CREATING NEB OURHOODS TOGETHER

Circular Transformation Roadmap

Deliverable No. D4.4

Date of submission: 18.12.2024
Lead Beneficiary: TUM
Dissemination Level: PU - Public

Grant Agreement No.: 101080052
Project Duration: 01.10.2022 – 31.03.2025

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DELIVERABLE NO. D4.4

Deliverable Title	Circular Transformation Roadmap
Work package Number	WP 4
Lead Beneficiary	TUM
Deliverable Type	D4.4 Report
Dissemination Level	PU - Public
Due Date Month	27
Authors of this report	Carsten Schade / Johannes Staudt / Catherine Steiner / Josef Rott / Werner Lang
Date of submission	18.12.2024

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VERSION

Version	Date	Author	Organization	Description
1.0	30.09.2024	Carsten Schade, Johannes Staudt	TUM	First draft, Structure & Content
1.1	09.10.2024	Carsten Schade, Johannes Staudt	TUM	Draft, Feedback project lead
2.0	16.12.2024	Carsten Schade, Johannes Staudt, Catherine Steiner, Josef Rott	TUM	Draft, Feedback project lead
2.0	18.12.2024	Carsten Schade, Johannes Staudt, Catherine Steiner, Josef Rott, Werner Lang	TUM	Final version

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GLOSSARY

EC	European Commission
EU	European Union
GFA	Gross Floor Area
HOAI	Honorarordnung für Architekten und Ingenieure/ Fee Structure for Architects and Engineers
HR	Handlungsraum der Stadtentwicklung / Urban Development Action Area
IHRK	Integriertes Handlungsraumkonzept / Integrated Urban Development Plan
ISEK	Integriertes Stadtteilentwicklungskonzept / Integrated Urban Regeneration Implementation Plan
M	Project Implementation Month
NEB	New European Bauhaus
NEBourhoods	Creating NEBourhoods Together
NGO	Non-Governmental Organisation
NPL	Munich Neuperlach
OA	Open Access
T	Task
WP	Work Package
Organisation Name (Consortium)	
AGM	Architekturgalerie München e.V.
BYF	Bayerische Forschungsallianz GmbH / Bavarian Research Alliance GmbH
GC	Green City e.V.
HM	HM Hochschule München University of Applied Sciences
HM:UniverCity	HM Innovationsnetzwerk / HM Innovation Network
MGS	MGS Münchener Gesellschaft für Stadterneuerung GmbH
MS	UnternehmerTUM MakerSpace GmbH
MUC	Landeshauptstadt München / City of Munich
MUC CCI	Kompetenzteam Kultur- und Kreativwirtschaft / Team of Excellence for the Cultural and Creative Industries
MUC CULT	Kulturreferat / Department of Arts and Culture
MUC LED	Referat für Arbeit und Wirtschaft / Department of Labor and Economic Development
MUC PLAN	Referat für Stadtplanung und Bauordnung / Department of Urban Planning and Building Regulations
SCE	Strascheg Center for Entrepreneurship
STR	Str.ucture GmbH
SAAD	Studio Animal-Aided Design GmbH
SSR	Studio | Stadt | Region Forster Kurz Architekten und Stadtplaner Partg Mbb
TUM	Technische Universität München / Technical University of Munich
UTO	Urban Transformation Office
UTUM	UnternehmerTUM GmbH
Organisation Name (in Cooperation with)	
MER	Münchner Ernährungsrat e.V.
MIN	Münchner Initiative Nachhaltigkeit
OTH	Ostbayerische Technische Hochschule Regensburg
Organisation Name (Associated Partners)	
BDA	Bund Deutscher Architektinnen und Architekten e.V.
BDA-By	Bund Deutscher Architektinnen und Architekten Bayern e.V.
ByAK	Bayerische Architektenkammer, Körperschaft des öffentlichen Rechts / BAK – Federal Chamber of German Architects

1 EXECUTIVE SUMMARY

This report is part of the deliverables of Creating NEBourhoods Together (2022-2025). NEBourhoods is one of the six lighthouse demonstrators of the New European Bauhaus funded by the EU to address the great challenges of climate, environment, and health. Combining co-creation and entrepreneurship while placing culture and creativity at the core of the transformation process, the project delivers accessible and empowering solutions to make the EU Green Deal beneficial for all in Munich Neuperlach and beyond. Our NEBourhoods action Circular Neuperlach aims to transform large, monofunctionally used office buildings in a fundamentally sustainable, circular, and neighborhood-oriented way. The goal is to identify new circular uses for existing buildings and to design their transformation for urban development for the common good.

We developed a new methodology – the Circular and Neighborhood-oriented Transformation – that brings together stakeholders from real estate, municipalities, planning, and civil society in early planning phases. Our research design was based on literature research and expert interviews to co-creatively develop the methodology in workshops and test it in teaching formats. This deliverable – the Circular Transformation Roadmap – describes the process of how we align the qualities and potential of existing buildings with overarching developments, the local context, and user and neighborhood needs. We explain how we use the information for the architectural programming of new uses and the design of the building transformation. We introduce a unifying framework –Circular Uses – to promote a circular transformation: Circular Uses combine continued use, change of use, intensified use, and multiple use of buildings. Supported by our newly developed analysis Concept of Layers and Zones, we show how the transformation can connect the building with the neighborhood.

This Circular Transformation Roadmap summarizes the research findings in six parts: After an introduction, we describe the basics to develop our roadmap. Next, we explain the three phases of our methodology (Analysis, Programming, Early Architectural Design) and the individual steps of these phases. Subsequently, we describe a series of workshops and the necessary actors to implement our approach. We conclude with a summary and finally provide policy recommendations. In the appendix, we give exemplary insights into individual methods we applied in our research.

A key finding is that an agile institution is needed to engage with various private and public actors on an equal footing in specific project developments. In our research, we established the Urban Transformation Office (UTO), which played a crucial role in implementing our methodology into specific project developments in early planning phases. Further recommendations such as stronger interdisciplinary collaboration, regulatory adjustments, or funding measures are summarized in the policy recommendations.

Currently, our findings are being incorporated into local political council resolutions. Furthermore, we intend to continue the work of the UTO institution. The step-by-step descriptions of our roadmap enable a transfer to other neighborhoods and cities in Germany and Europe. The roadmap is thus a prototype that can be adapted to specific contexts to advance the transformation within planetary boundaries while considering human needs.

2 INTRODUCTION

Figure 1: Circular Neuperlach: Transformation of existing large, monofunctionally used office buildings. Image Source: Carsten Schade & Johannes Staudt (TU Munich)/ NEBourhoods.

2.1 NEBOURHOODS PROJECT OVERVIEW

“Creating NEBourhoods Together” is one of the six lighthouse demonstrators of the New European Bauhaus funded by the EU to address the great challenges of climate, environment, and health. The aim is to collaborate on the European Green Deal to create more sustainable, inclusive, and beautiful living environments across the EU. In Munich-Neuperlach (NPL), one of Europe's largest post-war urban expansion areas, NEBourhoods is collaborating with citizens and stakeholders from culture, science, and business to implement ten actions from all fields of urban development, encompassing circular construction and redesign of residential and commercial buildings, innovative forms of mobility and energy communities, biodiversity and green space concepts and nutrition and youth culture. Encouragement of entrepreneurial thinking and action and practical implementation in co-creative processes support the formation of sustainable neighborhoods in livable, inclusive, and beautiful cities of the future. Combining co-creation and entrepreneurship while placing culture and creativity at the core of the transformation process, the project delivers accessible and empowering solutions, providing roadmaps and kickstarting actions to make the EU Green Deal beneficial for all in Neuperlach and beyond. With meticulous care, the district is being cultivated to become a resilient urban innovation landscape. Over a two-year period, we have been creating NEBourhoods together, demonstrating how circular thinking and acting in society and the economy can be realized, how the green transformation in construction, mobility, energy, food and health can be activated and how public spaces can be enhanced.

2.2 OBJECTIVE OF THIS NEB ACTION: CIRCULAR NEUPERLACH

“Circular Neuperlach” is one of the “NEB actions” of the “Creating NEBourhoods Together” project. Circular Neuperlach investigates how office buildings that fall out of use can contribute to regenerative, climate-friendly, and neighborhood-oriented urban development through transformative approaches. Large, monofunctionally used office buildings from the post-war period in private ownership have been identified by the City of Munich as a particular challenge for urban development in Neuperlach. The focus of our NEB action is on extending the building's lifespan, further use, conversion, intensified and multiple uses through innovative, circular strategies in a neighborhood-oriented way.

Our developed methodology for “circular and neighborhood-oriented transformation” of existing buildings aims to promote cooperative approaches between municipalities, owners or developers, and other stakeholders. It explores ways in which particular interests can engage with public interests in the sense of urban development for the common good in the early planning phases (Schneidewind, 2024; Bundesinstitut für Bau-, Stadt- und Raumforschung [BBSR], 2021). Circular Neuperlach thus contributes to fundamentally sustainable social, technological, economic, and ecological transitions to remain within the planetary boundaries identified by Rockström et al. (2009) and to ensure a safe and equitable operating space for humanity (Raworth, 2017), meeting the needs not only of current but also future generations (O’Neill et al., 2018).

Project Design

In a co-creative process, we developed a methodology for transformation that involves stakeholders from the real estate industry, city administration, planning, and civil society in planning and development processes at an early stage of project development. This “circular and neighborhood-oriented transformation” methodology builds on established design process models. It combines holistic analytical approaches such as systems thinking, mapping, and architectural programming (Peña & Parshall, 1969/2001) with solution-oriented methods, including design thinking, strategic design (Hill, 2012), and scenario-based design. We tested the methodology in teaching-research formats with students (see Figure 3: Case Studies) and further developed it through workshops with practitioners (see Figure 3: Workshops & Engagement).

Figure 2: Experts workshops on neighborhood needs in Neuperlach. Image Source: Carsten Schade & Johannes Staudt (TU Munich)/ NEBourhoods.

Below, we describe the individual steps of our research design (see Figure 3). The research is based on the challenge identified by the City of Munich: How can large, monofunctionally used office buildings from the post-war period in private ownership be developed and at the same time contribute to an urban development for the common good? First, we conducted a Literature Research to gain a deeper understanding of the problem. From our literature research, we derived the framework of “circular uses” – continued use, change of use, intensified use, and multiple use – to prioritize higher levels of circularity (Potting et al., 2017). We used this framework to structure our Expert Interviews with academia, civil society, governance, industry, and planning (Staudt et al., 2024). We interviewed experts on strategies and processes regarding continued use, change of use, intensified use, and multiple use of existing buildings. The evaluation revealed examples, challenges, and strategies for the successful implementation of circular uses, focusing on large, monofunctionally used office buildings (Staudt et al., 2024).

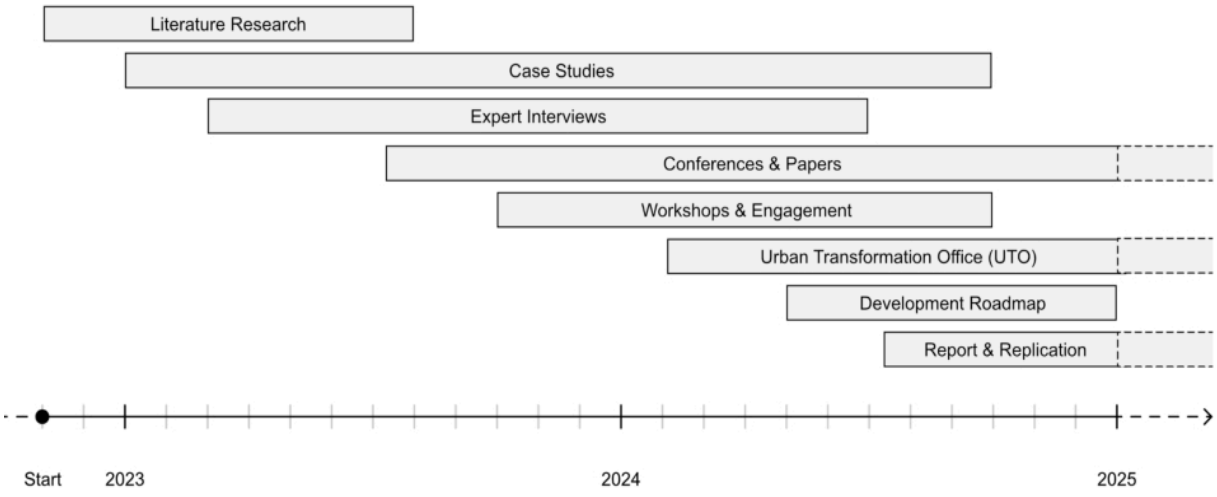


Figure 3: Research design of the NEB action “Circular Neuperlach”. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

Building on this, we analyzed specific existing buildings in Neuperlach as Case Studies. In our circularity analysis, we collected data about the neighborhood and the buildings and graphically processed the information (see Appendix for exemplary representations). This enabled us to present, assess, and discuss the complexity of the buildings and their potential contributions to circularity, particularly concerning the transformation of their neighborhood. Throughout the project, we provided information as a data basis for different groups, such as students, our own approach UTO (see chapter 4.5.2), and other stakeholders. In design studios, we tested transformation scenarios and building designs for existing non-residential buildings in Neuperlach with students. We visualized the findings graphically to make them

useable in planning practice. In parallel, we presented our findings at conferences and published them in scientific journals and practice-oriented publications (Conferences & Papers).

Our interdisciplinary team of creative professionals such as architects, urbanists, communication designers, and engineers (see chapter 2.3) developed in collaboration with other stakeholders a series of transferable workshops as the project progressed (Workshops & Engagement). Thanks to the research cooperation with the City of Munich, we were able to start testing our theoretical knowledge on a concrete ongoing project for the transformation of a monofunctionally used office building in Neuperlach. This collaboration also involved working together with project developers, the planning department of the City of Munich, and other stakeholders from planning practice, civil society, and administration.

Based on our findings from literature review, expert interviews, and initial tests of the methodology with practitioners, we established an institution, the Urban Transformation Office (UTO), as an integrated part of the Circular Neuperlach NEB action (see chapter 2.2). This institution enables acting as an official professional contact for stakeholders such as developers or city administration. UTO is an approach which plays a central role in implementing methods and incorporates research findings into specific project developments at an early stage. UTO pools expertise and brings together stakeholders from business and administration within the process.

The findings and the developed methodology, including the process steps for practical implementation, have been summarized in the present Circular Transformation Roadmap for Neuperlach (Development Roadmap). The roadmap makes the findings transferable to other cities (see chapter 4).

2.3 NEB ACTION TEAM

The research team consists of a core team from the NEB action Circular Neuperlach, which collaborates with an extended project team from the NEBourhoods project to conduct research together with practitioners.

Our interdisciplinary core team of creative professionals and researchers consists of the TUM Chair of Energy Efficient and Sustainable Design and Building (Johannes Staudt, Carsten Schade, Josef Rott, Catherine Steiner, Werner Lang). It is made up of architects and urbanists, engineers, artists, and literary scholars combining expertise in holistic sustainable analysis, planning, and design of buildings and neighborhoods. We draw on experience in building design and urban analysis, the conception and implementation of participatory formats and workshops, and sustainability and life cycle analysis.

The core team is supported by further creative professionals for the co-creation according to the NEBourhoods living-lab approach (Laura Maria Höpfner, Anna Várnai, Patrik Thomas), by the NEBourhoods TransitionHub team to support the co-creation process (Peter Brooren, Christina Schepper-Bonnet, and others), by the City of Munich (Landeshauptstadt München: Christoph Heidenhain, Sylvia Pintarits, Claudia Baukholt, and others) as a central stakeholder for implementation through contact, information updates, advice on current developments within and outside the administration, as well as workshop participation, by MGS (Münchner Gesellschaft für Stadterneuerung) as neighborhood management for locale expertise and replication (Torsten Müller, Tina Zoch), by Architekturgalerie München (Cornelia Hellstern, Nicola Borgmann) for communication and replication, by TUM Venture Lab Built Environment and UnternehmerTUM for entrepreneurial thinking. In the extended project team, we collaborated with communication experts and designers, neighborhood management, and the city planning department, and others. For our practice-oriented research, we engaged project developers, housing cooperatives, activists, and other stakeholders from the real estate industry, planning, administration, civil society, and academia.

Furthermore, we tested and disseminated our methodology and its potentials in the following study formats and further developed methods such as LCA approaches in master's theses (for a complete list of courses and master's theses, see the appendix): “Interdisziplinäres Projekt”, design studio in collaboration with TUM Chair of Building Physics, TUM Chair of Building Technology and Climate Responsive Design, TUM Chair of Timber Structures and Building Construction, and guests from planning practice; “Gemeinsam für die Bauwende” lecture series with 12 national universities and Architects for Future; “Interdisciplinary Design and Research Methods” project week in collaboration the Shaere Neuperlach; “EuroTeQ Collider” challenge of the TUM Munich School of Politics and Public Policy (Associate Professorship of Policy Analysis); “Hacking Neuperlach” challenge of the SCE at the Munich University of Applied Sciences (WP 3 Entrepreneurship). The appendix provides an overview of the activities through which the team has engaged various stakeholders in workshops, conferences, interviews, and other formats of exchange.

2.4 OBJECTIVE OF THIS DELIVERABLE: CIRCULAR TRANSFORMATION ROADMAP

This “Circular Transformation Roadmap” takes existing buildings as the starting point and outlines steps for their circular and neighborhood-oriented transformation, supporting urban development for the common good. The roadmap implements global, European, national, and local goals and frameworks, making them transferable to other neighborhoods and cities in Europe. It includes circular design, construction, and occupancy with the goal of contributing to climate neutrality, reducing resource consumption, extending the use phase of buildings, and closing material cycles. These goals can only contribute to fundamentally sustainable and resilient development if they are intertwined with urban development for the common good. For this, central dimensions of social sustainability, such as promoting social cohesion, must be a relevant part of the methodology.

We developed a practice-oriented methodology of “circular and neighborhood-oriented transformation” that enables decisions in early planning phases for more sufficiency, consistency, and efficiency in dealing with existing buildings. Our methodology and workshop series condense the findings from co-creative research with partners from administration, the real estate industry, planning, and civil society. This roadmap is intended as a prototype for new planning practices in the spirit of the New European Bauhaus and can be anchored in overarching municipal innovation processes in the future. It is addressed to planners in administration and planning offices, project developers, investors, and property owners, as well as all project participants and interested parties who are affected by and want to help shape the transformation of existing buildings.

The roadmap was developed using the example of the neighborhood Neuperlach in Munich. The results of this roadmap flow into existing overarching urban development processes in Munich, so that all involved stakeholders can jointly establish circular building and design practices in the long term.

2.5 HOW TO USE THIS ROADMAP

This Circular Transformation Roadmap consists of six parts: an introduction, background information of the basics to develop the roadmap, the roadmap itself, a summary with outlook, policy recommendations, and an appendix with a selection of methods. To make the contents of the roadmap more tangible, we have included examples. In the gray-highlighted info boxes, we show examples from our work process. In the purple-highlighted info boxes, we describe good practice examples for implementation.

In this Circular Transformation Roadmap, we first provide an overview of the current challenges, the local context, the current discourse and the state of research, and explain relevant terms (see chapter 3). We then describe our methodology for transforming existing buildings in early planning phases to be circular and neighborhood-oriented (see chapter 4.1): We outline the phases of the methodology (see chapter 4.2), individual steps of the process (see chapter 4.3), and propose a series of workshops for the implementation of the roadmap into the planning practice (see chapter 4.4). We describe the stakeholders involved in the process, present organizational forms and models for successful building transformation, and introduce our own institution, the Urban Transformation Office (UTO) (see chapter 4.5). We conclude with a conclusion and outlook (see chapter 5) and policy recommendations for decision-makers in planning, administration, and economy (see chapter 6). The appendix provides further insights into our working methods that can serve as an inspiration.

3 BASICS TO DEVELOP THE ROADMAP

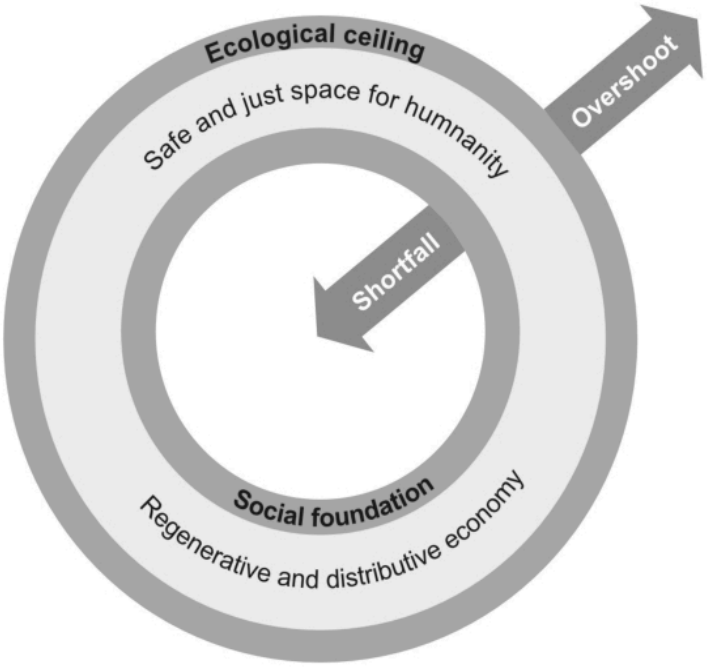
In this chapter, we describe the basics for developing our roadmap. We begin with the global and local challenges to which the built environment can contribute. Then, we explain theoretical and regulatory frameworks to gain a better understanding of the current conditions and the possibilities for systemic change. After that, we delve into our study area of Neuperlach and the case studies on which we based our roadmap. Next, we provide an overview of current discourse and the state of research regarding the transformation of existing buildings, circularity, and planning processes, including programming and early planning phases. We explain the term “circular uses,” which we developed as a unifying framework for the transformation of existing buildings. Building on this terminology, we outline circular transformation strategies and conclude by summarizing the hurdles to implementation. The basics of this chapter can be used by the reader to better understand the relevance and framework conditions for applying the roadmap. In particular, the term "Circular Uses," which we have newly introduced, has proven helpful in communication with stakeholders.
It is important to note that large sections of this chapter were written for our scientific publications related to the research project. The passages are quoted verbatim and highlighted accordingly. The publications have been accepted as manuscripts and are still in the peer review process at the time this Circular Transformation Roadmap was created.

3.1 CHALLENGES AND FRAMEWORKS

3.1.1 Challenges and the Role of Existing Buildings

Urgent issues of our time, such as the climate crisis, resource depletion, and affordable housing, highlight the difficulty of balancing human needs within the planet's ecological limits (see Figure 4; Raworth, 2017). The built environment has been recognized as a significant contributor to this multifaceted crisis (International Energy Agency [IEA], 2019). In Germany, for instance around 40 percent of greenhouse gas emissions are attributed to the construction and operation of buildings. A significant part of these emissions results from the so-called “embodied energy,” which is the energy required for the production, transportation, and disposal of building materials (BBSR, 2020). Furthermore, approximately 38 percent of raw

material consumption is attributed to the construction of buildings and infrastructure (Umweltbundesamt [UBA], 2022). The construction sector also constitutes the largest part of what is known as the “anthropogenic stock.” This term refers to the total stock of materials that humans require for their buildings, infrastructure, and consumer goods. Notably, 55 percent of these stock masses are bound in the building stock, amounting to an estimated material stock of over 50 billion tons (ibid.).



by Rockström et al. (2009) (no overshoot above the ecological ceiling) and assure a safe and just operating space for humanity (no shortfall below the social foundation).Image Source: Johannes Staudt (TU Munich)/ NEBourhoods, based on Raworth (2017).

In architecture and urban design, responses have typically been framed within existing growth paradigms (sustainable new construction) and technical solutions. The concept of circular economy has been suggested to address the challenges mentioned above (Cheshire, 2016). However, such growth models are increasingly being questioned by post-growth perspectives (Petschow, 2020).

In Europe, the transformation towards sustainable futures must occur within existing urban settings (WBGU, 2016), to adapt existing structures to new needs and avoid additional land use. The adaptation of existing buildings can contribute directly to sustainability by improving an efficient use of the built structures and energy efficiency or indirectly by supporting uses that promote social and environmental transformation. While refurbishment and conversion have been prominent topics in discussions for many years, the building practice continues to be dominated by demolition and new construction. This trend stems from a complex interplay of various factors, including regulatory, financial, and societal challenges (see chapter 3). One of the key questions regarding transformation processes in the built environment is: Who owns the land, and what interests are pursued with it? In Germany, for example, about 48 percent of around 21 million existing buildings (of which 3 million non-residential) are privately owned (EC, 2024a). For the transformation of this stock, municipalities have no direct access and comparatively limited control options. Therefore, in market-based, democratic systems, municipalities rely on cooperative approaches with owners, developers, and investors. Our research project builds on this point and has developed a transformative approach through a co-creative research process.

To extend the lifespan of buildings, we have examined reference planning processes and identified “architectural programming” – the conception of (new) uses for buildings (Peña & Parshall, 1969/2001]) – as an underexplored area within the urban circularity discourse (Staudt et al., 2024). In planning practice, there are approaches to further use, convert, expand, or multiply the use of existing buildings. For large, monofunctionally used office buildings, however, these approaches are currently limited to only a few innovative pilot projects and processes. Currently, there is a notable lack of structured guidance on effectively utilizing the early planning phases as levers to enhance existing buildings in a circular and neighborhood-oriented way (Schade et al., 2024) and thus extending their lifespan and integrating the neighborhood’s needs into the development process from the outset. This gap offers the opportunity to put the goals of the New European Bauhaus into practice and to implement approaches from the NEB Compass (European Commission [EC], 2022) into innovative planning processes.

3.1.2 Regulatory Frameworks for Sustainable Urban Development

We advocate for circularity as a fundamental framework because it integrates a complex, systemic approach to achieve transformative effects at multiple scales. This approach enables designers and planners to develop effective strategies for transforming existing buildings and neighborhoods.

To contextualize our research, we reference national and global sustainability frameworks such as the international Sustainable Development Goals (United Nations [UN], 2015), European climate targets (European Green Deal (EC, 2019)), European guidelines for socially and ecologically sustainable real estate development (EU Taxonomy; ESGs; NEB Roadmap and Investment Guidelines; Circular Economy Action Plan) (European Parliament [EP], 2020; EC, 2020a, 2022, 2024b) Additionally, we look at agreements of the EU ministers on integrated urban development for the common good (Leipzig Charta (EC, 2007), New Leipzig Charta (EC, 2020b), European programs (European Urban Initiative [EUI], 2022), and building culture (World Economic Forum, 2018). National goals like the 30-hectare target (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety [BMU], 2020) and associated key objectives such as double inner development through structural and green densification (Gstach & Berding, 2016) provide the framework for thoroughly analyzing existing built environments and established social structures.

3.1.3 Theoretical Framework for Systems Changes

To describe the desired transformation in the built environment, we refer to Frank W. Geels' (2011) multi-level perspectives model – a theoretical framework on how systems change. According to this model, there are three levels (see Figure 5): The top level involves long-term developments such as demographic change or changes in work, known as megatrends (Socio-technical Landscape). For the roadmap, it is important to understand which of these overarching developments have a particular influence on the local level (see chapter 4.3.3). The middle level describes an existing system with its institutionalized governance structures, economy, science, culture, regulations, etc., and the established stakeholders such as municipalities, politicians, developers (Socio-technical Regime). At this level, there are structures, practices, and path dependencies that ensure stability and continuity but can also prevent necessary changes. As part of Circular Neuperlach, we worked with actors from this level in co-creative processes to understand existing structures, regulations, and path dependencies in the different sectors and to identify leverage points for change (see chapters 3, 4.5). At the lowest level, Niche Innovations, innovations are developed and tested outside the existing system, such as co-working, multi-generational living, repair and maker spaces, etc. For our Circular Transformation Roadmap, these niche innovations are central to enable circular uses of existing buildings, i.e. continued use, change of use, intensified use, or multiple use of buildings (see chapters 3.4, 4.3.3, 4.3.4). The three levels interact with each other and can bring about transformation. Disruptive events such as the COVID-19 pandemic can open windows of opportunity, allowing innovations to change the regime, i.e. the existing system of technologies, rules, norms, and practices, in the long term.

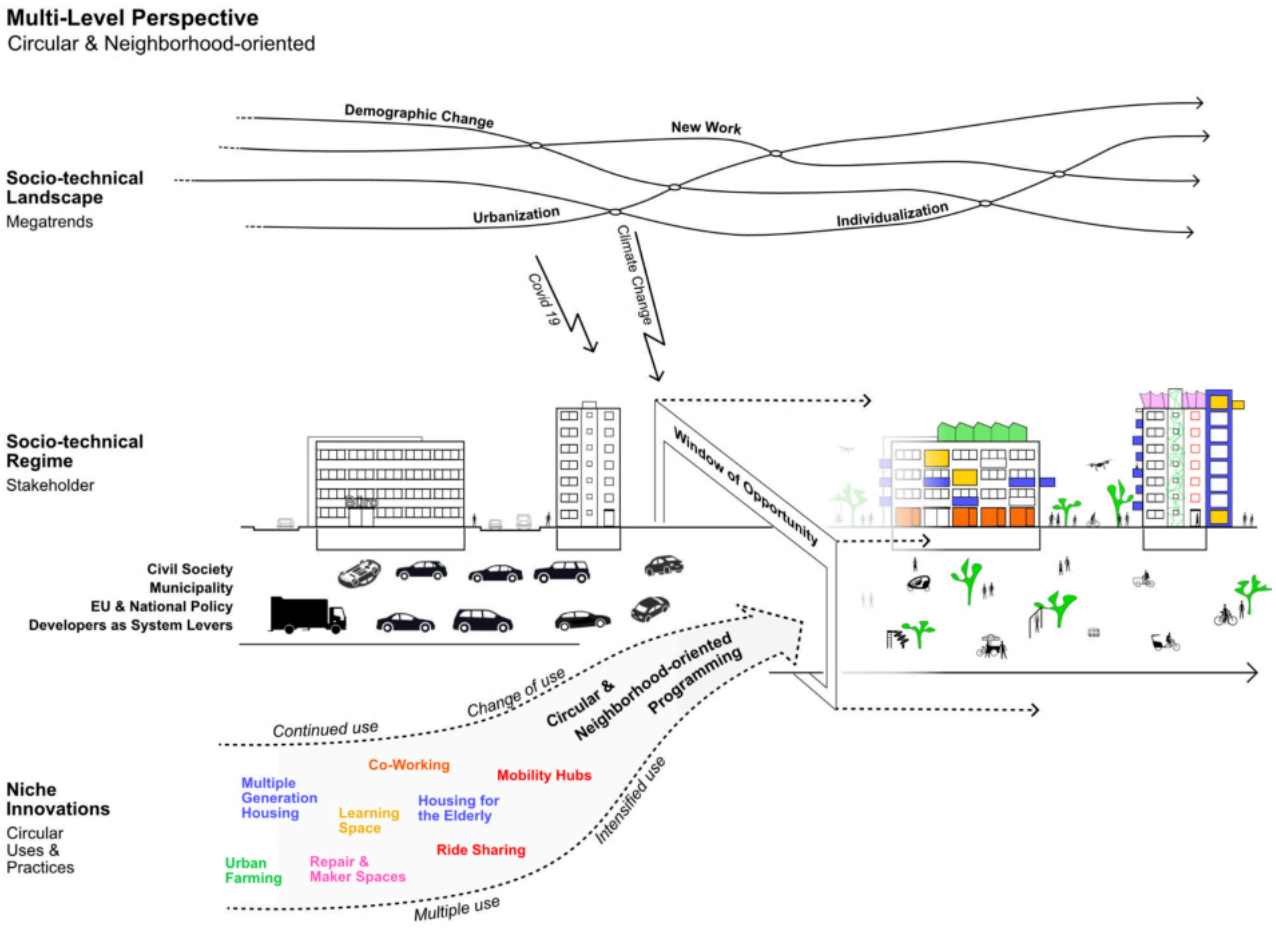


Figure 5: Multi-level perspective model as a theoretical framework on how systems change. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on Geels (2011), Rettich et al. (2023).

In Circular Neuperlach, we identified a window of opportunity for the transformation of large, mono-functional office buildings in Neuperlach. Disruptive events have favored long-term developments such as changes in work. Supported by digitalization, people are increasingly working from home. Large, mono-functional office buildings in Neuperlach are thus becoming increasingly obsolete and vacant. The upcoming transformation of these buildings opens windows of opportunity to implement niche innovations such as co-working or multi-generational living. For Circular Neuperlach, we worked with actors from the existing regime, such as the city administration or developers, to understand existing processes and achieve long-term changes. These desired changes are based on the values and working principles of the New European Bauhaus to promote a circular and neighborhood-oriented transformation for urban development for the common good.

To achieve this, we engaged in discourse, published scientific papers, and participated in conferences to exchange ideas with researchers. We also developed and disseminated new planning approaches with local and national stakeholders as well as with students as upcoming professionals and provide recommendations to support decision-makers.

3.2 NEUPERLACH AND THE LOCAL CONTEXT

The NEBourhoods project is situated in Munich's district of Neuperlach. Its main area is characterized by large-scale housing developed at the south-eastern edge in the late 1960s and 70s to meet the rising housing demand at the time (a so-called "Entlastungstadt"). The district was planned according to modern urban development principles, separating functions into housing, work, and leisure. Moreover, it was designed to be car-friendly, with wide roads and a clear separation of automobile and pedestrian traffic. The dominant building typologies are residential high-rise buildings and large-scale monofunctionally used office blocks. 21 percent of the gross floor area (GFA) of the buildings in Neuperlach are office buildings (Landeshauptstadt München [LHM], 2021, p. 54), which is a total of 483,992 m² GFA.

Figure 6: Neuperlach planned according to modern principles of urban development: Pedestrian bridges are a characteristic element of the car-oriented city of Neuperlach to separate automobile and pedestrian traffic. Image Source: Dieter Hinrichs.

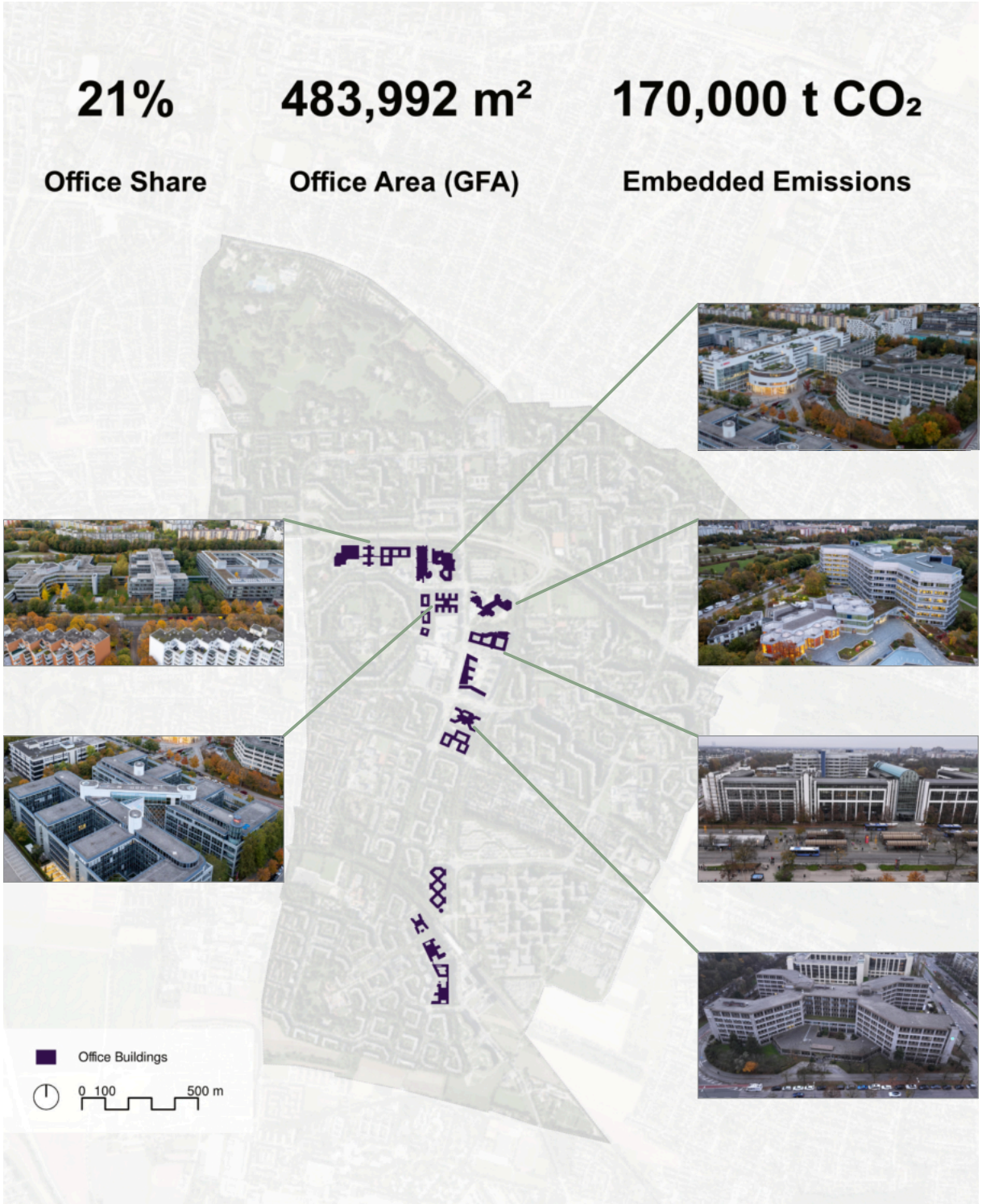


Figure 7: Potential case studies: Large, monofunctionally used office complexes. The numbers shown for office buildings in Neuperlach are based on the urban development concept (LHM 2021: 54). Image Source: Carsten Schade & Josef Rott (TU Munich) / NEBourhoods, Photos Patrik Thomas, NEBourhoods.

