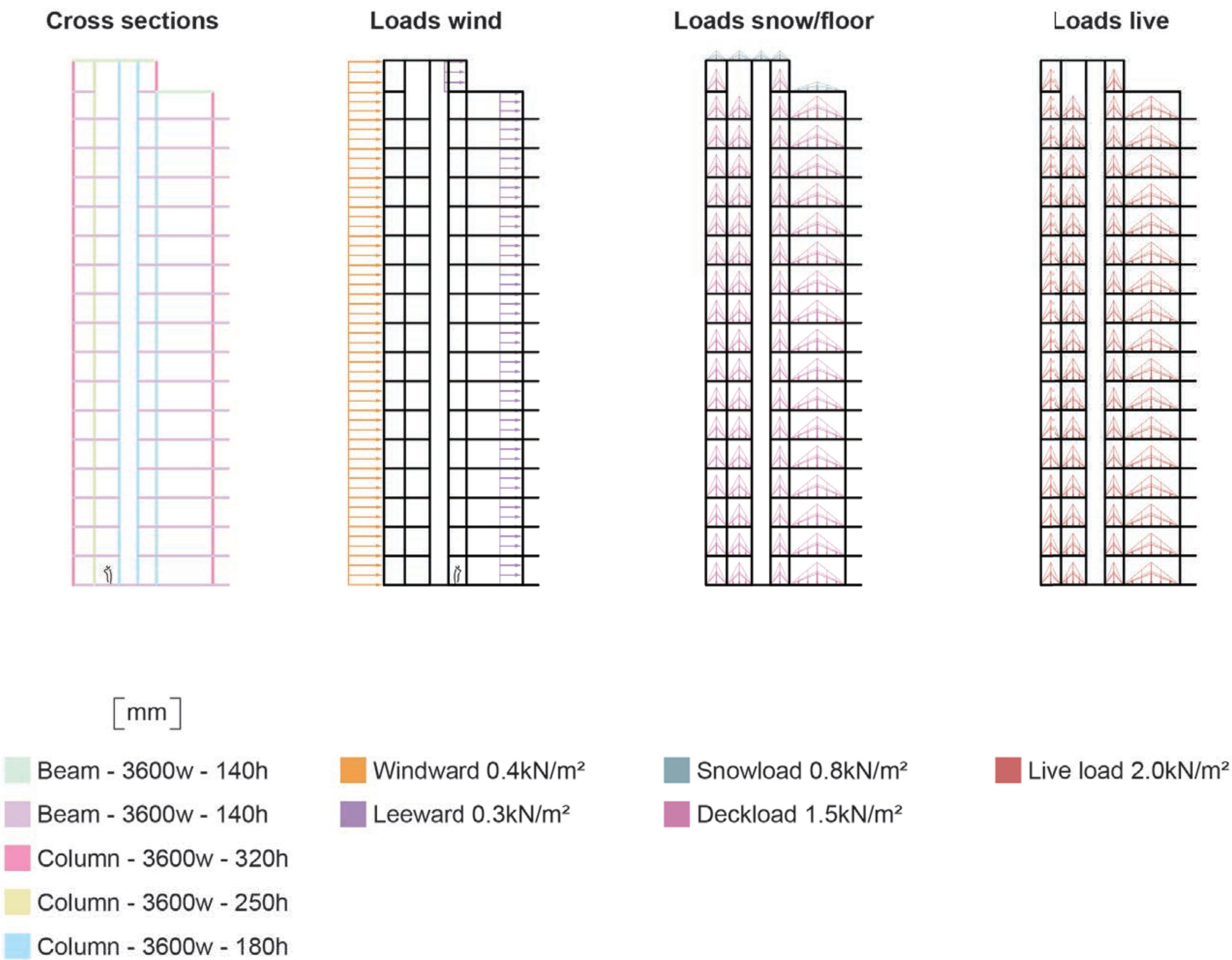
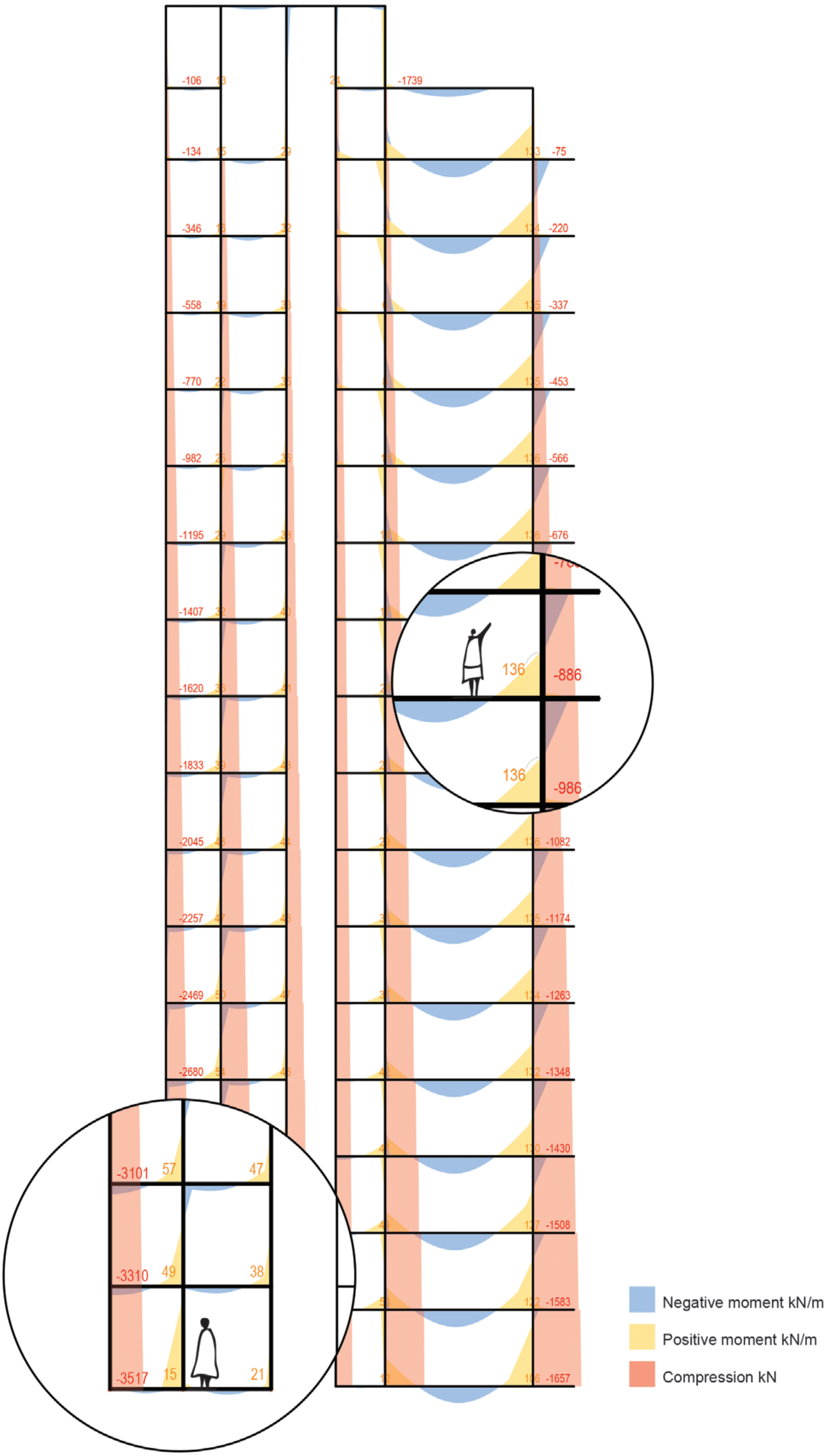


Fig. 042 / Loads and cross sections from Karamba3D

Fig. 044 / Highest stresses



As shown in Figure 44, the highest compressive loads occur in the lower storeys of the building. The maximum compression force observed in the simulation is 3517 kN, located in the bottom-most structural walls. It is assumed that the same concrete mix and rebar configuration, both in amount and specification, were used consistently throughout the structure. The strength of the element was calculated shown in annex F and was determined as shown on fig 45.

Using the assumed values, the walls and decks are rather underutilized. However, due to non-visible damages, such as hairline fractures, the full potential of the concrete walls should not be utilized in further design development. The material utilized for the rebuilding should therefore not be heavier than the original structure.

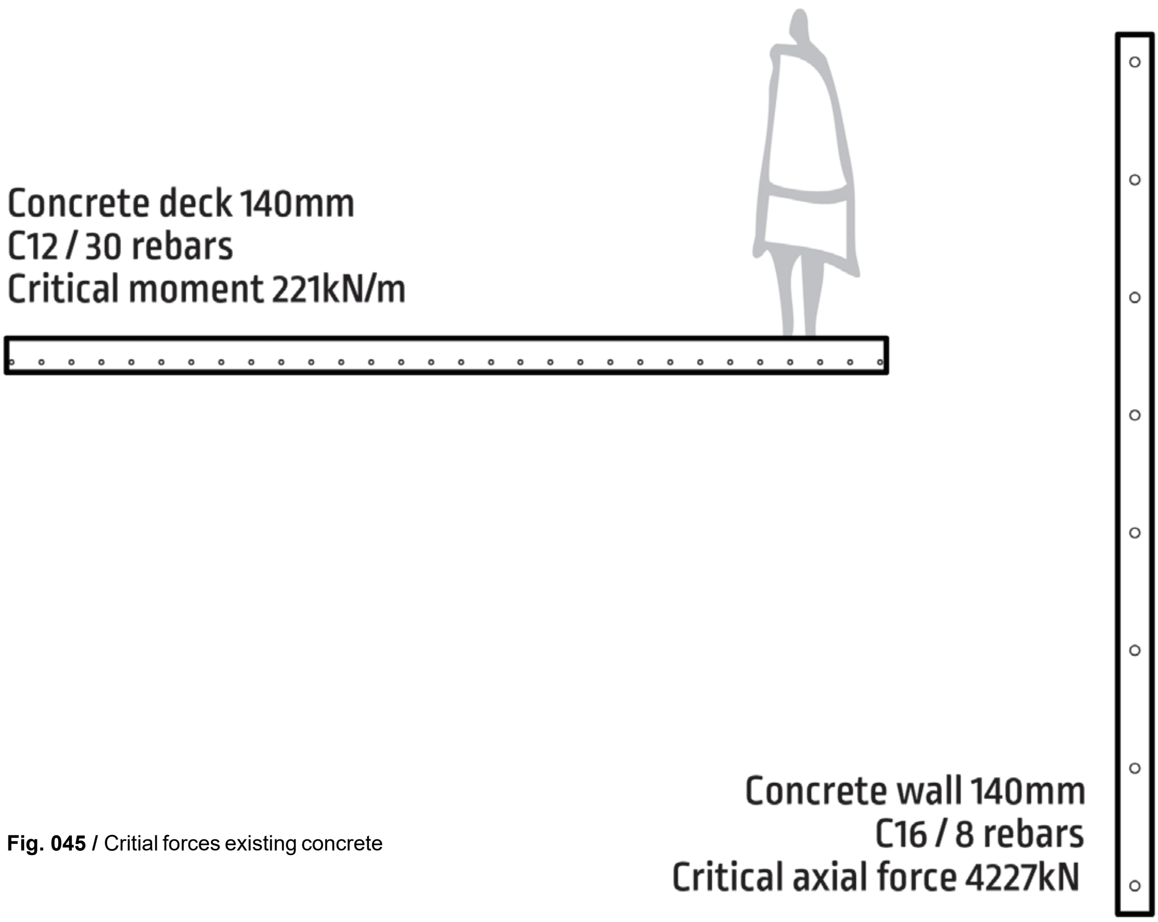


Fig. 045 / Critial forces existing concrete

WHERE TO START?

Taking point of departure from Section 4 of Block 82, which sustained the most severe structural damage, it is evident that a large number of critical load-bearing elements are missing. This has rendered the remaining structure highly vulnerable to partial or even complete collapse. As such, the thesis investigates the remaining load paths and structural integrity to determine which walls are currently carrying the highest loads and where reinforcement efforts should be prioritised.

According to Figure 46, generated using the Karamba3D modelling tool, the building's deformation pattern shows a pronounced tendency to collapse inward, or towards the right in the structural diagram, due to the many cantilevering sections now left unsupported.

A logical stabilisation strategy would be to introduce vertical structural elements, such as steel columns, to replace the missing internal walls. As illustrated in Figure 46, this significantly reduces deformation and improves the overall structural stability. However, implementing this strategy redirects forces from the cantilevered concrete elements downward, concentrating the loads on a few remaining walls whose current condition is uncertain, as they were previously buried under heavy debris.

Therefore, if linear structural elements are selected as the primary repair method, it is crucial to conduct a detailed analysis of their placement and the resulting load distribution. Special attention should be paid to the innermost elements, as these are likely to experience the highest compressive stresses from the overhanging concrete mass above.

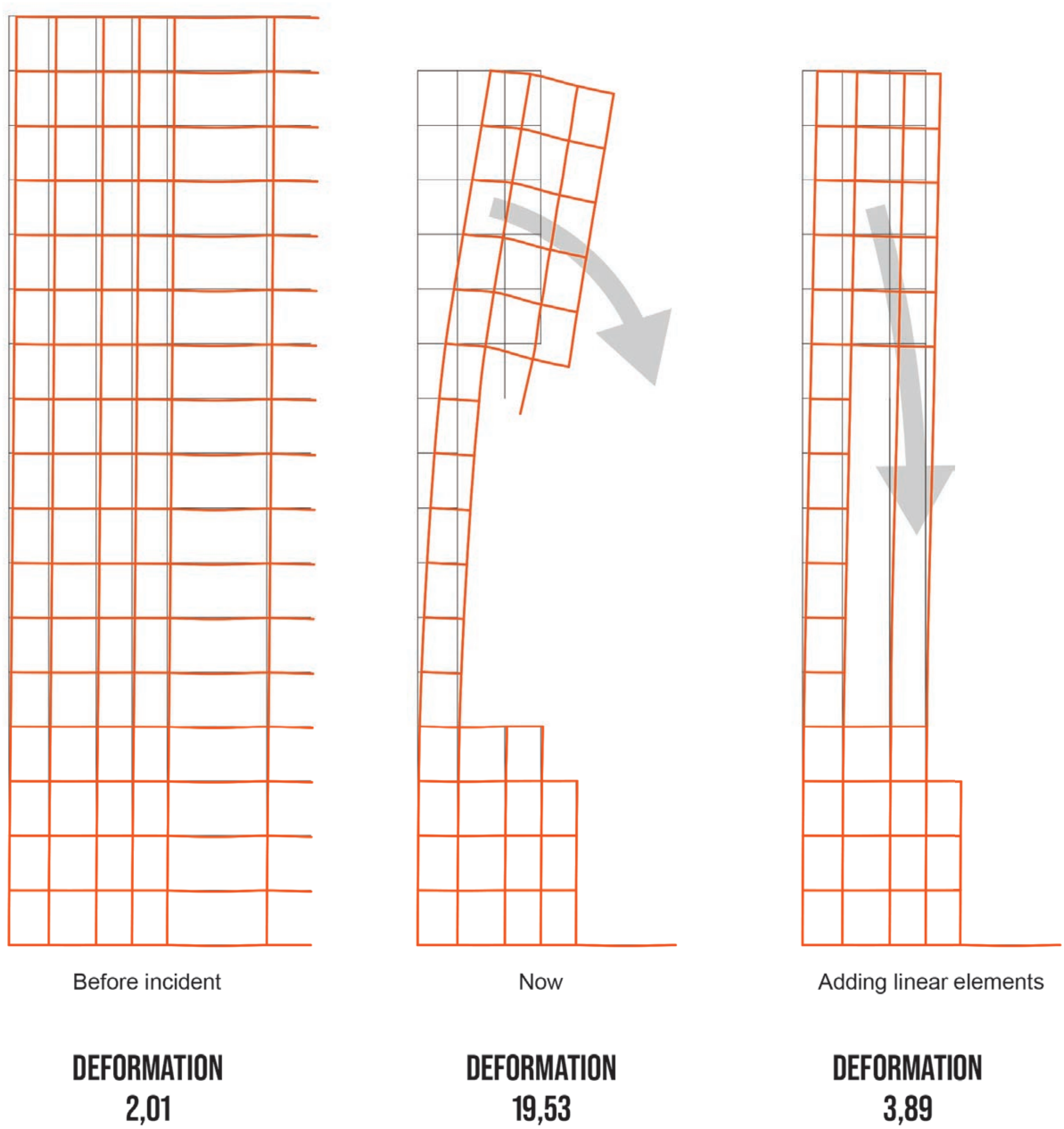


Fig. 046 / Deformations of section 4, Karamba3d

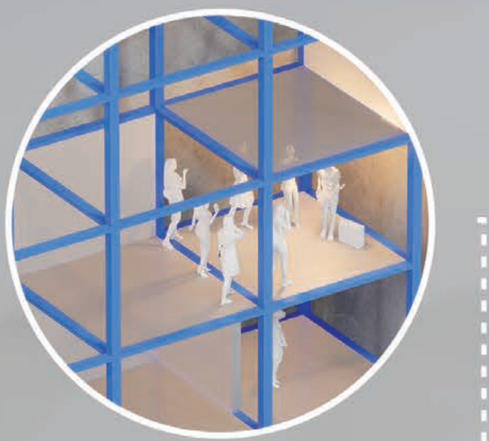
REBUILD SYSTEMS

Choosing an appropriate structural system for the reconstruction of Block 82 depends heavily on the condition of the remaining structure and the intended architectural and functional outcomes. Rebuilding the damaged sections using a slab or plate-based system would mirror the original Soviet construction method and could create a visually and structurally interesting contrast where new and old walls meet. However, as previously discussed, the integrity of the existing load-bearing walls is uncertain, and the design should not rely on their full capacity. Continuing with a plate-based system would impose uniform linear loads on these potentially weakened walls, which could compromise structural safety.

Conversely, adopting a frame or grid-like structural system introduces concentrated point loads, which, while heavier per location, are more predictable and controllable. These loads can be strategically transferred through carefully placed columns to zones of the existing structure that have been assessed as more capable of handling vertical loads, or to newly added foundations if needed. This approach significantly improves structural flexibility while reducing dependency on the existing walls' integrity (Knaack, 2012).

A frame system also introduces a formal and material contrast to the original construction, clearly distinguishing between the pre-existing and the reconstructed portions of the building. From a seismic and wind-load standpoint, however, frame systems require additional stiffening measures to counteract lateral forces. These can be achieved through the introduction of cross-bracing, shear walls, or reinforced vertical circulation cores. Where possible, these stiffening elements can be anchored into the original concrete walls or slabs, allowing the new and old structures to interact and enhance overall stability (Knaack, 2012).

Another notable advantage of using a frame structure is the decoupling of the building's internal partitions from its load-bearing system. This opens up new spatial possibilities for interior layouts, enabling customisation and adaptation to modern living standards. Residents would no longer be constrained by the rigid Soviet-era floor plans, and flexible or even open-plan layouts could be introduced—contributing to improved usability, comfort, and long-term value of the housing stock.



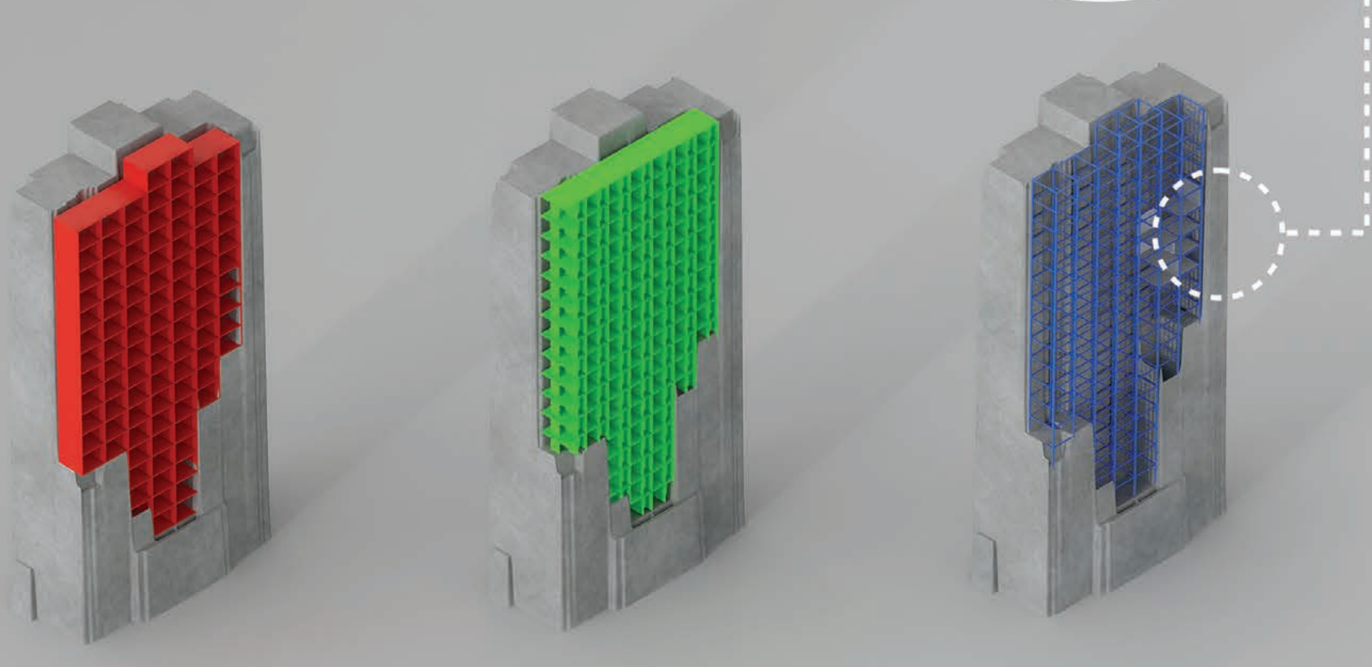


Fig. 047 / render, different reconstructive systems

FROM PLATES TO FRAMES

In an attempt to repair Block 82, one strategy involves constructing a new frame structure atop the surviving walls. This marks a significant shift in the structural system, from a load-bearing system dominated by planar elements (walls and slabs) to one composed primarily of linear elements (columns and beams). This transition should be further explored, particularly in terms of how the altered load paths affect the existing structure.

As previously discussed, the integrity of the remaining structure cannot be fully relied upon due to potential hidden damage such as microcracks, rebar corrosion, or weakened joints. Therefore, the placement of new columns, which must transfer vertical loads from upper storeys, requires careful consideration to ensure safe and efficient load distribution.

Placing columns at the midpoint of a horizontal slab would introduce a concentrated point load on an area with little to no direct support beneath. In this configuration, the slab would bear the majority of the load without the ability to transfer it efficiently to a vertical element. Given the uncertain condition of the existing slabs, this scenario is deemed structurally unviable.

A more beneficial approach would be to align new columns directly above existing vertical walls, enabling axial load transfer through elements designed to handle compressive forces. However, as previously noted, the central sections of these walls are already subjected to the highest loads. Adding additional weight in these areas risks overstressing potentially compromised concrete, especially if hidden damage is present.

Analysis of load distribution diagrams suggests that wall intersections near the building's corners experience comparatively lower compressive stress. Placing new columns at these junctions could take advantage of the inherent vertical strength of the concrete while avoiding the already highly utilised mid-wall zones. These corner intersections may also provide better redundancy in load distribution due to the overlapping geometry of intersecting walls.

Due to the thesis' limited scope regarding detailed slab (plate) behaviour, this conceptual approach to load distribution, emphasising safe column placement and conservative assumptions about existing wall capacity, will serve as the basis for the proposed structural repair strategy for Block 82.

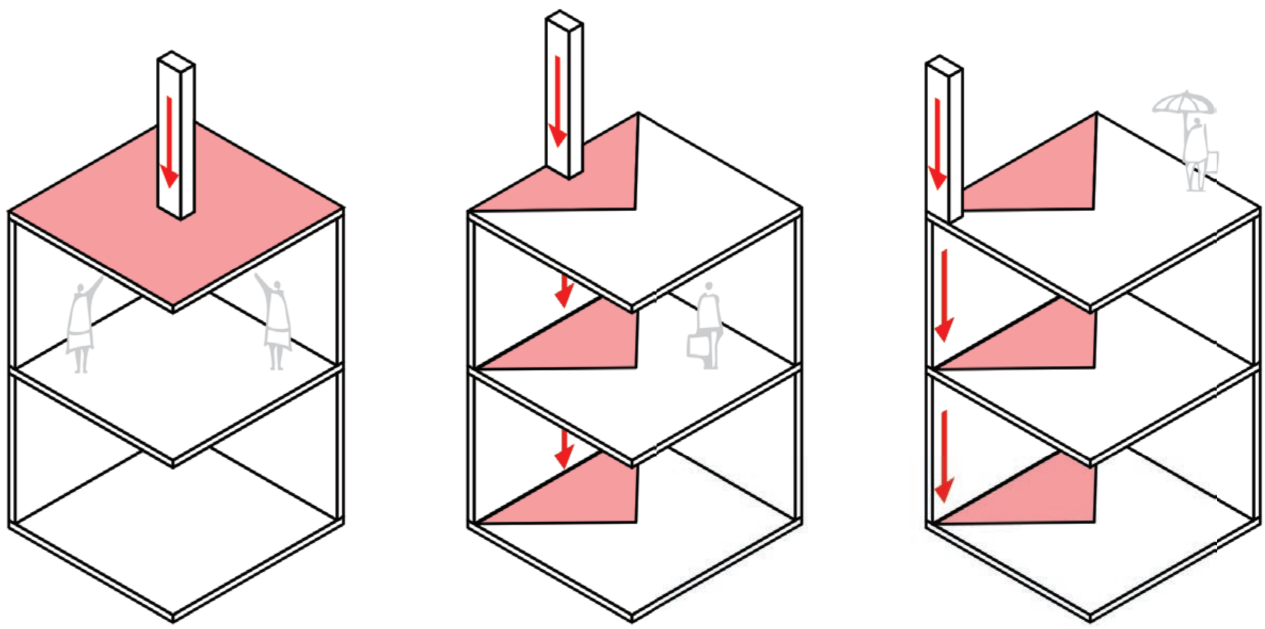


Fig. 048 / Linear to surface

MAKING AN IMPACT

The initial design iterations explored the use of wooden columns and beams as the main linear structural elements in the renovation of Block 82. This approach was based on the assumption that timber would be the most environmentally friendly structural system; however, this requires further investigation to validate through more detailed studies. All wooden joints were designed as fixed connections, including those anchoring to the existing concrete base.

The first variation aimed to reduce the cross-sectional size of the timber elements, which in their initial form were overly large and potentially inefficient. One strategy explored was to ‘rebuild’ the destroyed floors up to the seventh storey—the most heavily damaged part of the building. The concept was that the new timber construction would be supported by the remaining concrete structure, thereby eliminating the need for new columns in the lower levels. These lower columns would otherwise be subject to the highest compressive forces and therefore the greatest structural demand, posing the highest risk when attempting to reduce their size. However, this strategy did not lead to a significant reduction in element dimensions. Furthermore, at this stage, the project lacked a clear benchmark for defining when an element became “too large”—a subject further examined in the next chapter.

Two other design variations focused on creating a central community space in the area most affected by the missile strike. These concepts aimed to symbolise resilience and communal recovery by placing generous common areas where destruction had occurred. In particular, the “Big X” variation featured a structural system that concaved inward at the impact point, dramatically retelling the story of damage through architecture. These large spaces showcased the full capacity of the structural elements, both visually and functionally. However, introducing these common areas required converting the top floor into apartments in order to maintain the same overall residential capacity.

Despite their strong narrative potential, these centralised design strategies were ultimately set aside in favour of a new approach that distributes communal spaces vertically throughout the building. This shift aimed to create a more integrated and accessible sense of community across all levels.

Combined compression and y_bending
Load case: Live load
Wood: GL28H

Base

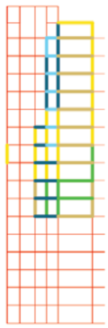
Cross sections:

Exterior columns 500x350

Interior columns 400x300

Beams 400x300

Concrete bottom



Cross sections

Exterior columns 400x300

Interior columns 300x300

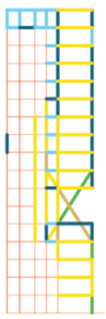
Beams 400x300

Double height room

Cross sections

No changes

Big X



Cross sections

No changes

Fig. 049 / Utilization rates of different designs

Utilization rates

<0 | 0 - 0.25 | 0.26 - 0.50 | 0.51 - 0.80 | 0.81 - 0.90 | 0.91 - 1.0 | 1.01 - 1.20 | >1.21

FIRE DESIGN

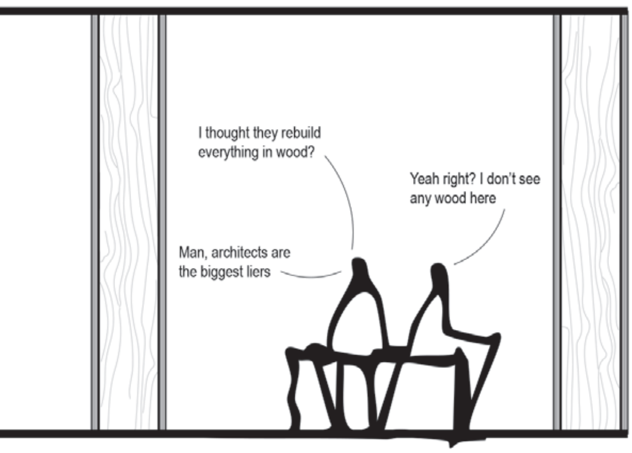
As the thesis relies on Danish building regulations in the absence of accessible Ukrainian standards, fire safety emerges as a critical design concern. According to Danish law, the height of the existing structure places the building in Safety Class IV, the highest category—equivalent to that of skyscrapers. This classification mandates that structural elements meet an REI 120 fire resistance requirement, meaning they must maintain their load-bearing capacity (R), integrity (E), and insulation (I) for at least 120 minutes in the event of a fire. This timeframe ensures both safe evacuation of occupants and sufficient time for emergency services to respond (Social- og Boligstyrelsen, 2018).

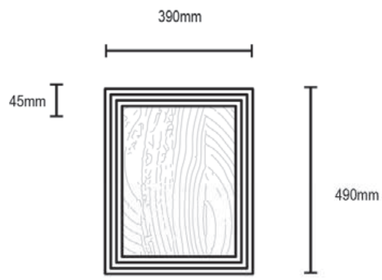
Taking the interior columns as a case study, Figure 50 illustrates different strategies for achieving REI 120 compliance. One method involves encasing the wooden columns in three layers of fire-resistant gypsum board, which can meet the requirement. However, this approach conceals the timber structure, contradicting the project's architectural concept of exposing materials to honour the narrative of transformation and reuse.

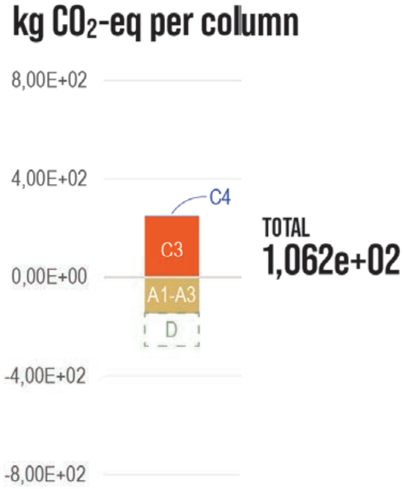
An alternative is to design the columns to accommodate a charring layer, whereby the timber burns in a controlled manner without compromising structural stability for the required duration. According to standard guidelines, glue-laminated timber chars at approximately 0.7 mm per minute, meaning that to withstand 120 minutes of fire exposure, an additional 84mm must be added to the cross-section on all exposed sides (Quiquero, Chorlton and Gales, 2018).

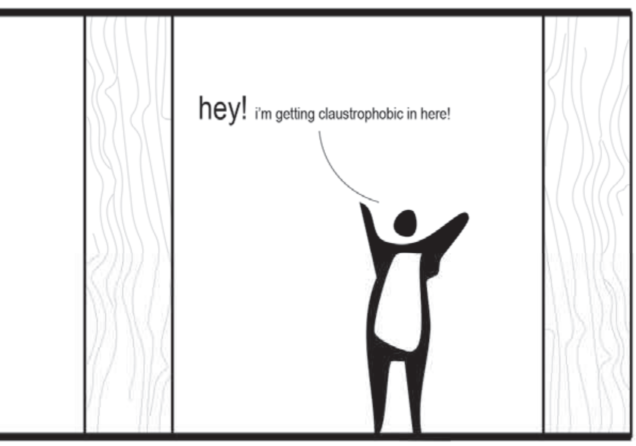
While this preserves the visibility of timber and aligns with the project's material honesty, it significantly increases the Global Warming Potential (GWP) of each column. This raises a critical question: does fireproofing with mass timber in this way remain environmentally viable, or does it undermine the project's sustainability goals? Moreover, this increase in cross section also takes up even more space, both physically and visually.

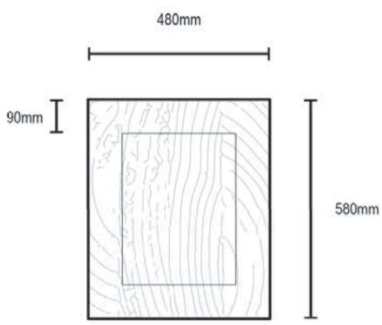
Fig. 050 / Two strategies for REI120

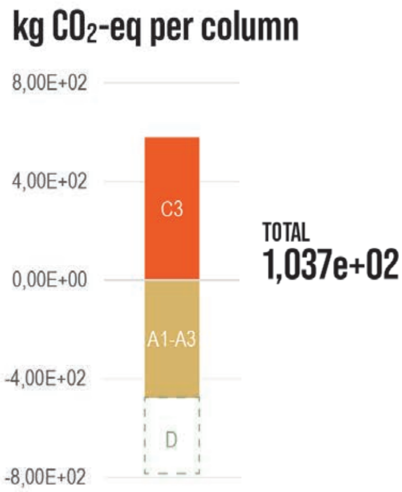












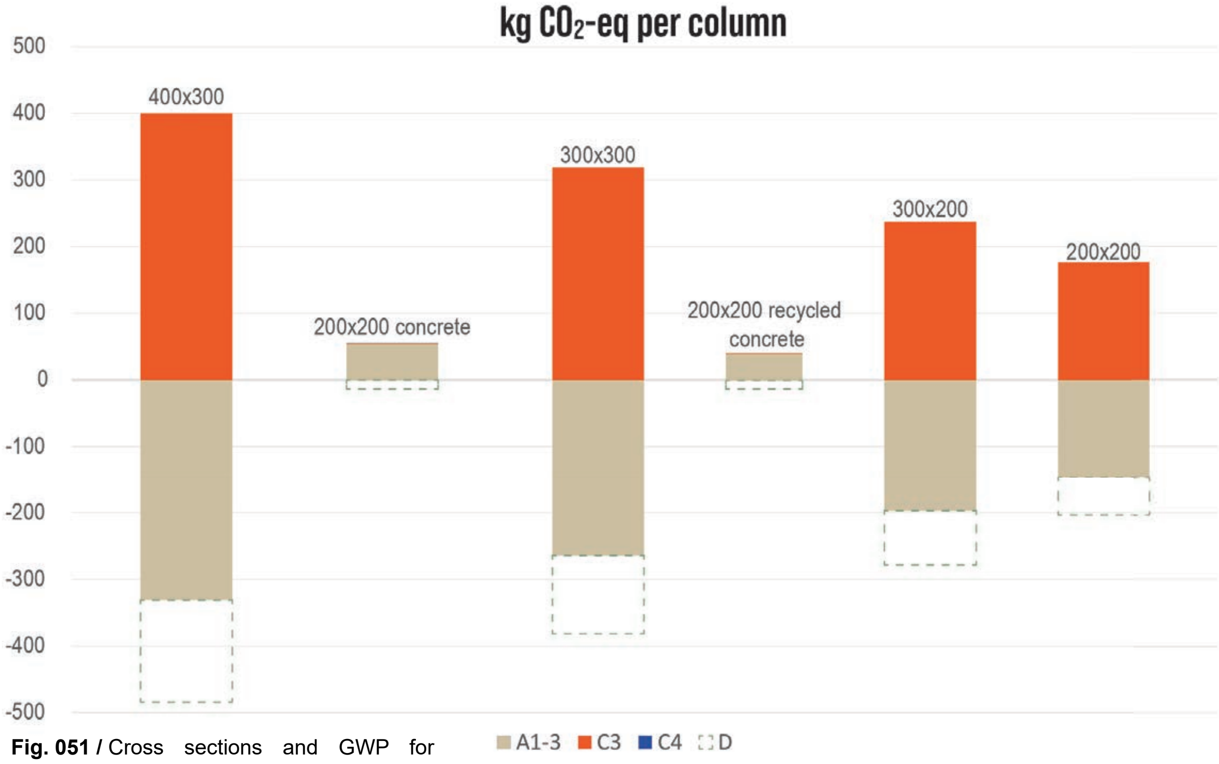
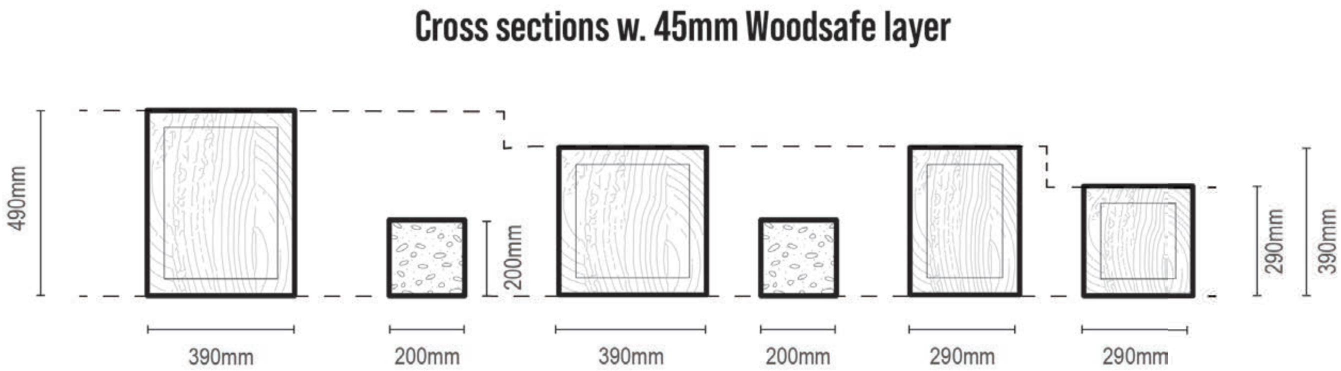


Fig. 051 / Cross sections and GWP for Woodsafe



A material also tested was Woodsafe, a fire-resistant wood cladding developed as an alternative to gypsum or metal cladding for façades. This product is based on pine or spruce wood that is impregnated with a proprietary fire-retardant chemical. At high temperatures, this chemical liquefies, suppressing combustion and charring the wood surface to prevent further burning (Woodsafe, 2025).

According to Woodsafe's technical documentation, the material achieves a reaction-to-fire classification of B-s1,d0, which is two classes higher than untreated structural timber. Based on this improved classification, it is assumed in the thesis that its charring rate is approximately half that of normal wood, allowing the use of only 45 mm of additional material on each exposed side of the structural section to meet the required REI120 rating.

A structural alternative using 200x200 mm concrete columns and beams was also evaluated, with full structural calculations presented in appendix G. Another concrete cross section with recycled aggregate has also been compared to the wooden cross sections. More about this material and its emissions in later chapters. When comparing the total global warming potential (GWP), the fire-protected timber option, despite its reduced thickness, still resulted in higher emissions than the equivalent concrete elements. As illustrated in Figure 51, a study was conducted to identify the minimum wooden cross-section size necessary to achieve a lower GWP than concrete and recycled concrete.

STRUCTURAL MATERIALS

As wood proved to have a higher-than-anticipated carbon footprint, a more in-depth structural material study was deemed necessary to determine whether timber should be used at all. The linear wooden elements from earlier design iterations were therefore replaced with various alternatives, as shown in Figure 52.

Three distinct material strategies were explored:

A steel structure using 200x200 mm columns with 10 mm thick walls and HEB200 profiles for beams,

A timber structure with 500x350 mm exterior columns and 400x300 mm beams and interior columns, and

A concrete structure using 200x200 mm profiles for both columns and beams.

Additionally, a hybrid solution combining timber and concrete was tested. This option aimed to reuse rubble from the damaged building as recycled aggregate in new concrete (a concept discussed in detail in Chapter 04), while also reducing the required size of timber members. In the section illustrated in Figure 51, the interior timber columns were reduced to 200x200 mm cross-sections. Any members that failed to meet load-bearing requirements were substituted with new concrete columns capable of handling the increased compressive forces.

This hybrid approach allowed the design to optimise the spatial efficiency of the interior layout by reducing column sizes, ultimately increasing usable space for residents. Moreover, the use of concrete, being a stiffer material than timber, helped reduce deformation in beams spanning from the 7th floor to the top floor. This improved their structural performance, as stress distribution became more favourable.

While wooden elements contributed negatively in terms of embodied carbon, they provided potential benefits in the D-phase of the Life Cycle Assessment. Although D-phase values are not included in official calculations, the potential offset is illustrated in Figure 52. Because of these positive characteristics of the wood along with the benefit of the cross sections becoming smaller and thus the apartments of the residents larger, the wooden and concrete hybrid system was chosen for further advancement in the design.

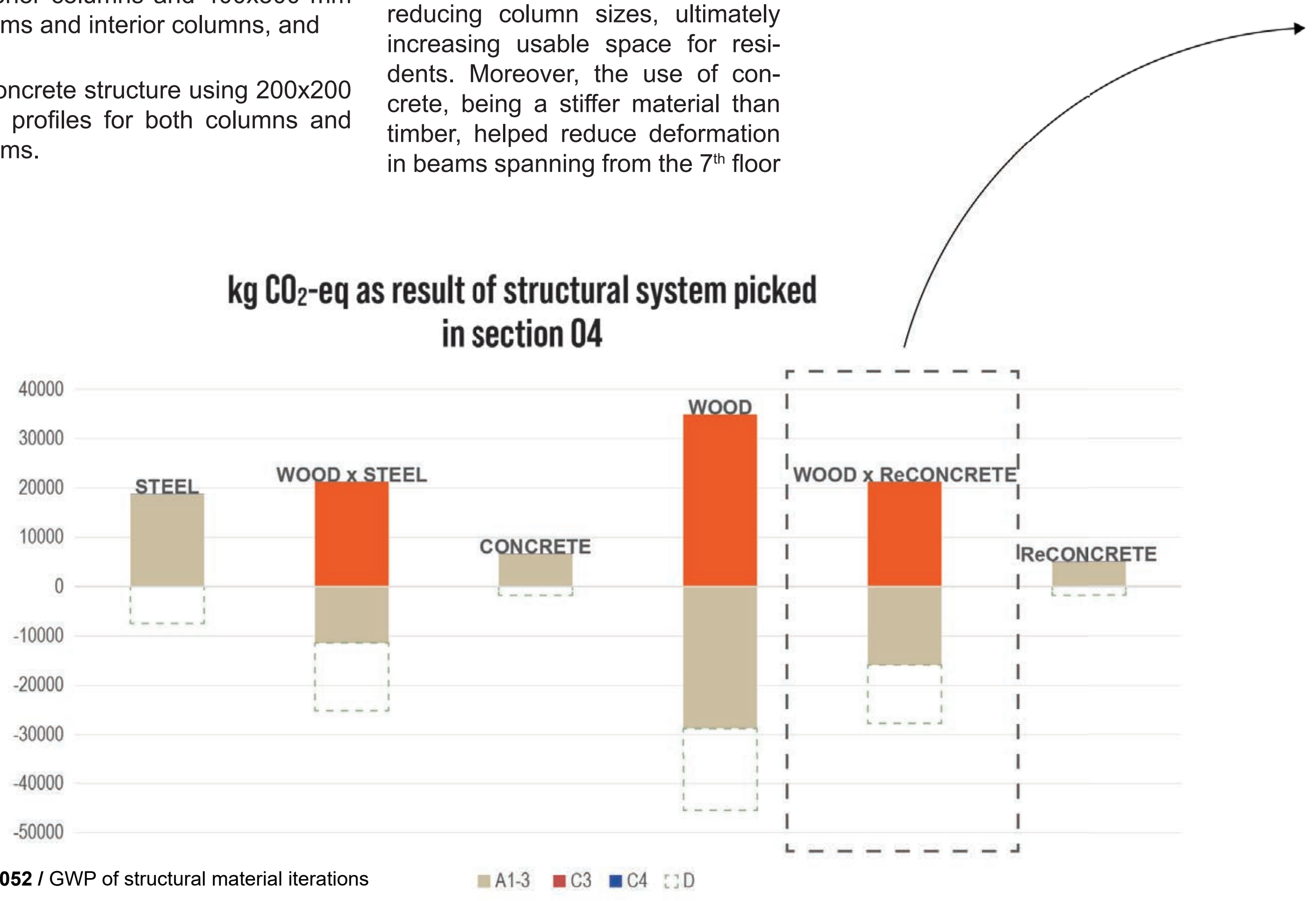


Fig. 052 / GWP of structural material iterations

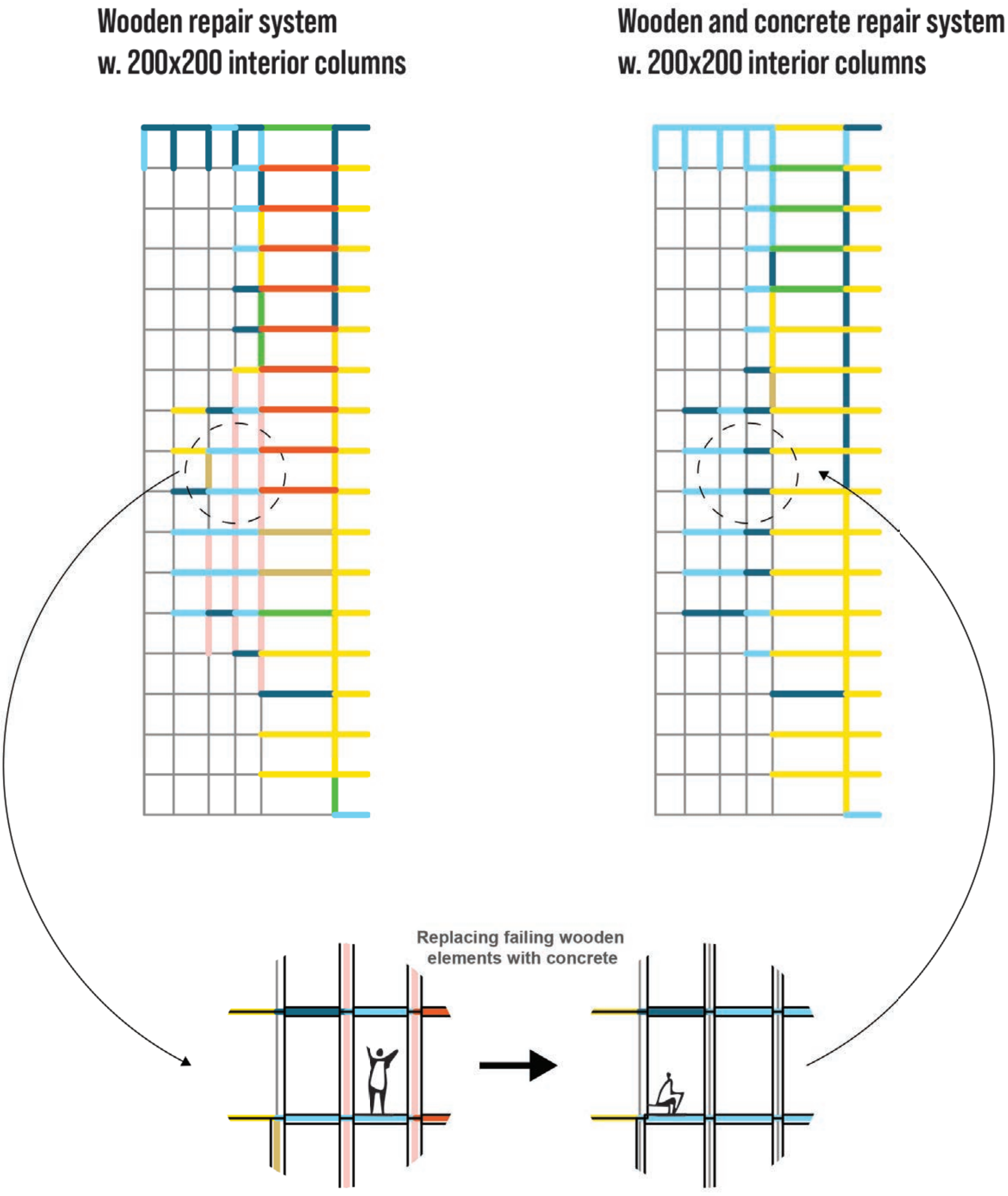


Fig. 053 / What elements to replace?

Utilization rates

<0 | 0 - 0.25 | 0.26 - 0.50 | 0.51 - 0.80 | 0.81 - 0.90 | 0.91 - 1.0 | 1.01 - 1.20 | >1.21

SUMMARY

Ultimately, this chapter reveals that repairing a structural system like that of Block 82 is far from straightforward. While the thesis initially pursued a simple reconstruction strategy with minimal deviation from the original system, the design evolved in complexity as layers of fire safety, stress distribution, and sustainability were integrated. This process highlights how even modest interventions can grow into multifaceted structural challenges when approached holistically.

The investigation into structural renovations revealed that damage need not be seen purely as a deficit, but can act as a generative force in both design and structure. Inspired by Lebbeus Woods' theories, destruction is reframed as an architectural opportunity, where scars become active agents in spatial redefinition. Structural simulations conducted in Karamba3D identified critical zones and informed targeted repair strategies using contextually appropriate materials. These were compared based on structural performance and environmental impact, leading to a repair approach that balances integrity, sustainability, and expressive architectural renewal.

- Structural analysis identified remaining elements as beam and column sections with concrete of C16 strength.
- Vulnerable structural points were mapped to guide targeted reinforcement efforts.
- A grid-like repair strategy was determined to be the most effective structural approach.
- A hybrid structural system was proposed, combining a timber frame with concrete elements cast using recycled aggregate.
- The chosen solution balances structural integrity with environmental sustainability.

CONTEMPORARY UKRAINIAN ARCHITECTURE

#3 “What does a modern Ukrainian building look like?”

Conclusions regarding feasibility and methods of reusing Block 82 lead to a subsequent question of how to approach this in a Ukrainian context. What characteristics, social needs, cultural values, and traditions define contemporary Ukrainian homes? By analysing social structures, residential typology transformation and Ukrainian heritage, this chapter aims to answer how tradition and modern needs can intersect in contemporary Ukrainian homes, and how to interpret and give form to contextually and culturally responsive architecture. This is informed by qualitative ethnographic research theoretical frameworks, case study and cultural investigations.

ETHNOGRAPHIC STUDIES #2

"Community"

Noun [C, + sing./pl. verb]

1. the people living in a particular area or people who are considered as a unit because of their common interests, social group, or nationality.
2. [Biology] a group of animals or plants **that live or grow together.**

What is community? According to Cambridge Dictionary, communities are defined by common interests, social groups, or nationality, which implies that the fabric of community varies from national and cultural contexts. Another interesting perspective is the perception of community from a biological point of view, which refers to beings living and growing together. Another intriguing perspective is the perception of community from a biological point of view, which refers to beings living and growing together (Cambridge Dictionary, 2025).

So, how do these definitions relate to the life of a contemporary Ukrainian, and more specifically, how do they relate to the life in similar typologies as Saltivka?

In the first interview with Orest Zub, the digital entrepreneur, he mentioned growing up in typology similar to Block 82, making him familiar with the concept of these Ukrainian micro districts. With the intent of inquiring a broader understanding to address the questions mentioned above, a follow-up interview with Orest was organized (see appendix A).

"*Communities are created organically, you know?*" Orest Zub, 2025 (Appendix B)

This quote marks the start of the conversation about communities in Ukraine and suggests that community is something that evolves and develops naturally, which refers to the biological definition. Orest then proceeded to tell stories of his childhood experience in a neighbourhood in Lviv, similar to the one in Northern Saltivka.

"*We'd even fight kids from the other blocks sometimes*" Orest Zub, 2025

He mentioned that he and the children from the other apartment blocks and neighbourhoods used to gather and play outside together, compete in football against each other, doing all sorts of activities together. The same applies to the elderly women and wives, who would meet outside in the parks to sit on the benches and gossip with each other. And the fathers, who would get together to play a game of chess or checkers. Additionally, religious events and celebrations bring people together.

Another point that Orest addressed during this interview, was the supportive nature of neighbourly relationships, as he explained how neighbours share common parental responsibilities and help each other by e.g. driving their children to and from school (appendix A).

The stories and experiences of Zub provided valuable insights into what defines community in a Ukrainian context, particularly in micro districts like Northern Saltivka. Community is not limited to relationships with immediate neighbours. It is something that extends beyond the boundaries of one's apartment block, fostering a larger circle of relationships across the neighbourhoods. These key qualities are essential and should be re-imagined and re-integrated into the fabric of Block 82, emphasizing community within and beyond the envelope.

Fig. 054 / Ukrainian community college

GORDON MATTA-CLARK

ambiguity of space

"*Now on the face of it nothing seems more ridiculous than undoing a building. (…) Everybody, to some extent, accepts architecture as something to look at, to experience as a static object. Few individuals think about or bother visualising how to work away from it, to make architecture into something other than a static object.*" – Gordon Matta-Clark (Walker, 2009, p. 31).

Born in New York City in 1943, Gordon Matta-Clark was an artist and trained architect who, rather paradoxically, chose not to build but rather to "unbuild" his environment, utilizing art to question the very foundation of what architecture is and how we humans relate to it. Here, "anarchitecture" was a movement created by Matta-Clark and his collaboration of contemporaries in search for a more ambiguous approach to architecture. The movement was so ambiguous in fact that even the name of the group was not allowed to be fixed, changing with each mention from "anarchitecture" to "anarchy torture", "an art collector" and then to "an arctic lecture" (De Monchaux, 2016a). The meaning of the movement, however, remained the same:

"*We were thinking about metaphoric voids, gaps, left-over spaces, places that were not developed. (…) Metaphoric in the sense that their interest or value wasn't in their possible use.*" (Moure, 2006, p. 166).

"Whether a non-functional space, or simply on a functional level that was so absurd as to deride the concept of function, this was what fascinated Matta-Clark: The leftover spaces that arose as a consequence of architecture, existing in a sort of limbo between useful and invisible: "For example, the places where you stop to tie your shoe-laces, places that are just interruptions in your own daily movements" (Moure, 2006, p. 166). A good example of this interest is Matta-Clark's exhibition "Fake Estates" where he bought 15 small and seemingly useless parcels of land in the New York City area. These included odd scraps like a piece of sidewalk or the narrow gap between a building's outer wall and a fence. They were leftover spaces, paradoxically created as a result of making space. (De Monchaux, 2016).

Matta-Clark's work involved cutting into abandoned buildings to reveal their insides and destabilize our expectations of form, function and order. His works were not simply about deconstructivism or destruction, but rather a form of spatial inquiry, a way of physically exposing the ambiguity and impermanence of architectural space. Cutting through walls, windows, floors and ceilings, Matta-Clark created voids that made the invisible visible, not only in terms of material layers in construction, but also in terms of the social, political and economic structures that are embedded within architectural fabric. By doing so, Matta-Clark essentially challenged, and continue to challenge, the idea of architecture as something "fixed" or "whole", proposing instead that it can be unstable, fluid and open to reinterpretation.

During the active years of Matta-Clark in 1960's and 1970's, many academic and cultural spheres were characterized by a general fracture in the apparent norms of discourse. Contemporary artists sought to radicalize, revise and reconstruct their traditional approaches to creation, often turning them upside down and inside out in a paroxysm of rebellion that came to define the time (Moure, 2006). A good example of this zeitgeist is Bjørn Nørgaard's "Hesteofringen" ("The Horse Sacrifice") in 1970. Here, the piece consists of a videotape of Nørgaard dissecting a horse and stuffing its intestines into glass jars (Nørgaard, no date). However, while Matta-Clark's agenda might appear typical of the provocative spirit shared by many contemporary artists during this era, it is not the provocative nature of his work but rather his refusal to offer solutions and his persistent commitment to questioning the very foundations of architecture that gives his work its enduring critical power. Simply put, it is this ability to question that remains paramount:

"*The truth is that in philosophy and even elsewhere it is a question of finding the problem and consequently of positioning it, even more than of solving it (…) Stating the problem is not simply uncovering, it is inventing (…) Invention gives being to what did not exist; it might never have happened*" (Bergson, 1946, pp. 58-59).

Deliberately resisting the idea of resolution, Matta-Clark did not aim for a definitive answer or an "oeuvre complete". Instead, he focused on the act of questioning itself and in positioning his inquiries, creating a more ambiguous interpretation of what something could be. As Henri Bergson puts it, it is precisely this process of questioning and continuous repositioning that becomes a form of invention, one that might never had emerged through direct problem-solving alone.

In the context of this project, approaching architecture as a process of questioning rather than simply building becomes a crucial point of departure. With approximately half of Block 82 now destroyed, the ambiguity of what could, or should, occupy its absence should be embraced. What deserves preservation, and what kind of architecture is needed today? Can a collapsed floor or stairwell be reimagined as a lightwell or a communal gathering space? Might the holes left behind serve as new thresholds rather than voids? Through the philosophy of Matta-Clark's anarchitecture, how can the scar of Block 82 be seen, not as an erasure, but as a revelation?

Fig. 055 / Gordon Matta-Clark's "Conical Intersect" (1975), ©Marc Petitjean

CASE:

530 dwellings, lacaton vassal - interior community

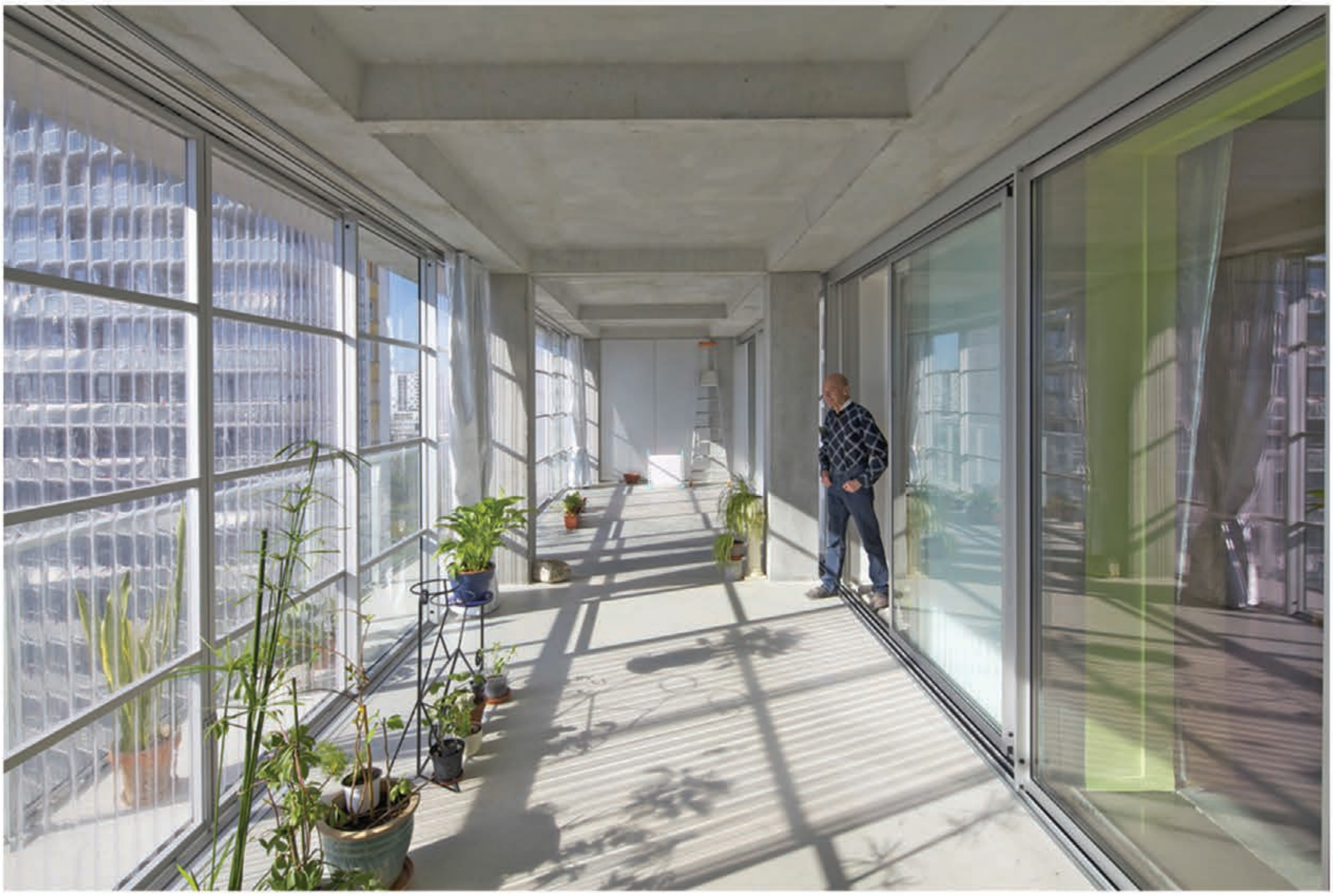


Fig. 056 / 530 Dwellings, ©Philippe Ruault

Architect: Christophe Hutin Architecture, Frédéric Druot, Lacaton & Vassal

Construction: 2016

Style: Modernism

Structural system: Prefabricated concrete slabs and columns

530 Dwellings, located in Bourdeaux, France, serves as a considerable example of how an architectural intervention can serve a multitude of functionalities, investing into the existing qualities and deficiencies of an existing structure and typology (Pintos, 2019).

This project addresses a transformation of three already-occupied modernist social housing buildings in Grand Parc, Bordeaux. The most prominent feature of this project is the addition of winter gardens and balconies to the southern façades. These extensions allow the residents to experience having a private outdoor space, similar to those in a house, while extending the opportunities of mobility and utilization of

Fig. 057 / Re-imagining circulation

the existing apartments. This fluidity is achieved though installing large window sliding doors that open onto the balconies, allowing for more daylight to wash the apartments and improved views (Pintos, 2019).

Another crucial factor is, that these extensions do not only achieve and improve the previously mentioned points but also enhances the thermal efficiency and reducing energy consumption. The added winter gardens are enclosed with a lightweight façade consisting of transparent, corrugated polycarbonate panels and aluminium frames with glass, endowed with reflective solar curtains. As a result, the semi outdoor spaces function as thermal buffers, collecting solar energy (Lacaton et al., no date).

The duration of which this transformation was built was reduced greatly by utilizing prefabricated modules for rapid assembly. Precast elements of slabs and columns were lifted into position by cranes and assembled manually, resulting in a freestanding structure resembling a scaffold (Lacaton et al., no date) . As pointed out in Ethnographic studies #1 on page (48), Orest Zub emphasises the importance of urgency within rebuilding efforts. 530 Dwellings exemplifies a method of design and construction that accelerates the process building through cleverly designed prefabricated modules. Although this transformation project concerns an addition to an intact structure, it still proposes a valid method for rapid renovation of the remains of Block 82.

The principle of adding private semi outdoor spaces in order to extend the apartments, enhance daylight and improve energy efficiency demonstrates an integrated approach to preserving heritage while improving comfortability. But could this approach be reinterpreted and reimagined as inspiration for alternative solutions? Instead of privatising this space, could the boundaries be dissolved to create a shared circulation space and act as a catalyst for community? Rather than being a freestanding extension, could it be integrated more into the apartments and become a play of morphology? These questions should be explored during the design process for the reconstruction of Block 82.

DESIGNING WITH COMMUNITY

Affording community has played a vital role throughout the design process of rebuilding Block 82. Analysing the building's layout as well as its connection to the surrounding urban environment revealed a central challenge: How and where to foster this sense of community.

/ community in plan

It is this exact question that has been explored in depth through multiple iterations in design, with each design proposing strategies taking root from different concepts within the fabric of the building. While some concepts take a more literal approach by incorporating large communal spaces, other iterations introduce a more subtle sense of community, such as shared balconies or mixed-use circulation areas, to further encourage interactions between neighbours.

One approach for creating community involved replacing the original circulation and elevator core with new community spaces. This location would allow residents to enjoy the afternoon sun, as they would be oriented towards west. Additionally, this approach did not interrupt the current apartment layouts. However, this would require removing a significant amount of existing stabilizing and supporting structure rather than utilizing it.

Another approach focused on converting some apartments into indoor common spaces. This would not necessarily require removing structural elements. However, it would reduce the number of apartments, resulting in having to allocate them elsewhere to accommodate the original resident capacity.

This challenge is addressed in an approach inspired by 530 Dwellings by Lacaton Vassal (see p. 84), which relocates the missing apartments into a new volume outside of the existing footprint. Here, the “scar” is left open, and a new external circulation system integrating shared balconies is introduced. However, as this introduces a whole new volume, it requires a significant amount of material and would prolong the repairing process of Block 82.

A more subtle approach focused on affording community by creating shared balconies. However, this proved to disrupt the privacy of the residents, as it allowed direct views into neighbouring apartments.

Utilizing the void or “scar” left by the destruction for common spaces showed potential as it preserves the structural integrity of the remains, while creating a narrative of life emerging from the scar. By combining these spaces with the circulation reinforces accessibility and encourages interactions.

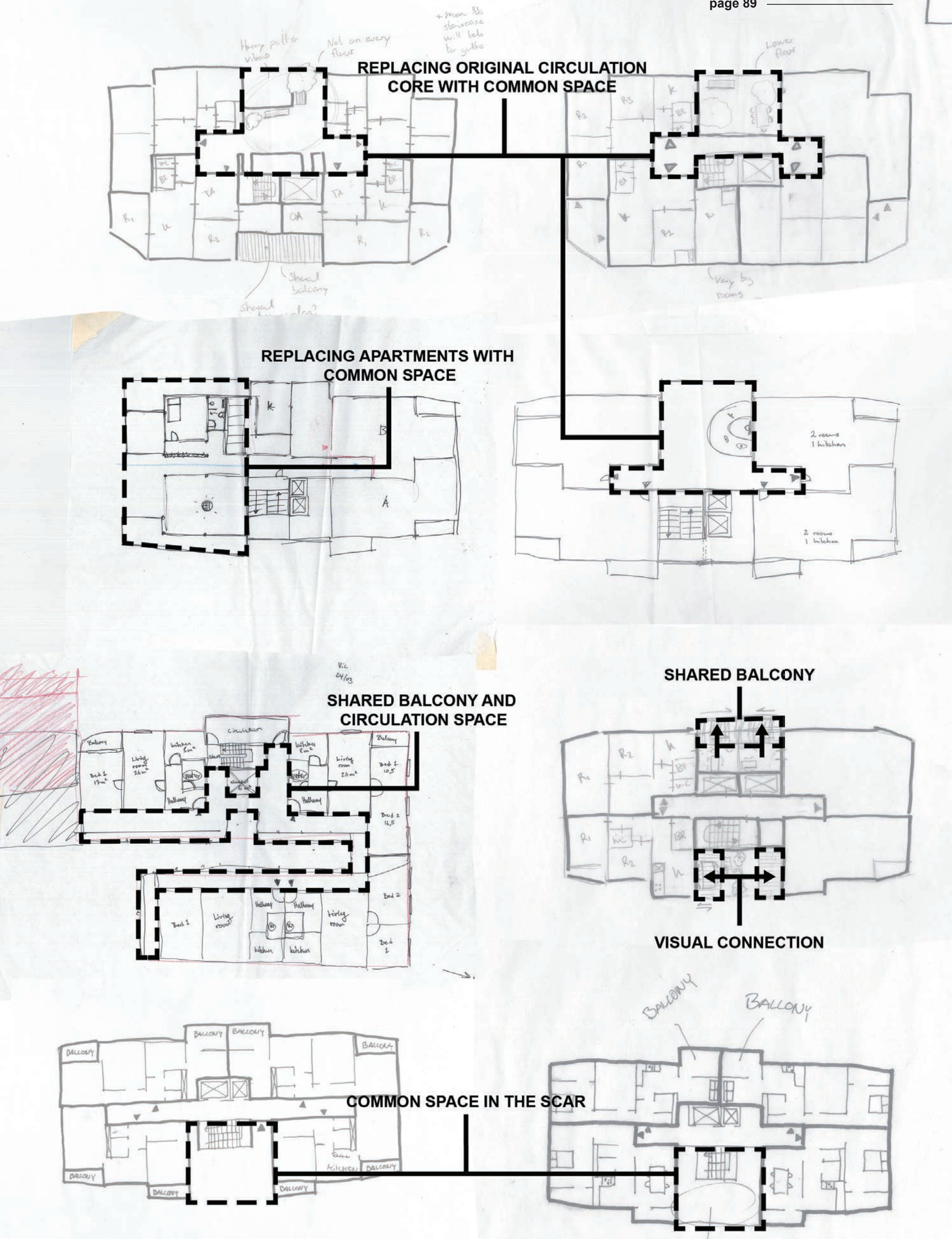


Fig. 058 / Re-imagining circulation

/ community in section

From plan to section, the iterations in design shifts from a horizontal to a vertical spatial distribution. Here, a starting concept envisioned community spaces expanding and receding along the east façade. As the building approaches ground level engages with the urban context, the aim was for the community to extend outwards, reaching into the surroundings in a welcoming gesture. These community zones became dynamic and highly expressive in the façade, while the circulation was tucked deeper into the building, acting as a static, structural spine.

However, as the design evolved, the relationship between community zones and circulation developed a more integrated symbiotic relationship. Here, the staircase, sculpturally woven vertically through the structure, began to serve as a spatial mediator, shaping what type of communities that could emerge along its path. Referencing the earlier plan-based designs, the idea of having the circulation as a facilitator of “spontaneous” meetings seemed like a natural element in the affordance of community and relationships between neighbours. This evolving understanding elevated the importance of the circulation system, making it not just a purely functional element, but a key driver in shaping the communities throughout the residential block. Here, a compromise emerged, as the elevators became a central and static service core, while the stairs would be free to pierce though the floors of the building, creating zones of community along its path.

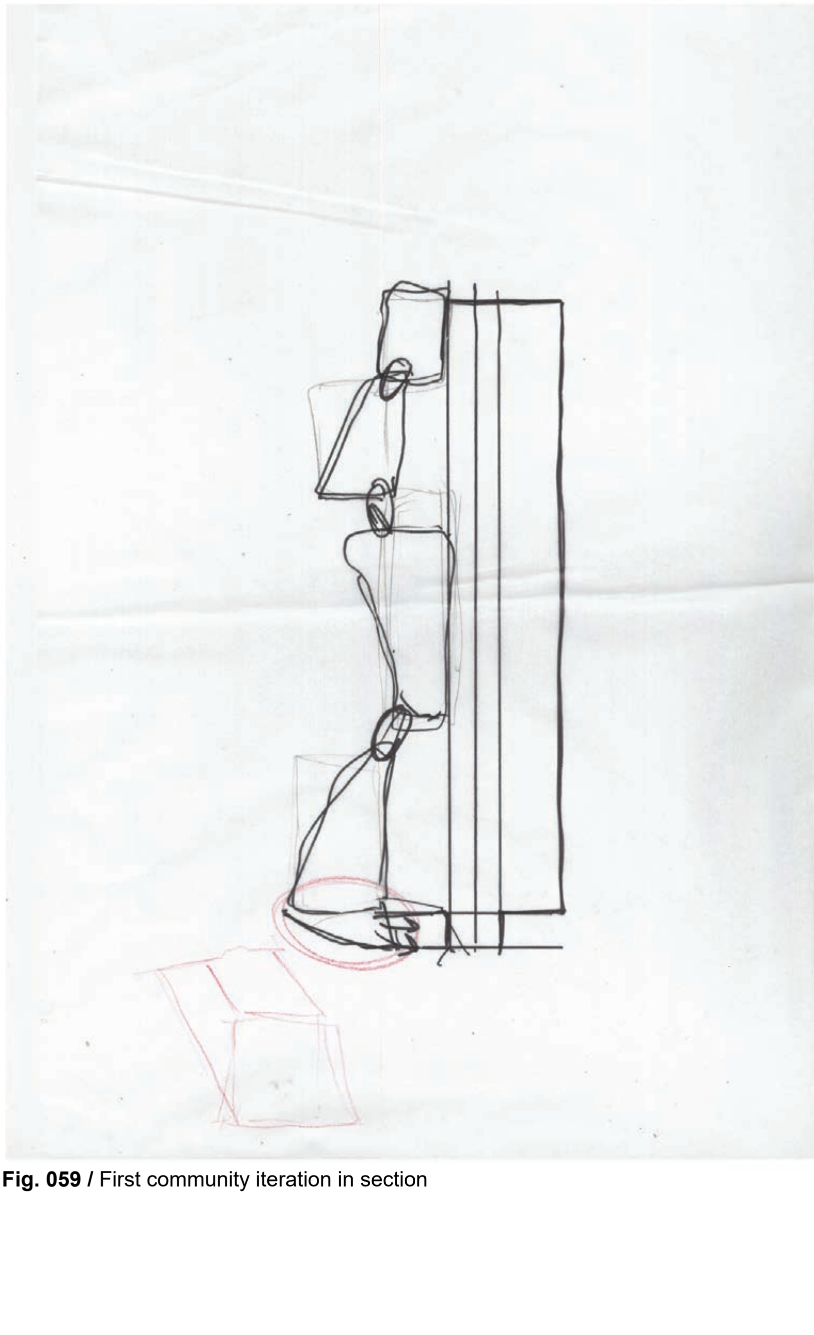
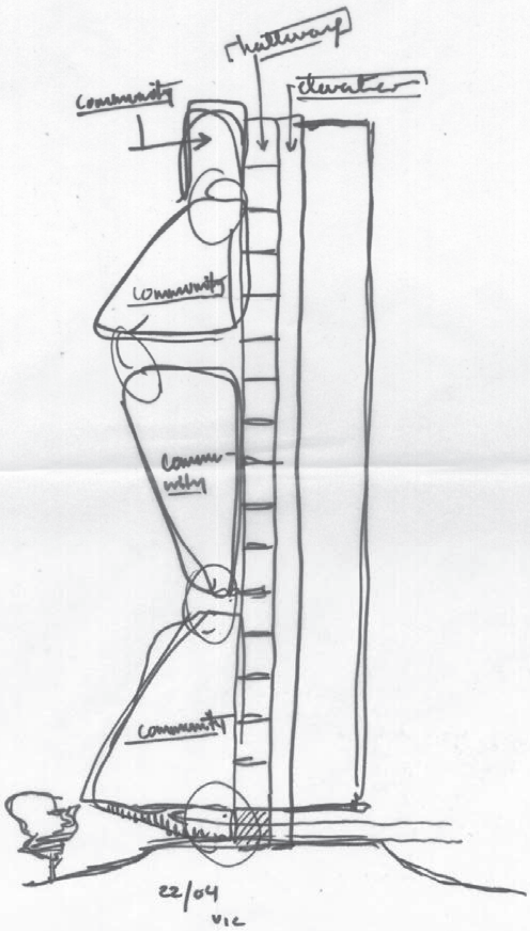
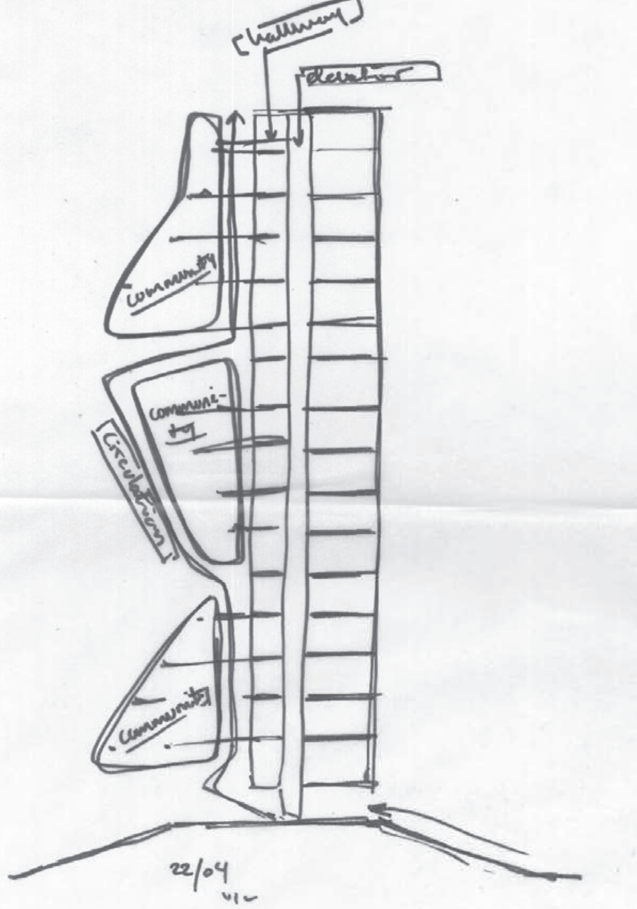
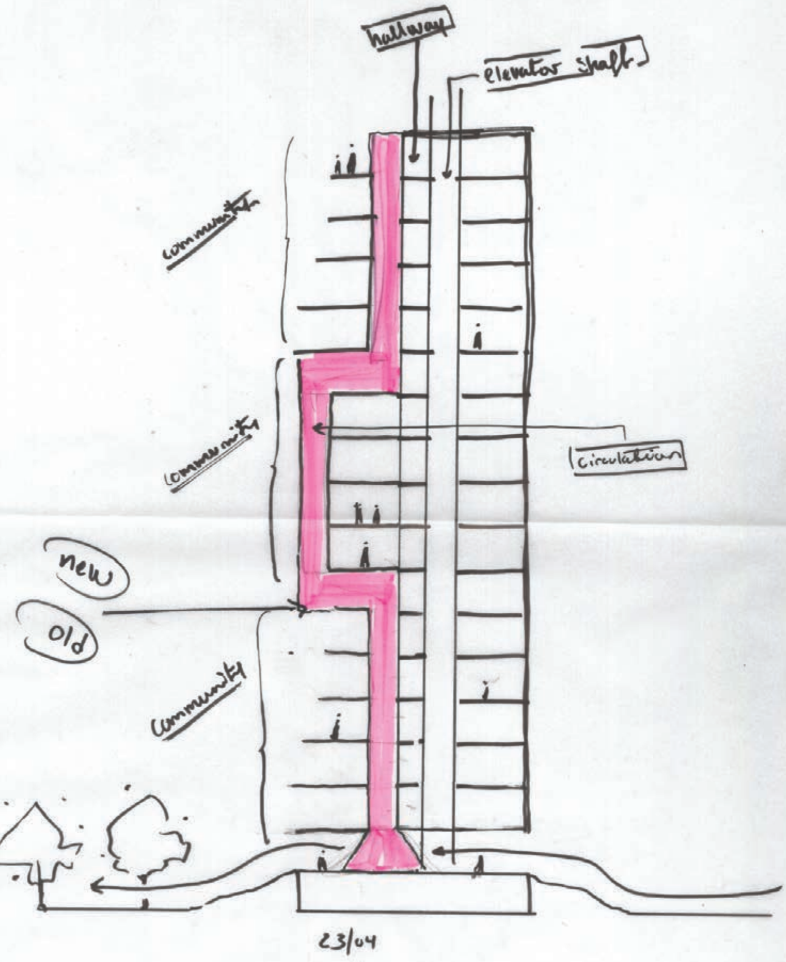


Fig. 059 / First community iteration in section







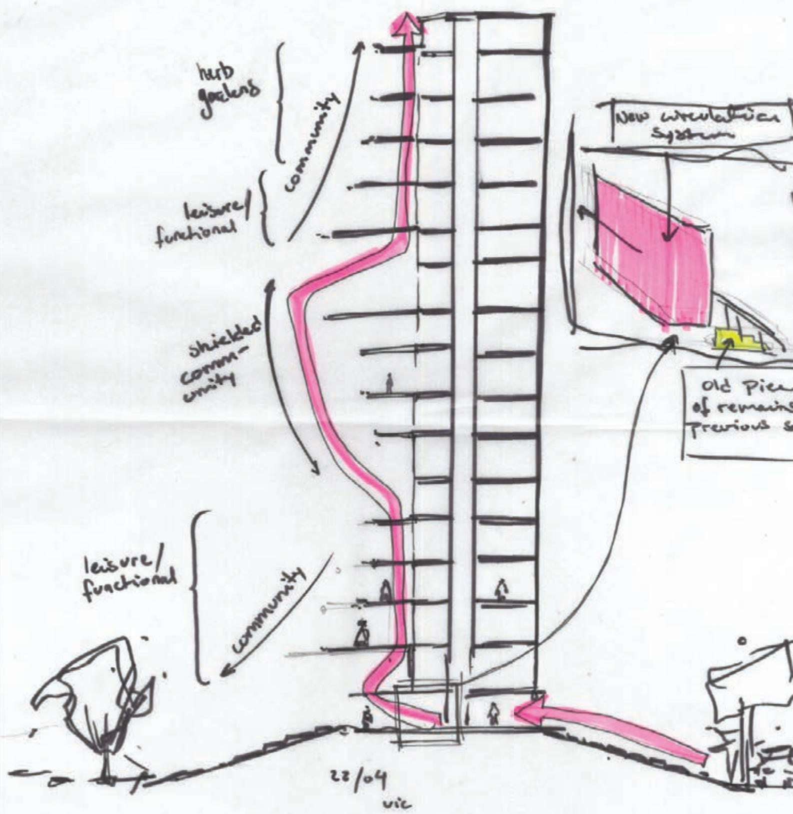


Fig. 060 / Second, third, fourth and fifth community iteration in section, respectively

UNDERSTANDING HERITAGE

“Architecture is more than just putting things together. It’s about the organic, about illusions, a sense of memory, and a textural approach”

Renzo Piano, 2001

The quote above is an excerpt of an interview conducted by Record’s editor, Robert Ivy, in 2001 (Architectural Records, 2001) In this interview, the Italian architect (John Zukowsky, no date) discussed the role of memory in architecture (Architectural Records, 2001). What Renzo Piano suggests with this quote is that architecture is more than just a building; it is a medium embodying historical narrative.

“*Sometimes memory, too, plays a part. Architecture is about illusion and symbolism, semantics, and the art of telling stories*” Renzo Piano, 2001 (Architectural Records, 2001)

What does this mean in a Ukrainian context? What is the symbolism, stories, and contextual narratives that Block 82 should possess and articulate?

/ architectural heritage

When exploring Ukrainian architectural history, styles like Baroque, Romantism, and Classicism are often mentioned. However, the works typically referred to are traditional churches and palaces.

Looking back at vernacular Ukrainian architecture, it becomes clear that earthen construction was prominent. The type of construction was based on locally available resources. A notable technique in this context is referred to as “Mazanka”. This technique includes utilizing wooden frames filled with a mixture of clay and straw, brushwood or similar materials. In regions with more forests, the technique may incorporate more timber in its construction. This technique reflects the general approach of traditional earthen building techniques, underlining a sustainable and harmonious relationship between the builder and the local environment (Earth Architecture, 2024). However far away from a Soviet-era residential block made of precast concrete the Mazanka may be, it remains relevant to look further into what “heritage” means in a Ukrainian context, not only in terms of construction, but also context, history and symbolism.

Fig. 061 / Mazanka technique by MrPanyGoff, CC BY-SA 3.0

/ contextural heritage

A building possesses contextual heritage through the environment it is situated. Block 82 is part of Northern Saltivka, an area composed by large apartment blocks constructed from concrete panels. When analysing the façades, it becomes apparent that these panels are a dominant visual feature of the overall expression, conveying a horizontal hierarchy. Another notable element is the variation in tones and colours, which often span the width of an apartment and appear to be retrofitted insulation panels. Integrating this language into the new skin of Block 82 could establish a contextual coherence.

/ historical heritage

There is no doubt that the ongoing conflict between Ukraine and Russia has had, and will continue to have, an impact on the history and mentality of Ukraine and its citizens. This applies especially in Saltivka, as this area has been severely damaged by frequent attacks (Institute for War & Peace Reporting, 2022) . However, as mentioned by Orest Zub in the previous chapter "Ethnographic studies #1: Resilience retold by Ukrainians" the mentality of the residents is characterised by resilience and patriotism. It is exactly this exclamation made by the locals of Saltivka, and retold by Zub, that signifies the importance of understanding and incorporating heritage into the architectural fabric of the reconstruction.