The total grey emissions in these offices are approximately 170,000 tons of CO2. Here, the existing reinforced concrete structure is responsible for more than half of the emissions. While the building-embedded emissions are in the order of around 360 kg CO2-eq./m² GFA the total emissions almost double to around 690 CO2-eq./m² GFA if the energy use emissions are being considered. Across Europe, office buildings account for approximately seven percent of the existing building stock (EC, 2024a). Therefore, extending their life and energy refurbishment can be vital in meeting the EU's ambitious climate goals.

Building	Year	GFA [m²]	Owner
Fritz-Schäffer-Str. 9	1981	41.747	International real estate developer
Fritz-Schäffer-Str. 9	2000	28.558	International real estate developer
Hanns-Seidel-Platz 4	1992	43.508	International real estate investor
Thomas-Dehler-Str. 3	1975	54.005	State institution for social insurance
Adenauerring 7	1999	22.720	National real estate investor
Adenauerring 9	1994	17.140	National real estate investor
Adenauerring 11	2007	34.954	National real estate investor
Thomas-Dehler-Str. 2	1994	35.806	N/A
Fritz-Schäffer-Str. 2	1981	5.850	International real estate fund
Charles-de-Gaulle-Str. 4	1982	4.515	Medical services company
Charles-de-Gaulle-Str. 2	1983	6.895	Educational institution
Thomas-Dehler-Str. 25	2002	16.429	Insurance company
Putzbrunner Str. 71	1987	14.790	International office service provider
Carl-Wery-Str. 34	2006	19.203	Household appliance manufacturer
Carl-Wery-Str. 34	2006	13.638	Household appliance manufacturer
Carl-Wery-Str. 42	2006	21.222	International research company

Table 1: Database of potential case studies of large office complexes in Neuperlach. Image Source: Josef Rott, Carsten Schade & Johannes Staudt (TU Munich)/ NEBourhoods.

In Neuperlach, the office blocks were (and some still are) used and operated by single owners or tenants as central administrative offices. Many of these owners and users have left, are, or will be leaving these buildings to seek smaller, more efficient, and more up-to-date locations. This has led to building obsolescence and opens new questions on whether and how to use these buildings in the future. Before the pandemic, 18-20 square meters per worker was typical, while some modern layouts now aim for a lower density to accommodate hybrid work models and collaborative spaces (AEW, 2024). This shift means that although companies may maintain similar overall square footage, the average office occupancy rate across Europe remains at 55% (as of February 2023), compared to 70% before the pandemic, with significant drops on Fridays. Generally, slightly higher office utilization can contribute to a productive working environment (Savills, 2023). The current trends are influenced by factors

like office class (economy, comfort, business) and additional communal spaces, which vary by organizational needs. For instance, smaller private companies might opt for more compact setups, while larger corporations typically require additional areas for conference rooms, kitchens, and lounges.

Figure 8: Neuperlach designed to be car-friendly with wide roads and a clear separation of automobile and pedestrian traffic. Image Source: Patrik Thomas/ NEBourhoods.

The transformation process in Neuperlach has already begun with prominent examples such as the “Fritz District” redevelopment of the former Allianz insurance building by a large international developer. Since 2022, 497 hectares of Neuperlach (LHM, 2021, p.8) have been designated as a redevelopment area (Stadtsanierungsgebiet, see Figure 9) as part of the German Urban Development Program (Städtebauförderung) to address urban deficiencies. To receive multilevel funding, an Integrated Urban Regeneration Implementation Plan (Integriertes Stadtentwicklungskonzept [ISEK]) was developed, which analyzes various urban aspects such as mobility, energy, or education and integrates them into planning measures over a period of 15 years, in line with German Urban Development Regulation. The urban development principles as laid out in the Leipzig Charter for Sustainable European Cities (EC, 2007) and the New Leipzig Charta on the transformative power of cities for the common good (EC, 2020b) are part of the framework for integrated urbane development in Germany. The ISEK is embedded in the City of Munich’s overarching urban development strategy to address pressing and future challenges of the growing city, such as climate protection and adaptation or affordable housing (LHM, 2024). The concept also reflects the ambitions of the City of

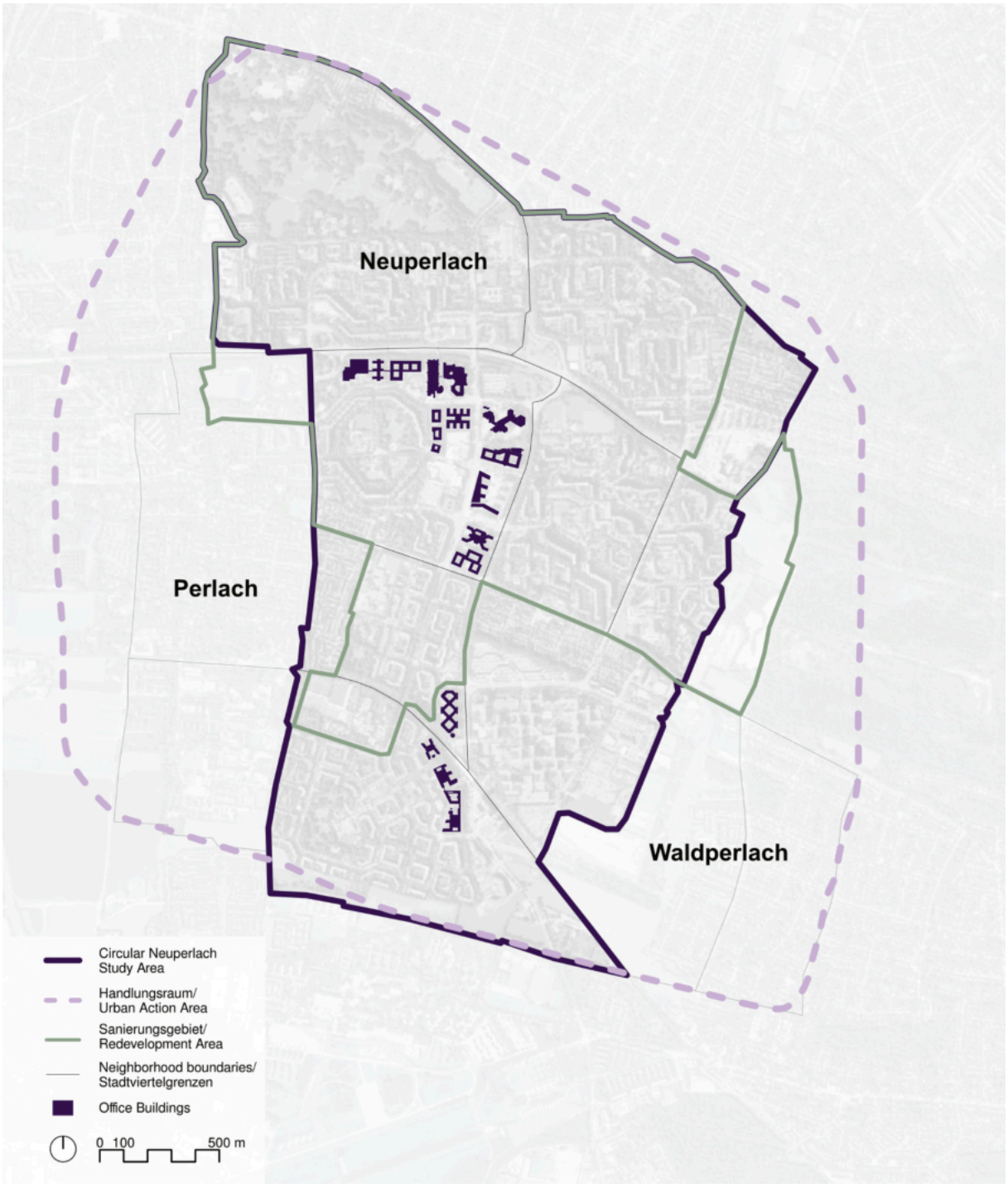


Figure 9: Study area of Circular Neuperlach with large office buildings. In Neuperlach, there are urban development concepts for a redevelopment area (Sanierungsgebiet, see ISEK) and an urban action area (Handlungsraum, see IHRK). Image Source: Josef Rott & Carsten Schade (TU Munich)/ NEbourhoods, based on GeoPortal München, Birk et al. (2024).

Munich as a Zero Waste City (Abfallwirtschaftsbetrieb München [AWM], n. d.) and as a pilot city for the built environment in the European Circular Cities and Regions Initiative (https:// circular-cities -and-regions.ec.europa.eu). The ISEK was developed in a two-year phase of “preparatory investigations” (Vorbereitende Untersuchung), data was collected, and participatory processes were conducted on-site. The funding of the proposed measures from the ISEK enables the pooling of resources and their implementation supported by a publicly funded neighborhood management. The medium- to long-term funding builds a crucial foundation for developing and permanently implementing the NEBourhoods measures in Neuperlach. The designated urban regeneration area is part of the larger area “Neuperlach and Surroundings" (Urban Action Area/ Handlungsraum, see Figure 9). There is an informal municipal planning plan and management for its integrated urban development (Integrated Urban Development Plan/ Integriertes Handlungsraumkonzept). The NEBourhoods project is active in this wider area. The study area of our NEB action Circular Neuperlach encompasses the official neighborhood boundaries (Stadtviertelgrenzen) of Neuperlach which covers around 662 hectares (see Figure 9). The area is characterized by multi-story building typologies with high density. It can be clearly distinguished from the surrounding development, which is predominantly characterized by single-family and row houses.

3.3 PRACTICE AND FIELD OF RESEARCH FOR TRANSFORMATION

3.3.1 Transformation of Existing Buildings

“The discourse on how to deal with existing buildings has developed considerably in recent years, intertwining mutually evolving strands of development. Historic preservation has a long history with a focus on cultural heritage, historic significance, and urban revitalization. Such types of adaptive reuses dominate the existing literature and largely focus on individual buildings of particular significance and often house special cultural and public functions. Another large swath of literature focuses on energy-efficient refurbishment (Richarz & Schulz, 2011). More recently the focus has shifted from energy consumption to the preservation of existing buildings to save resources and prevent emissions related to new building construction (Petzet & Heilmeyer, 2012; Wong 2023; BSBK, 2022).
The most recent discourse focuses on the conversion of existing buildings to contribute to transformational change, also framed as Umbaukultur (Grafe & Rieniets, 2020; Berke & de Monchaux, 2023; Heilmeyer & Hofmeister, 2024; Ngo et al., 2024). This paradigm shift is supported by recent geopolitical developments, such as supply bottlenecks resulting from the Ukraine crisis, as well as policy incentives, such as the EU taxonomy (EP 2020). Polemic positions even call for a ban on new construction (Fuhrhop, 2020) and document obsolete

buildings at risk of demolition to actively promote their transformation (www.abrissmoratorium.de; www.abbrechenabbrechen.de). The current issue of Arch+ (#256) describes this transformation in material, aesthetic, and social terms, particularly highlighting the social dimension (Ngo et al., 2024). The issue asks how more justice can be achieved through adaptive reuse and emphasizes that the price of this transformation must be negotiated socially.
We place our research in proximity to projects such as Obsolete Stadt (Rettich et al., 2023) that describes how overarching, long-term developments, so called megatrends (Naisbitt, 1982; Horx, 2014), lead to the obsolescence of certain building typologies. The buildings in question offer spatial potential for climate-friendly and co-productive urban development for the common good in growing cities. The existing buildings have the potential ‘to experiment with uses, programs, life models and economies that new buildings can no longer offer under today's more restrictive financial, legal and construction conditions.’ (Ngo et al., 2024, p.2). The experimental nature of transformation processes and the aspect of time are addressed by practices of interim use (www.netzwerkzwischennutzung.de), while recent research and internet platforms on multiple uses reflect a growing interest in multi-coded spaces (e. g. Teamwerk Architekten, 2021; www.teiln.de). (…)

To better understand the transformation of a building over time, Stewart Brand conceptualizes that a building consists of multiple layers which change and are changed at varying pace over time (1995; see also Figure 10). This model is missing the use (and user) of buildings and its context. It also limits the model to physical layers of the building and does not consider the spatial qualities which are essential to understand the potentials of existing structures to support new uses. In our research, we expand this layered and hierarchical model with a focus on use and context.” (Staudt et al., 2024). We further describe our extension of Brand’s model in chapter 4.3.3.

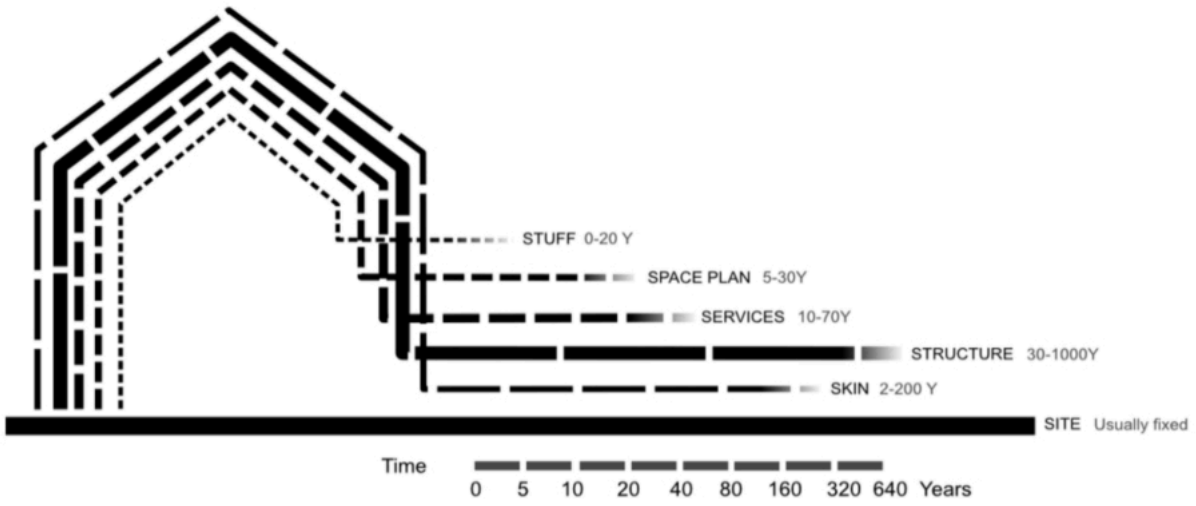


Figure 10: Building layers model. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods based on Brand (1995).

3.3.2 Circularity and the Built Environment

We refer to circularity as “a systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution” (Ellen MacArthur Foundation, 2022) to steer the transitions towards fundamentally sustainable and livable cities where the well-being of citizens is achieved while respecting the environmental limits of our biosphere. Our concept of fundamental sustainability can be linked to the idea of “absolute sustainability” (Hauschild et al., 2020), which refers to absolute boundaries posed by Earth's finite natural resources and the limited capacity of the environment to absorb pollution. It also relates to “deep sustainability” (Martin, 2022), which calls for the integration of human beings into the biosphere of planet Earth through a fundamental transformation of culture and civilization, including ways of doing science, business, education, and commerce. This kind of sustainability is also described in the “doughnut economics” model by Kate Raworth (2017): a space between the “social foundation” (representing the basic needs of human beings for civilizations to prosper) and an outer limit (“ecological ceiling”) as the “the safe and just space for humanity” (see also chapter 3.1.1). Related concepts of importance include resilience, livability, inclusiveness, diversity, and accessibility. In our research and teaching, we have developed a form of representation to develop fundamentally sustainable and livable cities (see Figure 12): In the interdependency wheel, fields of action are shown inside the circle and the goals outside the circle. This representation makes it possible to identify synergies and conflicts.

“The concept of circularity hierarchies referred to in various R strategies (e.g. Potting et al., 2017; see Figure 11) shows a hierarchical structure of circular actions designed to promote sustainability and circular economy practices. It offers a framework which integrates sufficiency (rethink), efficiency (reduce) and consistency (reuse, recycle).

Figure 11: Circularity hierarchies. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods based on Potting et al. (2017) and Meadows (1999).

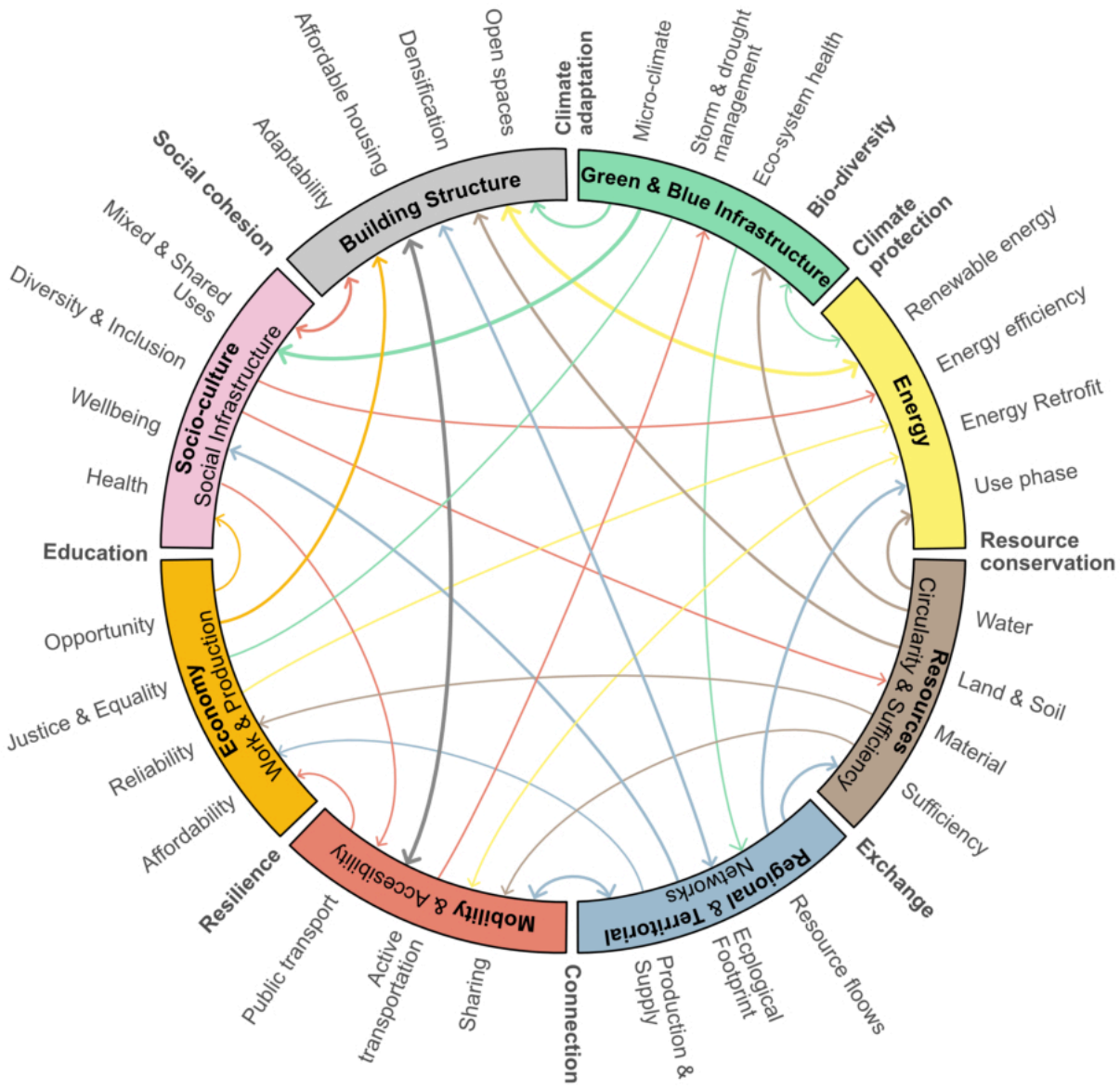


Figure 12: Interdependency wheel that represents aspects of sustainability and their interdependencies. Fields of action are shown inside the circle and the goals outside the circle. This representation makes it possible to identify synergies and conflicts. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

So far, the discourse regarding circularity in the built environment has focused predominantly on lower hierarchical levels of circularity, such as component reuse or material recycling (urban mining) and was separated from the conversation about building reuse and urban transformation (see Figure 13). However, circularity within the built environment requires a complex systems understanding, including multiple spatial and temporal scales as well as relevant actors of the specific context." (Staudt et al., 2024)

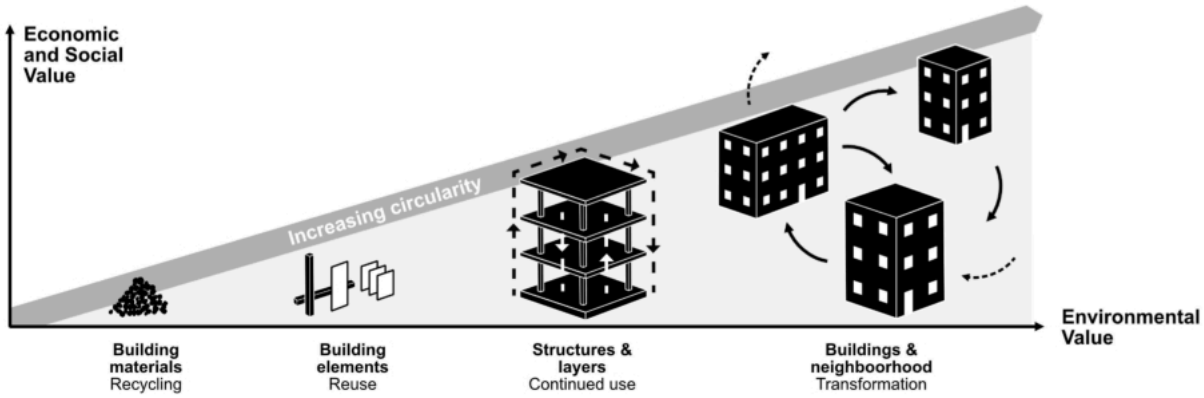


Figure 13: Circularity and scales in the built environment. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods based on Eberhardt et al. (2019).

"The life cycle of buildings with use-phases that last decades, sometimes centuries requires a different conceptual framing than product-based considerations. Since buildings do not exist in isolation a broader and more far-reaching framework has to describe and capture their systemic effects. Within these broader systems, buildings are not mere stocks of material flow in themselves but more importantly they house human activities which allow cities to thrive. The concept of circular cities goes beyond the commerce and production focused framing and captures cities as complex systems of consumption and human activities (Williams, 2021). A multi-dimensional, systemic conceptualization (Anders, 2016) helps to understand complex interrelations and systemic effects (see Figure 14). Conversion and redevelopment require a framework that understands the transformation of existing buildings as a complex circular system." (Staudt et al., 2024)

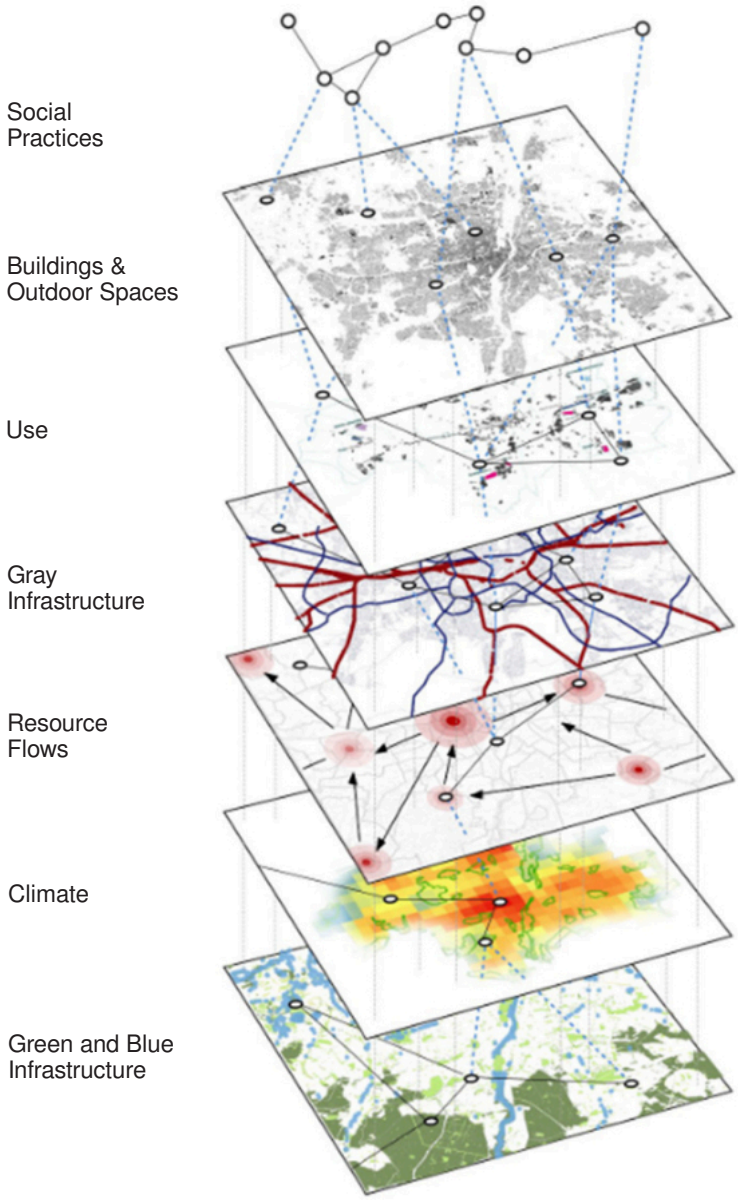


Figure 14: Exemplary layering of the city system into interconnected subsystems. Image Source: Johannes Staudt (TU Munich) based on Anders (2016).

3.3.3 Circular Uses as a Unifying Framework

“We propose a unifying framework of circular uses which allows planners and designers to consider transformations and uses of existing buildings together. Our focus on the use of buildings activates “the potential […] to experiment with uses, programs, life models and economies" (Ngo et al., 2024, p. 2). The aim is to create an awareness of circular uses so that the topic can be incorporated into planning and development processes at an early stage. Therefore, we take up existing planning approaches and practices and consistently develop them further in a neighborhood and transformation-oriented manner.

We define the following circular uses (zirkuläre Nutzungen) that extend, change, and intensify the use of buildings (see Figure 15): continued use (Weiternutzen), change of use (Umnutzen), intensified use (Mehrnutzen), and multiple use (Mehrfachnutzen).

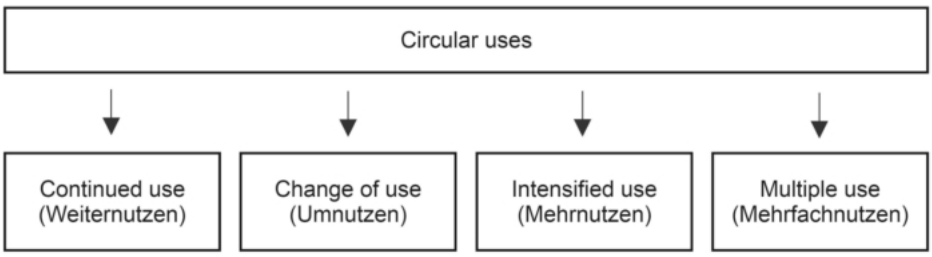


Figure 15: Unifying framework of "circular uses" for the transformation of existing buildings developed in the action Circular Neuperlach. Image Source: Johannes Staudt (TU Munich).

In the case of continued use, buildings continue to be used without any change of use. Interventions in the fabric of the building may nevertheless be necessary for functional, energy-related or aesthetic reasons. A change of use, in most cases, necessitates a more or less substantial conversion, as new functional and regulatory conditions apply. An obvious example of a change of use would be an office to housing conversion but staying within one use category can also equate to a change of use when the type of use has change so significantly that significant adaptations are necessary. With multiple use, several uses overlap in terms of time and/or space. Rooms are thus used differently depending on the time of day or requirements. Intensified use describes rooms that are used more intensively. As a sufficiency approach, rooms can accommodate more users in the same space or enable the same use in less space.
Circular uses are also associated with interim uses and the mixed use of buildings and neighborhoods, which can generate both ecological and social added value. However, interim uses in particular can also lead to precarious tenancies. The term pioneering use therefore indicates the intent of continuity of temporarily tested uses in a transitional process (ZUsammenKUNFT Berlin, 2021)." (Staudt et al., 2024)

3.3.4 Planning Processes: Programming and Early Planning Phases

The planning process for a building can be divided into different phases, which vary by country. In Germany, the HOAI (Fee Structure for Architects and Engineers) divides the process into nine phases, from preliminary design to construction supervision. These phases are essential for architects and engineers to document and bill for planning services.

However, it is important to note that these phases do not include the needs assessment according to DIN 18205 (DIN e.V., 2016) which precedes object planning and focuses on the immediate needs of building users. The needs assessment and other methods of early planning are increasingly discussed within the German planning discourse under the term “Phase Zero” (Phase Null, see Figure 16). This early planning stage serves as a lever for the implementation of sustainability goals (BSBK, 2022), as typically, new buildings are planned and developed in linear processes according to HOAI, based on the decisions made in this Phase Zero.

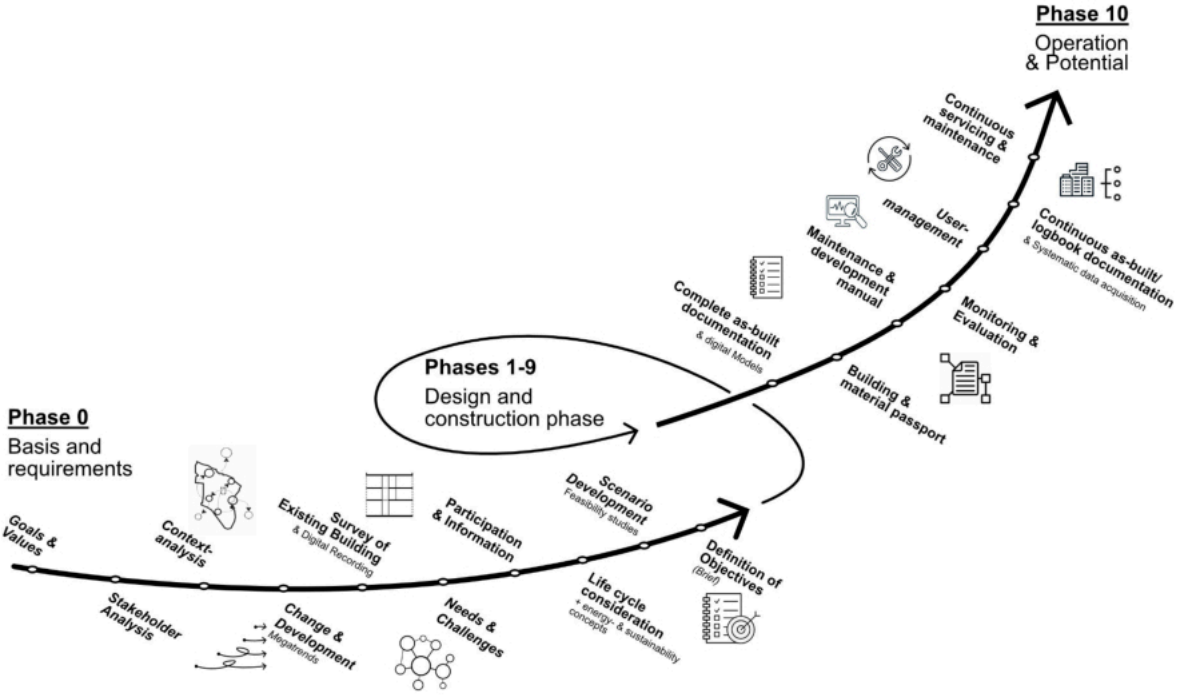


Figure 16: Conventional planning phase in Germany (HOAI phases 1-9), supplemented by Phase Zero (basis and requirements) and Phase Ten (operation and potential). Image Source: Johannes Staudt (TU Munich)/ NEBourhoods, based on BSBK (2022).

However, research shows that adjustments in the planning process become increasingly complex and costly as the level of detail and project complexity advance (Liebich et al., 2011). Therefore, suitable methods are needed to activate the potential of existing buildings early on in the process for sustainable, circular, and neighborhood-oriented project development. Identifying this potential early on is essential to keep costs low and more importantly broadens the range of available options before the window of opportunities starts to shrink. The quality and density of information is inevitably still quite coarse in the early planning phases. Effective decision-making therefore depends on a structured analysis and interpretation of this

information. Current processes insufficiently incorporate participatory and iterative processes to analyze and question project requirements and needs alongside the design. They also rarely consider systemic and socio-cultural contexts, such as neighborhood needs or the temporal development of uses over the lifecycle.

The methodology of “architectural programming” (Sanoff, 1977; Peña & Parshall, 1969/2001; see also Figure 17) offers helpful approaches to inform and guide the planning process for the transformation of existing buildings. Programming is already extensively practiced in the English-speaking world, utilizing design thinking approaches and exploring planning and design processes (Rittel, 2013). It relies on data and its analysis to establish well-founded design bases. Key stakeholders are engaged early to accurately gather needs and requirements. However, there is a shortage of appropriate methods and tools for a comprehensive systemic analysis of the complex interactions between urban design parameters and their interplay with individual buildings (Anders, 2016).

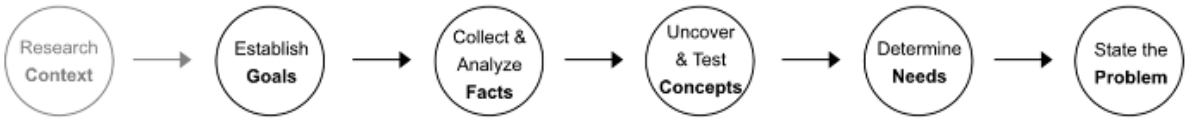


Figure 17: Programming process to determine in the early planning phases of a project development which problem should be addressed in the further planning process. Image Source: Johannes Staudt (TU Munich) / NEBourhoods, based on Peña & Parshall (2012) & Chantzaras (2022).

Our methodology of “circular and neighborhood-oriented transformation” adapts essential parts of the architectural programming methodology (see chapters 3.3.4, 4.2.2). It aims to gather all relevant information as early as possible to leverage the major factors for building transformation, which are pivotal for a multitude of subsequent decisions that will be made later in the project. “As a project-accompanying method, programming in iterative loops can serve the permanent alignment of planning with the overarching goals of neighborhood-oriented and circular development. Programming supplements traditional planning services with a systems & design thinking process that enables productive handling of the high complexity of a task, which results from a variety of mutually influencing factors. In line with the multidisciplinary nature of the task, a multidisciplinary team works together in an integrated manner to solve complex issues. This allows the needs of the project and the users to be iteratively aligned with the design and promotes innovative and holistic solutions that take economic, ecological, and social aspects into account. In this way, both efficiency of use and sufficiency can be effectively improved, and synergetic effects can be achieved. By taking a systemic view, the effect of various measures can be examined in scenarios” (Schade et al. 2024). By identifying levers early in the planning process and making holistic decisions, planners can develop their projects in a fundamentally sustainable way, better integrate them into the surroundings, and thus make them more resilient.

3.4 CIRCULAR TRANSFORMATION STRATEGIES

“Our research revealed several key strategies for implementing circular use in existing buildings, each focusing on different aspects of adaptive reuse and resource efficiency. These strategies aim to maximize the potential of existing structures while minimizing waste and new resource consumption.

3.4.1 Continued Use (Weiternutzen) & Minimal refurbishments (Minimalsanierung)

Continued use emphasizes using existing spaces as they are, encouraging users to adapt their behavior rather than substantially altering the space. This approach promotes creativity. (…) Immediate use also avoids delays for permits or supplies. (…) Conventional construction often limits creativity due to spatial, financial, and temporal constraints. Continued use allows for innovative use without significant investment, demonstrating that vibrant environments can be achieved within existing limits.
Conversions often lead to problems with regulations, since the protection of existing buildings and infrastructures (Bestandsschutz) no longer applies. Minimal refurbishments (Minimalsanierung) avoid triggering these new regulations by keeping the use the same and by working very closely with the existing buildings. Structural fire protection (baulicher Brandschutz), without unnecessary complexities, is essential for successful minimal refurbishment projects. (…) Minimal refurbishments may require building owners and users to accept lower standards such as minimum sound insulation or lower thermal standards. In current building practice developers and owners tend to ask for higher standards to ensure that minimum standards are exceeded to avoid future liabilities.

3.4.2 Simple Change of Use (Einfach Umnutzen)

Simple change of use emphasizes maximizing the use of existing buildings with minimal changes and regulatory hurdles. This approach encourages creative and unconventional strategies.

3.4.3 Multiple Use (Mehrfachnutzung)

Multiple use is a key strategy for addressing urban challenges by maximizing the utility of existing buildings. Evolving demands and economic pressures are pushing property owners to explore multiple-use strategies. Design considerations are crucial for facilitating multiple use; spaces must be flexible to accommodate multiple uses and adaptable to meet future needs, with provisions for easy reconfiguration and essential services such as electrical, digital infrastructure and water connections. Community engagement also plays a significant role in the success of multiple-use projects. Involving residents and other local stakeholders helps address their needs and concerns, leading to greater acceptance of diverse uses. Challenges similar to those in mixed-use developments, such as sound emissions and scheduling conflicts, must be managed through participatory involvement, improved programming, spatial modifications, or regulatory changes. Effective design and management of multiple-use spaces enhances efficiency and can create synergies among users.

3.4.4 Intensified Use (Mehrnutzung)

Intensified use activates additional use potential of existing spaces. As a sufficiency approach, rooms can accommodate more users in the same space or enable the same use in less space.

3.4.5 Interim Use (Zwischennutzung)

Temporary or interim uses offer a way to test ideas and align existing spaces with needs before long-term implementation. Their quick execution and immediate feedback allow for a fast learning curve. Interim uses demonstrate that much is possible with flexibility beyond strict standards tied to new construction. Interim use is seen as a practical approach to bridge the time required for planning and as a space for experimentation, which can inform future development. In this temporary lab, visions can be tested to balance existing spatial potentials with long-term needs. These uses, implemented at low cost (no rent, only operational expenses as well as costs for administration and organization of temporary uses), allow for evaluation of social and financial viability, helping to identify the right mix of profit-driven and public-oriented uses. Cultural and social functions are especially suited to interim uses, offering insight into neighborhood needs, spatial qualities, and technical requirements like acoustics. Challenges arise when spaces must be returned to their original state after interim use. Users sometimes make minimal adjustments and deal with consequences later, highlighting the need for flexibility and willingness to deviate from standards. To address the precarity of many interim use projects some call for pioneering use, as part of a transitional process.” (Staudt et al. 2024)

In Table 2, we provide an overview of which building properties support which circular uses.

Building properties	**Circular uses** supported by
Adaptable structures	Design for long-term change, accommodating future shifts in use or function over the building's lifecycle: Might require more significant interventions than flexible structures, e.g. adding new floors
Flexible structures	Allow immediate and frequent changes without major modifications to meet short-term needs, e.g. flexible layout with minimal fixed partitions
Overall construction quality	Ensure that building transformation can withstand modifications and continue to meet safety and usage standards
Robust structural framework	Allows modifications or additional loads for longevity and adaptability
Adequate ceiling heights	Higher ceilings (not excessively), e.g. to transform office to housing
Multiple entrances and good access	Independent entrances to better adapt to future changes in use; good access to meet current standards and allow various functions
Neutral room design	Design without specific function, e.g. similar room sizes and porportion
Multifunctionality	Spaces accommodate multiple functions, but not generic spaces
Natural light and ventilation	Improve desirability of spaces for multiple uses
Energy-efficiency	Reduce operational costs and environmental impact. However, excessive energy efficiency regulations can lead to building obsolescence and
Non-toxic materials	Allow continued use of the building and future reuse of materials
Urban planning context, location, and proximity to amenities and services	Consider aspects like mobility, green infrastructure, or seating in project development to ensure integration into the urban environment and enhance the potential for various uses and mixed-use developments
Connection to the neighborhood	Connect the building and its uses with the local community to enhance its relevance, functionality, and identity within the local context
Post-growth approaches	Incorporate parallel economies of exchanging and sharing to strengthen neighborhood ties
Preservation of familiar elements and paths	Maintain familiar features in the urban context to enhance community connection, navigation, and continuity
Outdoor spaces and tree population	Foster a sense of identity and belonging for users, e.g. preserving and integrating trees to support environmental sustainability and well-being

Table 2: Building properties supporting circular uses, based on literature research and expert interviews. Source: Staudt, et al. (2024).

3.5 HURDLES TO IMPLEMENT CIRCULAR USES

“Despite the promising potential of circular uses, several barriers – ranging from regulatory challenges to financial and planning obstacles – discourage property owners and developers from pursuing their implementation. The complexity of existing structures can limit adaptive reuse efforts, with issues such as inadequate room heights, structural integrity concerns, contamination, and compliance with modern codes complicating transformations. Missing documentation can further complicate assessment. Changing demands regarding spatial requirements, living habits, or technological advancements further lead to building obsolescence, as many older structures were not designed with flexibility and adaptability in mind.

Many experts noted that regulatory barriers are significant, with building codes and planning laws often favoring new construction over adaptive reuse, creating disincentives for adaptive reuse. Strict regulations on life safety, comfort, sound and thermal insulation create hurdles for projects attempting to repurpose existing buildings. The financial burden of complying with these standards frequently renders transformation projects prohibitively expensive and often discourages developers. Current financial incentives, tax structures, and municipal preferences for commercial developments due to associated tax revenues further skew favor towards new construction, with adaptive reuse projects facing disadvantages due to externalized costs.

Additionally, cultural resistance and a prevailing mindset in the construction industry prioritize new builds over transformations, with a lack of willingness to consider alternative uses for existing buildings. Experts emphasize the need for a shift in this narrative to foster a culture that values preservation and circular transformation. Planning processes also present obstacles, as conventional methods tend to focus on later phases of design and construction. However, effective transformation requires intense and coordinated collaboration among various stakeholders from the outset, which can be difficult to achieve. Complex dependencies at the neighborhood level such as parking space code, traffic noise, or capacity limits of existing social infrastructure in the transformation from offices to housing require specialist planners to exchange information with administrative departments and other experts at an early stage.

These challenges underscore the complexity of implementing circular uses and highlight the need for regulatory reform, shifts in stakeholder attitudes, and more collaborative planning processes to facilitate successful transformations. (…) The challenge is exacerbated by the large number of norms and technical regulations in Germany – over 3.500 – which, shaped by industrialization, impose significant control over construction aspects, including many that don’t address life safety. These constraints can hinder innovative approaches in building transformations.” (Staudt et al. 2024)

4 ROADMAP

4.1 METHODOLOGY: THE CIRCULAR AND NEIGHBOURHOOD-ORIENTED TRANSFORMATION

This chapter describes the methodology of “circular and neighborhood-oriented transformation,” which was developed and tested in our Circular Neuperlach NEB action. First, we provide an overview of the phases of the methodology (chapter 4.2) and describe the individual steps carried out in each phase (chapter 4.3). Here, we focus on overarching methodological questions and how the individual phases are interconnected. How the knowledge and the different actors are operationalized for early planning phases will be described later (chapter 4.4). Finally, we examine the stakeholders involved in the process and describe the competencies and disciplines to implement the m1ethodology in practice (chapter 4.5). We provide examples of suitable organizational forms and explain our own approach: The “Urban Transformation Office” (UTO) was newly established by researchers and practitioners involved in the Circular Neuperlach project to test our methodology with stakeholders through case studies in practice.

Our research focused on exploring which content, mental models, and methods are required to capture, analyze, and present transformation-relevant data and information. In the course of the research process, we combined, expanded, and related existing models and methods in new ways and made them applicable for practice. The main part of this Circular Transformation Roadmap focuses on the process and its implementation in practice. In the appendix, we provide exemplary insights into the applied methods and forms of presentation. This Circular Transformation Roadmap refers to a special form of programming (for programming see also chapter 3.3.4) which “plays a pivotal role in the design process linking urban scale issues to the building design” (Schade et al., 2024). The methodology of circular and neighborhood-oriented transformation “has been developed in the interplay of teaching and research. With this methodology, we link the demands of the neighborhood (urban development oriented for the common good) with the circular transformation of an existing building (continued use, change of use, intensified use, and multiple use of a building). The methodology focuses on the higher levels of circularity hierarchies such as regenerate, rethink, reduce, or reuse (Potting et al., 2017): It aims to reduce resource consumption and grey emissions by analyzing entire existing buildings and their transformation potential for future uses which address the demands of the surrounding neighborhood. This stronger linking of uses with the demands of the neighborhood enables a more resilient project development that is less vulnerable to external shocks and crises (Glaeser, 2022).” (Schade et al., 2024)

Circular and neighborhood-oriented transformation “expands existing programming methods with a special focus on existing neighborhoods and buildings. This requires a thorough analysis of the urban context as well as the existing built structure. Programming then has to synthesize these into a design basis to feed into the building design. This means that programming can no longer be separated from the design process, as Peña and Parshall suggest (1969/2012).” (Schade et al., 2024)

4.2 ROADMAP PHASES: STRUCTURE OF THE PROCESS

Our methodology of a “circular and neighborhood-oriented transformation” is situated within the early planning phases of conventional planning (see chapter 3.3.4). It is structured into three phases (see Figure 18): Analysis (chapter 4.2.1), Programming (chapter 4.2.2) und Early Architectural Design (chapter 4.2.3). Within the phases, individual steps are carried out (see also Figure 18). Depending on the individual project development, these steps are processed in iterative loops.

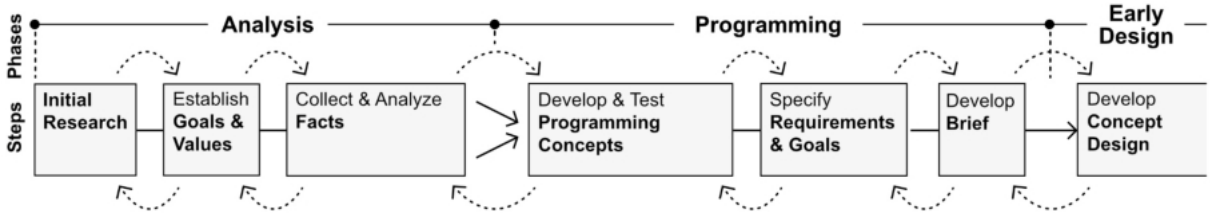


Figure 18: Circular and neighborhood-oriented transformation: Phases and steps of the methodology. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

When dealing with complex, non-linear processes, methods are needed to manage complexity: On the one hand, complexity must be captured as comprehensively as possible analytically. On the other hand, solution-oriented methods are needed that lead to a result-oriented goal. The British Design Council describes the creative process of problem identification and solution finding in the design process model of the Double Diamond (see Figure 19). The model distinguishes between a problem space (first diamond) and a solution space (second diamond). First, the problem is explored (discover) - a phase in which the process is opened up. Methods are applied that bring new influences, ideas, and approaches into the process. In the next step, the process is closed again and focusing methods are applied to define the problem (define). In the second diamond, the process is then opened again to explore a variety of solution approaches (develop), to focus and work out the

appropriate solution in the second part (deliver). A characteristic of the model is that phases and methods for opening and closing a process alternate. The model forms a simplified basis for solution-finding processes and can, in principle, be transferred to our method (Figure 20).

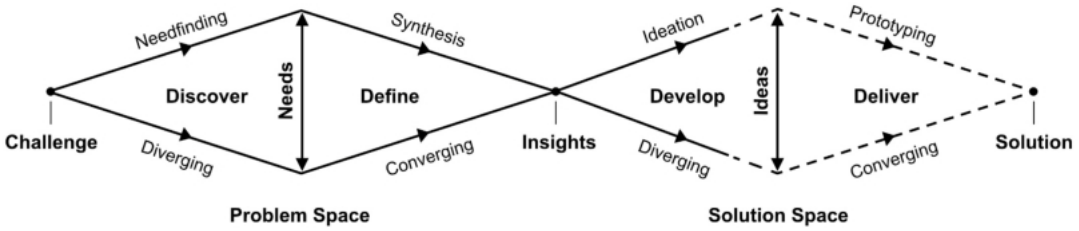


Figure 19: Double Diamond is a design process model for identifying problems (first diamond) and possible solutions (second diamond). It alternates between phases of opening up the process (divergent) and focusing the process (convergent). Image Source: Johannes Staudt (TU Munich, based on Design Council (2024).

The application of the different opening and closing methods in the process must be professionally accompanied to ensure that suitable actors and their knowledge are effectively combined at the appropriate time. What experiences, knowledge, and competencies are required for this are explained in a later chapter (see chapter 4.5). We explain the different steps sequentially below.

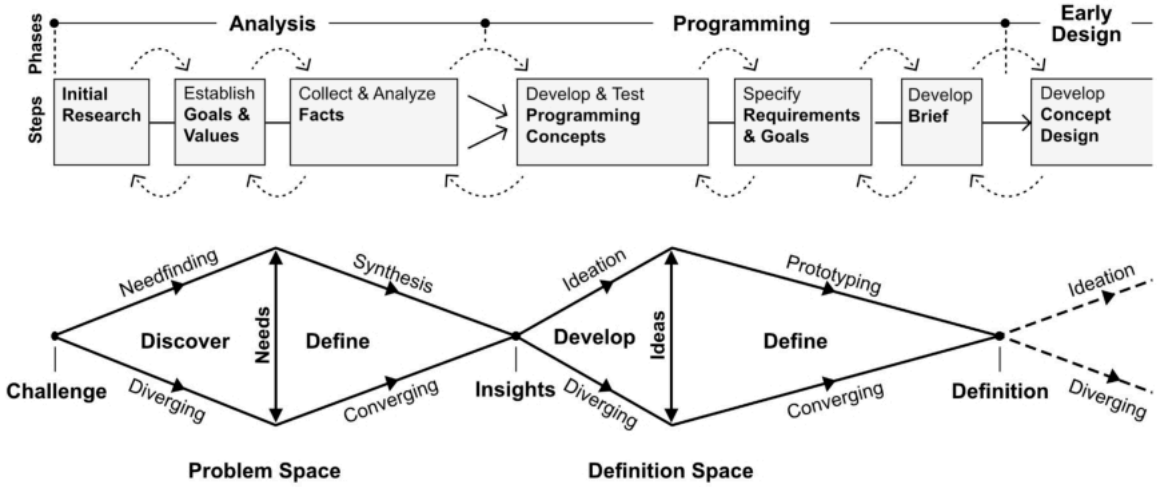


Figure 20: Circular and neighborhood-oriented transformation: Phases and steps of the methodology overlaid with the double diamond model. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

4.2.1 Analysis Phase

The analysis phase begins with an initial context analysis (Research Context) and involves the key project stakeholders to discuss common goals and values (Establish Goals & Values). Subsequently, all relevant project-relevant data is collected and thoroughly analyzed (Collect & Analyze Facts). This step includes an analysis of the overarching Changes and Developments that influence urban and project developments (> Megatrends), as well as an analysis of the specific Context, i.e., the neighborhood and the urban system. This information is then interrelated with the analysis of the Needs, which focuses on the current and future users of the building and particularly on the needs of the local community, so-called neighborhood needs. The final part of the collection and analysis of facts is the examination of the Existing building, which includes, among other things, an analysis by building layers and zones, a detailed structural investigation, and a 3D model.

4.2.2 Programming Phase

The Programming phase brings together the insights from the Analysis phase to create the foundation for the early Architectural design phase. The needs and the qualities of the existing building are integrated through scenario-based programming (Develop & Test Programming Concepts). To capture the various influences, we use a systemic approach where different scenarios are compared and evaluated. The evaluation includes established sustainability assessment methods, including life cycle analysis, life cycle costs, and social aspects. The input from various stakeholders is crucial to ensure their interests are represented. Based on the chosen scenario and the specification of the requirements (Specify Requirements & Goals), a programming brief is formulated, iteratively revised and finalized (Develop Brief).

4.2.3 Early Architectural Design Phase

The programming brief serves as the foundation for the subsequent conceptual design (Develop Concept Design). In Germany, this phase forms the interface to conventional planning phases and procedures such as planning competitions or innovative collaborative processes (Kooperative Verfahren) (see chapter 3.3.4). In our research, we have considered different planning processes, traditional urban design, and architectural competitions. In particular, collaborative processes are relevant for the transformation of existing buildings as they enable exchange and joint development of possible solutions. As an example, we describe the process of the “Fritz District” in Neuperlach (see chapter 4.3.7).

4.3 ROADMAP STEPS: METHODOLOGICAL STEPS

The previous chapter provided an overview of the phases of our methodology (see chapter 4.2). Below, we now explain the contents for the individual methodological steps of a circular and neighborhood-oriented transformation. Figure 21 provides an overview of the phases and steps and the associated contents.

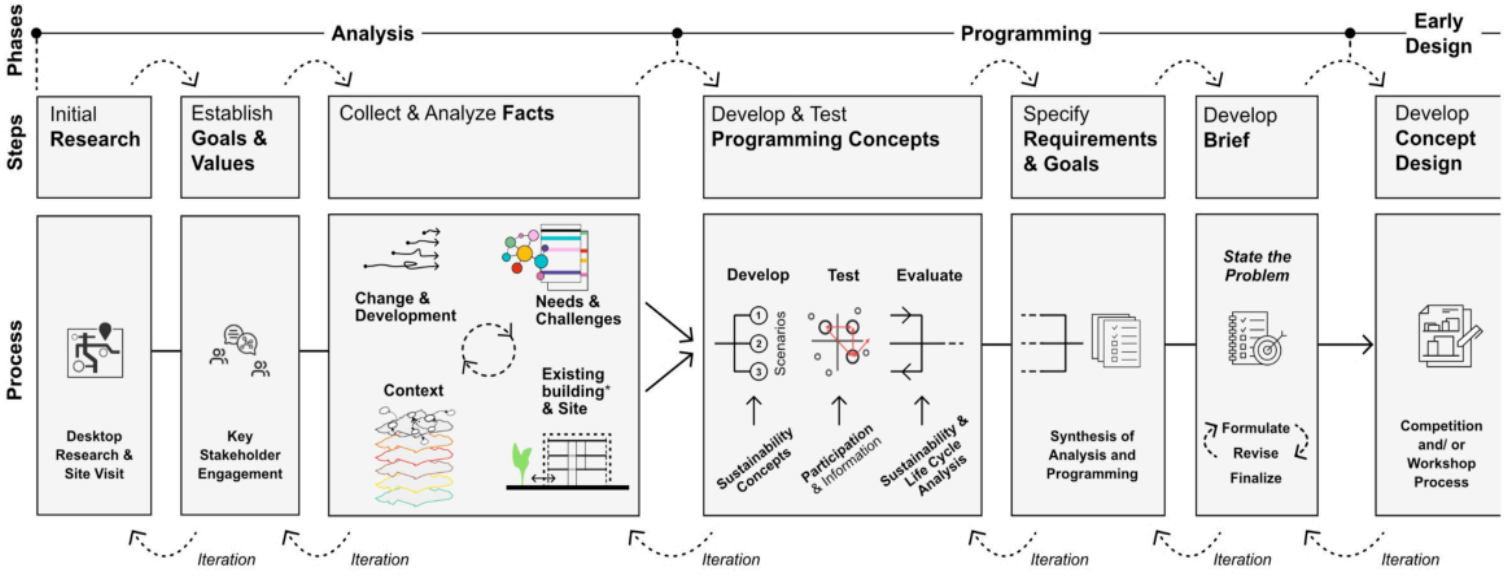


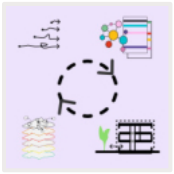
Figure 21: Methodological steps of the phases for a circular and neighborhood-oriented transformation. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

4.3.1 Initial research

The first step of the analysis phase, Research Context, seeks initial information about the project that is directly relevant to the project. Desktop research, client and stakeholder conversations and site visits provide an initial overview of the project and its context.

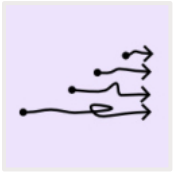
4.3.2 Establish Goals & Values

In the step Establish Goals and Values initial goals and values are established, and interests are aligned, together with relevant stakeholders.



4.3.3 Collect & Analyze Facts

The step Collect and Analyze Facts compiles all relevant information for the later programming of uses. In doing so, we have identified four sub-steps, which we will discuss in detail below: Change & Development, Context, Needs, and Existing Building (see Fig. X). These include different temporal and spatial scales as well as stakeholders.



4.3.3.1 Change & Development

The transformation of existing buildings is increasingly influenced by a combination of megatrends and local and regional development factors (see also below: Context). In the sub-step Change and Development, overarching influences on the building transformation are recorded and analyzed, which are relevant for the specific local context and its future development.

Example

Overarching Developments

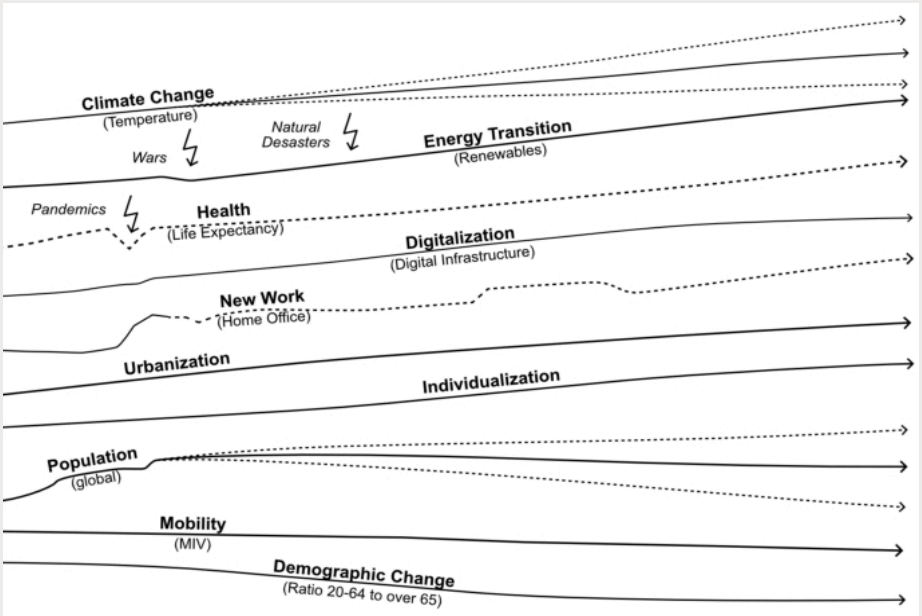
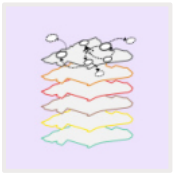


Figure 22: Overarching developments, known as megatrends, and their influence on the transformation of existing buildings. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods, based on Zukunftsinstitut (2023), Rettich et al. (2023).

Megatrends (Naisbit, 1982) are large-scale shifts in society, technology, environment, and the economy that shape long-term planning. Several megatrends play a significant role in the

transformation of existing buildings such as urbanization, climate change and sustainability, technological advancements and digitalization, aging population and demographical changes, economic shifts and workforce evolution (see Figure 22). For example, with urban populations growing, cities face the challenge of meeting increased demand for residential, commercial, and public spaces. This often results in re-purposing and upgrading older buildings to increase their density, usability, and functionality. General information can be obtained, for example, from futures research institutes such as Zukunftsinstitut (www.zukunftsinstitut.de) or FuturZwei (https://futurzwei.org). Data for the local context can be integrated in public documents such as urban development plans.



4.3.3.2 Context

The context of a neighborhood and its surrounding urban system has a substantial impact on the transformation and development of existing buildings, as both the social environment and physical infrastructure shape what kinds of transformations are feasible and desirable now and going forward. Additionally, local development policies and zoning regulations greatly influence how existing buildings can be transformed (see also chapters 2.5 and 8). In this sub-step Context, a deep understanding of the neighborhood is developed. It is closely related to the previous sub-step Change & Development.

A combination of community needs, local identity, infrastructure accessibility, policy frameworks, and local development factors determine what transformations are possible and which are sustainable and beneficial for both residents and the broader urban landscape. Below, we describe some of the most context-relevant factors:

- **Urban Infrastructure and Access**: The surrounding urban infrastructure – such as proximity to public transit, green spaces, and commercial hubs – also influences the scope of building transformations. For instance, buildings near public transportation might be more suited for high-density residential use, capitalizing on accessibility to reduce traffic and environmental impact. Similarly, cities like Barcelona have transformed areas once dominated by cars into pedestrian-friendly spaces, which support sustainable and inclusive development while enhancing community connections.

- **Zoning and Policy Context**: Local government policies and zoning regulations play a crucial role in shaping transformations. Flexible zoning can allow older office buildings to be repurposed as residential or mixed-use developments, especially in response to shifts in urban workforce dynamics, such as remote work trends (see above: Change & Development). Furthermore, regions with robust policies for energy efficiency and sustainability are more likely to see upgrades that make existing structures eco-friendlier and resilient to climate change impacts. Many municipalities offer incentives for transforming existing buildings, such as tax credits for heritage preservation or grants for energy-efficient upgrades. These financial aids can make the difference in whether a transformation project is feasible.

- **Economic and Social Equity Concerns**: In gentrifying neighborhoods, transformations can inadvertently lead to rising property values and resident displacement. To counter these effects, community-led projects with support from local governments, like those seen in Brooklyn's Bedford-Stuyvesant, focus on placemaking that retains affordability and social inclusion for legacy residents. Government support, in the form of funding and regulatory support for such projects, can help communities maintain control over redevelopment and minimize displacement effects.

- **Local resource and energy flows**: Understanding local resource and energy flows is essential to develop appropriate approaches on a building and neighborhood level. Availability of renewable energy sources and local renewable raw materials as well as local and regional resource loops are major drivers of circular system design with the goal of climate neutrality and ecosystem regeneration. Utilizing local materials minimizes transportation costs and environmental impact while supporting the local economy. Effective waste management, including recycling and composting, promotes a circular economy and reduces landfill waste. Local water management practices, such as rainwater harvesting and greywater recycling, ensure sustainable water use. Engaging local communities in resource planning fosters sustainable behaviors and practices, leading to long-term cost savings, green job creation, and increased property values. Overall, focusing on local resources and energy flows helps create more sustainable, resilient, and livable neighborhoods.

Information about the context includes a variety of data and information on diverse urban aspects such as demographics, building structure and typologies, social infrastructure, education and movement, green and blue infrastructure, mobility, energy and resources, etc. To incorporate the data

into urban development in a structured, systemic, holistic, and transparent manner, European cities can work with the approach of integrated urban development: The approach was agreed upon by the ministers of the European countries in the Leipzig Charter 2007 (EC, 2007) and expanded in 2020 in the New Leipzig Charter to include relevant aspects of the common good (EC, 2020b). In Germany, the information is summarized, for example, in Integrated Urban Regeneration Implementation Plan (ISEK) and made operational for practice. They provide a valuable basis for our context analysis.

Example

Context Analysis

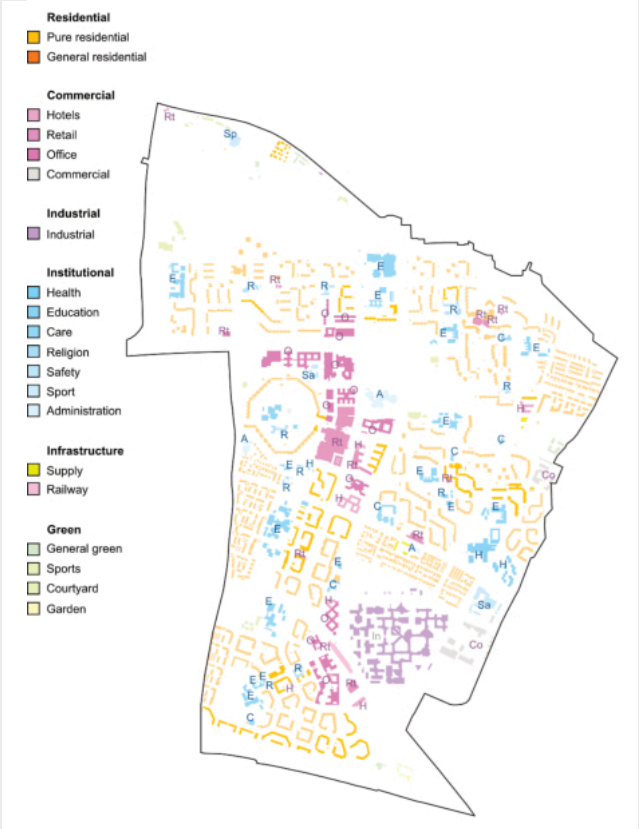


Figure 23: Context analysis of the neighborhood: Example of land use typologies in Neuperlach. Image Source: Josef Rott & Johannes Staudt (TU Munich)/ NEBourhoods.

A context analysis can encompass a variety of methods and should be reviewed and adjusted according to the specific project. For an analysis, planners “conduct a document analysis of relevant urban development concepts and other studies, maps, or statistics such as mobility studies, climate maps, data on demographics and the provision of social infrastructure. They also look at large-scale societal,

political, social, or cultural changes that affect the neighborhood. The analysis is supplemented by (...) SWOT analyses to holistically capture the challenges and potentials of the study area. The findings are visualized, for example, in an urban development layer analysis (Bentlin, 2021) based on this comprehensive understanding of the neighborhood and its key sustainability aspects" (Schade et al., 2024). The appendix provides further exemplary insights into methods we applied for the neighborhood analysis within this research project.

4.3.3.3 Needs & Challenges

The sub-step Needs & Challenges identifies different scalar and temporal dimensions and types of needs and challenges. It builds on the insights from previous sub-steps, views them from the perspective of needs and challenges, and supplements them with specific local aspects. Some needs arise from overarching requirements based on larger scales and develop from so-called megatrends (see Change & Development). These needs are often regional or even supra-regional and result from trends such as migration, climate change, or demographic change. On the other hand, there are needs that stem from the local context, so-called neighborhood needs. For the overarching needs, we examine both current developments and future forecasts. Social milieus and lifestyles help identify and describe different population groups. For the local needs, we work with surveys and workshops involving the local population and engage with local stakeholders, especially organizations committed to social issues.

The character of a neighborhood and the needs of its residents strongly influence redevelopment decisions. For example, in historically significant or culturally rich areas, transformations often prioritize preserving heritage while updating facilities for modern use. Community involvement is essential here, as residents advocate for changes that respect local history and support social needs, such as affordable housing or community centers that reflect and reinforce neighborhood identity. In areas facing gentrification pressures, community-led placemaking can help prevent displacement by fostering development that maintains local connections and supports long-standing residents.

Example

Analysis of Needs

The needs analysis includes, for example, site visits, surveys, photo documentations, interviews with neighborhood experts and direct interaction with locals.

Figure 24: Analysis of needs: Example of on-site surveys in Neuperlach. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

Local needs often drive the type of building transformations undertaken. For example, an area with a shortage of affordable housing may see older commercial buildings converted to low-income residential units, whereas neighborhoods with strong cultural identities may push for heritage preservation rather than large-scale redevelopment.

The needs derived from the overarching developments and context usually result in programming for the anchor uses which occupy most of the space of the transformed building. This can include affordable housing, housing for different age groups, or spaces for urban production. These uses often occupy the standard floors of the upper levels. The uses arising from local needs, such as education, health or other social facilities are often public or semi-public and therefore suitable for the first floors or publicly accessible top floors. All these uses are, of course, not static but will continue to evolve in the future. Appropriate flexibility and adaptability are essential to ensure that the building can continue to be used effectively in the future. Overlapping and synergies between the uses can also contribute to higher utilization of the building. In the case of multiple uses, the rooms are used by different users simultaneously or at different times. For example, different uses can take place at different times of the day, on different days of the week, or at different times of the year. Simple examples of this would be commercial office use during the week and social use on the weekend or school use in the morning and publicly accessible rooms in the afternoon.

Example

Stakeholder Analysis

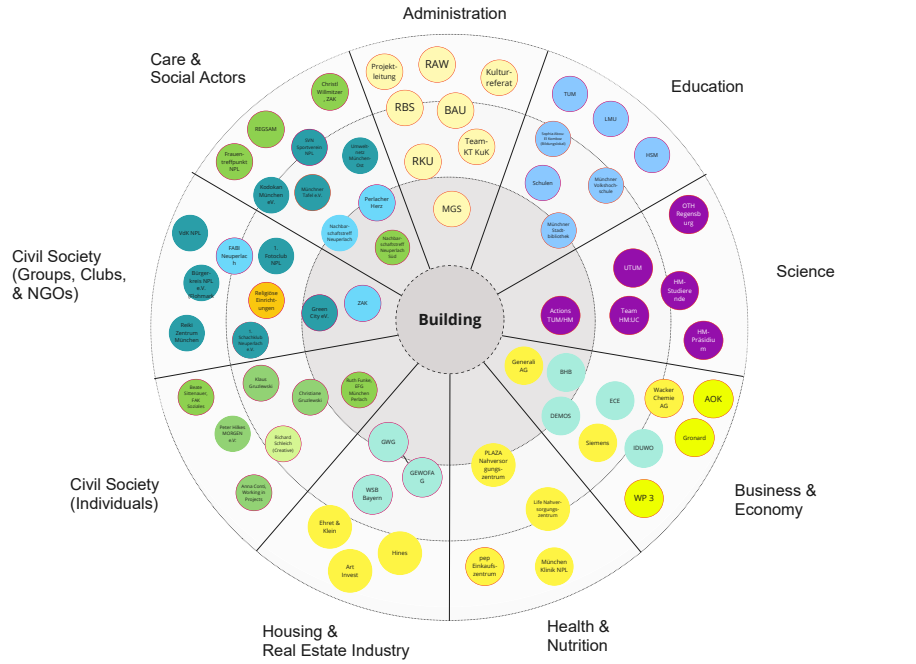
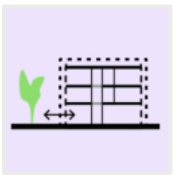


Figure 25: Example of a stakeholder analysis of the neighborhood. Image Source: Image Source: Johannes Staudt (TU Munich)/ NEBourhoods.



4.3.3.4 Existing Building

The sub-step Existing Building provides an overview of the existing structural and spatial framework. It highlights the possibilities and limitations of the building and establishes a foundation for the subsequent development of scenarios (see chapter 4.3.4). In our research on circularity in the built environment, we identified the analysis of buildings by layers, which was first conceived by architect Frank Duffy in the context of commercial office building adaptations, and later developed by Steward Brand with the concept of “Shearing Layers of Change” in the book “How Buildings Learn: What Happens After They’re Built” (Brand, 1995). The shearing layers described are: Site, Structure, Skin, Services, Space Plan and Stuff. All of the layers are characterized by different longevity and impact. The understanding of the sharing layers enables planners to capture and increase the circularity potential of a building already during the concept phases of a project. This concept of layers has since undergone significant development to offer a

deeper understanding of how different components and systems within a building interact with each other and contribute to architectural design, functionality, and environmental performance.

Expanding the Concept of Layers: Function of Layers for the Use Over Time

We have built upon the original layers concept for our methodology by adding new dimensions of use and spatial zones that allow for a more comprehensive analysis (see chapter 3.3.1). Specifically, we have introduced the idea of examining individual layers in relation to the specific function they serve within the context of the building's use over time. This allows for a more targeted investigation of how each layer contributes to the overall performance of the building in terms of energy performance, adaptability, and interaction with the urban context.

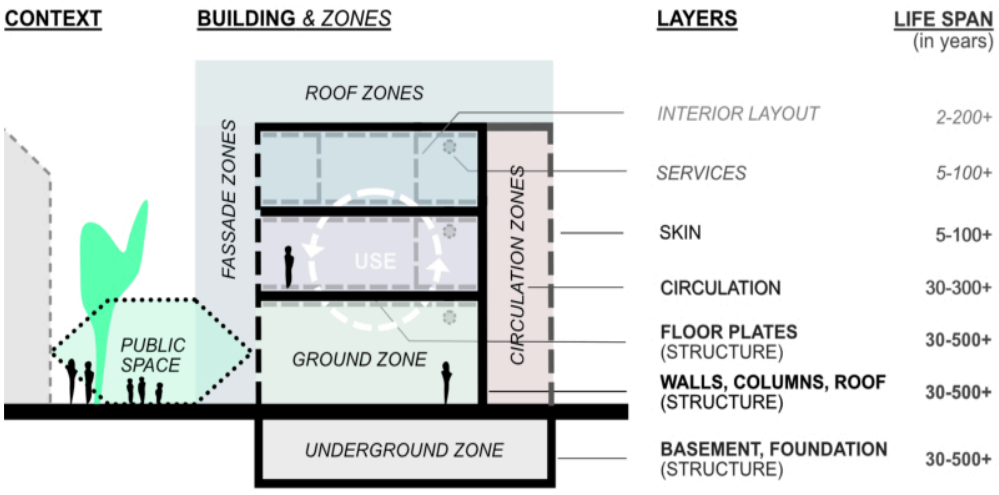


Figure 26: Building analysis concept of layers and zones with a focus on use and context. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods.