Fig. 062 / Facade 1, @warupcloseteam

Fig. 063 / Facade 2, @warupcloseteam

Fig. 064 / Facade 3, @warupcloseteam

Fig. 065 / Embroidered Ukrainian Map by Qypchak, CC BY-SA 3.0

/ symbolism

Ukraine has a variety of national symbolics that reflects Ukrainian mentality, culture, and history (Sribniak, 2024). Such as embroidery, which through techniques, patterns and motifs, embodies regional and symbolic significance and was thought to fend off evil. In the area of Kharkiv, the use of multi-coloured stitching and depth results in elegant and captivating motifs (The University of Kansas, no date).

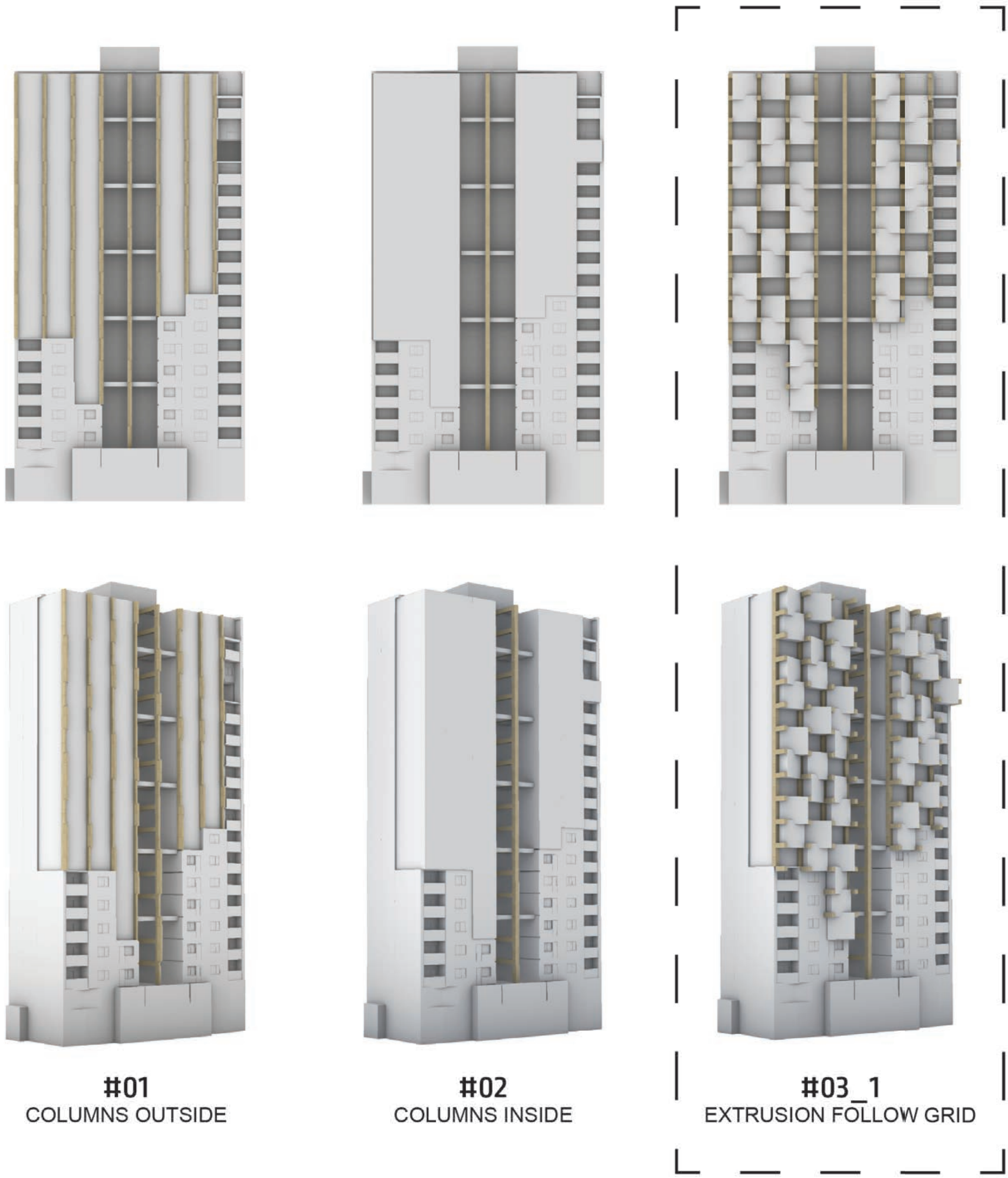
Like it does in many other parts of the world, flora and fauna also hold a certain significant symbolism in Ukraine. While the Galanthus signifies the coming of spring in many Danish lives, Ukrainians have certain symbolisms tied to local flowers. A prominent symbol for Ukraine is the sunflower ("Соняшник" – "Sonyashnyk" literally translated into "Sun plant"), which, according to Ukrainian folklore, brings fortune and happiness (Sribniak, 2024). But in modern times, the sunflower has also come to symbolize peace, resistance and unity (Hassan, 2022).

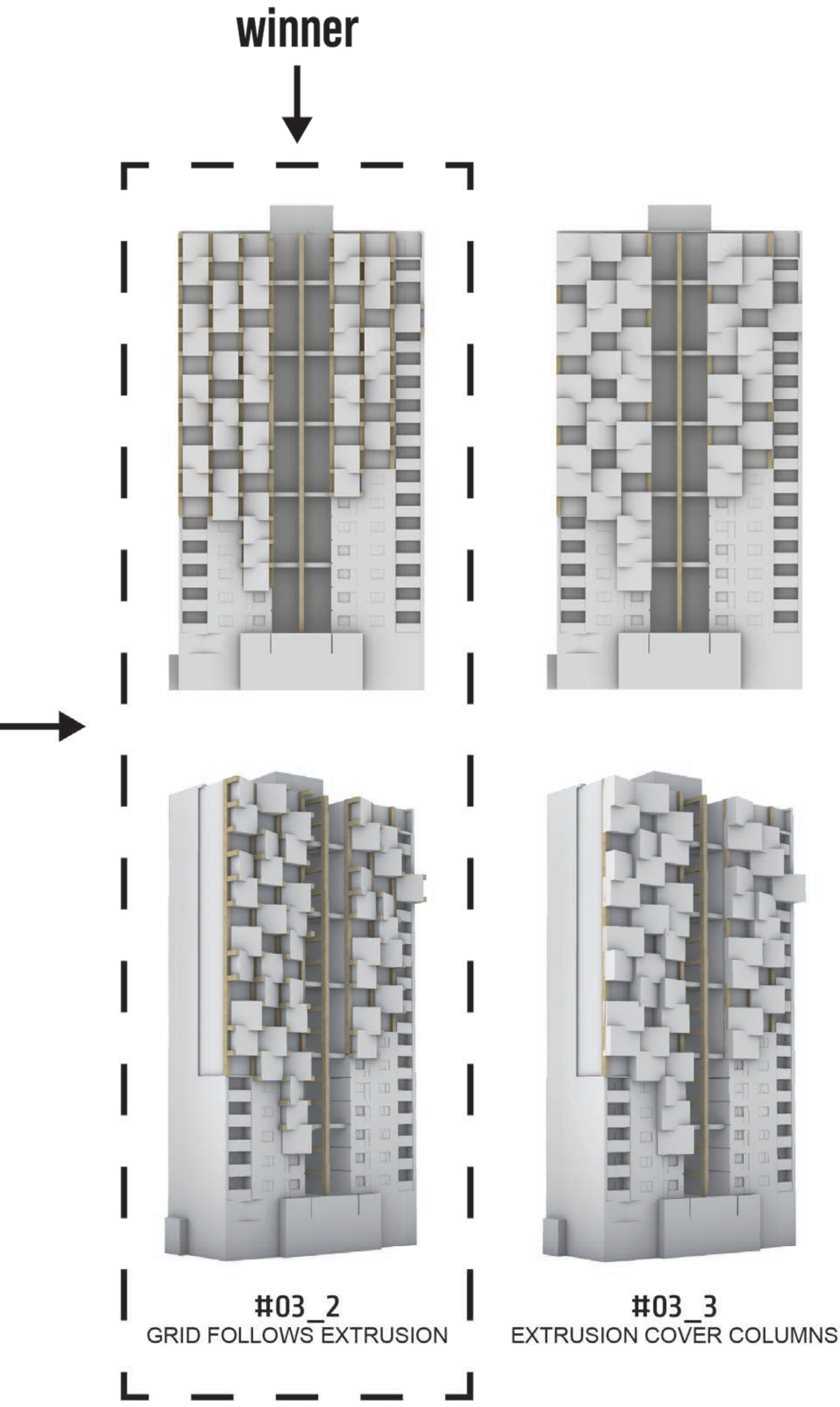
These motifs and symbolics can be woven into the architectural fabric by incorporating them into various elements, not only to establish a cultural association but also to convey a narrative of resilience, hope and life.

DESIGNING WITH HERRITAGE

Incorporating and emphasising heritage in the design has played a formative role throughout the process. It has been explored in multiple scales, from overall morphological languages to smaller architectural details, guided by a question of: How can Ukrainian heritage inform and cultivate the rebuilding of Block 82?

Fig. 066 / Volumetric investigation





/ volumetric storytelling

From the outset of the project, contrast has been a key principle. Not only to create a visual distinction between old and new, but more importantly, to emphasise the “new tissue of the scar”, symbolizing the healing of the damage caused by the missile attack.

In the pursuit to achieve this, various approaches were explored throughout the process. The volumetric 3D models illustrated investigates morphological expression and are evaluated based on the effectivity of emphasising the scar and convey the narrative of what happened to Block 82

The two first iterations, #01 and #02, investigated whether the new structural system should be expressed through the facade. It was concluded that incorporating the structural system in the façade emphasised the notion of a new tissue and a healing structure, introducing a contradictory vertical hierarchy to the existing horizontal hierarchy. However, this design only conveyed part of the narrative, the healing process.

Through further iterations, #03_1 emerged to convey a narrative of how the attack caused an explosion that fragmented the structure. This expression was refined by investigating the relational hierarchy each solution proposed. Iteration #03_2 was found to have the most potential, as it proposed a ruleset that controlled and individualised the extrusions (fragments), without excessive use of material with no structural purpose.

Iteration 03_2 featured a design composed of three types of extrusions with different orientations, arranged after a ruleset of: southern apartments must include a balcony, an enclosed bay window, and an enclosed balcony; northern apartments must include either an enclosed bay window and a balcony, or an enclosed bay window and an enclosed balcony.

Although the extrusions are composed by this ruleset, the resulting expression was too chaotic. Therefor it required analysis, simplification and reorganization.

Analysing revealed a key concern: The clash of dissimilar extrusions created undesired aesthetic results, as it did not align with the concept of individual extrusions.

Simplifying by organizing and limiting the alternations of extrusions to two versions, with only two orientations: South and perpendicular to the building, contributed to a cleaner and more coherent expression.

However, where long sides of extrusions met, unintended cavities appeared, creating potential nesting spaces for birds. This problem was solved by reorganizing the extrusions, preventing these cavities from forming.

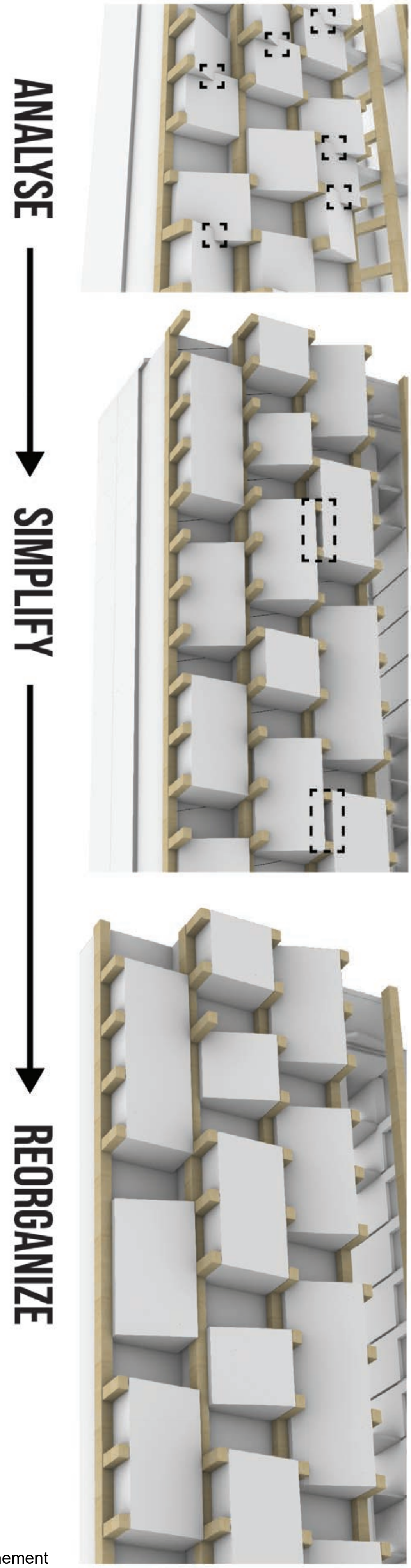
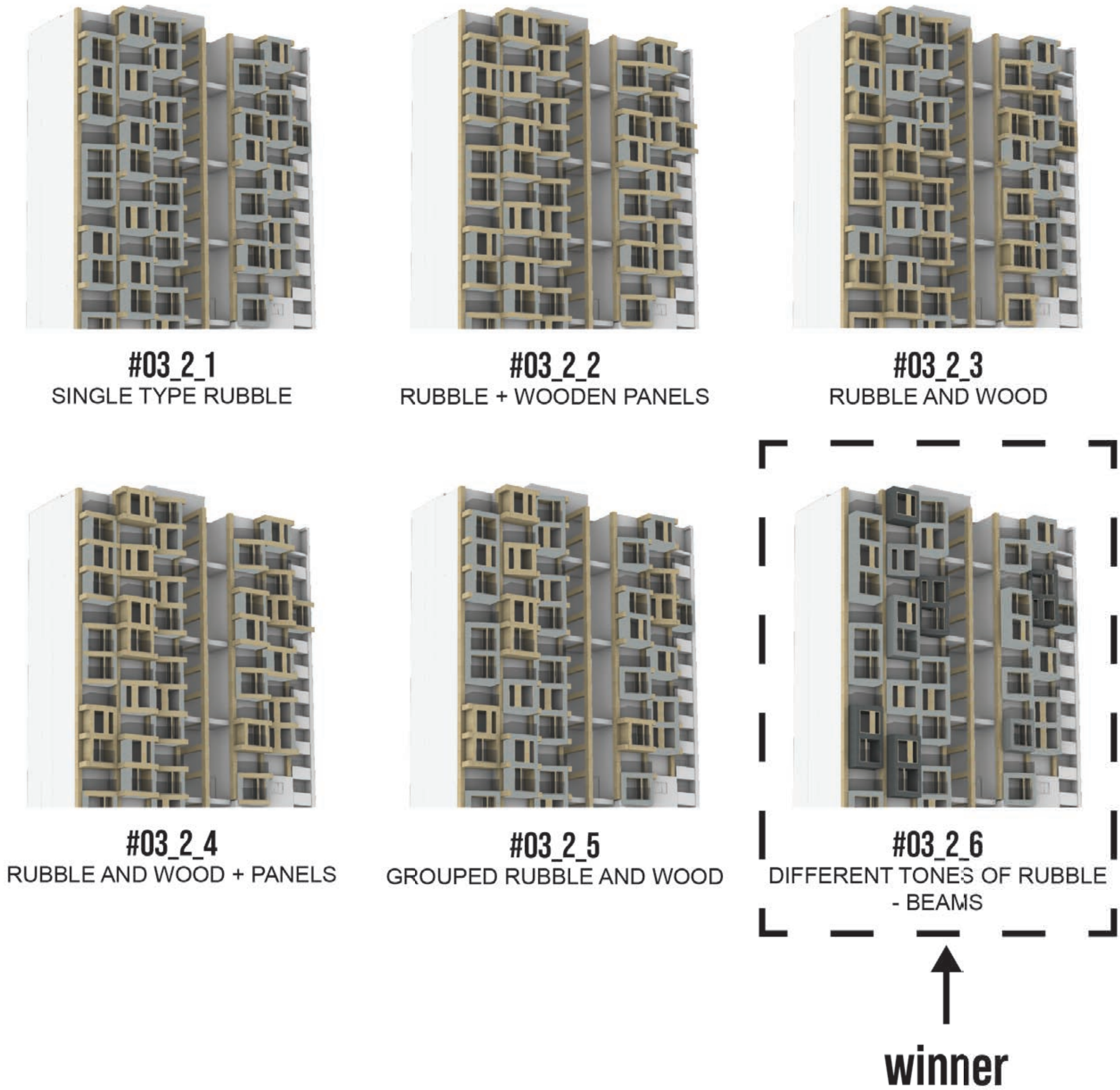


Fig. 067 / Morphological refinement

Fig. 068 / Material studies



Following the morphological refinement, a series of simple material studies were conducted. The primary focus has been wooden and concrete rubble cladding, although other materials such as zinc and aluminium were also explored.

Cladding the extrusions entirely with a single type of rubble panels resulted in an aesthetic reminiscent of a cliffside, contrasting the concept of individuality and fragmentation. Introducing horizontal wooden panels, spanning from beam to beam, altered the façade by introducing a dominant linear grid. However, upon closer inspection, the shape of the volumes made this grid increasingly irregular, losing its organizing intention.

Another approach, exemplified by #03_2_3, explored creating variation and emphasising fragmentation by combining rubble panels and wooden cladding in a random pattern. This suggested a potential to echo the diversity of tonal variation in the surrounding environment, like underlined in the previous subchapter, and enhancing contextual coherence. However, as also discussed, these tonal variations primarily occur at the scale of an entire apartment. In contrast, this iteration suggests a more randomized aesthetic and a lack of compositional coherence.

Revising this in iteration #03_2_5 material distribution was revised by grouping and arranging the cladding types in a way that more accurately reflected the material patterns of the surrounding buildings. While this enhanced contextual coherence, the contrast between wood and rubble remained very dominant. This was addressed in iteration #03_2_6, focusing on creating tonal variation and fragmentation through varying shades of concrete rubble panels and removing the extruding beams. This approach retains material variation, while achieving a unified aesthetic, aligning with the contextual heritage.

/ integrating symbolism into architectural elements

As mentioned in the previous subchapter, various motifs, patterns and symbolics can be woven into the fabric of the architecture. This has led to various iterations of architectural components such as the cladding and solar shading.

As the current exterior walls does not meet modern standards for energy efficiency and thermal performance, they require optimization. As concluded in the previous chapter, there is a potential to reuse the concrete rubble by grinding it into aggregate for casting new cladding panels. This strategy already carries symbolic value, as the debris caused by the attack is repurposed to help rebuild the building. However, producing new panels offers creative freedom and potential to embed additional meaning and narrative by incorporating Ukrainian embroidery motifs and regional techniques. The motif seen on fig. 69 depicts the 8-Pointed star, symbolising female and male union to create life (The University of Kansas, no date).

A similar principle has been explored in the solar shading on the west façade, where these motifs can create a dynamic interplay of light and shadow.

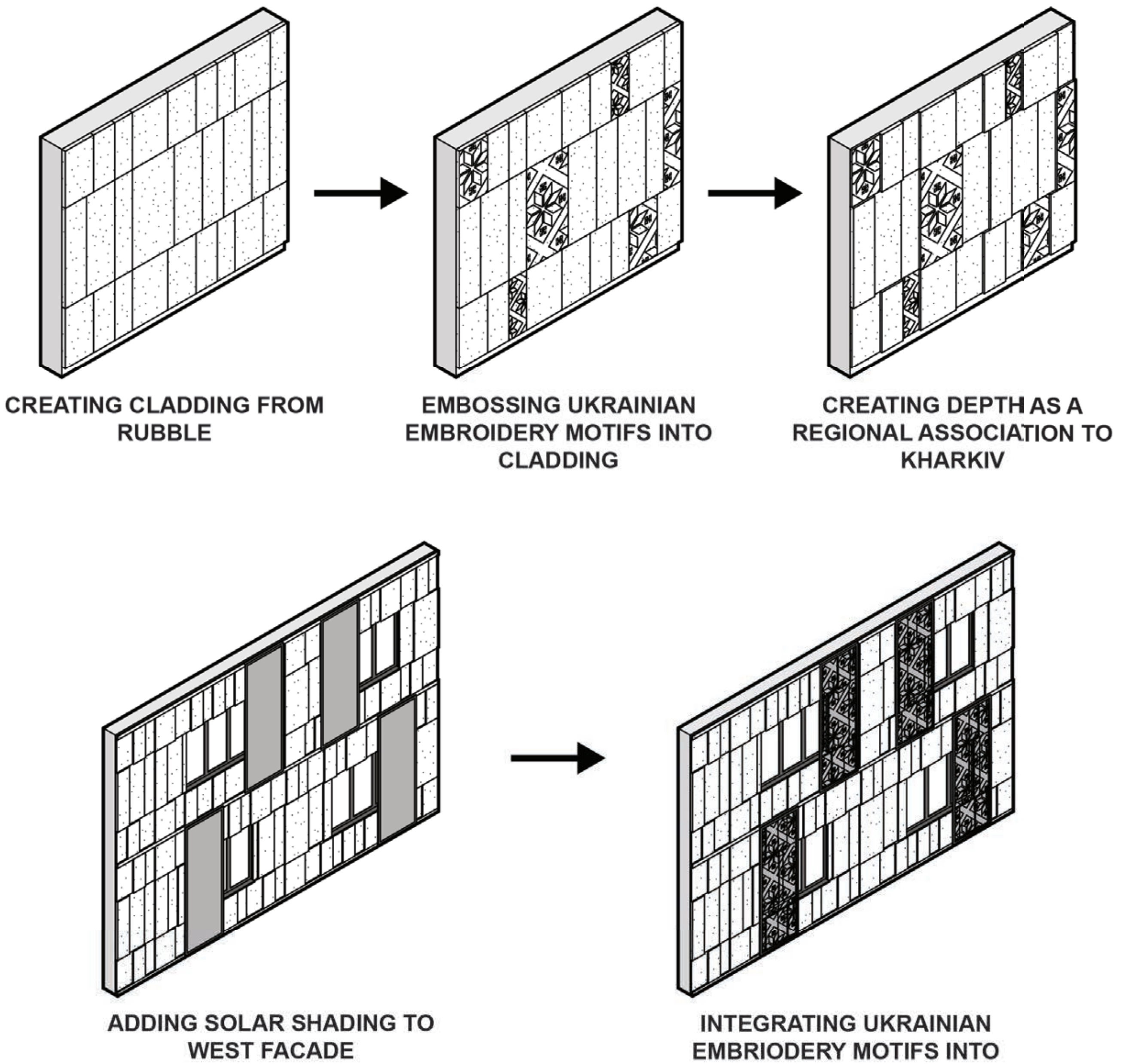


Fig. 069 / Embroidery motifs & techniques architectural elements

SUMMARY

Ultimately, the investigation revealed, that a modern Ukrainian building in this case consists of a synthesis uniting tradition and modernity through embedding cultural identity, community and collective memory into a resilient and contextually grounded design.

In addressing what defines a modern Ukrainian building, it became evident that community, in a context like Northern Saltivka, primarily is cultivated externally. However, in an effort to foster a stronger sense of internal community, the scar left by the destruction revealed a powerful potential to become social spaces, emphasising the narrative of life and community emerging from the ruins. Within this framework, the circulation evolved into an ambiguous, sculptural element, acting as a spatial mediator fostering spontaneous interaction and layered community experiences. Additionally, it became apparent that Ukrainian and contextual heritage can be woven into the architectural fabric by integrating symbolic embroidery motifs, regional techniques and materiality, as well as narrating the story of Block 82 through morphologic expression.

- The internal sense of community should be enforced by creating common spaces within the scar combined with the circulation, reinforcing accessibility and spontaneous encounters.

- The new staircase system should act as a spatial mediator for community spaces.

- The materiality of the new façade should echo the surrounding tonal variation for contextual coherence.

- Ukrainian embroidery motifs and techniques should be integrated into architectural elements such as cladding and shutters, emphasising cultural and historical coherence.

- The collective memory of what happened to Block 82 should be narrated through an explosive and fragmented morphological expression in the new façade of the renovation.

RUBB
TO
RESIL

#4 "How can we utilize the remains?"

LE

One recurring theme the thesis group has encountered throughout their education and practice in sustainable architecture is the concept of reuse. It is a straightforward idea, reusing existing building components or structures instead of producing new ones simply makes sense. Why expend additional resources, energy, and capital to create something new when viable materials are already available? However, while the logic is intuitive, the implementation is often far more complex. Legislation, logistical challenges, and time constraints frequently push designers toward familiar solutions—defaulting to conventional methods instead of embracing reuse. This chapter explores how much can be salvaged from what appears to be waste material left behind by the attack on Block 82, and examines the potential impact such reuse could have on reducing the building's Global Warming Potential (GWP) values.

IENCE

SUSTAINABLE DEFINITIONS

To address the question of recycling or reusing damaged building elements in a sustainable manner, this chapter begins by examining how such processes are defined within the architectural and constructional fields. On a broader level, the project situates itself between the terms repair, renovate, and restore, each carrying distinct implications for intervention strategy.

Repair typically refers to the act of fixing something that is broken, which this project indeed seeks to do. However, this definition suggests minimal intervention, limited to restoring basic function, without necessarily enhancing the quality of life for returning residents. Given that one of the project's core goals is to improve living standards, a simple repair is not deemed sufficient.

Restoration, on the other hand, implies returning the building to its former state. As explored earlier in this report, reverting Block 82 to its pre-war condition would not adequately serve the current or future needs of its residents, particularly in terms of energy efficiency, spatial flexibility, and contemporary living standards.

Renovation, by contrast, involves substantial alterations that can improve the building's functionality, performance, and aesthetic value. Since the aim of the project is to not only address the war-inflicted damage but also to elevate the quality of life for the inhabitants, the strategy aligns most closely with renovation as a concept (TITAN 360, 2025).

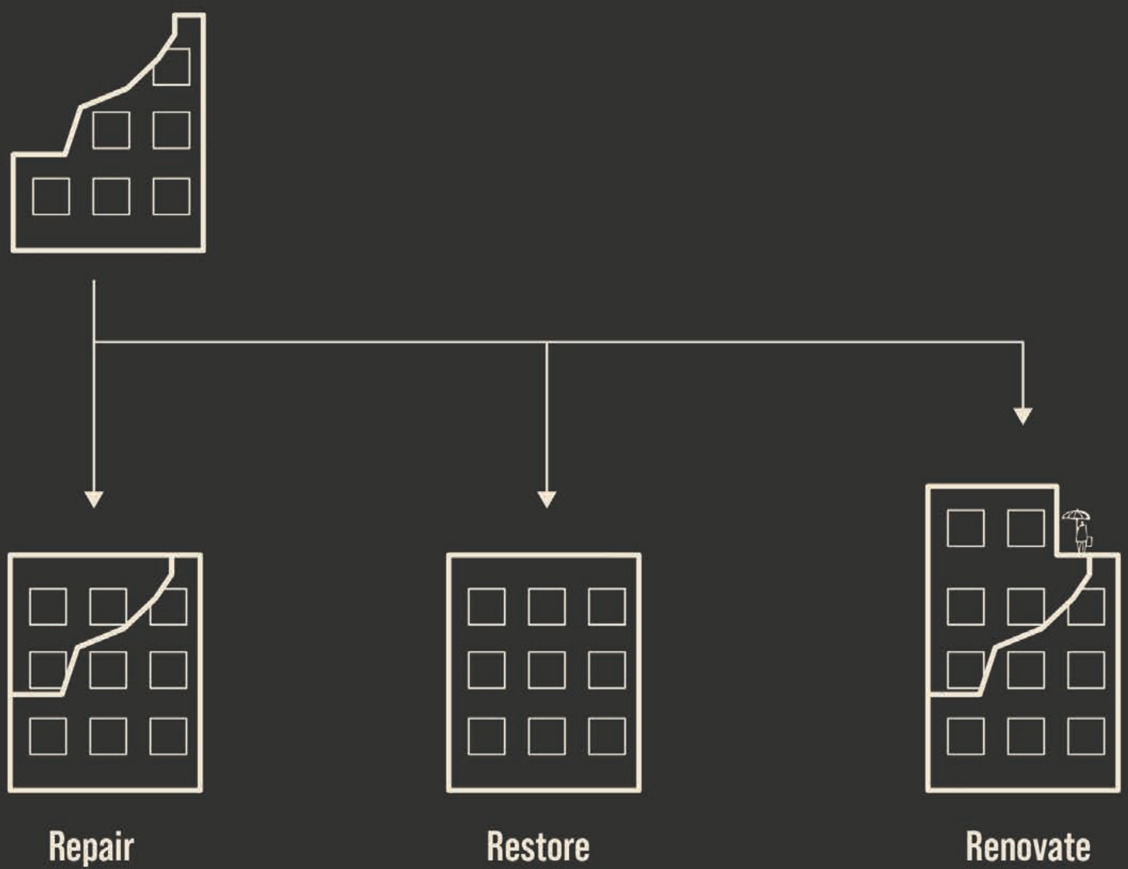


Fig. 070 / Re-words diagram

Fig. 071 / Rubble drone picture @warupcloseteam

On a smaller scale, individual construction elements from the damaged building also present opportunities for reuse. At this point, it is essential to clarify the approach this thesis will take in addressing the reuse of these elements.

When considering the intact or partially damaged parts of Block 82, inspiration can be drawn from existing practices in Denmark, particularly those explored in the project “Resource Rows” by Lendager. This initiative investigates how to renovate Danish social housing, often in so-called ‘ghetto’ areas, by mapping the material resources within existing buildings and forming a ‘material bank’ for reuse in either the same or new constructions. While effective in creating circular building systems, this strategy often involves dismantling the original building entirely, thereby transforming it into something new. (Heunicke et al., 2021)

However, in the case of Block 82, the thesis is grounded in a narrative of resilience, rebuilding not as erasure, but as continuity. As such, the complete disassembly of the structure is seen as contradictory to the project’s ethos. Instead, the intention is to preserve all remaining functional components of the original building, maintaining a physical and symbolic connection to its past.

Meanwhile, the rubble scattered at the base of the structure also presents a compelling opportunity: it offers a substantial material bank, rich with design potential. Rather than discarding this material as landfill or simply crushing it for use as road gravel, the common practice for demolished concrete, this project views the rubble as a powerful narrative element. By incorporating it into the new design, the scars of destruction are not hidden, but transformed into expressions of endurance and recovery.

To be able to explore the potentials of repurposing or recycling the rubble requires first to establish

an understanding of the scale, condition and quantity of available concrete rubble pieces.

RUBBLE SIMULATIONS

To gain a better understanding of the available material bank, a series of destruction simulations were conducted using the 3D modelling software Blender. The process began with a visual assessment and categorisation of missing or destroyed wall segments based on original drone footage provided by the War-Up-Close team. These observations were used to build a BIM model, which was then exported into Blender for simulation.

Within the software, the identified damaged walls were subjected to a cell fracture simulation, breaking the elements into smaller fragments. Following this, a gravity simulation was applied to allow the fractured pieces to fall naturally to the ground, providing an indicative visualisation of the distribution, quantity, and approximate condition of the resulting rubble.

While this approach cannot replicate the complexity and variability of real-world physics, it offers a useful approximation for assessing the scale of destruction and estimating the volume and type of material available for reuse. In a real-world scenario, a physical, on-site evaluation would be significantly more accurate. However, given the remote and theoretical nature of this thesis, the simulation method has proven to be a valuable tool for generating data and supporting further analysis.

Destroying walls in blender - a quick guide

Cell frac, how many pieces the object should break into. This was the main value increased between iterations.

Noise, a ‘random’ input, making numbers deviate or lines scramble. This was used to make the breaks and number of breaks more natural.

Regenerative, to generate again, at 1,5 every piece had a 50% chance of receiving the cell fracture 1 more time. This value was kept at 1 to spare processing power as with a lot of cell fractures it could result in an exponential long simulation.

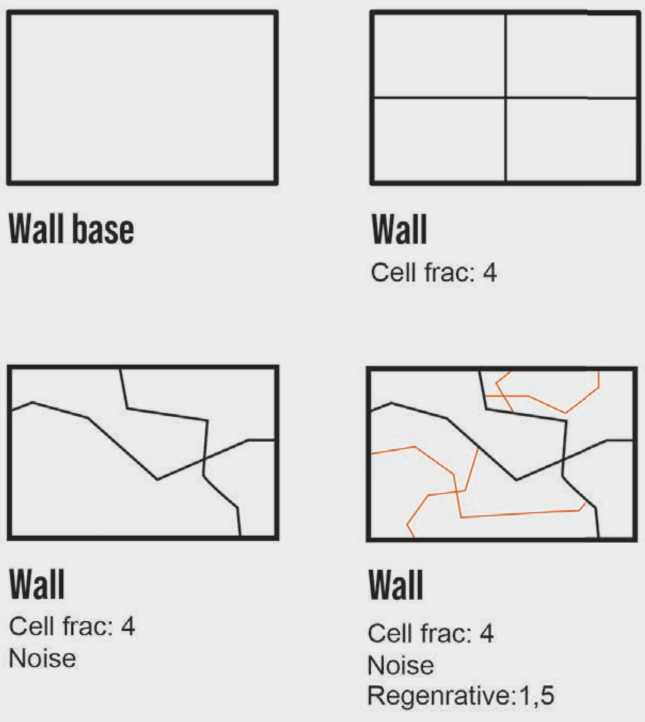


Fig. 072 / Breaking walls in blender diagram

Fig. 073 / Simulation visualisation

/ simulations results

Analysis of the rubble distribution graphs reveals a clear trend: as the number of cell fractures in the simulation increases, the resulting debris shifts toward a higher concentration of smaller fragments. While the simulations already produced a wide range of geometries useful for subsequent design development, it is believed that the results could have been further refined by increasing the number of cell fractures or regenerative fractures. The emerging pattern suggests that more extensive fracturing leads to a greater proportion of rubble falling within the small-piece or pebble-sized category.

Based on this observed trend, the design team assumes that the post-destruction material bank will consist predominantly of smaller fragments, with relatively fewer large, intact pieces. This assumption plays a key role in informing the strategies for reuse, upcycling, and incorporation of rubble into both the architectural and urban design proposals.

Fig. 074 / Distribution of piece size

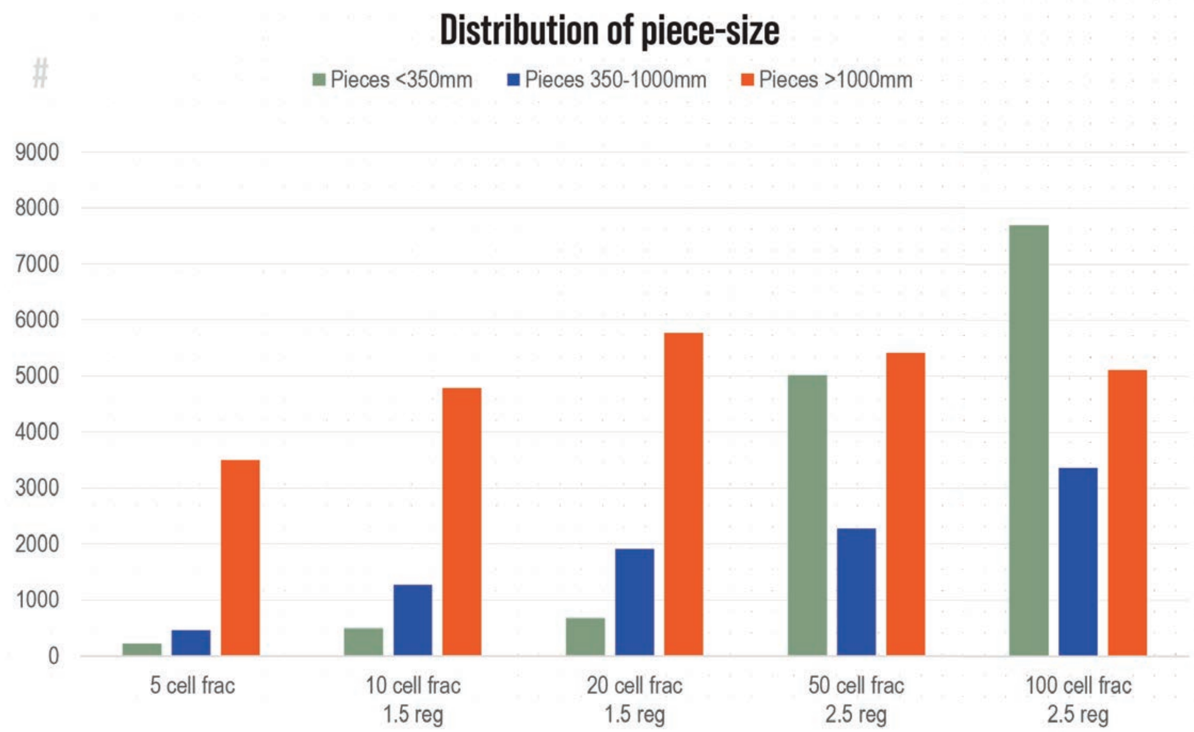
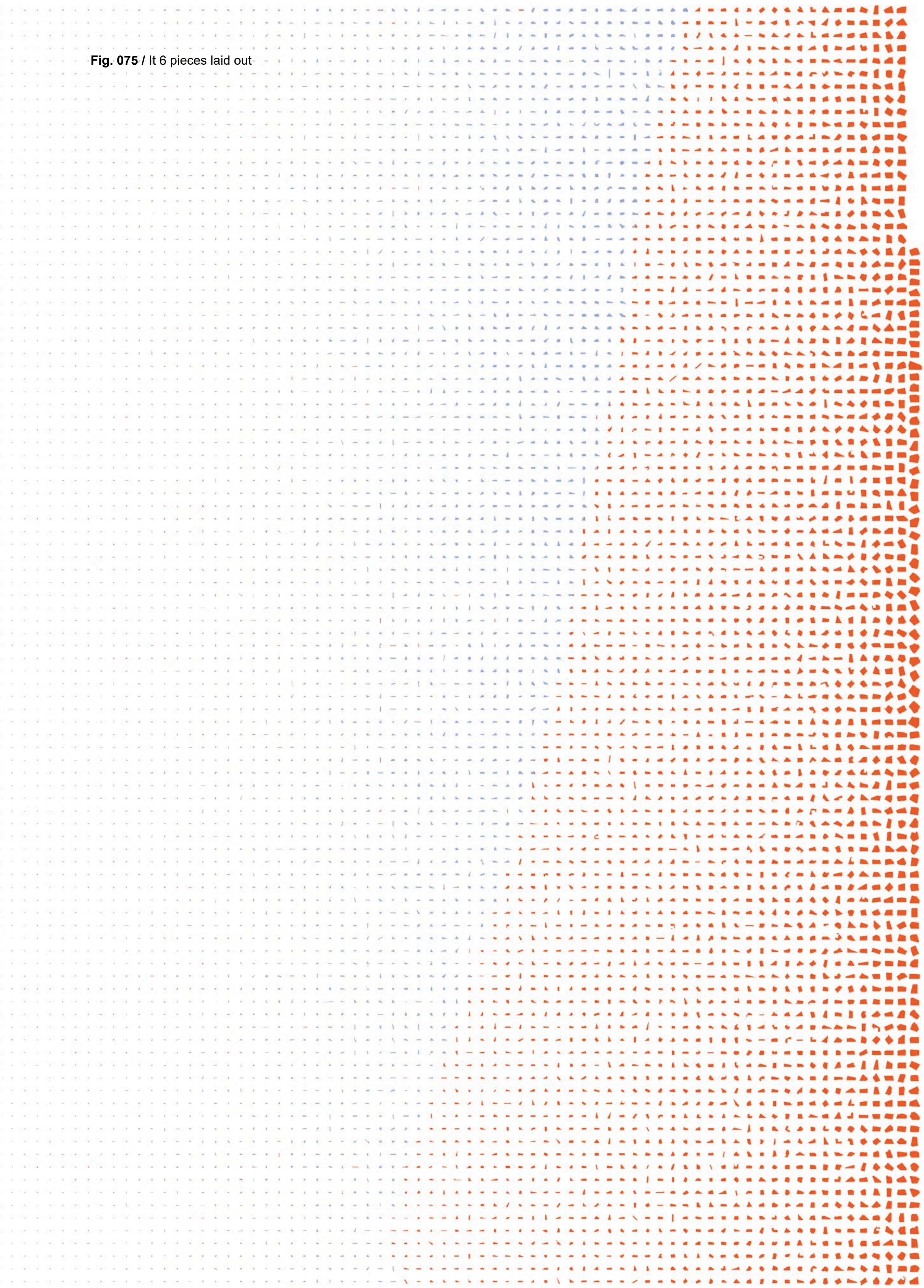


Fig. 075 / It 6 pieces laid out



RUBBLE REPURPOSE

/ urban furniture exploration

Large pieces of rubble that are difficult to relocate from where they originally landed present a unique opportunity for reuse. Much of this debris has fallen outward into the park area in front of Block 82, punctuating an otherwise empty grass expanse. Instead of treating these remnants as waste, the design reinterprets them as potential urban furniture—elements that enliven public space while preserving a tangible connection to the site's history.

To explore this concept, a series of prompts were developed and input into the AI image generator MidJourney, which produced visual interpretations of how the rubble could be repurposed. These speculative visuals then served as the foundation for integrating rubble into the urban landscape as functional and symbolic furniture pieces. The prompts used can be found in appendix C

Amphitheater created by stacking wall pieces.

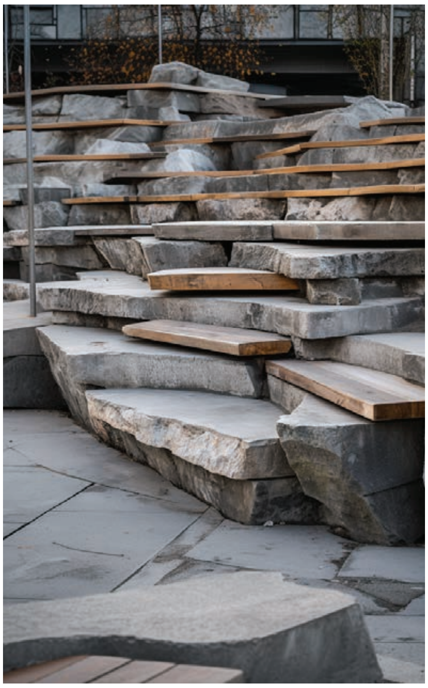


Fig. 076 / Rubble AI-gen 1 @MidJourney

Stool and table set created by putting wall pieces vertically and horizontally.