Expanding the Concept of Layers: Zones of Use

In addition to refining the layers concept, we have integrated "zones of use" into our analytical framework. These zones are defined based on empirical research and interviews, which have provided insights into the common patterns of building usage and the spatial requirements of various functions. A key realization from this research is the division of buildings into distinct zones based on the types of activities they accommodate.

- **Ground floor**: Typically, the ground floor of a building is most suitable for public uses, such as retail spaces, lobbies, or communal areas. This reflects the interaction between the building and the public realm, making this zone a critical interface for urban engagement.

- **Upper floors**: The upper floors are often allocated for housing and office spaces. These areas tend to be more private and are tailored to accommodate either residential or work-related functions. This can also include social infrastructures such as kindergardens, daycare, schools and other educational facilities.

- **Roof areas**: Roofs are increasingly being recognized as valuable zones for both public and semi-public uses, as well as for regenerative energy generation. Solar thermal and photovoltaic systems are particularly important in this regard. As green roofs they can contribute to water management, biodiversity and help manage interior climate. While there can be competition between different uses – such as rooftop gardens versus solar panels – synergetic approaches can be developed to maximize both social and environmental benefits.

- **Facade zones**: Facade zones can contribute to both social and environmental sustainability by enhancing urban interaction, adding usable areas, and improving climate regulation. Socially active and transparent facades with balconies or winter gardens foster engagement with the community. Adaptable spaces and public areas create gathering points that encourage inclusiveness and social cohesion. Environmentally, these zones can provide shading, natural ventilation, green walls, and buffer zones to regulate building temperature, reduce urban heat island effect, reduce energy consumption, and promote biodiversity. Approaches such as added insulation, high-performance materials, and renewable energy integration contribute to energy efficiency but do not address sustainability holistically. By combining environmental and social elements, facade zones create healthier, more resilient urban spaces that address both community needs and climate challenges. The building's facades thus serve as another key zone, functioning both as a climatic envelope and a zone for urban interaction. Facades are not only responsible for providing insulation and protection from the elements but also act as mediators between the internal and external environments. Their design can enhance natural ventilation, solar gain, and energy conservation, all of which are critical for sustainable building performance. Moreover, facades contribute to the building's aesthetic and social role within the city, engaging with the public through transparent elements, balconies, or shading systems

- **Circulation zones and fire egress**: Another critical zone in building analysis is circulation. Circulation zones, such as staircases, corridors, and elevators, are vital for providing access to various functions within the building. They also play a crucial role in ensuring safety, particularly in terms of fire egress. Circulation zones and egress are essential to meet changing requirements in building transformation projects. Effective circulation design must balance the need for efficient movement of people and safety considerations with social aspects of community and interaction. Escape routes must always remain clear and accessible in the event of an emergency. When thoughtfully designed, circulation zones can contribute to social sustainability by enhancing inclusivity, safety, and interaction. Broad, well-lit corridors and open staircases encourage social interaction and a sense of community, while barrier-free design ensures accessibility for all, promoting inclusiveness. These spaces can also be multifunctional, serving as casual gathering spots, showcasing art or announcing local events, fostering engagement. Fire egress routes, typically focused on safety, can also double as circulation spaces, promoting daily interaction while ensuring security, which is foundational for social well-being. Together, they enhance community connections, well-being, and inclusivity within the building.

- **Underground zones**: Existing underground zones are of particular significance for building transformations as they hold a significant amount of embedded emissions. They often serve important infrastructural functions by housing mechanical, electrical and plumbing services. Often these spaces serve as parking structures to meet mobility requirements for the functions of the building above. Alternative mobility concepts can help to free up some of these spaces for new uses. Since these underground structures often extend beyond the footprint of the building and can sometimes cover the entire plot, they can have a decisive impact on green infrastructure and water management.

The interaction between zones and layers and their role in sustainable development:

An essential aspect of our analysis is understanding how different zones within and around a building interact with the layers of a building. For example, expanding the analysis of the skin layer to include the adjacent space directly in front of a building – such as courtyards or pedestrian zones – helps us analyze the demands on this layer between these outdoor areas and the internal uses on the ground floor of the building. This plays a crucial

role in shaping the relationship between the building and its urban context, influencing everything from foot traffic to microclimate regulation.
The integration of these zones and layers into building analysis aligns with broader goals of sustainable development. By examining each layer and zone for its specific contribution to climate regulation, social interaction, and environmental impact, we can design buildings that are not only functional but also sustainable in the long term.

Additionally, understanding the interaction between internal zones (such as ground zones) and external urban zones (such as public plazas or pedestrian pathways) enables architects and planners to create buildings that contribute positively to the urban ecosystem. This holistic approach to building analysis and design ensures that both individual buildings and their surrounding environments are benefiting from the transformation.

The expansion of the layers concept in building analysis and design, combined with the introduction of zones of use, offers a powerful tool for understanding the complex interactions within a building and between the building and its urban context. This approach not only aids in the design of more functional and adaptable spaces but also supports the goals of sustainable development. By analyzing the role of each layer and zone in contributing to climate regulation, environmental performance, and social interaction, we can create buildings that are better integrated with their surroundings and more resilient in the face of future challenges.

Buildings Analysis

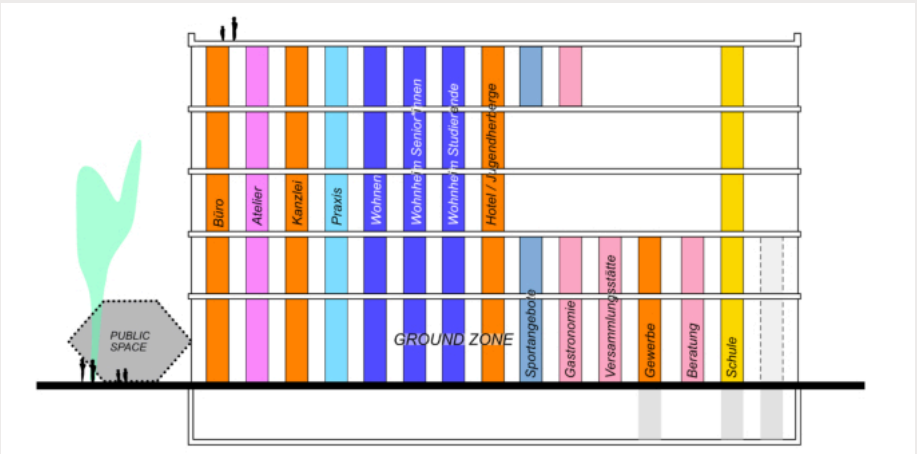


Figure 27: Building analysis: Exemplary distribution of potential uses within a building. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods, based on Eisele et al. (2020).

Example

The analysis of existing buildings encompasses a variety of topics and specialized knowledge. Although the methods are largely similar to those of a new construction project, some information is needed earlier and in greater detail for the transformation of existing buildings. For example, extensive statements on the structural integrity and construction of the existing building must be available very early to weigh potential uses with potential interventions in the building substance. At an early stage, a “digital 3D model in which the load-bearing structures, façade construction, lightweight walls, and building systems are shown separately [is needed]. The model provides a basis for subsequent simulations (climate, ventilation, shading, photovoltaics, structure), life cycle analyses, and visualizations. Spatial qualities such as room height, room depth, or lighting as well as technical conditions such as construction grids, façade grids, supply shafts, circulation cores, escape routes, maximum loads per floor, construction details and their consequences for building physics and noise protection, or existing parking lots are analyzed. They allow preliminary statements as to which uses are suitable for certain parts of the building according to current legal requirements and cultural customs. For example, high load-bearing capacities on upper floors can enable event rooms but make their use difficult due to spatial qualities such as low room heights or depths, technical requirements such as increased sound insulation or a lack of escape routes” (Schade et al., 2024).

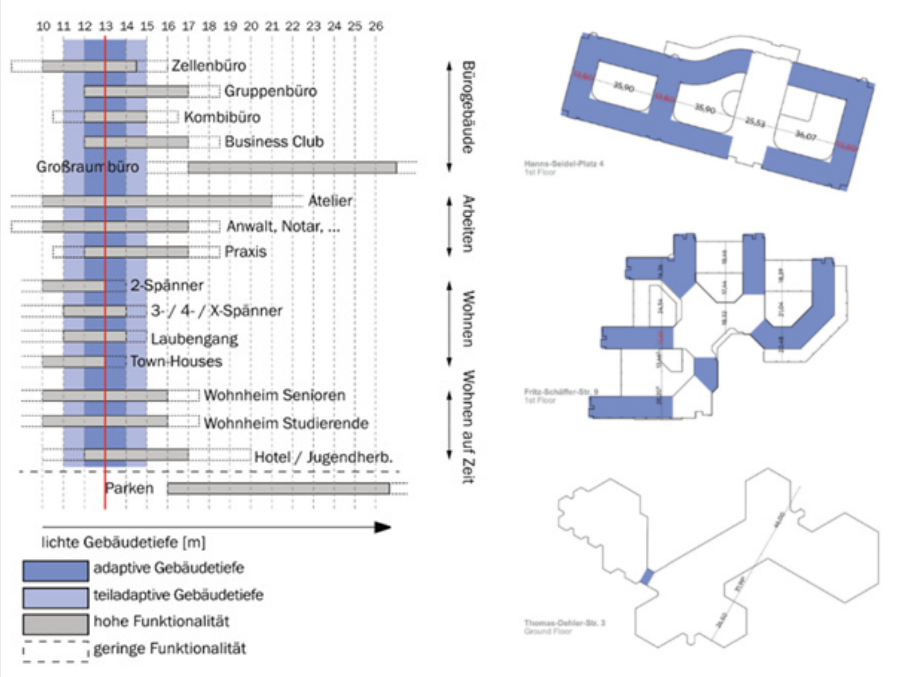
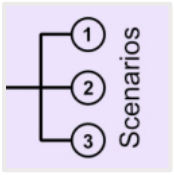


Figure 28: Building analysis concept of layers and zones with a focus on use and context. Image Source: Johannes Staudt (TU Munich)/ NEBourhoods.



4.3.4 Develop & Test Programming Concepts

To preserve as much as possible of the existing building, it is important to find suitable uses for the existing building that require as few changes to the existing structure as possible. We call this process “matching.” At the same time, it is crucial that programming addresses current needs while also addressing future developments. This often requires changes and additions to the existing building. Additions are also a possibility for densification by adding floors or extensions. Densification by adding additional buildings on unsealed soil should be evaluated carefully or ecological sustainability reasons. While such redensification is important to reduce urban sprawl it needs to be balanced against needs for green and blue infrastructure for climate adaptation and mitigation measures. Soil also has to be considered a vital resource.

Matching not only combines uses and existing buildings on a one-to-one basis but also considers possible transformations. It is not just simple programming but also includes concept, strategy, and design methods. All of this occurs in an iterative process of analysis and synthesis. The process includes desktop research, interaction with people on-site, building analyses, design phases, and workshops with various stakeholders.

Planners combine qualitative and quantitative methods to “compare potential suitable uses for the existing building structure with the neighborhood analysis in order to program a context-specific mix of uses: Therefore, uses oriented to the common good are combined with economically more profitable uses to achieve greater resilience and add value to the neighborhood. Additionally, synergies between different uses with comparable spatial requirements are identified, based on the neighborhood needs analysis. This influences the design approach: instead of designing a spatially complex physical solution that consumes more space and resources, such as the construction of a separate room for each use, an organizational solution for multiple uses of the same space by different users can be developed and captured in the program.

To create a use concept, planners can work with persona methods in combination with space-time diagrams to illustrate the connection with the neighborhood. Room usage diagrams visualize the multiple occupancy of rooms over the course of a day, week, or year and lead to more efficient and resource- and energy-saving solutions for the building's construction and maintenance. Based on possible future developments, scenarios for the

future use of rooms are developed and linked to the technical and spatial requirements of the design. For example, to keep a new space as flexible as possible for future uses, structural and infrastructural adaptations can be

Example

Programming: Synergies and Matching

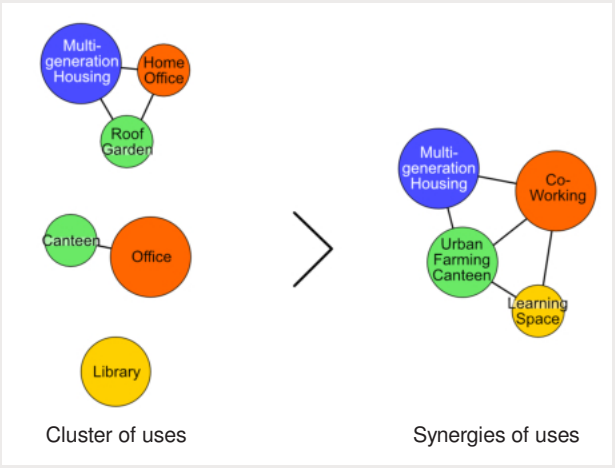


Figure 29: Programming: Exemplary method to identify synergies for multiple uses. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

Programming includes, for example, methods to identify synergies between different uses and 'locate' these uses in sections and floor plans of a specific existing building in workshop sessions.

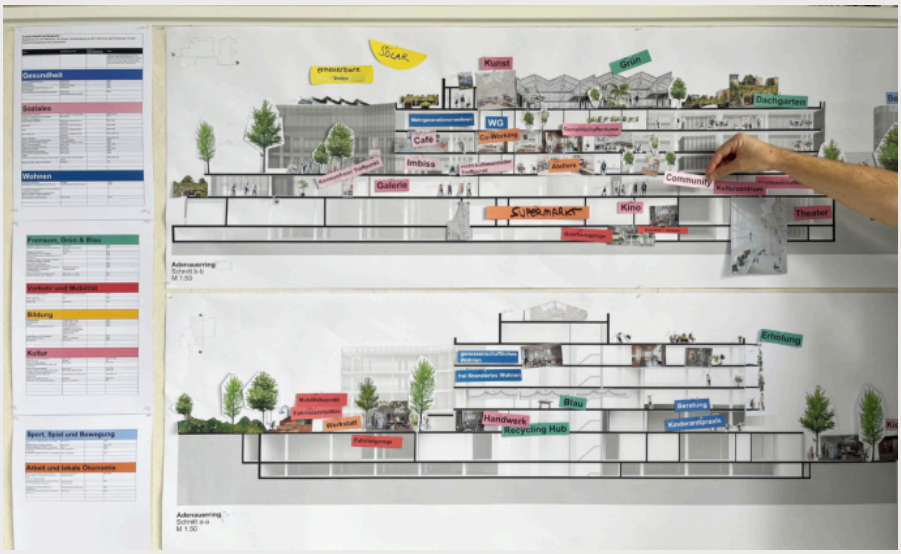


Figure 30: Programming: Exemplary method to match the needs with the existing building. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

planned, such as additional sanitary facilities, flexible partition walls, storage rooms for flexible furniture, oversized structural members for future uses, or retrofittable reinforcements for higher loads." (Schade et al., 2024)

Evaluation

To evaluate the results and scenarios, planners in our expert interviews "critiqued existing life cycle impact calculations for their inaccuracy, specifically noting that metrics such as CO_2 emissions per square meter annually often produce misleading results" (Staudt et al., 2024) since they don't include the user aspect of buildings and the dynamics of change. "To address this, they propose employing a building climate calculator to evaluate different strategies – minimal refurbishment, extensive refurbishment, or demolition – by analyzing their cumulative CO_2 impacts up to 2050, the target year for climate neutrality (…). This method provides a more precise assessment of environmental impacts and supports more informed, sustainable decision-making." (Staudt et al., 2024)

Example

Scenario-Based Evaluation of Design Variants

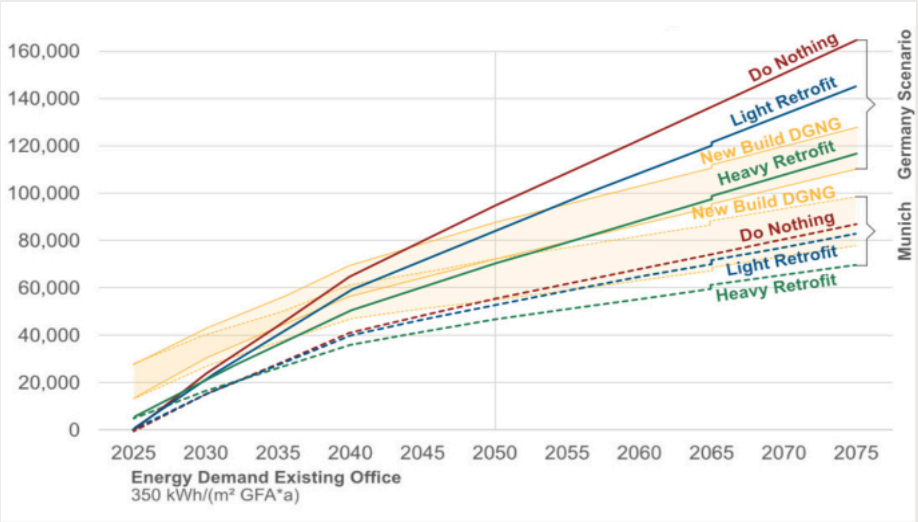


Figure 31: Cumulated emission scenarios for existing office buildings [t CO2-eq.]. "Munich" adjusted for lower heating emissions. Exemplary method to assess design variants against different energy scenarios: Life Cycle Assessment (LCA). Image Source: Josef Rott & Johannes Staudt (TU Munich)/ NEBourhoods based on Ökobaudat (2024); SWM (n. d. a); DGNB e.V. (2021).

Life Cycle Assessment (LCA) as an exemplary method to assess design variants against different energy supply scenarios. The diagram shows the cumulative CO2 emissions of different design variants for different energy scenarios for the existing office building in Neuperlach. The “Germany Scenario” is based on future predictions for Germany’s energy mix, the “Munich Scenario” includes low emissions, geothermal district heating, The new build variant (yellow) based on the German Society for Sustainable Building (DGNB) benchmarks shows the emission ranges of the five large-scale, skeleton construction office buildings (DGNB, 2021). Until 2050, the target year of climate neutrality (EC, 2021), the new build emissions will be higher than in the “Heavy Retrofit” scenario (green). This will gradually shift in favor of the new build variants until 2075.The “Do Nothing” variant (red) has the highest emissions of the existing building variants. Here, the energy demand of the existing office building was assumed to be 350 kWh/(m² GFA*a). The “Light Retrofit” variant (blue) with basement and roof ceiling insulation can only slightly reduce heating emissions. Additional measures in the “Heavy Retrofit” variant (green) include an upgrade of the existing facade and electricity reduction through a large-scale PV installation on the roof, which lead to more effective emission reductions. In both retrofit variants, major renovations will be due after 40 years in 2065, explaining the sharp rise in emissions. According to future predictions, the German electricity mix will drop from 360 grams CO2-eq./kWh in 2030 to 125 grams CO2-eq./kWh in 2050 (Sphera Solutions, 2023b, 2023c). In the “Germany Scenario” calculations, the German district heating mix with 250 grams CO2-eq./kWh was applied (Sphera Solutions GmbH, 2023a). With just 66 grams CO2-eq./kWh, the Munich district heating network is much lower (Stadtwerke München, n. d. a). This Munich scenario (low emissions heating supply) makes the new buildvariants less favourable.
In the future, the gray emissions, which can be avoided by preserving the existing building stock will gain increased relevance. At the same time, high-performance thermal envelopes will be less essential to achieve emission reduction due to the low emission heating supply. In Neuperlach, a planned climate-neutral district heating network will accelerate this development (Stadtwerke München, n. d. b).

Circular Use Scenarios

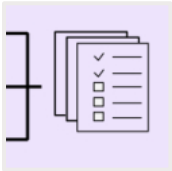
A circular and neighborhood-oriented transformation of large, monofunctionally used office buildings aims at a mix of uses to increase the resilience of the project. Circular and neighborhood-oriented programming promotes mixed-use solutions by creatively engaging with existing structures.

Example

Pioneering Uses

Figure 32: Exemplary documentation of pioneering uses. Image Source: Katharina Voll, Fabiana Ricco, Carsten Schade & Johannes Staudt (TU Munich)/ NEBourhoods.

Residual spaces or unfavorably shaped rooms in the existing buildings can be considered in the programming, and suitable solutions can be developed from the needs analysis, for instance, through pioneering uses (see chapter 3.4). As part of student project weeks at TU Munich, we developed a framework for students to document the pioneering uses. For this, Circular Neuperlach collaborated with "Shaere," one of the largest interim use projects in Germany, located in the former large, mono-functionally used Allianz office building at Fritz-Schäffer-Str. 9 in Neuperlach (2021-2024).



4.3.5 Specify Requirements & Goals

The step Specify Requirements & Goals critically aligns the project's requirements and goals (see chapter 4.3.2) with the preferred scenarios from the previous step (see chapter 4.3.4).

4.3.6 Develop Brief

This step, Develop Brief, summarizes the Requirements and Goals in a project brief (Formulate). This brief is then reviewed with the design team and iteratively adjusted to incorporate their input. The individual steps specifically involve actors with their respective expertise and experience (Revise). A final version of the brief precisely describes the problem, the associated objectives, and conditions for processing, as well as the desired outcomes (Finalize). This validated Brief forms the basis for the next phase, the Early Architectural Design (4.3.7).

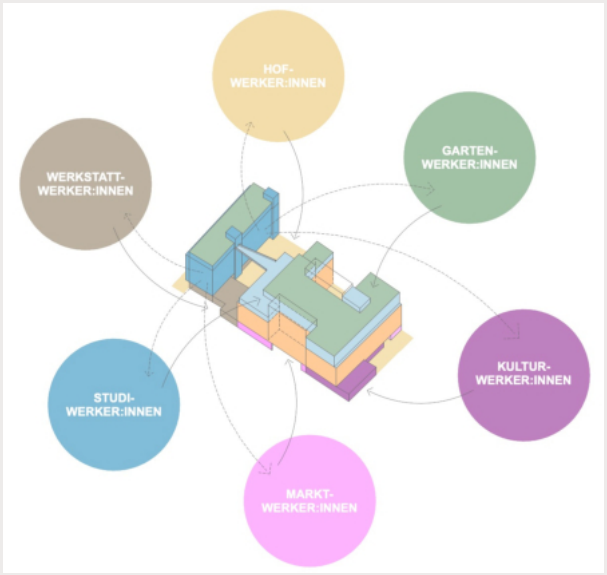
4.3.7 Early Architectural Design

The programming phase forms the basis for the early architectural design. While Peña and Parshall (1969/2012) strictly separate programming and design, our interviews with experts from planning practice confirm that project goals and solution strategies for existing building stock transformations cannot be rigidly set once and then simply executed: Rather, they are continually questioned and must be specifically adjusted based on new insights during the design process. This is particularly relevant when dealing with existing structures, which require greater flexibility, extensive expertise, experience, and creative handling. While major challenges should be identified as early as possible, an iterative approach is indispensable throughout the planning process.

With each step of the planning process, the level of detail and information density increases, leading to different, unpredictable challenges depending on the design strategy (see chapter 3). Working in variants allows for finding suitable solutions to problems in consultation with experts, even retrospectively. Continuous project support by experts in circular and neighborhood-oriented transformation can help identify relevant topics and effective levers for the further development of the project. Throughout the design process, the project goals should be re-evaluated based on the

Example

Design Studio “Interdisciplinary Project”



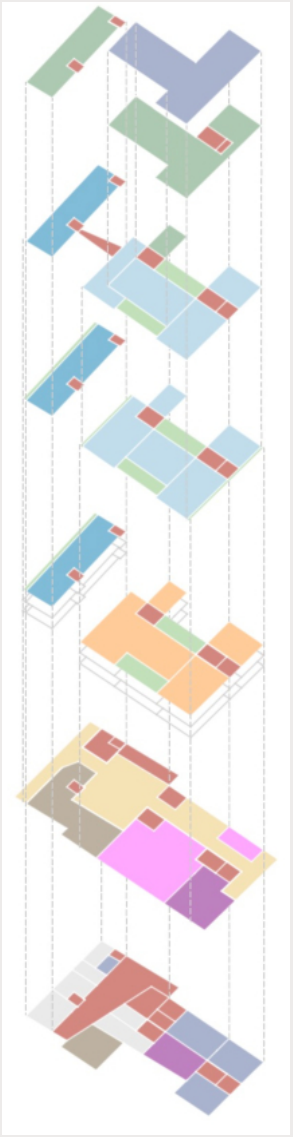


Figure 33: Exemplary design for a transformation. Image Source: Students Jicheng Wan, Lukas Stöckle, Julia Schmidt, Valentin Hegele, Juan Carlos Avalos Gutiérrez, Irina Vollmer under the guidance of Carsten Schade & Johannes Staudt (TU Munich).

In teaching formats such as the "Interdisciplinary Project," we tested parts of our methodology by guiding students through the steps from neighborhood analysis to architectural design. We incorporated the insights gained into the development of our Circular and Neighborhood-oriented Transformation methodology. In our scientific publication Schade et al. (2024), we describe this interplay between research and teaching in greater detail.

project evolution and additional information obtained. In the sense of project-accompanying programming, approaches to solutions and objectives can thus be adapted contextually and situationally.

Good Practice

Fritz District
Planning Process

“The Fritz District transformation project in Neuperlach exemplifies a pioneering approach to circular and cooperative urban planning, focusing on both repurposing buildings and revitalizing the neighborhood (...).

The project deviated from traditional competition formats for a cooperative, iterative process. It began with a critical preliminary research phase, or phase zero, to build consensus among diverse stakeholders. From 90 international firms, 11 were selected to participate in a two-day vision workshop with architects, developers, city officials, external experts, and neighborhood representatives. This workshop collaboratively shaped the project brief and established a unified vision before the formal competition.

The workshop shifted the focus from demolition to preservation, validating that urban planning goals could be met through this approach. The competition allowed for flexible preservation degrees – from 0 to 100 percent – encouraging innovative solutions beyond traditional norms that typically require uniform task descriptions.

The competition was conducted in two stages: a traditional urban design competition followed by a workshop phase with the three winning teams to refine their designs collaboratively. Key to the process was interdisciplinary collaboration among architects, engineers, and consultants on circularity and sustainability. Structural engineers created a 3D model, and building part hunters identified reusable elements. Insights from previous projects helped adapt urban planning guidelines to address the constraints of existing structures. This iterative and collaborative approach was essential for managing the complexity of the existing structures and achieving successful project outcomes that benefit owners, users and the neighborhood.” (Staudt et al., 2024).

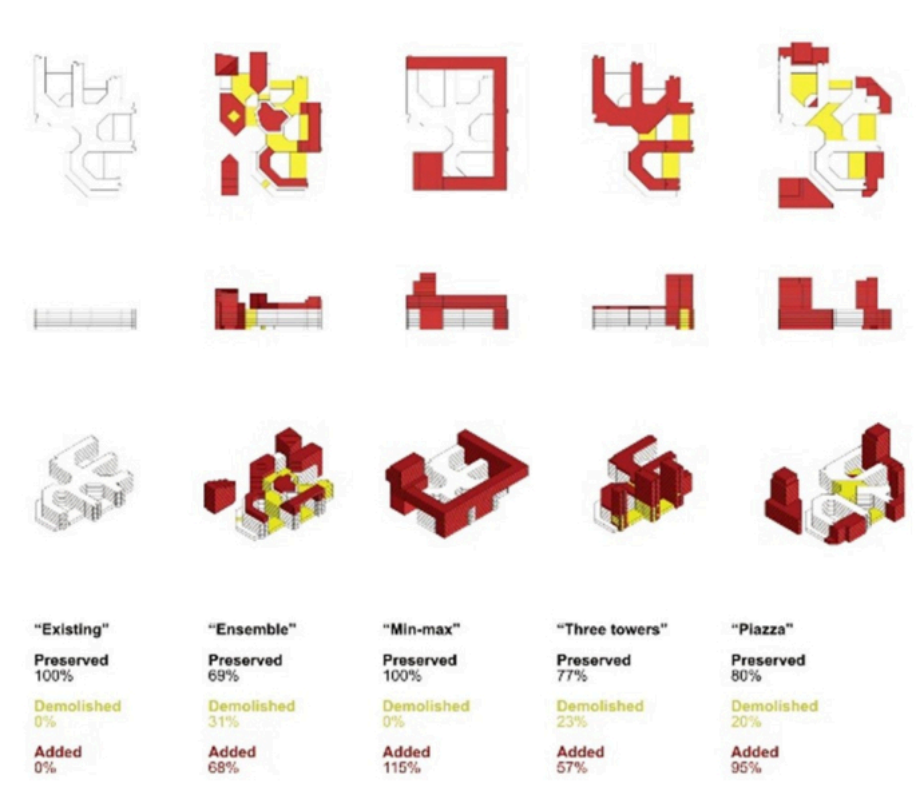


Figure 34: Results of the competition for the transformation of a large, monofunctionally used office building in Neuperlach (1st phase). During our research of reference processes, we examined the process and its results. Image source: Josef Rott & Johannes Staudt (TU Munich)/ NEBourhoods, based on the results of the Fritz District competition.

4.4 ROADMAP IMPLEMENTATION: SERIES OF WORKSHOPS

Below, we describe our series of workshops and steps for implementing the circular and neighborhood-oriented transformation of existing buildings in practice (see Figure 35). The sequence and content correspond to the process steps of the methodology (see chapter 4.3). In a series of workshops, the project participants create a common working and trust basis. During the analysis phase, they gather and structure relevant basic information, which is developed in the programming phase based on scenarios and then culminates in a strategic project brief for the early architectural design. The workshops alternate with phases of preparation and follow-up. They are supplemented by participation formats in which the specific needs and knowledge of the neighborhood and its residents are integrated into the process. This allows for the early identification of concerns focused on the common good, the identification and integration of synergies and conflicts into the process, to enable a resilient and sustainable project development in the sense of a circular and neighborhood-oriented urban development.

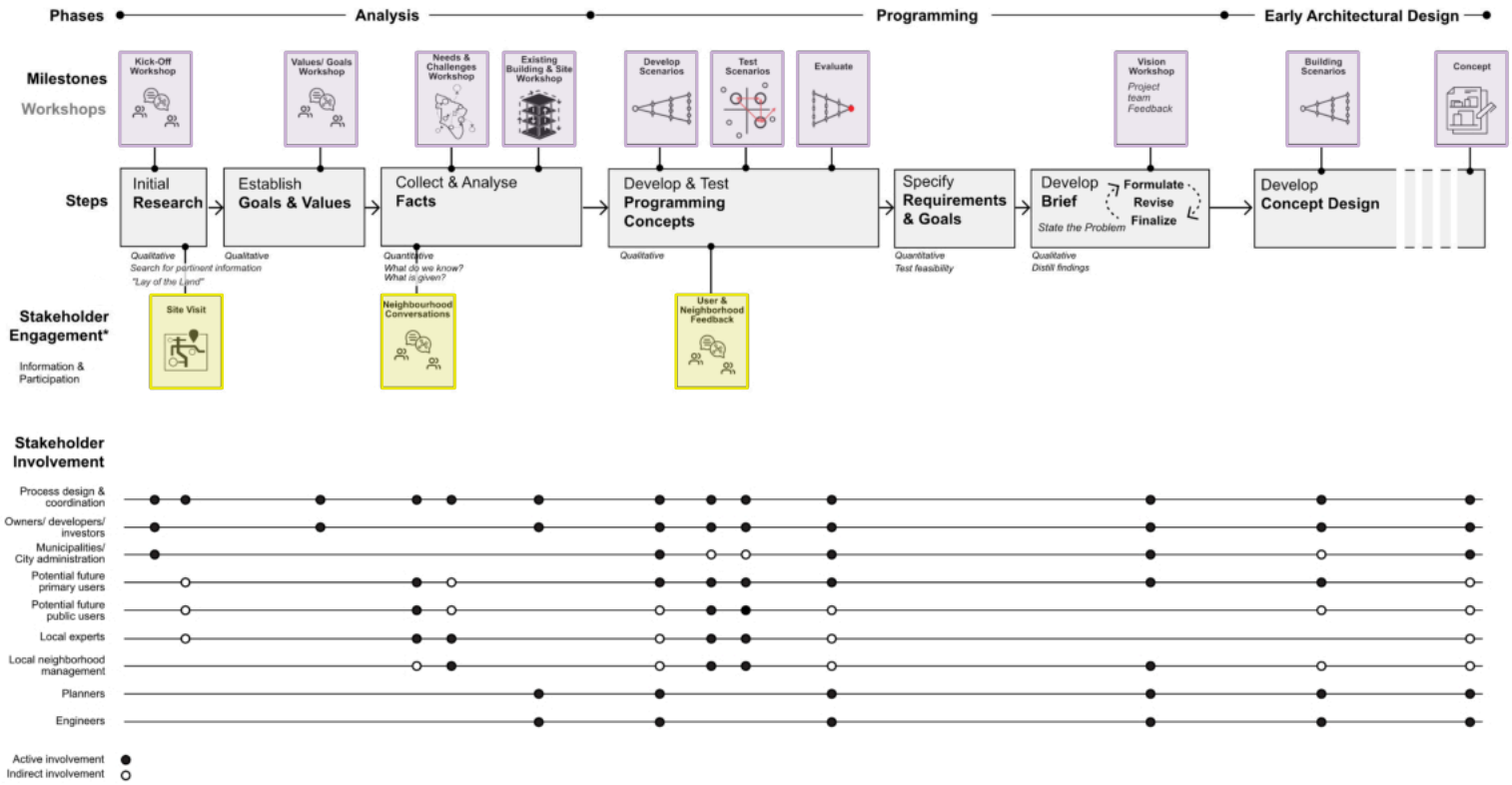


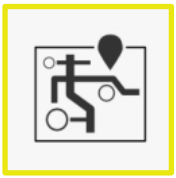
Figure 35: Circular and neighborhood-oriented transformation: Workshops and steps to implement findings in concrete project developments. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

The workshops and steps below condense our findings from co-creative research with partners from administration, real estate, planning, and civil society. The formats are intended as prototypes for a new planning practice in the spirit of the New European Bauhaus. The individual formats target early planning phases to influence key decisions. While the level of detail and accuracy of information during these early phases is relatively coarse, it is still possible to identify the most impactful fields of action. To do so, it is important to identify which information is already available. This includes available drawings and building documentations as well as existing neighborhood analysis and needs assessments. Already existing urban development plans are important to contextualize the future evolution of a project. Gathering, filtering and structuring this information helps to focus on what is relevant for the given project. For example, creating a three-dimensional model with design-relevant information on statics can be crucial to effectively and meaningfully utilize design potential in dealing with existing structures. To determine the right information density and level of detail, and to identify interactions, synergies, and conflicts between individual disciplinary aspects, building layers, and levels of the existing structure in a timely manner, the early and targeted involvement of expert knowledge is relevant. The following steps and workshops provide corresponding guidance.

A key finding from research on the transformation of existing buildings is that standard solutions must be questioned and contextually adapted in exchange with experts. The formats are thus to be understood as a starting point for practitioners to test in their own projects. Although we tested our formats with practice partners during the two-year project period, further applications in practice projects and additional expert validation are needed to further develop the methodology as a robust framework for practice.

4.4.1 Kick-Off

Phase:	Analysis
Step:	Research context
Basis:	Established contact between participants; Available information on potential project development of existing building; initial information about the context, for example, urban development concept
Participants:	Owner/ project developer/ investor; City administration/ municipality/ urban planning department; Process designers and coordinators
Content:	Get acquainted; Align interests
Outcome:	Agreement on the willingness to shape the process together; Commissioning the process designers



4.4.2 Site Visit

Phase:	Analysis
Step:	Research context
Basis:	Initial information from desktop research
Participants:	Process designers and coordinators
Content:	Talk to people on site; Observe the place and the neighborhood context.
Guiding question:	What is already there?
Outcome:	Photo documentation and notes

4.4.3 Values & Goals Workshop

Phase:	Analysis
Step:	Establish goals and values
Basis:	Non-disclosure agreement (NDA); Mission statement and institutional values and goals of the involved parties
Participants:	Owner/ project developer/ investor; Process designers and coordinators
Content:	Align values; Establish goals; Clarify roles, expertise, and capacities; Discuss temporal and organizational conditions.
Guiding question:	What does the client/ project team want to achieve and why?
Outcome:	Agreement on the scope, process steps, and timeline of the project

4.4.4 Neighborhood Conversations

Phase:	Analysis
Step:	Collect and analyze facts
Basis:	Results from the analysis of context, e.g., social milieus and lifestyles, demographic developments in the neighborhood
Participants:	Citizens/ residents/ people from/in the neighborhood; Neighborhood representatives; Experts in participation; Process designers and coordinators

Content:	Talk to people about neighborhood needs for their daily lives as well as existing potentials and conflicts; Conduct expert interviews with key stakeholders in the neighborhood
Guiding question:	What do the people on site know as everyday experts of their neighborhood?
Outcome:	Neighborhood needs identified in relation to everyday life in the neighborhood

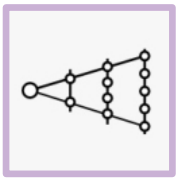
4.4.5 Needs & Challenges Workshop

Phase:	Analysis
Step:	Collect and analyze facts
Basis:	Results from the analysis of context as well as the analysis of development & change; Stakeholder analysis; Results from neighborhood participation formats
Participants:	Neighborhood management; Neighborhood representatives; Process designers and coordinators
Content:	Contextualizing the results from participation formats, stakeholder analysis, and desktop research within historical, current, and future urban developments, megatrends, demographic trends, everyday life, and identity-shaping places.
Guiding question:	What do we know? What is given?
Outcome:	Overview of the potential interactions between the project site and the neighborhood

4.4.6 Existing Building Workshop

Phase:	Analysis
Step:	Collect and analyze facts
Basis:	Existing drawings and documentation; 3D model; Information on the building structure, pollution, etc.; Analysis of the building's layers and spatial qualities
Participants:	Owner/ project developer/ investor; Planning team with architects, structural, civil, and building engineers; Process designers and coordinators

Content:	Discuss and assess the building's qualities, potentials, and limitations from the different disciplinary perspectives
Guiding question:	What do we know? What is given?
Outcome:	Building's qualities, potentials, and limitations are identified

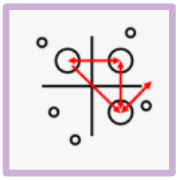


4.4.7 Develop Scenarios

Phase:	Programming
Step:	Develop programming concepts
Basis:	Results from the analysis phase about developments & change, context, needs, existing building, and goals of the project development; List of potential needs and uses, color-coded according to use categories such as residential, energy, commercial, social, etc.; Plans such as building sections and floor plans; Elements to work with low-threshold in the building sections, such as color-coded use suggestions (words) or illustrations of uses and people; Photos of the existing building and its surroundings
Participants:	Owner/ project developer/ investor; Potential operators such as cooperatives, foundations, providers of social or cultural institutions, etc.; Project team architects; City administration/ municipality/ urban planning department; Process designers and coordinators
Content:	1) Select and combine suitable uses for the specific project, work abstractly (without plans yet); 2) Identify synergies and conflicts between different uses; 3) Arrange the uses in the specific building section and floor plans; 4) Discuss and weigh use variants to develop a scenario, including questions of operation, cross-financing, emissions and compatibility of uses such as noise, odor nuisance, etc.; 5) Repeat the previous steps to develop different scenarios
Guiding question:	What is possible?
Outcome:	Various usage scenarios are created

4.4.8 User & Neighborhood Feedback

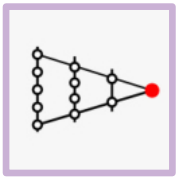
Phase:	Programming
Step:	Test programming concepts
Basis:	Invitation formats and Scheduling tailored to target groups for diverse user groups in the neighborhood, especially for people who are hard to reach in participation processes; Developed scenarios from previous workshop(s) and workshop material prepared for accessible use with diverse individuals from various cultural backgrounds and educational histories; Open-ended attitude of the project team and openness to criticism
Participants:	Citizens/ residents/ people from/in the neighborhood; Neighborhood representatives; Neighborhood management; Experts in participation; Owner/ project developer/ investor; Process designers and coordinators
Content:	Present, comment on, and discuss scenarios; Work out potentials and conflicts from the perspective of different user groups; Document the results for subsequent publication, for example through graphic recording and photo documentation
Guiding question:	How do the people in the neighborhood evaluate the scenarios as everyday experts of their neighborhood?
Outcome:	Feedback from the neighborhood and future users on the scenarios



4.4.9 Test Scenarios

Phase:	Programming
Step:	Test programming concepts
Basis:	Developed scenarios and neighborhood feedback from previous workshops
Participants:	Owner/ project developer/ investor; Potential operators; Neighborhood representatives; Experts in pioneering uses; Citizens/ residents/ people from/in the neighborhood; Process designers and coordinators

Content:	Discuss use combinations with experts and potential (local) operators for the respective uses; Test different uses, for example through pioneering uses or opening the building to the public
Guiding question:	What could actually work in practice?
Outcome:	Insights into possible implementation of uses and their synergistic composition as well as their potential acceptance in the neighborhood



4.4.10 Evaluate Scenarios

Phase:	Programming
Step:	Test programming concepts
Basis:	Developed and tested scenarios from previous workshops, including neighborhood feedback; Prior evaluation of the scenarios with discipline-specific methods and evaluation criteria
Participants:	Owner/ project developer/ investor; Potential operators; Planning team with architects, structural, civil, and building engineers, landscape architects; City administration/ municipality/ urban planning department; Process designers and coordinators
Content:	Evaluate and discuss the scenarios from different disciplinary perspectives; This can include prepared expert analysis using tools like live cycle analysis (LCA), life cycle cost analysis (LCC), structural analysis, pollutant analysis, biodiversity studies, building part documentations, etc.; Weigh the evaluation results and evaluation criteria with regard to the intended project goals and values.
Guiding question:	Which scenario should be pursued further to achieve the project goals?
Outcome:	Preferred scenario is selected

Project team Feedback

4.4.11 Vision Workshop

Phase:	Programming
Step:	Revise brief
Basis:	Brief for subsequent design process or formal competition
Participants:	Owner/ project developer/ investor; Planning team with architects, structural, civil, and building engineers, landscape architects; External experts for the design/ transformation of existing buildings; Neighborhood management; City administration/ municipality/ urban planning department; Process designers and coordinators
Content:	Shape the project brief collaboratively; Establish a unified vision for the subsequent design process or formal competition; Shift focus from demolition to preservation; Validate that urban planning goals can be met through this approach
Guiding question:	What has not yet been sufficiently considered? What needs to be adjusted?
Outcome:	Flexible task descriptions that allow for flexible preservation degrees (0% to 100%) to encourage innovative solutions beyond traditional norms

4.5 ACTORS TO GUIDE THROUGH THE ROADMAP

To guide the transformation of existing buildings in a circular and neighborhood-oriented manner, it is necessary to consider not only the phases (process-based) and the different scales (multi-scalar) but also the stakeholders involved in shaping the processes (multi-stakeholder; see Figure 36). Therefore, the goals and how they are to be achieved are crucial at the outset of project development. These factors determine which stakeholders should be involved in the process and to what extent. In the workshop series, we describe when the respective knowledge should be introduced to create leverage and best support the process (see chapter 4.4).

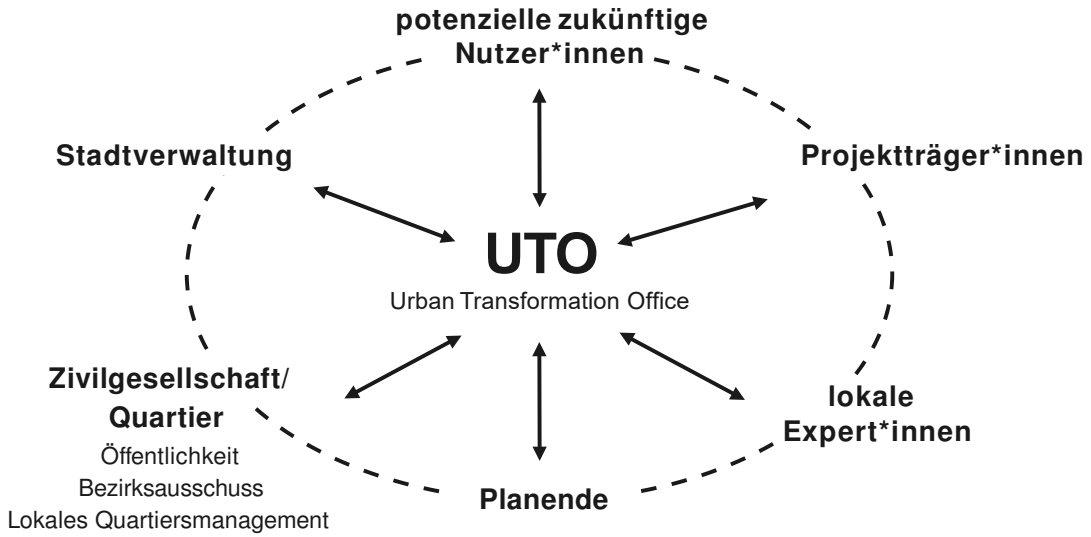


Figure 36: Circular and neighborhood-oriented transformation: Main actors in the process. Image Source: Laura Maria Höpfner, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

A particular challenge lies in the fact that processes in the early planning phases usually take place behind closed doors. However, large, monofunctionally used office buildings like those in Neuperlach are in the public eye: Due to their size (4,500 – 54,0000 m² GFA) and their relatively central location, they offer great potential to influence urban transformation processes in the sense of an urban development for the common good. Our expert interviews and literature research emphasize the need to actively involve affected citizens and civil society actors in the process at an early stage. By doing so, synergies and conflicts of needs can be identified and negotiated early on.

This tackles a central question in urban development for the common good: Whose interests are represented at what point in the process and by whom? This issue is particularly relevant when planning predominantly takes place without public involvement, while the outcomes significantly impact the neighborhood and the daily lives of its residents. The question of when and how processes in early planning phases should be made accessible to the public is crucial for achieving the goals of socially sustainable urban development for the common good and for making project development resilient. The processes examined carry a high risk that the concerns of local people, especially disadvantaged groups, are either not recognized or misinterpreted in an “advocacy planning” approach (Davidoff, 1965). Misunderstandings and conflicts can be avoided with good process design if those affected are involved at an early stage. The degree to which this should happen is determined, among other things, by the project goals. Standard participation models, such as Sherry Arnstein’s “ladder of participation” (1969), are helpful in this context. Having experience in participation processes in an urban context is crucial for success.

4.5.1 Forms of Organization

Looking into reference processes, we identified various exemplary and innovative institutions which mediate between actors and shape design processes. Basically, these institutions combine competencies such as moderation experience, conflict management and mediation, understanding of planning processes (ideally with practical experience in planning and design), project management, process design, people skills, and empathy. These competencies are particularly relevant for novel planning processes dealing with existing structures, to break up and adapt classical, linear processes. For example, it requires in-depth expertise combined with knowledge of organizational processes, existing hierarchies and silos within the organizations, as well as knowledge about the ‘right’ contact persons within the involved organizations to accelerate processes and dissolve entrenched fronts and prejudices. An external institution that possesses this knowledge and competencies while not being a part of any of the organizations involved can act in a more agile manner and accelerate processes. Furthermore, dealing with existing structures requires specific expertise, such as knowing the level of detail and information density needed at different stages of a planning process (as opposed to new construction). Traditionally, planning offices take on this role as representatives of the building owners. However, there are opportunities for new business models or governance structures specializing in process design and mediation in building stock transformation.

Office	Focus	Mission, Goals	Expertise, services	Form of Organzation	Funding
Metabolic (NL)	Circular consulting, data analysis and implementation agency	Enable systemic change to transition to a circular economy, with goals centered on achieving ecological sustainability, resilience, and equity at a global scale	Systems thinking, sustainability consulting, and circular design, delivering strategic advice, tools, and frameworks to tackle complex challenges	Mission-driven organization combining consultancy, research, and innovation	Combination of consulting fees, research grants, and partnership funding from public and private sectors
FutureBuilt (NO)	Support pilot projects to promote sustainable urban development and climate-neutral architecture in Norway	Create climate neutral urban areas, based on high quality architecture Support innovative projects which cut carbon emissions by at least 50% compared to current regulations and common practice	Guidance, knowledge sharing, and pilot projects to showcase innovative solutions for sustainable city planning	Public-private partnership that operates as a collaborative initiative, involving architects, developers, and other stakeholders	Combination of public funding from Norwegian municipalities, government grants, and contributions from private-sector partners
Team Zukunftsquartiere (GER)	Develop sustainable, future-ready neighborhoods through participatory and interdisciplinary approaches	Foster the creation of inclusive, climate-adapted urban quarters that meet current and future needs.	Interdisciplinary expertise in urban planning, climate strategy, and citizen engagement to shape livable neighborhoods	Collaborative, cross-disciplinary project team	Public research grants, municipal funds, and sometimes private contracts or project-based funding
Mitbauzentrale (GER)	Support and facilitate collaborative housing initiatives	Empower individuals and groups to co-create sustainable, affordable housing solutions	Consulting, project management, and support advisory services, workshops and events, networking and matchmaking to connect individuals, architects, and developers	Non-profit and mission-driven public-private organization	Primarily financed by the City of Munich through municipal funding, with potential for minor fees for specialized services
APUR (FR)	Urban research and planning to support sustainable development and improve the quality of life in the Paris metropolitan area. Accompany public policy	Provide data-driven insights and strategies for equitable and climate-resilient urban planning. Document, analyse and develop forward looking strategies which address urban and societal evolution	Urban analytics, strategic planning, and policy advisory services	Public urban research agency collaborating with local authorities and urban stakeholders	Public funding, including contributions from the City of Paris, regional authorities, and national government bodies
Denkstatt Sarl (CH)	Support businesses and organizations in integrating sustainability into their strategies and	Empower clients to create sustainable value and align their practices with environmental, social, and governance goals	Consulting on corporate sustainability, environmental management, and climate strategy	Private consultancy with a mission-driven approach	Consulting fees paid by private companies, public institutions, and organizations

Table 3: Selected institutions from our analysis of reference processes which mediate between actors and shape design processes. Image Source: Johannes Staudt, Carsten Schade & Josef Rott, (TU Munich)/ NEBourhoods.

We have examined national and international pilot projects and institutions involved in process design (see Table 3). A significant difference lies in who finances the institution. This determines which interests are primarily represented in the process: Depending on the financing model, process design can focus more on the representation of particular interests or the common good to varying degrees. Particularly interesting for cooperative urban development approaches by public authorities and private owners are mixed financing models of agile, ‘independent’ institutions for process design and facilitation, such as the Norwegian office FutureBuilt (see infobox).

Good Practice

FutureBuilt
Example collaboration platform

“An example of collaborative innovation is FutureBuilt, a partnership among several municipalities around Oslo established to advance innovation in the building industry to achieve climate goals (…). This initiative connects municipalities with developers to enhance communication and streamline project implementation. FutureBuilt engages with projects only when key stakeholders, especially developers, are committed to its objectives. Accepted projects benefit from consulting services, including assistance with building permits, local regulations, and connections to relevant researchers and consultants. The organization advocates for flexible municipal regulations to support innovative practices and seeks to document and disseminate project insights to foster continuous improvement and collaboration. FutureBuilt also serves as a networking hub, linking developers with resources and funding opportunities.” (Staudt et al., 2024)

4.5.2 Urban Transformation Office (UTO)

Within our Circular Neuperlach research project, we established our own institution – the Urban Transformation Office (UTO) – to engage with various private and public actors on an equal footing in specific project developments (see Figure 37). The necessity of this step arose partly from the theoretical insights gained from our analysis of reference processes and interviews with practitioners (see chapter 4.5.1). Additionally, it was practically necessary to develop a unified presence when dealing with third parties, allowing the diverse competencies of the interdisciplinary project team to be conveyed (see chapter 2.3) and to develop a distinct stance and identity.

UTO is a pioneering institution dedicated to addressing urban development challenges across the entire life cycle of projects, with a strong focus on the common good and within the limits of planetary boundaries. UTO approaches urban transformation with a multi-scalar

region, and neighborhood (Quartier). This approach is both inter- and transdisciplinary, combining insights from research and practical applications.

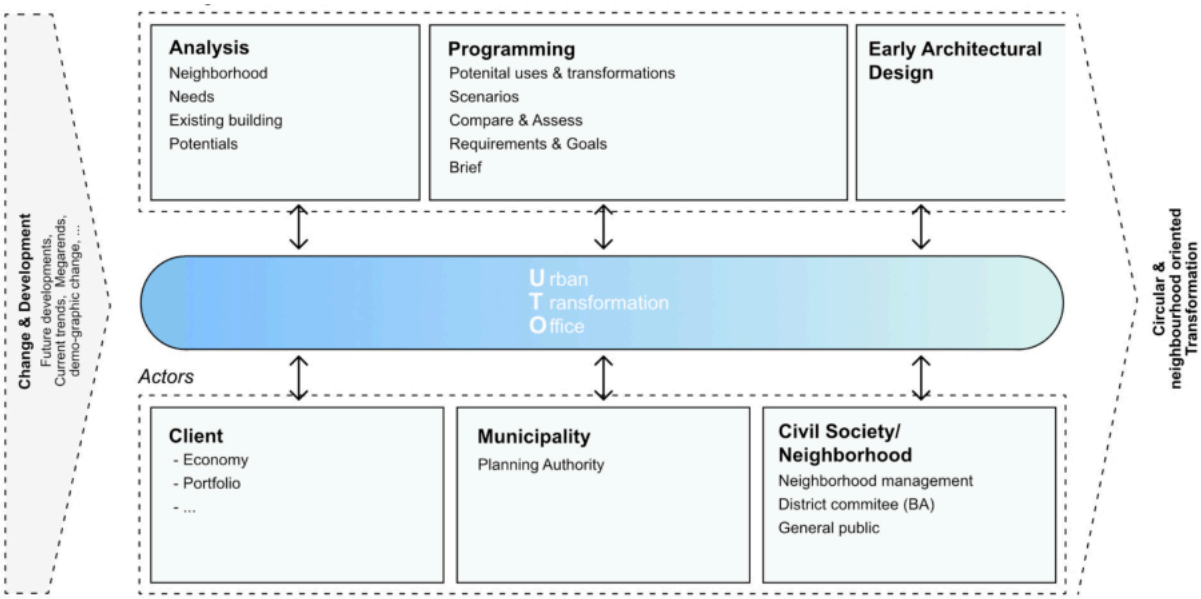


Figure 37: The Urban Transformation Office (blue field in the center) as an agile institution between the different actors (bottom fields) in early planning phases (top fields) to achieve a circular and neighborhood-oriented transformation. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

At the core of UTO's work is the idea of buildings as living organisms, capable of evolving and interacting with their surroundings. Adapting these buildings to new challenges can actively contribute to the sustainable transformation of existing neighborhoods. The institution acts as a vital interface between city planning and project implementation, carefully balancing interests for the common good with specific stakeholder interests from the very first phase, often referred to as "Phase Zero" (see chapter 3.3.4).

UTO places a significant emphasis on team building and networking, drawing in expertise progressively as required by the process. Workshops are integral to UTO's methodology, fostering collaboration and a collective approach to urban challenges. The organization is committed to developing systemic solutions that prioritize the public good, even while navigating the intricacies of financing, regulations, and particular local considerations. Overall, UTO embodies a holistic and forward-thinking approach to urban transformation, actively working towards sustainable and equitable urban spaces that respect the delicate balance of our planet's ecosystems.

UTO is an institution designed to be adaptable and responsive to the evolving needs of urban development, emphasizing a holistic and interdisciplinary approach. During the research process, questions arose regarding the legal and organizational form UTO can take in

Germany and what capabilities, services, or actions UTO can offer. These questions could not be conclusively answered within the research project. We are still keeping the legal and organizational form of UTO open. The advantages and disadvantages from a content perspective still need to be further researched.

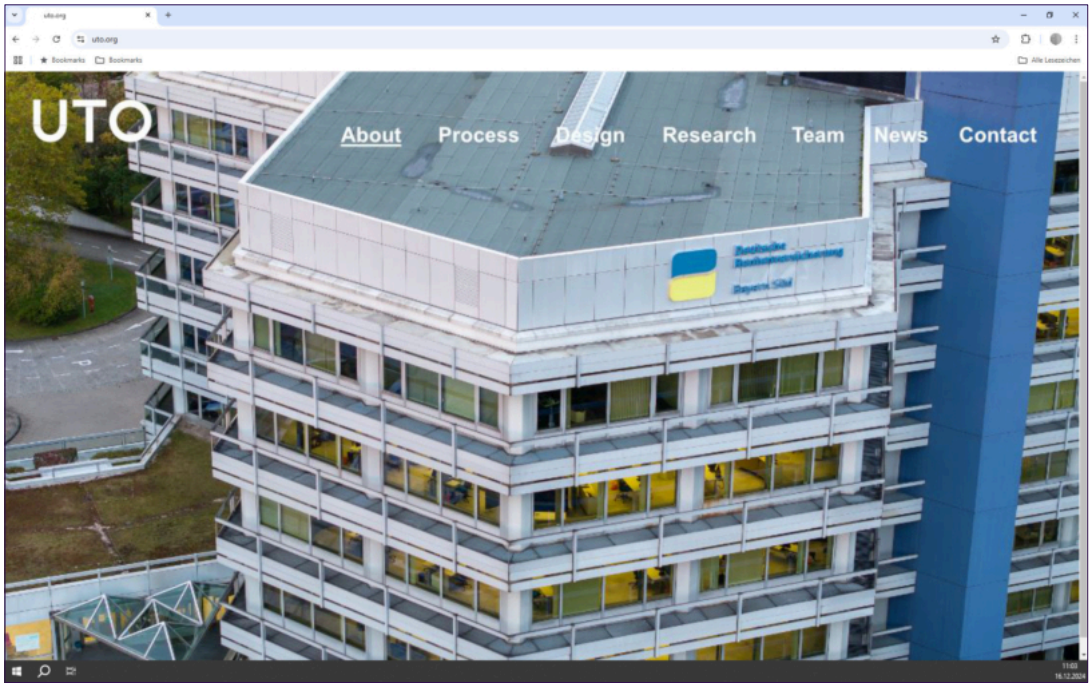


Figure 38: Mock-Up of a website for the Urban Transformation Office (UTO). Image Source: Johannes Staudt (TU Munich)/ NEBourhoods, Photo: Patrik Thomas, NEBourhoods.

Capabilities, services, or actions UTO can undertake:

- Consulting: Offering expert advice and strategic guidance on urban development projects.
- Moderation, Mediation: Facilitating discussions and resolving conflicts among stakeholders to ensure smooth project progression.
- Process Design & Management: Structuring and overseeing the various phases of urban transformation projects, from inception to completion.
- Workshop Moderation: Leading collaborative sessions to foster teamwork and innovative solutions.
- Programming: Developing and implementing software or digital tools to support urban planning and management.
- Planning: Creating detailed plans for urban development that balance communal welfare with stakeholder interests.

Legal and organizational forms UTO can take:

- Non-profit Organization: Operating with a focus on the common good and reinvesting any surplus into furthering the institution's mission.
- For-profit Office: Functioning as a business entity that generates profit while addressing urban development challenges.
- Municipal GmbH (Gesellschaft mit beschränkter Haftung): A limited liability company established by the municipality to manage urban transformation projects.
- Platform: Serving as a hub for collaboration and information exchange among various stakeholders.
- Network: Connecting different actors and organizations to facilitate knowledge sharing and joint initiatives.
- Context Research Hub: Conducting research on local needs, infrastructure, and stakeholders, often established by the municipality and funded by developers.
- Physical Space: Providing a tangible location such as a café, bar, or exhibition space to engage the community and stakeholders.
- Event: Organizing workshops, conferences, and discussions to promote collaboration and share insights on urban transformation.

Figure 39: Toolbox Urban Transformation Office (UTO) for the Circular and Neighborhood-oriented Transformation. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

Our NEB action actively contributes to the goals of EU funding to translate research findings into practice-oriented approaches to accelerate the achievement of the Green Deal (see chapters 3.1 and 6). The process was supported by a communication expert as part of the research project to elaborate the goals, content, and value proposition of such an institution. Furthermore, efforts were conceptually and consultatively supported by the entrepreneurial institutions within the research project (UnternehmerTUM) as well as additional start-up support at the university (TUM Venture Lab Built Environment).

5 CONCLUSION

5.1 LOOKING BACKWARD

5.1.1 Outcome of this Roadmap

The analysis and activation of the circular potential of the built environment in Neuperlach, as presented in this Circular Transformation Roadmap, address the goal of reducing resource consumption, extending the use phase of buildings and objects, and closing material cycles while simultaneously contributing to an urban development for the common good. This deliverable, the Circular Transformation Roadmap for Neuperlach, outlines concrete pathways for practice on how overarching global to local goals can be achieved together in a process-based, multi-scalar, and multi-stakeholder framework for circular and neighborhood-oriented transformation of the built environment. The co-creatively developed methodology of a ‘circular and neighborhood-oriented transformation’ of existing buildings (Staudt et al. 2024; Schade et al. 2024) describes novel design processes and technologies which address circular building and neighborhood practices. It outlines the necessary steps to shape project developments towards NEBourhoods values ‘sustainable’, ‘together’, and ‘beautiful’. It forms a basis for sustainability strategies, processes, and pathways towards circularity which includes aspects like legislation, regulation, new circular spaces as well as new business models (see chapters 5.2.2 and 6).

The roadmap focuses on the early planning phases, as these can have a high impact on sustainable and resilient project development with relatively low environmental and economic resources. Analysis and programming form the basis for the design: by involving all relevant stakeholders, levers are identified and utilized for the design. Through the various steps and workshops, project participants test suitable forms of collaboration and can build mutual trust for further process design. The aim is to structure these phases in such a way that all the necessary information and all relevant parameters are gathered early for decision-making and to develop, test, and evaluate programming concepts to formulatea project brief for the subsequent design phases.

5.1.2 NEBourhoods KPIs Achieved to Date with Circular Neuperlach

The KPIs (key performance indicators) measure the progress and success of the NEBourhoods project, ensuring that the objectives and achieving the goals set forth by the European Green Deal are met effectively. The key performance indicators of the NEBourhoods project and contributions of Circular Neuperlach achieved so far include:

Cultivate an inclusive, empowering and resilient urban innovation landscape:

KPI 1.1: Conducted 6 co-creation workshops of NEBourhoods for NPL.
KPI 1.2: Engaged between 4-25 stakeholders per workshop.
KPI 1.3: Collaborated with 2 creatives.

Involve entrepreneurship facilitation in urban development:

KPI 2.1: In the Hacking Neuperlach format of SCE and in the EuroTeq Collider 2023 format by TUM hfp, 4 teams worked on sustainable business ideas.
KPI 2.3: 1 NEBourhoods start-up team is made incubator ready.

Co-create diverse cutting-edge pilots in NPL:

KPI 3.2: Created 1 roadmap including various design approaches for use and further development in Munich and by third parties.

Deliver NEBourhoods - inspiring and replicable practices for sustainable urban development:

KPI 4.1: Participated in 2 relevant events with own contributions related to Circular Neuperlach (BBSR Lowtech & Sufficiency Symposium, Berlin, 06.2024, Research Colloquium Suffizienz im Gebäudebereich; EAAE Conference, Less is Must, Münster, 08.2024) and participated in national and international events and workshops in the field of circularity and neighborhood transformation (Circular Educators TU Delft, Circular Society Roadmap Hans Sauer Stiftung, Circular Republic Festival 2024, Münchner Quartierskongress 2023, Expo Real Munich 2024).

Contribute and nurture the NEB vision and movement:

KPI 5.2: 1 peer reviewed journal article (Staudt et al. 2024) and 1 peer reviewed conference article (Schade et al., 2024) published as a follow-up.

5.2 LOOKING FORWARD

5.2.1 Impact of this Roadmap

The developed strategies towards circular practices in the built environment with a focus on non-residential buildings and this Circular Transformation Roadmap for their implementation, have a high impact on the reduction of resource consumption, greenhouse gas emissions, and environmental degradation. This Circular Transformation Roadmap is a prototype that opens the results to a broader audience and connects researchers, planners, and entrepreneurs with relevant networks and stakeholders in the neighborhood, such as real estate, administrative, and civil society actors. The Circular Transformation Roadmap can be transferred to other cities in Germany and Europe. The inclusion of various stakeholders led to the development of a new business model (see chapter 4.5.2) and policy recommendations (see chapter 6).

5.2.2 Outlook

This Circular Transformation Roadmap for the circular and neighborhood-oriented transformation of existing buildings focuses on early planning phases to promote sustainable and resilient project development in terms of an urban development for the common good. The findings from the practice-oriented research and the policy recommendations aim to advance Munich as a circular city and support existing ambitions such as the European Circular Cities and Regions Initiative and Zero Waste City. The Circular Transformation Roadmap serves as a prototype for new planning practices in the spirit of the New European Bauhaus and can be integrated into overarching municipal innovation processes in the future.

A key finding for an effective implementation is, in addition to the necessary legal and regulatory adjustments, the necessity to establish, integrate, and publicly (co-)fund an institution that can act in an agile way and independently, initiating and supporting sustainable project developments (see chapter 4.5). As an innovation driver, it plays a crucial role liaising between private and public actors, in order to support a socio-ecological transformation in the real estate industry in the sense of circular and urban development for the common good under the existing conditions in which the relevant building stock is largely in private hands. It mediates between private sector interests from the real estate industry and institutions of city administration as well as civil society.

City Council Resolution

Key findings of this Circular Transformation Roadmap are intended to contribute to a city council resolution of the City of Munich to be permanently anchored in political and administrative processes and thus be replicated citywide with high impact.

Further Research

Our Circular Transformation Roadmap outlines ways to extend the lifespan of existing buildings, contributes to urban scale circular transformations, and provides approaches to address issues of urban development for the common good. In this context, there are numerous points of reference for further research into social sustainability as well as ecological sustainability in the transformation of existing buildings.

To address the demand for housing in metropolitan areas, existing building transformations offer an important spatial resource. However, these are often hardly suitable for conventional forms of housing. Cooperative approaches can play an important role here. Munich has a well-established scene for cooperative and cooperative-like construction, supported by publicly funded advisory services. However, cooperative construction still predominantly takes place in new buildings. Questions regarding the transformation of large, monofunctionally used office properties, as well as the possibilities of mixed operator models, are a forward-looking field of action and research. It is also necessary to investigate how existing building transformations can be broadly supported for subsidized housing and what political and legal adjustments are required for this. Further research should look into large scale societal changes in the context of climate change and demographic change while being embedded in ongoing, real-life building and neighborhood transformation processes. This will ensure topical relevance and immediate positive impact in an ongoing crisis.

To ensure this transformation contributes positively to socio-ecological change, new analysis and planning methods are needed that identify the levers for a fundamentally sustainable transformation early on and integrate them into further planning processes. Although there are already various approaches to implementing more sustainable and efficient methods in practice, there is often a lack of an interdisciplinary and holistic perspective to create effective change. Professional associations and chambers, as well as universities, should be additionally involved in jointly developing and implementing exemplary solutions together with partners from city administration, planning, real estate industry, and civil society.

6 POLICY RECOMMENDATIONS

“The integration of regenerative circularity into urban planning is not merely a trend but a necessary paradigm shift that recognizes the interconnectedness of social, ecological, technical, and economic systems. By adopting a holistic and iterative planning framework, cities can create vibrant, resilient spaces that respect their existing material and social context while addressing future needs. The insights from this research provide a solid foundation for advancing circular practices in urban planning, ultimately contributing to the development of sustainable, resilient, and inclusive urban environments.” (Staudt et al., 2024)

To implement the findings as quickly as possible and to achieve global to local sustainability goals in the spirit of the New European Bauhaus - sustainable, together, and beautiful -, political, regulatory, and organizational-institutional adjustments are particularly needed, as well as corresponding financial and human resources. Based on our research, we make the following recommendations to policymakers and decision-makers. The recommendations were developed based on the specific challenges of the local context in Munich. To transfer the recommendations to other cities and regions in Europe, they must be reviewed and adapted to the respective local conditions:

1. Promote a circular and neighborhood-oriented transformation of existing structures: Develop policies that prioritize and facilitate the renovation, repurposing, and densification of existing structures over new construction. This includes measures such as introducing "demolition permits" (Abbruchgenehmigung) based on life cycle assessments or the "model renovation ordinance" (Umbauordnung) initiative. Support transformation projects that explicitly incorporate the development and needs of the urban context as well as overarching trends (so-called megatrends) into the transformation of existing structures, thereby implementing the principles and criteria of the New European Bauhaus (neb.eitcommunity.eu).

2. Promote flexible regulatory frameworks: Create flexible, adaptable regulatory frameworks that enable and promote innovative solutions for circular uses, such as continued use, change of use, intensified use, and multiple use of existing buildings. Instead of rigid standards, establish goal-oriented frameworks that allow for adaptation to specific project challenges, such as deviating from housing subsidies (Wohnraumförderung) to make subsidized housing and alternative housing forms possible. Promote simplified approval procedures, for example, by eliminating parking space requirements (Stellplatznachweis) or relaxing setback regulations (Abstandflächen). There are already approaches for more specific considerations in monument protection.

3. Integrate sustainability into building regulations: Revise building regulations to enable mixed-use transformation projects that consider sustainability principles and promote flexibility in land use.

4. Introduce faster approval procedures: Establish fast-track procedures and accelerate approval for well-prepared and transparent project submissions that focus on circular, climate-friendly, and neighboorhood-oriented projects. Promote innovative transformations that enable temporary uses and pioneering uses, as demonstrated in the "Haus der Statistik" in Berlin or the "Shaere" in Munich, while retaining original usage rights.

5. Promote innovation in building types: Encourage the development of new classifications within building regulations, such as the "building type e," (Gebäudetyp e) which allows for creative and experimental designs, especially in existing structures.

6. Create financial incentives and support as well as advisory centers: Utilize and expand existing direct financial incentives and support for the transformation of existing structures, as well as indirect opportunities such as the EU Taxonomy, for example, by accounting for embodied energy in ESG criteria. Establish advisory centers that provide comprehensive advice on funding opportunities.

7. Promote education and training: Develop education and training programs for municipal employees, planners, and other stakeholders in circular urban development for the common good to enhance competencies in these areas. Provide resources and implement programs that enable and encourage municipal planning officers to act as advisors in the planning process. Establish cooperations between universities, chambers, voluntary professional associations, etc., with practice partners and municipalities that can showcase positive examples.

8. Facilitate knowledge exchange: Build and utilize existing networks between stakeholders and municipalities and invest in financial and human resources to improve knowledge exchange and promote cooperation initiatives focused on circular and neighborhood-oriented transformation.

9. Support trans- and interdisciplinary collaboration: Promote inter- and transdisciplinary collaboration between municipalities, planners (architects, urban planners, engineers, etc.), actors from the private sector, and civil society in the neighborhood to effectively address the complex challenges of urban transformation of existing structures.

10. Promote civic engagement: Embed civic engagement and participatory processes as an integral part of the transformation of existing buildings from the outset, such as in the "PlanBude" participatory process in Hamburg. Ensure that the voices, needs, and perspectives of the local population are heard and considered in decision-making,

especially in projects that significantly impact the neighborhood, to strengthen social sustainability.

11. Establish the early planning phase (Phase Zero/ Phase Null) as an integral part of circular and neighborhood-oriented project development: Identify and utilize opportunities for sustainable transformations, including providing funding programs and resources to raise awareness and promote early planning phases. In this early phase, it is crucial to actively involve all relevant stakeholders, including planners, municipalities, and civil society. This promotes comprehensive alignment and acceptance of project goals and enables the development of sustainable and needs-based solutions that ensure the long-term success and resilience of the project.

12. Create an institution for urban transformation: Establish an agile institution that can act independently to initiate and support innovative, transformative project developments, such as "FutureBuilt" in Norway (futurebuilt.no, see chapter 4.5.1) or the Urban Transformation Office (UTO) that has been established within the NEBourhoods project. This institution should mediate between the interests of the private sector, city administration, and civil society. For example, FutureBuilt is used by municipalities as a tool for urban development and is funded through a mix of municipal and public funds, as well as private sector funds (project-specific financing) and grants and subsidies from national and international programs.

13. Use existing pilot projects as model initiatives: Use successful examples and pilot projects such as the cooperative planning process "Fritz District" (Hines, see chapter 4.3.7), the conversion of an office into temporary student housing "Mega WG" (Bricks and Stories), or the open competition for possible uses of the Strafjustizzentrum (Initiative JustizzentrumErhalten/ AbbrechenAbbrechen) to inform future urban development processes and projects and promote similar approaches in the interest of the common good.

14. Adapt land policy: A comprehensive understanding of circularity in the built environment must also consider land as a resource. Societal issues such as land use must therefore be part of the discourse. The ability of municipalities to transform existing structures must be enhanced through an adapted land policy, such as the establishment of a revolving land fund in the city of Ulm but applied to existing buildings.

15. Develop a strategy for circular and common good-oriented cities: Integrate the principles of circularity and orientation for the common good in the spirit of the New European Bauhaus and the New Leipzig Charter. Formulate a coherent strategy that incorporates the concept of circularity into the broader framework of urban development for the common good, addresses sustainability goals at all levels, and links ecological, social, and economic aspects throughout the entire lifecycle of buildings, infrastructure, and urban spaces.