Fig. 077 / Rubble AI-gen 2 @MidJourney

Open air pavillion created by erecting parts of wall pieces.

Fig. 078 / Rubble AI-gen 3 @MidJourney

Fig. 079 / Rubble AI-gen 4 @MidJourney w. sketches

Photorealistic outdoor seating made from large broken concrete wall fragments, with chipped edges, rough surfaces, and visible texture. The concrete slabs are arranged into sculptural benches in a park on a grassfilled lawn. Photographed in the style of a product showcase: isolated composition, neutral or soft natural background, focused lighting that highlights form and material texture. Emphasis on realism, scale, and function. 8k, ultra detailed, architectural product photography, minimalist setting, --ar 1:1 –raw

/ sustainable concrete?

As the project requires stronger structural elements to stabilise the building, the potential of using rubble as recycled aggregate in new concrete is investigated as a sustainable alternative for utilising the site's substantial concrete material bank. An average Environmental Product Declaration (EPD) from the Danish concrete industry is referenced to estimate the environmental impact of substituting virgin aggregate with recycled aggregate from the site Click or tap here to enter text.

The process involves harvesting concrete rubble from the site and transporting it to a processing facility, where it is crushed into smaller particles suitable for reuse. This mirrors the standard procedure typically accounted for in the C4 (end-of-life) phase of concrete. According to the EPD, approximately 46% of concrete consists of aggregate, alongside cement, sand, and water. By replacing virgin aggregate with site-sourced material, the need for resource-intensive excavation is eliminated, resulting in a 46% reduction in emissions from the A1–A3 (production) phase. However, since the rubble must still be processed, the emissions associated with the C4 phase are incorporated into the adjusted A1–A3 phase.

This approach allows the project to produce more environmentally responsible concrete elements while embedding the demolished materials into new structural components. In doing so, it not only reduces the overall carbon footprint but also reinforces the project's core narrative—transforming destruction into resilience by reincorporating the original structure into its own reconstruction.

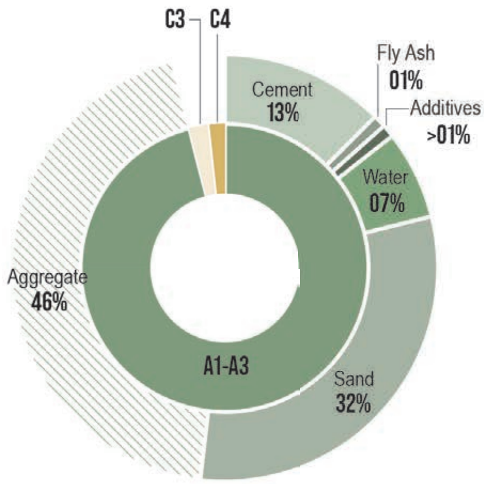


Fig. 080 / EPD and contents of concrete

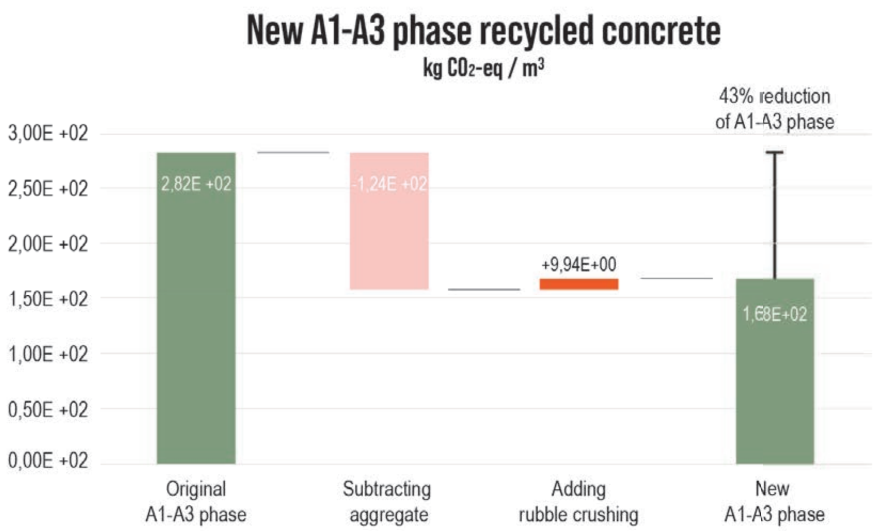


Fig. 081 / New A1-A3 phase / waterfall chart

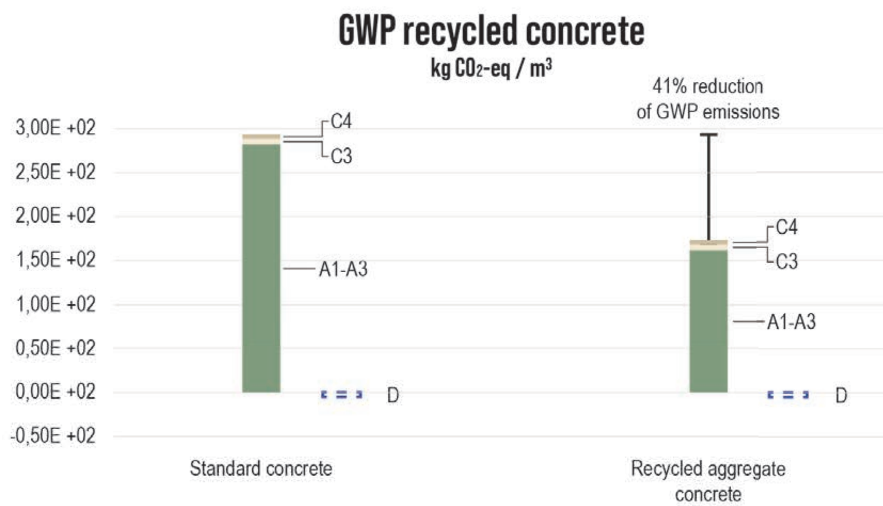


Fig. 082 / Recycled aggregate concrete GWP

/ piece by piece

One of the less beneficial aspects of incorporating rubble into new structural elements is that these components are typically located within the building's envelope, rendering them invisible to passers-by and residents in the surrounding area. As the thesis aims to highlight the narrative of resilience—where destroyed elements are reintegrated into the rebuilt structure and given new purpose—concealing these reused materials may limit the communicative power of the design. To address this, the potential for expressing this narrative more visibly through exterior applications is explored.

Given the building's current underperformance in terms of energy efficiency, a later chapter will address strategies for post-insulating the surviving walls. However, in parallel, this section investigates how rubble might be utilised as a visible façade element. Based on the material simulations, it is assumed that there will be a significant quantity of smaller rubble fragments, or pieces that can be easily processed on-site using tools such as angle grinders. These smaller fragments could be cast into panels using cement as a binder—much like conventional concrete production—forming a terrazzo-like cladding with scattered inclusions in varying shades of grey.

Such façade panels could not only contribute to thermal improvements but also serve as a visual and material expression of the building's history. By integrating pieces of the original structure into the exterior, the project physically and symbolically embeds the memory of destruction into its renewed architectural identity. These tiles could be constructed in all different shapes and sizes, which will be explored further upon in the following chapter:

Fig. 083 / Rubble AI-gen 5 @MidJourney

Cutting up pieces that are small enough to process but not small enough to immediately use.

Fig. 084 / Rubble AI-gen 6 @MidJourney

Assembling small rubble pieces in frames to create tiles.

Fig. 085 / Rubble AI-gen 7 @MidJourney

A finished tile piece with different shades of gray and a concrete base.

A large exterior architectural wall clad entirely in handmade terrazzo tiles, each tile composed of irregular fragments of concrete rubble. The tile pattern is visible and textured, showing the variety of recycled pieces embedded in a light grey base. Several people walk past the wall in motion blur, resembling a contemporary architectural visualisation. The setting is minimal and urban, with soft daylight casting shadows to reveal surface texture. Photorealistic, architectural realism, high detail on material finish, 8k, --ar 7:3 --raw

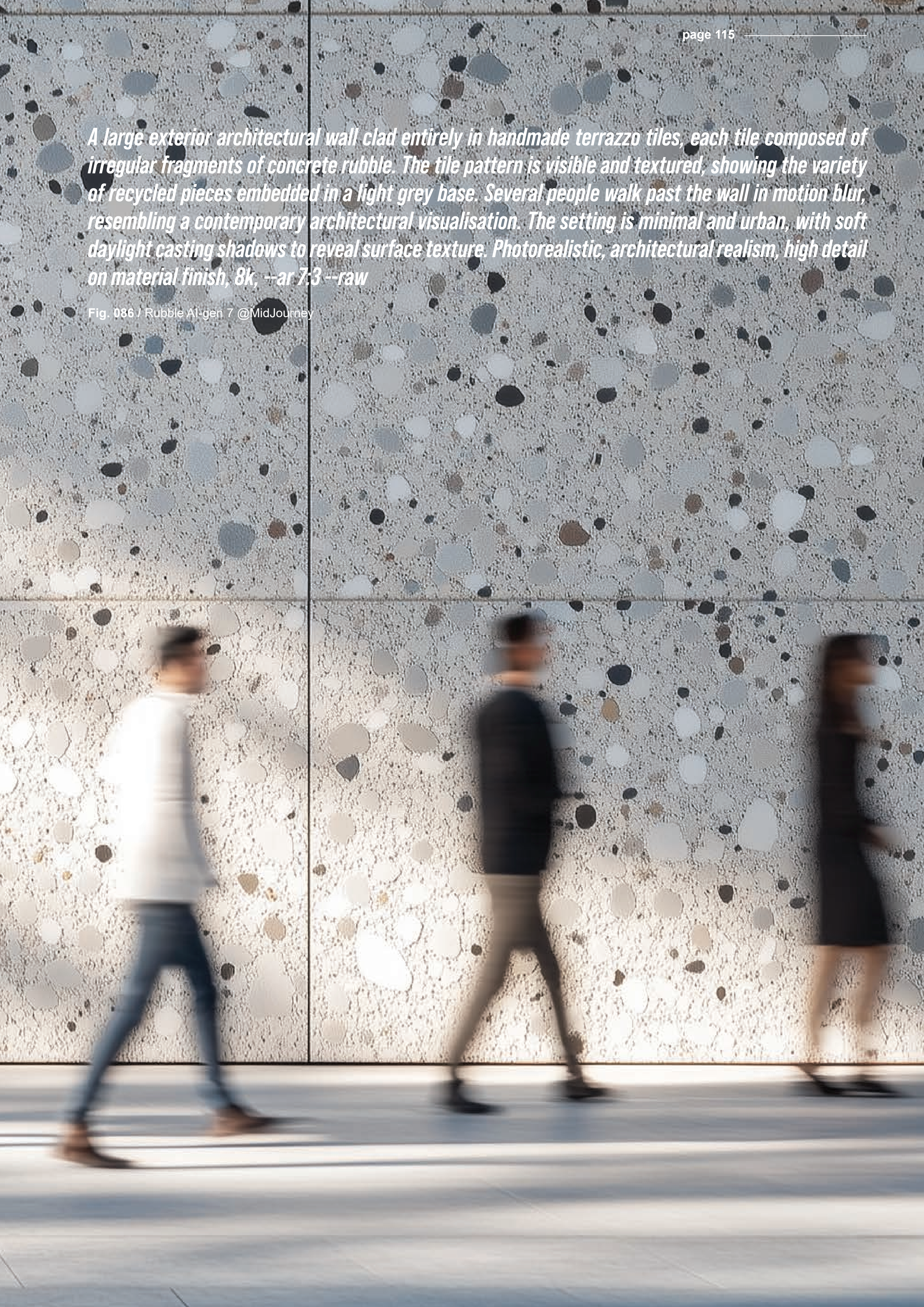


Fig. 086 / Rubble AI-gen 7 @MidJourney

DESIGNING WITH RUBBLE

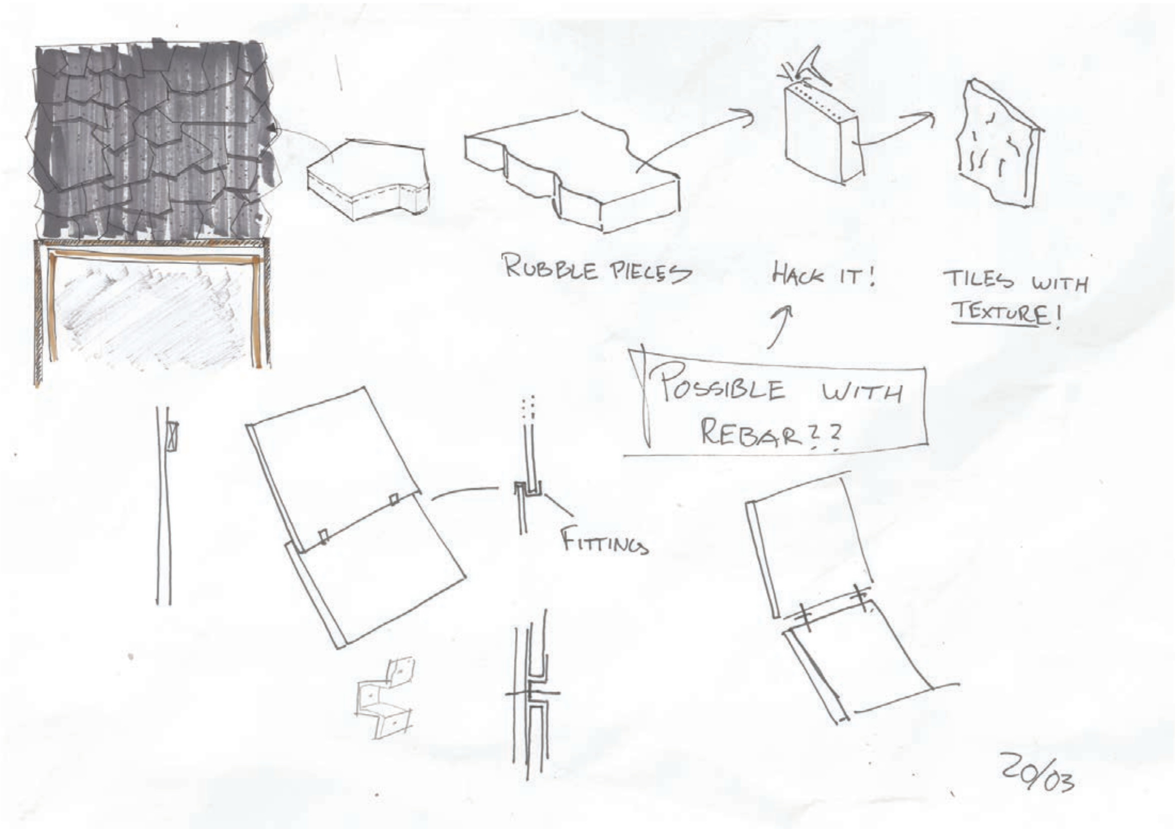
Analysing and exploring the concrete rubble as an available resource to be utilized, highlights the potential of reusing smaller pieces and pebbles in new architectural elements. This raises questions not only about appropriate shapes and sizes, but also about methods of fabrication, installation and practicality.

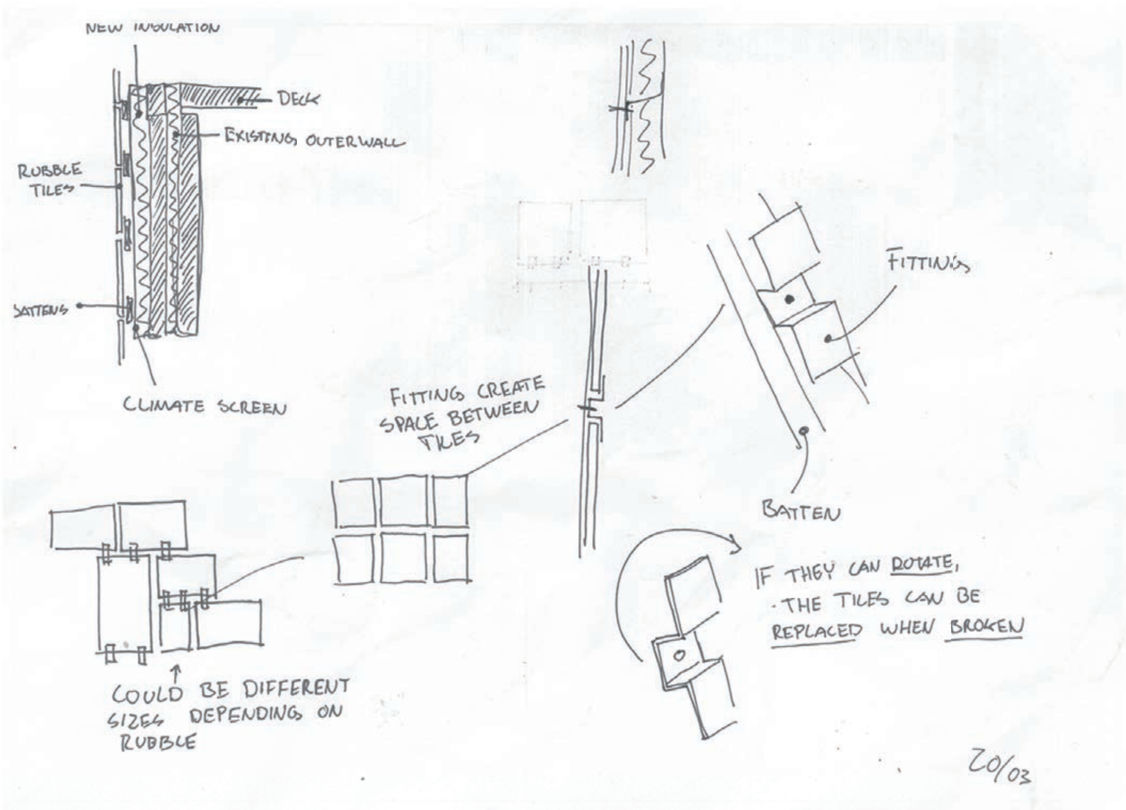
Analysing and exploring the concrete rubble as an available resource to be utilized, highlights the potential of reusing smaller pieces and pebbles in new architectural elements. This raises questions not only about appropriate shapes and sizes, but also about methods of fabrication, installation and practicality.

The reuse of rubble as tiles or cladding material has been an integral part of the early-stage design process. Here, a broad perspective of the potentials of reusing rubble has been investigated, initially primarily through sketching. As shown in the initial sketches on fig. 87, the categorization and sorting of different shapes and sizes of rubble pieces described in the earlier subchapter revealed a potential of reusing the rubble with minimal manufacturing, resulting in irregular and dynamic cladding panels. However, upon further reflection and investigation, this approach proved to carry a great deal of complexity regarding manufacturing as well as installation and labour. Given the urgency associated with the renovation of Block 82, this approach proved not to be viable in this case.

Therefore, a more standardized approach, informed by the rubble analysis, was investigated. Various configurations of square and rectangular panels were explored alongside the integration of smaller details such as fittings and different installation techniques. This strategy presented a more practical solution, simplifying both the manufacturing process and the method of assembly.

Fig. 087 / Cladding sketches





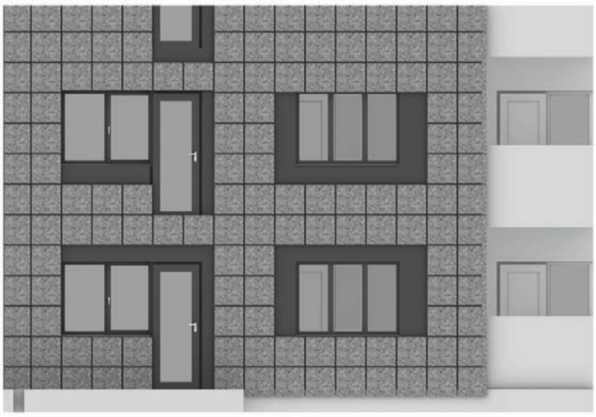
These principles were subsequently applied to the exterior walls in 3D, as illustrated in fig. 88. The initial approach explored a grid-based layout, wherein square and rectangular panels were arranged in a regular grid. This method offered advantages in terms of simplifying both the manufacturing and installation processes. However, the uniformity of the grid clashed with the irregular size and positioning of existing façade holes for doors and windows, resulting in a misalignment that undermined the grid's intended harmonizing effect. Additionally, the uniform grid created a flat and monotonous surface, which appeared visually underwhelming when applied across the entire building envelope.

These challenges were addressed in Iteration #02. In this version, rectangular panels of varying widths were introduced, with their heights determined by the positions of existing holes in the façade. This strategy achieved a sense of harmony through controlled irregularity. Furthermore, by varying the panel thicknesses, additional depth and visual complexity were introduced, creating a more compelling expressiveness of the façade. Despite their varied sizes, the consistent use of rectangular forms preserved the simplicity of production and installation.

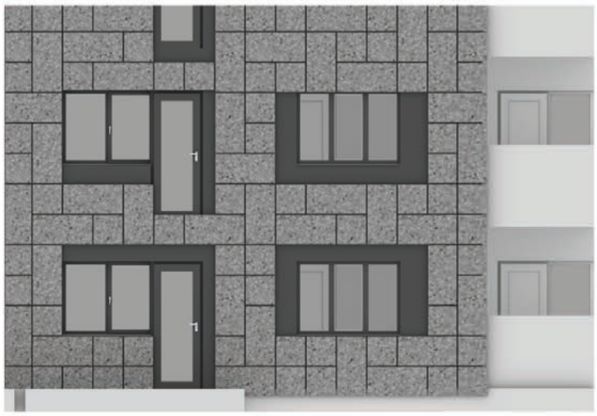
This concept was further developed through the testing of different panel layouts. Introducing horizontal divisions aligned with the windows created a more horizontally oriented hierarchy, echoing the original organizational logic of the prefabricated panel structure. To reinforce this hierarchy further, Iteration #02_3 employed longer panels divided at floor levels instead of window heights. However, this modification resulted in excessively large and heavy panels, complicating installation and diminishing the façade's perceived depth, ultimately producing a flatter appearance.

In response, Iteration #02_4 emerged as a synthesis of practicality and aesthetics, balancing constructability with a dynamic and articulated architectural expression.

Fig. 088 / 3D cladding investigation



#01
SQUARE GRID



#01_2
IRREGULAR GRID

#02
IRREGULAR PANEL

#02_2
IRREGULAR PANEL WINDOW SPLIT

#02_3
LONG IRREGULAR PANEL FLOORSPLIT

#02_4
IRREGULAR PANEL FLOORSPLIT

winner

SUMMARY

The extensive concrete rubble resulting from the attack on Block 82 represents a significant material resource that can be reused and integrated into the renovation with environmental, narrative and symbolic benefits.

Exploring the potential of reusing the remnants of the building and the destruction it has endured supports a strategy of selective reuse of functional elements and reintegration of concrete rubble. This approach not only offers environmental benefits but also reinforces two interrelated core narratives of the thesis: continuity over erasure and resilience. The concrete rubble demonstrates significant potential for repurposing, including its use in urban furniture or as grinded material for the production of new structural and cladding components.

- **The renovation should aim to reuse all existing structural components of functional condition and relevance.**

- **The large rubble remnants of the destruction should be reused and repurposed as urban furniture, affording recreation, monumental value and play**

- **The small rubble remnants should be grinded into aggregate for reuse in structural elements, as well as cladding tiles**

DESIGNING FOR LONGEVITY

This chapter explores how architectural design can foster longevity, both in physical durability and in long-term relevance. Grounded in theory and tested through design, this chapter examines how adaptability, thermal optimization, and daylight performance contribute answering the key aspect of longevity within the question of sustainable design.

#5 “How do we ensure longevity?”

SURVIVAL OF THE MOST ADAPTABLE

When considering longevity in design, it is important to build upon a theoretical foundation that reflects the processes of building materials and how buildings may change over time, either in function or form. As the renovation of Block 82 examines building upon ruins rather than replacing them, the question becomes not only what should be preserved, but how new interventions might age, adapt, or decay. Here, the project has already examined the building as something dynamic rather than a fixed entity. -An idea explored through the ideas of Gordon Matta-Clark and further radicalized in Lebbeus Woods' interventions in Sarajevo. However, to move away from the more speculative gestures and into sustainable practice, this chapter aims for a more tangible framework, one that continues to view the building as a kind of living organism, responsive to its own metabolism, but also relates to more perceptible problems within the case of Block 82.

Gottfried Semper's theory of Stoffwechsel offers a foundational lens through which the project can see architecture as temporal and, at least in part, evolving to its shifting needs. For Semper, construction was never about permanence, but more about cycles of renewal, repair and substitution. Each material carried not just structural weight, but cultural and historical significance, subject to change through use, weathering, and context (Austin, 1989; Mallgrave, 1996). Although Semper's theories are open to interpretation, it is this notion that the renovation of Block 82 should not just be seen as a fixed and binary process between ruin and repair, but rather a more metabolic view that dissolves the binary between new and old, positioning building as a continuous act of becoming, exemplified through gradual phases in construction (Usto, 2023). The argument for building upon an existing structure in the context of longevity connects back to Aleksandra Wagner, as she criticized a persistent human tendency: The impulse to destroy in order to create:

"*By naming destruction an inescapable beginning of all construction, a necessary yet effectively repressed platform of the ideology of progress, one has to realize that what is of interest are not the objects destroyed, but the inability or impossibility to see the world differently without destroying them.*" (Woods, 1997, p. 10).

This ideology of destruction-as-prelude is not only psychological or cultural but also material. As Wagner critiques the compulsion to clear away the old in the name of progress, Kemo Usto exposes the hidden consequences of this logic in physical terms. In his dissertation, Usto introduces the concept of the "material sink": a spatial and ideological void where discarded architectural matter is sent, both literally and symbolically, to be forgotten. He writes:

"A 'sink', in the chemical engineering sense—or that facility which functions as the sink—is in our human experience something which is often phenomenologically pushed far away (both physically and mentally) from our immediate everyday experience. A 'sink' is where our trash and excrements go. A kind of deep netherworld which 'magically' absorbs all our undesired entities and substances." (Usto, 2023, p. 116).

In ensuring longevity, these principles are paramount, however, adapting Block 82 structurally simply is not as straightforward. Here, the reinforced concrete plate system is inherently rigid, thus transforming this structure into something truly adaptable is technically difficult and too resource intensive. Yet even here, the principle of adaptation remains useful, not as a literal method in reconstruction, but as a conceptual guide to reinterpret damage as opportunity. Here, choosing to renovate the structure with an added frame structure, instead of continuing the plate system, is one way of making the structure more adaptable. By choosing to remain within the existing structural grid, the plan remains adaptable in the sense that it respects the existing spatial distribution, however, in certain areas it could be favourable to create larger spaces that have a more ambiguous nature.

DESIGN WITH ADAPTABILITY

As emphasised by Gottfried Semper's theory of Stoffwechsel, a building is a dynamic entity that evolves over time in response to changing human needs and societal developments. The notion of adaptability has been a central driver in nearly every aspect of the renovation of Block 82. It is reflected in the use of flexible floor plans, interchangeable cladding panels, and adjustable architectural elements, all grounded in a broader philosophy of reimagination of purpose and space.

/ adaptability in plan

As mentioned in previous chapters, the introduction of a structural system of columns and beams offers significant flexibility, as no load-bearing walls are needed. In addition, the amount of existing stabilizing structure around the intervention minimizes the need for new stabilizing elements.

Fig. 89½ illustrates various potential variations of a typical apartment within the newly constructed section of the building. As a result of the new flexible structural system, the apartment layout can be tailored to the specific needs of the residents and to adapt over time as those needs evolve and change. Furthermore, this approach promotes inclusivity as partition walls can be removed, repositioned or modified to accommodate accessibility requirements.

As for the existing apartments that were not destroyed, although the walls are stabilizing and load bearing and therefore cannot be modified, their rational and hierarchical distribution still allows for functional adaptation.

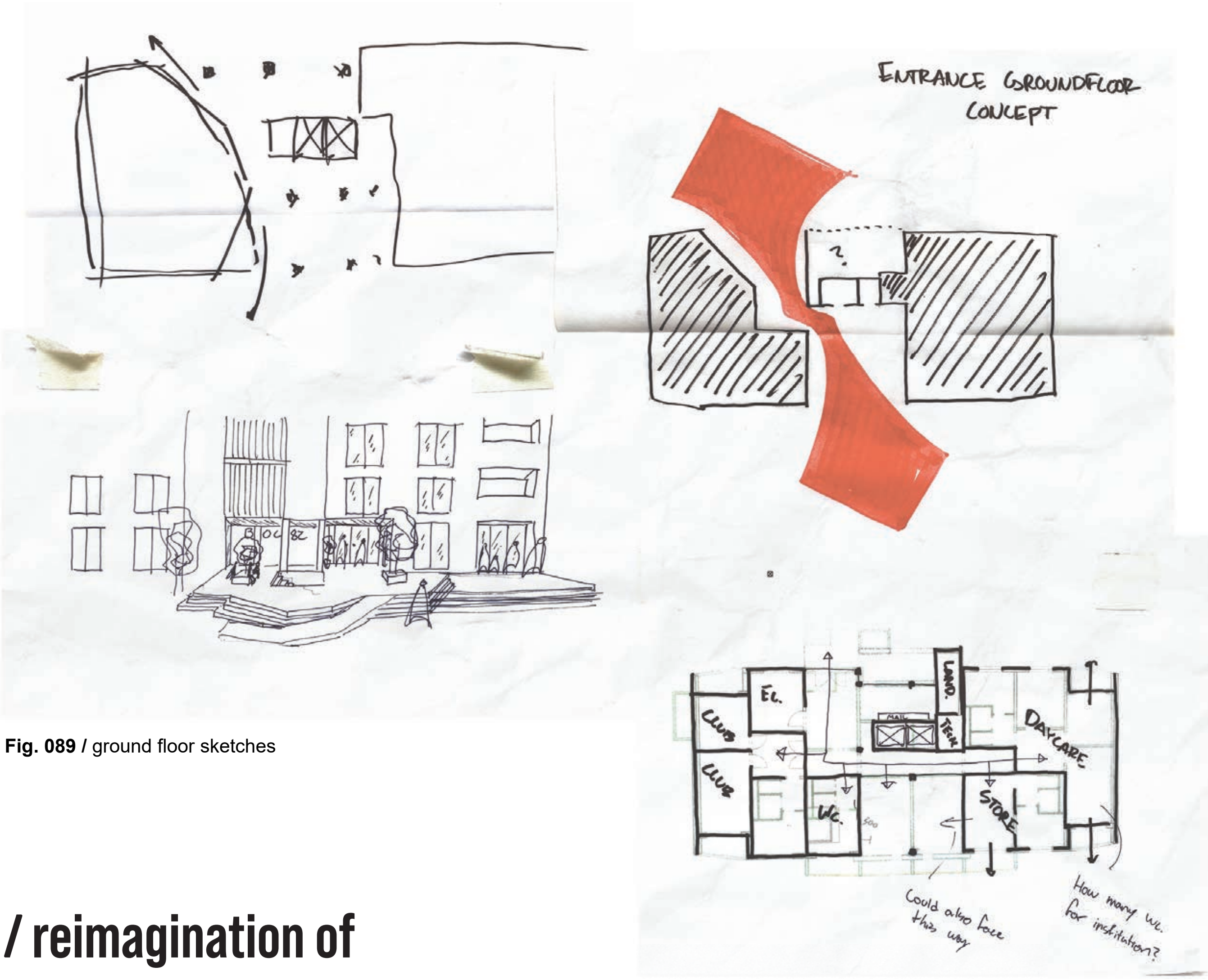


Fig. 089 / ground floor sketches

/ reimagination of purpose and space

The ground floor, which was originally private and primarily comprised apartments, has been explored in relation to reimagining its purpose and potentials, as shown in fig. 89. This investigation aimed to transform and create a building that not only occupies its site but actively engages with its surroundings.

A central focus in this investigation was to emphasize openness by introducing large, welcoming entrances on both the eastern and western façades, leading into a spacious common area. Another objective was to establish both visual and functional connection through the building by creating a passage across the ground floor that opens into the large public park on the eastern side of Block 82. This approach enhanced the ground floor's approachability by encouraging movement through the space.

In conjunction with this transformation, the functions of the ground floor had to be reconfigured to suit its new public nature. Consequently, iterations led to the adaptation of existing apartments to accommodate institutions, flexible common spaces, retail area, and public restrooms, facilitating both able-bodied and disabled users.

The notions of reimagination and spatial ambiguity have been applied throughout various aspects of the design. As demonstrated in previous chapters, circulation areas function as spatial mediators, fostering opportunities for community to evolve. While these spaces are assigned specific functions in the final proposal, they are intentionally designed to be adaptable over time, similar to the approach of the apartment layouts.

THERMAL DESIGNS

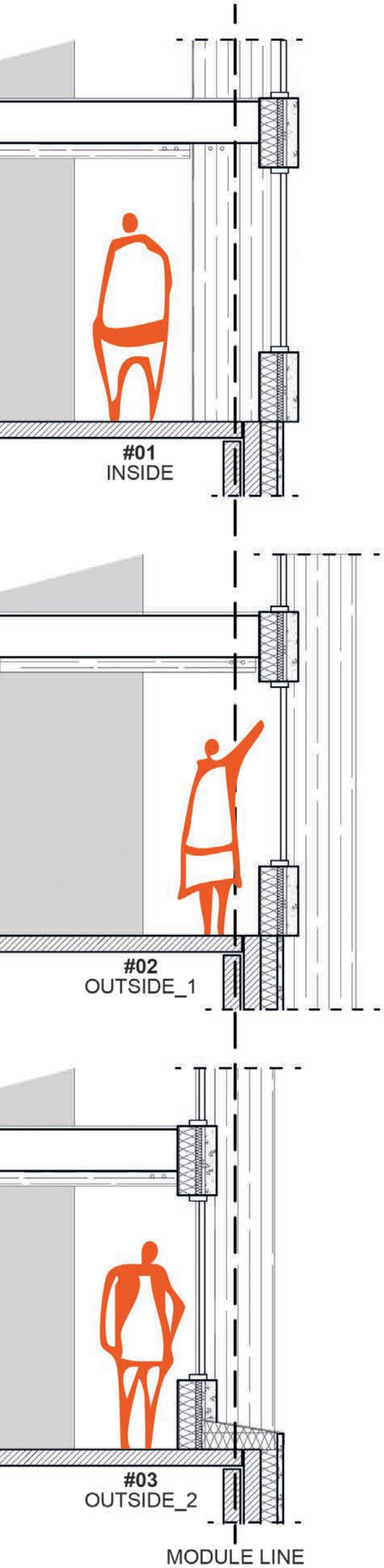


Fig. 090 / Section investigations

Conclusions regarding the structural system, specifically of columns and beams, as well as the morphological expression of extruded volumes from the façade, necessitate an exploration of how the structure is positioned in relation to the building envelope. The placement of the structural elements in relation to the outer wall, roof and floor, has interconnected implications for both energy efficiency, expression and spatial experience. These considerations have been explored through iterative studies in plan and section.

/ placement of column

The placement of the column is a critical consideration, both in terms of mitigating thermal bridging within the building envelope and in shaping the spatial and narrative qualities of the architecture. The sections illustrated in Figures #01-#03 on fig 90 present three primary scenarios explored in relation to the existing structural module and to each other. It is important to note, that the joints seen on fig. 91 are not final, but are meant to show the process of exploration.

In Iteration 01, the column is positioned entirely within the envelope, allowing it to be wrapped in a layer of insulation. This approach eliminates thermal bridging and integrates the column as a prominent interior element, acting as a spatial divider. However, this placement also renders the column invisible from the exterior, concealing its structural presence.

Iteration 02 adopts the opposite strategy, placing the column outside the envelope, making it a prominent feature of the exterior expression. This configuration maximizes the usable interior space while visually reinforcing a narrative of a healing structure stabilizing the existing building. However, because the column is not structurally connected to the existing framework, it results in material inefficiency, as it causes excessive use.

Iteration 03 seeks a balance between these two approaches. Here, the column is partially embedded, with its centre aligned with the structural module line and supported by the existing structure. While this reduces interior space due to the inward shift of the envelope, in order to add a layer of insulation inside of the column, the spatial loss is mitigated by the addition of the extruding volumes in the façade. This configuration preserves the expressive role of the column as a symbol of healing and resilience while improving structural efficiency. As a result, this iteration was selected for further development.

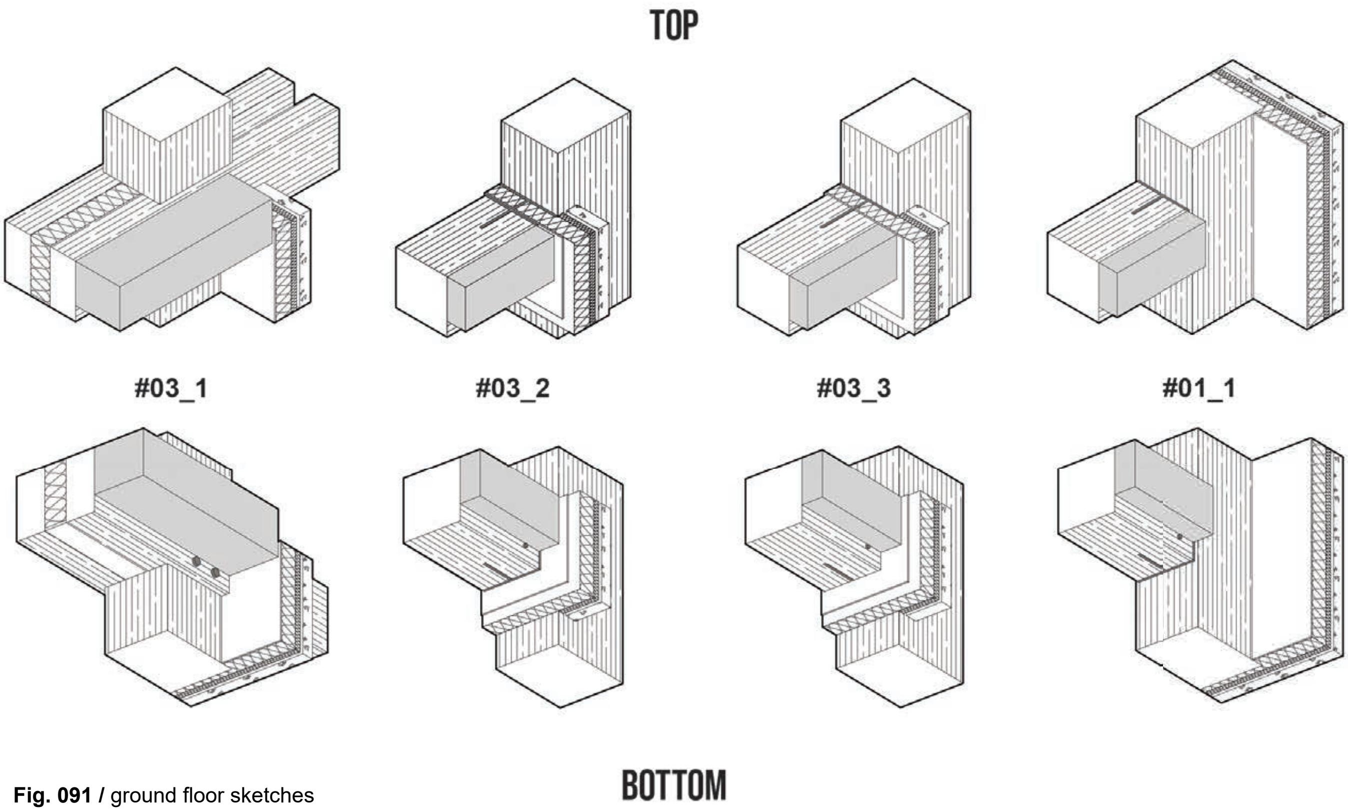


Fig. 091 / ground floor sketches

/ joints

Equally important to the placement of the column in relation to the building envelope is the connections between structural elements, specifically, the joints. This is particularly critical where exterior and interior elements connect. Consequently, investigations into column placement were conducted in parallel with joint detailing. These explorations focused on the joint's capacity to mitigate thermal bridging and expression. As with the sectional studies presented earlier, the joint iterations shown here are not final solutions but serve to illustrate the process of addressing thermal bridges.

Inspired by the narrative of an exposed, healing structure emerged a desire to visibly convey the method of assembly.

In Iteration #01_1, where the column is placed entirely within the envelope, thermal bridging is not a concern. However, in iteration #03, the focus shifts to the joining of an exterior glulam timber column and an interior beam of the same properties. In this joint, minimizing the contact surface between the two elements is crucial. If this is not done correctly, heat can easily transfer between the component, depending on material properties, leading to internal condensation and potential mold growth.

#03_1 utilizes a continuous beam split into half to reduce the surface contact between column and beam. However, as the beam is continuous, this effort becomes irrelevant. Iterations #03_2 and #03_3 utilise a steel fitting, acting as a spacer providing separation to install insulation in the gap. This way, surface contact is reduced to the thickness and height of the fitting, causing a very minimal heat conduction. As the conclusion regarding placement of the column resulted in exposed exterior columns, iterations #03_2 and #03_3 went to be further developed and explored.

Iteration #03_1 attempts to reduce surface contact by splitting a continuous beam into two. However, since the beam remains continuous from inside to outside, this approach proves insufficient. Iterations #03_2 and #03_3 introduce a steel fitting that acts as a spacer, creating a separation for installing insulation within the gap. This approach reduces the contact surface to just the thickness and height of the fitting, resulting in minimal heat conduction. Given that the conclusion regarding column placement led to exposed exterior columns, iterations #03_2 and #03_3 were further explored and developed.

DESIGN WITH DAYLIGHT

Ensuring the longevity in the renovation meant directly addressing the poor daylight conditions and energy inefficiencies of the original Soviet-era structure. Early daylight simulations revealed deep floor plates and limited façade exposure, resulting in underlit interiors and a heavy dependence on artificial lighting. These deficiencies not only affected occupant comfort but also increased operational energy demands. In response, the design process focused on improving daylight access through strategic architectural interventions: reorienting apartments, introducing larger and more appropriately placed openings, and reshaping the building's envelope to optimize solar exposure. Together, these interventions aim to reduce the need for electrical lighting and heating through increased daylight exposure and passive solar heating, contributing to a more resilient and energy-conscious building.

Taking these interventions into account, the daylight design aimed to increase spatial daylight autonomy (sDA) from 23.2% to at least 50%, with a corresponding increase in useful daylight illuminance (UDI) by at least 1.5 times. These targets were aligned with the minimum thresholds established by LEED v4.1, which considers an sDA of ≥ 55% [300 lux for 50% of the occupied hours] to be appropriate in residential contexts (LEED BD+C: Healthcare, no date).