7 SOURCES

Abfallwirtschaftsbetrieb München (n. d.): Zero Waste City München. Available online at https://www.awm-muenchen.de/vermeiden/zero-waste-city-muenchen, checked on 12/10/2024.

AEW (2024): European office markets starting to re-balance. Available online at https://www.aew.com/research/european-office-markets-starting-to-re-balance, checked on 12/10/2024.

Anders, Stephan (2016): Stadt als System. Methode zur ganzheitlichen Analyse von Planungskonzepten. Detmold: Rohn (Schriftenreihe Stadt + Landschaft, 09).

Arnstein, Sherry R. (1969): A ladder of citizen participation. In *Journal of the American Institute of Planners* 35 (4), pp. 216–224.

Bentlin, Felix (2021): Städtebauliche Schichtenanalyse. In Anna Juliane Heinrich, Séverine Marguin, Angela Million, Jörg Stollmann (Eds.): Handbuch qualitative und visuelle Methoden der Raumforschung. Bielefeld: transcript Verlag (utb, 5582), 309-326.

Berke, Deborah; Monchaux, Thomas de (Eds.) (2023): Transform. Promising places, second chances, and the architecture of transformational change. New York: Monacelli.

Birk, Deborah; Eßig, Natalie; Fischer, Katrin; Lösch, Claudia; Palloch, Matthias (2024): Zirkuläres Bauen erfolgreich umsetzen. Ein praxisnaher Leitfaden für Entscheidungstragende, Bauverantwortliche und Planende. Edited by LUBW Landesanstalt für Umwelt, Baden-Württemberg. Umweltverwaltung Baden-Württemberg. Karlsruhe. Available online at https://pudi.lubw.de/detailseite/-/publication/10662.

Brand, Stewart (1995): How buildings learn. What happens after they're built. London: Penguin Books.

Braune, Anna; Ekhvaia, Levan; Quante, Kathrin (2021): Benchmarks für die Treibhausgasemissionen der Gebäudekonstruktion. Ergebnisse einer Studie mit 50 Gebäuden. Edited by Deutsche Gesellschaft für Nachhaltiges Bauen –DGNB e.V. Available online at https://static.dgnb.de/fileadmin/dgnb-ev/de/themen/Klimaschutz/Toolbox/102021_Studie-Benchmarks-fuer-die-Treibhausgasemissionen-der-Gebaeudekonstruktion.pdf.

Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (2020): Glossary of Urban Development for the Common Good. Bonn (Nationale Stadtentwicklungspolitik). Available online at https://www.nationale-stadtentwicklungspolitik.de/NSPWeb/SharedDocs/Downloads/EN/glossary.pdf?__blob=publicationFile&v=2.

Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (2020): Umweltfußabdruck von Gebäuden in Deutschland. Kurzstudie zu sektorübergreifenden Wirkungen des Handlungsfelds „Errichtung und Nutzung von Hochbauten“ auf Klima und Umwelt. Bonn (BBSR-Online-Publikation, 17). Available online at https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/bbsr-online/2020/bbsr-online-17-2020-dl.pdf?__blob=publicationFile&v=3.

Bundesstiftung Baukultur (2022): Baukultur Report 2022/23. Baukultur of Conversion. Edited by Bundesstiftung Baukultur (BSBK). Available online at https://www.bundesstiftung-baukultur.de/publikationen/pdf-zum-download/baukulturberichte.

Chantzaras, Christos (2022): Architecture and Design of Innovation Processes. Applying architectural thinking and tools to the understanding and design of innovation processes in innovation management. Doctoral Dissertation. TUM School of Engineering and Design.

Cheshire, David (2016): Building revolutions. Applying the circular economy to the built environment. Newcastle upon Tyne: RIBA Publishing.

Davidoff, Paul (1965): Advocacy and Pluralism in Planning. In *Journal of the American Institute of Planners* 31 (4), pp. 331–338. Available online at https://architecturesofspatialjustice.wordpress.com/wp-content/uploads/2013/09/w08_davidoff_advocacy_and_pluralism_in_planning.pdf.

Design Council (2024): The Double Diamond. A universally accepted depiction of the design process. Available online at https://www.designcouncil.org.uk/our-resources/the-double-diamond/.

Deutsche Gesellschaft für Nachhaltiges Bauen (2021): Benchmarks für die Treibhausgasemissionen der Gebäudekonstruktion: Ergebnisse einer Studie mit 50 Gebäuden. Available online at https://static.dgnb.de/fileadmin/dgnb-ev/de/themen/Klimaschutz/Toolbox/102021_Studie-Benchmarks-fuer-die-Treibhausgasemissionen-der-Gebaeudekonstruktion.pdf, checked on 12/10/2024.

DIN e.V. (2016): DIN 18205:2016-11. Bedarfsplanung im Bauwesen.

Eberhardt, Leonora Charlotte Malabi; Birgisdottir, Harpa; Birkved, Morten (2019): Potential of Circular Economy in Sustainable Buildings. 9 IOP Conf. Ser.: Mater. Sci. Eng. 471 092051. Available online at file:///C:/Users/ge97roc/Downloads/Potential_of_Circular_Economy_in_Sustainable_Build.pdf.

Eisele, Johann; Harzdorf, Anne; Hüttig, Lukas; Otto, Jens; Stroetmann, Richard; Trautmann, Benjamin; Weller, Cornell (2020): Multifunktionale Büro- und Geschäftshäuser. Planung - Konstruktion - Ökologie - Ökonomie. 1. Auflage 2020. Wiesbaden: Springer Fachmedien Wiesbaden GmbH; Springer Vieweg.

Ellen MacArthur Foundation (2022): Introduction to circular design. We need to radically rethink how we design. Available online at https://www.ellenmacarthurfoundation.org/introduction-to-circular-design/we-need-to-radically-rethink-how-we-design.

European Commission (2019): Communication from the Commission. The European Green Deal. Available online at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN.

European Commission (2020a): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Commitee and the Committee of the Regions. A new Circular Economy Action Plan for a cleaner and more competitive Europe. COM(2020) 98 final. European Commission. Brussels. Available online at https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN.

European Commission (2024a): EU Building Stock Observatory – Database. Available online at https://building-stock-observatory.energy.ec.europa.eu/database/, checked on 12/10/2024.

European Commission (2024b): New European Bauhaus Investment Guidelines. Brussels. Available online at https://new-european-bauhaus.europa.eu/document/download/3f591237-1626-4959-920a-5271382bdd1b_en?filename=NEB%20Investment%20Guidelines.pdf.

European Commission (2020b): The New Leipzig Charter. The transformative power of cities for the common good. European Commission. Available online at https://ec.europa.eu/regional_policy/en/information/publications/communications/2020/the-new-leipzig-charter-the-transformative-power-of-cities-for-the-common-good.

European Commission (2007): Leipzig Charter. On Sustainable European Cities. European Commission.

European Commission (2021): Der europäische Grüne Deal. Available online at https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_de, checked on 12/10/2024.

European Commission (2022): New European Bauhaus Compass. Available online at https://new-european-bauhaus.europa.eu/tools-and-resources/use-compass_en.

European Parliament (2020): Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020. on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088. L 198/13. Available online at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852.

European Urban Initiative (2022): The Urban Agenda for the EU. Better Regulation | Better Funding | Better Knowledge.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2020): Environmental policy for a sustainable society. Sustainable Development Report by the Federal Environment Ministry on the implementation of the United Nations 2030 Agenda. Berlin. Available online at https://www.bmuv.de/fileadmin/Daten_BMU/Pools/Broschueren/umwelt_nachhaltige_gesellschaft_en_bf.pdf.

Fuhrhop, Daniel (2020): Verbietet das Bauen! Streitschrift gegen Spekulation, Abriss und Flächenfraß. München: Oekom.

Geels, Frank W. (2011): The multi-level perspective on sustainability transitions. Responses to seven criticisms. In *Environmental Innovation and Societal Transitions* 1 (1), pp. 24–40. DOI: 10.1016/j.eist.2011.02.002.

Glaeser, Edward L. (2022): Urban resilience. In *Urban Studies* 59 (1), pp. 3–35. DOI: 10.1177/00420980211052230.

Grafe, Christoph; Rieniets, Tim (Eds.) (2020): Umbaukultur. Für eine Architektur des Veränderns. Baukultur Nordrhein-Westfalen e. V; DruckVerlag Kettler GmbH. Dortmund: Kettler.

Gstach, Doris; Berding, Ulrich (2016): Doppelte Innenentwicklung – zur Wiederentdeckung eines alten Prinzips unter erschwerten Bedingungen. In *Informationen zur Raumentwicklung* (6), pp. 661–673. Available online at https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/izr/2016/6/Inhalt/downloads/gstach-berding-dl.html, checked on 8/8/2024.

Hauschild, Michael Z.; Kara, Sami; Røpke, Inge (2020): Absolute sustainability. Challenges to life cycle engineering. In *CIRP Annals* 69 (2), pp. 533–553. DOI: 10.1016/j.cirp.2020.05.004.

Heilmeyer, Florian; Hofmeister, Sandra (2024): Umbau-Architektur in Flandern/ Architecture of Transformation in Flanders. München: Detail.

Hill, Dan (2012): Dark matter and Trojan horses. A strategic design vocabulary. First edition. Moscow: Strelka Press.

Horx, Matthias (2014): Das Megatrend Prinzip. Wie die Welt von morgen entsteht. Munich: Pantheon.

International Energy Agency (Ed.) (2019): Perspectives for the Clean Energy Transition. The Critical Role of Buildings. International Energy Agency (IEA). Available online at https://www.iea.org/reports/the-critical-role-of-buildings.

Landeshauptstadt München (LHM) Referat für Stadtplanung und Bauordnung (2021): Neuperlach: Fit für die Zukunft! Integriertes Stadtteilentwicklungskonzept (ISEK). München (Stadtsanierung und Wohnungsbau).

Landeshauptstadt München (LHM) Referat für Stadtplanung und Bauordnung (2024): Stadtentwicklungskonzept "Perspektive München". Available online at https://stadt.muenchen.de/infos/stadtentwicklung-perspektive-muenchen.html, checked on 12/10/2024.

Liebich, Thomas; Schweer, Carl-Stephan; Wernik, Siegfried (2011): Die Auswirkungen von Building Information Modeling (BIM) auf die Leistungsbilder und Vergütungsstruktur für Architekten und Ingenieure sowie auf die Vertragsgestaltung. Endbericht, Forschungsprogramm Zukunft Bau, AZ 10.08.17.7-10.03. Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumentwicklung (BBR).

Martin, Glen T. (2022): Deep Sustainability: The UN Sustainable Developmet Goals versus the Unworkable UN System. In *MAS* 11 (01), pp. 10–14. DOI: 10.56011/mind-mri-111-20221.

Meadows, Donella H. (1999): Leverage Points. Places to Intervene in a System. The Sustainability Institute. Hartland, VT. Available online at https://groups.nceas.ucsb.edu/sustainability-science/2010%20weekly-sessions/session-112013-11.22.2010-managing-for-sustainability-speaker-pamela-matson/supplemental-readings-from-the-reader/Meadows.%201999%20Leverage_Points.pdf/at_download/file.

Naisbitt, John (1982): Megatrends. Ten new directions transforming our lives. New York, N.Y.: Warner Books.

Ngo, Anh-Linh; Dünser, Nora; Gatti, Mirko (Eds.) (2024): Umbau. Ansätze der Transformation. Berlin: Arch+ (ARCH+, Nr. 256 = 57. Jahrgang (Juli 2024)).

O'Neill, Daniel W.; Fanning, Andrew L.; Lamb, William F.; Steinberger, Julia K. (2018): A good life for all within planetary boundaries. In *Nature Sustainability* 1 (2), pp. 88–95. DOI: 10.1038/s41893-018-0021-4.

Ökobaudat: Ökobaudat. Informationsportal Nachhaltiges Bauen. Bundesministerium für Wohnen, Stadtentwicklung und Bauwesen. 2024. Available online at https://www.oekobaudat.de/.

Peña, William M.; Parshall, Steven A. (2012): Problem seeking. An architectural programming primer. 4th ed. Hoboken, N. J.: Wiley.

Petschow, Ulrich; Lange, Steffen; Hofmann, David; Pissarskoi, Eugen (2020): Social Well-Being Within Planetary Boundaries. the Precautionary Post-Growth Approach. Partial Report for the "Approaches to Resource Conservation in the Context of Post-Growth Concepts" project. German Environment Agency (Environmental Research of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety Project). Available online at https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2020_12_14_texte_234-2002_precautionary_post-growth.pdf.

Petzet, Muck; Heilmeyer, Florian (Eds.) (2012): Reduce, Reuse, Recycle. Architecture as ressource; German pavilion, 13th International Architecture Exhibition, La Biennale di Venezia 2012. With assistance of Erica Overmeer. Mostra Internazionale di Architettura. Ostfildern: Hatje Cantz.

Potting, José; Hekkert, M. P.; Worrell, Ernst; Hanemaaijer, Aldert (2017): Circular Economy: Measuring innovation in the product chain.

Raworth, Kate (2017): Doughnut economics. Seven ways to think like a 21st-century economist. London: Random House.

Rettich, Stefan; Tastel, Sabine; Schmidt, Anika; Beucker, Nicolas; Brück, Clemens (2023): Obsolete Stadt. Raumpotenziale für eine gemeinwohlorientierte, klimagerechte und koproduktive Stadtentwicklungspraxis in wachsenden Großstädten. Edited by Forschungsteam Obsolete Stadt. Available online at https://obsolete-stadt.net/wp-content/uploads/2023/05/RoBo_Abschlussbericht_RZ_digital.pdf, checked on 1/26/2024.

Richarz, Clemens; Schulz, Christina (2011): Energetische Sanierung. Grundlagen, Details, Beispiele. München: Detail (DETAIL Green Books).

Rittel, Horst W.J. (2013): Thinking Design. Transdisziplinäre Konzepte für Planer und Entwerfer. Basel: Birkhäuser/De Gruyter (Board of International Research in Design, BIRD).

Rockström, Johan; Steffen, Will; Noone, Kevin; Persson, Åsa; Chapin, F. Stuart, III; Lambin, Eric et al. (2009): Planetary Boundaries: Exploring the Safe Operating Space for Humanity. In *Ecology and Society* 14 (2), p. 32. DOI: 10.5751/ES-03180-140232.

Sanoff, Henry (1977): Methods of Architectural Programming. Stroudsburg, Pa: Dowden, Hutchinson & Ross.

Savills (2023): European office markets: Rebalancing occupancy trends post-pandemic. Available online at https://www.savills.com/research_articles/255800/343549-0, checked on 12/12/2024.

Schade, Carsten; Staudt, Johannes; Denk, Arno; Lang, Werner: Neighborhood-oriented and regenerative programming in teaching. The Interdisciplinary Project (IDP) as a case study from the Technical University of Munich. Manuscript submitted for publication. In : European Association of Architectural Education (EAAE) Conference.

Schneidewind, Uwe (2024): Gemeinwohlorientierte Innenstadtentwicklung. Herausforderungen und Chancen der öffentlich-privaten Zusammenarbeit. In *Forum Wohnen und Stadtentwicklung, Verbandszeitschrift des vhw e.V.* 16 (5), pp. 237–240. Available online at https://www.vhw.de/fileadmin/user_upload/08_publikationen/verbandszeitschrift/FWS/2024/FWS_5_2024/FWS_5_2024_Gesamtausgabe.pdf.

Sphera Solutions GmbH (2023a): Fernwärme Mix Deutschland. ÖKOBAUDAT. Available online at https://oekobaudat.de/OEKOBAU.DAT/datasetdetail/process.xhtml?uuid=bff1909a-5383-49bb-a450-aa9543e7a9ee&version=20.24.070&stock=OBD_2024_I&lang=de, checked on 12/10/2024.

Sphera Solutions GmbH (2023b): Residual Strommix 2030 (basierend auf "EU Referenz Szenario 2020"). ÖKOBAUDAT. Available online at https://oekobaudat.de/OEKOBAU.DAT/datasetdetail/process.xhtml?uuid=d69ad4c9-b104-43c3-9750-353ce6332f4e&version=20.24.070&stock=OBD_2024_I&lang=de, checked on 12/10/2024.

Sphera Solutions GmbH: Residual Strommix 2050 (basierend auf "EU Referenz Szenario 2020"). ÖKOBAUDAT. Available online at https://oekobaudat.de/OEKOBAU.DAT/datasetdetail/process.xhtml?uuid=628a5a75-a05d-4785-9aaa-4002b848010a&version=20.24.070&stock=OBD_2024_I&lang=de, checked on 12/10/2024.

Stadtwerke München (n. d. a): Fernwärme. District heating for business customers. Available online at https://www.swm.de/geschaeftskunden/fernwaerme, checked on 12/10/2024.

Stadtwerke München (n. d. b): Projekt Geothermieanlage Michaelibad. Available online at https://www.swm.de/lp/geothermie-michaelibad, checked on 12/10/2024.

Staudt, Johannes; Schade, Carsten; Steiner, Catherine; Lang, Werner (2024): Circular Uses. A framework for a circular and neighborhood-oriented transformation of existing buildings. Manuscript submitted for publication. In *Planung Neu Denken (PND)*.

Teamwerk Architekten (2021): Mehrraum. Die zeitgerechte Stadt - Potentiale der Mehrfachnutzung. Ministerium für Landesentwicklung und Wohnen Baden-Württemberg.

Umweltbundesamt (2022): Die Nutzung natürlicher Ressourcen. Ressourcenbericht für Deutschland 2022, Spezial: Rohstoffnutzung der Zukunft. Dessau-Roßlau. Available online at https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/fb_die_nutzung_natuerlicher_ressourcen_2022_0.pdf.

United Nations (2015): Resolution adopted by the General Assembly on 25 September 2015. Transforming our world: the 2030 Agenda for Sustainable Development (A/RES/70/1). Available online at https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf#:~:text=We%20are%20resolved%20to%20free%20the%20human%20race,world%20on%20to%20a%20sustainable%20and%20resilient%20path.

WBGU – Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (2016): Der Umzug der Menschheit. Die transformative Kraft der Städte. WBGU – Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen. Berlin. Available online at https://www.wbgu.de/de/publikationen/publikation/der-umzug-der-menschheit-die-transformative-kraft-der-staedte.

Williams, Jo (2021): Circular cities. A revolution in urban sustainability. London: Routledge (Routledge Studies in Sustainability).

Wong, Liliane (2023): Adaptive reuse in architecture. A typological index. Basel, Switzerland, Boston: Birkhäuser.

World Economic Forum (2018): Davos Declaration. Davos. Available online at https://davosdeclaration2018.ch/wp-content/uploads/sites/2/2023/06/2022-06-09-081317-davos-declaration.pdf.

ZUsammenKUNFT Berlin (2021): Band 3 Pioniernutzung. Modellprojekt Haus der Statistik. ZK/U Press. Berlin. Available online at https://hausderstatistik.org/publikation/.

APPENDIX

In this appendix, we have compiled exemplary methods and representations from our methodology of a Circular and Neighborhood-oriented Transformation. The appendix is structured around the three phases of the methodology: Analysis, Programming, and Early Architectural Design (see also chapter 4). The representations provide selected insights into our working methods and serve as inspiration for replication by planners and other process participants in the early planning phases. They complement the more detailed examples from our work process in the gray-highlighted info boxes in this Circular Transformation Roadmap (see chapters 2-4). The methods do not claim to be exhaustive and may need to be individually adapted, expanded, or supplemented depending on the project and process.

APPENDIX TABLE OF CONTENTS

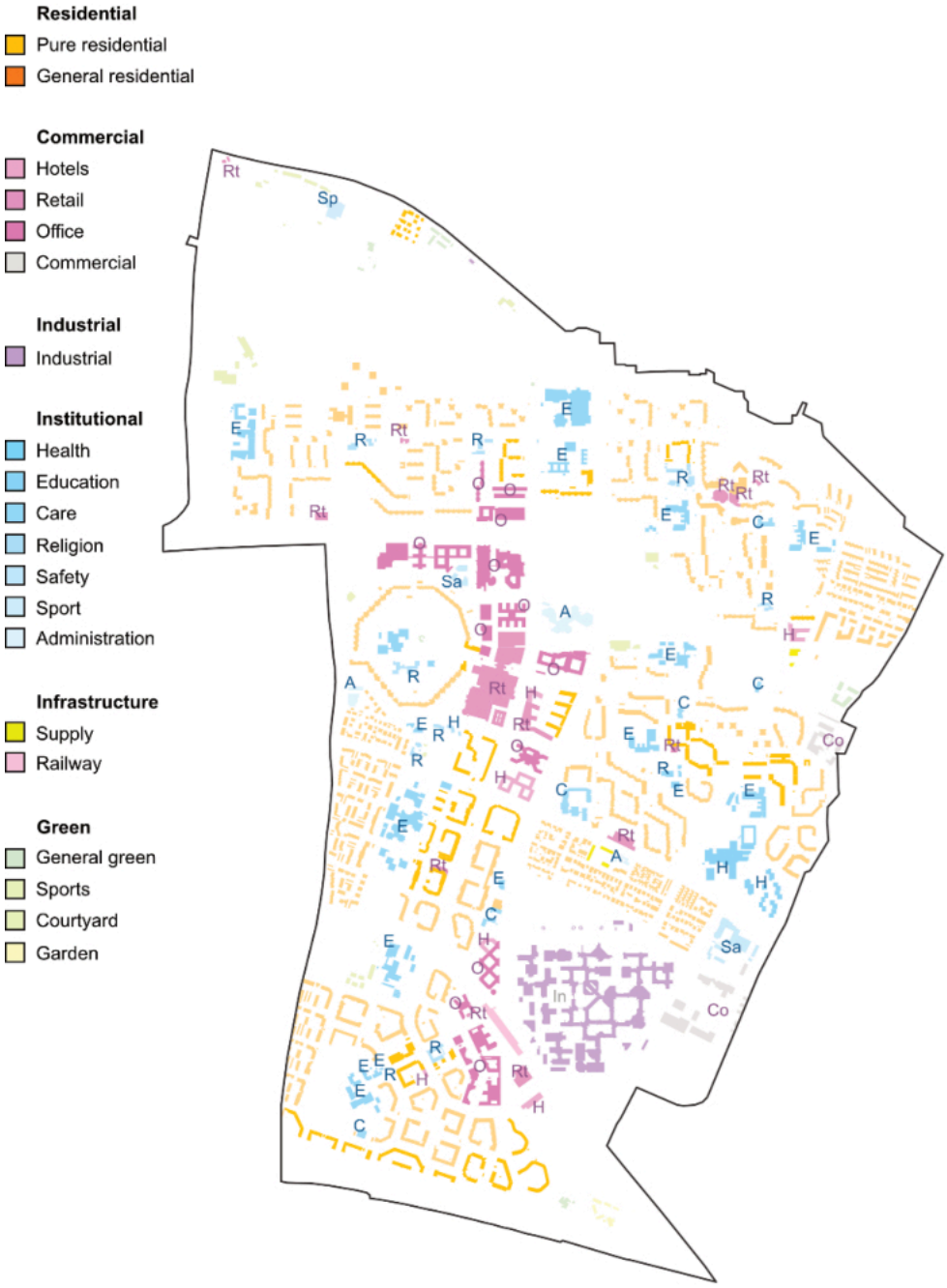
ANALYSIS

SCHEMATIC SECTION OF THE NEIGHBORHOOD TO DEFINE GOALS

Neighborhood analysis Neuperlach: Jointly define and locate goals in a schematic section.

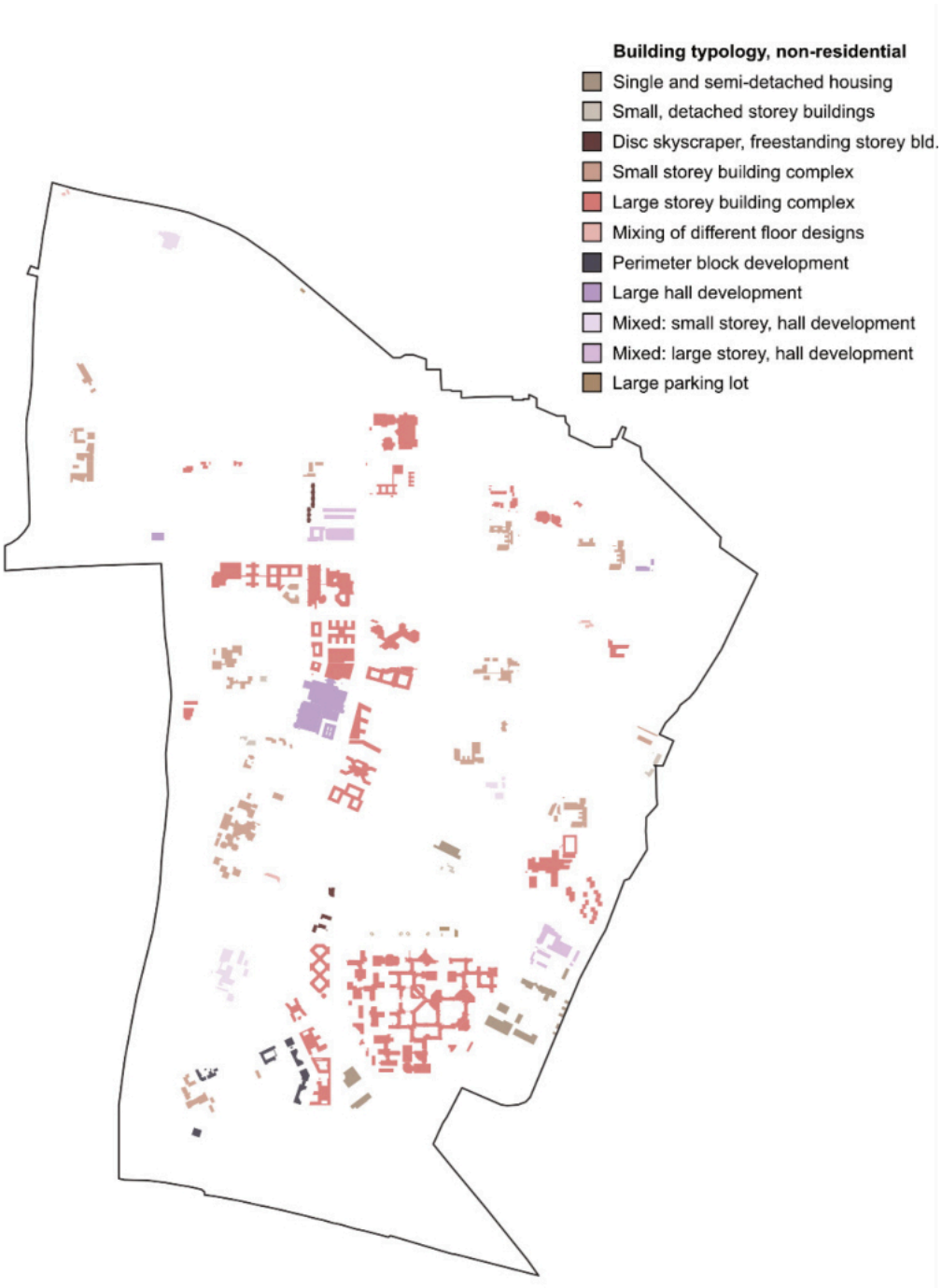
Image Source: Carsten Schade & Johannes Staudt (TU Munich)/ NEBourhoods.

LAND USE PLAN



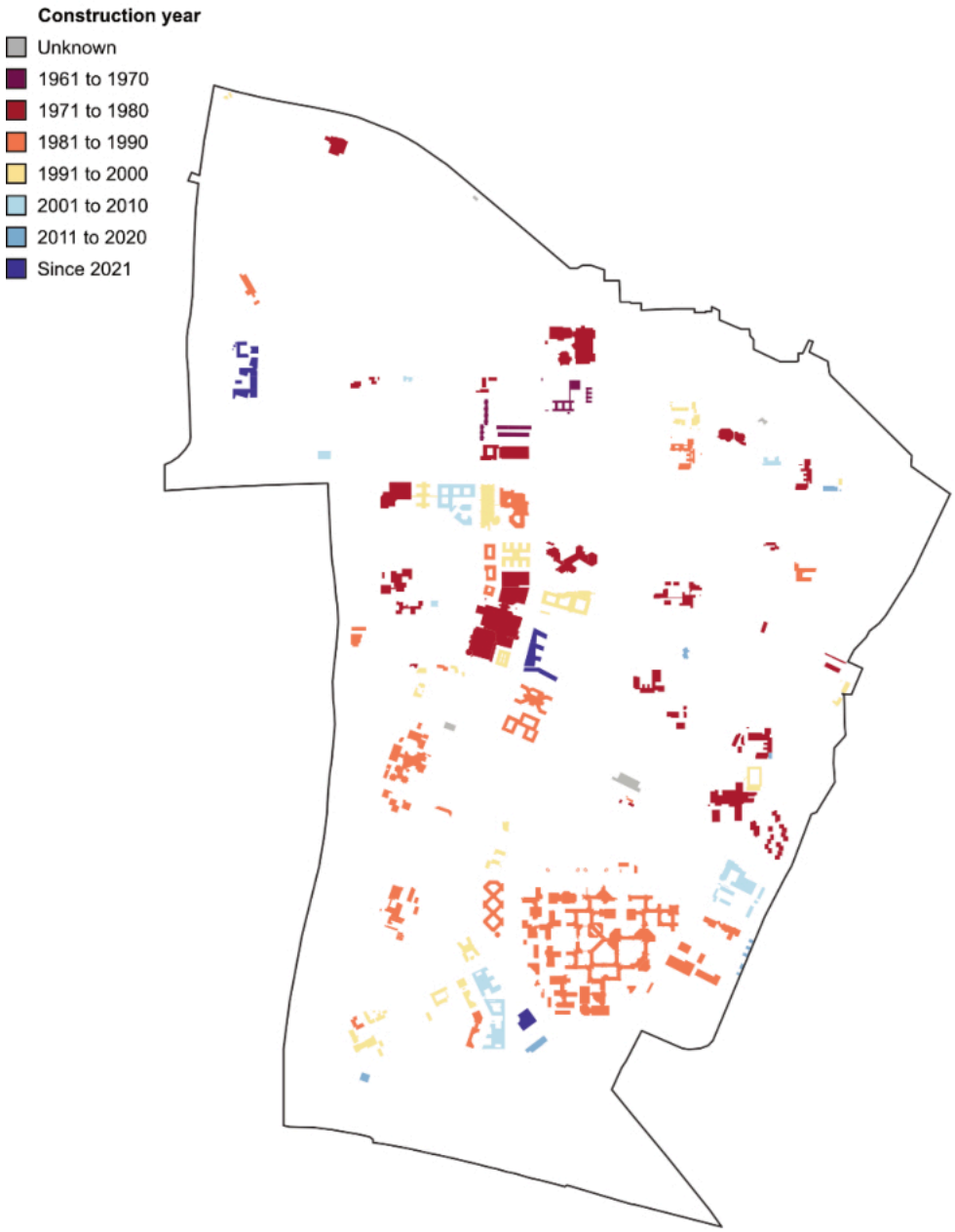
Neighborhood analysis Neuperlach: Analyzing the uses based on the official land use plan of the City of Munich. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on GeoPortal (https://geoportal.muenchen.de)

BUILDING TYPOLOGY
NON-RESIDENTIAL



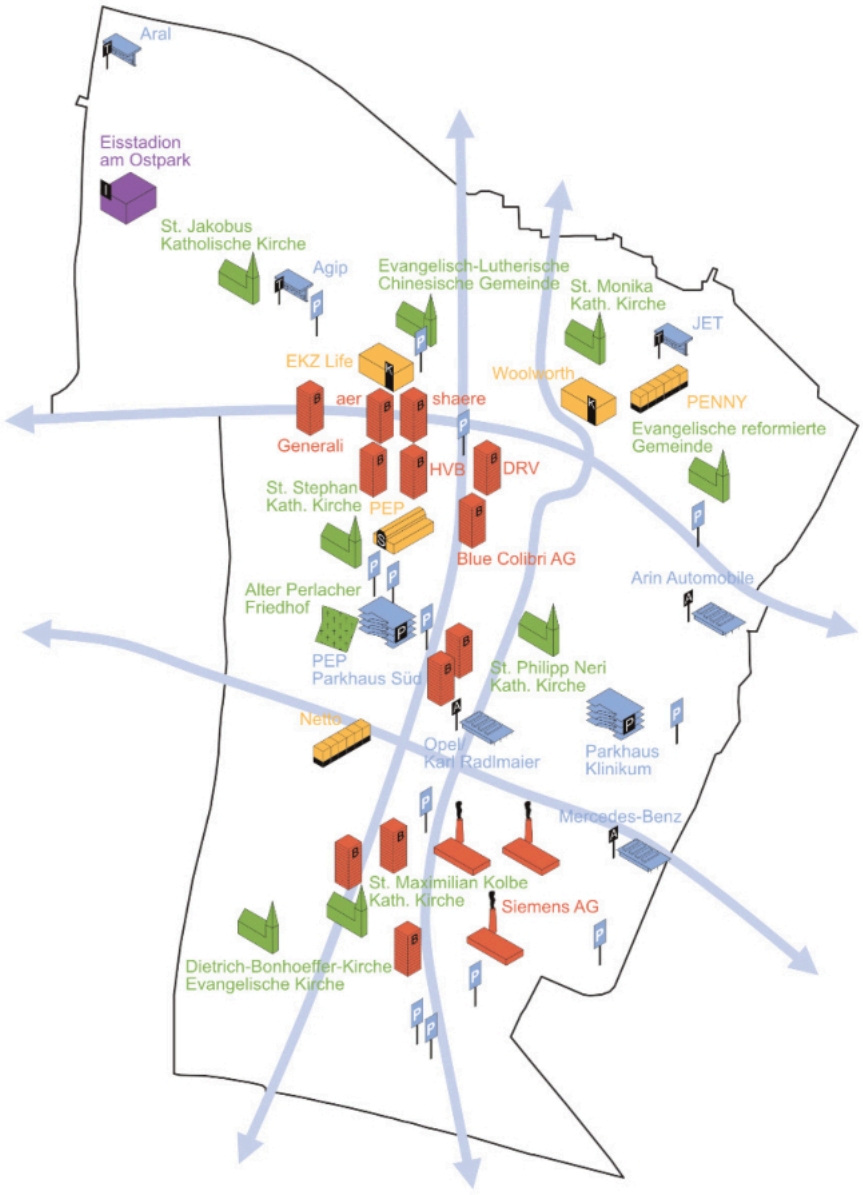
Neighborhood analysis Neuperlach: Analyzing the building typologies. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on GeoPortal (https://geoportal.muenchen.de)

CONSTRUCTION YEAR
NON-RESIDENTIAL



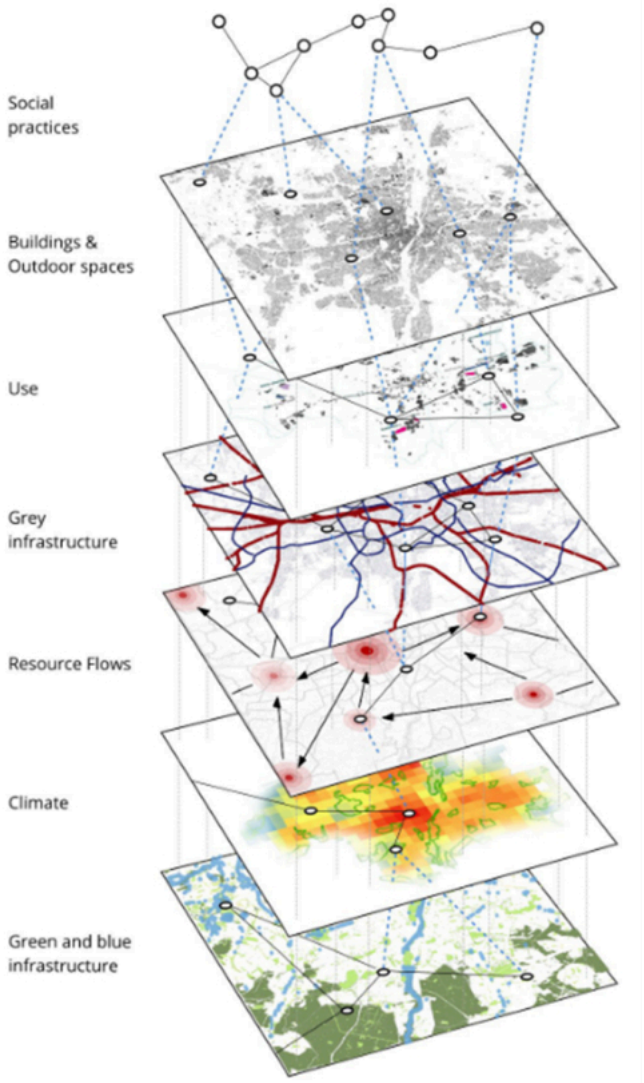
Neighborhood analysis Neuperlach: Analyzing the construction year. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on GeoPortal (https://geoportal.muenchen.de)

URBAN OBSOLESCENCE TYPOLOGIES



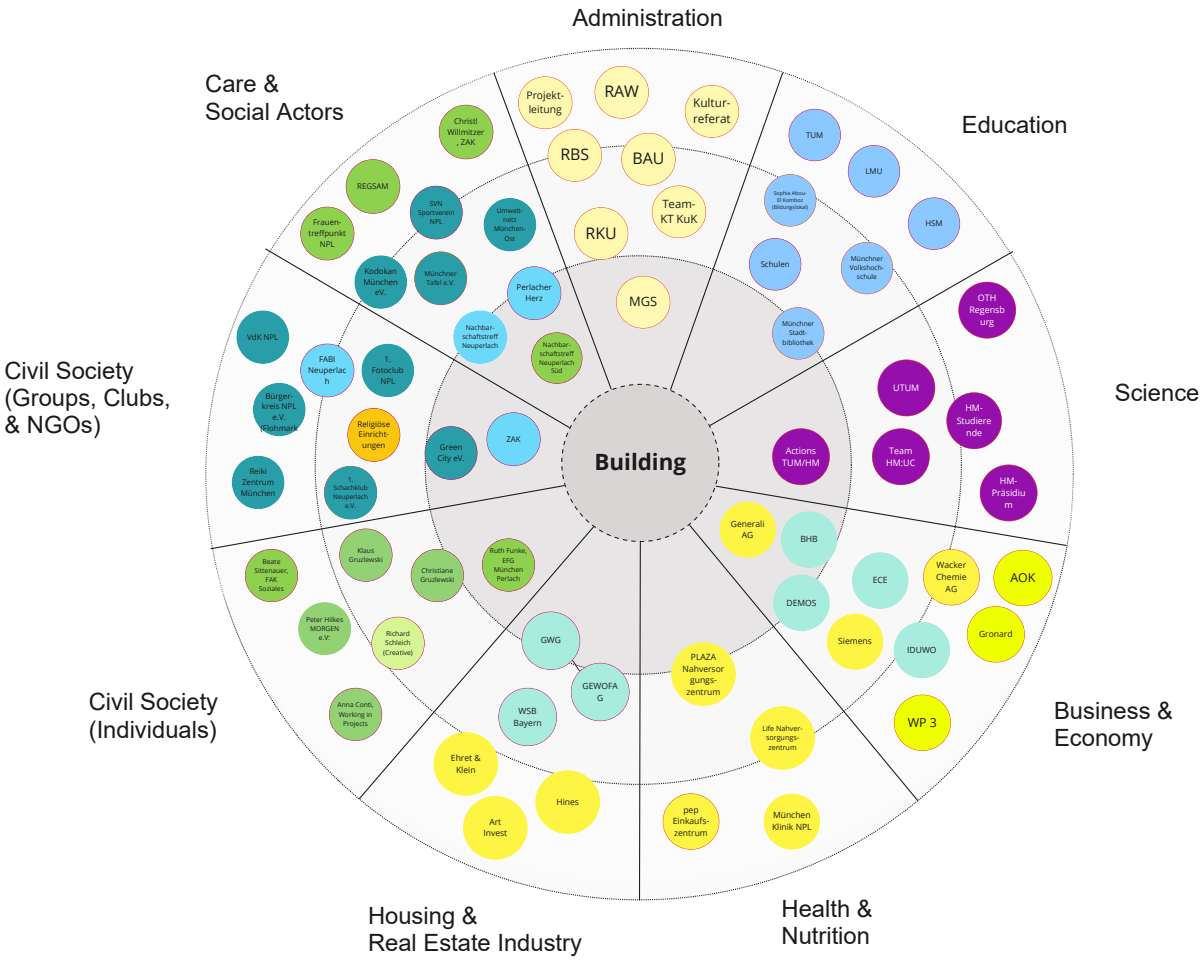
Neighborhood analysis Neuperlach: Urban obsolescence typologies. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on Rettich et al. (2023): Obsolete Stadt.