In this project, a 5% reduction from the LEED threshold was accepted in design, reflecting the fact that the thesis addresses a partial renovation and reconstruction of an existing building. This context necessitates a hierarchy in design interventions. In line with a self-aware design approach, the thesis acknowledges that certain compromises, such as accepting slightly lower daylight performance, may be preferable to jeopardizing the broader structural renovation goals, particularly when considering the potential impact on overall CO_2 emissions.

These daylight-related improvements meant that the renovation of Block 82 needed not only to increase the amount of daylight, but also to ensure the quality and orientation of that daylight. A key goal was to mitigate the harsh glare and heat gain from the western sun, while maximizing morning and midday light from the east. In early design iterations, one strategy explored was to preserve the large void created by the bombardment, effectively shaping the building into a south-facing U-shaped floor plan. This configuration aimed to draw more daylight into the building's core. However, this solution was not pursued further, as it would have required constructing significant new portions of the eastern façade from scratch. Such an approach conflicted with the project's fundamental premise: to build upon and reuse the existing structural framework as much as possible

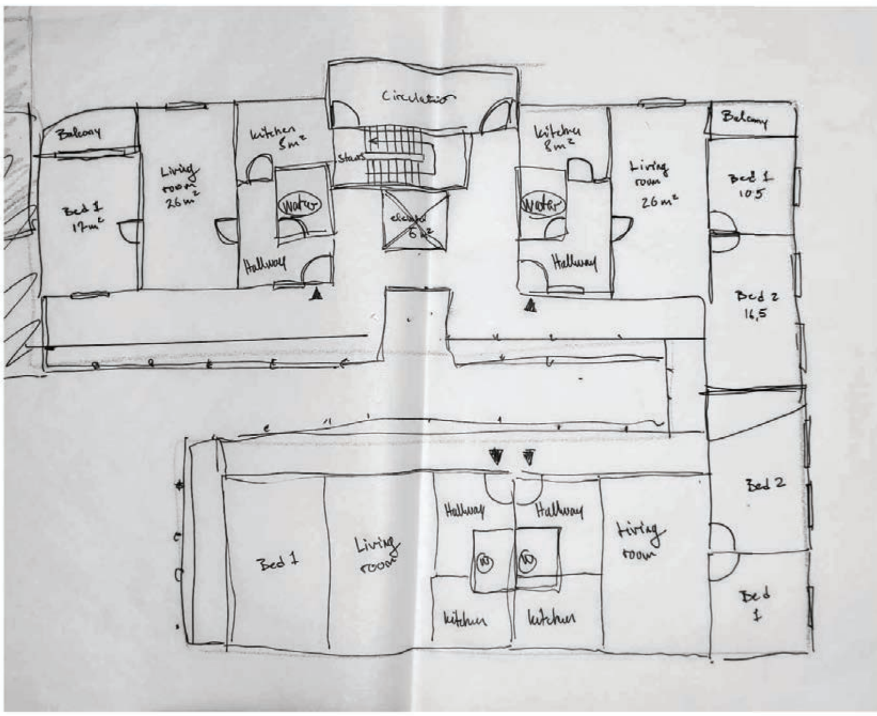


Fig. 092 / Daylight optimization idea

Inspired by the bay windows of the Salk Institute, a new design strategy introduced protruding volumes embedded into the existing east façade. These bay windows were intended to capture more southern light, reflecting it deeper into the interior and softening it to create a more diffused, ambient daylight quality. Multiple iterations of these volumes were developed—not only to evaluate their daylight performance, but also to assess their architectural impact. Given their prominence, the bay windows would significantly influence the character and identity of the east façade, making both functional and aesthetic considerations equally important in their design.

Each bay window iteration was tested using a simplified reconstruction of a single apartment, the southeast unit, as a reference case. This allowed for focused, comparative analysis of daylight performance and spatial usability. Through this process, the trapezoid-shaped bay window was selected as the most balanced solution. It offered a compromise between enhanced daylight conditions and functional interior space, whereas other shapes with sharp or irregular corners created areas that were impractical or unusable in a real-world setting.

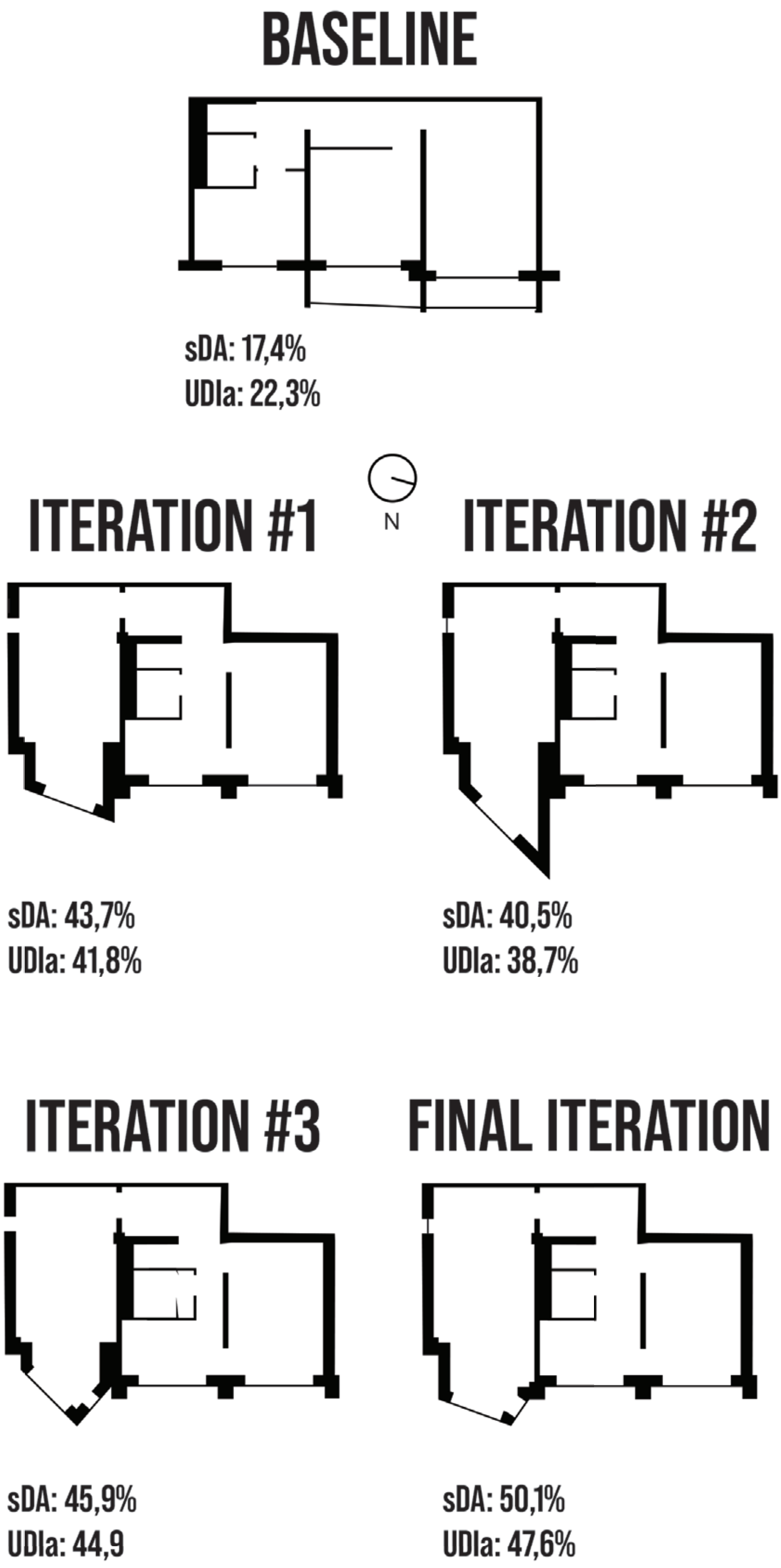


Fig. 093 / Daylight optimization models

SUMMARY

Designing for sustainability inherently means designing for longevity. Here, this chapter has explored the question of ensuring longevity through three interrelated design processes: Adaptability, thermal performance and daylight optimization.

From a theoretical foundation rooted in metabolic and cyclical approaches to architecture, the renovation of Block 82 is envisioned not as a something static or binary, but rather as a procedural repair, where phases in renovations should allow for there to be different stages of "finished", subsequently addressing the factor of time. Although constructed in concrete with a retrofitted, pre-existing plate structure, the design refers to reprogrammable spaces, allowing the building to adapt to evolving needs over time. Thermal optimization has been addressed through a strategic placement of columns in combination with thermally efficient joints, which ensure reduced thermal bridging while still maintaining the architectural expression of having the structural system visible throughout the building. Lastly, enhanced daylighting strategies, including reoriented layouts and integrated bay windows, aim to elevate both environmental performance and user comfort throughout the interior. In answering the question "How do we design for longevity", these are the key considerations:

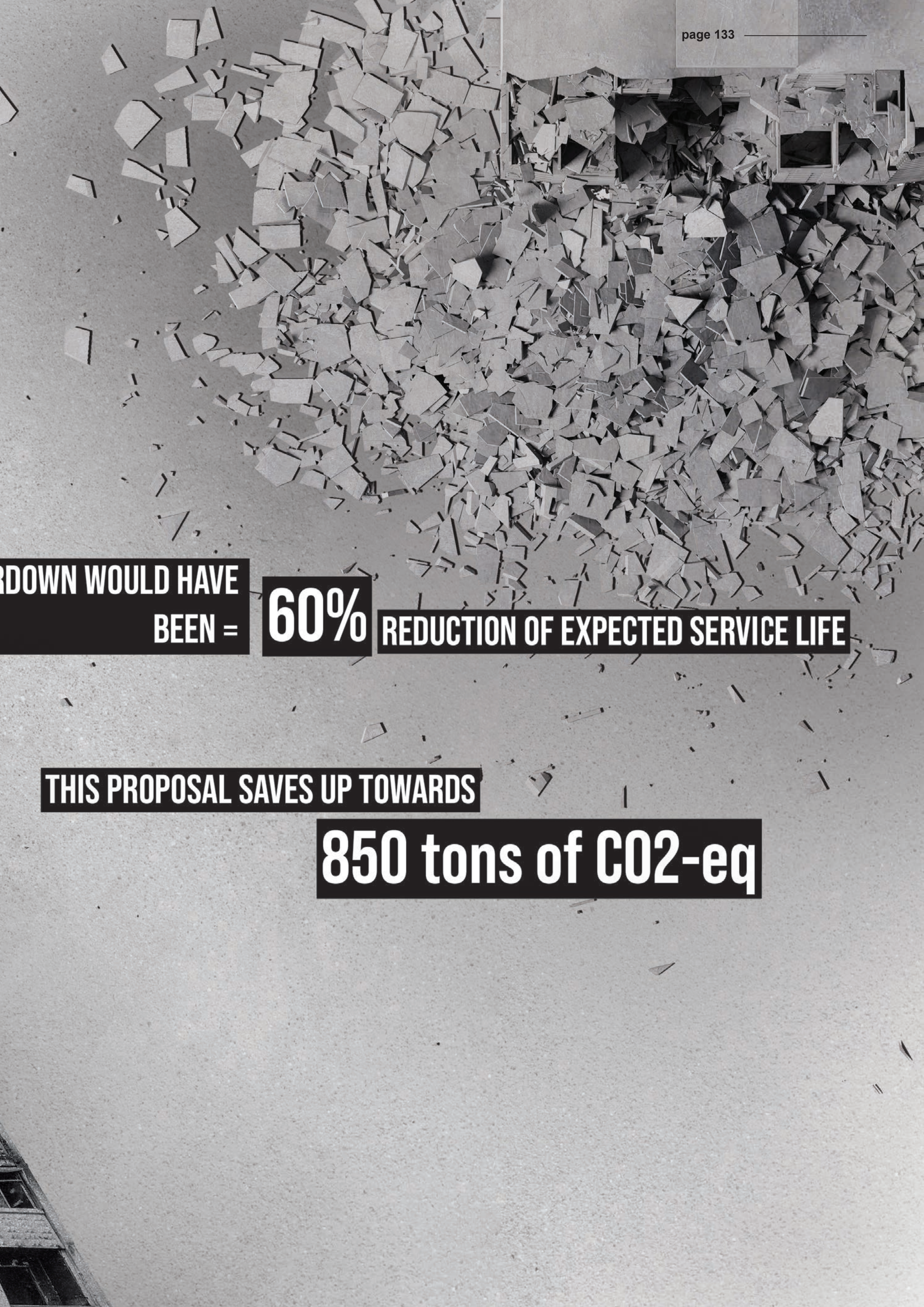
- The renovation of Block 82 is not binary, but a continuous process, defined in phases of construction.
- Use a flexible structural system (columns and beams) to avoid reliance on fixed load-bearing walls.
- Reimagine the ground floor as a permeable and publicly engaged space.
- Minimize thermal bridging where it counts, in joints and in placement of large, homogenous elements such as columns.
- Reduce energy demand while balancing spatial usability and architectural expression by optimizing daylight through targeted façade interventions, such as integrated bay windows.

DESIGN PROPOSAL

FOR THE RESTORATION OF BLOCK 82

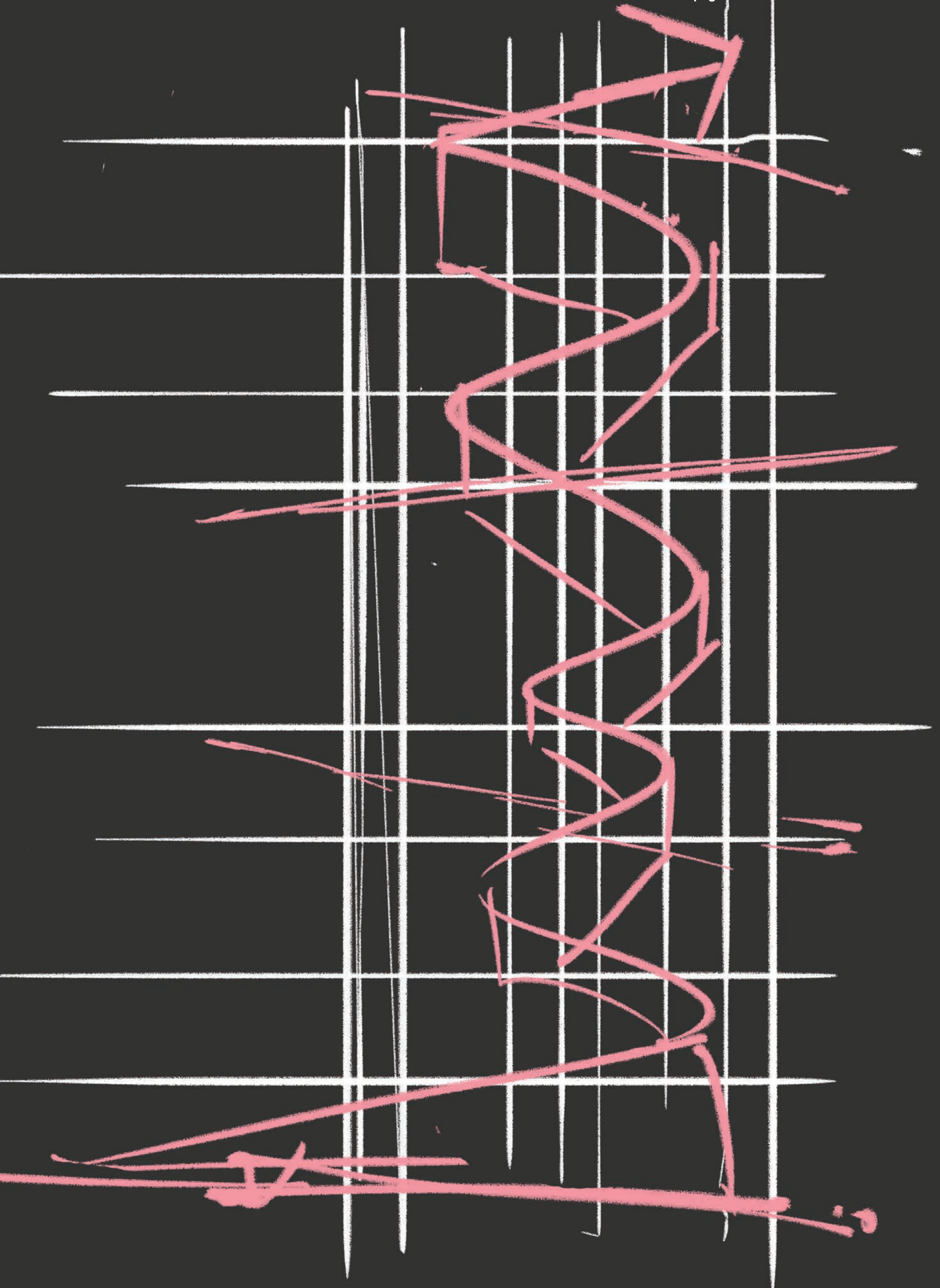
The Russian invasion of Ukraine has caused severe damage, particularly in Kharkiv and the neighbourhood of Northern Saltivka, due to its proximity to the Russian border. Many apartment blocks have been severely damaged, leaving the residents without homes. The large concrete panel apartment blocks that dominate this area have already emitted a considerable amount of carbon during its construction. Simply demolishing these structures will reduce their expected service life substantially, leading to waste of the embodied carbon. This presentation offers an alternative to that outcome, with a design proposal for the rebuild of Block 82 on Natalii Uzhvii Street.

TEAR


RDOWN WOULD HAVE
BEEN =
60%
REDUCTION OF EXPECTED SERVICE LIFE
THIS PROPOSAL SAVES UP TOWARDS
850 tons of C02-eq

The parti of this project emerges from the intersection of damage, memory, and renewal. Rather than erasing the scars of conflict, the design embraces them as integral to the architectural narrative, transforming what remains into a foundation for future life. The core vision is to work with the existing structure, not against it: to frame ruin as potential, not as failure. This approach is reflected in a clear formal strategy: retaining the structural rhythm of the original block while introducing new elements that afford adaptability and repair.

Fig. 095 / Parti



The connection between Block 82 and its surrounding context has been significantly enhanced through improved accessibility and openness. New entrance areas on both the eastern and western sides of the building promote accessibility and inclusivity by addressing height differences with integrated ramps, stairs, and seating. On the eastern side, the entrance opens to a large public park, where remnants of rubble from the site's past destruction have been woven into the urban fabric, creating spaces for recreation, play, and relaxation. The ground floor has been transformed into a public space, where the former apartments have been replaced and renovated to accommodate functions such as a kiosk, an institution, and communal areas for larger gatherings.

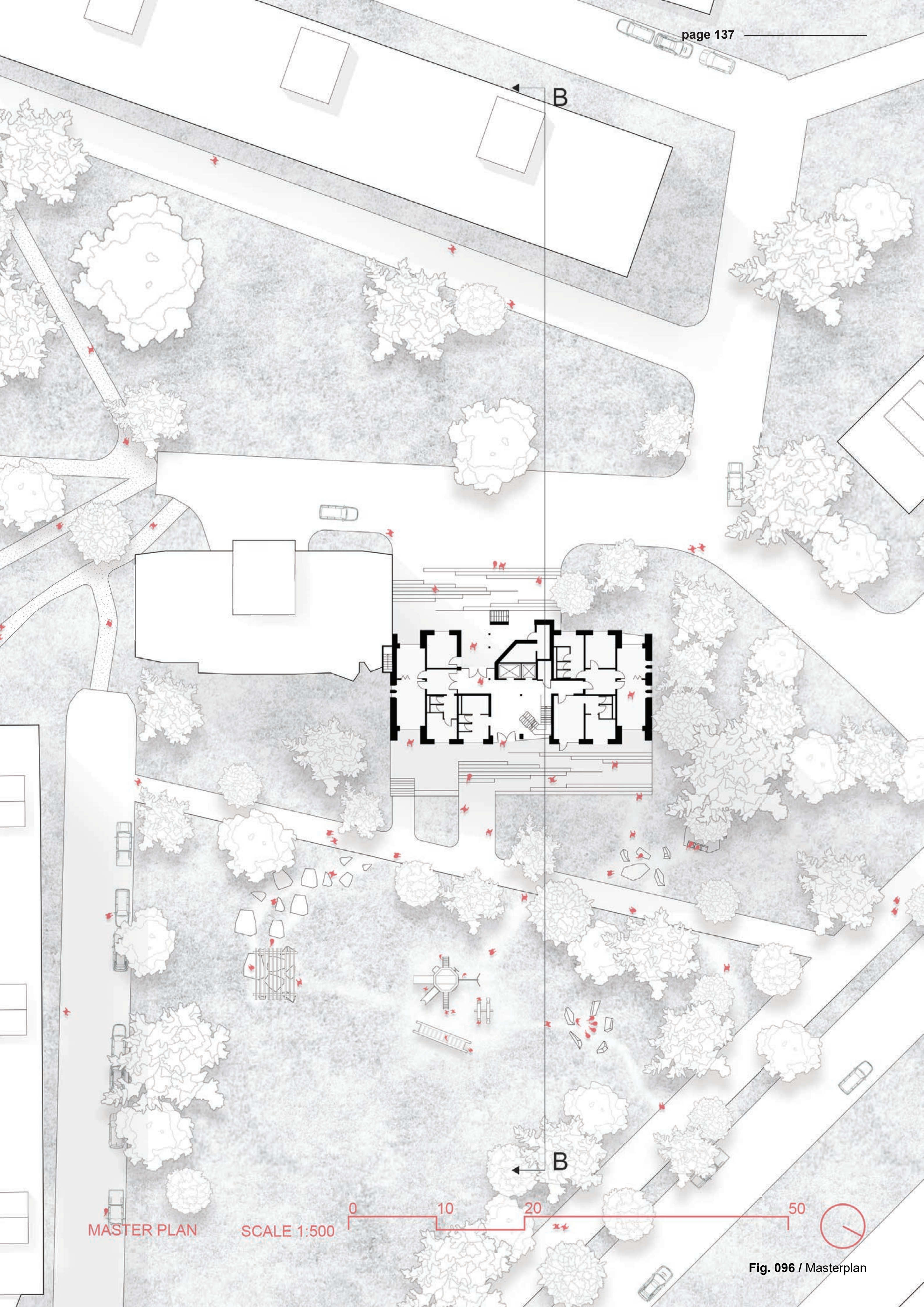
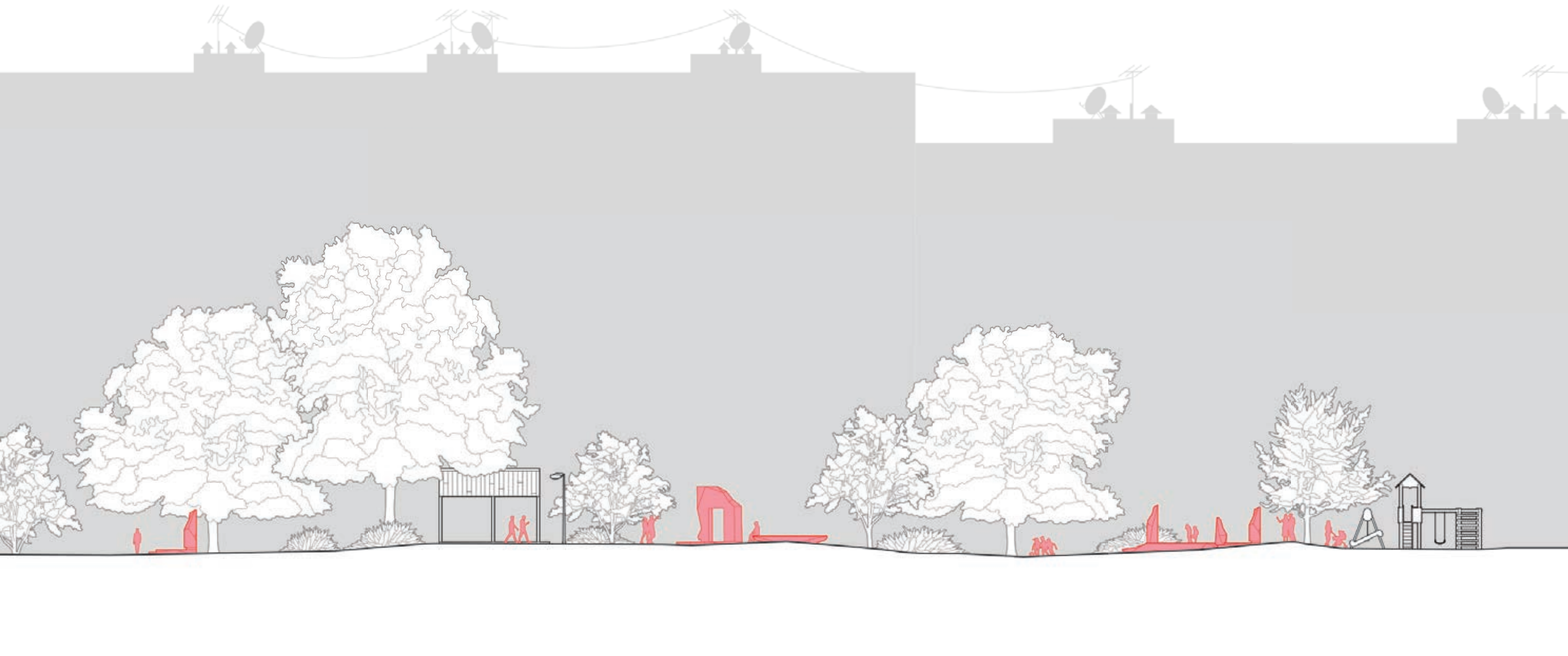


Fig. 096 / Masterplan



URBAN SECTION B-B

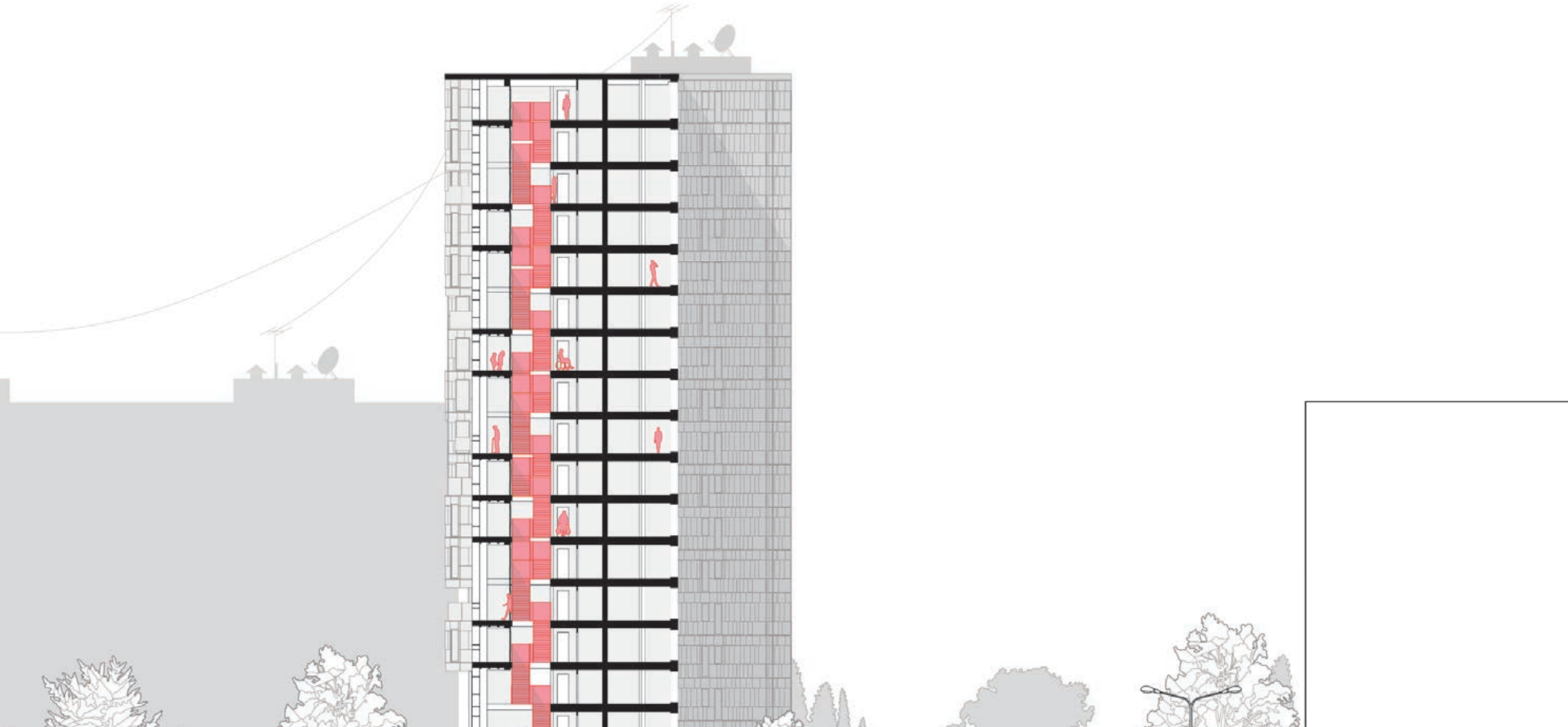
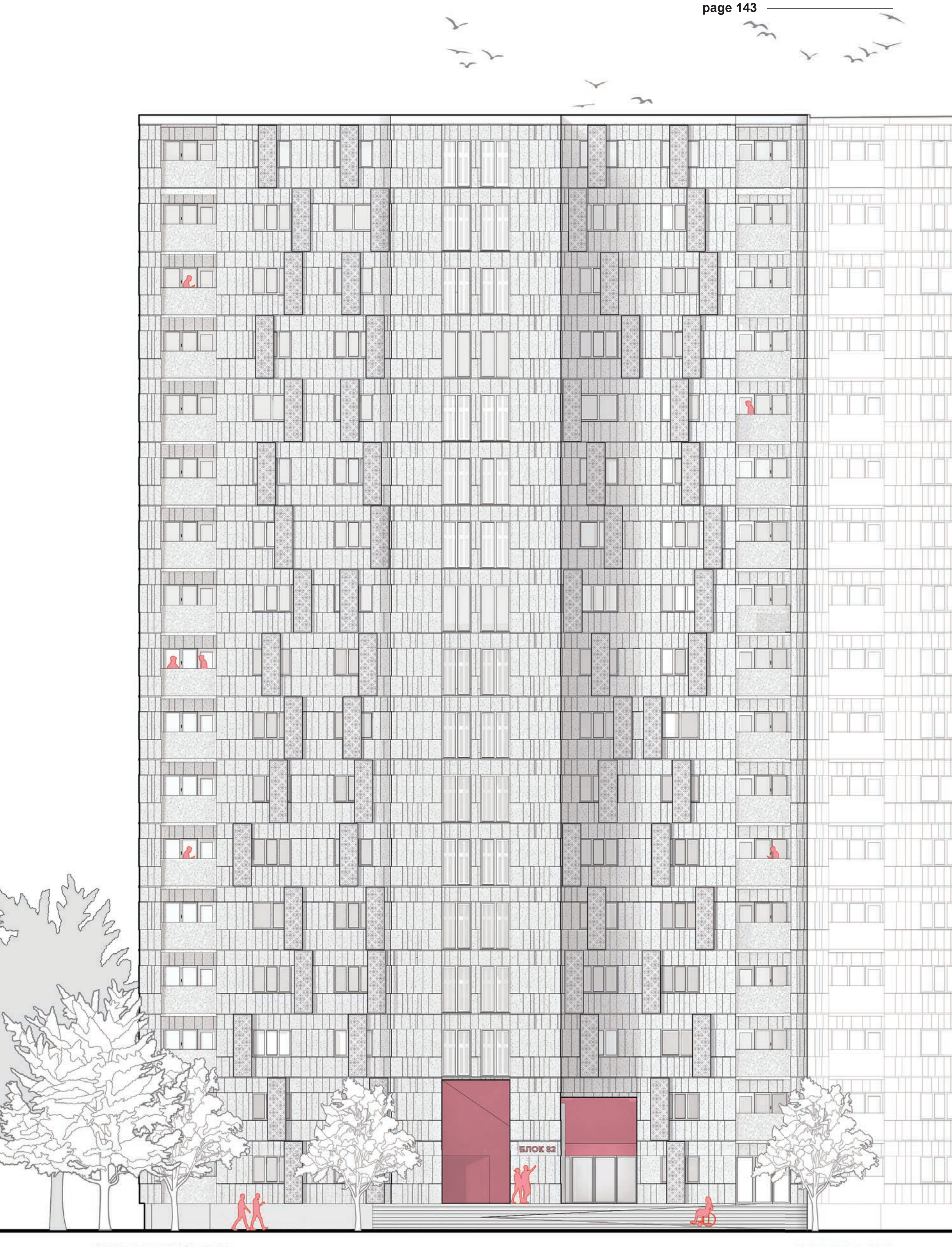


Fig. 097 / Urban section 1:500

Fig. 098 / Render outside

Fig. 099 / East elevation



WEST ELEVATION

SCALE 1:200

Fig. 100 / West elevation

Fig. 101 / Render outside

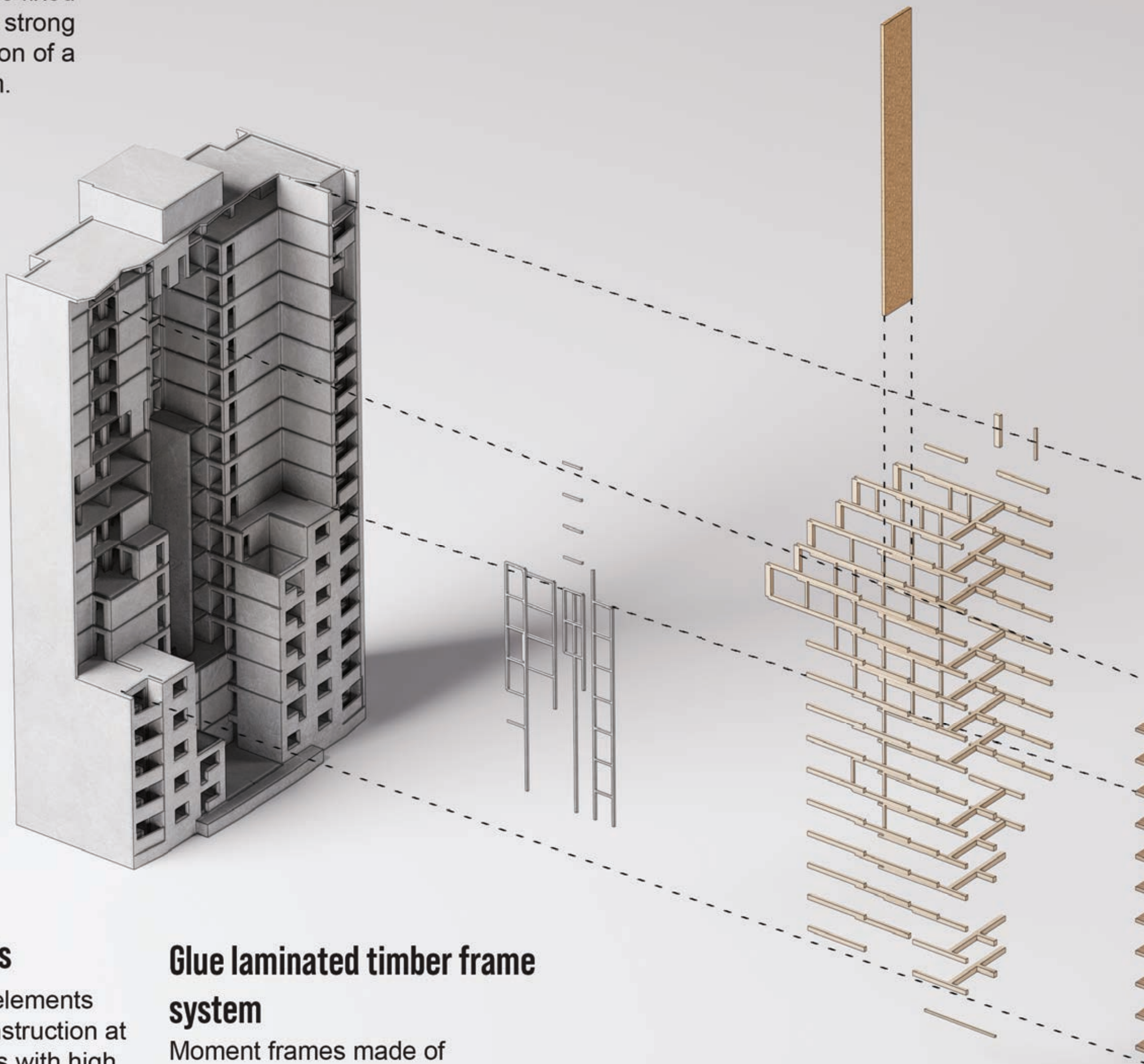
Fig. 102 / Render outside

The extruding volumes presents an explosive morphology, as the façade becomes a narrator of the past, telling the story of what happened to Saltivka and Block 82, while offering a variety of indoor and outdoor spaces for its residents. The existing exterior walls have been optimized and clad with new concrete panels made from rubble debris. The materiality and varying shades of the facade echo the surrounding buildings, preserving the contextual heritage of Saltivka. At the centre of the eastern façade, an interplay between the windows and rubble panels forms a visual of a scar, marking the point of impact of the attack, from where new life and community emerges.

New shutters embossed with Ukrainian embroidery motifs have been integrated into the western façade, facilitating solar shading to lower cooling in summer while celebrating cultural heritage.

Block 82 remnants

The remaining parts of Block 82 are reused as a stable base for the overall structural integrity of the repaired structure. Since all elements in the block are fixed together, they provide a strong foundation for the addition of a more rigid frame system.



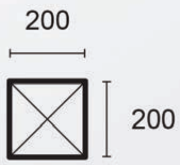
Concrete components

200x200 mm concrete elements replace the wooden construction at structurally critical points with high loads.

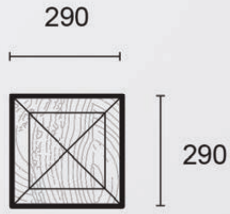
These concrete components are made using recycled aggregate from the destroyed parts of the building, significantly reducing CO_2-equivalent emissions.

Glue laminated timber frame system

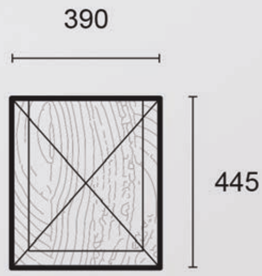
Moment frames made of glue-laminated timber replace the old wall system of Block 82. All elements are fixed together to create a unified and stable structural system.



Concrete columns



GLT interior column



GLT beam

CLT wall

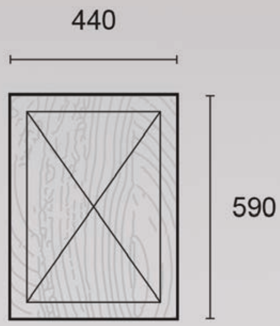
A CLT wall penetrates the wooden frame, helping the structure resist lateral forces.

Joist / flooring

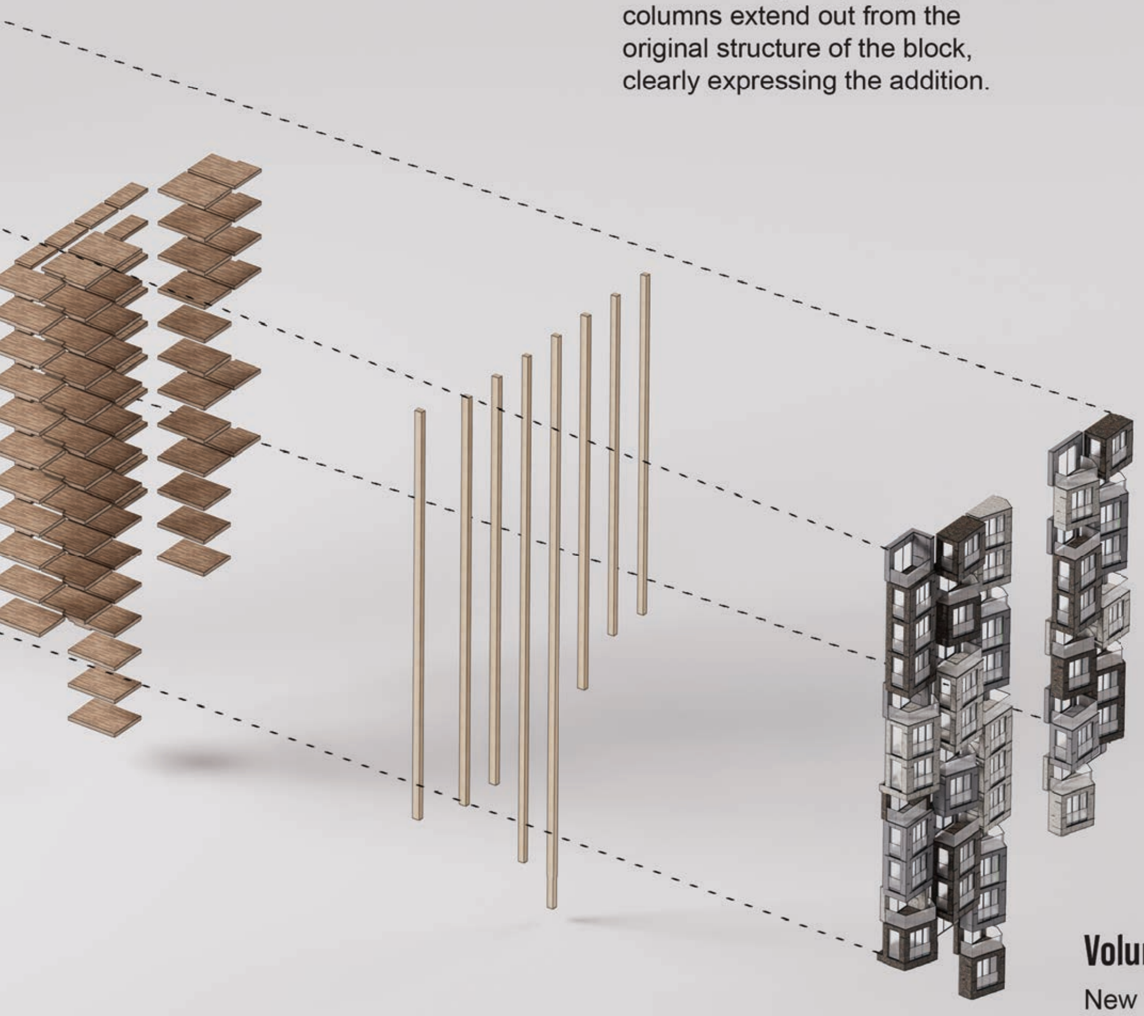
Flooring with joists ties the wooden frame system together, increasing stiffness and overall structural integrity.