LAYERS OF A CITY
CITY AS A SYSTEM



Neighborhood analysis Neuperlach: Analyzing different layers of the city and their interdependencies. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on Anders (2016): Stadt als System.

STAKEHOLDER ANALYSIS



Neighborhood analysis Neuperlach: Analyzing the stakeholders that are relevant for the neighborhood. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

NEIGHBORHOOD NEEDS

(Lokale) Bedarfe aus Neuperlach
Ergebnisse aus der Recherche, der Bürger*innenbefragung am 26.10.23 sowie des Workshops mit dem Quartiersmanagement MGS Neuperlach

Bedarfe	potenzielle Nutzer*innen	Genannt in Bürger*innenbefragung und/oder MGS Workshop	Quelle
Bedarfe aus bestehenden Analysen, Gesprächen, Interviews			*Integriertes Handlungsraumkonzept (IHRK, 2021, Integriertes Stadtentwicklungskonzept (ISEK, 2021, Entering the Urban Commons (MA Thesis Laura Maria Höpfner, 2023), Interview Klaus Gruziewski (Lätare Kirche, 2023), Befragung NEBourhoods Team (2024), Bürger*innenbefragung NPL, Workshop MGS*
Gesundheit			
Alten- und Pflegeeinrichtungen	Senior*innen		IHRK
Hausarztpraxen	NPLer*innen		ISEK
Kinderarztpraxen	Familien mit Kindern		ISEK
ambulante (medizinische) Versorgungs- und Beratungsstellen	NPLer*innen		IHRK
niedrigschwelliges Gesundheitsberatungsangebot	Senior*innen, einkommensschwache Gruppen		IHRK
Soziales			
(Konsumfreie) Treffpunkte	alle, v.a. Kinder und Jugendliche		IHRK, MA Imh
Angebote und Räume für (interkulturellen) Austausch und Begegnung	NPLer*innen		IHRK
Gastronomische Angebote	NPLer*innen, Besucher*innen, Arbeitende		IHRK, ISEK
Restaurants	NPLer*innen, Besucher*innen, Arbeitende		IHRK, ISEK
Cafés	NPLer*innen, Besucher*innen, Arbeitende		IHRK, ISEK
Bars, Kneipen etc.	NPLer*innen, Besucher*innen, Arbeitende		IHRK, ISEK, KG
Kioske, Treffpunkte	NPLer*innen		IHRK, ISEK, KG
Orte für Jugendliche & junge Erwachsene	Kinder, Jugendliche		IHRK
Angebote für benachteiligte Gruppen	maginalisierte Gruppen, Frauen		IHRK
Alten- und Servicezentren	Senior*innen		IHRK, ISEK
Angebote für obdachlose Menschen	Heimatlose		ISEK
Digitale lokale Angebote	NPLer*innen		IHRK, ISEK
Niedrigschwellige Kulturangebote	NPLer*innen		IHRK
Raum für Kultur und gemeinschaftliche Projekte	NPLer*innen		ISEK
Räume für die Zwischennutzungen aus dem shaere	Zwischennutzer*innen aus dem shaere		NEB Team (JK)
Räume für soziale Träger (z.B. Diakonie)	stadtweit ?		KG
Wohnen			
Bezahlbarer Wohnraum	stadtweit		IHRK
Barrierefreier und rollstuhlgerechter Wohnraum	mobilitätseingeschränkte Gruppen		IHRK
Zukünftige Infrastrukturbedarfe bei Nachverdichtung / Umnutzung von Bestand (betrifft Freiraumversorgung, Nahversorgung, Bildungsangebote, Soziale Infrastruktur)			
Wohnungsnahe Grundversorgung	NPLer*innen		ISEK
Sport, Spiel und Bewegung			
(Innen)räume für selbstorganisierten, informellen Sport	NPLer*innen		IHRK
öffentliche Sport- und Bewegungsflächen	NPLer*innen		IHRK, ISEK
öffentliche Spielflächen für Schul- und Kleinkinder	Kinder		IHRK
Innenräume und Schlechtwetterangebote für Kinder & Jugendliche	Kinder, Jugendliche		ISEK
Konsumfreie Treffpunkte für Kinder und Jugendliche	Kinder, Jugendliche		ISEK
Arbeit und lokale Ökonomie			
Räume für wirtschaftliche Innovation (z.B. Co-Working-Spaces, Crowdworking, Handwerk, Fab-Labs, Kultur- und Kreativwirtschaft)	Start-Ups, Unternehmen, Kreativschaffende		IHRK, ISEK
bezahlbare Räume für kleinere Handwerksbetriebe, wohnungsverträgliche Produktionen	Handwerker*innen, Kunstschaffende		IHRK
Arbeitsräume für Kreativschaffende und Künstler*innen	Kreativschaffende, Künstler*innen		IHRK
EGs: kleinere Gewerbenutzungen (Praxen, Büros, Studios, etc.)	NPLer*innen		ISEK

(Lokale) Bedarfe aus Neuperlach
Ergebnisse aus der Recherche, der Bürger*innenbefragung am 26.10.23 sowie des Workshops mit dem Quartiersmanagement MGS Neuperlach

Bedarfe	potenzielle Nutzer*innen	Genannt in Bürger*innenbefragung und/oder MGS Workshop	Quelle
Bedarfe aus bestehenden Analysen, Gesprächen, Interviews			*Integriertes Handlungsraumkonzept (IHRK, 2021, Integriertes Stadtentwicklungskonzept (ISEK, 2021, Entering the Urban Commons (MA Thesis Laura Maria Höpfner, 2023), Interview Klaus Gruziewski (Lätare Kirche, 2023), Befragung NEBourhoods Team (2024), Bürger*innenbefragung NPL, Workshop MGS*
Freiraum, Grün & Blau			
zugängliche öffentliche Grünflächen	NPLer*innen		IHRK
Zugang zu qualitativen Grün- und Erholungsräumen	alle, einkommensschwache Gruppen		IHRK
Zugang zu den Dächern	NPLer*innen		ISEK
Lebensräume für Tiere und Pflanzen	Tiere		IHRK
Flächen für Klimaanpassung, Biodiversität (z.B. auf den Dächern)			IHRK
Restflächen aktivieren: Abstandsgrün, Begleitgrün, Innenhöfe, Dachflächen, Parkplätze			IHRK
Grüne Dächer und Fassaden			IHRK
Schaffen von Großbaumstandorten			IHRK
Abfallsammelstellen (Recycling Hubs mit Infos zu Kreislaufwirtschaft, Tauschbörsen, Upcyclingworkshops)	NPLer*innen, Start-ups, Kreativschaffende		IHRK
Wasser und Brunnen im öffentlichen Raum	NPLer*innen, v.a. Kinder		ISEK
Freiräume für Spiel-, Sport-, Bewegung	NPLer*innen, v.a. Kinder		ISEK
Verkehr und Mobilität			
barrierefreie Mobilitätsangebote	mobilitätseingeschränkte Gruppen		IHRK
Sharing-Angebote (Räder, Roller, Autos, etc.)	alle		IHRK
Mobility Hubs	NPLer*innen		NEB
Bildung			
Kindertagesstätten	Familien, Eltern, Kinder		IHRK
Kinderbetreuung	Familien, Eltern, Kinder		IHRK
Schulen	Kinder, Jugendliche		IHRK
(Non-formale) Bildungsangebote für alle	alle Altersgruppen ohne Zugangsbarrieren für sozial schwächere und bildungsferne Gruppen, internationale Bewohner*innen		IHRK
digitale Bildungs- und Kulturangebote	Kinder		IHRK
außerschulische Lernorte	Kinder und Jugendliche		IHRK
Bildungslokale	NPLer*innen		IHRK
Kultur			
Kulturzentrum Hanns-Seidel-Platz	NPLer*innen		IHRK, KG, ISEK
Räume für Kunst	stadtweit		KG
Räume für bürgerschaftliches Engagement, selbstorganisiertes Freizeit- und Kulturangebot	NPLer*innen		IHRK, ISEK
Räume für Nachbarschaftstreffs	NPLer*innen		IHRK, ISEK
Kulturelle Angebote innen/außen (Kino, Konzert, Ausstellungen, Kulturveranstaltungen,e tc.)	NPLer*innen, Besucher*innen		IHRK, ISEK
Ausstellungsräume für Kreative und Künstler*innen	Kreativschaffende, Künstler*innen		IHRK, ISEK, KG
Räume für temporäre Nutzungen	Soziokultur		IHRK, ISEK
lokale Raum- und Zwischennutzungsbörse	Start-Ups, Unternehmen		ISEK

Neighborhood analysis Neuperlach: Analyzing the needs that are relevant for the neighborhood. Image Source: Laura Maria Höpfner, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods, based on Urban Regeneration Implementation Plan (ISEK), Integrated Urban Development Plan (IHRK).

OVERVIEW OF DOCUMENTS FOR A BUILDING ANALYSIS

EXISTING BUILDING ANALYSIS

Planmaterial, Dokumente:
- Bestandspläne (Lageplan. Grundrisse, Schnitte, Details)
- Brandschutzkonzept
- 3d Modell der Statik
- Fotodokumentation Bestand (falls vorhanden)
- Entwurfsunterlagen der Machbarkeitsstudie City-Förster

Gebäudebestand (nachSchichten):

zu allen Schichten:
- Material
- Aufbau
- Zustand (restliche Lebensdauer)
- Rückbaubarkeit
- Recyklierfähigkeit

Tragwerk:
- Statik
- Nutzlasten
- Teilabbruch
- Material

Raumdimensionen:
- Gebäudetiefen
- lichte Geschosshöhen

Erschliessung:
- vorhandene Erschliessung
- zusätzliche Erschliessung(skerne)
- Gebäudezugänge

Fassade:
- (energetische) Sanierungsbedarfe
- Fensterflächenanteil
- Verschattung

Dach:
- Nutzung
- Begrünung
- Photovoltaik

Gebäudetechnik
- Lüftungsschächte, Be- und Entlüftung
- Klimaanlagentechnik
- Leitungsschächte, Kabeltrassen
- Abwasser-, Frischwasserleitungen
- Nasszellen

Innenausbau:
- tragende und nichttragende Wände
- abgehängte Decken
- Einbauten

UG:
- Unterbauung
- vorhandene Stellplätze

Direktes Umfeld:
- vorhandene Stellplätze
- Möglichkeit zusätzlicher Stellplätze
- soziale Räume
- grün/ blaue Infrastruktur

Quartier

PROGRAMMING

Needs & Uses
- geplante Nutzungen
- Nutzungszeiten
- Nutzergruppen
- Quartiersorientierte Nutzungen
- Bedarfsanalyse
- Wertschöpfung
- Wirtschaftlichkeit

Aspekte der zirkulären und quartiersorientierten Planung:

Stadtstruktur
- Dichte/ Nachverdichtung
- Städtebauliche Einbindung
- Freiraum
- Urbaner Charakter
- Hochhausstudie mit Qualitätskriterien

Nutzungen, Soziokultur
- Quartiersorientierte Nutzungen
- Begegnungsorte
- SoBoN
- Lärm: Sportnutzungen, Gewerbe, Wohnen, Bildung,...

Klimaanpassung & Biodiversität
- Grün- Blaue Infrastruktur
- Versickerung
- Schwammstadtkonzept
- Klimaanpassung
- Baumbestand
- Artenschutz, Biodiversität
- Freiflächennachweis / öffentliche Grünfläche

Mobilität & Zugänglichkeit:
- Mobilitätskonzept (ÖPNV, Fahrrad, Sharing, MIV,...)
- Anbindung
- festgelegten Entfernungen von Haltestellen
- Stellplätze vorhanden und geplant (PKW, Fahrrad)
- Lärm (z.B. TG-Einfahrt und Wohnen)
- Luftqualität

Energie:
- Energiekonzept
- klimaneutrale bzw. klimapositive Energieversorgung

Ressourcen & Abfall
- Umnutzung
- Weiternutzung
- Mehrfachnutzung
- Wiederverwendung
- Weiterverwendung
- Recycling

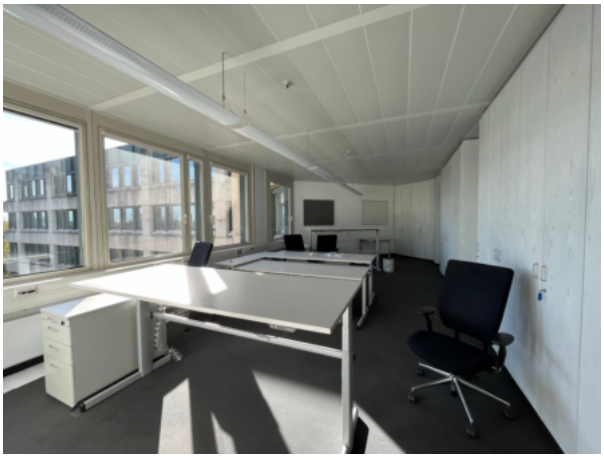
Erste Untersuchungen
- Verkehrsgutachten
- Stellplatzerfordernisse
- Klima(fahrplan)
- Energie
- Windkomfort
- Brandschutz
- Lärmschutz
- Tageslichtanalysen

Building analysis: Initial overview over the documents that are needed for the circular and neighborhood-oriented transformation. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

PHOTO DOCUMENTATION

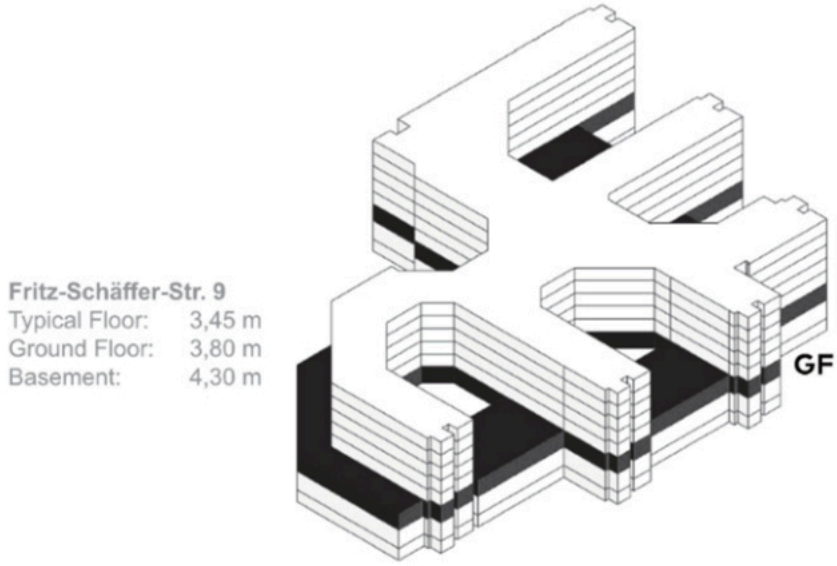


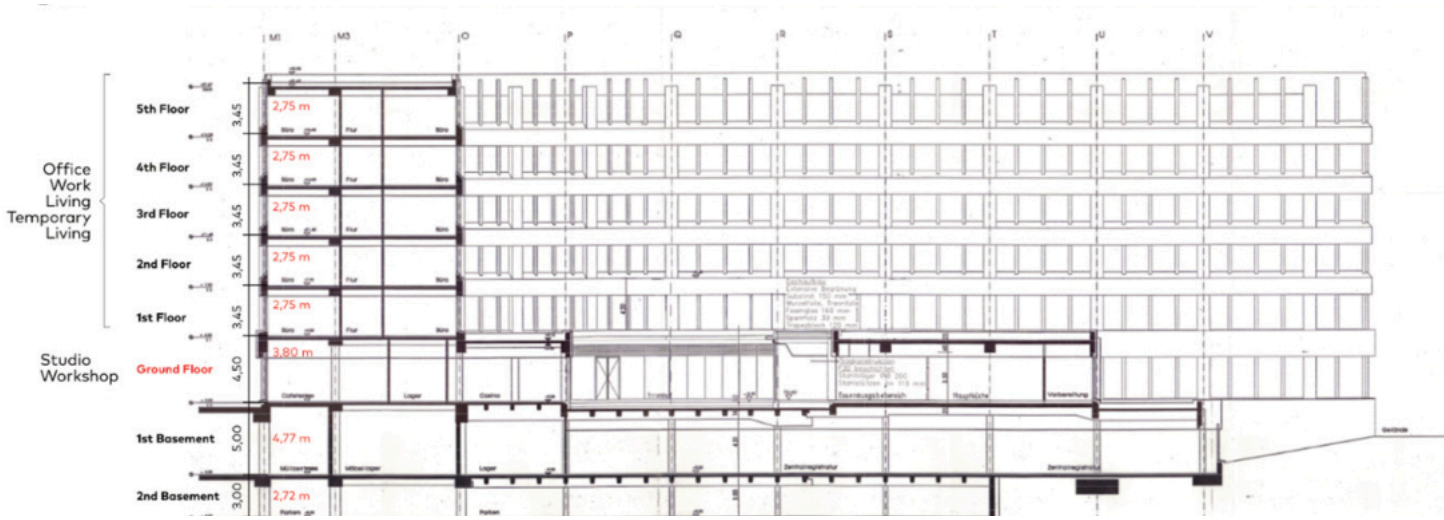


Building analysis: Exemplary photo documentation of the status quo of an existing builing in the Fritz-Schäffer-Straße 9. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods; Aerial view: Patrik Thomas, NEBourhoods.

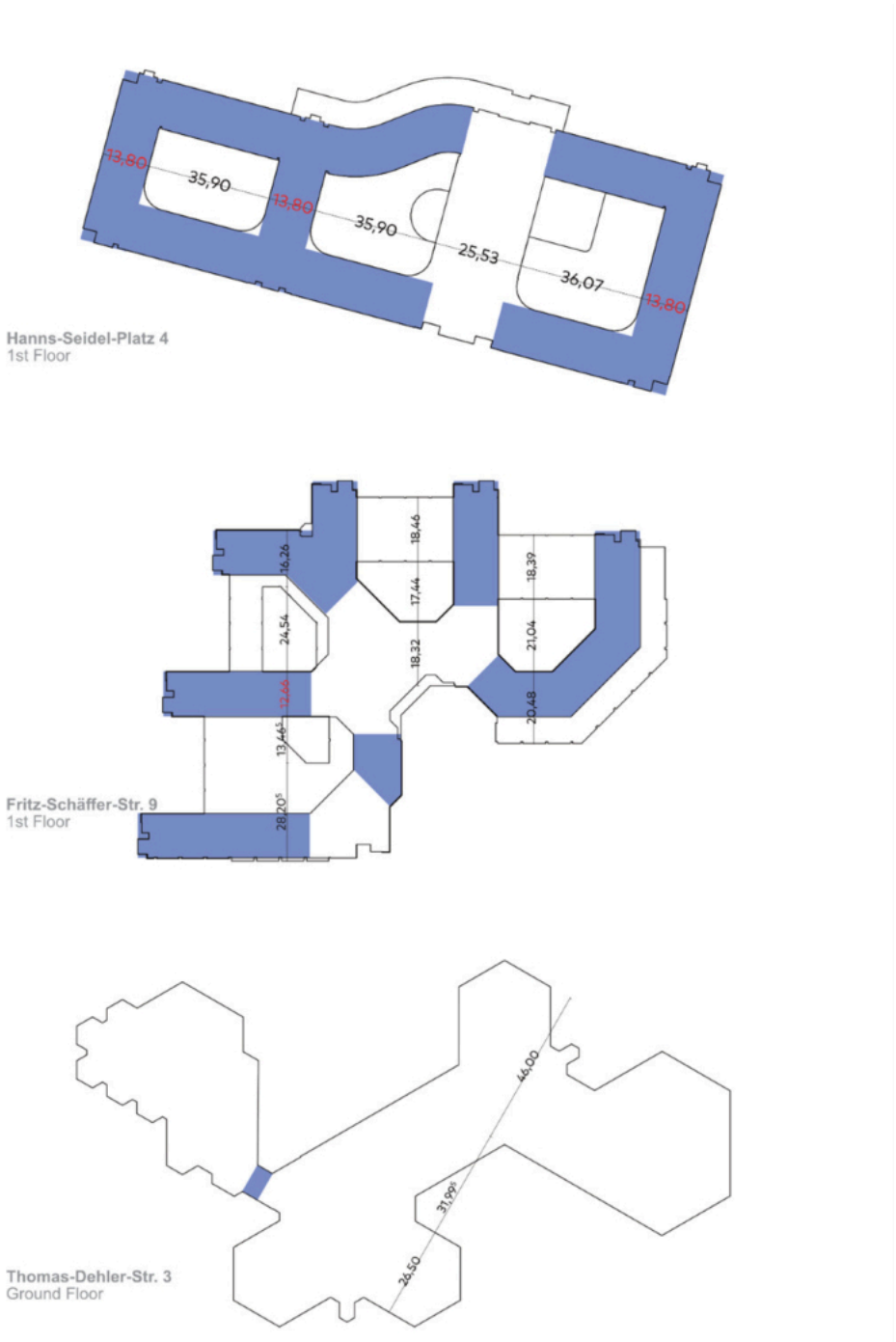
FLOOR HEIGHTS





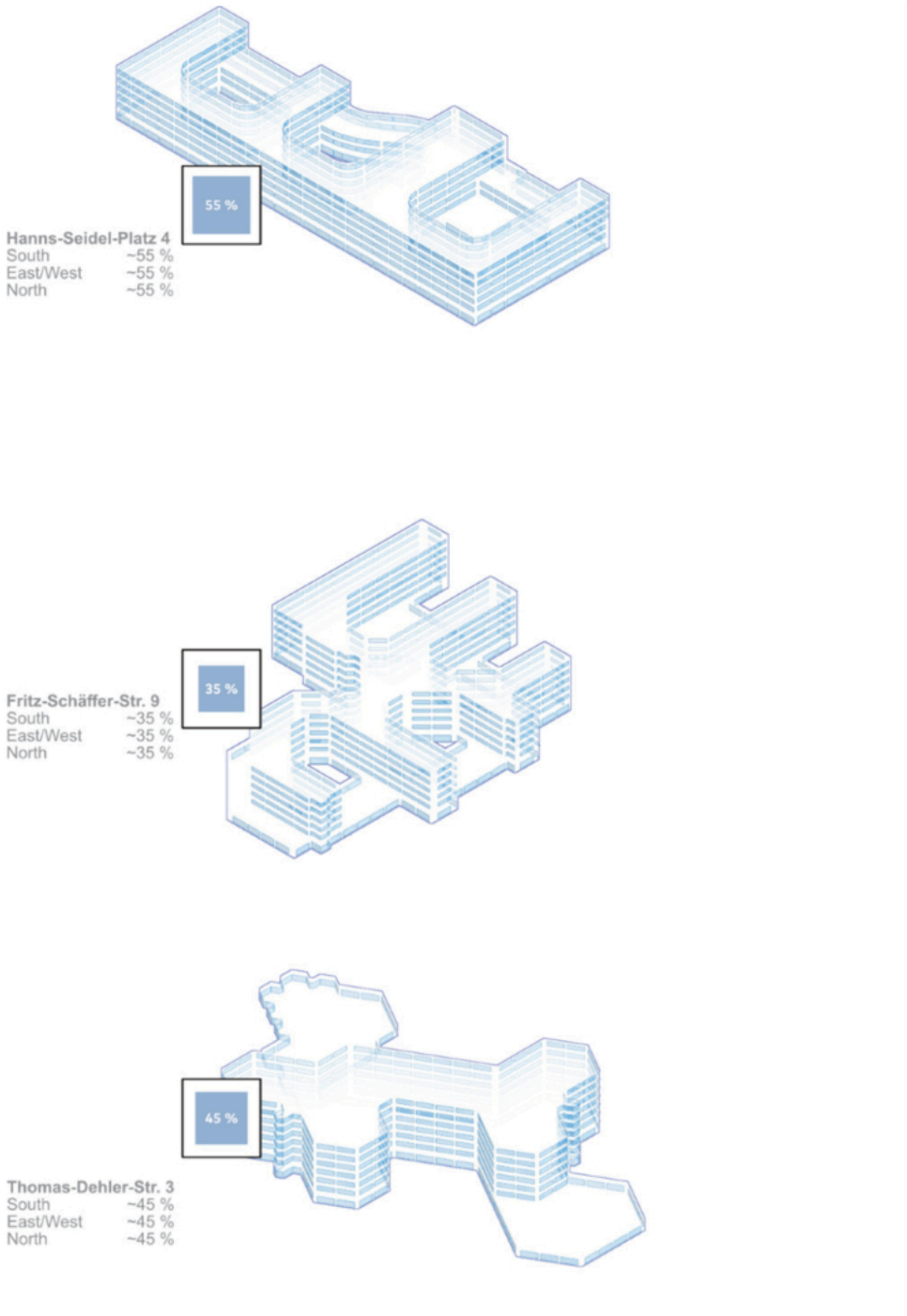
Building analysis: Analyzing the floor heights of the existing building for suitbale uses. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

BUILDING DEPTHS



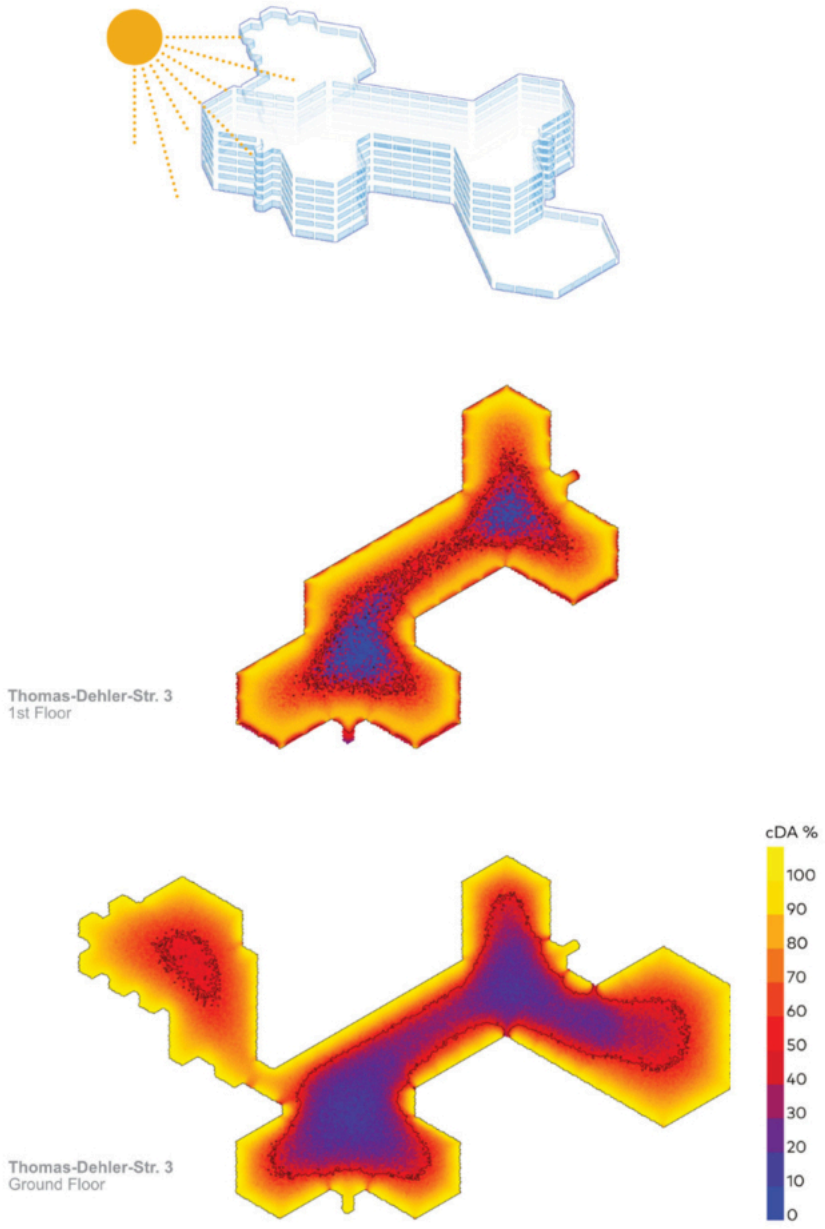
Building analysis: Analyzing the depths of the existing building for suitbale uses. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

FAÇADE OPENINGS



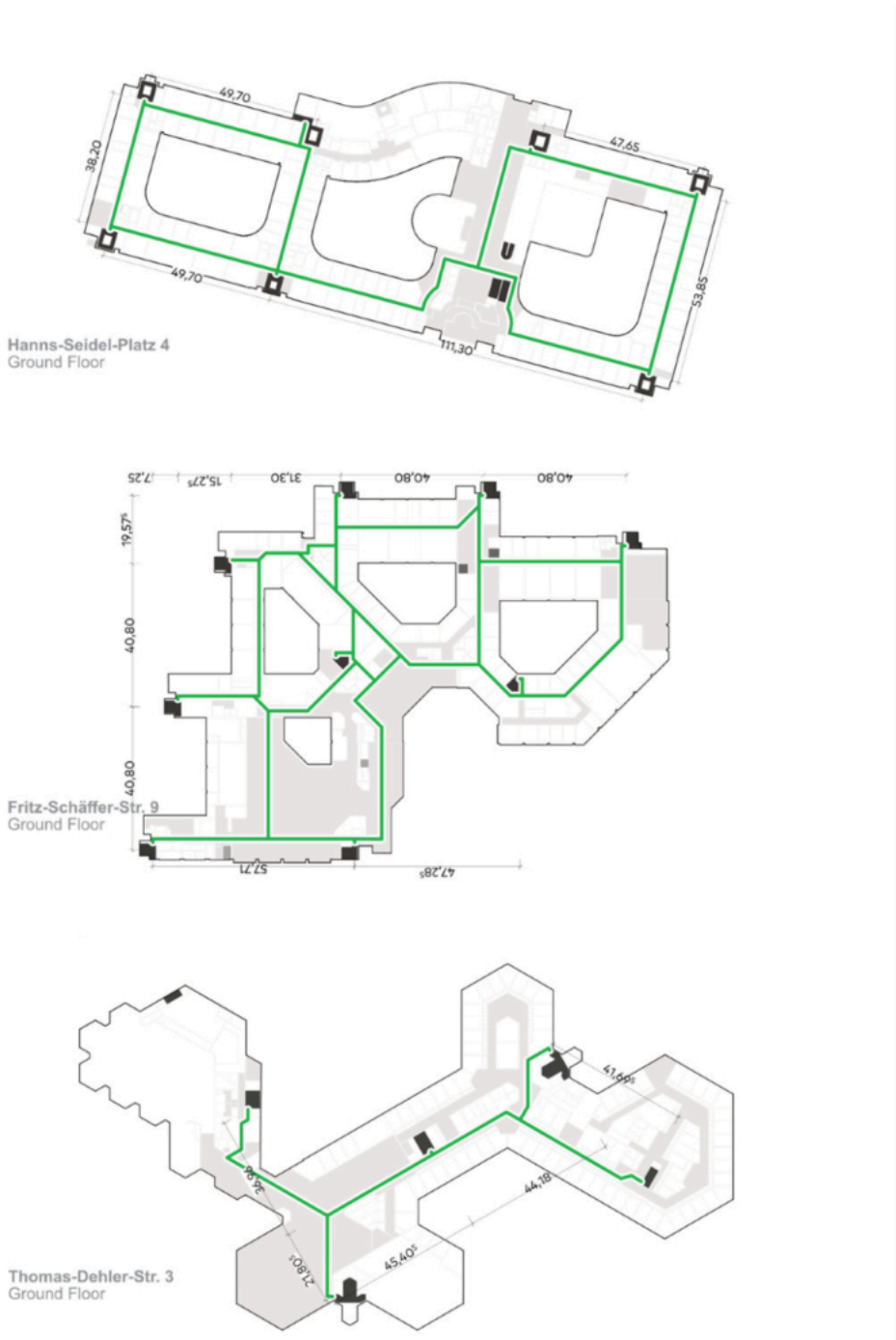
Building analysis: Analyzing the façade openings of the existing building for suitbale uses.
Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