Large exterior GLT columns

In the building's façade, large GLT columns extend out from the original structure of the block, clearly expressing the addition.



GLT exterior column



Volumes

New volumes that emerge through the exterior GLT columns offer residents more floor area and improved indoor environments.

These extensions are clad with panels made from recycled concrete.

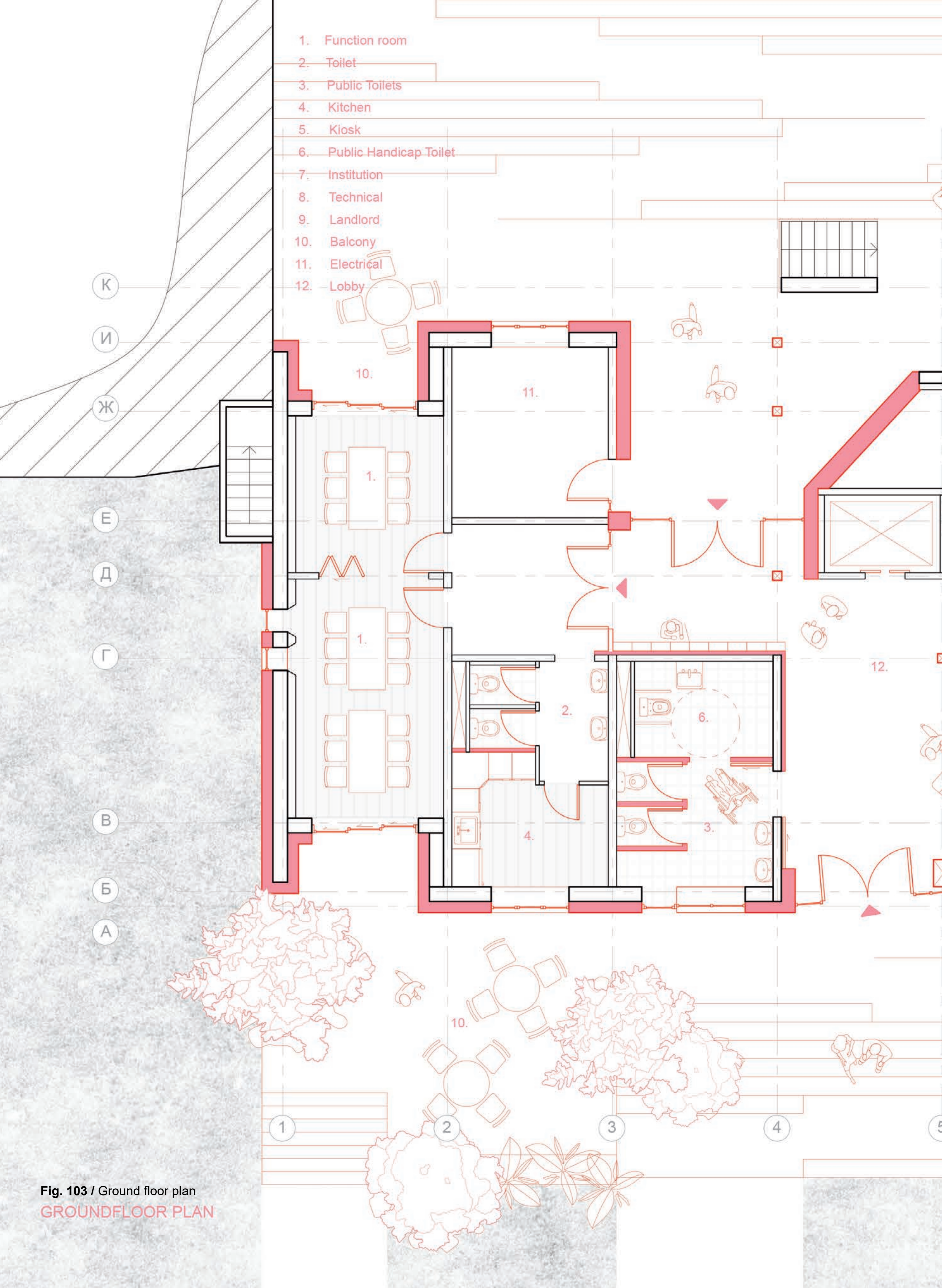
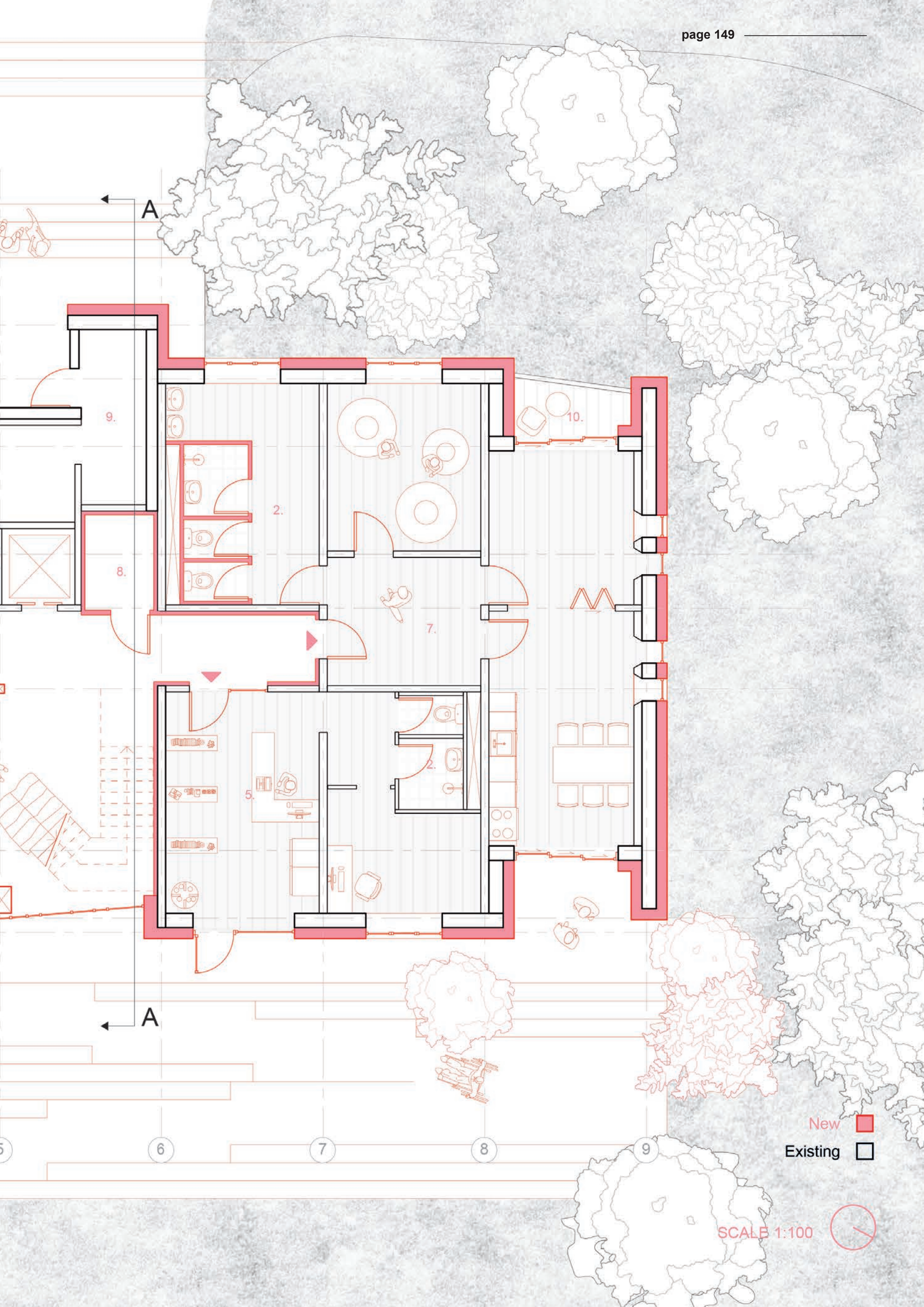


Fig. 103 / Ground floor plan

GROUNDFLOOR PLAN


A
9.
10.
2.
8.
7.
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2.
A
5
6
7
8
9
New
Existing
SCALE 1:100

column shoe concrete column /
concrete floor joint
section 1:30

Fig. 104 / Render staircase

/ recycling concrete

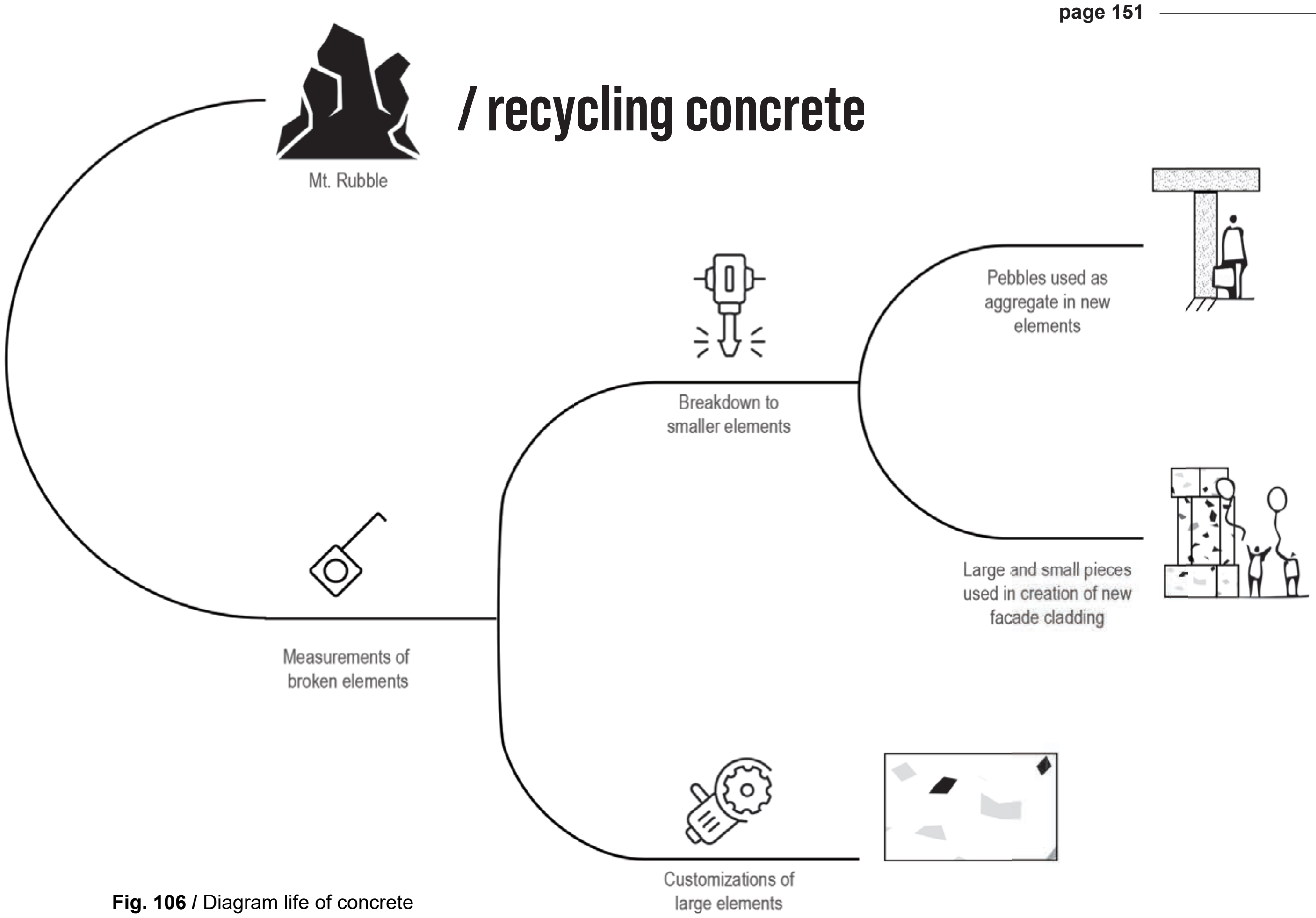
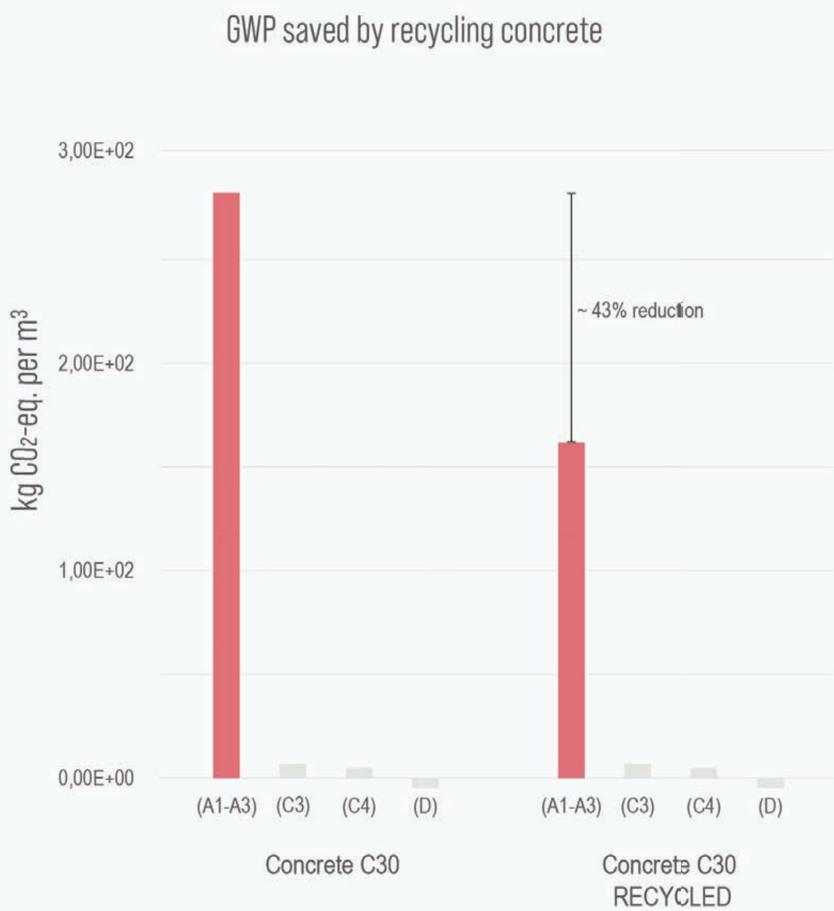


Fig. 106 / Diagram life of concrete

Fig. 105 / Diagram GWP savings



The smaller mountain of rubble and larger remnants of concrete at the foot of Block 82 are recycled into various components based on size and material demand.

Larger fragments, which would be difficult to transport or break down, are repurposed into architectural features that act as pillars in the public space of the microdistrict—serving as places to meet, rest, or gather, and embedding the memory of the building into the everyday life of the community.

Medium-sized pieces are reused directly in new façade cladding panels, enhancing the building's thermal performance and helping to reduce energy consumption. These panels also serve to shield and prolong the lifespan of the existing structural walls that survived the attack.

Smaller fragments are crushed into aggregate and used in the production of new concrete components, replacing virgin material and significantly reducing the building's embodied carbon footprint.

Fig. 107 / Render stairs

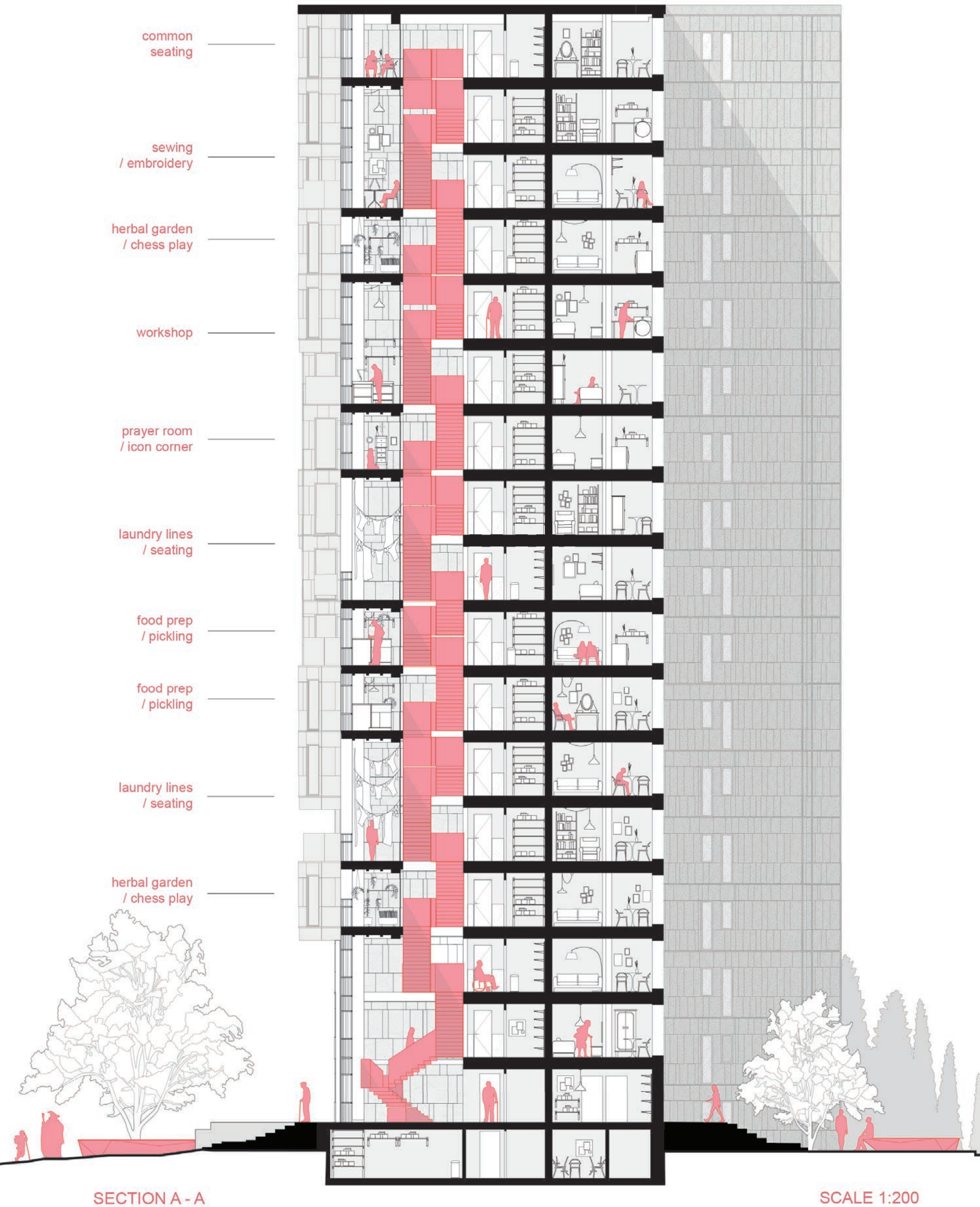


Fig. 108 / Section

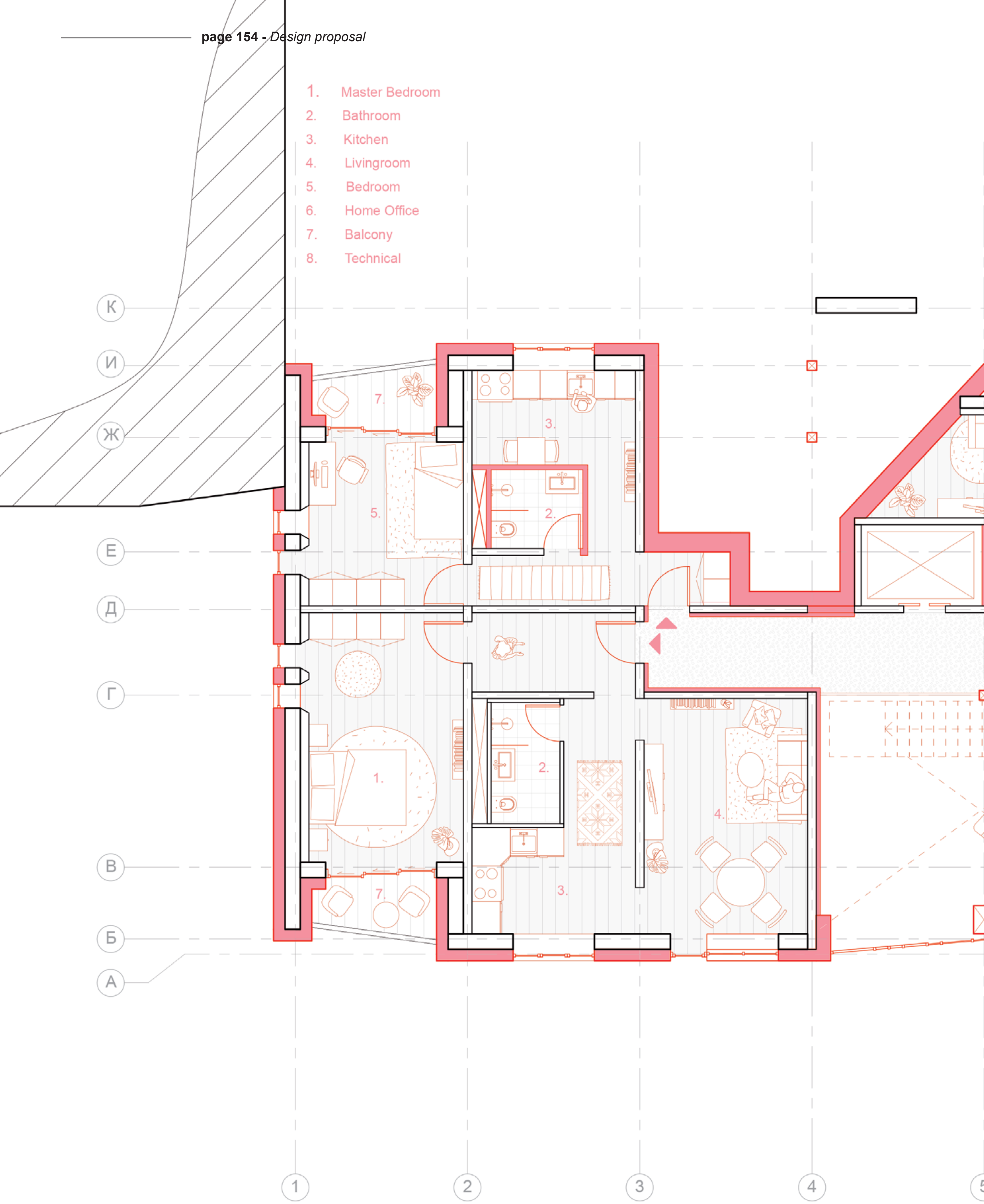
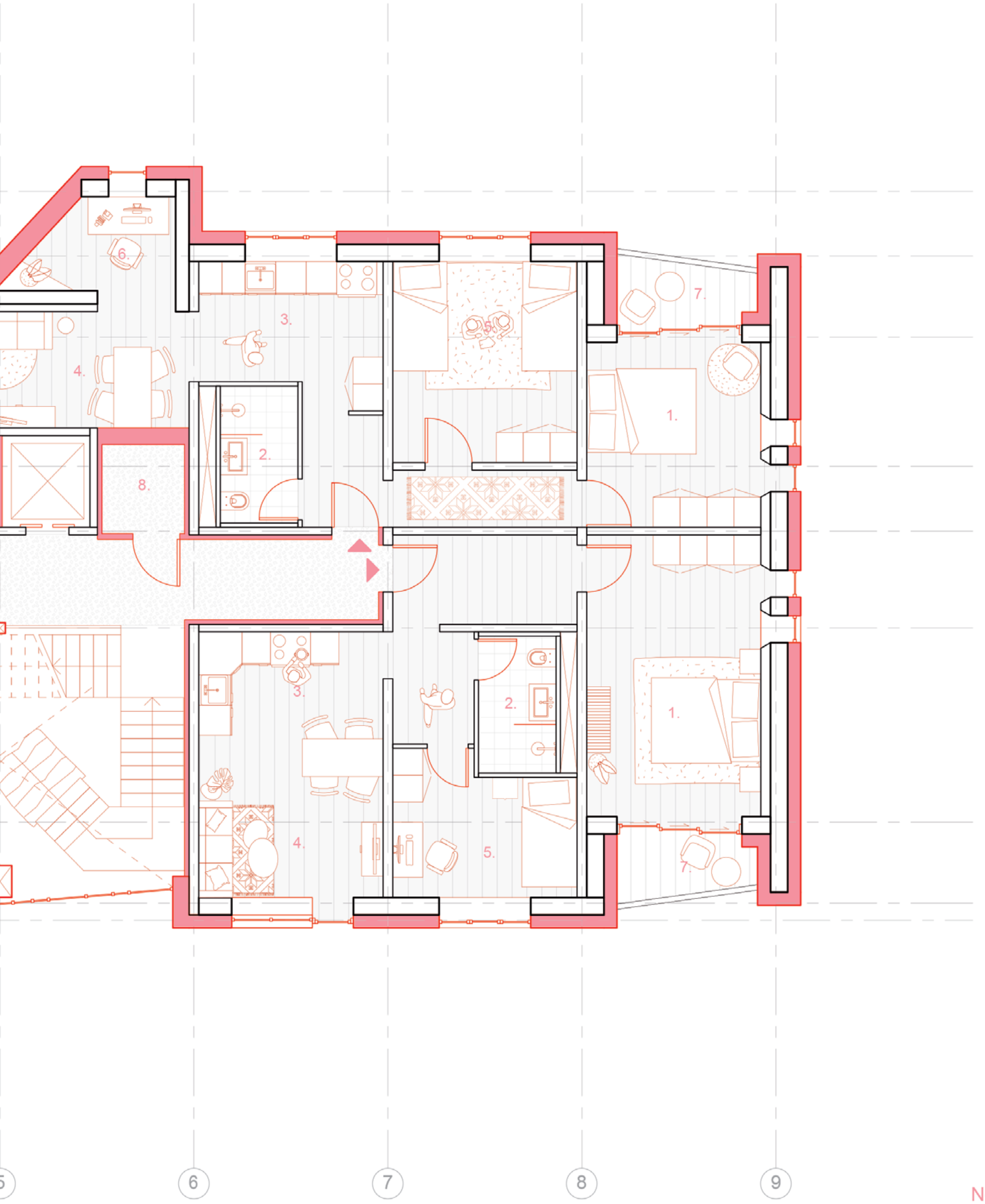


Fig. 109 / First floor plan

FIRST FLOOR PLAN



New

Existing

SCALE 1:100

Fig. 110 / Render outside

A variety of community spaces emerge along the circulation in the eastern façade, towards the public park. These spaces offer a range of activities such as carpentry, chess, gardening, and embroidery, while also accommodating practical functions like laundry. These environments provide spaces for the residents to meet intergenerationally, fostering social relations within Block 82.

Fig. 111 / Render community

Fig. 112 / Render community

The implementation of a new structural system, consisting of moment frames of glulam (GLT) beams and columns, fosters flexibility in the floor plan by reducing the need for loadbearing or stabilizing walls. The remaining construction consists of prefabricated timber elements, which are craned into place and installed within and between the moment frames. Floor decks, partition walls and exterior walls are installed as separate components, while the extruding volumes are pre-assembled and installed in its entirety onto the exposed timber columns in the façade as extensions. This method reduces on-site labour, shortening the time of construction and enables faster rehousing of displaced residents.

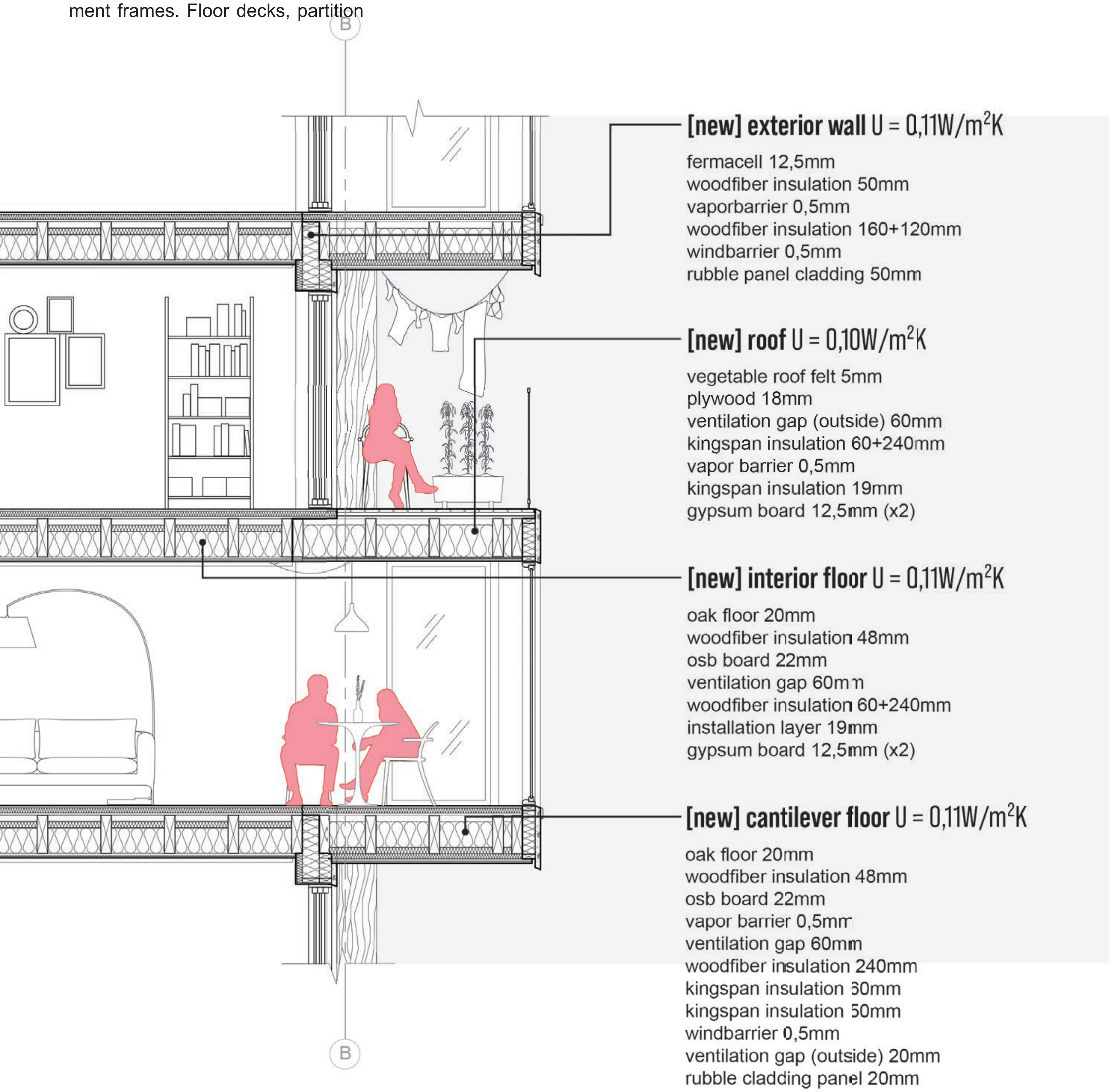
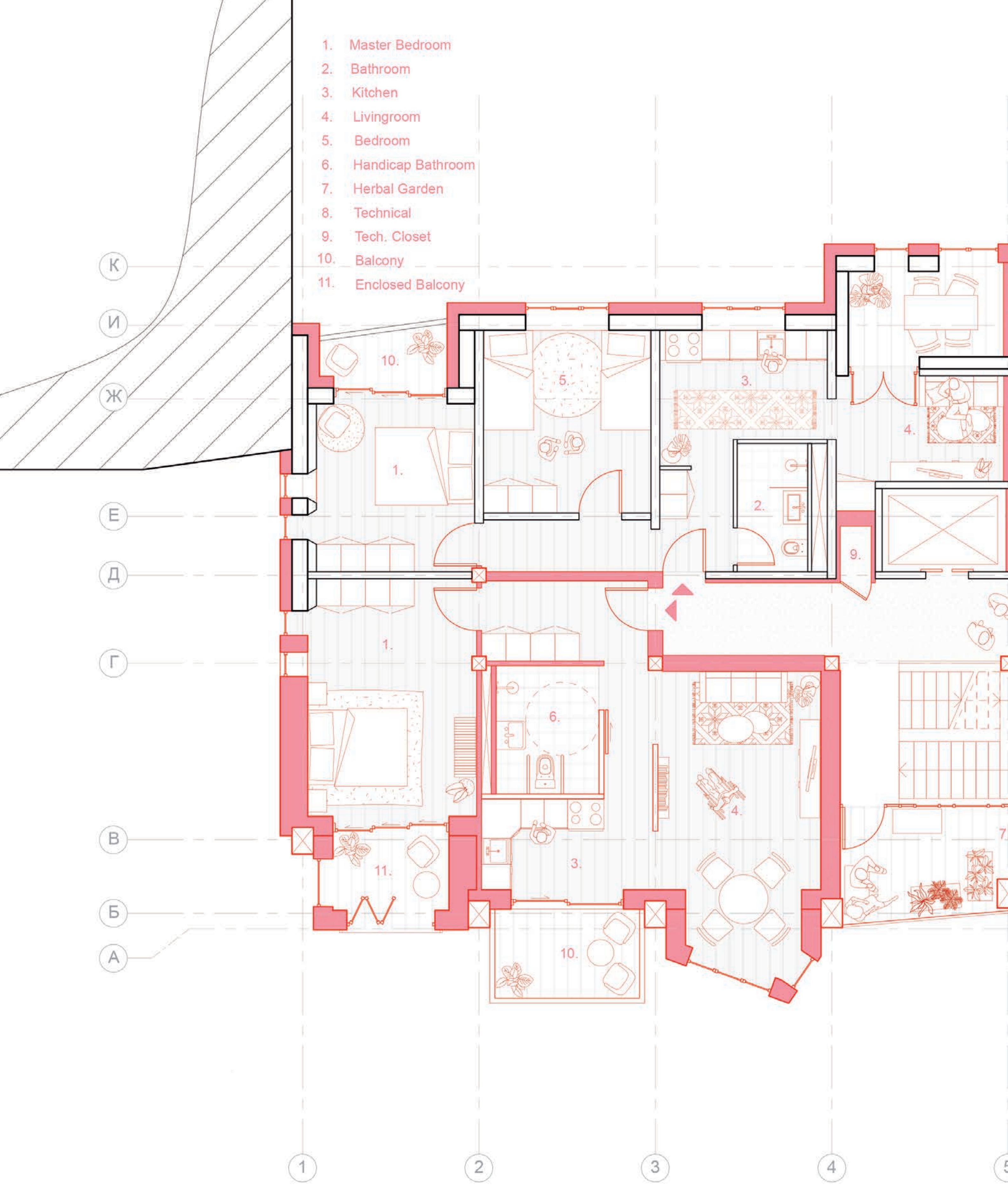


Fig. 113 / Detail section

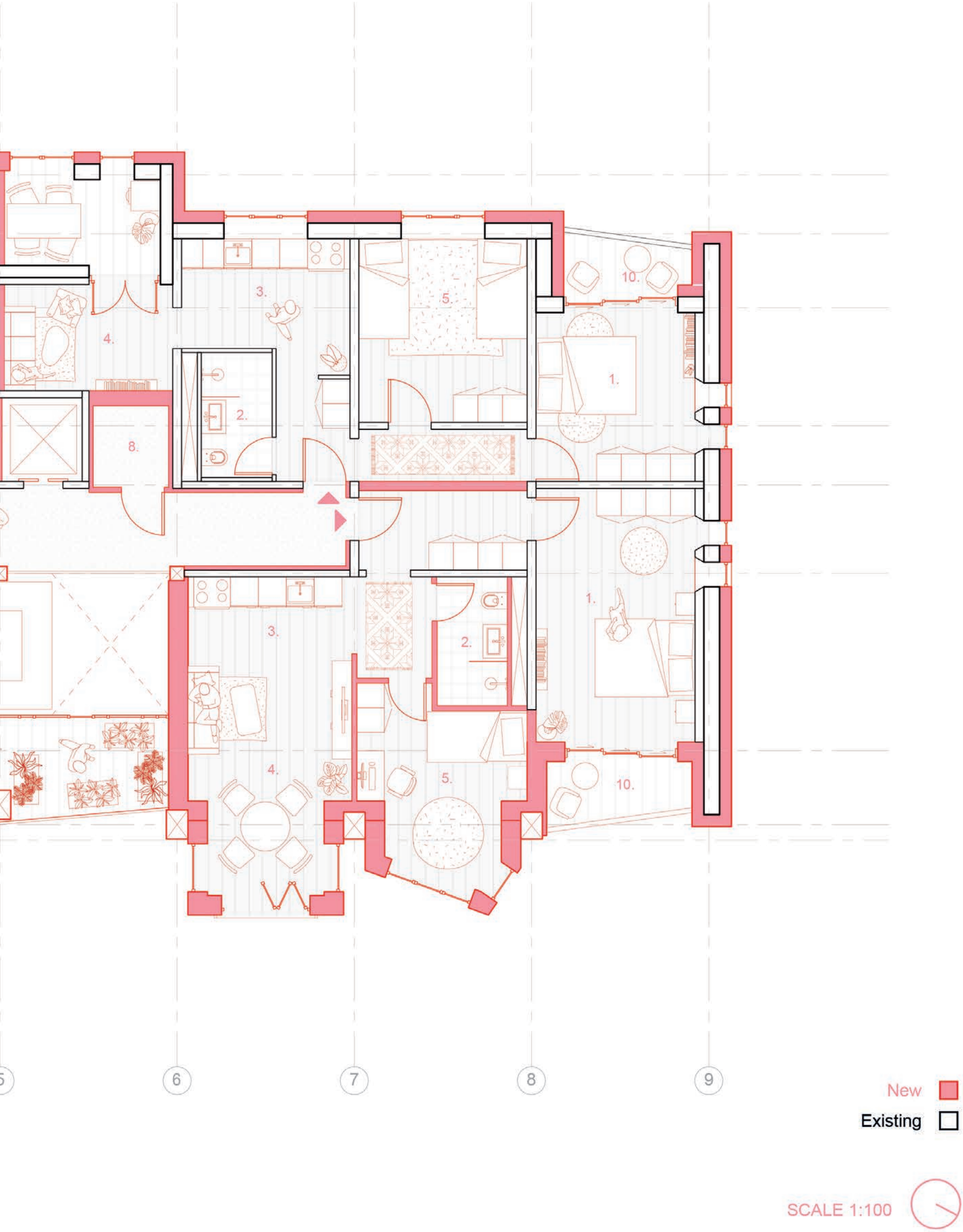
DETAIL SECTION

SCALE 1:50

Fig. 114 / Render balconies



TYPICAL FLOORPLAN


10.
3.
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New
Existing
SCALE 1:100

Fig. 115 / Render hallway

Fig. 116 / Render kitchen

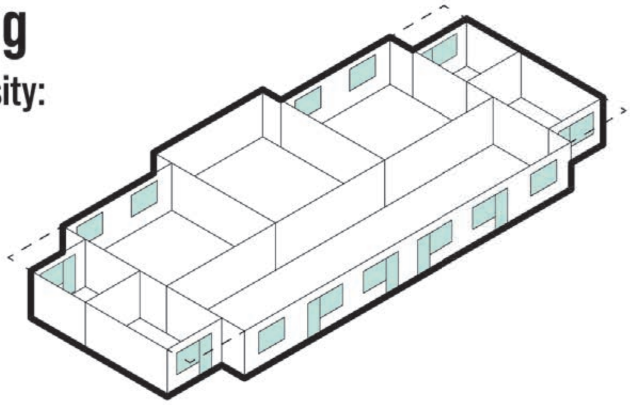
Fig. 117 / Render kitchen

ENERGY

By post-insulating the existing façade, installing new windows, and building a new construction that followed low-energy U-value standard, Block 82's Energy Use Intensity (EUI) has been reduced from 179 kWh/m²/year to 49 kWh/m²/year. This represents a total 73% decrease in energy consumption, targeting the significant problems the original construction had, especially concerning heating demands and heat loss.

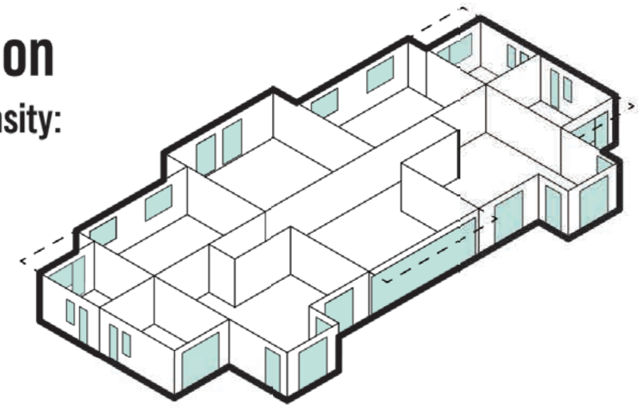
Pre-existing

Energy Use Intensity:
179 [kWh/m²/yr]



Optimization

Energy Use Intensity:
49 [kWh/m²/yr]



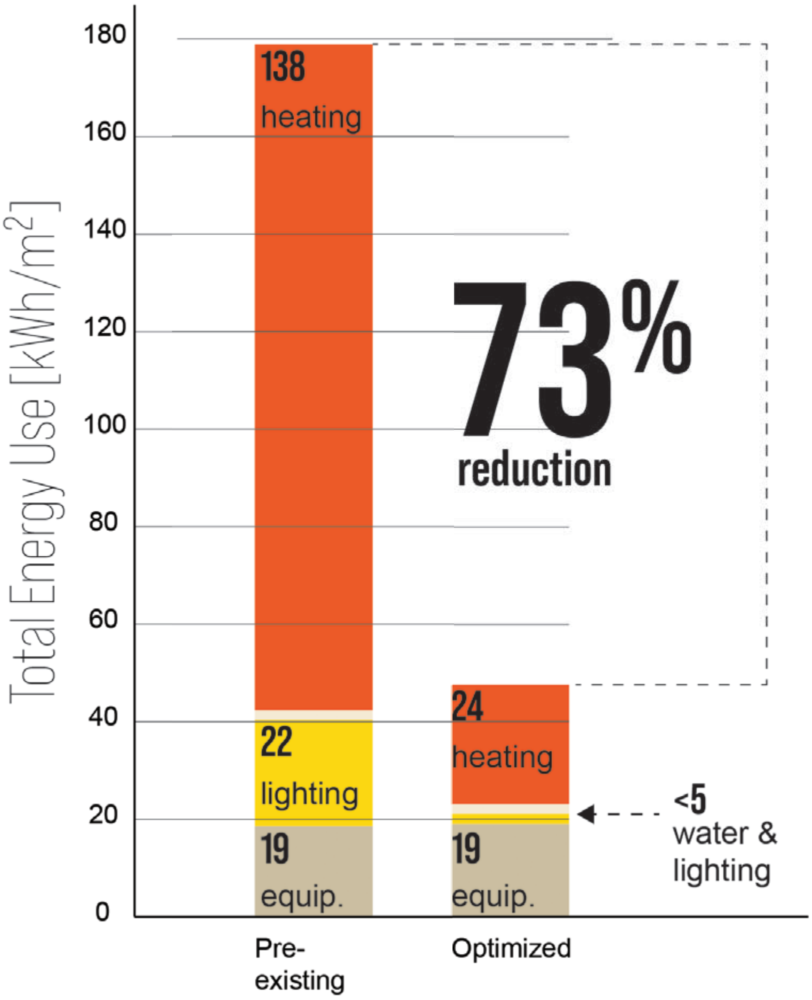
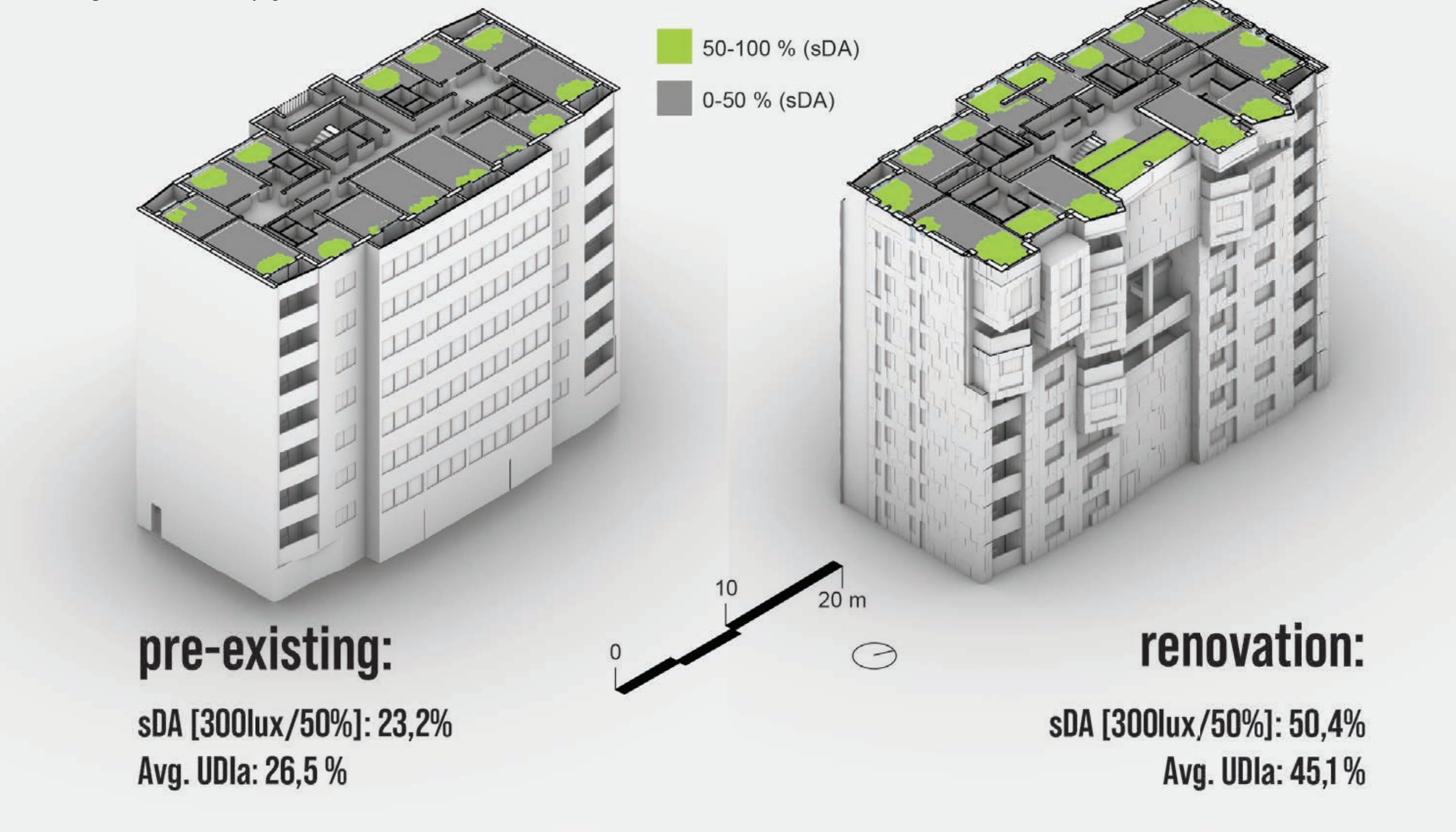


Fig. 118 / Total energy usage

Soviet-era concrete panel residential blocks, such as the one Block 82 originally was, are widely characterized by thermal bridging in its construction, modest insulation and single-glazed windows resulting in high energy consumptions and significant heat loss through the construction's envelope. These types of constructions often greatly exceed modern standards in terms of energy use intensity (EUI), with values often reaching beyond 150 kWh/m²/yr. With Block 82, this is no exception, although certain characteristics for the pre-existing energy model have been revised. Here, more limited values for certain elements such as windows with a U-value of 3,6 W/m²K instead of 6 have been used in combination with a more modest infiltration rate. This approach has been taken to evaluate the results based on a scenario where the baseline construction has already undergone some level of maintenance and informal upgrades since its original establishment in the Soviet era.

Fig. 119 / Render bedroom

Fig. 121 / Models daylight



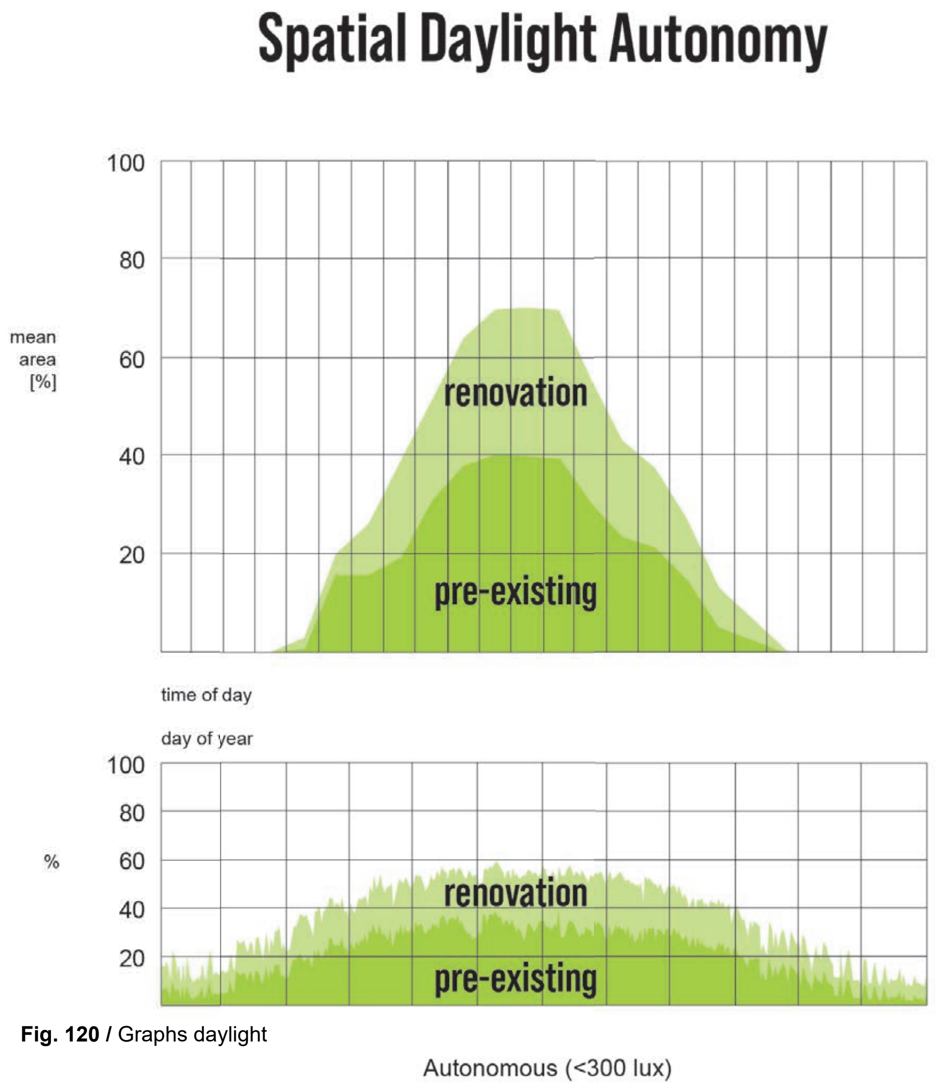


Fig. 120 / Graphs daylight

The renovation of Block 82 demonstrates the project's efforts to address the significant daylighting deficiencies that existed within the pre-existing Soviet-era construction. The increase in spatial daylight autonomy (sDA) from 23.2% to 50.4% reflects a substantial improvement, showing that more than half of the regularly occupied areas now receive sufficient daylight (at least 300 lux) for at least 50% of occupied hours, as compared to less than a quarter in the pre-existing construction. Similarly, the rise in Useful Daylight Illuminance (UDIa) from 26.5% to 45.1% indicates not only greater daylight availability but also better daylight quality, with levels that support occupant comfort by avoiding excessive glare or under-illumination. Overall, these improvements not only demonstrate a general increase in daylight, but also reflects a deliberate effort to introduce useful daylight into the building while carefully managing its intensity.

Fig. 122 / Render livingroom

The project is designed to be constructed in phases, enabling the rapid rehousing of a significant portion of Block 82 as early as possible. This phased approach supports the faster rehabilitation of both the building and the surrounding district, allowing the process of recovery to begin sooner. With many Ukrainians currently displaced and without stable housing, the opportunity for early return holds profound significance—offering not only shelter, but also a sense of stability and continuity.

PHASE 01

Ensuring structural integrity

The first phase of reconstruction focuses on stabilizing the existing structure. This is achieved by introducing a hybrid beam and column construction system combining glulam (GLT) and concrete elements, as well as stabilizing CLT wall elements. During this phase, new decks, circulation and elevators are also incorporated.

PHASE 02

Renovation, optimization & partly rehousing

The second phase involves renovating and optimizing the existing structure and building envelope. This includes refurbishing and transforming the existing apartments, as well as adding insulation to walls and decks to ensure a reasonable indoor climate. Once this is complete, some of the displaced residents can return to Block 82.

PHASE 03

Adding new apartments and community spaces

The third phase of the reconstruction focuses on adding new apartments built with prefabricated timber elements. It also introduces new community spaces for residents to enjoy together. This phase accommodates the remaining displaced residents, resulting in a fully functional and restored building

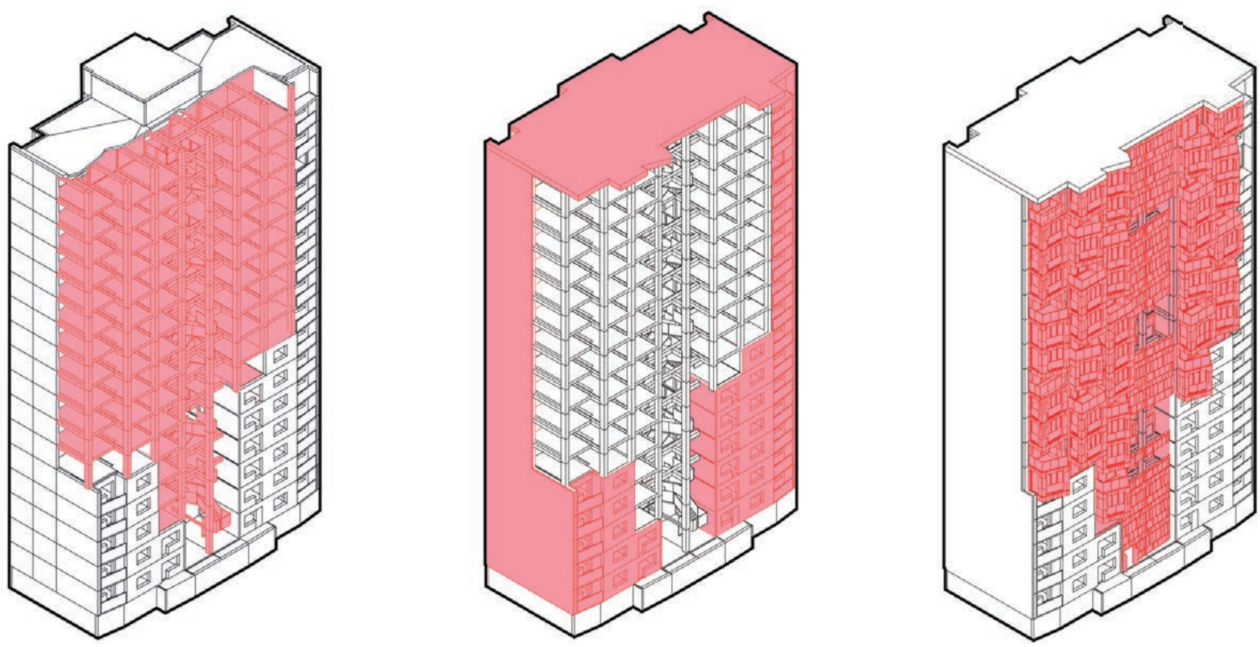


Fig. 123 / Diagram phases

EPILOGUE

The lines have been drawn, and the design—as you've witnessed—now has shape. Block 82 has undergone an iterative design process grounded in research, experiments, and case studies. What remains is to assess whether these efforts have been worthwhile. This final chapter reflects on the outcomes of the renovation, evaluates the chosen approach, and ultimately ties together the conclusions of this thesis.

#6 "Is it worth to salvage a building?"

IN NUMBERS

The carbon emission estimates initially compared two scenarios—demolition with rebuild and demolition with new build—but a third path has since emerged: repair and renovation. By using a timber-based structural system along with wood-fibre insulation, the renovation of Block 82 stores a considerable amount of carbon in the building materials, postponing its release until the end of the building's life. Extending the lifespan of the remaining concrete also distributes its original carbon footprint over a longer period, reducing its overall impact. Moreover, reusing rubble from the damaged concrete has decreased the need for virgin aggregate in new concrete, further lowering emissions from material production. While the renovated building does not meet low-energy classification standards, it performs significantly better than in its original state. The thermal upgrades—although the largest contributor to renovation-related emissions—have proven to be a worthwhile and effective improvement.

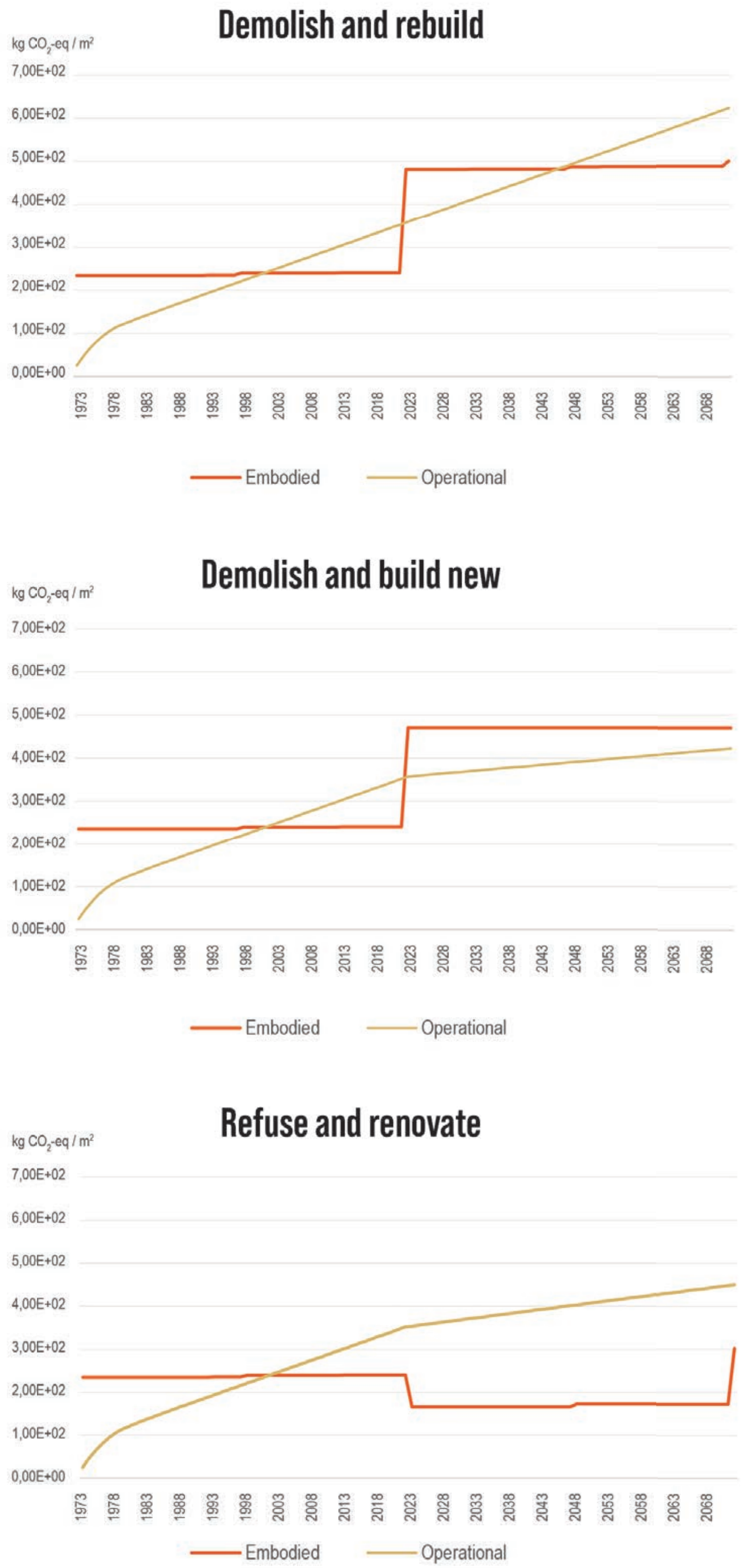
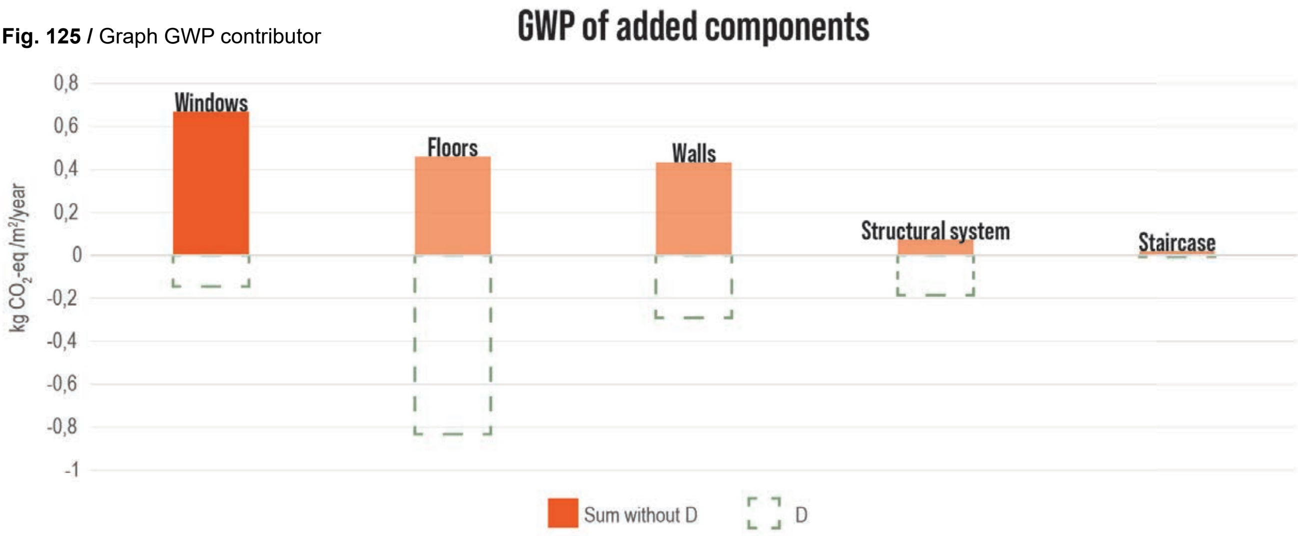


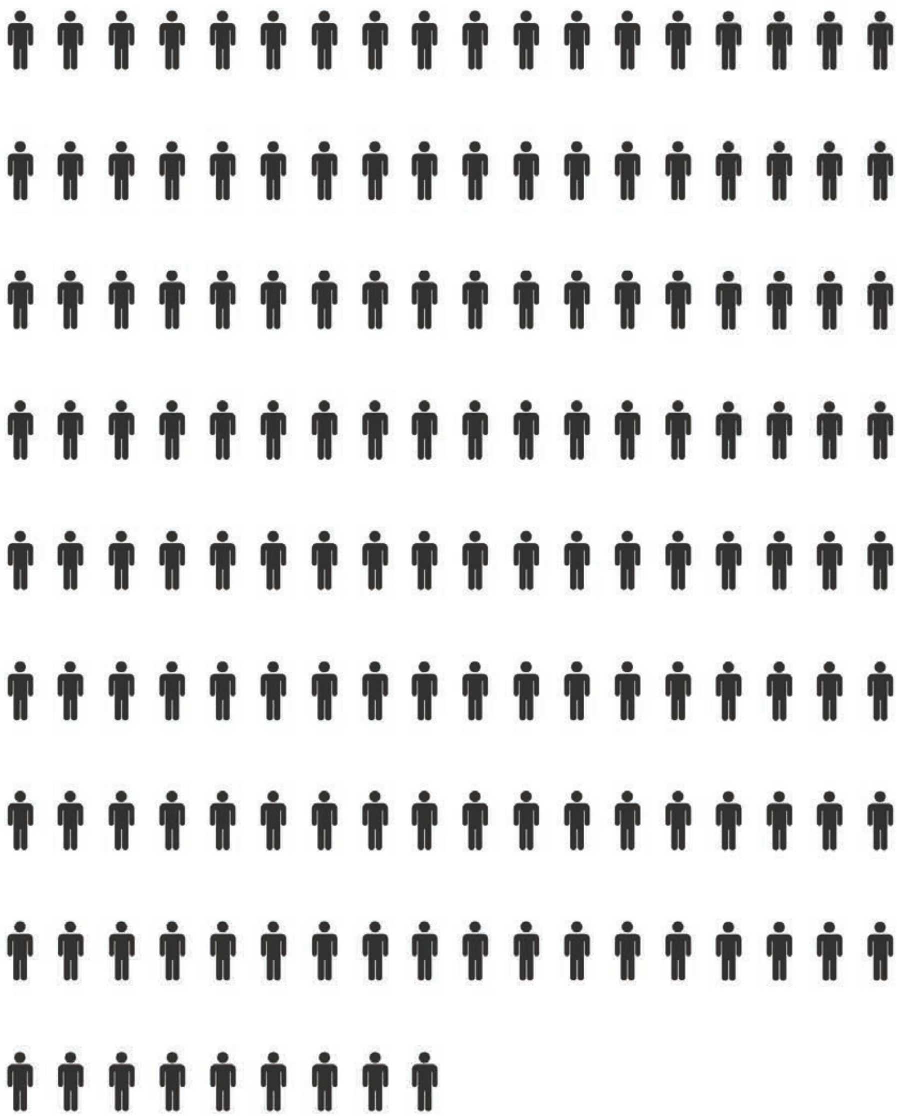
Fig. 124 / Graphs LCA scenarios

Fig. 125 / Graph GWP contributor



Another significant contributor to emissions is the window category. These emissions are split between the thermally upgraded apartment windows and the large curtain wall on the eastern façade. Although the glass surface is extensive, it offers transparency into the building, reinforces the architectural narrative, and accommodates generous communal spaces—all of which help justify its environmental cost.

When comparing the renovation to the demolition and rebuild scenario, the difference in long-term emissions becomes clear. Over a 100-year period, the rebuild scenario would result in 893 kg CO_2/m², while the renovation design emits only 752 kg CO_2/m². Though a difference of 140 kg CO_2/m² may seem modest at first glance, across Block 82's approximately 6,100 m², this equates to 857 tonnes of CO_2 saved—roughly equivalent to the annual carbon emissions of 185 European citizens.



APPROACH

One of the key considerations of this master thesis is its potential for broader applicability. As discussed throughout the chapters, several assumptions had to be made due to the theoretical nature of the project and the lack of access to on-site investigation. It is therefore important to critically reflect on how these limitations may have influenced the results. Furthermore, the design approach adopted in this thesis may diverge from established renovation guidelines for this typology. This chapter will examine the aspects most impacted by the project's theoretical basis and where the threshold lies between universally applicable design strategies and those that are inherently site-specific.

When approaching reconstruction, one must first consider the impact on both the residents and the environment. Repairing existing housing stock—rather than replacing it entirely—has the potential to preserve a sense of familiarity and strengthen community ties, which new construction might not. Moreover, by extending the service life of the existing structure, the embodied carbon is preserved and amortised over a longer timespan, offering environmental benefits. However, these potentials are only meaningful if the local community sees value in the structure being repaired. As such, the first steps should involve engaging with the current or former residents of the area. Without their investment in the project, even the most well-intentioned reconstruction risks missing its mark. While this thesis incorporated an ethnographic study rooted in qualitative data, a real-world implementation would require the inclusion of quantitative stakeholder data and broader community involvement in decision-making. Early benchmarks should also be established for sustainability and operational performance, highlighting the importance of accurately assessing both energy performance and embodied emissions.

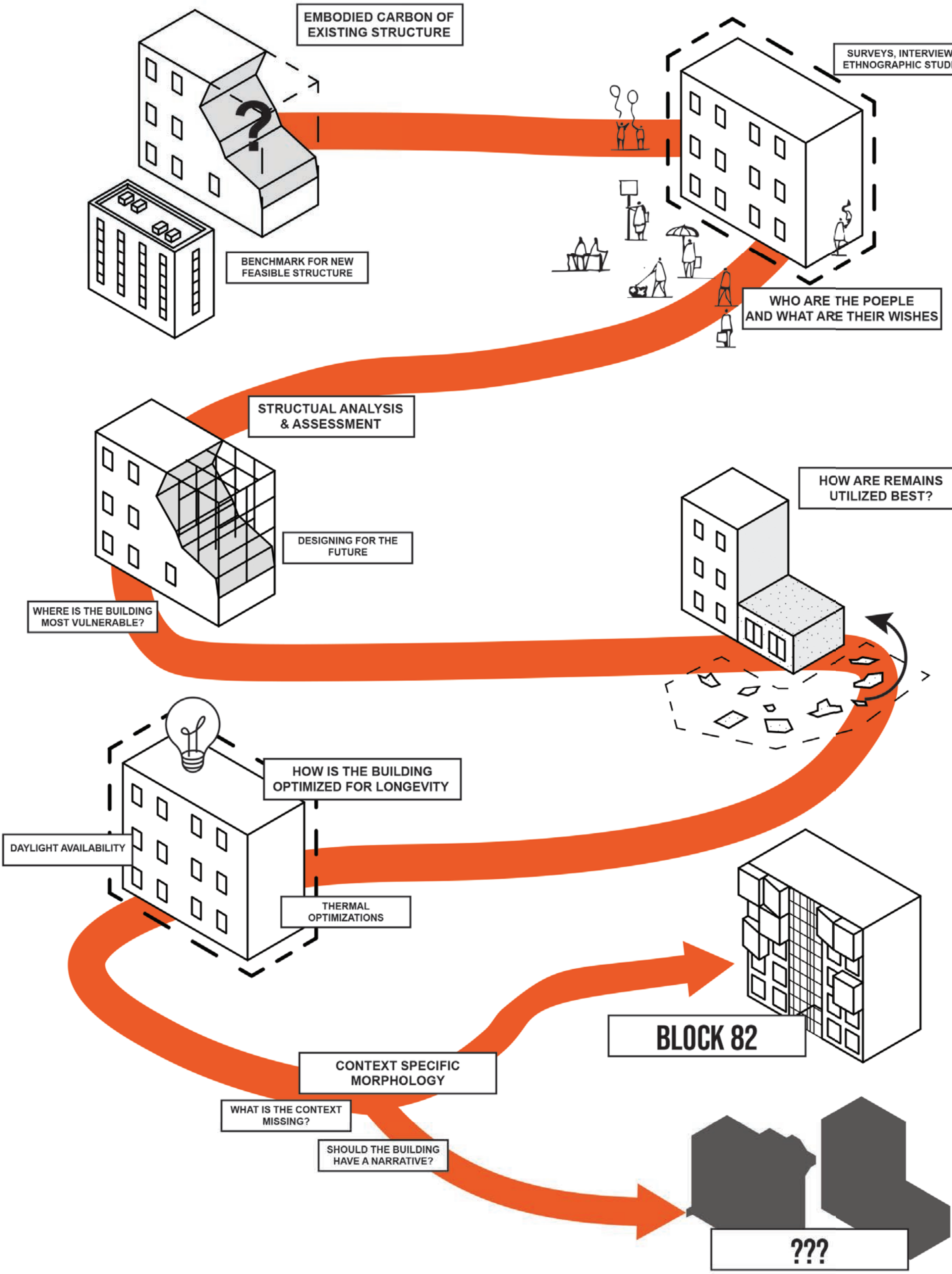
Understanding the structure and the nature of its damage is fundamental when addressing reconstruction. The next step in such a process is to assess the building's pre-damage structural characteristics and evaluate the current state through a detailed damage assessment. This "structural attributes and damage assessment" serves not only to identify critical vulnerabilities but also to highlight opportunities for structural improvement. In this thesis, the structural system was simplified to a 2D frame model to facilitate simulation, but in a practical setting, comprehensive 3D finite element analysis would be necessary to ensure structural safety and design feasibility.

A key goal in reconstructing damaged concrete housing must be the reduction of carbon emissions associated with the building industry. For that reason, mapping and reusing available rubble becomes essential. This project, for example, proposes the use of a terrazzo-like tile incorporating crushed concrete from Block 82's former walls—an act that transforms destruction into a gesture of resilience. A similar narrative unfolds in the expressive morphology of the façade, where the original thermally optimized flush geometry evolves into jagged protrusions held in rhythm by monumental glulam columns. While this conceptual direction draws inspiration from Lebbeus Woods and the aesthetics of destroyed monuments, such a strategy is not universally applicable.

As noted by Orest Zub in an interview for this thesis, reconstruction must be sensitive to context, community needs, and local identity, the history and damages done must not be forgotten, but war is not a place to live;

"However, I think when you say "approach" to reconstruction, you shouldn't always include a visible scar. There are many buildings in the area that are also very damaged. Having scars on every building would be too big of a reminder of the war. Like the war zone is still there. But I think working with your building (as) a sort of a monument piece it should work "(Orest Zub, annex xxx)

Fig. 126 / Diagram approach



REFLECTIONS

During the development of this master thesis, a series of reflections emerged, spanning from general approach to assumptions, applicability and decision making. This chapter aims to provide transparency by highlighting uncertainties and identifying potential points of improvement in this thesis.

/ system of approach

In the beginning of the project, a system of approach was established to ensure a clear path towards a final conclusion. The thesis adopted a research based approach, an approach that diverged from the conventional process practised during this education. This was partly done by following a methodology of Research Based Design and by pre-establishing six research questions, guiding the investigation process. Entering a space of uncertainty, this approach provided structure to the process and to keep focus on what investigations were required, to reach conclusions. In theory, this approach positioned research as the primary driver of design (Groat and Wang, 2013). However, at certain points of the process, the framework provided by this method was expanded by the introduction of the Integrated Design Process by Mary-Ann Knudstrup. An example of this is the development of the extruding volumes in the eastern façade. In this case, a narrative initiated the development of the design, which was then analysed and refined. Rather than research informing the concept, the concept informed the research, ultimately elevating the design.

/ assumptions

Throughout the research and analytical process, several assumptions were made due to limited access to information and resources. One key example involves the treatment of concrete rubble. As outlined in the limitations section of the introductory chapter, the generation of rubble was simulated using 3D computer graphics software. This method, combined with visual damage assessments from drone footage provided by the War Up Close Team served as the primary basis for investigation. While this approach offered a solid foundation for a theoretical project and facilitated the development of a strategy for renovating Block 82, a real-life scenario would benefit from on-site visits to accurately map the destruction and generate a detailed point-cloud base model of Block 82, which would yield more precise and realistic outcomes.

Due to data constraints, assumptions were additionally made when estimating carbon emissions, particularly regarding the impact of aggregate in concrete production.

In the chapter addressing rubble reuse, it was estimated that aggregate accounts for 43% of concrete's total carbon emissions, based on its volumetric content in the finished concrete product. However, this figure does not necessarily directly reflect the actual emissions generated during excavation and processing of aggregate. This assumption, made as a result of limited data on the matter, has an inherent influence on the comparative analysis of material emissions and, consequently, on the final conclusions.

Additionally, more in-depth research into the process of crushing concrete rubble into various aggregate sizes, including associated emissions and structural performance, would strengthen the foundation for dimensioning structural elements. A clearer understanding of the balance between material strength and carbon footprint would lead to more informed and robust design decisions.

/ including the context

During the development of this thesis, Life Cycle Assessment (LCA) has been employed not only as a means of verifying environmental performance of the final product but as a design tool for informing and supporting decision-making. This strategy includes comparative analyses regarding various materials and renovation strategies, allowing for objectively addressing potential solutions.

However, in addition to the previously mentioned assumptions, the process also led to subjective decision-making, particularly concerning comparison of different systems for reconstruction. A hybrid system combining glulam timber elements and concrete columns was selected as the most feasible system, despite the fact that a system composed entirely of concrete beams and columns made with recycled aggregate from concrete rubble demonstrated lower carbon emissions in the LCA. This decision was influenced by the potential benefits seen in the D-phase (beyond end-of-life), even though this phase is not included in official calculations. Within the theoretical framework of this thesis, this decision was considered justifiable. However, in the context of real-world scenarios, this decision may prove less valid due to standard practices and protocols.

Looking back, this thesis has been as much a process of discovery as it has been of design. The journey from hypothesis to final proposal required constant negotiation between performance data, cultural insight, and architectural intuition. At times, design decisions had to be made without complete information, relying instead on critical judgment, precedent, and contextual awareness. The complexity of working with a damaged structure in a post-conflict setting revealed that sustainable renovation is not a formula, but a layered and evolving inquiry. Here, the thesis recognizes that no design is ever truly complete. However, within the framework established, this project demonstrates that sustainable approaches to the renovation of post-conflict and disaster-damaged concrete housing are not only a viable alternative to full reconstruction, but can offer greater structural, social, and architectural value. While this design is not a universal solution, it stands as one possible response among many, grounded in the realities of its context and the ambition to build through what already exists

SUMMARY

The renovation of Block 82 has provided an approach for exploring how post-conflict and disaster-damaged concrete housing can be salvaged, reimagined, and made viable once again. In a global context where reducing carbon emissions is becoming an urgent political and environmental priority, the construction industry faces a pivotal opportunity, and responsibility, to rethink how we build, rebuild, and reuse our existing structures and resources. This has been a pivotal motivator for the creation of this very approach. What began as a hypothesis about structural and material preservation quickly grew into multi-layered design process, shaped by simulation, analysis, dialogue and iteration. In doing so, the design process not only delved in a speculative, theoretical design, but instead applied itself in a plethora of disciplines, subsequently involving structural, social, environmental, cultural and emotional dimensions to be brought into the dialogue through design.

Through a performance-based, iterative design approach, the design process was informed through structural simulations, daylight -and energy performance analyses, as well as life cycle assessments, all of which helped shape a design that moved toward a lower environmental footprint. Structurally, the introduction of a frame system (column/ beam structure) allowed for adaptable layouts and minimized material waste. Daylight and thermal simulations guided envelope design, improving both spatial quality and energy performance. The LCA results clearly showed that renovation significantly reduces embodied carbon compared to full reconstruction. Here, the utilisation of rubble exemplifies a large part of the thesis' aim to reduce carbon footprint while simultaneously creating a strong architectural narrative. By reintroducing the destroyed remnants of the building as aggregate in new concrete construction, and as material for furniture, this exemplifies the project's role in continuously moving between two distinct, yet converging realms: The technical and poetic.

Socially, the design was continuously shaped by ethnographic interviews and cultural research, which ensured that the architecture was responsive to local needs, Ukrainian identity and not lest memory. Although the design process has been informed by several performance-based investigations, it also includes architectural interventions driven not by metrics, but by the intention to create spaces that are both functional and meaningful within their immediate context. This notion highlights how the general sustainable approach for renovating damaged concrete structures inherently must become a case-specific design at some point. Here, the thesis recognizes that to create lasting architectural value, the design process and general approach must also deviate into context specific detail.

Architecturally, the project balances continuity with adaptation. While existing structural rhythms within the residential block were respected, new elements, such as larger structural spans in certain areas, as well as bay windows, brought in light, and improved usability, and redefined the building's expression in a context-specific manner. Rather than seeing damage as something to erase, the project embraced it as a starting point for renewal.

In conclusion, this thesis confirms the hypothesis it is worth salvaging damaged concrete housing, if approached systematically and holistically. When guided by analysis, contextual understanding, and clear design intent, renovation of these structures becomes a compelling alternative to demolition, one that not only conserves resources and reduces carbon emissions but also fosters a more resilient and responsive built environment

Fig. 127 / AI-gen 10 @MidJourney

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Paragraph locked by Victor Rosenkilde Jørgensen

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FIG. LIST

LICENSES

Fig nr: 012

Title: Soviet-era residential blocks by Alex Ugolkov

Creator: Alex Ugolkov

Source: https://www.pexels.com/@asysin/

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Fig nr: 013

Title: Brezhnevka block by Mykhailo Volkov

Creator: Mykhailo Volkov

Source: https://www.pexels.com/@movievolkov/

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Fig nr: 024, 025, 026, 062, 063, 064, 071.

Title: Various

Creator: ©Warupclose

Source: Харків - Віртуальні тури в 360°| VR музей «Війна Впритул»

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Fig nr 032

Title: Julia Zghurska

Creator: ©Radio Vagabond

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Fig nr 033

Title: Orest Zub

Creator: Orest Zub

Source: https://www.instagram.com/orestzub/

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Fig nr: 036

Title: Igreja de São Domingos main entrance

Creator: Uhooep

Source: https://commons.wikimedia.org/wiki/File:Igreja_de_S%C3%A3o_Domingos_%28Lisbon%29.jpg

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Fig nr: 037

Title: Igreja de São Domingos interior

Creator: Vitor Oliveira

Source: https://commons.wikimedia.org/wiki/File:I-greja_de_S%C3%A3o_Domingos_-_Lisboa_-_Portu-gal_%2852144038895%29.jpg

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Fig nr: 040

Title: Guernica by Pablo Picasso, image by Jules Verne Times

Creator: Jules Verne Times

Source: https://commons.wikimedia.org/wiki/File:Mural_del_%22Guernica%22_de_Picasso.jpg

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Fig nr: 054

Title: Saltivka Scene - Saltivka Residential District - Kharkiv (Kharkov) - Ukraine - 06

Creator: Adam Jones

Source: https://www.flickr.com/photos/adam_jones/43089171365

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Fig nr: 054

Title: Chess players in park, kiev

Creator: Robert Broadie

Source: https://commons.wikimedia.org/wiki/File:Chess_play-ers_in_park,_kiev.JPG

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Fig nr 055

Title: Gordon Matta-Clark's "Conical Intersect" (1975)

Creator: Marc Petitjean

Source: https://www.marcpetitjean.fr/

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Fig nr: 056

Title: 530 Dwellings, ©Philippe Ruault

Creator: ©Philippe Ruault

Source: https://www.archdaily.com/915431/transforma-tion-of-530-dwellings-lacaton-and-vassal-plus-freder-ic-druot-plus-christophe-hutin-architecture/5cb8950f284d-d1a8120000cd-transformation-of-530-dwellings-lacaton-and-vas-sal-plus-frederic-druot-plus-christophe-hutin-architecture-photo

License: ©Philippe Ruault

Fig nr: 061

Title: Mazanka technique by MrPanyGoff,

Creator: MrPanyGoff

Source: https://commons.wikimedia.org/wiki/File:Wattle_and_daub_construction.jpg

License: CC BY-SA 3.0

Fig nr: 065

Title: Embroidered Ukrainian Map

Creator: Qypchak

Source: https://commons.wikimedia.org/wiki/File:Embroidered_Ukrainian_Map.jpg

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Fig nr: Front page

Title: Front page

Creator: Warupclose

Source: Харків - Віртуальні тури в 360°| VR музей «Війна Впритул»

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APPENDIX A

Aalborg University - master thesis title page

AALBORG UNIVERSITET

THESIS TITLE PAGE

This form must be submitted for all theses written in programs under the Study Board of Architecture and Design, and it should be placed at the beginning of the appendix section of the assignment.

A printed copy of the form must be submitted along with the printed copy of the thesis.

The information given in this form must also be available in PURE.

(All fields must be filled out)

Program: **Architecture** ☒ **Industrial Design** ☐ **Urban Design** ☐
This thesis was written by (full name):
Frederik Sejling Nielsen
Thor Møller Toussaint
Victor Rosenkilde Jørgensen
Title of the thesis: From Ruins to Resilience: Sustainable Design Approaches for Post-Conflict and Disaster-Damaged Concrete Housing.
Supervisor´s name: Luìs Filipe Dos Santos
Submission date/year: 02.06-2025
Is the project confidential? **Yes** ☐ **No** ☒
External collaboration* **Yes** ☐ **No** ☒
External collaboration partner (name of company/organization):
Contact at external collaboration partner (title, name og email):

What is an external collaboration? Read more here.

APPENDIX B

Transcriptions of all conducted interviews

interview with orest zub #1, march 6th, 2025

(Victor)

Great to meet you. Is it okay with you if we transcribe this for future reference?

(Orest)

Yes, no problem.

(Victor)

To start, could you tell us a little about yourself? Part of your work has focused on raising awareness about the impact of the war in Ukraine. Why is that important to you?