INTERIOR CONTINUOUS DAYLIGHT AUTONOMY



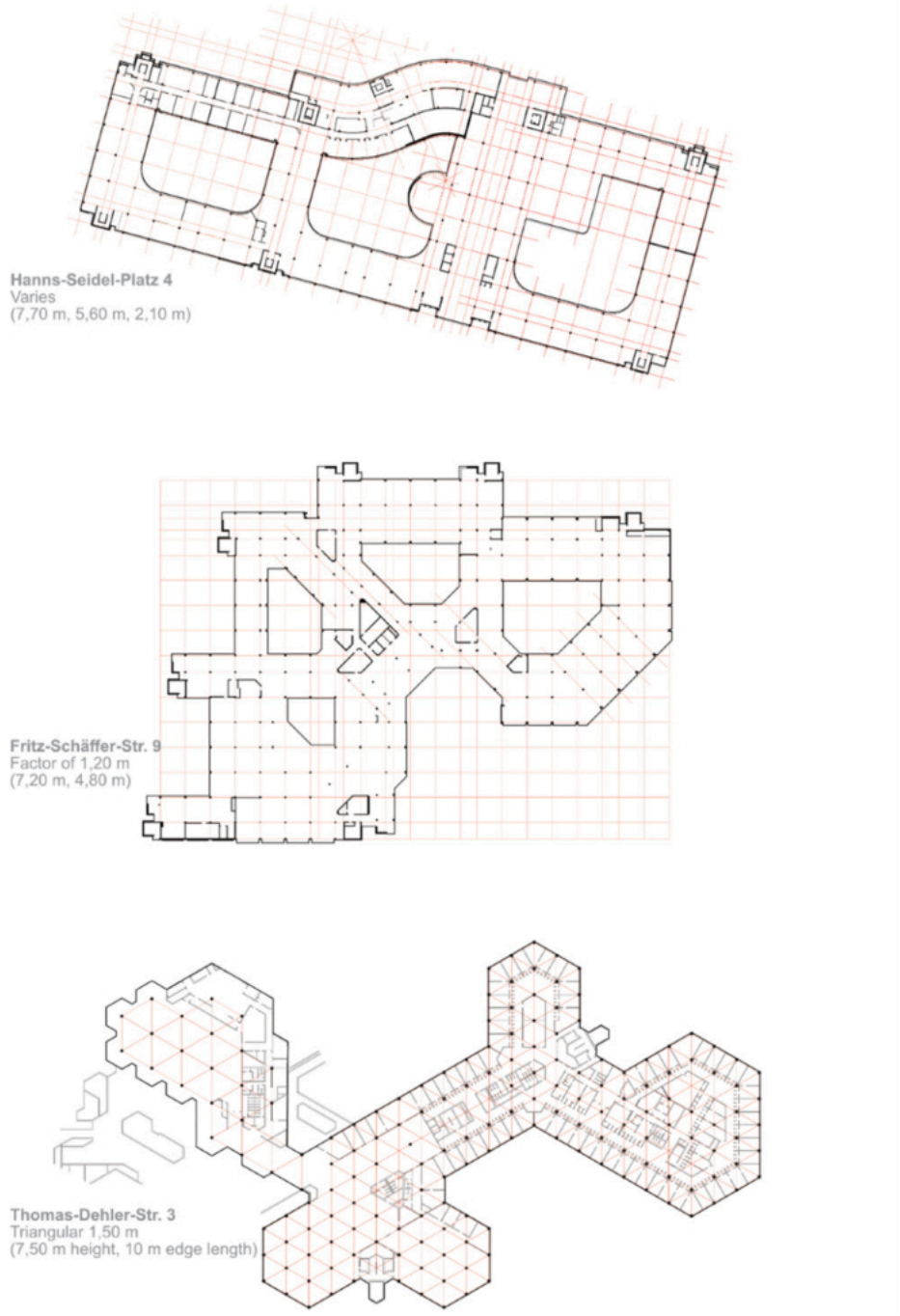
Building analysis: Analyzing the interior continuous daylight autonomy of the existing building for suitable uses.
Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

DISTANCES OF STAIRCASES



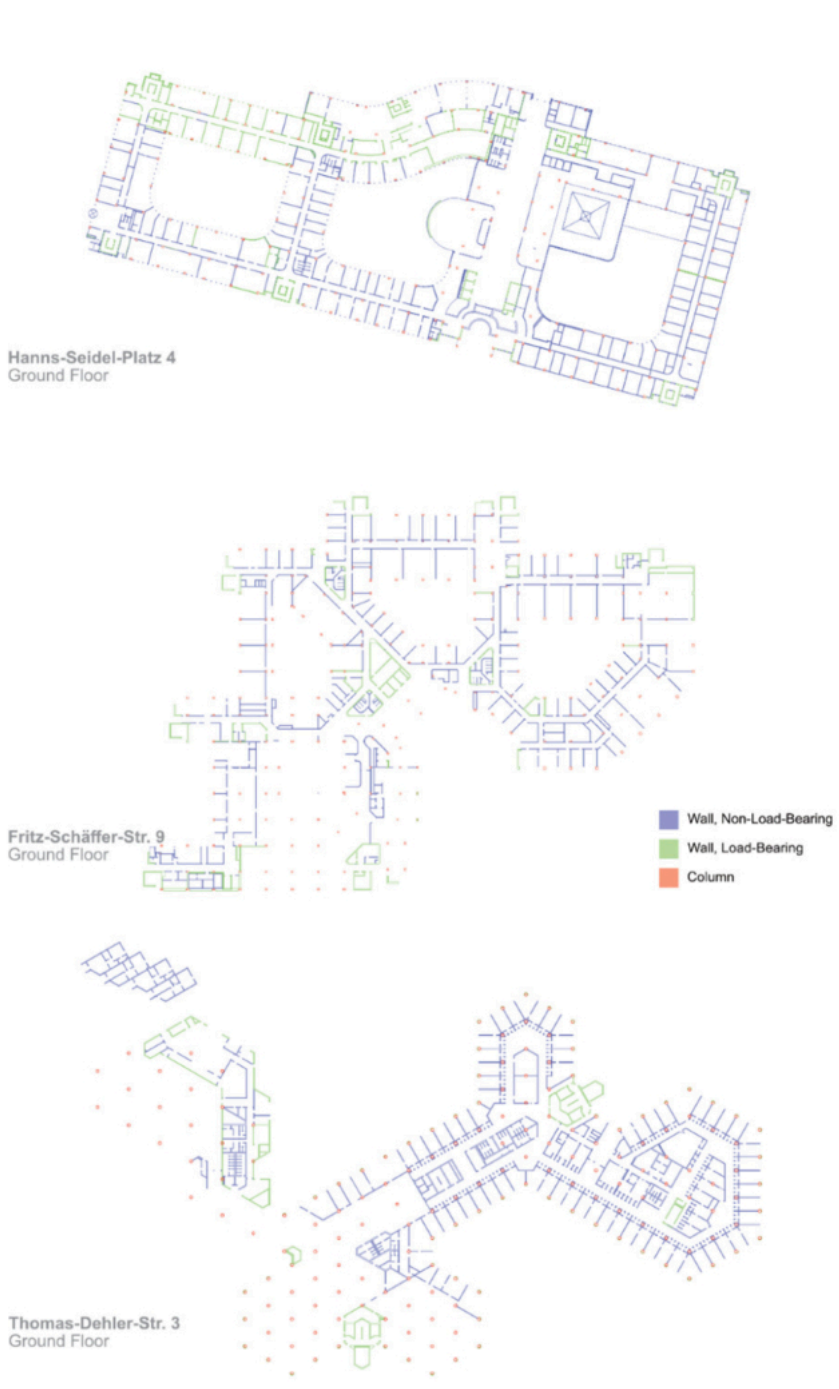
Building analysis: Analyzing the distances of the stair cases of the existing building for suitable uses.
Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

FLOOR PLAN GRIDS



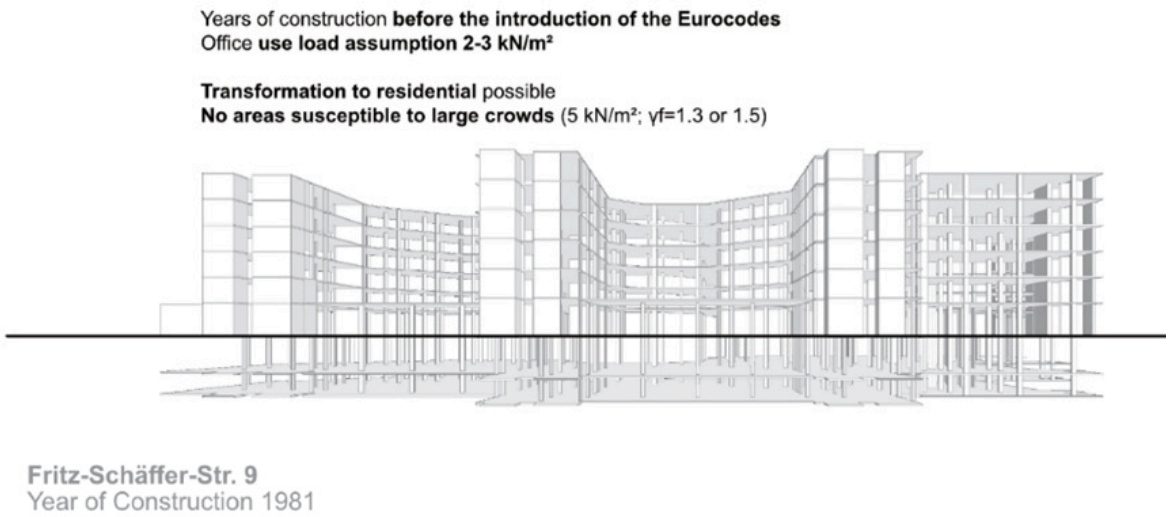
Building analysis: Analyzing the floor plan grid of the existing building. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

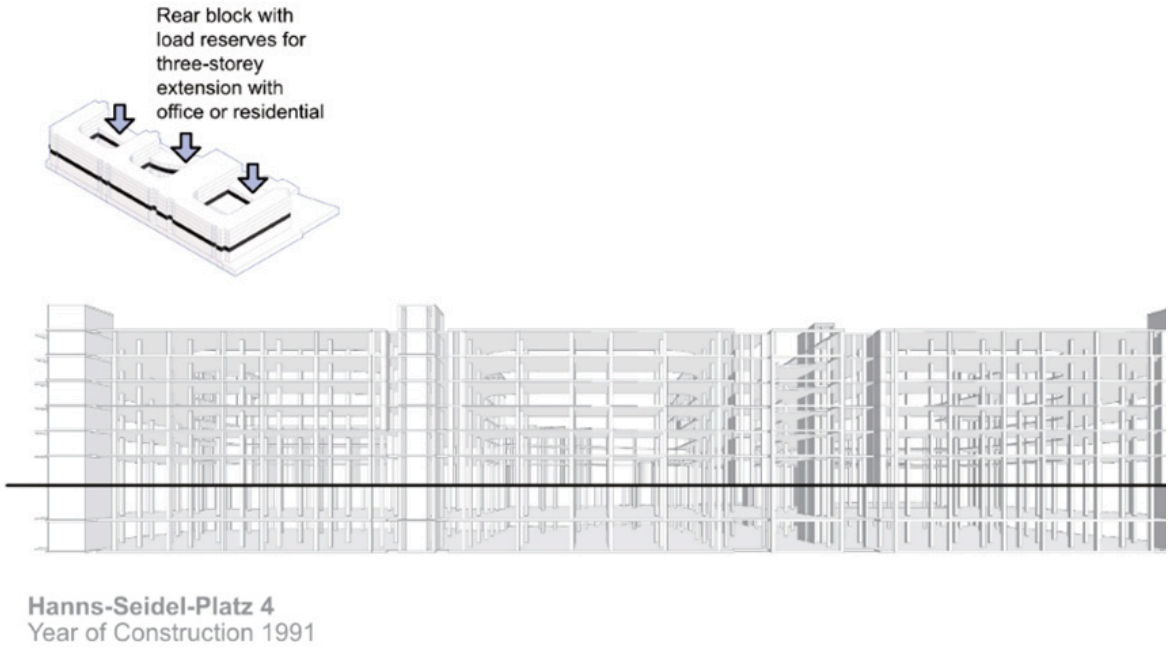
STRUCTURAL ANALYSIS



Building analysis: Analyzing the structure of the existing building. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

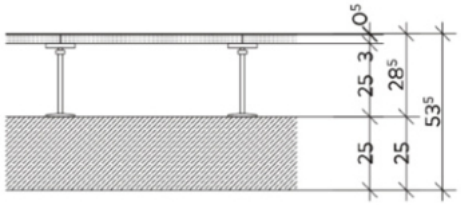
PAYLOADS



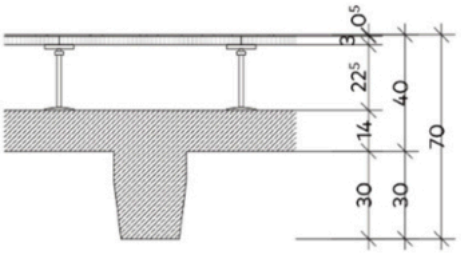


Building analysis: Analyzing the payloads of the existing building for suitbale uses. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

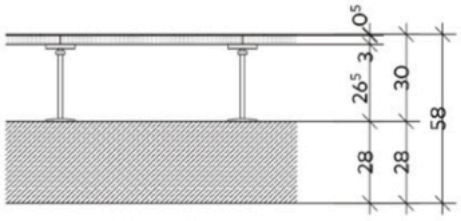
SLAB STRUCTURE AND FLOOR BUILD UPS



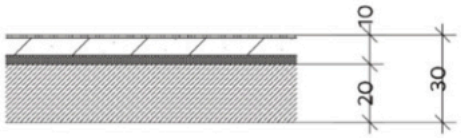
Hanns-Seidel-Platz 4



Fritz-Schäffer-Str. 9



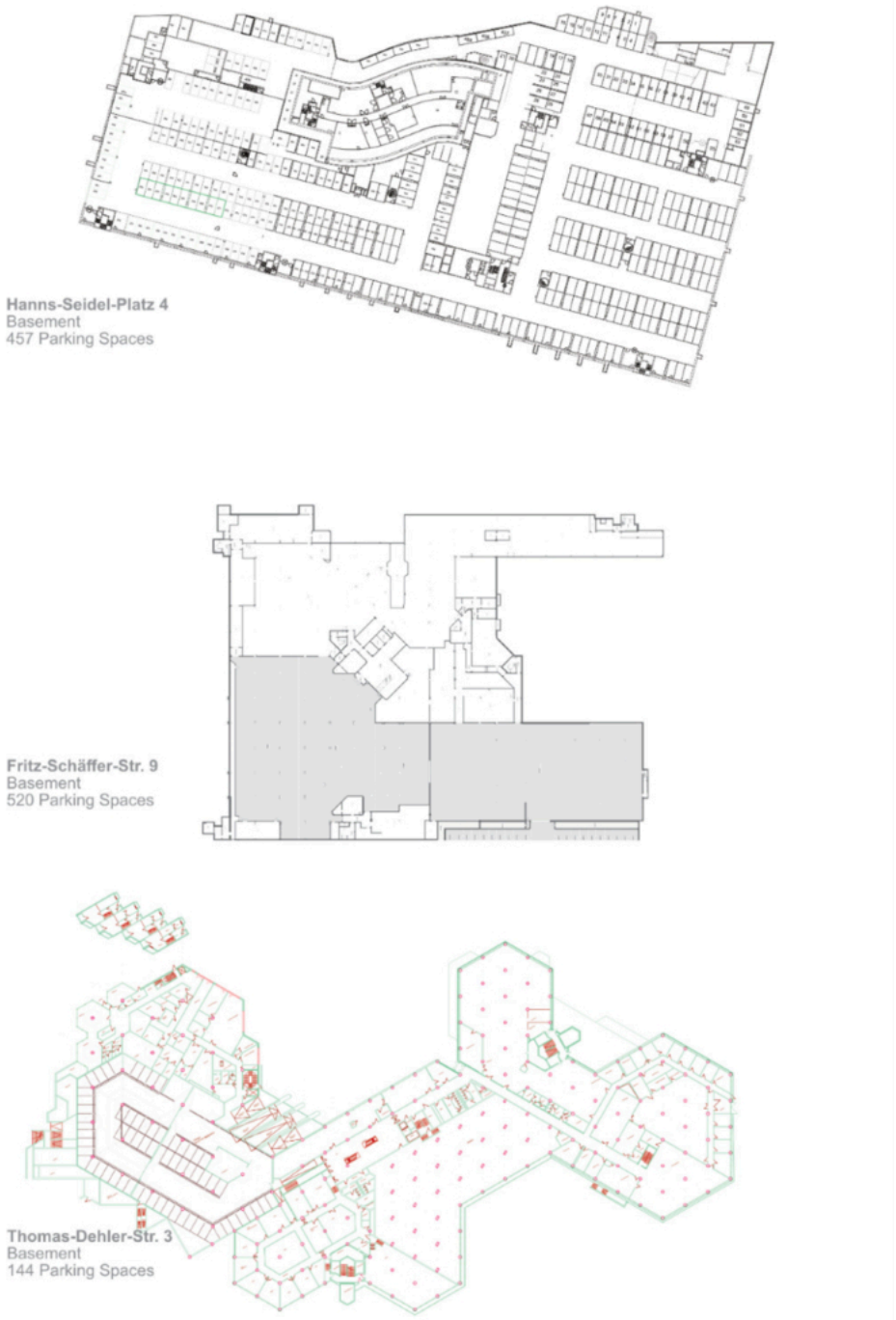
Thomas-Dehler-Str. 3



Thomas-Dehler-Str. 3

Building analysis: Analyzing the slab structure and floor build ups of the existing building.
Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

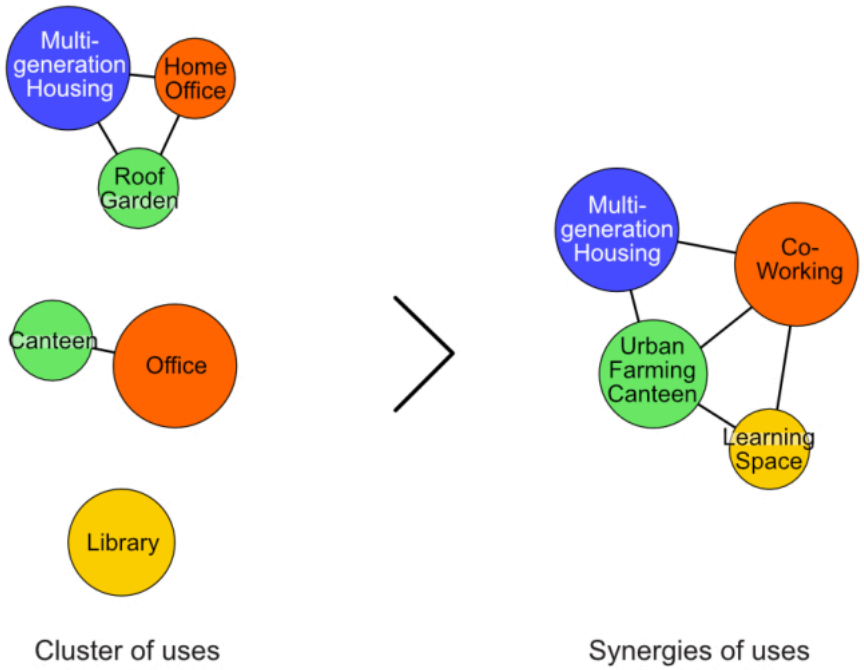
UNDERGROUND CAR PARKING SPACE



Building analysis: Analyzing the underground car parking space the existing building. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

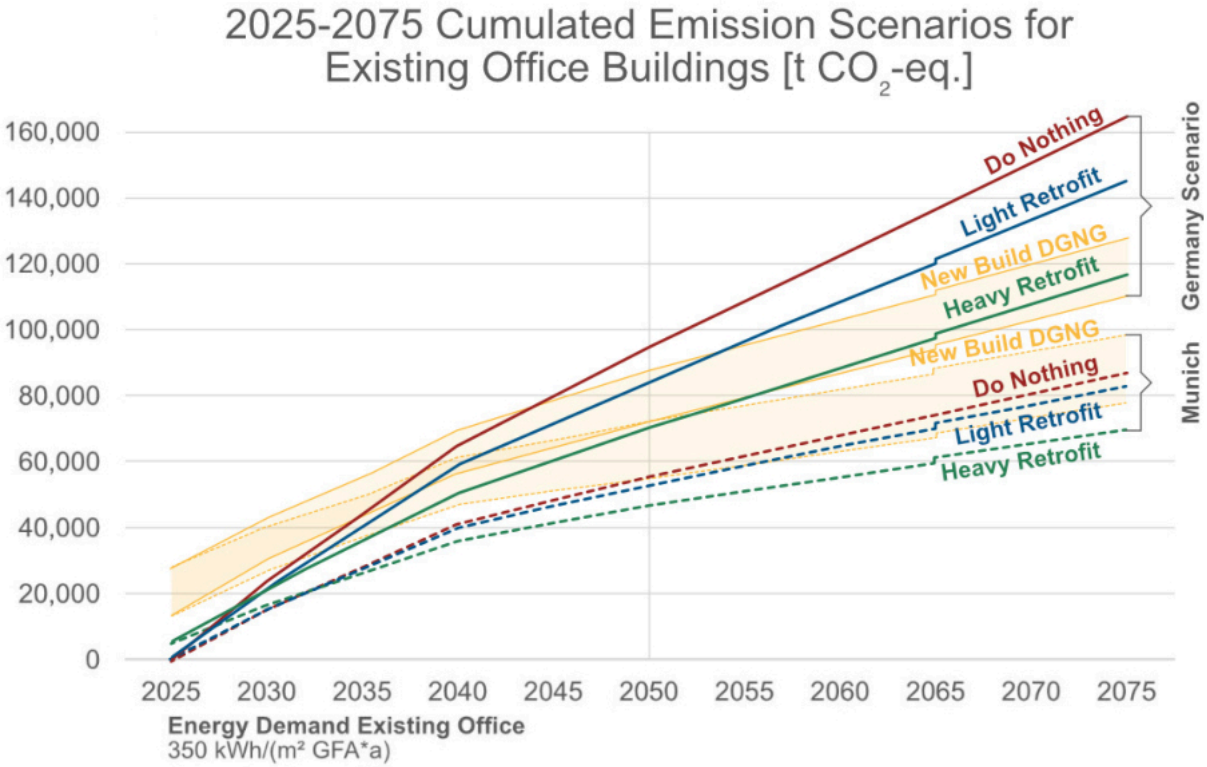
PROGRAMMING

PROGRAMMING SYNERGIES OF USES



Programming: Identifiying synergies of uses. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

LIFE CYCLE ASSESSMENT TO EVALUATE SCEANRIOS



Programming: Life cycle assessment (LCA) to evaluate different scenarios. Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

PIONEERING USES TO TEST SCENARIOS

TEXTILWERKSTATT

BESCHREIBUNG DES RAUMS
Fläche: ca. 34 m²
Nutzeranzahl: kleine Gruppen
Geschoss: Erdgeschoss

NUTZUNG:
Nähraum

GEEIGNET FÜR FOLGENDE PRAKTIKEN:
Primär: Nähen
Sekundär: Treffpunkt

BEREITSTELLUNG DURCH:
Shaere

NUTZENDE:
Offen für alle

ZUGÄNGLICHKEIT:
Nur auf Anfrage

ANFORDERUNGEN AN DEN RAUM:
Raumhöhe: normal
Raumtiefe: normal
Natürliche Belichtung: ja
Anforderung an das Tragwerk: normal
Wasseranschluss: nein

Innen — Außen
Privat — Gemeinwohlorientiert
Monofunktional — Multifunktional
Kurzzeitnutzung — Langzeitnutzung
Geringe Auslastung — hohe Auslastung
Geringer Anpassungsbedarf — hoher Anpassungsbedarf

Textilwerkstatt. Modifiziert nach [7].

AUSSTATTUNG:
Nähmaschienen
Stühle
Tische
Regale
Stoffe

ERFORDERT WEITERE RÄUME:
Notwendig:
Empfang
Sanitäranlagen

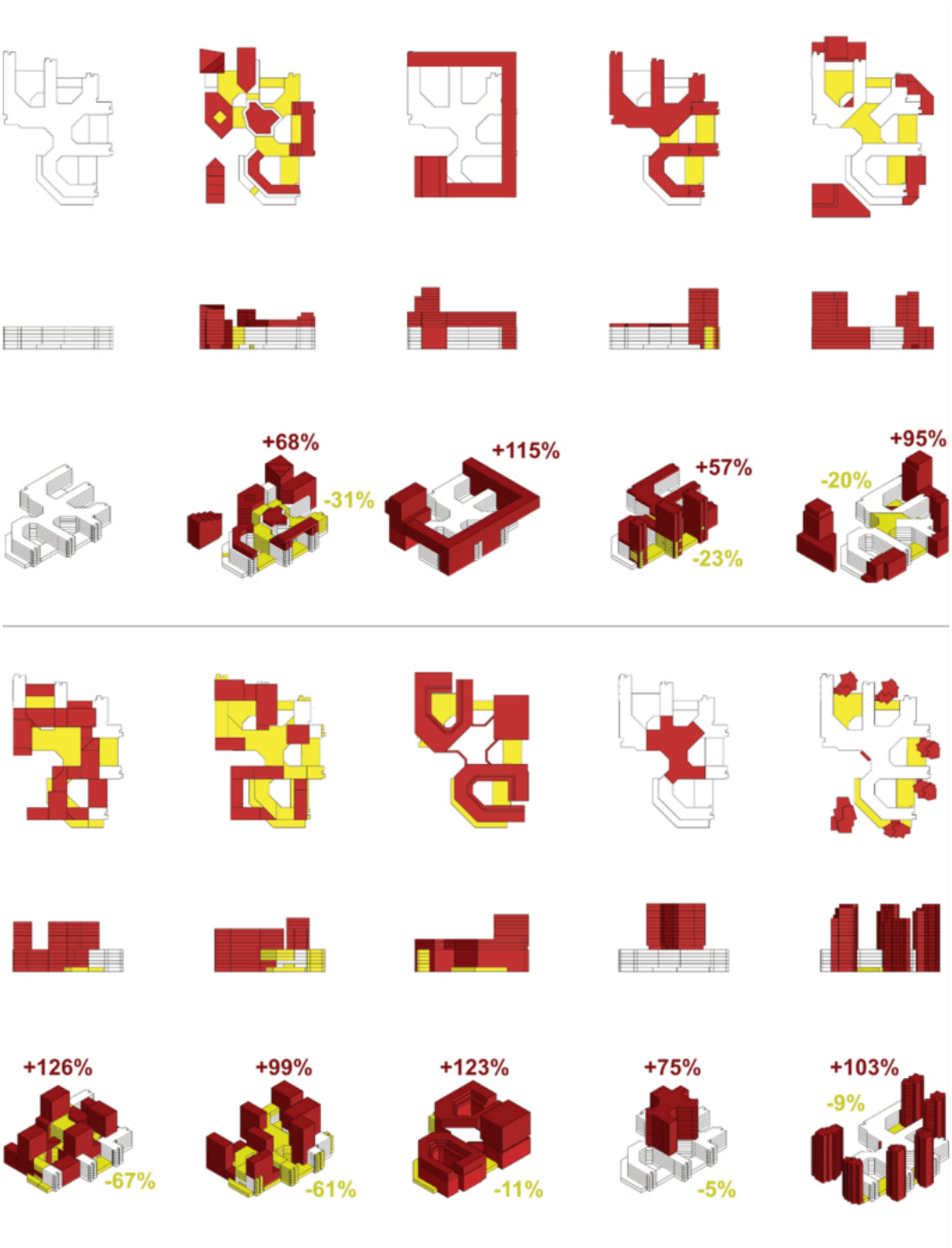
Optional:
SHAERE-Kitchen

TEXTILWERKSTATT

Programming: Pioneering uses to test suitable uses and scenarios. Image Source: Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

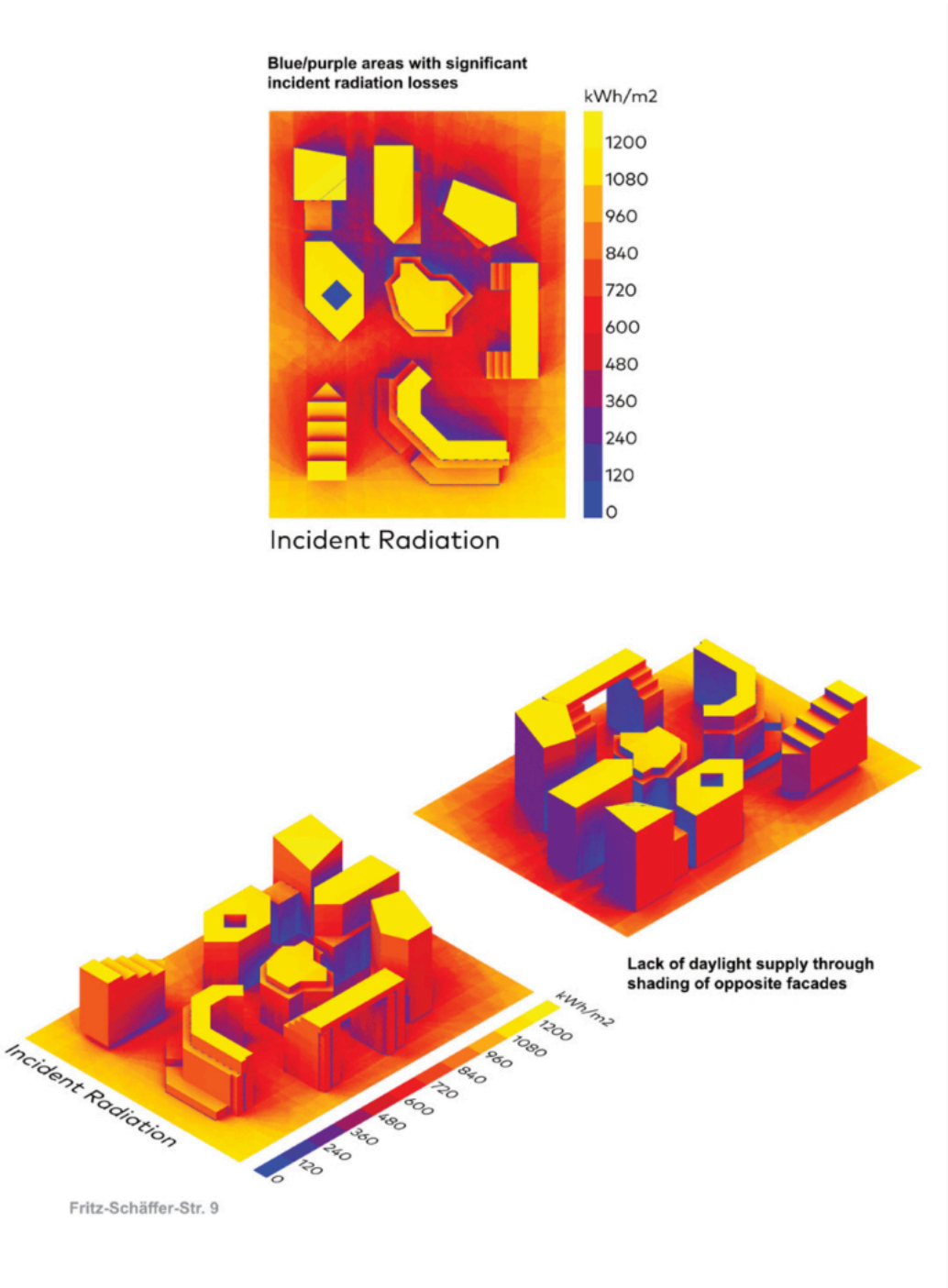
EARLY ARCHITECTURAL DESIGN

ARCHITECTURAL COMPETITION



Early Architectural Design: Conducting an architectural competition, including an assessment of the preservation of existing structures and densification. Example of the "Fritz District", Fritz-Schäffer-Straße 9, Neuperlach. Image Source: Josef Rott & Johannes Staudt (TU Munich)/ NEBourhoods, based on the results of the Fritz District competition.

INCIDENT RADIATION



Early Architectural Design: Evaluating different design variants: Annual solar radiation.
Image Source: Josef Rott, Johannes Staudt & Carsten Schade (TU Munich)/ NEBourhoods.

ACTIVITIES OF ‘CIRCULAR NEUPERLACH’

Lectures and talks

- Expo Real, Munich, 10.2024
- EAAE Conference, Münster, 08.2024
- VerhandelBar/ Hans Sauer Stiftung, empty buildings walk, München, 08.2024
- BBSR Sufficiency Research Colloquium, Berlin, 05.2024
- Gemeinsam für die Bauwende, Online, 05.2024
- Hans Sauer Stiftung, Circular Society Colloquium, München, 06.2024
- Landeshauptstadt München, Pressetermin zur Baukultur in München, 11.2023
- DASL 7. Hochschultag der Nationalen Stadtentwicklungspolitik, Berlin, 06.2023
- UnternehmerTUM, BeFive Future Day, München, 05.2023
- BTU Cottbus/ Hans Sauer Stiftung, Roadmap to a Circular Society, Berlin, 02.2023

Teaching activities

- Gemeinsam für die Bauwende, lecture series with 12 universities, summer term 2024
- Interdisciplinary design and research methods, project week, winter term 2023-24
- Sociocultural Perspectives of Sustainable Cities, seminar and lecture, winter term 2022-23 + winter term 2023-24
- Hacking Neuperlach, challenge in cooperation with the SCE of the Munich University of Applied Sciences, winter term 2023-24
- Interdisziplinäres Projekt, design studio, summer term 2023
- EuroTeQ Collider at TUM, challenge in cooperation with the TUM hfp, summer term 2023
- Interdisziplinäres Projekt Urban, design studio, winter term 2022-23

Master theses

- Cai, Liyan: How to design social quality in circulation areas within existing buildings? 04.2024
- Girling, Grace: Shifting urban areas towards a circular economy: A case study of the Neuperlach neighbourhood of Munich, 09.2023
- Ossenbach, Markus: Optimizing sustainability in early-stage building design (ongoing)

- Rott, Josef: Community vs. Developer Adaptive Reuse: A Mixed-Methods Approach to Synthesis (ongoing)
- Schlitzer, Hannah: Social quality in architecture: user-oriented approach to evaluating social quality using the example criterion 'sense of security' and application in design, 04.2024
- Schmidt, Fabian: Development of an LCA-based method for assessing the environmental impact of different adaptation scenarios in architectural design, 11.2024
- Volz, Elina: Schlachthofquartier 2.0 – prototypes for a circular city, 09.2024

Workshops and discussions

- Public expert workshop on the “Transformation of existing buildings for the common good” with AbbrechenAbbrechen, Mitbauzentrale München, Mietshäusersyndikat Görzer128, Cooperative Das große kleine Haus, and KVL Group, 10.2024
- Expert workshop on neighborhood demands with MGS, 07.2024
- Survey on neighborhood demands in Neuperlach, 07.2024
- Talks and workshops with Munich city administration and project developer, since 04.2024
- Internal preparatory workshops
- Discussions and interviews with experts

Publications

- PND journal article, double-blind peer-reviewed (accepted): Staudt, J., Schade, C., Steiner, C., Lang, W. (2024). Circular Uses: A framework for a circular and neighborhood-oriented transformation of existing buildings. Manuscript submitted for publication at Planung Neu Denken (PND).
- EAAE conference paper, peer-reviewed (accepted): Schade, C., Staudt, J., Denk, A., Lang, W. (2024). Neighborhood-oriented and regenerative programming in teaching: The Interdisciplinary Project (IDP) as a case study from the Technical University of Munich. Manuscript submitted for publication at European Association of Architectural Education (EAAE) Conference.
- BBSR contribution to the anthology: Documentation Sufficiency Research Colloquium (in press): Staudt, J. & Schade, C. (2024): Bürokomplexe zirkulär transformieren als Suffizienz-Strategie: Das Forschungsprojekt NEBourhoods. Manuscript submitted for publication at BBSR Dokumentation des Suffizienz Forschungskolloquiums im Jun. 2024.

Project Participants and Acknowledgements

We would like to thank the project participants for their involvement in our NEBourhoods Action Circular Neuperlach: The creative professionals for the co-creation according to the NEBourhoods living-lab approach (Laura Maria Höpfner, Anna Várnai, Patrik Thomas), the NEBourhoods TransitionHub team for the support the co-creation process (Peter Brooren, Christina Schepper-Bonnet, and others), the City of Munich (Landeshauptstadt München: Christoph Heidenhain, Sylvia Pintarits, Claudia Baukholt, and others) as a central stakeholder for implementation through contact, information updates, advice on current developments within and outside the administration, as well as workshop participation, the MGS (Münchner Gesellschaft für Stadterneuerung) as neighborhood management for locale expertise and replication (Torsten Müller, Tina Zoch), the Architekturgalerie München (Cornelia Hellstern, Nicola Borgmann) for communication and replication, the TUM Venture Lab Built Environment and UnternehmerTUM for entrepreneurial thinking. In the extended project team, we collaborated with communication experts and designers, neighborhood management, and the city planning department, and others. For our practice-oriented research, we engaged project developers, housing cooperatives, activists, and other stakeholders from the real estate industry, planning, administration, civil society, and academia.

Impressum

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Technical University of Munich
Chair of Energy Efficient and Sustainable Design and Building

Munich, 2024.

Recommended citation:
Schade, Carsten; Staudt, Johannes; Steiner, Catherine; Rott, Josef; Lang, Werner (2024). Circular Transformation Roadmap. Munich: Technical University of Munich, Chair of Energy Efficient and Sustainable Design and Building.