(Orest)

Well, I'm from Ukraine. That connects me directly, right? What could be more important than events happening in your own country, your own home?

(Victor)

Yeah, of course. Throughout your career, you've been to several conflict zones. Can you name some of the places you've been?

(Orest)

Yeah, I've been to quite a few. So, let's say, like for example, only during the last 12 months, like last year, I've been doing like in the reverse. Myanmar, Syria, Afghanistan, Karabakh, Lebanon.

(Victor)

OK.

(Orest)

Those are direct conflict zones. Then there are other areas with uncertain futures or complex histories, like Taiwan, and some border regions in Bangladesh.

(Victor)

And of course, you've also been to Ukraine during the war there.

(Orest)

Yes, and to western Uzbekistan, specifically the Karakalpakstan region. In 2022, protests there turned violent and hundreds were killed. More recently, I visited the border zones of Rwanda and Congo. I was supposed to go to eastern Congo, but war erupted there about three weeks ago. As you may know, the M23 militia took control of large areas.

(Victor)

Wow, it seems like you've been quite busy.

(Orest)

Yeah.

(Victor)

We saw your video about Saltivka and your visit to Kharkiv two years ago. Can you talk about how Saltivka stood out compared to other conflict zones you've visited?

(Orest)

I've been to Kharkiv, including Saltivka, several times. Ukraine is a unique case due to the sheer scale of the war—it's currently the largest military conflict in the world in terms of casualties, military expenditure, and geopolitical impact.

Kharkiv, specifically, experienced a full-scale land invasion from Russia. Tens of thousands of Russian troops nearly encircled the city. The front line was right at the city's edge—literally, across a field from the buildings.

The Russian advance stalled when the war turned urban. Urban warfare is incredibly difficult. When advancing forces can't push through, they often resort to destroying buildings to force defenders and civilians out. That's what happened in Saltivka, which used to house up to 400,000 people.

The level of destruction there is immense and symbolic of the war's impact. Even though I'm from Lviv, which is far from Kharkiv—almost as far from Kharkiv as Denmark is—it affected me. To give a personal example, my wife's sister's fiancé is from Saltivka. His apartment was damaged by shelling. He's now in Canada.

(Victor)

Did you speak to any residents while you were there?

(Victor)

What did they talk about?

(Orest)

Honestly, just how terrible everything was. It's tragic. There's a certain irony when we laugh, it's just a way of coping.

(Victor)

What made people stay?

(Orest)

Well, I've visited Saltivka multiple times. The first time, the front line was only a few kilometers away, and artillery was still hitting the city. Later visits came after Ukraine pushed Russian forces back beyond artillery range.

Most of the destruction you saw was caused by artillery. When the front was close—within 20–25 kilometers—that's when heavy shelling occurred. Once it moved farther back, only missiles or drones could reach the city, and those are used more sparingly.

At the height of the shelling, the area was almost empty. The people who stayed were often those who had no choice—no money, no place to go—or those who were just extremely determined or emotionally attached to their homes.

Later, some families returned, mostly for similar reasons: financial limitations or a strong desire to live in their own home, contributed to rebuilding, and stayed rooted in their community.

(Victor)

I read that Saltivka had a large population of lower-income, Russian-speaking residents. Do you think financial hardship was the main reason people stayed?

(Orest)

Kharkiv is predominantly Russian-speaking—around 90% spoke Russian as their first language before the war. This isn't just in Saltivka, it's city-wide.

As for why people stayed or returned—yes, financial limitations were a major factor. If you can't find a better option elsewhere, you make do with what you have. The other reason is patriotism—people who feel strongly about staying and rebuilding their country.

(Victor)

Many of the buildings in Saltivka are Soviet-era concrete structures. What's your opinion about these buildings?

(Orest)

These are typical Soviet panel buildings, built cheaply in the 70s and 80s during the country's industrialization. They were mass-produced to house millions—copy-paste architecture.

There are different types: five-story buildings from the 60s, called "Khrushchyovkas," often without elevators, and nine-story versions from the Brezhnev era.

They were built quickly using prefabricated panels. The problem is that when they're hit by a blast, entire sections can collapse—kind of like a house of cards. Brick buildings, on the other hand, are much sturdier. A missile might damage part of a brick building, but the rest usually stands.

Most of Saltivka consists of these panel buildings, so the damage from shelling was devastating.

(Victor)

What's the general public opinion in Ukraine about these Soviet-style buildings?

(Orest)

They're seen as entry-level housing—nothing luxurious, but not awful either. I wouldn't compare them to Western-style social housing. Inside, they're often well-maintained, with Wi-Fi and good infrastructure.

Nobody dreams of living in them, but they're functional. Most Ukrainians don't have strong feelings about them—neither particularly negative nor positive.

(Victor)

Our thesis is about taking one of these buildings and exploring whether it can be salvaged instead of demolished—both to save costs and reduce carbon emissions. What's your take on that idea?

(Orest)

I'm not an architect, so I can't give a technical assessment. But if something can be improved—sure, why not?

That said, don't just think like an architect; think like an urbanist. It's not just about rebuilding the structure. You have to consider the full ecosystem: jobs, schools, transport, healthcare, and community services. A great building is useless if no one wants—or is able—to live there.

(Victor)

We've read about how Soviet planning aimed to create micro-districts with everything within walking distance—schools, shops, jobs. Saltivka was designed that way. But some people say this model doesn't work anymore. Do you think the micro-district idea could still be improved?

(Orest)

The micro-district isn't a Soviet invention. The concept began in mid-19th century Barcelona and works very well there. Today, the idea of the "15-minute city" is becoming popular again.

The issue isn't the concept, it's the implementation. In some places, it works; in others, it doesn't. It depends on how well it's integrated with modern infrastructure and how adaptable the system is to current needs.

(Victor)

OK. So, we have one final question, and then we'll let you go to your next call.

We were quite surprised when you said that Ukrainian people don't really mind these Soviet-era concrete structures.

What do you think the general public's opinion would be about salvaging these buildings instead of simply tearing them down and building something new?

Do you think they would like the idea, or would they rather have something new instead of continuing with the old?

(Orest)

Well, how can I put it... It's always easier not to start from scratch. If something still works, it's usually better to preserve it than to tear it down and build a new—especially because that takes years. It creates uncertainty and delays. So, I think, for someone whose building was damaged, their personal interest would be to return and use that space as soon as possible.

If the building can be restored without too much time, effort, or uncertainty, that's probably the preferred option. Tearing it down and constructing something new? You're talking about years of waiting, not knowing what will happen, paying rent somewhere else, dealing with all the logistics... And I've seen so many destroyed buildings.

And you can't always say if your apartment is destroyed or not, just by looking at the building. If the damage is on a corner, the rest of the building might still function. Elevators can work; utilities might still be intact. But if the damage is in the center—where the elevator shafts or main pipelines are—then that's a much bigger issue.

Each case must be reviewed individually. Every building was damaged differently, so there needs to be a custom solution for each one. It just depends on what's the best path forward for the people living there. Ultimately, a resident just wants to come home and live there comfortably as soon as possible—without compromising on basic comfort or safety.

(Victor)

Of course. You can only speak from your own experience and personal opinion. We totally understand that. OK, I think we have what we need. Is there anything else we should talk about?

(Thor)

No, I think that was everything. Would you be open to answering some follow-up questions by email? And maybe doing another interview later?

(Orest)

Yeah, no problem. I'm always around somewhere.

(Victor)

OK. Thank you so much, Orest. That's all we have for now.

Thanks again for your hope to speak to you soon. Have a great rest of your day!

(Orest)

All the best, guys. Thanks for raising this topic.

interview with orest zub #2, april 18th, 2025

(Victor)

Hello again, Orest! Great to see you.

(Orest)

Also great to see you guys.

So, just to let you know, I've just spent many hours driving through the Somali countryside. Not very pleasant, and very hot. So, please excuse if I am a bit exhausted at the moment.

(Victor)

That is completely fair Orest. We will also make sure to make this meeting quite short. We have some general topics that we'd like to hear your opinion about. Of course we understand that you can't speak for every Ukrainian regarding these topics, but please just tell us your experiences to the best of your ability.

These topics touch a bit upon the general demographic of Saltivka, if you have any additional information from your talk with locals, and then we'd like to talk to you a bit about what makes community uniquely Ukrainian. Finally, we'd like to share some thoughts with you regarding our approach to the project, and the role that we think the architecture should play within the renovation of Block 82.

(Orest)

Sounds good.

(Victor)

So, to start, we would like to talk to you about creating a community, specifically one that is Ukrainian. In this building were creating, we've noticed that a sense of community is one thing that is missing that could help bind the fabric of the building together.

We've looked into the original Soviet-era urban planning, where these micro-districts that Saltivka is a part of were supposed to create micro-communities, but because of different aspects this never really happened (like many other aspirations the Soviet Union set forth in this era). These micro-districts were very literal in their interpretation, creating a community based of functions like kindergarten, shops, schools etc… However, what we'd like to know is how is community defined in a Ukrainian context? How is social life visible in Ukraine? Do people push their chairs out into the street? Is it through cooking? Sports?

(Orest)

So, Ukrainian people are normal people. We go to work, drive our kids to school, participate in sports, leisure activities, things like that, much like the rest of the world. So, things really aren't that different from anywhere else.

(Victor)

OK. Yes, of course, we understand that Ukraine is a place that functions much like every other society. I think what we're inkling at is what sort of things that are typical to do together for Ukrainians. So, say you're at home doing "nothing". How would Ukrainians do "nothing" together with each other?

(Orest)

Okay, so there are some things that Ukrainians like to do together without really doing "anything". Of course, cooking is one of them. Many elders and women like to cook. Often times, people also like to invite people over, say for family gatherings, birthdays and national holidays. Here, people usually bring food and cook quite a lot of Ukrainian dishes. However, in the context of these Brezhnevkas, you usually can't fit many people. Maybe no more than like 10 or 15 people. So, for larger gatherings, like parties and weddings, it's difficult to find space.

(Victor)

Okay, that sounds great. Are there other scenarios similar to this you can think of?

(Orest)

Yeah, so elderly people, like men in particular, often like to sit in the parks and around, playing chess or checkers, and elderly women and wives like to meet and kind of "gossip" you know? Of course, there are different things that are typical for men and women to do, such as fixing stuff or doing the laundry, and they can also do these things together, either with each other, or with friends.

(Victor)

That's great. Do you have some experiences from your childhood, growing up in a similar type of neighbourhood in Lviv, that you can tell us about?

(Orest)

Growing up, all the kids from one Block or area would typically play together. We'd even fight kids from the other blocks sometimes. I guess you could say that every neighbourhood has its own little community.

(Victor)

Great, yeah. So, moving into the second theme we'd like to talk to you about. In defining the demographic that resides in Saltivka we've been looking for some statistics. Last time we talked, you mentioned that Kharkiv is a city that houses a large Russian-speaking population. Here, is Saltivka a generally considered a low-income neighbourhood?

(Orest)

I'm afraid I can only talk from my own experience here, but generally yes. Kharkiv is a city that is very much Ukrainian but is geographically close to Russia. This means that almost everybody can speak Russian. Most young people do also speak Ukrainian, but many older people, however, can only speak Russian. A lot of it has to do with the time Ukraine was a part of the Soviet Union as you may know. They [the elders] do however try their best to speak Ukrainian when they can.

As for the demographic I do not know that much. Yes, the neighbourhood is generally mid-level to low-level income, but it isn't like a "poor" neighbourhood, you know? Just regular.

I can tell you this. These soviet style apartments were not created with handicap in mind. Some of the buildings have since been retrofitted with ramps, that is quite common. But unfortunately, after the war we will probably see more people with physical disabilities. Therefore I think it is really important that you focus on making these apartments much more accessible.

(Victor)

OK., great. This is actually what we were going to ask more into. So, in terms of better defining the needs of the residents, you're saying that we should focus on making the apartment block more accessible for handicapped people? Like people with physical constraints because of the war?

(Orest)

Yes, exactly.

(Victor)

Last time we also talked about the idea of time being of the essence in reconstruction. One thing you emphasized last time was to rehouse the residents as quickly and comfortably as possible, as some might not have very good alternatives right now.

(Orest)

Yes. Whatever makes the construction process shorter I think it should be done, because Ukraine has a lot of reconstruction and rebuilding to do, you know? Right now, people just want their regular lives back, or at least something close to it.

(Victor)

Okay, okay. That's good to hear. We have been thinking the same thing here. Okay, so to round off, I think we'd like to talk a bit more about the general approach to the architecture if that's fine with you.

(Orest)

Yes, of course. Sounds good.

(Victor)

Last time we spoke of how these type of apartment blocks are functional yet are nothing exciting or to dream of. If you were to imagine this type of building reconstructed, are there any functional or aesthetic elements you hope to see preserved or re-imagined? Is there any new functions or elements you think would improve the comfortability and life in these types of structures?

(Orest)

These apartments are not very good insulated. These apartments were created when there was a big housing crisis and people needed a place to live quickly, so the way these buildings were made was very fast, you know, prefabricated stuff. The walls aren't very well insulated, and there could be some problem with leakage or such if you were unlucky. So this is definitely important, but I think you already know this.

(Victor)

Okay. So, in terms of what role the architecture should play. As you know, were creating a sort of general approach to how these buildings could be rebuild as an alternative to tearing down. Here, we'd like to work with the ruins of the building, the "scar" if you will. What do you think of this idea?

(Orest)

I think it's good. I think when rebuilding it is also difficult to hide something like that, especially if you need to work quickly and efficiently. So, in a way, it makes more sense to work with it. However, I think when you say "approach" to reconstruction, you shouldn't always include a visible scar. There are many buildings in the area that are also very damaged. Having scars on every building would be too big of a reminder of the war. Like the war zone is still there. But I think working with your building a sort of a monument piece it should work.

(Victor)

Okay yes, that makes sense. So, for example, the building right behind ours has a large hole in the roof. Here, we shouldn't show any remains of damages, but rather just fix it.

(Orest)

Yes, exactly.

(Victor)

Okay, thank you so much Orest. I think that is all that we had for you. Hopefully we didn't tire you too much on top of your travels.

(Orest)

No, that is OK. Thank you for taking up this issue, and good luck with your report.

interview with julia zghurska, may 15th, 2025

(Question):

First, could you describe to us a bit about your background, who you are, your work with the tourism board, your hometown etc.? And would it be okay with you if we quote you on some of your answers, mentioning you by name, and possibly a picture of you for visual input in our report? With your help we'd like to mention and acknowledge every helping partner in our research process.

(Answer):

I'm the Deputy Director of the International Cooperation Office at the Kharkiv City Council, where I've worked in various roles since 2006. I specialize in tourism development, international relations, and European integration projects.

I hold master's degrees in public administration, project management, and a bachelor's in philology. Since 2018, I've also been teaching courses on business tourism and international tourism policy at V. N. Karazin Kharkiv National University. I'm fluent in Ukrainian, Russian, and English, with a basic knowledge of German. My interests include tourism, politics, and international cooperation.

Yes, you're welcome to quote me by name and use a photo in your report. I'm happy to support your research.

(Question):

Very generally, we're interested in getting to know more about the character of Kharkiv, and what role the district of Saltivka has within it. Could you give us your thoughts on what sets Kharkiv apart from other cities in Ukraine?

(Answer):

Kharkiv is one of the most distinctive and dynamic cities in Ukraine and has a strong industrial, scientific and educational core that defines its character. What makes Kharkiv unique?

Industrial heritage: Kharkiv has been a major centre of mechanical and electrical engineering since Soviet times. Factories, NGOs and research institutes shaped the city's profile. Although some of the industry has declined, this history continues to influence the mentality: many residents come from engineering or technical backgrounds.

Educational centre: Kharkiv has one of the largest concentrations of universities in Ukraine. Before the full-scale invasion, tens of thousands of students from all over the country, as well as foreigners, studied here. This creates a youthful hometown atmosphere.

Kharkiv is a city of poets, scientists and students. Despite the war, exhibitions, lectures, and poetry readings are held here. Language, thought, creativity - all this has become another front. And Kharkiv is winning on it.

Saltivka is the heart of residential Kharkiv. Saltivka is the largest residential area in Kharkiv, and one of the largest in Europe. Its image is deeply rooted in the collective imagination of the city. Built in the 1970s and 1980s, Saltivka is a typical product of Soviet urbanism with high-rise buildings and wide avenues. It embodies Kharkiv as a city with a simple, straightforward mentality. In 2022, Saltivka became a symbol of resistance and suffering, as the neighbourhood was heavily damaged by shelling. This further strengthened its emotional connection with Kharkiv residents and made it a new identity marker. Kharkiv is a city of strength, science and adaptation. It is distinguished by its ability to adapt to change. Kharkiv is not just a large Ukrainian city in the east of the country. It is an outpost city, a phoenix city that proves time and again that it cannot be broken. -And this combination of an industrial worker and a young student creates a unique social mix.

(Question):

We could understand from our interviews with Orest that these neighbourhoods and the building typologies present are typically characterized by entry-level housing. Could you maybe tell us a bit more about the typical resident in the Saltivka area? Are they characterized by low-income, median-income? Families or predominantly singles? Occupation?

(Answer):

Northern Saltivka is a classic residential neighbourhood built in the 1970s and 1980s according to the Soviet panel typology. It is dominated by high-rise buildings - 9-, 12- and 16-storey buildings.

Income level: Mostly middle class. Nowadays, the majority of residents are pensioners or people of pre-retirement age. These people stayed because of a strong emotional connection with the house. Electricity, water and heating have been restored in some houses. However, many houses remain without proper living conditions due to extensive damage.

(Question):

how is the Saltivka area recovering? Have you seen a recent influx of residents returning, or is this yet to happen? Has reconstruction begun?

(Answer):

The restoration of Northern Saltivka in Kharkiv is well underway, although the process remains complex and lengthy. The city authorities, international partners and residents themselves are joining forces to rebuild the area, which suffered significant damage during the war.

(Question):

We've looked into many functions and institutions in the area as they existed before the invasion, which now have been compromised. Do you have any knowledge as to if any of the shops, institutions and the like in Saltivka are now operating again?

(Answer):

As of 2025, Northern Saltivka has retail facilities, including supermarkets, grocery stores, pharmacies and medical facilities, as well as other shops and consumer services such as service stations and car washes.

APPENDIX C

An overview of prompts and image generating AI-systems used throughout the thesis

MidJourney AI-gen 1

An outdoor amphitheatre seating installation built from stacked concrete wall rubble. Irregular slabs form wide, stepped seating tiers. The top edge of each step features a wooden board cladding for added comfort. Concrete shows signs of past use chipped corners, graffiti remnants, natural patina. Photographed in the style of a product showcase: soft urban background, balanced composition, natural directional light, clear texture details. 8k photorealism, --ar 1:1 --raw

MidJourney AI-gen 2

Modern outdoor table and stools created from salvaged concrete wall fragments. The table top is a heavy concrete slab set on reused block bases; stools are made from concrete rubble with wooden planks applied to the seating surfaces. Set on a timber platform or gravel surface. Photographed in a clean product showcase style: soft natural light, isolated composition, high detail on materials and joinery. 8k photorealistic, --ar 1:1 --raw

MidJourney AI-gen 3

An open-air pavilion made from large salvaged concrete wall fragments, arranged vertically like monoliths to form partial enclosures. One or two slabs feature added wooden benches integrated at the base. The fragments retain natural breaks, surface wear, and textures. Photographed in the style of a product showcase: minimalist ground (gravel or grass), moody sky, directional natural light, strong focus on materials, texture and form. 8k, photorealistic architectural presentation, --ar 1:1 --raw

MidJourney AI-gen 4

Photorealistic outdoor seating made from large broken concrete wall fragments, with chipped edges, rough surfaces, and visible texture. The concrete slabs are arranged into sculptural benches in a park on a grassfilled lawn. Photographed in the style of a product showcase: isolated composition, neutral or soft natural background, focused lighting that highlights form and material texture. Emphasis on realism, scale, and function. 8k, ultra detailed, architectural product photography, minimalist setting, --ar 1:1 –raw

MidJourney AI-gen 5

Photorealistic scene of a person cutting a large piece of concrete rubble into smaller fragments using an angle grinder or concrete saw. The concrete shows exposed aggregate and chipped edges. Dust and small debris in the air, with safety gloves and protective gear visible. Industrial background, natural lighting, high realism. Process documentation style, 8k, architectural detail focus, --ar 3:2 --raw

MidJourney AI-gen 6

A person assembling a handmade terrazzo tile using small fragments of cut concrete rubble, placing the pieces into a square wooden tile mould. The frame lies on a workbench with tools nearby. The fragments are varied in shape and texture, clearly showing their reused origin. Natural workshop lighting, high material detail, realistic textures, close-up composition, photorealistic, 8k, process documentation, --ar 3:2 --raw

MidJourney AI-gen 7

A finished terrazzo tile made entirely from cut concrete rubble fragments, resting on a clean white surface. The tile is square, with a light grey cementitious base holding the small, rough-edged concrete pieces in place. The texture and colour variations in the fragments suggest their origin from old construction material. Photographed in the style of a product showcase: top-down view, strong natural light, clean shadows, 8k, ultra detailed, realistic material rendering, --raw --ar 3:2

MidJourney AI-gen 8

A large exterior architectural wall clad entirely in handmade terrazzo tiles, each tile composed of irregular fragments of concrete rubble. The tile pattern is visible and textured, showing the variety of recycled pieces embedded in a light grey base. Several people walk past the wall in motion blur, resembling a contemporary architectural visualisation. The setting is minimal and urban, with soft daylight casting shadows to reveal surface texture. Photorealistic, architectural realism, high detail on material finish, 8k, --ar 7:3 --raw

ChatGPT - AI-gen 9

I want Midjourney to give me a picture of how it would look if Lebbeus Woods' theories were applied in the context I am building in, in my thesis. Write a prompt describing a construction as it was made by Lebbeus Woods in the context of a damaged concrete soviet residential block [Here, ChatGPT mistook the prompt and created an image from it]

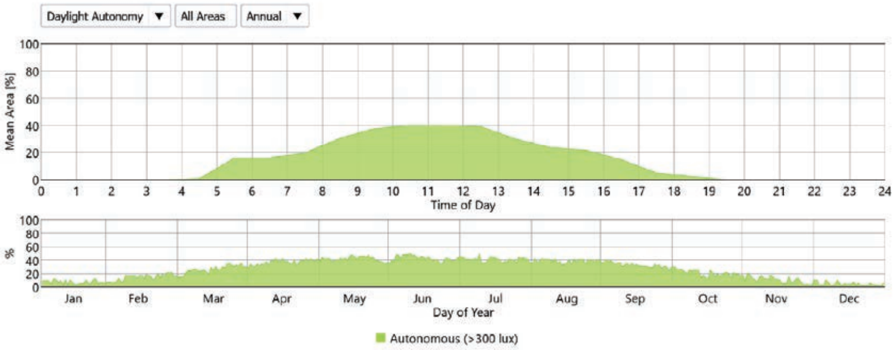
MidJourney AI-gen 10

A single large terrazzo tile with a sunflower pattern made of colourful stone chips (terracotta, dark green, yellow-orange) lying on a wooden floor. The terrazzo has a light beige base with naturally scattered fragments. The tile is oversized compared to the wood planks, showing clear scale. Warm sunrays fall across the surface, casting soft shadows and highlighting the textures. Photorealistic, natural lighting, top-down perspective, 8k, high detail, crisp textures, product photography style

APPENDIX D

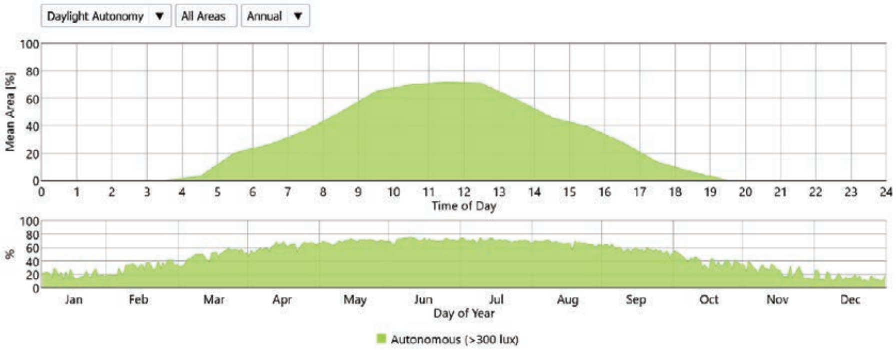
Daylight simulations and results

/ cs daylight simulation results (entire floor)



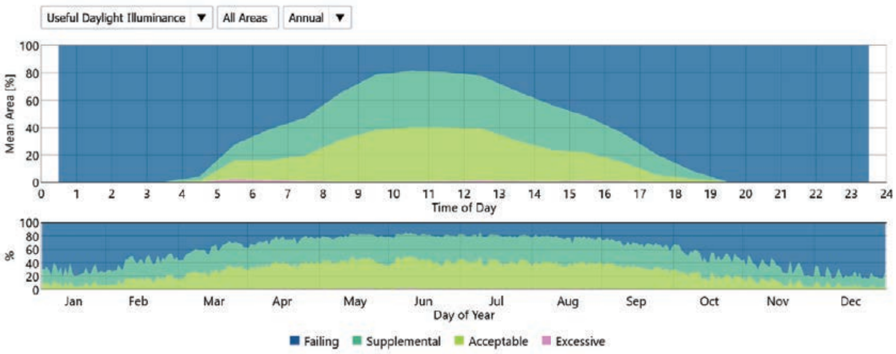
sDA pre-existing:

23,2% [300lux/50%]



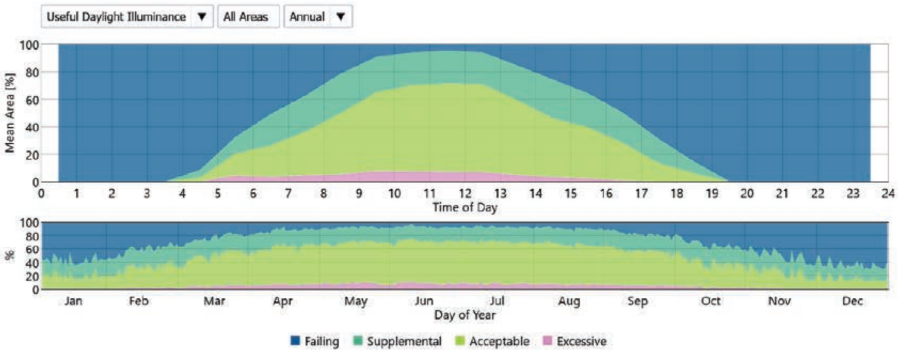
sDA renovation:

50,4% [300lux/50%]



UDIa pre-existing:

avg. 26,5%

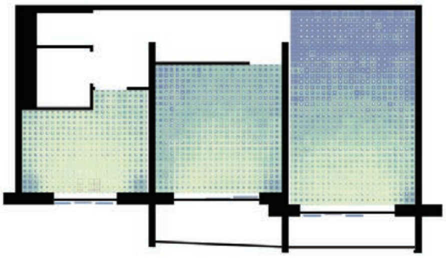


UDIa renovation:

avg. 45,1%

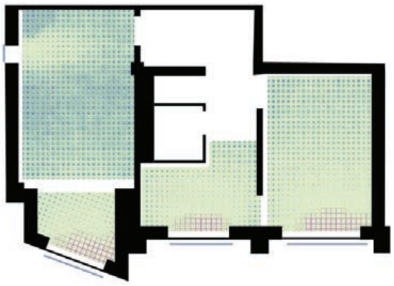
/ cs daylight simulation results (bay window iterations)

BASELINE



sDA: 17,4%
UDIa: 22,3%

ITERATION #1

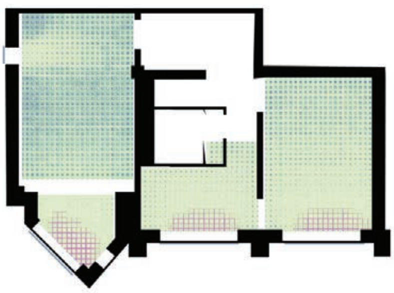


sDA: 43,7%
UDIa: 41,8%

ITERATION #2

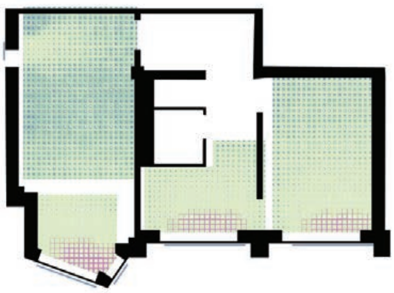
sDA: 40,5%
UDIa: 38,7%

ITERATION #3



sDA: 45,9%
UDIa: 44,9

FINAL ITERATION

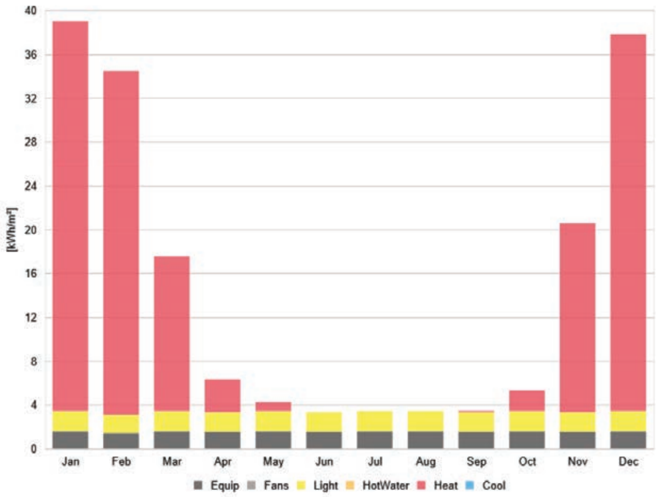


sDA: 50,1%
UDIa: 47,6%

APPENDIX E

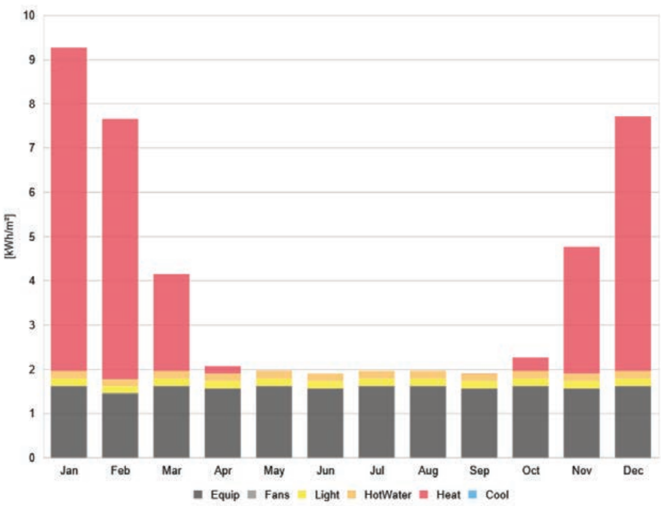
Energy simulations

/ cs energy simulation results

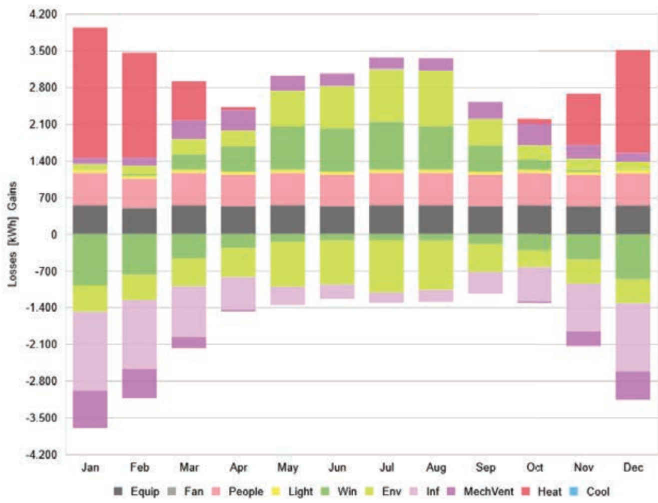


energy use intensity (EUI) pre-existing

energy flows pre-existing



energy use intensity (EUI) renovation

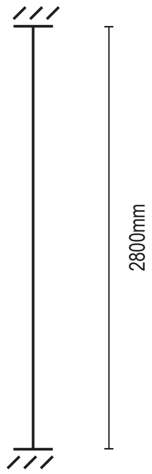


energy flows renovation

APPENDIX F

Calculations of old concrete strenght

/ calculations of old concrete strenght / column



Boundary conditions/ assumptions:

Concrete wall is calculated as a columns, with the cross section, height and boundary conditioned shown in the illustration.

Concrete safety class is: reinforced / 1.4

Steel safety class: 1.2

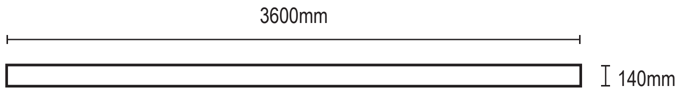
Moderate environmental class

Reinforcement has a charactertical tension strenght of 200MPa

Reinforcement rods have a radius of 8mm

The column is subject to a compression load of 3517kN

Goal is to find the minimum strenght of concrete for the maximum measured compression load of the structure



Initial concrete strenght tested: C12

$$f_{ck} = 12$$

$$\alpha = 26$$

$$\frac{f_{cd} \times 10^{-4}}{\pi^2 \times E_{0crd}} = 1.0$$

Calculative strenght concrete:

$$f_{cd} = \frac{12MPa}{1.4} = 8{,}57MPa$$

Radius of gyration:

$$i = \frac{140mm}{\sqrt{12}} = 40{,}41$$

Allowable stress in concrete:

$$\frac{8{,}57MPa}{\left(1+1.0\times10^{-4}\times\left(\frac{2800mm}{40{,}41mm}\right)^2\right)} = 5{,}79MPa$$

Critical axial force concrete:

$$5{,}79MPa \times 140mm \times 3600mm = 2.9Ne + 06$$

$$2.9Ne + 06 \Rightarrow 2.900.000N \times 10^{-3} = 2918kN$$

Amount of reinforcement: 8

Reinforcement ratio is not allowed to surpass 0,04

Section area: $140mm \times 3600mm = 504.000mm^2$

Reinforcement area: $8 \times \pi \times (8mm)^2 = 201mm^2$

Reinforcement ratio: $\frac{201mm^2}{504.000mm^2} = 0{,}003$

Calculative strenght of reinforcement: $\frac{200MPa}{1{,}2} = 166{,}66MPa$

Critical axial force:

$$N_{crd} =_{min} \begin{matrix} 2918kN \times (1 \times 26 \times 0{,}039) = \underline{3161N} \\ 2918kN + \left(504.000mm^2 \times 166{,}6MPa\right) = 3187kN \end{matrix}$$

✗

Trying C16 instead:

Critical axial force:

$$N_{crd} =_{min} \begin{matrix} 3891kN \times (1 \times 23 \times 0{,}039) = 4177kN \\ 3891kN + \left(504.000mm^2 \times 166{,}6MPa\right) = \underline{4160kN} \end{matrix}$$

✓

/ calculations of old concrete strenght / beam

Boundary conditions/ assumptions:

Concrete deck is calculated as a beam, with the cross section, height and boundary conditioned shown in the illustration.

Concrete safety class is: reinforced / 1.4

Steel safety class: 1.2

Moderate environmental class

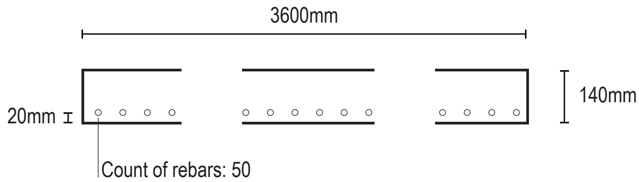
Reinforcement has a characterical tension strenght of 200MPa

Reinforcement rods have a radius of 8mm

The beam is subject to a moment of 136kNm moment.

As the concrete walls were C16 minimum this is the starting point of these calculations

Goal is to find the minimum strenght of concrete for the maximum measured moment load of the structure



Allowable compressive strenght of concrete:

$$f_{cd} = \frac{16MPa}{1.4} = 11{,}43MPa$$

Allowable yield stress of steel:

$$\frac{200MPa}{1{,}2} = 166{,}6MPa$$

Center of gravity for reinforcement is determined:

$$\frac{20 \times 50}{50} = 20mm$$

Effective height of the cross section:

$$140mm - 20mm = 120mm$$

Reinforcement area is determined:

$$50 \times \pi \times (8mm)^2 = 10.053mm^2$$

Force in reinforcement when it yields:

$$10.053mm^2 \times 166{,}6MPa = 1675500N$$

Finding neautral axis height:

$$\frac{1675500N}{0{,}8 \times 3600mm \times 11{,}43MPa} = 51mm$$

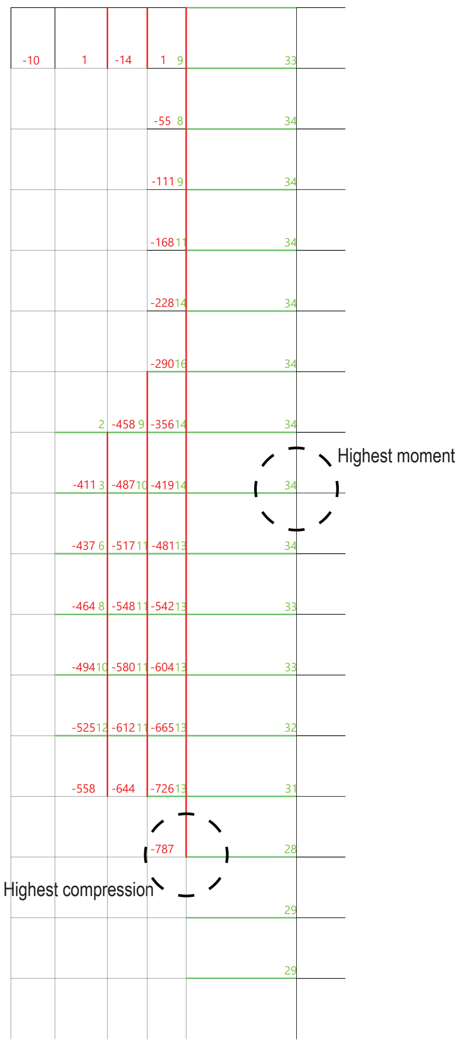
Maximum load beam can resist:

$$1675500N \times (120 - 0{,}4 \times 51) = 166kNm$$

✓

APPENDIX G

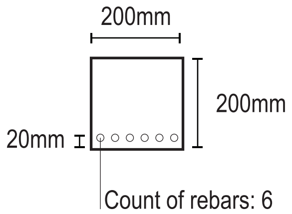
Sizing of concrete elements in all-concrete variation



Highest moment occours in long spanning deck beam, the moment is 34kNm

Highest compression occours in lower interior column, the stress is 787kN

/ sizing of concrete beam



Boundary conditions/ assumptions:

Concrete safety class is: reinforced / 1.4

Steel safety class: 1.2

Moderate environmental class

Reinforcement has a characterical tension strenght of 500MPa

Reinforcement rods have a radius of 8mm

The beam is subject to a moment of 34kNm moment.

New concrete is C30

Goal is to check wether a C30 beam with 8 pieces of rebar can withstand the forces posed upon the element

Allowable compressive strenght of concrete:

$$f_{cd} = \frac{30MPa}{1.4} = 21{,}43MPa$$

Allowable yield stress of steel:

$$\frac{500MPa}{1{,}2} = 458{,}33MPa$$

Center of gravity for reinforcement is determined:

$$\frac{20 \times 6}{6} = 20mm$$

Effective height of the cross section:

$$200mm - 20mm = 180mm$$

Reinforcement area is determined:

$$6 \times \pi \times (8mm)^2 = 1206mm^2$$

Force in reinforcement when it yields:

$$1206mm^2 \times ,458{,}33MPa = 552.750N$$

Finding neautral axis height:

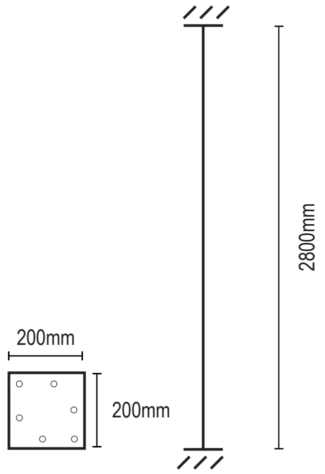
$$\frac{552.750N}{0{,}8 \times 200mm \times ,21{,}43MPa} = 161mm$$

Maximum load beam can resist:

$$552.750N \times (180 - 0{,}4 \times 161) = 63{,}9Nm$$

✓

/ sizing of concrete column



$f_{ck} = 30$

$\alpha = 16$

$\frac{f_{cd} \times 10^{-4}}{\pi^2 \times E_{0crd}} = 1.1$

Calculative strenght concrete:

$f_{cd} = \frac{30MPa}{1.4} = 21{,}43MPa$

Radius of gyration:

$i = \frac{200mm}{\sqrt{12}} = 57{,}74$

Allowable stress in concrete:

$$\frac{21{,}43MPa}{\left(1 + 1.1 \times 10^{-4} \times \left(\frac{2800mm}{57{,}74mm}\right)^2\right)} = 17{,}02MPa$$

Critical axial force concrete:

$17{,}02MPa \times 200mm \times 200mm = 0{,}68Ne + 06$

$0{,}68Ne + 06 \Rightarrow 680.964N \times 10^{-3} = 681kN$

Section area:

$200mm \times 200mm = 40.000mm^2$

Reinforcement area:

$6 \times \pi \times (8mm)^2 = 1206mm^2$

Reinforcement ratio:

$\frac{2106mm^2}{40000mm^2} = 0{,}030$

Calculative strenght of reinforcement:

$\frac{500MPa}{1{,}2} = 416{,}6MPa$

Critical axial force:

$$N_{crd} =_{min} \begin{cases} 681kN \times (1 \times 16 \times 0{,}030) = \underline{1009kN} \; ✓ \\ 681kN + \left(.1206mm^2 \times ,416{,}66MPa\right) = 1183kN \end{cases}$$

Boundary conditions/ assumptions:

Concrete safety class is: reinforced / 1.4

Steel safety class: 1.2

Moderate environmental class

Reinforcement has a characterical tension strenght of 500MPa

Reinforcement rods have a radius of 8mm

The column is subject to a compression stress of 787kN.

New concrete is C30

Goal is to check wether a C30 column with 6 pieces of rebar can withstand the forces posed upon the element

Aalborg University
MSc04 Group 06
Frederik Sejling Nielsen
Thor Møller Toussaint
Victor Rosenkilde Jørgensen

@warupcloseteam